landscape master plan

ellida subject site

The site is located in the Rockhampton suburb of Parkhurst within the Rockhampton City Council (RCC) area, west of the Bruce Highway (Yaamba Road) approximately 10-15 minutes north of the Rockhampton City centre. The site is bound by Ramsay Creek to the north, the Bruce Highway (Yaamba Road) and North Coast Railway defines the eastern site boundary, as well as the rural / industrial fringe boundary to the south and west. There is existing and approved residential living to the east and west.

The existing site has had a variety of past uses and most recently has been used for cattle grazing. Consequently the majority of the site is characterised by open grassy paddocks with scattered remnant tree groupings. An existing overhead powerline easement transects the site running from the north-east corner to the south-west corner. There are several ridgelines which provide views throughout the balance of the site whilst also creating watercourses for overland flow. An existing church is also located on a high point within a separate site in the south-eastern corner.

The proposed master plan involves development of a residential master planned community with residential dwellings, village centre, possible retirement village, and parklands.

landscape master plan

stages 1-3 - master plan

The entry to Ellida is established through stages 1-3 and provides the initial experience into this community. The character is influenced from the surrounding rural context of rolling hills, grassland and scattered woodland.

Emphasis has been place on respecting the local context whilst also creating a unique signature for the development through creating an individual identity for this new community.

LEGEND

- subject site
- 1 primary entry
- 2 entrance to key activity node
- 3 major avenue (arterial)
- 4 district recreation park
- 5 neighbourhood centre
- 6 main street
- 7 easement corridor open space
- 8 Queensland Rail corridor

landscape structure

open space area analysis - whole of site

The adjacent concept masterplan is **approximate only,** for the purposes of demonstrating the total approximate open space area envisaged for the Ellida Project.

A significant component the open space strategy is the **36Ha** Ramsay Creek Corridor, which by itself provides over 13% of planned open space. In total the Ellida project will deliver approximately **68Ha** of open space. Council's rates of provision requirements have been considered during the preparation of the open space design, however broader connectivity, maximising the existing natural features and slope constraints have generated an alternative design response to some of councils desired standard of service requirements. Based on Council's rates of provisions the following is required:

District Park - 0.8Ha per 1,000 people = **4.4Ha**
Regional Community Facilities - 1.5Ha or where collocated with a District Park = **2,000sqm**
Local Park - 1.2 Ha per 1,000 = **6.6Ha**

Assumptions:
Average Household size based on 2016 Census - 2.4pph
Approximate total number of dwellings - 2,300.

The Ramsay Creek corridor is a critical component in addressing Council's minimum Local Park requirements. The Ellida project proposes a linear solution of smaller interventions along the Ramsay Creek edge. **Refer to Page 9**. Smaller neighbourhood hilltop parks are being considered centrally within the site to assist with walkable catchments. A stand-alone Local Park will be provided in the southern parcel below William Palfrey road.

The District Park and Community Facility design seeks to build upon the Ramsay Creek corridor via existing retained natural connections. The combined area will be a single cohesive system that connects East to West. The District Park and Community Facility meet usable open space requirements, however a shortfall of 0.55Ha is noted when compared with Council rates of provisions. When viewed in the context of a 36Ha corridor and broader 68ha system, we believe the shortfall is inconsequential to the systems overall function.

Considerations in developing the concept masterplan include:

1. Utilising the natural form and slope constraints
2. Retention of existing electrical infrastructure and easements
3. Existing vegetation, State Vegetation mapping and riparian buffers
5. Flood mapping constraints
6. EPBC requirements
7. Stormwater treatment requirements
8. Connectivity and walkable catchments
9. CPTED
10. Noise constraints/treatment requirements

landscape structure

open space area analysis - district park and community facilities

LEGEND

Total District Park Area - **3.80Ha**

1 Primary Activity Area inclusive of Community Facilities.

2 Useable Area - 2.21ha
District Park - 2.01ha
Community Facilites - 2,000sqm

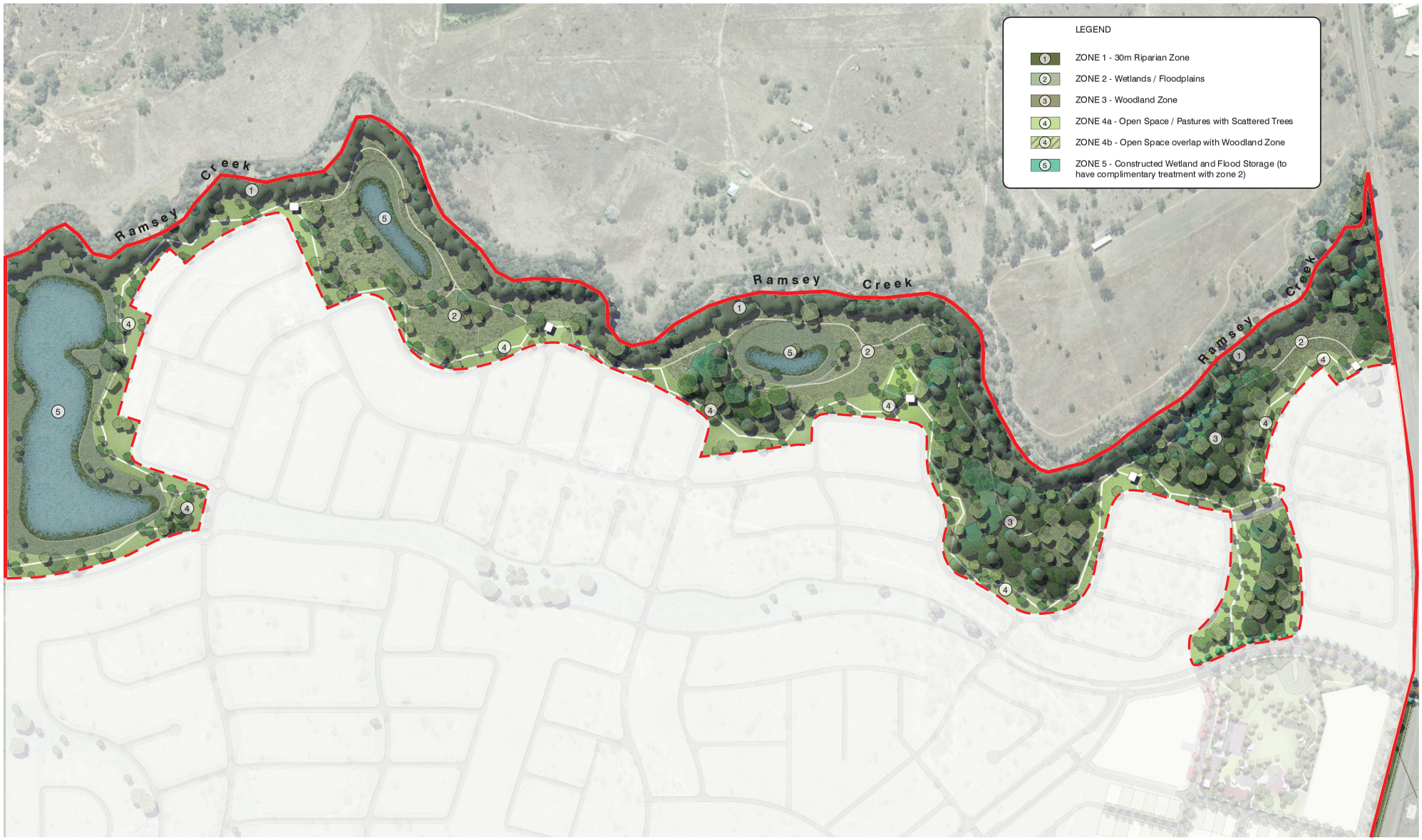
3 Non Useable Area - 1.59Ha Inclusive of stormwater treatment, entry statements and 2% AEP developed flood area.

