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SPIRES ESTATE
LOT 772 BALDIVIS ROAD
LOTS 214, 294, 295, 55 & 56 KEROSENE LANE
BALDIVIS

SPP 5.4 ACOUSTIC ASSESSMENT

APRIL 2016

OUR REFERENCE: 20360-2-16084

DOCUMENT CONTROL PAGE

ACOUSTIC ASSESSMENT

SPIRES ESTATE

Job No: 16084

Document Reference: 20360-2-16084

FOR

SPATIAL PROPERTY GROUP

DOCUMENT INFORMATION			
Author:	Tim Reynolds	**Checked By:**	Paul Daly
Date of Issue :	05 April 2016		

REVISION HISTORY				
Revision	**Description**	**Date**	**Author**	**Checked**
1	Revised for client comments	15/04/16	TR	PLD

DOCUMENT DISTRIBUTION				
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CONTENTS

APPENDICIES

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Spatial Property Group to undertake an acoustical assessment of noise received within the proposed Spires Estate residential area, being lot 772 Baldivis Road and lots 294, 295, 55 and 56 Kerosene Lane, Baldivis.

It is noted that the subdivision is bounded on the northern side by Kerosene Lane. However, the future traffic flows are significantly below the threshold for which State planning Policy is applicable. Thus, the acoustic assessment has only be undertaken for Nairn Drive and Baldivis Road. Therefore, as part of the study, the following was carried out:

- Determine by noise modelling of the noise levels that would be received at residences within the development from vehicles travelling on the Baldivis Road and the future Nairn drive.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.4 *"Road and Rail Transportation Noise and Freight Consideration in Land Use Planning"* (SPP 5.4).
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, the local structure 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", the appropriate acoustic criteria for this subdivision would be the "Noise Limits" as described below.

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}

Noise received at an outdoor area, should as close as practicable, aim to achieve an L_{Aeq} of 50 dB(A) during the night period.

Additional to the above external noise levels, SPP 5.4 also lists the following internal acoustic criteria:

Internal

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

Firstly, we note that from previous noise monitoring, for Baldivis Road the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ is less than 5 dB(A). Hence for noise received from Baldivis Road the critical period for compliance is the night period and if compliance with the night period is achieved, then compliance with the day period will also be achieved. However, with regard to the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ for Nairn Road, guidance is taken from the DEFRA publication and using this publication, the difference would be greater than 5 dB(A). Thus for Nairn Road, the critical period for compliance is the day period, for if compliance with the day period is achieved, then compliance with the night period would also be achieved.

With regards to Baldivis Road, the modelling shows that noise received at the adjacent residence comply with the "Noise Limits", but exceed the "Noise Targets" as outlined in SPP 5.4.Thus, to comply with the requirements of SPP 5.4, Package "A" Quiet House Design is required for these residences. Additionally, Notifications on Titles are also required to the first row of residence located adjacent to Baldivis Road, as shown on Figure E1 in Appendix E. It is also recommended that for those residences that either back on to or are side on to Baldivis Road, that a 1.8m high barrier is constructed, as shown on Figure B1 in Appendix B.

The noise modelling indicates that without any noise amelioration, noise received at the residence located adjacent to the future Nairn Road would exceed the "Noise Limit" criteria. For residence located adjacent to Nairn Drive, the following noise mitigation methods are recommended:

- For residence with access roads between the residence and Nairn Drive (ie front of residence facing Nairn Drive) incorporate "Quiet House" design into the design of each residence. In this case Package "B" would be required. In these cases, the residence itself provides a barrier to the back yard, thus noise received at the outdoor area would comply with the required acoustic criteria.

- For residence backing on to Nairn Drive (ie, back yards bounding Nairn Drive), construct a 2.2 metre high barrier at the boundary to Nairn Drive and use Package "A" Quiet House design.

- Additionally, these residences also require Notifications on Titles.

The Lots requiring "Quiet House" design and/or Notification on Titles are shown on Figure E1 in Appendix E.

Given the current structure plan, as attached in Appendix A, the recommended barriers are shown on Figure D1 in Appendix D. Also shown on Figure D1 in Appendix D are those residence requiring "Quiet House" design.

It is noted that under the policy, that for those residences where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles. These residences are also indicated on Figure D1, attached in Appendix D. Information on Packages A and B "Quiet House" design measures are also attached in Appendix E.

