PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL

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Land Lease Community Retirement Village 'Thrive Nirimba'

Aura Precinct 10

Noise Impact Assessment

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Prepared for: Stockland Residential Communities

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1. Introduction

Trinity Consultants Australia (T/A ASK Consulting Engineers ASK) was commissioned by Stockland Residential Communities to provide a rail and road traffic noise assessment for the proposed Land Lease Community (LLC) retirement village development proposed within Aura Precinct 10. This acoustic report is to accompany on Application for Compliance Assessment Endorsement for consideration by EDQ.

This report is a revision on the previous ASK report 197401.0244.R01V01, dated 30/10/2019, as it includes a revised site layout and an updated assessment.

The purpose of this report is as follows:

- Outline the relevant project noise criteria.
- Predict and assess the road/future rail traffic noise impact onto the development.
- Predict and assess the noise impacts onto the development.
- Describe noise mitigation requirements, if any.

To aid in the understanding of the terms in this report a glossary is included in **Appendix A**.



2. Study Area Description

The site is located within the Caloundra South Priority Development Area (Aura). More specifically the site is within Precinct 10 as shown in **Figure 2.1**. The North-South Sub-Arterial Road (Aura Boulevard, a Council controlled road) is to the east of the site, while the future CAMCOS rail line is located to the south.



Figure 2.1 Site Location of the Proposed LLC Relative to Nearby Transport Corridors

The proposed development is potentially impacted upon in the future by rail traffic noise from the adjoining CAMCOS Rail Corridor to the south, and road traffic noise from North-South Sub-Arterial Road to the east. These noise issues are to be considered in the project design.



3. Proposed Development

The proposed development includes approximately 244 lots, and a club house and community facilities at the centre of the development site.

The site layout is shown in Figure 3.1 and is included in Appendix B.



Figure 3.1 Site Layout



4. Acoustic Criteria

4.1 Overview

Acoustic criteria for the project are required to assess the road traffic and future rail noise impacts onto the various lots of the proposed development.

The acoustic assessment will be undertaken in accordance with the following relevant criteria:

- Criteria provided by Economic Development Queensland (EDQ)
- Department of State Development Infrastructure and Planning (DSDIP) State Assessment and Referral Agency (SARA) State Development Assessment Provisions (SDAP).
- Department of Housing and Public Works (HPW) Queensland Development Code (QDC) Mandatory Part 4.4 (MP4.4) 'Buildings in transport noise corridors'.
- Sunshine Coast Council Planning Scheme 2014.
- Australian Standard AS/NZS 2107–2016: Acoustics— Recommended design sound levels and reverberation times for building interiors.

4.2 Economic Development Queensland (EDQ)

The approved Plan of Development (PoD) applicable to the proposal (EDQ Ref DEV20131469) requires the following design standards to be met:

DS15.20: All dwellings are to be designed and constructed using materials which ensure that any habitable rooms meet the following noise criteria based on the predicted Transport Noise Category for the railway being operational, being Queensland Development Code QDC MP4.4, or \leq 45 dBA single event maximum sound pressure level. An Acoustic Report, prepared by a suitably qualified person, is to be lodged with any application for compliance assessment, demonstrating how this will be achieved.

DS15.21: Each dwelling is to have an area of $10m^2$ with a minimum diameter of 2m which meets the following external noise criteria in outdoor spaces for passive recreation based on the predicted Transport Noise Category for the railway being operational, being ≤ 84 dBA L_{max} (single event maximum sounds pressure level) free field. An Acoustic Report, prepared by a suitably qualified person, is to be lodged with any application for compliance assessment, demonstrating how this will be achieved.

The above criteria from the PoD have been taken form the State Assessment and Referral Agency (SARA) State Development Assessment Provisions (SDAP) regarding rail noise.

4.3 State Assessment and Referral Agency (SARA) – State Development Assessment Provisions (SDAP)

4.3.1 Overview

Acoustic criteria for the project will address rail noise intrusion into the development in accordance with the current version of the SDAP, being v2.5, effective 1 July 2019.

The following glossary of terms is provided in SDAP for accommodation activities:

• Accommodation activity means any of the following: caretaker's accommodation, community residence, dual occupancy, dwelling house, dwelling unit, multiple dwelling, relocatable home park, residential care facility, resort complex, retirement facility, rooming accommodation, short-term accommodation, tourist park, or a development with a combination of these uses.



- Private open space means an outdoor space for the exclusive use of occupants of a building.
- Passive recreation area means an area used for passive recreation such as a park, playground or walking track. This term does not include drainage reserves or channels, landscape buffer strips, environmental areas or corridors, or conservation areas or corridors.
- Residential building means a class 1, class 2, class 3 or class 4 building as defined in the Building Code of Australia.

