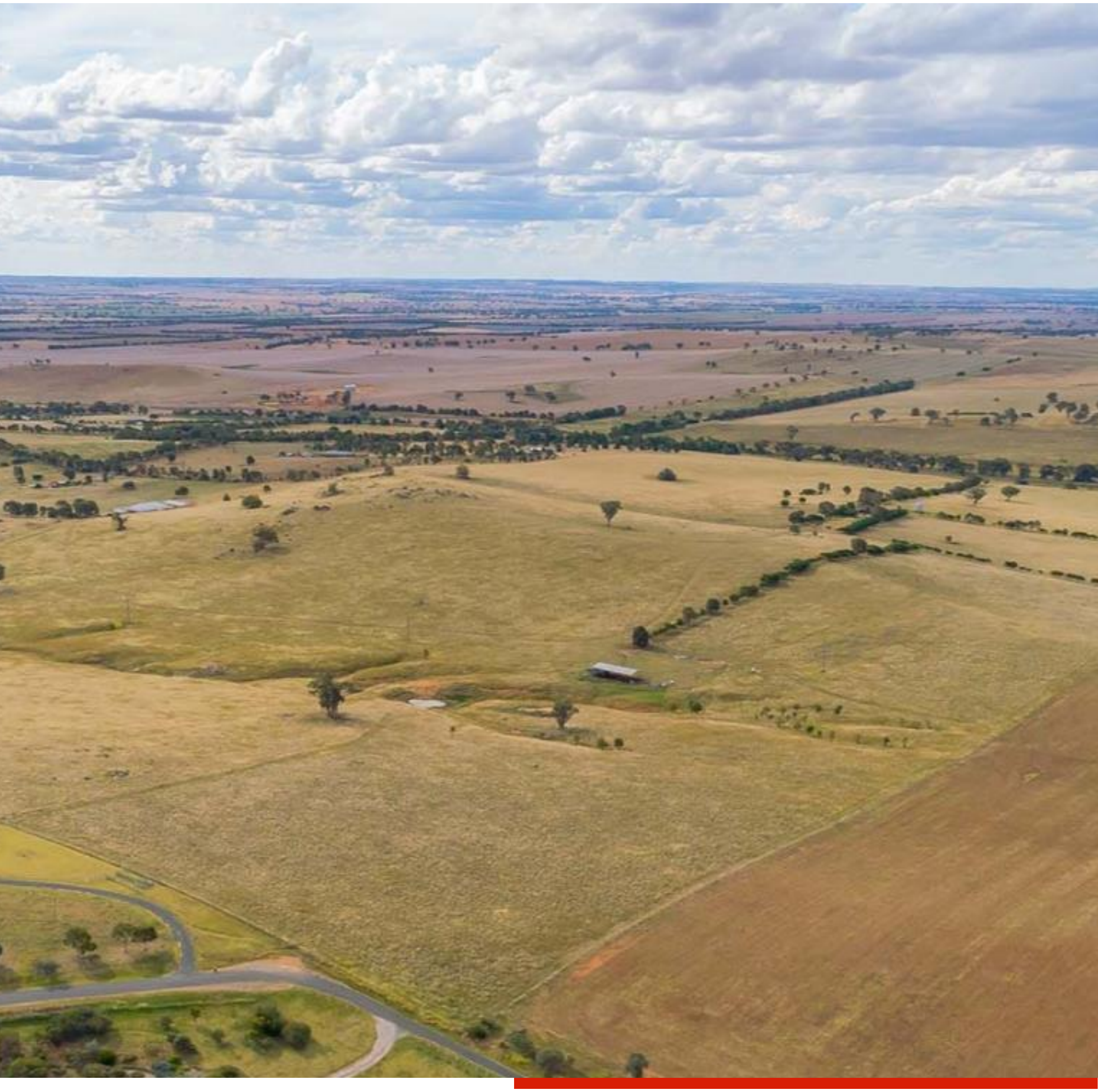


192 WATERWORKS RD STORMWATER MANAGEMENT REPORT

OCTOBER 2023

PREPARED FOR JUNEE ONE PTY LTD

This report has been prepared by the office of Spiire.
Suite 5, Level 1, 243 Northbourne Ave, Lyneham **Canberra** ACT 2602

Issue Date	Rev No	Authors	Checked	Approved
Oct 2023	0	E.R.	M.Y.	T.C.

Spiire Job Number: 321154

Citation: Spiire 2023, 192 WATERWORKS RD STORMWATER MANAGEMENT REPORT for JUNEE ONE PTY LTD.
Authors: Ericson Reyes Spiire Australia Pty Ltd. Project Number 321154

File Name: \\spiire.com.au\candata\Data\32\321154\001\Water\Documents & Calculations\Reports

Cover photo: Credits to the owner https://www.onthehouse.com.au/property/nsw/junee-2663/192-waterworks-rd-junee-nsw-2663-14853168), showing the view from the South East corner ohonf the site overlooking the parcel to North West of the site.

TABLE OF CONTENTS

1. INTRODUCTION

Spiire Australia Pty Ltd (Spiire) has been engaged by Junee One Pty Ltd to prepare a Stormwater Management Report to analyse the capture, conveyance, and treatment of stormwater flows for the proposed rezoning of 192 Waterworks Road, Junee from RU1- Primary production to RU5 – General Residential

This report investigates the minimum size of water assets servicing future general residential use.

2. BACKGROUND

2.1 LOCATION

192 Waterworks Road is located approximately 3km east of the Junee township and has an area of 78 hectares.

The site is bounded by Waterworks Road, Railway and Olympic Highway to the north; neighbouring rural land to the east; large residential lots and Kinvara Road to the south; and large residential lots to the west. Figure 1 shows these key features in relation to the site.

