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STORMWATER MANAGEMENT PLAN

PARTRIDGE CREEK DEVELOPMENT, PORT MACQUARIE, NSW 2444

CLIENT: PORT MACQUARIE-HASTINGS COUNCIL

Document Verification Schedule

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Project:
Stormwater Management Plan for Partridge Creek Development
At Port Macquarie, NSW 2444

Rev.	Date	Prepared By		Checked By		Approved By	
Rev.01	Oct 16	M McFeeters		J Sutcliffe		M McFeeters	
Rev.02	Aug 17	M McFeeters		J Sutcliffe		M McFeeters	
Rev.03	Aug 18	M McFeeters		J Sutcliffe		M McFeeters	
Rev.04	March 19	M McFeeters		M McFeeters		M McFeeters	

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1 INTRODUCTION

The subject of this Stormwater Management Plan includes land within the 'Partridge Creek Residential' precinct, within the Thrumster Urban Release Area.

The land is located approximately 7km to the west of the Port Macquarie city centre.

The subject land includes two parcels which are legally described as Lot 1 DP1087368 and Lot 2 DP1172154. The land is accessible from Thrumster Street only, having no other public road frontages.

This drainage design strategy is intended to maintain the objectives for land subdivisions within the Port Macquarie-Hastings council (PMHC) area as follows:

- provide safety for the public
- minimise and control, nuisance flooding and to provide for the safe passage of less frequent flood.
- protect property
- enhance the urban landscape
- maximise the land area available for dwellings
- minimise the environmental impact of urban runoff
- ensure discharge rates from new developments, do not exceed the capacity of the downstream stormwater systems nor result in additional scour and instability of natural creek and river systems and artificial channels.
- the system is designed to generally conform to natural drainage patterns and discharge to natural drainage paths in the catchment.

2 SITE DESCRIPTION

The development land is irregular in shape and comprises approximately 211.7 hectares. The development area only comprises about 55 hectares of this.

The land is heavily vegetated in parts, mainly contained to the eastern and northern-most parts of the site. The land is free of improvements, excepting a sewer pumping station which is in the north-western corner.

2.1 EXISTING CATCHMENTS

The development area is undulating but is generally defined by a ridgeline that runs north-south. There is an existing water course that runs north-south through the subject land, which is a tributary of Partridge Creek located further to the north. There is also another water course that runs North through the proposed development area and meets with the tributary.

Key statistics of the catchments are provided in Table 1 below:

Catchment Number	Area
C1	14.5ha
C2	11.3ha
C3	9.7ha
C4	12.1ha
C5	11.5ha
C6	2.8ha
C7	2.1ha
C8	4.0ha

