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Stormwater Management Plan for DA

Peppertree Estate, Gundy Road SCONE

Prepared for: Charles David Pty Ltd

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Source: Near Maps

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Revisions

Revision	Description	Date	Prepared by	Approved by
01	For Approval	19 August 2021	Ulrika Knight	Josh Rhodes
02	For Approval	18 February 2022	Ulrika Knight	Josh Rhodes

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Appendices

1 Introduction

ACOR Consultants have been engaged by Charles David Pty Ltd C/- MM Hyndes Bailey & Co to prepare a Stormwater Management Plan for Development Approval for a residential subdivision development at Lot 2 (DP1169320) Gundy Road, Scone.

The stormwater drainage items addressed in this report include:

- Stormwater conveyance/network;
- Stormwater detention
- Operational water quality management incorporating Water Sensitive Urban Design (WSUD) principles
- Construction water quality management incorporating soil and water management.

2 Previous Stormwater Drainage Assessments

The following stormwater drainage assessment have been completed previously for the proposed subdivision development at this site by others:

- *Stormwater Drainage Strategy Peppertree Estate Scone* by MM Hyndes Bailey dated November 2017
- *Stormwater Quality Report* by Barker Ryan Steward dated November 2017
- *Stormwater Drainage Strategy Supplementary Report 70-80% Impervious Peppertree Estate Scone* by MM Hyndes Bailey dated November 2019

The site layout for the proposed subdivision has been revised and as such an updated Stormwater Drainage Management Plan is required and is contained within this report.

Revision 1 of this report was issued on 19 August 2021. A peer review of the Stormwater Management Plan was undertaken by Northrop. Refer to Northrop letter titled *"Review of Stormwater Management Plan at 150 Gundy Road, Scone"*, and dated 19 January 2022 with a reference number NL213311. In response to the peer review, section of this report have been amended and additional information provided. A response to the Northrop peer review is contained in ACOR letter dated 18 February 2022.

As noted in Northrop's letter, a detailed two-dimensional flood assessment is to be prepared to suit the proposed subdivision layout. A flood assessment has been undertaken by Torrent Consulting. Refer to report titled *"Flood Impact Assessment at Gundy Road, Scone"* dated February 2022.

2.1 Location

The site is located east of Scone at Lot 2 Gundy Road, Scone. The proposed development is bounded by Gundy Road to the north, rural properties to the easy and south, and abuts to the age care facility "Strathearn" to the north west. Refer to Figure 1 for Locality Plan.

2.2 Topography

The existing site comprises of approximately 57 Hectares of gently sloping grasslands. There is a second order stream traversing through the site from east to west. The stream divides the proposed development into a northern section and a southern section.

The northern section of the site grades at approximately 4% from the north east to the south west towards the stream. The levels on site for the northern section range from approximate RL 226m AHD at the north east boundary to RL 214m AHD at the south west boundary at the stream.

Most of the southern section of the site grades at approximately 5% from the south east to the north west towards the stream. There is a crest in the southern section of the site that runs from east to west which means that a small section of the southern area grades to the south west. The levels for the southern section range from approximately RL 243m AHD at the south east boundary to RL 208m AHD at the north west boundary at the stream and RL 215m AHD at the south west boundary.

A farm dam is located within the site at the eastern end of the stream.

Refer to Figure 2 for the existing site topography.

2.3 Existing Land Use and Vegetation

The site in its current condition is mostly cleared grassland with some trees within the stream.

2.4 External Catchments

There is an upstream catchment north east of the site that drains to the culverts under Gundy Road and then feeds the stream through the development site from the east. This catchment is approximately 98 Hectares and is mostly grassland with some trees. The most northern part of this catchment is within the Scone Mountain National Park and has more vegetation than the lower section of the catchment.

There is an upstream catchment to the east of the site that feeds the stream through the development site. This catchment is approximately 53 Hectares and is mostly grassland.

The development site has frontage to Gundy Road. Gundy Road has a grassed swale along both sides of the road. In minor storm events, flows are directed to the west along Gundy Road but in major storm events the flows that cannot be contained within the grassed swale overflow into the development site and are directed south west to the stream traversing through the site.

The upstream external catchments draining through the development site are shown in Figure 3.

2.5 Existing Flowpaths and Water Bodies

There is a second order stream traversing through the site from east to west. This stream is fed from the upstream catchments to the north east under Gundy Road and to the east of the site. The stream is not well defined in places but is generally in good condition with minimal scouring.

A hydraulic analysis was undertaken by MM Hyndes Bailey on the second order stream. The results from the study are detailed in MM Hyndes Bailey report *Stormwater Drainage Strategy Peppertree Estate Scone* dated November 2017, Section 5.

A flood impact assessment for the latest subdivision layout has been completed by Torrent Consulting. The results

There is a farm dam located at the eastern site boundary within the stream. This dam is to remain, but further investigation will be required at the construction certificate stage to ensure that the overflows from the dam for 1% AEP flows are safe and do not impact the proposed residential lots.

3 Proposed Development

The proposed development will consist of three hundred and eighty five (385) residential lots, six (6) public parks and an open space, as well as associated roads and stormwater drainage infrastructure including basins. The subdivision is proposed to be development in sixteen (16) stages. The lot areas and staging details are shown in Table 1.