Figure 1: Site context map

2.2 SITE CONSTRAINTS AND CONTEXT

The following information has been informed by:

- Lyall and Associates (2011), *Lower Butlers Gully Floodplain Risk Study and Plan Final Report* (March 2011)

- Lyall and Associates (2013), *Detention Basins on Rocky Creek and Kinvara Overland Flow Path Concept Design Volume 1 Report* (October 2013)

- Aitken Rowe (2012), *Geotechnical Investigation – Proposed Detention Basin 1, Kinvara Water Course, Cedric Street, Junee, NSW* (September 2012).

Site constraints and considerations are summarised in the below table.

Item	Description
Kinvara Overland flow path	Historical studies identified that the southern catchment of the subject site's runoff contributes to stormwater inflows to the east of the Junee township.
Soil Conditions	Geotechnical information is not yet available for the subject site. Lyall and Associates engaged Aitken Rowe to conduct a preliminary geotechnical investigation approximately 265m west of the southwestern boundary of the subject site. The report indicates that the tested areas have silty sand, sandy clay, and weathered granite rock within the investigated depth of 5.5 to 6.0m. Low plasticity sandy clay, silty sand, and granite bedrock were encountered in the borehole locations, which seepage loss may be significant due to the nature of the high permeability.
Local Stormwater Asset Guidelines	As there is no documentation available at this stage, all relevant guidelines will be adopted.

Based on the current available information, these values and constraints have been considered in the concepts developed so far.

2.3 EXISTING CONDITIONS

The site is currently zoned as RU1- Primary production and has been historically used for grazing and dry cropping. The site is split by a ridge line in its centre, forming two distinct stormwater catchments. The northern catchment drains to the north, via culverts through both the Main Southern Railway and the Olympic Highway corridors into neighbouring farmland. The southern catchment drains to the west, via an incised gully into neighbouring development consisting of low density residential lots before entering the Junee Township. There are multiple farm dams, sheds, and silos located on the site.

3. HYDROLOGY

The hydrological analysis forms the basis for sizing key infrastructure and ensuring the safe conveyance of flow. This includes confirming catchments, determining flow paths, and estimating the critical flow for the pre and post developed conditions.

3.1 REQUIREMENTS & OBJECTIVES

A hydrological RORB model was used to determine the critical peak flow values for the 20% AEP (5-year ARI) (minor) and 1% AEP (100-year ARI) (major) storm events. These principles guide the following:

- Sizing of retarding infrastructure – designed to attenuate the 1 % and 20% AEP developed peak flows and,
- Sizing of stormwater quality infrastructure – designed to treat 4EY developed flow.

This section focuses primarily on the flow conditions in existing and post development scenarios.

Modelling has taken into account flows entering the subject site from external catchments as part of the investigation.

3.2 CURRENT CONDITIONS

3.2.1 CATCHMENT DESCRIPTION

Two independent catchments are created by the site's ridge line, which also creates two separate outfalls. The site normally has a slope of 2% to 20%, with greater slopes in some locations near the ridgelines and within the existing southern catchment gully. In Figure 2, the northern and southern catchment boundaries, identified flow pathways, and site slopes are displayed.

