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ASK Consulting Engineers Pty Ltd

ABN: 55 622 586 522 ACN: 128 491 967

PO Box 3901 South Brisbane QLD 4101

P: 07 3255 3355 F: 07 3844 7180

www.askconsulting.com.au

mail@askconsulting.com.au

Local Centre

Lot 8001, Bells Reach Subdivision, Caloundra South

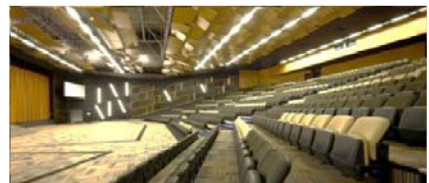
Noise Impact Assessment

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Author Signature		Approver Signature	
Name	Mitch Ryan	Name	Stephen Pugh
Title	Engineer	Title	Director

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1. Introduction

ASK Consulting Engineers Pty Ltd (ASK) was commissioned by Stockland Development Pty Ltd to provide acoustic consultancy services for the proposed local centre development to be located at Lot 8001 in the Bells Reach subdivision in Caloundra South. The development forms part of the Caloundra South Priority Development Area. This acoustic report is to form part of the Development Application for consideration by Economic Development Queensland (EDQ).

The development is proposed to include two retail uses, residential dwellings, car parking areas and open space.

ASK has previously undertaken noise impact assessments for this lot as presented in ASK report 6157R01V02 dated 05/12/2011 and report 6157R02V04 dated 10/04/2012. Since the time of these previous assessments the proposed development for the lot has changed, and an updated noise assessment report is required for the submission of a new Development Application.

The purpose of this report is as follows:

- Outline the relevant project noise criteria.
- Present the results of noise monitoring.
- Assess traffic noise impact from Bellvista Boulevard and Bells Reach Drive onto the residential lots.
- Predict and assess the noise emissions from 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 proposed development is to be located on Lot 8001 in the Bells Reach subdivision in Caloundra South. The site location is shown in **Figure 2.1** and **Figure 2.2**.

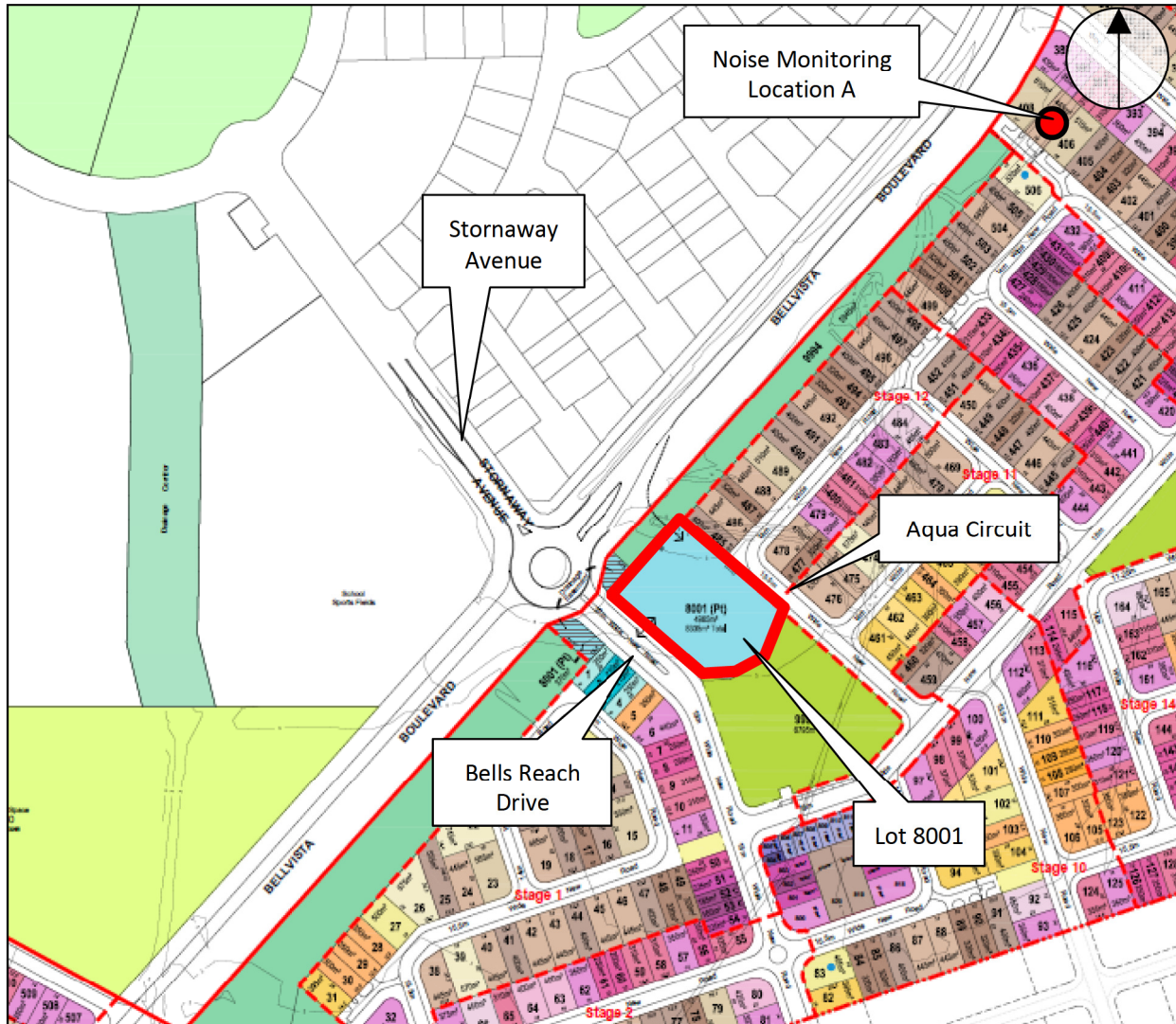


Figure 2.1 Site Location Lot Plan



Figure 2.2 Site Location Aerial (Source: Google Earth Pro)

The site currently contains car parking areas, a Stockland sales office, a cafe and open space areas. The proposed development is surrounded by the following premises:

- Bellvista Boulevard to the north-west, with residential premises further to the north-west.
- Bells Reach Drive to the south-west, with residential premises further to the south-west.
- Residential dwellings to the north-east.
- Parkland including an existing playground to the south-east.

The proposed development is potentially impacted upon by road traffic noise from Bellvista Boulevard and Bells Reach Drive, and this is required to be considered in the project design.

Noise emissions from the proposed development onto surrounding residential premises and residential premises proposed within the development are also required to be assessed.

3. Proposed Development

The development is proposed to include the following:

- 13 residential lots, including:
 - Three small office/home office (SoHo) lots (two storey)
 - 10 x urban terrace residential lots (two storey)
- Two retail buildings, anticipated to facilitate a cafe and a local corner store/takeaway restaurant/ small commercial office (i.e. real estate) type use
- 19 retail car parking spaces
- Access road to residential lots and 8 residential parking spaces.

It is understood that a smaller cafe currently operates on the site from 6:30am to 5:00pm using a temporary tenancy.

The site layout plan is presented in **Figure 3.1**. At the present time detailed design for the development, both the retail buildings and residential dwellings, has not yet been undertaken.

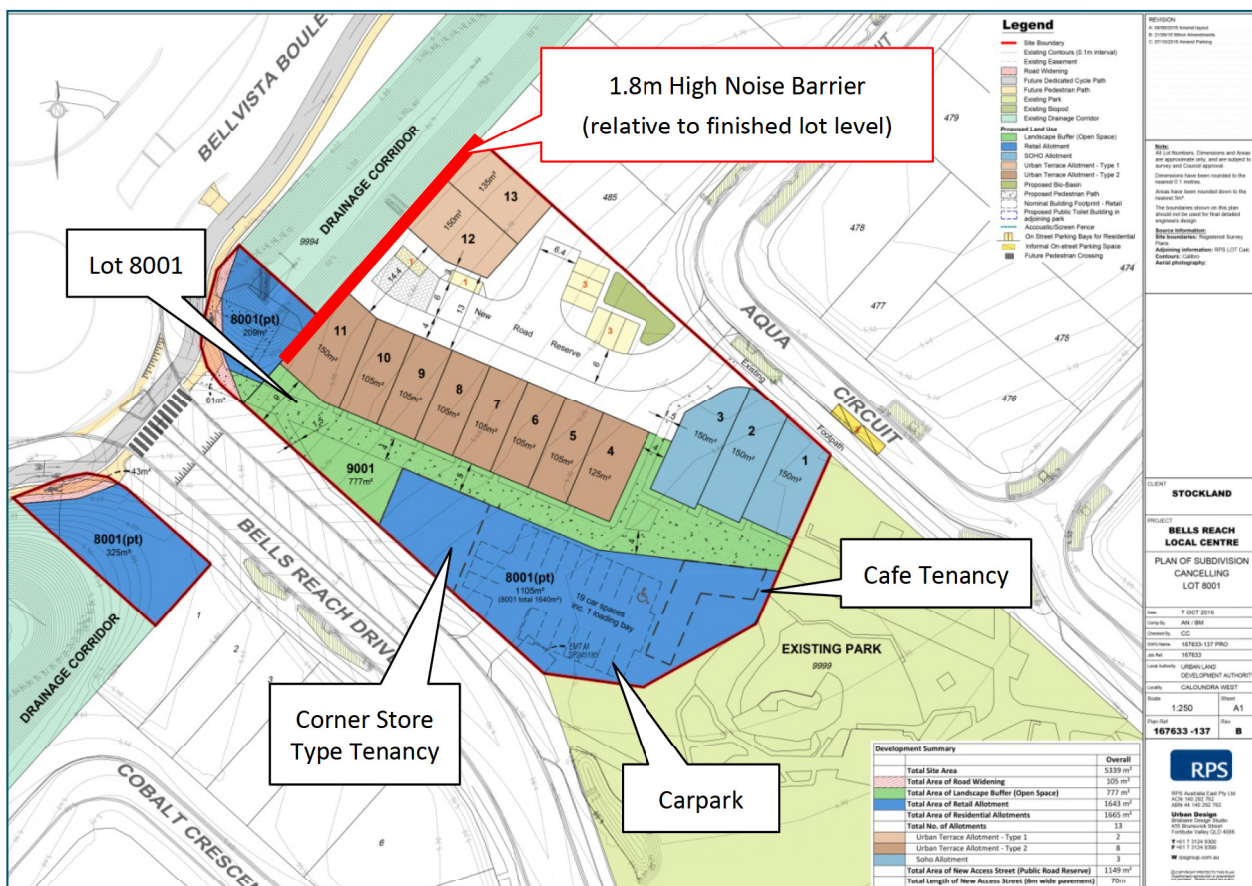


Figure 3.1 Lot 8001 Layout Plan

Based on the type of development proposed, this noise assessment has considered noise impacts from the car parking areas, cafe patron noise, mechanical plant and waste collection. No significant noise sources are assumed to be associated with the corner store type retail use, with the exception of mechanical plant. The residential lots within Lot 8001 are subject to the Bells Reach Acoustic Covenant, which specifies façade acoustic rating and construction requirements for potential aircraft noise intrusion. No further assessment of aircraft noise is required to be undertaken.

4. Acoustic Criteria

4.1 Overview

Acoustic criteria for the project are required to assess road traffic noise impacts onto the development and noise emissions from the development onto nearby sensitive receptors. As EDQ does not prescribe noise impact assessment criteria, the acoustic assessment has been undertaken in accordance with the following criteria which is considered relevant:

- Sunshine Coast Regional Council Planning Scheme 2014.
- Australian Standard AS/NZS 2107–2000: Acoustics — Recommended design sound levels and reverberation times for building interiors.
- Department of Environment and Heritage Protection (EHP) – Environmental Protection Policy (Noise) and Environmental Protection Act.
- Department of Transport and Main Roads (TMR) Road Traffic Noise Management: Code of Practice.
- Office of Liquor and Gaming Regulation (OLGR) – Guideline for Acoustic Consultants.