district park and community facilities - compliance

Characteristic	Recreation Parks and Land for Community Facilities		Compliance
	District	Regional	
Minimum size of open space (hectares)	Two (2) hectares of usable space for parkland		✓
		1.5 hectares of usable space for land for community facilities	*Refer Table 4.4.5.1 Public Parks and Land for Community Facilities Network Desired Standards of Service.* 2,000 square metres of land for community facilities is to be provided when such land is collocated with a district and regional park. *Accessibility standards are identified in Table 4.4.5.3.*
Shape of land	The preferred shape for a park/land for community facilities is square to rectangular with the sides no greater than 2:1		✓
Minimum desired flood immunity for parks	At least twenty-five (25) per cent of total area above 2% AEP with main activity area/s above 1% AEP		✓
Maximum desired grade	Recreation parks — average grade of 1:14 for eighty (80) per cent of the area of the park to facilitate wheelchair access to parks. Variable topography is satisfactory for the remaining area		✓
	No area of the park will have a grade greater than 1:6		✓
	Community facilities — a maximum grade of no more than six (6) per cent for the entirety of the site– or ten (10) per cent for the footprint of the community facility		✓
Road frontage and visibility	Twenty-five (25) per cent of park perimeter to have direct road frontage, preferably on a collector road		✓
Internal roads	None		✓
Car parking	Forty (40) sealed car parks		✓
Fencing/bollards, lock rail	Fencing/bollards along road frontages and including a lock rail		DD
Lighting	Lighting to all roadways, parking, picnic nodes and primary pedestrian paths		✓
Toilets/public amenities	One (1) toilet		To form part of a future Community Facility Building
Pedestrian pathway access network	2.2 metre wide concrete shared pedestrian and cycle path through and around park connecting to adjacent pathways		✓
Bench seating	Minimum of four (4), located for supervision of any play area (if not otherwise serviced by sheltered tables), and/or along recreation corridors/pedestrian pathways to provide rest stops		DD
Shade structures or trees (over playgrounds)	Yes		DD
Shelters/gazebo with tables and seating and bins	Minimum of six (6) shaded tables, seating and bins		DD
Tap/bubbler	Three (3) drinking fountain/bubbler and taps		DD
Barbeques	Three (3) barbeques		DD
Rubbish bins	As required to service activity areas, picnic nodes, key access/egress areas and pathway systems		DD
Landscaping and turfing	Shade trees, landscaping and turfing to enhance amenity		✓
Signage	Park identification and way finding signage, located at key entrances. Optional — interpretive signage (for nature appreciation areas) or trail signage (for example distance markers on recreation corridors)		DD
Recreation activity areas	Mix of ten (10) recreation activity areas, clustered in two or more nodes (for example mix of toddlers, children, youth, picnic and barbecue area, dog off-leash, skate park, meeting area, older adults, pathway systems)		✓
Irrigation	In identified high use areas		✓
Bike racks	Three (3) bike racks for a minimum of fifteen (15) bikes		DD
Bus pull-through	No		NA
Bus parking	No		NA

landscape structure

ramsey creek corridor concept



landscape structure

landscape design issues

LEGEND

- district recreation park
- community facility
- open space corridor - landscaped corridor
- WSUD elements (indicative only)
  wetland
- culvert crossing - refer to civil engineers for details

Notes:

Refer to stormwater management plan for further detail and confirmation of treatment areas.

Final locations and landscape detailing of wetlands, basins, drainage channels and culverts to be coordinated at OPW submission.

landscape structure

open space and public realm

OPEN SPACE TYPE AND PROVISION

Open Space		Approx Land
	district park and community facilities	3.8 ha
	open space corridor - easement	0.5 ha
Total open space		4.3 ha

landscape structure

connectivity

LEGEND

primary on-road cycleway and pedestrian pathway to both sides of verge

cycle / shared pathway

main street

pedestrian connection

major anchors

landscape structure

street trees

The street tree strategy proposed is based on a combination of both formal and informal arrangements determined by the road hierachy and physical location.

Arterial and sub-arterial roadways are to form signature linear corridors achieved through strong form, colour and repetition. These roadways are to create the greatest impact on users moving along these thoroughfares. A major collector will form an esplanade in the neighbourhood centre, which will have high amenity planting to achieve colour, shade and visual interest.

Street trees to the general residential precincts have been spearated into mixes that will be applied in zones indicated in the street tree structure plan. These species will be planted informally to achieve a more natural appearance that compliments the surrounding landscape. Through creating mixes, a visual change will be evident as a viewer passes throughout the development.

LEGEND

- 1 street tree mix 1
- 2 street tree mix 2 urban
- arterial
- minor collector type 1
- minor collector type 2 (main street)

landscape structure

street tree palette

STREET TREE MIX 1 ①

ATRACTOCARPUS fitzalanii

BACKHOUSIA citriodora

CORYMBIA ptychocarpa

STREET TREE MIX 2 ②

BUCKINGHAMIA celsissima

FLINDERSIA australis

XANTHOSTEMON chrysanthus

URBAN SUB ARTERIAL

CENTRE MEDIAN SPECIES

DELONIX regia

VERGE SPECIES 1

CASSIA brewsteri

MINOR COLLECTOR - TYPE 1

WATERHOUSIA floribunda

MINOR COLLECTOR - TYPE 2 MAIN STREET (KEY ACTIVITY ROADWAY)

TABEBUIA palmeri

landscape structure

feature palettes

DISTRICT PARK


corymbia tessellaris


eucalyptus tereticornis


lophostemon suaveolens


melaleuca sp.


westringia sp.


baeckea sp.


grevillea 'robyn gordon'


leptospermum 'pink cascade'


lomandra longifolia katrinus deluxe

callistemon betka beauty


grevillea sp.


myoporum parvifolium

landscape precinct

district recreation park and community facilities

The district park and future community facilities forms a key activity node in stages 1-3 of the development. Varied active and passive recreational needs are catered for, facilitating community activity to multiple neighbourhoods. A variety of spaces and embellishments will cater for a range of users and enable community events to be held. The district park is designed to cater for all age groups and levels of ability in its users.