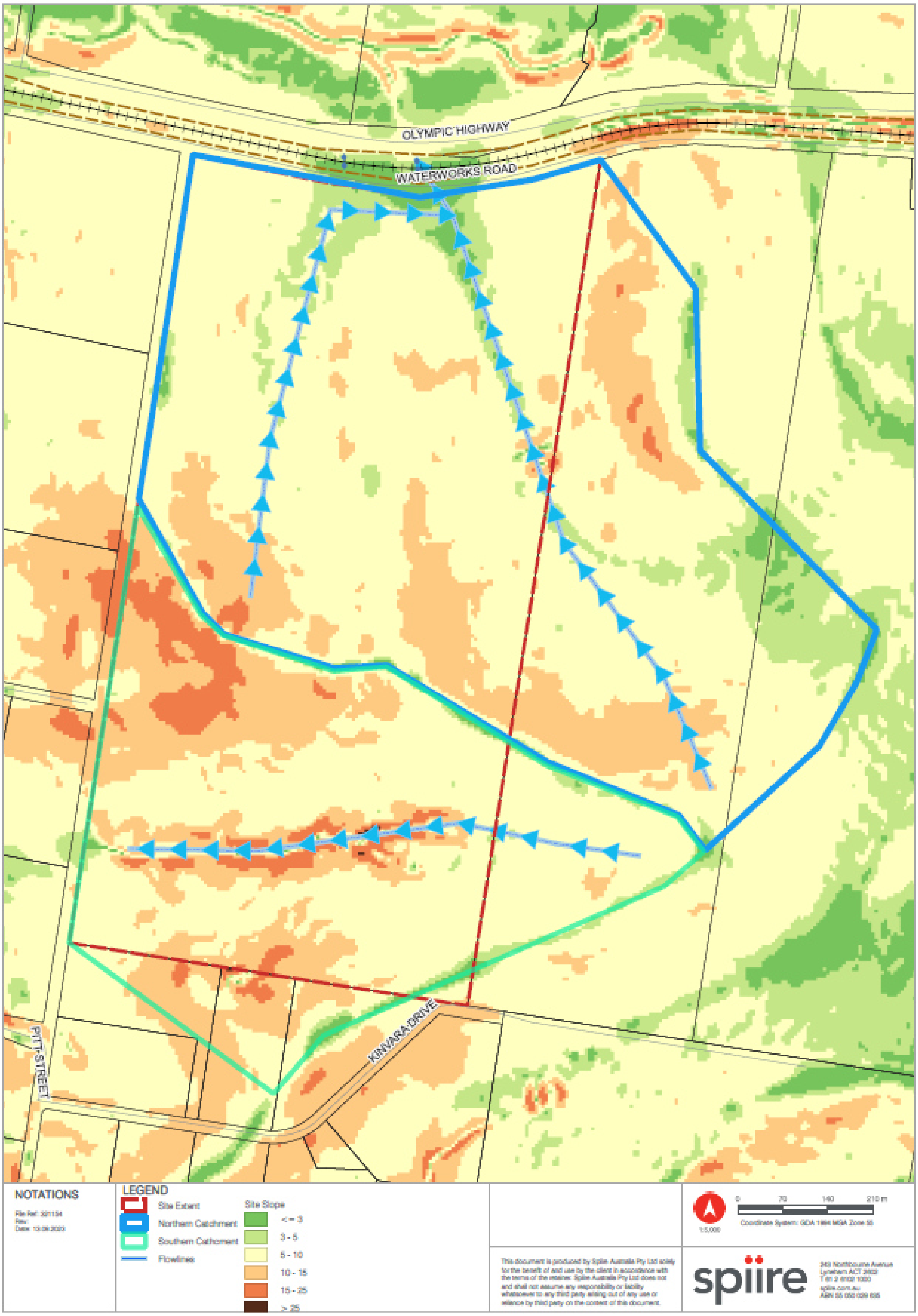


Figure 2: Catchment Description

3.3 HYDROLOGY MODELLING

3.3.1 EXISTING CONDITIONS

The site naturally drains in two directions, which form the northern catchment (blue) and the southern catchment (green), as displayed in Figure 3 which shows the RORB Model catchment delineation. A more detailed catchment plan is presented in Appendix A.

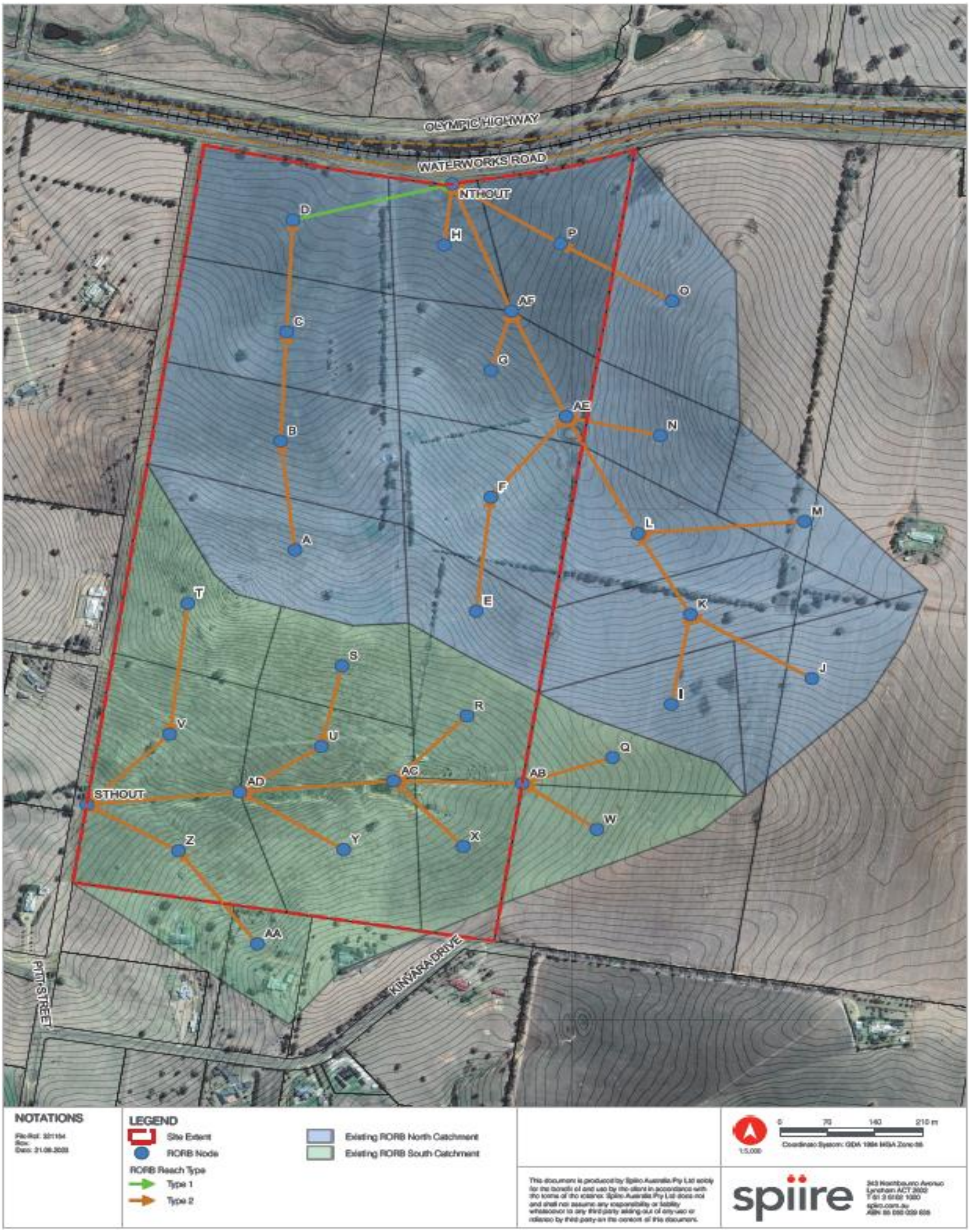


Figure 3: Existing Conditions RORB Catchment Plan

The two sub catchments were modelled using the hydraulic design program RORB in accordance with the Australian Rainfall Runoff (ARR) 2019 methodology. RORB reach types 1 and 2 were used to model all reaches due to the slope of the site.

In accordance with ARR2019 guidelines, an ensemble simulation was used to calculate the median flow plus 1 as the critical event. The rainfall temporal patterns were obtained through the ARR Data Hub website on July 26, 2023. The rainfall IFD's data was obtained through the BOM website on July 26, 2023.

Initial and continuing loss values were also obtained through the ARR Data Hub website.

