GLEN IRIS ESTATE

APPENDIX 6
ACOUSTIC ASSESSMENT

GLEN IRIS GOLF COURSE

DEAN RD, JANDAKOT

STRUCTURE PLAN
ACOUSTIC ASSESSMENT

SEPTEMBER 2021

OUR REFERENCE: 27789-6-20325

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GLEN IRIS GOLF COURSE

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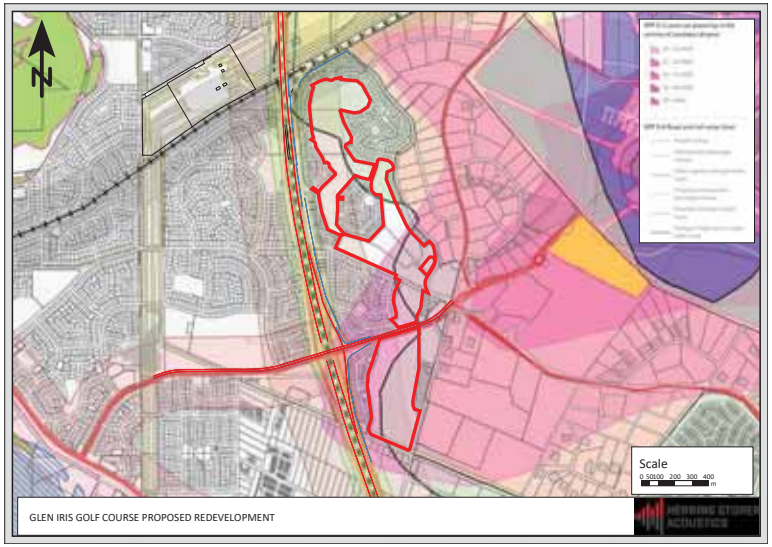
APPENDICIES

EXECUTIVE SUMMARY

Herring Storer Acoustics have been commissioned by Acumen Development Solutions to carry out an acoustical assessment of the proposed development of the Glen Iris Golf Course into residential land use.

This acoustic assessment is provided in support of the Structure Plan process, therefore provides high level acoustic advice for the proposed development to inform the development team and regulatory authorities of the potential noise issues and associated noise controls. It is noted that detailed design for these requirements can be applied at subdivision staging, once further information is available.

The proposed residential estate is potentially impacted by noise from road traffic (Kwinana Freeway and Berigan Drive), rail traffic (Yangebup Freight Rail Line and future Thornlie to Cockburn Passenger Rail Line) and aircraft associated with Jandakot Airport with the figure below showing the PlanWa advice regarding noise impacts. Consideration has also been given to the potential impact from noise related to existing industry to the south of the development on Prinsep Road.



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

ROAD TRAFFIC AND RAIL NOISE

External

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

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

Internal

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

AIRCRAFT NOISE

Internal

Sleeping areas	50 dB(A) L_{Amax}
Other habitable spaces	55 dB(A) L_{Amax}

ROAD NOISE

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential with some commercial usage for the section to the north of Berrigan Drive. Noise levels for the future road traffic are such, that at some of the lot façades, the noise could exceed the 55 dB(A) noise Target. Therefore, amelioration in the form of Quiet House Design is required. These areas have been identified and general "deemed to satisfy packages" as per the SPP 5.4 guidelines applied. Detailed design for these requirements can be applied at subdivision staging once further information is available.

Given the noise levels, the lot façades would require Quiet House Design in the form of Package A. Appendix F contains the deemed to satisfy packages or Quiet House Design requirements and an area plan outlining the effected Lots.

Additionally, as they are over the "Target" noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

RAIL NOISE

For train noise associated with the Yangebup Freight Line, due to the topography (line being in a cutting) and the noise wall and residential housing between the rail line and the development, the noise levels for the worst-case future scenario of one train per hour have been assessed as being below the night time noise Target criteria at the façade lots of the development boundary, hence there are no acoustic requirements.

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the lot façades, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

Notwithstanding the above, confirmation assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall

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located along the existing residence boarding the rail line. When the proposed passenger rail development is constructed, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides a conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.3.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) are to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.3.

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided within this report for areas within the ANEF 20-25 noise contour. This can form the basis of future concept designs and can be refined at subdivision staging. For area outside the ANEF 20 but contained within the Frame Area upgraded glazing would be required (as per LPP 1.12).

INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.4.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall (Prinsep Road)
2. Upgrade Building Design (As per SPP 5.3)
3. Setback

Given the implementation of the above, noise levels can be managed, regardless of compliance with the regulatory criteria.

1.0 INTRODUCTION

Herring Storer Acoustics have been commissioned by Acumen Development Solutions to carry out an acoustical assessment of the proposed development of the Glen Iris Golf Course into residential land use.

The proposed residential estate is potentially impacted by noise from the following noise sources:

- Road Traffic Noise- Kwinana Freeway and Berrigan Drive.
- Rail Traffic Noise - Existing Yangebup Freight Rail Line and proposed Thornlie to Cockburn Passenger Rail Line.
- Aircraft Noise – Aircrafts associated with Jandakot Airport.
- Industrial Noise – Existing Industry located on Prinsep Road.

The objectives of the study were to:

- Measure existing noise levels at the proposed development from vehicles travelling on Kwinana Freeway and Berrigan Drive.
- Measure existing noise levels at the proposed development from trains travelling on the Yangebup Freight Rail Line.
- Determine by noise modelling the noise levels that would be received at residences within the development from vehicles travelling on the future Kwinana Freeway, Berrigan Drive and Yangebup freight Rail Line and proposed passenger rail.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.4 "Road and Rail Noise" (SPP 5.4).
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.3 "Land Use Planning in the Vicinity of Jandakot Airport" (SPP 5.3).
- Consider impacts of industrial noise associated with existing industry located on Prinsep Road, in accordance with the City of Cockburn's Local Planning Policy 1.12 (LPP 1.12).

This acoustic assessment is provided in support of the Structure Plan process, therefore provides high level acoustic advice for the proposed development to inform the development team and regulatory authorities of the potential noise issues and associated noise controls. It is noted that detailed design for these requirements can be applied at subdivision staging, once further information is available.

2.0 CRITERIA

2.1 NOISE INGRESS INTO DEVELOPMENT

The Western Australian Planning Commission (WAPC) released on 6th September 2019 State Planning Policy 5.4 *"Road and Rail Noise"*. The requirements of State Planning Policy 5.4 are outlined below.

