Civil Engineering Report

Development Application

313 Magpie Lane, Galambine NSW - Caravan Park

Prepared for: CAM Engineering & Construction
383 Freemans Drive, Cooranbong NSW 2264

Project no: NS230540

Report no: NS230540-R01-B

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Revisions

Date	Revision/ Issue No.	Revision Description	Prepared by	Approved by
09/11/2023	A	For Approval	C. Davis	U. Knight
26/02/2024	B	For Approval	C. Davis	U. Knight

It is the responsibility of the reader to verify the currency of the version number of this report.

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1 INTRODUCTION

1.1 General

ACOR Consultants have been engaged by CAM Engineering & Construction to prepare an engineering report to support the Development Application for a proposed caravan park located at 313 Magpie Lane, Galambine in NSW. The property titles are Lot 1, DP 1003242 and DP 174385.

This report covers the concept design of:

- Road and site grading
- Stormwater drainage quantity
- Stormwater drainage quality

Stormwater quantity items addressed in this report include:

- Stormwater conveyance/network;
- Stormwater detention

Stormwater quality items addressed in this report include:

- Operational water quality management incorporating Water Sensitive Urban Design principles (WSUD);
- Construction water quality management incorporating soil and water management.

Refer to ACOR drawing set (Project No. NS230540) for the design of the road works, site grading and stormwater drainage for the proposed development.

2 SITE

2.1 Location

The site is located at 313 Magpie Lane, Galambine. The site is bounded to the north by Magpie Lane, to the west by Guntawang Road and by rural properties to the south and east. The total site area is 73.58ha. ACOR drawing C01-001 shows the location of the site.

2.2 Topography

The existing site grades generally from the south east to the north west at varying grades across the site. There are a number of existing dams and contour banks on the properties. ACOR drawing C08-401 shows the existing site topography.

The levels on the site currently range from approximate RL444m AHD at the southern corner boundary, RL442m AHD at the north eastern corner boundary, and RL421m AHD at the north western corner boundary.

2.3 Existing/previous Land Use

The site is currently used as grazing land for cattle and horses. There is a single building, fences and several dams on site. The site in its current condition is mostly cleared with some areas of vegetation spread-out throughout the properties as well as some gravel driveways.

2.4 Existing Site Drainage

The site currently drains from the southeast and east to the west and northwest. There are a number of existing dams and contour banks on the properties. There are a number of existing culvert crossings under Guntawang Road and Magpie Lane. ACOR drawing C08-401 shows the existing dams, contour banks and road culverts.

There are two (2) mapped 1st order and one (1) 2nd order streams within the property. These three (3) mapped watercourses are feeder tributaries of Pig and Whistle Creek. Refer to the Riparian Assessment Report (SEP Ref: 3282) by Anderson Environment & Planning for details on the existing streams.

2.5 External Catchments

There is an existing upstream catchment to the west of approximately 123 hectares. The upstream catchment drains through the development site along the eastern boundary and along Guntawang Road.

2.6 Proposed Development

The proposed development is a caravan park with approximately 240 long term MHE sites and 147 short term caravan park sites with associated community centre and activities areas. The proposed development includes road works, earthworks and stormwater drainage infrastructure including a detention basin and two water quality basins.

The main access to the site will be off Magpie Lane. Two emergency exits from the site are also being provided. The first emergency exit is located at the short term caravan park east of the main site access off Magpie Lane. The second emergency exit is located off Guntawang Road at the southern end of the long term sites.

The intersection of Magpie Lane and Guntawang Road is proposed to be upgraded from a Give Way BAR/BAL T-intersection to a CHR(s)/BAL intersection.

Magpie Lane is proposed to be upgrade up to the main site access to be a minimum 7m wide rural local road to Mid-Western Council's standards.

The total area of proposed development is approximately 22.5 hectares. ACOR drawing C01-201 shows the proposed development layout.

3 CONCEPT CIVIL DESIGN

3.1 Public Road Works

The main access to the site will be off Magpie Lane. Magpie Lane is proposed to be upgrade up to the main site access to be a minimum 7m wide rural local road to Mid-Western Council's standards. Refer to ACOR drawing C05-001 and C05-002 for the general arrangement plan, C06-601 for main entry intersection layout, C06-102 and C06-03 for the road longitudinal sections, and C06-201 for typical cross-section.

The intersection of Magpie Lane and Guntawang Road is proposed to be upgraded from a Give Way BAR/BAL T-intersection to a CHR(s)/BAL intersection. No additional road works are proposed in Guntawang Road. Refer to ACOR drawing C06-501 for the general arrangement plan for the intersection, and C06-101 for Guntawang Road longitudinal section at the intersection.

3.2 Concept Site and Road Grading

Access to the site and individual sites are required to meet the requirements of the Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation, Australian Standard AS2890.1-2004 Parking facilities Part 1: Off-street car parking and for Magpie Lane the requirements of Mid-Western Regional Council.

The concept grading for the proposed development was undertaken generally following the natural topography of the site. The grading of the roadways ranges from a minimum of 0.5% to a maximum of

6%. Road widths have been designed to meet the requirements the Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation.

ACOR drawings C05-002 to C05-010 show the concept site grading for the development.

ACOR drawings C06-110 to C06-190 show concept road longitudinal sections and C06-201 to C06-203 show typical road cross sections.

A roundabout is proposed to be provided at the entry to the short term caravan park sites. Refer to ACOR drawing C05-002 for the proposed roundabout layout.

The sites have generally been graded to provide 3% falls and retaining walls have been proposed at the rear of the sites to suit the proposed road grading. ACOR drawings C01-201 and C09-001 to C09-005 show the proposed site sections.

3.3 Bulk Earthworks

The bulk earthworks for the proposed road and site grading are shown in ACOR drawings C04-001 to C04-003. The preliminary earthworks volumes shown on ACOR drawing C04-001 are calculated from the existing surface levels to the design levels. Stripping of topsoil and boxing out for pavements has not been included in these volumes. The preliminary earthworks volumes are:

- Cut 97,000m^3
- Fill 78,000m^3
- Balance is 19,000m^3 to spoil

At detail design stage, the bulk earthworks should incorporate stripping of topsoil and pavement box out, and adjustments to the site grading to balance the earthworks volumes.

4 STORMWATER MANAGEMENT

4.1 General

Stormwater management for the site will consist of stormwater quantity including detention and stormwater quality. These elements are described below.

The catchment flows from the long term sites are proposed to be directed to a detention/bio-retention basin located to the west of the development.

The catchment flows from the short term sites are proposed to be directed to a bio-retention basin located to the north west of the development.

The stormwater management plans for the development are shown in ACOR drawings C08-001 to C08-009.

5 STORMWATER QUANTITY MANAGEMENT

5.1 Objectives

The objectives of the stormwater quantity management for the site are:

- Provide a stormwater conveyance system in accordance with Australian Rainfall and Runoff's minor/major system philosophy and the requirements of Mid-western Regional Council.
- Design for new stormwater culverts and upgrades to existing.
- Address detention requirements for the site.
- Conveyance of flows from external catchments.

5.2 Stormwater Conveyance

5.2.1 Minor Storm Event Conveyance

Minor system stormwater conveyance for the development will be a via a traditional pit and pipe system. The minor stormwater system should be designed to convey the peak flows from a 20% AEP storm event. The fraction impervious for the sites and roads should be confirmed during the detailed design stage.

The concept minor stormwater management system for the development is shown in ACOR drawings C08-001 to C08-009.

5.2.2 Major Storm Event Conveyance

Major system stormwater conveyance for the proposed development will be via overland flow. This will be via traditional trunk drainage along the road carriage way and footpath. The major stormwater system will have the capacity to safely convey the peak flows from the 1% AEP storm events within the road reserve.

5.2.3 Upstream External Catchments

Catch drains have been proposed to the west of the development to direct flows from the upstream catchments around the proposed sites.

ACOR drawings C08-001 to C08-009 show the location of the catch drains and C10-001 to C10-006 detail the longitudinal sections for the catch drains.

5.2.4 Road Culverts

There are existing road culverts under Guntawang Road and Magpie Lane. The existing road culverts are shown on ACOR drawing C08-401. The capacity of the existing road culverts was found to be less than 50% AEP.

The two road culverts under Guntawang Road are to remain. The two road culverts under Magpie Lane are to be upgraded to provide capacity for 50% AEP flows and ensure that 1% AEP flows can safely discharge over the road. The culvert upgrade is generally in line with the capacity of the existing culverts. Road culvert capacity requirements should be confirmed with Council at the detail design stage.

The road culverts proposed within the development should be sized to provide capacity for 5% AEP flows and ensure that 1% AEP flows can safely discharge over the road.

ACOR drawing C08-402 shows the details for the road culverts.

5.3 Stormwater Detention

5.3.1 General

Detention has been provided for the development to ensure the developed flows from the site are not increased, thus ensuring to neighbouring properties are negatively affected by this development.

A fraction impervious of 70% has been adopted for the lots and road catchments for the detention calculations. The fraction impervious for the development should be confirmed at the detail design stage.

5.3.2 DRAINS Modelling

DRAINS modelling was undertaken to determine the predeveloped and developed peak flows for a range of AEP's from 20% to 1%, for storm durations ranging from 5 minutes to 6 hours for the proposed development.

The predeveloped and developed DRAINS models include for the upstream catchments draining through the site. The existing and proposed road culverts have also been included in the DRAINS models to confirm their capacity.

The predeveloped and post developed catchments are shown in ACOR drawings C08-401 and C08-402 respectively.

5.3.3 Predeveloped Flows

There are a total of four (4) existing road culverts draining flows from the site. There are two (2) road culverts in Guntawang Road which discharge to the west. The overflows from these culverts are directed north along the western side of Guntawang Road to the existing culverts in Magpie Lane.

The flows discharging through the existing culverts under Guntawang Road are the same in the predeveloped and post developed scenarios, hence they have not been included in the total predeveloped flows shown in Table 1 which represent the predeveloped flows from the site through the two culverts under Magpie Lane.

Table 1 - Predeveloped Flows at Magpie Lane

AEP	Predeveloped Flow (m^3/s)
20%	9.710
10%	13.600
5%	16.400
2%	20.100
1%	25.500

5.3.4 Post Developed Flows

To reduce the post developed flows below the predeveloped flows, a detention basin is proposed to be installed. Refer to ACOR drawing C08-602 for Basin 1 details.

The following basin configuration was used in the DRAINS model for the detention basin:

- Top level of Basin: RL432.5
- Bottom level of Basin: RL430.2
- Outlet discharge configuration
  - Outlet pit - 1500mm x 9000mm surface inlet pit at RL430.2
  - Outlet pipe from pit – 1200mm x 300mm box culvert
- Weir - 10m wide at RL432.0
- The stage storage areas for the basin are shown in Table 2

Table 2: Basin 1 - Stage Storage Areas

Height (m)	Surface Area (m^2)
430.2	4657
432.0	8031
432.5	9032

The total predeveloped flows and post developed flows with the proposed BASIN 1 detention are shown in Table 3.

Table 3: Predeveloped and Post Developed Flows at Magpie Lane

AEP	Predeveloped Peak Flows	Developed Flows (with Basin)	Decrease	% Decrease
(%)	(m^3/s)	(m^3/s)	(m^3/s)	
20%	9.710	9.590	-0.120	-1
10%	13.600	13.200	-0.400	-3
5%	16.400	15.800	-0.600	-4
2%	20.100	19.300	-0.800	-4
1%	25.500	24.200	-1.300	-5

As can be seen from the results above, the post developed flows have been reduced below the predeveloped flows downstream of Magpie Lane with the proposed detention basin configuration.

6 STORMWATER QUALITY MANAGEMENT

6.1 Objectives

The objectives of the Stormwater Quality for the site are:

- Meet the water quality objectives of Mid-Western Regional Council
- % Reductions from the developed site of:
  - 80% reduction in Total Suspended Solids (TSS)
  - 45% reduction in Total Phosphorus (TP)
  - 45% reduction in Total Nitrogen (TN)
  - 70% reduction in litter/gross pollutants
- The % reductions are from Mudgee Shire Council Urban Stormwater Management Plan.

6.2 Operational Phase Water Quality Management

6.2.1 General

To meet the water quality requirements outlined above, a range of water quality improvement devices will be required. The water quality improvement devices that can be provided for this development include:

- Rainwater tanks
- Gross pollutant traps
- Bioretention Basins

The above water quality improvement devices act as a treatment train, progressively reducing pollutants as they pass through each one.

6.2.2 Stormwater Quality Modelling

6.2.2.1 Introduction

The MUSIC model version 6 was used to assess the pollutant generation from the development and the performance of the stormwater quality treatment train. MUSIC modelling was undertaken in accordance with the NSW MUSIC Modelling Guidelines (WBM, 2015).

6.2.2.2 Rainfall Data and Evapotranspiration Data

The rainfall and evapotranspiration data used in the MUSIC model was for Canberra Rainfall and Evaporation Data 6 hour Data.

This is the closest available and relevant data in the MUSIC program database for the development site. It is similar distance from the eastern coastline and has similar environmental conditions.

For detailed design, rainfall and evapotranspiration data could be sourced for the location of the development to improve the accuracy of the MUSIC modelling.

6.2.2.3 MUSIC Model Source Inputs

The source data for the MUSIC model for the developed model were adopted from the NSW MUSIC Modelling Guidelines. The area for each roof of within the long stay housing development was assumed as 200 m^2 was adopted for the modelling. An overall lot fraction impervious of 70% was adopted (including the roof area) for lots. A fraction impervious of 70% was adopted for the road catchments.

The source node parameters adopted for the projects are shown in Table 4.