landscape precinct

district recreation park - indicative concept plan

LEGEND

- subject site
- 1 major entry statement
- 2 vegetated buffers to residential blocks
- 3 shared 2.2m wide pedestrian/ cycleway
- 4 piped drain with outlet to parkland
- 5 sculpted drainage channel
- 6 open lawn drainage channel
- 7 inlet pond and culvert connection
- 8 open lawn/kickabout space
- 9 park shelter with BBQ facilities
- 10 multi-use sports court
- 11 junior play
- 12 middle play
- 13 senior play
- 14 carparking
- 15 community building
- 16 toilet block
- 17 dog off-leash area
- 18 wetland area
- 19 ramsay creek connection

landscape precinct

district recreation park - sections

Section A

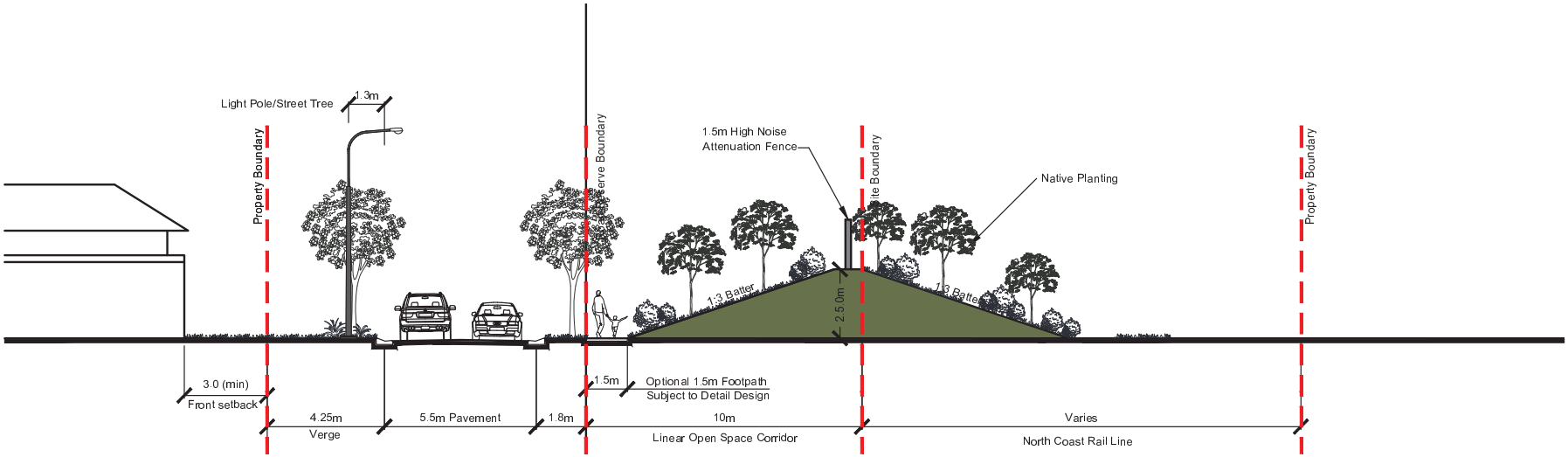
Section B

Section C

landscape precinct

open space corridor - noise attenuation mound

The noise attenuation mound will form a linear section of parkland that provides a safe pedestrian and cycle connection along the eastern boundary of the subject site. Strategically placed activity nodes will reinforce and promote the active lifestyle driver for the development. The corridor addresses acoustic constraints through vegetated soft landscape treatments.



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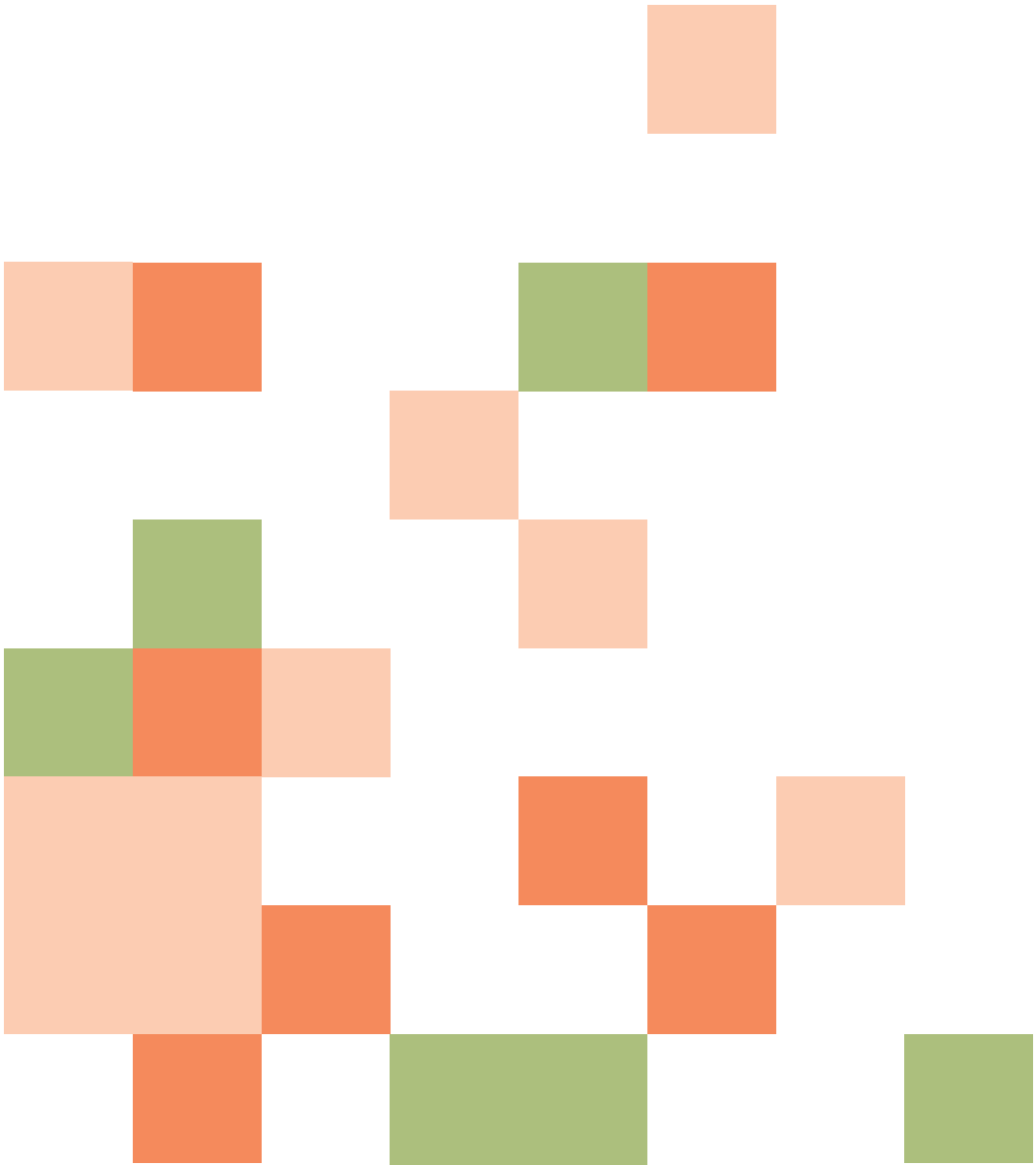

