LOT 2021
LAKELANDS

STATE PLANNING POLICY 5.4
TRAFFIC ACOUSTIC ASSESSMENT

JUNE 2018

OUR REFERENCE: 23175-1-15096-05

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
P.O. Box 219, Como, W.A. 6952
(08) 9367 6200
hsa@hsacoustics.com.au

DOCUMENT CONTROL PAGE

ACOUSTIC ASSESSMENT

LAKELANDS

Job No: 15096-05

Document Reference: 23175-1-15096-05

FOR

PEET

DOCUMENT INFORMATION			
Author:	Tim Reynolds	**Checked By:**	George Watts
Date of Issue :	12 June 2018		

REVISION HISTORY

Revision	Description	Date	Author	Checked

DOCUMENT DISTRIBUTION

Copy No.	Version No.	Destination	Hard Copy	Electronic Copy
1	1	PEET Attn: Luke Oliver Email: Luke@peet.com.au		✓

CONTENTS

APPENDICIES

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Peet Limited to consolidate the State Planning Policy 5.4 acoustic reports associated with the noise that would be received at residence within Lot 2021 of the Lakelands Estate from both Mandurah Road and the future Road "B".

As part of this review, the following was carried out:

- Consolidate the noise models previously undertaken into single contour plots encapsulating the entirety of Lot 2021.
- Review the predicted noise levels for compliance with the appropriate criteria.
- Consolidate the acoustic requirements, with regards to noise mitigation by way of barriers and "Quiet House" Design in to the one document for ease of reference.

For reference, the subdivisional plan is attached in Appendix A.

2. SUMMARY

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning" (SPP 5.4), the appropriate criteria for assessment for this development are:

EXTERNAL

$L_{Aeq(Day)}$ of 60 dB(A);
$L_{Aeq(Night)}$ of 55 dB(A).

INTERNAL

$L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
$L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

Additional to the above, noise received at an outdoor area should also be reduced as far as practicable, with an aim of achieving an L_{Aeq} of 50 dB(A) during the night period.

The results of the acoustic modelling show that without any noise amelioration, noise received at the majority of residences located adjacent to the roads would exceed the "Noise Limits". To comply with the requirements of SPP 5.4 it is recommended that a barrier be constructed along the boundary of the development and the road reserve. The recommended heights of the barrier are shown on Figure C1 in Appendix C. Additional to the barriers, "Quiet House" design is also required for some residences, with the package requirements shown on Figure C1 in Appendix C.

Finally, Notification on Titles would be required for those residence which receive a noise level that exceeds the "Noise Targets". Lots requiring notifications are also shown on Figure C1 in Appendix C.

A summary of the "Quiet House" Design Packages are attached in Appendix D.

3. CRITERIA

3.1 STATE PLANNING POLICY 5.4

The Western Australian Planning Commission (WAPC) released on 22 September 2009 State Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations In Land Use Planning" (SPP 5.4). Section 5.3 – Noise Criteria, outlines the acoustic criteria and states:

"5.3 - NOISE CRITERIA

Table 1 sets out the outdoor noise criteria that apply to proposals for new noise-sensitive development or new major roads and railways assessed under this policy.

These criteria do not apply to—

- *proposals for redevelopment of existing major roads or railways, which are dealt with by a separate approach as described in section 5.4.1; and*
- *proposals for new freight handling facilities, for which a separate approach is described in section 5.4.2.*
- *The outdoor noise criteria set out in Table 1 apply to the emission of road and rail transport noise as received at a noise-sensitive land use. These noise levels apply at the following locations—*
- *for new road or rail infrastructure proposals, at 1m from the most exposed, habitable façade of the building receiving the noise, at ground floor level only; and*
- *for new noise-sensitive development proposals, at 1m from the most exposed, habitable façade of the proposed building, at each floor level, and within at least one outdoor living area on each residential lot.*

Further information is provided in the guidelines.