4.3.2 State Code 2: Development in a Railway Environment

Table 4.1SDAP State Code 2 Performance and Acceptable Outcomes (Partial Copy Table 2.2.2:
Environmental Emissions)

Performance Outcomes	Acceptable Outcomes		
Accommodation Activities			
PO24	AO24.1		
Development involving: 1. An accommodation activity; or	A noise barrier or earth mound is provided which is designed, sited and constructed:		
2. Land for a future accommodation activity	 To meet the following external noise criteria at all facades of the building envelope: 		
Minimises noise intrusion from a railway or type 2 multi-modal corridor in habitable rooms.	 a. ≤65 dB(A) Leq (24 hour) façade corrected b. ≤87 dB(A) (single event maximum sound pressure level) façade corrected 		
	 In accordance with the Civil Engineering Technical Requirement – CIVIL-SR-014 Design of noise barriers adjacent to railways, Queensland Rail, 2011. 		
	Note: To demonstrate compliance with the acceptable outcome, it is recommended a RPEQ certified noise assessment report be provided. The noise assessment report should be prepared in accordance with the State Development Assessment Provisions Supporting Information – Community Amenity (Noise), Department of Transport and Main Roads, 2013.		
	If the building envelope is unknown, the deemed-to-comply setback distances for buildings stipulated by the local planning instrument or relevant building regulations should be used. In some instances, the design of noise barriers and mounds to achieve the noise criteria above the ground floor may not be reasonable or practicable. In these instances, any relaxation of the criteria is at the discretion of the Department of Transport and Main Roads.		
	OR all of the following acceptable outcomes apply:		
	AO24.2		
	Buildings which include a habitable room are setback the maximum distance possible from a railway or type 2 multi-modal corridor.		
	AND		
	AO24.3		
	Buildings are designed and oriented so that habitable rooms are located furthest from a railway or type 2 multi-modal corridor.		



Performance Outcomes	Acceptable Outcomes		
	AND		
	AO24.4		
	Buildings (other than a relevant residential building or relocated building) are designed and constructed using materials which ensure that habitable rooms meet the following internal noise criteria:		
	1. ≤45 dB(A) single event maximum sound pressure level.		
	Statutory note: Noise levels from railways or type 2 multi- modal corridors are to be measured in accordance with AS1055.1–1997 Acoustics – Description and measurement of environmental noise.		
	Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report be provided. The noise assessment report should be prepared in accordance with the State Development Assessment Provisions Supporting Information – Community Amenity (Noise), Department of Transport and Main Roads, 2013.		
	Habitable rooms of relevant residential buildings located within a transport noise corridor must comply with the Queensland Development Code MP4.4 Buildings in a transport noise corridor, Queensland Government, 2015. Transport noise corridors are mapped on the State Planning Policy Interactive Mapping System.		
PO25	A025.1		
Development involving an accommodation activity minimises noise intrusion from a railway	A noise barrier or earth mound is provided which is designed, sited and constructed:		
or type 2 multimodal corridor in outdoor spaces for passive recreation.	 To meet the following external noise criteria in outdoor spaces for passive recreation: 		
	a. ≤62 dB(A) Leq (24 hour) free field		
	 b. ≤84 dB(A) (single event maximum sound pressure level) free field 		
	 In accordance with the Civil Engineering Technical Requirement – CIVIL-SR-014 Design of noise barriers adjacent to railways, Queensland Rail, 2011. 		
	OR		
	AO25.2		
	Each dwelling has access to an outdoor space for passive recreation which is shielded from a railway or type 2 multi- modal corridor by a building, a solid gap-free fence, or other solid gap-free structure.		
	AND		
	A025.3		
	Each dwelling with a balcony directly exposed to noise from a railway or type 2 multi-modal corridor has a continuous solid gap-free balustrade (other than gaps required for drainage purposes to comply with the Building Code of Australia).		



4.4 Department of Housing and Public Works – MP4.4

The Department of Housing and Public Works (HPW) has a number of mandatory Codes that must be complied with at building application stage. These are referred to as Queensland Development Codes (QDC).

QDC Mandatory Part (MP) 4.4 relates to new buildings in transport noise corridors. This mandatory Code deals with buildings within residential developments close to state-controlled roads and railways. MP4.4 sets mandatory construction standards for new residential development, or additions to existing residential development, within a Transport Noise Corridor.

The noise level categories extend out to 69 dBA L_{max} for rail noise. The noise categories and corresponding rail noise levels from Schedule 3, Table 1 of MP4.4 are as follows:

- Category 0: \leq 69 dBA L_{max}
- Category 1: $70 74 \text{ dBA } L_{max}$
- Category 2: $75 79 \text{ dBA } L_{max}$
- Category 3: 80 84 dBA L_{max}
- Category 4: \geq 85 dBA L_{max}

4.5 Sunshine Coast Council – Sunshine Coast Planning Scheme 2014

On 14 April 2014 Sunshine Coast Council (SCC) adopted the Sunshine Coast Planning Scheme 2014 and the associated planning scheme policies. The planning scheme and the planning scheme policies were gazetted on 2 May 2014 and commenced on 21 May 2014. The Sunshine Coast Planning Scheme 2014 replaces the Caloundra City Plan 2004 and Maroochydore City Plan 2000 planning schemes with one plan for the region.

