LOTS 2 & 3 ANKETELL ROAD, ANKETELL

SUBDIVISION ACOUSTIC ASSESSMENT

FOR

TERRANOVIS

JUNE 2020

OUR REFERENCE: 23699-2-16150-05

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DOCUMENT CONTROL PAGE

ACOUSTIC ASSESSMENT

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ANKETELL

Job No: 16150-05
Document Reference: 23699-2-16150-05

FOR

TERRANOVIS

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Date of Issue :	29 June 2020		

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EXECUTIVE SUMMARY

Herring Storer Acoustics was commissioned by Terranovis to undertake an acoustical assessment of noise that would be received at the proposed residential development located at Lots 2 and 3 Anketell Road, Anketell from road traffic noise associated with the future Anketell Road.

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.

From information provided, we understand that Anketell Road may, in the future, undergo a re-alignment, which would affect noise levels onto the development. Therefore, this report considers noise level associated with the proposed future road alignment.

The modification to Anketell Road would be considered as major upgrade and hence the infrastructure provided is obliged to achieve compliance with the "Noise Limits" at the ground floor. This normally requires the infrastructure provider to construct the barrier walls. However, in this case, as outlined in the policy under Section 5.3.2 where a major road project is to be constructed in the vicinity of a future noise sensitive land use, the infrastructure provider and developer are both responsible for ensuring that the objectives of this policy are achieved. Similarly, for an upgrade to Anketell Road, the infrastructure provider would be responsible for achieving compliance with the "Noise Limits", which in this case would be the use of a dense graded asphalt road surface. However, once again, discussions should take place between the infrastructure provider and the developer to ensure that a mutually beneficial noise management plan is developed and implemented.

The results of the acoustic assessment indicate that without any noise amelioration, noise received at the residences in the future would exceed the "Noise Limits" as outlined in the Western Australian Planning Commission (WAPC) Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning".

For residential developments, the possible noise amelioration options that are normally considered are:

- Noise bunds and / or barriers; and
- "Quiet House" design applied to the first row of residences.

For this proposal, the first row of Lots located adjacent to Anketell Road are to contain commercial uses. These buildings would provide a significant barrier to the residential lots behind, hence reducing the requirement for noise amelioration. Alternative noise levels have also been provided for these residential locations if the commercial development is not in place. This allows for alternative construction requirement s for quiet house design prior to the commercial build form providing a barrier.

Individual noise control in the form of “Quiet House” design has been developed for individual lots with the details contained within this report. Alternative construction would be possible if a suitably qualified acoustical consultant assessed the individual building requirements at the time of building licence approval.

1. INTRODUCTION

Herring Storer Acoustics were commissioned by Terranovis to carry out an acoustical assessment of noise received at the subdivisional stage of the residential development located at Lot 2 and 3 Anketell Road, Anketell.

Lots 2 and 3 Anketell Road are identified in the Anketell North Local Structure Plan (LSP) as being commercial land use. Application under a scheme amendment is being sought to sub divide these lots as both commercial and residential. This acoustic study has been undertaken to assess the suitability of residential premises in these lots and provide recommendations in regard to noise amelioration.

As the built form of the commercial premises at the façade Lots to Anketell Road is unknown, an alternative assessment has been conducted to included noise amelioration for residential housing, prior to the completion of any commercial development.

As part of the study, the following was carried out:

- Measure existing noise levels at the proposed development site, from noise associated with the current Anketell Road traffic.
- Determine by noise modelling, the noise that would be received at proposed residences within this stage of the scheme amendment from vehicles travelling on the roadway (Anketell Road) for the future road alignment.
- Assess the predicted noise levels for compliance with the appropriate criteria.
- Provide detailed information as to noise control requirements such as quiet house design, noise walls and notification on titles.

2. CRITERIA

The 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 the 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.

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.

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.

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.

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).

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. NOISE MONITORING

Noise monitoring was undertaken at the boundary of the proposed development between the 27th June and the 4th July 2016. From these measurements, the noise received at the development from vehicles travelling along Anketell Road was determined.

The results of the noise data logging are summarised in Table 3.1 with the graphical data contained in Appendix D.

TABLE 3.1 – DETERMINATION OF TRANSPORTATION NOISE AT LOGGERS, dB(A)

Location	$L_{A10\ 18hr}$	$L_{Aeq(day)}$	$L_{Aeq(night)}$
Boundary of Development (7 metres from the road edge)	71.0	69.2	62.2

Based on the noise monitoring, the calculated difference between the $L_{A10,18hour}$ and $L_{Aeq,8hour}$, and the $L_{Aeq10,18hr}$ and $L_{Aeq,16\ hr}$ is -8.8 and -1.8 dB respectively. As the difference between day and night L_{Aeq} noise levels is greater than 5 dB(A) (i.e. 7 dB(A)), hence, the day period is the critical period for compliance.

4. MODELLING

To determine the requirements of any noise amelioration, acoustic modelling was carried out using the computer program 'SoundPlan'. Acoustic modelling was carried out for road traffic flows 20 years in the future.

TABLE 4.1 - NOISE MODELLING INPUT DATA

Parameter	Current Anketell Road (2016)	Future Anketell Road (2031)
Traffic flows	*7,226 vpd	#20,000 vpd
Heavy Vehicles (%)	19.6%	19.6%
Speed Limit (km/hr)	80/110	80/110
Road Surface	Chip Seal	Chip Seal
Façade Correction	+2.5 dB(A)	+2.5 dB(A)

*as per Transcore traffic report ref *t10.007.mr.r01f.doc*

As provided by City of Kwinana and Dept of Planning

Noise modelling was carried out for noise received within the development for current traffic volumes and road alignment to calibrate the noise model.

Advice has been provided by WAPC, MRWA and City of Kwinana that there is to be a major upgrade of Anketell Road in the future. This upgrade will likely align the road closer to the development boundary. Advice was also sought on the projected future traffic volumes, with the values shown in Table 4.1 above.

Based on the above information the following scenarios have been considered:

Scenario 1 – Future road alignment with future traffic volumes, no noise control (Appendix B Figure B1).

Scenario 2 – Future road alignment with future traffic volumes, with a 1.8 metre noise wall (minimum of 15kg/m^2 surface density) at the boundary of the residential Lots and residential building (Appendix B Figure B2).

Scenario 3 - Future road alignment with future traffic volumes, with a 1.8 metre wall (minimum of 15kg/m^2 surface density) at the boundary of the residential Lots commercial buildings in Lot 2 & 3 and residential buildings (Appendix B Figure B3).

Whilst there is no detail or design on the future alignment general information has been provided, with the proposed future roadway noted on the City of Kwinana's Indian Ocean Gateway.

5. TRAFFIC NOISE ASSESSMENT

Under the WAPC State Planning Policy 5.4, for this development, the Noise Limits as listed in Table 1 are the appropriate noise levels to be achieved. Based on the noise monitoring, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be greater than 5 dB(A). Therefore, if compliance with the day period noise limit is achieved, then compliance with the night period noise limits would also be achieved. 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 target levels in least one outdoor living area.

For residential premises, the Policy states that residence should be designed to meet the following acceptable internal noise levels:

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

The results of the acoustic assessment indicate that noise received at the proposed residential lots located adjacent to the future Anketell Road, without any commercial development, could exceed the above acoustic criteria. In the worst case location, the level of exceedance would be approximately 7 dB(A).

Therefore, predictive noise modelling was conducted with the inclusion of the built-form commercial buildings to assess the barrier of these façade structures. Table 5.1 details the noise level for each proposed residential Lot.