Table 1: Lot areas and staging details

Development Stage	Lot numbers	Lot areas m^2
1	101 – 121 (21 lots)	637 – 1052
2	201 – 223 (22 lots and a park)	648 – 1650
3	301 – 313 (13 lots)	678 – 1227
4	401 - 418 (18 lots and a park)	703 – 898
5	501 – 514 (13 lots, a restricted land use and a park)	704 – 978
6	601 – 630 (30 lots)	705 – 1055
7	701 – 723 (23 lots)	707 – 982
8	801 – 832 (32 lots)	701 - 1348
9	900 – 927 (28 lots)	706 - 1077
10	1001 – 1036 (36 lots)	708 - 1222
11	1101 – 1121 (21 lots)	701 - 1016
12	1201 – 1235 (35 lots)	709 - 1070
13	1301 – 1326 (24 lots, park and basin)	702 - 1373
14	1401 – 1428 (28 lots)	770 - 1277
15	1501 – 1521 (21 lots)	707 - 977
16	1601 – 1621 (20 lots and open space)	704 – 821

Access to the subdivision will be from Gundy Road.

Stages 1, 2 and 3 are located on the northern side of the stream adjacent to Gundy Road.

The remainder of the stages are located on the southern side of the stream. A road crossing with reinforced concrete box culverts is proposed to span the stream to the southern side of the development.

Figure 4 shows the development layout for the subdivision.

4 Stormwater Quantity Management

4.1 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 Upper Hunter Shire Council (UHSC). The minor stormwater conveyance system will be designed to convey peak flows from the 20% Annual Exceedance Probability (AEP) storm event and the major stormwater conveyance system will be designed to convey the peak flows from the 1% AEP storm events.
- Provide stormwater detention to reduce the peak flows from the site to or below the current peak runoff from the site.

4.2 Stormwater Conveyance

4.2.1 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 will have the capacity to convey the peak flows from a 20% AEP storm event.

Figures 5 and 6 show a preliminary layout for the stormwater drainage system.

4.2.2 Major Storm Event Conveyance

Major system stormwater conveyance for the proposed development will be via overland flow. This will be via traditional trunk drainage utilising the road carriage way and footpath. The major stormwater system will have the capacity to convey the peak flows from a 1% AEP storm event, containing flows within the road reserve and limiting velocity depth product to or below 0.4 m^2/s.

4.3 Stormwater Detention

4.3.1 General

Stormwater detention needs to be provided to ensure that the post development flows from the total site are reduced to the predevelopment flows for AEPs from 20% to 1% so that downstream properties are not impacted by increased flows from this proposed development.

The previous stormwater drainage study only considered the development site in the modelling.

This stormwater drainage study is a full catchment analysis and includes the upstream catchments that drain through the stream traversing through the proposed development.

4.3.2 DRAINS Modelling

DRAINS modelling was undertaken to determine the predeveloped and developed peak flows at the western boundary for a range of AEPs from 20% to 1%, for storm durations ranging from 5 minutes to 6 hours. ARR 2019 procedures were utilised in the DRAINS models.

The available detention volumes from the rainwater tanks which are a requirement of BASIX for each dwelling were not accounted for in the modelling.

The large undeveloped rural catchments were modelled using RAFTS storage routing model within DRAINS. For sub-catchment routing, RAFTS uses the equation:

S = BX . IBFL . PERN . 0.285 A0.52. (1+U)-1.97. Sc-0.50. Q0.715

where BX is a calibration factor similar to RORB's kc, IBFL is a factor for modelling overbank flow, PERN is a factor that adjusts the catchment routing factor to allow for catchment roughness, A is the sub-catchment area (km2), U is the fraction of the catchment that is urbanized, and Sc is the main drainage slope of the sub-catchment.

For routing along stream reaches, RAFTS applies a translation over a nominated time, or performs Muskingum-Cunge routing based on the stream cross-section and roughness.

The proposed developed catchments were modelled using the Initial Loss – Continuing Loss (IL-CL) model. The IL-CL hydrology procedure in DRAINS is an alternative to Horton (ILSAX). Both methods are accepted in the ARR 2019 guidelines and discussed in Book 5 Chapter 3. The IL-CL model and its parameters are set out in Section 3.5.3 of ARR 2019.

4.3.3 Rainfall Data

The Australian Rainfall and Runoff (AR&R) Data Hub was used to obtain data (Storm Losses, Temporal Patterns, BOM IFD Depths, Preburst Depths and Ratios and Interim Climate Change Factors) for the development site. The AR&R Data Hub results are shown in Appendix A.

4.3.4 Fraction Impervious

The fraction impervious to be used in stormwater drainage modelling is outlined with UHSC DRAFT Engineering Guidelines for Subdivisions and Developments Table 5.5 and shown in Table 2.

Table 2: Fraction Impervious for Various Land Use

Land Use	Fraction Impervious
Normal residential lot only	0.6
Normal residential lot including half road	0.65
Half width road reserve	0.8
Public recreation areas	0.4
Open space (natural bushland)	0.35

For the upstream catchments, a fraction impervious of 0.35 was adopted for rural/natural bushland in accordance with Council's standards.

To be conservative in determining the predeveloped and post developed flows at the western boundary, a fraction impervious of zero (0) was adopted for the predeveloped site (existing rural property) and a fraction impervious of 0.75 was adopted for the proposed subdivision in the DRAINS models.

4.3.5 Time of Concentration

Time of concentration for the catchments that are modelled using RAFTS was determined by the program. Catchment information such as area, fraction impervious, catchment slope and a Manning's n value are entered into the Sub-Catchment Data.

The Manning's n values adopted for the modelling are in line with recommendations from Australian Rainfall and Runoff: A Guide to Flood Estimation Table 6.2.2. The relevant land use and the recommended Manning's n range are shown in Table 3.

