Sonas Childcare Centre - Wanneroo

Acoustic Report

Prepared for: Charter Hall Holdings Pty Ltd

Attention: Ben Lourey

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Prepared by: Jason Lim & Imran Khan

Ref: 44241

Wood & Grieve Engineers now part of Stantec
Ground Floor, 226 Adelaide Terrace, Perth WA 6000
Tel: +61 8 6222 7000 Email: perth@wge.com.au www.wge.com.au

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Contents

Executive Summary 2

1. Introduction 3

1.1 Site Description 3

2. Acoustic Criteria 4

2.2 State Planning Policy 5.4(2019) 6

2.3 Internal Noise Levels 7

3. Road Traffic Noise Impact Assessment 8

3.1 State Planning Policy 5.4 - Assessment 8

3.2 Noise Modelling Results 9

3.3 External Envelope 9

3.4 Roof Construction 10

3.5 Outdoor Play Area - Fencing 10

4. Noise Emission Assessment 12

5. Conclusion 13

Appendix A Glossary of Acoustic Terms 14

Appendix B Noise Contours 16

Executive Summary

Wood and Grieve Engineers (WGE) were commissioned by Charter Hall Group Pty Limited to undertake acoustic assessment in support of the Development Application for a new childcare centre. Sonas childcare centre is proposed for 950 Wanneroo Road, Wanneroo and is within the City of Wanneroo.

As part of the Development Application, noise impacts from Wanneroo Rd have been assessed against the State Planning Policy 5.4 -2019 (SPP 5.4). Assessments were undertaken to determine the extent of acoustic treatment necessary for compliance with criteria established by SPP 5.4 and other relevant Australian Standards.

Assessments were conducted in accordance with methodology described by SPP 5.4 and have considered current and future (15-20 year) projected traffic volumes, as well as the proposed layout of the project. Road traffic noise projections were made using 3D noise modelling (SoundPLAN v8.0) and the Calculation of Road Traffic Noise algorithm (CoRTN).

Based on the predicted external noise levels façade design and recommendations were provided to achieve compliance to the internal noise levels as per SPP5.4. Additional reasonable and practical measures in the form of a noise barrier has been recommended to reduce the noise levels in the outdoor areas of the childcare centre.

At this stage of the project, information regarding proposed mechanical plant equipment selections have not been provided. Thus, a preliminary noise emission assessment has been conducted to established maximum permissible noise levels of such plant for compliance with Western Australia Environmental Protection (Noise) Regulations 1997 (EPNR).

By addressing the above-mentioned items, the requirements established by the applicable regulations will be complied with at the Development Application stage.

1. Introduction

This report presents an acoustic assessment conducted for Sonas childcare development proposed at 950 Wanneroo Road, Wanneroo. The acoustic aspects of the project have been analysed to identify potential issues related to the proposal and recommendations are provided to address them at Development Application stage.

This report identifies the applicable criteria to the project. The following regulations, policies and Australian Standards apply to the project;

- Western Australian Planning Commission – State Planning Policy 5.4 'Road and Rail Noise Guidelines September 2019' (SPP 5.4);
- Western Australia Environmental Protection (Noise) Regulations 1997 (EPNR); and
- Australian Standard AS2107:2016 – Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors (AS2107).

1.1 Site Description

The project site is located at 950 Wanneroo Rd, Wanneroo. Adjacent and to the east of the project location is Wanneroo Central shopping centre with several other commercial and residential properties located to the south, west and north.

Figure 1-1 presents the project location in context to the aforementioned locations.

Source: Nearmap

Figure 1-1: Project site and surrounding areas

2. Acoustic Criteria

Environmental noise impacts resulting from the noise emissions from the project are addressed through the Environmental Protection Act 1986, with the regulatory requirements detailed in the Environmental Protection (Noise) Regulations 1997 (EPNR).

The EPNR establishes the maximum permissible noise emission levels (assigned levels) to be received at all adjacent noise-sensitive premises during specific periods of the day as a result of the cumulative noise emissions from all sources proposed for the project site. Compliance to relevant noise limits outlined in the EPNR is compulsory.

The EPNR states noise emissions from any premises are considered not to *significantly contribute to* the noise at a receiver if the noise emissions are 5 dB or below the assigned levels.

In brief, the assigned levels are determined by considering of the amount of commercial and industrial zones, as well as main transport corridors and sporting venues surrounding the noise sensitive premises. The assigned levels apply at premises receiving the noise (noise sensitive receiver) and not to areas within the project site or lot. In addition, the Environmental Protection (Noise) Regulations 1997 identify the following in Schedule 3, clause 2A:

> *"If the land within either of the circles is categorised on the land use map as land in respect of which mixed uses are permitted, the use of that land that results in the highest influencing factor is to be used in the determination of the influencing factor."*

The nearest noise sensitive receivers have been considered as the residential properties in the surrounding the area, with the closest measurable noise sensitive receiver located at 36 Leach Rd, Wanneroo.

