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Stormwater Management Report

World Class End of Life Program - Health Infrastructure Hospitals

Prepared for: Health Infrastructure NSW

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Revisions

Revision	Description	Date	Prepared by	Approved by
R01	ISSUE FOR TENDER	07/04/2025	Tim Wu	Viola Yao

Review Panel

Division/ office	Name
Sydney	

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1 Introduction

ACOR Consultants Pty Ltd (ACOR) has been engaged by Health Infrastructure NSW (HINSW) to assist the design team with the Design Development design of the World Class End of Life Care Program (WCEoLP) relating to Civil Services. The development consists of the additional of a new facility adjacent to the existing Palliative Care unit at Tamworth Hospital for this part of the proposed WCEoLP works.

This stormwater management plan has been prepared for the assessment of a Tender submission for the proposed development and to support the documentation for the site, providing an assessment of the proposed development with respect to stormwater drainage, quantity, and quality management.

This report documents the methodology involved in determining the design of the proposed stormwater drainage system and is to be read in conjunction with drawings by ACOR.

1.1 Project Description

In accordance with the Australian Rainfall & Runoff 2019, the proposed stormwater management system will, in principle, consist of a major and minor stormwater runoff conveyance system and incorporate surface collection pits and underground pipes for minor flow. Major flows in excess of the capacity of the pipe system will be safely conveyed overland.

1.2 Available Data

The following available information was utilised in the preparation of this report.

- Tamworth Regional Council Development Control Plan 2010 (DCP)
- Tamworth Regional Council Engineering Design Minimum Standards May 2023
- Standard Pollutant Export Rates contained in MUSIC model
- BOM Design Rainfall Data System 2016
- Australian Rainfall and Runoff 2019

2 Site

2.1 Location

The proposed development is located within Tamworth Hospital situated at Dean Street, North Tamworth, NSW, 2340. The building is situated at the north-western corner of the Tamworth hospital.

To the north of the development, there is an existing access driveway, while to the south and east, existing Tamworth Hospital is located. The site generally slopes towards the south-eastern corner, where existing stormwater pits and pipes are located.

3 Development

3.1 Existing Development

The total site area is approximately 1,679m^2, and at the south-western corner of the site, the landscape area remains existing.

3.2 Proposed Development

The proposed development is mainly comprised of the following broad elements:

- Construction of the End-of-Life Facility, refer to drawing EOL-ACG-TAM-DWG-AR-200003 TAM-01A-0000003, as shown in Figure 1below.
- Removal and re-routing of existing stormwater drainage system, refer to Drawing WCP-ACR-DRW-CIV-TAM-01A-0000003, as shown in Figure 2 below.

