

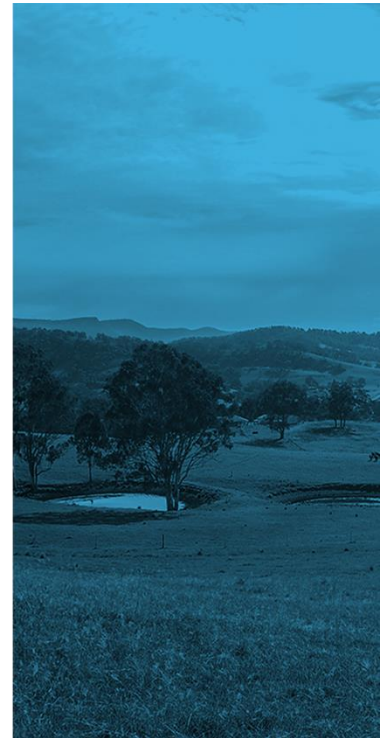
Integrated Water Cycle Management Report

Tranche 5 DA05a

Mirvac Residential

Lot 4 & 6 in DP 1276275

No. 589 & 593 Cobbitty Road, COBBITTY



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Effective Date: 18/05/2023

Document Control

Revision	Prepared	Reviewed	Approved	Date	Description	Project Reference
A	Hewad Shinwari	Christopher Scholes	Mariano Polisciuk	18/05/2023	Issued for DA	23-0088-01

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Executive Summary

This report has been prepared by Orion Consulting (Orion) for Mirvac Homes (NSW) Pty Limited (Mircvac) to support the development application for the site known as No. 589 & 593 Cobbitty Road, Cobbitty, located within the Oran Park release area. This report is to be read in conjunction with the Road and Drainage Civil Engineering Plans as prepared by Orion Consulting (Job Reference 23-0088-01) for the proposed development.

This report demonstrates that the current proposed integrated water cycle management strategy meets the stormwater management and water sensitive urban design requirements as specified by Camden Council and other regulating authorities for this proposed development application.

1 Introduction

1.1 Site Description

The subject site is located within Camden Council LGA, approximately 3km South West of the new Oran Park town centre. The proposed development led by Mirvac comprises approximately 8.45 hectares in area with site extents shown in the figure below.

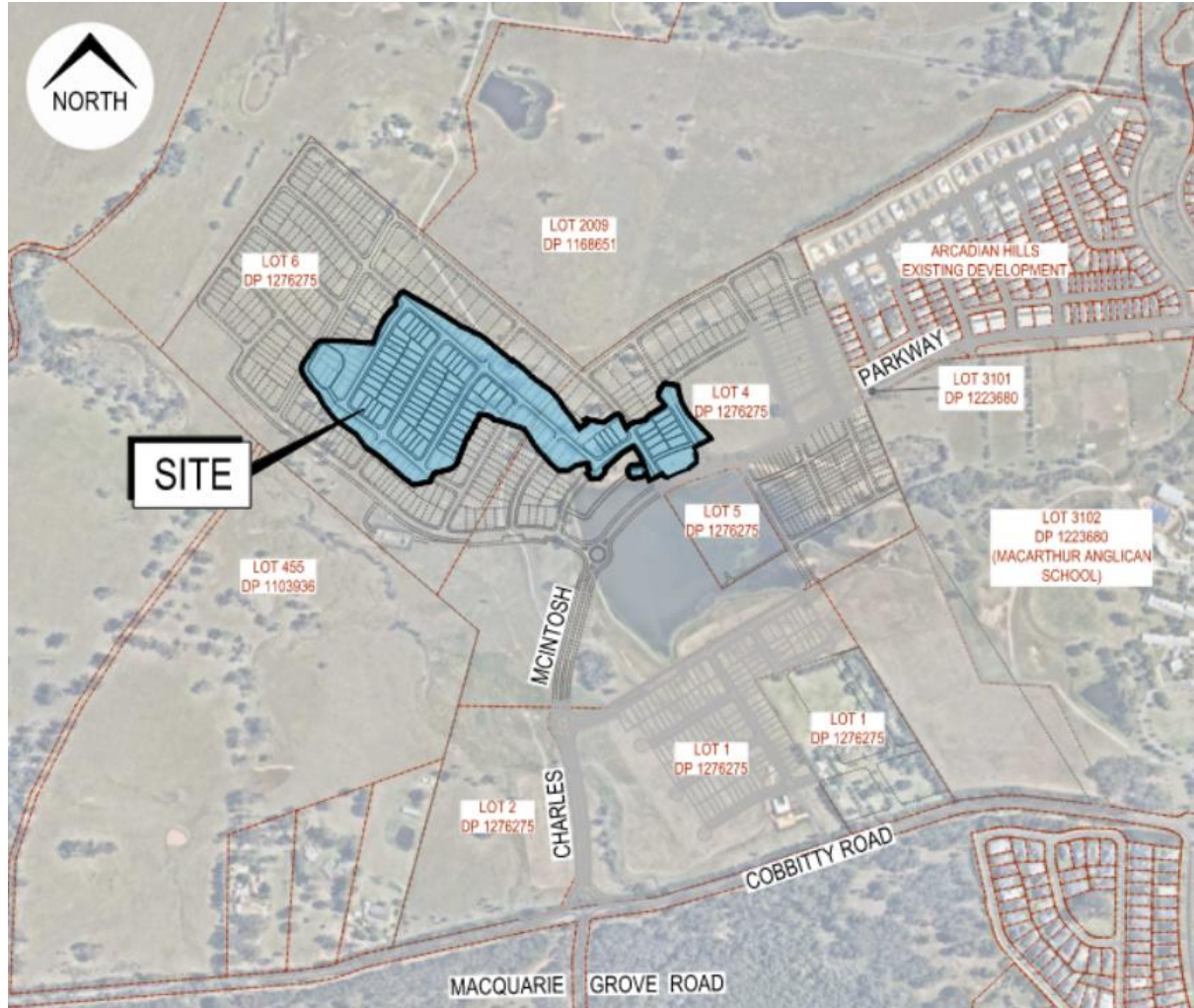


Figure 1 – Site Extents (Imagery courtesy of Nearmap ©)