APPENDIX K
NOISE AMENITY ASSESSMENT

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/117-2017

Dated: 12 September 2018

NOISE AMENITY ASSESSMENT

STAGES 1 TO 3

'ELLIDA'

PARKHURST NORTH

Prepared for:

Stockland Development Pty Ltd

Prepared by:

MWA Environmental

31 October 2013

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Job Name: Parkhurst

Job No: 11-007

Original Date of Issue: 31 October 2013

DOCUMENT DETAILS

Title:	Noise Amenity Assessment – Stages 1 to 3 – 'Ellida' - Parkhurst North
Principal Author:	Mr Ben Hyde
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REVISION/CHECKING HISTORY

Version Number	Date	Issued By		Checked By	
1 Report	27/02/13	BH		PAK	
2 v2 Report	31/10/13	BH		PAK	
3					
4					
5					
6					
7					
8					

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CONTENTS TABLE

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

MWA Environmental has been engaged by Stockland Development Pty Ltd to undertake a Noise Amenity Assessment for Stages 1 to 3 of the Ellida development at Parkhurst.

MWA Environmental has previously prepared the report *Masterplan Environmental Amenity Assessment – Proposed Master Planned Community – 'Ellida' - Parkhurst North* (27 February 2013) (**"the Masterplan Report"**) which provides an overview of the noise, air quality and lighting issues at the Ellida development. The report provides specific assessment of the following noise issues relevant to Stages 1 to 3 of the development:

- Impact of road traffic noise from the Bruce Highway;
- Impact of railway noise from the North Coast Railway;
- Impact of noise from industrial land uses to the south; and
- Impact of road traffic noise on major roadways within the development;

The assessment has considered the requirement for sensitive land uses to be located such that a reasonable standard of acoustic amenity is achieved.

1.2 SITE DESCRIPTION

The subject site comprises Stages 1 to 3 of the 'Ellida' development at Parkhurst.

The 'Ellida' site is located on William Palfrey Road at Parkhurst, approximately 7.5km north of the Rockhampton city centre.

The Stages 1 to 3 site is located adjacent the eastern site boundary, south of the Olive Street access point.

An aerial photograph showing the location and extent of the subject site is included as **Figure 1**.

The site topography is undulating. Preliminary earthworks design provided by Brown Consulting has been applied to the computer noise modelling.

1.3 SURROUNDING LAND USES

Land uses within 1km of the subject site include:

- Rural
- Residential
- Industrial (Low Impact, Medium Impact, High Impact, Noxious & Offensive)
- Some commercial / tourism uses

The surrounding land uses are shown on **Figure 2.**

Specific land uses identified in the Masterplan Report as having the potential to impact on noise amenity at the Stages 1 to 3 site are:

- Queensland Magnesia (QMAG) - production of calcined, dead burned, and electrofused magnesia products from magnesite
- AUSTRAK – concrete railway sleeper manufacture
- Industrial uses to east – including heavy engineering type uses
- The North Coast Railway
- The Bruce Highway

The locations of these specific land uses are shown on **Figure 2.**

1.4 PROPOSED DEVELOPMENT

The proposed development is a reconfiguration of lot for Stages 1 to 3 of the 'Ellida' master planned community including the following land uses:

- Housing on residential allotments averaging 550 to 600m^2
- Mixed Use site within Stage 2e – subject to future development application
- Parkland / Open Space

The Stages 1 to 3 development plan is included as **Figure 3.**

2.0 NOISE AMENITY ASSESSMENT

2.1 NOISE MONITORING

To enable an assessment of the existing noise exposure of the subject site long-term and short-term noise measurements have been undertaken.

The recorded noise levels are presented as statistical components, which are described as:

- L_{max}: Instantaneous maximum sound pressure level.
- L_{10}: Noise level exceeded for 10 percent of the measurement period, referred to as the averaged maximum sound pressure level.
- L_{90}: Noise level exceeded for 90 percent of the measurement period. AS1055.1–1997[1] notes that the L_{90} is described as the background sound pressure level.
- L_{eq} An "average" measurement, and as per AS1055.1–1997 defined as the value of the sound pressure level of a continuous steady sound state, that within a measurement period, has the same mean square sound pressure as a sound under consideration whose level varies with time

A noise datalogger was located at the site over the eleven day period 9 to 19 March 2011 to characterise the existing noise environment. The noise datalogger location was adjacent to the eastern site boundary to assess current ambient, road traffic and railway noise levels at the most affected site boundary.

The noise datalogger location is shown on **Figure 4**.

Table 1 below provides the minimum, maximum and average statistical noise levels recorded by the noise datalogger.

[1] Australian Standard *AS 1055.1-1997 Acoustics – Description and measurement of environmental noise, Part 1: General procedures*

**Table 1: Datalogger Recorded Statistical Noise Levels– dB(A)
9 to 19 March 2011 – 15-Minute Samples**

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dBA		
		MINIMUM	MAXIMUM	AVERAGE
L_{max}	Daytime (7am-6pm)	52.5	99.5	67.1
	Evening (6pm-10pm)	55.5	96.5	65.4
	Nighttime (10pm-7am)	49.5	96.5	62.8
L_{10}	Daytime (7am-6pm)	45.5	64.5	54.1
	Evening (6pm-10pm)	48.5	62.5	53.8
	Nighttime (10pm-7am)	42.0	63.5	50.6
L_{90}	Daytime (7am-6pm)	35.5	52.5	44.8
	Evening (6pm-10pm)	37.5	49.5	43.6
	Nighttime (10pm-7am)	33.0	57.0	40.3
L_{eq}	Daytime (7am-6pm)	42.5	70.5	52.0
	Evening (6pm-10pm)	45.0	68.0	51.4
	Nighttime (10pm-7am)	40.5	70.5	48.2

The noise datalogger recorded statistical noise level parameters included:

Range Recorded L_{10}(18-hour) =	50.3 to 55.7 dB(A)
Average Recorded L_{10}(18-hour) =	53.6 dB(A)
Average Recorded L_{90}(8-hour) =	39.3 dB(A)
Range Recorded L_{eq}(24-hour) =	47.8 to 52.8 dB(A)
Average Recorded L_{eq}(24-hour) =	50.4 dB(A)
Highest Day Single Event Maximum Train L_{max}:	89.8 dB(A)[2]

The complete results from the noise datalogger are presented as a trace of noise level versus time for the statistical noise level descriptors L_1, L_{10}, L_{90} and L_{eq} as **Attachment 1**.