TABLE 5.1 – DEVELOPMENT NOISE LEVELS (GROUND FLOOR)

Scenario 2: Future Traffic Volumes – Future Road Alignment with Noise Wall and Future Residential and Commercial Building								
Location	**L_{AeqDay}**	**Requirements**	**Location**	**L_{AeqDay}**	**Requirements**	**Location**	**L_{AeqDay}**	**Requirements**
Lot 101	57	A,N	Lot 142	53	Nil	Lot 222	53	Nil
Lot 102	57	N	Lot 143	53	Nil	Lot 223	53	Nil
Lot 103	50	Nil	Lot 144	53	Nil	Lot 224	54	Nil
Lot 104	50	Nil	Lot 145	53	Nil	Lot 225	53	Nil
Lot 105	50	Nil	Lot 146	53	Nil	Lot 226	53	Nil
Lot 106	51	Nil	Lot 147	51	Nil	Lot 227	55	N
Lot 107	53	Nil	Lot 148	51	Nil	Lot 228	53	Nil
Lot 108	53	Nil	Lot 149	51	Nil	Lot 229	54	Nil
Lot 109	53	Nil	Lot 150	51	Nil	Lot 230	57	N
Lot 110	53	Nil	Lot 151	51	Nil			
Lot 111	53	Nil	Lot 152	51	Nil			
Lot 133	60	A,N	Lot 153	51	Nil			
Lot 134	60	A,N	Lot 154	51	Nil			
Lot 135	59	N	Lot 155	51	Nil			
Lot 136	58	N	Lot 156	51	Nil			
Lot 137	55	N	Lot 157	51	Nil			
Lot 138	54	Nil	Lot 158	51	Nil			
Lot 139	54	Nil	Lot 159	51	Nil			
Lot 140	53	Nil	Lot 160	52	Nil			
Lot 141	53	Nil	Lot 221	55	A,N			

Note: Nil No Requirements
N Notification on Title
A Package A Quiet House Design
B Package B Quiet House Design
C Package C Quiet House Design

Hence, to comply with the Policy, the following options have been provided:

- Rear Lots – Combination of Quiet House Design and Notification on Titles

As the first row of lots located adjacent to the Anketell Road are to contain multi storey commercial, these buildings would provide a significant barrier to the residential lots behind, hence negating the requirement for any further noise amelioration.

Rear lots are protected by the façade commercial buildings at the entrance. These lots generally only require treatment on the eastern and western boundaries and where noted, require notification on titles.

Note : For information, the Quiet House requirements, without the development of the commercial premises, are also shown in Appendix C.

The modification to Anketell Road would be considered as major upgrade and hence the infrastructure provided is obliged to achieve compliance with the “Noise Limits” at the ground floor. This normally requires the infrastructure provider to construct the barrier walls. However, in this case as, as outlined in the policy under Section 5.3.2 where a major road project is to be constructed in the vicinity of a future noise sensitive land use, the infrastructure provider and developer are both responsible for ensuring that the objectives of this policy are achieved. Similarly, for an upgrade to Anketell Road, the infrastructure provider would be responsible for achieving compliance with the “Noise Limits”, which in this case would be the use of a dense graded asphalt road surface. However, once again, discussions should take place between the infrastructure provider and the developer to ensure that a mutually beneficial noise management plan is developed and implemented.

Individual noise control in the form of “Quiet House” design has been developed for individual lots with the details contained in Appendix C. Alternative construction would be possible if a suitably qualified acoustical consultant assessed the individual building requirements at the time of building licence approval.