Table 1: Outdoor Noise Criteria

Time of day	*Noise Target*	*Noise Limit*
Day (6 am–10 pm)	$L_{Aeq(Day)}$ *= 55 dB(A)*	$L_{Aeq(Day)}$ *= 60 dB(A)*
Night (10 pm–6 am)	$L_{Aeq(Night)}$ *= 50 dB(A)*	$L_{Aeq(Night)}$ *= 55 dB(A)*

The 5 dB difference between the outdoor noise target and the outdoor noise limit, as prescribed in Table 1, represents an acceptable margin for compliance. In most situations in which either the noise-sensitive land use or the major road or railway already exists, it should be practicable to achieve outdoor noise levels within this acceptable margin. In relation to greenfield sites, however, there is an expectation that the design of the proposal will be consistent with the target ultimately being achieved.

Because the range of noise amelioration measures available for implementation is dependent upon the type of proposal being considered, the application of the noise criteria will vary slightly for each different type. Policy interpretation of the criteria for each type of proposal is outlined in sections 5.3.1 and 5.3.2.

The noise criteria were developed after consideration of road and rail transport noise criteria in Australia and overseas, and after a series of case studies to assess whether the levels were practicable. The noise criteria take into account the considerable body of research into the effects of noise on humans, particularly community annoyance, sleep disturbance, long-term effects on cardiovascular health, effects on children's learning performance, and impacts on vulnerable groups such as children and the elderly. Reference is made to the World Health Organization (WHO) recommendations for noise policies in their publications

on community noise and the Night Noise Guidelines for Europe. See the policy guidelines for suggested further reading.

5.3.1 Interpretation and application for noise-sensitive development proposals

In the application of these outdoor noise criteria to new noise-sensitive developments, the objective of this policy is to achieve –

- *acceptable indoor noise levels in noise-sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- *a reasonable degree of acoustic amenity in at least one outdoor living area on each residential lot[1].*

If a noise-sensitive development takes place in an area where outdoor noise levels will meet the noise target, no further measures are required under this policy.

In areas where the noise target is likely to be exceeded, but noise levels are likely to be within the 5dB margin, mitigation measures should be implemented by the developer with a view to achieving the target levels in a least one outdoor living area on each residential lot[1]. Where indoor spaces are planned to be facing any outdoor area in the margin, noise mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces. In this case, compliance with this policy can be achieved for residential buildings through implementation of the deemed-to-comply measures detailed in the guidelines.

In areas where the outdoor noise limit is likely to be exceeded (i.e. above $L_{Aeq(Day)}$ of 60 dB(A) or $L_{Aeq(Night)}$ of 55 dB(A)), a detailed noise assessment in accordance with the guidelines should be undertaken by the developer. Customised noise mitigation measures should be implemented with a view to achieving the noise target in at least one outdoor living or recreation area on each noise-sensitive lot or, if this is not practicable, within the margin. Where indoor spaces will face outdoor areas that are above the noise limit, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces, as specified in the following paragraphs.

For residential buildings, acceptable indoor noise levels are $L_{Aeq(Day)}$ of 40 dB(A) in living and work areas and $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms[2]. For all other noise-sensitive buildings, acceptable indoor noise levels under this policy comprise noise levels that meet the recommended design sound levels in Table 1 of Australian Standard AS 2107:2000 Acoustics—Recommended design sound levels and reverberation times for building interiors.

1 For non residential noise-sensitive developments, (e.g. schools and child care centres) consideration should be given to providing a suitable outdoor area that achieves the noise target, where this is appropriate to the type of use.
2 For residential buildings, indoor noise levels are not set for utility spaces such as bathrooms. This policy encourages effective “quiet house” design, which positions these non-sensitive spaces to shield the more sensitive spaces from transport noise (see guidelines for further information).

These requirements also apply in the case of new noise-sensitive developments in the vicinity of a major transport corridor where there is no existing railway or major road (bearing in mind the policy's 15-20 year planning horizon). In these instances, the developer should engage in dialogue with the relevant infrastructure provider to develop a noise management plan to ascertain individual responsibilities, cost sharing arrangements and construction time frame.

If the policy objectives for noise-sensitive developments are not achievable, best practicable measures should be implemented, having regard to section 5.8 and the guidelines."

The Policy, under Section 5.7, also provides the following information regarding "Notifications on Titles":

"5.7 - NOTIFICATION ON TITLE

If the measures outlined previously cannot practicably achieve the target noise levels for new noise-sensitive developments, this should be notified on the certificate of title.

Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from major road and rail corridors can be effective in warning people who are sensitive to the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need to reduce the impact of noise through sensitive design and construction of buildings and the location of outdoor living areas.

The notification is to ensure that prospective purchasers are advised of –

- *the potential for transport noise impacts; and*
- *the potential for quiet house design requirements to minimise noise intrusion through house layout and noise insulation (see the guidelines).*

Notification should be provided to prospective purchasers and be required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development as well as planning approval involving noise-sensitive development, where noise levels are forecast or estimated to exceed the target outdoor noise criteria, regardless of proposed noise attenuation measures. The requirement for notification as a condition of subdivision and the land area over which the notification requirement applies, should be identified in the noise management plan in accordance with the guidelines.
An example of a standard form of wording for notifications is presented in the guidelines."

3.2 APPROPRIATE CRITERIA

Based on the above, the following criteria are proposed for this development:

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}
Outdoor Living Areas*	Maximum of 50 dB(A) $L_{Aeq\ (night\ period)}$

Internal

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

*This is a suggested noise level; noise is to be reduced as far as practicably possible.

4. MONITORING

For this development, noise monitoring was undertaken along Mandurah Road, as part of a previous assessment in October 2014.

The automatic noise data logger records sound pressure levels in accordance with Australian Standard 2702-1984: *Acoustics - Method For Measurement of Road Traffic Noise.* The logger used records statistical noise level data, of which the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} levels are reported. These are defined below:

L_{A10} The noise level exceeded for 10% of the time (in this instance, the noise level exceeded for 6 minutes in each 1-hour period).

L_{Aeq} The energy equivalent noise level for the 1-hour period. A single number value that expresses the time-varying sound level for the 1-hour period as though it were a constant sound level with the same total sound energy as the time-varying level.

L_{A90} The noise level exceeded for 90% of the time (in this instance, the noise level exceeded for 54 minutes in each 1-hour period).

Monitoring was undertaken during the previous assessment for Lakelands and the results are summarised in Table 4.1.

TABLE 4.1 - SUMMARY OF MEASURED NOISE LEVELS (MANDURAH ROAD)

Parameter	Measured Level (dB(A))*	Differences (dB(A))
$L_{A10\ (18\ hour)}$	72.6	N/A
$L_{Aeq,\ day\ (6am\ to\ 10pm)}$	70.5	= $L_{A10\ (18\ hour)}$ - 2.1
$L_{Aeq,\ night\ (10pm\ to\ 6am)}$	64.4	= $L_{Aeq\ (day)}$ – 8.2

* It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.
Note: The road traffic volumes along Mandurah Road have remained relatively consistent since the monitoring was undertake. Additionally, as the monitoring data is used to calibrate the noise model, based on traffic data for the year the monitoring was undertaken, the monitoring data is valid.

5. MODELLING

Modelling of noise received within the study area within Lot 2021 of the Lakelands Estate was carried out using SoundPlan, using the Calculation of Road Traffic Noise (CoRTN) algorithms. The input data, as used for previous assessments, for the model included:

- Ground contours as obtained from previous assessment.
- Other traffic data as listed in Table 5.1.
- A +2.5 dB adjustment to allow for façade reflection.

Table 4.1 - Noise Modelling Input Data – Mandurah Road and Road B

Parameter	Value	
	Mandurah Road	Road B
Traffic flows for 2031	50700vpd	16000vpd
Heavy Vehicles (%)	6.6	7
Speed (km/hr)	80	80
Façade Correction	+ 2.5 dB(A)	+2.5 dB(A)
Road Surface	Chip Seal	Dense Graded Asphalt

Traffic flow for the future flow was based on information provided by Main Roads.

Noise modelling was undertaken for the following scenarios:

1. Without any noise amelioration.

2. With barriers, as outlined in Figure C1 in Appendix C and the first row of residences.

We note that to determine the extent of the residences requiring "Quiet House" design and / or Notifications, additional noise modelling noise modelling was undertaken with generic residences built on the Lots exposed to traffic noise.

6. RESULTS

We note that with the difference between the $L_{Aeq,8hr}$ and the $L_{Aeq,16hr}$ being greater than 5 dB(A), the day period is the critical period for compliance and achieving compliance with the day period criteria will also result in compliance with the night period criteria. Therefore, noise modelling was only undertaken for the day period and the results are shown graphically in Appendix B.