4.2 Sunshine Coast Regional Council - Sunshine Coast Planning Scheme 2014

On 14 April 2014 Sunshine Coast Regional Council (SCRC) 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 Maroochy Plan 2000 planning schemes with one plan for the region.

In 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.
- 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 Heritage Protection (EHP) – Environmental Protection Policy (Noise) and Environmental Protection Act.
- Department of Transport and Main Roads (TMR) – Road Traffic Noise Management: Code of Practice.

ASK contacted SCRC 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.

4.2.1 Road Traffic Noise

Caloundra City Council and Maroochy Shire Council specified an external building facade limit of 63 dBA L₁₀(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 2107-2000 entitled “Acoustics - Recommended design sound levels and reverberation times for building interiors”.

For road traffic noise intrusion into private open spaces, ASK has been advised by Council that the recommended criteria are the Acoustic Quality Objectives outdoor limits presented in Schedule 1 of the Environmental Protection (Noise) Policy (2008) (EPP (Noise)). ASK does not consider the implementation of the Acoustic Quality Objectives limits for private open spaces as realistic because these limits are well below those recommended by TMR and other local council authorities. The Planning Scheme Policy for the Nuisance Code also refers to TMR’s Road Traffic Noise Management Code of Practice and therefore the noise limits for formal outdoor space from this code are proposed to be applied. The noise limits as prescribed in the TMR Code of Practice (which are the same as prescribed by the State Development Assessment Provisions) are presented in **Section 4.4**.

4.2.2 Nuisance Code

The Sunshine Coast Regional Council (SCRC) City Plan addresses noise within the Nuisance Code and Planning Scheme Policy for the Nuisance Code.

From the Nuisance Code, the Assessment Criteria are in Table 9.4.3.3.1 of the Code, the relevant contents of which are presented in **Table 4.1**.

Table 4.1 Criteria for Assessable Development (From Table 9.4.3.3.1 of Nuisance Code)

Performance Outcomes	Acceptable Outcomes
PO1: Development, other than development involving live entertainment or amplified sound in a hospitality area or as part of a temporary event, is located, designed, constructed and operated to ensure that noise emissions do not adversely impact on surrounding sensitive land uses. Note—this performance outcome applies even if noise emissions are generated by sensitive land uses, from sources such as communal areas, service areas, plant and equipment (e.g. air conditioning units) and the like	AO1: Development does not involve activities that would cause noise related environmental harm or nuisance. OR Development ensures noise does not emanate from the <i>site</i> through site layout, design, construction, and operation.
PO2: Development that is a <i>sensitive land use</i> is located, designed, constructed and operated to achieve a satisfactory level of acoustic amenity where there is potential for noise emissions generated from surrounding development to adversely affect the <i>sensitive land use</i>. Editor’s note—this performance outcome relates to a ‘reverse amenity’ situation where a proposed <i>sensitive land use</i> may be adversely impacted by noise emissions from surrounding development. In such cases, it is contingent upon the proposed <i>sensitive land use</i> to implement measures to ensure a satisfactory level of acoustic amenity is provided to prospective occupants and users of the development.	AO2: The <i>sensitive land use</i> is not established in an area that will be adversely impacted by noise generated by existing land uses, activities and possible future development in the area. OR Where located in an area where adverse noise impacts are likely, the <i>sensitive land use</i> mitigates all potential impacts through site layout, design, construction, and operation.

Performance Outcomes	Acceptable Outcomes
PO3: Development involving live entertainment or amplified sound in a hospitality area, or as part of a temporary event, provides a satisfactory level of acoustic amenity for surrounding <i>sensitive land uses</i> , having regard to the location and setting of the development and the frequency of the event	AO3: No acceptable outcome provided.

From the above table, the relevant acceptable outcome for noise from onsite activities is in AO1, i.e. “development ensures noise does not emanate from the *site* through site layout, design, construction, and operation”. The planning scheme policy (SC6.15) provides guidance for achieving this outcome.

From SC6.15.4 in the planning scheme policy for the nuisance code, the following information is provided:

“The following is advice for achieving Performance Outcomes PO1 and PO2 of Table 9.4.3.3.1 (Criteria for assessable development) of the Nuisance code where there is potential for noise and/or vibration emissions or imissions to cause environmental harm or nuisance at a sensitive land use:-

- (a) compliance with Performance Outcomes PO1 and PO2 of Table 9.4.3.3.1 (Criteria for assessable development) of the Nuisance code may be demonstrated in part or aided by the submission of a noise impact assessment report prepared by a competent person, which properly addresses, describes or includes the following:-*
 - (i) a location plan identifying the subject site and sensitive land uses or the nearest potentially sensitive land uses to the subject site and any significant features such as topographic variation, barriers and intervening buildings;*
 - (ii) the results of measurements of background L_{A90} noise levels using an appropriate methodology at a location representative of the nearest potentially affected sensitive land uses to the subject site in the absence of noise emissions from the subject site, with:-*
 - (A) the background noise levels to include time periods that are most likely to be sensitive from a noise perspective (generally at night); and*
 - (B) the background noise monitoring to be completed for a sufficient period of time to establish ‘the average minimum background noise levels’ for the locality;*
 - (iii) comparison of the background noise level with predicted source noise levels using an appropriately recognised methodology and criteria, from the proposed activity at the nearest potentially affected sensitive land uses to determine compliance with criteria as defined in Schedule 1 of the Environmental Protection (Noise) Policy 2008; and*
 - (iv) specification of appropriate control and mitigation measures as necessary”*

The advice above references Schedule 1 of the Environmental Protection (Noise) Policy 2008 (the EPP(Noise)). Schedule 1 of the EPP(Noise) includes a range of acoustic quality objectives for a range of receptors. The objectives are in the form of noise levels, and are defined for various periods of the day, and use a number of acoustic parameters. The noise limits prescribed by the EPP(Noise) are presented in **Section 4.5**.

4.3 Australian Standard AS 2107:2000

For road traffic noise, Council recommends the most applicable assessment methodology would be the application of indoor noise levels specified in AS 2107:2000 “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**.

Table 4.2 Recommended Internal Noise Levels from AS 2107

Road Type	Type of Occupancy / Activity	Design Sound Level L_{eq} 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	30 to 40
	Work areas	35 to 45

Based on the design sound levels presented in **Table 4.1**. The recommended internal design noise limits for the development from AS 2107 are 35 dBA L_{eq} (1 hour) for bedrooms, and 40 dBA L_{eq} (1 hour) for other habitable rooms.

4.4 Queensland Department of Transport and Main Roads (TMR)

The Department of Transport and Main Roads (TMR) “Road Traffic Noise Management: Code of Practice” has road traffic noise criteria for residential developments including for balconies and formal open space. Formal external space is defined as the private or communal recreational area “required” by a local government. For this scenario TMR recommend:

- The L_{10} (18 hour) should be equal to or less than 60 dBA, where existing levels measured at the local government deemed-to-comply dwelling setback distance are greater than 45 dBA L_{90} (18 hour) between 6 am and 12 midnight.
- The L_{10} (18 hour) should be equal to or less than 57 dBA, where existing levels measured at the local government deemed-to-comply dwelling setback distance are less than or equal to 45 dBA L_{90} (18 hour) between 6 am and 10 midnight.

All external noise levels stated are free-field with the expectation that an additional 2.5 dBA increase is applied for the façade correction when the building is constructed. This will achieve a level of equal to or less than 63 dBA and 60 dBA respectively, 1m from the most exposed facade of a building.

4.5 Environmental Protection (Noise) Policy

4.5.1 Overview

In respect of the acoustic environment, the object of the Act is achieved by the Environmental Protection (Noise) Policy 2008 (EPP (Noise)). This policy identifies environmental values to be enhanced or protected, states acoustic quality objectives, and provides a framework for making decisions about the acoustic environment.

4.5.2 Background Creep

The EPP(Noise) contains noise criteria for controlling background creep, which are to be applied “for an activity involving noise”. The criteria are as follows:

To the extent that it is reasonable to do so, noise from an activity must not be—

- for noise that is continuous noise measured by $L_{A90,T}$ —more than nil dBA greater than the existing acoustic environment measured by $L_{A90,T}$; or
- for noise that varies over time measured by $L_{Aeq,adj,T}$ —more than 5dBA greater than the existing acoustic environment measured by $L_{A90,T}$.

The EPP(Noise) does not define “continuous noise”, but by definition, the “continuous noise” would be required to occur for at least 90% of a measurement period (typically 15 minutes or 60 minutes). Thus this criterion could apply for equipment such as mechanical plant.

The criterion for “noise that varies over time” is appropriate for noise sources operating for less than 90% of a measurement period, and could apply to intermittent events (e.g. vehicles) or mechanical plant that does not run continuously (e.g. air-conditioning).

4.5.3 Acoustic Quality Objectives

The EPP (Noise) contains a range of acoustic quality objectives for a range of receptors. The objectives are in the form of noise levels, and are defined for various periods of the day, and use a number of acoustic parameters.

Schedule 1 of the EPP(Noise) includes the following acoustic quality objectives to be met at residential dwellings:

- Outdoors
 - Daytime and Evening: 50 dBA $L_{Aeq,adj,1hr}$, 55 dBA $L_{A10,adj,1hr}$ and 65 dBA $L_{A1,adj,1hr}$
- Indoors
 - Daytime and Evening: 35 dBA $L_{Aeq,adj,1hr}$, 40 dBA $L_{A10,adj,1hr}$ and 45 dBA $L_{A1,adj,1hr}$
 - Night: 30 dBA $L_{Aeq,adj,1hr}$, 35 dBA $L_{A10,adj,1hr}$ and 40 dBA $L_{A1,adj,1hr}$

In the DEHP EcoAccess Guideline “Planning For Noise Control” documentation it is proposed that the noise reduction provided by a typical residential building façade is 7 dBA assuming open windows, whilst numerous local councils prescribe that a 5 dBA reduction should be applied. That is, with an external noise source, a 5 dBA reduction in noise levels from outside a house to inside a house is expected when windows are fully open. Thus, applying a +5 dBA adjustment, the indoor noise objectives noted above could be converted to the following external objectives (with windows open):

- Daytime and Evening: 40 dBA $L_{Aeq,adj,1hr}$, 45 dBA $L_{A10,adj,1hr}$ and 50 dBA $L_{A1,adj,1hr}$
- Night: 35 dBA $L_{Aeq,adj,1hr}$, 40 dBA $L_{A10,adj,1hr}$ and 45 dBA $L_{A1,adj,1hr}$

4.6 EcoAccess Guidelines

DEHP has a number of EcoAccess guidelines relevant to the assessment of noise and vibration. These are summarised as follows.

4.6.1 EcoAccess – Planning for Noise Control

DEHP EcoAccess Guideline “Planning For Noise Control” contains procedures and methods that are applicable for setting conditions relating to noise emitted from industrial premises for planning purposes. The guideline is applicable to noise from all sources, individually and in combination, which contribute to the total noise from a site.

4.6.2 Control and Prevention of Background Creep

The procedure takes into account three factors: firstly, the control and prevention of background noise creep in the case of a steady noise level from equipment such as caused by ventilation fans and other continuously operating machinery; secondly, the containment of variable noise levels and short-term noise events such as those caused by forklifts and isolated hand tools to an acceptable level above the background noise level; thirdly, the setting of noise limits that should not be exceeded to avoid sleep disturbance.

