



Our Reference: 240370 - WCMP

No.110-112 Deccan Street, GOULBURN

Water Cycle Management Study/Strategy

Prepared by: Daniel Cheng

BE(civil) MIEAust

Checked by: Robert Eltobbagi

BE(Civil) MIEAust CPEng NER RPEQ APEC-Engineer IntPE(Aus)

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REVISION A – DA SUBMISSION

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1. EXECUTIVE SUMMARY

As specified in Goulburn Mulwaree Development Control Plan 2009 Chapter 7.3.2 – ‘Water Sensitive Urban Design’ (urban), a development must comply with the neutral or beneficial effect on water quality test State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011.

All development applications in the Sydney drinking water catchment should include a Water Cycle Management Study (WCMS) or equivalent information, which will be required to demonstrate in the DA submission to Council.

The purpose of this Report is to address whether a proposed development can achieve a sustainable neutral or beneficial effect on water quality including during periods of wet weather, which in turn, will lead to a more sustainable outcome that will protect the environment.

The following items will be addressed in the Report:

- **Site & Development details;**
- **On-Site Stormwater Retention & Detention;**
- **Proposed Stormwater Management and ‘offset’ measures;**
- **‘MUSIC’ modelling & results;**
- **Stormwater Quality Targets**

2. CAUTIONARY NOTE ON THE USE OF DATA IN THIS REPORT

The data shown in this Report applicable to development is based on a number of critical assumptions. At no point should this data be adopted as guidelines for design in any way or to reduce responsibility to carefully undertake the requisite design calculations.

The proposal for development does still need to be supported with a detailed:

- *geotechnical report,*
- *Final Architectural Plans*

Work undertaken for this project is based on broad planning policies (*e.g. geotechnical report, existing stormwater drainage information, and finalized architectural plans for DA*); detailed site conditions were not provided at the time of preparing this Report.

3. CATCHMENT CONDITIONS

3.1 General Topography and Drainage

The catchment soil type is predominantly of Upper Silurian and Lower Devonian sediments, generally found in the foot of the catchment where slopes and valley floors are evident. General catchment slope gradients are in the order of < 10%. More detailed information on this catchment area is contained in Scown, Murphy and Johnston (1988).

The proposed childcare development itself includes excavation of site for basement parking area, and regrading of site for children's play area.

The site catchment covers an area of 1,193m². The site runoff is conveyed via kerb outlet to council's kerb and gutter



Figure 1 **Site location**

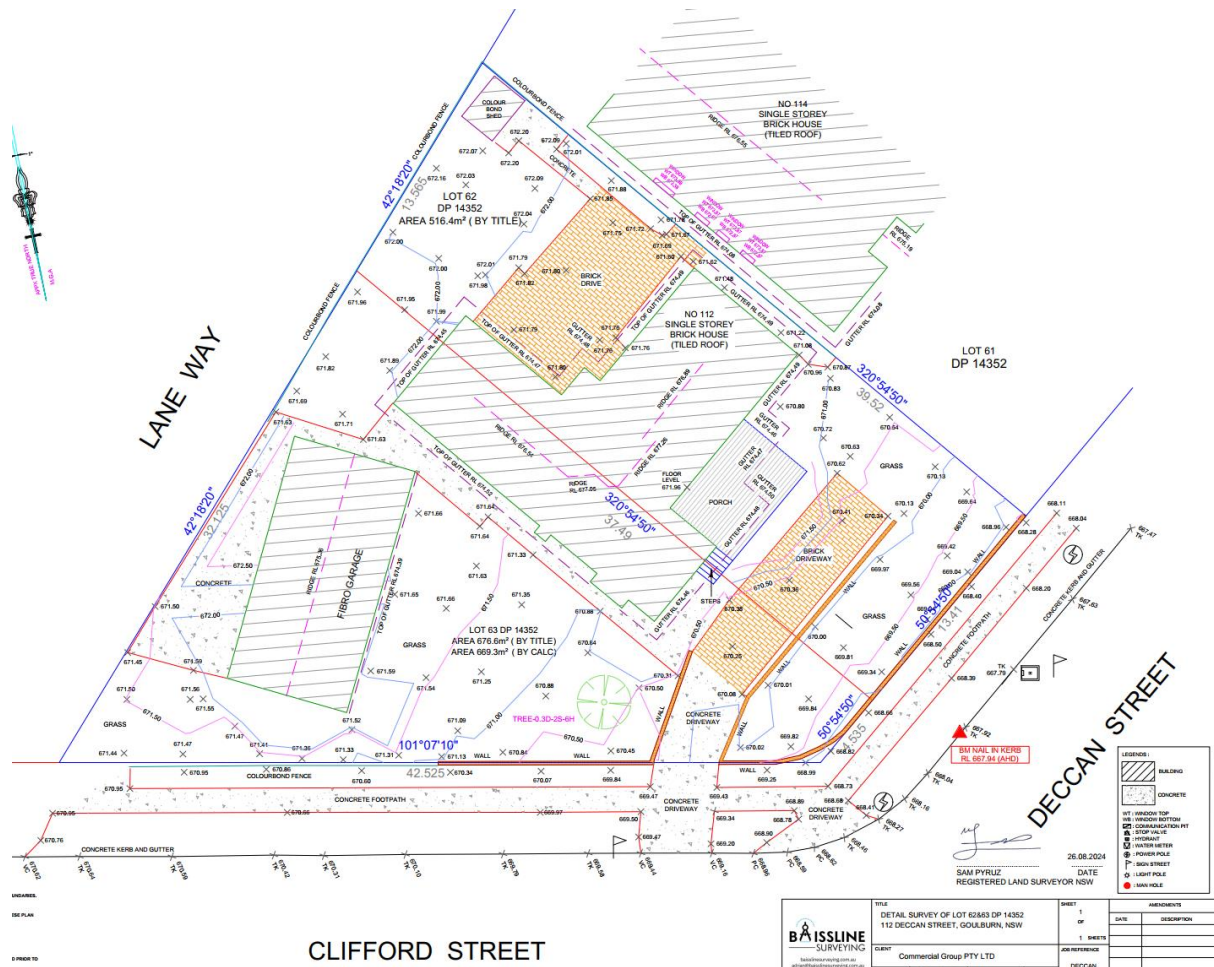


Figure 2 Survey Plan

3.2 Soils

The proposed childcare development overlays over Bullamalita (Code: bl) soil landscapes as described by the 'Soil Landscapes of the Goulburn 1:250,000 Sheet':