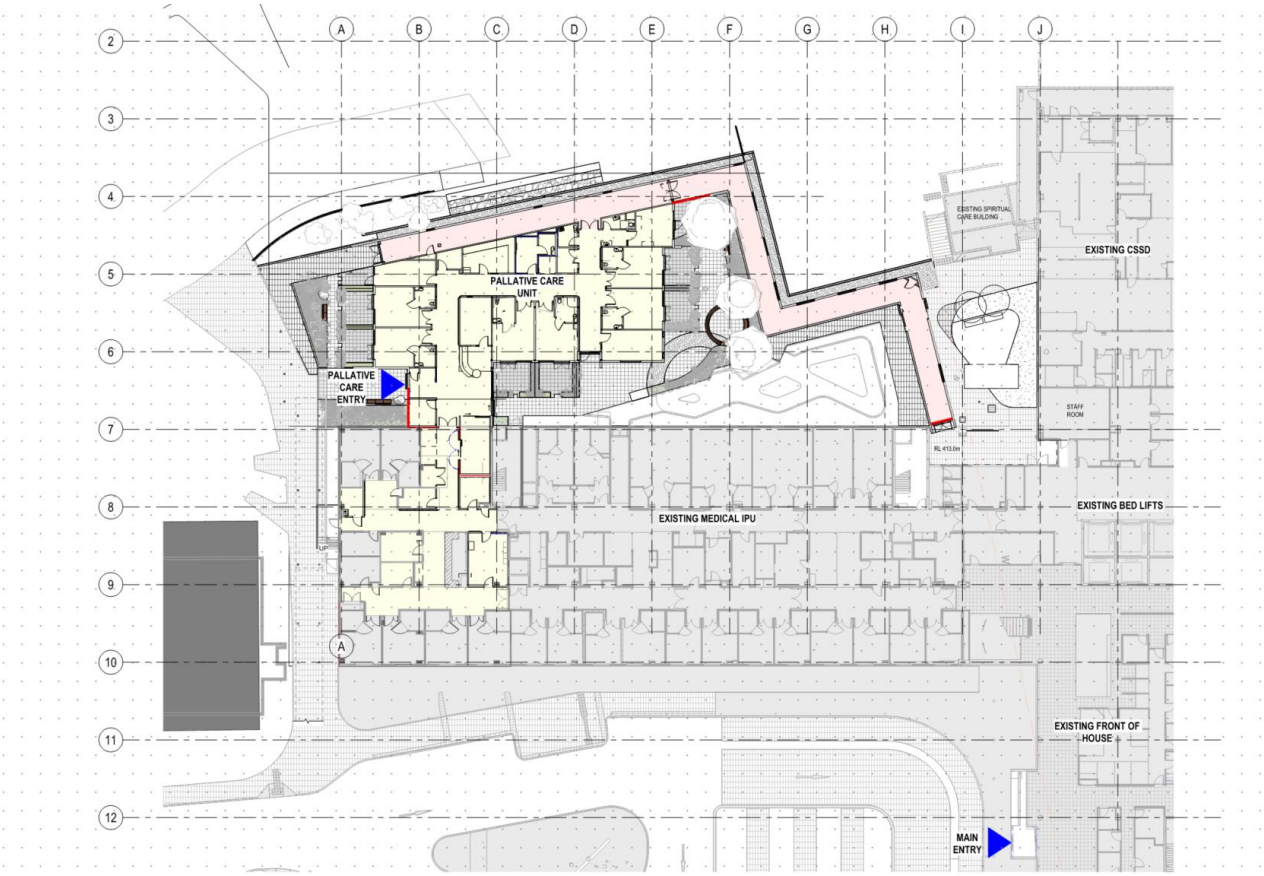

Figure 1: Proposed End-of-Life Facility

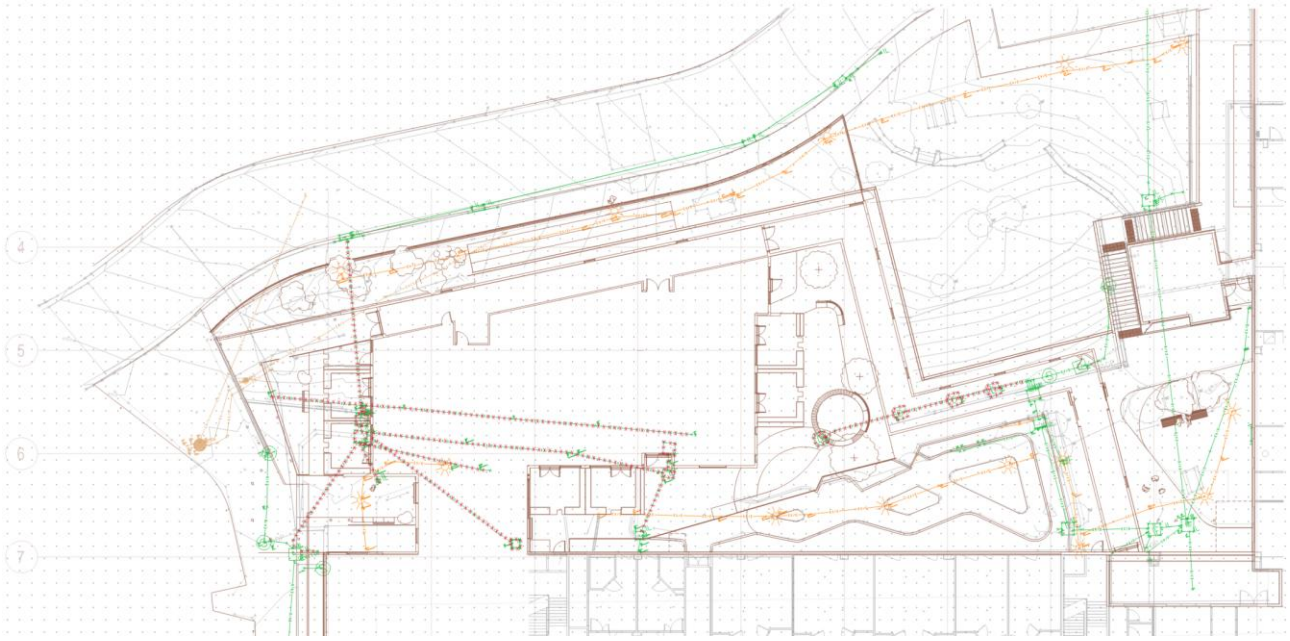

Figure 2: Proposed Removal and Re-routing of Stormwater System

3.3 Developed Catchments - Quantity and Quality

The proposed stormwater design consists of pit and pipe network to discharge surface flows to the existing pits at North-eastern corner of the development site.

The majority of the site's stormwater will be directed to an OSD tank located at the south-eastern corner entrance, with a bypass area that drains to the existing pit adjacent to the proposed building.