The site is bordered by a proposed development to the east (DA 2023/215/1, Orion ref: 21-0258-13), rural properties and farmland to the West and North and No 581 Cobbitty Rd to the south.

1.2 The Proposed Development

As a part of the development, Mirvac are proposing to provide the following:

- To provide temporary integrated water cycle management control facilities to ensure performance objectives are met for the proposed development footprint to facilitate the development of;
- 85 residential lots.

1.3 Objectives

The purpose of this report and assessment is to design, establish and present the integrated water cycle management strategy proposed for this development submission, including the following:

- Stormwater management controls that meet the intent of the Oran Park Development Control Plan (DCP).
- Water Sensitive Urban Design (WSUD) to meet the requirements of the DCP for the post-development percentage reduction targets for total suspended solids, phosphorus, nitrogen and gross pollutants.
- Implementation of a temporary water quality treatment train for water quality control.

1.4 Study Methodology

The study methodology is in two distinct components; water quantity assessment and water quality or WSUD controls.

1.4.1 Water Quantity Methodology

- Development of overall catchment plans encompassing the whole study area with clear structure for a suitable rainfall-runoff-routing hydrologic model. The overall catchment mapping is consistent with the Tranche 3 Stage 1 approved IWCM Report under DA2022/176 and associated SWC Approval (Orion Consulting, job ref 21-0258-03, REV C, dated 15th September 2022).
- Post development catchment plans developed to consider the adjoining proposed development to the east under DA 2023/215/1 (Orion reference 21-0258-13) as well as the proposed development.

1.4.2 Water Quality Methodology

- Development of a detailed catchment plan encompassing a breakdown of total lots and proposed land use by sub-catchment.
- Development of a MUSIC Model (Model for Urban Stormwater Improvement Conceptualisation) for the developed scenario to determine the temporary treatment train requirements to achieve the percentage reduction targets.

2 Adopted Information

2.1 Integrated Water Cycle Management Report (Orion Consulting, job ref 21-0258-03, REV C, dated 15/09/2022)

A previous IWCN report has been prepared by Orion Consulting detailing the water cycle requirements for Tranche 3 Stage 1, to the north of this proposed development.

The basis for the catchment mapping, hydrological assessment and water quality assessment have been adopted from this study to assess the current proposal.

A key difference between studies is that the previous report adopted WBNM the hydrological model to assess the water quantity requirements of the proposed development.

2.2 Integrated Water Cycle Management Addendum Report to approved DA2022/176/1 for SWC Approval (Orion Consulting, job ref 21-0258-09, REV A, dated 31/01/2022)

An addendum report has been prepared in addition to the Tranche 3 Stage 1 DA report discussed above. The addendum report adopts a DRAINS-RAFTS hydrological model to determine the water quantity requirements. This study has adopted the DRAINS-RAFTS model utilised in the addendum report.

3 Hydrology – DRAINS-RAFTS

3.1 Catchment Delineation

The following catchments have been delineated for the Pre-Developed DRAINS-RAFTS Hydrological model.

The figure below shows an extract of the pre-developed scenario catchment plan and can be found in full in Appendix A.