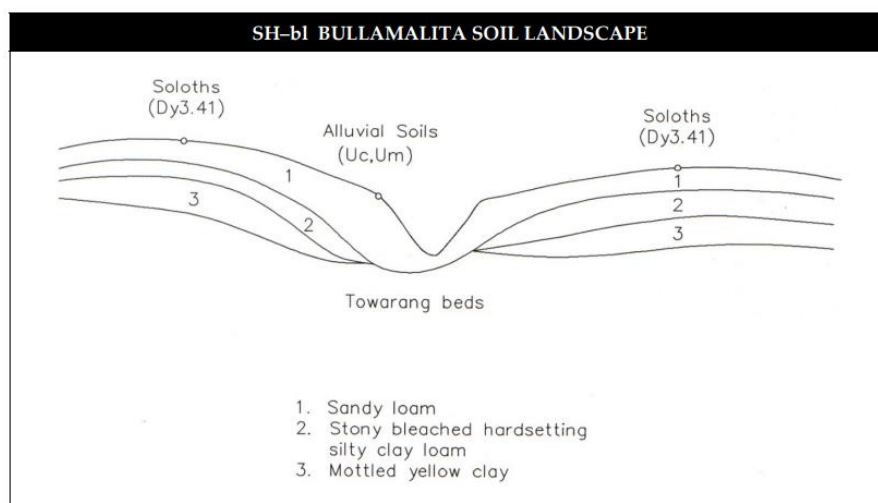


Figure 3 Soil Profile

<u>Parameter</u>	<u>Bullamalita</u>
Surface Condition	Hardsetting
Drainage	Poor
Soil Permeability	Slow
Available Water Holding Capacity	High
pH	5.5-6.0
Soil Salinity	Evident
Erodibility	High
Erosion Hazard	High

Table 1 - Soil Landscapes
(Source: Soil landscapes of the Goulburn 1:250,000 Sheet)

Disturbance of either of the soil landscape surfaces for urban development will create significant short term erosion problems. This is of particular concern due to Sloane Street precinct/s being in close proximity to the Mulwaree River.

Sediment and erosion control will need to be rigorously managed in the proposed development area to prevent gullyng and sheet erosion.

4. SITE DEVELOPMENT

4.1 Existing

Currently, the site is established as residential development with an existing dwelling, driveways and garage covering the site of 50.8% impervious area.

4.2 Proposed

The proposed development includes 23 parking spots(8 staff parking) & 2 floors of internal & external childcare area.

SITE AREA CALCULATIONS		
TOTAL SITE AREA	1193.0	m ²
EXISTING DEVELOPMENT		
BUILDING FOOTPRINT AREA	332.85	m ²
PAVED AREA	205.95	m ²
DRIVEWAY AREA	67.41	m ²
TOTAL IMPERVIOUS AREA	606.2	m ²
IMPERVIOUS AREA PERCENTAGE	50.8%	
PROPOSED DEVELOPMENT		
BUILDING FOOTPRINT AREA	786.56	m ²
PAVED AREA	30.4	m ²
DRIVEWAY AREA	123.38	m ²
TOTAL IMPERVIOUS AREA	940.3	m ²
INCREASE IN IMPERVIOUS AREA	334.1	m ²
TOTAL IMPERVIOUS AREA PERCENTAGE	78.8%	