Refer to **Error! Reference source not found.** for OSD catchment plan.

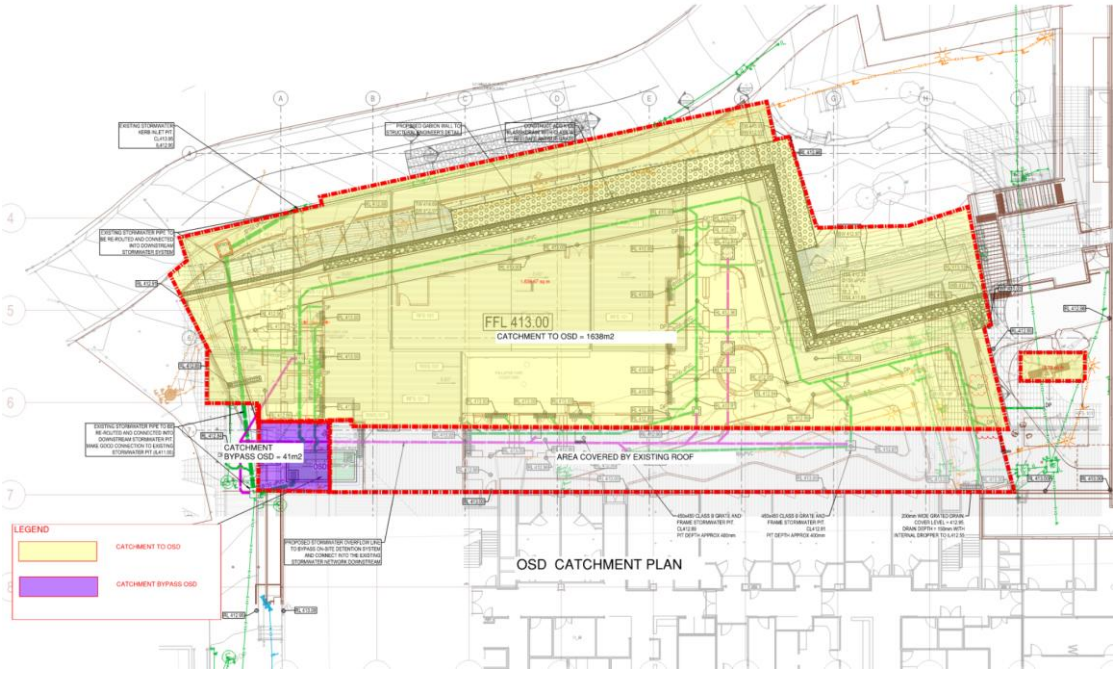

Figure 3: OSD catchment plan

Within the proposed post-development catchment, to analyse the water quality targets, the catchment drain into Water Quality Chamber is divided into four catchments as following categories:

- Roof Catchment to Water Quality Chamber = 940 m^2
- Paved Catchment to Water Quality Chamber = 580 m^2
- Landscape Catchment to Water Quality Chamber = 118 m^2
- Paved Catchment bypass Water Quality Chamber = 41 m^2

Refer to **Error! Reference source not found.** for Music catchment plan.