The current City of Wanneroo District Planning Scheme 2 (DPS2) was accessed via the City of Wanneroo online mapping system.

Traffic data for roads surrounding the nearest noise sensitive receiver were obtained from Main Roads Western Australia (MRWA) on the 4th September 2019. The available traffic data has been presented in Table 2-1.

Table 2-1:Traffic count data (MRWA)

Transport Corridors	EPNR Classification 1)	Average Daily Traffic Volumes					
		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Wanneroo Road (South of Dunebar Rd)	Major Road	-	-	27589	-	-	24891
Dunebar Rd (East of Wanneroo Rd)	Secondary Road	-	-	10525	-	-	-

1) As defined by the EPNR. Secondary roads have between 6000-15000 vehicles per day. Major roads have greater than 15000 vehicles per day.

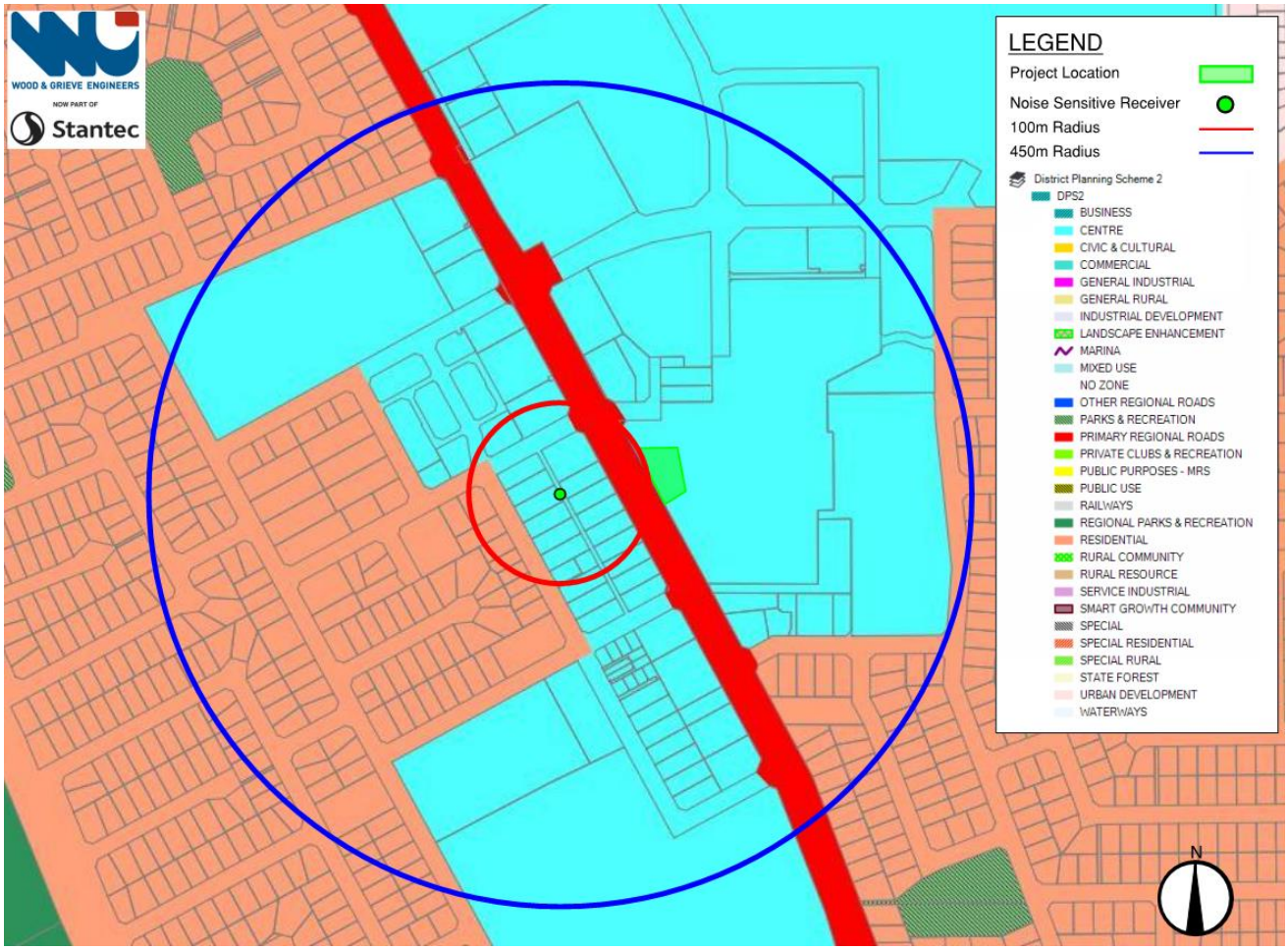
2.1.1 Influencing Factor for 36 Leach Rd

The influencing factor for 36 Leach Rd results from identifying major roads, commercial and industrial areas for all nearest noise sensitive receivers is 11 dB, as summarized in Table 2-2.