POLICY APPLICATION (Section 4)

When and where it applies (Section 4.1)

SPP 5.4 applies to the preparation and assessment of planning instruments, including region and local planning schemes; planning strategies, structure plans; subdivision and development proposals in Western Australia, where there is proposed:

*a) noise-sensitive land-use within the policy's trigger distance of a transport corridor as specified in **Table 1**;*

*b) New or major upgrades of roads as specified in **Table 1** and maps **(Schedule 1,2 and 3);** or*

*c) New railways or major upgrades of railways as specified in maps (**Schedule 1, 2 and 3);** or any other works that increase capacity for rail vehicle storage or movement and will result in an increased level of noise.*

Policy trigger distances (Section 4.1.2)

***Table 1** identifies the State's transport corridors and the trigger distances to which the policy applies.*

*The designation of land within the trigger distances outlined in **Table 1** should not be interpreted to imply that land is affected by noise and/or that areas outside the trigger distances are un-affected by noise.*

*Where any part of the lot is within the specified trigger distance, an assessment against the policy is required to determine the likely level of transport noise and management/ mitigation required. An initial screening assessment (**guidelines: Table 2: noise exposure forecast**) will determine if the lot is affected and to what extent."*

TABLE 1: TRANSPORT CORRIDOR CLASSIFICATION AND TRIGGER DISTANCES

Transport corridor classification	*Trigger distance*	*Distance measured from*
Roads		
Strategic freight and major traffic routes *Roads as defined by Perth and Peel Planning Frameworks and/or roads with either 500 or more Class 7 to 12 Austroads vehicles per day, and/or 50,000 per day traffic volume*	*300 metres*	*Road carriageway edge*
Other significant freight/traffic routes *These are generally any State administered road and/or local government road identified as being a future State administered road (red road) and other roads that meet the criteria of either >=23,000 daily traffic count (averaged equivalent to 25,000 vehicles passenger car units under region schemes)*	*200 metres*	*Road carriageway edge*
Passenger railways		
	100 metres	*Centreline of the closest track*
Freight railways		
	200 metres	*Centreline of the closest track*

Proponents are advised to consult with the decision making authority as site specific conditions (significant differences in ground levels, extreme noise levels) may influence the noise mitigation measures required, that may extend beyond the trigger distance.

POLICY MEASURES (Section 6)

The policy applies a performance-based approach to the management and mitigation of transport noise. The policy measures and resultant noise mitigation will be influenced by the function of the transport corridor and the type and intensity of the land-use proposed. Where there is risk of future land-use conflict in close proximity to strategic freight routes, a precautionary approach should be applied. Planning should also consider other broader planning policies. This is to ensure a balanced approach takes into consideration reasonable and practical considerations.

Noise Targets (Section 6.1)

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

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

- *indoor noise levels as specified in **Table 2** in noise sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- *a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and child care centres the design of outdoor areas should take into consideration the noise target.*

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

TABLE 2: NOISE TARGETS

Proposals	New/Upgrade	Noise Targets		
		Outdoor		Indoor
		Day (L_{Aeq}(Day) dB) (6 am-10 pm)	Night (L_{Aeq}(Night)dB) (10 pm-6 am)	(L_{Aeq} dB)
Noise-sensitive land-use and/or development	New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor	55	50	L_{Aeq} (Day) 40(Living and work areas) L_{Aeq} (Night) 35 (bedrooms)
Roads	New	55	50	N/A
	Upgrade	60	55	N/A
Railways	New	55	50	N/A
	Upgrade	60	55	N/A

Notes:

- *The noise target is to be measured at one metre from the most exposed, habitable façade of the proposed building, which has the greatest exposure to the noise-source. A habitable room has the same meaning as defined in State Planning Policy 3.1 Residential Design Codes.*
- *For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.*
- *The 5dB difference in the criteria between new and upgrade infrastructure proposals acknowledges the challenges in achieving noise level reduction where existing infrastructure is surrounded by existing noise-sensitive development.*
- *Outdoor targets are to be met at all outdoor areas as far as is reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.*

Noise Exposure Forecast (Section 6.2)

*When it is determined that SPP 5.4 applies to a planning proposal as outlined in Section 4, proponents and/or decision makers are required to undertake a preliminary assessment using **Table 2**: noise exposure forecast in the guidelines. This will provide an estimate of the potential noise impacts on noise-sensitive land-use and/ or development within the trigger distance of a specified transport corridor. The outcomes of the initial assessment will determine whether:*

- *no further measures is required;*
- *noise-sensitive land-use and/or development is acceptable subject to deemed-to-comply mitigation measures; or*
- *noise-sensitive land-use and/or development is not recommended. Any noise-sensitive land-use and/ or development is subject to mitigation measures outlined in a noise management plan."*

2.2 STATE PLANNING POLICY 5.3 LAND USE IN THE VICINITY OF JANDAKOT AIRPORT

AS2021: Acoustics – Aircraft Noise Intrusion-Building Siting and Construction, provides guidelines for determines the type of building construction necessary to provide a given noise reduction, given that external windows and doors are closed.

Additionally, guidance has been sought from *State Planning Policy 5.3 Land use in the vicinity of Jandakot airport.*

2.2.1 Building Site Acceptability

AS2021:2015 lists the building types compared to the acceptable ANEF contour in Table 2.1 of AS2021:2015. The applicable building types are reproduced in Table 1 below.

TABLE 1 – ANEF ACCEPTABILITY FOR SITING AND CONSTRUCTION

Building Type	ANEF zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF

AS2021:2015 *"Acoustics – Aircraft Noise Intrusion-Building Siting and Construction"* provides guidelines for determining the type of building construction necessary to provide a given noise reduction, given that external windows and doors are closed.

Indoor design sound levels for determination of aircraft noise reductions are given as follows:

Sleeping areas	-	50 dB(A)
Other habitable spaces	-	55 dB(A)

For commercial buildings:

Private offices	-	55 dB(A)
Open offices	-	65 dB(A)
Shops, showrooms etc.	-	75 dB(A)
Industrial	-	75 dB(A)

We note that the above noise levels are maximum noise levels.

2.3 CITY OF COCKBURN LOCAL PLANNING POLICY 1.12 – NOISE ATTENUATION

An Acoustic Report must accompany a Structure Plan, variations to a Structure Plan that materially alter the Plans intent or a Local Development Plan. The Acoustic Report shall be prepared in accordance with the attached City of Cockburn Noise Attenuation Guidelines where:

1. Noise sensitive development is proposed in the vicinity of an existing or future major road, rail infrastructure or a freight handling facility as required by SPP 5.4;
2. The land is located within either the Core Area or Frame Area for Jandakot Airport as identified by SPP 5.3; or
3. Noise sensitive development and commercial, industrial or light industry land uses or essential infrastructure are proposed in close proximity.

2.3.1 NOISE INTRUSION (NOISE SENSITIVE DEVELOPMENT)

1. Noise sensitive developments are to be designed to achieve the following sound levels:

   (a) Leq 35 dB(A) in sleeping areas (bedrooms); and
   (b) Leq 40 dB(A) in living/work areas and other habitable rooms.

   IMPORTANT NOTE:
   The Leq level should not be unduly biased toward the lower frequencies of the octave band spectrum. If lower frequencies are dominant in sound levels taken during the sampling phase of reporting (below 200Hz or a 15-20dB difference between LA and LC levels), the Acoustic Consultant shall discuss the findings with the City in developing appropriate solutions to ensure that low frequency noise is appropriately attenuated, prior to the submission of the final Acoustic Report.