Notes:

1 Given the location of the development and the projected market, we understand that 2 storey residences are unlikely, hence the "Quiet House" design requirements outlined above are for single storey residence only. If double storey residences are proposed, then it is recommended that specialist acoustic advice be sought by the proponent.

2 We understand that the development is a structure plan stage, hence the information contained in Appendix D regarding areas requiring "Quiet House" design will need to be refined once the lots have been defined. Additionally, any modifications to the Structure Plan, would vary the noise mitigation requirements relating to barriers and "Quiet House" design outlined in Appendix.

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". Section 5.3 – Noise Criteria, which outlines the acoustic criteria, 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 1 m 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 1 m 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}

Internal

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

Additional to these criteria, noise received at an outdoor area, where practicable, should also achieve an L_{Aeq} of 50 dB(A) during the night period.

4. MONITORING

As part of previous assessments, noise monitoring of Baldivis Road has been carried out and the results of the monitoring are shown on Table 4.1.

TABLE 4.1 – SUMMARY OF 2005 MONITORING

Location	Measured Noise Level (dB(A))		
	$L_{10,18hour}$	$L_{eq,16hour}$	$L_{eq,8hour}$
Baldivis Road	52.6	51.1	47.1

The results of the noise monitoring are shown graphically in Appendix B.

Based on the noise monitoring results, the relationship between the $L_{A10(18\ hour)}$ and the $L_{Aeq(16hour)}$ and $L_{Aeq(8hour)}$ are as listed in Table 4.2.

TABLE 4.2 – RELATIONSHIP BETWEEN ACOUSTIC PARAMETERS

Road	Parameter	Measured Level dB(A)*	Difference between $L_{10(18hour)}$ and $L_{Aeq(parameter)}$ dB(A)
Baldivis Road	$L_{A10\ (18\ hour)}$	52.6	N/A
	$L_{Aeq,\ day\ (6am\ to\ 10pm)}$	51.1	= $L_{A10\ (18\ hour)}$ – 1.4
	$L_{Aeq,\ night\ (10pm\ to\ 6am)}$	47.1	= $L_{A10(18\ hour)}$ – 5.5

* It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.

With regards to the noise monitoring, we note that given the night period noise levels recorded adjacent to Baldivis Road, we believe that the night period L_{Aeq} of 47.1 dB was influenced by other environmental noises (such as wind in trees). Therefore, the assessment of noise received at residence located adjacent to Baldivis Road would be conservative.

5. MODELLING

Current and future road traffic volumes were based on information used in previous noise assessments or as supplied by the client. This and other information relevant to the calculations are shown below in Table 5.1.

TABLE 5.1 - NOISE MODELLING INPUT DATA

Parameter	Value	
	Current	Future
Traffic flows		
Nairn Road	-	20,400
Baldivis Road	2370	14,400
Heavy Vehicles (%)	8.0	

Other input data for the model included:

- Topographical data, with the ground level within the subdivision from information supplied by client;
- For future traffic, as listed in Table 5.1.
- A +2.5 dB adjustment to allow for façade reflection.

To determine the noise that would be received within the development from the surrounding road network, acoustic modelling was carried out using the computer program 'SoundPlan'.

Apart from noise modelling of current road traffic flows to calibrate the noise model for Baldivis Road, the following future traffic flow scenarios were also modelled:

1. Without any noise amelioration.

2. With a 2.2m high barrier at boundary of the road reserve to Nairn Road and a standard 1.8m high side and rear fencing for those residences adjacent to Baldivis Road. The extent of fencing is shown in Appendix D on Figure D1.

We note that noise received at residence located adjacent to Baldivis Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be less than 5 dB(A) and the night period is the critical period for compliance. However, as Nairn Road would be constructed sometime in the future as per the Implementation Guidelines for SPP 5.4, reference is made to the DEFRA publication. Thus based on the DEFRA publication, for Nairn Road the difference between the $L_{A10(18hr(}$ and the $L_{Aeq(8hr)}$ and the $L_{Aeq(16hr)}$ has been determined to be around 10 and 2 dB(A) respectively. Thus, for residence located adjacent to Nairn Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be greater than 5 dB(A) and the day period is the critical period for compliance.

Based on the above, the noise contours for noise the above modelling scenarios are :

Nairn Road – Day period noise contours are attached in Appendix B.

Baldivis Road – Night period noise contours are attached in Appendix C.