7. DISCUSSION / RECOMMENDATIONS

The results of the acoustic modelling show that without any noise mitigation, noise received at some of the residences located adjacent to Mandurah Road and the future Road "B" would exceed the "Noise Limits" as outlined in SPP 5.4. To comply with the requirements of SPP 5.4 it is recommended that a barrier be constructed along the boundary of the development and the road reserves. The recommended heights of the barrier are shown on Figure C1 in Appendix C. Additional to the barriers, "Quiet House" design is also required for some residence, with the package requirements shown on Figure C1 in Appendix C.

Finally, Notification on Titles would be required for those residence which receive a noise level that exceeds the "Noise Targets". Lots requiring notifications are also shown on Figure C1 in Appendix C.

A summary of the Quiet House Design Packages are attached in Appendix D.

Note : It is noted that Quiet House Design Packages attached are "Deemed to Satisfy" constructions and alternative constructions would be acceptable, provided they are supported by an acoustic report prepared by a suitably qualified acoustic consultant.

APPENDIX A

SUBDIVISIONAL PLAN

LEGEND

TOTAL APPLICATION AREA (9.4785ha)

LOT SUMMARY

Lot Type	LOT YIELD No. Lots	LOT YIELD % Total Lots	LOT AREA Average Size	LOT AREA % of Total Area
Front Loaded				
12.5m x 20m	12	6.63%	257m²	4.94%
15m x 20m	5	2.76%	326m²	2.62%
10.5m x 25m	34	18.78%	284m²	15.48%
12.5m x 25m	43	23.76%	335m²	23.12%
15m x 25m	10	5.52%	430m²	6.89%
10.5m x 30m+	27	14.92%	332m²	14.37%
12.5m x 30m+	44	24.31%	400m²	28.27%
15m x 30m	6	3.31%	448m²	4.31%
Total Number of Lots	**181**			

Minimum Lot Size 245m² | Average Lot Size 344m²
Maximum Lot Size 619m² | Total Lot Area 62403m²

Lot Typology Plan

LOT 2021 MANDURAH ROAD, LAKELANDS

A PEET MANDURAH SYNDICATE LIMITED PROJECT

DRAFT

plan:	93/079/212E
date:	20/10/2017
projection:	PCG 94
designed:	ME
checked:	LM
drawn:	NM

scale: 1:2000@A3 | 1:1000@A1

0 20 40m

Taylor Burrell Barnett Town Planning & Design
187 Roberts Road Subiaco Western Australia 6008
p: (08) 9382 2911 f: (08) 9382 4586 e: admin@tbbplanning.com.au

APPENDIX B

$L_{Aeq(16hr)}$ DAY PERIOD NOISE CONTOURS

Noise level
LAeq(Day)
in dB(A)

= 55.0
= 60.0
= 65.0

Scale 1:2500

0 12.5 25 50 75 100 m

LOT YIELD	
Lot Type	No Lots
Front Loaded	
12.5m x 20m	12
15m x 20m	5
10.5m x 25m	34
12.5m x 25m	43
15m x 25m	10
10.5m x 30m+	27
12.5m x 30m+	44
15m x 30m	6
Total Number of Lots	181

Minimum Lot Size 245m²
Maximum Lot Size 619m²

Herring Storer Acoustics
Job No : 15096-03
Date : 11 June 2018
File : 1001

LAeq DAY PERIOD NOISE CONTOURS
GROUND FLOOR
WITH 2200mm BARRIER TO BOTH MANDURAH ROAD and ROAD B

Figure B1

Noise level
LAeq(Day)
in dB(A)

= 55.0
= 60.0
= 65.0

Scale 1:2500
0 12.5 25 50 75 100 m

LOT YIELD

Lot Type	No Lots
Front Loaded	
12.5m x 20m	12
15m x 20m	5
10.5m x 25m	34
12.5m x 25m	43
15m x 25m	10
10.5m x 30m+	27
12.5m x 30m+	44
15m x 30m	6
Total Number of Lots	181