2. For all other developments, noise intrusion is to be controlled to achieve the indoor design sound levels for buildings as set out in Australian Standard AS/NZS2107: "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors".
3. For noise sensitive developments in close proximity to road and rail infrastructure, the report must address the requirements of SPP 5.4, including the requirement for a reasonable degree of acoustic amenity in at least one outdoor living area.
4. For noise sensitive developments in close proximity to freight rail infrastructure or other sources of vibration, the Acoustic Report should also address ground borne vibration levels to ensure that occupants of the development are not exposed to an unacceptable level of vibration. The report should make reference to:
   (a) Australian Standard 2670.2-1990 "Evaluation of human exposure to whole-body vibration; Part 2: Continuous and shock induced vibration in buildings (1 to 80 Hz)"
   (b) ISO 2631-2:2003 "Evaluation of human exposure to whole-body vibration Part 2: Vibration in buildings (1 Hz to 80 Hz)";
   (c) British Standard BS6472-2008: "Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)".
5. Residential developments are to be constructed to meet the requirements of the National Construction Code (as amended) and the Building Code of Australia Part F5 (as amended).

2.3.2 NOISE SOURCE IDENTIFICATION

Acoustic reports must identify all noise sources relevant to a development, including those which may require detailed assessment at a later stage. Ambient environmental noise sources that are relevant within the City of Cockburn include the following:

1. Noise from Road, Rail and Freight Infrastructure
2. Breakout and Street Noise
3. Mechanical Plant and Equipment
4. Co-existing Land Uses
5. Noise Sensitive Developments in Proximity to Jandakot Airport

2.4 APPROPRIATE CRITERIA

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

ROAD TRAFFIC AND RAIL NOISE

External

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

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

Internal

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

AIRCRAFT NOISE

Internal

Sleeping areas	50 dB(A) L_{Amax}
Other habitable spaces	55 dB(A) L_{Amax}

3.0 NOISE MONITORING

Noise monitoring was undertaken as part of the study with the results used to calibrate the noise model.

In summary, the monitoring was undertaken over seven-day period commencing Monday 2nd December 2020. Monitoring was conducted at two locations, firstly at the northern end of the golf course, with the second location being in the south of the golf course

The results of this monitoring are summarised in Table 3.1.

TABLE 3.1 : SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS (dB(A))

Date	Day of week	North Monitor		South Monitor	
		$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)	$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)
2/12/2020	Wednesday	-	-	55.9	48.0
3/12/2020	Thursday	56.7	49.8	55.4	48.4
4/12/2020	Friday	57.4	48.0	57.3	48.6
5/12/2020	Saturday	56.8	49.1	55.2	49.3
6/12/2020	Sunday	55.1	50.2	53.6	47.4
7/12/2020	Monday	54.3	47.0	51.9	47.4
8/12/2020	Tuesday	54.6	48.1	52.5	45.7
Average (Weekdays)		**55.8**	**48.2**	**54.6**	**47.6**

Note: Based on the results of the noise monitoring the difference between the L_{Aeq} (Day) and L_{Aeq} (Night) is greater than 5 dB(A). Hence, achieving compliance with the day period criteria would also result in compliance with the night period criteria. Thus, the day period has been used for the assessment.

A third measurement location was included to calibrate noise levels for Berrigan Drive. The measurement was conducted on 14th September 2021. Short term (15 minute), noise levels were measured during peak traffic volumes, as referenced from the MRWA traffic count web site. The $L_{Aeq(15minute)}$ has been used as the overall L_{Aeq} day, based on current traffic volumes.

This method was used in place of continuous monitoring over 3 weekdays due to the potential change in traffic speeds etc and due to the construction of Jandakot Road, which was impacting Berrigan Drive in this area.

The short-term measurement of road traffic has been shown (previously) as being a conservative method when assessing noise levels for an existing roadway. This is due to the L_{Aeq} noise level measurement being based on peak traffic flows, hence is generally higher than the L_{Aeaday}, when measured over a 16-hour period.

This method provides information for the Structure Plan, which is used to inform the general acoustic requirements, and once Berrigan Drive returns to normal traffic conditions on the completion of the Jandakot Road works, then confirmation noise levels can be conducted.

The summarised results are contained in table 3.2.

TABLE 3.2 : SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS BERRIGAN DRIVE (dB(A))

Date	Day of week	L_{Aeq}	L_{A10}	L_{A90}
14/09/2021	Tuesday	68.8	72.5	56.7

For information, the results of the monitoring are shown graphically in Appendix E, with Figure 3.1 showing the location map, and Figure 3.2 showing the monitors in situ.

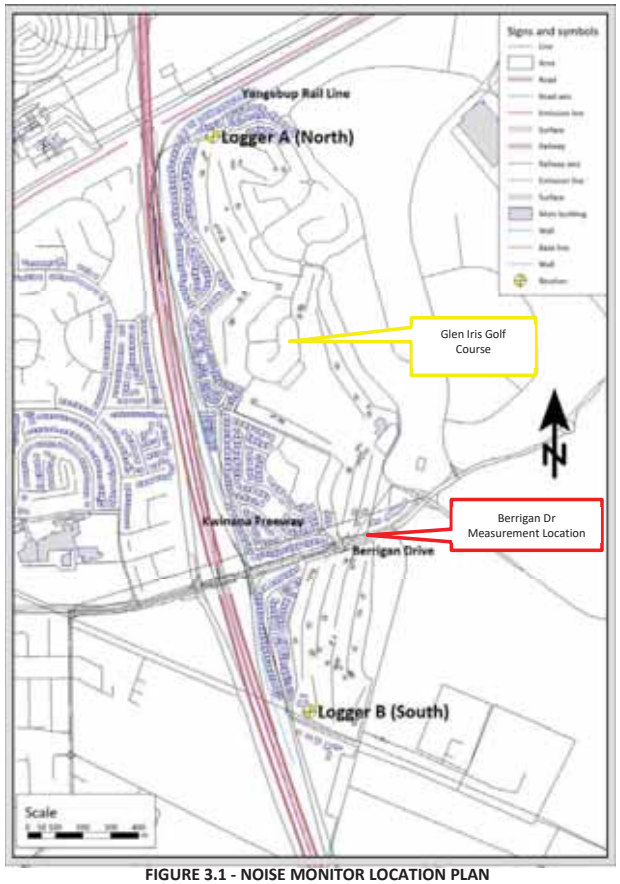


FIGURE 3.1 - NOISE MONITOR LOCATION PLAN


FIGURE 3.2 - NOISE MONITOR IN SITU

4.0 METHODOLOGY

4.1 ROAD TRAFFIC

The future road traffic volumes were based on information provided by the MRWA traffic modelling department. ROM24 2016 validation plots for 2016 and 2041 link volume plots were provided.

Predictive noise modelling has allowed for the following traffic data. It is noted that where available on the MRWA traffic maps site, current traffic counts were used to calibrate the measured noise levels.

Other information relevant to the calculations are shown below in Table 4.1.