Table 1. Partridge Creek subdivision key statistics by catchment

Figure 1. Aerial Image of Development Site and Surrounds

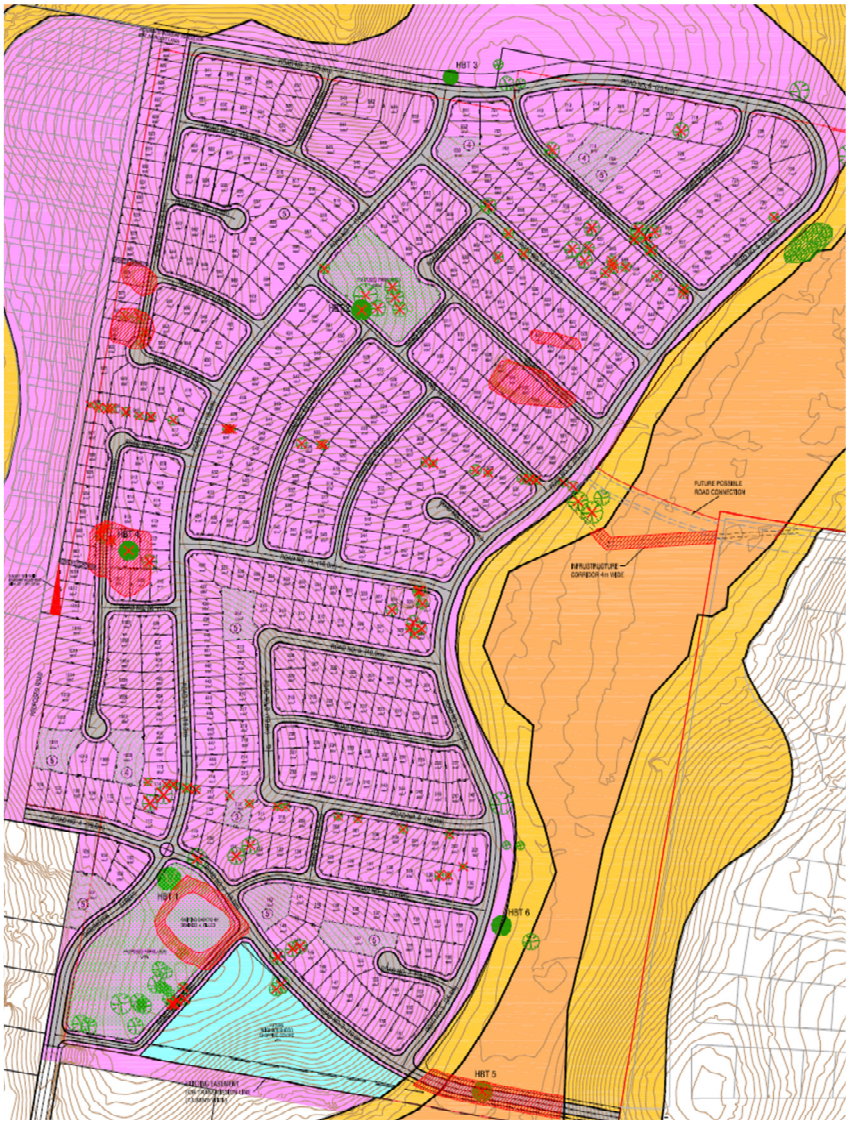


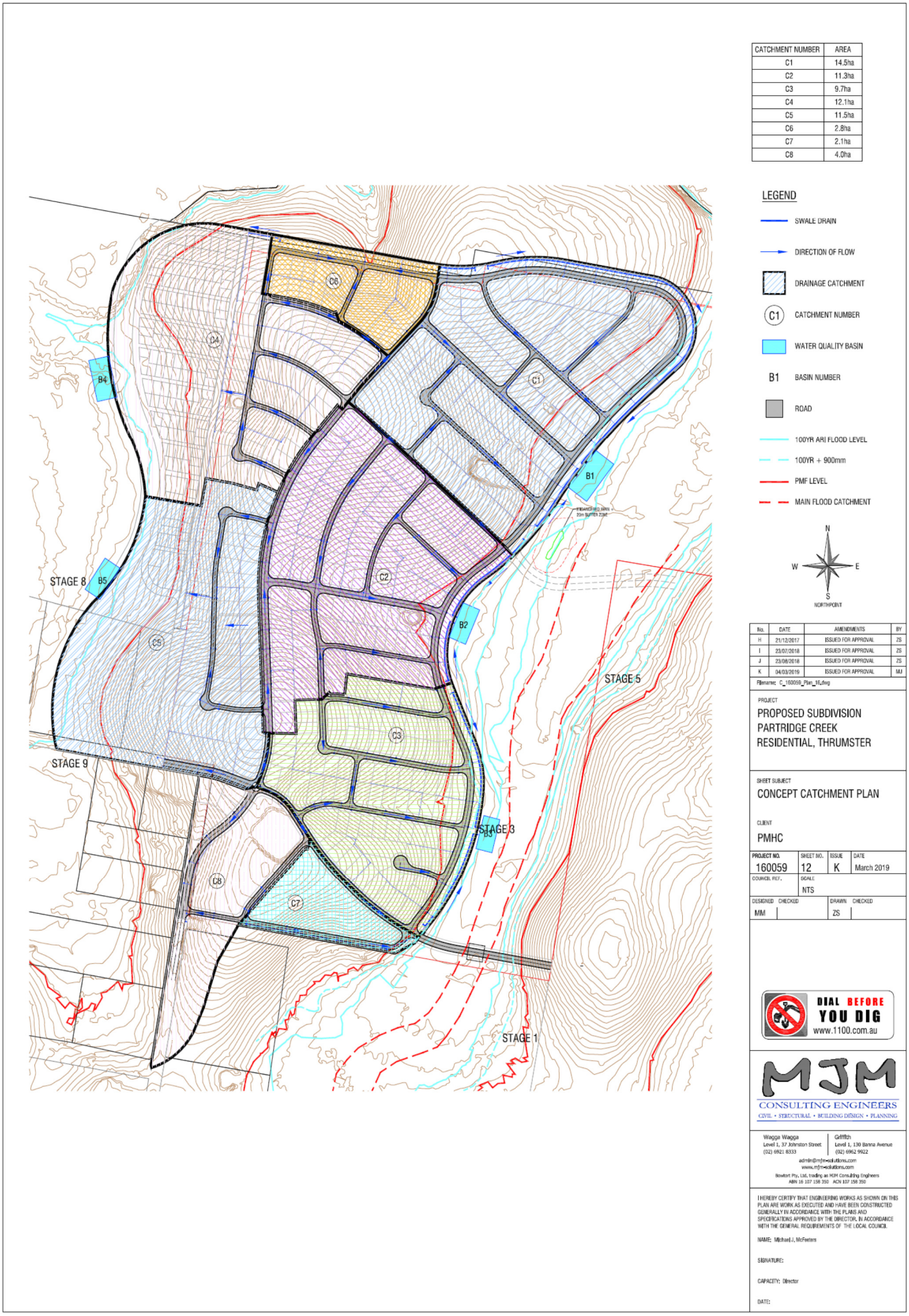
Figure 2. Proposed Subdivision Layout.

3 CATCHMENT CHARACTERISTICS

3.1 CATCHMENT DEFINITIONS

The Partridge Creek development consists of eight individual catchments as defined on the Catchment Plan in Figure 3 below. These eight catchments fall within a wider area catchment as defined in the 'Maunsell|AECOM Thrumster Integrated Water Management Plan Flood Study' as catchment A5.2 and A1-8. Local catchments defined as C4-6 fall within areas A1-8 of the Mansell's Report and a Stormwater Management Plan for this area has been prepared by King & Campbell. Local catchment areas C1-3 and C7-8 fall within the area defined as A5-1. Both catchments fall at the bottom of overall catchments, detention within the lower bounds is not as effective as detention in the upper catchments in reducing the overall peak flow and flood heights. This principle is referenced in King & Campbell Report, "Stormwater detention facilities have been shown to be more effective, the higher their location within the catchment, conversely with a reduction in their effectiveness as we move downstream. In some cases, providing detention within the lower reaches of a catchment may perversely result in increases in the downstream flow rates, due to the peak flow from the downstream sub-catchment being delayed through the use of detention basins to then coincide with the rising peak of the greater catchment at the point of discharge."

Figure 3. Concept Catchment Plan



3.2 HYDROLOGY

To assess the impacts of development on the existing downstream infrastructure the catchment hydrology has been analysed by using the "Drains" with Base model supplied by PMHC. These models have been prepared to determine both the time of concentration and the peak flows for pre and post development.

Storms 1 year, 5 year and 100 year with rainfall events from 5 minutes to 2 hours where analysed to produce peak flows for pre and post development. These models have also incorporated detention to assess the projected volumes to restrict the outflow to pre-developed flows. These times of concentration that have been calculated to help us determine if the time of concentration will correlate to the overall flood times for the Hastings River catchment. Summaries of these are shown in Figure 3 on the previous page. Given that the peak discharge would occur between 40 – 50 minutes for the detention system and between 25 – 30 minutes for the undetained system, the treatment would be redundant. The critical time of concentration for both natural catchments A1-8 and A5-2 is 9 hours. The flows generated by these catchments have been determined for the 1:100 year storm in the Maunsell flood study (2007). It was determined that catchments A1-8 and A5-2 generate 140.9m^3/sec in their current state. Even if the proposed development were to double the impervious area, the total flows would still only represent 0.6% of the total Hastings River flows in the worst case scenario where both peaks were to coincide. Our recommendation in accordance with Council's policy is that all eight catchments be undetained as they have little to no impact on the overall flood heights.

