WATER & WASTEWATER NETWORK INVESTIGATION

Appendix E RRC Boundary Conditions

STOCKLAND DEVELOPMENT PTY LTD

David Hohn

From: Mal McCann <Mal.McCann@calibregroup.com>
Sent: Thursday, December 7, 2017 3:13 PM
To: Peter Wheelhouse
Subject: RE: Stockland Supply Boundary Conditions

Thanks Peter, much appreciated.

Mal

Mal McCann
Water & Environment Leader
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E Mal.McCann@calibregroup.com

Ground Floor, 545 Queen Street, Brisbane, Qld, 4000

From: Peter Wheelhouse [mailto:Peter.Wheelhouse@rrc.qld.gov.au]
Sent: Thursday, 7 December 2017 3:04 PM
To: Mal McCann <Mal.McCann@calibregroup.com>
Subject: Stockland Supply Boundary Conditions

Hi Mal

As per your request this morning for water supply boundary conditions to prepare network analysis to service the Stockland Parkhurst site.

From previous investigations it is understood a 450mm diameter main is to run through the Stockland site commencing with a connection to the Yaamba Road 600mm diameter main and connecting to the Mclaughlin Street 300mm main.

The pressure in the 600mm diameter Yaamba Road main is approximated to be in the order of 800kPa to 1,000kPa

Reticulation connections off the 450mm main would each require pressure reduction valves.

Please advise if you require any further detail in regards to these boundary conditions.

Regards

Peter Wheelhouse
Network Systems Engineer | Strategic Infrastructure Planning
Rockhampton Regional Council

Ph: 07 4936 8403 │ E-mail: peter.wheelhouse@rrc.qld.gov.au
Address: PO Box 1860, Rockhampton Q 4700 Web: http://rockhamptonregion.qld.gov.au
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Merry Christmas from Rockhampton Regional Council!

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David Hohn

From: Peter Wheelhouse <Peter.Wheelhouse@rrc.qld.gov.au>
Sent: Tuesday, January 30, 2018 7:53 AM
To: David Hohn
Subject: RE: Ellida, Parkhurst project
Attachments: RE: Stockland Supply Boundary Conditions

Hi David

Please refer to most recent advice provided to Mal McCann regarding water supply boundary conditions to the subject site.

Regards

Peter Wheelhouse
Network Systems Engineer | Strategic Infrastructure Planning
Rockhampton Regional Council
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From: David Hohn [mailto:David.Hohn@calibregroup.com]
Sent: Monday, 29 January 2018 9:29 AM
To: Peter Wheelhouse
Subject: RE: Ellida, Parkhurst project

Hi Peter,

Thanks for that.

Are you able to additionally provide the most recent water boundary conditions for the lot including any estimate pressures you may have for the proposed WAT-45 trunk main (2021).

Feel free to give me a call to discuss.

Regards,

David Hohn
Graduate Engineer
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E David.Hohn@calibregroup.com

calibregroup.com
Ground Floor, 545 Queen Street, Brisbane, Qld, 4000

From: Peter Wheelhouse [mailto:Peter.Wheelhouse@rrc.qld.gov.au]
Sent: Thursday, January 25, 2018 7:41 AM
To: David Hohn <David.Hohn@calibregroup.com>
Subject: RE: Ellida, Parkhurst project

Hi David,

I can advise you that recent network analysis on the existing 300mm sewer main on Yaamba road has confirmed the spare to capacity to be at least 900ET.

Regards

Peter Wheelhouse
Network Systems Engineer | Strategic Infrastructure Planning
Rockhampton Regional Council
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From: David Hohn [mailto:David.Hohn@calibregroup.com]
Sent: Wednesday, 24 January 2018 11:53 AM
To: Peter Wheelhouse
Subject: Ellida, Parkhurst project

Hi Peter,

I'm currently working on the Ellida, Parkhurst project.

I'm trying source a value for the spare capacity of the existing 300mm Sewer main on Yaamba Rd. Looking back over some old emails between yourself and Toby in 2012 the spare capacity was 500 ET. Are you aware of whether this is still an accurate value?

I have attached a copy of prior liaison email, for your memory.

Cheers,

David Hohn
Graduate Engineer
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Ground Floor, 545 Queen Street, Brisbane, Qld, 4000

APPENDIX I
STORMWATER MANAGEMENT PLAN

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

ELLIDA

STORMWATER QUALITY MANAGEMENT PLAN

STAGES 1-3

DesignFlow

Prepared for Stockland Development Pty Ltd

October 2013

Document Control Sheet

Report title:	Elfin Stages 1 to 4 Stormwater Quality Management Plan
Suggested Reference:	*Elfin Stages 1 to 3 - Stormwater Quality Management Plan Masterplan* (DesignFlow, 2012)
Version:	Final 04
Client:	Stockland Development Pty Ltd
Author(s):	Shaun Leinster
Reviewed By:	Nic Smith
Approved By:	Shaun Leinster
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Unless expressly stated otherwise, historical climate data has been used in, or underpins, the analyses that are presented in this report. The historical climate is not necessarily a valid indicator of future climate, which may contain prolonged periods that are wetter or drier than the historical record used for this analysis. There is significant uncertainty surrounding how climate, and in particular, rainfall, will be impacted by various levels of greenhouse gas accumulation in the atmosphere. Rainfall has a much greater spatial variability than temperature and some areas are likely to become wetter whilst other areas become drier. Further to this there may be changes in the seasonality and intensity of rainfall. Such changes in climate could affect the conclusions and recommendations of this report.

Inherent natural variability in soils and plants
Where particular types of soils are recommended, such recommendations are based on information provided by soils suppliers, laboratories and published industry guidelines. There can be inconsistencies in the behaviour of soils under field conditions compared to laboratory conditions, and, for both natural and blended soils, many soils are non-homogeneous and properties and behaviour can be variable. Where particular plant species have been recommended, such recommendations are based on botanical knowledge and observations of similar species growing in similar, but not identical conditions. Plants can be sensitive to subtle changes in climate, hydrology, soil and surrounding ecological conditions. Further to this, plant health is often closely linked to the level of maintenance provided. No warranty or guarantee, whether explicit or implied is made with respect to the suitability or performance of soils or plant species recommended in this report.