Table 2-2:Influencing factor (IF) noise sensitive at 36 Leach Rd

Noise Sensitive Premises	Commercial Zones	Industrial Zones	Transport Corridors	Influencing Factor
36 Leach Rd	53 % within a 100 m radius 56 % within a 450 m radius	0 % within a 450 m radius	Wanneroo Rd within a 100m radius	**11 dB**

Figure 2-1 indicate the land use zones surrounding at 36 Leach Rd.



Source: City of Wanneroo Intramaps

Figure 2-1: Zoning map of areas surrounding 36 Leach Rd

2.1.2 Assigned Levels for Nearest Sensitive Receiver

Table 2-3 summarises the assigned levels at the nearest noise sensitive premises, which is added to the influencing factor calculated for the receiver detailed in Table 2-3. It is required that all noise emissions from the development are below the assigned level for all defined periods of the day and at the lot boundary of the receiver or 15m from any associated building. It is noted that the EPNR assigned levels only apply at the premises receiving the noise only and not to noise within the site.

Table 2-3: Assigned levels for 36 Leach Rd

Type of premises receiving noise	Time of day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: Highly sensitive area	0700 to 1900 hours Monday to Saturday	56	66	76
	0900 to 1900 hours Sunday & public holidays	51	61	76
	1900 to 2200 hours all days	51	61	66
	2200 hours on any day to 0700 hours Monday to Saturday, and 0900 hours Sunday & public holidays	46	56	66
Noise sensitive premises: any area other than highly sensitive areas	All Hours	60	75	80

Type of premises receiving noise	Time of day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Commercial premises	All Hours	60	75	80
Industrial and utility premises	All Hours	65	80	90

2.1.3 Noise Character Adjustment

Regulation 7 states that the noise character must be "free" of annoying characteristics, namely —

- Tonality, e.g. whining, droning;
- Modulation, e.g. like a siren; and
- Impulsiveness, e.g. banging, thumping.

Regulation 9 (1) establishes the methodology for determining noise characteristics. If these characteristics cannot be reasonably and practicably removed, a series of adjustments to the measured levels are required, indicated in Table 2-4.

Table 2-4: Noise character adjustment

Adjustment where noise emission is not music (Cumulative to a maximum of 15 dB)			Adjustment where noise emission is music	
Where tonality is present	Where modulation is present	Where impulsiveness is present	Where impulsiveness is not present	Where impulsiveness is present
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

2.1.4 Noise Emissions – Mechanical Services

It is important that noise emissions from the site do not present any form of tonality, modulation or impulsiveness (as defined by the EPNR).

Given that data from mechanical plant manufacturers is generally limited to broadband data or in 1/1 octave band value, it is not possible to objectively determine tonality, as it is described in the EPNR. 1/3 octave band data is required yet is typically unavailable.

Therefore, a 5 dB penalty shall be conservatively assigned to the noise criteria when assessing noise emissions from mechanical equipment. As the development is proposed to be a childcare centre, it is assumed that mechanical services will only operate during the day (0700 to 1900 hours Monday to Saturday).

In summary, the most stringent criterion at the noise sensitive receiver for day-time criterion L_{A10} 56 dB, becomes L_{A10} 51 dB after a 5 dB correction for tonality, is applied.

2.2 State Planning Policy 5.4(2019)

State Planning Policy 5.4 2019 (SPP 5.4 2019) establishes the outdoor noise criteria that apply to a noise sensitive land use due to noise emissions from road and rail transport. A detailed assessment is required for any noise land use within 300 m of a major freeway.

Table 2-5: Outdoor noise criteria for SPP5.4

Proposal	New	Noise Targets		
		Outdoor		Indoor
		Day (L_{Aeq} (Day) dB) (6am - 10 pm)	Night (L_{Aeq} (Night) dB) (10pm - 6am)	L_{Aeq} dB
Noise-Sensitive land-use and/or development	New noise-sensitive land-use and/or development within the trigger distance of an existing/proposed transport corridor	55	50	L_{Aeq} (Day) 40 (living and work areas) L_{Aeq} (Night) 35 (Bedrooms)

2.3 Internal Noise Levels

2.3.1 Australian Standard AS2107

The internal noise level criteria detailed in this section are based on the recommendations provided in the Australian / New Zealand Standard AS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors' (AS 2107).