Further to this, it may be shown that the implementation of on site detention could adversely impact the maximum flood height at the confluence of catchments A1-8 and A5-2. The Maunsell flood study (2007) determined that the 100 year time of concentration for the catchments were 9 hours each. By detaining stormwater generated by the development, we would converge the developed and natural flows thus increasing the peak flows from both catchments. This peak amplification could have implications on the capacity of down stream infrastructure.

It has been noted that the development of catchment C8 may result in adverse impacts on the adjacent roadside swale of Thrumster Street. The proportion of additional flows generated by the catchment are anticipated to be low. There currently exists a road through the catchment, and the proposed development will add four residential blocks. In order to mitigate any adverse impacts, lots 101-104 shall be required to restrict their post developed flows to the natural flow rate for that lot by means of on-site detention using water tanks. Flows generated by the proposed road will be offset by the deletion of the existing Thrumster Street connection.

4 CULVERT CROSSINGS

The Site includes two major creek crossings on the eastern side adjoining Lot 206 DP 754434 (L'Estrange). (refer to Figure 5). The design flows and flood plain encroachment have been derived from the flood studies as below.

Patterson Britton & Partners Pty Ltd -
"Area 13 'East Expansion, Precinct At Thrumster , Floodplain Encroachment Assessment "
"Figure 3 - Catchment A & B Encroachment Analysis"

Maunsell|AECOM –
"Thrumster Integrated Water Management Plan Flood Study"
"Stage 3,Peak Flood Level Contours, For The 100 Year Ari Event"

The flows were adopted at node A5-2a for culvert 1 the most southern culvert (10.2m3/s) and at A5-2b for the northern most culvert (12.8m3/s). We have conducted a preliminary estimate of size of box culvert however this will need to be detailed designed prior to construction certificate. We have allowed with a max head diff of 0.1m and a submerged outlet.

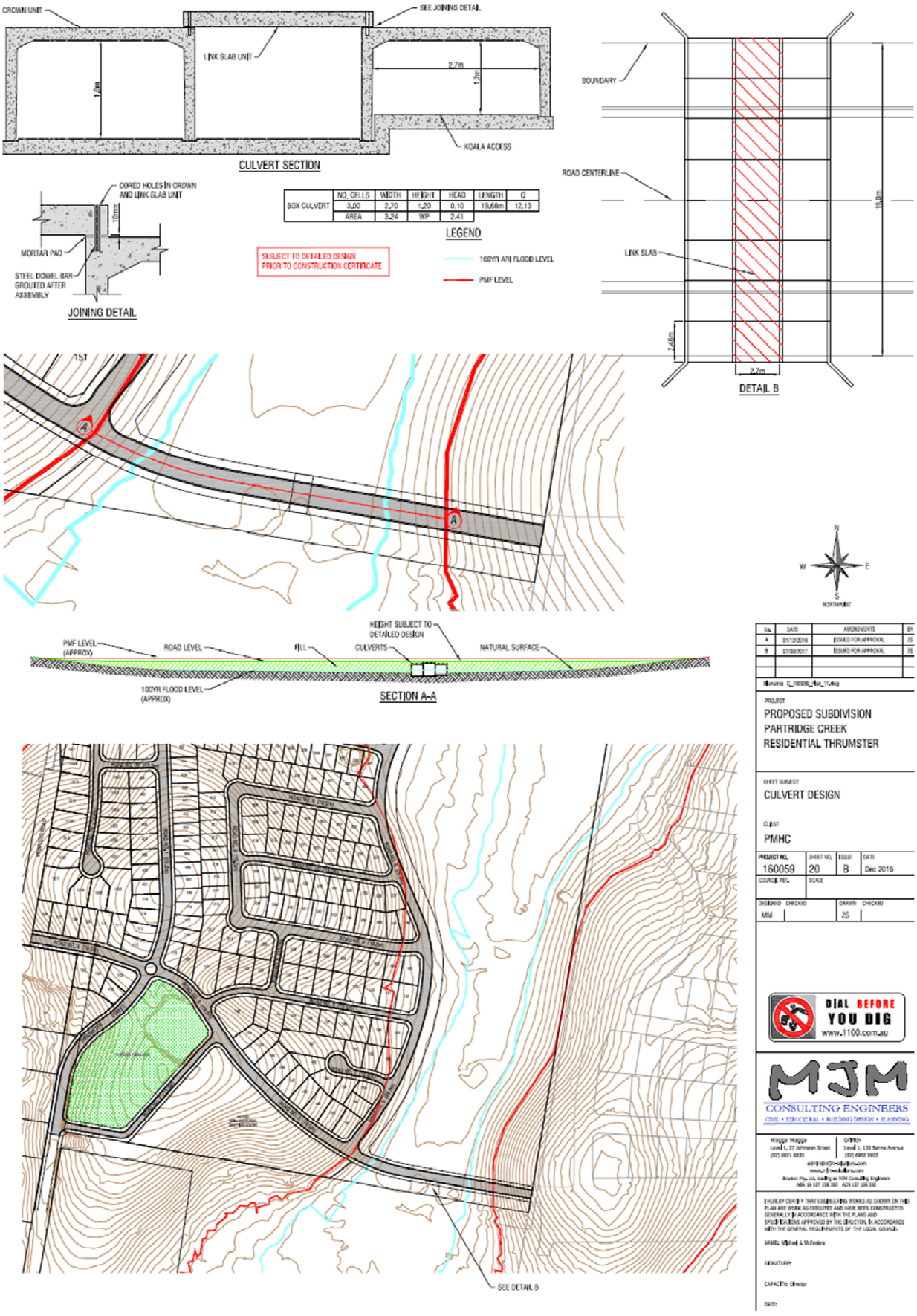
Culvert at Node A5-2a

	NO. CELLS	WIDTH	HEIGHT	HEAD	LENGTH	Q
BOX CULVERT	4.00	2.70	1.20	0.10	20.0m	16.18
	AREA	3.24	WP	2.41		

Culvert at Node A5-2b

	NO. CELLS	WIDTH	HEIGHT	HEAD	LENGTH	Q
BOX CULVERT	3.00	2.70	1.20	0.10	20.0m	12.13
	AREA	3.24	WP	2.41		

Figure 4. Culvert Design



5 STORMWATER QUALITY

5.1 PRE-DEVELOPED SITE CONDITIONS

The site is legally described as Lot 1 DP1087368 and Lot 2 DP1172154, accessible from Thrumster Street only, and the area of the development is approximately 59 hectares which is being developed into approx. 500 residential lots.

