



SOUTH JERRABOMBERRA ESTATE 2 NORTHERN CATCHMENT CIVIL ENGINEERING

SUBDIVISION DEVELOPMENT APPLICATION
JULY 2025

PREPARED FOR VILLAGE BUILDING COMPANY

This report has been prepared by the office of Spiire
Suite 3, Level 1, 243 Northbourne Ave, Lyneham **Canberra** ACT 2602

Issue Date	Rev No	Authors	Checked	Approved
30-06-2025	0	RM		
01-07-2025	1	RM		
09-07-2025	2	RM	CJC	CJC
18-09-2025	3	RM	CJC	CJC

Spiire Job Number: 323444-001

Citation: Spiire 2025, SOUTH JERRABOMBERRA ESTATE 2 NORTHERN CATCHMENT CIVIL ENGINEERING Report for VBC
Authors: R. Murdock, Spiire Australia Pty Ltd. Project Number 323444-001

File Name: \spiire\candata\Data\31\310868\001\Civil\Reports\310868CG-Engineering - Estate 2 Northern Catchment DA Report.docx

© Spiire

The information contained in this document is intended solely for the use of the client named for the purpose for which it has been prepared and no representation is made or is to be implied as being made to any third party. Other than for the exclusive use of the named client, no part of this report may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior written permission of Spiire.

Cover photo: Courtesy of Spiire Pty Ltd

TABLE OF CONTENTS

1.	INTRODUCTION	5
1.1	OVERVIEW	5
1.2	INTENDED OUTCOMES	5
1.3	CIVIL ENGINEERING DA DRAWINGS	6
2.	THE SITE	7
2.1	LOCATION	7
2.2	TOPOGRAPHY	7
2.3	DRAINAGE	7
2.4	EXISTING SERVICES	8
2.5	CONSTRAINTS	8
3.	DEPARTURES FROM QPRC DESIGN SPECIFICATIONS	9
4.	ROAD INFRASTRUCTURE	10
4.1	TRAFFIC STUDY	10
4.2	EXISTING ROADS	10
4.3	PROPOSED ROAD NETWORK DESIGN PRINCIPLES	10
4.4	ROAD HIERARCHY	10
4.4.1	COLLECTOR STREET (BUS ROUTE)	10
4.4.2	LOCAL STREET	11
4.5	DESIGN SPEED	11
4.6	LONGITUDINAL GRADIENT	11
4.7	HORIZONTAL GEOMETRY	11
4.8	VERTICAL GEOMETRY	11
4.9	TURNING MOVEMENTS	11
4.10	LINEMARKING	12
4.11	SIGHT DISTANCES	12
4.12	PUBLIC TRANSPORT	12
4.13	PARKING	12
4.14	STREET LIGHTING	13
5.	CYCLING AND PEDESTRIAN ACCESS	14
6.	SEWER MASTER PLAN	15
6.1	EXISTING SEWER INFRASTRUCTURE	15

6.1.1	INFRASTRUCTURE REPORT	15
6.1.2	EXISTING SERVICES	15
6.2	PROPOSED SEWER INFRASTRUCTURE	15
<hr/>		
7.	WATER SUPPLY MASTER PLAN	18
7.1	EXISTING WATER INFRASTRUCTURE	18
7.1.1	INFRASTRUCTURE REPORT	18
7.1.2	EXISTING SERVICES	18
7.2	PROPOSED WATER SUPPLY INFRASTRUCTURE	18
<hr/>		
8.	STORMWATER MASTERPLAN	20
8.1	REQUIREMENTS AND OBJECTIVE	20
8.2	STORM WATER PEAK FLOW MANAGEMENT	20
8.2.1	REQUIREMENTS AND OBJECTIVE	20
8.2.2	PREDEVELOPED CATCHMENT	20
8.2.3	PREDEVELOPED CONDITIONS HYDROLOGY MODELLING	21
8.2.4	PROPOSED DEVELOPED CONDITIONS	23
8.2.5	OUTLET CONFIGURATION	25
8.2.6	BASIN SIZING	25
8.2.7	RECOMMENDATIONS	26
8.3	STORMWATER QUALITY	26
8.3.1	REQUIREMENTS AND OBJECTIVES FOR STORMWATER TREATMENT	26
8.3.2	PREDEVELOPED CONDITIONS	26
8.3.3	PROPOSED CONDITONS	26
8.3.4	ASSET SIZING	28
8.4	SUMMARY	29
8.5	ESTATE DRAINAGE	29
8.5.1	OPEN CHANNEL	29
8.5.2	ESTATE PIPE DRAINAGE	30
<hr/>		
9.	UTILITIES	32
9.1	NBN	32
9.2	ELECTRICITY	32
<hr/>		
10.	SITE RE-GRADING	33
10.1	EXISTING SLOPE	33
10.2	PROPOSED SLOPE	33

10.3	SITE GRADING.....	33
10.4	RETAINING WALLS.....	33
<hr/>		
11.	SEDIMENT AND EROSION CONTROL.....	34
11.1	CONCEPT EROSION AND SEDIMENT CONTROL PLAN	34
<hr/>		
	APPENDIX A – PREDEVELOPED STORMWATER CATCHMENT	37
	APPENDIX B – DEVELOPED STORMWATER CATCHMENT.....	38
	APPENDIX C – HECRAS MODELLING RESULTS	39

1. INTRODUCTION

1.1 OVERVIEW

This Development Application (**DA**) has been prepared on behalf of Village Building Company (VBC). Its function is to support the DA documents which are being submitted for Northern Catchment (Stages 2D to 2I) of South Jerrabomberra Estate 2, Queanbeyan.

The land proposed to be subdivided is legally described as Lot 189 DP1269436 Lot 126 DP1269436 and is located at the Southern end of Environa Drive, Queanbeyan, also known as South Jerrabomberra Estate 2 (**SJE2**). SJE2 is approximately 8 km south-west of the Queanbeyan City Centre.

A Concept DA has previously been submitted for the entire SJE2 development, with the intention to provide a high-level overview of the development. This DA provides further details of stages 2D to 2I outlined in the Concept DA.

The proposed DA deals with an area of land hereafter referred to as “the Site”. The Site is approximately 7.2Ha of land captured within the DA Boundary line on the Civil Engineering DA Drawings.

1.2 INTENDED OUTCOMES

The purpose behind this DA is to create:

- ▶ 191 Residential Lots
- ▶ 2 Open Space Lots

This report will outline how these outcomes are to be achieved from an engineering perspective, in accordance with the QPRC Design Specifications.

1.3 CIVIL ENGINEERING DA DRAWINGS

Table 1 CIVIL ENGINEERING DA DRAWING LIST

DRAWING SCHEDULE		
DRAWING NO	DESCRIPTION	REVISION
CD001	COVER SHEET & DRAWING SCHEDULE SHEET 1	-
CD005	GENERAL ARRANGEMENT PLAN SHEET 1	-
CD010	EXISTING SERVICES PLAN SHEET 1	-
CD015	STAGING PLAN SHEET 1	-
CD040	STREET HIERARCHY, PATH & DRIVEWAY PLAN SHEET 1	-
CD050	BUS ROUTE PLAN SHEET 1	-
CD060	TYPICAL CROSS SECTIONS SHEET 1	-
CD061	TYPICAL CROSS SECTIONS SHEET 2	-
CD062	TYPICAL CROSS SECTIONS SHEET 3	-
CD100	SIGHT DISTANCE SHEET 1	-
CD101	SIGHT DISTANCE SHEET 2	-
CD102	SIGHT DISTANCE SHEET 3	-
CD103	SIGHT DISTANCE SHEET 4	-
CD104	SIGHT DISTANCE SHEET 5	-
CD120	TURNING MOVEMENTS SHEET 1	-
CD121	TURNING MOVEMENTS SHEET 2	-
CD122	TURNING MOVEMENTS SHEET 3	-
CD123	TURNING MOVEMENTS SHEET 4	-
CD200	GRADING PLAN SHEET 1	-
CD240	EXISTING SLOPE ANALYSIS PLAN SHEET 1	-
CD250	PROPOSED SLOPE ANALYSIS PLAN SHEET 1	-
CD410	SEWER CATCHMENT PLAN SHEET 1	-
CD411	SEWER CATCHMENT PLAN SHEET 2	-
CD420	SEWER SERVICING STRATEGY PLAN SHEET 1	-
CD450	PORTABLE WATER MASTER PLAN SHEET 1	-
CD451	PORTABLE WATER MASTER PLAN SHEET 2	-
CD500	STORMWATER CATCHMENT PLAN SHEET 1	-
CD520	DRAINAGE SERVICING STRATEGY PLAN SHEET 1	-
CD521	DRAINAGE SERVICING STRATEGY PLAN SHEET 2	-
CD522	DRAINAGE SERVICING STRATEGY PLAN SHEET 3	-
CD600	WSUD ASSET KEYPLAN AND DETAILS SHEET 1	-
CD601	WSUD ASSET KEYPLAN AND DETAILS SHEET 2	-
CD602	WSUD ASSET KEYPLAN AND DETAILS SHEET 3	-
CD610	UTILITY MASTER PLAN SHEET 1	-
CD611	SHARED TRENCH TYPICAL DETAIL SHEET 1	-
CD620	RIPARIAN CORRIDOR OFFSET PLAN SHEET 1	-
CD700	SOIL, WATER & VEGETATION CONCEPT MANAGEMENT PLAN SHEET 1	-
CD701	SOIL, WATER & VEGETATION CONCEPT MANAGEMENT PLAN SHEET 2	-

2. THE SITE

2.1 LOCATION

The Site is geographically bound as follows:

- ▶ The North boundary is adjacent to South Jerrabomberra Estate 2 (SJE2) Stage 2C and Stage 2E.
- ▶ The West boundary is bound by undeveloped land of SJE2.
- ▶ The Northeast boundary adjoins SJE2 Stage 2B.
- ▶ The East boundary is adjacent to the proposed Biodiversity Stewardship Site

Refer Figure 1 for Site Location.