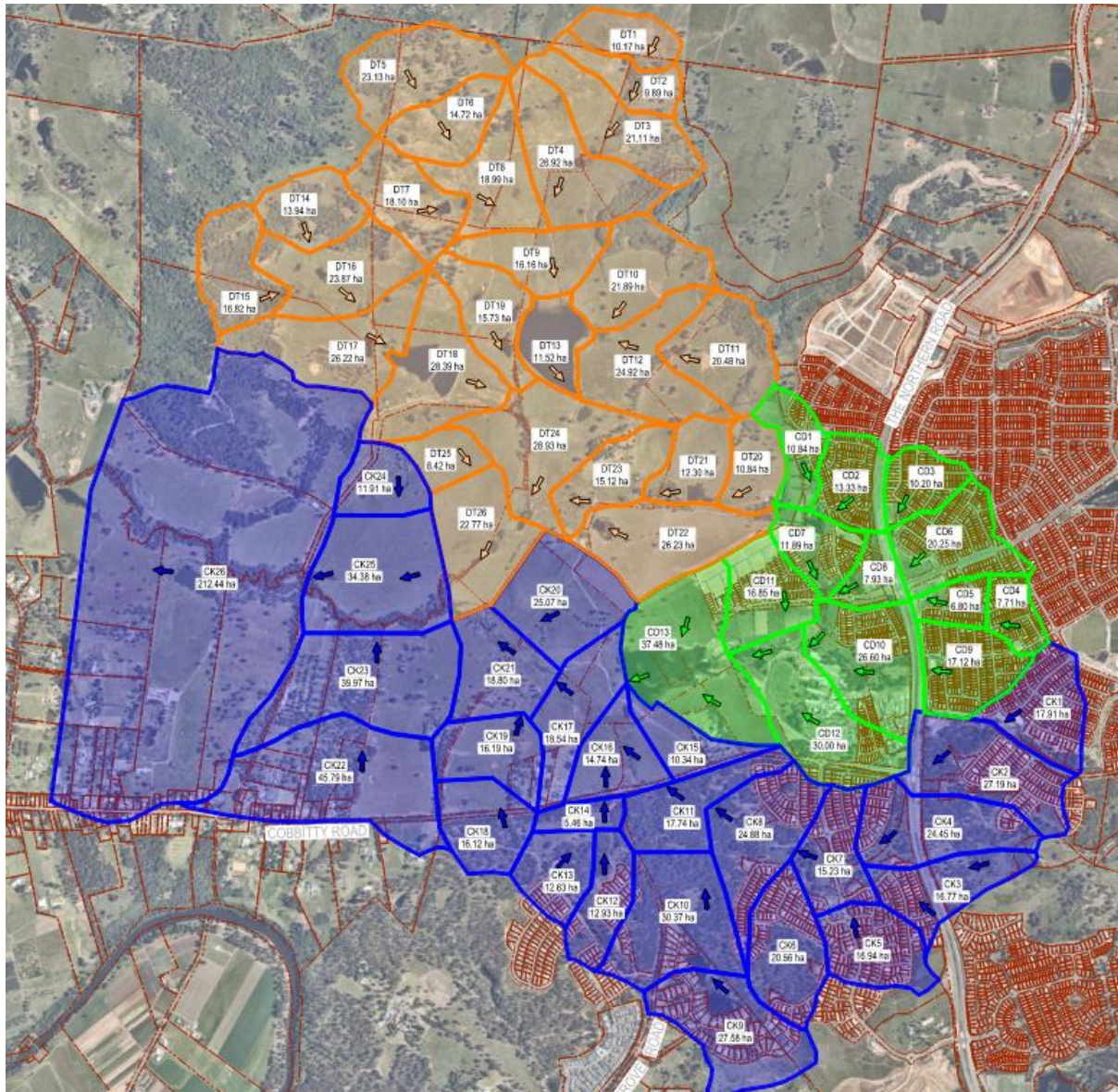


Figure 2 - Pre-Developed Scenario Catchment Plan

The pre-developed scenario catchment delineation is adjusted to suite the proposed civil engineering works. The figure below shows an extract of the post developed scenario catchment plan and can be found in full in Appendix A.