APPENDIX A

FIGURE A1 – SITE LAYOUT

FIGURE A1 – SITE LAYOUT

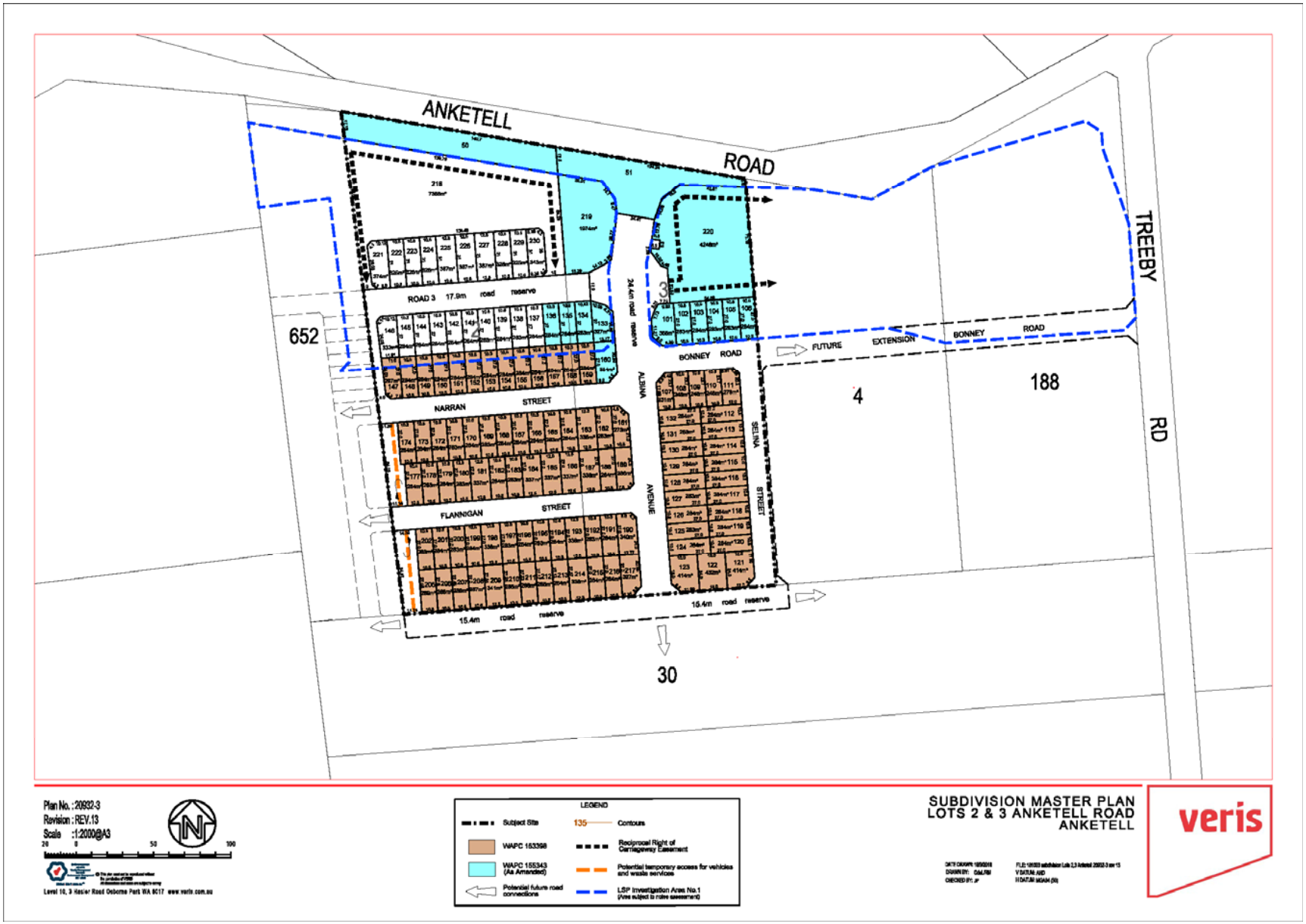


FIGURE A2 – SITE LAYOUT