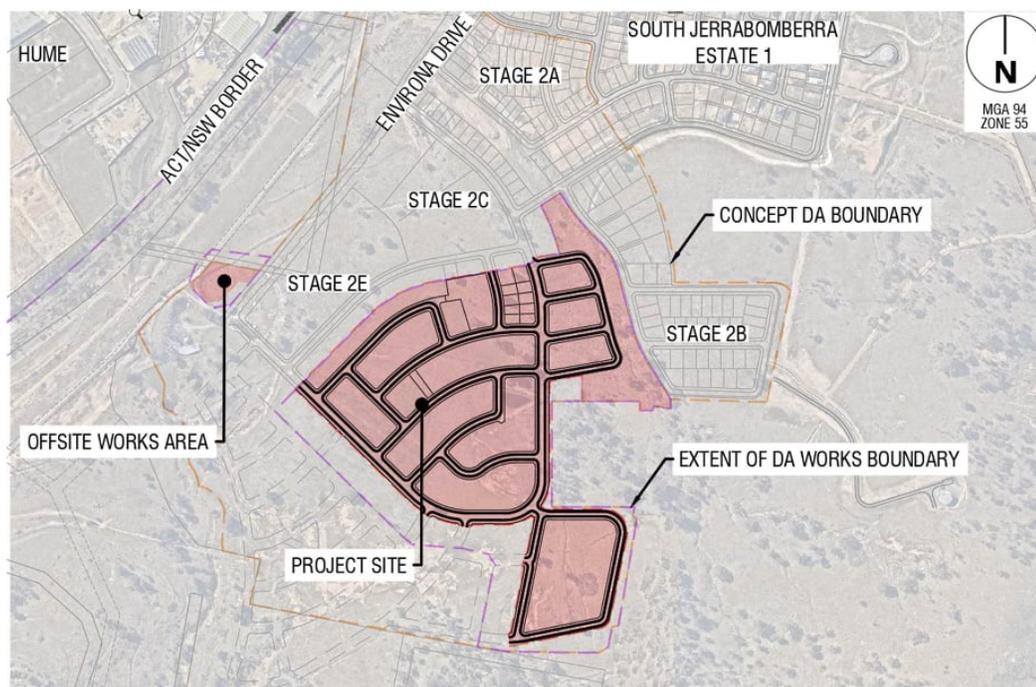


Figure 1 Site Location

2.2 TOPOGRAPHY

The Site is a particularly steep parcel of land that ranges from 5-25% grade (refer Drawing 323444-001CD240). The Site naturally falls to the North-East corner, where it joins Abelia Aveune (part of DA DA.2021.1284 (**Stage 2C**)).

2.3 DRAINAGE

The Site has a well-defined natural gully to its east which falls to the north towards Stage 2C. As such, in the existing scenario, upstream stormwater catchments are conveyed through the Site via the gully and discharged into Stage 2C.

Further information on the drainage for the Site can be found in Section 8 of this Report.

2.4 EXISTING SERVICES

The Site has no existing services within it but connects to the following existing services.

- ▶ Potable Water
- ▶ Gravity Sewer
- ▶ Road Drainage
- ▶ Electrical
- ▶ Telecommunications

2.5 CONSTRAINTS

The Site has several constraints that have been considered in the preparation of this DA. These constraints include, but are not limited to the following:

- ▶ Existing SJE2 (Stage 2B, 2C and 2E) levels and services
- ▶ Close proximity to neighbouring lands
- ▶ Environmentally sensitive lands to the South and East (refer Ecology Report)
- ▶ Steep grades
- ▶ Large upstream stormwater catchments
- ▶ Existing high value trees

3. DEPARTURES FROM QPRC DESIGN SPECIFICATIONS

The DA is generally in accordance with the QPRC design specifications, although the following table outlines proposed departures:

Table 2 Departures from QPRC Design Specifications

Design Specification	Rule/Criteria	Departure	Reason for Departure
Figure D1.3 – Access Street	<i>Minimum Verge Width (5.0m)</i>	Road 05 and Road 18 have a verge width of 2.5m when there is open space located outside the road reserve.	A 5m verge is not required as the only service in the verge is a water main (located 600mm behind the kerb). There are no footpaths, trees or streetlights proposed where the verge is 2.5m. A vehicle barrier is proposed on the road reserve boundary to prevent errant vehicles from accessing the open space areas.
D1.14 (Collector Street)	<i>Road Reserve Characteristics: Collector street</i>	Parking not provided everywhere	It is proposed that portions of Abelia Avenue will not have parking allowed to ensure sight distances at intersections are adequate. Signage is proposed to restrict parking at the locations specified (refer 323444-001CD100-CD104)
D5.16	<i>Rural (predeveloped) fraction impervious < 10% slope 40% > 10% slope 70%</i>	Predeveloped fraction impervious 10%	In line with other design standards and industry practice. Consistent with the approach used for DA1 of South Jerrabomberra Estate 2 DA 2021.1284
D5.18.1	<i>Stormwater Conduits: Materials and Pipe Class</i>	Change in pipe material	It is proposed that pipes smaller than Ø675 are to be StormPRO, BlackMAX or equivalent to ensure consistency with the products used in South Jerrabomberra Estate 1 for ease of maintenance.

4. ROAD INFRASTRUCTURE

4.1 TRAFFIC STUDY

A traffic study was prepared for SJE1 which considered and allowed for future development of SJE2 and its expected traffic generation.

The traffic generation was determined by the number of Residential Lots in the entire SJE and was ultimately capped at 1,500. The combined total dwellings across both SJE1, Stage 2A, Stage 2B, Stage 2C, Stage 2E and this DA is 1298, under the maximum catered for within Environa Drive as part of the Estates original approval.

Accordingly, traffic generated in this DA does not exceed that which has been permitted as part of the overall SJ development.

Further information regarding the previous traffic studies can be found within existing QPRC records.

4.2 EXISTING ROADS

The Site is adjacent to the following road infrastructure:

- ▶ Abelia Avenue (Stage 2E) to the North and South
- ▶ Road 03 (Stage 2E)

4.3 PROPOSED ROAD NETWORK DESIGN PRINCIPLES

The road network has been designed to convey the road's function to the road users and encourage appropriate driver behaviour. The overarching design principles for the proposed road network include:

- ▶ Designing to convey the road's function to the road users and encourage appropriate driver behaviour
- ▶ Ensuring the traffic volumes and speeds on roads are compatible with the residential functions of the road
- ▶ Providing suitable amenity for bicycle and pedestrian access
- ▶ Avoiding road links that have a change in road level of more than two levels (i.e. Local Street connection with a Sub-Arterial)
- ▶ Avoiding four-way intersections
- ▶ Providing provisions for future development to the south-west

4.4 ROAD HIERARCHY

It is proposed to have a Local Sub-Arterial road, collector bus route and local/edge roads within the Site. Refer to Drawing 323444-001CD040 for details. We note that this is consistent with the road hierarchy of SJE1 and QPRC design specifications.

4.4.1 COLLECTOR STREET (BUS ROUTE)

The proposed Collector Street (Abelia Avenue) will be the main traffic route for vehicle access and reticulation through the site in addition to being the bus route.

Abelia Avenue is generally in accordance with QPRC’s D1.07.6, although it is proposed to prohibit carriageway parking in some areas to ensure safe intersection sight distances are met.

Abelia Avenue also has a wider (6m) verge on one side to accommodate the 2.5m trunk shared path.

4.4.2 LOCAL STREET

The proposed Local Streets are proposed to provide a balance between access and residential amenity functions.

The Local Streets are in accordance with QPRC’s D1.07.05 (Refer Sections 3-6 Drawing 323444-001CD061 to 62). We note that the outer verge of Road 05 and Road 18 is 2.5 wide, consistent with other edge roads within the Estate. All proposed services still exist within the road reserve.

4.5 DESIGN SPEED

The chosen design speeds for the Site are in accordance with D1.09.3. The proposed signposted speed limits for the differing road types are consistent with that of SJE1. This is summarised in the Table below.

Table 3: Design Speeds

Road Type	Design Speed (QPRC D1.09.3) (km/h)
Local Street/Edge Road	40
Collector Street	50

4.6 LONGITUDINAL GRADIENT

The proposed longitudinal gradients of roads within the Site are in accordance with QPRC’s D1.10 Table D1.1. We note that while there are instances where the proposed road grades approach the “absolute maximum percentage” per QPRC’s Table D1.1, we believe this is acceptable as:

- ▶ The sections of steep grades as less than 150m long (per Table D1.1)
- ▶ The road grades are constrained by the naturally steep topography of the site.

4.7 HORIZONTAL GEOMETRY

The proposed horizontal geometry of the roads within the Site are in accordance with QPRC’s D1.11.

Kerb return radii proposed for roads in the Site are as follows:

- ▶ Collector Street with Bus Route 10.0m or 12.0m where turning paths require
- ▶ Local Street 8.0m

4.8 VERTICAL GEOMETRY

The vertical geometry proposed for roads within the Site are in accordance with QPRC’s D1.12.

4.9 TURNING MOVEMENTS

Turning movements for roads within the Site are in accordance with QPRC’s D1.17.9.

Turning movements for the Site are shown on Drawings 323444-001CD120 to CD123. They demonstrate the following:

- ▶ Service Vehicle (8.8m) and Passenger Vehicle (B99) can safely pass each other on all roads at 5km/h
- ▶ Minimum 0.5m from the vehicle bodies is maintained from all pedestrian crossings

4.10 LINEMARKING

In addition to standard signage and linemarking throughout the estate, intersection linemarking and signage is proposed at the following locations (refer Figure 2) to mitigate the risk of conflicting movements:

- ▶ Intersection of Road 05 and Road 14 to delineate Road 05 as the priority road.
- ▶ Intersection of Abelia Avenue and Road 05 to delineate Abelia Avenue as the priority road and guide users to follow Road 05 upon exiting the collector road.

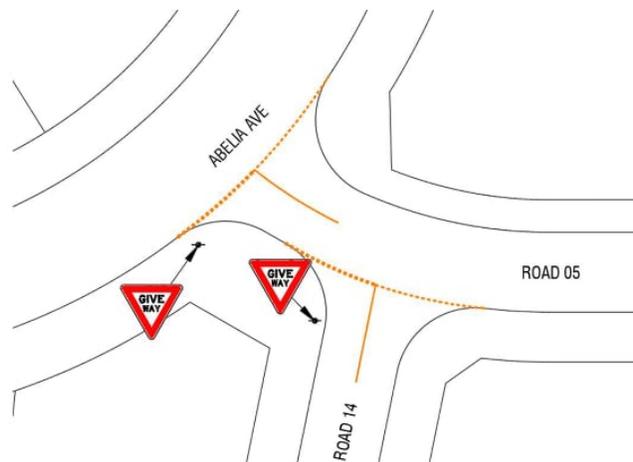


Figure 2 – Concept line marking

4.11 SIGHT DISTANCES

Sight distance checks have been completed for intersections within the Site in accordance with QPRC's D1.17.6. These are shown on Drawings 323444-001CD100-CD104

We note that the approach car speeds used for the sight distance checks have been set as per QPRC's D1 Specification (See Section 4.5). We note in some instances it is unlikely the speed used for these sight distance checks would in reality be achieved.