Minimum Lot Size 245m²
Maximum Lot Size 619m²

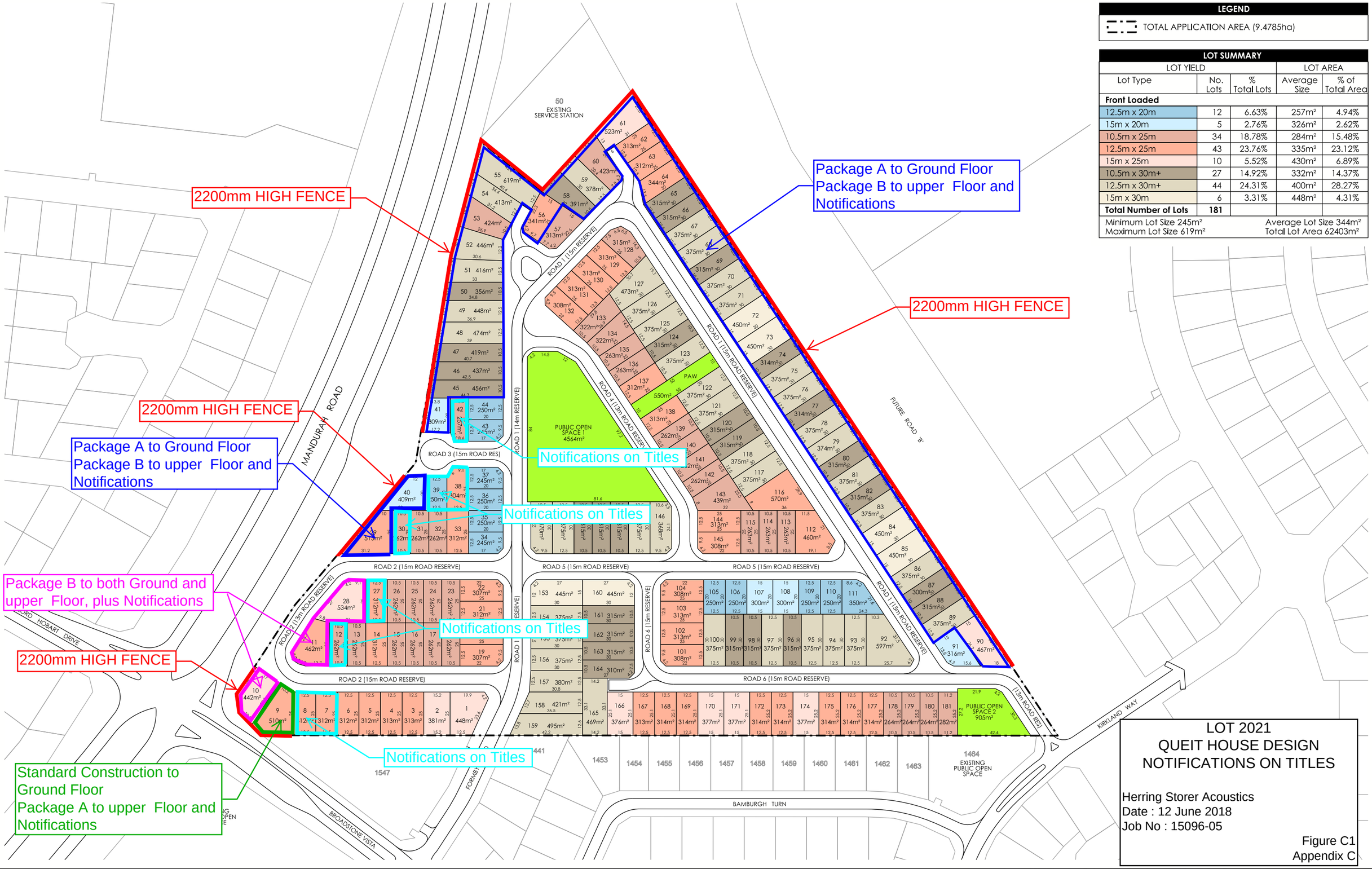
Herring Storer Acoustics
Job No : 15096-03
Date : 11 June 2018
File : 1002

LAeq DAY PERIOD NOISE CONTOURS
FIRST FLOOR WITH 2200mm HIGH BARRIERS

Figure B2

APPENDIX C

NOISE BARRIER, "QUIET HOUSE" DESIGN REQUIREMENTS
AND NOTIFICATIONS



LEGEND

TOTAL APPLICATION AREA (9.4785ha)

