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Civil Engineering

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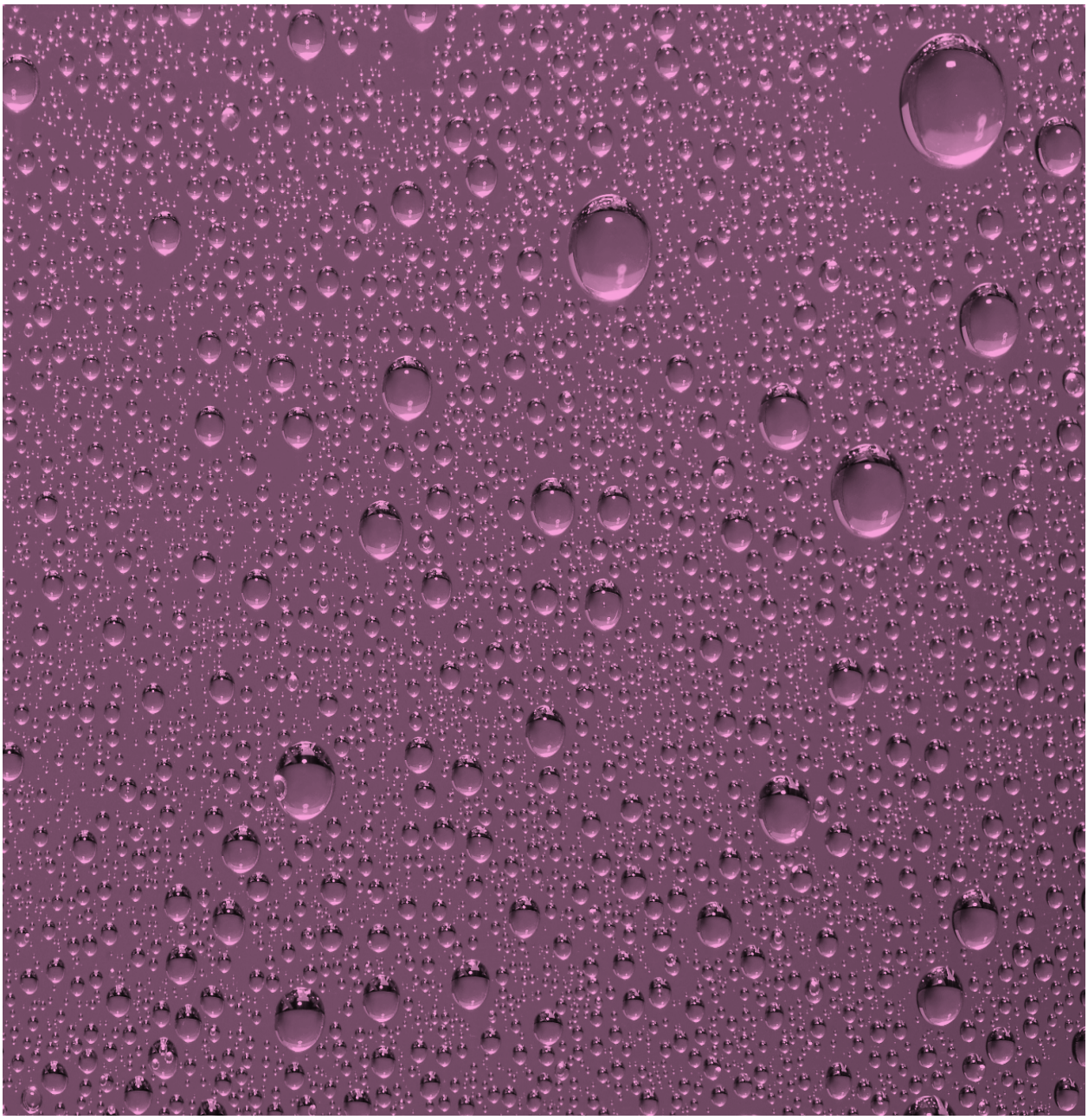
Water Management Report

Proposed Residential State Significant Development Application

93-107 Cecil Ave & 9-10 Roger Ave, Castle Hill



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Proposed Residential State Significant Development Application
93-107 Cecil Ave & 9-10 Roger Ave, Castle Hill

Prepared for our client:
Alton Property Group Pty Ltd

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Prepared by

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18 December 2024
P171426-RP-CV-001
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Reviewed: Tyler Karvinen

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Executive Summary

The Water Management Plan includes both this report and the supporting drawings. It outlines the philosophy and process for the design of the water management for the proposed residential development at 93-107 Cecil Ave & 9-10 Roger Ave, Castle Hill. A separate report covers the overland flow risk for the site and the development.

The design is based on a set of design criteria derived from guidelines from organisations including The Hills Shire Council, Sydney Water, the Water Services Association of Australia, and the Australian Rainfall and Runoff Guide

The design criteria are also based on consultation with and specific requirements of The Hills Shire Council (Arsham Khamissi) and Sydney Water (Adam MacDowell)

Site stormwater addresses both peak flows and water quality

The site stormwater is collected in a network of pits and pipes. It is conveyed, for each of the three stages, firstly to a bioretention basin, then to an on site stormwater detention (OSD) system, sized using the Upper Parramatta River Trust method and containing stormwater filters.

The three bioretention basins and OSD tanks provide a treatment chain, for each stage, that meets the Water Sensitive Urban Design and peak flow targets outlined in The Hills Shire Development Control Plan. Once the project is fully developed, the peak flows and water quality targets will also be met for the entire site.

Public infrastructure stormwater network has capacity

Once the stormwater leaves the site it is drained via two boundary pits to a new 375mm diameter trunk stormwater extension proposed in Roger Avenue. The extension connects at an existing sag pit adjacent to number 4 Roger Avenue.

The broader capacity of the trunk network was modelled using DRAINS and sufficient capacity for the peak flows was verified.

Sewer diversion proposed

The site is serviced by two existing sewer mains, one of which carries flow from an upstream catchment that will remain. This main will be diverted around the southwestern edge of the site and the architectural design accommodates this in the set back.

The existing mains will not have capacity for the final development however there are several options for upgraded connection points.

Water servicing from Cecil Avenue

There are several Sydney Water mains in Cecil Ave and nearby Terminus Street with adequate flow. A combination of main upgrades and/or pressure boosting will provide an adequate water service for the fully developed site.

Overall, the water management plan includes some trunk upgrades and demonstrates a feasible solution for drainage, water and sewer.

1.0 Introduction

The purpose of this report is to outline the philosophy and process for the design of the water management for the proposed residential development. The purpose of the design itself is to prove feasibility for the purposes of a development application.

It covers:

- The on site stormwater drainage management, including capture, conveyance and treatment.
- The interface with and upgrade of the public stormwater network downstream in Roger Avenue, including the hydraulic modelling conducted to assess capacity and verify safe connection.
- The proposed water and sewer network connection philosophy.

The design process revealed a range of feasible solutions. This report documents the optimal balanced solution given the range of internal design constraints and the input of external stakeholders, including The Hills Shire Council and Sydney Water.

2.0 Information Relied Upon

The stormwater design relies on the following inputs:

- The Hills Shire Development Control Plan Part D Section 21
- The Hills Shire Local Environment Plan 2019
- Survey by SDG 22/02/2017
- Architectural Drawings by A Plus Design Group 19 December 2024
- Landscape Drawings by Site Image December 2024

To give context, this report should be read in conjunction with the following.

- Stellen Consulting civil and stormwater design drawings (December 2024)
- Overland Flow Assessment by Stellen Consulting (P171426-LT-FL-001-00)

3.0 Design Criteria

— The design should accept the overland from any upstream flows from catchments as calculated from the DRAINS model.

— Minor flows (20% AEP) should be conveyed in the pit and pipe system.

— Major flows (up to 1% AEP) should be generally contained safely within the landscaping and pose low hydraulic hazard.

— Discharge flows must not pose a hydraulic hazard at the kerb or otherwise be connected directly to the trunk stormwater network.

— Stormwater quality must meet the WSUD targets from the DCP.