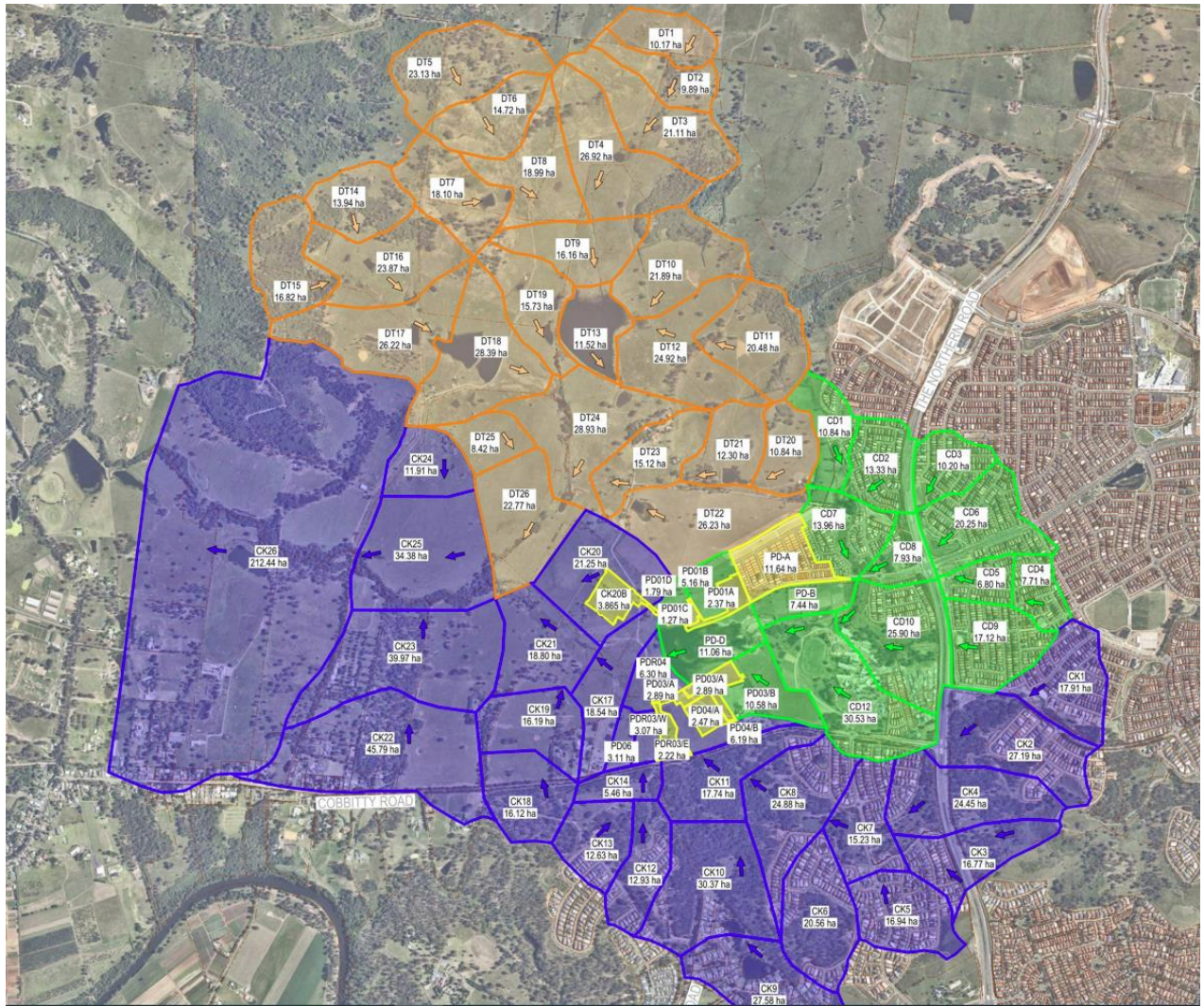


Figure 3 - Post-Developed Scenario Catchment Plan

Catchment CK20 has been split into 2 catchments; CK20 which remains undeveloped and CK20B which forms a part of the site. Both of these catchments leads to temporary basin T5.1. Furthermore, catchment PD01D has been created, acting as an external catchment to PD01C. Both of these catchments lead to the existing farm dam. PD01B

3.2 Modelling Parameters

3.2.1 Rainfall Data

ARR1987 Rainfall data was extracted from the Nepean River Tributaries study (Cardno, 2022) for the DRAINS RAFTS model. The coefficients adopted for rainfall and storm event generation are shown in Table 1 below:

Table 1 - ARR1987 Rainfall Data Coefficients

Coefficient	Value
2 Year ARI, 1 Hour Intensity	29.7 mm/hr
2 Year ARI, 12 Hour Intensity	6.36 mm/hr
2 Year ARI, 72 Hour Intensity	1.86 mm/hr
50 Year ARI, 1 Hour Intensity	59.9 mm/hr
50 Year ARI, 12 Hour Intensity	13.0 mm/hr
50 Year ARI, 72 Hour Intensity	4.06 mm/hr
F2 Factor	4.29
F50 Factor	15.78
Skew	0.02

3.2.2 Soil Loss Model

To account for soil infiltration losses an Initial Loss - Continuing Loss (ILCL) model was with the parameters shown in Table 2 below:

Table 2 - Soil Loss Model Parameters

Parameter	Loss
Initial Loss (pervious)	15 mm
Continuing Loss (pervious)	2.5 mm/hr
Initial Loss (impervious)	1.0 mm
Continuing Loss (impervious)	0 mm/hr

3.2.3 Lag Parameters

For the DRAINS-RAFTS Model the Bx factor was left at **1.0**

3.2.4 Calibration

Discussion of model calibration is contained within the Orion Consulting reports IWCM Report under DA2022/176 (Orion Consulting, job ref 21-0258-03, REV C, dated 15th September 2022) and Integrated Water Cycle Management Addendum Report to approved DA2022/176/1 for SWC Approval (Orion Consulting, job ref 21-058-09, REV A, dated 31/01/2023).

3.3 Post Developed Scenario Management Strategy

On-Site Stormwater Detention Control Measures are proposed as follows. Two temporary basins, T5.1 and T5.2, have been designed to accommodate for the increase in the developed area. Basin T5.1 is positioned to the west of the site and is significantly larger in size than basin T5.2, which is located to the east of the site. Basin T5.2 is not an OSD basin. Basin T5.2 leads out into the farm dam, which is being used as an OSD. The table below summaries the proposed development.

Table 3 – On-Site Stormwater Detention Facilities

Outlet / Catchment	Control Measures (Orion DA)
CK20B - Developed Catchment (Same as T5.1 Basin for Music Modelling Catchment labelling purposes)	Temporary OSD Basin Low Flow Outlet: Ø 300mm pipe RL 68.8 High Flow Outlet 1.8m Wide Weir RL 70.5 (cut into DCP)
Existing Farm Dam – online to existing stream	Storage above permanent water level. Weir 1: 2.3m wide @ RL73.5 Weir 2: 5.5 wide @ RL 74.85

3.3.1 On-Site Stormwater Detention Performance

OSD performance has been measured for the 5, 10, 20, 50 and 100 Year ARI critical duration events at a number of locations within the subject site.

Results have been extracted from several locations. Refer to table below.

Table 4 - Pre vs Post Developed Scenario Flow Summary – Downstream Boundary

Event	Q _{PRE} J12-CK17	Q _{POST} PDR04-CK17	ΔQ CK17 ST
ARI	cu.m/s	cu.m/s	cu.m/s
5	19.7	19.4	-0.3
10	23.8	23.30	-0.5
20	28.96	28.60	-0.36
50	35.2	34.70	-0.5
100	41.7	41.50	-0.2

From the above table the proposed OSD design reduces the post developed flows to below the modelled pre-developed flow rates downstream of the subject site. This model takes into account the existing active storage that the farm dam provides for both pre and post development scenarios.