4.6.3 Sleep Disturbance Criteria

The World Health Organization (WHO) issued its “Guidelines for Community Noise” in April 1999. The WHO guideline states the following in regard to sleep disturbance from continuous noise from activities such as mining operations:

“Where noise is continuous, the equivalent sound pressure level should not exceed 30 dBA indoors, if negative effects on sleep are to be avoided. When noise is composed of a large proportion of low-frequency sounds a still lower guideline value is recommended, because low-frequency noise (eg from a ventilation system) can disturb rest and sleep even at low sound pressure levels.”

The EcoAccess Guideline “Planning for Noise Control”, in referring to the World Health Organisation guidelines, makes the following general recommendation regarding short term transient noise events:

“As a rule in planning for short-term or transient noise events, for good sleep over eight hours, the indoor sound pressure level measured as a maximum instantaneous value should not exceed approximately 45 dBA maxLpA more than 10 to 15 times per night.”

For less regular night events, the allowable internal noise level is higher, as follows:

- Approximately 3 events per night: 50 dBA L_{max} .
- Approximately 1 event per night: 65 dBA L_{max} .

Note: For the purpose of this assessment the maxLpA level is defined using the L_{max} descriptor.

The WHO guideline states the following in regard to annoyance response to community noise:

“Annoyance to community noise varies with the type of activity producing the noise. During the daytime few people are seriously annoyed by activities with L_{Aeq} levels below 55 dBA; or moderately annoyed by L_{Aeq} levels below 50 dBA. Sound pressure levels during the evening and night should be 5 – 10 dBA lower than during the day. Noise with low frequency components requires even lower levels.”

Applying the +5 dBA correction for noise reduction through a facade with an open window (as prescribed by local Councils), the indoor noise objectives noted above could be considered external objectives (with windows open). The criteria are summarised in **Table 4.3**.

Table 4.3 Summary of WHO Sleep Disturbance and Annoyance Criteria

Descriptor	Number of Noise Events	Indoor Criterion dBA	Outdoor Criterion dBA
Sleep Disturbance (Short Duration Events)	10 – 15	L_{max} 45	L_{max} 50
	3	L_{max} 50	L_{max} 55
	1	L_{max} 55	L_{max} 60
Sleep Disturbance (Continuous Noise)	Continuous	L_{eq} 30	L_{eq} 35
Annoyance (Night Time)	Continuous	L_{eq} 35	L_{eq} 40

Note: The outdoor criteria are based on a outdoor-to-indoor noise reduction of 5 dBA for open windows.

4.7 Office of Liquor and Gaming Regulation

It is understood that the cafe tenant may apply for a liquor license, and therefore the noise criteria prescribed by Queensland Office of Liquor and Gaming Regulation (OLGR) have been included for reference.

The current noise criteria prescribed by OLGR (formerly Liquor Licensing) are presented within the “Guideline for Acoustic Consultants”, which includes the following noise criteria.

The acoustic criteria for Affected Premises, where affected premises includes commercial and residential premises, are as follows.

- The night-time criterion (10pm to 6am) is: The sound pressure level L_{OCT10} , in a full octave band with centre frequencies from 63 Hz to 2000 Hz must not exceed the background level, L_{OCT90} , by more than 8 dB in any octave band when measured at any affected premises.
- The day and evening criterion (6am to 10pm) is: The adjusted maximum sound pressure level L_{10} , plus adjustments for tonal and impulse components, must not exceed the background level L_{90} by more than 10 dBA when measured at any affected premises.

The criteria standard applies to indoor and outdoor parts of the premises.

The noise levels are to be normalized using a low-frequency weighted spectrum detailed in the guideline. This normalisation procedure is used to ensure that the assessment allows for the possibility of amplified music with significant low-frequency sound, even if testing is conducted with music devoid of significant low-frequency sound.

The noise levels are inclusive of all noise from the premises, including amplified music, patrons, and mechanical plant.

Noise limits are generally only provided for two time periods - before 10pm and after 10pm. These hours may be altered to suit the times that noise may impact on affected premises.

Noise limits are generally set at 3 metres from the primary sound source, e.g. main speaker(s). However, in some premises a distributed sound system would be used, and the noise limit may be applied at a location specified within an acoustic report (e.g. centrally between all the speakers).

In some instances where a noise report is not provided, a general noise limit is set, being 75 dBC L_{10} at 3 metres from the speakers. It is understood that even if this limit is set, the premises is required to comply with the acoustic criteria nominated in the dot points above.

5. Acoustic Measurements

5.1 Overview

Acoustic measurements consisted of noise logging and an attended noise measurement. The noise measurement location is shown in **Figure 2.1**. The noise monitoring was undertaken in general accordance with Australian Standard AS1055 Acoustics – Description and measurement of environmental noise and the EHP Noise Measurement Manual.

Noise monitoring was undertaken in 2011 as part of the previous noise assessments undertaken by ASK. The results of the noise monitoring from 2011 are considered applicable for the purposes of this assessment.

5.2 Attended Noise Measurement

An attended noise measurement was undertaken at Location A as shown on **Figure 2.1**.

The measurement was undertaken on 18/07/2011 at 12:23pm over a 15 minute period using a field and laboratory calibrated Rion NA27 sound level meter. The microphone height was approximately 1.3m above natural ground level and was located in the free field.

The measured noise levels are summarised in **Table 5.1**. The parameters noted in **Table 5.1** are described in the glossary in **Appendix A**.

Table 5.1 Attended Noise Measurement Results

Location	Date & Time	Period (Minutes)	Results & Notes
A	12:23pm 18/07/2011	15	Statistical noise levels: L ₁₀ 60 dB(A), L _{eq} 56 dB(A), L ₉₀ 41 dB(A) Passing cars 50 – 56 dB(A) Passing van/4WD 56 – 62 dB(A) Truck 58 – 64 dB(A) Helicopter 50 – 68 dB(A) Background noise 35 – 45 dB(A)

5.3 Noise Logging

Noise logging was undertaken at Location A as shown on **Figure 2.1**. Logging was undertaken from 19/07/2011 to 04/08/2011 using a field and laboratory calibrated Rion NL-22 environmental noise logger. Noise logging was undertaken in the free field.

Weather during the time of monitoring was mostly fine, with small amounts of rain recorded on the 1st, 4th, 5th and 8th of August. The measured noise levels are shown in **Figure 5.1**. The parameters graphed in **Figure 5.1** are described in the glossary in **Appendix A**.

From the noise logging the statistical results have been summarised in **Table 5.2**. The background noise levels at Location A calculated using the lowest 10th percentile method are shown in **Table 5.3**.

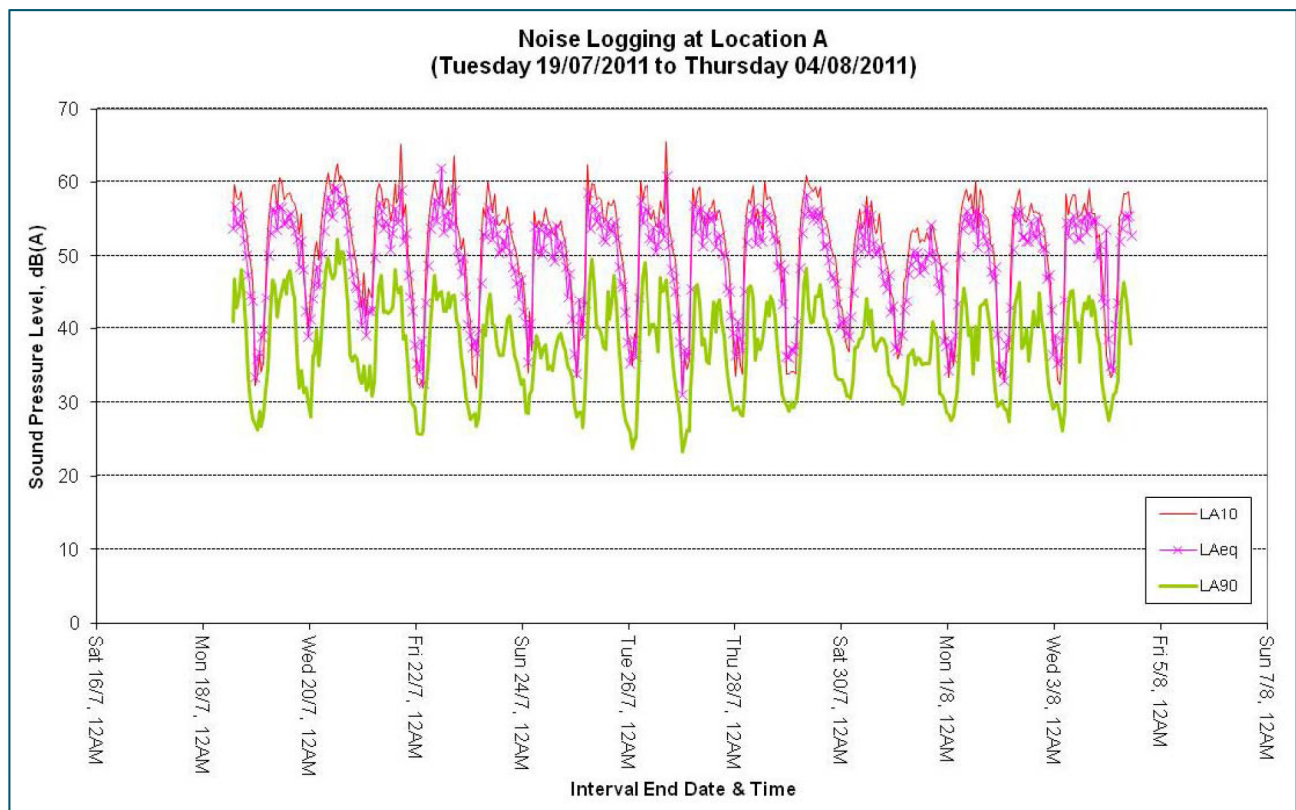


Figure 5.1 Graph of Noise Logging Results at Location A

Table 5.2 Statistical Noise Levels at Location A

Parameter	Statistic	Noise Levels dB(A)		
		Day	Evening	Night
L _{max}	Maximum	95	78	98
	Minimum	66	61	53
	Lowest 10%	69	63	56
	Average	74	69	64
L ₀₁	Maximum	76	68	71
	Minimum	58	55	42
	Lowest 10%	60	56	49
	Average	64	58	54
L ₁₀	Maximum	66	57	62
	Minimum	52	47	32
	Lowest 10%	54	48	34
	Average	57	52	43
L ₉₀	Maximum	52	45	47
	Minimum	34	29	23
	Lowest 10%	36	31	27
	Average	42	37	32
L _{eq}	Maximum	62	55	59
	Minimum	48	43	31
	Lowest 10%	51	45	36
	Average	54	48	43

Table 5.3 Background Noise Levels at Location A

Period	Background Noise Level L_{90} dBA
Day (7am to 6pm)	37
Evening (6pm to 10pm)	32
Night (10pm to 7am)	28

As shown in **Figure 2.1**, the noise logger was located in reasonably close proximity to Bellvista Boulevard. Some parts of the proposed development are located further from Bellvista Boulevard than the noise logger, and consideration must be given to whether the measured noise levels are representative of the proposed development and surrounding residential areas. Given that future roads are to be constructed around the proposed development and surrounding areas, the measured noise levels are considered to be representative of the proposed development for the high noise level parameters (L_{max} , L_{01} , L_{10} , L_{eq}). In addition the background noise levels in this kind of area would not be expected to vary greatly, and therefore the background noise levels (L_{90}) are also considered representative of the proposed development and surrounding areas.