AS2107 provides recommended internal noise levels (defined as the equivalent continuous A-weighted sound pressure level — $L_{Aeq,t}$) for optimising the acoustic amenity in occupied spaces. The level of noise in an enclosed space typically consists of noise from building services and/or noise intrusion due to external sources (e.g. traffic).

The relevant internal noise level criteria have been outlined in Table 2-6.

Table 2-6: Recommended internal noise levels from AS2107

Type of occupancy/activity	Recommended design sound level, Leq dB(A)	Recommended design Reverberation Time (T) Range, s
Corridor and lobby areas	< 50	Note 1
Kitchen	< 55	–
Office/Staff room	40 – 45	0.4 – 0.6
Foyer/Family area	45 – 50	–
Activity Room	35 – 45	0.6 – 0.8
Reception	40 – 45	0.6 – 0.8
Child WC/Milk Prep/Nappy Change	45 – 55	–
Cot Room	35 – 40	–

The internal noise level criteria in AS2107 recommend continuous equivalent (L_{Aeq}) levels for background noise. This document is a common reference for establishing satisfactory goals for quasi-static mechanical and external traffic noise ingress.

3. Road Traffic Noise Impact Assessment

Acoustic assessment was undertaken in accordance with SPP 5.4 to determine road traffic noise impacts affecting the project site.

Detailed methodology and assessment specifications are detailed in the SPP 5.4 *Road and Rail Noise Guidelines September 2019* (referred to as the Guidelines in the remainder of this report). Sound PLAN v8.0 (3D noise modelling software) was used to simulate noise emissions expected from road transport corridors and, subsequently, to determine noise levels 1 metre from the façade as well as external noise sensitive areas.

A noise intrusion assessment for the proposed development was conducted based on the predicted noise levels from the 3D model. Roof configuration and external wall and glazing performance requirements have been provided according to the noise intrusion assessment results with the view of providing satisfactory internal noise levels that achieve the AS2107 criteria detailed in this report in Section 2.3.

3.1 State Planning Policy 5.4 - Assessment

3.1.1 Methodology

Topography

Topographical data for the project site and surrounding areas was based on data imported from Nearmaps within the SoundPLAN software. This included elevation points that had been validated against the land survey information for the project.

Road Traffic

The road traffic noise assessment has been conducted based on the methodology described by the Calculation of Road Traffic Noise algorithm (CoRTN, UK Transport Agency).

The CoRTN algorithm has been developed to calculate $L_{A10,18hr}$ noise levels. However, SPP5.4 requires road noise assessments to be based upon the energy averaged $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ noise descriptors for the daytime and night time respectively. Conversions are applied using the method outlined in the DEFRA publication, *"Method for Converting the UK Road Traffic Noise Index $L_{A10,18hour}$ to the EU Noise Indices for Road Noise Mapping."*

This algorithm considers the following parameters;

- Traffic volume during each period of the day, and for current and future scenarios;
- Average traffic speeds;
- Height of each individual noise source (passenger vehicles, heavy vehicles – engine and exhaust);
- Percentage of heavy vehicles; and
- Gradient and surface of road.

Road traffic noise source heights were incorporated into the noise model in accordance to the description detailed by the Guidelines. The modelled heights of vehicle "strings" are provided below;

- Passenger vehicles: + 0.5 m
- Heavy vehicles — Engine noise: + 1.5 m
- Heavy vehicles — Exhaust: + 3.6 m

3.1.2 Noise Source Inputs

Road Traffic

Historical average daily traffic volumes were obtained from the Main Roads Western Australia (MRWA) to determine the proportion of vehicles during day and night, as well as the percentage of heavy vehicles that transit Wanneroo Rd.

SPP 5.4 requires all noise assessments to consider changes in traffic volumes expected over the next 20 years. An increase rate of 3% per year has been conservatively assumed to determine future traffic volumes. Day-time volumes have been predicted based on hourly traffic count data.

Table 3-1 summarises the current and future predicted traffic volumes used in the assessment model.

Table 3-1: Current and Predicted Future Traffic Volumes

Road	Assessment Year	Predicted Daily Vehicle Volume	Day time [1)] vehicle volume per hour	Heavy Vehicle Percentage	Mean Speed
Wanneroo Road (South of Dunebar Rd)	Current - 2019	24891	1443	Day-time – 8.9%	60 km/h
	Future - 2039	44956	2606		

1) Day time period refers to 0600 AM – 2200 PM. Night-time refers to 2200 PM – 0600 AM.