Table 5 - Pre vs Post Developed Scenario Flow Summary – T5.1 Basin Outlet (Located within Site)

Event	Q _{PRE} CK20	Q _{POST} CK20	ΔQ CK20
ARI (duration)	cu.m/s	cu.m/s	cu.m/s
5	1.54	1.50	-0.04
10	1.80	1.74	-0.06
20	2.23	2.12	-0.11
50	2.65	2.63	-0.02
100	3.16	3.15	-0.01

Table 6 - Pre vs Post Developed Scenario Flow Summary – Cobbitty Creek CK21

Event	Q _{PRE} CK21-J17	Q _{POST} CK21-J17	ΔQ CK21-J17
ARI (duration)	cu.m/s	cu.m/s	cu.m/s
5	23.20	22.50	-0.70
10	27.90	26.80	-1.10
20	33.80	32.70	-1.10
50	40.80	39.60	-1.20
100	48.30	47.40	-0.90

Table 7 - Pre vs Post Developed Scenario Flow Summary – Farm Dam Outlet

Event	Q _{PRE} CD13 OO	Q _{POST} FD Out	ΔQ CD13 OO
ARI (duration)	cu.m/s	cu.m/s	cu.m/s
5	6.18	5.96	-0.22
10	7.72	7.28	-0.44
20	10.10	9.69	-0.41
50	12.60	12.70	0.10
100	15.00	15.80	0.80

Table 8 - Post Developed Scenario - OSD Storage Facility Water Level Summary

T5.1 Temp Basin		
	m(AHD)	Volume (m ³)
Initial Water Level	69.5	-
5 Year ARI	70.27	804.4
10 Year ARI	70.38	996.1
20 Year ARI	70.51	1255
50 Year ARI	70.61	1452.6
100 Year ARI	70.66	1561.2
Top of Bank (Max.) RL	71	

4 Water Quality

The water quality or water sensitive urban design strategy for the proposed development has been determined through the adoption and implementation of a MUSIC model. MUSIC is an industry standard modelling tool to design and size water quality controls subject to a number of water quality assessment criteria.

4.1 Assessment Metrics

The Oran Park Development Control Plan Section 6.2 identifies the following assessment criteria for water sensitive urban design:

Percentage reduction targets:

- Total Suspended Solids (TSS) 85%
- Total Phosphorus (TP) 65%
- Total Nitrogen (TN) 45%
- Gross Pollutants (GP) 90%

4.2 Proposed Treatment Train

The table below summarises the proposed treatment train strategy for the proposed development:

Table 7 - Water Quality Control Treatment Train Strategy

Outlet / Catchment	Control Measures	Comments
T5.1(CK20B)	Temporary GPT and Temporary 350 m ² Conventional Raingarden	Conventional raingarden. 300mm Extended Detention depth with 500mm deep filter media. Temporary only until regional controls established
T5.2 (PD01C)	Temporary GPT and Temporary 100 m ² Conventional Raingarden	Conventional raingarden. 300mm Extended Detention depth with 500mm deep filter media. Temporary only until regional controls established

4.3 Modelling Input Data

Camden Council MUSIC Link version 6.34 was implemented for water quality modelling and assessment.

4.3.1 Sub-Catchment Breakdown

To apply both a conservative and accurate modelling approach sub-catchments and adopted impervious areas were defined by the following method:

- i. Breakdown of the total lot areas into both roof area and supplementary (garden, driveway) areas. Supplementary areas (setbacks/gardens/driveways) were modelled as 65% impervious.
- ii. A conservative estimate of minimum 60% of the lot area (or 600sq.m per roof) has been allowed for the roof area with 50% of the roof area to drain to a rainwater tank. All roof areas were modelled as 100% impervious.

4.3.2 Catchment Areas Summary

The tables below summarises the primary sub-catchment areas and breakdown of land use:

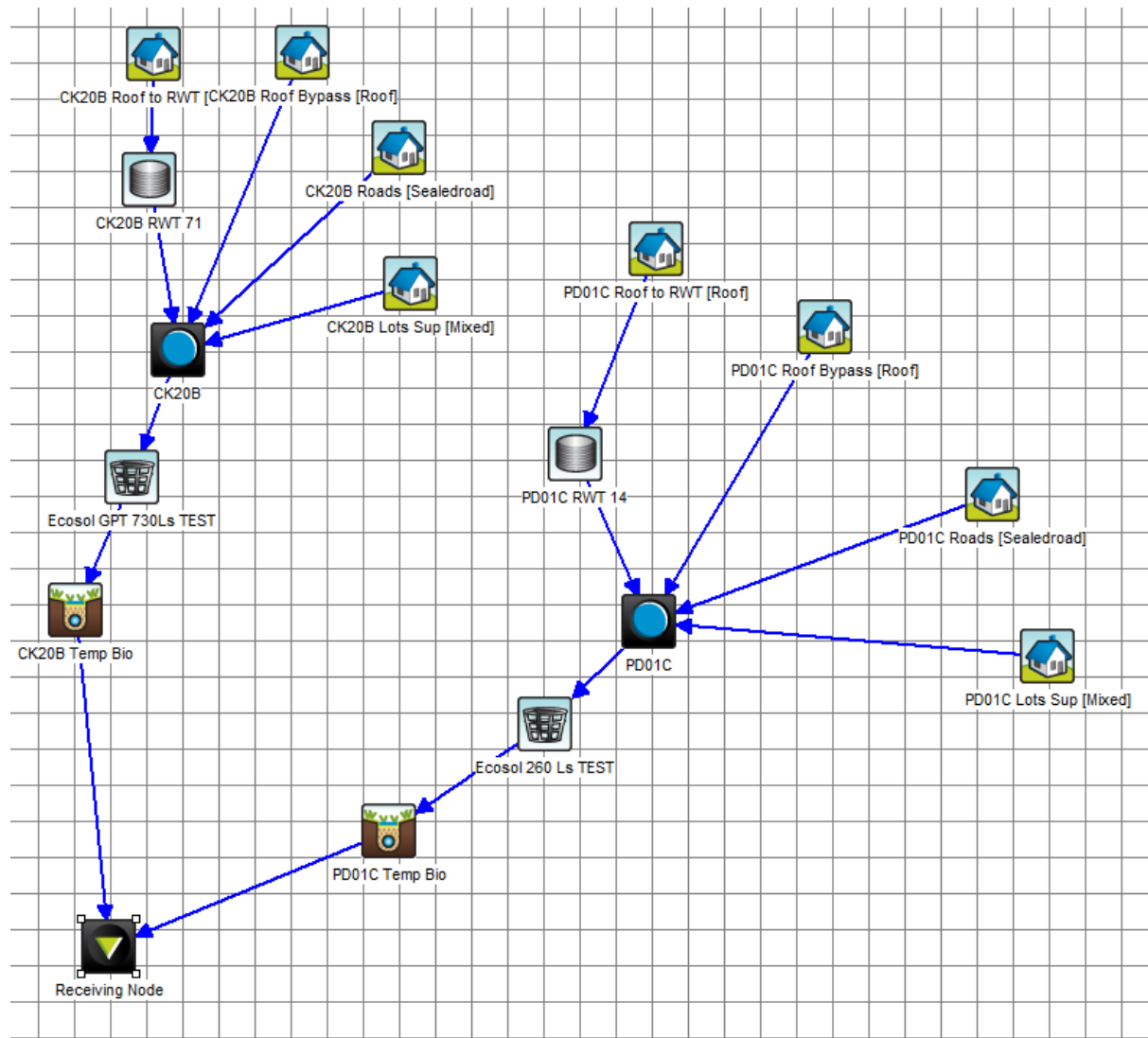
Table 8 - MUSIC Sub-Catchment Summary

	T5.1 (CK20B)	T5.2 (PD01C)
Lot Area (ha)	2.48	0.52
Roof Area (ha)	1.59	0.32
Lot Sup. Area (ha)	0.88	0.2
Roads (ha)	1.46	0.59
Residue revegetated	-	0.16
Total Area (ha)	3.94	1.27

4.3.3 Model Layout

The figure below shows the MUSIC model layout and breakdown and can be reviewed in full in the provided modelling file (.sqz).

Figure 4 - MUSIC Model Layout



4.4 MUSIC Modelling Results

The table below summarises post-developed scenario source and residual pollutant loads as well as the percentage reduction results.

Table 9 - Treatment Train Effectiveness

	Sources	Residual Load	% Reduction	% Target
TSS (kg/yr)	6,180	502	91.9	85
TP (kg/yr)	12.2	3.13	74.4	65
TN (kg/yr)	77.8	35.4	54.4	45
Gross Pollutants (kg/yr)	909	0	100	90

The above table demonstrates percentage reduction targets are achieved with the proposed treatment train and water quality management strategy.

5 Conclusion and Recommendations

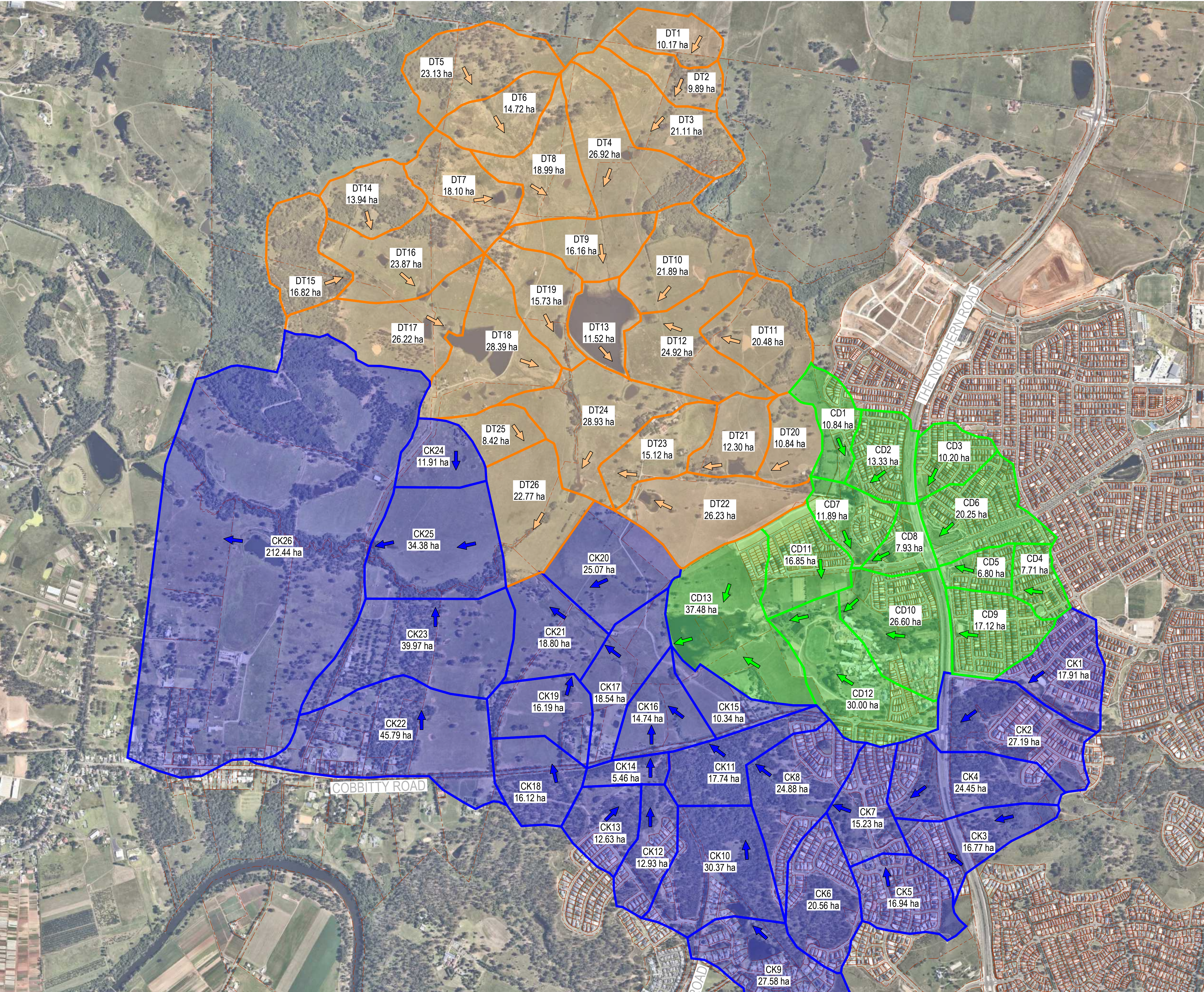
For both water quantity and water quality this report demonstrates that the proposed management strategies reduce downstream peak flows and meet the relevant regulatory requirements for water quality targets. As such, we consider that this integrated water cycle management strategy is suitable to support the development proposal.