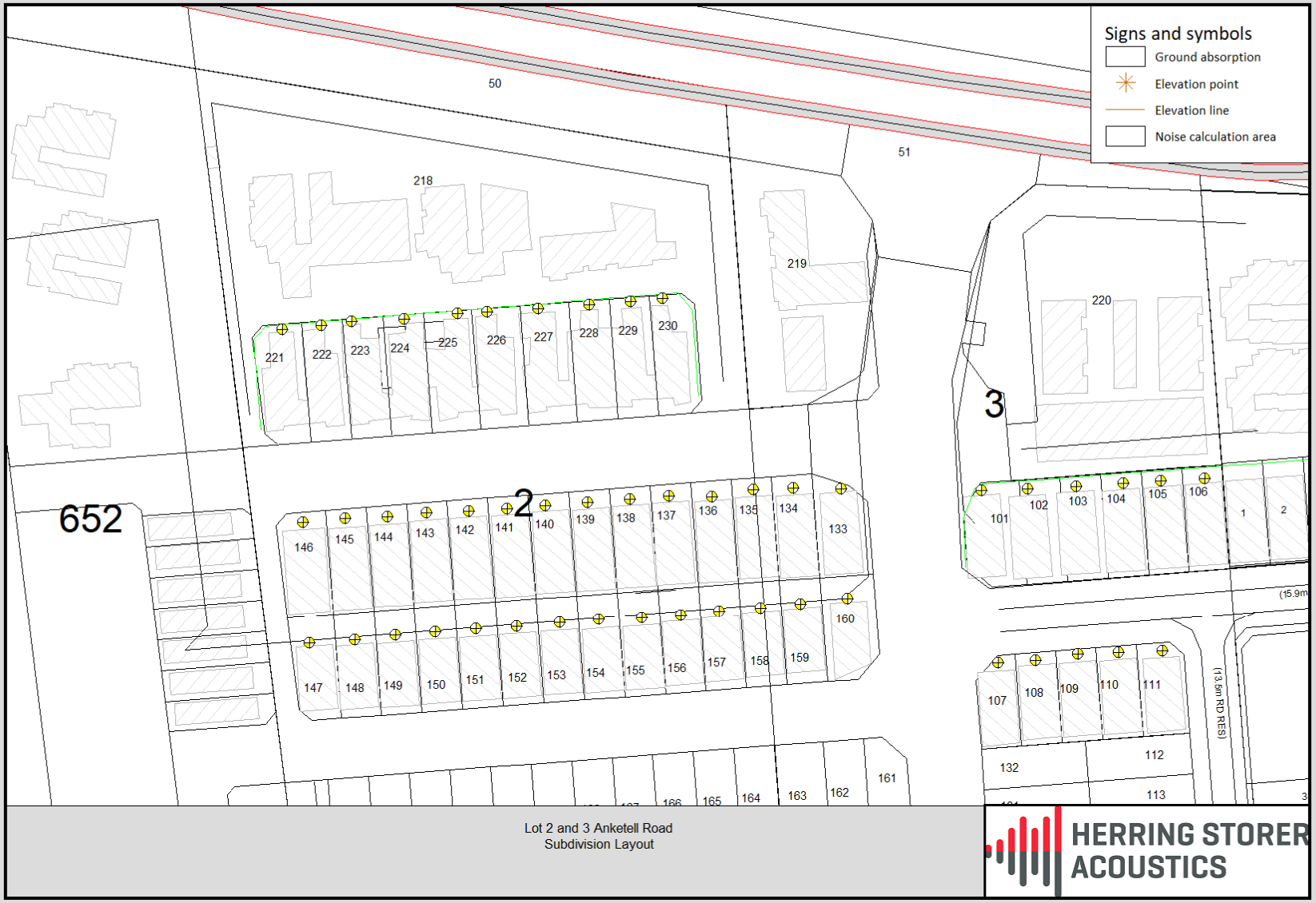
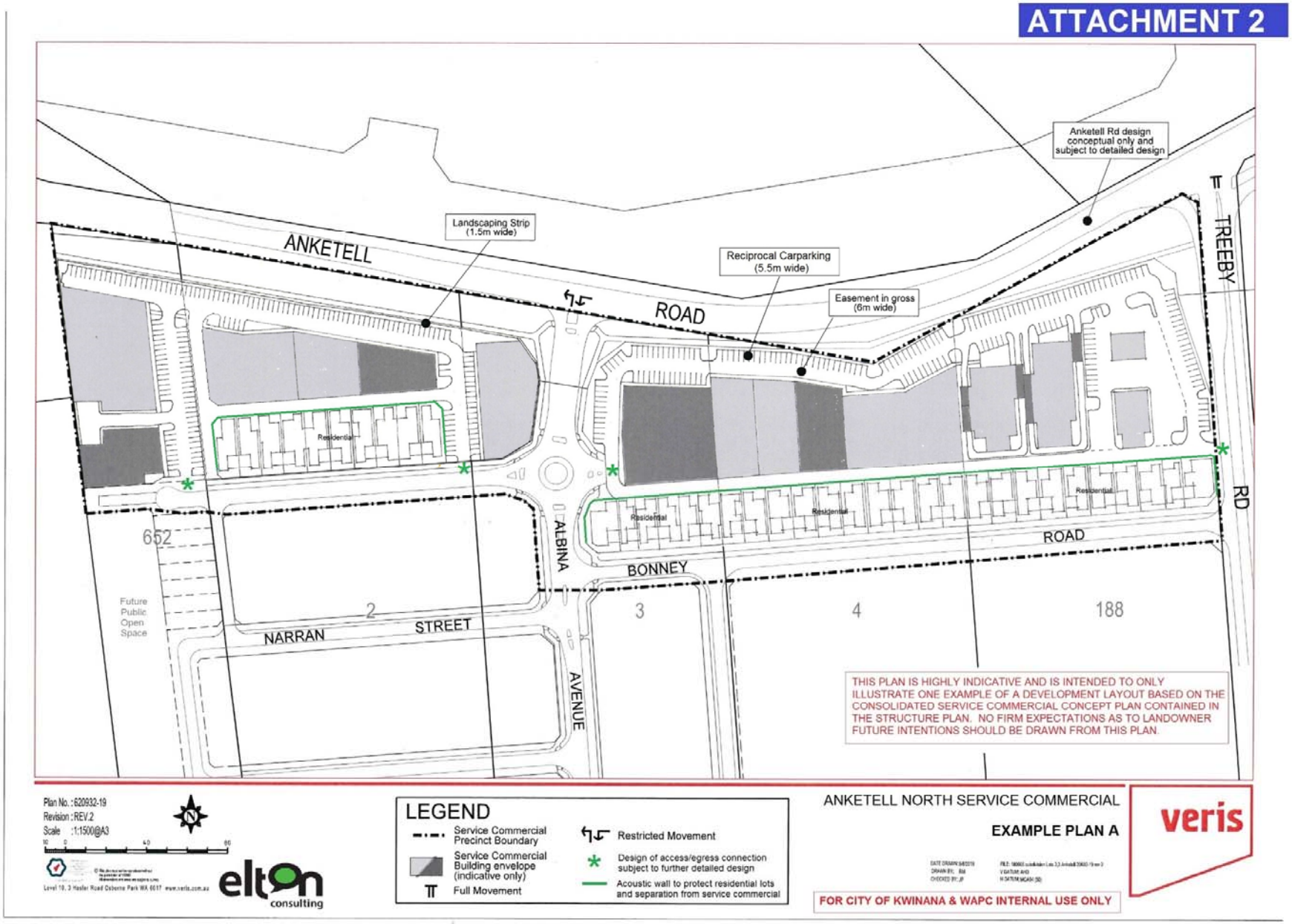
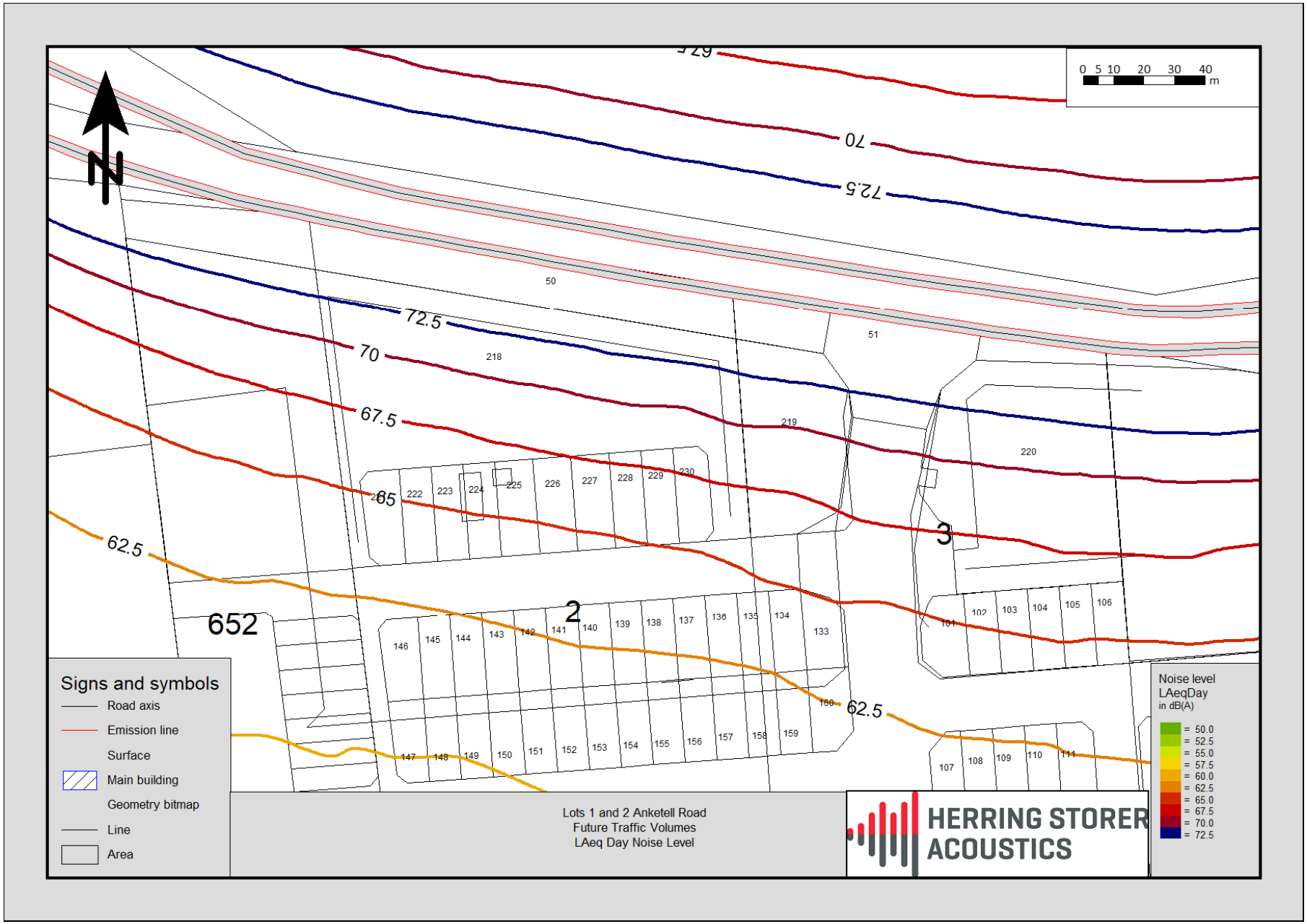