— Adequate drinking water flow and pressure should be available to the development (to WSAA Sydney Water Requirements).

— Sufficient sewerage capacity, ideally gravity, should be available to the development (to WSAA Sydney Water Requirements.

4.0 Site Context

The subject site, located at 93-107 Cecil Avenue and 9-10 Roger Avenue, Castle Hill, is irregular in shape and consists of 18 residential lots, covering a total area of approximately 17,610m². It has a primary frontage along Cecil Avenue, with a secondary frontage along Roger Avenue, which serves two lots and is a cul-de-sac connecting to Francis Street. The southwestern boundary of the site borders a church and St. Paul's Cemetery. Figure 1 displays the subject site (yellow boundary) and location plan.

The site falls from the north-west to the south-east by approximately 14 metres.

The development proposal involves the demolition of existing buildings, and replacing them with a mixed use, multi-storey development comprised of three stages with four buildings.

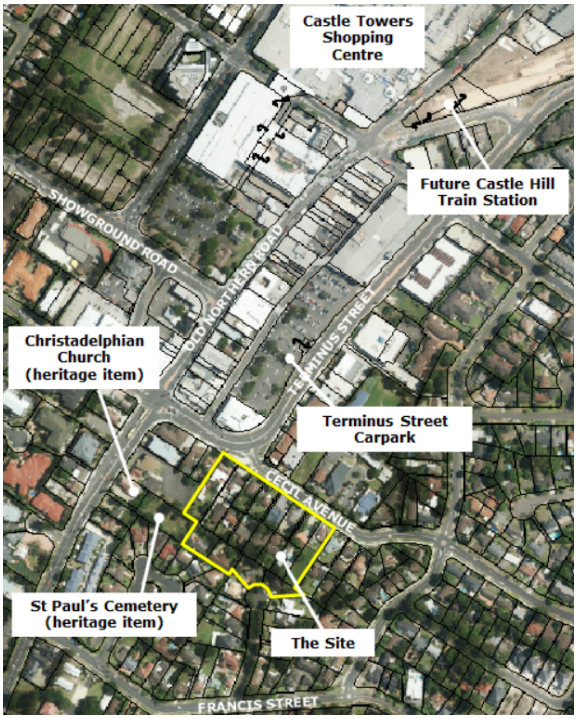

Figure 1 - Aerial view of the site and surrounding locality

5.0 Upstream Catchments and Overland Flow

A detailed overland flow risk assessment was conducted (refer to document P171426-LT-FL-001-00). The proposed development encompasses six distinct catchments that contribute to overland flow within the site (Figure 2).

The overland flow analysis predicts that the site will avoid significant overland flooding during the 1% AEP flood event. Key conclusions drawn from the results include:

- The site is situated atop a hill and upstream catchments are predicted to bypass it.
- The lowest point on the site (116.5mAHD), is sufficiently high above the downstream low point at Roger Avenue, ensuring that overland flows from catchments 1 and 3 do not affect the site.
- The road capacity along Cecil Avenue is sufficient to manage the peak flow from catchment 2 (0.108 m^3/s), as the road can handle up to 0.487 m^3/s, well above the expected flow from this catchment.

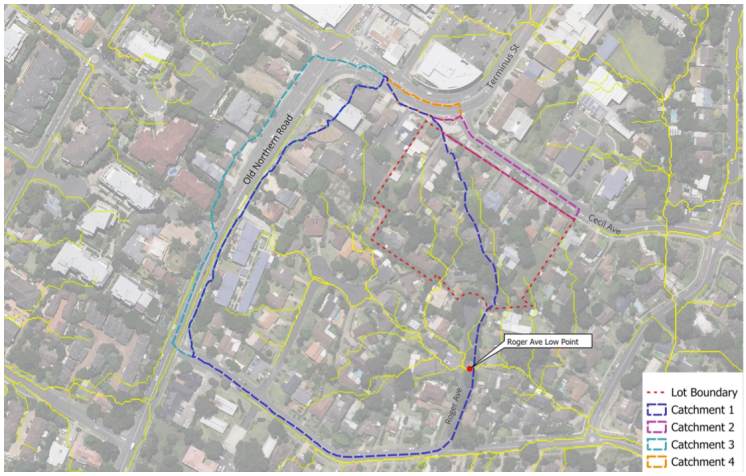

Figure 2. Upstream catchment definition

6.0 Site Stormwater Management

The stormwater management plan is detailed in the Stellen Consulting drawings dated 19/12/24. The system is divided into three separate networks to facilitate the proposed construction staging of the site. Roof water and surface runoff are conveyed to bioretention basins for preliminary treatment before being directed to OSD systems equipped with stormfilter cartridges for additional treatment. The flows from each OSD system are then routed to two boundary pits that connect to the Council's stormwater system on Roger Avenue.

As part of the site's stormwater management strategy, new trunk stormwater infrastructure is proposed to extend from Roger Avenue to the site frontage within the cul-de-sac, extending approximately 65 meters south of the site.

The key components of the stormwater management system include:

- Extension of Council's trunk stormwater infrastructure in Roger Ave to the site frontage.
- Three OSD systems totalling 801 m³ storage capacity
- Three bioretention basins with extended detention, totalling 352 m²
- Nine Ocean Protect Psorb cartridges (690mm)
- Two OceanProtect "OceanGuard" pit baskets

The proposed stormwater drainage system has been designed using DRAINS using a minor/major drainage philosophy. The site drainage has been designed based on the following:

- Council drainage system: 10% AEP (minor)
- Site drainage including OSD: 1% AEP (major)

6.1 Capture and conveyance

The site stormwater is collected in a network of pits and pipes. It is conveyed, for each of the three stages, firstly to a bioretention basin, then to an OSD system.

6.1.1 On site detention sizing

The OSD system has been designed to attenuate peak flows downstream of the site, ensuring no adverse flooding or stormwater impacts on downstream properties. Design parameters adhere to the guidelines outlined in the Upper Parramatta River Catchment Trust (UPRCT) On-Site Stormwater Detention Handbook (Version 4).

The OSD system is divided into three networks to align with the staged development plan. The proposed catchment plan is shown in Drawing DR-010. Sizing calculations for the OSD system, based on spreadsheets from the UPRCT OSD Handbook (Version 4), are provided in Appendix C.

The SSR and PSD for each development stage are as follows:

Stage 1: SSR: 413 m3 PSD: 150 l/s

Stage 2: SSR: 235 m3 PSD: 85 l/s

Stage 3: SSR: 153 m3 PSD: 54 l/s

6.2 Stormwater quality

The three bioretention basins and OSD tanks provide a treatment chain, for each stage, that meets the Water Sensitive Urban Design and peak flow targets advised directly by The Hills Shire Council. Once the project is fully developed, the peak flows and water quality targets will also be meet for the entire site.

To manage runoff quality, the proposed water-sensitive urban design (WSUD) measures include:

- Three bioretention basins with extended detention, totalling 352 m².
- Three OSD systems incorporating a total of 9 stormfilter cartridges (690mm Psorb by OceanProtect)
- Two pit baskets (Ocean Guard by Ocean Protect).

Conceptual water quality modelling using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Version 6.3 was undertaken to estimate the effectiveness of the proposed stormwater management strategy at removing pollutants, particularly sediment, phosphorous and nitrogen, over the long term.

The model configuration and proposed treatment train is shown in Appendix B.

The water quality catchments for roof/rainwater and other areas were estimated based on the proposed architectural drawings. DR-014 summarises the WSUD catchment plan and areas. The MUSIC model is based on completion of all three stages of the development.

The Water Quality Management Strategy design is required to meet the requirements of The Hills Shire Council water quality targets and the *Hill Shire Residential DCP Appendix B – WSUD*.

Table 1: Comparison of Water Quality Objectives (Council DCP) and the proposed development

Pollutant	Load Reduction Target (DCP)	Load Reduction Achieved (Development)
Total Suspended Solids (TSS)	85%	90.4%
Total Phosphorus (TP)	65%	67.4%
Total Nitrogen (TN)	45%	69.0%
Gross Pollutants	90%	100%

The MUSIC model results show that the proposed Water Quality Management Strategy provides a reduction in post-development loads of Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants that meet Council's pollution reduction targets of 85%, 65%, 45% and 90% respectively.