4.12 PUBLIC TRANSPORT

The proposed bus route through the entire SJE2 development is along Abelia Avenue. Refer to Drawing 323444-001CD050 for details. The bus route has been designed in accordance with QPRC's D1 Specification.

4.13 PARKING

Proposed parking within the Site is generally in accordance with the QPRC's D1.10, and includes the following:

- ▶ On-Street informal parking along Local Roads and Collector Streets

4.14 STREET LIGHTING

Street lighting for the Site is proposed in locations specified in Drawings 323444-001CD060-CD061

The street lighting columns are proposed to be frangible in accordance with QPRC design specification D1.34.

The Street lighting will be designed in accordance with AS/NZS 1158. The design of the streetlights is proposed to be undertaken at the detailed design stage.

5. CYCLING AND PEDESTRIAN ACCESS

It is proposed to have a 2.5m key path on one side of the verges of Abelia Avenue which allows connection to the bus stops, and a 1.5m path on the opposite verge. It is proposed to provide all other roads within the site with 1.5m footpaths on both sides of the road when not adjacent open space. When adjacent open space the path is proposed to be only on the dwelling side of the road. The extents of the proposed path network and crossing locations is shown on Drawing 323444-001CD040

6. SEWER MASTER PLAN

6.1 EXISTING SEWER INFRASTRUCTURE

6.1.1 INFRASTRUCTURE REPORT

An infrastructure servicing report was prepared by Calibre Consulting as part of the REF application for the entire development area. The Site falls within the development area covered by this report.

The Equivalent Population (**EP**) for the servicing report allowed for 1,500 dwellings to be contributing to the overall sewer load allowed for as part of the REF. The combined total of dwellings across both SJE1, 3 approved stages of Estate 2 and Stage 2E is 1298, under the 1,500 dwellings.

6.1.2 EXISTING SERVICES

At the time of writing this report, there is no commissioned sewer infrastructure to service the Site as it is being undertaken with the Stage 2E DA at the time of writing this report. The Stage 2E design has provided the following provisions for the Site:

- ▶ 150mm diameter sewer main stub to the north of open space lot 137
- ▶ 150mm diameter sewer main stub on the western verge of Abelia Avenue, adjacent block 208
- ▶ 150mm diameter sewer main stub on the northern verge of Road 18
- ▶ 225mm diameter sewer main stub in the northern verge of Abelia Avenue

6.2 PROPOSED SEWER INFRASTRUCTURE

The sewer catchments used to design the proposed sewer infrastructure and the catchment details are shown on Drawing 323444-001CD410.

The proposed sewer layout is shown on Drawing 323444-001CD420. In summary, the following has been proposed:

- ▶ Internal sewer main reticulation, predominately underneath footpaths
- ▶ Sewer mains located in shared sewer/stormwater 3.5m wide back of block easements where required
- ▶ Connections to the existing downstream network

A series of nodes have been chosen at critical locations to determine the minimum grade and sizing of the sewer (refer Drawing 323444-001CD410-CD411).

The sewer network has been designed in accordance with and QPRC-D12 and WSA02 2014-3.1. The criteria used for design is as follows:

Table 4 SEWER DESIGN CRITERIA

Sewerage Flow Estimation		
Design Criteria	Value	Source
EP/ha	3.5 per Lot (Residential)	WSA02-2014-3.1 Table A1
ADWF	180 L/EP/d	QPRC D12-Appendix B
PDWF	d x ADWF	WSA02-2014-3.1-Appendix C
d	$d = 0.01(\log A)^4 - 0.19(\log A)^3 + 1.4(\log A)^2 - 4.66\log A + 7.57$	WSA02-2014-3.1-Appendix C
GWI	$0.025 \times A \times \text{Portion}_{\text{wet}}$	WSA02-3.2 Appendix C
A	Gross Plan area of developments catchment in hectares (Leak tight sewerage system assumed, therefore no road catchment included).	WSA02-2014-3.1-Appendix C
RDI	$0.028 \times A_{\text{eff}} \times C \times I$	WSA02-2014-3.1-Appendix C
A_{eff} (Non-Residential)	$A_{\text{eff}} = A \times (1 - 0.75 \text{ Portion Impervious})$	WSA02-2014-3.1-Appendix C
A_{eff} (Residential)	$A_{\text{eff}} = A \times (\text{Density}/150)^{0.5}$	WSA02-2014-3.1-Appendix C
Portion Impervious	75% (Mixed density Residential)	QPRC D5 - Table D5.6
C	1.0 (leak tight system specified)	WSA02-2014-3.1-Appendix C
I	$I_{1,10} \times F_{\text{size}} \times F_{\text{containment}}$	WSA02-2014-3.1-Appendix C and QPRC D12-Appendix B
$I_{1,10}$	23.0mm/hr	South Jerrabomberra Masterplan
F_{size}	$(40/A_{\text{eff}})^{0.12}$	WSA02-2014-3.1-Appendix C
Containment Frequency	10 years	QPRC D12-Appendix B

F _{containment}	1.5	WSA02-2014-3.1-Appendix C
PWWF	PDWF + GWI + RDI	QPRC D12-Appendix B
Material	PVC-U	QPRC D12-Appendix B

Sewerage Pipe Hydraulics

Design Criteria	Value	Source
Minimum Velocity (PDWF) velocity	0.70 m/s	QPRC D12-Appendix B
Maximum Velocity (PWWF) velocity	2.0m/s	QPRC D12-Appendix B
Maximum Depth ratio at (PDWF)	50%	QPRC D12-Appendix B
Maximum Depth ratio at (PWWF)	95%	QPRC D12-Appendix B
Minimum Self-Cleansing Shear Stress (PDWF)	1.6Pa	WSA02-2014-5.5.7
Design Minimum Grades (DN150)	0.55%	WSA02-2014-5.5.7
Design Minimum Grades (DN225)	0.33%	WSA02-2014-5.5.7

7. WATER SUPPLY MASTER PLAN

7.1 EXISTING WATER INFRASTRUCTURE

7.1.1 INFRASTRUCTURE REPORT

An infrastructure servicing report was prepared by Calibre Consulting as part of the REF application for the entire development area. The Site falls within the development area covered by this report.

The infrastructure servicing report considered a water supply demand for a total of 1,500 dwellings across the SJ development area split between three zones (Low, Intermediate and High). The combined total of dwellings across both SJE1, the 3 already approved stages of Estate 2, Stage 2E and this DA is 1298, under the demand provisioned for in the water infrastructure study. The Site falls within the Intermediate Zone and High Zone of the water supply network.

7.1.2 EXISTING SERVICES

At the time of writing this report, there is no commissioned water infrastructure to service the Site as it is still under construction as part of Stage 2B and being assessed under the Stage 2E DA at the time of writing this report. The Stage 2B and 2E designs provide the following provisions for the Site:

- ▶ 225mm water main on the western verge of Road 13 (part of Stage 2B, this will require a water main crossing under the swale)
- ▶ 150mm water main on the eastern verge of Abelia Avenue
- ▶ 150mm water main on the southern verge of Abelia Avenue
- ▶ 100mm water main on the eastern verge of Road 29

The pressure zone boundaries are as follows:

- ▶ Intermediate Zone ≤ RL690.0
- ▶ High Zone > RL690.0

7.2 PROPOSED WATER SUPPLY INFRASTRUCTURE

As part of this DA, water modelling was undertaken to determine the internal water main sizing for the Site.

The design criteria used for the assessment were as follows:

Table 5 WATER DESIGN CRITERIA

Parameter	Value	Source
Average Day Demand	630 L/ET/day	Queanbeyan Design Spec D11.05
Peak Hour Demand Factor	3.0	UWS Memo
Maximum Service Pressure	Maximum service pressure is 800kPa	Queanbeyan Design Spec D11.05

Parameter	Value	Source
Minimum Service Pressure	20m	WSA 03-2011 Water Supply Code T2.3
Firefighting	10L/s	AS2419.1
Firefighting Requirements	Pressure 15m min at the flowing hydrant	AS2419.1
Maximum Velocity	$\leq 2\text{m/s}$ under general operational conditions $\leq 4\text{m/s}$ under fire flow conditions	WSA 03-2011 Water Supply Code C13.1.6.4
Maximum Head loss	<ul style="list-style-type: none"> ▶ 5m head/km for \leq DN150 ▶ 3m head/km for \geq DN200 	WSA 03-2011 Water Supply Code C13.1.6.2
Minimum Pipe Size	100mm	QPRC Design Spec D11.09
Material	Series 2 PVC-M PN 16	QPRC Design Spec D11.09
Hydrant Spacing	60m	QPRC Design Spec D11.07
Minimum pipeline radii using joint deflection	300 x pipe diameter	iPlex Pipelines

The proposed pipe network, demands, pressures and fire flow residual pressures can be seen on Drawing 323444-001CD450.

8. STORMWATER MASTERPLAN

8.1 REQUIREMENTS AND OBJECTIVE

This section of the report details the stormwater management strategy for the site and demonstrates that the proposed assets are appropriate for approval. This shall be read in conjunction with Section 8 of DA1 of South Jerrabomberra Estate 2 Civil Engineering Report revision 2 (February 2024), *DA 2021.1284*.

The scope, detailed further in following sections, is broken down into the following objectives:

- ▶ Stormwater Quantity
 - Identify requirements and objectives for stormwater peak flow (flood) management.
 - Hydrological analysis for the existing and proposed conditions, including reporting of peak flows for the 20% and 1% AEP events.
 - Proposed stormwater detention strategy
- ▶ Stormwater Quality
 - Identify requirements and objectives for stormwater quality strategy
 - Proposed asset types and sizing
 - MUSIC model parameters and performance
- ▶ Estate Drainage Network
 - Open Channel Design
 - Pipe Network Design

8.2 STORM WATER PEAK FLOW MANAGEMENT

8.2.1 REQUIREMENTS AND OBJECTIVE

As required by QPRC's Development Design Specification – Part D5, the following permissible wider catchment discharge limits will apply:

- ▶ Predevelopment peak discharge rates for 20% and 1% AEP events will not be exceeded.
- ▶ 1% AEP water levels in any detention asset will have minimum 0.5m freeboard to floor levels.