6. DISCUSSION / RECOMMENDATION

Under the WAPC State Planning Policy 5.4, for this development, the "Noise Limits" as listed in Table 1 are the appropriate noise levels for to be achieved for this development. Under The SPP 5.4, the "Noise Limits" criteria which are applicable external to a residence are:

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}

The policy states that the outdoor criteria applies to the ground floor level only, however, it also states that noise mitigation measures should be implemented with a view to achieving the "Noise Target" levels in least one outdoor living area. The Policy states the following acceptable internal noise levels:

Internal

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

From previous noise monitoring of Baldivis Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be less than 5 dB(A) and for Baldivis Road the night period is the critical period for compliance. However, with Nairn Road still to be constructed, to determine the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$, guidance is taken from the DEFRA publication and using this publication, the difference would be greater than 5 dB(A). Thus for Nairn Road, the critical period for compliance is the day period.

For this development, compliance with the requirements of SP 5.4, noise modelling and assessment are based on the day period for residence located adjacent to Nairn Road and the night period for these residence located adjacent to Baldivis Road.

With regards to Baldivis Road, the modelling shows that noise received at the adjacent residence would comply with the "Noise Limits", but exceed the "Noise Targets" as outlined in SPP 5.4. Thus to comply with the requirements of SPP 5.4, Package "A" Quiet House design are required for these residence. Additionally, as the noise levels exceed the "Target Noise" levels, Notifications on Titles are still required for this first row of residence. Thus, for residence located adjacent to Baldivis Road, it is recommended that :

- 1.8m high barriers be constructed for those residence that either back on to Baldivis Road, as shown on Figure D1 in Appendix D; and
- Notification on Titles be placed on the Lots as shown on Figure D1 in Appendix D.

The results of the acoustic assessment indicate that noise received at residences located adjacent to Nairn Road would exceed the "Noise Limits" as outlined in SPP 5.4. To comply with the requirements of SPP 5.4, the following noise mitigation methods are recommended :

- For residence with access roads between the residence and Nairn Drive (ie front of residence facing Nairn Drive) incorporate "Quiet House" design into the design of each residence. In this case Package "B" would be required. In these cases, the residence itself provides a barrier to the back yard, thus noise received at the outdoor area would comply with the required acoustic criteria.
- For residence backing on to Nairn Drive (ie, back yards bounding Nairn Drive), construct a 2.2 metre high barrier at the boundary to Nairn Drive and use Package "A" Quiet House design.
- Additionally, these residence also require Notifications on Titles.

Given the current structure plan, as attached in Appendix A, the recommended barriers are shown on Figure D1 in Appendix D. The lots where “Quiet House” design are required are also shown on Figure D1 in Appendix D.

It is noted that under the policy, that for those residences where noise would exceed the “Noise Target”, notification of vehicle noise will need to be stated on the titles. These residences are indicated on Figure D1, attached in Appendix D. Information on Packages A and B “Quiet House” design measures are also attached in Appendix E.

Notes:

1 Given the location of the development and the projected market, we understand that 2 storey residences are unlikely, hence the Quiet House Design is for single storey residence only. If double storey residences are proposed, then it is recommended that specialist acoustic advice be sought by the proponent.

2 We understand that the development is a structure plan stage, hence the information contained in Appendix D regarding areas requiring “Quiet House” design will need to be refined once the lots have been defined. Additionally, any modifications to the Structure Plan, would vary the noise mitigation requirements relating to barriers and “Quiet House” design outlined in Appendix D.

3 The summary of the Quiet House Design Packages are attached in Appendix E, are “Deemed to Satisfy” constructions. Alternative constructions would be acceptable, provided they are supported by an acoustic report prepared by a suitably qualified acoustic consultant.

APPENDIX A

LOCAL STRUCTURE PLAN

N

KEROSENE LANE

NAIRN DRIVE

BALDIVIS ROAD

Lot 772

Lot 294

Lot 55

Lot 1212

Lot 1211

INDICATIVE DESIGN ONLY

Lot 1210

POS/ DRAINAGE

POS / DRAINAGE

POS/ DRAINAGE

Lot 295

Lot 56

POS

LEGEND

- SUBJECT LAND
- EXISTING LOT BOUNDARY
- PROPOSED LOT BOUNDARY

LAND USE

- RESIDENTIAL - R25 (RMD)
- RESIDENTIAL - R25-30 (RMD)
- RESIDENTIAL - R30-40 (RMD)
- PUBLIC OPEN SPACE

ROAD HIERARCHY

- INTEGRATOR A
- INTEGRATOR B
- NEIGHBORHOOD CONNECTOR A
- ACCESS STREET C

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CADASTRAL INFORMATION
SOURCE: WATERCORP
YYMMDD:
DWG REF:
PROJECTION: MGA94