5.4 Private Outdoor Area Noise Limits

The private open space criteria prescribed by TMR (see **Section 4.4**) is dependent on the existing measured background noise level represented by the L_{90} (8 hour) between 10:00pm and 6:00am and the measured L_{90} (18 hour) between 6:00am and 12:00am (midnight). The measured L_{90} (18 hour) at Location A was 40 dBA L_{90} (18 hour), and therefore the applicable outdoor noise limit for outdoor areas is 57 dBA L_{10} (18 hour) free field (60 dBA L_{10} (18 hour) facade corrected). It is noted that the ambient noise environment will alter as the subdivision and surrounding areas (i.e. Aura development) are further populated and traffic volumes increase.

6. Road Traffic Noise Assessment

6.1 Overview

Road traffic noise has been assessed from Bellvista Boulevard and Bells Reach Drive onto the proposed development. The relevant assessment criteria are outlined in **Section 4**.

TMR 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 PEN3D computer model, based on the CoRTN88 traffic noise prediction method and is approved by TMR.

ASK previously developed a PEN3D noise model of the site and surrounding areas, including Bellvista Boulevard, as part of the road traffic noise assessment for the Bells Reach subdivision (ASK ref 5950). This model was updated to include the proposed development.

6.2 Data

The following data has been used in the noise calculations:

- Noise source height of a 0.5 m.
- Ground contours for the existing and proposed site were provided by Calibre Consulting Pty Ltd (previously Brown Consulting Pty Ltd).
- Receiver heights for the allotments were placed 1.8m and 4.6m above ground contour height for the ground floors and first floors respectively.
- A noise barrier is proposed to be located along the north-western boundary of the site as shown in **Figure 3.1** and the project plans included in **Appendix B**. The barrier is to be 1.8m high, relative to the finished ground level of the lots. This noise barrier has been included in the traffic noise predictions.
- Existing road alignment as per site inspection and Google Earth Pro images.
- Traffic volumes have been obtained from Cardno Eppell Olsen and are shown in **Appendix C** for the existing 2011 and ultimate traffic years. A nominal minimum traffic volume for the duplicated Bellvista Boulevard of 10,000 vehicles/day has been advised by Stockland. This has been applied to Bellvista Boulevard south of Stornaway Avenue.
- All modelled roads have a traffic speed of 60km/h and commercial vehicle content of 2.7% as advised by Cardno Eppell Olsen.
- 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 $L_{10}(18 \text{ hour})$. Predicted $L_{10}(18 \text{ hour})$ noise levels are converted to $L_{eq}(1 \text{ hour})$ day levels using corrections obtained from the noise monitoring data. Corrections of +3.1 and -3.0 dB(A) have been applied to the $L_{10}(18 \text{ hour})$ predicted levels to predict the $L_{eq}(1 \text{ hour})$ day and night values respectively.
- The Queensland CoRTN calibration correction factors for free field (-0.7 dBA) and facade corrected (-1.7 dBA) noise predictions as prescribed by TMR have been applied in this assessment.
- A +2.5 dB(A) facade reflection allowance is included in the road traffic noise level predictions.

6.3 Verification

The results of the noise survey carried out at Location A have been used to verify the road traffic noise model of Bellvista Boulevard and Bells Reach Drive.

The road traffic verification model uses the 2011 traffic flow, as stated in **Section 5.2** and current road alignment to determine the $L_{10}(18 \text{ hour})$. **Table 5.1** compares the results obtained from the noise survey with the calculated results from the computer model.

Table 6.1 Measured and Calculated Road Traffic Noise Levels at Location A

Receptor Height (metres)	Measured Noise Level $L_{10}(18 \text{ hour})$ dBA	Calculated Noise Level $L_{10}(18 \text{ hour})$ dBA
1.3m	54.2	55.3

The road traffic model is considered to be verified since the calculated level is within ± 2.0 dB(A) of the measured level. As the predicted level is higher than the measured level no correction has been made to the predicted noise levels.

6.4 Calculations

The road traffic noise levels have been predicted for the potentially worst affected facade for each residential lot (Lots 1 to 13). Noise levels have been predicted for ground floor and upper floor receptors for each lot, including the influence of the 1.8m high noise barrier along the north-western boundary of Lots 11 to 13. The predicted $L_{10}(18 \text{ hour})$ noise levels at each lot are shown in **Table 6.2**.

Table 6.2 Predicted Road Traffic Noise Levels

Lot	Level	Predicted Noise Levels dBA			Required Traffic Noise Reduction
		$L_{10}(18 \text{ hour})$ dBA	Maximum Day $L_{eq}(1 \text{ hour})$ dBA	Maximum Night $L_{eq}(1 \text{ hour})$ dBA	
1	Gr	54	57	51	12
2	Gr	55	58	52	13
3	Gr	55	58	52	13
4	Gr	56	59	53	14
5	Gr	57	60	54	15
6	Gr	57	60	54	15
7	Gr	58	61	55	16
8	Gr	58	61	55	16
9	Gr	59	62	56	17
10	Gr	60	63	57	18
11	Gr	61	64	58	19
12	Gr	59	62	56	17
13	Gr	59	62	56	17
1	Up	56	59	53	14
2	Up	57	60	54	15
3	Up	57	60	54	15
4	Up	58	61	55	16
5	Up	59	62	56	17
6	Up	59	62	56	17
7	Up	60	63	57	18

Lot	Level	Predicted Noise Levels dBA			Required Traffic Noise Reduction
8	Up	60	64	57	19
9	Up	61	64	58	19
10	Up	62	65	59	20
11	Up	63	67	60	22
12	Up	62	65	59	20
13	Up	62	65	59	20

Note: All noise predictions in **Table 6.2** include façade reflection.

From **Table 6.2** it is evident that the highest predicted noise level is 63 dBA L_{10} (18 hour) at the upper level of Lot 11, which is the closest lot to Bellvista Boulevard and Bells Reach Drive. The predicted road traffic noise levels for all lots comply with the external facade noise limit of 63 dBA L_{10} (18 hour).

The predicted noise levels for the worst affected private outdoor recreational areas for each lot (based on an assumed location at the rear of the lot) are presented in **Table 6.3**. The calculations include the effect of the 1.8m high noise barrier as shown in **Figure 3.1**. As discussed in **Section 5.4**, the noise limit for outdoor recreation areas is 57 dBA L_{10} (18 hour) free field.

Table 6.3 Predicted Noise Levels for Private Outdoor Recreation Areas

Lot	Predicted Road Traffic Noise Level dBA L_{10} (18 hour) (free field)
13	53
12	54
11	57
10	56
9	56

Note: All noise predictions in **Table 6.3** are free-field and do not include façade reflection.

From **Table 6.3** the highest predicted noise level in a private outdoor recreation area is 57 dBA L_{10} (18 hour) at Lot 11. The predicted road traffic noise levels for all lots therefore comply with the outdoor area noise limit of 57 dBA L_{10} (18 hour) (free field).

6.5 Assessment and Mitigation Measures

6.5.1 External Assessment (Private Outdoor Areas)

The predicted noise levels for all private outdoor areas comply with the noise limit of 57 dBA L_{10} (18 hour) (free field) with the inclusion of the proposed noise barrier (1.8m high relative to finished ground level of the lots, as shown in **Figure 3.1**). As the predicted noise levels comply with the criterion, no further mitigation is required.

The noise barrier as per **Figure 3.1** may be constructed in accordance with a number of alternative designs including via timber, brick, concrete block, sheet metal or earth mound. A solid timber barrier with overlapping palings is usually the most economic. The minimum acoustic requirement of the noise barrier is that it be solid and continuous with negligible holes and gaps between palings or panels or near the ground. The minimum required surface density is 12.5 kg/m².

6.5.2 Internal Assessment

The predicted road traffic noise levels for all lots comply with the external facade noise limit of 63 dBA L_{10} (18 hour) for both ground and upper floors, and therefore no further mitigation is required.

As shown in **Table 6.2**, all lots require a Traffic Noise Reduction (TNR) greater than 11 dB(A) which will require windows and doors to be closed to achieve acceptable internal noise levels. Therefore natural ventilation may be required to be substituted in the form of mechanical ventilation for some rooms, in accordance with the Building Code of Australia.

7. Noise Emissions from the Development

This section assesses noise emissions from the development onto sensitive receptors proposed within the development and receptors located outside the subject site.

7.1 Cafe Patron Noise

A cafe is proposed to be included within the retail tenancy in the south-eastern corner of the site as shown in **Figure 7.1**. The cafe is proposed to include an outdoor dining area.

It is understood that a temporary cafe currently located on the site (in a similar location) operates from 6:30am to 5:00pm. The new cafe tenancy is proposed to operate from 6:30am into the evening (6:00pm to 10:00pm) and potentially the night (considered to be 10:00pm to 7:00am).

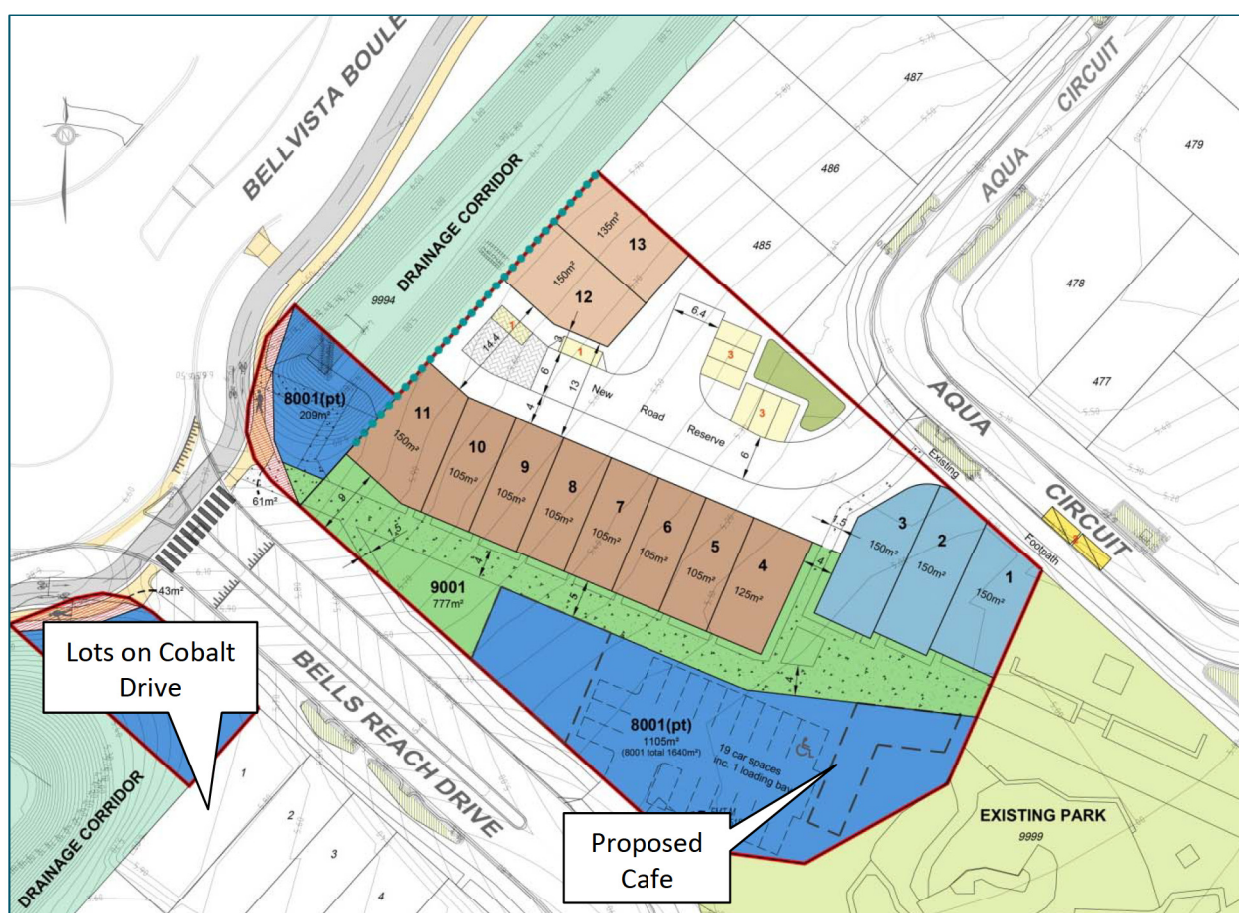


Figure 7.1 Location of Proposed Cafe Tenancy and Nearest Sensitive Receptors

The potentially worst affected sensitive receptors near the cafe tenancy are Lots 1 to 4 within the proposed development (north of the cafe tenancy), and the existing single storey residences across Bells Reach Drive. The most exposed residence across Bells Reach Drive is the dwelling at 29 Cobalt Crescent (see **Figure 2.2**). Existing residences on Aqua Circuit are located at a similar distance to the cafe as those located on Cobalt Crescent, but have less angle of view to the outdoor dining area.