Table 2 - Site Impervious Area Calculation



Figure 4 Basement Plan

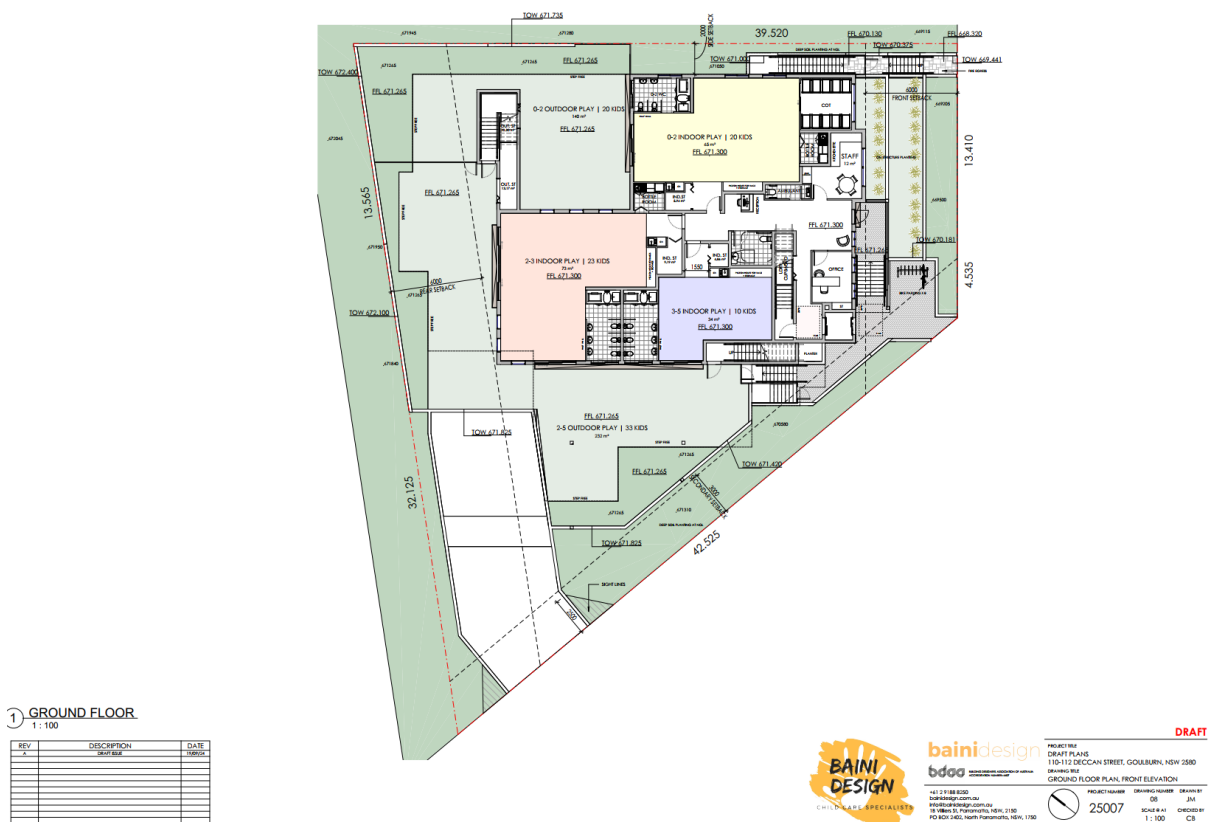


Figure 5 Ground Floor Plan

5. GENERAL REQUIREMENTS

5.1 Councils requirements 'Stormwater Management Plan'

Councils 'stormwater management' Strategy for new developments is extensive and very broad.

Relevant objectives contained within Councils 'SMP' include:

- Urban development should only occur in areas where a land capability study has indicated that area is physically capable of supporting the proposed type of development without significant soil erosion, land slip or water pollution;
- 'Water Sensitive Urban Design' principles should be incorporated in the development;
- A strong emphasis should be placed on the management of stormwater at or near the source. This applies to both the quantity and quality of stormwater;
- Reuse of stormwater for non-portable purposes should be encouraged. This should be undertaken in the context of total water cycle management;
- Where appropriate, 'natural' channel designs should be adopted in preference to grass or concrete lined floodway, unless there are specific requirements for a lined channel;
- Site specific studies should be undertaken to identify the sustainable pollutant export from the development site. In the absence of these studies, there should be no net increase in the average annual load of pollutants critical to the health of receiving water ecosystems and human health, under post-development conditions. If this cannot be achieved, an 'offset' scheme could be developed where contributions are obtained from developers from rectifying existing affecting the 'health' of watercourse and water bodies within the catchment;
- Soil and Water Management practices should be implemented during the construction phase of the development to minimise soil erosion and sediment export;
- Applicable 'Water Quality' guidelines should be met for water bodies receiving stormwater runoff that is used for water supply purposes;
- Impact of urban stormwater on weed propagation and growth in bushland should be minimised;
- Impact of stormwater on public health and safety should be minimised;
- Opportunities for the multiple use of drainage facilities are to be encouraged, to the degree that they are compatible with other management objectives;
- Visual amenity and landscaping opportunities of stormwater systems are to be optimised;
- Peak flows from the development site should be attenuated so that there is no net increase in flows for event from the 1 year to 100-year average recurrence interval;
- Risk of property damage due to stormwater and groundwater should be minimised;
- Disruption to traffic and pedestrians during frequent storm events should be minimised;
- Protect and maintain natural wetlands, watercourses and riparian corridors; and
- Use of vegetated flow paths maximised.

5.2 State Environmental Planning Policy (Biodiversity and Conservation) 2021

Under the State Environmental Planning Policy (Biodiversity and Conservation) 2021, all new development proposals within the hydrological catchment of Sydney's drinking water supply must be assessed for their effect on water quality.

Development proponents therefore are required to submit a 'water cycle management plan' for consideration by SCA.

This plan needs to outline:

- *Whether the development will have a neutral or beneficial effect on the water quality (including pollutant flows, loads or concentrations);*
- *Impact of the development on receiving waters;*

- 'Water Cycle Management Strategies' and best management practices, including maintenance and monitoring, to address any potential impacts;
- Long-term sustainability of water cycle management strategies.

The Goulburn Mulwaree DCP (2009) – Section 7.3.2 'Water Sensitive Urban Design (Urban)', the development must comply with the neutral or beneficial effect on water quality test State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011. This requires at least 10% improvement for total suspended solids, total phosphorus and total nitrogen loads on comparison of the pre- and post-development case.

Pollutant/Issued	Retention Criteria
Total Suspended solids (kg/yr)	10% of average annual pollutant load
Total Phosphorus (kg/yr)	50-98% of average annual pollutant load
Total Nitrogen (kg/yr)	50-98% of average annual pollutant load
Cross Pollutants (kg/yr)	10% of average annual pollutant load

Table 3 Stormwater treatment target
(Source: Using 'MUSIC' - Sydney Drinking Water Catchment)

6. WATER MANAGEMENT STRATEGY

'Water Sensitive Urban Design' (WSUD) applies a treatment train approach to the management of the water cycle on new or existing development.

The 'water cycle' is generally broken down into three main phases of controls:

- 1. Source Controls – at the lot scale of development**
 - Examples are rainwater tanks with plumbed reuse and infiltration trenches to infiltrate overflows from the rainwater tanks
- 2. Conveyance Controls – between the lot and the end of pipe system**
 - Examples are grassed swales, bio-retention trenches, pipes and channels
- 3. End of line Controls – lower down in the catchment and aim to treat large contributing areas**
 - Examples are wetlands, sand filters, GPTs, vegetated uptake systems or similar

In regard to the stormwater drainage design for the proposed development, on site controls to manage water quantity typically employ On-Site Detention (OSD) and On-Site Retention (OSR) systems. Traditionally, these have been in the form of an on-site detention tank and/or infiltration trench. More recently, rainwater tanks have re-emerged to combined OSD and OSR in one device. Further information on on-site detention tank and rainwater tanks in accordance with Goulburn Mulwaree Council's design policy are presented in the next section of our Report.