7.0 Infrastructure – Stormwater Connection and Upgrade

To support the proposed stormwater plan, an extension to Council's trunk stormwater infrastructure in Roger Ave is proposed. This involves installing a new 375mm diameter reinforced concrete stormwater pipe extending approximately 65 meters from the existing Council drainage system to the site frontage.

The stormwater extension and hydraulic grade line are shown in Drawings DR-012 and DR-100. DRAINS model results are included in Appendix B.

7.1 Hydraulic Model

The extension design has been completed using DRAINS hydrologic and hydraulic urban catchment modelling. Rainfall data was derived from BOM IFD data specific to the site's location. Key design parameters include:

- soil type = 2.5
- antecedent moisture content, AMC = 3
- Depression Storage: paved area = 1 mm, grassed area = 5 mm
- hardstand areas Horton retardance coefficient 'n': 0.012
- pervious areas Horton retardance coefficient 'n': 0.03
- pit loss coefficients "k" generally accordance with Queensland Urban Drainage Manual
- Pit blockage factors of 50% at the inlet.
- At the downstream connection pint, tailwater levels of 114.06 and 114.03 mAHD are adopted for the major and minor design events (respectively) (refer below)

The tailwater levels were calculated using a separate DRAINS model, detailed in 7.1Hydraulic Model, which addresses overland flow in Roger Avenue.

Based on the DRAINS model, a 375 RCP (Class 4) pipe is proposed to extend from Council's existing stormwater system in Roger Ave to the site frontage. Model files and DRAINS results are attached in Appendix B.

7.1.1 Contributing catchment in Roger Ave

The catchments were delineated using a combination of DEM data, DBYD stormwater drainage information, Google Earth imagery, and site observations.

Figure 3, depicts the extent of the catchments and indicative potential flow paths.

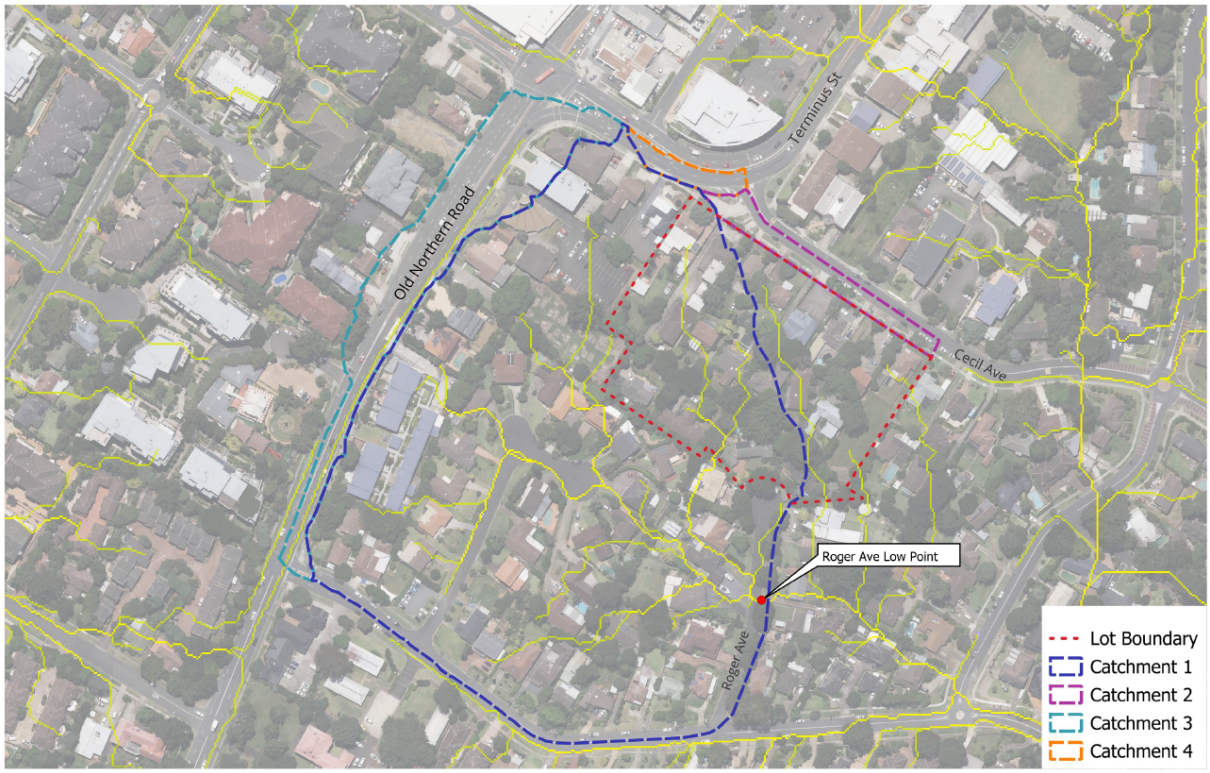

Figure 3 - External catchment plan

Table 1 presents the details of the catchments.

Table 1 - Catchment areas and peak flows

Catchment ID	Area (ha)
1	6.272
2	0.176
3	0.824
4	0.077

Based on the catchment plan and topography of the land:

- Flows from catchment 1 (which includes part of the site) and catchment 3 are directed towards the overland flow path along the low point at Roger Avenue.
- Catchment 4 flows down Cecil Avenue towards Terminus Street, while Catchment 2 flows south-eastward along Cecil Avenue towards the Orange Grove intersection.

The total catchment area contributing flow to Rodger Ave is 7.096 ha and is estimated to be 80% impervious.

7.1.2 Calculating the tailwater level in Roger Ave

Based on the catchment delineation some flooding due to overland flow is expected to occur within Roger Ave during large rain events. To inform the design of the OSD system, a separate DRAINS model was used to calculate the corresponding tailwater level in Roger Ave during the 10% and 1% AEP events.

The approach for calculated the tailwater level in Roger Ave was:

1. Calculate the contributing catchment upstream of the connection point in Roger Ave (see s7.1.1)
2. Build a DRAINS model to calculate the corresponding tailwater level at the connection point in Roger Ave during the 10% and 1% AEP events.

DRAINS Model Setup

The DRAINS model adopted the same rainfall data and assumptions outlined in 7.1.

The total catchment area contributing flow to Rodger Ave is 7.096 ha and is estimated to be 80% impervious.

The model setup is shown below in Figure 4.

Overland flow path 1 (OF1) is modelled as a parabolic broad crested weir with a 10m length. Overland flow path 2 (OF2) was manually built into the model based on LIDAR information. Sections for OF1 and OF2 and shown below in Figure 5 and Figure 6, respectively.