Table 4: MUSIC Residential Source Node Soil Properties

Soil Parameter	Value
Rainfall Threshold (mm/day)	1.00
Soil Storage Capacity (mm)	120
Initial Storage (% of Capacity)	25
Field Capacity	80
Infiltration Capacity Coefficient – a	200
Infiltration Capacity Coefficient – b	1.00
Groundwater Initial Depth (mm)	10
Groundwater Daily Recharge Rate (%)	25
Groundwater Daily Base Flow (%)	5
Groundwater Daily Deep Seepage Rate (%)	0

6.2.2.4 Catchments Pollutant Mean Concentrations

The pollutant Event Mean Concentration (EMC) values for both base flows and storm flows. The developed catchments were divided into residential lots (roofs and yards) and road areas. Table 5 shows the base flow and stormflow Pollutant Event Mean Concentrations adopted for the modelling.

Table 5: Base Flow and Storm Flow Pollutant Event Mean Concentration Values

Catchment Type	Flow	TSS (log 10)		TP (log 10)		TN (log 10)	
		Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Residential	Base Flow	1.2	0.17	-0.85	0.19	0.11	0.12
	Storm Flow	2.15	0.32	-0.60	0.25	0.30	0.19
Roofs	Base Flow	1.10	0.17	-0.82	0.19	0.32	0.12
	Storm Flow	1.30	0.32	-0.89	0.25	0.30	0.19
Mixed	Base Flow	1.10	0.17	-0.82	0.19	0.32	0.12
	Storm Flow	2.2	0.32	-0.45	0.25	0.42	0.19
Sealed Roads	Base Flow	1.20	0.17	-0.85	0.19	0.11	0.12
	Storm Flow	2.43	0.32	-0.3	0.25	0.34	0.19

6.2.2.5 MUSIC Model Treatment Train

The stormwater quality treatment train for each of the two catchments consist of three parts; rainwater tanks, a gross pollutant trap and a bioretention basin. A schematic of the MUSIC model is shown in Figure 1.

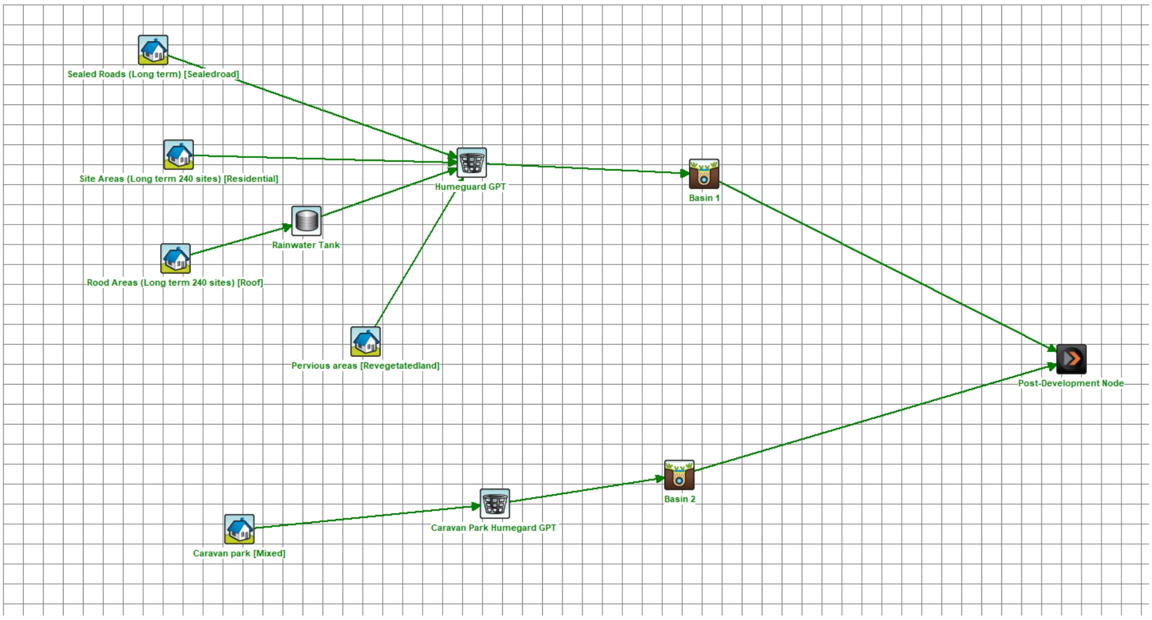


Figure 1 – MUSIC model Schematic

A brief description on each treatment measure is listed below.

- Rainwater Tanks. Rainwater tanks receive water from the roof area of each lot. A 2kL rainwater tank was assumed for each long term site. Water captured in the rainwater tanks is expected to be reused for toilet flushing, clothes washing, hot water and garden irrigation. An average of 2 persons was assumed for each house. The reuse per house was adopted from the NSW MUSIC Modelling Guidelines, Table 6-1. The reuse adopted for each lot is shown in Table 6.

Table 6: Rainwater Tank Reuse (per lot)

Rainwater Reuse	
Internal (L/day/dwelling)	212
External (L/day/dwelling)	151

- The GPT's modelled were the Humeguard GPT units for upstream of bioretention basins. These products remove gross pollutants, sediment and attached nutrients. The MUSIC node for the Humeguard was provided by HUMES. The removal efficiencies have been confirmed via independent testing. An equivalent product could be used. Table 7 show the removal efficiencies of the Humeguard unit.

Table 7: HUMES Humeguard GPT Performance

Pollutant	Removal
TSS	41%
TP	34%
TN	24%
Gross Pollutants	85%

- Bioretention Basin. A bioretention basin is the final part of the treatment train for each of the catchments for the site. Bioretention systems remove sediments (TSS) as well as nutrients (TN and TP) for the stormwater. The bioretention basin consists of a shallow dry basin with deep rooted vegetation and grass on the surface, over an infiltration/filtration area and an underdrain area.

  Vegetation in the bioretention basins will be in accordance with Mid-Western Regional Council requirements. Table 8 shows the bioretention basin inputs.

Table 8: Bioretention Basin MUSIC Model Inputs

Property	Basin 1	Basin 2
Extended Detention Depth (m)	0.3	0.3
Surface Area (m^2)	4657	230
Filter Area (m^2)	500	200
Unlined Filter Material (m)	0.01	0.01
Saturated Hydraulic Conductivity (mm/hr)	100	100
Filter Depth (m)	0.4	0.4
TN Content of Filter Media (mg/kg)	400	400
Orthophosphate of Filter Media (mg/kg)	40	40
Exfiltration Rate (mm/hr)	0	0
Base Lined	No	No
Vegetation Removing Plants	Yes	Yes
Under Drain Present	Yes	Yes

6.2.3 Stormwater Quality Modelling Results

The results of the MUSIC model for the total catchment showing the mean annual pollutant loads for the existing and the developed catchment are shown in Table 9.

Table 9: MUSIC Model Developed Results

	Source Loads	Developed Load (with Treatment)	Reduction	% Reduction Achieved	% Reduction Required
TSS (kg/yr)	14900	685	14215	95.4	80
TP (kg/yr)	29.1	5.89	23.21	79.8	45
TN (kg/yr)	200	63.6	136.4	68.3	45
Gross Pollutants (kg/yr)	3210	0	3210	100	70

The results from the MUSIC modelling show that the reductions in the pollutants meet the requirements set out by Council.

6.3 Construction Phase Water Quality Management

6.3.1 General

During the construction phase of the development, an Erosion and Sediment Control Plan will be implemented to minimise the water quality impacts. The erosion and sediment controls will be in accordance with Landcom's Managing Urban Stormwater: Soils and Construction Volume 1, 4th Edition (Landcom, 2004) and the requirements of Port Stephens Council. Erosion and sediment controls will be required preconstruction, during construction and post construction until the site is stabilized. The expected erosion and sediment control measures will include stabilized site access, sediment fence, gully pit sediment barriers, rock outlet scour protection and temporary sediment basins.

ACOR drawings C03-001 to C03-010, C03-101, C03-201 and C03-202 show concept Erosion and Sediment Control Plans for the proposed development.

6.3.2 Pre-Construction Erosion and Sediment Control

Due to the topography of the site, the preconstruction erosion and sediment controls will be limited to stabilized site access, sediment fence and temporary sediment basins until the initial bulk earthworks is undertaken. The proposed basins will be utilised as sediment basins while construction is being undertaken.

6.3.3 During Construction Erosion and Sediment Control

During the construction phase of the development, the erosion and sediment controls will consist of sediment fence, sediment basins, gully pit sediment barriers and permanent rock outlet scour protection.

Regular inspection and maintenance of the erosion and sediment controls will be required during the construction process.

6.3.4 Post Construction Erosion and Sediment Control

The contractor/developer will be responsible for the maintenance of the erosion and sediment control devices from the practical completion of the works for a minimum of 6 months or until stabilization has occurred.

6.4 Water Quality Maintenance Plan

6.4.1 General

General maintenance 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 in the basins will be delayed until a significant proportion of the contributing lots are built on and established.

6.4.2 Gross Pollutant Traps

HUMES Humeguard GPT (or equivalent) units will be used upstream of the bioretention basins for the development. Maintenance will be in accordance with the manufacturer's recommendations.

6.4.3 Bioretention Basin

Regular maintenance of the bioretention basins will require removal of sediment build up, maintenance of vegetation and flushing of the underdrain to maintain performance. Eventually the biofiltration material may need replacement when it has reached the end of its lifecycle. This will be determined by testing of the soil properties after 5-10 years of use.

7 CONCLUSION

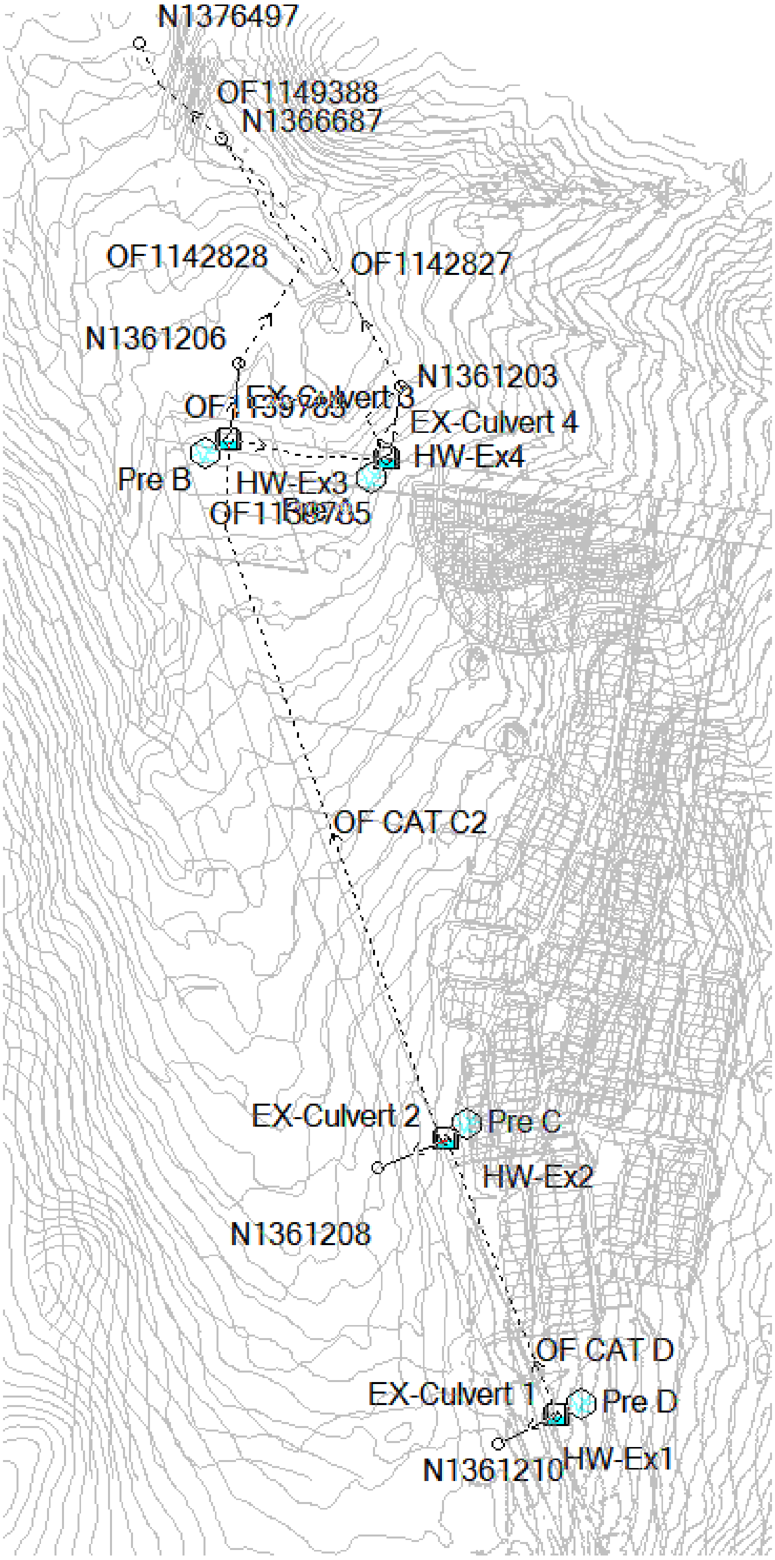
This engineering report addresses the concept civil design for the proposed caravan park development located at 313 Magpie Lane, Galambine.

Road and site grading as well as stormwater quantity and stormwater quality (both operational and construction phases) management have been addressed to the requirements of Mid-Western Regional Council.