As shown in **Figure 2.2** and **Figure 7.1** there is an existing playground and park located to the south-east of the cafe tenancy, with the cafe proposed to include an outdoor dining area facing the park.

As there is an existing playground located directly to the south-east of the cafe tenancy site (see **Figure 2.2** and **Figure 7.1**), noise impacts from patrons associated with the cafe are not anticipated to significantly impact nearby sensitive receptors during the day (6:30am to 6:00pm), and therefore the assessment has focused on noise impacts during the evening and night-time only. The period between 6:00am and 7:00am is strictly considered the night time, but is commonly referred to as a shoulder period, and in this instance the period between 6:30am to 7:00am has been considered as daytime.

At this stage of the development proposal, detailed design plans are not available for the design of the cafe tenancy, however through discussion with Stockland it is understood that it is likely that the tenancy will be comprised of lightweight construction. The proposed plan of development for the cafe is shown in **Figure 7.2**.

The cafe is proposed to be an L-shaped design, with an outdoor dining area located to the south-east of the building facing the existing park and playground. Access to the cafe is proposed via a door on the northern side of the cafe, with access also available via the outdoor dining area.

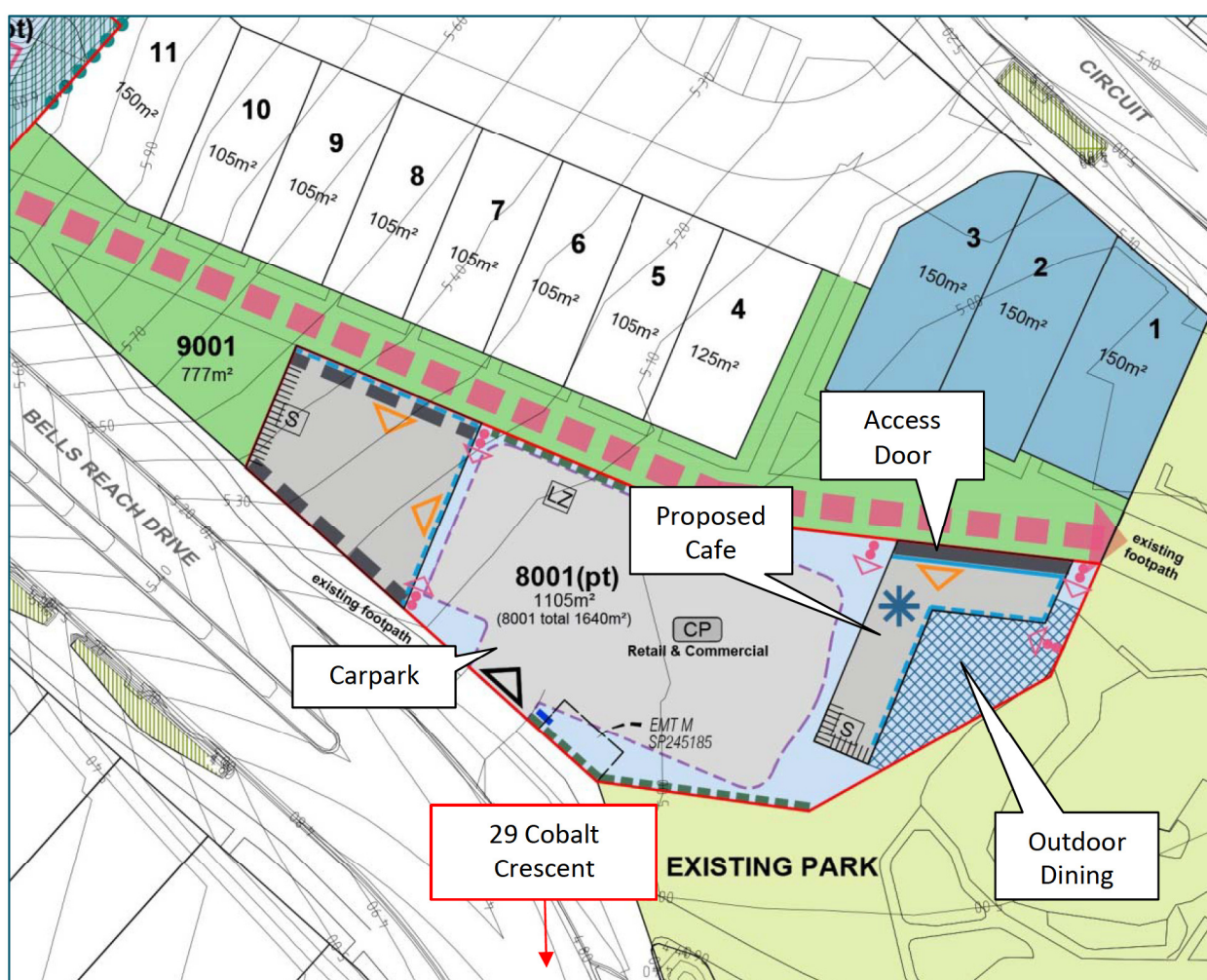


Figure 7.2 Plan of Development for Cafe Tenancy

To assess the potential impact of patron noise from outdoor dining areas, noise modelling has been undertaken using the 3D noise model developed for the assessment of road traffic noise. The assessment has considered the L_{eq} (time weighted average) noise descriptor as this is considered the most applicable for patron noise.

The applicable noise limits for patron noise are considered to be the Acoustic Quality Objectives noise limits as discussed in **Section 4.5.3**. The external Acoustic Quality Objectives noise limits for residential dwellings are 40 dBA $L_{Aeq,adj,1hr}$ (day and evening) and 35 dBA $L_{Aeq,adj,1hr}$ (night).

It is noted that if the cafe was to obtain a liquor license, the noise limit for the day and evening would be background + 10 dBA, assessed as the L_{10} descriptor. Based on the results of noise logging undertaken at Location A, the noise limit under the OLGR criteria would be 42 dBA L_{10} , which is comparable to the Acoustic Quality Objectives Limit of 40 dBA $L_{Aeq,adj,1hr}$ (evening).

The following data has been included in the noise modelling:

- Receptor heights for each of the lots within the development (i.e. Lots 1 to 4) have been modelled at 1.8m (ground) and 4.8m (upper) above the finished ground levels nominated by the project drawings.
- The sound power levels (L_w) used for modelling noise emissions from patrons were based on published literature for patron noise, and are considered representative for a cafe of this nature.
- The size of the outdoor dining area and the size of the dining area within the cafe was estimated to be approximately 160m² in total (80m² per area) based on the current layout plan. Noise predictions were initially undertaken assuming a patron occupancy rate of 1 person/m², and also assuming that 50% of patrons are speaking at any one time (i.e. 40 people speaking in outdoor dining area, 40 people speaking in indoor dining area).
- The height of the cafe tenancy walls were assumed to be 2.9m high.

The construction of the cafe was assumed to be as follows:

- Roof construction (Rw 30): 2mm thick steel, lined internally with 10mm plasterboard (or similar construction achieving acoustic rating of Rw 30).
- Wall construction (Rw 30): 2mm thick steel, lined internally with 10mm plasterboard (or similar construction achieving acoustic rating of Rw 30).
- Northern entry door (Rw 32) (dimensions of 2.1m wide x 2.1m high): Sliding glazed door with 6mm thick glass and acoustic perimeter seals.

Noise predictions were initially undertaken assuming that the entire outdoor dining area was used and that the northern entry door (2.1m x 2.1m glazed sliding door) was open, however the predicted noise levels exceeded the nominated noise limit of 40 dBA $L_{Aeq,adj,1hr}$ for the evening. The initial noise calculations indicated that the following noise management strategies were required to achieve the evening noise limit:

- The northern entry door (Rw 32 glazed sliding door) is required to be closed.
- The short eastern wall and western wall of the tenancy are required to be solid, with construction similar to the wall construction nominated above (achieving an acoustic rating of Rw 30). The northern wall is required to be solid with the exception of the northern entry door, which is to be closed. See **Figure 7.3**.
- The area of the outdoor dining area to be used during the evening and night-time is to be limited to the area shown in **Figure 7.3**.
- The number of patrons within the outdoor dining area is to be limited to 40 patrons (20 patrons speaking at one time).

The predicted noise levels with the incorporation of these strategies are presented in **Table 7.1**.