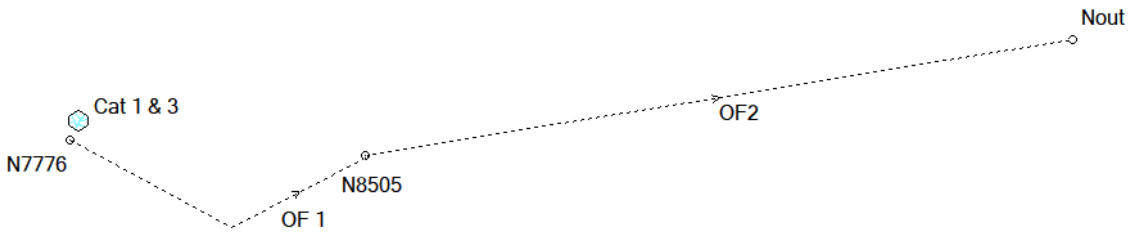

Figure 4 - Roger Ave, overland flow model setup

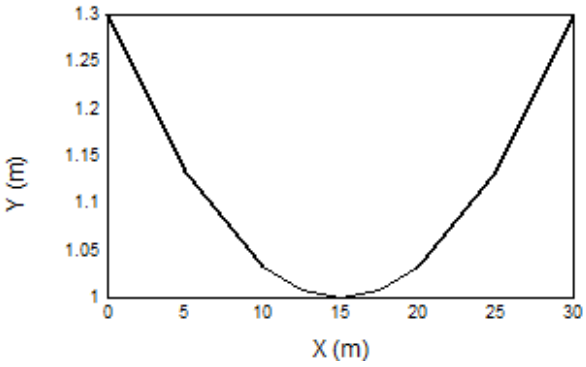

Figure 5 - Section through OF1

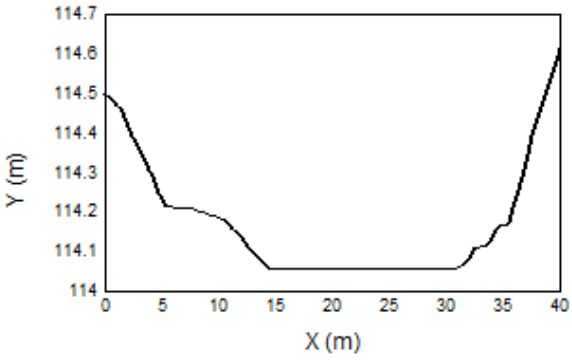

Figure 6 - Section through OF2

Based on the results of the DRAINS model, the calculated tailwater level within Roger Ave, at the point of connection for the proposed stormwater extension are:

10% AEP: 137mm depth, corresponding to a level of 114.03 mAHD

1% AEP: 168mm depth, corresponding to a level of 114.06 mAHD

Model files are DRAINS results are attached in Appendix B.

The tailwater levels have been factored into the design of the stormwater extension and the on site stormwater system design.

8.0 Infrastructure -- Water Services

8.1 Sewer diversion and upgrade

The site is serviced by two existing sewer mains which also carry flow from upstream catchment that will remain. This main will be diverted around the southwest edge of the site and the architectural design will accommodate this in the set back.

Based on preliminary calculations, the existing mains will not have capacity for the final development however there are several options for upgraded connection points. A Water Services Coordinator will be engaged to arrange either a s73 approval application, or a Concept s73 Review for an alternative solution.

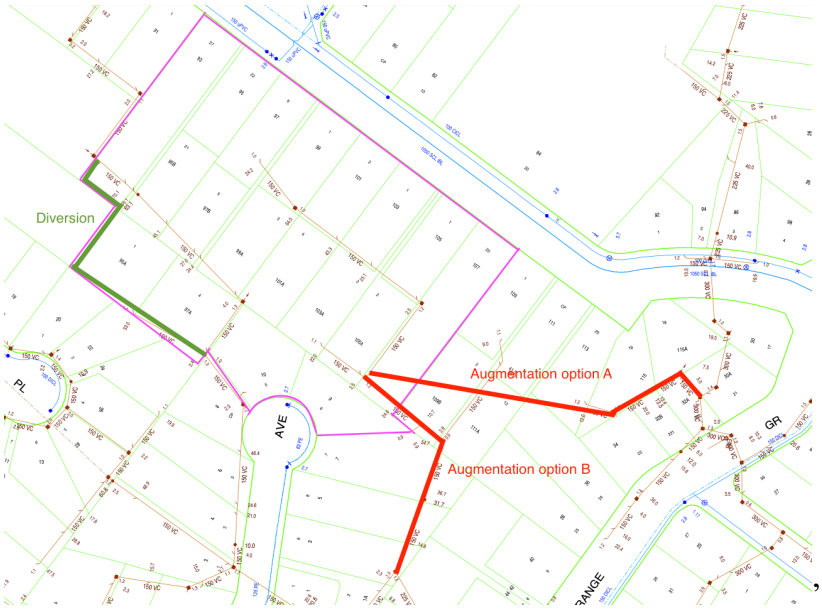

Figure 7. Concept sewer servicing strategy

8.2 Water servicing strategy

Preliminary calculations indicate the following demands for the fully developed site.

Average daily demand (kL)	288
Average flow (l/s)	344
Peak flow (l/s)	17

Preliminary calculations indicate the following demands for the fully developed site.

Initial consultation with Sydney Water indicates the existing water mains along Cecil Avenue are likely to have adequate flow but not adequate pressure, given the heights of Buildings B and C.

The Neuron Infrastructure Delivery Management and Staging Plan indicates a ring main solution combined with two options for main upgrades.

Early consultation with Sydney Water WSC indicates SWC would likely prefer Option 1.

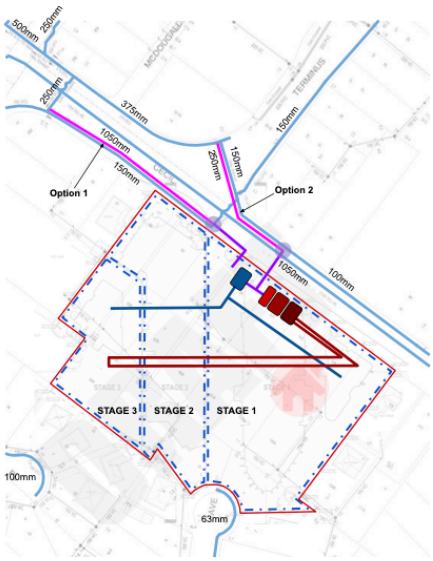

Figure 8. Two options for water main upgrade

Statement of Available Pressure and Flow

Sydney WATER

Ian Warren
93 Pittwater Road
Manly, 2095

Attention: Ian Warren Date: 21/11/2024

Pressure & Flow Application Number: 2013568
Your Pressure Inquiry Dated: 2024-11-06
Property Address: 93 Cecil Avenue, Castle Hill 2154

The expected maximum and minimum pressures available in the water main given below relate to modelled existing demand conditions, either with or without extra flows for emergency fire fighting, and are not to be construed as availability for normal domestic supply for any proposed development.

ASSUMED CONNECTION DETAILS

Street Name: Cecil Avenue	Side of Street: South
Distance & Direction from Nearest Cross Street	18 metres West from Terminus Street
Approximate Ground Level (AHD):	133 metres
Nominal Size of Water Main (DN):	150 mm

EXPECTED WATER MAIN PRESSURES AT CONNECTION POINT

Normal Supply Conditions	
Maximum Pressure	77 metre head
Minimum Pressure	41 metre head

WITH PROPERTY FIRE PREVENTION SYSTEM DEMANDS	Flow l/s	Pressure head m
Fire Hose Reel Installations (Two hose reels simultaneously)	0.66	41
Fire Hydrant / Sprinkler Installations (Pressure expected to be maintained for 95% of the time)	10 15 20 25 30 40 50 60	44 44 44 43 43 42 41 40
Fire Installations based on peak demand (Pressure expected to be maintained with flows combined with peak demand in the water main)	10 15 20 25 30 40 50 60	41 40 40 39 39 38 37 35
Maximum Permissible Flow	67	34

(Please refer to reverse side for Notes)

For any further inquiries regarding this application please email :

hydraulicassessment@sydneywater.com.au

Sydney Water Corporation ABN 49 776 225 038
1 Smith St Parramatta 2150 | PO Box 399 Parramatta 2124 | DX 14 Sydney | T 13 20 92 | www.sydneywater.com.au
Delivering essential and sustainable water services for the benefit of the community

9.0 Conclusion

The proposed stormwater management plan has been designed in accordance with the relevant codes and standards and in consultation with The Hills Shire Council. The MUSIC model results showed that the proposed WSUD measures are capable of meeting Council's pollutant reduction targets. The DRAINS modelling verified that the existing network can safely accept the developments flows, once the trunk infrastructure upgrade is completed.

The site is well serviced by water and sewer infrastructure. Several feasible options exist for water and sewer servicing, all of which will require an upgrade or extension and diversion. Preliminary consultation with Sydney Water indicates a more likely scenario however a Water Services Coordinator will be engaged to provide a formal s73 application and, if required, an alternative solution design for the sewer.