Appendix A

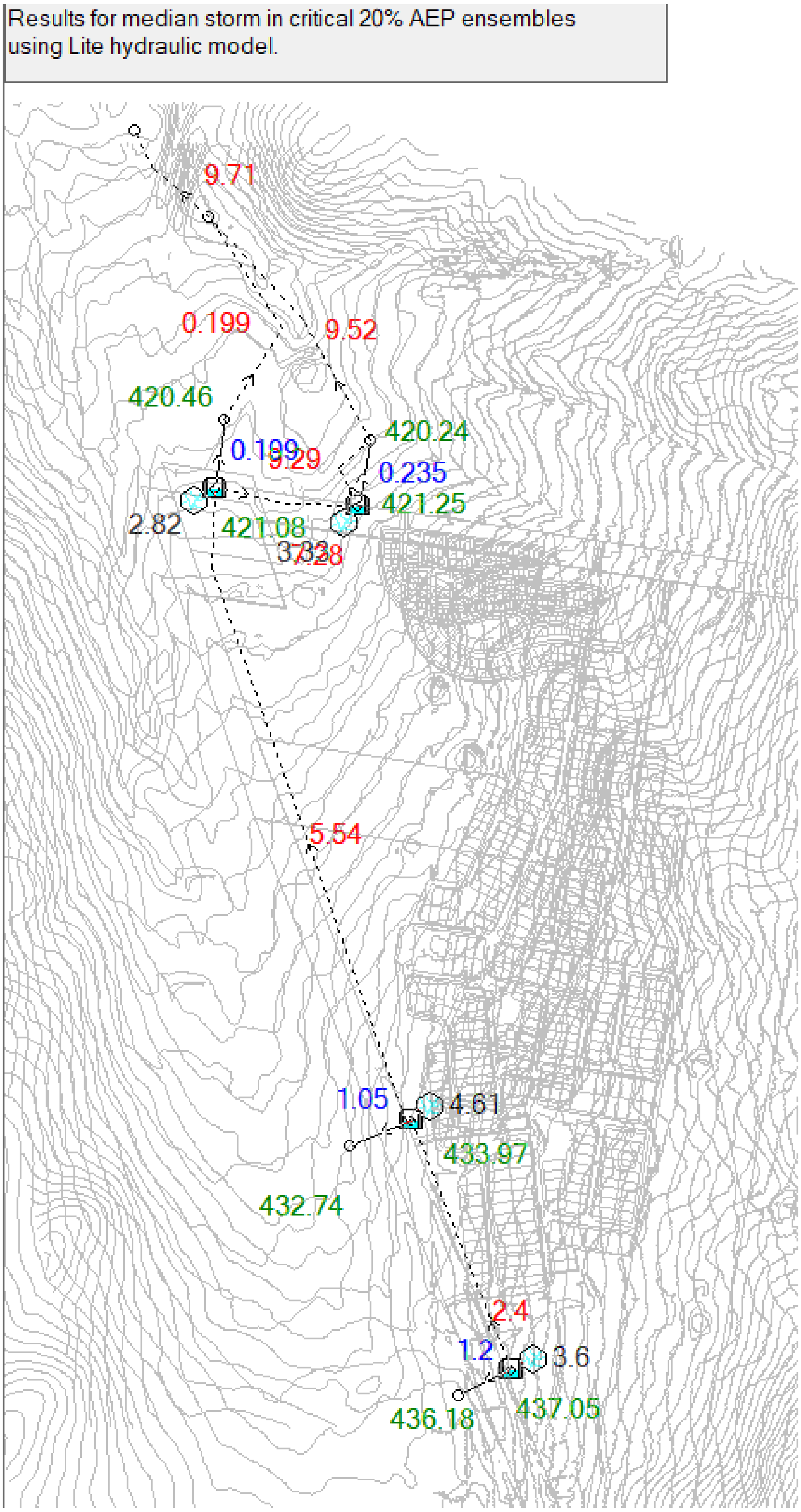
DRAINS Inputs and Results

DRAINS – PREDEVELOPED MODEL

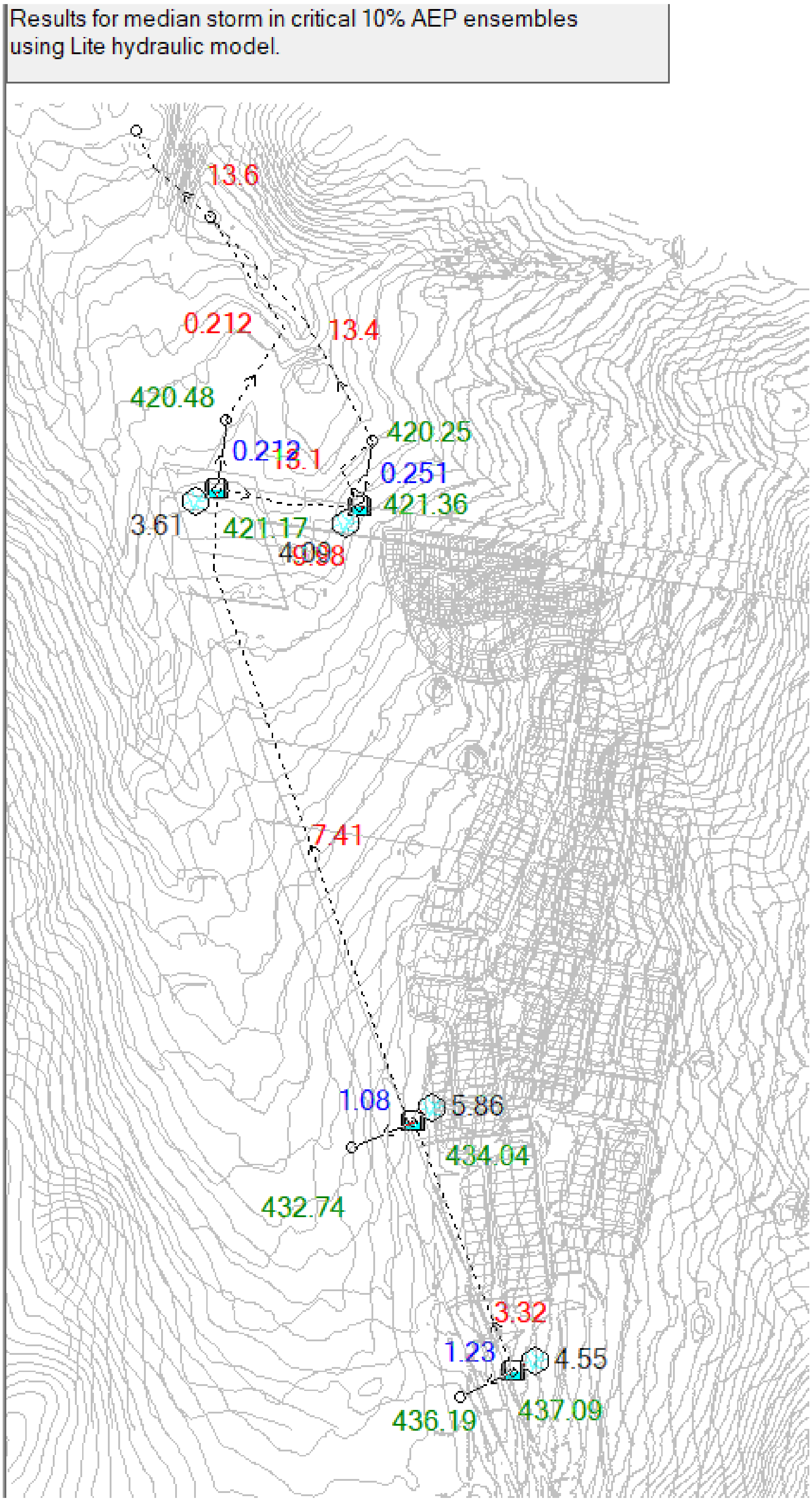


DRAINS – Predeveloped Model Schematic

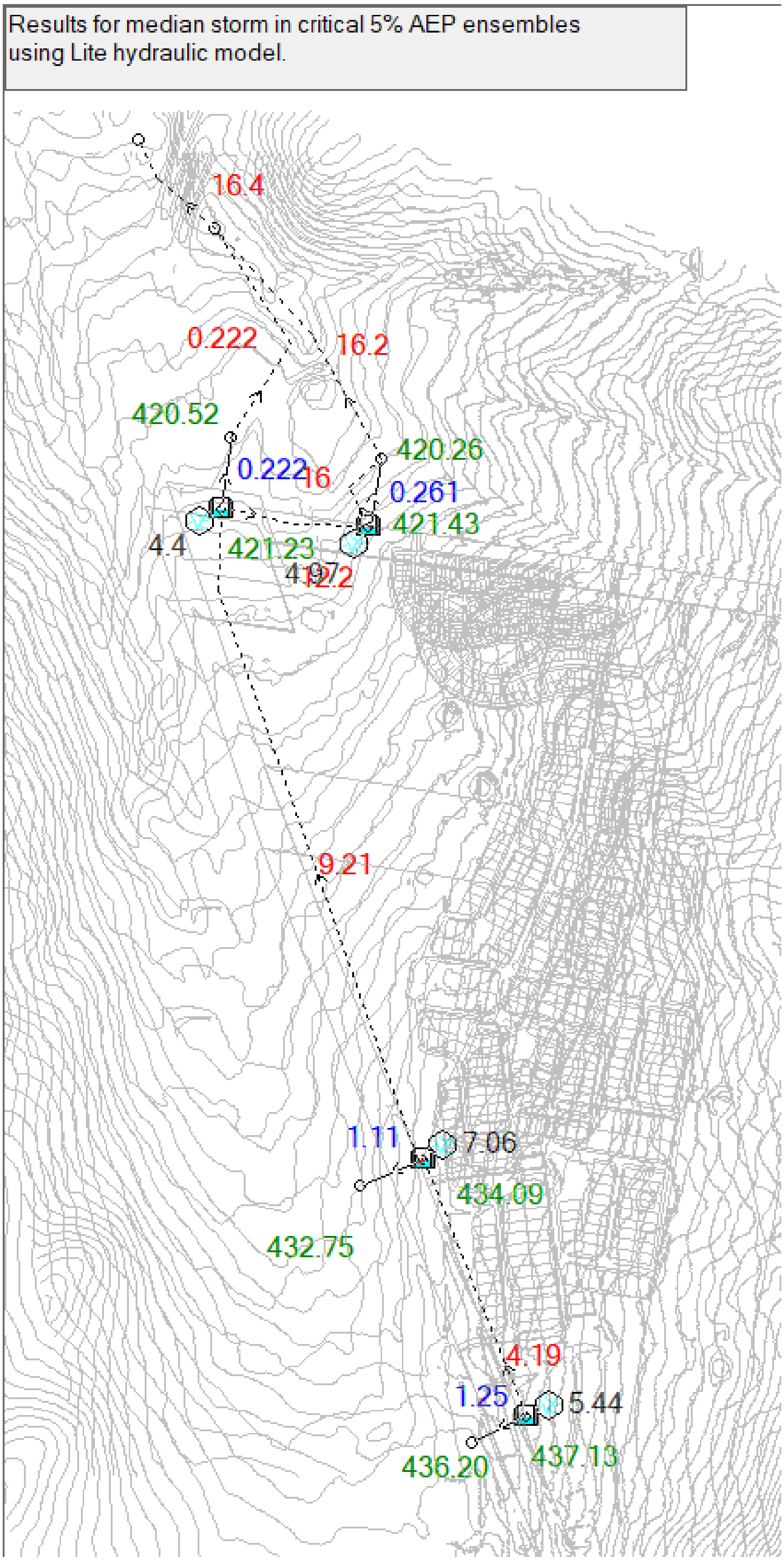
DRAINS Predeveloped Model Input Data																	
PIT / NODE DETAILS			Version 15														
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full	Inflow	Pit is	Internal
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor			lid		Shock Loss	Hydrograph		Width
				(cu.m)	Coeff. Ku			(cu.m/s)									(mm)
HW-Ex4	Headwall				0.5	420.82		0		733886.184	6411434.536		634617220				
N1361203	Node					420.76		0		733904.282	6411535.882		634617222		No		
HW-Ex3	Headwall				0.5	420.72		0		733662.682	6411462.587		634617224				
N1361206	Node					420.8		0		733677.16	6411569.362		634617226		No		
HW-Ex2	Headwall				0.5	433.67		0		733969.432	6410479.9		634617227				
N1361208	Node					433.33		0		733872.611	6410439.181		634617229		No		
HW-Ex1	Headwall				0.5	436.88		0		734123.26	6410090.806		634617230				
N1361210	Node					436.64		0		734041.822	6410050.992		634617232		No		
N1366687	Node							0		733653.295	6411885.926		634631511		No		
N1376497	Node							0		733536.386	6412019.943		634656795		No		
DETENTION BASIN DETAILS																	
Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m)	id		
SUB-CATCHMENT DETAILS																	
Name	Pit or	Total	Impervious	Avg	Mannings	Time lag	Rainfall	Hydrological									
	Node	Area	Area	Slope(%)	n	(mins)	Multiplier	Model									
Pre A	HW-Ex4	55.416	1	3	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Pre B	HW-Ex3	45.454	2	3	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Pre C	HW-Ex2	58.858	1	6	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Pre D	HW-Ex1	40.841	2	6	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
PIPE DETAILS																	
Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	RI	Chg
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)
EX-Culvert 4	HW-Ex4	N1361203	7.56	420.274	420.008	3.52	RCP-2	375	375	0.013	New	1	HW-Ex4	0			
EX-Culvert 3	HW-Ex3	N1361206	10.1	420.343	420.183	1.58	RCP-2	375	375	0.013	New	1	HW-Ex3	0			
EX-Culvert 2	HW-Ex2	N1361208	13.5	432.651	432.317	2.47	RCP-2	750	750	0.013	New	1	HW-Ex2	0			
EX-Culvert 1	HW-Ex1	N1361210	12.374	435.995	435.792	1.64	RCP-2	600	600	0.013	New	2	HW-Ex1	0			
DETAILS of SERVICES CROSSING PIPES																	
Pipe	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	etc							
	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	etc							
CHANNEL DETAILS																	
Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Roofed				
				(m)	(m)	(m)	(%)	(m)	(1:?)	(1:?)	n	(m)					
OVERFLOW ROUTE DETAILS																	
Name	From	To	Travel	Spill	Crest	Weir	Cross	Safe Depth	SafeDepth	Safe	Bed	D/S Area		id	U/S IL	D/S IL	Length (m)
			Time	Level	Length	Coeff. C	Section	Major Storms	Minor Storms	DxV	Slope	Contributing					
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%					
OF1139783	HW-Ex4	N1361203	0.6	420.82	20	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1	0		634617488	422	421.9	25
OF1142827	N1361203	N1366687	11.9				Open Swale Start	0.5	0.5	2	0.44	0		634631514	420	415	500
OF1139785	HW-Ex3	HW-Ex4	0.6	420.72	20	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1	0		634617491	420.6	420.3	25
OF1142828	N1361206	N1366687	3.9				Open Swale End	1.6	1.6	2	1	0		634631515	420	415	406
OF CAT C2	HW-Ex2	HW-Ex3	19.6	433.67	20	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1.26	0		634617494	432.65	420.343	975
OF CAT D	HW-Ex1	HW-Ex2	10	436.88	20	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	0.87	0		634617495	437.1	433.5	415
OF1149388	N1366687	N1376497	0.6				Open Swale End	1.6	1.6	2	1	0		634656659	415	414.5	60
PIPE COVER DETAILS																	
Name	Type	Dia (mm)	Safe Cover (m)	Cover (m)													
EX-Culvert 4	RCP-2	375	0.6	0.14	Unsafe												
EX-Culvert 3	RCP-2	375	0.6	-0.03	Unsafe												
EX-Culvert 2	RCP-2	750	0.6	0.2	Unsafe												
EX-Culvert 1	RCP-2	600	0.6	0.2	Unsafe												
This model has no pipes with non-return valves																	