6.1 Rainwater Retention Requirements

Goulburn Mulwaree Council 'Development Application' submissions require rainwater collection system based on the guidelines outlined 'Stormwater Drainage and Rainwater Collection Systems Policy' effective from 16 August 2022. The following minimum requirements are outlined:

Minimum rainwater tank sizes in areas serviced by reticulated water:

A rainwater tank is installed in conjunction with the building construction and subject to the following:

- *Residential and non-residential developments for lot size 701m² to 2,000m² = 22,500 litres;*
- *Design and installation being in accordance with SEPP Exempt and Complying Development Code, BASIX Certificate, the Plumbing & Drainage Act 2011, AS 3500 Part 1, Water Supply and the Building Code of Australia*
- *Tank supply may also be used for landscape and garden irrigation*
- *Any Bushfire Fighting water storage requirements are in addition to the above minimum tank size*

Proposed RWT volume provided for our development:

- *Total site area = 1193.0m²*
- *Total Rainwater Re-use Volume required = 22,500 litres*

Rainwater Re-Use shall be used for toilet flushing, &, irrigation.

6.2 On-Site Detention (OSD) Targets

OSD is only one aspect of the management of the water cycle on a site. Under the heading of Water Sensitive Urban Design (WSUD), water management needs to consider the opportunities to better mimic the natural phenomenon of water cycle.

As previously addressed in the last Section of our Report, 'on-site retention (RWTs) is one means of achieving this. In addition, the use of infiltration (where appropriate) can also be utilised - though not applicable for this development.

On-Site Detention (OSD) has been provided for our development to limit post development 'peak' flows for all storm events up to and including the 100 year ARI (1% Annual Exceedance Probability) storm event.

- ***Refer to Figure 10 below for 'Permissible Site Discharge' table as outlined by Council***

Permissible Site Discharge (l/s/ha)

Percent Impervious	Percentage of Development Area Draining to OSD System						
	100	95	90	85	80	75	70
10	277	273	268	262	255	254	253
20	264	259	254	249	243	242	241
30	251	245	240	236	232	230	228
40	238	232	225	223	220	218	216
50	225	218	211	210	208	206	203
60	222	215	208	204	201	195	190
70	219	212	205	199	194	185	177
80	215	208	201	194	187	175	163
90	212	205	198	189	180	165	150

Area is total site area in hectares

Figure 10 Permissible Site Discharge

- Refer to Figure 11 below for 'Site Storage' table as outlined by Council

Site Storage Requirement (cum/ha)

Percent Impervious	Percentage of Development Area Draining to OSD System						
	100	95	90	85	80	75	70
10	20	26	32	36	39	41	43
20	37	43	50	54	58	62	66
30	53	61	68	73	77	83	89
40	70	78	86	91	96	104	111
50	86	95	104	110	115	125	134
60	103	112	121	127	133	142	152
70	119	129	138	144	150	160	169
80	136	145	155	161	168	177	187
90	152	162	172	179	185	195	204

Figure 11 Site Storage

An underground On-Site Detention tank has been proposed and incorporated into the proposed development building construction. The following parameters have been adopted:

- **Site PSD** = $187 \text{ l/s/ha} \times 0.1193 \text{ ha} = 22.31 \text{ l/s (1\% AEP/100yr ARI)}$
 - **Bypass OSD** = $187 \text{ l/s/ha} \times 0.0250 \text{ ha} = 4.68 \text{ l/s}$
 - **OSD discharge** = $22.31 \text{ l/s} - 4.68 \text{ l/s} = 17.62 \text{ l/s (so not to exceed Site PSD)}$
 - **SSR** = $168 \text{ m}^3/\text{ha} \times 0.1193 \text{ ha} = 20.04 \text{ m}^3$
 - **Rainwater Credit** = $22.50 \text{ m}^3 \times 0.5 = 11.25 \text{ m}^3 \text{ (OSD credit)}$
- ❖ **Final OSD Require for the development:**
= $20.04 \text{ m}^3 - 11.25 \text{ m}^3$
= 8.79 m^3

6.3 Overland Flow and Flooding

The site is not affected by overland flooding from the local upstream catchment as it is located in the local crest area/high point of the catchment. Therefore, Flood Control requirements are not applicable to the subject site.

The runoff from the localised upstream catchment is captured by existing roadside kerb & gutter drainage system. The existing roadside drainage system has sufficient capacity to convey upstream runoff.

On-Site Retention & On-Site Detention has been incorporated into the development to reduce the burden on the downstream catchment.



Figure 12 *Site Topography Map*

7. WATER QUALITY MODELLING

QUANTUM ENGINEERS has investigated pre and post development water quality by examining three key pollutants associated with stormwater runoff:

- *Primarily Total suspended solids (TSS),*
- *Total Phosphorus (TP), and*
- *Total Nitrogen (TN)*

Water quality modelling can provide an estimate of pollutant export loads and runoff volumes for a catchment under different land uses. By comparing estimates of export pollutant loads from the existing land uses (pre-development) with proposed land uses, an indication of the effects of development on receiving waters can be obtained. It is then transparent whether the strategy meet Council's and WaterNSW's water quality requirements.

The Water Quality modelling for the proposed development was undertaken using **MUSIC v6.3.0**

The adopted 'MUSIC' parameters utilised were as follows:

- **SCA Climate ZONES – Zone 1 meteorological templates that include the rainfall and potential evapo-transpiration data for various catchment areas and which form the basis for the hydrologic calculation in MUSIC;**
- **Rainfall Station – Zone A 6min Bungonia Windthorpe;**
- **WaterNSW by using 'Using MUSIC in the Sydney Drinking Water Catchment' guideline utilizing modified % impervious area, rainfall threshold, soil properties & pollutant concentration;**
- **No drainage routing between nodes.**