With regards to the assessment of noise impacts, the relevant sections of the planning scheme are the Nuisance Code (Section 9.4.3) and the Planning Scheme Policy for the Nuisance Code (Section SC6.15). The Nuisance Code presents Performance Outcomes and Acceptable Outcomes for assessable development for acoustic amenity and noise but does not specifically nominate noise limits or assessment criteria. The Planning Scheme Policy for the Nuisance Code provides guidance for the assessment of road and rail noise, live entertainment, amplified music and voices (patrons). The policy does not specify noise limits but references the following guidelines to achieve the nuisance code outcomes:

- Australian Standard AS/NZS2107–2000: Acoustics— Recommended design sound levels and reverberation times for building interiors. This document is superseded by the 2016 version.
- Department of Housing and Public Works (HPW) Queensland Development Code (QDC) Mandatory Part 4.4 (MP4.4) 'Buildings in transport noise corridors'.
- Department of Environment and Science (DES) (formerly Department of Environment and Heritage Protection) Environmental Protection Policy (Noise) and Environmental Protection Act.
- Department of Transport and Main Roads (TMR) Road Traffic Noise Management: Code of Practice.

ASK contacted SCC on 29th September 2014 to discuss the application of the Sunshine Coast Planning Scheme 2014. ASK was advised by Council that at the present time, road traffic noise intrusion into buildings should still be assessed against the criteria previously applied by Caloundra City Council and Maroochy Shire Council.

Caloundra City Council and Maroochy Shire Council specified an external building facade limit of $63 \, dBA \, L_{10}(18 \, hour)$ (façade corrected) on residential land. For those instances where this external noise limit was predicted to be exceeded, the internal noise levels within habitable rooms were required to be designed to meet the maximum recommended design sound levels stated in Table 1 of AS/NZS 2107-2016 entitled "Acoustics - Recommended design sound levels and reverberation times for building interiors".



4.6 Australian Standard AS 2107:2016

For road traffic noise, Council recommends the most applicable assessment methodology would be the application of indoor noise levels specified in AS 2107:2016 "Acoustics - Recommended design sound levels and reverberation times for building interiors" (AS 2107). AS 2107 lists recommended internal noise levels for various building and room types, including residential bedrooms and other areas. For development near major and minor roads, the recommended design levels are as listed in **Table 4.2**.

Road Type	Type of Occupancy / Activity	Design Sound Level Leq dBA
Minor Road	Living areas	30 to 40
	Sleeping areas	30 to 35
	Work areas	35 to 40
Major Road	Living areas	35 to 45
	Sleeping areas	35 to 40
	Work areas	35 to 45

Table 4.2 Recommended Internal Noise Levels from AS 2107:2016

4.7 Summary of Criteria

The summary of noise criteria nominated for the development is as follows:

- EDQ Rail Noise Criteria (from future CAMCOS corridor):
 - In outdoor spaces for passive recreation (e.g. back yard)
 - ≤84 dBA single event maximum sound pressure level free field
 - Habitable rooms are designed and constructed as per rail noise requirements of QDC MP4.4, or designed to achieve an internal noise level of ≤45 dBA single event maximum sound pressure level.
- SDAP Rail Noise Criteria (from future CAMCOS corridor):
 - At 1m from the building façades:
 - ≤65 dBA L_{eq} (24 hour) façade corrected.
 - ≤87 dBA single event maximum sound pressure level façade corrected.
 - In outdoor spaces for passive recreation (e.g. back yard)
 - ≤62 dBA L_{eq} (24 hour) free field
 - ≤84 dBA single event maximum sound pressure level free field
 - Habitable rooms are designed and constructed as per rail noise requirements of QDC MP4.4, or designed to achieve an internal noise level of ≤45 dBA single event maximum sound pressure level
 - Habitable rooms are designed and constructed as per road noise requirements of QDC MP4.4.
- Council Road Noise Criteria (from North-South Sub Arterial, a future Council controlled road):
 - External facade noise limit: 63 dBA L₁₀ (18 hour) (facade corrected).
 - Internal noise limit (if external limit exceeded): internal design noise levels from AS/NZS 2107:2016, specifically:
 - 30 dBA L_{eq}(1 hour) for bedrooms in residences.
 - 35 dBA L_{eq}(1 hour) for other habitable rooms in residences.

From the above dot points it can be seen that the EDQ criteria match parts of the requirements of SDAP.



5. Rail Noise Assessment

5.1 Overview

Rail noise from the future CAMCOS corridor has been assessed onto the proposed development. The relevant assessment criteria are presented in **Section 4**.

At present, there is limited information available in relation to the future CAMCOS corridor, and there is some doubt about the ultimate timing of the service.