SIZE A3

1:4000

0 metres 40 80 120 160 200

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
C	ROAD HIERARCHY	160127	RF	ED/DP
B	UPDATED DESIGN	160104	RF	DP
A	LOCAL STRUCTURE PLAN	151214	RF	DP

LOCAL STRUCTURE PLAN

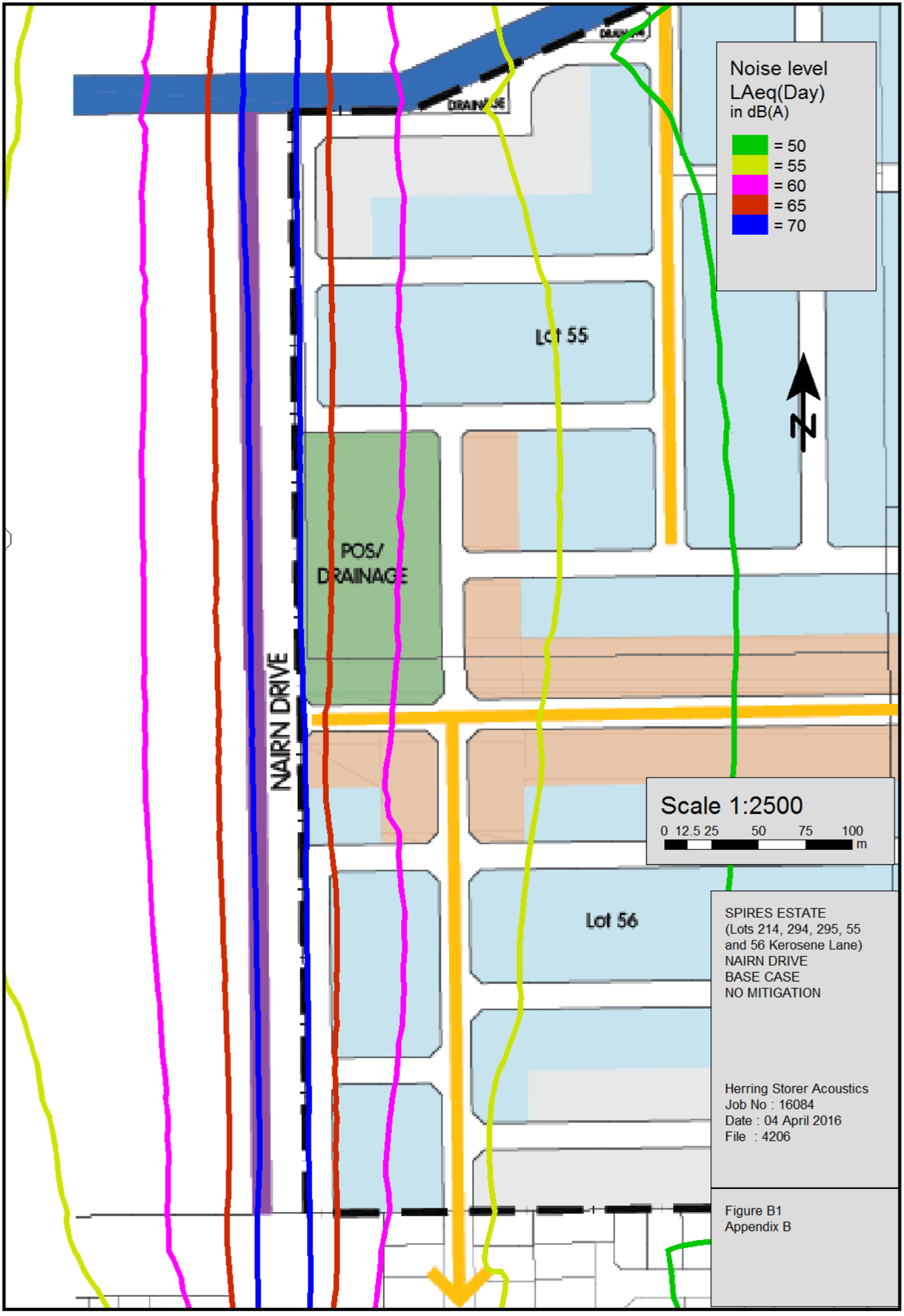
Lots 55, 56, 294 & 295 Kerosene Lane

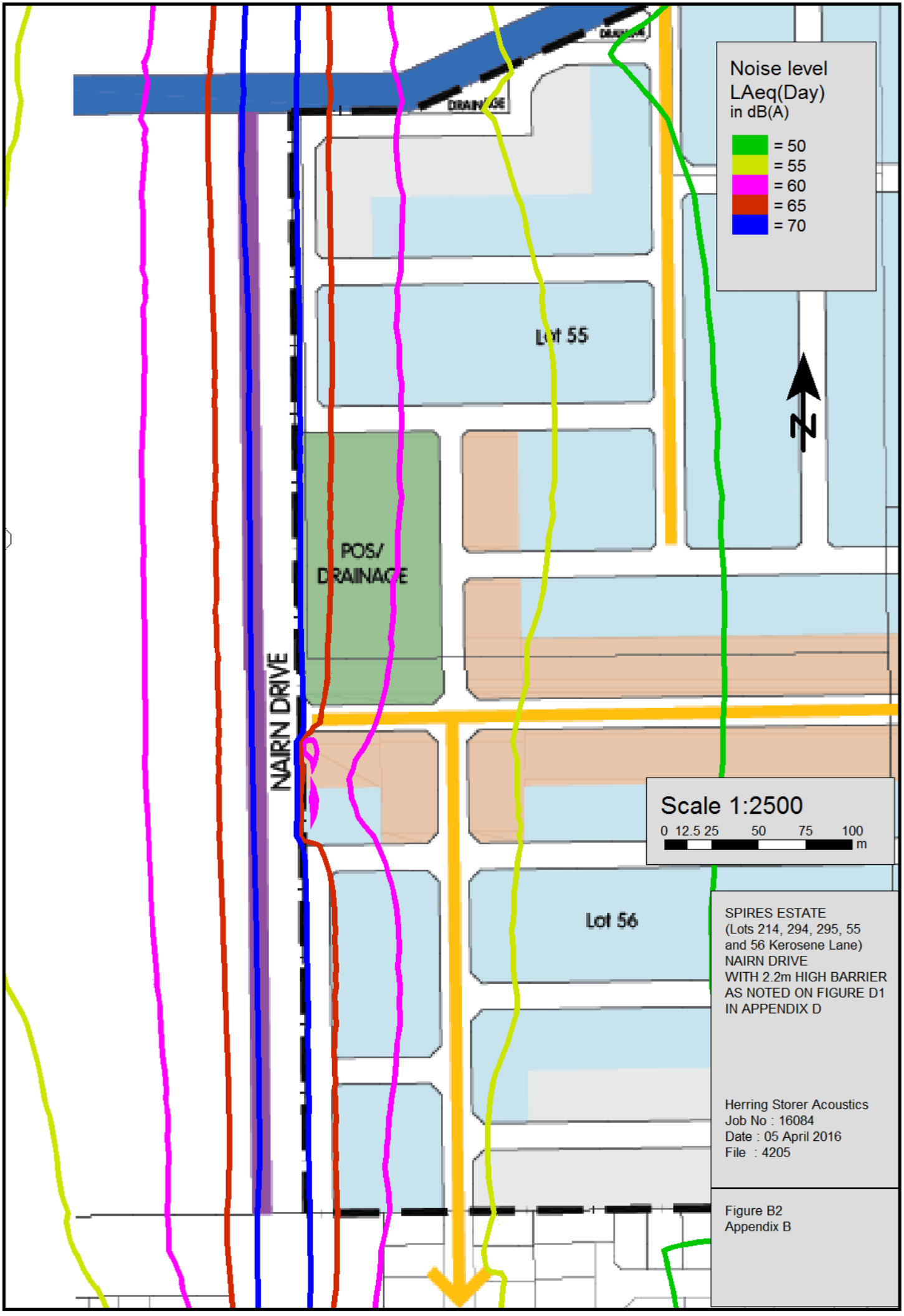