Table 3: Land Use Type and Recommended Manning's n

Land Use Type	Recommended Manning 'n'
Open pervious areas, nominal vegetation (grassed)	0.03 – 0.05
Open pervious areas, moderate vegetation (shrubs)	0.05 – 0.07
Open pervious areas, thick vegetation (trees)	0.07 – 0.12
Waterways/channels – minimal vegetation	0.02 – 0.04
Waterways/channels – vegetated	0.04 – 0.1

A Manning's n value of 0.05 was adopted for the external catchments (rural/natural bushland).

A Manning's n value of 0.04 was adopted for the predevelopment site catchment (rural grassed).

A Manning's n value of 0.04 was adopted for the stream traversing through the development site (waterways with minimal vegetation and trees).

The minimum time of concentration adopted for the developed catchments utilising the Initial Loss – Continuing Loss Model are 5 minutes for the impervious catchments and 10 minutes for pervious catchments. This is the time of concentration for lot runoff. Additional flow travel times were added to the developed catchments in accordance with Queensland Urban Drainage Manual Section 4.6.7.

4.3.6 Predeveloped Peak Discharge

The peak discharge for the predeveloped catchments in accordance with Figure 3 are shown in Table 4.

The two upstream catchment (EXTL A and B) and Site A catchment all discharge at the western boundary of the site. Site B catchment discharges at the south west boundary of the site.

Table 4: Predeveloped Catchment Flows

Catchment Name	Area (Ha)	Predeveloped Peak Discharge m^3/s (AEP)				
		20%	**10%**	**5%**	**2%**	**1%**
EXTL A	97.773	12.9	17.3	20.8	25.9	30.3
EXTL B	52.601	6.11	7.5	9.39	12.1	14.5
SITE A	48.752	2.3	3.07	3.89	4.89	602
Peak discharge at west boundary		**20.9**	**25.4**	**31.8**	**40.3**	**47.6**
SITE B	9.217	0.523	0.737	0.921	1.18	1.42
Peak discharge at south west boundary		**0.523**	**0.737**	**0.921**	**1.18**	**1.42**

The DRAINS input data and results are contained in Appendix A.

4.3.7 Post Development Peak Discharge

The details for catchments EXTL A and EXTL B are as per the predeveloped model and the flows are the same.

Catchment Site A has been divided into catchments to represent the existing stream traversing the site, and the subdivision development at relevant discharge points. Refer to Figure 7 for the post development catchment plan.

The proposed road crossing the existing stream was also incorporated into the DRAINS model. Reinforced concrete box culverts (RCBC) were modelled as detailed below:

- Top of road RL 216.0
- Pavement thickness allowed for 500mm
- 2400x750 RCBC – 11 culverts required
- Invert of RCBC RL214.575
- Length of culverts 30m

The peak discharge for the post developed catchments at the western boundary and the south west boundary are shown in Table 5.

Table 5: Post developed Peak Flows

Storm Event (AEP)	Post Developed Peak Discharge m^3/s (AEP)	
	At west boundary	**At south west boundary**
20%	20.3	1.05
10%	25.6	1.25
5%	31.5	1.44

Storm Event (AEP)	Post Developed Peak Discharge m³/s (AEP)	
	At west boundary	At south west boundary
2%	40.2	1.73
1%	47.2	1.95

The DRAINS input data and results are contained in Appendix A.

4.3.8 Post versus Predeveloped Peak Discharge

The comparison of the predeveloped and post developed peak flows at the western boundary are shown in Table 6.

Table 6: Post versus Predeveloped Peak Flows at Western Boundary

Storm Event (AEP)	Peak Discharge at Western Boundary m³/s (AEP)		
	Predeveloped	Post developed	Difference %
20%	20.9	20.3	-2.9%
10%	25.4	25.6	0.8%
5%	31.8	31.5	-0.9%
2%	40.3	40.2	-0.2%
1%	47.6	47.2	-0.8%

The comparison of the predeveloped and post developed peak flows at the south west boundary are shown in Table 7.

Table 7: Post versus Predeveloped Peak Flows at South West Boundary

Storm Event (AEP)	Peak Discharge at South West Boundary m³/s (AEP)		
	Predeveloped	Post developed	Difference %
20%	0.523	1.05	101%
10%	0.737	1.25	70%
5%	0.921	1.44	56%
2%	1.180	1.73	47%
1%	1.420	1.95	37%

4.3.9 Detention Basins

It is a standard requirement for most councils including UHSC, that stormwater detention be provided to ensure that the post developed from are reduced to the predeveloped flows for AEPs from 20% to 1% so that downstream properties are not impacted by increased flows from this proposed development.

The stormwater drainage modelling undertaken is a catchment wide analysis and includes the upstream catchments running through the site as well as the proposed development. As the proposed development is at the downstream end of the overall catchment draining to the western boundary of the site, the flow travel times from each catchment are important.

Generally, with this sort of catchment configuration, the post development flows are found to only increase marginally or not at all. As the post developed catchment times of concentrations are shorter, the flows from the developed catchment have already travelled downstream before the flows from the larger undeveloped upstream catchment have arrived downstream.

This is evident in the post developed peak flows draining to the western boundary via the existing stream shown in Table 6. The post developed peak flows are below the predeveloped peak flows for all storm events except for 10% AEP. The increase in flows for the 10% AEP is less than 1% which is within the accuracy of the stormwater drainage modelling and will have minimal impact downstream. Therefore, no detention basins are required to reduce the post developed flows at the western boundary.

With the catchment configuration for this site, providing detention at the downstream end of the catchment will only increase the flows at the western boundary as the travel flow times for the developed catchments are lengthened due to the detention basin. This will result in the flows discharging from the basin aligning with the large upstream flows and increasing the overall peak flows at the western boundary.