7.1 MUSIC Modelling

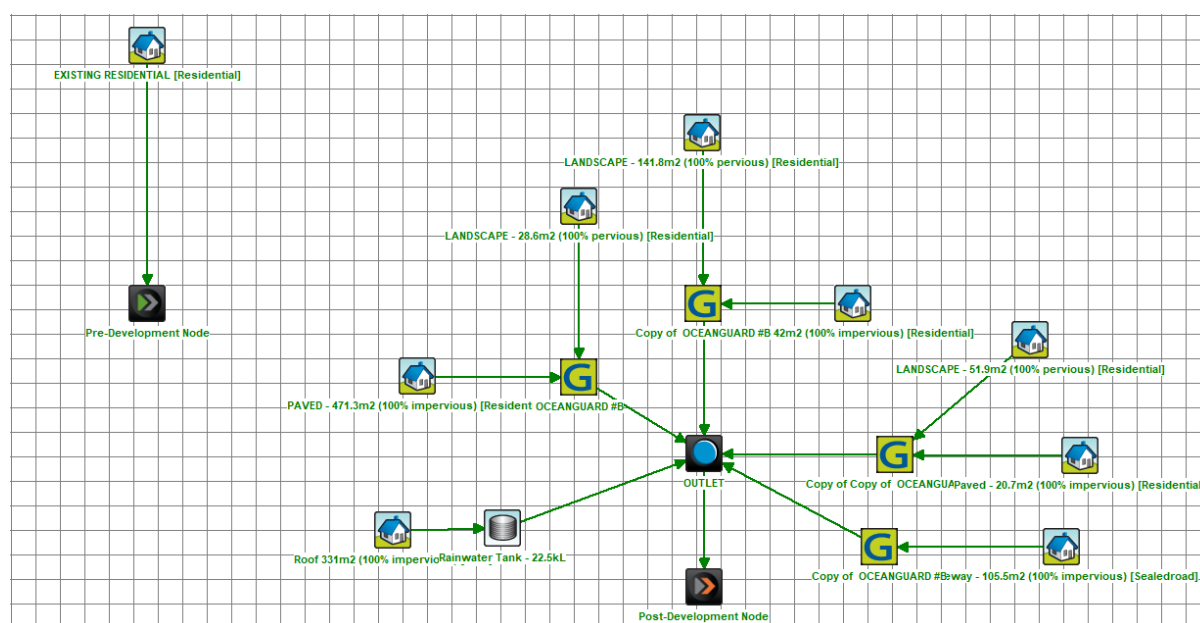


Figure 12

'MUSIC' modelling layout

7.2 Pre-development

The current land use throughout the catchment is general residential.

The areas include existing dwelling, driveways and garage covering the site of 50.8% impervious area.

7.3 Post-development Treatment Measures

Separate nodes were set up to represent:

- *ROOF – node for the proposed roof area. The roof area, which is 100% impervious, is based on an average roof size of 4454 sqm/lot.*
- *PAVED AREA – separate node to represent the artificial turf area (outdoor play area), concrete pavement and other impervious pavement which is assumed to be 100% impervious.*
- *LANDSCAPE GROUND – pervious ground landscaping area which is 0% impervious.*
- *DRIVEWAY - areas that bypass the OSD, OSR that drains to GPT and discharge to the outlet.*

The proposed treatment measures are included:

- *Rainwater tanks (underground)*
- *Gross Pollutant Traps (filter baskets)*
- *OSD tank (underground)*
- *Bio-retention basin*

7.4 Gross Pollutant Traps (Filter Baskets inside Pits):

6 filter baskets were placed throughout the site to remove coarse debris & organic matter before draining to the bioretention basin.

Gross pollutant traps are typically provided to remove litter, organic debris and medium to coarse sediment that may otherwise overload other treatment measures provided to manage fine particulates and nutrients.

8. MODEL RESULTS

The pre- and post- development MUSIC model results summary for the site are shown in Table 4.

	Pre-Dev	Post-Dev	Reduction	Improvement
Total Suspended Solids (kg/yr)	71.2	37.5	33.7	47%
Total Phosphorus (kg/yr)	0.12	0.104	0.016	13%
Total Nitrogen (kg/yr)	0.892	0.764	0.128	14%
Gross Pollutants (kg/yr)	15.6	1.25	14.35	92%

Table 4 'MUSIC' MODELLING POLLUTANT LOAD RESULTS

The total suspended solids, total phosphorus and total nitrogen runoff concentrations for the post - development scenario are lower than or equal to the pre-development conditions between the 50th and 98th percentiles as part of the NorBE test.

9. CONCLUSION

The 'MUSIC' model results conceptually show that NorBE criteria would be achieved for the site.

The modelled post-development total suspended solids, total phosphorus, total nitrogen, and gross pollutant loads are all 10% less than pre-development conditions. The 50th to 98th percentiles of total suspended solids, total phosphorus and total nitrogen concentrations for the post-development scenario are all lower than the pre-development conditions.

Achievement of an overall sustainable neutral or beneficial effect on water quality for the development will require stormwater management measures consisting of:

- **Installing 22.5kL rainwater tank for the main building with extensive as re-use in toilets, taps and for general landscape watering;**
- **Designing all roofs to ensure maximum capture of runoff into the rainwater tanks;**
- **Provide 8.79m³ of Underground On-Site Detention to reduce total site discharge;**
- **Provide 6 gross pollutant traps (filter basket) at nominated locations on stormwater plans;**

Maintenance Schedule is recommended to remain on site.

10. OPERATION & MAINTENANCE

The maintenance of bioretention systems, particularly regular removal of accumulated litter & fine sediment/debris, will ensure the plants remain healthy and will then assist in ensuring high nutrient removal efficiency.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site.

Detailed Maintenance Schedule for the treatment is listed in the following table.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
RAINWATER TANK			
Check Inlet Leaf Strainer	3 months & major storms	Owner	This strainer should be cleaned regularly to ensure it does not become blocked with leaves etc
Check Tank Lip	1 year & major storms	Owner	Make sure lid is tight fitting with no tears – replace or repair if necessary
Check Base Area	1 year & major storms	Maintenance Contractor	Inspect the base area for any movement or damage to the slab or pavers. If the base begins to move or crack, empty the tank to remove the weight and have the fault corrected to prevent damage to the tank
Check Sediment Build Up Inside	2 years & major storms	Maintenance Contractor	Wait for your tank to be empty and then open the bottom valve (or disconnect your pump, if required) and with a high-pressure washer or hose thru the removed inlet strainer you can stir up the sediment and allow it to run out
Check Smelly Water & Water Quality	1 year & major storms	Maintenance Contractor	Check roof and gutters and remove accumulated debris, including leaf and other plant material (more often if trees overhang, or gutter guards not installed)
Check Mozzies	1 year & major storms	Maintenance Contractor	Same method as described in checking smelly water above
Check Pump	6 months & major storms	Maintenance Contractor	All pumps should be removed and serviced every few years to help ensure they remain in good working order
Check Sediment Filters	1 year & major storms	Maintenance Contractor	Sediment filters are recommended when tanks are connected to toilets. To open the filter housing, you first need to isolate the water from the tank and the mains (if connected). Release pressure from the filter by turning on a tap or flushing the connected toilet. Unscrew the filter housing, remove the filter and replace it with a new one. Re-fit the housing, slowly open up the water source/s and