Baldivis

REF NO.	DRAW NO.	REV.
CGC NBA	**RD1 200**	**C**

APPENDIX B

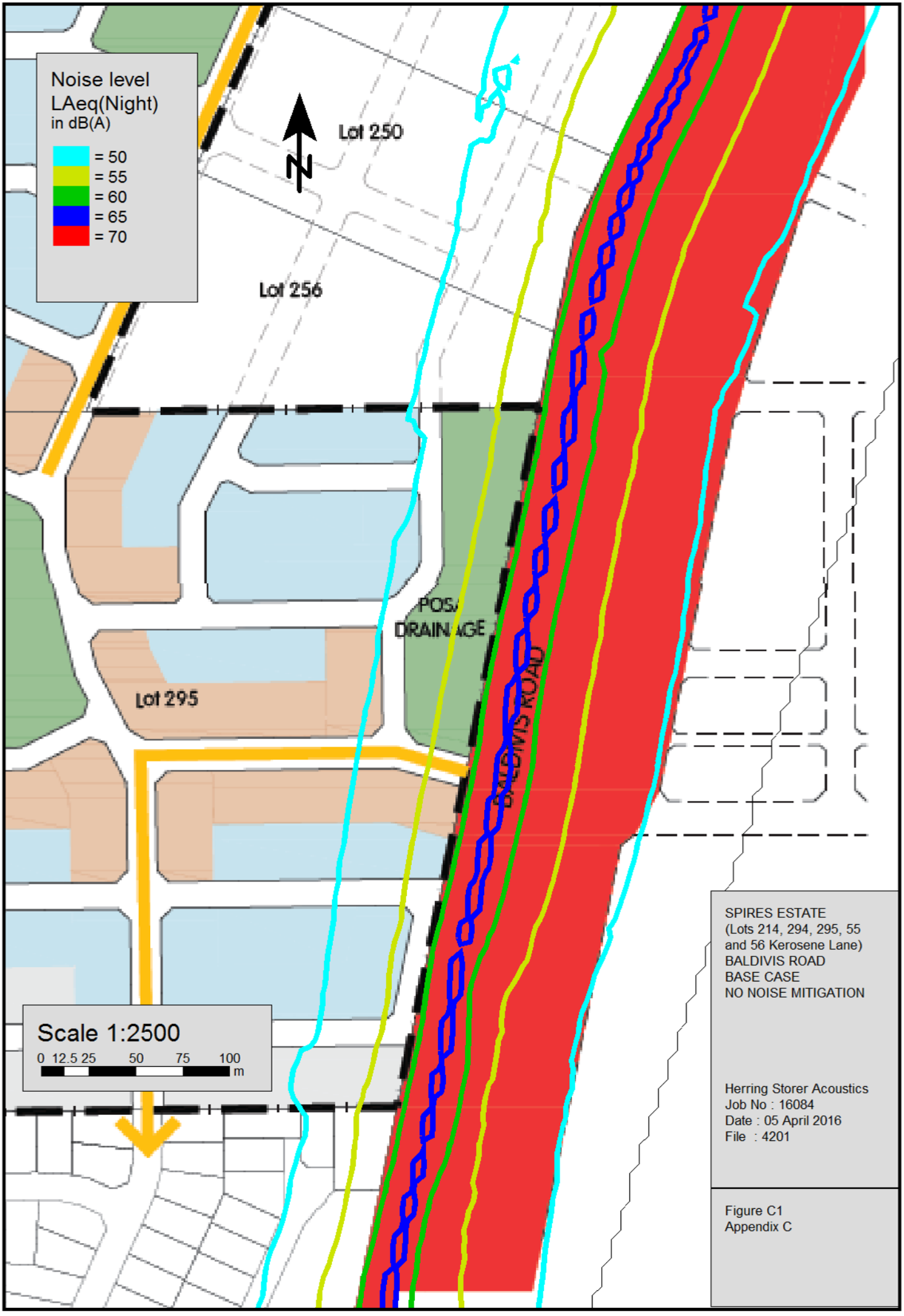
FIGURES B1 TO B2
$L_{Aeq(16hr)}$ NOISE CONTOURS FOR NAIRN ROAD