8.2.2 PREDEVELOPED CATCHMENT

The South Jerrabomberra Catchment falls naturally to the Goulburn Bombala railway line which traverse the NSW/ACT border. The railway line has four stormwater culverts within the vicinity of the estate as presented in Figure 2. The site falls within the Central culvert sub catchment. The Central culvert is therefore the outfall location and legal point of discharge for the site.

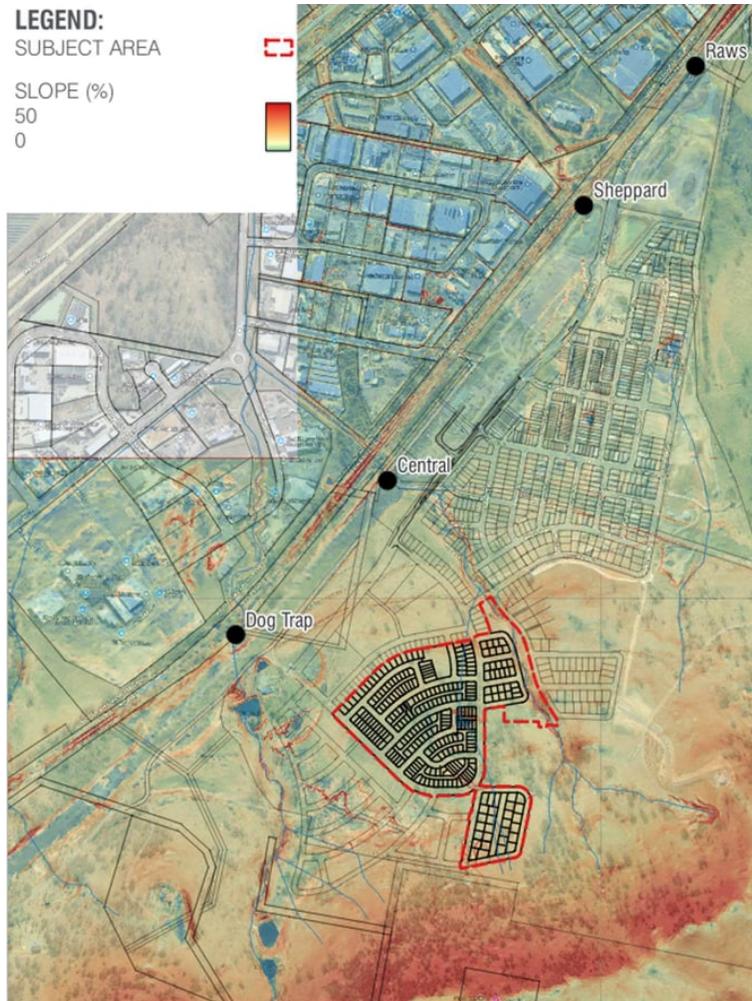


Figure 2 Existing Topography

The Central Culvert catchment includes areas already developed during the South Jerrabomberra Estate 1 works, current works been undertaken in the 2A and 2B estates and future developed areas of the wider South Jerrabomberra Estate.

The existing catchment is 0.96 km² in size and can be typified as agricultural grazing lands, with a transition to grassy woodlands in the upper reaches. From the site outlet the catchment extends steeply to the southeast, with heavily degrade gullies capturing and conveying flows to the Central Culvert.

8.2.3 PREDEVELOPED CONDITIONS HYDROLOGY MODELLING

To analyse the peak stormwater flow, Spiire have utilised the hydrology modelling program RORBwin (RORB) in accordance with ARR2019 guidelines. The Predeveloped catchment plan is presented in Figure 3, with the full catchment plan presented in Appendix A.

All catchments were assessed to have a Fraction Impervious of 0.1 in line with standard industry practice, a departure from the 0.4 and 0.7 listed in the QPRC D5 specification.

All reaches were modelled as type 2 to better represent the steep topography of the site and the gully flow expected to occur during a significant rainfall event.

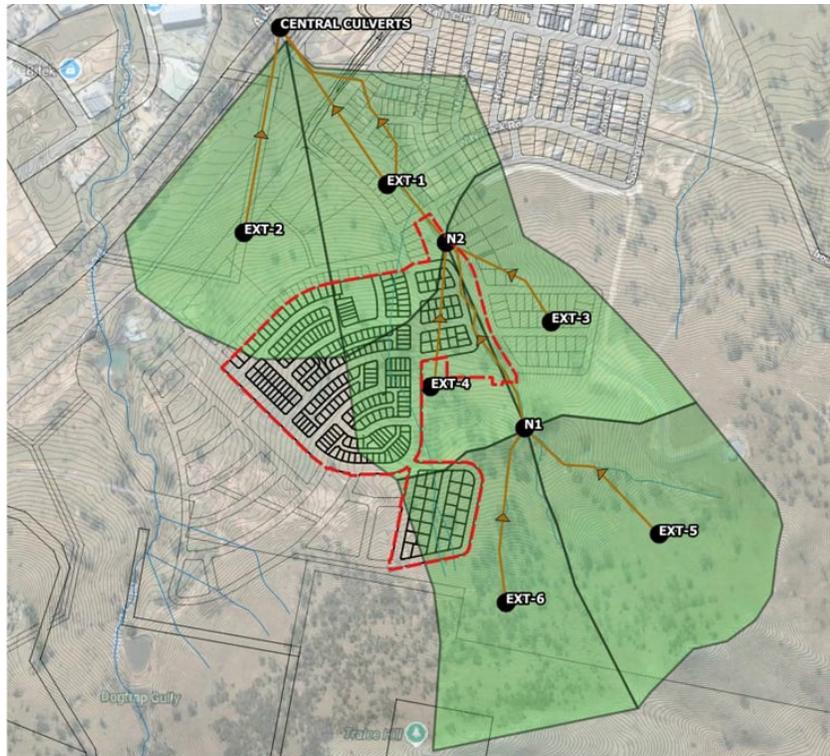


Figure 3 Existing Catchment Plan

8.2.3.1 RORB PARAMETERS

The RORB runoff routing parameters (K_c , m) were selected in accordance with the *South Jerrabomberra Handbook or Drainage Design Criteria* (QCC, 2015). The initial loss was also based on the design handbook.

A continuing loss model was used instead of a Runoff Coefficient model as is the current ARR recommended practice. As the design handbook does not provide a value for continuing loss, the ARR datahub parameters (downloaded 15/11/22) were adopted with the NSW Office of Environment and Heritage (OEH) reduction factors applied.

Table 6 summarises the RORB parameters used for the existing hydrology model.

Table 6: Existing conditions RORB model parameters.

Parameter		Central
Loss Parameters	Initial Loss (mm)	10
	Continuing Loss (mm/hr)	2.08
RORB runoff routing parameters	m	0.8
	$K_c = 2.2A^{0.5}$	2.15
Catchment Fraction Impervious		0.1

The model was run using an ensemble analysis with Intensity Frequency Duration (IFD) and temporal patterns obtained through the ARR Data Hub (downloaded 15/11/22).

8.2.3.2 Model Results

The median flow for the peak duration is presented below for the four outlets.

Table 7: Existing Outlet Flows

	Flow (m ³ /s)	Temporal Pattern
20% AEP Event	5.5	1hr TP5
1% AEP Event	14.7	30min TP26

The existing conditions RORB model 1% AEP flow result was compared against both the Regional Flood Frequency Estimation (RFFE) tool and a conventional Rational Method calculation, using the Adams method for time of concentration with an equivalent area calculation.

The results of this are presented below.

Table 8: Model Validation

	Central Catchment (m ³ /s)
Rational Method	13.9
RFFE	12.2
RORB model	14.7

Increase in the flow calculated by RORB was attributed to the methods ability to more accurately represent the catchment topography. Specifically, the effect of the very steep upper reaches. The model was deemed fit for use.

8.2.4 PROPOSED DEVELOPED CONDITIONS

The Central catchment is proposed to consist of multiple different land uses which will increase the overall fraction impervious and hence the runoff during significant rainfall events. To mitigate this effect, it is proposed to attenuate peak flows to the objectives described in this report and the QPRC D5 specification, using detention ponds.

The developed catchment plan is presented in Figure 4 Developed Catchment Plan with the full catchment plan presented in Appendix B . Reach types have been changed to reach type 3 to represent the proposed estate pipe network. Changes in the land use have been represented through changes in the fraction impervious values. Fraction impervious values for the different land uses are presented in Table 9 and are in accordance with QPRC D5 specification.

Table 9 Proposed Fraction Impervious

Land use	Fraction Impervious
Undeveloped/Park Fraction Impervious	0.1
Residential Fraction Impervious	0.65
Multiunit Fraction Impervious	0.75
Commercial Fraction Impervious	0.85

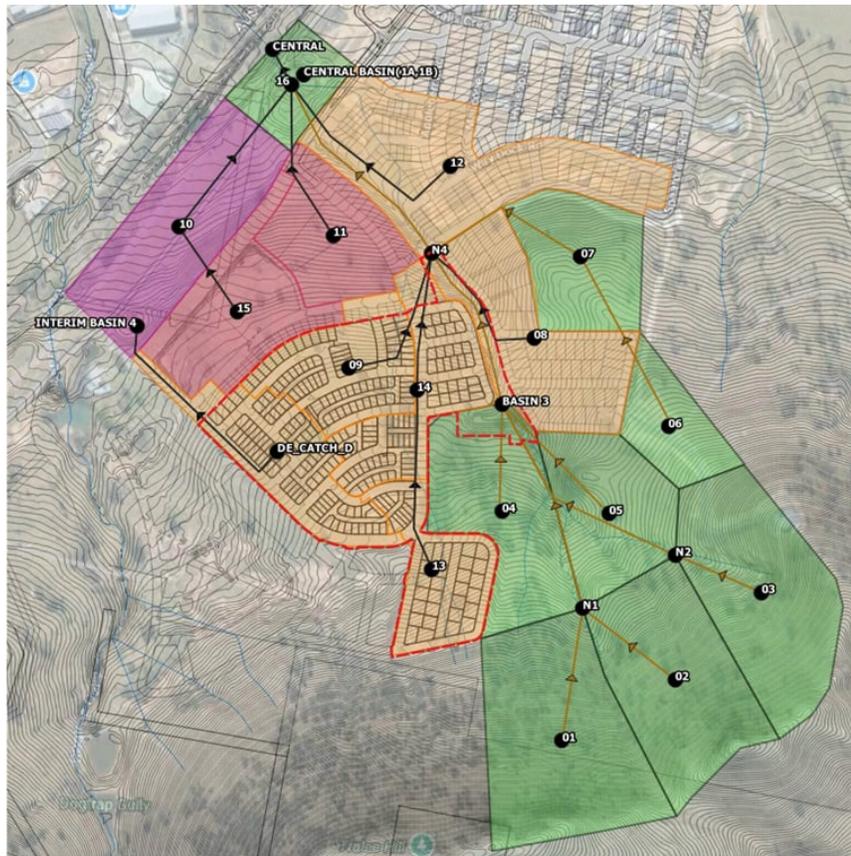


Figure 4 Developed Catchment Plan

Three basins have been nominated for construction to service the developed catchments: CENTRAL BASIN (1A and 1B), Basin 3, and Interim Basin 4.