To assess the potential noise levels from rail traffic, indicative information has been drawn from the following documents:

- ARUP, Caboolture to Maroochydore Corridor Study Stage 3 Caloundra Options Assessment Report, date: March 1999.
- ARUP, Caboolture to Maroochydore Corridor Study Final Impact Assessment and Land Use Transport Strategy, Chapter 5 Environmental Setting, date: February 2001.

Future rail traffic noise levels across the site have been predicted using the SoundPlan computer model, based on the Kilde rail noise prediction method, which is approved by Queensland Rail.

5.2 Data

The following data has been used in the noise calculations:

- Due to the location of the corridor, it is assumed that only electric passenger trains will utilise the CAMCOS rail line. A noise source height of 0.5m has been applied for electric passenger trains.
- Ground contours for the site and the area of the CAMCOS corridor were provided by Calibre Consulting. The ground contours for the CAMCOS corridor do not included detailed consideration of the rail lines or required civil works.
- Receiver heights for the allotments were placed 1.8m above ground contour height.
- A +2.5 dBA facade reflection allowance is included in the rail noise level predictions.
- ASK has been advised by Stockland that the corridor has been design to support train travel speeds up to 100 km/h. Modelling of rail noise has applied this speed.
- ASK has been advised by Stockland that frequency of train travel for the corridor is unknown, however rail traffic is forecast to be running at a 30 minute headway by 2050. It is therefore assumed that there will be at least 15 train movements per day.
- Based on ASK's experience with similar rail noise assessments, L_{max} noise predictions typically determine the required mitigation measures (i.e. not set by L_{eq} noise predictions), and therefore due to absence of information regarding train frequencies, the assessment has been undertaken using L_{max} noise predictions only.
- Noise predictions have been undertaken using the eastbound rail line only, which is closest to the development. The setback distance from eastbound rail line to the boundary of LLC retirement village (closest boundary) is approximately 14 metres. The height of the rail line is based on the finished earthworks level of the corridor (between the rail lines) as it is the only data available. The application of this height is considered acceptable for the purposes of this assessment.
- A 2.4m high acoustic barrier is included along the railway line boundary to the west and east of the subject site (beyond the subject site). The top-of-barrier heights at the western side of the brook (i.e. P11-P14 Banya side) and eastern side of the brook (i.e. Thrive site) are modelled as 8.96 metres (i.e. 6.56 + 2.4) and 10.37 metres (i.e. 6.97 + 2.4), respectively. It is assumed that the barrier height adjacent the brook progresses linearly between these two top-of-barrier levels. The actual barrier design may vary but these heights should be considered as the minimum requirement.



5.3 Limitations & Assumptions

The assessment of future rail noise impacts has been undertaken with the most up-to-date design information available for the project. Although detailed design for the CAMCOS corridor has not yet been undertaken, the level of design information is considered appropriate for the current stage of assessment. Further assessment of rail noise impacts could be undertaken following progression of the design of the development and the CAMCOS corridor.

5.4 Verification

As the CAMCOS rail corridor has not been constructed, noise measurements of rail pass-bys are not able to be undertaken.

Verification of the rail noise model has been undertaken using the generic passenger train sound exposure level (SEL) data provided by QR, and the corrections included in the SoundPlan model under the Kilde method, as required by QR. This method is considered suitable for the assessment and therefore the resulting noise predictions are considered accurate.

5.5 Calculations and Assessment

5.5.1 In Outdoor Spaces

The predicted noise levels in external outdoor recreational areas for each lot adjacent the southern boundary are presented in **Table 5.1**. The centre of the outdoor recreation area was modelled as approximately 3 to 4 metres from the southern (rear) boundary fence. This includes results with no barriers along the southern property boundary and with 2.4m barrier.

Lot	Rail Noise Level L _{max} (single event maximum sound pressure level) dBA (free-field)		
	No Barrier	2.4m Barrier	
112	90	81	
113	90	81	
114	90	81	
115	90	81	
116	90	81	
117	90	81	
118	90	81	
119	90	81	
120	90	81	
121	90 81		
122	90 81		
123	90 81		
124	90 81		
125	90 81		
126	90	81	
127	90	81	
128	90	81	
129	90	81	

Table 5.1	Predicted Noise Levels in Outdo	or Spaces for Passive Recreation



Lot	Rail Noise Level L _{max} (single event maximum sound pressure level) dBA (free-field)		
	No Barrier	2.4m Barrier	
130	90	81	
131	90	81	
132	90	81	
133	90	81	
134	90	81	
135	90	80	
136	90	80	
137	90	80	
138	90	80	
139	90	81	
140	90	81	
141	90	81	
142	90 81		
143	90	81	
144	90	81	
145	90	81	
146	90	81	
147	90	81	
148	90	81	
149	90 81		

Note: All noise predictions in **Table 5.1** are free-field and do not include façade reflection.

From **Table 5.1** it can also be seen that the EDQ and SDAP criterion of '≤84 dBA single event maximum sound pressure level free field' is achieved at all lots with the proposed 2.4m barrier.