As the subject site falls within the NSW region, the NSW Office of Environment and Heritage (OEH 2019) hierarchical approach to modify the ARR data hub design losses has been applied.

The model was initially run using calculated Kc's from the Regional equation; Eastern NSW (Kleemola), the results do not correlate with the RFFE and Rational values; hence adjustments to Kc were applied instead.

The Kc routing coefficient was modified until the results were closer to the Rational Bransby Williams T_c method's and RFFE model's estimated peak flows; this was to mimic existing flow conditions.

Parameters used in the RORB model are presented below in Table 1.

Table 1: Pre-developed RORB model parameters

Parameter		Value
Loss Parameters	1% AEP Initial Loss (mm)	*27
	20%AEP Initial Loss (mm)	*27
	Continuing Loss (mm/hr)	1.8
RORB runoff routing parameters	m	0.8
	Kc (North)	1.30
	Kc (South)	1.35
Catchment Fraction Impervious		0.05

**ARR datahub values – RORB model was set to factor in OEH 2019 recommended Probability Neutral Bust Initial Loss*

The results of the analysis were compared to the rational method calculation using a Bransby Williams T_c and the RFFE model. The results of the different methods are also presented in Table 2 below.

Table 2: RORB model Comparison (existing site 1% AEP peak flows)

Catchment	Design Event	RFFE	Rational (Bransby Williams)	RORB
North	**1%AEP Flow (m^3/s)**	5.49	5.71	5.63
South	**1%AEP Flow (m^3/s)**	3.32	3.57	3.40

All three methodologies produced similar results; therefore, the model was deemed fit for use.

3.3.2 PROPOSED CONDITIONS

Information on the future development masterplan was not available at the time of this assessment, assumptions were made to allow hydrological analysis for the developed condition. A detailed developed catchment plan is presented in Appendix B.

The assumptions are as follows:

- All areas within the site boundary are to be in developed conditions.
- Fraction impervious, FI = 0.65
- Developed catchment delineations are similar to the predeveloped condition.
- Catchments outside the site boundary to remain undeveloped and contribute to the overall catchment flows.
- Parameters used in the Developed condition RORB model are presented below in Table 3.

Table 3: Developed condition RORB model parameters

Parameter		Value
Loss Parameters	1% AEP Initial Loss (mm)	*27
	20%AEP Initial Loss (mm)	*27
	Continuing Loss (mm/hr)	1.8
RORB runoff routing parameters	m	0.8
	Kc (North)	1.30
	Kc (South)	1.35
Developed Catchment Fraction Impervious		0.65
Undeveloped External Catchment Fraction Impervious		0.05

**ARR datahub values – RORB model was set to factor in OEH 2019 recommended Probability Neutral Bust Initial Loss*

The model was iteratively run with a detention basin until the predeveloped flow for the site was achieved for both the 1% and 20% AEP events. The results of this analysis as well as the proposed basin size are presented in Tables 4 and 5.

The outlet configuration for the detention basin was assumed to be 4 x 900mm DIA pipe (North WL) and a 3 x 900mm DIA pipe (South WL).This was sized to choke the flows back to the predeveloped values for both the major (1%) and minor (20%) events.

Table 4: North Catchment Developed Model Results

NORTH CATCHMENT	20%AEP	1%AEP
Predeveloped Flow	2.17 m^3/s	5.63 m^3/s
Developed Unattenuated Flow	7.72 m^3/s	17.56 m^3/s
Developed Attenuated Flow	2.09 m^3/s	5.31 m^3/s
Basin Storage Volume	12,500 m^3	23,000 m^3

Table 5 South Catchment Developed Model Results

SOUTH CATCHMENT	20%AEP	1%AEP
Predeveloped Flow	1.31 m^3/s	3.40 m^3/s
Developed Unattenuated Flow	5.31 m^3/s	12.00 m^3/s
Developed Attenuated Flow	1.26 m^3/s	2.95 m^3/s
Basin Storage Volume	7,300 m^3	14,000 m^3

Figure 4 shows the proposed indicative location of the Northern and Southern Wetland Retarding Basins.