TABLE 4.1 - NOISE MODELLING INPUT DATA

Parameter	Traffic Flow VPD Current	Traffic Flow VPD Future (2041)	Traffic Speed km/hr	Road Surface
Traffic flows VPD Kwinana Freeway South Bound	*48,368 (13%)	124,300 (11%)	100	Dense Graded Asphalt
Traffic flows VPD Kwinana Freeway North Bound	*55,082 (14%)	118,000 (11%)	100	Dense Graded Asphalt
Kwinana Freeway (South Bound) Berrigan Drive Offramp	9,000 (13%)	20,900 (11%)	60	Dense Graded Asphalt
Berrigan Drive to Kwinana Freeway (South Bound) Onramp	2,300 (17%)	7,700 (11%)	60	Dense Graded Asphalt
Berrigan Drive East of Kwinana Freeway (East Bound)	*27,780 (11%)*	20,000 (9%)	70	Dense Graded Asphalt
Berrigan Drive East of Kwinana Freeway (West Bound)		17,300 (11%)	70	Dense Graded Asphalt

* Based on current traffic counts (2018 to 2021)

Other input data for the model included:

- Traffic data from MRWA (https://mrapps.mainroads.wa.gov.au/TrafficMap/)
- Noise source heights for the three road source strings (Passenger Vehicles, Heavy Vehicles Engine and Heavy Vehicle Exhausts) are +0.5, +1.5 and +3.6m, with a noise correction of -0.8 and -8.0 applied to the heavy vehicles engine and exhaust noise sources.

- Topographical data, with the ground level within the development based on natural ground levels as surveys conducted.
- A +2.5 dB adjustment to allow for façade reflection.
- Development receiver heights at 1.4m above ground level.
- Calculations based on CoRTN algorithms.
- Other parameter listed in SPP 5.4 as to guidance for modelling road traffic noise / assessment.

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'.

The following scenario have been modelled:

- Current Traffic flows, with existing walls and surrounding residential housing.
- Future traffic flows, with existing walls and surrounding residential housing

Based on the above, the noise contours plot for day period for the above modelling scenario is attached in Appendix B.

4.2 RAIL TRAFFIC

4.2.1 FREIGHT RAIL

To determine the requirements of noise associated with the Yangebup freight Line, acoustic modelling was carried out using the computer program 'SoundPlan' using Nord2000 calculation methodology.

As the Freeway is the dominant noise source in the area, it is impacting the ability to measure current noise levels of train movements on the freight line and provide a basis for a statistical analysis. Additionally, the freight line is contained within a cutting for this section of track, as well as there being a noise wall and two storey residential buildings between the development and the rail line.

Reference was made to other monitoring conducted on the Cockburn freight line as to the validity of using an $L_{Aeq(1hour)}$ level for calibration of this assessment. Previous studies resulted in an $L_{Aeq(130seconds)}$ of 68.7 dB(A) for busier sections of the freight line. This was at a monitoring point 20m from the freight line. For information, calculating this noise level to the equivalent $L_{Aeq(1hour)}$ gives a resultant noise level of 54.3 dB(A).

Freight rail movements generally involved S class locomotives, with up to 150 wagons. Speeds were generally posted as 70km per hour.

Based on the calibrated freight rail line, the following scenarios were modelled:

1. Ultimate capacity volumes, i.e. 24 per 24 hours at 1 per hour, with existing walls and residential buildings between train line and proposed development.

Based on the above, the noise contours plots for day and night period for the above modelling scenarios are attached in Appendix C with the resultant level discussed further in the next section.

4.2.2 PROPOSED FUTURE FREIGHT / PASSENGER RAIL

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the façade lots, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

It is noted that assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line, and the two storey dwellings currently in place. If the proposed passenger rail development goes ahead, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides as conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

5.0 RESULTS / ASSESSMENT

5.1 ROAD TRAFFIC

Under the WAPC State Planning Policy 5.4, for this development, the appropriate "Noise Targets" to be achieved under SPP 5.4, external to a residence are:

External	
Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".

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)

For this development, compliance with the requirements of SPP 5.4, noise modelling and assessment are based on the day period.

The results of the acoustic assessment indicate that noise received at the proposed residential development would generally comply with the "Noise Targets" as outlined in SPP 5.4 with the exception of three main areas. These are identified below in Figure 5.1 and are discussed further below.

FIGURE 5.1 – FUTURE ROAD TRAFFIC NOISE LEVELS

5.1.1 AREA A - NORTH

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential. As per Figure 5.2 the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots. This is shown by the spread of noise through the existing dwellings located between the development and the Freeway.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway noise impact.

FIGURE 5.2 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA A - NORTH

5.1.1 AREA B - CENTRAL

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential. As per Figure 5.3, the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots. This is shown by the spread of noise through the existing dwellings located between the development and the Freeway.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway noise impact.

FIGURE 5.3 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA B - CENTRAL

5.1.1 AREA C – BERRIGAN DRIVE AND SOUTH

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential south of Berrigan Drive, and Commercial for the section to the north of Berrigan Drive. As per Figure 5.4 the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

FIGURE 5.4 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA C - SOUTH

5.2 RAIL TRAFFIC

Under the WAPC State Planning Policy 5.4, for this development, the appropriate "Noise Targets" to be achieved under SPP 5.4, external to a residence are:

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".
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)

For this development, compliance with the requirements of SPP 5.4, noise modelling and assessment are based on the night period.

The results of the acoustic assessment indicate that noise received at the proposed residential development would comply with the "Noise Targets" as outlined in SPP 5.4. The resultant noise level for the future night period, considering one train movement per hour is shown below in Figure 5.5.

FIGURE 5.5 – FUTURE FREIGHT RAIL NOISE LEVELS

It is noted that the existing freight rail as per Section 4.2.1, has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line. If the proposed passenger rail development goes ahead, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides as conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

5.3 AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.6.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) is to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.6.

Whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided below for development within the ANEF 20-25 contour. This can form the basis of future concept designs and can be refined at subdivision staging.

Glazing:

Bedrooms:

- Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing (R_w+C_{tr} 28 dB). Sealed awning or casement windows may use 6 mm glazing instead.
- Up to 60% floor area: as per above but must be sealed awning or casement type windows (R_w+C_{tr} 31dB).

Indoor living and work areas:

- Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (R_w+C_{tr} 25dB).
- Up to 60% floor area: As per Bedrooms at up to 40% area (R_w+C_{tr} 28 dB).
- Up to 80% floor area: As per Bedrooms at up to 60% area (R_w+C_{tr} 31dB).

Walls:

Bedroom and indoor living and work areas to R_w+C_{tr} 45dB:

- 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 or one layer of 19mm board cladding fixed to the outside of the channels; and
  - 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and
  - Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs.
  - Single leaf of 150mm brick masonry with 13mm cement render on each face.
  - Double brick: two leaves of 90mm clay brick masonry with a 20mm cavity between leaves.

Roof and Ceiling:

Tiled or colorbond roof with sarking and 10mm plasterboard ceiling R_w+C_{tr} 35.

Additional to the above there is a requirement where the lots within the ANEF 20 noise contour require notifications on titles for aircraft noise. The wording for the notification on title is as follows:

Notification:

"This lot is situated in the vicinity of Jandakot Airport, and is currently affected, or may in the future, be affected by aircraft noise. Noise exposure levels are likely to increase in the future as a result of increases in numbers of aircraft using the airport, changes in aircraft type or other operational changes. Further information about aircraft noise, including development restrictions and noise insulation requirements for noise-affected properties, are available on request from the relevant local government offices."

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, development outside of the ANEF 20-25 contour, but within the Frame Area would require upgraded glazing in the form of 6.38 laminate.