5.2 POST-DEVELOPED SITE CONDITION

The site forms part of the 'Partridge Creek Residential' precinct, within the Thrumster Urban Release Area. The development significantly increases the impervious area therefor modelling of the impacts have been carried out below.

The stormwater system is designed such that reduction in pollutants occurs prior to the outlet located in the bio detention basins. The stormwater quality analysis was carried out using the MUSIC modelling program for post-developed conditions with the PMHC template. It is noted that full pollutant reduction will not be achievable in all catchments, namely C6 and C8. Each of these catchments will require Gross Pollutant Traps (GPT) to be installed on their respective drainage outlets. Additional treatment capacity will also be implemented in the bioretention basins to offset the untreated water from these catchments. The result of the additional capacity shall be such that the net water quality generated by the proposed development will be in accordance with relevant standards. Further Music modelling will need to be conducted prior to Construction Certificate to show how the net reduction will be achieved.

The stormwater line from the site is to be directed to the bio detention basin as defined by PMHC and then to the existing Creek line. The site will not include rain water tanks as defined in Auspec D5 and D7.

5.3 COMPARISON OF PRE- AND POST-DEVELOPMENT POLLUTANT LOADS

The computer modelling program MUSIC V6.1 was used to investigate the performance of the treatment systems incorporated in the design. The main pollutants were analysed at the point of discharge.

The proposed stormwater system incorporates the treatment systems of bio detention basin and discharge to the existing creek line as defined in the catchment plan in Figure 3.

5.4 SUMMARY OF RESULTS

In summary, the reductions meet the requirements of the PMHC as defined in Auspec D7. Find summary, pre and post conditions, and a copy of input and output in tables and figures below.

	Sources		Residual Load		% Reduction		Target
	Pre	Post	Pre	Post	Pre	Post	
Flow (ML/y)	218	403	218	390	0	3.23	-
Total Suspended Solids (kg/yr)	28000	65000	28000	2200	0	96.6	85
Total Phosphorus (kg/yr)	85.3	154	85.3	82.4	0	46.5	45
Total Nitrogen (kg/yr)	549	1120	549	342	0	69.5	45
Gross Pollutants (kg/yr)	516	11200	516	0	0	100	100