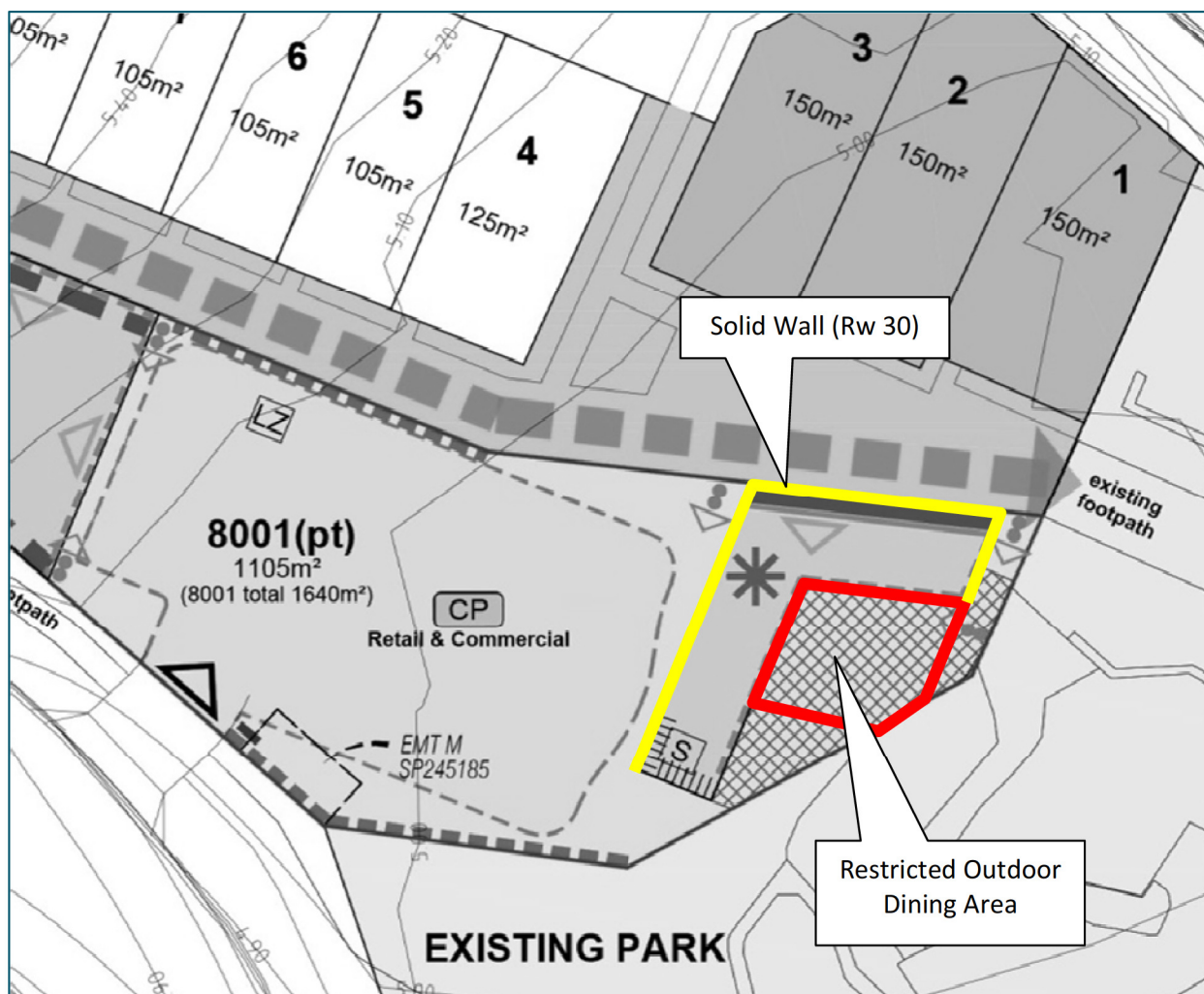


Figure 7.3 Restricted Outdoor Dining Area

Table 7.1 Predicted Patron Noise Levels

Receptor	Level	Noise Limit	Predicted L_{eq} (1 hour) Noise Level dBA	Exceedance of Evening Noise Limit	Exceedance of Night Noise Limit
Lot 1	Ground	Evening: 40 dBA $L_{Aeq,adj,1hr}$ Night: 35 dBA $L_{Aeq,adj,1hr}$	39	0	4
	Upper		40	0	5
Lot 2	Ground		39	0	4
	Upper		40	0	5
Lot 3	Ground		39	0	4
	Upper		40	0	5
Lot 4	Ground		38	0	3
	Upper		39	0	4
29 Cobalt Crescent	Ground		39	0	4

It is evident from the predicted noise levels shown in **Table 7.1** that patron noise emissions from the cafe comply with the evening noise limit of 40 dBA $L_{Aeq,adj,1hr}$, but do not comply with the night noise limit of 35 $L_{Aeq,adj,1hr}$. Therefore the cafe can accommodate patrons until 10:00pm, but cannot operate during the night (from 10:00pm onwards).

It is noted that if the cafe applies for a liquor license, noise emissions from the cafe (including patron noise, music and mechanical plant) will be regulated by OLGR using the criteria discussed in **Section 4.7**.

The operator of the cafe will be required to manage patrons to ensure noise emissions from the cafe are managed. The development and operation of the cafe will also need to abide by the following conditions:

- The wall and roof construction is to achieve an acoustic rating of at least Rw 30, and the construction is to be such that the northern (with the exception of entry door), western and small eastern walls are solid with no openings, as shown in **Figure 7.3**.
- The northern entry door is to have a total area in the order of 4.4m² and achieve an acoustic rating of Rw 32. Acoustic certification should be provided by the door supplier to demonstrate that the installed system (glass, frame, seals) achieves this acoustic rating. The door is required to be closed at all times during operation of the cafe in the evening.
- During the evening, the outdoor dining area should be limited to the area shown in **Figure 7.3**. A maximum of 40 patrons are allowed to be accommodated in the outdoor dining area during the evening.
- The cafe should be managed such that noise emissions from its operation are minimised as much as possible.

7.2 Carpark

Two parking areas are proposed to be included within the development, a residential parking area to be located off the new access road and a retail parking area with access off Bells Reach Drive (see **Figure 7.4**).

Based on the nature and design of the residential carpark and the small number of parking spaces (eight spaces), noise from the residential parking area is not expected to significantly impact nearby residential dwellings and therefore noise from this car parking area has not been considered further.

Bells Reach Drive is located between the retail parking area and the closest non-associated dwellings on Cobalt Crescent (which also have frontage to Bells Reach Drive), and therefore noise from this carpark is also not anticipated to be discernible from general road traffic on Bells Reach Drive and has not been considered further.

Due to the small separation distance between the retail parking area and the nearest residential lots proposed in the development (6 metres to Lots 4 and 5), noise from the retail carpark has the potential to impact these dwellings and therefore has been addressed in this assessment.

Due to the presence of Bellvista Boulevard and Bells Reach Drive (which have both been assessed in this report) the size of the carpark (19 spaces), and the acoustic construction upgrades to address aircraft noise (as per the Bells Reach Acoustic Covenant), noise from vehicle movement within the retail carpark during the day (6:30am to 6:00pm) and the evening (6:00pm to 10:00pm) is not expected to significantly impact the adjacent residential lots. Therefore use of the carpark during the day and evening periods is considered acceptable. Vehicle activity during the night (10:00pm to 7:00am) has the potential to cause sleep disturbance and therefore further assessment of short-term maximum (L_{max}) noise events during the night-time requires further consideration.



Figure 7.4 Car Parking Area Layout

The Sunshine Coast Planning Scheme does not specify which events should be considered for the assessment of short-term events, however other Councils within south-east Queensland recommend that the assessment of L_{max} events should exclude vehicle pass-by noise (i.e. engine, exhaust, induction, tyres), and therefore the assessment has considered noise emissions from car door slams only. Based on ASK measurements of car door slams, a sound power level (SWL) of 93 dBA L_{max} SWL (55 dBA L_{max} at 30m) is considered representative for this source.

Using the noise model developed for the assessment of road traffic noise, L_{max} noise levels from car door slams within the retail carpark were predicted at the closest residential lots. The predicted L_{max} noise levels are presented in **Table 7.2**. The applicable noise limit for carpark noise events is the sleep disturbance noise limit of 50 dBA L_{max} as discussed in **Section 4.6.3**.

Table 7.2 Predicted Car Door Slam L_{max} Noise Levels

Receptor	Level	Noise Limit	Predicted L_{max} Noise Level dBA	Exceedance of Noise Limit
Lot 4	Ground	52 dBA L_{max}	61	11
	Upper		61	11
Lot 5	Ground		61	11
	Upper		61	11
Lot 6	Ground		60	10
	Upper		60	10

It is evident from the noise levels shown in **Table 7.2** that the predicted noise levels significantly exceed the sleep disturbance noise limit of 50 dBA L_{max} . It is understood that a noise barrier along the carpark boundary is not a preferred design option, and it is noted that as the adjacent lots can be developed as two storey dwellings, a noise barrier will not be effective to mitigate noise impacts to the upper levels of dwellings on these lots. Therefore it is recommended that the use of the carpark is limited to the hours of 6:30am to 10:00pm. This may require that the operation of the local corner store type use is also limited to operate between the hours of 6:30am to 10:00pm.

7.3 Mechanical Plant

To comply with the EPP (Noise) background creep criteria, the noise generated from mechanical plant (which is considered to be continuous noise, see **Section 4.5.2**) must not exceed the background noise level (i.e. nil dBA greater than the existing L_{90}) at the location of nearby sensitive receptors.

From the noise logging results at Location A (see **Figure 2.1**), the lowest 10% of the background noise levels (L_{90}) have been used to calculate the mechanical plant noise limits at nearby sensitive receivers and are presented in **Table 7.3**. The noise limits nominated are applicable to mechanical plant associated with the retail tenancies (i.e. cafe and corner store).

Table 7.3 Mechanical Plant Noise Limits

Time Period	Background Noise Level L_{90} dBA	Measured Limit $L_{Aeq,adj,T}$ dBA	Component 'Design' Limit $L_{Aeq,adj,T}$ dBA
Day (7am – 6pm)	37	40	37
Evening (6pm – 10pm)	32	35	32
Night (10pm – 7am)	28	31	28

From **Table 7.3** the measured limits are the resulting noise levels from both mechanical plant and existing background noise levels, while the component limits are only mechanical plant noise levels.

At this stage there is no detailed mechanical plant information, and it is recommended that the plant is selected, designed and located to achieve the component 'design' noise limits presented in **Table 7.3**.

It is recommended that further acoustic assessment of mechanical plant noise emissions is undertaken when plant items have been selected, as mitigation (i.e. acoustic screening, louvres) may be required if noisier plant is selected.

7.4 Waste Collection

Waste collection is common activity and occurs for every residential and commercial development. To reduce the potential for noise impacts from waste collection, it is recommended that collection is restricted to daytime hours (7:00am to 6:00pm) only.

8. Recommendations & Conclusion

A noise assessment has been conducted for the proposed local centre development to be located on Lot 8001 in the Bells Reach subdivision in Caloundra South. The results and recommendations of the assessment are as follows:

Aircraft

- The residential lots within Lot 8001 are subject to the Bells Reach Acoustic Covenant, which specifies façade acoustic rating and construction requirements for potential aircraft noise intrusion. No further assessment of aircraft noise is required to be undertaken

Road

- Assessment of road traffic noise is presented in **Section 6**. Predicted noise levels for the external facade of all lots are shown in **Table 6.2**. Predicted noise levels for the worst affected private outdoor recreation areas are presented in **Table 6.3**.
- The predicted road traffic noise levels comply with the nominated external facade and private outdoor area noise limits with the inclusion of the 1.8m high (relative to finished lot level) noise barrier proposed along the north-western boundary of Lots 11 to 13 as shown in **Figure 3.1**.
- As shown in **Table 6.2**, all lots require a Traffic Noise Reduction (TNR) greater than 11 dB(A) which will require windows and doors to be closed to achieve acceptable internal noise levels. Therefore natural ventilation may be required to be substituted in the form of mechanical ventilation for some rooms, in accordance with the Building Code of Australia.
- The noise barrier as per **Figure 3.1** may be constructed in accordance with a number of alternative designs including via timber, brick, concrete block, sheet metal or earth mound. A solid timber barrier with overlapping palings is usually the most economic. The minimum acoustic requirement of the noise barrier is that it be solid and continuous with negligible holes and gaps between palings or panels or near the ground. The minimum required surface density is 12.5 kg/m².

Cafe

- Assessment of patron noise emissions from the cafe is presented in **Section 7.1**. Due to the presence of an existing park and playground the operation of the cafe during the hours of 6:30am to 6:00pm is considered acceptable without restriction. For the cafe to operate during the evening (6:00pm to 10:00pm), the following conditions are required to be achieved:
 - The wall and roof construction is to achieve an acoustic rating of at least Rw 30, and the construction is to be such that the northern (with the exception of entry door), western and small eastern walls are solid as shown in **Figure 7.3**.
 - The northern entry door is to have a total area in the order of 4.4m² and achieve an acoustic rating of Rw 32. Acoustic certification should be provided by the door supplier to demonstrate that the installed system (glass, frame, seals) achieves this acoustic rating. The door is required to be closed at all times during operation of the cafe in the evening.
 - During the evening, the outdoor dining area should be limited to the area shown in **Figure 7.3**. A maximum of 40 patrons are allowed to be accommodated in the outdoor dining area during the evening.
 - The cafe should be managed such that noise emissions from its operation are minimised as much as possible.

Carpark and Other Retail Tenancy

- Assessment of noise emissions from the use of the carpark is presented in **Section 7.2**. The use of the carpark should be limited to between the hours of 6:30am to 10:00pm.