FIGURE 5.6 – JANDAKOT AIRPORT FRAME AREA NOISE CONSIDERATIONS

5.4 INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.7.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall

   A solid, masonry barrier has been allowed for on the eastern boundary of the development, bounding Prinsep Road. The height of the wall has been set at 1.8m. As the proposed Lots are to back onto Prinsep Road, this will provide protection od outdoor living areas for noise associated with surrounding land use.

2. Upgrade Building Design

   As the proposed Lots for the southern section of the development lay within the Frame Area / ANEF 20/25 for Jandakot Airport, these residential dwellings will be required to meet the upgrade design as per SPP 5.4 / LPP 1.12. This will provide attenuation for other noise sources, such as industrial noise within the surrounding area.

3. Setback

As per the development plan attached in Appendix A, there is a 50m setback of lots from the southern boundary of the development. This will provide further amelioration in the form of distance attenuation.

FIGURE 5.7 – PLANNING LAND USE MAP

6.0 CONCLUSION

ROAD NOISE

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential with some commercial usage for the section to the north of Berrigan Drive. Noise levels for the future road traffic are such, that at some of the lot façades, the noise could exceed the 55 dB(A) noise Target. Therefore, amelioration in the form of Quiet House Design is required. These areas have been identified and general "deemed to satisfy packages" as per the SPP 5.4 guidelines applied. Detailed design for these requirements can be applied at subdivision staging once further information is available.

Given the noise levels, the lot façades would require Quiet House Design in the form of Package A. Appendix F contains the deemed to satisfy packages or Quiet House Design requirements and an area plan outlining the effected Lots.

Additionally, as they are over the "Target" noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

RAIL NOISE

For train noise associated with the Yangebup Freight Line, due to the topography (line being in a cutting) and the noise wall and residential housing between the rail line and the development, the noise levels for the worst-case future scenario of one train per hour have been assessed as being below the night time noise Target criteria at the façade lots of the development boundary, hence there are no acoustic requirements.

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the lot façades, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

Notwithstanding the above, confirmation assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line. When the proposed passenger rail development is constructed, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides a conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.3.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) are to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.3.

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided within this report for areas within the ANEF 20-25 noise contour. This can form the basis of future concept designs and can be refined at subdivision staging. For area outside the ANEF 20 but contained within the Frame Area upgraded glazing would be required (as per LPP 1.12).

INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.4.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

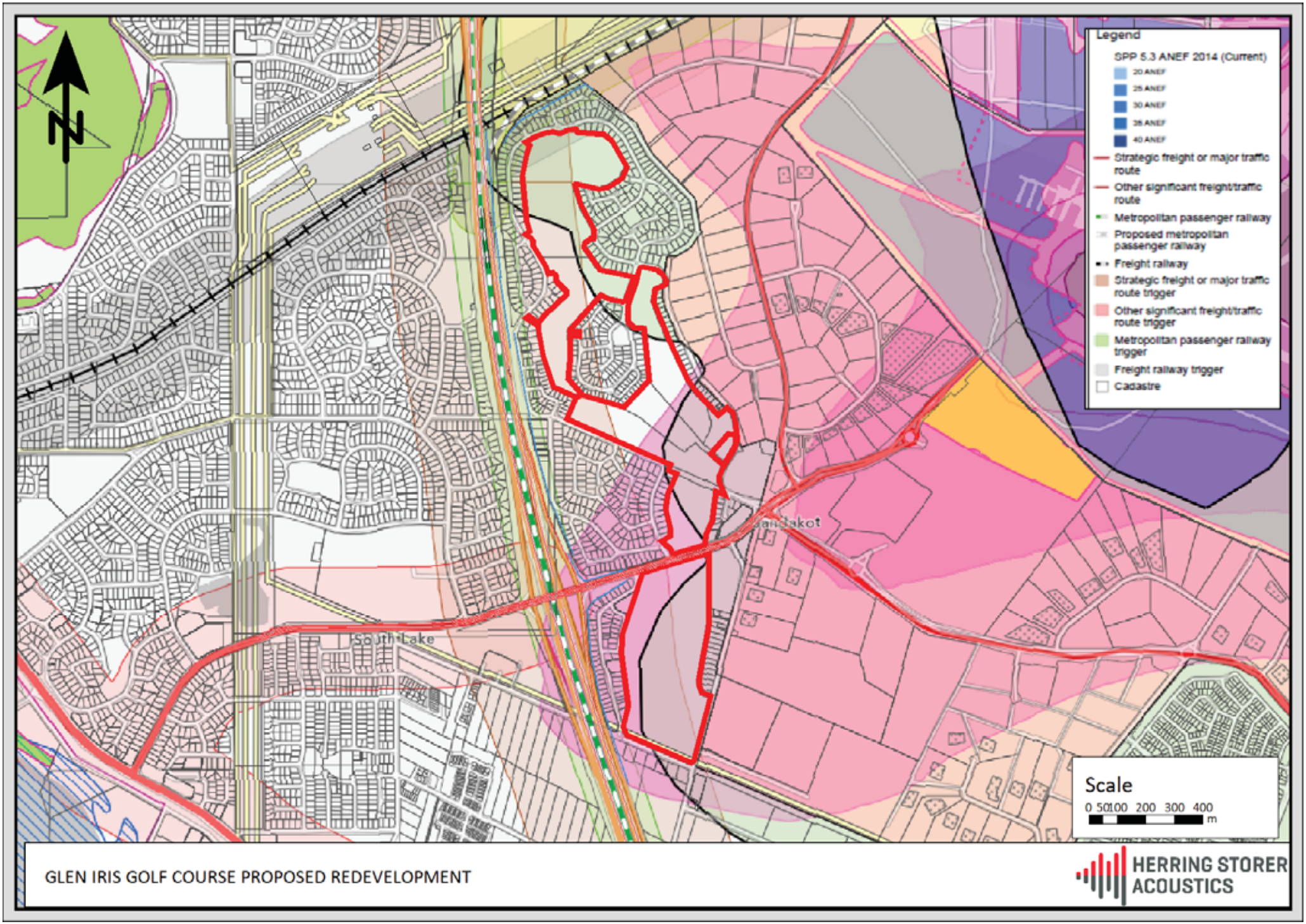
Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall (Prinsep Road)
2. Upgrade Building Design (As per SPP 5.3)
3. Setback

Given the implementation of the above, noise levels can be managed, regardless of compliance with the regulatory criteria.