The noise datalogger used was an Acoustic Research Laboratories noise datalogger, model EL-315, programmed to provide statistical analysis results based on 15-minute sampling periods. The datalogger was pre-calibrated to 94 dB at 1kHz using a Bruel & Kjaer Sound Calibrator, Type 4231, and displayed a deviation of less than ±0.5 dB from this level at post-calibration.

In addition to the above noise datalogging, attended noise measurements were undertaken on 9 March 2011 at a range of locations on the site to characterise the variation in the noise environment and identify influences from specific sources. The results of the attended noise measurements are provided in **Table 2** below, with noise measurement locations shown on **Figure 4**.

[2] The *Queensland Rail Code of Practice for Railway Noise Management* defines the "Single Event Maximum Sound Pressure Level" as the arithmetic average of maximum levels from the highest 15 single events over a given 24 hour period.

Table 2: Attended Noise Monitoring Data – dB(A)
9 March 2011

#	LOCATION	TIME	RECORDED STATISTICAL NOISE LEVEL - dB(A)				COMMENTS
			L_1	L_{10}	L_{90}	L_{eq}	
1	Southwestern Corner of Site	2055 - 2110	52	50	47	49	QMAG background, loudest location at SW corner of site, not perceived as tonal
		0950 - 1005	55	53	48	51	QMAG background, distant traffic noise
2	Eastern Site Boundary	1035 - 1050	61	55	45	52	Highway traffic, industry rattle gun
3	Centre William Palfrey Road Frontage	1125 - 1140	53	49	44	47	Highway traffic
		2115 - 2130	53	50	43	48	QMAG barely audible with light easterly, highway traffic
4	Southeastern Corner of Site	1205 - 1220	50	47	42	45	AUSTRAK beepers and plant noise, moderate easterly, occasional reversing beepers from industry to east
		2030 - 2045	51	49	44	47	QMAG background, insects, AUSTRAK beepers audible, train low 60s, horns at crossing
5	Southern Boundary	1230 - 1245	54	51	47	50	Background QMAG, AUSTRAK beepers audible
6	Western End William Palfrey Road Frontage	1255 - 1310	46	43	39	44	distant QMAG background with wind in trees also

The attended noise monitoring was undertaken with a Bruel & Kjaer 2250 Sound Level Meter, pre-calibrated to 94 dB at 1kHz. There was no deviation from this level at post-calibration.

Noise monitoring was also undertaken adjacent to the surrounding industrial facilities including QMAG and AUSTRAK to identify the nature and level of noise emissions from the operation of these facilities.

2.2 RAILWAY NOISE ASSESSMENT

2.2.1 Description of North Coast Railway

The North Coast Railway is located directly to the east of the subject site.

The railway carries freight trains and long distance passenger trains.

An average of approximately 10 train movements per day pass the subject site based upon the noise monitoring data obtained over the period 9 to 19 March 2011 the railway line. This may, however, vary seasonally and/or annually.

Train movements were observed to occur during the day, evening and night periods.

Trains past the subject site travel at relatively low speed due to proximity to level crossings and urban areas. Horns were noted to be sounded by some trains when passing the level crossing at William Palfrey Road.

The noise of horns has been considered in assessing the single event maximum railway noise levels impacting on the proposed development.

2.2.2 Railway Noise Criteria

Residential land uses within Stages 1 to 3 are located the following minimum distances from the railway line[3]:

Stage 1:	250 metres from the railway line
Stage 2:	70 metres from the railway line
Stage 3:	No residential allotments

The proposed development is a reconfiguration of lot and does not include any built form development for residential uses. As such, the relevant Queensland Transport **external** railway noise criteria for the assessment of residential developments are:

87 dB(A) L_{Amax}

65 dB(A) L_{Aeq} 24 hour average

Since implementation in August 2010, assessment of **internal** railway noise amenity (i.e. within habitable rooms) is now regulated by the Queensland Development Code (QDC) MP4.4 *Buildings in a Transport Noise Corridor.* A copy of QDC MP4.4 is included as **Attachment 2.**

[3] Note distance is from residential boundary to **railway line,** not railway land

The requirements of QDC MP4.4 are implemented at the building approval stages for future residential dwellings and overrides the 45 dB(A) L_{Amax} within habitable rooms internal noise criteria referenced in the Department of Transport and Main Roads *Policy Position Statement: Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure* (Version 2, 10 May 2013) document at the relevant building approval stage. Under the Building Act 1975 the transport chief executive may designate land as being within a transport noise corridor if the land is within:

- 100 metres of railway land; or
- Up to 250 metres of railway land if the noise of trains exceeds 58 dB(A).

However, the 58 dB(A) trigger in the Building Act 1975 is not consistent with QDC MP4.4 which does not require acoustic treatment of dwellings when external railway noise levels are below L_{Amax} 69 dB(A).

Effectively, for the purposes of land use planning assessment and the design of future dwellings in accordance with the QDC, acoustic treatment may be required for dwellings located within 250 metres of the railway if external L_{Amax} noise levels exceed 69 dB(A).

Under MP4.4 the specific acoustic treatment requirements for proposed dwellings are dependent upon the noise exposure category of the building site, as follows:

Table 3: Summary of QDC MP4.4 Railway Noise Categories

QDC MP4.4 Noise Category	Single event maximum noise* (L_{Amax}) for railway land
Category 4	≥ 85 dB(A)
Category 3	80 – 84 dB(A)
Category 2	75 – 79 dB(A)
Category 1	70 - 74 dB(A)
Category 0 (no acoustic treatment required)	≤ 69 dB(A)

** measured at 1 m from the façade of the proposed or existing building.*

The default noise category for properties within transport noise corridors is set by the State Government based upon a relatively simple calculation and may be reassessed in appropriate detail by an acoustic engineer with consideration of site-specific railway noise levels and intervening structural and/or topographic shielding. The builder / certifier is then required to ensure that the building construction achieves the minimum R_W ratings specified in Schedule 1 of MP4.4. Schedule 2 of MP4.4 provides "acceptable forms of construction" to achieve these R_W requirements, however, there is the option to use alternative materials that the manufacturer certifies will achieve the required R_W.