Table of Contents

1 INTRODUCTION 1
1.1 MASTERPLAN STORMWATER STRATEGY 1
1.2 THIS STORMWATER STRATEGY 3
2 PROPOSED STAGES 1 – 3 DEVELOPMENT 4
3 DESIGN OBJECTIVES 6
3.1 CONSTRUCTION PHASE WATER QUALITY 6
3.2 OPERATIONAL PHASE WATER QUALITY 7
3.3 WATERWAY STABILITY 8
3.4 FLOOD MANAGEMENT 8
4 STORMWATER MANAGEMENT STRATEGY 9
4.2 RAILWAY CORRIDOR DRAINAGE 11
4.3 CONSTRUCTED WETLAND J1 12
4.4 BIORETENTION SYSTEM J2 14
4.5 INTERIM SEDIMENT BASIN A1 15
4.6 WATERWAY STABILITY STORAGE 15
5 STORMWATER TREATMENT PERFORMANCE ASSESSMENT 16
5.1 MODEL STRUCTURE 16
5.1.1 CATCHMENT DATA 16
5.1.3 CONSTRUCTED WETLANDS 19
5.1.4 BIORETENTION SYSTEMS 20
5.2 RESULTS 21
6 CONCLUSION 22
7 REFERENCES 23
APPENDIX A: CONCEPTUAL EARTHWORKS OF WETLAND AND BIORETENTION 24

List of Tables

Table 1: Construction phase stormwater discharge criteria 6
Table 2: Stormwater quality design objective. 7
Table 3: Waterway stability design objective 8
Table 4: Stormwater management strategy elements 9
Table 5: Swale and Constructed Wetland design parameters 12
Table 6: Bioretention design parameters 15
Table 7: MUSIC model data summary 16
Table 8: MUSIC catchment data 17
Table 9: Constructed wetland node reporting table 19
Table 10: Bioretention Basin node reporting table. 20
Table 11: MUSIC model results – stormwater quality 21

List of Figures

Figure 1: Ellida Masterplan SQMP 2
Figure 2: Development layout Stages 1 to 3 5
Figure 3: Ellida Stages 1 to 3 Stormwater Strategy 10
Figure 4: Swale and wetland integration with parkland – concept design only 13
Figure 5: Swale and wetland integration with parkland (concept design only) 14
Figure 6: MUSIC catchment delineation and model layout 18

1 INTRODUCTION

The Ellida development is a proposed new residential subdivision in the northern suburbs of Rockhampton. The development will comprise different styles of residential housing including low and medium density dwellings with small neighbourhood centre and retirement living across the 280 ha site.

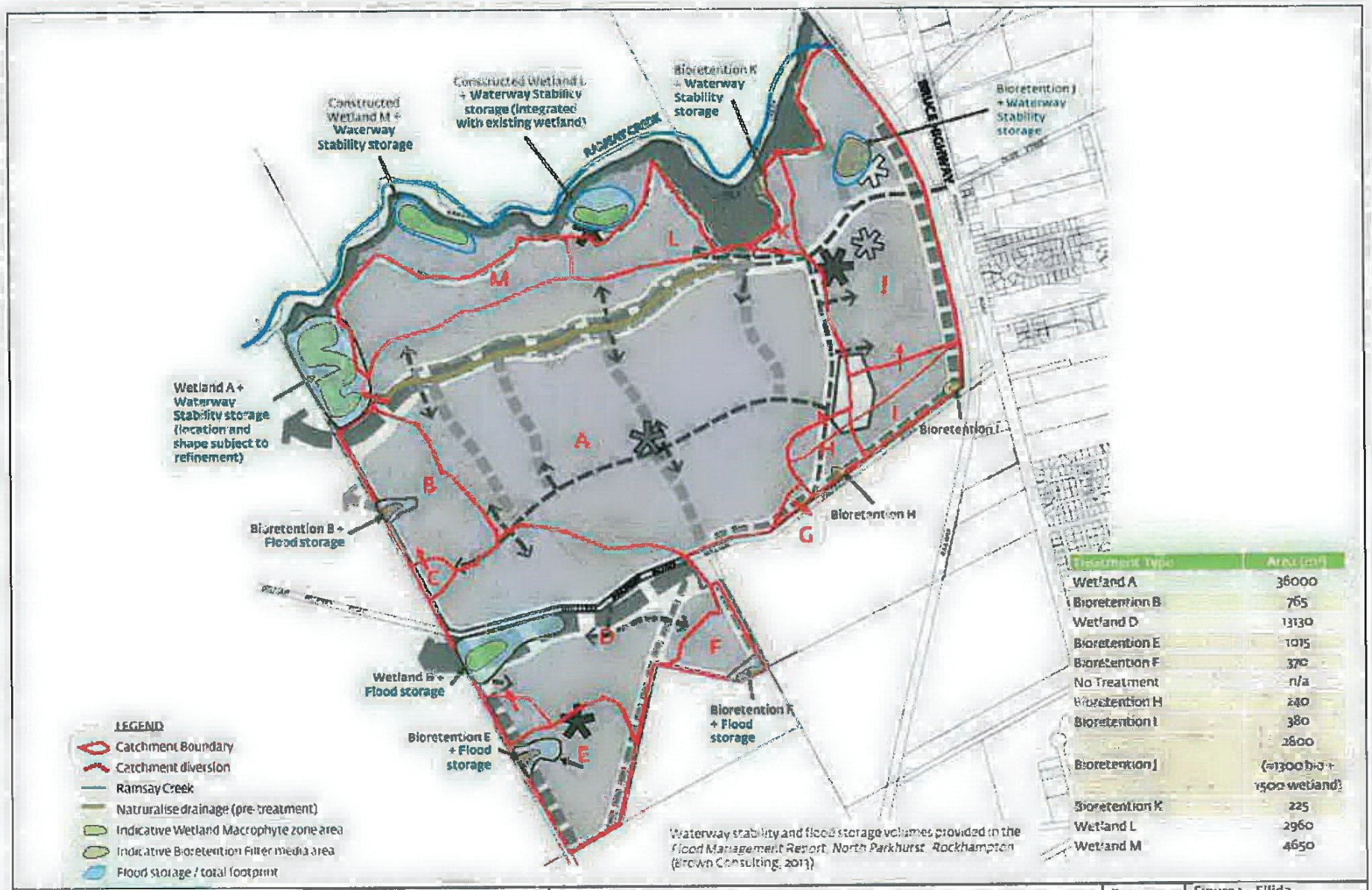
As part of Stockland Development Pty Ltd's commitment to environmental sustainability, the Ellida residential development is to be guided by the principles of Water Sensitive Urban Design (WSUD). It is envisaged that WSUD will be used extensively to create a development zone that promotes sustainable and integrated management of land and water resources, and incorporates best practice stormwater management.