We recommend the water management plan (as described in the drawings) as a safe and feasible solution to support the development.

Appendix A – DRAINS Model Results

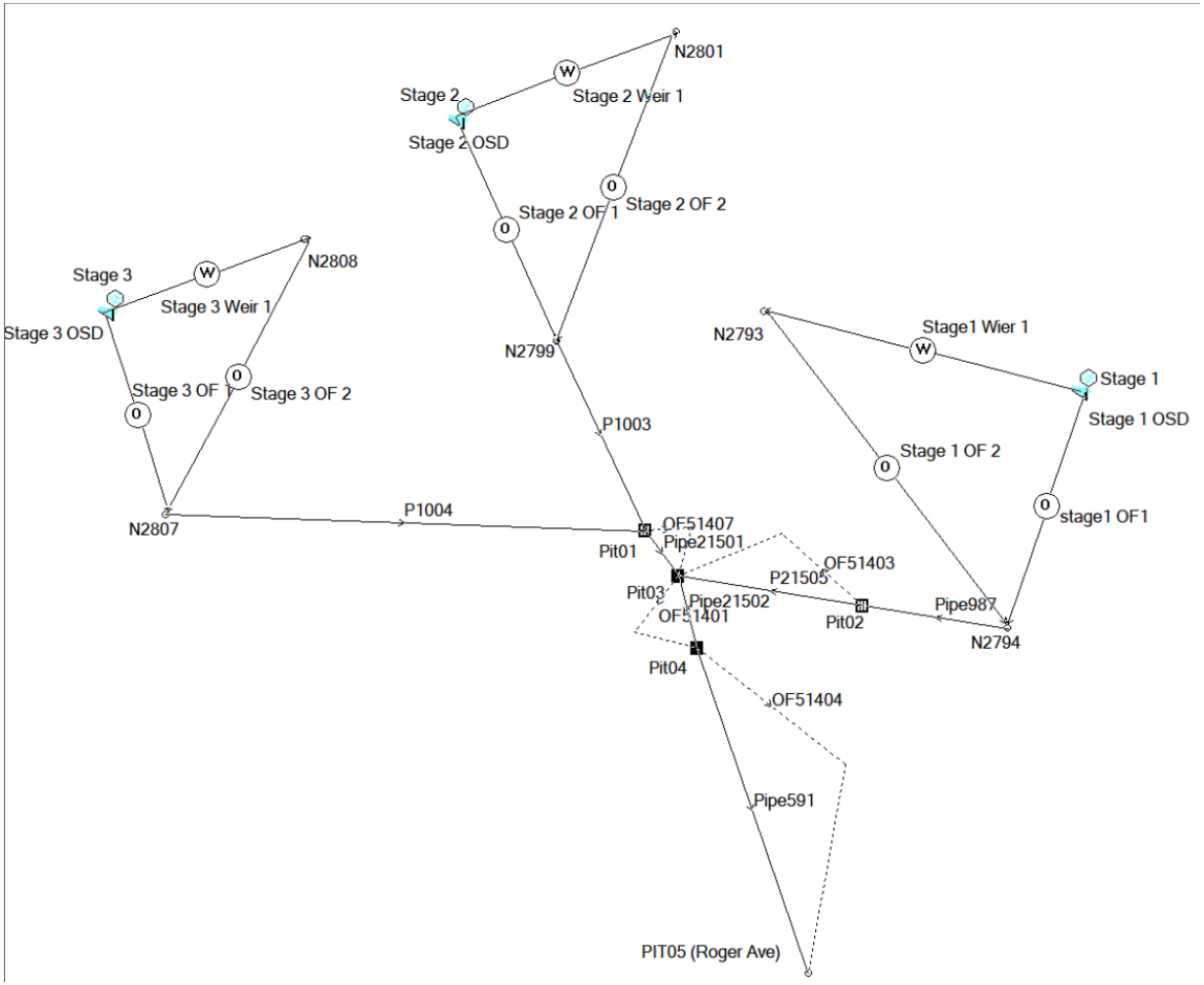

Figure 9 - DRAINS model setup

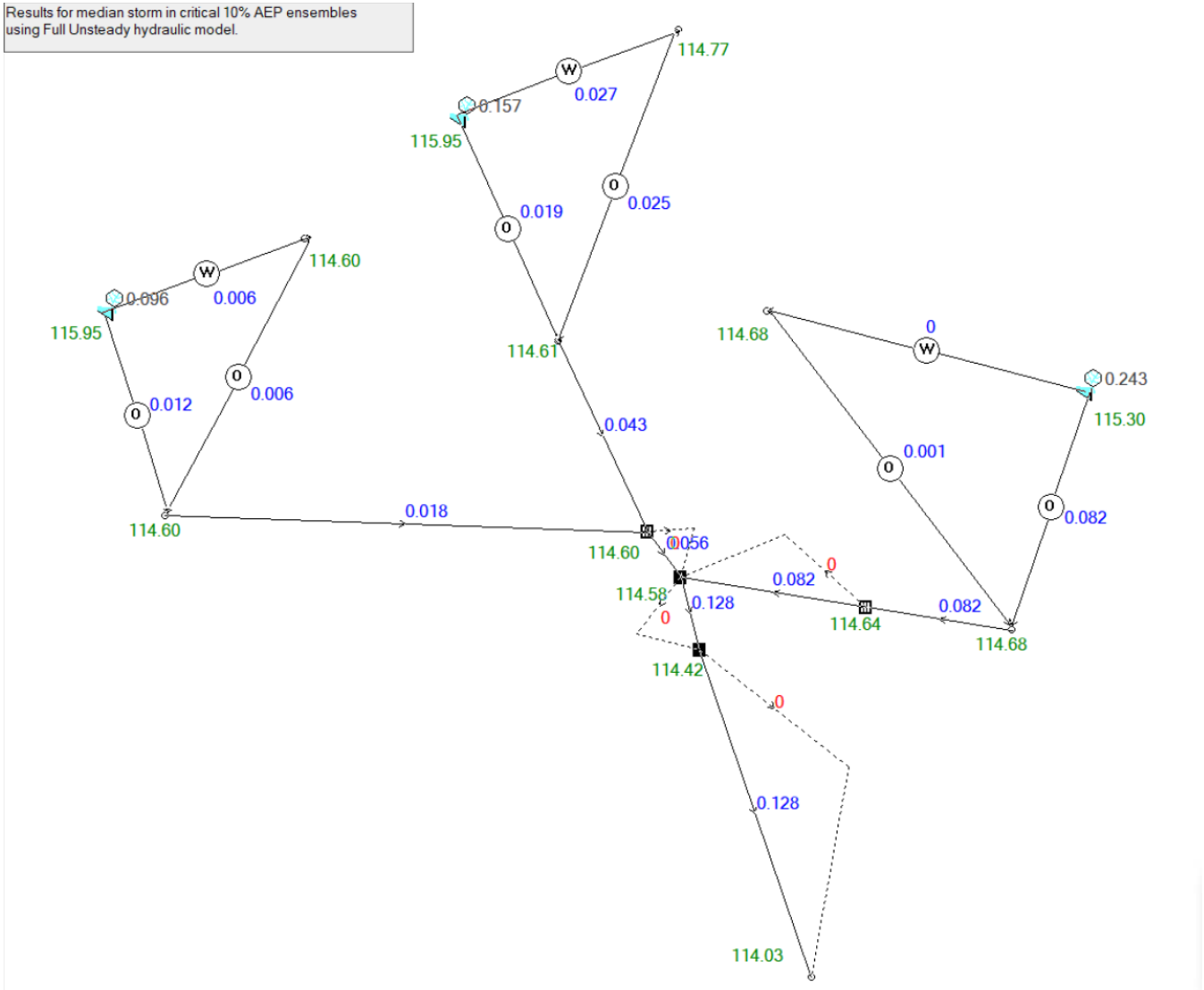

Figure 10 - DRAINS model results, 10% AEP event

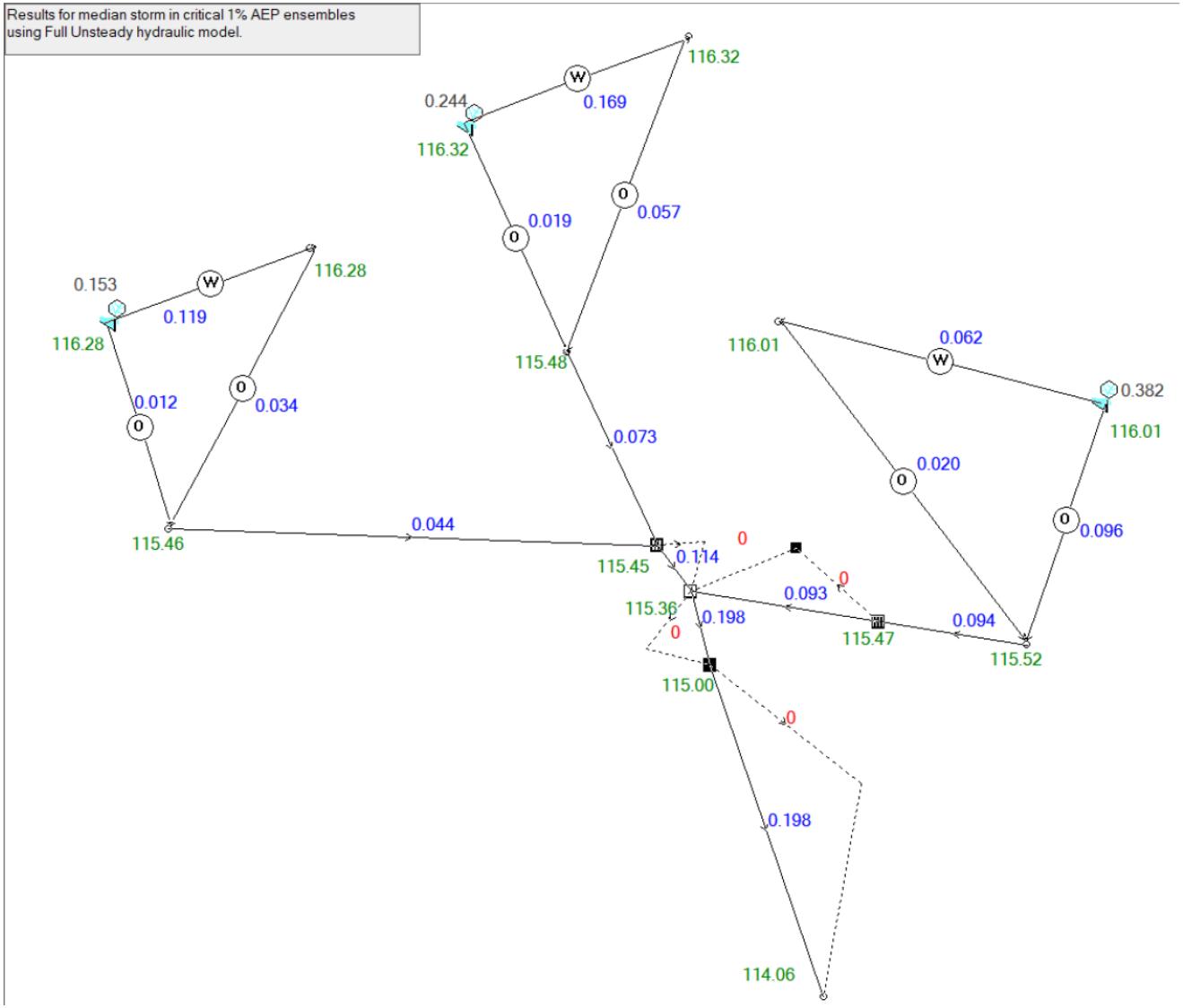

Figure 11 - DRAINS model results, 1%AEP event

Figure 12 - DRAINS model setup, tailwater level in Roger Ave