5.5.2 At Façade of Residences

Façade corrected noise levels are not required to be assessed using the EDQ criteria but are assessed under SDAP criteria.

The predicted noise levels at the façades for each lot adjacent the southern boundary are presented in **Table 5.2** and **Appendix C** contours.

Table 5.2	Predicted	Noise	Levels	at	Facades
10010 012				~ ~	

Lot	Rail Noise Level L_{max} (single event maximum sound pressure level) dBA (inclu façade reflection)		
	No Barrier	2.4m Barrier	
112	92	84	
113	92	83	
114	92	83	
115	92	83	
116	92	83	
117	92	83	
118	92	83	
119	92	83	



Lot	Rail Noise Level L _{max} (single event maximum sound pressure level) dBA (including façade reflection)		
	No Barrier	2.4m Barrier	
120	92	83	
121	92	83	
122	92	83	
123	92	83	
124	92	83	
125	92	83	
126	92	83	
127	92	83	
128	92	83	
129	92	83	
130	92	83	
131	92	83	
132	92	83	
133	92	83	
134	92	83	
135	92	83	
136	92	83	
137	92	83	
138	92	83	
139	92	83	
140	92	83	
141	92	83	
142	92	83	
143	92	83	
144	92	83	
145	92	83	
146	92	83	
147	92	83	
148	92	83	
149	92	83	

Note: All noise predictions in **Table 5.2** include façade reflection.

From **Table 5.2** it can also be seen that the SDAP criterion of '≤87 dBA single event maximum sound pressure level façade corrected' is achieved at all lots with the proposed 2.4m high noise barrier.



5.5.3 Inside Residences

This assessment addresses single storey, slab on ground construction dwellings.

Future residences can be designed by one of three methods, summarised as follows:

- (1) Design habitable rooms of dwellings to MP4.4 category based on the calculated rail noise levels, i.e. the MP4.4 categories in Figure C.2 in Appendix C. These categories apply to the façade closest to the rail way line and may be lower on other facades subject to determination by 3D rail noise modelling. This category is considered a voluntary rating and the categories have been summarised in Table 5.3.
- (2) Design habitable rooms of dwellings to achieve an internal noise level of 45 dBA L_{max} (Single event) based on the calculated rail noise levels, i.e. the rail noise level contours shown in Figure C.2 in Appendix C. The external rail noise levels are listed in Table 5.2, which applies to the façade closest to the rail way line and may be lower on other facades subject to determination by 3D rail noise modelling. This category is considered a voluntary rating.
- (3) Design habitable rooms of dwellings to achieve the minimum required MP4.4 Categories listed in Table 5.3 and shown in Figure 5.1. These ratings have been determined from an agreement between Stockland and EDQ on the basis that the corridor isn't gazetted yet and that it was not reasonable nor relevant to require a proponent to introduce significant acoustic amelioration requirements on residential lots that would significantly increase construction costs. Requirements are limited to Category 2 for the row of lots adjacent the railway line, and Category 1 for the next rows of lots.

QDC MP4.4 Category	MP4.4 Affected Lots for Two Design Methods (Voluntary and Minimum Required)		
	Voluntary ¹ Categories i.e. Design Method Option (1) - based on Contours in Figure C.2	Minimum Required ² Categories i.e. Design Method Option (3) – refer Figure 5.1	
3	112 to 149	nil	
2	97 to 111, 150 to 168	112 to 149	
1	67 to 96, 169 to 194	67 to 111, 150 to 194	

Table 5.3 QDC MP4.4 Rail Noise Categories

Notes 1. Voluntary MP4.4 ratings have been determined for the most exposed façade of a dwelling and are based on calculated rail noise levels in **Figure C.2** in **Appendix C**.

2. Minimum required MP4.4 ratings have been determined from an agreement between Stockland and EDQ and apply to all facades of the dwelling.

From **Table 5.3** it can be seen that the number of affected lots is the same for both design methods (i.e. voluntary and minimum required) but the categories are lower for the minimum required method.

The construction requirements to achieve the nominated MP4.4 Categories are included in Appendix E.





Figure 5.1 Minimum Required Rail MP4.4 Categories (Yellow Box = Category 2 Lots, Green Box = Category 1 Lots)

EDQ Note - Barrier Requirements

It is noted that noise barriers adjacent to railways must be designed, sited and constructed in accordance minimum requirements stated in Table 5.3 i.e. Categories stated in the Queensland Development Code (QDC) Mandatory Part 4.4 `Buildings in transport noise corridors'. On the basis that the CAMCOS corridor is not yet gazetted (as at September 2021), the construction of noise barriers adjacent to the CAMCOS corridor will be the responsibility of State Government.





6. Road Traffic Noise Assessment

6.1 Overview

Road traffic noise from the North-South Sub-Arterial Road (Aura Boulevard) has been assessed onto the site.