To meet these principles Stockland Development Pty Ltd commissioned DesignFlow to develop a stormwater strategy for Stages 1 to 3 of the Ellida development. The objective of the strategy is to minimise the impact on the adjacent aquatic ecosystems and achieve Stockland Development Pty Ltds obligations under the *State Planning Policy 4/10 for Healthy Waters* (DERM (NOW DEHP), 2010).

This report presents the Stormwater Quality Management Strategy for Ellida Stages 1 to 3.

1.1 MASTERPLAN STORMWATER STRATEGY

Stages 1 to 3 forms part of a much large parcel of land to be developed by Stockland Development Pty Ltd at Parkhurst. As part of the land use planning for Ellida, a Masterplan Stormwater Quality Management Strategy was established and documented in *Ellida - Stormwater Quality Management Plan Masterplan* (DesignFlow, 2013). This strategy is presented in Figure 1 below along with the location of Stages 1 to 3 in the context of the site. Stages 1 to 3 are located within Catchments J1, which drains to the proposed constructed wetland system and Catchment J2 which drains to the bioretention systems.



Treatment Type	Area (m²)
Wetland A	36000
Bioretention B	765
Wetland D	13130
Bioretention E	1015
Bioretention F	370
No Treatment	n/a
Bioretention H	240
Bioretention I	380
Bioretention J	2800 (=1300 b-o + 1500 wetland)
Bioretention K	225
Wetland L	2960
Wetland M	4650

Stockland

Associated consultants: DesignFlow

Project: Ellida, Rockhampton

Date: 2013-10-25
Scale: NTS

Figure 1 – Ellida Stormwater Masterplan

1.2 THIS STORMWATER STRATEGY

This Stormwater Quality Management Plan focuses on stormwater quality treatment for Stages 1 to 3. It provides details of how stormwater quality management will occur including conceptual earthworks designs to illustrate there is space in the development layout for the treatment systems.

The catchments associated with Stages 1-3 remain consistent with those defined in *Ellida - Stormwater Quality Management Plan Masterplan* (DesignFlow, 2013). The stormwater management for Stages 1 to 3 will involve the following:

- Catchment J – 23.55ha of catchment J (35.7ha) will be developed as part of Stages 1 to 3. Management of this area will occur through naturalised drains/swales, a 1500m^2 wetland and two 650m^2 bioretention systems. These have been integrated into the development and landscape design to ensure a high aesthetic and low maintenance.

Flood and waterway stability management are described in the *Flood Management Report, North Parkhurst, Rockhampton* (Brown, 20113). Suitable volume is provided in Catchment J for waterways stability management.

2 PROPOSED STAGES 1 – 3 DEVELOPMENT

The site is proposed to be developed into a residential allotments varying in size from 340om² to 1010m². The development plan for Stages 1 to 3 is provided in Figure 2. A large parkland is to be created at the entry to the site along with a small neighbourhood centre.

The topography, details of Ramsay Creek and site vegetation are described in *Ellida - Stormwater Quality Management Plan Masterplan* (DesignFlow, 2013) and not repeated here.

Figure 2: Development layout Stages 1 to 3

3 DESIGN OBJECTIVES

3.1 CONSTRUCTION PHASE WATER QUALITY

The primary focus of stormwater management during the construction phase is erosion and sediment control. The stormwater management objectives for the construction phase take the form of best-practice concentration-based discharge standards. The performance criteria are limited to those parameters that are directly linked to construction site activities. As the criteria are discharge standards, they apply to runoff events or pumped discharges (during dewatering of siltation basins) from the development site. The criteria for stormwater discharged from the site during the construction phase are listed in Table 1 and represent our understanding of the construction phase objectives for medium-large scale construction sites in Queensland the requirements are specified in the *State Planning Policy 4/10 for Healthy Waters* and associated guideline.

This document does not propose erosion and sediment control measures for meeting these objectives. These will be developed as part of the operational works design.

Table 1: Construction phase stormwater discharge criteria

POLLUTANT/ISSUE	STORMWATER DESIGN OBJECTIVES[1]
Coarse sediment	Retain coarse sediment on site
Fine sediment (Total Suspended Solids - TSS)	Reasonable and practical measures should be taken to capture runoff from disturbed areas. Concentrations of TSS in water discharged (either by runoff or dewatering of siltation basins) should be less than 50mg/l.
Turbidity[2]	Turbidity in discharge waters should be <10% higher than receiving water turbidity (measured directly upstream of discharge point).
Nutrients (eg. N and P)	Construction phase nutrient management should occur via appropriate sediment management.
pH	Subject to the mobility of specific elements that may be present on site, pH of waters discharged from site must be between 6.5 and 8.5.
Dissolved oxygen	Dissolved oxygen concentration > 80% saturation.
Litter and gross pollutants	Prevent discharge of litter from site entering stormwater system/internal watercourses by ▪ Minimising litter production ▪ Containing litter on site by the provision and maintenance of rubbish bins with appropriate lids
Hydrocarbons and other contaminants[3]	Discharge of hydrocarbons and other contaminants should be prevented from site by: ▪ At-source control of contaminants. ▪ Preventing entry of contaminants into stormwater system or internal watercourses. ▪ Disposing of waste must to authorised

POLLUTANT/ISSUE	STORMWATER DESIGN OBJECTIVES[1]
	facilities. ▪ Storing hydrocarbons according to Australian Standard AS1940. ▪ Ensuring that discharged waters have no visible oil or grease sheen
Wash down areas	Prevent entry of wash down water into stormwater system or internal watercourses that discharge from site.
Cations and anions	As required under an approved Acid Sulfate Soil Management Plan, including aluminium, iron and sulphate.
Stormwater Quantity	Take all reasonable and practical measures to minimise changes to the hydrology of the receiving environment. Protection of in stream habitat and flood characteristics by: ▪ managing peak flows for the 1-year and 100-year ARI event ▪ managing run-off volumes entering receiving waters ▪ preventing uncontrolled release of contaminated stormwater.

[1] Compliance release limits for rainfall events less than the design storm event – (based on the 80%ile 5day rainfall depth).
Site-specific calibration of turbidity must be performed.
Refer to the contaminant list in the *Environmental Protection Regulation 1999*

3.2 OPERATIONAL PHASE WATER QUALITY

The stormwater quality management objectives that apply to the operational phase of Ellida have been established considering the *State Planning Policy 4/10 for Healthy Waters* which applies the load-based objectives specified in the *Urban Stormwater Quality Planning Guidelines* 2010.