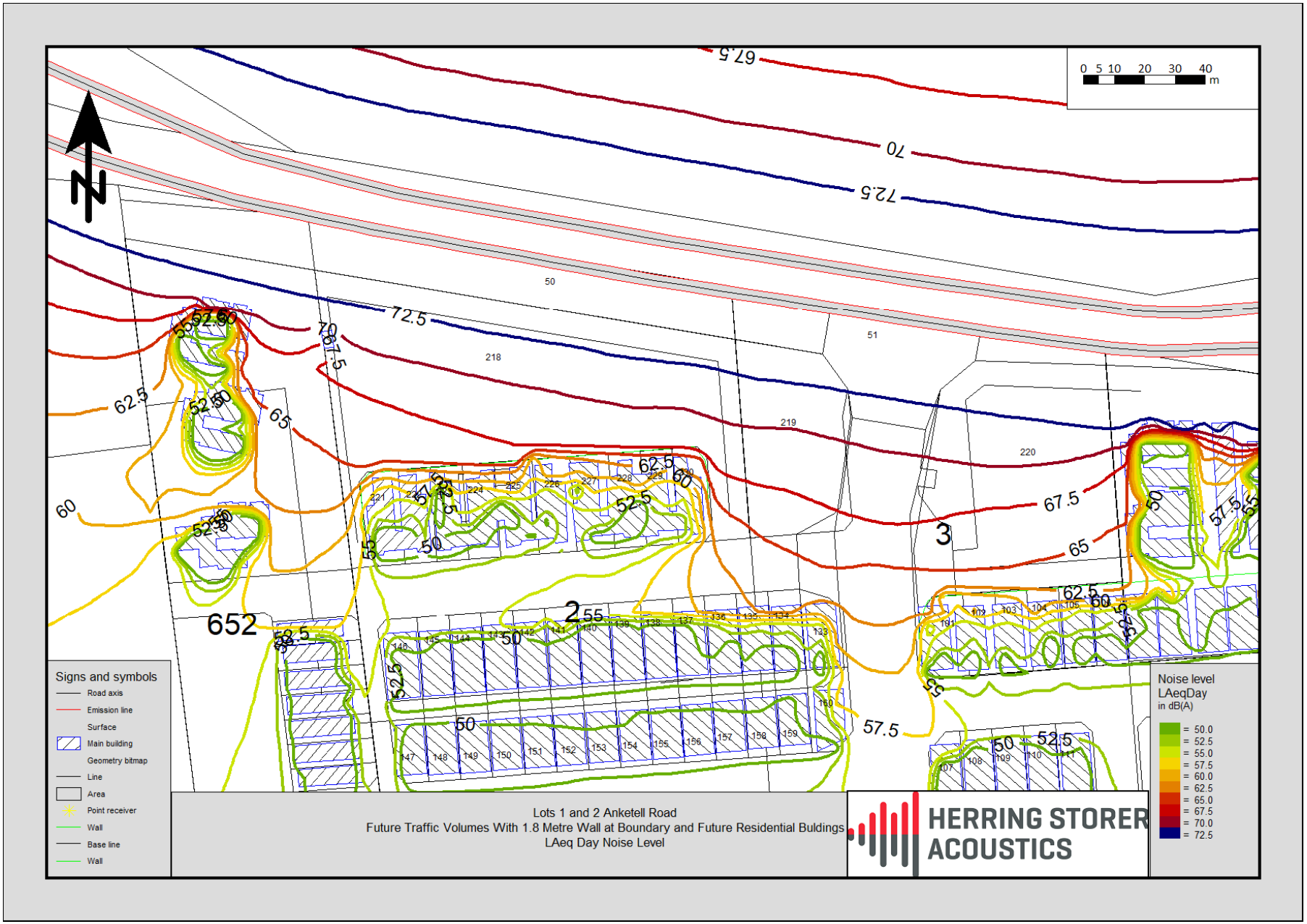
FIGURE A3 – LOT 2 and 3 CONCEPT DESIGN (FUTURE COMMERCIAL)