As detailed above, approximately 9.2 hectares of the southern catchment of the site currently drains to the south west. With the proposed development, this area will be reduced to approximately 4.9 hectares.

As can be seen from Table 7, the post developed flows have increased compared to the predeveloped flows due to the increased fraction impervious of 75% for the proposed development.

As there is no downstream development that can be impacted by this minor flow increase, a detention basin to reduce the flows will not be provided at this location. This strategy was previously agreed to by council.

4.3.10 Impact of Climate Change on Catchment Flows

The impact of climate change on the catchment flows was assessed in accordance with the Interim Climate Change Factors provided by the AR&R Data Hub. A Climate Change Rainfall Multiplier of 1.2 was utilised in the DRAINS predeveloped and post developed models.

The comparison of the predeveloped and post developed peak flows including the effects of climate change at the western boundary are shown in Table 8.

Table 8: Post versus Predeveloped Peak Flows at Western Boundary

Storm Event (AEP)	Peak Discharge at Western Boundary m^3/s (AEP)		
	Predeveloped	Post developed	Difference %
20%	26.300	26.400	0.4%
10%	33.700	33.200	-1.5%
5%	41.400	40.100	-3.1%
2%	51.800	59.700	15.3%
1%	60.300	69.800	15.8%

As can be seen from Table 8, the post developed flows due to the impact of climate change are generally still below the predeveloped flows except for the major storm events where they are only marginally higher.

The comparison of the predeveloped and post developed peak flows including the effects of climate change at the south west boundary are shown in Table 9.

Table 9: Post versus Predeveloped Peak Flows at South West Boundary

Storm Event (AEP)	Peak Discharge at South West Boundary m^3/s (AEP)		
	Predeveloped	Post developed	Difference %
20%	0.734	1.26	72%

Storm Event (AEP)	Peak Discharge at South West Boundary m³/s (AEP)		
	Predeveloped	Post developed	Difference %
10%	0.989	1.5	52%
5%	1.220	1.73	42%
2%	1.540	2.08	35%
1%	1.840	2.35	28%

As can be seen from Table 9, the percentage difference between the predeveloped and post developed flows due to the impact of climate change have been reduced.

4.3.11 Comparison of Peak Flows

The modelled pre-developed peak flows discharging at the western boundary through the existing stream have been compared to the previous drainage study *Stormwater Drainage Strategy Peppertree Estate Scone* by MM Hyndes Bailey dated November 2017.

The comparison of the peak flows are presented in Table 10 below.

Table 10: Comparison of Predeveloped Peak Flows at Western Boundary

Storm Event (AEP)	Predeveloped Peak Flows at Western Boundary m³/s (AEP)	
	From MM Hyndes Bailey report dated November 2017	From this Drainage Study
20%	6.56	20.9
5%	14.8	31.8
1%	29.8	47.6

The stormwater drainage modelling undertaken as part of this drainage study to determine the peak flows discharging at the western boundary are in accordance with AR&R 2019 and utilised the RAFTS storage routing model for the large rural catchments upstream and for the existing catchment conditions for the development site. The

The stormwater drainage modelling undertaken by MM Hyndes Bailey utilised the Regional Flood Frequency model in accordance with AR&R 2016.

The difference in the peak flows from the previous drainage study and the current drainage study is due to the following:

- Updated standard being utilised for modelling – AR&R 2019
- Modelling methodology – RAFTS storage routing model versus Regional Flood Frequency model
- Catchment data inputs – division of catchments, time of concentration, catchment parameters, catchment lag times etc.

The DRAINS input data and results are contained in Appendix A.

5 Stormwater Quality Management

5.1 Objectives

The objectives of the Stormwater Quality for the site are:

- Meet the water quality objectives of Upper Hunter Shire Council (UHSC) for the operational phase of the site by using best practice stormwater treatment measures.
- The strategy for stormwater quality management as detailed in the report prepared by Barker Ryan Stewart *Stormwater Quality Report* dated November 2017 has been approved by Council, and states:

  "Consultation was undertaken with Council to set a water quality target that would meet the objectives of the UHSC DCP, that is 'to ensure that stormwater generated from development does not result in pollution of water courses or receiving waters'. Mathew Pringle, Director of Environmental and Community Services advised that the pre-development forested condition of the site would be a suitable guide and an acceptable target for this development."

5.2 Operational Phase Water Quality Management

5.2.1 General

To meet the water quality requirements of UHSC, a range of water quality improvement devices will be required.

The proposed water quality improvement devices for the site will include:

- rainwater tanks
- Ecosol GPTs
- bioretention basins

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

5.2.2 Stormwater Quality Modelling

5.2.2.1 Introduction

The MUSIC model version 6.3 was used to assess the pollutant generation from the development and the performance of the stormwater quality treatment train.

5.2.2.2 Rainfall Data and Evaporation Data

The rainfall data and evapotranspiration data collected from the Liddell Power Station was used in line with the previous MUSIC modelling undertaken by Barker Ryan Stewart (as discussed above).

5.2.2.3 Soil Types

As detailed in the Barker Ryan Steward report, the soil profile at the development site is composed of heavy clay underlain by coarse light medium clay. This information was obtained from *"The Soils Essential Report – NSW Soil and Land Information System for Scone High School".*

5.2.2.4 Catchments

The catchments for the MUSIC modelling are the same as the catchment used in the DRAINS modelling discussed above. Refer to Figure 7 for the post development catchment plan.

The catchments for the MUSIC modelling were subdivided into road areas, roof areas and remaining lot areas as detailed in Table 11.