3.2 Noise Modelling Results

Road traffic noise impact for the future year (2039) predicted external noise levels in the range of 60-70dB(A), depending on the orientation of the façade. Coloured noise maps are provided in Appendix B. As the predicted noise levels externally are higher than the 'noise target' values in SPP5.4 acoustic treatments are required to achieve compliance.

Detailed noise intrusion assessment and recommendation for the external envelope are provided to achieve compliance to the internal noise level criteria of SPP5.4. Details of assessment & recommendations are provided in Section 3.3.

3.3 External Envelope

Noise intrusion calculations were undertaken following the methodology described in British Standard BS EN 12354:2000 and by utilizing the worst case (i.e. highest predicted) noise levels at each façade to determine suitable glazing to achieve the required internal noise levels. Appropriate corrections were applied to the linear spectral noise levels to compensate for potential losses due to flanking paths and façade correction.

3.3.1 External Wall

The noise intrusion has been calculated for all façade elements, which is relative to their surface area.

WGE recommends solid wall elements have a minimum performance of $R_w + C_{tr}$ 50. As discussed with the architects, the proposed wall construction is to be made of concrete with stud wall lining. The configuration detailed in Table 3-2 below is expected to meet the recommended performance.

Table 3-2: External wall

Wall Construction	Expected Performance
90mm thick concrete panel with – - 20 mm cavity; - One row 64 mm steel studs at 600mm centres; - Minimum 60 mm thick glasswool insulation (min. density 14kg/m^3) positioned between the row of studs; and - One layer 10 mm standard plasterboard fixed to the outside face of the row of studs	**$R_w + C_{tr} \geq 50$**

3.3.2 Glazing

Glazing systems and entryway elements typically provide lower airborne sound insulation performance than external walls, forming weak acoustic links in the building envelope.

To satisfy internal noise level design targets, glazed elements located at the façades are determined based on the composite sound reduction index (i.e. the combined sound insulation performance of all façade elements relative to their surface area).

Glazing types for each noise sensitive space located at each façade of the proposed development have been comparatively assessed against the noise levels detailed in this report**.** Table 3-3 provides the glazing performance and proposed locations required to satisfy internal noise level design targets.

The performance ratings outlined in Table 3-3 are required for compliance to internal noise level design targets and apply to the glazing system as a whole (i.e. frame, seals and window hardware), with a maximum allowable deviation of 2-3dB only.

Table 3-3: Glazing Configurations

Location	Glazing Configuration	Rw + Ctr	Spectrum Sound Transmission Loss (dB)						
			63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
South-west facade	10.38 mm laminated glass	32 (35; -3)	20	23	28	32	35	37	47
All other facades	6.38 mm laminated glass	29 (32;-3)	15	19	24	29	33	35	41

3.4 Roof Construction

Roof construction should be adequately designed to control external noise intrusion from noise sources identified in this report to satisfactorily provide internal noise levels which are compliant with the criteria established in Section 2.3.

The following roof configuration is expected to achieve the above objectives:

One layer of Colorbond sheet metal or similar (0.42 mm); and

- 75 mm thick high-density Anticon insulation hard-fixed to the underside of roof and over steel purlins;
- Suspended ceiling system; and
- Min. 90 mm thick glasswool insulation (min. 11kg/m^3) one layer of 13 mm standard plasterboard.

3.5 Outdoor Play Area - Fencing

Due to the proximity to a major road it is extremely difficult to control the noise levels in the outdoor area and achieve compliance to the outdoor criteria.

Reasonable and practical measures in the form of a noise barrier has been recommended to reduce the noise levels in the outdoor areas of the childcare centre as far as practical. The extent of noise barrier is shown in . Noise contours illustrating the effects of the noise barrier can be found in Appendix B.

Noise barriers shall be without air gaps or features that would allow sound to be transmitted through the material. Typical barrier shall be constructed using materials having a surface density of 10kg/m^2. Example materials include cement sheet, wood or Perspex.