APPENDIX B

NOISE CONTOURS PLOT


0 5 10 20 30 40
m
N
72.5
70
67.5
65
62.5
652
2
3
Signs and symbols
Road axis
Emission line
Surface
Main building
Geometry bitmap
Line
Area
Noise level
LAeqDay
in dB(A)
= 50.0
= 52.5
= 55.0
= 57.5
= 60.0
= 62.5
= 65.0
= 67.5
= 70.0
= 72.5
Lots 1 and 2 Anketell Road
Future Traffic Volumes
LAeq Day Noise Level
HERRING STORER
ACOUSTICS


0 5 10 20 30 40
m
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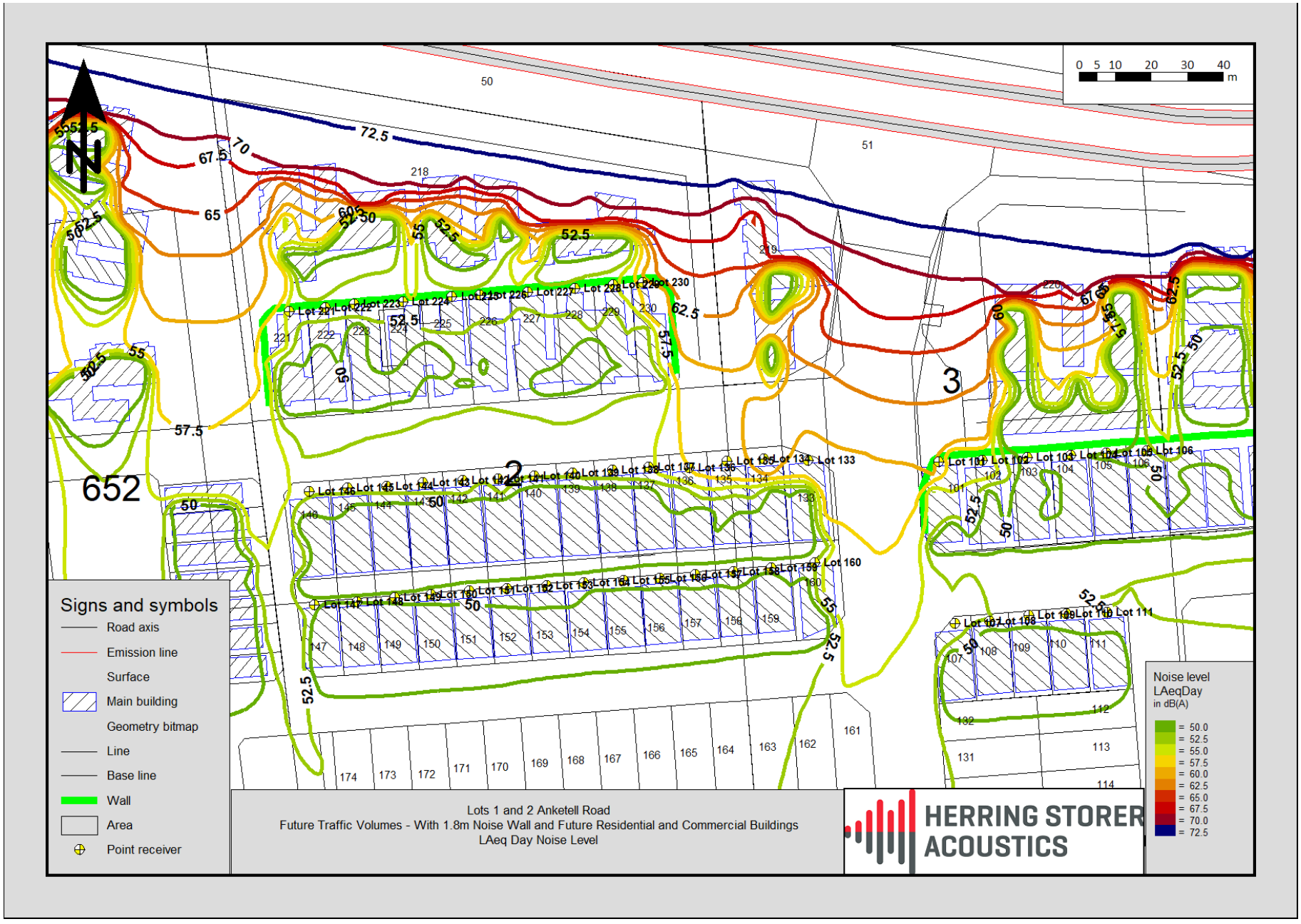
Signs and symbols
Road axis
Emission line
Surface
Main building
Geometry bitmap
Line
Area
Point receiver
Wall
Base line
Wall
Noise level
LAeqDay
in dB(A)
= 50.0
= 52.5
= 55.0
= 57.5
= 60.0
= 62.5
= 65.0
= 67.5
= 70.0
= 72.5
Lots 1 and 2 Anketell Road
Future Traffic Volumes With 1.8 Metre Wall at Boundary and Future Residential Buldings
LAeq Day Noise Level
HERRING STORER
ACOUSTICS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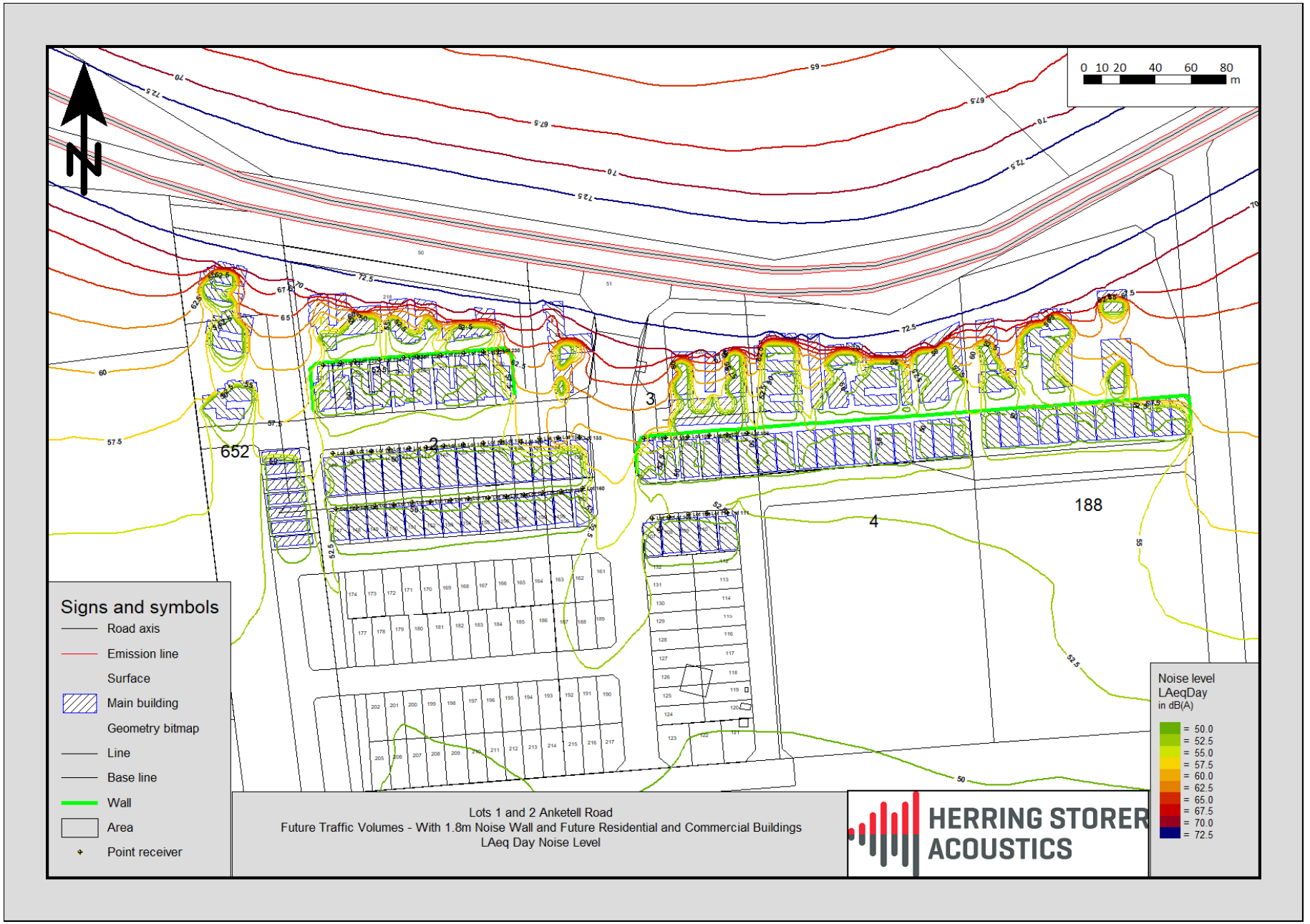
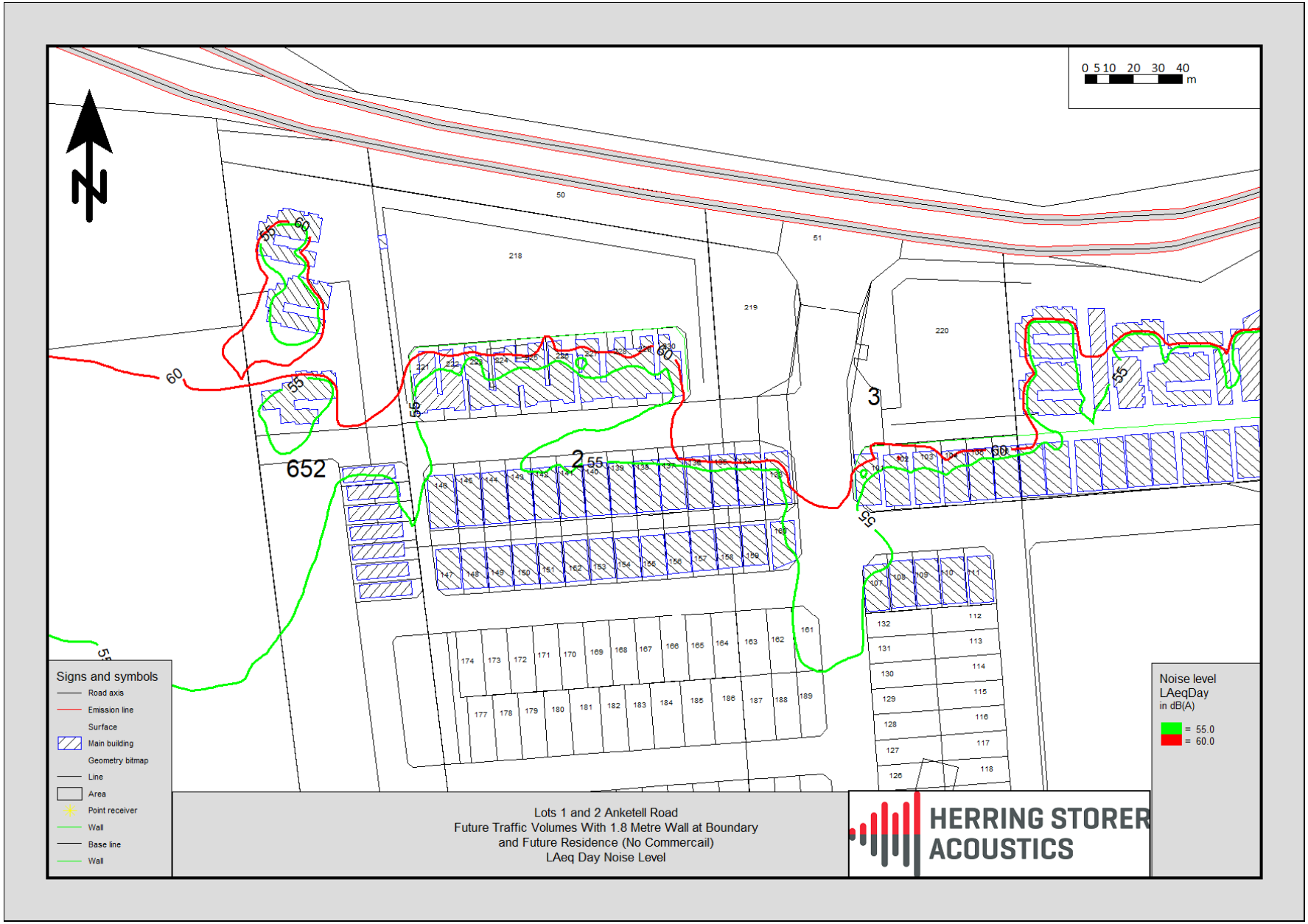
Signs and symbols
Road axis
Emission line
Surface
Main building
Geometry bitmap
Line
Base line
Wall
Area
Point receiver
Noise level
LAeqDay
in dB(A)
= 50.0
= 52.5
= 55.0
= 57.5
= 60.0
= 62.5
= 65.0
= 67.5
= 70.0
= 72.5
652
Lots 1 and 2 Anketell Road
Future Traffic Volumes - With 1.8m Noise Wall and Future Residential and Commercial Buildings
LAeq Day Noise Level
HERRING STORER ACOUSTICS