The stormwater quality objectives contained in the above policy are the load-based objectives for the Central Coast (South) Region and are presented in Table 2.

Table 2: Stormwater quality design objective

Pollutant	Discharge Criteria (% reduction in mean annual loads)
Total suspended solids (TSS)	85%
Total phosphorus (TP)	70%
Total nitrogen (TN)	45%
Gross Pollutants (GP)	90%

3.3 WATERWAY STABILITY

The management of erosion in Ramsay Creek is a critical objective for the development of Ellida. To minimise the risk of waterway instability within the Ellida site and the downstream waterways, a waterway stability objective has been defined based on the *State Planning Policy 4/10 for Healthy Waters* (DERM (now DEHP), 2010) which applies the objectives specified in the *Urban Stormwater Quality Planning Guidelines* 2010 (DERM (now DEHP), 2010).

The waterway stability objective contained in the above policy, and which have been applied to the site, are presented in Table 2.

Table 3: Waterway stability design objective

Criterion	Design Objective
To reduce the impacts of urban development on channel-bed and bank erosion by limiting changes in flow rate and flow duration within the receiving waters.	Limit the post-development peak one-year average recurrence interval (ARI) event discharge within the receiving waters to the pre-development peak.

The strategy for achieving the waterway stability objective is provided in the *Flood Investigation Report for William Palfrey Road, North Parkhurst, Rockhampton* (Brown Consulting, 2013). Given the timing of the hydraulics from the site in relation to upstream catchment flows in Ramsay Creek, this objective is difficult to strictly comply with. Therefore, the objective of the design was to limit changes in 1 year flow and velocity within Ramsay Creek to minimise risk of erosion.

3.4 FLOOD MANAGEMENT

The introduction of impervious surfaces with the Ellida development site will result in increased in flood flows leaving the site.

The flood management objectives and strategy is provided in the *Flood Investigation Report for William Palfrey Road, North Parkhurst, Rockhampton* (Brown Consulting, 2013).

4 STORMWATER MANAGEMENT STRATEGY

In developing the urban design for Ellida Stages 1 to 3, the location and footprint requirements for stormwater management elements have been considered in the design. Importantly, stormwater management was a key element in the design process and collaboration with Stockland Development Pty Ltd and the design team has ensured the proposed development is suitably informed by stormwater.

Table 4 and Figure 3 present the conceptual stormwater strategy for the site with the functional description and details of each element provided in the following sections (i.e. location, scale and size).

Table 4: Stormwater management strategy elements

Catchment		Treatment	
ID	Area	Type	Area*
J1	13.3	Swale + Wetland (overflow from this enter J2 bioretention)	1500 m²
J2	10.25	Bioretention	1300 m²
Total	29.0		

* Relates to area of wetland macrophyte zone or bioretention filter media. Refer to earthworks concepts in Appendix A for full footprint including inlet ponds, batters and maintenance access.

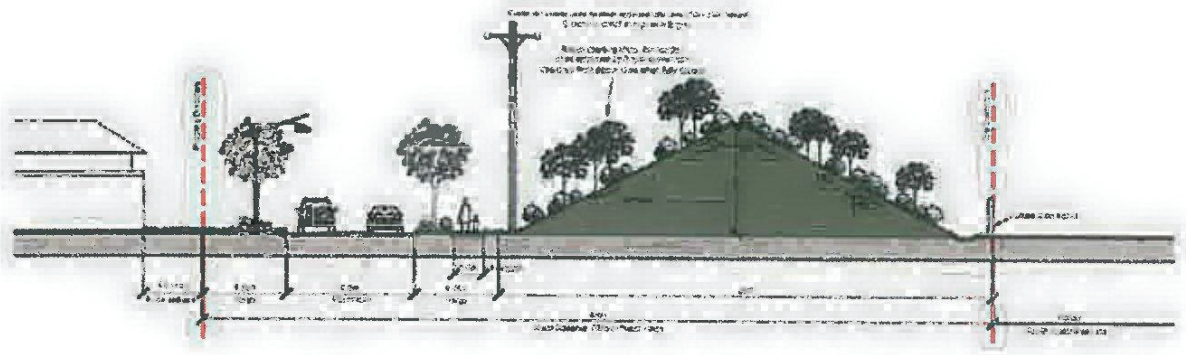
** The treatment area of the wetland and bioretention systems is conceptual only. The size, location and shape will be refined through the Operational Works process.

Stockland	Associated consultants: DesignFlow	Project: Ellida, Rockhampton	Date: 2013-10-25 Scale: NTS	Figure 3– Ellida Stages 1 to 3 Stormwater Management

4.2 RAILWAY CORRIDOR DRAINAGE

A small catchment (~9.7ha) drains into the site from the under from the highway and railway corridor as marked in Figure 3. This stormwater will be accepted and drain through the Stages 1 to 3 development via an open drain within the electrical easement and then into piped drainage within the road reserve. The drainage and earthworks will be designs to ensure no drainage impacts within the railway corridor.

Please see below a typical section through the easement which highlights the location of the open drain in relation to the electrical easement and proposal sound barrier.



RPS

LINEAR OPEN SPACE CROSS-SECTION
ELLIDA

4.3 CONSTRUCTED WETLAND J1

A 100m swale and 1500m² constructed wetland will provide stormwater treatment for Catchment J1. Key design parameters for the swale and wetland are provided in Table 5. MUSIC modelling of this system indicated it does not quit achieve the water quality objectives defined in Section 3. Rather than increase the size of the wetland and remove trees in the parkland, untreated overflows from the wetland inlet pond will discharge downstream to be treated in the J2 bioretention systems. This will ensure the water quality objectives for Catchment J1 and J2 are achieved.

Table 5: Swale and Constructed Wetland design parameters

Parameter	Swale
Contributing catchments	J1
Catchment Area (ha)	13.3
Length	100m
Depth	0.5m
Side slopes	1 in 4
Vegetation	Grasses, sedges, shrubs
Slope	1.5%
Parameter	**Constructed Wetland**
Contributing catchments	J1
Catchment Area (ha)	13.3
Inlet pond volume (m3)	200
Macrophyte zone area (m²)	1500*
Proportion Contributing catchment area (%)	1.13%
Extended detention depth (m)	0.5
Average depth (m)	0.3
Notional Detention Time (h)	48

* The wetland cannot be any larger due to tree constraints. Therefore, overflows from the wetland enter bioretention basin J2 for additional treatment.

** The treatment area of the wetland and bioretention systems is conceptual only. The size, location and shape will be refined through the Operational Works process.