CENTRAL BASIN (1A and 1B) – This basin has already been designed and approved as part of the earlier South Jerrabomberra Estate 2 DA1 submission (DA 2021.1284, revised February 2024). An updated hydrological model, reflecting the latest proposed lot layout, has been completed.

In this update, the model's K_c parameter was adjusted proportionally to the average flow length, while all other parameters remained unchanged. The model parameters are shown in Table 10, and the results are presented in Table 11. Central Basin continues to meet the required attenuation targets.

Table 10: Developed Model Parameters

Parameter	Central	
Loss Parameters	Initial Loss (mm)	10
	Continuing Loss (mm/hr)	2.08
RORB runoff routing parameters	m	0.8
	K_c	1.64

Table 11: Developed Outflows

	Predeveloped Flow (m ³ /s)	Developed Flow (m ³ /s)
20% AEP Event	5.5 (1hr TP5)	5.28 (30min TP8)
1% AEP Event	14.7 (30min TP26)	13.48 (30min TP26)

BASIN 3 - A dry detention basin, referred to as Basin 3, is proposed within the development catchment. It is designed to capture and temporarily store runoff from the upstream external catchment, to reduce peak flows before discharging downstream, supporting the site's stormwater management strategy. The basin has been sized to ensure it meets the relevant attenuation targets and integrates with the overall stormwater management strategy for the site.

INTERIM BASIN 4 – Interim Basin 4 is proposed for the portion of the development catchment that does not drain to Central Basin (designated as DE_CATCH_D). This catchment contributes to the larger catchment of the balance of Estate 2 which will ultimately be serviced by future basins. This basin will serve a dual function as both detention and treatment roles, designed to attenuate peak flows to pre-development levels in line with stormwater quantity objectives. The design parameters used for modelling this basin are discussed in the sections that follow. Interim Basin 4 will function as a construction pond during the construction phase, to be converted after 80% of the catchment is fully developed.

8.2.5 OUTLET CONFIGURATION

Basin 3 was designed with a 2x1200mm diameter pipe culvert outlet and auxiliary overflow path to safely convey the unattenuated 1% AEP flow.

Interim Basin 4 was designed with a 2-stage outfall arrangement which consists of a 375mm and 600mm diameter pipe to attenuate 20% AEP and 1% AEP flows respectively.

8.2.6 BASIN SIZING

The required retarding basin volume sizing is presented in Table 12.

Table 12: Basin Sizing

1% AEP	Central Basin (1A/1B)	Basin 3	Interim Basin 4
Flood Depth (m)	2m (from EDD)	2.0m (from base)	1.34m (from EDD)
Flood storage (m ³)	7,500	2,500	1,400

The peak developed flows at Basins 3 and 4 are presented in Table 13.

Table 13: Basin 3 and 4 Developed Inflows/Outflows

WSUD Asset	AEP Event	Inflow (m ³ /s)	Outflow (m ³ /s)
BASIN 3	20% AEP Event	3.3 (45min TP6)	3.0 (45min TP6)
	1% AEP Event	8.4 (30min TP28)	7.0 (30min TP28)
INTERIM BASIN 4	20% AEP Event	0.85 (20min TP4)	0.21 (1hr TP1)
	1% AEP Event	1.9 (15min TP21)	0.57 (1hr TP26)

8.2.7 RECOMMENDATIONS

The proposed development requires the construction of two stormwater basins to achieve the flow objectives. Through a combination of these two basins, and the already constructed CENTRAL BASIN (1A and 1B), the development achieves the peak flow objectives listed in section 8.2.1.

8.3 STORMWATER QUALITY

8.3.1 REQUIREMENTS AND OBJECTIVES FOR STORMWATER TREATMENT

The pollution reduction targets for the site will be in accordance with those detailed by the QPRC Development Design Specification, D7, water quality treatment targets, which are as follows:

- ▶ Reduction of gross pollutant export load = 100%
- ▶ Reduction in average annual suspended solids (SS) export load = 80%
- ▶ Reduction in average annual total phosphorus (TP) export load = 65%
- ▶ Reduction in average annual total nitrogen (TN) export load = 65%

Treatment targets are defined as the reduction percentage of the difference in pollutant loading between the existing and proposed conditions (i.e. a reduction of 100% means the same annual load of pollutant will be leaving the site in the post development scenario as the undeveloped scenario).

To calculate the stormwater pollutant generation a MUSIC model was developed. The MUSIC modelling was undertaken following the guidance provided in *Transport Canberra and City Service Municipal Infrastructure Standard 08 – Stormwater* (MIS08), including the use of the Canberra Airport 1968 to 1977 meteorological template.

8.3.2 PREDEVELOPED CONDITIONS

All predeveloped (undeveloped) catchments were classified as Agricultural. Pollutant load generation parameters from MIS08 were used.

8.3.3 PROPOSED CONDITIONS

With reference to the updated catchment plan 323444-001CD600, the majority of the proposed development has already been accounted for within the 1B basin catchment. An updated MUSIC catchment with the revised lot layout is presented in Figure 5.

The stormwater quality assets accounting for the 1B catchment have already been designed and documented within the preceding DA1 report (February 2024), *DA 2021.1284*. No further stormwater quality infrastructure is proposed to be constructed for this catchment as part of this application.

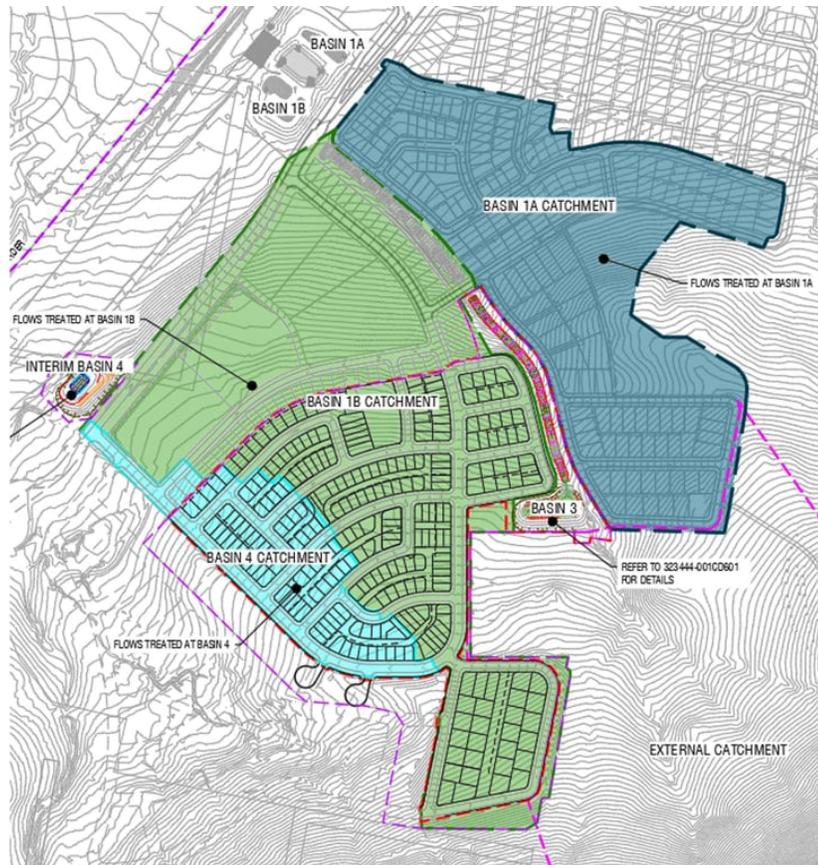


Figure 5: MUSIC Developed Catchment

The proposed development area that does not drain to the Central basin (Basin 4 Catchment) is proposed to be treated by Interim Basin 4. To achieve the stormwater quality objectives, it is proposed to provide a treatment train consisting of a GPT and a sediment pond.

8.3.3.1 Gross Pollutant Traps (GPT)

GPT's provide primary treatment for gross pollutants including litter and sediments. Proprietary GPT's are proposed to be constructed at all low flow outlets.

The GPT's will require regular maintenance and clean out. They have been designed to have a cleanout frequency of 2 times per year once the catchment is fully developed but will require inspection after all significant rainfall events.

In the MUSIC model a HumeGard GPT has been selected with the Blacktown City Council reduced treatment parameters used instead of the supplier supplied data.

8.3.3.2 Sediment Ponds

Sediment Pond provide secondary water quality treatment. The sediment basin proposed for the site has been designed with the following additional objectives that are not listed in the QPRC D7 design standards:

- ▶ Removal of 95% of all suspended sediment down to 125um
- ▶ Sediment storage volume is sized for a 5-year cleanout frequency (sediment accumulation zone is 0.5m below NWL)

- ▶ Velocity through the sediment forebay during the peak 1% AEP event is ≤ 0.5 m/s

8.3.3.3 MUSIC Treatment Train

The treatment train for the entire development catchment including the already approved South Jerrabomberra Estate 2, basin 1B and 1A catchments (CENTRAL CATCHMENTS), as represented in MUSIC, is shown in Figure 6. The treatment train highlighted by the red box represents the additional catchment area draining to Interim Basin 4.