A summary of key findings is provided below:

- i. The proposed temporary basin (T5.1) consists of a 300mm diameter outlet pipe as well as a 1.8m wide weir in order to cater for the proposed developed.
- ii. The existing farm dam, as per DA 2023/215/1. Orion reference 21-0258-13, has the capacity to cater for the proposed development.
- iii. The proposed water quality treatment train comprising of rainwater tanks, a GPT and a temporary bioretention system meets the post developed percentage reduction targets as outlined in the Oran Park DCP

We note that the modelling and reporting of this strategy is concept in nature and future stages, under separate approvals, will be subject to further review and refinement as more detailed design of the proposed management methodology is undertaken.

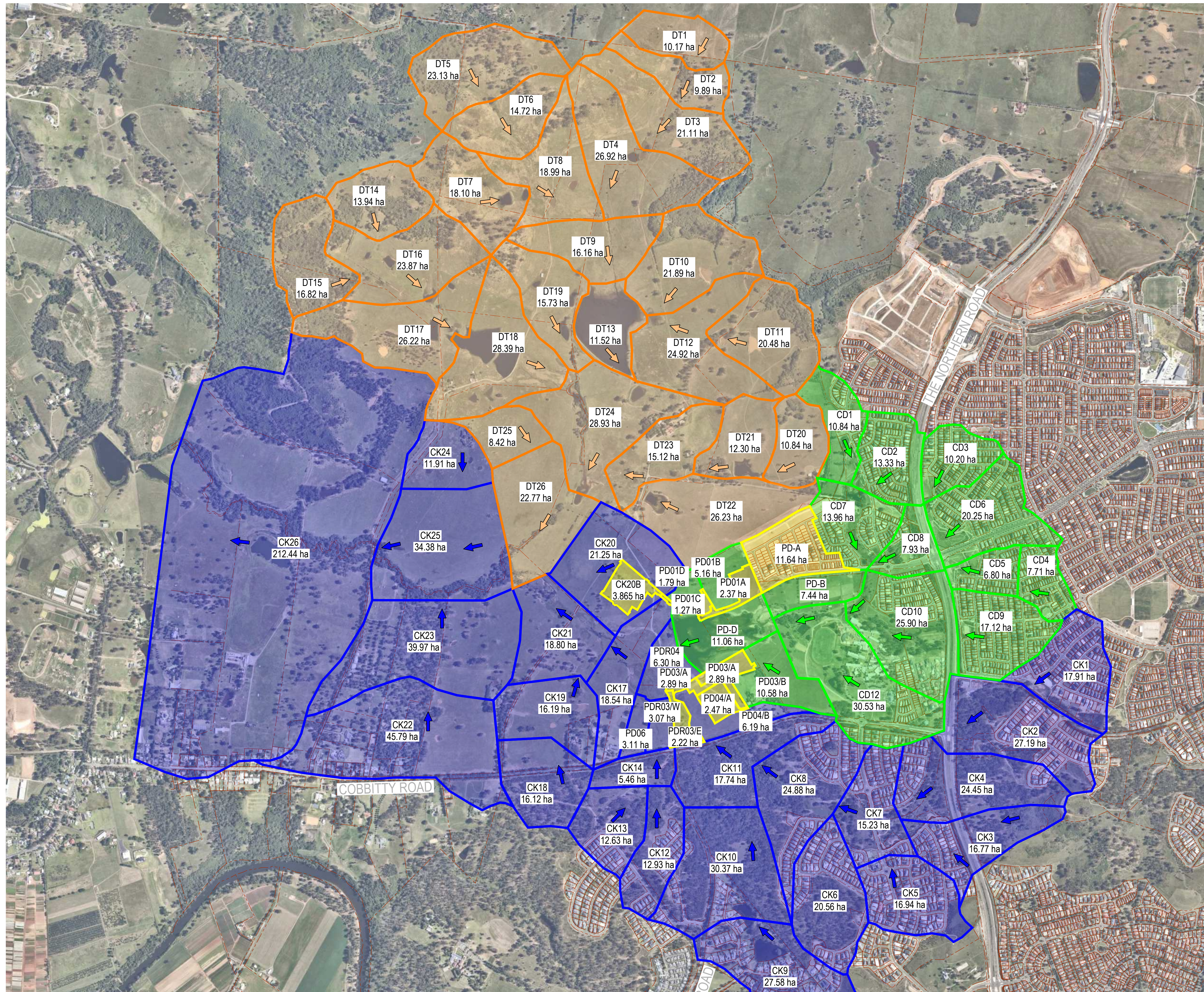
APPENDIX A - Catchment Plans

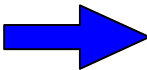
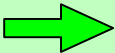