The area provided in Table 5 is the macrophyte zone only. The total footprint of the constructed wetland needs to consider the macrophyte zone (defined by the normal water level in the wetland), batters, high flow bypass, inlet pond, maintenance access and discharge structures. Typically this means that the total footprint of a properly designed constructed wetland systems is 2 times larger than the macrophyte zone area (and can be more for systems that are on sloping topography).

A conceptual earthworks design have been completed for the wetland to illustrate there is space for all element of the system (macrophyte zone, inlet pond, batters,

maintenance access etc.). The design is provided in Appendix A. Figure 4 below illustrates how the wetland (and bioretention) systems operate.

The wetland has been broadly located to minimise the removal of existing vegetation and integration with parkland as illustrated in Figure 5. The Healthy Waterways Technical Design Guidelines and IPWEAQ standard drawings for constructed wetlands will be adopted for the site.

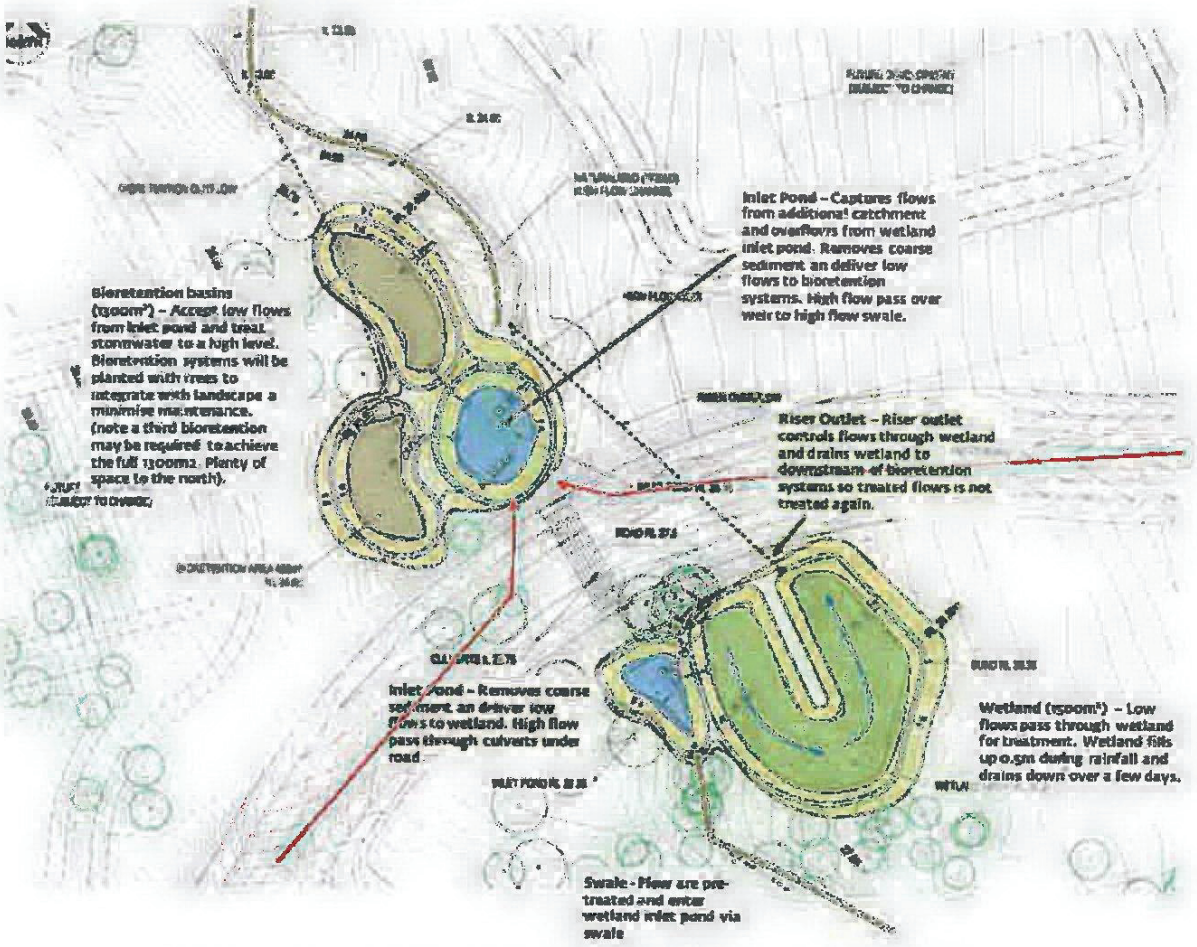


Figure 4: Swale and wetland integration with parkland – concept design only

Figure 5: Swale and wetland integration with parkland (concept design only)

4.4 BIORETENTION SYSTEM J2

Two small bioretention basins will accept and manage flows from catchment J2 and overflows from J1. Given the size of the bioretention area (1300m^2) and the need to manage high flows, an inlet pond and high flow channel has been incorporated into the design. Figure 4 illustrates the location, shape and operation of the bioretention systems, inlet pond and high flow channel.

The conceptual bioretention design has been based on the *Concept Design Guidelines for Water Sensitive Urban Design* (Water by Design, 2010) and the *WSUD Technical Design Guidelines for SEQ* (Water by Design, 2006). Key design parameters for each of the basins are provided in Table 6. MUSIC modelling of these basins confirms the performance to meet the water quality objectives for the site as described in Section 3.

Table 6: Bioretention design parameters

Parameter	Bioretention Basin*
Contributing catchments	J2
Catchment Area (ha)	10.25 + overflow from J1
Extended detention depth (m)	0.3
Filter area (m^2)	1300
Proportion Contributing catchment area (%)	1.17%
Filter media specification	In accordance with FAWB (2009)
Filter depth (m)	0.7

* This bioretention also accepts overflows from Wetland J1

** The treatment area of the wetland and bioretention systems is conceptual only. The size, location and shape will be refined through the Operational Works process.

The bioretention basins will be planted with trees and so the filter media depth of 0.7m has been adopted. The bioretention systems may ultimately be designed to include a saturated zone for supporting vegetation during the dry periods but this will be discussed with Council prior to confirming.