In response to a Queensland Department of Transport and Main Roads (TMR) *Information Request* (7 May 2013) by MWA Environmental[4] advised that:

> The ultimate intention of the State and the MWA Environmental reports is that the Queensland Development Code MP4.4 be applied to streamline the acoustic design and assessment process for future residential dwellings. Once the transport chief executive gazettes land as transport noise corridors for railways under the Building Act 1975, the Queensland Development Code MP4.4 will apply to residential dwellings within the development that are located within (potentially) 250 metres of the railway.
>
> Discussions with TMR indicate that the Department will not consider the implementation of the QDC MP4.4 provisions through the Local Plan as a means to achieve a streamlined acoustic design process whilst protecting state interests until such time as transport noise corridors for railways are gazetted under the Building Act 1975.
>
> As such, MWA Environmental has reviewed the acoustic treatment requirements applicable under the Department of Transport and Main Roads Policy Position Statement: Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure (Version 2, 10 May 2013).
>
> In order to minimise administrative requirements at the transition between the application of Policy Position Statement and QDC MP4.4 acoustic treatment processed (once transport noise corridors for railways are gazetted), it is recommended that consideration be given to conditioning the development on the basis of requirements 'prior to' and 'following' gazettal of transport noise corridors for railways.

As such, the acoustic treatment for houses to mitigate railway noise has been undertaken based upon the Department of Transport and Main Roads *Policy Position Statement: Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure.*

[4] *Response to Queensland Department of Transport and Main Roads Information Request - Noise Impact Assessment for Proposed Master Planned Community – 'Ellida' - Parkhurst North* (L15713/BH/11-007, 7 August 2013)

2.2.3 Measured Railway Noise Levels

In order to assess current L_{Amax} and L_{Aeq} 24 hour railway noise levels at the eastern site boundary a noise datalogger was installed at the location shown on **Figure 4** over the period 9 to 19 March 2011. Additionally, attended noise measurements were conducted on 9 March 2011 to verify L_{Amax} noise levels from individual train movements derived from the longer-term monitoring data. The datalogger monitoring location was 38 metres from the railway line.

The datalogger recorded noise levels are included as graphical traces of noise level versus time in **Attachment 1**.

The recorded L_{Aeq} 24 hour noise levels at the most exposed boundary ranged 47.8 to 52.8 dB(A), with an average of 50.4 dB(A).

A table presenting all extracted train L_{max} noise levels is presented in **Attachment 3.**

The 'single event maximum' L_{Amax} noise levels from train movements past the site were extracted from the data for each day and are summarised in **Table 4** below. As a conservative assumption, the highest 'single event maximum' noise level recorded for any of the days has been applied as a source level for the purposes of this assessment.

Table 4: Summary of Train Movement L_{Amax} Noise Levels – dB(A) Noise Datalogger Location (refer Figure 4)

DATE	AVERAGE L_{max}	# TRAINS
11/03/2011	88.9	7
12/03/2011	85.9	7
13/03/2011	88.4	9
14/03/2011	82.2	6
15/03/2011	88.0	11
16/03/2011	89.8	11
17/03/2011	87.3	14
18/03/2011	83.0	11
19/03/2011	87.8	3
HIGHEST DAY 'SINGLE EVENT MAXIMUM'	**89.8**	-

Calculations were undertaken to derive an appropriate site-specific train Sound Power Level (SWL) for input to a detailed computer noise model.

2.2.4 Predicted Railway Noise Levels

2.2.4.1 L_{eq} 24 Hour Railway Noise Levels

The measured existing L_{Aeq} 24 hour noise levels adjacent to the eastern site boundary, including additive Bruce Highway traffic noise, ranged 47.8 to 52.8 dB(A). Even based upon on the conservative assumptions that only railway noise contributed to the L_{Aeq} 24 hour noise levels and train movements may hypothetically double within a 10 year design horizon, railway L_{Aeq} 24 hour noise levels will remain below 56 dB(A)[5] at the nearest Stages 1 to 3 residential dwelling facades.

As such, given the relatively low number of train movements passing the subject site, 10 year design horizon L_{Aeq} 24 hour noise levels will readily comply with the 65 dB(A) external criterion at the most affected residential allotments within Stages 1 to 3.

2.2.4.2 L_{max} Railway Noise Levels

Based upon noise monitoring conducted at the eastern site boundary, the relevant 'single event maximum' noise level for the assessment is L_{max} 89.8 dB(A) at 38 metres from the railway line.

Considering the short-term peak L_{max} noise emissions from a railway as being generated by a point source, the L_{max} at the nearest future residential dwelling for residential lots within Stage 1 is calculated to be approximately 76 dB(A) without any consideration of ground absorption or earth mound / acoustic barrier, as follows:

$$L_{p2} = L_{p1} + 20 \times \text{Log}_{10}(r_1/r_2) + FR$$

where: L_{p1} = L_{max} at 38 metres source level
L_{p2} = L_{max} at nearest future residential dwelling
r_1 = source level setback distance (38m)
r_2 = railway setback from future dwelling
FR = façade reflection i.e. +2.5 dB(A)

Therefore:

$$L_{p2} = 89.8 + 20 \times \text{Log}_{10}(38/250) + 2.5$$

$$L_{p2} = 76 \text{ dB(A) } L_{max}$$

The L_{max} at the nearest future residential dwelling for residential lots within Stage 2 is calculated to be approximately 87 dB(A) without any consideration of ground absorption or earth mound / acoustic barrier shielding, as follows:

[5] Based upon calculation of increase due to doubling of train volumes in a 24 hour period and including +2.5dB façade reflection

$L_{p2} = L_{p1} + 20 \times \text{Log}_{10}(r_1/r_2) + FR$

where: L_{p1} = L_{max} at 38 metres source level
L_{p2} = L_{max} at nearest future residential dwelling
r_1 = source level setback distance (38m)
r_2 = railway setback from future dwelling
FR = façade reflection i.e. +2.5 dB(A)

Therefore:

$L_{p2} = 89.8 + 20 \times \text{Log}_{10}(38/70)+2.5$

$L_{p2} = 87$ dB(A) L_{max}

It is noted that over the significant separation distances between the railway line and the proposed residential allotments, ground absorption will provide substantial excess noise attenuation.

Computer noise modelling verifies the above calculations which indicate that **no acoustic barrier is required to comply with the external railway noise criteria at the Stages 1 to 3 residential allotments.**

This notwithstanding, **Stockland proposes to construct a 5.5 metre high earth mound within the Open Space Corridor south of the Olive Street access point.** The proposed acoustic mound will provide a significant attenuation of railway noise levels within the adjacent residential area and reduce reliance upon acoustic treatment of dwellings. The proposed earth mound alignment is shown on **Figure 5**.

To provide a more detailed assessment of peak railway noise levels across the site considering topographical and ground absorption effects in addition to the proposed 5.5 metre high earth mound, a SoundPLAN 7.1 model was prepared to predict the L_{max} railway noise levels across the Stages 1 to 3 site.

The predicted L_{max} railway noise levels at the proposed residential land uses within Stages 1 to 3 are presented in **Attachment 4**.

The model demonstrates that proposed residential land uses south of the Olive Street access are sufficiently setback from the rail line and shielded by the earth mound to comply with the 87 dB(A) L_{max} planning level.