There are no EDQ criteria for road traffic noise, but assessment is required as per Council noise criteria given it is a Council controlled road.

Council recommends that the prediction of road traffic noise is to be conducted according to the United Kingdom Department of Transport (1988) procedure published as "Calculation of Road Traffic Noise" (CoRTN88). The road traffic noise levels have been predicted using the SoundPLAN computer model, based on the CoRTN88 traffic noise prediction method and is approved by Council.

6.2 Data

The following data has been used in the noise calculations:

- Noise source height of 0.5 m.
- Ground contours for the site and North-South Sub-Arterial Road corridor were provided by Calibre Consulting.
- Receiver heights for the allotments were placed 1.8m above ground contour height.
- A +2.5 dBA facade reflection allowance is included in the road traffic noise level predictions.
- Road width as per design drawings provided by Calibre Consulting, and traffic lane advice provided by MWH Global.
- Forecast traffic volumes for the year 2031 for the north-south sub-arterial roads shown in **Table 6.1** have been provided by MWH Global. Traffic volumes for the sub-arterial road were provided in the form of AM and PM pear hour traffic volumes. These volumes were converted to a 24 hour Annual Average Weekday Traffic (AAWT) volume (sum of the AM/PM peaks, multiplied by 5), and then converted to a Annual Average Daily Traffic (AADT) volume (multiplied by conversion factor of 0.945), based on advice provided by MWH Global.
- The road segments indicated in **Table 6.1** are presented graphically in **Figure 6.1**.
- The 18-hour traffic flow is taken to be 94% of the ultimate daily traffic flow.
- The road surface for all the roads used in the noise model is dense graded asphalt (DGA).
- The CoRTN road traffic noise model predicts the L₁₀(18 hour).
- Road traffic noise level predictions include the CoRTN calibration factors for Queensland conditions as detailed in Section 4.3.2.1 in TMR's Transport Noise Management Code of Practice (2013). The corrections are -1.7dBA for facade corrected predictions, and -0.7dBA for free field predictions.

Road	Segment	Direction	AADT	18 Hour Traffic Volume	Heavy Vehicle % (CV%)	Speed
North-South Sub-Arterial Road	B1	Southbound	14132	13285	3	60
		Northbound	11132	10464		
	В2	Southbound	2679	2518		
		Northbound	3662	3442		
	B3	Southbound	2396	2252		

Table 6.1 Traffic Data for the North-South Sub-Arterial Road



Road	Segment	Direction	AADT	18 Hour Traffic Volume	Heavy Vehicle % (CV%)	Speed
		Northbound	3175	2985		
	В4	Southbound	3270	3074		
		Northbound	3341	3140		



Figure 6.1 Road Segments

6.3 Verification

As the North-South Sub-Arterial and the internal road network have not been developed completely, road traffic noise measurements are unable to be undertaken, and therefore the road traffic noise model for the site is unable to be validated. The accuracy of the noise modelling undertaken is considered acceptable for the purposes of the assessment.

6.4 Calculations and Assessment

The road traffic noise levels for 2031 have been predicted at the proposed retirement village. The predicted façade corrected L10(18 hour) noise levels are presented in terms of noise contours in **Figure D.1** in **Appendix D**.

From **Figure D.1** it can be seen that the road traffic noise levels at all lots achieve the Council's 63 dBA L_{10} (18hour) façade corrected noise limit. No noise barriers or house upgrades are proposed for road traffic noise.



7. Recommendations & Conclusion

Future rail and road noise impacts onto the proposed LLC retirement village have been considered. Rail noise impacts relate to the adjoining CAMCOS corridor which may be constructed at some point in the future and this has been assessed as per EDQ and SDAP criteria. Road traffic noise impacts consider the North-South Sub-Arterial and this has been assessed as per Council criteria. The outcomes of the road and rail noise assessment are as follows:

- Rail noise levels in open spaces (i.e. back yards) of residences along the southern site boundary are compliant with EDQ and SDAP criteria with 2.4m high noise barrier at the southern site boundary.
- Rail noise levels at the facade of residences along the southern site boundary are compliant with SDAP criteria with a 2.4m high noise barrier to the southern site boundary.
- Future residences can be designed by one of three methods, summarised as follows:
 - Design habitable rooms of dwellings to MP4.4 category based on the calculated rail noise levels, i.e. the MP4.4 categories in Figure C.2 in Appendix C. These categories apply to the façade closest to the rail way line and may be lower on other facades subject to determination by 3D rail noise modelling. This category is considered a voluntary rating and the categories have been summarised in Table 5.3.
 - Design habitable rooms of dwellings to achieve an internal noise level of 45 dBA L_{max} (Single event) based on the calculated rail noise levels, i.e. the rail noise level contours shown in Figure C.2 in Appendix C. The external rail noise levels are listed in Table 5.2, which applies to the façade closest to the rail way line and may be lower on other facades subject to determination by 3D rail noise modelling. This category is considered a voluntary rating.
 - Design habitable rooms of dwellings to achieve the minimum required MP4.4 Categories listed in Table 5.3 and shown in Figure 5.1. These ratings have been determined from an agreement between Stockland and EDQ on the basis that the corridor isn't gazetted yet and that it was not reasonable nor relevant to require a proponent to introduce significant acoustic amelioration requirements on residential lots that would significantly increase construction costs. Requirements are limited to Category 2 for the row of lots adjacent the railway line, and Category 1 for the next rows of lots.
- Of the above three design methods, the last 'Minimum Required' method is expected to result in the least construction upgrades, and is consistent with the approach used for other residential allotments along the CAMCOS rail corridor.
- The construction requirements to achieve the nominated MP4.4 Categories are included in **Appendix E**.
- Road noise from the adjoining North-South Sub Arterial road has been assessed as per Council criteria and is compliant. No noise barriers or house construction upgrades are proposed for road traffic noise.