Music Modelling Results

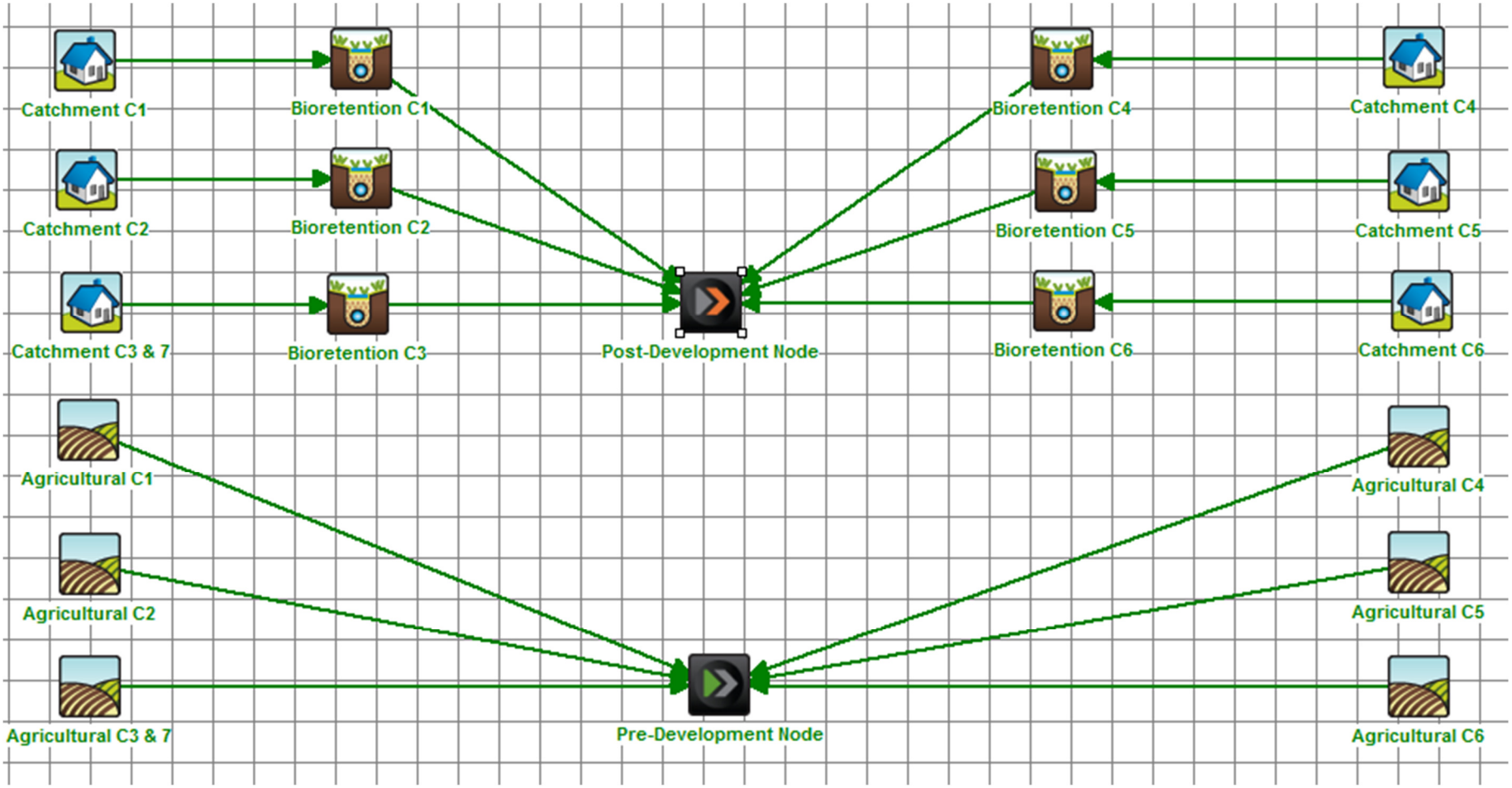


Diagram 1: Network Pre and Post Development Diagram

Figure 5. Site Area Image

VersionNumber	204						{MUSIC Setup File version number}
MeteorologicalTemplate	Z:\Jobs\160059_subdivision Partridge Creek Port Macquarie\Drains\MUSIC\Lower Inland 1997-2000 Daily.mlb						{MLB Filename}
ConstituentAbbreviation	TSS						{Constituent Abbreviation}
ConstituentName	Total Suspended Solids						{Constituent Name}
MUSIC-link Project - Enabled	1						{0 = enabled | 1 = disabled}
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	{Node Type}
Node Name	Catchment C1	Catchment C2	Catchment C3 & 7	Catchment C4	Catchment C5	Catchment C6	{Node Name}
Node ID	1	4	7	21	23	26	{Node ID}
Coordinates	70.0096822332752:73.7825443820989	70.226138624407:60.2900657495336	70.7229223235438:46.3921875183308	219.952435268072:74.1304061201782	220.608990517489:60.0144682577101	220.857152369095:46.6151645354191	{Coordinates}{[X:Y]}
General - Location	Catchment C1	Catchment C2	Catchment C3 & 7	Catchment C4	Catchment C5	Catchment C6	
General - Flux unit	mm	mm	mm	mm	mm	mm	
Areas - Total Area (ha)	14.5	11.3	10.7	13	10.7	2.8	{ha}
Areas - Impervious (%)	40	40	40	40	40	40	{%}
Areas - Pervious (%)	60	60	60	60	60	60	{%}
Rainfall-Runoff - Impervious Area - Rainfall Threshold (mm/day)	1	1	1	1	1	1	{mm/day}
Rainfall-Runoff - Pervious Area - Soil Storage Capacity (mm)	120	120	120	120	120	120	{mm}
Rainfall-Runoff - Pervious Area - Initial Storage (% of Capacity)	25	25	25	25	25	25	{% of Capacity}
Rainfall-Runoff - Pervious Area - Field Capacity (mm)	80	80	80	80	80	80	{mm}
Rainfall-Runoff - Pervious Area - Infiltration Capacity Coefficient - a	200	200	200	200	200	200	
Rainfall-Runoff - Pervious Area - Infiltration Capacity Exponent - b	1	1	1	1	1	1	
Rainfall-Runoff - Groundwater Properties - Initial Depth (mm)	10	10	10	10	10	10	{mm}
Rainfall-Runoff - Groundwater Properties - Daily Recharge Rate (%)	25	25	25	25	25	25	{%}
Rainfall-Runoff - Groundwater Properties - Daily Baseflow Rate (%)	5	5	5	5	5	5	{%}
Rainfall-Runoff - Groundwater Properties - Daily Deep Seepage Rate (%)	0	0	0	0	0	0	{%}
Total Suspended Solids - Base Flow Concentration - Mean (log mg/L)	1.1	1.1	1.1	1.1	1.1	1.1	{log mg/L}
Total Suspended Solids - Base Flow Concentration - Std Dev (log mg/L)	0.17	0.17	0.17	0.17	0.17	0.17	{log mg/L}
Total Suspended Solids - Base Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Suspended Solids - Base Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Suspended Solids - Storm Flow Concentration - Mean (log mg/L)	2.2	2.2	2.2	2.2	2.2	2.2	{log mg/L}
Total Suspended Solids - Storm Flow Concentration - Std Dev (log mg/L)	0.32	0.32	0.32	0.32	0.32	0.32	{log mg/L}

Total Suspended Solids - Storm Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Suspended Solids - Storm Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Phosphorus - Base Flow Concentration - Mean (log mg/L)	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	{log mg/L}
Total Phosphorus - Base Flow Concentration - Std Dev (log mg/L)	0.19	0.19	0.19	0.19	0.19	0.19	{log mg/L}
Total Phosphorus - Base Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Phosphorus - Base Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Phosphorus - Storm Flow Concentration - Mean (log mg/L)	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	{log mg/L}
Total Phosphorus - Storm Flow Concentration - Std Dev (log mg/L)	0.25	0.25	0.25	0.25	0.25	0.25	{log mg/L}
Total Phosphorus - Storm Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Phosphorus - Storm Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Nitrogen - Base Flow Concentration - Mean (log mg/L)	0.32	0.32	0.32	0.32	0.32	0.32	{log mg/L}
Total Nitrogen - Base Flow Concentration - Std Dev (log mg/L)	0.12	0.12	0.12	0.12	0.12	0.12	{log mg/L}
Total Nitrogen - Base Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Nitrogen - Base Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Nitrogen - Storm Flow Concentration - Mean (log mg/L)	0.42	0.42	0.42	0.42	0.42	0.42	{log mg/L}
Total Nitrogen - Storm Flow Concentration - Std Dev (log mg/L)	0.19	0.19	0.19	0.19	0.19	0.19	{log mg/L}
Total Nitrogen - Storm Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Nitrogen - Storm Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Import Flow Properties - Import Flow Enabled	1	1	1	1	1	1	
Import Flow Properties - Import Flow File							
Import Flow Properties - Header lines	0	0	0	0	0	0	
Import Flow Properties - Baseflow Column	0	0	0	0	0	0	