Water quantity and quality assessment is undertaken for the site in accordance with Tamworth Regional Council DCP. This is further explained in Section 4 of this report.

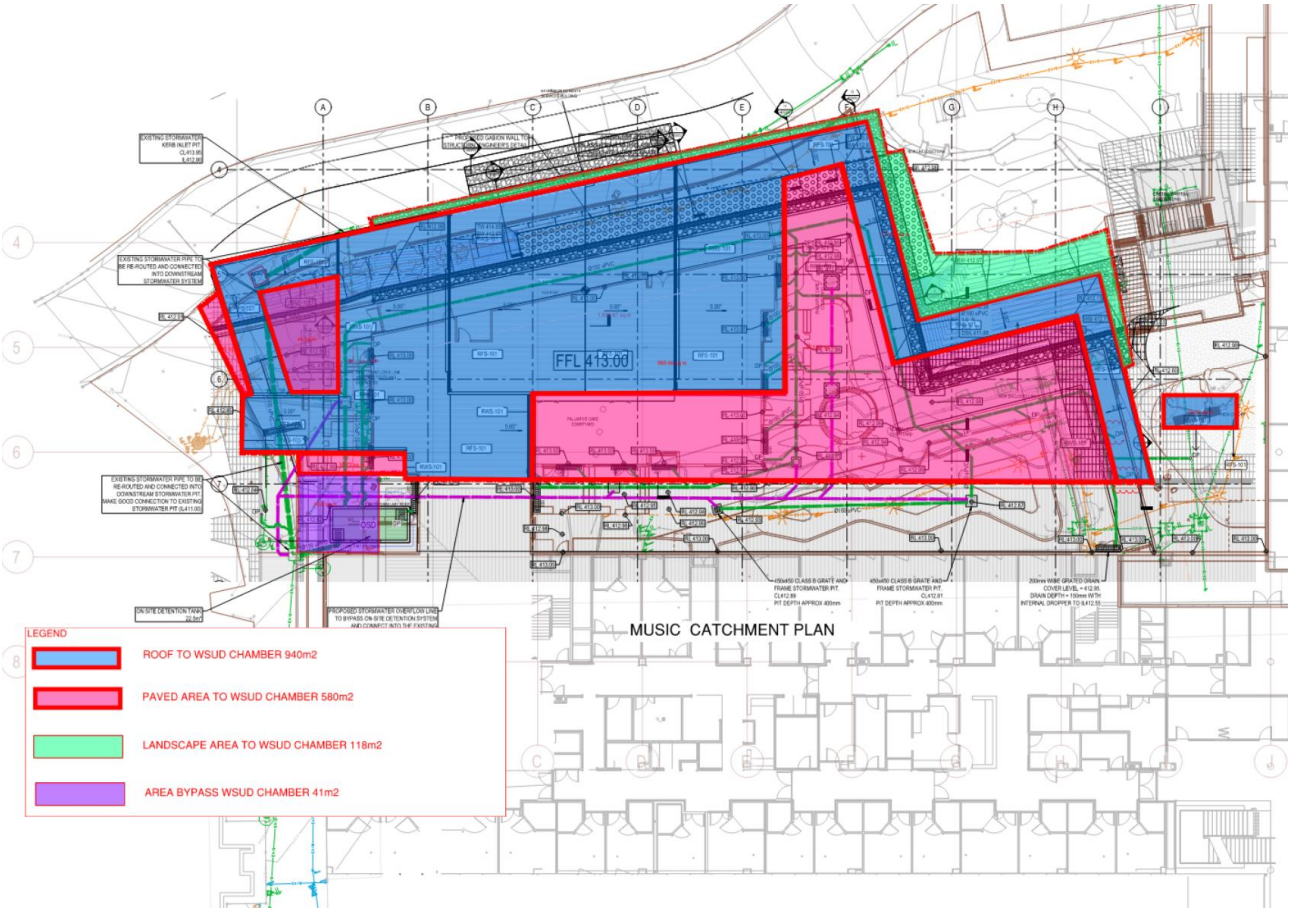

Figure 4: Music Catchment Plan

4 Stormwater Quantity

4.1 Standards

The stormwater quantity measures implemented in this design have been designed as per the following documents:

- Tamworth Regional Council Engineering Design Minimum Standards May 2023
- Australian Rainfall and Runoff 2019.Minor Flow – Pit and Pipe Network
- Minor pit and pipe system with the capacity to convey 5% AEP flows
- Major overland system of flow path capacity to convey 1% AEP flows
- The OSD system is designed to maintain the existing undeveloped discharge for all storm durations and frequencies in the range from the 0.5EY up to and including 1% AEP events.

4.2 Methodology and Modelling

DRAINS was used to model the proposed catchments and drainage system, including predicted overland flow paths. The model also includes the post-development system utilising an OSD.

The current stormwater drainage design will be refined in a progressive manner as final design of the site is confirmed. The current modelling and design has been completed to demonstrate that the performance requirements of the stormwater system can be achieved as required in the Tamworth Regional Council Engineering Design Minimum Standards.

- Drains Version 2025.01.9147.24925 (64 bit)
- 0.5EY up to and including 1% AEP events

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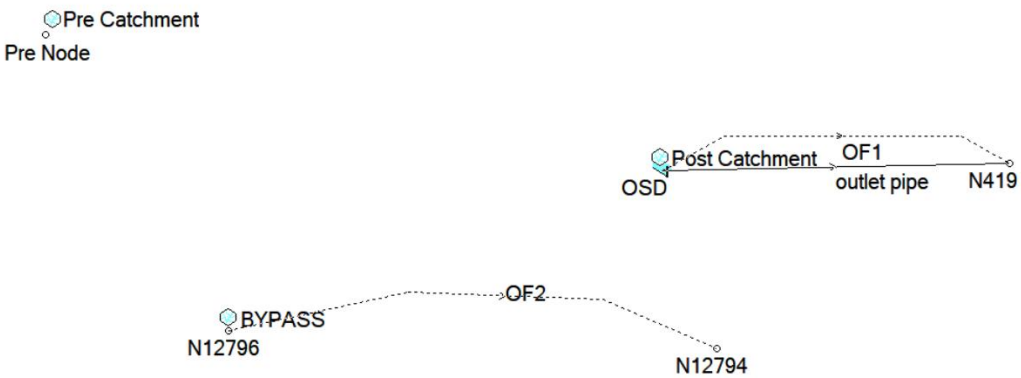

Figure 5: Drains Model Schematic Plan

4.3 Rainfall Data

Rainfall data for the Tamworth region was obtained from the Bureau of Meteorology (BOM) IFD Tables and imported into DRAINS for the 1% AEP rainfall events.

Refer to Appendix A

4.4 Model parameters

4.4.1 Soil parameter

Soil parameter values adopted in the DRAINS hydrological models

Parameter	Value
Soil Type	3
Grassed Depression Storage (mm)	5
Paved Depression Storage (mm)	1

4.4.2 Roughness

Roughness parameter values (Manning's coefficients) adopted in the DRAINS hydrological models

Model – surface type	Surface roughness 'n' value
Pervious Areas	0.10
Supplementary Areas	0.030
Impervious Areas	0.015

4.5 Design Storm and Time of Concentration

For each storm event, we analyse duration from 5mins up to 6 hours.

Model – surface type	Time of Concentration
Pervious Areas	5
Supplementary Areas	0
Impervious Areas	10

4.6 Pre-Development Peak Discharge

Catchment Name	Area (Ha)	Peak Discharge m^3/s: AEP(%)			
		0.5EY	20	5	1
Pre-Catchment	0.1653	0.02	0.028	0.043	0.063

4.7 Post Development Peak Discharge (undetained)

Catchment Name	Area (Ha)	Peak Discharge m^3/s: AEP(%)			
		0.5EY	20	5	1
Post-Catchment	0.1638	0.034	0.042	0.059	0.081
Bypass	0.004	0.001	0.001	0.002	0.002

4.8 Peak Discharge Post (detained) vs Pre-Development

Storm Event year ARI	Peak Discharge m^3/s: AEP(%)		
	Pre-Development	Post Development	Difference %
0.5EY	0.02	0.019	5
5	0.028	0.022	21
20	0.043	0.028	35
100	0.063	0.056	11

5 Conveyance Facilities

5.1 Minor Pipework

The minor system for stormwater conveyance consists of pits and pipes catering for 20 year ARI flows in accordance with Tamworth Regional Council Engineering Design Minimum Standards Chapter 3.11.1.3 Design Criteria.