DRAINS – Predeveloped Model Schematic for 20% AEP

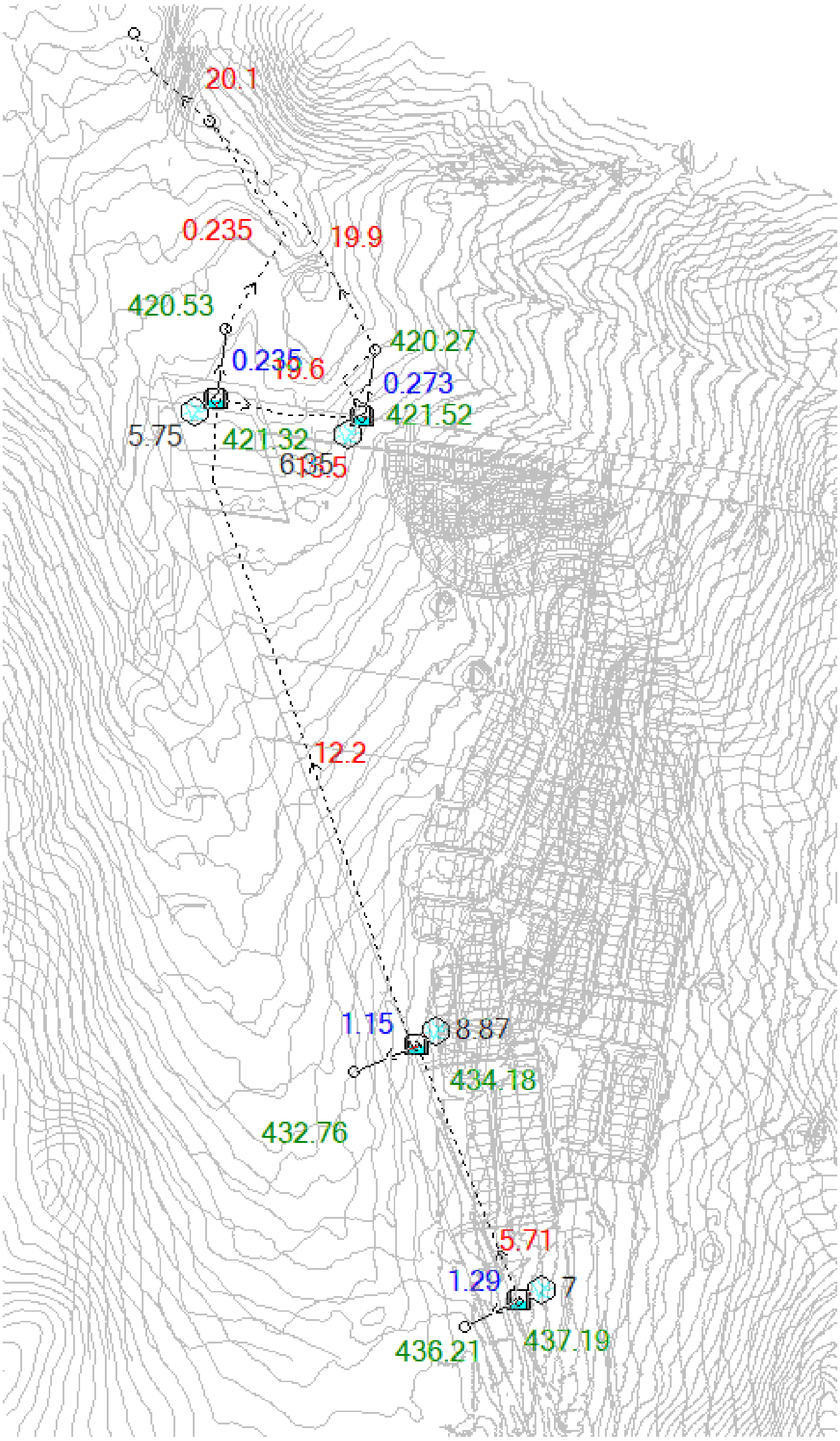


DRAINS – Predeveloped Model Schematic for 10% AEP

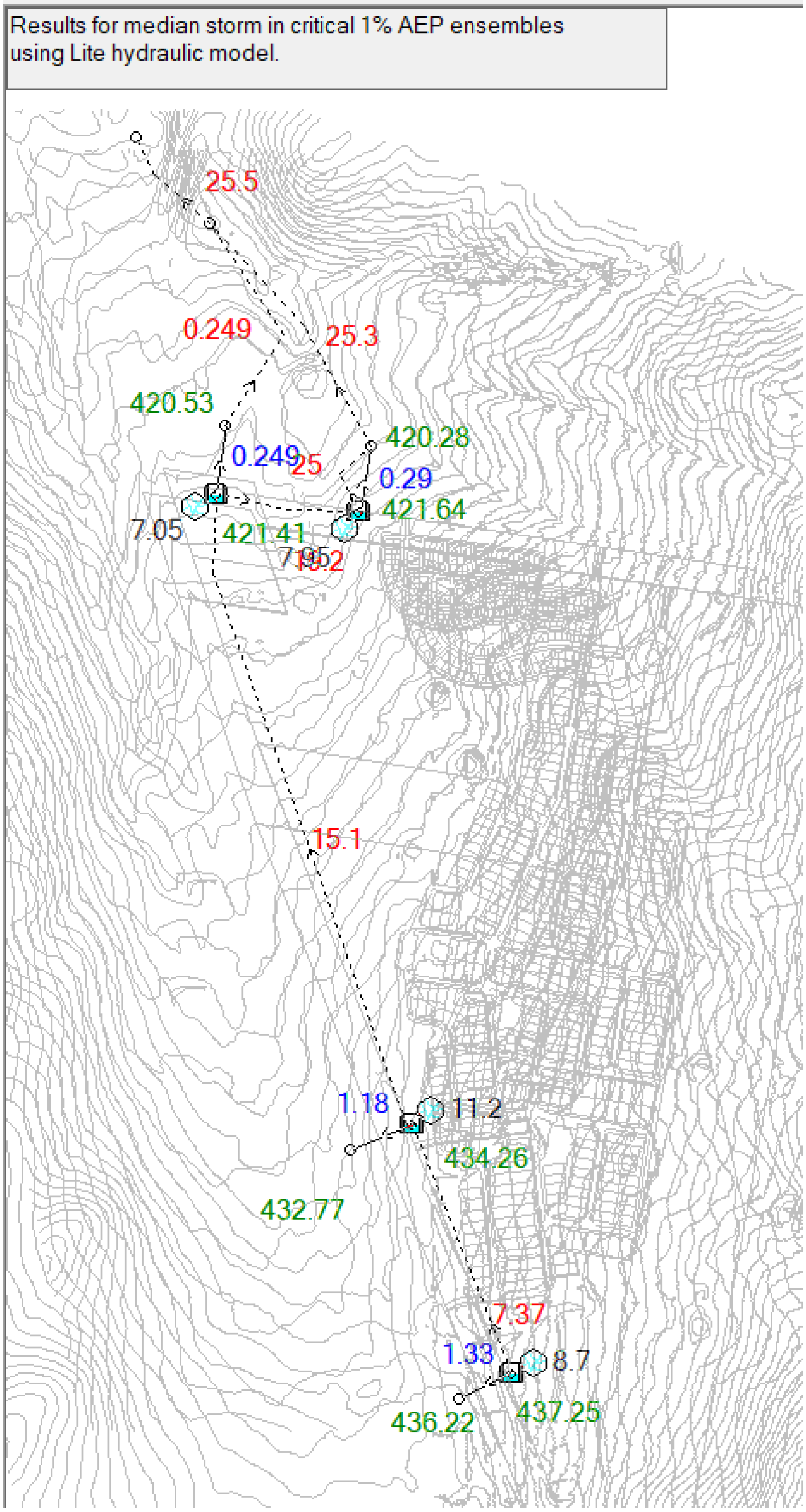


DRAINS – Predeveloped Model Schematic for 5% AEP

Results for median storm in critical 2% AEP ensembles
using Lite hydraulic model.