			then turn off any taps which were turned on.
Check First Flush Diverters	1 year & major storms	Maintenance Contractor	If you have first flush diverters installed, frequently unscrew the cap at the base of the diverter and remove the filter. Wash the filter with clean water. There is also a flow restrictor inside the cap which should be removed and washed. Re-fit the flow restrictor facing "top", insert the filter and screw the cap back on.
GENERAL			
Inspect gutters of buildings and remove any debris/sludge	1 year	Owner	
Inspect site for litter and floatable debris and remove	2 weeks	Owner	

11. REFERENCES

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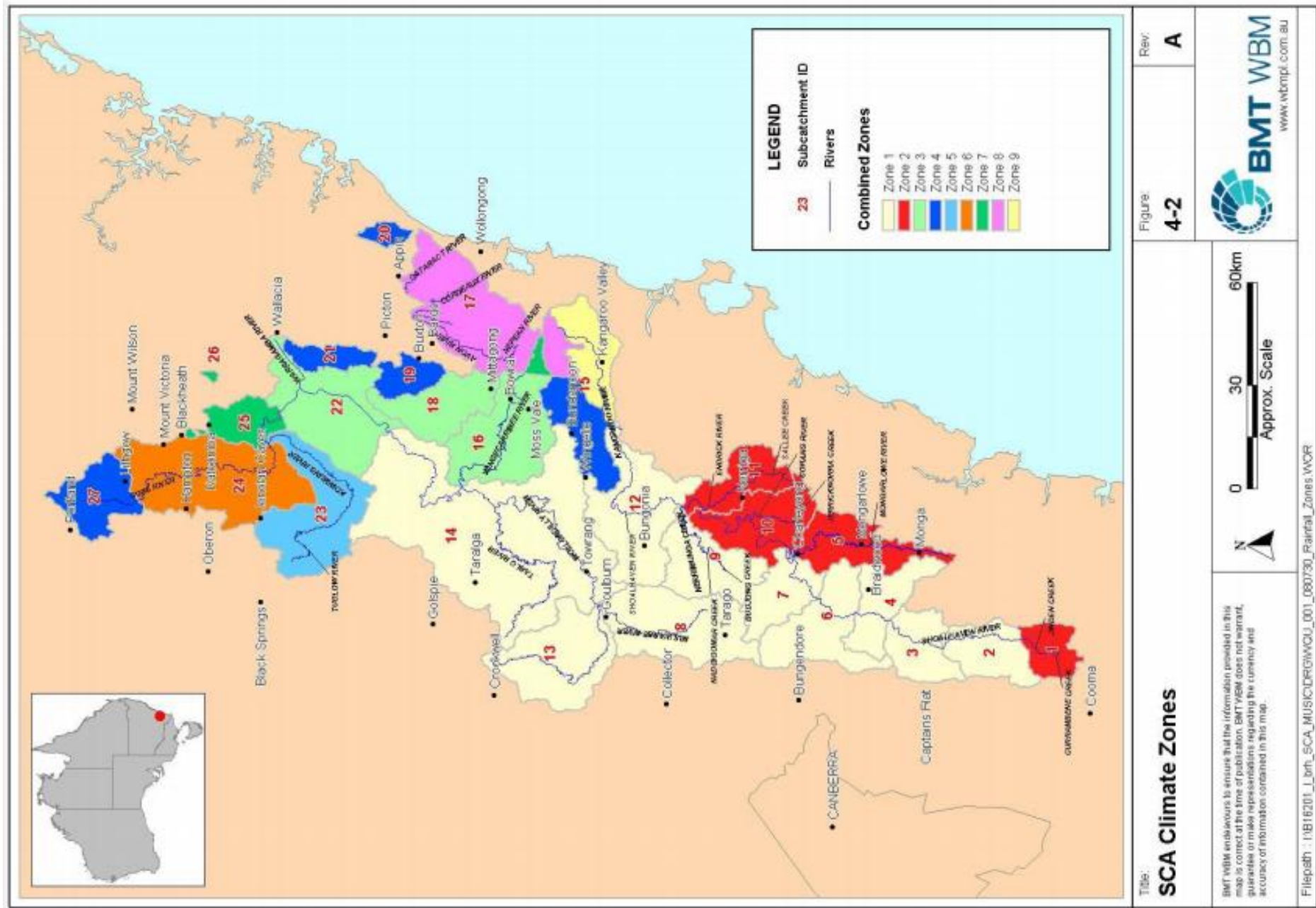
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Appendix A