5.2 Major Flow – Overland Flow Paths

The major system for stormwater conveyance consists of overland flow paths for all flows in excess of the pipe drainage system capacity and above the 100 year ARI flows in accordance with Tamworth Regional Council Engineering Design Minimum Standards Chapter 3.11.1.3 Design Criteria.

6 Stormwater Detention

6.1 Purpose

To mitigate the post development peak discharge to no greater than the predevelopment values.

6.2 Catchment and Conveyance

Refer to Figure 3: OSD catchment plan.

6.3 OSD Tank Description and Details

Refer to OSD Plan and Sections at Drawing WCP-ACR-DRW-CIV-TAM-01A-0000007.

7 Stormwater Quality

7.1 Standards

The stormwater quality measures implemented in this design have been designed as per the following documents:

- Tamworth Regional Council Development Control Plan 2010 (DCP)

The overall water quality performance objectives as outlined in Stormwater Quality Target -Subdivision are as follows for development less than 2,000m^2:

- 90% reduction in total gross pollutants (GP),
- 80% reduction in total suspended solids (TSS),
- 65% reduction in total phosphorus (TP)
- 45% reduction in total nitrogen (TN)

7.2 Methodology and Modelling

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) is used to assess the pollutant generation from the site in post-development conditions and to evaluate the proposed treatment train effectiveness.

- MUSIC model version 6.3
- Draft NSW MUSIC Modelling Guidelines 2010

Modelling has been undertaken in accordance with BMT WBM (2015) guidelines with the developed site based on conceptual layout with water quality treatment devices included to achieve councils' objectives. This report is based on the MUSIC model by ACOR, as shown below in Figure 6.