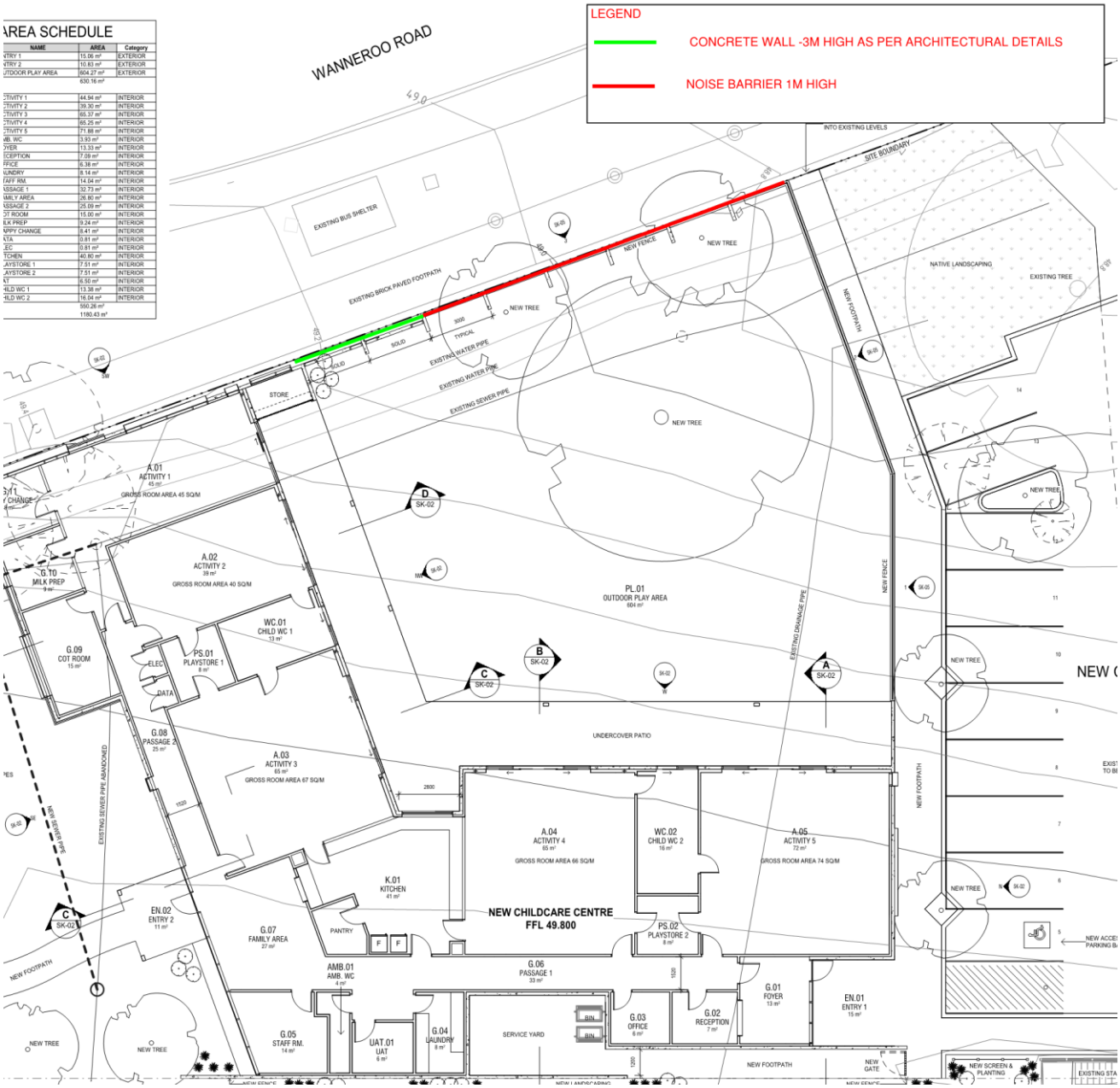


Figure 3-1: Extent of noise barrier

4. Noise Emission Assessment

Noise generated via the mechanical services from the proposed development is required to comply with EPNR criteria. At this stage, no information has been provided regarding mechanical equipment selection.

It is expected that mechanical services will only be running during the day and turned off at night. Therefore, the most stringent criterion at the closest external noise sensitive receiver for day-time criterion L_{A10} 56 dB, becomes L_{A10} 51 dB after a 5 dB correction for tonality is applied.

An assessment has been conducted in to ascertain the cumulative maximum sound power level that the development's expected mechanical services may generate to comply with the above criteria.

The closest noise sensitive receiver located at 36 Leach Rd is approximately 100 m away from the project site. Given this, the cumulative maximum sound power level that may be generated from mechanical service equipment is L_w 95 dB(A).

5. Conclusion

Noise impact from Wanneroo Rd has been assessed against the State Planning Policy 5.4 using a detailed 3D noise model within the software package SoundPLAN v8.0.

The predicted external noise levels due to road traffic noise were predicted to exceed he SPP5.4 criteria for external noise levels. Façade design of the childcare centre was assessed to achieve compliance to internal noise levels in accordance with the policy. Recommendations for external glazing, wall and roof configurations have been provided to meet the internal noise level criteria.