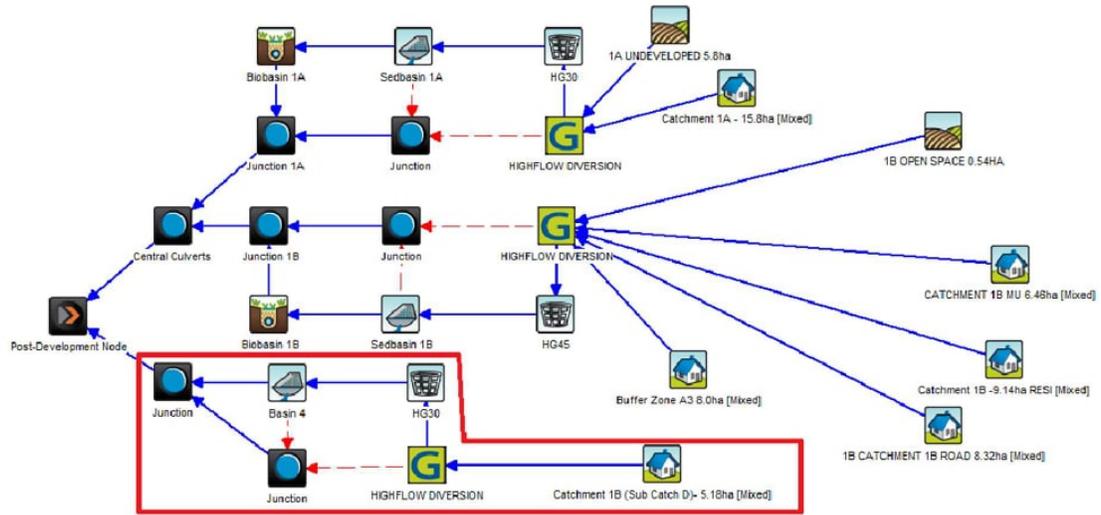


Figure 6: MUSIC Model

8.3.4 ASSET SIZING

The sizing for the assets as determined through the MUSIC modelling analysis are presented in Table 14. The asset is presented in design drawing CD602.

Table 14 Asset sizing

Treatment Asset	INTERIM BASIN
GPT	HG30
Sediment Basin (m ²)	320

8.3.4.1 Treatment Performance

The MUSIC model treatment train effectiveness of the proposed system is shown in Table 15. The model has been updated to reflect changes in the proposed lot layout and catchment configuration. It is important to note that the MUSIC results presented represent the performance of the combined treatment trains across the estate as depicted in Figure 4. As can be seen, the combined estates treatment trains meets the QPRC development treatment targets, with total nitrogen being the critical pollutant.

Table 15 MUSIC Treatment Results

	Total Suspended Solids	Total Phosphorus	Total Nitrogen
Undeveloped (kg/yr)	9,074	18.1	171.1
Developed Untreated (kg/yr)	40,140	58.7	694.8
Developed Treated (kg/yr)	6,696	31	356.7
Reduction	108%	68%	65%

8.4 SUMMARY

The Stormwater quality objectives can be achieved using a treatment train as demonstrated through MUSIC modelling. The treatment train should consist of the following elements:

- ▶ Gross pollutant trap
- ▶ Sediment Basin

8.5 ESTATE DRAINAGE

8.5.1 OPEN CHANNEL

Under the existing conditions, the external catchment traverses the site through a highly eroded gully. It is proposed to retain this channel and therefore it is required to be stabilised and formalised within the estate design.

This design is an amendment to the original approved development application (DA.2021.1284) which piped flows up to the 1% AEP event through the site. With new industry guidance around the adaptation for climate change and future proofing of drainage infrastructure this was no longer seen as a preferred option and the open channel was instead adopted for the site.

To maximise the landscape potential of the channel it was elected to construct a channel with rock chutes which in turn allows the construction of flatter sections that can be vegetated. Rock chutes were designed with a maximum long fall slope of 20%. The cross fall was altered to transition to the surrounding estate and maintain at least 0.5m freeboard during the 1% AEP event to the top of bank. This involved rock stabilised batters of up to 1(h) to 1.5(v) slope in places.

The channel was designed using HEC-RAS The shear stress limits for different surface treatments were obtained from MIS08, Fischenich 2001 (a common reference for waterway design standards (i.e. Melbourne Water)). Scour protection threshold limits adopted are presented in Table 16.

Table 16 Scour Protection Limits

Surface Treatment	Allowable Velocity (m/s)	Allowable Shear Stress (Pa)
Short Native Grass	1.0	45
Long Native Grass	2.0	80
D50 = 300mm Rock Work	-	190

Where the scour protection limits were exceeded rock scour protection was sized utilising the equations presented in QUDM section 9.9.

The results of the HECRAS modelling including calculated shear stress are presented in Appendix C.

The result show that the velocity depth limit ($<0.4\text{m}^2/\text{s}$) is achieved for the majority of the flood fringe zone (depth $<0.4\text{m}$) during the 1% AEP event. The velocity depth limit is exceeded at the rock chutes sections of the channel. It is proposed to provide a vegetation buffer to discourage pedestrian egress. Additionally advisory signs warning about the channel shall also be included in the design.

The results also show that 0.5m freeboard can be provided during the 1% AEP design event.

8.5.2 ESTATE PIPE DRAINAGE

As required by QPRC's Development Design Specification – Part D5, the following conveyance capacities will apply:

- ▶ The minor drainage network, i.e. the stormwater drainage pipe network, will be required to convey 20% AEP event flows, as the site will be a general residential area.
- ▶ The major drainage network, i.e. stormwater flow overland through road reserves, is required to convey the gap flow between the 1% and 20% AEP events. Furthermore:
 - All overland flows will be subject to the relevant Velocity x Depth criteria to ensure safety of pedestrians and vehicles. where used
 - Freeboard to floor levels will be minimum 0.5 metres from the 1% AEP flood level. Areas where the road is in fill or overtopping of kerbs and flow through properties may occur a 0.1 metre freeboard shall be provided between the ponding level of water in the road and the high point in the footpath.

The estates pipe network has been preliminarily sized using 12D using the Rational Hydrology model. The parameters used in the model are presented below.

Stormwater Pipe Sizing

Design Criteria	Value	Source
Runoff Method	ARR1987, as precursor to ARR2016	QPRC D5 D5.06, 1.
Rainfall Event	5 year ARI / 20% AEP	QPRC D5 D5.04, 5.
Runoff Coefficient	C = 0.9 for Impervious	Handbook of Drainage Design Criteria – South Jerrabomberra
Time of Concentration	Minimum Tc = 5min. Maximum Tc = 20min.	Handbook of Drainage Design Criteria – South Jerrabomberra
Impervious %	70% Impervious, mixed catchment types	QPRC D5 D5.16, 4.

Velocity depth limits have been assessed at points of large approach and/or bypass flows have been calculated by the model. The 1D hydraulic program PC-convey has been used to calculate the velocity depth through the road sections. Manning values for pavement have been assumed to be 0.013 and for grassed areas 0.035. Pipes have been upsized or additional pits added where the velocity depth limits are exceeded within the road network.

The estates piped drainage network will discharge into Stage 2E. Low flows will discharge into the pipe network and flows greater than the 1EY will be diverted by pit and discharged into the existing drainage channel in 2C.

This stage of works will require inter allotment drainage due to the slope of the site. All inter allotment drainage will be contained within a drainage (or drainage and sewer) easement with a minimum width of 2.5m.

The drainage network can be seen on Drawing 323444-001CD500 and 323444-001CD520

9. UTILITIES

It is proposed to provide utility servicing to the Site via a shared trench for Electrical and Telecommunications. The proposed shared trench arrangements are shown on Drawings 323444-001CD610 and 611.

9.1 NBN

At the time of writing this report, NBN has not confirmed whether they can service the Site, however no servicing issues are expected.

It is proposed that the Site will connect to the SJE2 2E NBN network.

9.2 ELECTRICITY

At the time of writing this report, Essential Energy has not confirmed whether they can service the Site, however no servicing issues are expected.

The typical shared trench arrangements are shown on Drawings 323444-0001CD611

Four substations are proposed within the Site:

- ▶ On the southern edge of the open space lot 137
- ▶ On the eastern verge of Abelia Avenue
- ▶ On the northern verge of Road 05

10. SITE RE-GRADING

10.1 EXISTING SLOPE

As described in Section 2.2 and shown on Drawing 323444-001CD240, the existing slope of the Site is particularly steep and ranges between 5-25%+, falling in the Northeast direction. The grades increase significantly around the well-defined gully and adjacent the existing hill to the east of the site.

10.2 PROPOSED SLOPE

As shown on Drawing 323444-001CD250, the proposed slope of the development ranges between 0-25%.

We note that the proposed grading on residential blocks is less than 20%, in accordance with QPRC's D6 Specification.

10.3 SITE GRADING

As shown on Drawing 323444-001CD250 re-grading is proposed across the majority of the Site. The proposed site grading considers the following design principles:

- ▶ Matching into proposed Stage 2B and 2E design levels
- ▶ Creating roads that comply with QPRC's D1 Specification
- ▶ Allowing to capture the external stormwater catchments without overtopping into the SJE2 road network
- ▶ Retention of two high value trees

This results in a net import of material in the order of 18,150m³. A breakdown of the earthworks can be seen in the table below. We note that these quantities are taken from a the existing surface to the finished surface so are subject to change during design progression.

Table 7 Earthworks Quantities

Cut (m3) approx.	131,050
Fill (m3) approx.	149,200
Balance – Import (m3) approx.	18,150

Temporary batters at the edge of the Site have been designed at maximum 1:4 grades.

10.4 RETAINING WALLS

One 900mm (max) high retaining wall may be required on the southern edge of the Estate (Road 05) and eastern edge of the estate (Abelia Avenue). Details to be confirmed at detailed design.

On-block retaining walls may be investigated as part of the Subdivision Works Certificate design progression.

11. SEDIMENT AND EROSION CONTROL

11.1 CONCEPT EROSION AND SEDIMENT CONTROL PLAN

A concept Sediment and Erosion Control Plan (**ESC-P**) has been prepared for the site and is shown on Drawings 323444-001CD700 and 323444-001CD701. A final ESCP will be prepared by the Contractor as part of CMP and have a basis of design from *Managing Urban Stormwater, Soils & Construction (BlueBook)*. The final ESCP will be subject to the subsequent staging of the detailed design and construction packages of work. An overall concept plan has been provided for clarity.