- On the basis that the CAMCOS corridor is not yet gazetted (as at September 2021), the construction of noise barriers adjacent to the CAMCOS corridor will be the responsibility of State Government.





Appendix A Glossary

Parameter or Term	Description
dB	The decibel (dB) is the unit measure of sound. Most noises occur in a range of 20 dB (quiet rural area at night) to 120 dB (nightclub dance floor or concert).
dBA	Noise levels are most commonly expressed in terms of the 'A' weighted decibel scale, dBA. This scale closely approximates the response of the human ear, thus providing a measure of the subjective loudness of noise and enabling the intensity of noises with different frequency characteristics (e.g. pitch and tone) to be compared.
Day	The period between 7am and 6pm.
Evening	The period between 6pm and 10pm.
Night	The period between 10pm and 7am.
Free-field	The description of a noise receiver or source location which is away from any significantly reflective objects (e.g. buildings, walls).
L ₁	The noise level exceeded for 1% of the measurement period.
L ₁₀	The noise level exceeded for 10% of the measurement period. It is sometimes referred to as the average maximum noise level.
L ₉₀	The noise level exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
L _{eq}	The equivalent continuous sound level, which is the constant sound level over a given time period, which is equivalent in total sound energy to the time-varying sound level, measured over the same time period.
Leq,1hour	As for L_{eq} except the measurement intervals are defined as 1 hour duration.
L _{max}	Maximum A-weighted sound pressure level.
L _{eq} (24 hour)	The average L_{eq} noise level over the 24-hour period from midnight to midnight.
L10(18 hour)	The arithmetic average of the one-hour L_{10} values between 6am and midnight. This parameter is used in the assessment of road traffic noise.
Rw	Weighted Sound Reduction Index – is a single number evaluation of the property of a partition to attenuate sounds. For the majority of partitions, the value of Rw will be similar to the value for STC. Partitions with particularly poor performance at 100 Hz may have lower values for Rw than for STC. Conversely, partitions with poor performance at 4000 Hz may have higher Rw than for STC. (As per AS1276.1-1999).
Habitable Rooms	According to the "Building Code of Australia" a Habitable Room is: " a room used for normal domestic activities and Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre, and sunroom, but Excludes a bathroom laundry water closet pantry, walk in wardroba, corridor, ballway
	lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods."



Appendix B Project Drawings





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Appendix C Rail Traffic Noise Contours



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Z:\Large project files\197401\0244 - LLC Retire Aura\Model\0244R01V01\Figure C.2 new2.sgs



Appendix D Road Traffic Noise Contours



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Appendix E MP4.4 Construction Requirements

Table E.1 Acceptable Forms of Construction

Component of Buildings External Envelope	Minimum Acoustic Rating (R _w)	Acceptable Forms of Construction
Noise Category	3	
Glazing	38 (where total area of glazing for a habitable room is greater than 1.8m ²)	Minimum 14.38mm thick laminated glass, with full perimeter acoustically rated seals; OR Double glazing consisting of one pane of minimum 5mm thick glass and one pane of minimum 6mm thick glass with at least 44mm air gap, and full perimeter acoustically rated seals
	35 (where total area of glazing for a habitable room is less than or equal to 1.8m ²)	Minimum 10.38mm thick laminated glass, with full perimeter acoustically rated seals.
External walls	47	Two leaves of clay brick masonry at least 110mm thick with:
		(i) cavity not less than 50mm between leaves; and
		(ii) 50mm thick mineral insulation or 50mm thick glass wool insulation with a density of 11kg/m ³ or 50mm thick polyester insulation with a density of 20kg/m ³ in the cavity.
		I wo leaves of clay brick masonry at last 110mm thick with:
		(i) cavity not less than somm between leaves; and
		OR
		Single leaf of clay brick masonry at least 110mm thick with:
		 (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and
		 (ii) Mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m³ positioned between studs; and
		(iii) One layer of plasterboard at least 13mm thick fixed to outside face of studs.
		OR
		Single leaf of minimum 150mm thick masonry of hollow, dense concrete blocks, with mortar joints laid to prevent moisture bridging.
Roof	41	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling joists, glass wool insulation at least 50mm thick with a density of at least 11kg/m ³ or polyester insulation at least 50mm thick with a density of at least 20kg/m ³ in the cavity. OR
		Concrete suspended slab at least 100mm thick.