4.5 WATERWAY STABILITY STORAGE

Flood modelling was completed by Brown Consulting for the whole Ellida development to confirm the stormwater strategy meets the waterway stability objective (1yr ARI) and flood management objectives (preserving the 2 to 100yr ARI). Please refer to the *Flood Management Report, Ellida North Parkhurst, Rockhampton* (Brown Consulting, 2013) for details of the flood modelling and results. The following has been taken from that report and applied to Stages 1 to 3:

- For catchment J, flood detention is not required but storage of $3,100m^3$ is required for achieving the waterway stability storage. Initial earthworks assessment of the proposal stormwater management strategy for Stages 1 to 3 indicates there is more than $3100m^3$ available for this purpose (ample space available). Please refer to Appendix A. Specific details of the storage and outlet structures will be resolved as part of the Operational Works application

5 STORMWATER TREATMENT PERFORMANCE ASSESSMENT

MUSIC modelling was conducted to quantitatively assess the stormwater treatment performance of the proposed stormwater strategy. MUSIC version 5.0 was used for the assessment and the parameters have been established in accordance with the *MUSIC Modelling Guidelines for South East Queensland* (Water by Design, 2010).

Details of the modelling assumptions, parameters and results are presented in the following sections.

5.1 MODEL STRUCTURE

The structure of the MUSIC model is shown in Figure 6 with the general data upon which the model is based provided in Table 7.

Table 7: MUSIC model data summary

Input	Data used in modelling
Rainfall station	39083 Rockhampton Aero
Time step	6 minute
Modelling period	1980 to 1989
Mean annual rainfall	762 mm (long term mean: 805, long term median 726 mm/yr)
Evapotranspiration	Rockhampton PET (BOM), 1702 mm/yr
Rainfall runoff parameters	Urban Residential
Pollutant export parameters	Urban Residential

All information above has been sourced from Water by Design, 2009

5.1.1 Catchment data

The development has been split into 3 sub-catchments. The model adopts the split catchment approach which accounts for the variability of pollutant generation from different surfaces. Each of the sub-catchments has been assigned areas and imperviousness based on the development plan for the site.

Most of the site is urban residential. A neighbourhood centre (1.3ha) is included in catchment J2 along with a portion of the retained church land. The parkland, future urban and power easement has been included in catchment J1. The external catchment east of J1 has not been included in the modelling.

Summary catchment data is provided in Table 8. The MUSIC model layout and catchment delineation is shown in Figure 6.

Table 8: MUSIC catchment data

Catchment			Area (ha)						
ID	Area	Lots	Roof	Road Reserve	Ground level	Parkland / Easement	Neighbourhood Centre (commercial)	Church	Impervious
J1	13.3	~110*	2.5	3.325	2.945	4.53	-	-	42%
J2	10.25	47*	1.176	4.484	2.011	-	1.3	1.28	56%
Total			3.676	7.809	4.956	4.53	1.3	1.28	48%

* Includes the future lots/dwellings

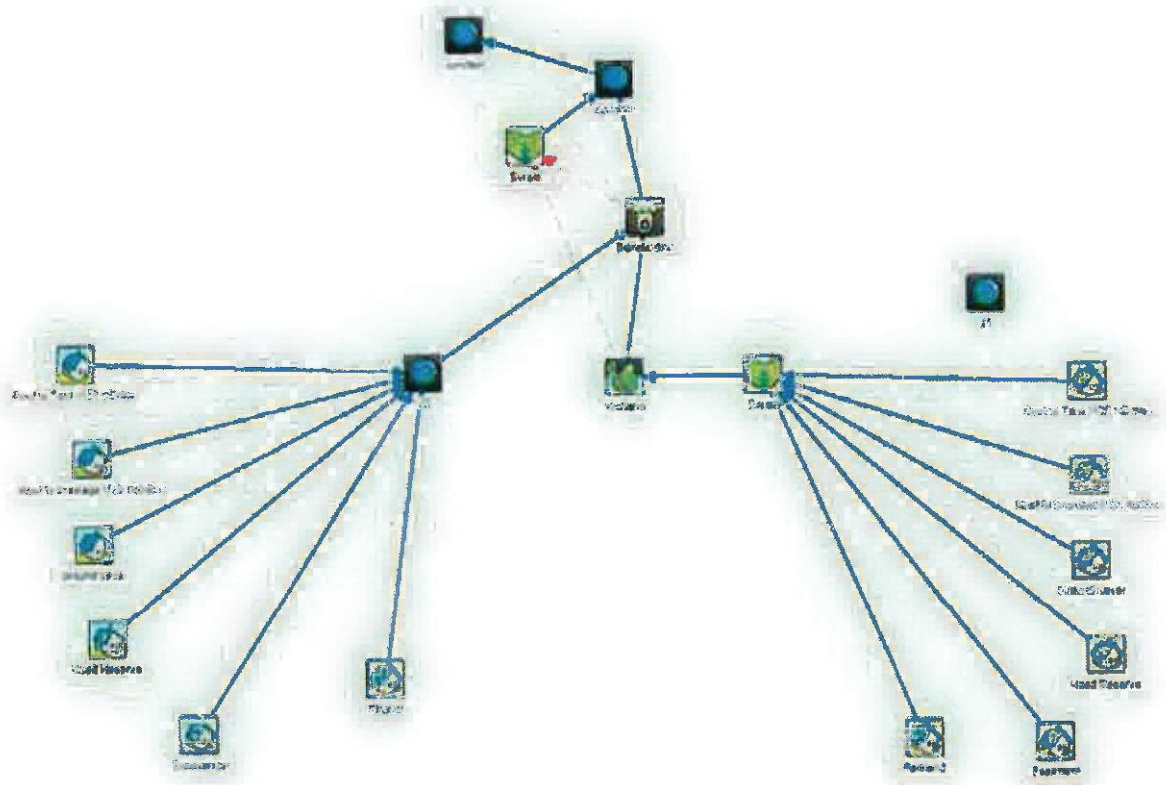


Figure 6: MUSIC catchment delineation and model layout

5.1.3 Constructed wetlands

Stormwater quality from four catchments at Ellida will be managed using constructed wetlands. The wetlands were modelled in accordance with the *MUSIC Modelling Guidelines for South East Queensland* (Water by Design, 2010), with the parameters adopted for the Ellida site shown in Table 9 below.

Table 9: Constructed wetland node reporting table

Parameter	Constructed Wetland
Contributing catchments	J1
Catchment Area (ha)	13.3
Inlet pond volume (m^3)	200
Macrophyte zone area (m^2)	1500
Has the surface area been calculated appropriately?	Yes, surface area = macrophyte zone at normal water level
Proportion Contributing catchment area (%)	1.1%
Extended detention depth (m)	0.5
Permanent pool volume (m^3)	450
Average depth (m)	0.3
Exfiltration rate (mm/hr)	0
Evaporative loss (% of PET)	125
Notional Detention Time (h)	48
Number of CSTR cells	4
Confirmation that K and C* remain default?	Y

5.1.4 Bioretention Systems

The bioretention basins were modelled in accordance with the *MUSIC Modelling Guidelines for South East Queensland* (Water by Design, 2010). The parameters that have been adopted for the Ellida site are shown in Table 10.