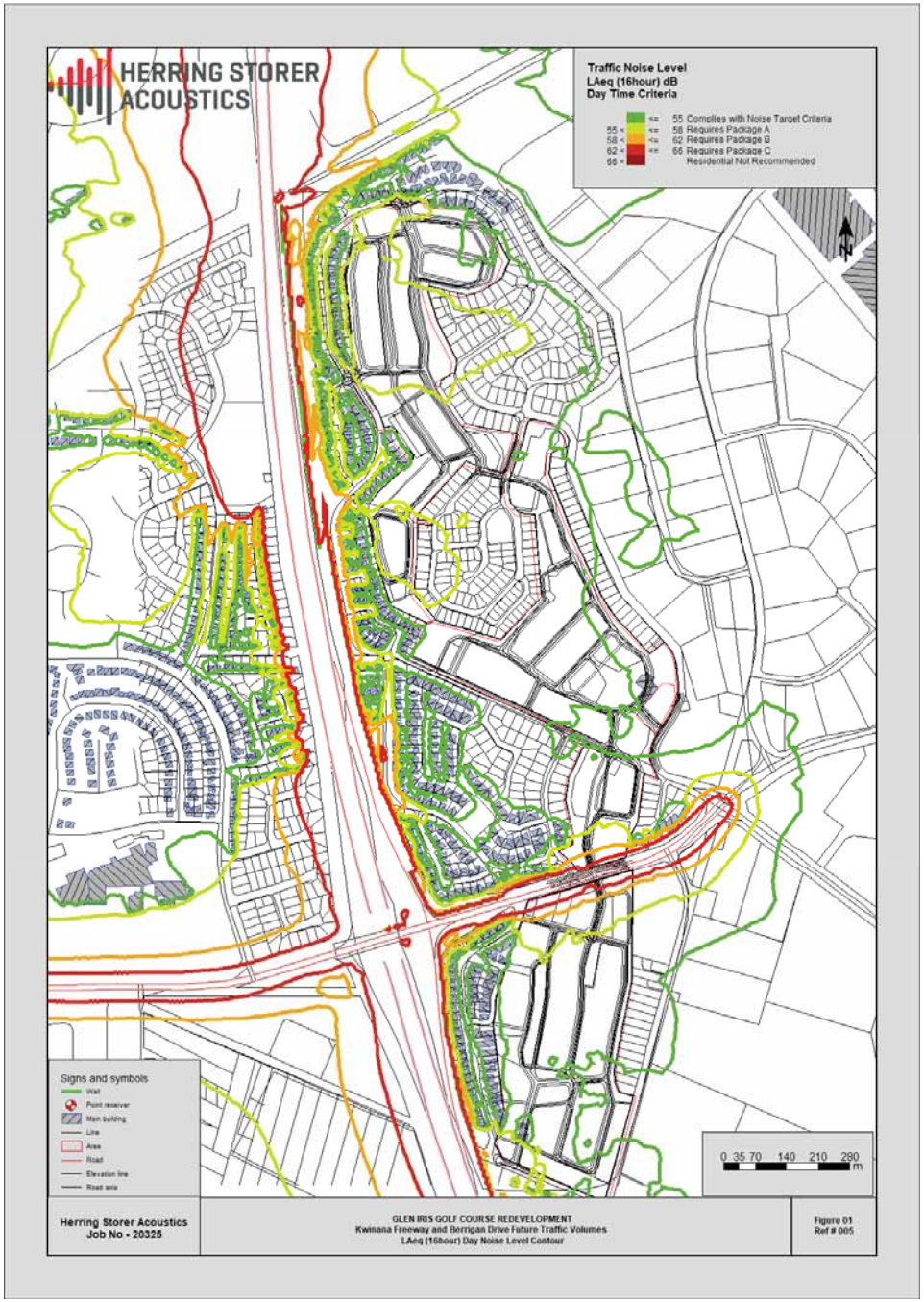
APPENDIX A

Area Plan



APPENDIX B

$L_{Aeq(16hr)}$ DAY
NOISE CONTOURS FOR FUTURE KWINANA FREEWAY and BERRIGAN DRIVE



APPENDIX C

$L_{Aeq(8hr)}$ NIGHT
NOISE CONTOURS FOR FUTURE YANGEBUP FREIGHT LINE

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APPENDIX D

TRAFFIC FLOW VOLUMES – KWINANA FREEWAY and BERRIGAN DRIVE

mainroads
WESTERN AUSTRALIA

Hourly Volume

SITE 8437

Kwinana Fwy (H015)

2017/18

Monday to Friday

SB At Bridge Under Berrigan Dr (SLK 16.90)

All Vehicles

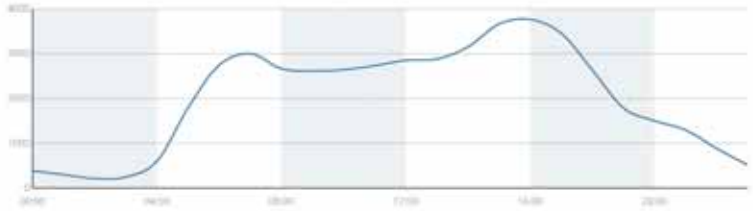
	SB							
00:00	108							
01:00	100							
02:00	213							
03:00	257							
04:00	555							
05:00	1167							
06:00	2146							
07:00	2970							
08:00	3666							
09:00	2814							
10:00	2643							
11:00	2734							
12:00	2872							
13:00	2883							
14:00	3153							
15:00	3501							
16:00	3768							
17:00	3454							
18:00	2529							
19:00	1793							
20:00	1334							
21:00	1098							
22:00	867							
23:00	576							
TOTAL	48368							