Figure 13 - DRAINS model setup, tailwater level in Roger Ave, 10% AEP event

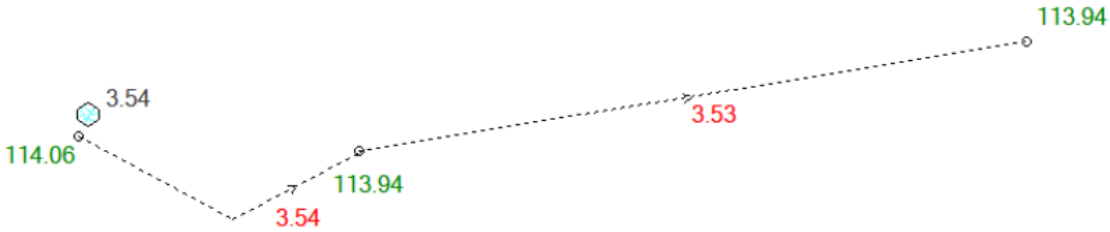

Figure 14 - DRAINS model setup, tailwater level in Roger Ave, 1% AEP event

Appendix B – MUSIC Model

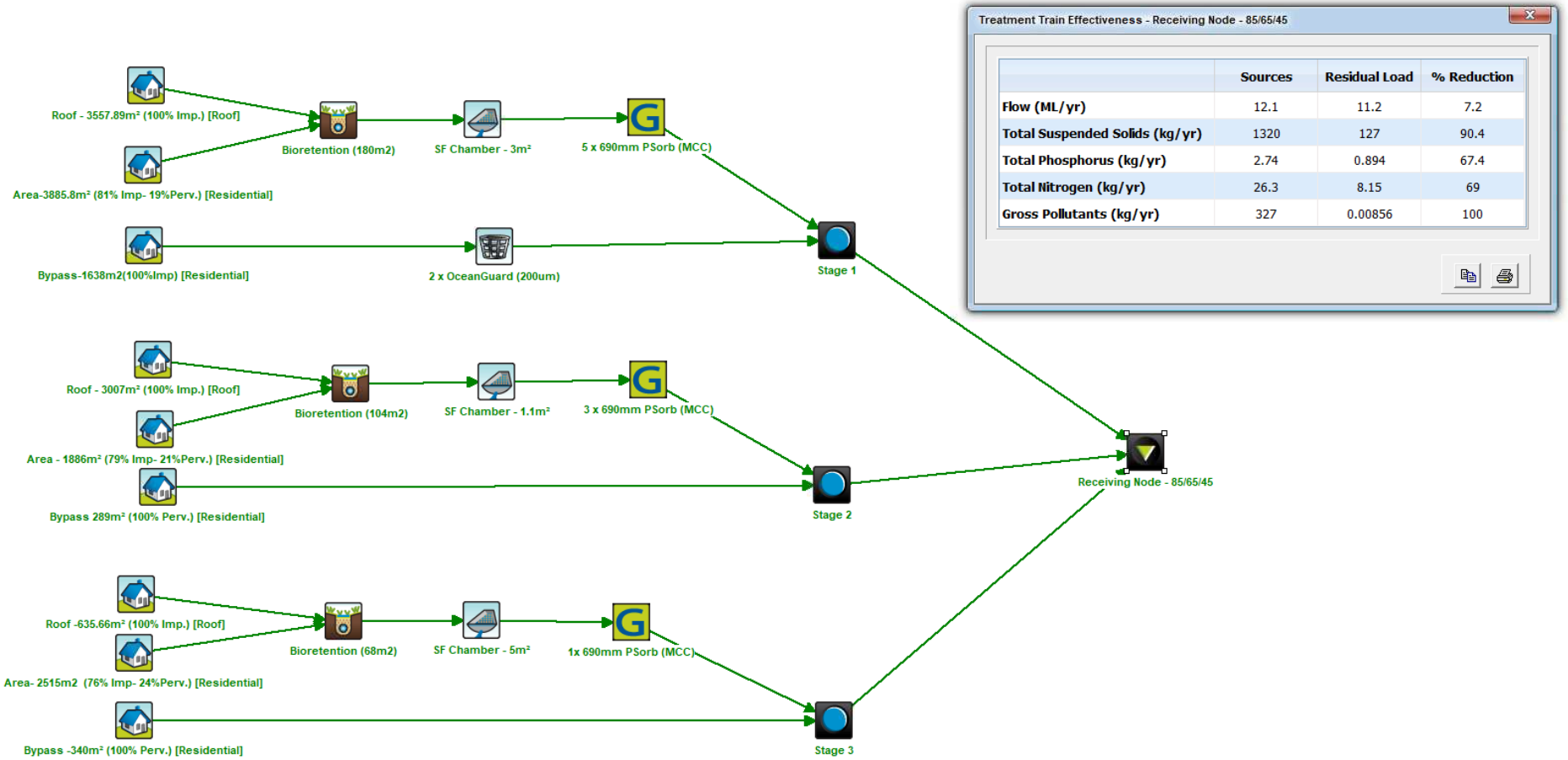

Figure 15 - Water Quality Management Strategy MUSIC Model Configuration

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Appendix C – OSD Calculations