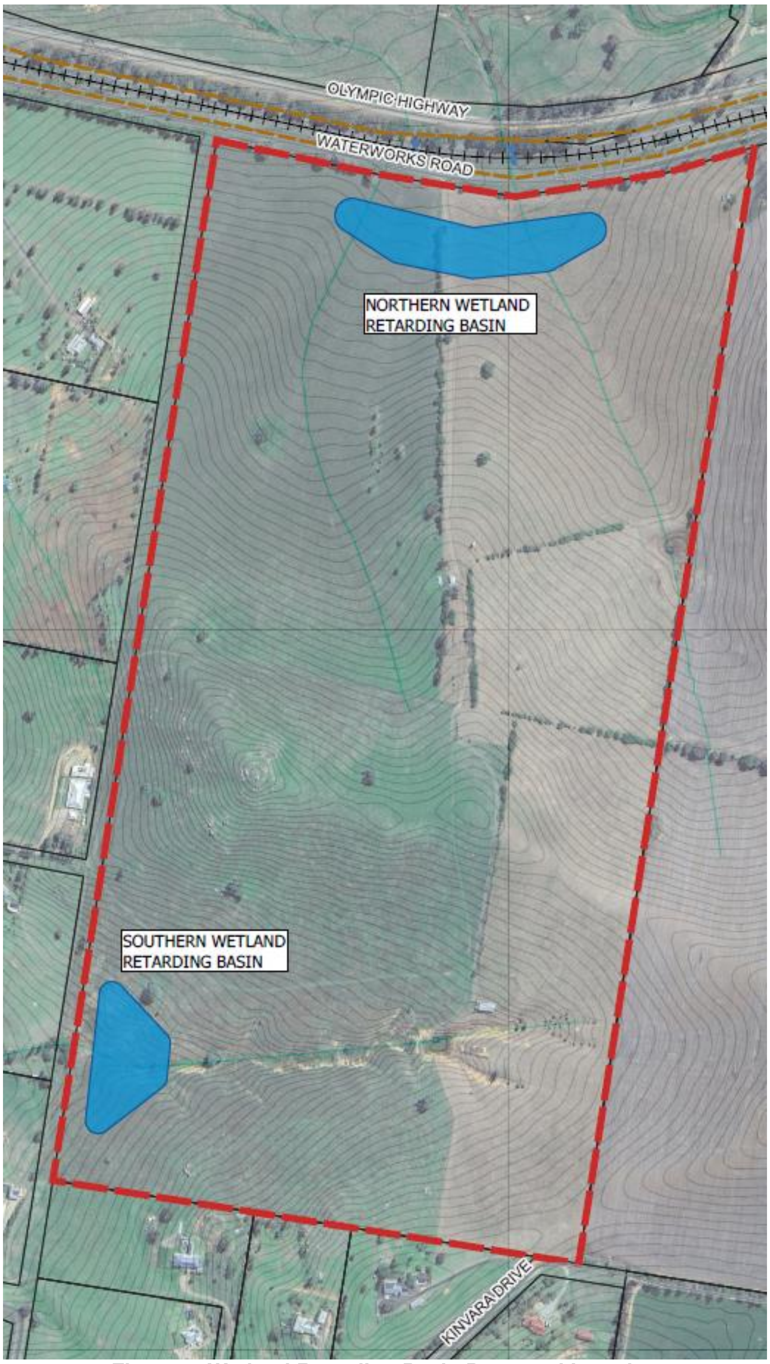


Figure 4: Wetland Retarding Basin Proposed Location

3.3.3 EXTERNAL FLOWS

3.3.3.1 Northern Catchment

External flows entering the eastern boundary of the site in the 20% AEP event was calculated at 2.53m^3/s. At this flowrate, future road drainage network can convey this with a minimum size of 1200mm diameter pipe.

3.4 SUMMARY

- Increased flows to the northern and southern catchments due to development can be managed by retarding basins initially sized at 23,000 m^3 and 14,000 m^3 respectively.
- Initial sizing is based on the scenario that the whole area of the land will be fully developed; basin sizing may change once a development plan is available.

4. STORMWATER QUALITY

4.1 REQUIREMENTS & OBJECTIVES

Stormwater quality policies and guidelines are not currently available at the local council. In lieu of this, Spiire has adopted the relevant available guidelines.

NSW's MUSIC Modelling Guidelines 2015 were adopted to assess the stormwater quality of the proposed rezoning area.

Target load-based reductions are based on *Sydney Water's Stormwater Quality Targets Policy 2021,* which are as follows:

- 85% reduction in the annual load of Total Suspended Solids (TSS)
- 60% reduction in the annual load of Total Phosphorus (TP)
- 45% reduction in the annual load of Total Nitrogen (TN)
- 90% reduction in the annual Gross Pollutants (GP)

4.2 DESIGN PARAMETERS

A summary of design parameters for modelling catchments in MUSIC is provided in Table 6.

Table 6: General soil parameters

MUSIC Parameter	Value
Developed Fraction impervious	0.65
Soil storage capacity	*142 mm
Field capacity	*94 mm

**NSW MUSIC Guidelines 2015 Table 5-5*

The overall parameters used in modelling the sediment pond and wetland nodes in MUSIC are provided in Table 7.

Table 7: Node design parameters

MUSIC Parameter	Design Criteria
Design flow	$Q_{20\%}$
Extended detention depth (EDD)	350 mm
Detention Period	72 Hours

4.3 DRAINAGE ASSET SIZING

Sediment ponds and Wetland retarding basins were modelled for each catchment. Figure 5 shows the MUSIC model diagram used for the northern catchment and Figure 6 shows the southern catchment.