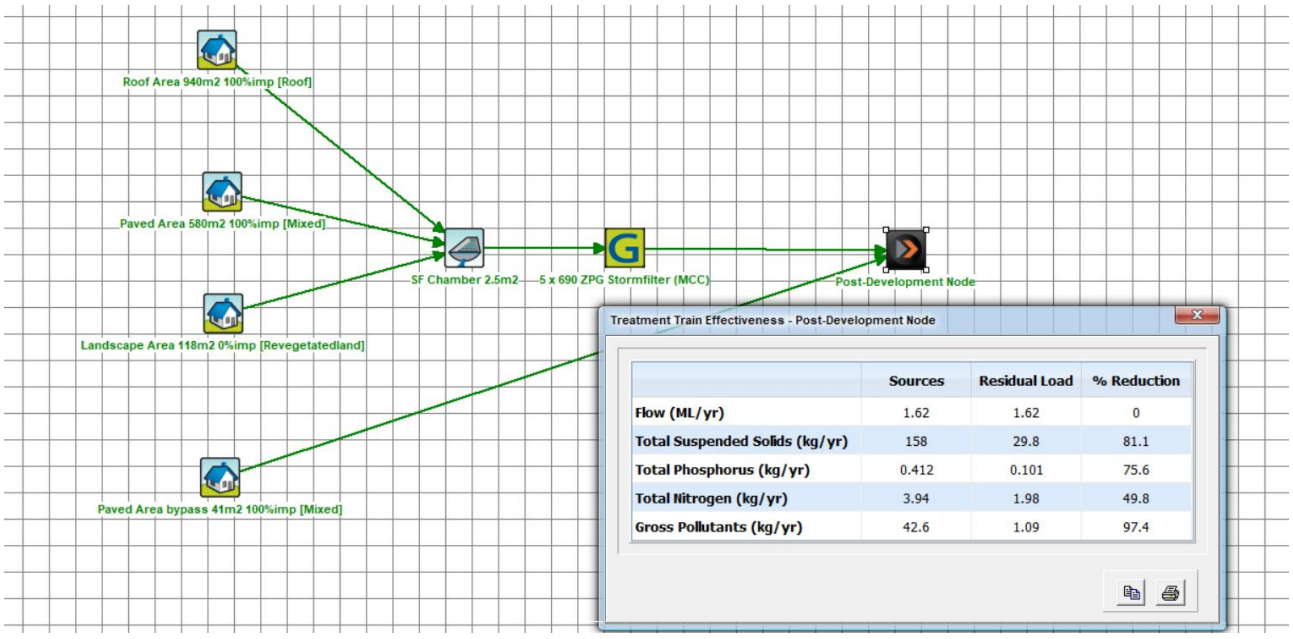

Figure 6: MUSIC Model Layout and Results

7.3 Source Parameters

MUSIC Parameters for the Developed Site

Parameter	Roof	Paved	Landscape
Surface Type Classification	**Roof**	**Mixed**	**Revegetated**
Impervious Area			
Impervious Area percentage	100%	100%	0%
Rainfall Threshold (mm/day)	1.0	1.0	1.0
Pervious Area			
Soil Storage Capacity (mm)	170	170	170
Initial Storage (% of Capacity)	30	30	30
Field Capacity (mm)	70	70	70
Infiltration Capacity Coefficient – a	210	210	210
Infiltration Capacity Coefficient – b	4.7	4.7	4.7
Ground Water Properties			
Groundwater Initial Depth (mm)	10	10	10
Groundwater Daily Recharge Rate (%)	50	50	50
Daily Base Flow Rate (%)	5	5	5
Daily Deep Seepage Rate (%)	0	0	0

7.4 Catchments

Refer to Figure 4: Music Catchment Plan.

7.5 Treatment Train

The stormwater treatment train is to consist of:

- 2.5m2 SF Chamber
- 5 X 690 ZPG Stormfilter (MCC)

7.6 Model Results

MUSIC Model Results

	Source Load	Residual Load	% Achieved Reduction	% Required Reduction
Flow (ML/yr)	1.62	1.62	0	0
TSS (kg/yr)	158	29.8	81.1	80.00
TP (kg/yr)	0.412	0.101	75.6	65.00
TN (kg/yr)	3.94	1.98	49.8	45.00
Gross Pollutants (kg/yr)	42.6	1.09	97.4	90.00

The above results show that the proposed treatment train meet the treatment targets and there are expected to be effective in reducing post-developed average annual pollutant loads in accordance with Tamworth Regional Council.

8 Stormwater Quality - Construction Phase

8.1 General

During the construction phase of the development, an Erosion and Sediment Control Program will be implemented to minimise water quality impacts. A detailed Erosion and Sediment Control Program will be prepared at the detailed design stage and will be employed throughout the site. The control measures shall include silt fences, cut-off drains for polluted stormwater and diversion channels for clean stormwater run-off, gully pit sediment barriers, field inlet sediment traps and temporary bioretention filter protection.

Details of the required construction phase control measures will be provided on the detailed engineering drawings and shall be in accordance with the required standards. However, the contractor shall be responsible for the provision of the construction phase water quality objectives which shall be enforced by the preparation and implementation of an Erosion and Sediment Control Program.

The following information is provided to identify controls and procedures, and who is responsible for them, and should be incorporated into the Erosion and Sediment Control Program.

8.2 Pre-Construction

- Establish a single stabilised entry/exit point for each stage of construction. This point should also include a vehicle shakedown device to mitigate the transportation of dust and dirt.
- Sediment fences are to be placed along the low side of the site to slow flows, reduce scour and capture some sediment runoff.
- Sediment fences are to be constructed at the base of fill embankments.
- Divert up-slope water around the work site and appropriately stabilise any drainage channels.
- Areas for plant and construction material storage are to be designated along with associated diversion drains and spillage holding ponds.
- Diversion banks are to be created at the upstream boundary of construction activities to ensure upstream runoff is diverted around any areas to be exposed. Catch drains are to be created at the downstream boundary of construction activities.
- Construction of temporary sediment basins where required.
- Site personnel are to be educated to the sediment and erosion control measures implemented on site.