Peak Statistics

AM	TIME	07:15						
	VOL	3208						
PM	TIME	15:45						
	VOL	3781						

Information Not Available

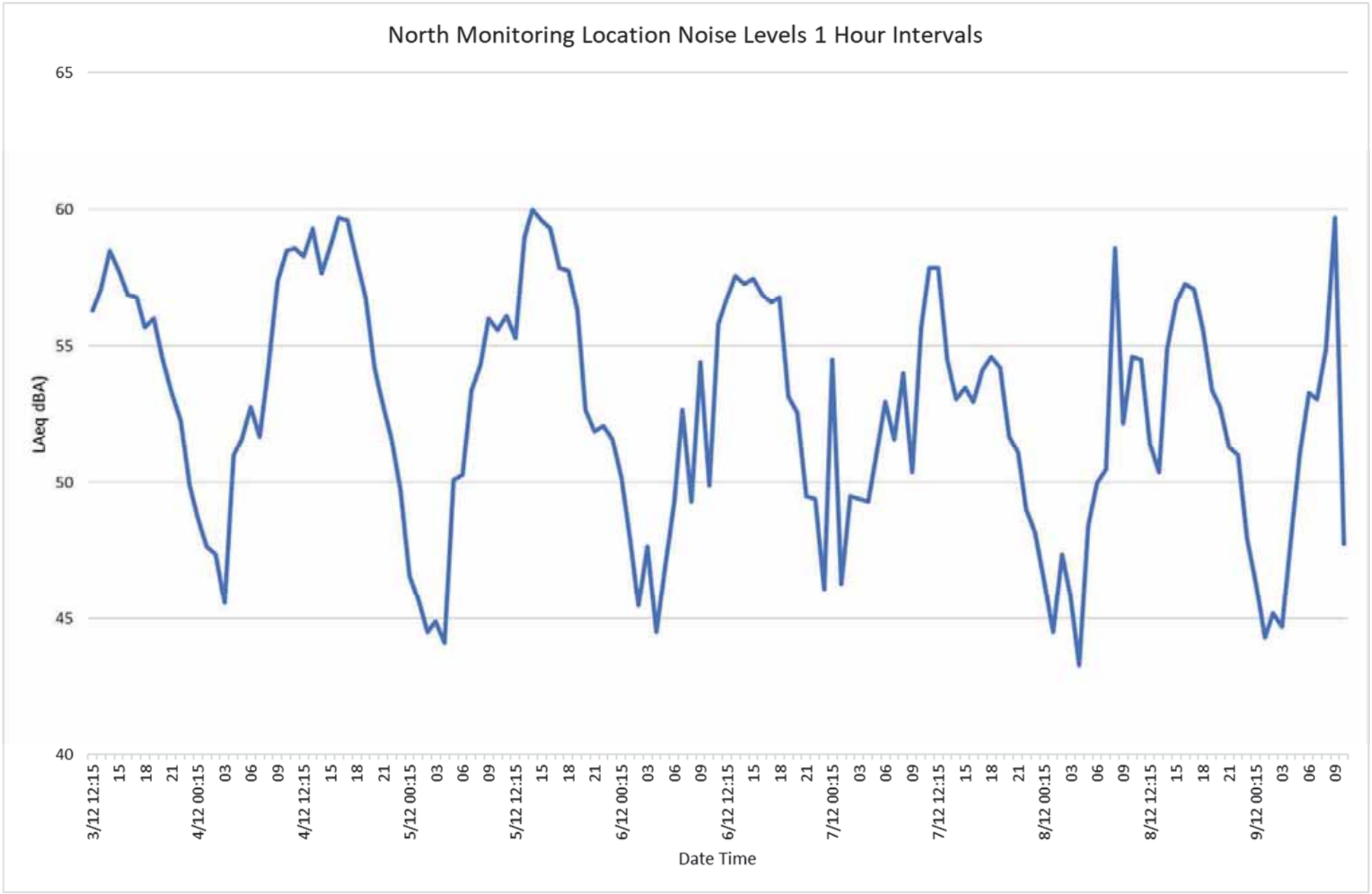
Volume

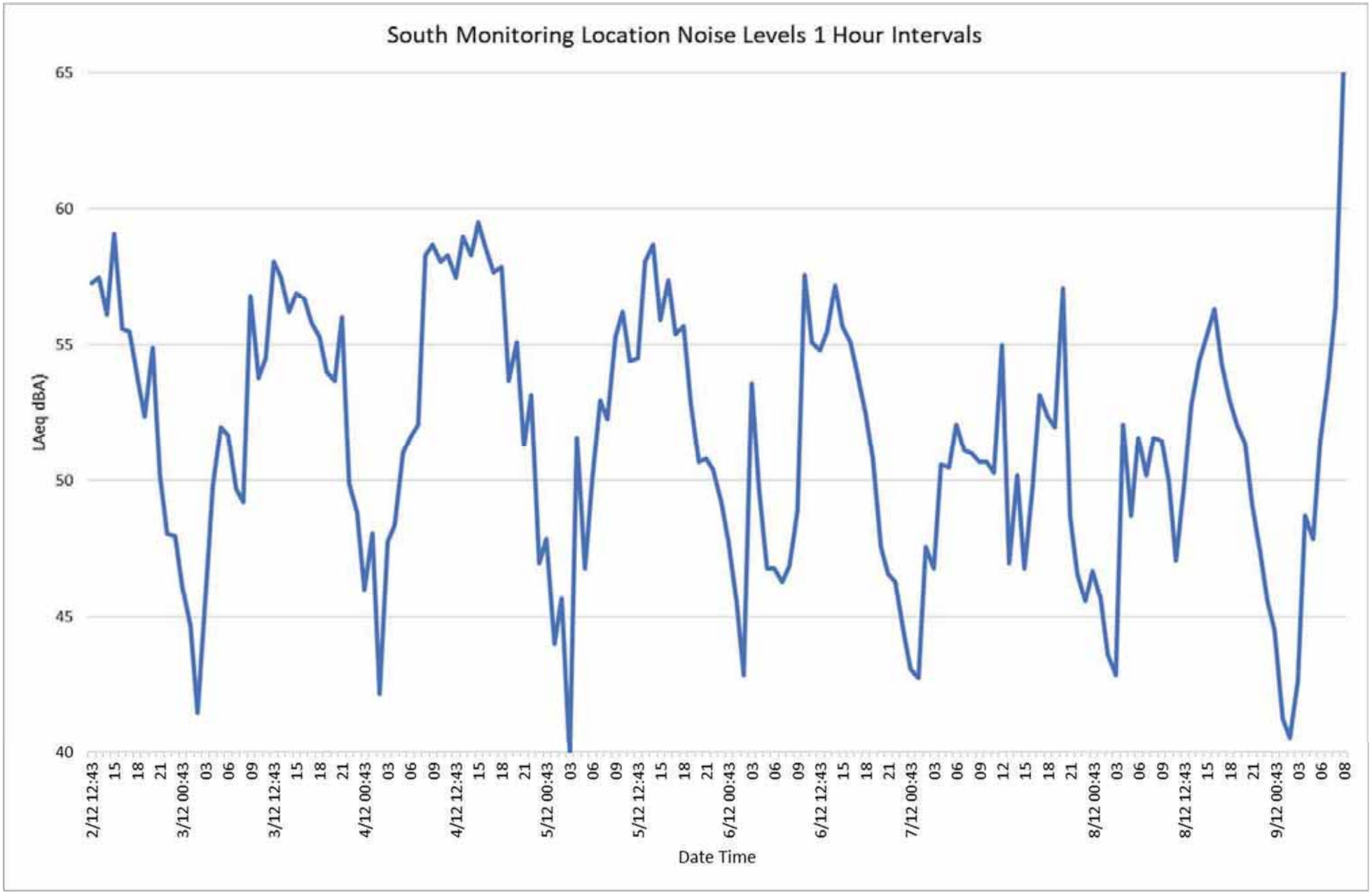


Southbound

APPENDIX E

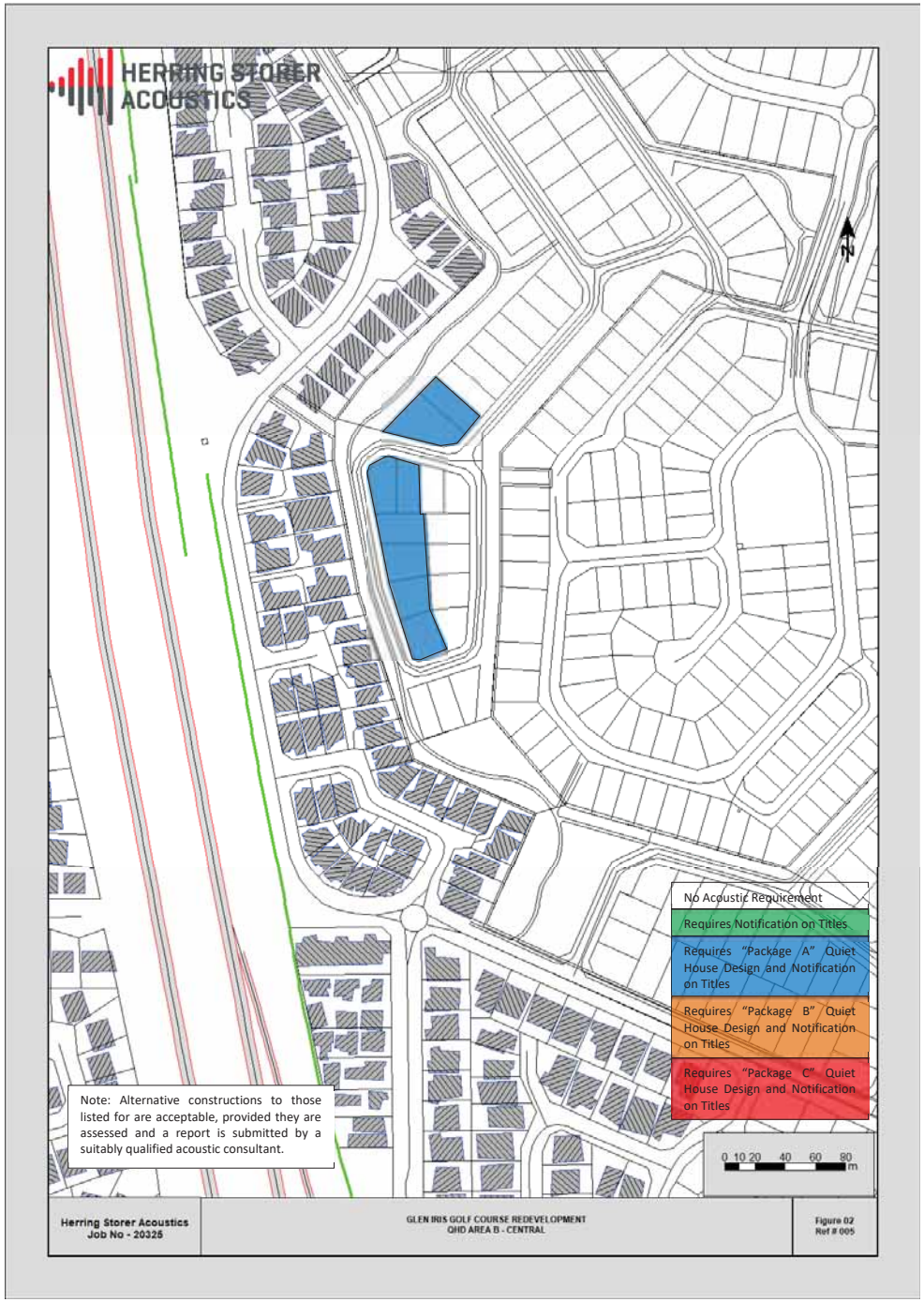
MONITORING DATA





APPENDIX F

QUIET HOUSE DESIGN REQUIREMENTS



Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
A **Quiet House A**	**Facing**	**Bedroom and Indoor Living and work areas to Rw + Ctr 45dB** **Stud Frame Walls** ➢ One row of 92mm studs at 60mm centres with: ➢ Resilient steel channels fixed to the outside of the studs; and ➢ 9.5mm hardboard or 9mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and ➢ 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and ➢ -Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs. **Brick Walls** ➢ Single leaf of 150mm brick masonry with 13mm cement render on each face: **OR** ➢ Double brick: two leaves of 90 mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals: **OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**)**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	➢ At least one outdoor living area located on the opposite side of the building from the transport corridor 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	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side On		As per "Facing" above, except R_w+C_{tr} values may be 3dB less, e.g. glazed sliding door with 10 mm glass and weather seals for bedrooms	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			
	Opposite		No specific requirements	No specific requirements			

Freight Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
A+ **Quiet House A+**	**All Facades**	**Brick Walls Only** ➢ Double brick: two leaves of 90 mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms**: ➢ No external doors for bedrooms with entry facing rail corridor and for other facades, fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**). **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	➢ At least one outdoor living area located on the opposite side of the building from the transport corridor 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	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems not recommended ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
B **Quiet House B**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation 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 or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor areas: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**Rw+Ctr 31dB**). ➢ Up to 60% floor area: as per above but must be minimum10mm single or 6mm-12mm-10mm double insulated glazing (**Rw+Ctr 34dB**) **Indoor Living and work areas** ➢ Up to 40% floor area; Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (R_w+C_{tr} 28dB). Sealed awning or casement windows may use 6mm glazing instead. **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**R_w+C_{tr} 31dB**). **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 34dB).**	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile sarking and at least 10mm plasterboard ceiling, R3.0+ insulation **OR** ➢ Metal sheet roof, sarking and at least 10mm plasterboard ceiling, R3.0+ insulation	➢ At least one outdoor living area located on the opposite side of the building from the corridor 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	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side-On		**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead. **: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**). **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			
	Opposite		As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			

Freight Rail
Quiet House Requirements

(*Based on Table 3 of State Planning Policy 5.4 2019*)							
Exposure Category	**Orientation to corridor**	**Acoustic rating and example constructions**					**Mechanical ventilation/air conditioning considerations**
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