Project:	**93-107 Cecil Ave - Stage 1**
Site Address	**93-107 Cecil Ave, Castle Hill**
Job No:	**P171426**
Designer:	**MAI**
Telephone:	**(03) 99692673**

Site Data

OSD Area:	**Upper Parramatta River Catchment**						
L.G.A	**Parramatta City Council**						
Site Area	**0.908172**	ha	**9,082**	m^2			
Total Roof Area	**0.05807**	ha	**581**	m^2			
Area of Site draining to OSD Storage	**0.8173548**	ha	**8,174**	m^2	**Satisfactory**		
Residual Site Area (Lot Area - Roof Area)	**0.850**	ha					
Area Bypassing Storage	**0.0908172**	ha					
Area Bypassing / Residual Site Area	**10.7%**				**Satisfactory**	**30% Max**	
No. of Dwellings on Site	**1**				**Satisfactory**		
Site Area per Dwelling	**0.908**	ha					
Roof Area per Dwelling	**0.058**	ha					

Basic OSD Parameters

		Extended Detention			Detention	
Basic SSR Vols	Ext Detention Storage	**300**	m^3/ha	Total Storage	**455**	m^3/ha
Basic SRDs	Primary Outlet	**40**	L/s/ha	Secondary Outlet	**150**	L/s/ha

OSD Tank Bypass

Residual Lot Capture in OSD Tank	**89%**				
Adjusted SRDs	**37**	L/s/ha		**129**	L/s/ha

OSD Calculations

		Extended Detention				Detention	
Basic SSR Volume	Ext Detention Storage	**272.45**	m^3		Total Storage	**413.22**	m^3
Total Rainwater Tank Credits		**0.00**	m^3			**0.00**	m^3
Storage Volume					Total	**413.22**	m^3
Storage Volume	Ext Detention Storage	**272.45**	m^3		Flood Detention Storage	**140.77**	m^3
OSD Discharges	Primary Outlet	**33.42**	L/s		Secondary Outlet	**116.82**	L/s
RL of Top Water Level of Storage		**115.840**	m			**116.560**	m
RL of Orifice Centre-line		**114.450**	m			**114.450**	m
Number of Orifices		**1**				**1**	
Estimated Downstream Flood Level		**114.19**	1.5 yr ARI			**114.33**	100 yr ARI
Downstream FL - RL of Orifice Cente-line		**-0.26**	**Satisfactory**		**Satisfactory**	**-0.12**	m
Design Head to Orifice Centre		**1.390**	m		TWL Ext Detn Storage - RL Orifice	**1.390**	m
Calculated Orifice Diameter		**117**	mm	**Satisfactory**	**Satisfactory**	**218**	mm

Overflow Weir & Freeboard Calculation

RL of Minimum Habitable Floor Level		**117.000**	m
RL of Minimum Garage Floor Level		**117.000**	m
Length of Overflow Weir		**2.40**	m
Site Runoff Coefficient	**Parramatta City Council**	**0.80**	
Storm Intensity (5 min 100 yr ARI)		**245**	mm/h
Peak Flow over Weir		**445.0**	L/s
Depth of Flow over Weir		**235**	mm
Freeboard to Habitable Floor	**Satisfactory**	**205**	mm
Freeboard to Garage Floor	**Satisfactory**	**205**	mm

Rainwater Tank Calculations (per Dwelling)

Only Complete this Section if a Rainwater Tank Airspace Credit is Claimed

The calculations assume that the same size rainwater tank is installed on each dwelling

				Min	Max
% of Roof draining to Rainwater Tank	0.0%		Satisfactory	0.0%	100%
Total Rainwater Tank Volume	0.00	kL	Minimum 0.0 kL		
Min Volume that triggers Top-up	0.00	kL	Note - Min Vol in Tank < 10% Total Tank Vol		
Total Tank Vol - Min Top-up Vol	0.00	kL			
Dedicated Airspace					
Dedicated Airspace	0.00	kL	Satisfactory		
	Extended Detention			Detention	
Dedicated Airspace Credit	0.00	kL		0.00	kL
Maximum Tank PSD	40	L/s/ha			
Maximum Tank Discharge	0.0	L/s			
Maximum Head to Centre of Tank Orifice	0.000	m	No Dedicated Airspace		
Calculated Orifice Diameter	0	mm	No Dedicated Airspace		
Dynamic Airspace					
Maximum Dynamic Storage (Nett Vol)	0.00	kL	Controls minimum % Roof to Rainwater Tank		
Daily Demand on Rainwater Tank	0	kL/d	Satisfactory		
Dynamic Airspace at start of Storm	0.00	kL			
	Extended Detention			Detention	
Dynamic Airspace Credit	0.00	kL		0.00	kL
Combined Rainwater Tank Credit	0.00	kL		0.00	kL
Maximum Rainwater Tank Credit	0.00	kL		0.00	kL
Rainwater Tank Credit per Dwelling	0.00	kL		0.00	kL
Rainwater Tank Credit for the Site	0.00	m^3		0.00	m^3

Signature: _____ **Date:** _____

Project:	**93-107 Cecil Ave - Stage 2**
Site Address	**93-107 Cecil Ave, Castle Hill**
Job No:	**P171426**
Designer:	**MAI**
Telephone:	**(03) 99692673**

Site Data

OSD Area:	**Upper Parramatta River Catchment**						
L.G.A	**Parramatta City Council**						
Site Area	**0.518175**	ha	**5,182**	m^2			
Total Roof Area	**0.0548**	ha	**548**	m^2			
Area of Site draining to OSD Storage	**0.4664**	ha	**4,664**	m^2	**Satisfactory**		
Residual Site Area (Lot Area - Roof Area)	**0.463**	ha					
Area Bypassing Storage	**0.051775**	ha					
Area Bypassing / Residual Site Area	**11.2%**				**Satisfactory**	**30% Max**	
No. of Dwellings on Site	**1**				**Satisfactory**		
Site Area per Dwelling	**0.518**	ha					
Roof Area per Dwelling	**0.055**	ha					

Basic OSD Parameters

		Extended Detention			Detention	
Basic SSR Vols	Ext Detention Storage	**300**	m^3/ha	Total Storage	**455**	m^3/ha
Basic SRDs	Primary Outlet	**40**	L/s/ha	Secondary Outlet	**150**	L/s/ha

OSD Tank Bypass

Residual Lot Capture in OSD Tank	**89%**				
Adjusted SRDs	**37**	L/s/ha		**128**	L/s/ha