Import Flow Properties - Impervious Stormflow Column	0	0	0	0	0	0	
Import Flow Properties - Pervious Stormflow Column	0	0	0	0	0	0	
Import Flow Properties - Unit	5	5	5	5	5	5	{Index from 0 to 14 for "ML" | "kL" | "L" | "mL" | "ML/s" | "m3/s" | "L/s" | "mL/s" | "ML/day" | "kL/day" | "L/day" | "mL/day" | "km" | "m" | "mm"}
Import Flow Properties - Catchment Area for GP (ha)	1	1	1	1	1	1	{ha}
Node Type	AgriculturalSourceNode	AgriculturalSourceNode	AgriculturalSourceNode	AgriculturalSourceNode	AgriculturalSourceNode	AgriculturalSourceNode	{Node Type}
Node Name	Agricultural C1	Agricultural C2	Agricultural C3 & 7	Agricultural C4	Agricultural C5	Agricultural C6	{Node Name}
Node ID	9	10	11	27	28	29	{Node ID}
Coordinates	70.3705740783174:32.0297629159723	70.5275987460788:16.9553948108759	70.5275987460788:3.13722404787095	220.606213121334:31.2041528858522	220.458076234359:17.0835305649062	220.458076234359:3.11586584912311	{Coordinates}{[X:Y]}
General - Location	Agricultural C1	Agricultural C2	Agricultural C3 & 7	Agricultural C4	Agricultural C5	Agricultural C6	
General - Notes							
General - Flux unit	mm	mm	mm	mm	mm	mm	
Areas - Total Area (ha)	14.5	11.3	10.2	13	10.7	2.8	{ha}
Areas - Impervious (%)	3	3	3	3	3	3	{%}
Areas - Pervious (%)	97	97	97	97	97	97	{%}
Rainfall-Runoff - Impervious Area - Rainfall Threshold (mm/day)	1	1	1	1	1	1	{mm/day}
Rainfall-Runoff - Pervious Area - Soil Storage Capacity (mm)	120	120	120	120	120	120	{mm}
Rainfall-Runoff - Pervious Area - Initial Storage (% of Capacity)	25	25	25	25	25	25	{% of Capacity}
Rainfall-Runoff - Pervious Area - Field Capacity (mm)	80	80	80	80	80	80	{mm}
Rainfall-Runoff - Pervious Area - Infiltration Capacity Coefficient - a	200	200	200	200	200	200	
Rainfall-Runoff - Pervious Area - Infiltration Capacity Exponent - b	1	1	1	1	1	1	
Rainfall-Runoff - Groundwater Properties - Initial Depth (mm)	10	10	10	10	10	10	{mm}
Rainfall-Runoff - Groundwater Properties - Daily Recharge Rate (%)	25	25	25	25	25	25	{%}
Rainfall-Runoff - Groundwater Properties - Daily Baseflow Rate (%)	5	5	5	5	5	5	{%}
Rainfall-Runoff - Groundwater Properties - Daily Deep Seepage Rate (%)	0	0	0	0	0	0	{%}
Total Suspended Solids - Base Flow Concentration - Mean (log mg/L)	1.4	1.4	1.4	1.4	1.4	1.4	{log mg/L}
Total Suspended Solids - Base Flow Concentration - Std Dev (log mg/L)	0.13	0.13	0.13	0.13	0.13	0.13	{log mg/L}
Total Suspended Solids - Base Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Suspended Solids - Base Flow Concentration - Serial Correlation	0	0	0	0	0	0	{R squared}

(R squared)							
Total Suspended Solids - Storm Flow Concentration - Mean (log mg/L)	2.3	2.3	2.3	2.3	2.3	2.3	{log mg/L}
Total Suspended Solids - Storm Flow Concentration - Std Dev (log mg/L)	0.31	0.31	0.31	0.31	0.31	0.31	{log mg/L}
Total Suspended Solids - Storm Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Suspended Solids - Storm Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Phosphorus - Base Flow Concentration - Mean (log mg/L)	-0.88	-0.88	-0.88	-0.88	-0.88	-0.88	{log mg/L}
Total Phosphorus - Base Flow Concentration - Std Dev (log mg/L)	0.13	0.13	0.13	0.13	0.13	0.13	{log mg/L}
Total Phosphorus - Base Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Phosphorus - Base Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Phosphorus - Storm Flow Concentration - Mean (log mg/L)	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	{log mg/L}
Total Phosphorus - Storm Flow Concentration - Std Dev (log mg/L)	0.3	0.3	0.3	0.3	0.3	0.3	{log mg/L}
Total Phosphorus - Storm Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Phosphorus - Storm Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Nitrogen - Base Flow Concentration - Mean (log mg/L)	0.074	0.074	0.074	0.074	0.074	0.074	{log mg/L}
Total Nitrogen - Base Flow Concentration - Std Dev (log mg/L)	0.13	0.13	0.13	0.13	0.13	0.13	{log mg/L}
Total Nitrogen - Base Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Nitrogen - Base Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Total Nitrogen - Storm Flow Concentration - Mean (log mg/L)	0.59	0.59	0.59	0.59	0.59	0.59	{log mg/L}
Total Nitrogen - Storm Flow Concentration - Std Dev (log mg/L)	0.26	0.26	0.26	0.26	0.26	0.26	{log mg/L}
Total Nitrogen - Storm Flow Concentration - Estimation Method	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Nitrogen - Storm Flow Concentration - Serial Correlation (R squared)	0	0	0	0	0	0	{R squared}
Import Flow Properties - Import Flow Enabled	1	1	1	1	1	1	

Import Flow Properties - Import Flow File							
Import Flow Properties - Header lines	0	0	0	0	0	0	
Import Flow Properties - Baseflow Column	0	0	0	0	0	0	
Import Flow Properties - Impervious Stormflow Column	0	0	0	0	0	0	
Import Flow Properties - Pervious Stormflow Column	0	0	0	0	0	0	
Import Flow Properties - Unit	5	5	5	5	5	5	{Index from 0 to 14 for "ML" | "kL" | "L" | "mL" | "ML/s" | "m3/s" | "L/s" | "mL/s" | "ML/day" | "kL/day" | "L/day" | "mL/day" | "km" | "m" | "mm"}
Import Flow Properties - Catchment Area for GP (ha)	1	1	1	1	1	1	{ha}
Node Type	BioRetentionNodeV4	BioRetentionNodeV4	BioRetentionNodeV4	BioRetentionNodeV4	BioRetentionNodeV4	BioRetentionNodeV4	{Node Type}
Node Name	Bioretention C1	Bioretention C2	Bioretention C3	Bioretention C4	Bioretention C5	Bioretention C6	{Node Name}
Node ID	2	5	6	22	24	25	{Node ID}
Coordinates	101.115935123573:73.9662673078239	101.115935123573:60.5068846947729	100.787657498864:46.2268080199506	180.230842678336:73.9662673078239	180.723259115399:60.0144682577101	180.559120303044:46.5550856446591	{Coordinates}{[X:Y]}
General - Location	Bioretention C1	Bioretention C2	Bioretention C3	Bioretention C4	Bioretention C5	Bioretention C6	
General - Notes							
General - Fluxes							
General - Flux File Timestep (in seconds)	86400	86400	86400	86400	86400	86400	{in seconds}
Inlet Properties - Low Flow By-pass (cubic metres per sec)	0	0	0	0	0	0	{cubic metres per sec}
Inlet Properties - High Flow By-pass (cubic metres per sec)	100	100	100	100	100	100	{cubic metres per sec}
Storage Properties - Extended Detention Depth (metres)	0	0	0	0	0	0	{metres}
Storage Properties - Surface Area (square metres)	1000	13500	1000	2300	1600	600	{square metres}
Filter and Media Properties - Filter Area (square metres)	800	1250	900	450	1400	400	{square metres}
Filter and Media Properties - Unlined Filter Media Perimeter (metres)	14	14	14	14	14	14	{metres}
Filter and Media Properties - Saturated Hydraulic Conductivity (mm/hr)	100	100	100	100	100	100	{mm/hr}
Filter and Media Properties - Filter Depth (metres)	0.5	0.5	0.5	0.5	0.5	0.5	{metres}
Filter and Media Properties - TN Content of Filter Media (mg/kg)	800	800	800	800	800	800	{mg/kg}
Filter and Media Properties - Orthophosphate Content of Filter Media (mg/kg)	80	80	80	80	80	80	{mg/kg}
Infiltration Properties - Exfiltration Rate (mm/hr)	0	0	0	0	0	0	{mm/hr}
Lining Properties - Base Lined	1	1	1	1	1	1	