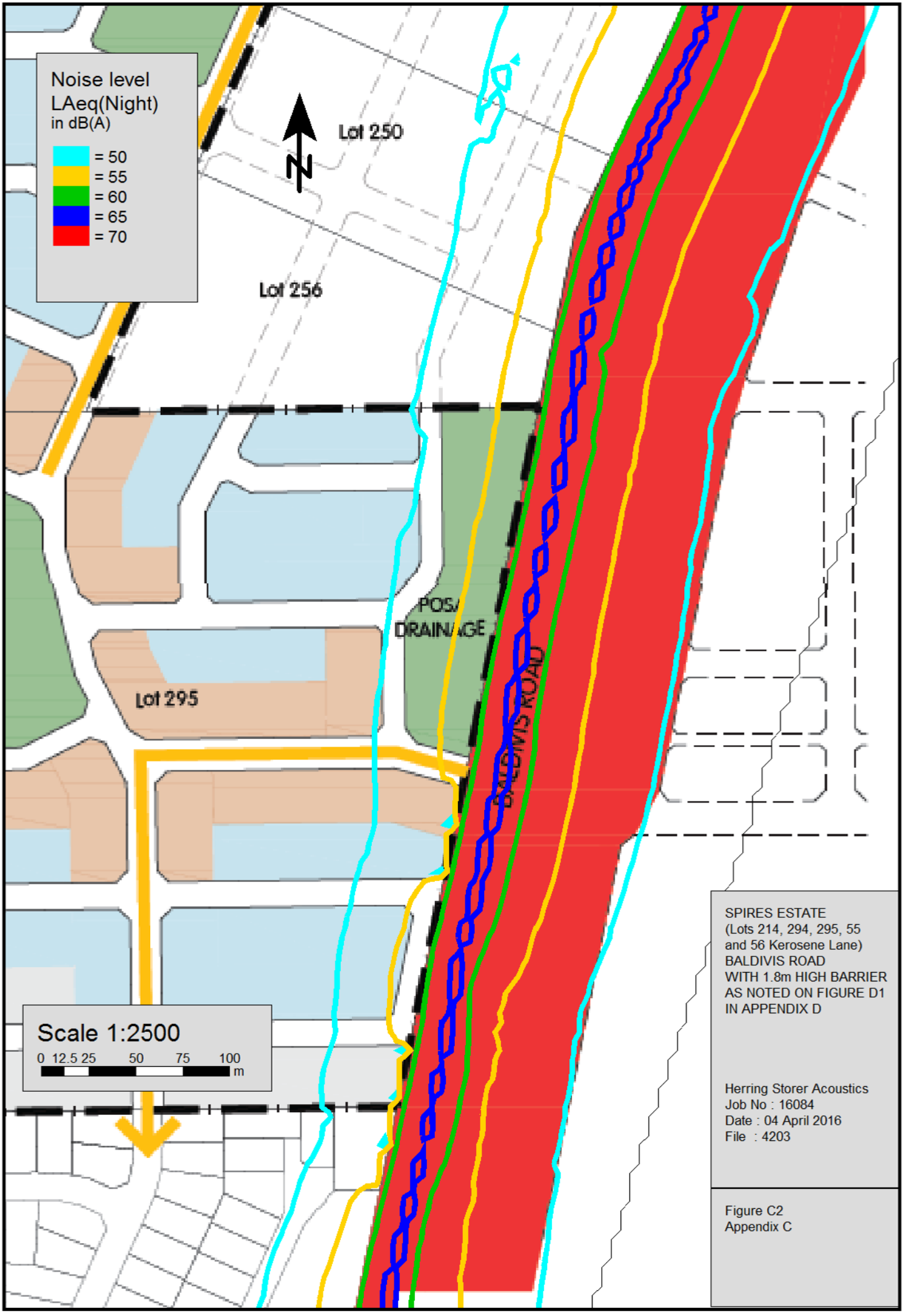

Noise level
LAeq(Day)
in dB(A)
= 50
= 55
= 60
= 65
= 70
Lot 55
POS/
DRAINAGE
NAIRN DRIVE
N
Scale 1:2500
0 12.5 25 50 75 100
m
Lot 56
SPIRES ESTATE
(Lots 214, 294, 295, 55
and 56 Kerosene Lane)
NAIRN DRIVE
BASE CASE
NO MITIGATION
Herring Storer Acoustics
Job No : 16084
Date : 04 April 2016
File : 4206
Figure B1
Appendix B


Noise level
LAeq(Day)
in dB(A)
= 50
= 55
= 60
= 65
= 70
Lot 55
POS/
DRAINAGE
NAIRN DRIVE
N
Scale 1:2500
0 12.5 25 50 75 100
m
Lot 56
SPIRES ESTATE
(Lots 214, 294, 295, 55
and 56 Kerosene Lane)
NAIRN DRIVE
WITH 2.2m HIGH BARRIER
AS NOTED ON FIGURE D1
IN APPENDIX D
Herring Storer Acoustics
Job No : 16084
Date : 05 April 2016
File : 4205
Figure B2
Appendix B