Table 10: Bioretention Basin node reporting table

Parameter	Bioretention Basin
Contributing catchments	J2 (plus overflows from J1)
Catchment Area (ha)	10.25 (plus overflows from J1)
Surface Area (m^2)	1300
Has the surface area been calculated appropriately?	Yes, equal surface area method
Extended detention depth (m)	0.3
Filter area (m^2)	1300
Proportion Contributing catchment area (%)	1.26%
Hydraulic conductivity (mm/hr)	200
Filter depth (m)	0.7
Filter median particle diameter (mm)	0.45
Overflow weir width (m)	50
Seepage loss (mm/hr)	0
Confirmation that K and C* remain default?	Y

5.2 RESULTS

The results of the MUSIC modelling for the proposed development are shown in Table 11. The results demonstrate that the proposed stormwater strategy meets the stormwater quality design objectives for site.

Table 11: MUSIC model results – stormwater quality

Catchment		Treatment		Annual Pollutant Load removal (%)		
ID	Area (ha)	Type	Area (m^2)	TSS	TP	TN
J1	13.3	Swale + Wetland	1500m^2 80m swale	72.4	58.3	25.4
J2 (plus overflows from J1)	10.25	Bioretention Basin	1300m^2	89.3	72.7	46.7
Total	29.0	-		89.7	71.1	45.0
Objective				85	70	45

6 CONCLUSION

Stockland Development Pty Ltd is proposing to develop Stages 1 to 3 of the Ellida site into residential allotments and a neighbourhood centre. The site lies adjacent to Ramsay Creek and has some waterway, ecological and vegetation values that will need to be protected. In addition, the state government policy requires dictate regional stormwater load reduction (stormwater quality) objectives, and hydrologic objectives for sites throughout Queensland under the *State Planning Policy 4/10 for Healthy Waters* (DERM (now DEHP), 2010) and the *Urban Stormwater Quality Planning Guidelines* (DERM (now DEHP) 2010).

As part of the design for Stages 1 to 3, DesignFlow were commissioned to develop a stormwater management strategy for the site. DesignFlow have collaborated closely with the client (Stockland Development Pty Ltd) and the team of urban designers (RPS), hydraulic and civil engineers (Brown Consulting), and traffic engineers (Cambray) to develop a stormwater management strategy that demonstrates compliance with the required objectives, thereby affording appropriate protection to Ramsay Creek.

The strategy includes the use of swales, an interim sediment basin, a wetland and a bioretention basin. The key outcomes of the stormwater quality management strategy for the site are that stormwater quality objectives are achieved as required by the SPP for healthy waters (DERM (now DEHP) 2010).

Conceptual earthworks design of the stormwater management elements has occurred and is provided to support this report.

7 REFERENCES

Brown Consulting (2013). *Flood Management Report, North Parkhurst, Rockhampton*. A report for Stockland Development Pty Ltd Development Pty Ltd. Report Number B11007/W-01

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QDC (2008) *Queensland Development Code Mandatory Part MP 4.2 (Water Savings Targets)*. Department of Infrastructure and Planning. 22 Oct 2008

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RPS (2010) *Due Diligence – Ecological and Environmental Constraints William Palfrey Road, North Parkhurst* Final Report July 2010

Water by Design (2009), *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands*, SEQ Healthy Waterways Partnership. Brisbane, Queensland.

Water by Design (2006), *Water Sensitive Urban Design Technical Design Guidelines for South East Queensland Version 1*. Moreton Bay and Waterways Catchments Partnership. Brisbane, Queensland.

Water by Design (2009), *MUSIC Modelling Guidelines for South East Queensland*. SEQ Healthy Waterways Partnership. Brisbane, Queensland.

APPENDIX A: CONCEPTUAL EARTHWORKS OF WETLAND AND BIORETENTION

A	PRELIMINARY ISSUE	SL	14.01.19	SL	14.01.19
ISSUE	DESCRIPTION	DATE DRAWN	DATE	DATE APPROVED	DATE

ISSUED FOR
PRELIMINARY
NOT FOR CONSTRUCTION

DesignFlow
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CLIENT	STOCKLAND
DESIGNED	MJM 14.01.19
DRAWN	SL 14.01.19
CHECKED	
SCALE	1:1000 A3
PROJECT	PARKHURST
DRAWING TITLE	STAGE 1 - 4 STORMWATER MANAGEMENT CONCEPTS
JOB NO.	4155
DRAWING NO.	D9001
ISSUE	A