Consideration has been given to the proposed residential allotments within 250 metres of the railway corridor upon which dwellings will require acoustic treatment in order to achieve the design indoor railway noise levels specified in the Department of Transport and Main Roads *Policy Position Statement: Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure* (Version 2, 10 May 2013)[6]. The relevant secondary (internal) environmental criterion for railways is 45 dB(A) single event maximum within a habitable room.

[6] *Note that this is an updated from the Version 1 document referenced in the TMR Information Request and includes a more stringent 45 dB(A) single event maximum indoor noise criterion for habitable rooms (recreation areas) for all period of the day*

AS3671-1989 – Road traffic noise intrusion – Building siting and construction, states that a noise reduction of approximately 10 dB(A) is expected from dwellings of standard construction with open windows and doors comprising up to 10% of the exposed façade. On this basis, acoustic treatment of dwellings would be required on allotments where the external single event maximum rail noise levels exceed 55 dB(A).

All residential land uses within 250 metres of the rail land are predicted to experience single event maximum rail noise levels above 55 dB(A) without consideration of shielding from future building structures. As such, it may be necessary to acoustically treat future dwellings within 250 metres of the railway land to achieve the 45 dB(A) single event maximum indoor noise level. It is not considered reasonable to require acoustic treatment of dwellings setback more than 250 metres from railway land.

A plan showing the areas where residential dwellings will require acoustic treatment to address railway and/or industry noise impacts is provided as **Figure 6**.

Based upon the predicted single event maximum rail noise levels with the 5.5 metre high earth mound within the Open Space Corridor south of the Olive Street access point, **Figure 7** depicts zones of Transport Noise Reductions (TNR) required through residential building facades to achieve the 45 dB(A) indoor level. The minimum TNR zones have been set on the basis of Schedule 1 of QDC MP4.4 to allow for simple assessment of acceptable forms of construction to achieve the required noise reductions **as** per Schedule 2 of QDC MP4.4.

2.2.5 Railway Noise Mitigation Measures

Based upon the railway noise assessment conducted:

1. The proposed development can comply with Performance Criteria P1 of the *Rockhampton City Plan* Rail Noise Code with the provision of appropriate noise mitigation measures.
2. No acoustic barrier is required to comply with the relevant external railway noise planning levels for residential allotments within Stages 1 to 3. This notwithstanding, Stockland proposes to construct a 5.5 metre high earth mound within the Open Space Corridor south of the Olive Street access point
3. Future residential dwellings within Stages 1 to 3 will require acoustic treatment in accordance with DTMR requirements. The region where railway noise acoustic treatment will be required is shown on **Figure 6**. Air conditioning and/or mechanical ventilation will be required to habitable rooms to allow residents to close doors and windows as desired to minimise railway noise.
4. **Figure 7** depicts zones of Transport Noise Reductions (TNR) required through residential building facades to achieve the 45 dB(A) indoor level.

2.3 BRUCE HIGHWAY TRAFFIC NOISE ASSESSMENT

2.3.1 Description of Bruce Highway

The Bruce Highway is located approximately 70 metres to the east of the subject site, beyond the North Coast Railway. Proposed residential land uses within Stages 1 to 3 are setback a minimum of 110 metres from the Bruce Highway.

The Bruce Highway past the subject site is a single lane in each direction undivided carriageway with extended turning lanes along part of the alignment. The posted speed limit is 70km/h.

Existing (Year 2011) and 10 year design horizon (Year 2025) traffic volume data for the Brice Highway was provided by Cambray Consulting Pty Ltd based upon:

- TMR 2009 count data
- A conservatively high 3% per annum growth rate
- Additional traffic generated by the proposed development

The derived Bruce Highway traffic data for the purposes of this assessment is summarised in **Table 5** below. In accordance with standard assumptions, the 18 hour traffic volume from 6am to midnight was taken as 94% of the daily volume and the peak 1 hour traffic volume was taken as 10% of the daily volume.

Table 5: Bruce Highway Traffic Data

YEAR	AADT	18 HOUR (6am to midnight)	PEAK 1 HOUR	COMMERCIAL VEHICLE %
2011	10494	9865	1049	10.6
2025	15874	14922	1587	10.6

2.3.2 Road Traffic Noise Criteria

The appropriate traffic noise criteria are those specified in the TMR *Road Traffic Noise Management: Code of Practice* (the COP), which is as follows:

Residential (Temporary or Permanent Occupancy)

Habitable Floors

- *60 dB(A) L_{10} (18 hour) or less, where existing levels measured at the local government deemed-to-comply dwelling setback distance are greater than 40 dB(A) L_{90} (8 hour) between 10pm and 6am; or*
- *57 dB(A) L_{10} (18 hour) or less, where existing levels measured at the local government deemed-to-comply dwelling setback distance are less than or equal to 40 dB(A) L_{90} (8 hour) between 10pm and 6am;*
- *where the above criteria cannot be met, internal maximum design criterion levels specified in Table 1, AS2107-1987.*

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

Balconies and Formal External Open Space

- *60 dB(A) L_{10} (18 hour) or less, where existing levels measured at the local government deemed-to-comply dwelling setback distance are greater than 45 dB(A) L_{90} (18 hour); or*
- *57 dB(A) L_{10} (18 hour) or less, where existing levels measured at the local government deemed-to-comply dwelling setback distance are less than or equal to 45 dB(A) L_{90} (18 hour).*

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

Formal external open space is the private or communal recreational area of a development "required" by a local government.

The recorded L_{90} (8-hour) levels at the noise datalogger location averaged 39.3 dB(A) which for the undeveloped site is slightly below the 40 dB(A) threshold for assessing the relevant external noise criterion.

However, considering the nature of the proposed development on the subject site it is likely that L_{90} (8-hour) levels will actually exceed 40 dB(A) once the site is developed.

This notwithstanding, it is conservatively assumed that the appropriate traffic noise criterion as per the DMR CoP is **60 dB(A) L_{10} (18-hour) facade reflection adjusted** external to proposed residential building facades for the purposes of this assessment.

Since implementation in August 2010, assessment of internal road traffic noise amenity (i.e. within habitable rooms) is now regulated at Building Application stages through the Queensland Development Code (QDC) MP4.4 *Buildings in a Transport Noise Corridor*. A copy of QDC MP4.4 is included as **Attachment 2.**

The requirements of QDC MP4.4 supersede the previous TMR acoustic covenant process. Under the Building Act 1975 the transport chief executive may designate land as being within a transport noise corridor if the land is within:

- 100 metres of a state-controlled road; or
- Up to 250 metres of a state-controlled road if the noise of traffic on the road is at least 58 dB(A).

Effectively, for the purposes of land use planning assessment and the design of future dwellings in accordance with the QDC, acoustic treatment may be required for dwellings located within 250 metres of the highway if external L_{10} (18 hour) noise levels exceed 57.5 dB(A).