The concept ESCP involves the follow works:

- ▶ Proposed 4 temporary sediment basins to split the catchment
- ▶ Catch drains to divert dirty water from the Site towards the sediment basins
- ▶ Catch drains / diversion bunds to divert clean upstream overland flows around the Site
- ▶ Silt fencing, filter rolls, and ground cover to protect existing stormwater assets
- ▶ Temporary sediment basins have been sized in accordance with BlueBook. The design criteria can be seen in Table 17. Details of the Site and proposed basin sizing is seen in Tables 18-21 respectively.

Table 17 Temporary Sediment Basin Design Criteria

Parameter	Value	Source
5-day rainfall depth, 90 th percentile. (R)	33mm	(Section 6, Table 6.3a Bluebook Volume 1).
R-Factor (Rainfall Erosivity).	1500	(Map 12, Appendix B Bluebook Volume 1)
Sediment Type.	Type D	(Table C24, Appendix C Bluebook Volume 1)
Soil Hydrological Group.	Group B and C	(Table C24, Appendix C Bluebook Volume 1)
Runoff Coefficient (Cv)	0.56	(Table F2, Appendix F-4 Bluebook Volume 1)
Settling Zone Volume (m ³)	$10 * C_v * R * A$	(J.4, Appendix J Bluebook Volume 1)

Table 18 Temporary Sediment Basin A Sizing

Total Catchment Area	4.3 Ha
Disturbed Catchment Area	4.3 Ha
<hr/>	
Sediment basin storage (soil) Volume	190m ³
Sediment basin settling (water) Volume	795m ³
<hr/>	
Sediment Basin A Total Volume	985m³

Table 19 Temporary Sediment Basin B Sizing

Total Catchment Area	5.5 Ha
Disturbed Catchment Area	5.5 Ha
<hr/>	
Sediment basin storage (soil) Volume	243m ³
Sediment basin settling (water) Volume	1016m ³
<hr/>	
Sediment Basin B Total Volume	1259m³

Table 20 Temporary Sediment Basin C Sizing

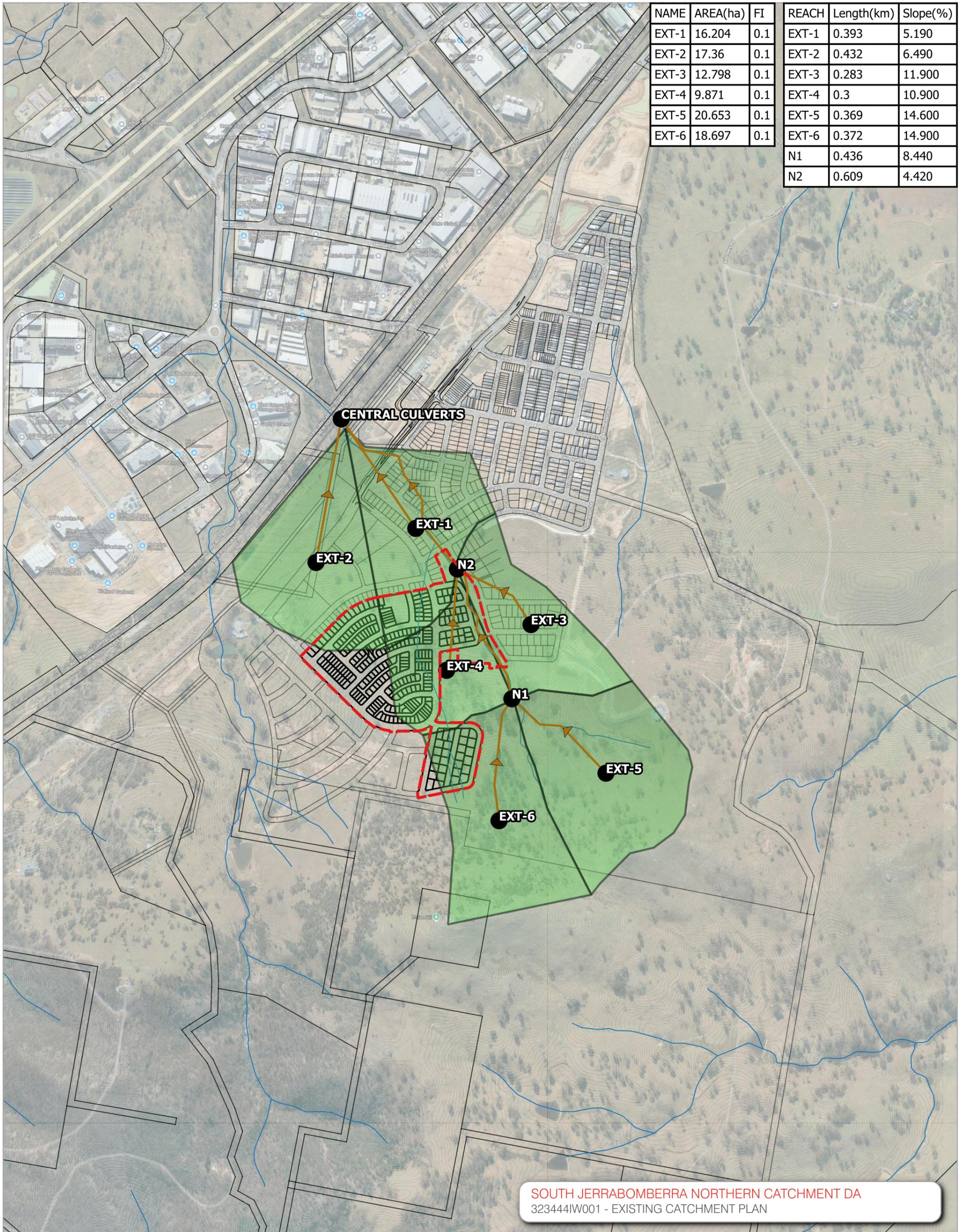
Total Catchment Area	4.5 Ha
Disturbed Catchment Area	4.5 Ha
<hr/>	
Sediment basin storage (soil) Volume	199m ³
Sediment basin settling (water) Volume	832m ³
<hr/>	
Sediment Basin C Total Volume	1031m³

Table 21 Temporary Sediment Basin D Sizing

Total Catchment Area	5.6 Ha
Disturbed Catchment Area	5.6 Ha
<hr/>	
Sediment basin storage (soil) Volume	247m ³
Sediment basin settling (water) Volume	1035m ³
<hr/>	
Sediment Basin D Total Volume	1282m³

APPENDIX A – PREDEVELOPED STORMWATER CATCHMENT

NAME	AREA(ha)	FI	REACH	Length(km)	Slope(%)
EXT-1	16.204	0.1	EXT-1	0.393	5.190
EXT-2	17.36	0.1	EXT-2	0.432	6.490
EXT-3	12.798	0.1	EXT-3	0.283	11.900
EXT-4	9.871	0.1	EXT-4	0.3	10.900
EXT-5	20.653	0.1	EXT-5	0.369	14.600
EXT-6	18.697	0.1	EXT-6	0.372	14.900
N1			N1	0.436	8.440
N2			N2	0.609	4.420



SOUTH JERRABOMBERRA NORTHERN CATCHMENT DA
3234441W001 - EXISTING CATCHMENT PLAN

LEGEND

SITE AREA
FRACTION IMPERVIOUS

0.1	
0.65	
0.75	
0.85	

FOR INFORMATION ONLY

RORB REACH TYPE

	1
	2
	3

The Village Building Co Est. 1988

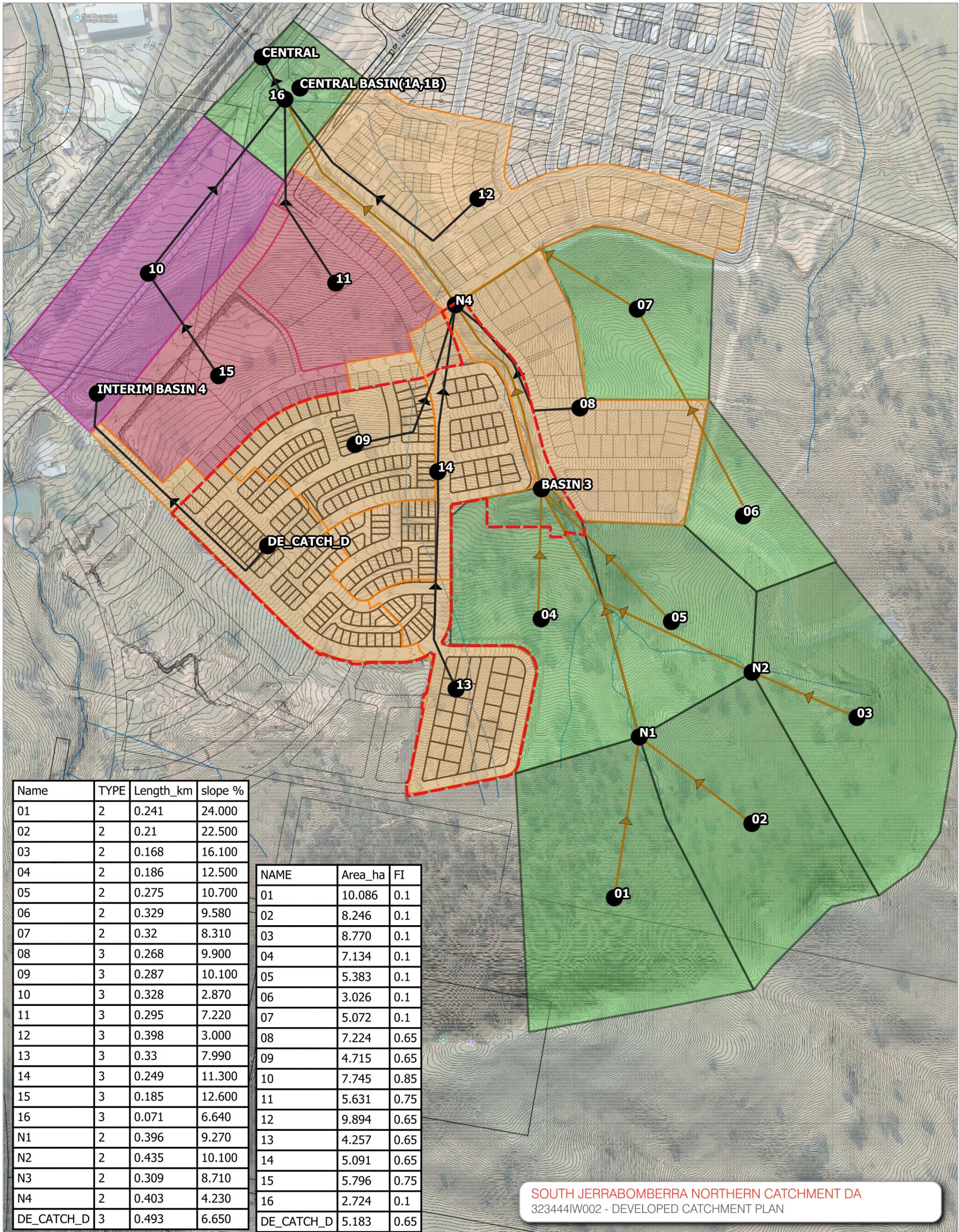
This document is produced by Spiire Australia Pty Ltd solely for the benefit of and use by the client in accordance with the terms of the retainer. Spiire Australia Pty Ltd does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