LOT SUMMARY

Lot Type	LOT YIELD No. Lots	LOT YIELD % Total Lots	LOT AREA Average Size	LOT AREA % of Total Area
Front Loaded				
12.5m x 20m	12	6.63%	257m²	4.94%
15m x 20m	5	2.76%	326m²	2.62%
10.5m x 25m	34	18.78%	284m²	15.48%
12.5m x 25m	43	23.76%	335m²	23.12%
15m x 25m	10	5.52%	430m²	6.89%
10.5m x 30m+	27	14.92%	332m²	14.37%
12.5m x 30m+	44	24.31%	400m²	28.27%
15m x 30m	6	3.31%	448m²	4.31%
Total Number of Lots	**181**			

Minimum Lot Size 245m² — Average Lot Size 344m²
Maximum Lot Size 619m² — Total Lot Area 62403m²

LOT 2021
QUEIT HOUSE DESIGN
NOTIFICATIONS ON TITLES

Herring Storer Acoustics
Date : 12 June 2018
Job No : 15096-05

Figure C1
Appendix C

Lot Typology Plan

LOT 2021 MANDURAH ROAD, LAKELANDS
A PEET MANDURAH SYNDICATE LIMITED PROJECT

DRAFT

plan: 93/079/212E
date: 20/10/2017
projection: PCG 94
designed: ME
checked: LM
drawn: NM
scale: 1:2000@A3 | 1:1000@A1

Taylor Burrell Barnett Town Planning & Design
187 Roberts Road Subiaco Western Australia 6008
p: (08) 9382 2911 f: (08) 9382 4586 e: admin@tbbplanning.com.au

APPENDIX D

SUMMARY OF “QUIET HOUSE” DESIGN REQUIREMENTS

Area	Orientation to road or rail corridor	Package A L_{Aeq},Day up to 60dB L_{Aeq},Night up to 55dB	Package B L_{Aeq},Day up to 63dB L_{Aeq},Night up to 58dB
Bedrooms	Facing	• Walls to R_w+C_{tr} 45dB • Windows and external door systems: Minimum R_w+C_{tr} 28dB (Table 6.4), total glazing area up to 40% of room floor area. [if R_w+C_{tr} 31dB: 60%] [if R_w+C_{tr} 34dB: 80%] • Roof and ceiling to R_w+C_{tr} 35dB (1 layer 10mm plasterboard) • Mechanical ventilation as per Section 6.3.1 of the Implementation Guidelines	• Walls to R_w+C_{tr} 50dB • Windows and external door systems: Minimum R_w+C_{tr} 31dB (Table 6.4), total glazing area up to 40% of room floor area. [if R_w+C_{tr} 34dB: 60%] • Roof and ceiling to R_w+C_{tr} 35dB (1 layer 10mm plasterboard) • Mechanical ventilation as per Section 6.3.1 of the Implementation Guidelines
	Side-on		
	Opposite	• No requirements	• As per Package A 'Side On'
Indoor living and work Areas	Facing	• Walls to Rw+Ctr 45dB • Windows and external door systems: Minimum Rw+Ctr 25dB (Table 6.4), total glazing area limited to 40% of room floor area. [if Rw+Ctr 28dB: 60%] [if Rw+Ctr 31dB: 80%] • External doors other than glass doors to Rw+Ctr 26dB (Table 6.4) • Mechanical ventilation as per Section 6.3.1 of the Implementation Guidelines	• Walls to Rw+Ctr 50dB • Windows and external door systems: Minimum Rw+Ctr 28dB (Table 6.4), total glazing area up to 40% of room floor area. [if Rw+Ctr 31dB: 60%] [if Rw+Ctr 34dB: 80%] • External doors other than glass doors to Rw+Ctr 26dB (Table 6.4) • Mechanical ventilation as per Section 6.3.1 of the Implementation Guidelines
	Side-on		
	Opposite	• No requirements	• As per Package A 'Side On'
Other indoor areas	Any	• No requirements	• No requirements

Alternative constructions are acceptable, provided they are supported by a report prepared by a suitably qualified Acoustical Consultant.