B+ **Quiet House B**	**All Facades**	**Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** **Bedrooms**: ➢ No external doors for bedrooms with entry facing or side on to rail corridor and for other facades, fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 28dB**) **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr31 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 34 dB**).	**To R_w+C_{tr} 40dB** ➢ To all bedrooms, 2 layers of 10mm plasterboard, or one layer 13mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity**: and** ➢ Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens	➢ At least one outdoor living area located on the opposite side of the building from the corridor 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	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems not recommended ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	**Mechanical ventilation/air conditioning considerations**
C **Quiet House C**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation 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 or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ External doors to bedrooms facing the corridor are not recommended. **Indoor Living and work areas** ➢ Fully glazed hinged door with certified **Rw+Ctr 31dB** rated door and frame including seals and 10mm glass**: OR** 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified **Rw 32dB** acoustically rated door and frame system including seals	**Bedrooms**: ➢ Total external door and window system area up to 20% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 31dB): OR** ➢ Up to 40% floor area; as per above but must be minimum 10mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 34dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (**R_w+C_{tr} 31dB**). Sealed awning or casement windows may use 6mm glazing instead**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr 34dB)**	**To R_w+C_{tr} 40dB** ➢ To al bedrooms, 2 layers of 10mm plasterboard, or one layer 13mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity **: and** ➢ Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens	➢ At least one outdoor living area located on the opposite side of the building from the corridor 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	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces. ➢ Evaporative systems require attenuated ceiling air cents to allow closed windows. ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, close or relocated to building sides facing away from the corridor where practicable.
	Side-on	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals					
	Opposite	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals		**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB): OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			

Freight Rail
Quiet House Requirements

(*Based on Table 3 of State Planning Policy 5.4 2019*)								
Exposure Category	**Orientation to corridor**	**Acoustic rating and example constructions**						
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	**Mechanical ventilation/air conditioning considerations**
C+ **Quiet House C+**	**All Facades**	**Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ External doors to bedrooms facing or side onto the corridor are not recommended. **Indoor Living and work areas** ➢ Fully glazed hinged door with certified **Rw+Ctr 31dB** rated door and frame including seals and 10mm glass**: OR** ➢ 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified **Rw 32dB** acoustically rated door and frame system including seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 31dB**) **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr34 dB**)	**To R_w+C_{tr} 45dB** ➢ To al bedrooms, 2 layers of 10mm plasterboard, affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity **: and** ➢ Concrete or terracotta tile roof with sarking, (No metal sheet roofing)	➢ At least one outdoor living area located on the opposite side of the building from the corridor 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	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces. ➢ Evaporative systems require attenuated ceiling air cents to allow closed windows. ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, close or relocated to building sides facing away from the corridor where practicable.