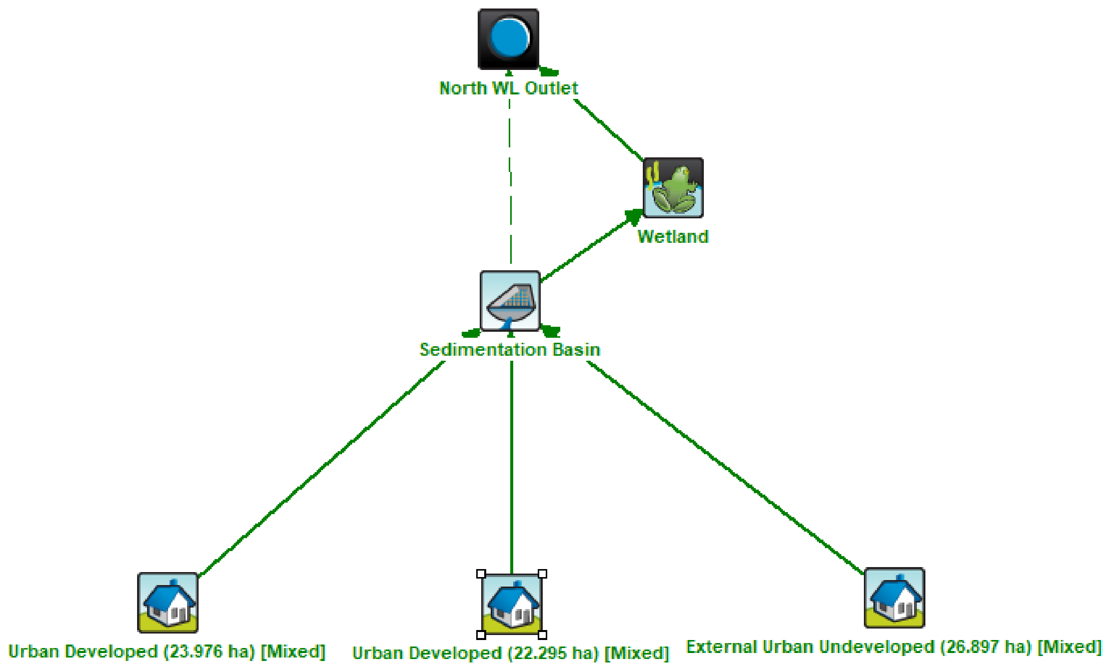


Figure 5: MUSIC modelling diagram – Northern Catchment

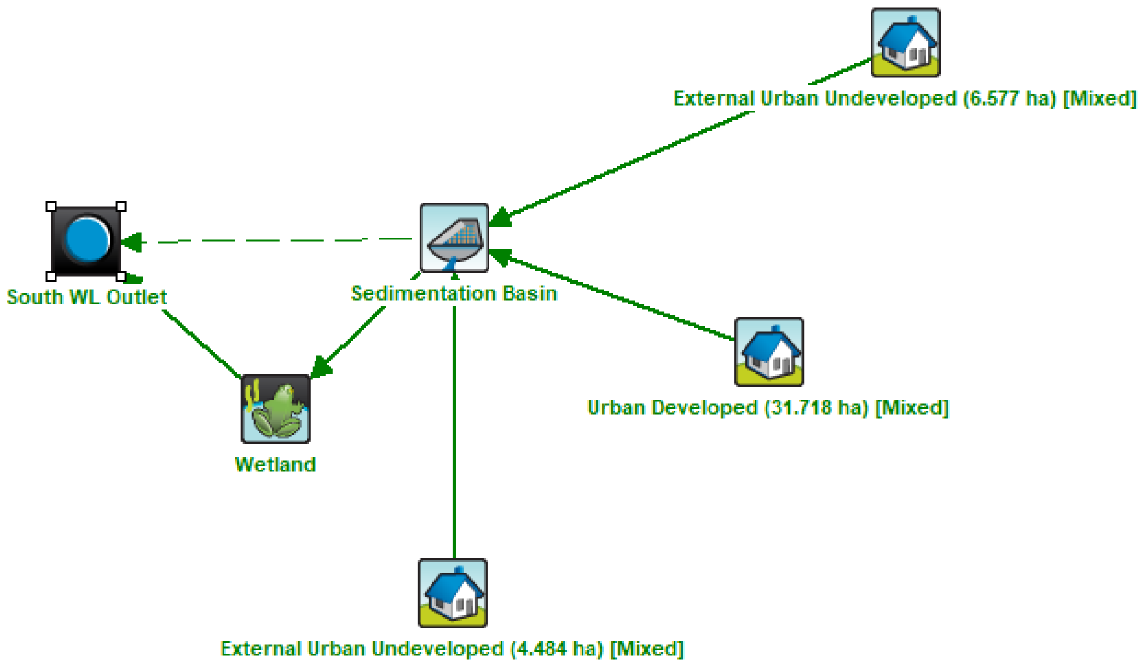


Figure 6: MUSIC modelling diagram – Southern Catchment

The drainage assets were sized in MUSIC to achieve best practice targets. A summary of the drainage asset sizes is provided in Table 8. Note that further refinement of the design parameters when development plans are available could potentially change the size.

Table 8: Drainage asset size summary

Drainage Asset	Area at NWL (m^2)
North Sediment Pond	1,260
North Wetland Retarding Basin	15,400
South Sediment Pond	990
South Wetland Retarding Basin	10,450

4.4 RESULTS

Results of the MUSIC model for the total treatment train for 192 Waterworks Road are shown below in Table 9 and Table 10 below.

Table 9: North Wetland Retarding System

	Sources	Residual Load	% Reduction	Criteria Met?
Total suspended solids (kg/year)	28,300	3,830	86	Yes
Total phosphorous (kg/year)	46.8	13.8	70	Yes
Total nitrogen (kg/year)	348	191	45	Yes
Gross pollutants (kg/year)	5,900	0	100	Yes

Table 10: South Wetland Retarding System

	Sources	Residual Load	% Reduction	Criteria Met?
Total suspended solids (kg/year)	19,100	2,600	86	Yes
Total phosphorous (kg/year)	31.1	9.11	70	Yes
Total nitrogen (kg/year)	235	128	45	Yes
Gross pollutants (kg/year)	4,090	0	100	Yes

The above results show that all targets have been met; this could potentially be changed when developed conditions are accurately defined.