Table 11: MUSIC Modelling Catchments

Catchment	CAT 1	CAT 2	CAT 3 & 6	CAT 4
Number of lots	70	56	232	34
Lot areas (Ha)	3.83	3.52	13.05	2.39
Roof areas (Ha)	1.75	1.40	5.80	0.85
Road areas (Ha)	1.67	2.59	6.43	1.25
Total catchment area (Ha)	**7.25**	**7.51**	**25.27**	**4.49**

A fraction impervious of 80% was adopted for the roads.

The residential lots were divided up into roof areas and remaining lot areas. It was assumed that for an average size lot (800m²) with a fraction impervious of 75% and a roof area is 250m², the remaining lot is 550m² with a fraction impervious of 64%. Therefore, conservatively a fraction impervious of 65% was adopted for lots (excluding roof area).

In line with UHSC advice, the pre-existing (forest) catchment was model in MUSIC to compare the mean annual pollutants loads with the post developed catchment.

Currently the site is used for farming/agriculture, so this catchment type was also model in MUSIC for comparison.

5.2.2.5 MUSIC Model Source Inputs

The source data for the MUSIC model was adopted from the Sydney Catchment Authority (SCA) MUSIC Manual in line with the modelling undertaken by Barker Ryan Stewart.

Table 12: MUSIC Source Node Soil Properties

Soil Parameter	Value
Rainfall Threshold (mm/day)	Roofs 0.3 / Roads 1.5 / Land uses 1.0
Soil Storage Capacity (mm)	90
Initial Storage (% of Capacity)	25
Field Capacity	58
Infiltration Capacity Coefficient – a	135
Infiltration Capacity Coefficient – b	4
Groundwater Initial Depth (mm)	10
Groundwater Daily Recharge Rate (%)	10
Groundwater Daily Base Flow (%)	10
Groundwater Daily Deep Seepage Rate (%)	0

5.2.2.6 Catchments Pollutant Mean Concentrations

The pollutant Event Mean Concentration (EMC) values were adopted from SCA MUSIC Manual for both the base flows and storm flows. The base flow values are shown in Table 13 and the storm flow values are shown in Table 14 for various catchment types.

Table 13: Base Flow Pollutant Event Mean Concentration Values

	Base Flow Pollutant Event Mean Concentration Values					
	TSS (log 10)		TP (log 10)		TN (log 10)	
Catchment Type	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**
Forest	0.78	0.13	-1.52	0.13	-0.52	0.13
Agriculture	1.30	0.13	-1.05	0.13	0.04	0.13
Road (mixed)	1.10	0.17	-0.82	0.19	0.32	0.12
Roof	0	0	0	0	0	0
Residential lots	1.20	0.17	-0.85	0.19	0.11	0.12

Table 14: Storm Flow Pollutant Event Mean Concentration Values

	Storm Flow Pollutant Event Mean Concentration Values					
	TSS (log 10)		TP (log 10)		TN (log 10)	
Catchment Type	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**
Forest	1.60	0.20	-1.10	0.22	-0.05	0.24
Agriculture	2.15	0.31	-0.22	0.3	0.48	0.26
Road (mixed)	2.20	0.32	-0.45	0.25	0.42	0.19
Roof	1.30	3.20	-0.89	0.25	0.30	0.19
Residential lots	2.15	0.32	-0.60	0.25	0.30	0.19

5.2.2.7 MUSIC Model Treatment Train

The stormwater quality treatment train consist of three parts; rainwater tanks, Ecosol GPTs and bioretention basins. A schematic of the MUSIC model is shown in Appendix B.

A brief description on each treatment measure is listed below.

- Rainwater Tanks - Rainwater tanks receive water from the roof area of each lot. A 3kL rainwater tank was assumed for each standard residential lot. Water captured in the rainwater tanks is expected to be reused for toilet flushing, clothes washing, hot water and garden irrigation. An average of 4 persons was assumed for each house. The reuse per house was adopted from SCA MUSIC Manual Table 5.4. The reuse adopted for each lot is shown in Table 15.

Table 15: Rainwater Tank Reuse (per lot)

Rainwater Reuse	
Internal (kL/yr/dwelling)	343
External (kL/yr/dwelling)	55
Total (kL/yr/dwelling)	398

- Ecosol GPTs are proposed to be installed at all pipe outlets. The GPTs remove gross pollutants, sediment and attached nutrients. The MUSIC node for the GPT was provided by Ecosol. The removal efficiencies have been confirmed via independent testing. An equivalent product could be used. The flows to the GPT will be limited to the 50% of the peak 63.2% AEP storm in accordance with SCA MUSIC Manual Table 5.5. Table 16 shows the removal efficiencies of the Ecosol GPT.

Table 16: Ecosol GPT Removal Efficiencies

Gross Pollutant Removal (%)	TSS Removal (%)	TP Removal (%)	TN Removal (%)
98	**61**	**29**	**1**

- Bioretention Basins are the final part of the treatment train for this development. Three bioretention basin are proposed to be provided. Bioretention systems remove sediments (TSS) as well as nutrients (TN and TP) from 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 Upper Hunter Shire Council requirements.

  To avoid potential salinity problems, an impermeable HDPE liner is to be provided in the bioretention basins to prevent any water infiltrating into the surrounding basin areas.

  The MUSIC inputs for the four bioretention basins are shown in Table 17.