- *Climate Zone Key Map*
- *Music Results*



Climate Zone Key Map

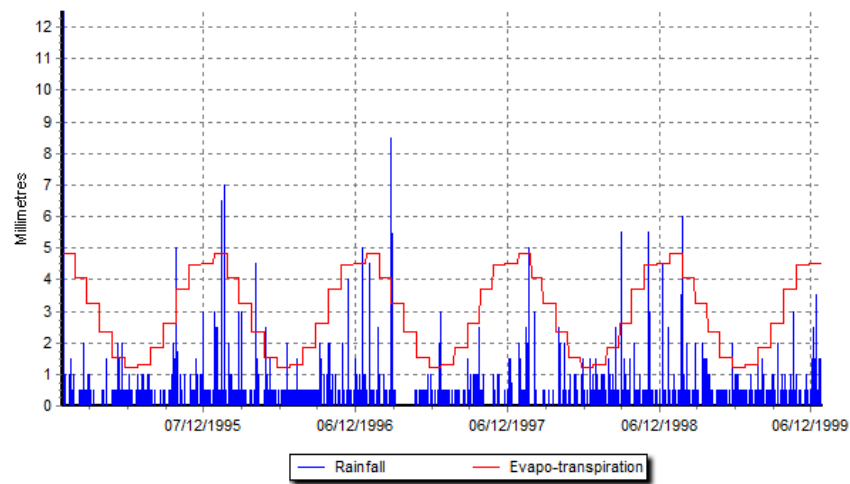


Table A Meteorological Data for Post-Development

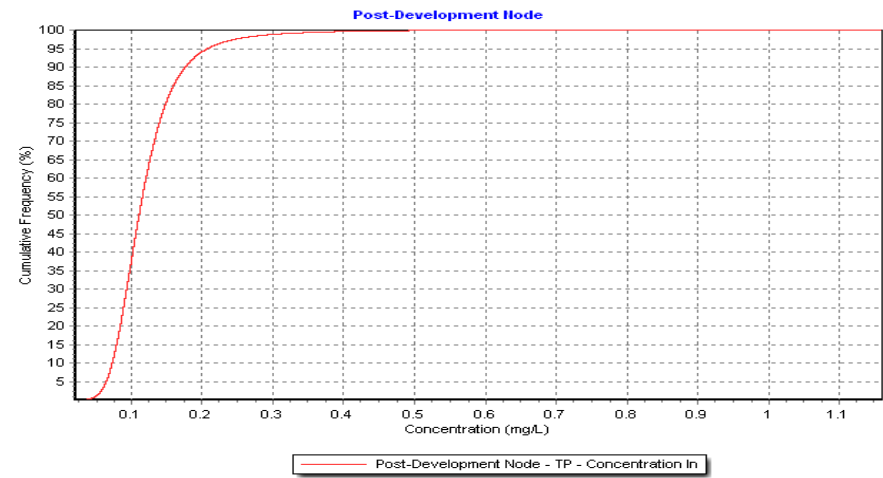


Table C Total Phosphorus Load Post-Development

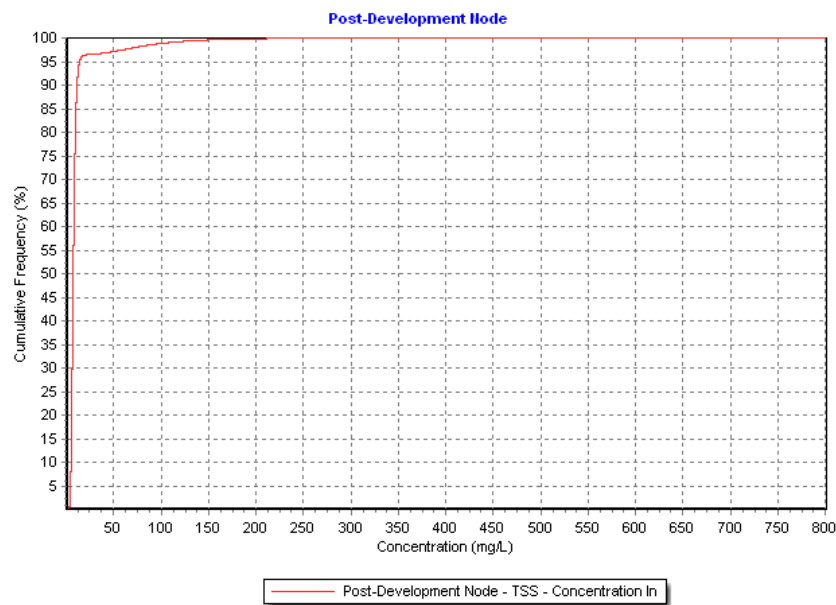


Table B Total Suspended Solids Load Post-Development

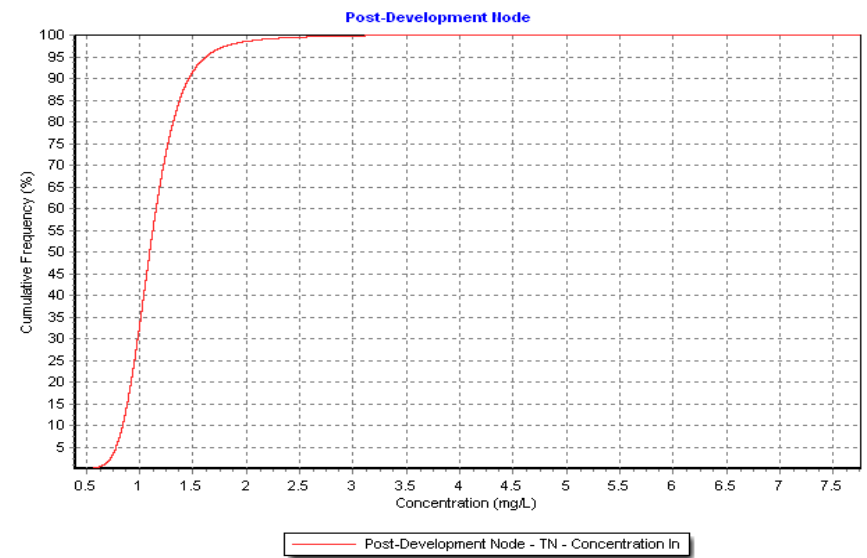


Table D Total Nitrogen Load Post-Development