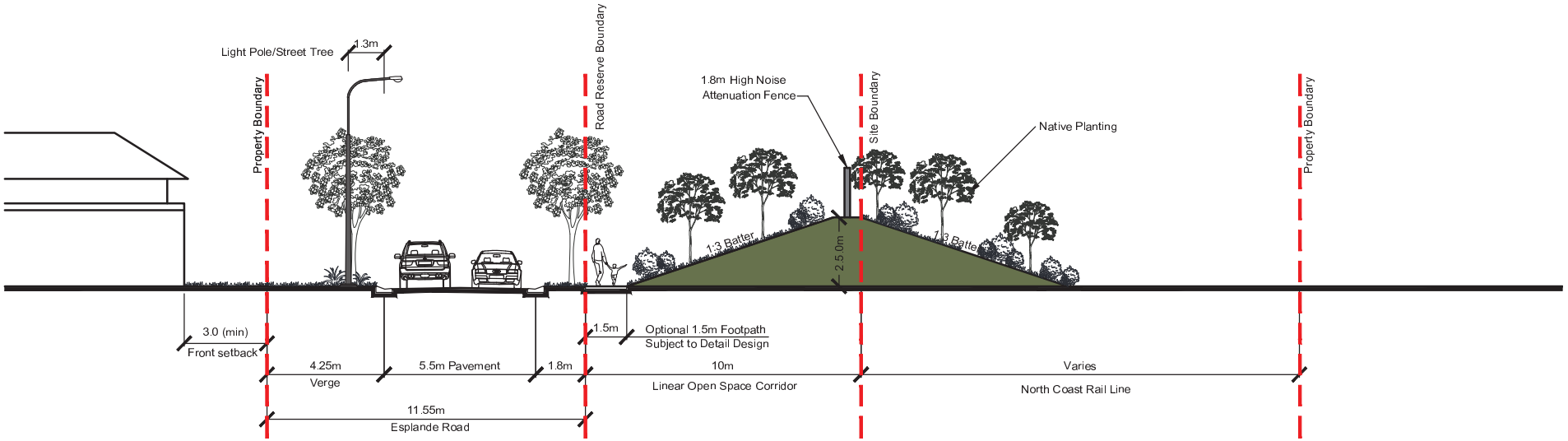
ROCKHAMPTON REGIONAL COUNCIL

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



RPS

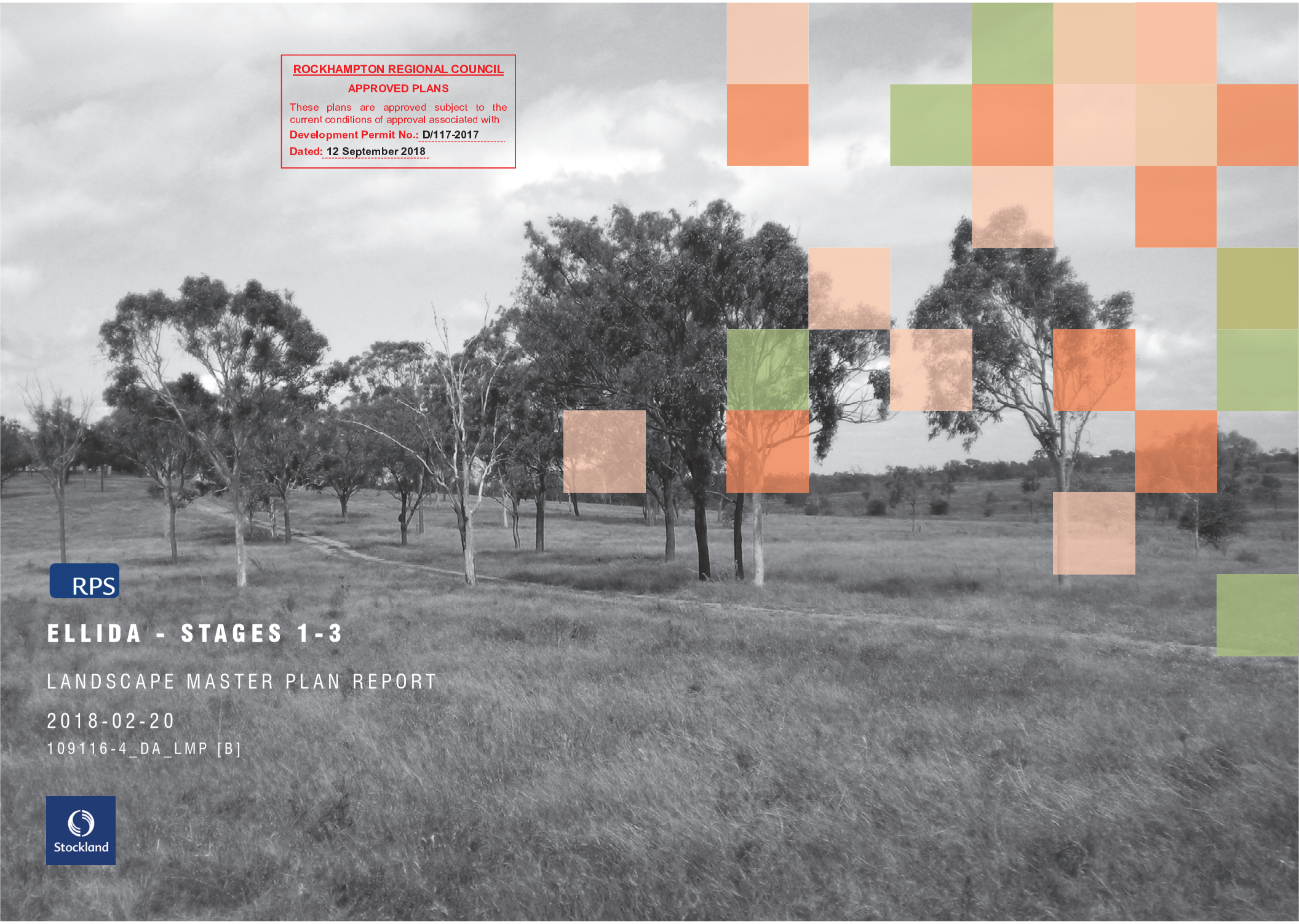
SCALE 1 : 150 @ A3

0 2 4 6 8 10 12 14 16

QR LINEAR OPEN SPACE CROSS-SECTION

ELLIDA

DATE : 05 JAN 2018 DWG NAME : 109116-114



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

RPS

ELLIDA - STAGES 1-3

LANDSCAPE MASTER PLAN REPORT

2018-02-20

109116-4_DA_LMP [B]

Stockland

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Revision	Date	Prepared by	Approved by
[B]	2018-02-20	TFC	TFC
[A]	2018-02-16	DKG	TFC

purpose of the landscape master plan

Landscape plays the crucial role of integrating people with the surrounding environment. The vision of Ellida is to offer the community a healthy and active outdoor lifestyle through the careful design open space and the public realm.

This document embraces the strategy articulated in the MCU through developing a landscape masterplan for Ellida Stages 1 - 3. This masterplan is based on a detailed understanding and consideration of the site and application of core principles that respond to landform, recreation, ecology and cultural values.

This masterplan document reflects the Parks and Public Open Space Strategy which outlines the proposed open space and streetscape framework for the development. Within Stages 1-3, the district park is a major component in the overall open space fabric and offers significant value to the community. The masterplan also identifies linear corridors, such as the roadways and cycleways, which address connectivity and and experiential values.

The masterplan document has been further guided by the following technical reports:

- Ecological Assessment, Vegetation Management Plan, Bushfire Management Plan and Rehabilitation Management Plan.
- Planning Scheme documents for Rockhampton Regional Council , including:
  - Schedule 6.12 - Landscaping Design and Street Tree Planning Scheme Policy
  - Schedule 6.4 - Bicycle Network Planning Scheme Policy

contents

landscape master plan

- ellida subject site
- stages 1-3 - master plan

landscape structure

- open space area analysis - whole of site
- open space area analysis - district park and community facilities
- district park and community facilities - compliance
- ramsay creek corridor concept
- landscape design issues
- open space and public realm
- connectivity
- street trees
- street tree palette
- feature palette

landscape precinct

- district recreation park
- district recreation sections
- open space corridor - noise attenuation mound