Table 17: Bioretention Basin MUSIC Model Inputs

	Basin 1	Basin 2	Basin 3	Basin 4
Extended Detention Depth (m)	0.3	0.3	0.3	0.3
Surface Area (m2)	1800	480	4800	480
Filter Area (m2)	1500	400	4000	400
Unlined Filter Material (m)	80	80	80	80
Saturated Hydraulic Conductivity (mm/hr)	100	100	100	100
Filter Depth (m)	0.4	0.4	0.4	0.4
TN Content of Filter Media (mg/kg)	800	800	800	800
Orthophosphate of Filter Media (mg/kg)	55	55	55	55
Exfiltration Rate (mm/hr)	0	0	0	0
Base Lined	Yes	Yes	Yes	Yes
Vegetation Removing Plants	Yes	Yes	Yes	Yes
Under Drain Present	Yes	Yes	Yes	Yes

5.2.2.8 Stormwater Quality Modelling Results

The mean annual pollutant loads from the MUSIC model for the pre-existing site (forest), predeveloped site (agricultural) and the post developed site (residential subdivision) are shown in Table 18.

Table 18: Mean Annual Pollutant Loads

	Mean Annual Pollutant Loads		
	Pre-existing Forest	Predeveloped Agricultural	Post developed Residential Subdivision
TSS (kg/yr.)	3340	13600	2450
TP (kg/yr.)	6.77	56.8	15.4
TN (kg/yr.)	77.3	269	125
Gross Pollutants (kg/yr.)	3120	3120	662

For the post developed (residential subdivision), the Mean Annual Pollutant Loads for TSS have been reduced below the pre-existing conditions (forest), but the TP and TN could not be reduced with the proposed treatment train.

The Mean Annual Loads for the post developed site have been reduced to below the predeveloped site conditions (agriculture) as shown in Table 18.

Most councils within the Hunter provide targets for the pollutant reductions for TSS, TP and TN. For example, the reductions in the average annual loads for Maitland Council are 85% for TSS, 45% for TP and 45% for TN.

Table 19 below shows the reductions achieved in the average annual loads for the total proposed development, and hence the effectiveness of the proposed treatment train. The percentage reductions are higher than required for most councils in the Hunter.

Table 19: MUSIC Model Treatment Train Effectiveness – Total Site

	Source Mean Annual Load	Residual Mean Annual Load	% Developed Reduction
TSS (kg/yr.)	17100	1300	92.4
TP (kg/yr.)	34.4	12.8	62.8
TN (kg/yr.)	290	106	63.5
Gross Pollutants (kg/yr.)	4690	497	89.4

Table 20 below shows the reductions achieved in the average annual loads for the proposed development at the western boundary outlet, and hence the effectiveness of the proposed treatment train. The percentage reductions are higher than required for most councils in the Hunter.

Table 20: MUSIC Model Treatment Train Effectiveness – At Western Boundary Outlet

	Source Mean Annual Load	Residual Mean Annual Load	% Developed Reduction
TSS (kg/yr.)	15300	1190	92.2
TP (kg/yr.)	30.7	11.5	62.8
TN (kg/yr.)	261	94.6	63.8
Gross Pollutants (kg/yr.)	4250	497	88.3

Table 21 below shows the reductions achieved in the average annual loads for the proposed development at the south west boundary outlet, and hence the effectiveness of the proposed treatment train. The percentage reductions are higher than required for most councils in the Hunter.

Table 21: MUSIC Model Treatment Train Effectiveness – At South West Boundary Outlet

	Source Mean Annual Load	Residual Mean Annual Load	% Developed Reduction
TSS (kg/yr.)	1810	109	94
TP (kg/yr.)	3.61	1.33	63.2
TN (kg/yr.)	29	11.4	60.8
Gross Pollutants (kg/yr.)	438	0	100

The results of the MUSIC modelling show that the proposed water quality treatments sufficiently reduce the pollutants to an acceptable level. The MUSIC modelling summary report detailing the inputs and results are shown in Appendix B.

5.3 Construction Phase Water Quality Management

5.3.1 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 UHSC. 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 a temporary sediment basin. Erosion and sediment control plans will be provided for the development at the Construction Certificate stage.

5.3.2 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 a temporary sediment basin until the initial bulk earthworks is undertaken. The proposed water quality basins will be used as a sediment basin while construction is being undertaken.

5.3.3 During Construction Erosion and Sediment Control

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

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

5.3.4 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 to the satisfaction of Council.

It is standard practice to delay the construction of the bioretention filtration media in the basin until a significant proportion of the contributing lots are built on and established.

6 Conclusion

The catchment wide modelling undertaken using DRAINS has shown that stormwater detention is not required for the proposed development. Due to the large upstream catchments draining through the existing stream traversing the development site, the post developed flows at the downstream boundary are generally below the predeveloped flows. The proposed installation of the reinforced box culverts under the road crossing between the northern and southern sections of the subdivision also provide some control to the post development flows downstream.

The MUSIC modelling undertaken has shown that the proposed treatment train of rainwater tanks, GPTs and bioretention basins has sufficiently reduced the mean annual pollutants loads from the proposed development. The bioretention basin configuration, levels and inlet/outlet details will need to be confirmed at the Construction Certificate design stage.

During the construction phase of the development, an Erosion and Sediment Control Plan will be implemented to minimise the water quality impacts. Erosion and Sediment Control Plans and details will need to be prepared at the Construction Certificate design stage.