5. SUMMARY/RECOMMENDATIONS

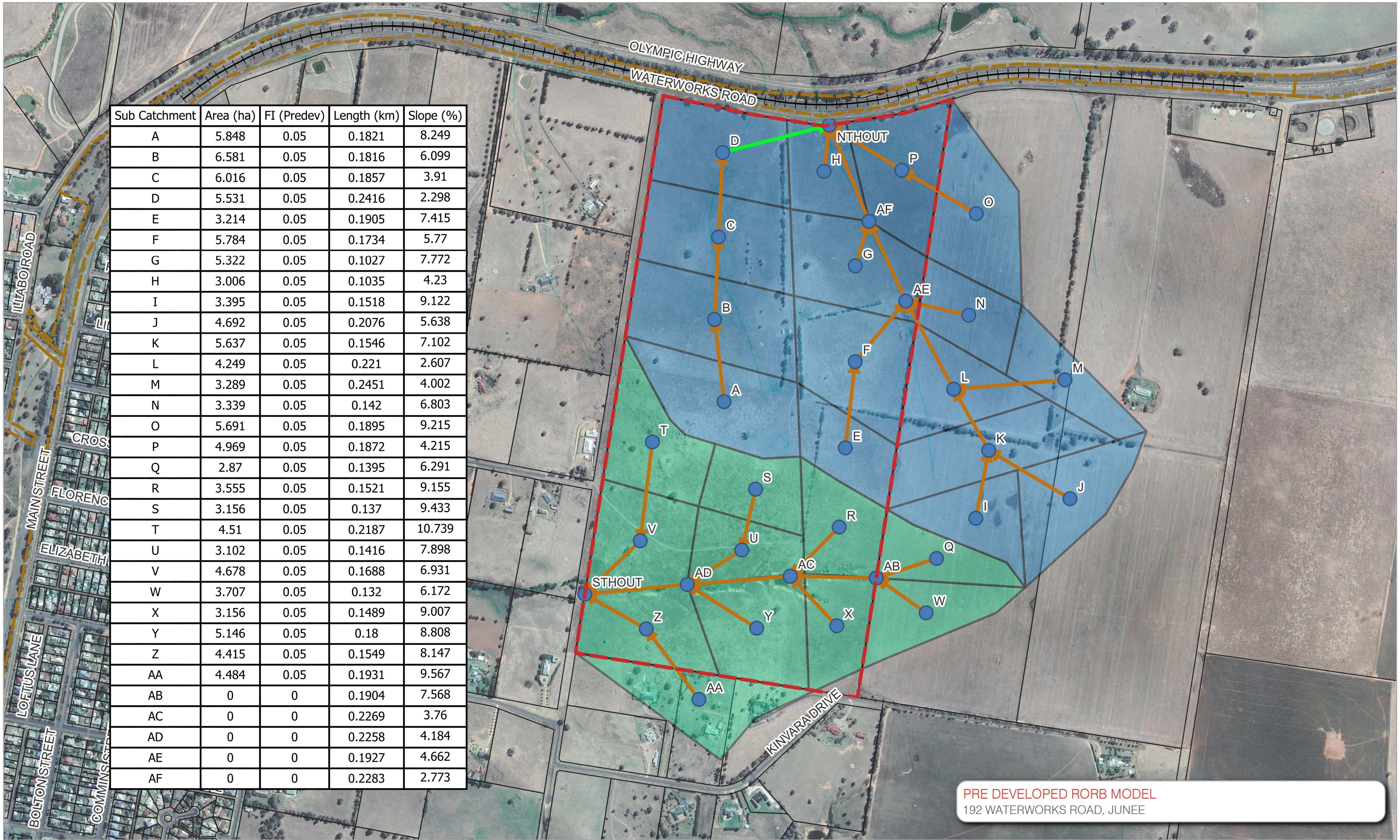
This document provides supporting information regarding stormwater components of the 192 Waterworks Road Junee's rezoning proposal. The primary findings from this report include:

- Identification of attenuated developed peak flows exiting the site.
- Predeveloped external flows entering the site boundary can be conveyed through road drainage network to be sized during future design phases.
- Minimum Wetland Retarding Basin sizing requirements to service future land use.

6. REFERENCES

- Lyall and Associates (2011), Lower Butlers Gully Floodplain Risk Study and Plan Final Report (March 2011)
- Lyall and Associates (2013), Detention Basins on Rocky Creek and Kinvara Overland Flow Path Concept Design Volume 1 Report (October 2013)
- Aitken Rowe (2012), Geotechnical Investigation – Proposed Detention Basin 1, Kinvara Water Course, Cedric Street, Junee, NSW (September 2012).
- NSW, MUSIC *Modelling Guidelines* (August 2015)
- Sydney Water, Stormwater quality targets policy (2021)

APPENDIX A – PRE DEVELOPED CATCHMENT PLAN



Sub Catchment	Area (ha)	FI (Predev)	Length (km)	Slope (%)
A	5.848	0.05	0.1821	8.249
B	6.581	0.05	0.1816	6.099
C	6.016	0.05	0.1857	3.91
D	5.531	0.05	0.2416	2.298
E	3.214	0.05	0.1905	7.415
F	5.784	0.05	0.1734	5.77
G	5.322	0.05	0.1027	7.772
H	3.006	0.05	0.1035	4.23
I	3.395	0.05	0.1518	9.122
J	4.692	0.05	0.2076	5.638
K	5.637	0.05	0.1546	7.102
L	4.249	0.05	0.221	2.607
M	3.289	0.05	0.2451	4.002
N	3.339	0.05	0.142	6.803
O	5.691	0.05	0.1895	9.215
P	4.969	0.05	0.1872	4.215
Q	2.87	0.05	0.1395	6.291
R	3.555	0.05	0.1521	9.155
S	3.156	0.05	0.137	9.433
T	4.51	0.05	0.2187	10.739
U	3.102	0.05	0.1416	7.898
V	4.678	0.05	0.1688	6.931
W	3.707	0.05	0.132	6.172
X	3.156	0.05	0.1489	9.007
Y	5.146	0.05	0.18	8.808
Z	4.415	0.05	0.1549	8.147
AA	4.484	0.05	0.1931	9.567
AB	0	0	0.1904	7.568
AC	0	0	0.2269	3.76
AD	0	0	0.2258	4.184
AE	0	0	0.1927	4.662
AF	0	0	0.2283	2.773

PRE DEVELOPED RORB MODEL
192 WATERWORKS ROAD, JUNEE

NOTATIONS

File Ref: 321154
Rev:
Date: 23.08.2023

LEGEND

Site Extent
RORB Node
RORB Reach Type
Type 1
Type 2
Existing RORB North Catchment
Existing RORB South Catchment