Under MP4.4 the specific acoustic treatment requirements for proposed dwellings are dependent upon the noise exposure category of the building site, as follows:

Table 6: **Summary of QDC MP4.4 Traffic Noise Categories**

QDC MP4.4 Noise Category	L_{10} 18 hour* for state-controlled roads
Category 4	≥ 73 dB(A)
Category 3	68 – 72 dB(A)
Category 2	63 – 67 dB(A)
Category 1	58 - 62 dB(A)
Category 0 (no acoustic treatment required)	≤ 57 dB(A)

** measured at 1 m from the façade of the proposed or existing building.*

The default noise category for properties within transport noise corridors is set by the State Government based upon a relatively simple calculation and may be reassessed in appropriate detail by an acoustic engineer with consideration of site-specific traffic noise levels and intervening structural shielding. The builder / certifier are then required to ensure that the building construction achieves the minimum R_W ratings specified in Schedule 1 of MP4.4. Schedule 2 of MP4.4 provides "acceptable forms of construction" to achieve these R_W requirements, however, there is the option to use alternative materials that the manufacturer certifies will achieve the required R_W.

2.3.3 Road Traffic Noise Modelling

2.3.3.1 Description of Traffic Noise Model

Traffic noise modelling has been conducted using the SoundPlan 7.1 software applying the accepted CoRTN traffic noise prediction methodology.

Site specific topographic information was input to the model based upon preliminary design finished surface levels for Stages 1 to 3 and existing surface levels for the balance site and surrounds provided by Brown Consulting (Qld) Pty Ltd.

The traffic noise model has been setup to represent Year 2011 traffic conditions for validation purposes and also for a Year 2025 10 year design horizon model.

2.3.3.2 Model Validation

The first step in the predictive traffic noise process is to validate the model to the recorded noise levels, i.e. the aim being to predict the same level as that recorded, with selected parameters used in the future traffic noise modelling scenarios.

The highest L_{10}(18 hour) noise level at the noise datalogger location was recorded to be 55.7 dB(A) (free-field), with an average of 53.6 dB(A).

Using the relevant 2011 traffic volume data, the SoundPlan 7.1 model predicted at the datalogger location a level of 55.5 dB(A) L_{10} (18 hour) (free-field). It is considered that this is a satisfactory validation of the model to the existing traffic noise levels at the site.

2.3.3.3 Design Horizon Modelling

The SoundPlan 7.1 model was setup to represent the 10 year design horizon (Year 2025) traffic volumes on the Bruce Highway.

The model was used to predict the 10 year design horizon L_{10}(18 hour) traffic noise levels across the subject site for Ground Level (+1.8m) receptor heights suitable for the assessment of noise amenity at outdoor recreation areas and single storey dwelling facades. Although single storey dwellings are anticipated within Stages 1 to 3 modelling has also been undertaken for Upper Level (+4.3m) receptor heights.

Although L_{90} (8 hour) noise levels would be expected to exceed 40 dB(A) once the site is developed, a 60 dB(A) L_{10} (18 hour) (facade reflection adjusted) external noise criterion has been conservatively adopted for the assessment of external facade and outdoor recreation area traffic noise exposure at the proposed Stages 1 to 3 residential allotments based upon the pre-development L_{90} (8 hour) noise levels.

The results of the SoundPlan 7.1 modelling are presented in **Attachment 5** as plots of the predicted L_{10} (18 hour) (façade reflection adjusted) noise levels over the development plan for Ground Level (+1.8m) receivers.

The results of the modelling demonstrate that 10 year design horizon (Year 2025) Bruce Highway traffic noise levels will comply with the 60 dB(A) L_{10} (18 hour) (facade reflection adjusted) external noise criterion at outdoor recreation areas and single or two storey dwelling facades on all proposed residential allotments without any requirement for an acoustic barrier.

Included in **Attachment 5** is a plan showing the applicable QDC MP4.4 Noise Categories (0 to 4, refer **Attachment 2**) over the proposed Stages 1 to 3 development layout due to Bruce Highway traffic noise. The highest QDC Noise Category that will apply to residential dwellings within Stages 1 to 3 due to Bruce Highway traffic noise is Category 1. On this basis, the acoustic treatment of dwellings within the affected zone to mitigate railway noise (refer **Section 2.2**) will override any road traffic noise requirements.

2.3.4 Road Traffic Noise Mitigation Measures

Based upon the Bruce Highway traffic noise assessment conducted:

1. The proposed development can comply with the external noise criteria specified in the TMR *Road Traffic Noise Management: Code of Practice* without any requirements for acoustic barriers.
2. The Queensland Development Code MP4.4 acoustic treatment requirements for future residential dwellings due to railway noise will override any road traffic noise requirements.

2.4 INTERNAL ROADS TRAFFIC NOISE ASSESSMENT

2.4.1 Description of Internal Roadways

The proposed development incorporates an internal road network. This assessment has considered the requirement to achieve an appropriate level of traffic noise amenity at residential dwelling facades and ground level recreation areas on residential allotments.

The assessment has considered potential impacts from roadways projected to carry ultimate traffic volumes of at least 3,000 vehicles per day. Based upon information provided by Cambray the no roadways affecting Stage 1 to 3 residential allotments that will carry over 3,000 vpd.

As such, no detailed assessment of noise amenity impacts from internal roads is required for the Stages 1 to 3 development.

2.5 INDUSTRY NOISE ASSESSMENT

2.5.1 Industry Noise Affecting Stages 1 to 3

Detailed assessment of the impact of steady-state processing noise and intermittent short-term peaks from industrial land uses in proximity to the subject site is provided in the Masterplan Report (27 February 2013).

The detailed assessment determined that residential dwellings within the area shown on **Figure 6** will require acoustic treatment to achieve the indoor Acoustic Quality Objectives. For the purposes of this reconfiguration of lot application, only three lots within Stage 2d are located within the affected area (refer **Figure 8**).

2.5.2 Required Acoustic Treatment of Stage 3c Dwellings

Based upon the detailed modelling and assessment presented in the Masterplan Report (27 February 2013), the required sound transmission loss through dwelling facades to achieve the indoor Acoustic Quality Objectives is less than 20 dB(A) which is achievable using relatively standard building construction techniques and materials. Air conditioning and/or mechanical ventilation will be required to habitable rooms to allow residents to close doors and windows as desired to minimise industry noise.

The acoustic treatment requirements for dwellings on the three affected lots within Stage 2d will be overridden by the required acoustic treatments for railway noise under QDC MP4.4.

2.5.3 Industry Noise Mitigation Measures

Based upon the industry noise assessment conducted:

1. The outdoor Acoustic Quality Objectives of the Queensland *Environmental Protection (Noise) Policy 2008* will be achieved considering industry noise at Stages 1 to 3 residential allotments.
2. The indoor the Acoustic Quality Objectives of the Queensland *Environmental Protection (Noise) Policy 2008* will be achieved for industry noise for three industry noise affected allotments within Stage 2d due to the overriding railway noise treatment requirements (refer **Figure 8**).