7 FIGURES

SCALE 1:2500 @ A1
SCALE 1:5000 @ A3
0 25 50 100 150 200 250 metres

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Issue	Description	Date	Drawn	Approved
B	ISSUED FOR APPROVAL	19.08.21	ADS	UK
A	ISSUED FOR CLIENT REVIEW	21.03.21	ADS	UK

0 1cm at full size 10cm 20cm

North

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Project
STORMWATER MANAGEMENT PLAN

LOT 2, DP1169320
GUNDY ROAD, SCONE

Drawing Title
LOCALITY PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
ADS	MAR 2021	1:2500	UK	12.03.21

Designed	Project No.	Dwg. No.	Issue
UK	NSW202732	FIGURE 1	B

\\192.168.2.1\Synergy\Projects\NSW20\NSW202732\D… Aug 20, 2021 - 11:58am

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SCALE 1:5000 @ A3

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B	LOT BOUNDARIES UPDATED, ISSUED FOR CLIENT REVIEW	19.08.21	ADS	UK
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Project
STORMWATER MANAGEMENT PLAN

LOT 2, DP1169320
GUNDY ROAD, SCONE

Drawing Title
EXISTING SITE TOPOGRAPHY

Drawn	Date	Scale A1	Q.A. Check	Date
ADS	MAR 2021	1:2500	UK	12.03.21
Designed	Project No.		Dwg. No.	Issue
UK	NSW202732		FIGURE 2	B

Aug 20, 2021 - 11:58am

SCALE 1:5000 @ A1
SCALE 1:10000 @ A3
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STORMWATER MANAGEMENT PLAN

LOT 2, DP1169320
GUNDY ROAD, SCONE

Drawing Title
PREDEVELOPED CATCHMENT PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
ADS	MAR 2021	1:2500	UK	12.03.21

Designed	Project No.	Dwg. No.	Issue
UK	NSW202732	FIGURE 3	B

\\192.168.2.1\Synergy\Projects\NSW20\NSW202732\Drawings\CAD\CIV\ Aug 20, 2021 - 11:58am

STAGE	RES. LOTS	AVG. AREA
1	21	891
2	22	841
3	13	894
4	18	770
5	13	765
6	30	789
7	23	798
8	32	802
9	28	795
10	36	827
11	21	810
12	35	836
13	24	899
14	28	903
15	21	827
16	20	758
TOTAL	385	825

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C	RE-ISSUED FOR APPROVAL	15.02.22	ADS	UK
B	LOT BOUNDARIES UPDATED, ISSUED FOR CLIENT REVIEW	19.08.21	ADS	UK
A	ISSUED FOR CLIENT REVIEW	21.03.21	ADS	UK

1 0 1cm at full size 10cm 20cm

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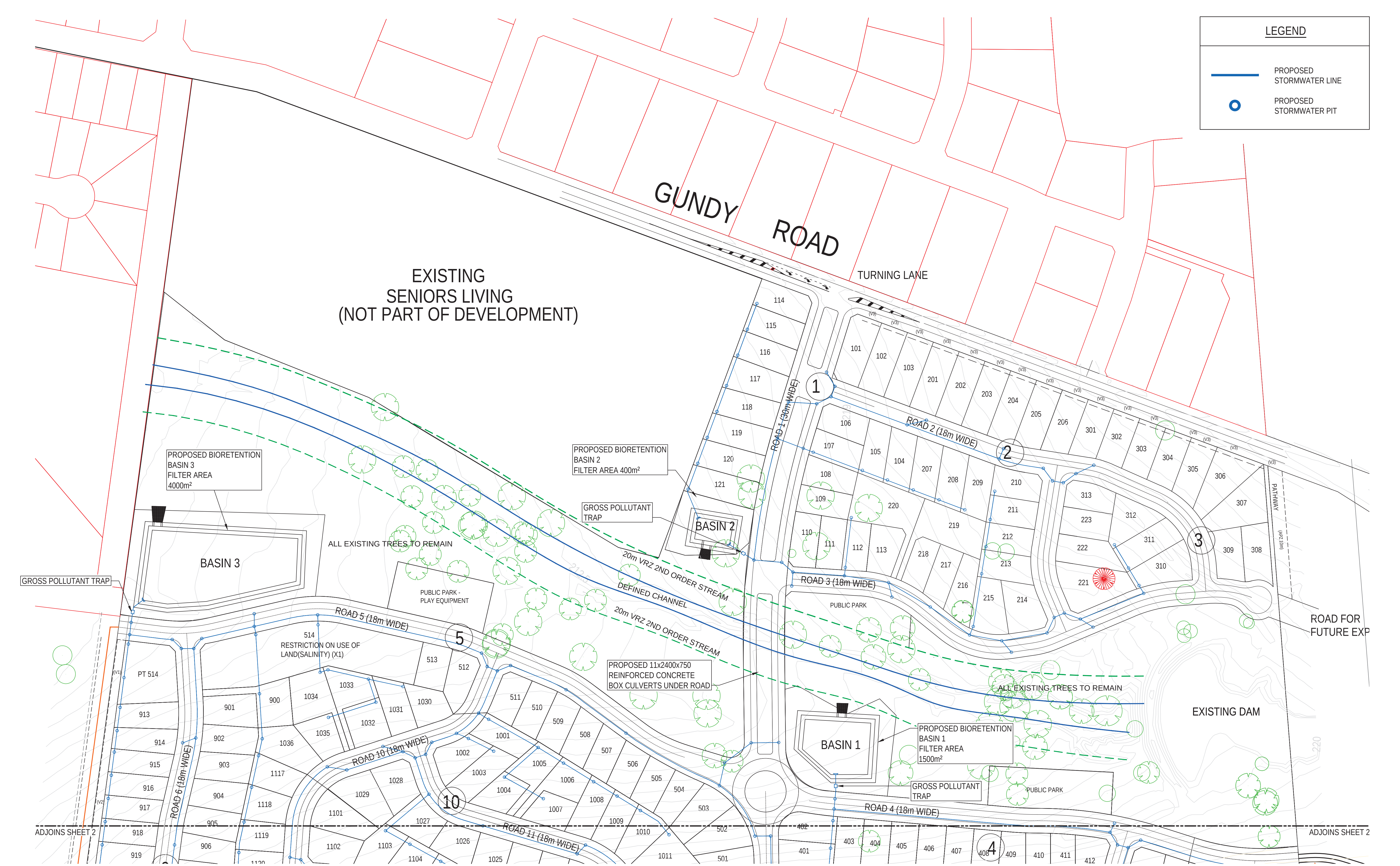
STORMWATER MANAGEMENT PLAN