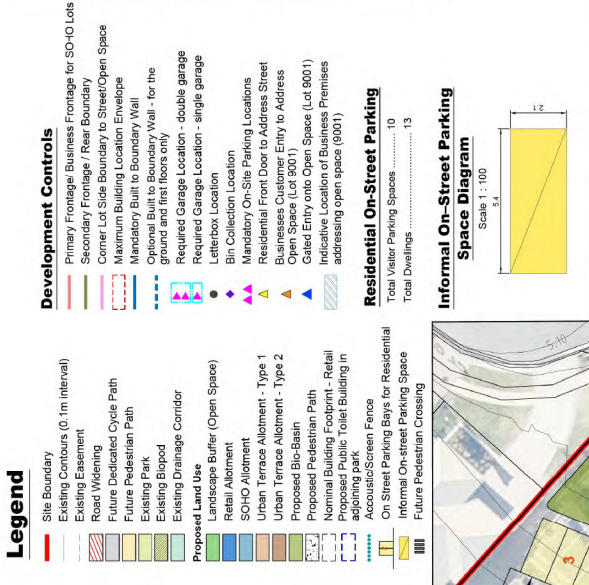
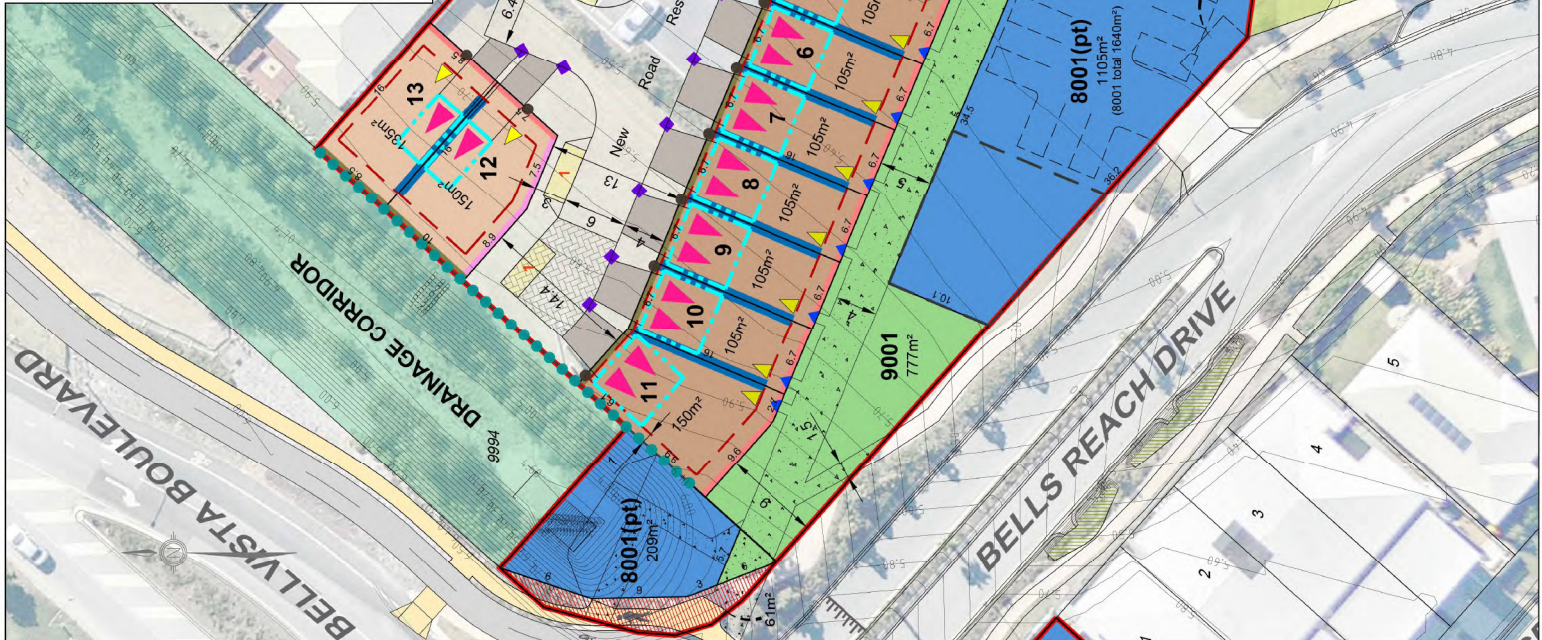
- Due to the allowable hours of operation for the carpark, the use of the other retail tenancy (local corner store type use) may be required to be limited to between 6:30am to 10:00pm. It has been assumed that no significant noise sources are associated with the other retail tenancy, with the exception of mechanical plant.
- At this stage there is no detailed mechanical plant information, and it is recommended that the plant is selected, designed and located to achieve the component 'design' noise limits presented in **Table 7.3**. It is recommended that further acoustic assessment of mechanical plant noise emissions is undertaken when plant items have been selected as mitigation (i.e. acoustic screening, louvres) may be required if noisier plant is selected.
- It is recommended that waste collection is restricted to daytime hours (7:00am to 6:00pm) only.

Compliance with the above recommendations is predicted to result in compliance with relevant noise criteria.

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.
$L_{eq,1hour}$	As for L_{eq} except the measurement intervals are defined as 1 hour duration.
L_{max}	Maximum A-weighted sound pressure level.
$L_{eq}(24 \text{ hour})$	The average L_{eq} noise level over the 24-hour period from midnight to midnight.
$L_{10}(18 \text{ hour})$	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.
R_w	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 R_w will be similar to the value for STC. Partitions with particularly poor performance at 100 Hz may have lower values for R_w than for STC. Conversely, partitions with poor performance at 4000 Hz may have higher R_w than for STC. (As per AS1276.1-1999).

Appendix B Project Drawings



	Plan of Development Table					
	SOHO Terrace Allotments		Urban Terrace Allotments - Type 1		Urban Terrace Allotments - Type 2	
	7.5m-9m+	8.5m-10m	Ground Floor	Upper Floors	Ground Floor	6.2m / 7.2m+ Upper Floors
Front Frontage (Business Frontage or SOHO Lots) —————>	2.0m	2.0m	2.0m	n/a	2.0m	2.0m
Allowable Proportion Into Setback or Front Porches	n/a	n/a	1.0m	1.0m	1.0m	n/a
Side Side Built to Boundary	0.0m	0.0m	0.0m	0.0m	0.0m	0.0m
Rear Rear Non Built to Boundary	1.0m	1.0m	1.0m	1.0m	1.0m	1.0m
Corner Corner Lot(s) (to street or open space)	1.5m	1.5m	1.5m	1.5m	1.0m	1.0m
Secondary Secondary Frontage (Residential rear) for SOHO Lots) ————>	2.0m	2.0m	n/a	n/a	n/a	n/a
Garaages and On-site Parking Garaages and On-site parking requirements (minimum)	n/a	n/a	2.0m	2.0m	0.5m	0.5m
Garages and On-site Parking Garage	4.5m	n/a	n/a	n/a	1.0m	n/a
Notes:	1 space to be covered and enclosed AND 1 space uncovered (may be in tandem). Double garages are permitted.					1 space to be covered and enclosed. Single, tandem or double garage spaces may be located along the built-to boundary wall.
Side Cover (maximum)	85%					85% Garages are to be located along the built-to boundary wall.

Development Controls

Development Controls

13. Fencing along street boundaries and boundaries shared with open space must be either 50% transparent or max. 1.2m high.
- Parking and Driveways**
14. Double garages must be setback at least 0.5m behind the main residential facade, excluding balconies and porches, of the dwelling.
15. A maximum of one driveway per dwelling is permitted.
16. Shared driveways are mandatory where shown on plan.
17. The maximum width of a driveway at the lot boundary & where crossing the verge:
 - a. serving a single garage shall be 3.0m;
 - b. serving a double garage shall be 4.8m at the property boundary tapering to 4.0 at the kerb and 3.0m at the verge;
 - c. when shared between two dwellings shall be 7.0m along the property boundary and 4.8m at the kerb.
18. Parking spaces on driveways do not have to comply with AS2890.
19. Driveways should avoid on-street works such as dedicated on-street parking bays, street trees, drainage pits and service pillars.
20. The minimum distance of a driveway from an intersection of one street with another street shall be 6.0 metres.

General	Setbacks
1. All development is to be undertaken in accordance with the Development Approval.	4. Setbacks are as per the Plan of Development Table unless dimensioned otherwise on plan.
2. Building setbacks and built to boundary wall locations shown are subject to future proposed easements and/or underground services.	5. Built to Boundary Walls: a. Built to boundary wall dimensions are limited by the boundary setbacks and building height limit. Building plans and details of appropriate development staging and construction methods must be submitted for approval; b. where not adopted, the setbacks for non built to boundary walls in the Plan of Development Table apply.
3. Maximum building height is 11m for all dwellings.	6. Boundary setbacks are measured to the wall of the building. Eaves should not encroach closer than 450mm to the lot boundary except in the case of:

should not be closer than : 350mm".

- Side boundary setback to a street or open space (corner lot) where eaves should not be closer than 700mm; and
- Walls that are built to boundary.

7. Entrance porches/porticos/porchways permitted to extend up to 1.0m into the Primary and Secondary Frontage setback provided the height of the portico does not exceed 4.5m, the portico remains open and not enclosed and the width of the portico is limited to the front entry area only.

8. Upper floor setbacks must exceed the minimum ground floor setbacks, including roof top terraces.

9. Roofed gatehouses and arches are permitted within the boundary setback of the Primary and Secondary Frontages of the lot provided they meet the requirements of the Queensland Development Code, having

- a maximum area of 4m²; and
- not more than 2m wide vertically to the street; and
- not more than 3m in height.

Site Cover and Amenity

10. Site cover for each lot is not to exceed that shown in the Plan of Development table except where the dwelling is in accordance with approved house plans and where appropriate building staging and construction techniques have been demonstrated.

11. Private open space must be provided, may be roofed, is not less than 9m² with a minimum dimension of 2.5m, is directly accessible from a living area of the dwelling, and may be a balcony, verandah or rooftop terrace.

Business Frontage for SOHO lots

21. Business uses on-site must address the open space parcel 9001.

22. The business component may be either operated as Home Based Business with a maximum GFA for the business use of 50m²; or as a business shop use that can be leased independently of the residential use, in which case the business GFA may not exceed 90m² and the premises must comply with applicable requirements for fire separation.

23. The area shown on plan for the business use is indicative only and may adopt a different shape or extent (may extend further into the lot or extend over the ground and first floors) provided it addresses the business frontage of the lot directly.

24. Business must present a shop-front to the open space (9001):

- significant glazing into the ground floor;
- a clearly designated customer entry/shop door;
- a small awning over the customer entry, 1.0m deep and min. 1.0m wide AND
- signage on the face of the building or awning that is integrated into the design of the building and does not visually dominate.

25. SOHO lots must provide a minimum of 2 parking spaces on site

- 1 covered; and
- 1 may be uncovered & provided in tandem

26. Signage advertising the business is not permitted on the Residential Frontage of the allotment.

27. Private open space and bin storage areas must not be visible from the street or open space.

Privacy & Overlooking

12 Buildings must be sited and designed to provide adequate visual privacy for neighbours. Where the distance separating a window or balcony of an adjoining dwelling from the side or rear boundary is less than 1.5m,

- a. a permanent window and a balcony has a window/balcony screen extending across the line of sight from the sill to at least 1.5m above the adjacent floor level, or
- b. a window has a sill height more than 1.5m above the adjacent floor level, or
- c. a window has obscure glazing below 1.5m;

where: Window and Window/Balcony Screen has the same meaning as in the Queensland Development Code.