APPENDIX C

FIGURES C1 TO C2
$L_{Aeq(8hr)}$ NOISE CONTOURS FOR BALDIVIS ROAD


Noise level
LAeq(Night)
in dB(A)
= 50
= 55
= 60
= 65
= 70
N
Lot 250
Lot 256
Lot 295
POS
DRAIN AGE
BALDIVIS ROAD
Scale 1:2500
0 12.5 25 50 75 100
m
SPIRES ESTATE
(Lots 214, 294, 295, 55
and 56 Kerosene Lane)
BALDIVIS ROAD
BASE CASE
NO NOISE MITIGATION
Herring Storer Acoustics
Job No : 16084
Date : 05 April 2016
File : 4201
Figure C1
Appendix C


Noise level
LAeq(Night)
in dB(A)
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= 55
= 60
= 65
= 70
N
Lot 250
Lot 256
POS/
DRAIN/GE
Lot 295
BALDIVIS ROAD
Scale 1:2500
0 12.5 25 50 75 100
m
SPIRES ESTATE
(Lots 214, 294, 295, 55
and 56 Kerosene Lane)
BALDIVIS ROAD
WITH 1.8m HIGH BARRIER
AS NOTED ON FIGURE D1
IN APPENDIX D
Herring Storer Acoustics
Job No : 16084
Date : 04 April 2016
File : 4203
Figure C2
Appendix C

APPENDIX D

LOTS REQUIRING “QUIET HOUSE” DESIGN AND NOTIFICATIONS

N

KEROSENE LANE

DRAINAGE

DRAINAGE

Lot 214

Package B and Notification to Titles for first row of residence

POS/ DRAINAGE

Lot 268

Lot 294

Lot 250

Lot 55

Lot 256

Package A and Notification to Titles

POS/ DRAINAGE

NAIRN DRIVE

POS

POS/ DRAINAGE

Notification to Titles

Lot 295

BALDIVIS ROAD

Lot 56

2.2m barrier to Nairn Drive

1.8m barrier to Baldivis Road

POS

Package A and Notification to Titles

Package B and Notification to Titles for first row of residence

Notification to Titles

LEGEND

SUBJECT LAND

EXISTING LOT BOUNDARY

PROPOSED LOT BOUNDARY

LAND USE

RESIDENTIAL - R25 (RMD)

RESIDENTIAL - R25-30 (RMD)

LOTS REQUIRING BARRIERS, QUIET HOUSE DESIGN and NOTIFICATION ON TITLES

Herring Storer Acoustics
Date : 15 April 2016
Job No : 16084

Figure D1
Appendix D

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CADASTRAL INFORMATION
SOURCE: WATERCORP
YYMMDD:
DWG REF:
PROJECTION: MGA94

SIZE A3

1:4000

0 metres 40 80 120 160 200

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
A	LOCAL STRUCTURE PLAN	151214	RF	DP

LOCAL STRUCTURE PLAN
Lots 214, 294, 295, 55 & 56 Kerosene Lane
Baldivis

REF NO.	DRAW NO.	REV.
CGC NBA	**RD1 200**	**A**

APPENDIX E

"QUIET HOUSE" DESIGN – GENERAL INFORMATION

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	Package C L_{Aeq},Day up to 65dB L_{Aeq},Night up to 60dB
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	• 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	• Walls to R_w+C_{tr} 50dB • Windows and external door systems: Minimum R_w+C_{tr} 34dB (Table 6.4), total glazing area limited to 40% of room floor area [if 20% of floor area or less, R_w+C_{tr} 31dB] • Roof and ceiling to R_w+C_{tr} 40dB (2 layers 10mm plasterboard) • Mechanical ventilation as per Section 6.3.1
	Side-on	•As above, except glazing Rw+Ctr values for each package may be 3dB less, or max % area increased by 20%		
	Opposite	• No requirements • As per Package A 'Side On' • As per Package A 'Facing'	• No requirements • As per Package A 'Side On' • As per Package A 'Facing'	• No requirements • As per Package A 'Side On' • As per Package A 'Facing'
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	• 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	• 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%] • External doors other than glass doors to R_w+C_{tr} 30dB (Table 6.4) • Mechanical ventilation as per Section 6.3.1
	Side-on	• As above, except the glazing R_w+C_{tr} values for each package may be 3dB less, or max % area increased by 20%		
	Opposite	• No requirements	• As per Package A 'Side On'	• As per Package A 'Facing'
Other indoor areas	Any	• No requirements	• No requirements	• No requirements
Outdoor living areas	Any (Section 6.2.3)	• As per Package C, and/or • At least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2 metres height above ground level	• As per Package C, and/or • At least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2.4 metres height above ground level	• At least one outdoor living area located on the opposite side of the building from the transport corridor

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