Based on the predicted external noise levels façade design and recommendations were provided to achieve compliance to the internal noise levels as per SPP5.4. Additional reasonable and practical measures in the form of a noise barrier has been recommended to reduce the noise levels in the outdoor areas of the childcare centre.

At this stage no information has been provided regarding mechanical service selection. A maximum cumulative sound power level has been advised by WGE in order to comply with the relevant day-time EPNR criteria.

By addressing the above-mentioned items, the requirements established by the applicable regulations will be complied with at the Development Application stage.

Appendix A Glossary of Acoustic Terms

Term	Description
A-weighting	A frequency dependent filter applied to an instrument-measured noise. In its simplest form, the filter is designed to replicate the relative sensitivity to loudness perceived by the human ear.
Acoustic Barrier	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
Ambient Noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Background Noise	A term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed.
Ctr	A standard weighting curve which replicates low frequency noise, such as that from traffic. Often added to DnT,W or RW to characterise airborne sound insulation performance.
dB	The abbreviation for decibel.
dB(A)	A-weighted sound level in decibels.
DnT,W	Similar to DW, DnT,W is the weighted standardised level difference, which also considers reverberation and background noise level of the receiver room.
DW	A single number value that represents a field measurement of the weighted level difference between two adjacent spaces separated by a partition. DW = L1 – L2 where, L1 is the average sound pressure level in the source room; and L2 is the average sound pressure level in the receiver room.
Extraneous Noise	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Flanking Path	The transmission of sound from a source room to a receiving room by paths other than through the separating partition i.e. via the ceiling, unsealed gaps and cracks or ineffective door seals etc.
Frequency	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz). Most noise sources typically comprise of a vast, and often complex, range of frequencies.
LA1	The A-weighted sound pressure level exceeded for 1% of the measurement time period.
LA10	The A-weighted sound pressure level exceeded for 10% of the measurement time period.
LA90	The A-weighted sound pressure level exceeded for 90% of the measurement time period. Typically represents the background noise level of an environment.

Term	Description
LAeq	The equivalent continuous sound pressure level in dB(A). It is often accompanied by an additional suffix “T”, which is indicative of the measurement time period. (e.g. LAeq,15min , symbolising the measurement is evaluated over 15-minutes.)
LAmax	The maximum A-weighted sound pressure level recorded over the measurement period.
Noise Logger	A sound level meter situated at a particular point of interest. The instrument is typically for an extended period in order to ascertain typical noise patterns associated with the measurement position.
Reflection	Sound wave changed in direction of propagation due to a solid object met on its path.
Reverberation	The persistence of a sound within a space, which will naturally decay over time. Most apparent once the source signal has ceased emitting. Reverberation may have effects on speech intelligibility if not adequately controlled. Reverberation time, represented in seconds, can vary depending on the volume and surface finishes of the space.
RW	A single number value which represents the airborne sound insulation performance of a partition or building element that has been determined under laboratory testing conditions.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Power Level (LW or SWL)	The total sound energy radiated by a source, expressed in Watts. The sound power level is ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Sound Pressure Level (LP or SPL)	The measured acoustic wave strength in a given environment and at a particular point of interest where the total sound level expressed is relative to a reference pressure, i.e. the threshold of human hearing. Sound pressure level is typically measured using a standard sound level meter with a microphone, expressed in decibels (dB).
Tmf	Describe in AS/NZS 2107:2016 as the arithmetic average of the reverberation time in octave bands at 500 Hz & 1000 Hz.

Appendix B Noise Contours

Sonas Child Care Centre

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FUTURE DAY TIME
SCENARIO (YEAR 2039)

NOISE CONTOUR at 1.4 m
RECIEVER HEIGHT

No acoustic treatment applied

Precast concrete fins

3m high precast concrete panel

Noise level
in dB(A)

<=	< 40.0
40.0 <=	< 42.5
42.5 <=	< 45.0
45.0 <=	< 47.5
47.5 <=	< 50.0
50.0 <=	< 52.5
52.5 <=	< 55.0
55.0 <=	< 57.5
57.5 <=	< 60.0
60.0 <=	< 62.5
62.5 <=	< 65.0
65.0 <=	< 67.5
67.5 <=	< 70.0
70.0 <=	< 72.5
72.5 <=	< 75.0
75.0 <=	