MINIMUM ACOUSTIC RATING OF SELECTED EXTERNAL BUILDING EXTERIOR WALLS

Building Element	Type	$R_w + C_{tr}$,dB	Example Constructions
External wall	Steel framed	45	One row of 92mm studs at 600mm centres with – • resilient steel channels fixed to the outside of the studs; and • 9.5mm hardboard or 9mm fibre cement sheeting or 11mm fibre cement weatherboards fixed to the outside of the channels; and • 75mm thick glass or mineral wool insulation with a density of 11kg/m3 or • 75mm thick polyester insulation with a density of 14kg/m3, positioned between the studs; and • two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs.
			One row of 92mm studs at 600mm centres with – • resilient steel channels fixed to the outside of the studs; and • one layer of 19mm board cladding fixed to the outside of the channels; and • 6mm fibre cement sheets fixed to the inside of the channels; and • 75mm thick glass or mineral wool insulation with a density of 11 kg/m3 or • 75mm thick polyester insulation with a density of 14 kg/m3, positioned between the studs; and • two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs.
	Single leaf masonry, brick veneer	45	• Single leaf of 150mm brick masonry with 13mm cement render on each face.
		50	Single leaf of 90mm clay brick masonry with – • a row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; and • a cavity of 25mm between leaves; and • 75mm thick glass or mineral wool insulation with a density of 11kg/m3 or 75mm thick polyester insulation with a density of 14kg/m3 positioned between studs; and • one layer of 10mm plasterboard fixed to the inside face.
			Single leaf of 220mm brick masonry with 13mm cement render on each face.
			150mm thick unlined concrete panel.
			200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face.
	Double brick	45	Two leaves of 90mm clay brick masonry with a 20mm cavity between leaves.
		50	Two leaves of 90mm clay brick masonry with – • a 50mm cavity between leaves; and • 50mm thick glass wool insulation with a density of 11kg/m3 or 50mm thick polyester insulation with a density of 14 kg/m3 in the cavity; and • Where wall ties are required to connect leaves, the ties are of the resilient type.
			Two leaves of 110mm clay brick masonry with – • a 50mm cavity between leaves; and • 50mm thick glass wool insulation with a density of 11kg/m3 or 50mm thick polyester insulation with a density of 14 kg/m3 in the cavity.

MINIMUM ACOUSTIC RATING OF GLAZED ELEMENTS

Building Element	Type	Airborne weighted sound reduction rating with traffic correction R_w+C_{tr}, dB	Building element Type Airborne weighted sound
Window, uPVC, aluminium or timber frame	Sliding or double hung opening	23	• 4mm monolithic glass
		26	• Single pane glazing to R_w 33dB • 6mm monolithic or laminated glass • 6mm toughened safety glass • '6-12-6' double insulated glass unit (IGU)
		29	• Single pane glazing to Rw 36dB • 10mm monolithic (aka float) glass • 10mm laminated or toughened safety glass • 6mm-12mm-10mm double insulating
	Fixed sash, awning or casement type opening	26	• 4mm monolithic glass
		31	• Single pane glazing to R_w 33dB • 6mm monolithic or laminated glass • 6mm toughened safety glass • '6-12-6' double insulated glass unit (IGU)
		34	• Single pane glazing to R_w 36dB • 10mm monolithic (a.k.a. float) glass • 10mm laminated or toughened safety glass • 6mm-12mm-10mm double insulated glass unit (IGU)
Single external door, aluminium uPVC or timber frame	Fully glazed sliding door	24	• 6mm monolithic or laminated • 5 or 6mm toughened safety glass
		27	• 10mm monolithic or laminated • 10mm toughened safety glass
	Fully glazed hinged door	28	• Certified R_w 31dB acoustically rated door and frame including seals • 6mm monolithic or laminated • 5 or 6mm toughened safety glass
		31	• Certified R_w 34dB acoustically rated door and frame including seals • 10mm monolithic or laminated • 10mm toughened safety glass
	Solid core timber frame, side hinged	26	• Certified R_w 28dB acoustically rated door and frame system including seals • 35mm solid core timber
		30	• Certified R_w 32dB acoustically rated door and frame system including seals • 40mm solid core timber without glass insert • 40mm solid core timber with not less than 6mm