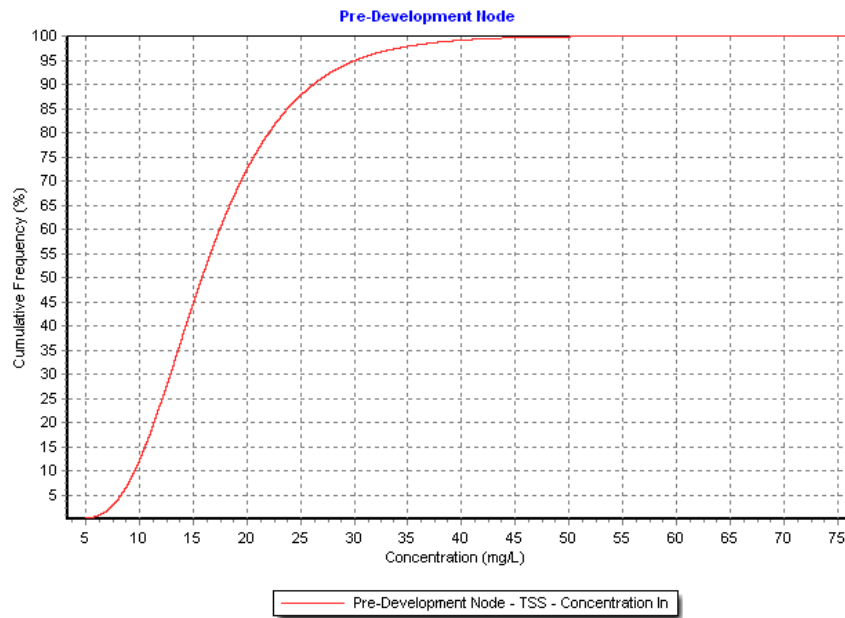


Table E **PRE-General Residential Flow Based Sub – sample TSS**

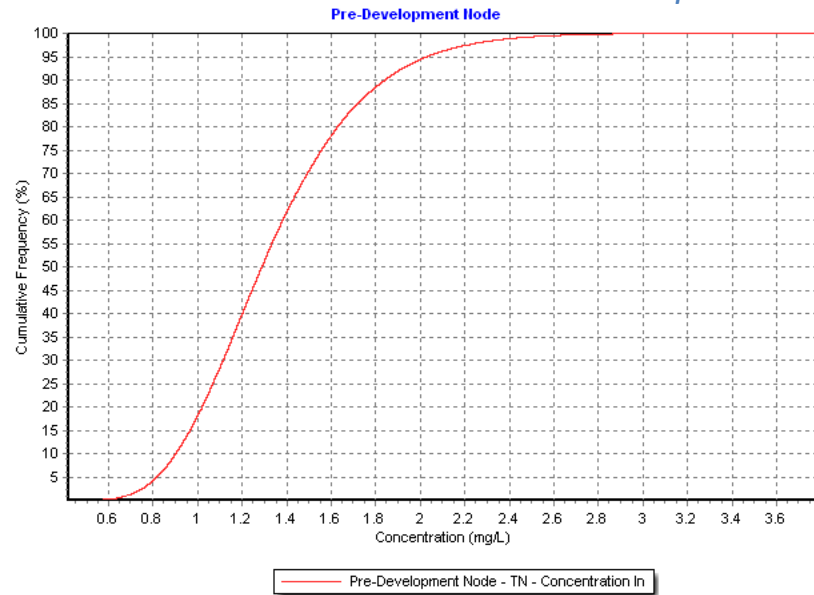


Table G **PRE-General Residential Flow Based Sub – sample TN**

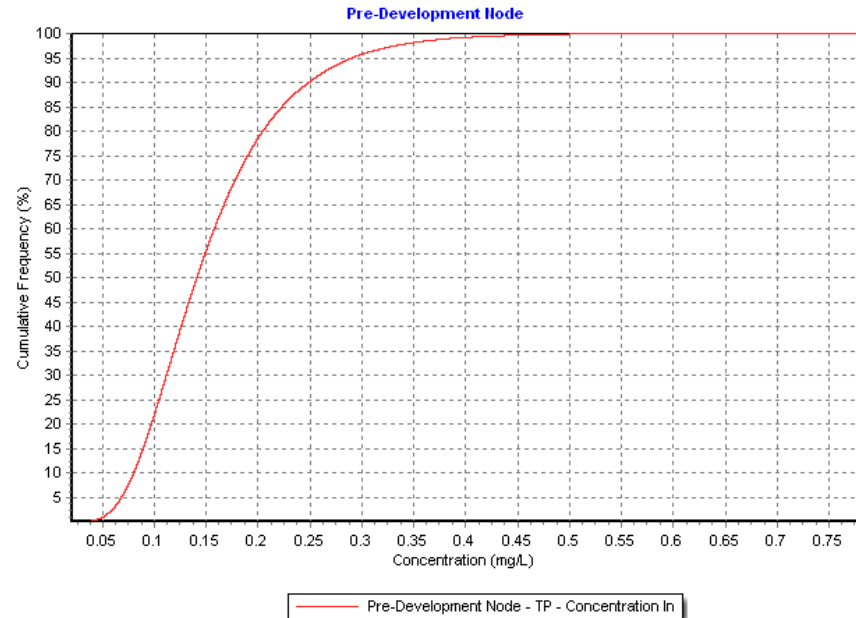


Table F **PRE-General Residential Flow Based Sub – sample TP**

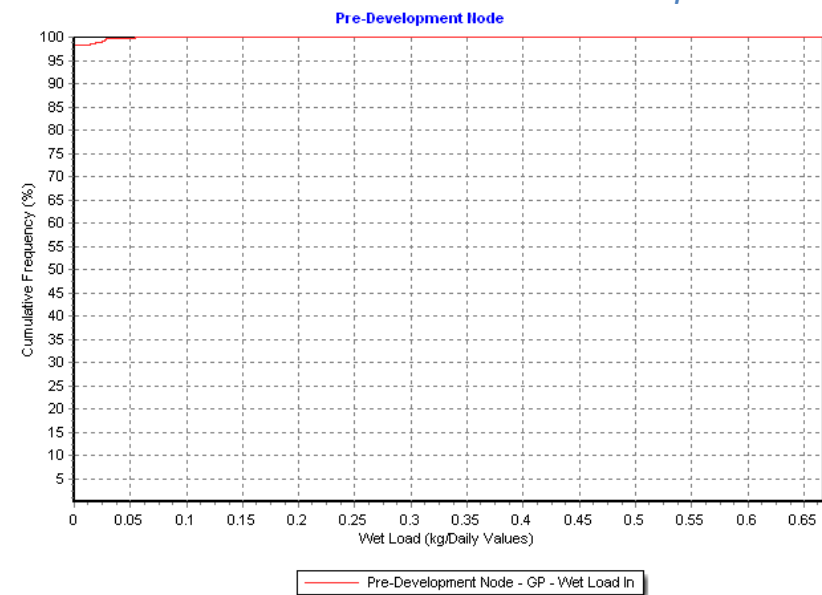


Table H **PRE-General Residential Flow Based Sub – sample GROSS POLLUTANTS**