LEGEND	
CATCHMENT NAME, DIRECTION OF FALL & AREA	DESIGN 0.1760ha
COBBITTY DAM CATCHMENTS	
COBBITTY CREEK CATCHMENTS	
DENBIGH TRIBUTARY CATCHMENTS	

ISSUED FOR **DEVELOPMENT APPLICATION**
NOT FOR CONSTRUCTION

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A	WP	CS/SH	MP	AP	17/05/2023	ISSUED FOR DEVELOPMENT APPLICATION						
Rev	Drawn	Design	Check	Appd.	Date	Revision Description						



LEGEND	
CATCHMENT NAME, DIRECTION OF FALL & AREA	DESIGN 0.1760ha 
COBBITTY DAM CATCHMENTS	
COBBITTY CREEK CATCHMENTS	
POST DEVELOPED CATCHMENTS	
DENBIGH TRIBUTARY CATCHMENTS	

ISSUED FOR **DEVELOPMENT APPLICATION**
NOT FOR CONSTRUCTION

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APPENDIX B - MUSIC Link Report



MUSIC-link Report

Project Details		Company Details	
Project:	Mrvac - Cobbitty T5DA5a	Company:	The Orion Group
Report Export Date:	5/9/2023	Contact:	Hewad Shinwari
Catchment Name:	T5 DA05a MUSIC MODEL	Address:	Suite 4.04/12 Century Circuit, Norwest 2153
Catchment Area:	5.05ha	Phone:	(02) 8660 0035
Impervious Area*:	90.67%	Email:	h.shinwari@theoriongroup.au
Rainfall Station:	67035 LIVERPOOL(WHITLAM		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1985 - 31/12/1994 11:54:00 PM		
Mean Annual Rainfall:	783mm		
Evapotranspiration:	1261mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Camden City Council		
Scenario:	Camden City Council		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	Reduction	Node Type	Number	Node Type	Number
Flow	15.6%	Rain Water Tank Node	2	Urban Source Node	8
TSS	91.9%	Bio Retention Node	2		
TP	74.4%	GPT Node	2		
TN	54.4%				
GP	100%				

Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	CK20B Temp Bio	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	CK20B Temp Bio	PET Scaling Factor	2.1	2.1	2.1
Bio	PD01C Temp Bio	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	PD01C Temp Bio	PET Scaling Factor	2.1	2.1	2.1
GPT	Ecosol 260 Ls TEST	Hi-flow bypass rate (cum/sec)	None	99	0.26
GPT	Ecosol GPT 730Ls TEST	Hi-flow bypass rate (cum/sec)	None	99	0.73
Rain	CK20B RWT 71	% Reuse Demand Met	None	None	36.44
Rain	PD01C RWT 14	% Reuse Demand Met	None	None	36.72
Receiving	Receiving Node	% Load Reduction	None	None	15.6
Receiving	Receiving Node	GP % Load Reduction	90	None	100
Receiving	Receiving Node	TN % Load Reduction	45	None	54.4
Receiving	Receiving Node	TP % Load Reduction	65	None	74.4
Receiving	Receiving Node	TSS % Load Reduction	85	None	91.9
Urban	CK20B Lots Sup	Area Impervious (ha)	None	None	0.575
Urban	CK20B Lots Sup	Area Pervious (ha)	None	None	0.304
Urban	CK20B Lots Sup	Total Area (ha)	None	None	0.88
Urban	CK20B Roads	Area Impervious (ha)	None	None	1.390
Urban	CK20B Roads	Area Pervious (ha)	None	None	0.069
Urban	CK20B Roads	Total Area (ha)	None	None	1.46
Urban	CK20B Roof Bypass	Area Impervious (ha)	None	None	0.8
Urban	CK20B Roof Bypass	Area Pervious (ha)	None	None	0
Urban	CK20B Roof Bypass	Total Area (ha)	None	None	0.8
Urban	CK20B Roof to RWT	Area Impervious (ha)	None	None	0.8
Urban	CK20B Roof to RWT	Area Pervious (ha)	None	None	0
Urban	CK20B Roof to RWT	Total Area (ha)	None	None	0.8
Urban	PD01C Lots Sup	Area Impervious (ha)	None	None	0.130
Urban	PD01C Lots Sup	Area Pervious (ha)	None	None	0.069
Urban	PD01C Lots Sup	Total Area (ha)	None	None	0.2
Urban	PD01C Roads	Area Impervious (ha)	None	None	0.561
Urban	PD01C Roads	Area Pervious (ha)	None	None	0.028
Urban	PD01C Roads	Total Area (ha)	None	None	0.59
Urban	PD01C Roof Bypass	Area Impervious (ha)	None	None	0.16
Urban	PD01C Roof Bypass	Area Pervious (ha)	None	None	0
Urban	PD01C Roof Bypass	Total Area (ha)	None	None	0.16
Urban	PD01C Roof to RWT	Area Impervious (ha)	None	None	0.16
Urban	PD01C Roof to RWT	Area Pervious (ha)	None	None	0
Urban	PD01C Roof to RWT	Total Area (ha)	None	None	0.16

Only certain parameters are reported when they pass validation