Vegetation Properties - Vegetation Properties	0	0	0	0	0	0	{Index from 0 to 2 for "Vegetated with Effective Nutrient Removal Plants" | "Vegetated with Ineffective Nutrient Removal Plants" | "Unvegetated"}
Outlet Properties - Overflow Weir Width (metres)	2	2	2	2	2	2	{metres}
Outlet Properties - Underdrain Present	0	0	0	0	0	0	
Outlet Properties - Submerged Zone With Carbon Present	1	1	1	1	1	1	
Outlet Properties - Submerged Zone Depth (metres)	0.45	0.45	0.45	0.45	0.45	0.45	{metres}
Advanced Properties - Total Suspended Solids - k (m/yr)	8000	8000	8000	8000	8000	8000	{m/yr}
Advanced Properties - Total Suspended Solids - C* (mg/L)	20	20	20	20	20	20	{mg/L}
Advanced Properties - Total Phosphorus - k (m/yr)	6000	6000	6000	6000	6000	6000	{m/yr}
Advanced Properties - Total Phosphorus - C* (mg/L)	0.13	0.13	0.13	0.13	0.13	0.13	{mg/L}
Advanced Properties - Total Nitrogen - k (m/yr)	500	500	500	500	500	500	{m/yr}
Advanced Properties - Total Nitrogen - C* (mg/L)	1.4	1.4	1.4	1.4	1.4	1.4	{mg/L}
Advanced Properties - Filter Media Soil Type	1	1	1	1	1	1	{Index from 0 to 4 for "Sand" | "Loamy Sand" | "Sandy Loam" | "Silt Loam" | "Loam"}
Advanced Properties - Weir Coefficient	1.7	1.7	1.7	1.7	1.7	1.7	
Advanced Properties - Pet Scaling Factor	2.1	2.1	2.1	2.1	2.1	2.1	
Advanced Properties - Number of CSTR Cells	3	3	3	3	3	3	
Advanced Properties - Porosity of Filter Media	0.35	0.35	0.35	0.35	0.35	0.35	
Advanced Properties - Porosity of Submerged Zone	0.35	0.35	0.35	0.35	0.35	0.35	
Advanced Properties - Horizontal Flow Coefficient	3	3	3	3	3	3	
Node Type	PreDevelopmentNode	{Node Type}					
Node Name	Pre-Development Node	{Node Name}					
Node ID	8	{Node ID}					
Coordinates	141.633480387727:3.16877915101925	{Coordinates}{[X:Y]}					
General - Location	Pre-Development Node						
Node Type	PostDevelopmentNode	{Node Type}					
Node Name	Post-Development Node	{Node Name}					
Node ID	3	{Node ID}					
Coordinates	140.582375223201:46.3824375846556	{Coordinates}{[X:Y]}					
General - Location	Post-Development Node						

Link Name	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source Node ID	2	5	6	9	10	11	22
Target Node ID	3	3	3	8	8	8	3
Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
Muskingum K	7200	7200	7200	7200	7200	7200	7200
Muskingum Theta	0.25	0.25	0.25	0.25	0.25	0.25	0.25

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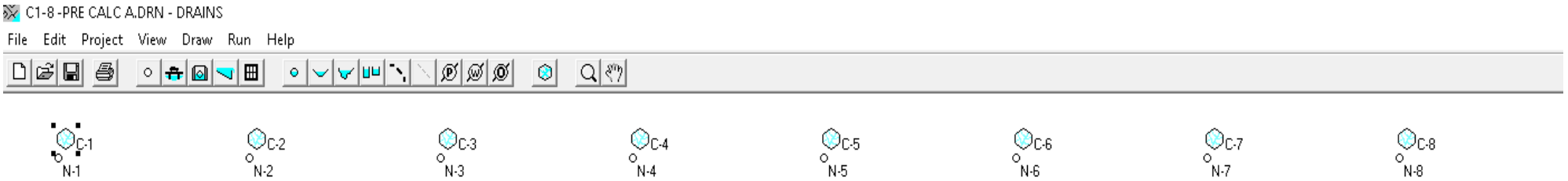
APPENDIX 1: DRAINS INPUT FOR PRE-DEVELOPMENT MODEL

Figure 6. Drains model for Pre-Developed catchment



SUB-CATCHMENT DETAILS							
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)	
C-1	7.225	0	7.225	0	10.49	0	1% AEP, 15 min burst, Storm 3
C-2	5.867	0	5.867	0	9.57	0	1% AEP, 15 min burst, Storm 3
C-3	5.401	0	5.401	0	8.18	0	1% AEP, 10 min burst, Storm 2
C-4	6.738	0	6.738	0	8.2	0	1% AEP, 10 min burst, Storm 10
C-5	6.766	0	6.766	0	7.53	0	1% AEP, 10 min burst, Storm 7
C-6	2.132	0	2.132	0	3.33	0	1% AEP, 5 min burst, Storm 1
C-7	1.599	0	1.599	0	3.33	0	1% AEP, 5 min burst, Storm 1
C-8	2.569	0	2.569	0	4.51	0	1% AEP, 10 min burst, Storm 1