OSD Calculations

		Extended Detention				Detention	
Basic SSR Volume	Ext Detention Storage	**155.45**	m^3		Total Storage	**235.77**	m^3
Total Rainwater Tank Credits		**0.00**	m^3			**0.00**	m^3
Storage Volume					Total	**235.77**	m^3
Storage Volume	Ext Detention Storage	**155.45**	m^3		Flood Detention Storage	**80.32**	m^3
OSD Discharges	Primary Outlet	**18.99**	L/s		Secondary Outlet	**66.15**	L/s
RL of Top Water Level of Storage		**115.916**	m			**116.657**	m
RL of Orifice Centre-line		**114.450**	m			**114.450**	m
Number of Orifices		**1**				**1**	
Estimated Downstream Flood Level		**114.19**	1.5 yr ARI			**114.33**	100 yr ARI
Downstream FL - RL of Orifice Cente-line		**-0.26**	**Satisfactory**		**Satisfactory**	**-0.12**	m
Design Head to Orifice Centre		**1.466**	m		TWL Ext Detn Storage - RL Orifice	**1.466**	m
Calculated Orifice Diameter		**87**	mm	**Satisfactory**	**Satisfactory**	**162**	mm

Overflow Weir & Freeboard Calculation

RL of Minimum Habitable Floor Level		**117.000**	m
RL of Minimum Garage Floor Level		**117.000**	m
Length of Overflow Weir		**2.40**	m
Site Runoff Coefficient	**Parramatta City Council**	**0.80**	
Storm Intensity (5 min 100 yr ARI)		**245**	mm/h
Peak Flow over Weir		**253.9**	L/s
Depth of Flow over Weir		**161**	mm
Freeboard to Habitable Floor	**Unacceptable - Min Freeboard = 200 mm**	**182**	mm
Freeboard to Garage Floor	**Satisfactory**	**182**	mm

Rainwater Tank Calculations (per Dwelling)

Only Complete this Section if a Rainwater Tank Airspace Credit is Claimed

The calculations assume that the same size rainwater tank is installed on each dwelling

				Min	Max
% of Roof draining to Rainwater Tank	0.0%		Satisfactory	0.0%	100%
Total Rainwater Tank Volume	0.00	kL	Minimum 0.0 kL		
Min Volume that triggers Top-up	0.00	kL	Note - Min Vol in Tank < 10% Total Tank Vol		
Total Tank Vol - Min Top-up Vol	0.00	kL			
Dedicated Airspace					
Dedicated Airspace	0.00	kL	Satisfactory		
	Extended Detention			Detention	
Dedicated Airspace Credit	0.00	kL		0.00	kL
Maximum Tank PSD	40	L/s/ha			
Maximum Tank Discharge	0.0	L/s			
Maximum Head to Centre of Tank Orifice	0.000	m	No Dedicated Airspace		
Calculated Orifice Diameter	0	mm	No Dedicated Airspace		
Dynamic Airspace					
Maximum Dynamic Storage (Nett Vol)	0.00	kL	Controls minimum % Roof to Rainwater Tank		
Daily Demand on Rainwater Tank	0	kL/d	Satisfactory		
Dynamic Airspace at start of Storm	0.00	kL			
	Extended Detention			Detention	
Dynamic Airspace Credit	0.00	kL		0.00	kL
Combined Rainwater Tank Credit	0.00	kL		0.00	kL
Maximum Rainwater Tank Credit	0.00	kL		0.00	kL
Rainwater Tank Credit per Dwelling	0.00	kL		0.00	kL
Rainwater Tank Credit for the Site	0.00	m^3		0.00	m^3

Signature: _____ **Date:** _____

Project:	**93-107 Cecil Ave - Stage 3**
Site Address	**93-107 Cecil Ave, Castle Hill**
Job No:	**P171426**
Designer:	**MAI**
Telephone:	**(03) 99692673**

Site Data

OSD Area:	**Upper Parramatta River Catchment**						
L.G.A	**Parramatta City Council**						
Site Area	**0.335976**	ha	**3,360**	m^2			
Total Roof Area	**0.0635**	ha	**635**	m^2			
Area of Site draining to OSD Storage	**0.302373**	ha	**3,024**	m^2	**Satisfactory**		
Residual Site Area (Lot Area - Roof Area)	**0.272**	ha					
Area Bypassing Storage	**0.033603**	ha					
Area Bypassing / Residual Site Area	**12.3%**				**Satisfactory**		**30% Max**
No. of Dwellings on Site	**1**				**Satisfactory**		
Site Area per Dwelling	**0.336**	ha					
Roof Area per Dwelling	**0.064**	ha					

Basic OSD Parameters

		Extended Detention			Detention	
Basic SSR Vols	Ext Detention Storage	**300**	m^3/ha	Total Storage	**455**	m^3/ha
Basic SRDs	Primary Outlet	**40**	L/s/ha	Secondary Outlet	**150**	L/s/ha

OSD Tank Bypass

Residual Lot Capture in OSD Tank	**88%**				
Adjusted SRDs	**36**	L/s/ha		**125**	L/s/ha

OSD Calculations

		Extended Detention				Detention	
Basic SSR Volume	Ext Detention Storage	**100.79**	m^3		Total Storage	**152.87**	m^3
Total Rainwater Tank Credits		**0.00**	m^3			**0.00**	m^3
Storage Volume					Total	**152.87**	m^3
Storage Volume	Ext Detention Storage	**100.79**	m^3		Flood Detention Storage	**52.08**	m^3
OSD Discharges	Primary Outlet	**12.20**	L/s		Secondary Outlet	**42.11**	L/s
RL of Top Water Level of Storage		**115.940**	m			**116.670**	m
RL of Orifice Centre-line		**114.450**	m			**114.450**	m
Number of Orifices		**1**				**1**	
Estimated Downstream Flood Level		**114.30**	1.5 yr ARI			**114.35**	100 yr ARI
Downstream FL - RL of Orifice Cente-line		**-0.15**	**Satisfactory**		**Satisfactory**	**-0.10**	m
Design Head to Orifice Centre		**1.490**	m		TWL Ext Detn Storage - RL Orifice	**1.490**	m
Calculated Orifice Diameter		**69**	mm	**Satisfactory**	**Satisfactory**	**129**	mm

Overflow Weir & Freeboard Calculation

RL of Minimum Habitable Floor Level		**117.000**	m
RL of Minimum Garage Floor Level		**117.000**	m
Length of Overflow Weir		**2.40**	m
Site Runoff Coefficient	**Parramatta City Council**	**0.80**	
Storm Intensity (5 min 100 yr ARI)		**245**	mm/h
Peak Flow over Weir		**164.6**	L/s
Depth of Flow over Weir		**121**	mm
Freeboard to Habitable Floor	**Satisfactory**	**209**	mm
Freeboard to Garage Floor	**Satisfactory**	**209**	mm

Rainwater Tank Calculations (per Dwelling)

Only Complete this Section if a Rainwater Tank Airspace Credit is Claimed

The calculations assume that the same size rainwater tank is installed on each dwelling

				Min	Max
% of Roof draining to Rainwater Tank	0.0%		Satisfactory	0.0%	100%
Total Rainwater Tank Volume	0.00	kL	Minimum 0.0 kL		
Min Volume that triggers Top-up	0.00	kL	Note - Min Vol in Tank < 10% Total Tank Vol		
Total Tank Vol - Min Top-up Vol	0.00	kL			
Dedicated Airspace					
Dedicated Airspace	0.00	kL	Satisfactory		
	Extended Detention			Detention	
Dedicated Airspace Credit	0.00	kL		0.00	kL
Maximum Tank PSD	40	L/s/ha			
Maximum Tank Discharge	0.0	L/s			
Maximum Head to Centre of Tank Orifice	0.000	m	No Dedicated Airspace		
Calculated Orifice Diameter	0	mm	No Dedicated Airspace		
Dynamic Airspace					
Maximum Dynamic Storage (Nett Vol)	0.00	kL	Controls minimum % Roof to Rainwater Tank		
Daily Demand on Rainwater Tank	0	kL/d	Satisfactory		
Dynamic Airspace at start of Storm	0.00	kL			
	Extended Detention			Detention	
Dynamic Airspace Credit	0.00	kL		0.00	kL
Combined Rainwater Tank Credit	0.00	kL		0.00	kL
Maximum Rainwater Tank Credit	0.00	kL		0.00	kL
Rainwater Tank Credit per Dwelling	0.00	kL		0.00	kL
Rainwater Tank Credit for the Site	0.00	m^3		0.00	m^3

Signature: _____ **Date:** _____