0 1 2 3 4 5 m

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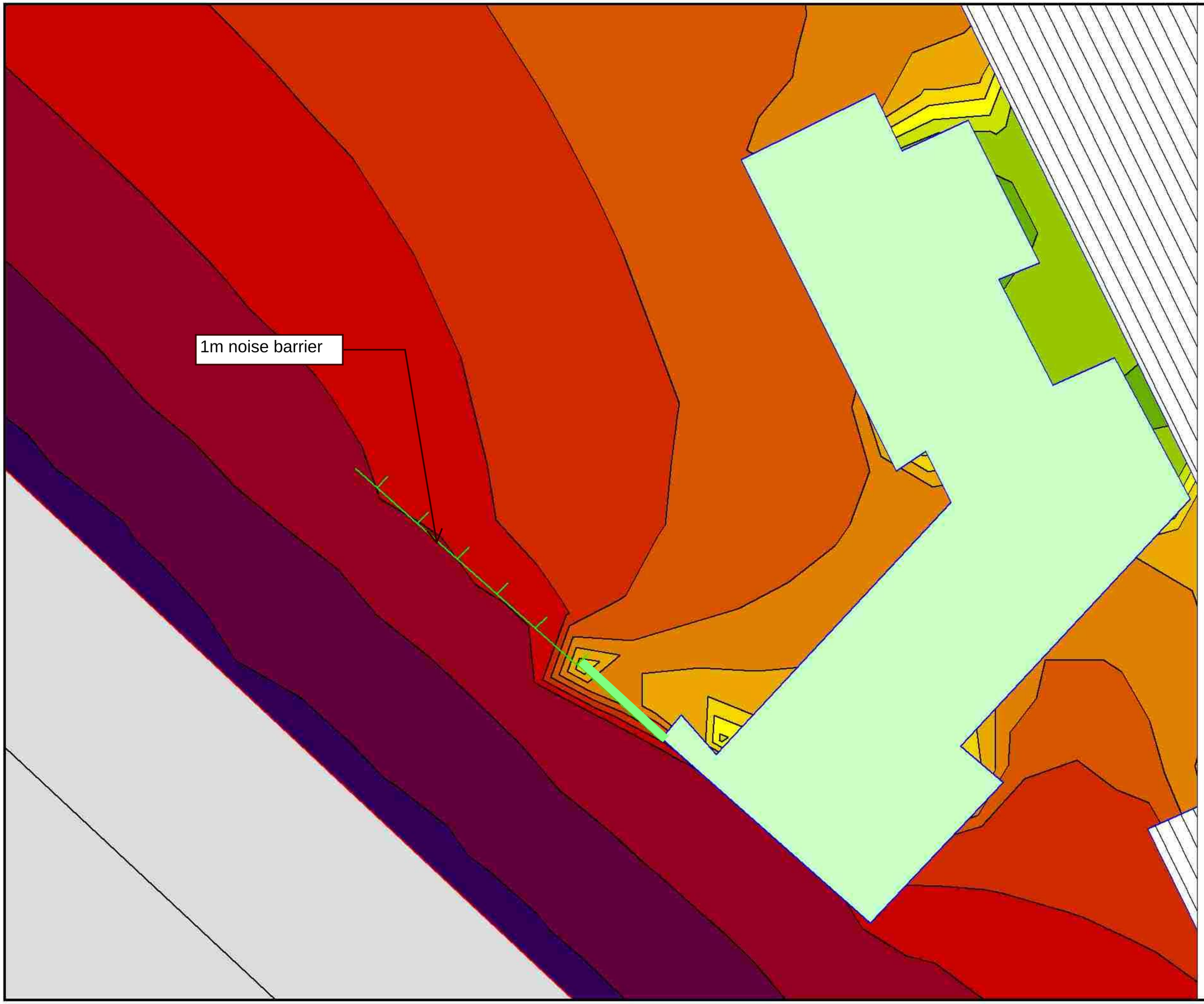

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FUTURE DAY TIME
SCENARIO (YEAR 2039)

NOISE CONTOUR at 1.4 m
RECIEVER HEIGHT

Acoustic treatment applied - 1m high noise barrier

Noise level
in dB(A)

<=	< 40.0
40.0 <=	< 42.5
42.5 <=	< 45.0
45.0 <=	< 47.5
47.5 <=	< 50.0
50.0 <=	< 52.5
52.5 <=	< 55.0
55.0 <=	< 57.5
57.5 <=	< 60.0
60.0 <=	< 62.5
62.5 <=	< 65.0
65.0 <=	< 67.5
67.5 <=	< 70.0
70.0 <=	< 72.5
72.5 <=	< 75.0
75.0 <=	

0 1 2 3 4 5 m

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Stantec

Design with
community in mind

Ground Floor
226 Adelaide Terrace
Perth WA 6000
Tel +61 +61 8 6222 7000
E perth@wge.com.au

For more information please visit
www.wge.com.au

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