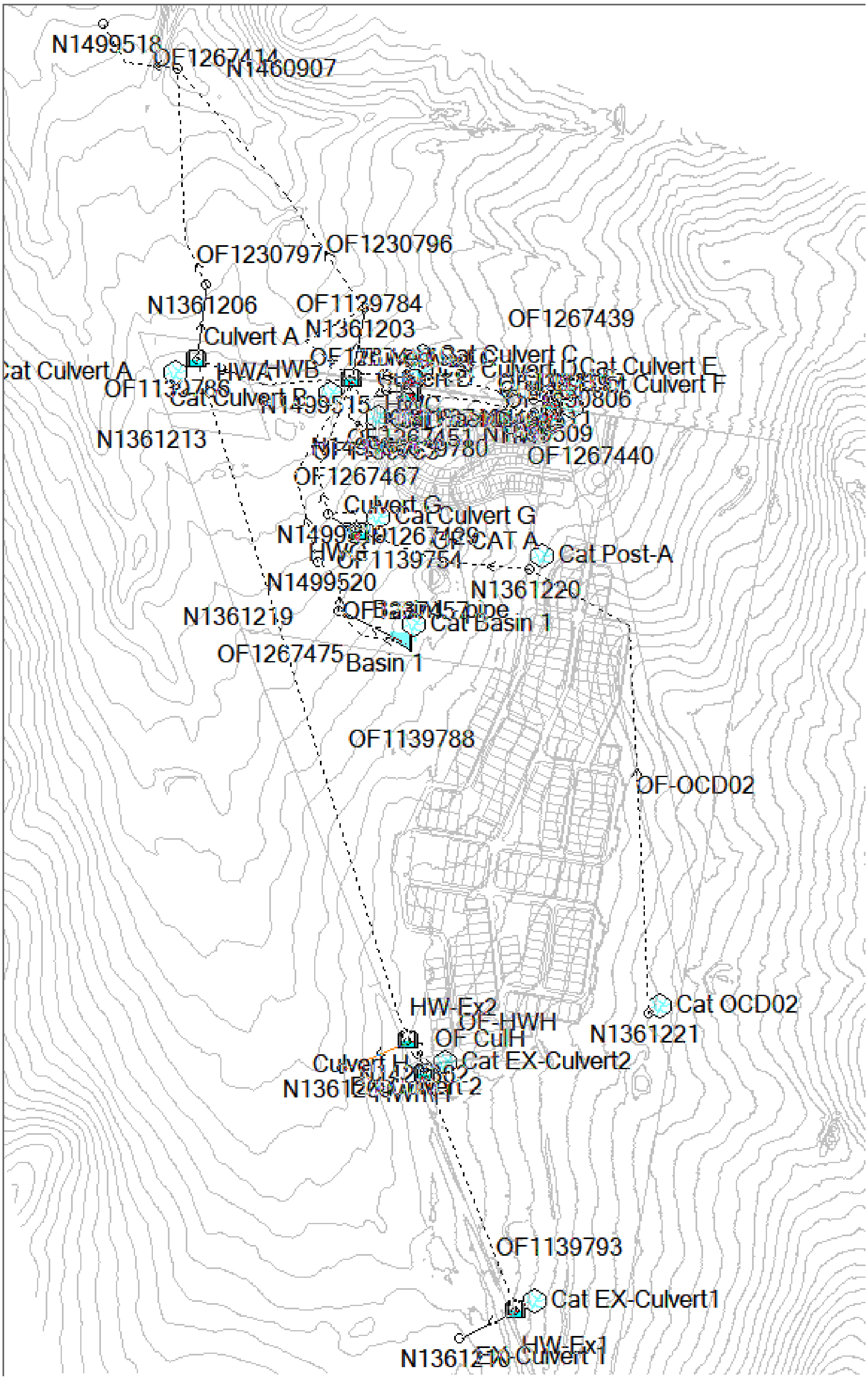


DRAINS – Predeveloped Model Schematic for 2% AEP



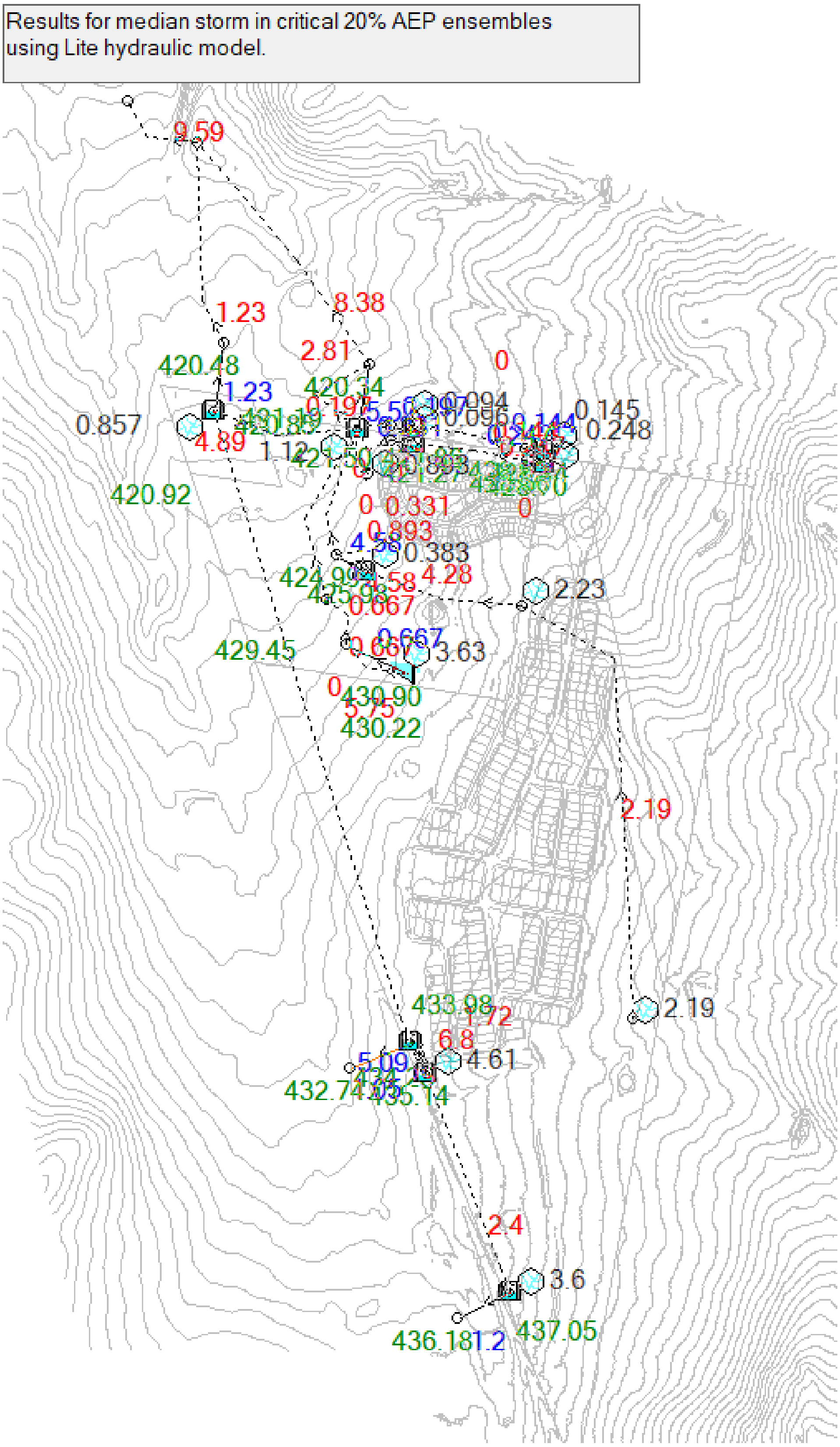
DRAINS – Predeveloped Model Schematic for 1% AEP