0 10 20 40 60 80 m
N
652
2
3
4
188
Signs and symbols
Road axis
Emission line
Surface
Main building
Geometry bitmap
Line
Base line
Wall
Area
Point receiver
Noise level
LAeqDay
in dB(A)
= 50.0
= 52.5
= 55.0
= 57.5
= 60.0
= 62.5
= 65.0
= 67.5
= 70.0
= 72.5
Lots 1 and 2 Anketell Road
Future Traffic Volumes - With 1.8m Noise Wall and Future Residential and Commercial Buildings
LAeq Day Noise Level
HERRING STORER ACOUSTICS

APPENDIX C

QUIET HOUSE DESIGN GUIDELINES


0 5 10 20 30 40
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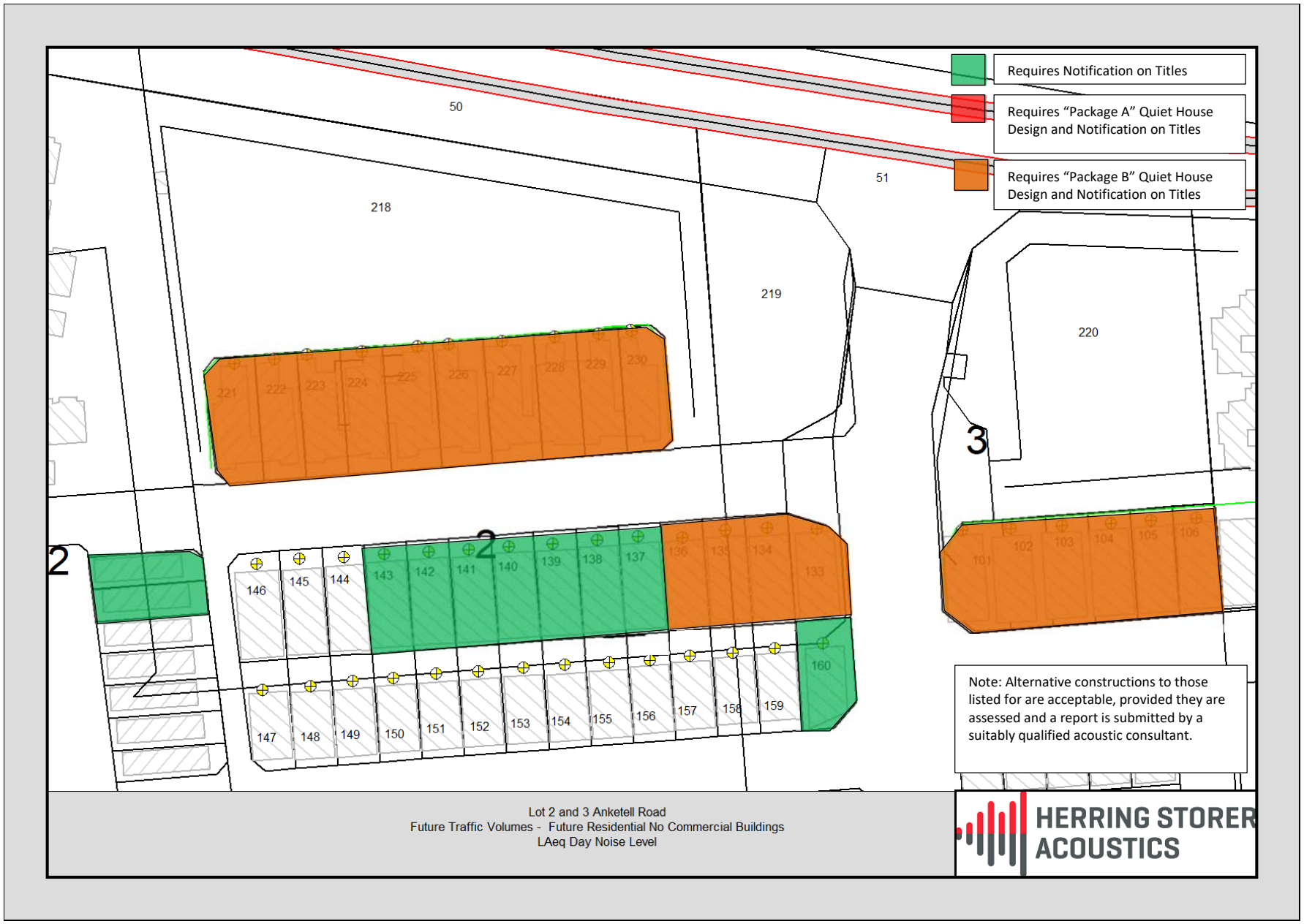
652
Signs and symbols
Road axis
Emission line
Surface
Main building
Geometry bitmap
Line
Area
Point receiver
Wall
Base line
Wall
Noise level
LAeqDay
in dB(A)
= 55.0
= 60.0
Lots 1 and 2 Anketell Road
Future Traffic Volumes With 1.8 Metre Wall at Boundary
and Future Residence (No Commercail)
LAeq Day Noise Level
HERRING STORER
ACOUSTICS


Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Requires "Package B" Quiet House Design and Notification on Titles
50
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218
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222
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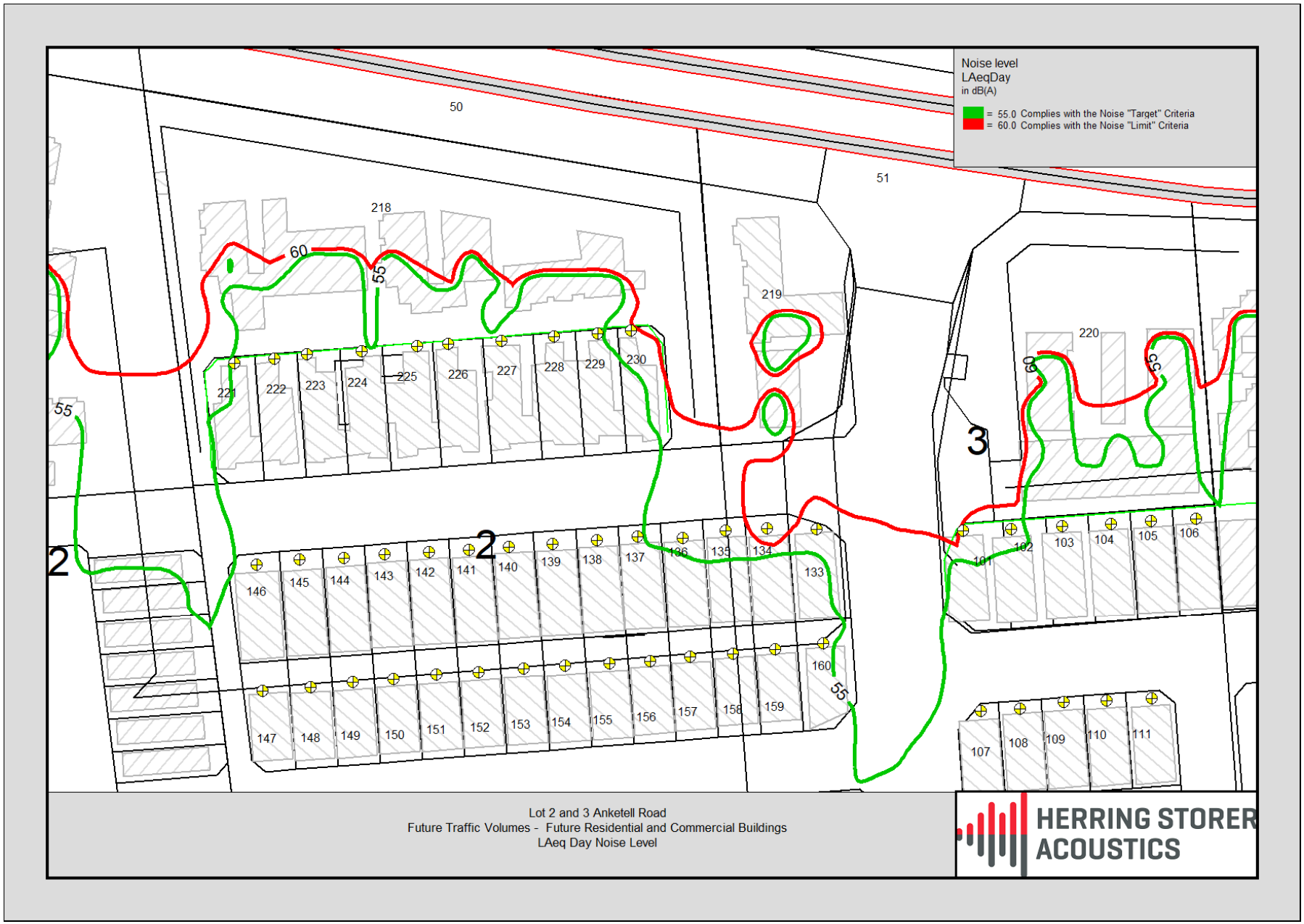
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
Lot 2 and 3 Anketell Road
Future Traffic Volumes - Future Residential No Commercial Buildings
LAeq Day Noise Level
HERRING STORER ACOUSTICS