8.3 During Construction

- Progressive stabilization of filled areas and fill batters.
- Construction activities are to be confined to the necessary construction areas.
- The provision of a construction entry/exit to prevent the tracking of debris from tyres of vehicles onto public roads and to limit the movement of construction equipment.
- The topsoil stockpile location will be nominated to coincide with areas previously disturbed. A sediment fence is to be constructed around the bottom of the stockpile to trap sediment. A diversion drain is to be installed upstream of the stockpile if required.
- Roof downpipes should be installed as soon as practicable after the roof is constructed.
- Transport loads that are subject to loss through wind or spillage shall be covered or sealed to prevent entry of pollutants to the stormwater system.
- Regular inspection and maintenance of slit fences, sediment basins and other erosion control measures. Following rainfall events greater than 50mm inspection of erosion control measures and removal of collected material should be undertaken. Replacement of any damaged equipment should be performed immediately.

8.4 Post Construction

- The Contractor/ Developer will be responsible for the maintenance of erosion and sediment control devices from the possession of the site until stabilisation has occurred to the satisfaction of the superintendent and Principal.
- The Erosion and Sediment Control Management Plans should be provided to all people involved with the site, including sub-contractors, private certifiers, body corporates and regulators.

8.5 Monitoring and Maintenance

A detailed water quality maintenance plan for the water quality infrastructure in the development will be provided as part of the detailed engineering design. Preliminary maintenance information is described below.

This will involve implementation of a regular inspection and maintenance schedule. As a minimum, the inspection and maintenance program is to follow the manufacturer's recommended time frame plus after any significant rain event. The inspection regime may be increased when housing construction commences to determine if a more frequent maintenance period is required.

Installation of the bioretention filtration media and vegetation will be delayed until a significant proportion of the contributing lots are built on and established.

8.6 Maintenance – Stormfilters

Maintenance activities and frequencies will be in accordance with manufacturer's recommendations and Council's experience.

Appendix A IFD Rainfall Chart – Tamworth Hospital

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	109	123	167	198	229	271	304
2 min	91.9	103	139	165	192	228	255
3 min	85.3	95.5	129	153	178	211	235
4 min	80.3	90.1	122	145	168	198	221
5 min	76.0	85.4	116	137	159	187	210
10 min	59.9	67.6	92.2	109	126	149	167
15 min	49.7	56.1	76.6	90.8	105	124	140
20 min	42.6	48.1	65.7	77.9	90.1	107	120
25 min	37.5	42.3	57.7	68.5	79.3	94.1	106
30 min	33.6	37.8	51.6	61.2	70.9	84.2	94.8
45 min	25.9	29.1	39.5	46.9	54.4	64.7	72.7
1 hour	21.4	24.0	32.4	38.5	44.6	52.9	59.5
1.5 hour	16.2	18.1	24.3	28.8	33.3	39.5	44.3
2 hour	13.3	14.8	19.8	23.4	27.0	31.9	35.7
3 hour	10.0	11.2	14.8	17.4	20.0	23.6	26.4
4.5 hour	7.60	8.44	11.1	13.0	14.9	17.5	19.6
6 hour	6.24	6.93	9.13	10.7	12.2	14.3	15.9
9 hour	4.74	5.26	6.92	8.06	9.19	10.8	12.0
12 hour	3.89	4.32	5.68	6.63	7.56	8.86	9.92
18 hour	2.94	3.26	4.31	5.03	5.76	6.80	7.63
24 hour	2.39	2.66	3.52	4.14	4.76	5.65	6.37
30 hour	2.03	2.26	3.00	3.54	4.10	4.89	5.54
36 hour	1.77	1.97	2.63	3.12	3.62	4.35	4.94
48 hour	1.42	1.58	2.12	2.53	2.96	3.59	4.10
72 hour	1.03	1.14	1.54	1.86	2.20	2.69	3.11
96 hour	0.813	0.903	1.22	1.47	1.75	2.15	2.50
120 hour	0.677	0.752	1.02	1.22	1.44	1.78	2.07
144 hour	0.583	0.648	0.871	1.04	1.22	1.51	1.76
168 hour	0.515	0.572	0.765	0.908	1.06	1.29	1.51