DRAINS – POST DEVELOPED MODEL

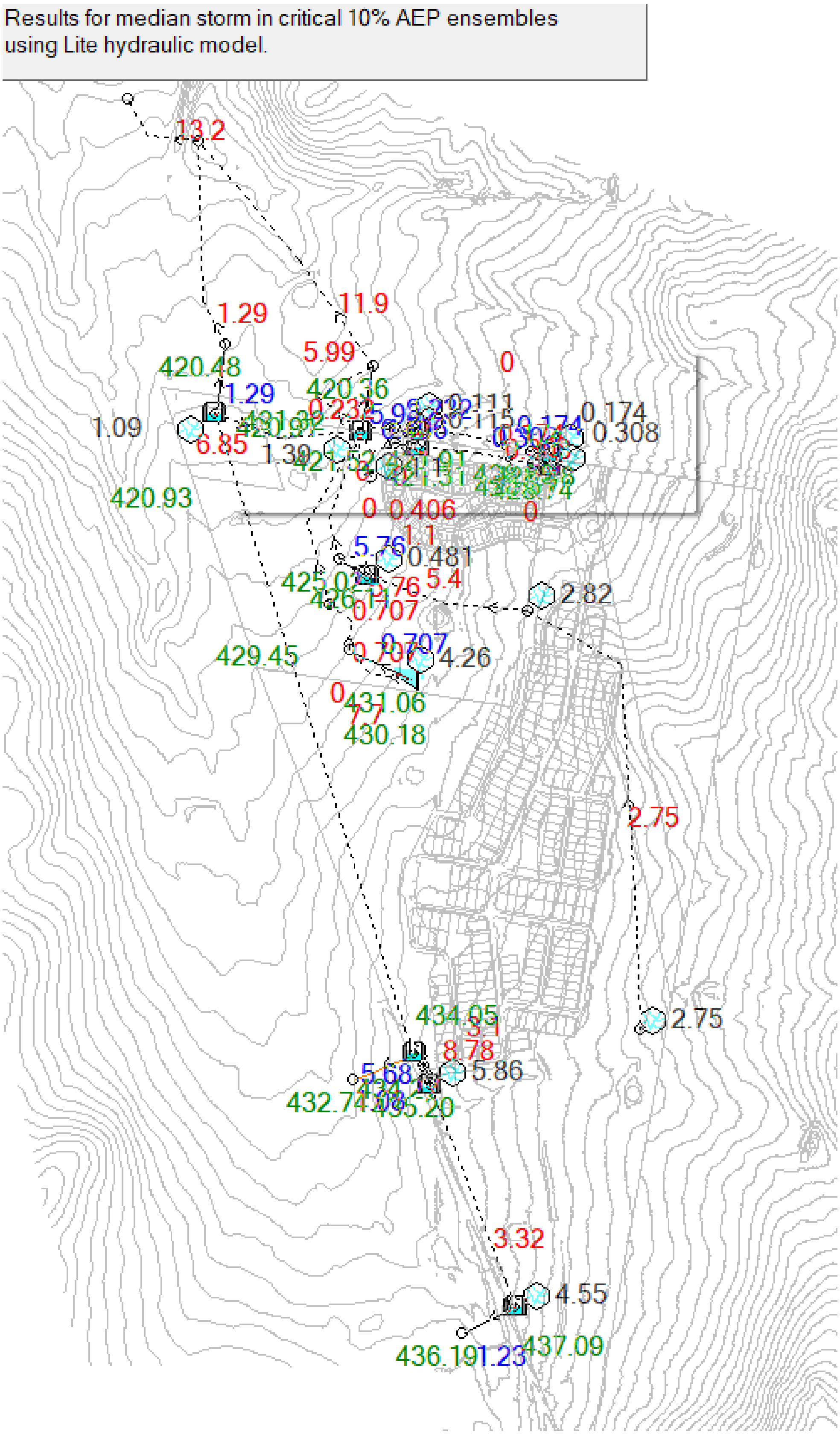


DRAINS – Post Developed Model Schematic

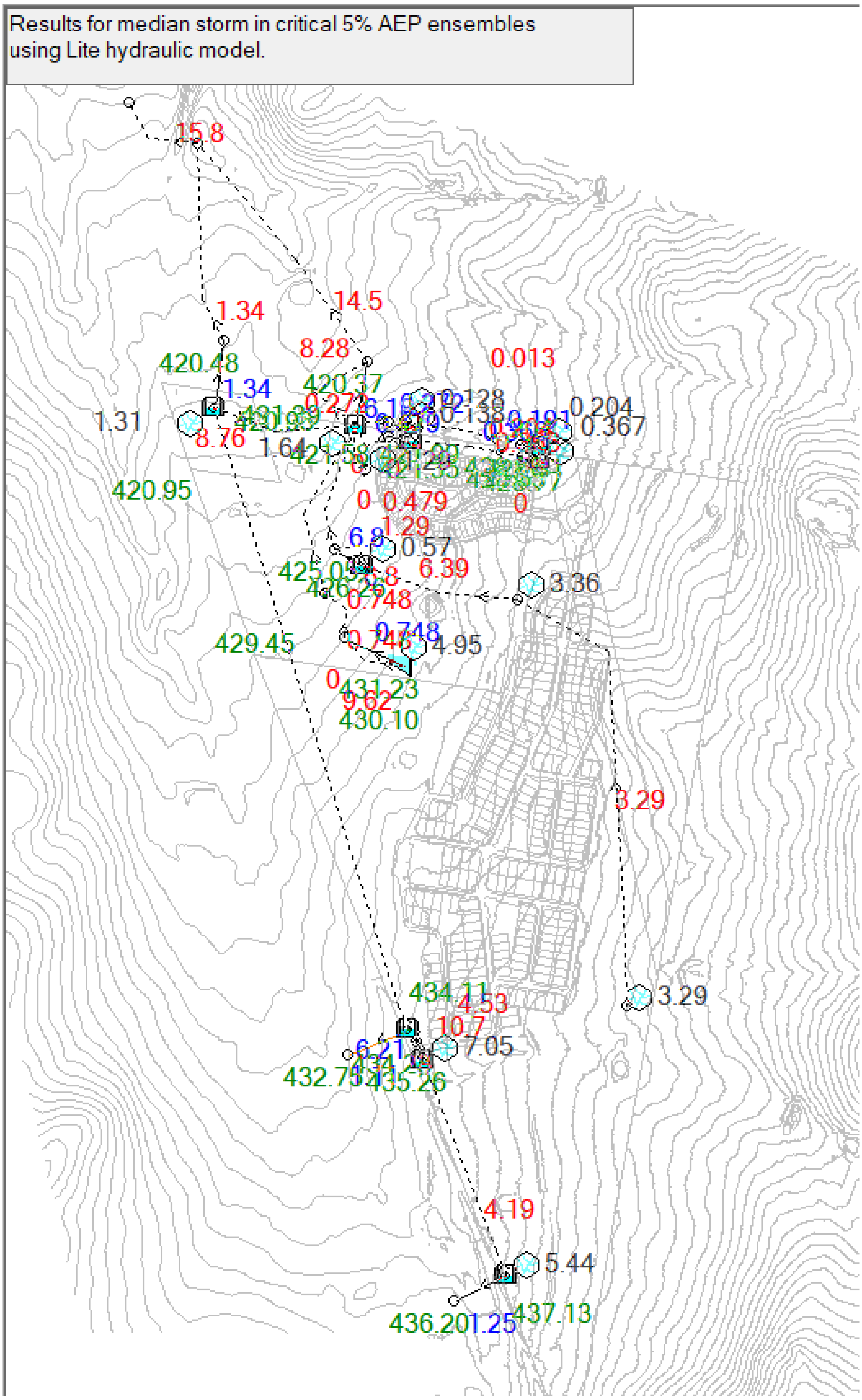
DRAINS Predeveloped Model Input Data																	
PIT / NODE DETAILS			Version 15														
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full	Inflow	Pit is	Internal
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor			lid		Shock Loss	Hydrograph		Width
				(cu.m)	Coeff. Ku			(cu.m/s)									(mm)
HWB	Headwall				0.5	421		0		733886.184	6411434.536		634617220				
N1361203	Node					422.6		0		733904.282	6411535.882		634617222		No		
HWA	Headwall				0.5	420.64		0		733662.682	6411462.587		634617224				
N1361206	Node					421.8		0		733677.16	6411569.362		634617226		No		
HW-Ex2	Headwall				0.5	433.67		0		733969.432	6410479.9		634617227				
N1361208	Node					433.33		0		733872.611	6410439.181		634617229		No		
HW-Ex1	Headwall				0.5	436.88		0		734123.26	6410090.806		634617230				
N1361210	Node					436.64		0		734041.822	6410050.992		634617232		No		
HWD	Headwall				0.5	422.2		0		733973.575	6411411.57		634617235				
N1361213	Node					422		0		733937.013	6411417.055		634617236		No		
N1361219	Node					430		0		733867.759	6411098.935		634617270		No		
N1361220	Node					443		0		734142.862	6411158.53		634617274		No		
N1361221	Node							0		734315.063	6410518.009		634617294		No		
N1460907	Node							0		733636.268	6411879.866		634898817		No		
HWh\H	Headwall				0.5	435		0		733993.055	6410432.496		635011946				
N1423362	Node					434.8		0		733981.27	6410460.765		634794367		No		
HWG	Headwall				0.5	426.4		0		733897.439	6411212.647		635029079				
N1499519	Node					426.2		0		733852.039	6411237.842		635068723		No		
HWF	Headwall				0.5	429.4		0		734174.434	6411381.716		635036159				
N1499509	Node					429.2		0		734148.461	6411384.487		635037067		No		
HWE	Headwall				0.5	428.8		0		734177.898	6411400.071		635037548				
N1499511	Node					428.7		0		734148.115	6411404.919		635038192		No		
HWC	Headwall				0.5	422.2		0		733975.619	6411433.758		635041528				
N1499515	Node					421.8		0		733937.941	6411439.169		635042427		No		
N1499518	Node							0		733527.084	6411946.326		635054379		No		
N1499520	Node					430.14		0		733836.586	6411170.307		635076196		No		
N1499528	Node							0		733901.832	6411364.327		635098975		No		
DETENTION BASIN DETAILS																	
Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m)	id		
Basin 1	430.2	4657		Pit/Sump				Surface Inlet Pits	Surface Inlet Pit 900 x 900	733962.527	6411053.446	No			634617239		
	432	8031															
	432.5	9032															
SUB-CATCHMENT DETAILS																	
Name	Pit or	Total	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp
	Node	Area	Area	Area	Area	Time	Time	Time	Length	Length	Length	Slope(%)	Slope	Slope	Rough	Rough	Rough
		(ha)	%	%	%	(min)	(min)	(min)	(m)	(m)	(m)	%	%	%			
Cat Basin 1	Basin 1	20.783	70	30	0	8	11	0	50	50	0	3	3	0	0.013	0.2	0
Cat Basin2	N1499528	4.889	0	100	0	8	11	2									
Name	Pit or	Total	Impervious	Avg	Mannings	Time lag	Rainfall	Hydrological									
	Node	Area	Area	Slope(%)	n	(mins)	Multiplier	Model									
Cat Culvert B	HWB	6.57	3	3	0.015	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat Culvert A	HWA	10.848	0.1	3	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat EX-Culvert1	HW-Ex1	40.841	2	6	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat Culvert D	HWD	0.768	0	3	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat Post-A	N1361220	24.833	0	6	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat OCD02	N1361221	24.172	0	6	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat EX-Culvert2	HWh\H	58.82	1	6	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat Culvert G	HWG	4.031	0	3	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat Culvert F	HWF	2.349	0	3	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat Culvert E	HWE	1.214	0.2	3	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
Cat Culvert C	HWC	0.437	34	3	0.035	0	1	STORAGE RAFTS- Galambine NSW 2850 2023									
PIPE DETAILS																	
Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	Rl	Chg
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)
Culvert B	HWB	N1361203	11.5	420.15	420	1.3	RCBC	2.1W x 0.6H		0.012	NewFixed	2	HWB	0			
Culvert A	HWA	N1361206	13.5	420.25	420.18	0.52	RCBC	1.2W x 0.3H		0.012	NewFixed	2	HWA	0			
EX-Culvert 2	HW-Ex2	N1361208	13.5	432.651	432.317	2.47	RCP-2	750	750	0.013	Existing	1	HW-Ex2	0			
EX-Culvert 1	HW-Ex1	N1361210	12.374	435.995	435.792	1.64	RCP-2	600	600	0.013	New	2	HW-Ex1	0			
Culvert D	HWD	N1361213	17.6	421	420.8	1.14	RCBC	1.5W x 0.6H		0.012	NewFixed	1	HWD	0			
Basin1 - pipe	Basin 1	N1361219	64	429.5	429.15	0.55	RCBC	1.2W x 0.3H		0.012	NewFixed	1	Basin 1	0			
Culvert H	HWh\H	N1423362	24.3	434.4	434	1.65	RCBC	2.7W x 0.6H		0.012	NewFixed	2	HWh\H	0			
Culvert G	HWG	N1499519	16.5	425.3	424.8	3.03	RCBC	2.7W x 0.6H		0.012	NewFixed	2	HWG	0			
Culvert F	HWF	N1499509	7.5	428.48	428.4	1.07	RCBC	1.5W x 0.6H		0.012	NewFixed	1	HWF	0			
Culvert E	HWE	N1499511	18.7	428.45	428.35	0.53	RCBC	0.6W x 0.3H		0.012	NewFixed	1	HWE	0			
Culvert C	HWC	N1499515	30.5	421.5	421.3	0.66	RCBC	0.6W x 0.3H		0.012	NewFixed	1	HWC	0			
DETAILS of SERVICES CROSSING PIPES																	
Pipe	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	etc							
	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	etc							
CHANNEL DETAILS																	
Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Roofed				
				(m)	(m)	(m)	(%)	(m)	(1:?)	(1:?)	n	(m)					
OVERFLOW ROUTE DETAILS																	
Name	From	To	Travel	Spill	Crest	Weir	Cross	Safe Depth	SafeDepth	Safe	Bed	D/S Area		id	U/S IL	D/S IL	Length (m)
			Time	Level	Length	Coeff. C	Section	Major Storms	Minor Storms	DxV	Slope	Contributing					
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%					
OF1139784	HWB	N1361203	0.3	421	20	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1	0		634617515	421.1	420.9	11.5
OF1230796	N1361203	N1460907	11.3				Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1	0		634898815	420	415	500
OF1139786	HWA	HWB	0.5	420.64	30	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1	0		634617522	422	421.8	23.8
OF1230797	N1361206	N1460907	8.2				Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1.23	0		634898816	420	415	406
OF1139788	HW-Ex2	HWA	19.6	433.67	20	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1.26	0		634617529	432.65	420.343	975
OF1139793	HW-Ex1	HWh\H	7.5	436.88	20	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	0.87	0		634617581	437.1	434.4	311
OF1139780	HWD	N1361213	0.4	422.2	15	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1.14	0		634617484	422	421.8	17.6
OF1139753	N1361213	HWB	0.4				Swale 1	1.2	1.2	2	1	0		634617266	420.8	420	50
OF1267475	Basin 1	N1361219	1.4	432	10	2	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1	0		635108329	432	430	64
OF1267457	N1361219	N1499520	1.5				Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	0.66	0		635093646	429.15	428.8	53
OF CAT A	N1361220	HWG	4.2				Western Cutoff Drain 1:2	2	1.5	0.6	2.62	0		634617341	441.726	431	420
OF-OCD02	N1361221	N1361220	5.1				Western Cutoff Drain 1:2	2	1.5	0.6	0.3	0		634617338	443.25	441.726	263
OF1267414	N1460907	N1499518	1.5				Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	0.83	0		635052974	415	414.5	60
OF-HWH	HWh\H	N1423362	0.6	435	20	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	0.8	0		634794249	435	434.8	24.3
OF CulH	N1423362	HW-Ex2	1.8				Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1.14	0		634794371	434	432.651	83
OF1267451	HWG	N1499519	0.3	426.4	15	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1.21	0		635086935	426.5	426.3	16.5
OF1267429	N1499519	HWB	3.7				4 m wide pathway	0.3	0.15	0.4	1	0		635068952	424.8	423	450
OF1267440	HWF	N1499509	0.1	429.4	15	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1.33	0		635080423	429.3	429.2	7.5
OF1230806	N1499509	HWD	1.8				Dummy Headwall Outlet 1	2	2	5	1	0		634898929	428.4	421.6	280
OF1267439	HWE	N1499511	0.6	428.8	15	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	0.53	0		635080263	428.8	428.7	18.7
OF1267397	N1499511	HWC	1.8				Dummy Headwall Outlet 1	2	2	5	1	0		635040244	428.35	421.6	280
OF1267404	HWC	N1499515	0.6	422.2	15	1.67	Overflow across road low point - parabola x = 15, y = 0.3	0.05	0	0.6	1.31	0		635042882	422.2	421.8	30.5
OF1267407	N1499515	HWB	0.4				Swale 1	1.2	1.2	2	1	0		635044584	421.3	421	50
OF1139754	N1499520	HWB	3.7				4 m wide pathway	0.3	0.15	0.4	1	0		634617267	430.14	423	450
OF1267467	N1499528	HWB	0.4				Swale 1	1.2	1.2	2	1	0		635100096	421.5	421	50
PIPE COVER DETAILS																	
Name	Type	Dia (mm)	Safe Cover (m)	Cover (m)													
Culvert B	RCBC	0	0.4	0.06	Unsafe												
Culvert A	RCBC	0	0.4	-0.06	Unsafe												
EX-Culvert 2	RCP-2	750	0.6	0.2	Unsafe												
EX-Culvert 1	RCP-2	600	0.6	0.2	Unsafe												
Culvert D	RCBC	0	0.4	0.43													
Basin1 - pipe	RCBC	0	0.4	0.25	Unsafe												
Culvert H	RCBC	0	0.4	-0.22	Unsafe												
Culvert G	RCBC	0	0.4	0.28	Unsafe												
Culvert F	RCBC	0	0.4	0.03	Unsafe												
Culvert E	RCBC	0	0.4	-0.06	Unsafe												
Culvert C	RCBC	0	0.4	0.09	Unsafe												
This model has no pipes with non-return valves																	



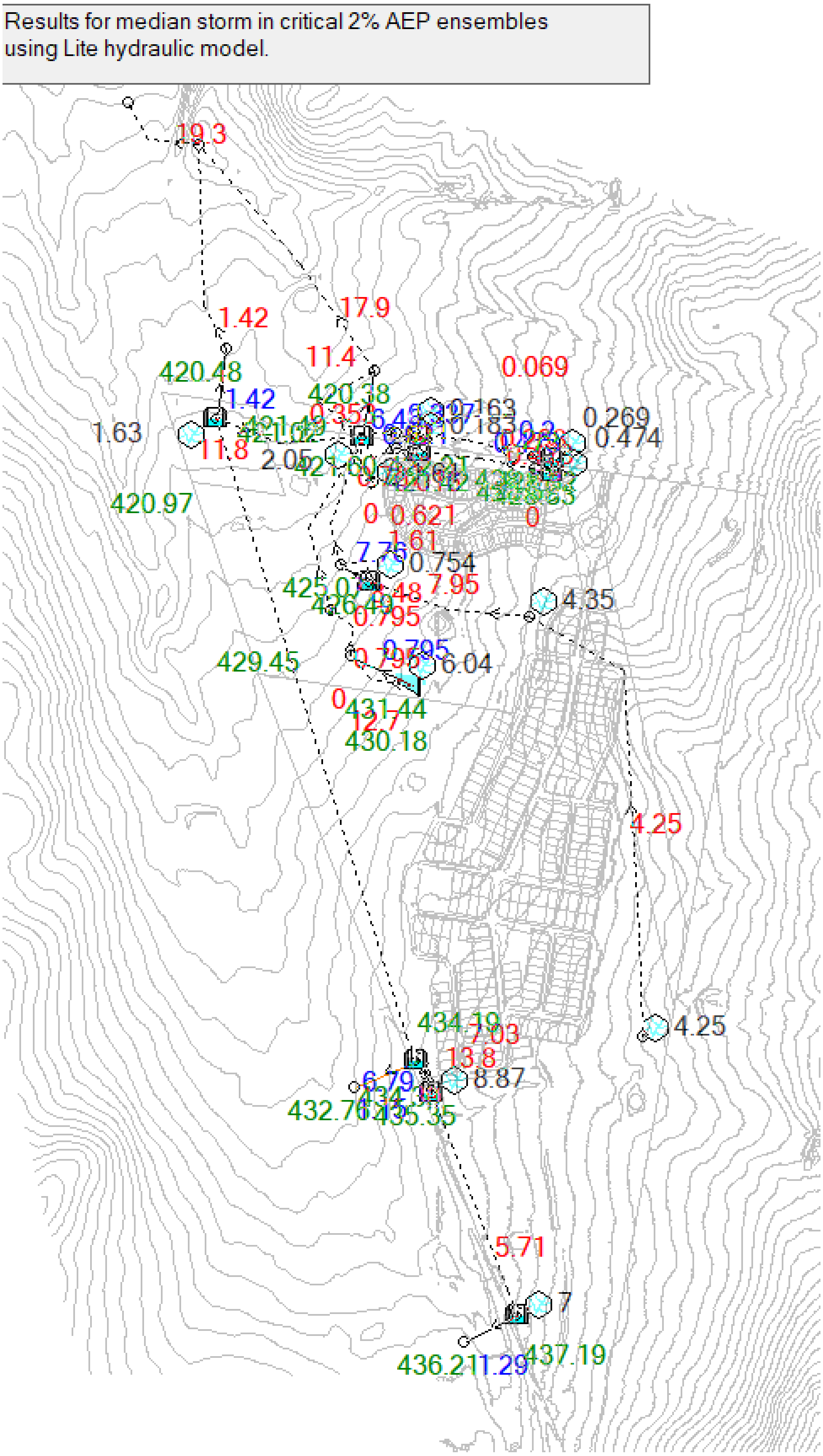
DRAINS – Post Developed Model Schematic for 20% AEP