Coordinate System: GDA 1994 MGA Zone 55
1:10,000.00001
Paper size A3 Landscape

spiire

Suite 3 | Level 1,
243 Northbourne
Avenue Lyneham
ACT 2602
T 61 3 9993 7888
spiire.com.au
ABN 55 050 029 635

APPENDIX B – DEVELOPED STORMWATER CATCHMENT



Name	TYPE	Length_km	slope %
01	2	0.241	24.000
02	2	0.21	22.500
03	2	0.168	16.100
04	2	0.186	12.500
05	2	0.275	10.700
06	2	0.329	9.580
07	2	0.32	8.310
08	3	0.268	9.900
09	3	0.287	10.100
10	3	0.328	2.870
11	3	0.295	7.220
12	3	0.398	3.000
13	3	0.33	7.990
14	3	0.249	11.300
15	3	0.185	12.600
16	3	0.071	6.640
N1	2	0.396	9.270
N2	2	0.435	10.100
N3	2	0.309	8.710
N4	2	0.403	4.230
DE_CATCH_D	3	0.493	6.650

NAME	Area_ha	FI
01	10.086	0.1
02	8.246	0.1
03	8.770	0.1
04	7.134	0.1
05	5.383	0.1
06	3.026	0.1
07	5.072	0.1
08	7.224	0.65
09	4.715	0.65
10	7.745	0.85
11	5.631	0.75
12	9.894	0.65
13	4.257	0.65
14	5.091	0.65
15	5.796	0.75
16	2.724	0.1
DE_CATCH_D	5.183	0.65

SOUTH JERRABOMBERRA NORTHERN CATCHMENT DA
 323444IW002 - DEVELOPED CATCHMENT PLAN

FOR INFORMATION ONLY

LEGEND

 SITE AREA

Fraction Impervious

- 0.1
- 0.65
- 0.75
- 0.85

ROBB REACH TYPE

- 1
- 2
- 3

The Village Building Co Est. 1988

This document is produced by Spiire Australia Pty Ltd solely for the benefit of and use by the client in accordance with the terms of the retainer. Spiire Australia Pty Ltd does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

50 0 50 100 150 m

Coordinate System: GDA 1994 MGA Zone 55
 1:5,000.000005
 Paper size A3 Landscape

spiire

Suite 3 | Level 1,
 243 Northbourne
 Avenue Lyneham
 ACT 2602
 T 61 3 9993 7888
 spiire.com.au
 ABN 55 050 029 635

APPENDIX C – HECRAS MODELLING RESULTS



SOUTH JERRABOMBERRA ESTATE 2 - NORTHERN CATCHMENT DA
323444IW010 - FLOW DEPTH 1%AEP

LEGEND

-  SITE AREA
-  CONTOUR INCREMENT
-  0.5m

FLOW DEPTH 1%AEP (m)

-  0.2
-  0.5
-  1
-  1.5
-  5

FOR INFORMATION ONLY

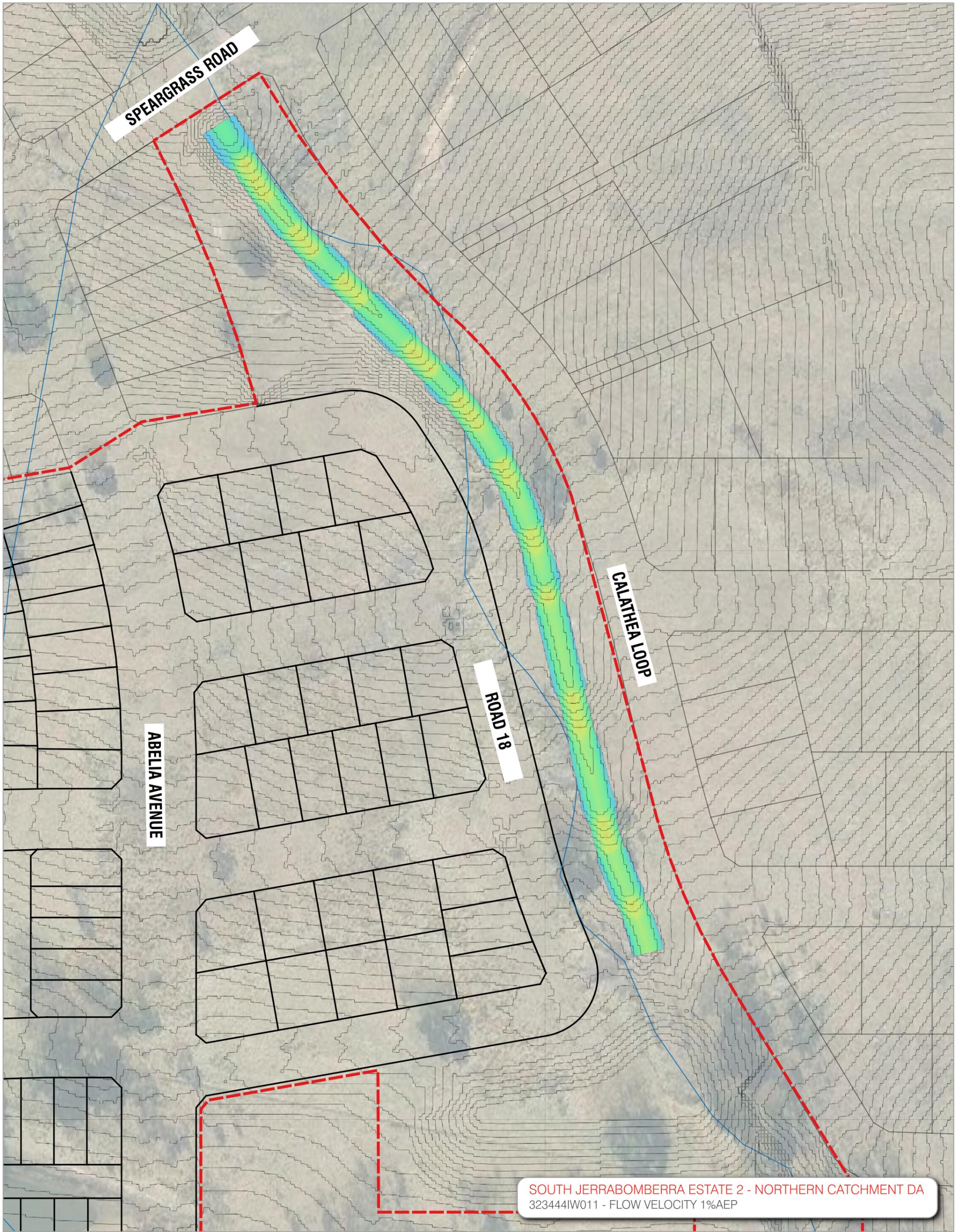


10 0 10 20 30 m
Coordinate System: GDA 1994 MGA Zone 55
Paper size A3 Landscape

This document is produced by Spiire Australia Pty Ltd solely for the benefit of and use by the client in accordance with the terms of the retainer. Spiire Australia Pty Ltd does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Suite 3 | Level 1,
243 Northbourne
Avenue Lyneham
ACT 2602
T 61 3 9993 7888
spiire.com.au
ABN 55 050 029 635



SOUTH JERRABOMBERRA ESTATE 2 - NORTHERN CATCHMENT DA
 323444IW011 - FLOW VELOCITY 1%AEP

LEGEND

 SITE AREA
 — CONTOUR INCREMENT
 — 0.5m

1% AEP FLOW VELOCITY

-  0.5m/s Bare Earth
-  1.0m/s Short Grass
-  2m/s Long Grass
-  4m/s 300mm Rock
-  >4m/s Rock Armour

The Village Building Co Est. 1988 



10 0 10 20 30 m
 Coordinate System: GDA 1994 MGA Zone 55
 Paper size A3 Landscape

FOR INFORMATION ONLY

This document is produced by Spiire Australia Pty Ltd solely for the benefit of and use by the client in accordance with the terms of the retainer. Spiire Australia Pty Ltd does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Suite 3 | Level 1,
 243 Northbourne
 Avenue Lyneham
 ACT 2602
 T 61 3 9993 7888
 spiire.com.au
 ABN 55 050 029 635



SOUTH JERRABOMBERRA ESTATE 2 - NORTHERN CATCHMENT DA
 323444IW012 - SHEAR STRESS 1%AEP

LEGEND

-  SITE AREA
-  CONTOUR INCREMENT
-  0.5m

SHEAR STRESS 1%AEP

-  <= 45Pa Short Native Grass
-  45 - 80Pa Long Native Grass
-  80 - 190Pa 300mm Rocks
-  > 190Pa Rock Armouring



10 0 10 20 30 m
 Coordinate System: GDA 1994 MGA Zone 55
 Paper size A3 Landscape

FOR INFORMATION ONLY

This document is produced by Spiire Australia Pty Ltd solely for the benefit of and use by the client in accordance with the terms of the retainer. Spiire Australia Pty Ltd does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Suite 3 | Level 1,
 243 Northbourne
 Avenue Lyneham
 ACT 2602
 T 61 3 9993 7888
 spiire.com.au
 ABN 55 050 029 635