Noise level
LAeqDay
in dB(A)
= 55.0 Complies with the Noise "Target" Criteria
= 60.0 Complies with the Noise "Limit" Criteria
50
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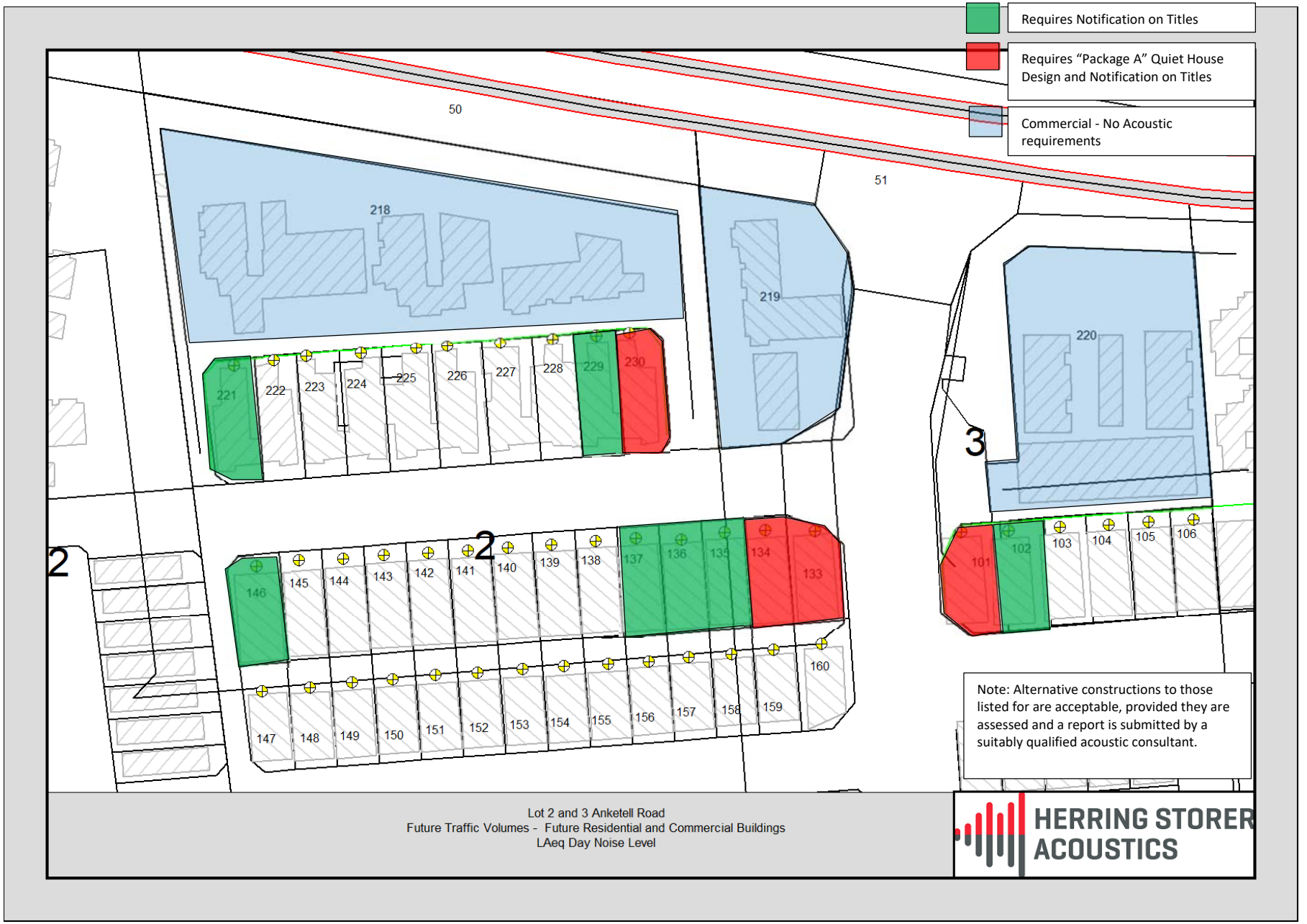
Lot 2 and 3 Anketell Road
Future Traffic Volumes - Future Residential and Commercial Buildings
LAeq Day Noise Level
HERRING STORER ACOUSTICS


Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Commercial - No Acoustic requirements
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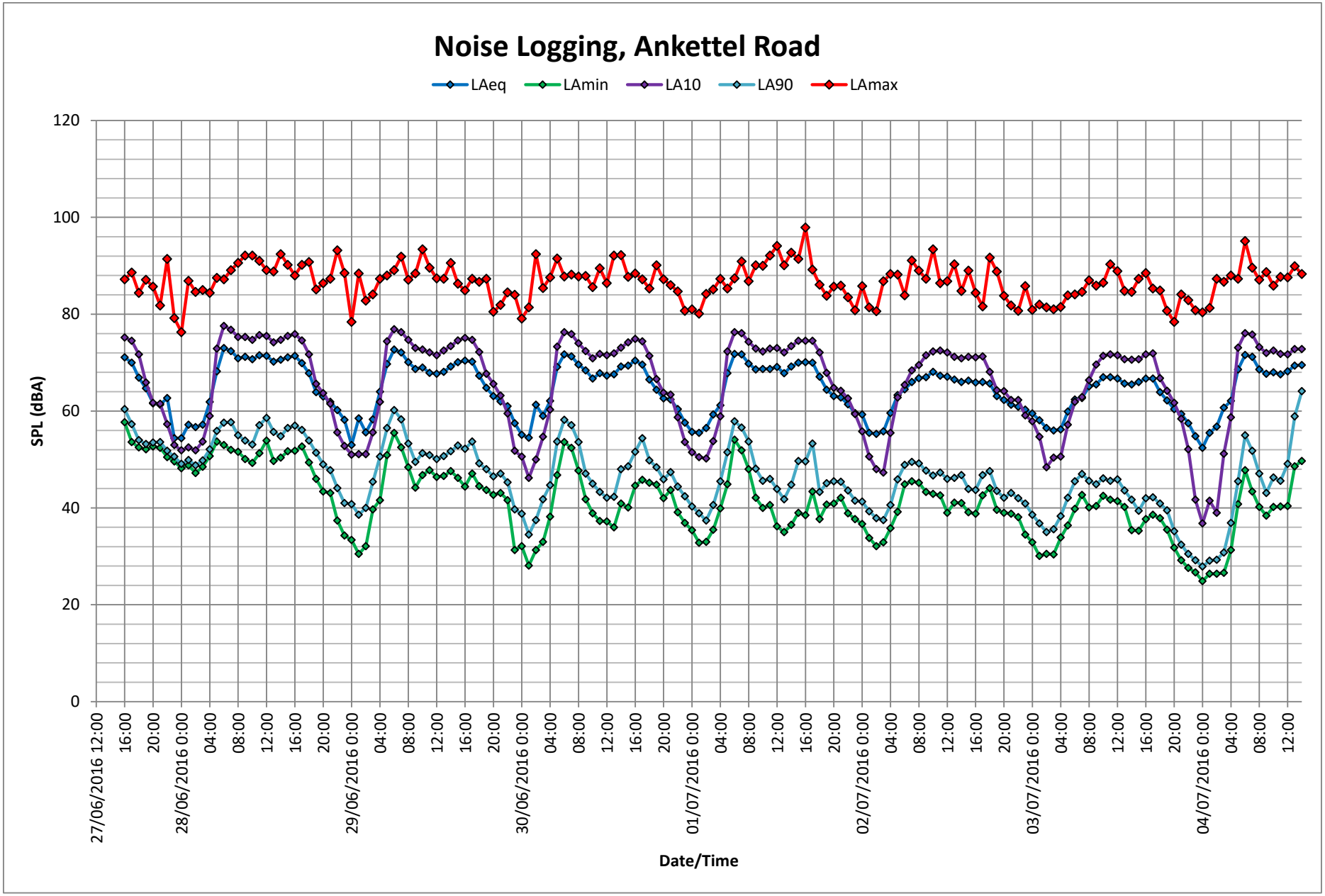
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
Lot 2 and 3 Anketell Road
Future Traffic Volumes - Future Residential and Commercial Buildings
LAeq Day Noise Level
HERRING STORER ACOUSTICS

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

Table C1 – Quiet House Design "Deemed to Satisfy" Construction Guidelines

APPENDIX D

NOISE MONITORING RESULTS


Noise Logging, Ankettel Road
LAeq
LAmin
LA10
LA90
LAmax
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SPL (dBA)
27/06/2016 12:00
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