REVISION

A.	8/9/2016	Amend Layout
B.	21/09/2016	Finalise Controls
C.	07/10/2016	Amend Parking

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.
Dimensions have been rounded to the nearest 0.1 metres.
Areas have been rounded down to the nearest 5m².
The boundaries shown on this plan should not be used for final detailed engineers design.
Source information:
Site boundaries: Registered Survey Plans.
Adjoining information: RPS Lot, Calc
Contours: Calibre
Aerial photography:

[illegible]

CLIENT	STOCKLAND
PROJECT	BELLS REACH LOCAL CENTRE

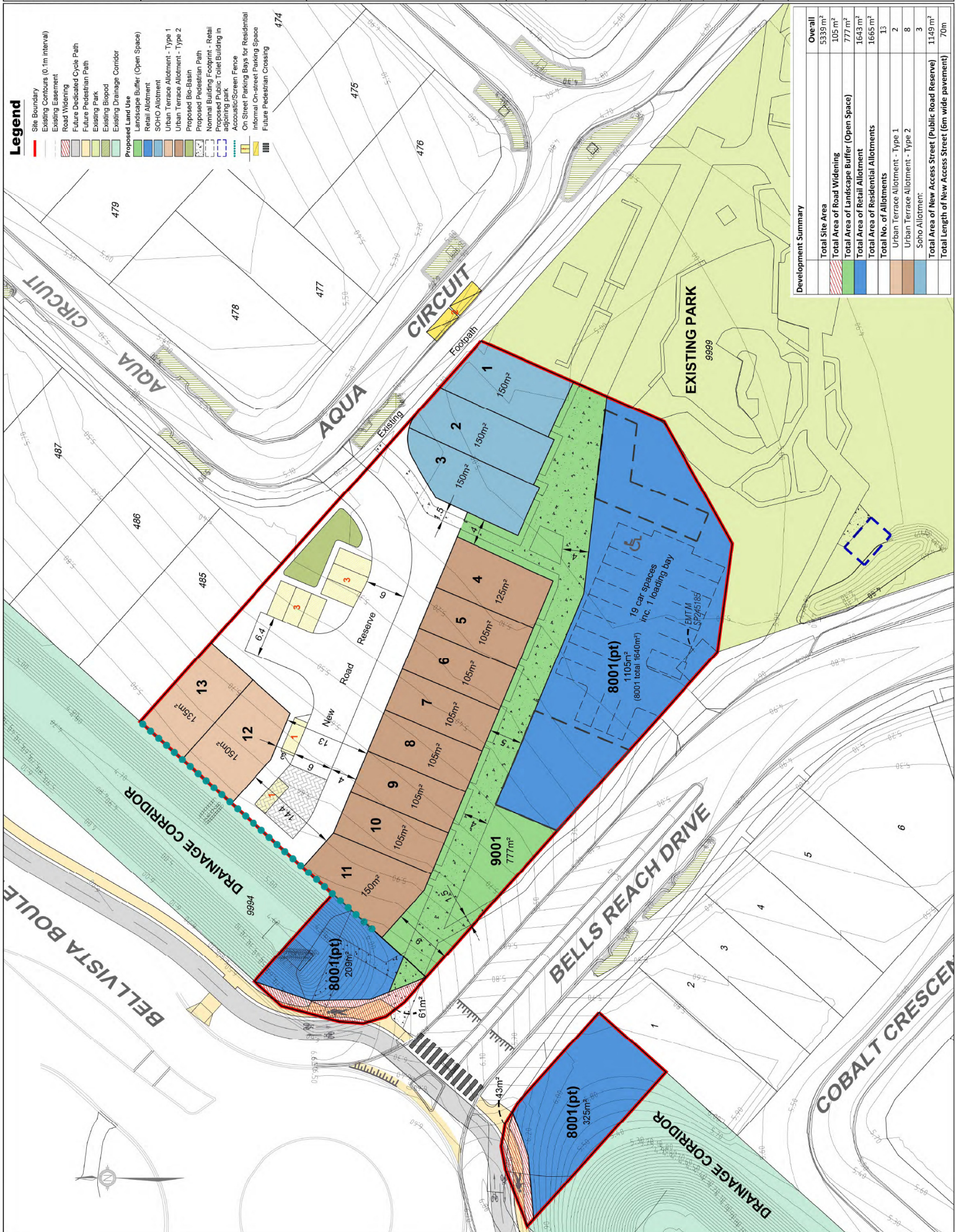
PLAN OF
DEVELOPMENT FOR
RESIDENTIAL LOTS

Date: 7 OCT 2016

Comp By	AN / EM
Created By	CC
DWD Name	107033-137 PRO
Job Ref.	107033
Local Authority	
URBAN LAND DEVELOPMENT AUTHORITY	
Locality	CALOUNDA WEST
Scale	1:250
Sheet	A1
Plan Ref	Rev
107033-138	
C	

RPS
RPS Australia East Pty Ltd
PO Box 200
URBAN 410 292 762
Urban Design
Brisbane Design Studio
455 Brunswick Street
Fortitude Valley QLD 4006
T +61 7 3124 9300
F +61 7 3124 9099
W rpsgroup.com.au

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- Legend
- Site Boundary
 - Existing Contours (0.1m interval)
 - Existing Easement
 - Road Widening
 - Future Dedicated Cycle Path
 - Future Pedestrian Path
 - Existing Park
 - Existing Sloped
 - Existing Drainage Corridor
 - Proposed Land Use
 - Landscape Buffer (Open Space)
 - Retail Allotment
 - SOHO Allotment
 - Urban Terrace Allotment - Type 1
 - Urban Terrace Allotment - Type 2
 - Proposed Bio-Basin
 - Proposed Pedestrian Path
 - Nominal Building Footprint - Retail
 - Proposed Public Toilet Building in adjoining park
 - Acoustic/Screen Fence
 - On Street Parking Bays for Residential
 - Informal On-street Parking Space
 - Future Pedestrian Crossing

Development Summary

Overall	5339m²
Total Site Area	5339m²
Total Area of Road Widening	105m²
Total Area of Landscape Buffer (Open Space)	777m²
Total Area of Retail Allotment	1643m²
Total Area of Residential Allotments	1665m²
Total No. of Allotments	13
Urban Terrace Allotment - Type 1	2
Urban Terrace Allotment - Type 2	8
Soho Allotment	3
Total Area of New Access Street (Public Road Reserve)	1149m²
Total Length of New Access Street (6m wide pavement)	70m

RPS

RPS Australia East Pty Ltd
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Legend

- Parcel Boundary
- Existing Contours (0.1m interval)
- Retail Allotment
- Existing Easement
- Adjoining Landscape Buffer (Open Space)
- Adjoining Park
- SOHO Allotments
- Adjoining Drainage Reserve
- Road Widening
- Major Pedestrian Thoroughfare
- Wheelchair accessible toilets and baby change room to be located in existing park
- Acoustic/Screen Fence
- Existing Biopod

Interfaces

- Required built form edge
- Desired built form edge
- Preferred building entry location
- Preferred vehicle access location
- Preferred pedestrian entry location
- Retail to directly front open space
- Retail to front internal walkways/ outdoor dining areas
- Architectural screening required
- Landscaped setback

Land Use Outcomes

- Indicative building footprint
- On site carparking area
- Customer parking for retail and commercial (lot 8001)
- CP Retail & Commercial
- Loading zone - indicative location
- Services & Storage area - indicative location. Must be screened from view.
- Cafe outdoor dining zone overlooking Park (deck or terrace)
- Cafe/Food Premises overlooking park
- Preserved landscape civic area within site

Signage

- Existing Estate Signage Elements to be retained
- Proposed Signage locations for Retail

Permitted Acceptable Uses

- Business
- Shop
- Food Premises (Licensed or otherwise)
- Fast food premises (excluding drive-through)

Total GFA permitted: 320m²



Scale 1 : 400 @ A3

Plan Ref 167633 – 139B

Date: 7 Oct 2016
Client: Stockland
Dwg Name: 7633-139
Drawn By: BM
Checked By: CC

BELLS REACH

LOCAL CENTRE RETAIL ALLOTMENT - Plan of Development



Urban Design
Brisbane Design Studio
455 Brunswick Street
Fortitude Valley QLD 4006
P +61 7 3124 6399
W rpsgroup.com.au

RPS

Appendix C Traffic Volumes

Traffic volume figures provided by Cardno Eppell Olsen for Bells Reach subdivision road traffic noise assessment as documented in ASK report 5950R01V04 dated 28/03/2014

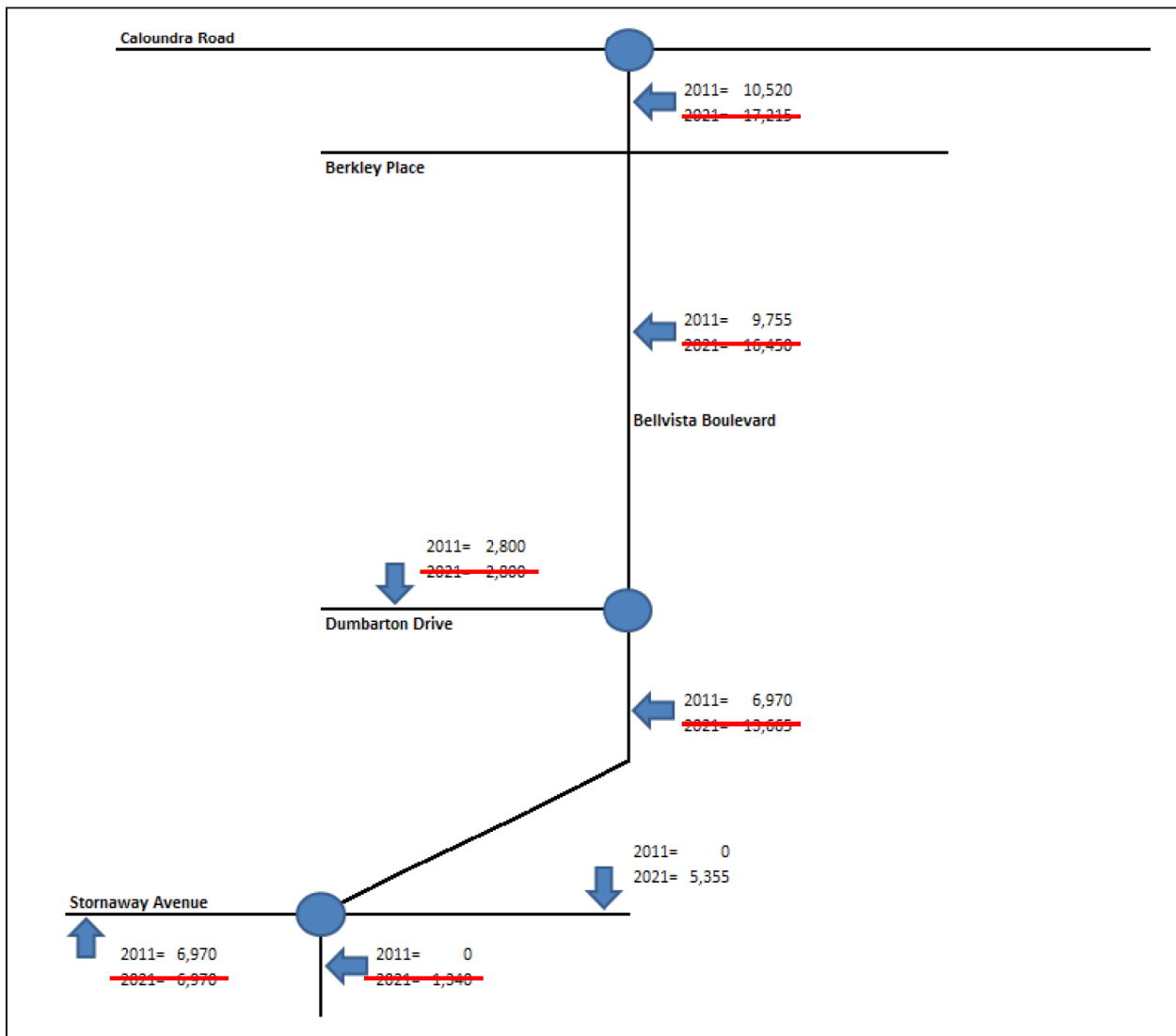


Figure C.1 Existing (2011) Traffic Volumes