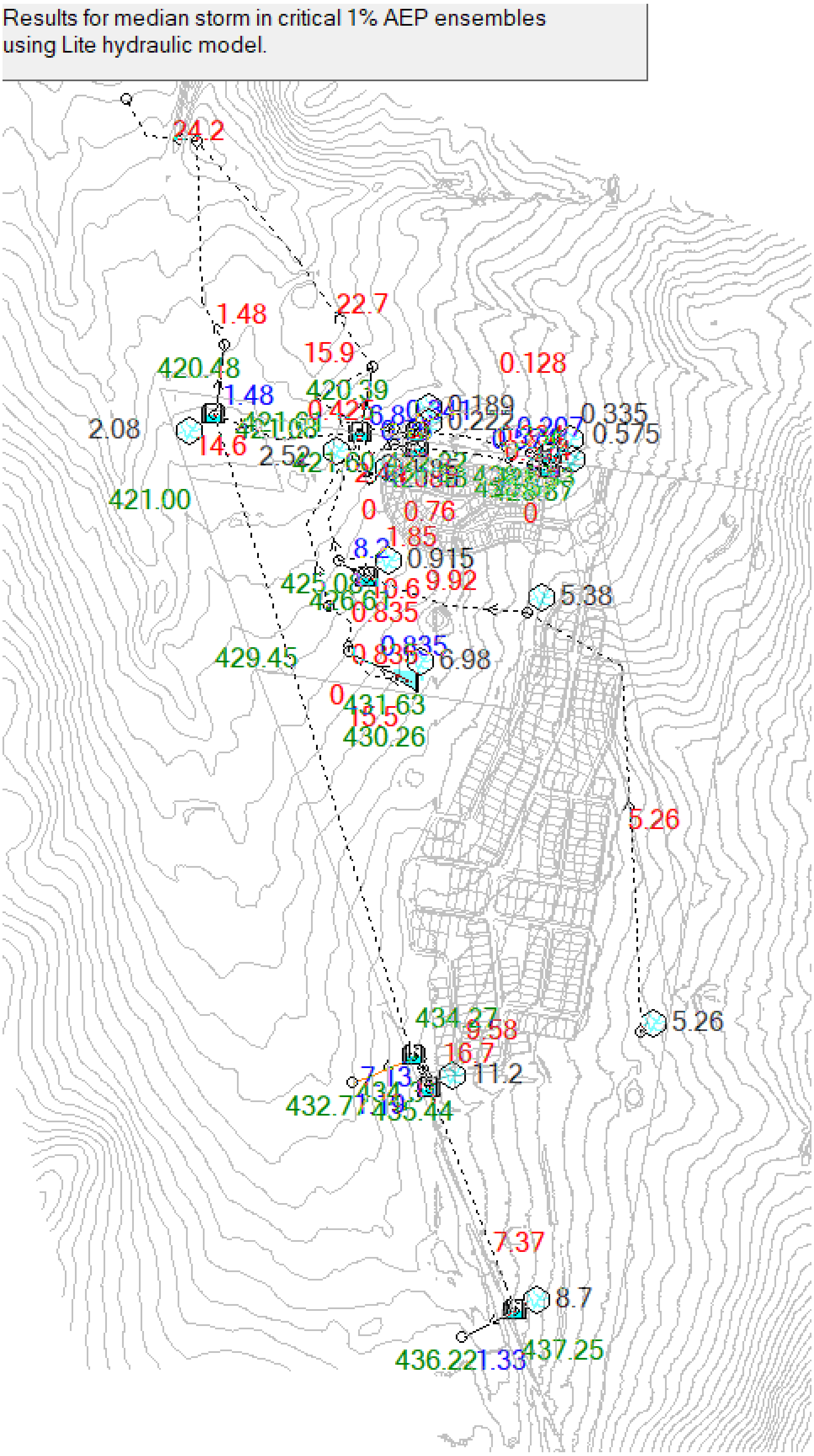
DRAINS – Post Developed Model Schematic for 10% AEP



DRAINS – Post Developed Model Schematic for 5% AEP



DRAINS – Post Developed Model Schematic for 2% AEP



DRAINS – Post Developed Model Schematic for 1% AEP

Appendix B

MUSIC Report

Source nodes
Location,Site Areas (Long term 240 sites),Sealed Roads (Long term),Rood Areas (Long term 240 sites),Caravan park,Pervious areas
ID,1,2,3,4,11
Node Type,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode
Zoning Surface Type,Residential,Sealedroad,Roof,Mixed,Revegetatedland
Total Area (ha),7.163,5.02,4.8,4.889,3.8
Area Impervious (ha),5.03922395522388,3.53160746268657,4.8,3.42704305970149,0
Area Pervious (ha),2.12377604477612,1.48839253731343,0,1.46195694029851,3.8
Field Capacity (mm),80,80,80,80,80
Pervious Area Infiltration Capacity coefficient - a,200,200,200,200,200
Pervious Area Infiltration Capacity exponent - b,1,1,1,1,1
Impervious Area Rainfall Threshold (mm/day),1,1,1,1,1
Pervious Area Soil Storage Capacity (mm),120,120,120,120,120
Pervious Area Soil Initial Storage (% of Capacity),25,25,25,25,25
Groundwater Initial Depth (mm),10,10,10,10,10
Groundwater Daily Recharge Rate (%),25,25,25,25,25
Groundwater Daily Baseflow Rate (%),5,5,5,5,5
Groundwater Daily Deep Seepage Rate (%),0,0,0,0,0
Stormflow Total Suspended Solids Mean (log mg/L),2.15,2.43,1.3,2.2,1.95
Stormflow Total Suspended Solids Standard Deviation (log mg/L),0.32,0.32,0.32,0.32,0.32
Stormflow Total Suspended Solids Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Suspended Solids Serial Correlation,0,0,0,0,0
Stormflow Total Phosphorus Mean (log mg/L),-0.6,-0.3,-0.89,-0.45,-0.66
Stormflow Total Phosphorus Standard Deviation (log mg/L),0.25,0.25,0.25,0.25,0.25
Stormflow Total Phosphorus Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Phosphorus Serial Correlation,0,0,0,0,0
Stormflow Total Nitrogen Mean (log mg/L),0.3,0.34,0.3,0.42,0.3
Stormflow Total Nitrogen Standard Deviation (log mg/L),0.19,0.19,0.19,0.19,0.19
Stormflow Total Nitrogen Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Nitrogen Serial Correlation,0,0,0,0,0
Baseflow Total Suspended Solids Mean (log mg/L),1.2,1.2,1.1,1.1,1.15
Baseflow Total Suspended Solids Standard Deviation (log mg/L),0.17,0.17,0.17,0.17,0.17
Baseflow Total Suspended Solids Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Suspended Solids Serial Correlation,0,0,0,0,0
Baseflow Total Phosphorus Mean (log mg/L),-0.85,-0.85,-0.82,-0.82,-1.22
Baseflow Total Phosphorus Standard Deviation (log mg/L),0.19,0.19,0.19,0.19,0.19
Baseflow Total Phosphorus Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Phosphorus Serial Correlation,0,0,0,0,0
Baseflow Total Nitrogen Mean (log mg/L),0.11,0.11,0.32,0.32,-0.05
Baseflow Total Nitrogen Standard Deviation (log mg/L),0.12,0.12,0.12,0.12,0.12
Baseflow Total Nitrogen Estimation Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Nitrogen Serial Correlation,0,0,0,0,0
Flow based constituent generation - enabled,Off,Off,Off,Off,Off
Flow based constituent generation - flow file, , , , ,
Flow based constituent generation - base flow column, , , , ,
Flow based constituent generation - pervious flow column, , , , ,
Flow based constituent generation - impervious flow column, , , , ,
Flow based constituent generation - unit, , , , ,
OUT - Mean Annual Flow (ML/yr),25.7,18.0,23.5,17.6,2.18
OUT - TSS Mean Annual Load (kg/yr),4.41E3,6.10E3,600,3.64E3,68.5
OUT - TP Mean Annual Load (kg/yr),7.74,10.3,3.44,7.27,0.234
OUT - TN Mean Annual Load (kg/yr),54.1,42.9,50.8,51.1,2.44
OUT - Gross Pollutant Mean Annual Load (kg/yr),1.01E3,707,808,689,0.00

Rain In (ML/yr),40.3084,28.2491,27.0111,27.5119,21.3838
ET Loss (ML/yr),14.5585,10.203,3.54259,9.9367,19.2005
Deep Seepage Loss (ML/yr),0,0,0,0,0
Baseflow Out (ML/yr),1.05048,0.736202,0,0.716992,1.85762
Imp. Stormflow Out (ML/yr),24.5153,17.1809,23.4685,16.7326,0
Perv. Stormflow Out (ML/yr),0.184207,0.129097,0,0.125728,0.325741
Total Stormflow Out (ML/yr),24.6995,17.31,23.4685,16.8583,0.325741
Total Outflow (ML/yr),25.75,18.0462,23.4685,17.5753,2.18336
Change in Soil Storage (ML/yr),-7.5E-5,-5.2E-5,0,-5.1E-5,-0.000132
TSS Baseflow Out (kg/yr),18.0192,12.5388,0,9.78035,28.2312
TSS Total Stormflow Out (kg/yr),4390.89,6083.36,599.873,3629.59,40.3186
TSS Total Outflow (kg/yr),4408.91,6095.9,599.873,3639.37,68.5498
TP Baseflow Out (kg/yr),0.163379,0.114858,0,0.119199,0.122466
TP Total Stormflow Out (kg/yr),7.57323,10.1962,3.44238,7.14686,0.111367
TP Total Outflow (kg/yr),7.73661,10.311,3.44238,7.26606,0.233833
TN Baseflow Out (kg/yr),1.4024,0.98351,0,1.54854,1.72213
TN Total Stormflow Out (kg/yr),52.7399,41.8685,50.8134,49.5385,0.722687
TN Total Outflow (kg/yr),54.1423,42.852,50.8134,51.087,2.44481
GP Total Outflow (kg/yr),1010.14,707.932,808.393,689.458,0

No Imported Data Source nodes

USTM treatment nodes
Location,Basin 1,Basin 2,Rainwater Tank
ID,6,9,10
Node Type,BioRetentionNodeV4,BioRetentionNodeV4,RainWaterTankNode
Lo-flow bypass rate (cum/sec),0,0,0
Hi-flow bypass rate (cum/sec),100,100,1.2
Inlet pond volume, , ,0
Area (sqm),4657,230,240
Initial Volume (m^3), , ,48
Extended detention depth (m),0.3,0.3,0.2
Number of Rainwater tanks, , ,240
Permanent Pool Volume (cubic metres), , ,480
Proportion vegetated, , ,0
Equivalent Pipe Diameter (mm), , ,1549
Overflow weir width (m),10,10,10
Notional Detention Time (hrs), , ,5.33E-3
Orifice Discharge Coefficient, , ,0.6
Weir Coefficient,1.7,1.7,1.7
Number of CSTR Cells,3,3,2
Total Suspended Solids - k (m/yr),8000,8000,400
Total Suspended Solids - C* (mg/L),20,20,12
Total Suspended Solids - C** (mg/L), , ,12
Total Phosphorus - k (m/yr),6000,6000,300
Total Phosphorus - C* (mg/L),0.13,0.13,0.13
Total Phosphorus - C** (mg/L), , ,0.13
Total Nitrogen - k (m/yr),500,500,40
Total Nitrogen - C* (mg/L),1.4,1.4,1.4
Total Nitrogen - C** (mg/L), , ,1.4
Threshold Hydraulic Loading for C** (m/yr), , ,0
Horizontal Flow Coefficient,3,3,
Reuse Enabled,Off,Off,On
Max drawdown height (m), , ,2
Annual Demand Enabled,Off,Off,On
Annual Demand Value (ML/year), , ,13.228
Annual Demand Distribution, , ,PET
Annual Demand Monthly Distribution: Jan, , ,

Annual Demand Monthly Distribution: Feb, , ,
Annual Demand Monthly Distribution: Mar, , ,
Annual Demand Monthly Distribution: Apr, , ,
Annual Demand Monthly Distribution: May, , ,
Annual Demand Monthly Distribution: Jun, , ,
Annual Demand Monthly Distribution: Jul, , ,
Annual Demand Monthly Distribution: Aug, , ,
Annual Demand Monthly Distribution: Sep, , ,
Annual Demand Monthly Distribution: Oct, , ,
Annual Demand Monthly Distribution: Nov, , ,
Annual Demand Monthly Distribution: Dec, , ,
Daily Demand Enabled,Off,Off,On
Daily Demand Value (ML/day), , ,0.05088
Custom Demand Enabled,Off,Off,Off
Custom Demand Time Series File, , ,
Custom Demand Time Series Units, , ,
Filter area (sqm),500,200,
Filter perimeter (m),0.01,0.01,
Filter depth (m),0.4,0.4,
Filter Median Particle Diameter (mm), , ,
Saturated Hydraulic Conductivity (mm/hr),100,100,
Infiltration Media Porosity,0.35,0.35,
Length (m), , ,
Bed slope, , ,
Base Width (m), , ,
Top width (m), , ,
Vegetation height (m), , ,
Vegetation Type,Vegetated with Effective Nutrient Removal Plants,Vegetated with Effective Nutrient Removal Plants,
Total Nitrogen Content in Filter (mg/kg),400,400,
Orthophosphate Content in Filter (mg/kg),40,40,
Is Base Lined?,No,No,
Is Underdrain Present?,Yes,Yes,
Is Submerged Zone Present?,No,No,
Submerged Zone Depth (m), , ,
B for Media Soil Texture,13,13,-9999
Proportion of upstream impervious area treated, , ,
Exfiltration Rate (mm/hr),0,0,0
Evaporative Loss as % of PET,100,100,0
Depth in metres below the drain pipe, , ,
TSS A Coefficient, , ,
TSS B Coefficient, , ,
TP A Coefficient, , ,
TP B Coefficient, , ,
TN A Coefficient, , ,
TN B Coefficient, , ,
Sfc,0.61,0.61,
S*,0.37,0.37,
Sw,0.11,0.11,
Sh,0.05,0.05,
Emax (m/day),0.008,0.008,
Ew (m/day),0.001,0.001,
IN - Mean Annual Flow (ML/yr),57.5,17.6,23.5
IN - TSS Mean Annual Load (kg/yr),6.40E3,2.15E3,600
IN - TP Mean Annual Load (kg/yr),13.2,4.80,3.44
IN - TN Mean Annual Load (kg/yr),94.3,38.8,50.8
IN - Gross Pollutant Mean Annual Load (kg/yr),258,104,808
OUT - Mean Annual Flow (ML/yr),55.3,17.2,11.5