Component of Buildings External Envelope	Minimum Acoustic Rating (R _w)	Acceptable Forms of Construction
Floors	45	Concrete slab at least 100mm thick OR
		Tongued and grooved boards at least 19mm thick with:
		(i) timber joists not less than 175mm x 50mm; and
		(ii) mineral insulation or glass wool insulation at least 75mm thick with a density of at least 11kg/m ³ positioned between joists and laid on plasterboard at least 10mm thick fixed to underside of joists; and
		(iii) mineral insulation or glass wool insulation at least 25mm thick with a density of at least 11kg/m ³ laid over entire floor, including tops of joists before flooring is laid; and
		(iv) secured to battens at least 75mm x 50mm; and
		(v) the assembled flooring laid over the joists, but not fixed to them, with battens lying between the joists.
Entry doors	33	Fixed so as to overlap the frame or rebate of the frame by not less than 10mm, fitted with full perimeter acoustically rated seals and constructed of - (i) solid core, wood, particleboard or blockboard not less than 45mm
		thick; and/or
		(ii) acoustically laminated glass not less than 10.38mm thick.
Noise Category 2	2	
Glazing	35 (where total area of glazing for a habitable room is greater than 1.8m ²)	Minimum 10.38mm thick laminated glass, with full perimeter acoustically rated seals.
	32 (where total area of glazing for a habitable room is less than or equal to 1.8m ²)	Minimum 6.38mm thick laminated glass with full perimeter acoustically rated seals.



Component of Buildings External Envelope	Minimum Acoustic Rating (R _w)	Acceptable Forms of Construction
External walls	41	Two leaves of clay brick masonry at least 110mm thick with cavity not less than 50mm between leaves OR
		Single leaf of clay brick masonry at last 110mm thick with:
		 (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and
		 (ii) mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m3 positioned between studs; and
		(iii) One layer of plasterboard at least 10mm thick fixed to outside face of studs
		OR
		Single leaf of brick masonry at least 110mm thick with at least 13mm thick render on each face
		OR
		Concrete brickwork at least 110mm thick
		OR
		Precast concrete at least 100mm thick and without joints.
Boof	38	Concrete or terracotta tile or metal sheet roof with sarking plasterboard
		ceiling at least 10mm thick fixed to ceiling cavity, mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m ³ .
Floors	45	Concrete slab at least 100mm thick
		OR
		Tongued and grooved boards at least 19mm thick with:
		(i) timber joists not less than 175mm x 50mm; and
		(ii) mineral insulation or glass wool insulation at least 75mm thick with a density of at least 11kg/m ³ positioned between joists and laid on plasterboard at least 10mm thick fixed to underside of joists; and
		(iii) mineral insulation or glass wool insulation at least 25mm thick with a density of at least 11kg/m ³ laid over entire floor, including tops of joists before flooring is laid; and
		(iv) secured to battens at least 75mm x 50mm; and
		(v) the assembled flooring laid over the joists, but not fixed to them, with battens lying between the joists.
Entry doors	33	Fixed so as to overlap the frame or rebate of the frame by not less than 10mm, fitted with full perimeter acoustically rated seals and constructed of -
		 (i) solid core, wood, particleboard or blockboard not less than 45mm thick; and/or
		(ii) acoustically laminated glass not less than 10.38mm thick.
Noise Category	L	



Component of Buildings External Envelope	Minimum Acoustic Rating (R _w)	Acceptable Forms of Construction	
Glazing	27 (where total area of glazing for a habitable room is greater than 1.8m ²)	Minimum 4mm thick glass with full perimeter acoustically rated seals	
	24 (where total area of glazing for a habitable room is less than or equal to 1.8m ²)	Minimum 4mm thick glass with standard weather seals	
External walls	35	 Single leaf of clay brick masonry at least 110mm thick with: (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) One layer of plasterboard at least 10mm thick fixed to outside face of studs OR 	
		Minimum 6mm thick fibre cement sheeting or weatherboards or plank cladding externally, minimum 90mm deep timber stud or 92mm metal stud, standard plasterboard at least 13mm thick internally.	
Roof	35	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling cavity.	
Entry doors	28	 Fixed so as to overlap the frame or rebate of the frame, constructed of - (i) Wood, particleboard or blockboard not less than 33mm thick; or (ii) Compressed fibre reinforced sheeting not less than 9mm thick; or (iii) Other suitable material with a mass per unit area not less than 24.4kg/m²; or (iv) Solid core timber door not less than 35mm thick fitted with full perimeter acoustically rated seals. 	
Noise Category 0			
No additional ac	oustic treatment requir	ed – standard building assessment provisions apply.	