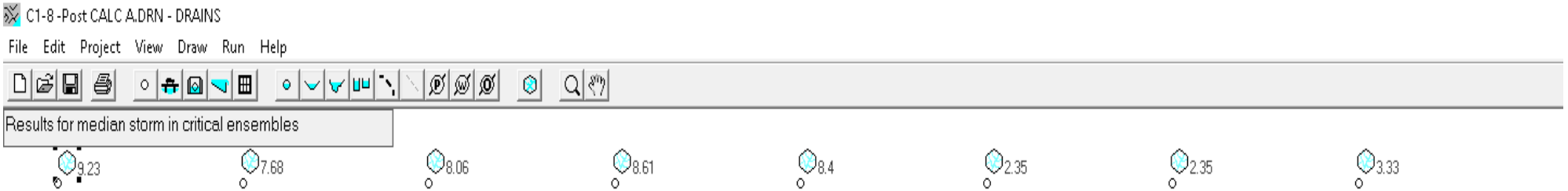
Run Log for C1 run at 14:26:16 on 4/3/2019

PIT / NODE DETAILS			Version 14																		
Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	Internal Width (mm)	Inflow is Misaligne	Minor Saf Pond Dep (m)	Major Safe Pond Depth (m)	
N-1	Node					3.5		0		596	-300				No						
N-2	Node					4.5		0		598	-300				No						
N-3	Node					4.5		0		600	-300				No						
N-4	Node					3.5		0		602	-300				No						
N-5	Node					3.5		0		604	-300				No						
N-6	Node					4.5		0		606	-300				No						
N-7	Node					4.5		0		608	-300				No						
N-8	Node					4.5		0		610	-300				No						

SUB-CATCHMENT DETAILS																						
Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFacto	Rainfall Multiplier
C-1	N-1	14.5	0	100	0	0	4	0	0	100	0	0	3	0	0	0.053	0	0				1
C-2	N-2	11.3	0	100	0	0	4	0	0	100	0	0	5	0	0	0.053	0	0				1
C-3	N-3	9.7	0	100	0	0	3	0	0	100	0	0	5	0	0	0.053	0	0				1
C-4	N-4	12.1	0	100	0	0	3.2	0	0	100	0	0	5.6	0	0	0.053	0	0				1
C-5	N-5	11.5	0	100	0	0	3	0	0	100	0	0	7.8	0	0	0.053	0	0				1
C-6	N-6	2.8	0	100	0	0	2	0	0	20	0	0	13	0	0	0.053	0	0				1
C-7	N-7	2.1	0	100	0	0	2	0	0	20	0	0	13	0	0	0.053	0	0				1
C-8	N-8	4	0	100	0	0	2	0	0	30	0	0	5	0	0	0.053	0	0				1

APPENDIX 2: DRAINS INPUT FOR POST-DEVELOPMENT MODEL

Figure 7. Drains model for Post-Developed catchment



SUB-CATCHMENT DETAILS									
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm		
C-1P	9.226	6.804	2.422	6.42	8.51	0	1% AEP, 10 min burst, Storm 7		
C-2P	7.683	6.392	1.29	5.14	7.69	0	1% AEP, 5 min burst, Storm 1		
C-3P	8.063	5.847	2.215	4.05	3.43	0	1% AEP, 5 min burst, Storm 1		
C-4P	8.605	7.224	1.382	4.27	7.13	0	1% AEP, 5 min burst, Storm 1		
C-5P	8.399	6.898	1.501	4.16	6.77	0	1% AEP, 5 min burst, Storm 1		
C-6P	2.347	1.692	0.655	1.6	1.95	0	1% AEP, 5 min burst, Storm 1		
C-7P	2.347	1.692	0.655	1.62	2	0	1% AEP, 5 min burst, Storm 1		
C-8P	3.331	2.417	0.914	2.02	3.32	0	1% AEP, 5 min burst, Storm 1		

Run Log for C1 run at 14:26:16 on 4/3/2019

PIT / NODE DETAILS			Version 14																		
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full	Inflow	Pit is	Internal	Inflow is	Minor Saf	Major Safe	
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor			lid		Shock Los	Hydrograph		Width	Misaligne	Pond Dep	Pond Depth	
				(cu.m)	Coeff. Ku			(cu.m/s)									(mm)		(m)	(m)	
N-1P	Node					3		0		596	-300				No						
N-2P	Node					4		0		598	-300				No						
N-3P	Node					3.5		0		600	-300				No						
N-4P	Node					3.5		0		602	-300				No						
N-5P	Node					3		0		604	-300				No						
N-6P	Node					3.5		0		606	-300				No						
N-7P	Node					3.5		0		608	-300				No						
N-8P	Node					3.5		0		610	-300				No						

SUB-CATCHMENT DETAILS																					
Name	Pit or	Total	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Lag Time	Gutter	Gutter	Gutter	Rainfall
	Node	Area	Area	Area	Area	Time	Time	Time	Length	Length	Length	Slope(%)	Slope	Slope	Rough	Rough	Rough	or Factor	Length	Slope	FlowFacto	Multiplier
		(ha)	%	%	%	(min)	(min)	(min)	(m)	(m)	(m)	%	%	%					(m)	%		
C-1P	N-1P	14.5	70	30	0	4	0	0	94	94	0	3.9	3	0	0.014	0.1	0	0				1
C-2P	N-2P	11.3	70	30	0	4	4	0	30	30	0	3.5	3.5	0	0.014	0.1	0	0				1
C-3P	N-3P	9.7	70	30	0	3	0	0	30	30	0	4.5	4.5	0	0.014	0.1	0	0				1
C-4P	N-4P	12.1	70	30	0	3	3	0	40	40	0	4.3	4.3	0	0.014	0.1	0	0				1
C-5P	N-5P	11.5	70	30	0	3	3	0	44	44	0	7	7	0	0.014	0.1	0	0				1
C-6P	N-6P	2.8	70	30	0	1	0	0	20	20	0	13	13	0	0.014	0.1	0	0				1
C-7P	N-7P	2.8	70	30	0	1	0	0	20	20	0	12	12	0	0.014	0.1	0	0				1
C-8P	N-8P	4	70	30	0	1	0	0	30	30	0	5	5	0	0.014	0.1	0	0				1