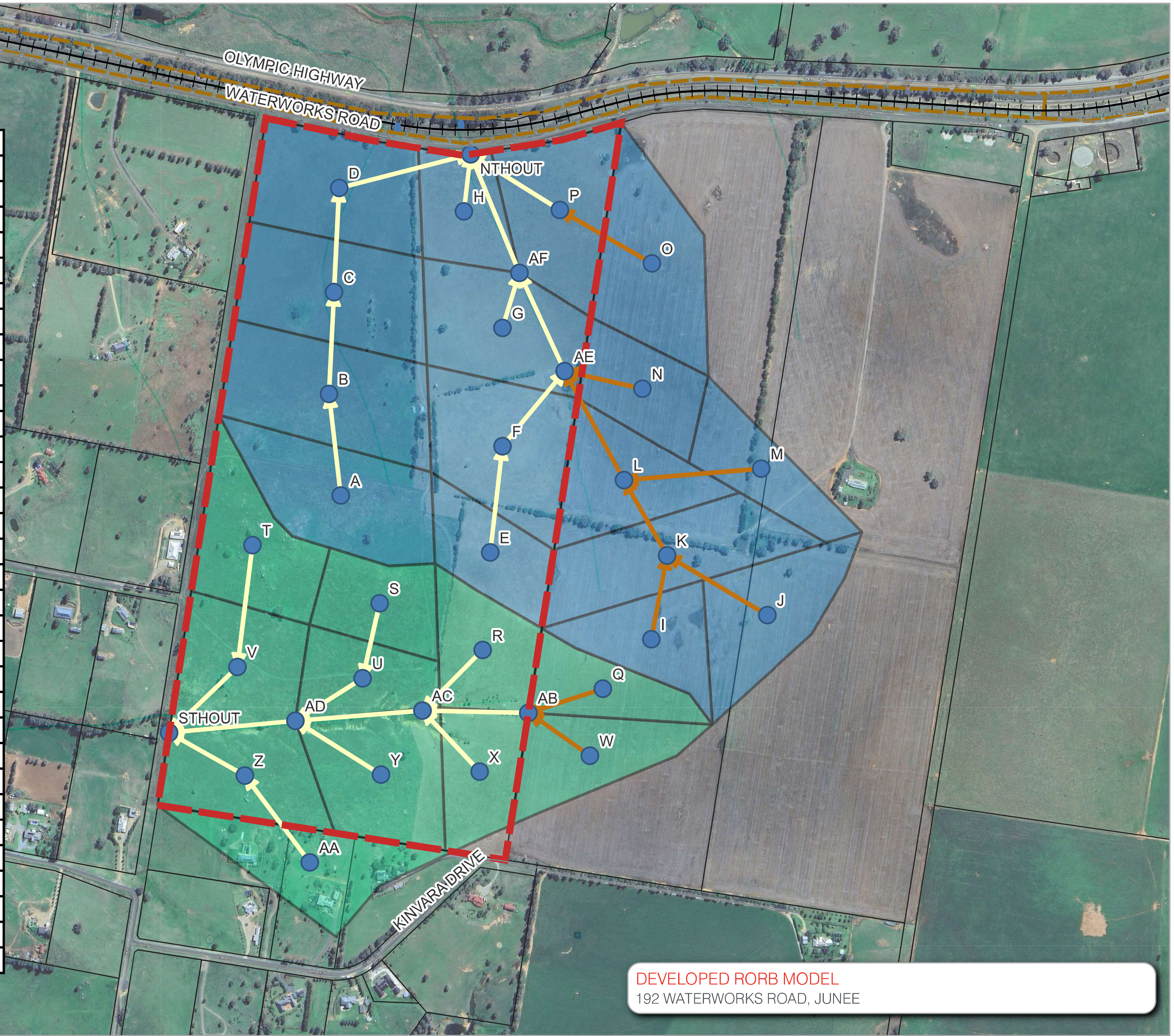
0 110 220 330 m

1:7,516.915906 Coordinate System: GDA 1994 MGA Zone 55

spiire
243 Northbourne Avenue
Lyneham ACT 2602
T 61 2 6102 1000
spiire.com.au
ABN 55 050 029 635

APPENDIX B – DEVELOPED CATCHMENT PLAN

Sub Catchment	Area (ha)	FI (Dev)	Length (km)	Slope (%)
A	5.848	0.65	0.1821	8.249
B	6.581	0.65	0.1816	6.099
C	6.016	0.65	0.1857	3.91
D	5.531	0.65	0.2416	2.298
E	3.214	0.65	0.1905	7.415
F	5.784	0.65	0.1734	5.77
G	5.322	0.65	0.1027	7.772
H	3.006	0.65	0.1035	4.23
I	3.395	0.05	0.1518	9.122
J	4.692	0.05	0.2076	5.638
K	5.637	0.05	0.1546	7.102
L	4.249	0.05	0.221	2.607
M	3.289	0.05	0.2451	4.002
N	3.339	0.05	0.142	6.803
O	5.691	0.05	0.1895	9.215
P	4.969	0.65	0.1872	4.215
Q	2.87	0.05	0.1395	6.291
R	3.555	0.65	0.1521	9.155
S	3.156	0.65	0.137	9.433
T	4.51	0.65	0.2187	10.739
U	3.102	0.65	0.1416	7.898
V	4.678	0.65	0.1688	6.931
W	3.707	0.05	0.132	6.172
X	3.156	0.65	0.1489	9.007
Y	5.146	0.65	0.18	8.808
Z	4.415	0.65	0.1549	8.147
AA	4.484	0.05	0.1931	9.567
AB	0	0	0.1904	7.568
AC	0	0	0.2269	3.76
AD	0	0	0.2258	4.184
AE	0	0	0.1927	4.662
AF	0	0	0.2283	2.773



DEVELOPED RORB MODEL
192 WATERWORKS ROAD, JUNEE

NOTATIONS

File Ref: 321154
Rev:
Date: 04.10.2023

LEGEND

Site Extent
RORB Node
DEVELOPED RORB Reach
Type 2
Type 3
Developed RORB North Catchment
Developed RORB South Catchment

0 110 220 330 m

1:7,516.915906 Coordinate System: GDA 1994 MGA Zone 55

spiire
243 Northbourne Avenue
Lyneham ACT 2602
T 61 2 6102 1000
spiire.com.au
ABN 55 050 029 635