OUT - TSS Mean Annual Load (kg/yr),304,389,270
OUT - TP Mean Annual Load (kg/yr),4.00,1.88,1.66
OUT - TN Mean Annual Load (kg/yr),42.7,21.5,24.6
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00
Flow In (ML/yr),57.473,17.5735,23.4685
ET Loss (ML/yr),0.906095,0.353881,0
Infiltration Loss (ML/yr),0,0,0
Low Flow Bypass Out (ML/yr),0,0,0
High Flow Bypass Out (ML/yr),0,0,0
Orifice / Filter Out (ML/yr),46.7319,10.6785,11.4979
Weir Out (ML/yr),8.5656,6.52301,0
Transfer Function Out (ML/yr),0,0,0
Reuse Supplied (ML/yr),0,0,11.5458
Reuse Requested (ML/yr),0,0,31.7896
% Reuse Demand Met,0,0,36.3194
% Load Reduction,3.78517,2.11697,51.0071
TSS Flow In (kg/yr),6396.27,2146.96,599.873
TSS ET Loss (kg/yr),0,0,0
TSS Infiltration Loss (kg/yr),0,0,0
TSS Low Flow Bypass Out (kg/yr),0,0,0
TSS High Flow Bypass Out (kg/yr),0,0,0
TSS Orifice / Filter Out (kg/yr),117.303,28.9941,269.643
TSS Weir Out (kg/yr),186.732,359.651,0
TSS Transfer Function Out (kg/yr),0,0,0
TSS Reuse Supplied (kg/yr),0,0,177.57
TSS Reuse Requested (kg/yr),0,0,0
TSS % Reuse Demand Met,0,0,0
TSS % Load Reduction,95.2467,81.8979,55.05
TP Flow In (kg/yr),13.1579,4.79516,3.44238
TP ET Loss (kg/yr),0,0,0
TP Infiltration Loss (kg/yr),0,0,0
TP Low Flow Bypass Out (kg/yr),0,0,0
TP High Flow Bypass Out (kg/yr),0,0,0
TP Orifice / Filter Out (kg/yr),2.85236,0.680985,1.65698
TP Weir Out (kg/yr),1.14539,1.19826,0
TP Transfer Function Out (kg/yr),0,0,0
TP Reuse Supplied (kg/yr),0,0,1.55762
TP Reuse Requested (kg/yr),0,0,0
TP % Reuse Demand Met,0,0,0
TP % Load Reduction,69.6171,60.8095,51.8653
TN Flow In (kg/yr),94.2579,38.8199,50.8134
TN ET Loss (kg/yr),0,0,0
TN Infiltration Loss (kg/yr),0,0,0
TN Low Flow Bypass Out (kg/yr),0,0,0
TN High Flow Bypass Out (kg/yr),0,0,0
TN Orifice / Filter Out (kg/yr),29.4648,7.64678,24.6003
TN Weir Out (kg/yr),13.2359,13.8464,0
TN Transfer Function Out (kg/yr),0,0,0
TN Reuse Supplied (kg/yr),0,0,22.8943
TN Reuse Requested (kg/yr),0,0,0
TN % Reuse Demand Met,0,0,0
TN % Load Reduction,54.698,44.6337,51.587
GP Flow In (kg/yr),257.949,103.515,808.393
GP ET Loss (kg/yr),0,0,0
GP Infiltration Loss (kg/yr),0,0,0
GP Low Flow Bypass Out (kg/yr),0,0,0
GP High Flow Bypass Out (kg/yr),0,0,0
GP Orifice / Filter Out (kg/yr),0,0,0

GP Weir Out (kg/yr),0,0,0
GP Transfer Function Out (kg/yr),0,0,0
GP Reuse Supplied (kg/yr),0,0,0
GP Reuse Requested (kg/yr),0,0,0
GP % Reuse Demand Met,0,0,0
GP % Load Reduction,100,100,100
PET Scaling Factor,2.1,2.1,

Generic treatment nodes
Location,Humeguard GPT ,Caravan Park Humegard GPT
ID,5,8
Node Type,GPTNode,GPTNode
Lo-flow bypass rate (cum/sec),0,0
Hi-flow bypass rate (cum/sec),100,100
Flow Transfer Function
Input (cum/sec),0,0
Output (cum/sec),0,0
Input (cum/sec),10,10
Output (cum/sec),10,10
Input (cum/sec), ,
Output (cum/sec), ,
Input (cum/sec), ,
Output (cum/sec), ,
Input (cum/sec), ,
Output (cum/sec), ,
Input (cum/sec), ,
Output (cum/sec), ,
Input (cum/sec), ,
Output (cum/sec), ,
Input (cum/sec), ,
Output (cum/sec), ,
Input (cum/sec), ,
Output (cum/sec), ,
Input (cum/sec), ,
Output (cum/sec), ,
Gross Pollutant Transfer Function
Enabled,True,True
Input (kg/ML),0,0
Output (kg/ML),0,0
Input (kg/ML),14.9664,14.9664
Output (kg/ML),2.2499,2.2499
Input (kg/ML), ,
Output (kg/ML), ,
Input (kg/ML), ,
Output (kg/ML), ,
Input (kg/ML), ,
Output (kg/ML), ,
Input (kg/ML), ,
Output (kg/ML), ,
Input (kg/ML), ,
Output (kg/ML), ,
Input (kg/ML), ,
Output (kg/ML), ,
Input (kg/ML), ,
Output (kg/ML), ,
Input (kg/ML), ,
Output (kg/ML), ,
Total Nitrogen Transfer Function

Enabled,True,True
Input (mg/L),0,0
Output (mg/L),0,0
Input (mg/L),5,5
Output (mg/L),3.8,3.8
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Total Phosphorus Transfer Function
Enabled,True,True
Input (mg/L),0,0
Output (mg/L),0,0
Input (mg/L),5,5
Output (mg/L),3.3,3.3
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Total Suspended Solids Transfer Function
Enabled,True,True
Input (mg/L),0,0
Output (mg/L),0,0
Input (mg/L),500,500
Output (mg/L),295,295
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,

Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
TSS Flow based Efficiency Enabled,Off,Off
TSS Flow based Efficiency, ,
TP Flow based Efficiency Enabled,Off,Off
TP Flow based Efficiency, ,
TN Flow based Efficiency Enabled,Off,Off
TN Flow based Efficiency, ,
GP Flow based Efficiency Enabled,Off,Off
GP Flow based Efficiency, ,
IN - Mean Annual Flow (ML/yr),57.5,17.6
IN - TSS Mean Annual Load (kg/yr),10.8E3,3.64E3
IN - TP Mean Annual Load (kg/yr),19.9,7.27
IN - TN Mean Annual Load (kg/yr),124,51.1
IN - Gross Pollutant Mean Annual Load (kg/yr),1.72E3,689
OUT - Mean Annual Flow (ML/yr),57.5,17.6
OUT - TSS Mean Annual Load (kg/yr),6.40E3,2.15E3
OUT - TP Mean Annual Load (kg/yr),13.2,4.80
OUT - TN Mean Annual Load (kg/yr),94.3,38.8
OUT - Gross Pollutant Mean Annual Load (kg/yr),258,104
Flow In (ML/yr),57.473,17.5735
ET Loss (ML/yr),0,0
Infiltration Loss (ML/yr),0,0
Low Flow Bypass Out (ML/yr),0,0
High Flow Bypass Out (ML/yr),0,0
Orifice / Filter Out (ML/yr),0,0
Weir Out (ML/yr),0,0
Transfer Function Out (ML/yr),57.473,17.5735
Reuse Supplied (ML/yr),0,0
Reuse Requested (ML/yr),0,0
% Reuse Demand Met,0,0
% Load Reduction,0,0
TSS Flow In (kg/yr),10840.7,3638.86
TSS ET Loss (kg/yr),0,0
TSS Infiltration Loss (kg/yr),0,0
TSS Low Flow Bypass Out (kg/yr),0,0
TSS High Flow Bypass Out (kg/yr),0,0
TSS Orifice / Filter Out (kg/yr),0,0
TSS Weir Out (kg/yr),0,0
TSS Transfer Function Out (kg/yr),6396.27,2146.96
TSS Reuse Supplied (kg/yr),0,0
TSS Reuse Requested (kg/yr),0,0
TSS % Reuse Demand Met,0,0
TSS % Load Reduction,40.9974,40.9989
TP Flow In (kg/yr),19.9357,7.26536
TP ET Loss (kg/yr),0,0
TP Infiltration Loss (kg/yr),0,0
TP Low Flow Bypass Out (kg/yr),0,0
TP High Flow Bypass Out (kg/yr),0,0
TP Orifice / Filter Out (kg/yr),0,0
TP Weir Out (kg/yr),0,0
TP Transfer Function Out (kg/yr),13.1579,4.79516
TP Reuse Supplied (kg/yr),0,0

TP Reuse Requested (kg/yr),0,0
TP % Reuse Demand Met,0,0
TP % Load Reduction,33.9984,33.9997
TN Flow In (kg/yr),124.027,51.0809
TN ET Loss (kg/yr),0,0
TN Infiltration Loss (kg/yr),0,0
TN Low Flow Bypass Out (kg/yr),0,0
TN High Flow Bypass Out (kg/yr),0,0
TN Orifice / Filter Out (kg/yr),0,0
TN Weir Out (kg/yr),0,0
TN Transfer Function Out (kg/yr),94.2579,38.8199
TN Reuse Supplied (kg/yr),0,0
TN Reuse Requested (kg/yr),0,0
TN % Reuse Demand Met,0,0
TN % Load Reduction,24.0021,24.0032
GP Flow In (kg/yr),1715.89,688.581
GP ET Loss (kg/yr),0,0
GP Infiltration Loss (kg/yr),0,0
GP Low Flow Bypass Out (kg/yr),0,0
GP High Flow Bypass Out (kg/yr),0,0
GP Orifice / Filter Out (kg/yr),0,0
GP Weir Out (kg/yr),0,0
GP Transfer Function Out (kg/yr),257.949,103.515
GP Reuse Supplied (kg/yr),0,0
GP Reuse Requested (kg/yr),0,0
GP % Reuse Demand Met,0,0
GP % Load Reduction,100,100

Other nodes
Location,Post-Development Node
ID,7
Node Type,PostDevelopmentNode
IN - Mean Annual Flow (ML/yr),72.5
IN - TSS Mean Annual Load (kg/yr),693
IN - TP Mean Annual Load (kg/yr),5.88
IN - TN Mean Annual Load (kg/yr),64.2
IN - Gross Pollutant Mean Annual Load (kg/yr),0.00
OUT - Mean Annual Flow (ML/yr),72.5
OUT - TSS Mean Annual Load (kg/yr),693
OUT - TP Mean Annual Load (kg/yr),5.88
OUT - TN Mean Annual Load (kg/yr),64.2
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00
% Load Reduction,16.7
TSS % Load Reduction,95.3
TN % Load Reduction,68.1
TP % Load Reduction,79.7
GP % Load Reduction,100

Links
Location,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link
Source node ID,2,1,5,6,4,8,9,3,10,11
Target node ID,5,5,6,7,8,9,7,10,5,5
Muskingum-Cunge Routing,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed
Muskingum K, , , , , , , , , ,
Muskingum theta, , , , , , , , , ,
IN - Mean Annual Flow (ML/yr),18.0,25.7,57.5,55.3,17.6,17.6,17.2,23.5,11.5,2.18

IN - TSS Mean Annual Load (kg/yr),6.10E3,4.41E3,6.40E3,304,3.64E3,2.15E3,389,600,270,68.5
IN - TP Mean Annual Load (kg/yr),10.3,7.74,13.2,4.00,7.27,4.80,1.88,3.44,1.66,0.234
IN - TN Mean Annual Load (kg/yr),42.9,54.1,94.3,42.7,51.1,38.8,21.5,50.8,24.6,2.44
IN - Gross Pollutant Mean Annual Load (kg/yr),707,1.01E3,258,0.00,689,104,0.00,808,0.00,0.00
OUT - Mean Annual Flow (ML/yr),18.0,25.7,57.5,55.3,17.6,17.6,17.2,23.5,11.5,2.18
OUT - TSS Mean Annual Load (kg/yr),6.10E3,4.41E3,6.40E3,304,3.64E3,2.15E3,389,600,270,68.5
OUT - TP Mean Annual Load (kg/yr),10.3,7.74,13.2,4.00,7.27,4.80,1.88,3.44,1.66,0.234
OUT - TN Mean Annual Load (kg/yr),42.9,54.1,94.3,42.7,51.1,38.8,21.5,50.8,24.6,2.44
OUT - Gross Pollutant Mean Annual Load (kg/yr),707,1.01E3,258,0.00,689,104,0.00,808,0.00,0.00

Catchment Details
Catchment Name,Magpie Lane Music Model_081123
Timestep,6 Minutes
Start Date,1/01/1991
End Date,31/12/1991 11:54:00 PM
Rainfall Station, 70014 CANBERRA
ET Station,Monthly User Defined
Mean Annual Rainfall (mm), 563
Mean Annual ET (mm), 1115