LOT 2, DP1169320
GUNDY ROAD, SCONE

Drawing Title
PROPOSED DEVELOPMENT LAYOUT

Drawn	Date	Scale A1	Q.A. Check	Date
ADS	MAR 2021	N.T.S.	UK	12.03.21
Designed	**Project No.**		**Dwg. No.**	**Issue**
UK	NSW202732		FIGURE 4	C

Feb 18, 2022 - 4:14pm



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Project
STORMWATER MANAGEMENT PLAN

LOT 2, DP1169320
GUNDY ROAD, SCONE

Drawing Title
STORMWATER DRAINAGE SYSTEM
PRELIMINARY LAYOUT

Drawn	Date	Scale A1	Q.A. Check	Date
ADS	MAR 2021	N.T.S.	UK	12.03.21
Designed	Project No.		Dwg. No.	Issue
UK	NSW202732		FIGURE 5	C

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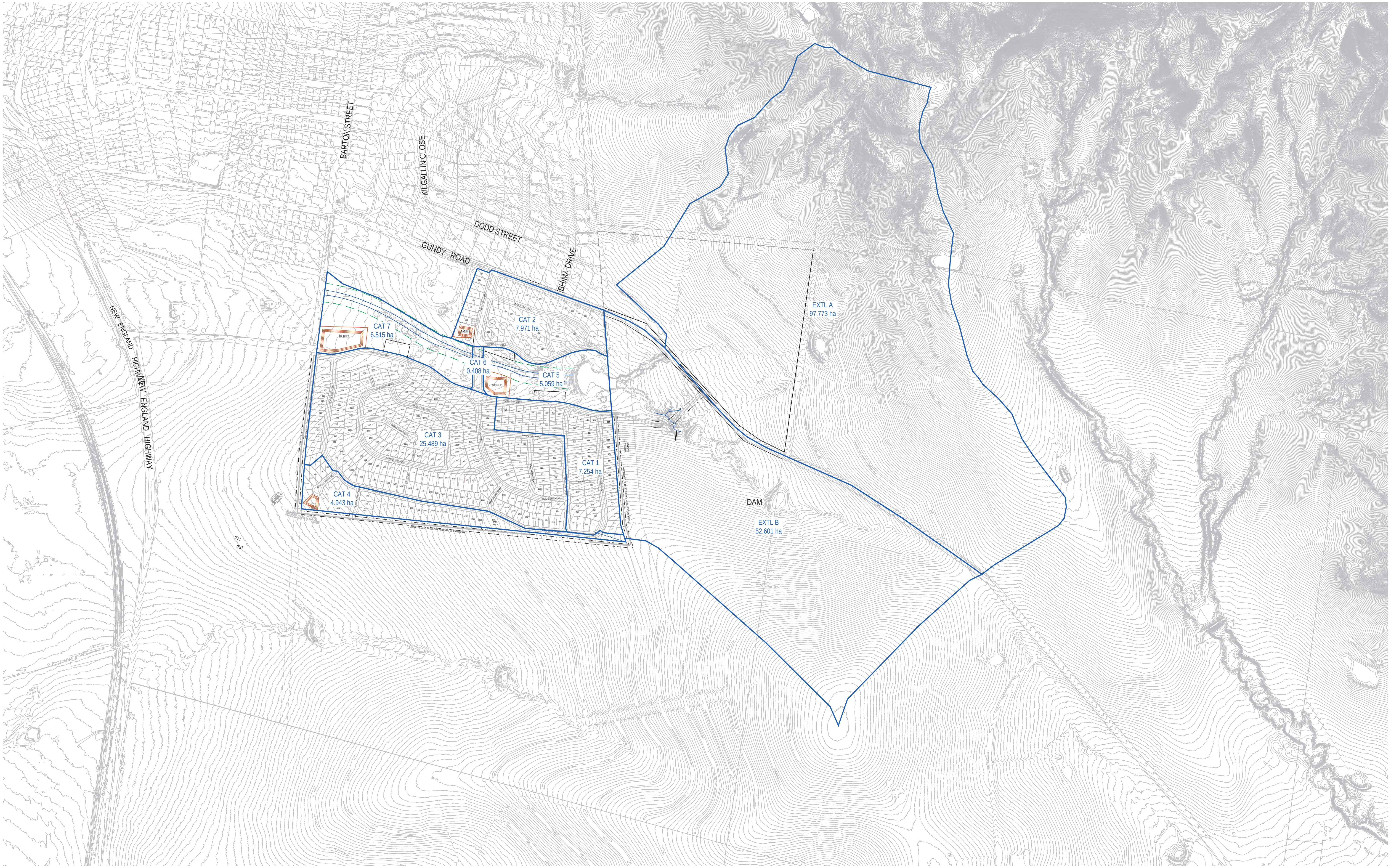
LOT 2, DP1169320
GUNDY ROAD, SCONE

Drawing Title: STORMWATER MANAGEMENT PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
ADS	MAR 2021	1:1000	UK	12.03.21

Designed	Project No.	Dwg. No.	Issue
UK	NSW202732	FIGURE 6	C



SCALE 1:5000 @ A1
SCALE 1:10000 @ A3

0 50 100 200 300 400 500 metres

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C	RE-ISSUED FOR APPROVAL	15.02.22	ADS	UK
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STORMWATER MANAGEMENT PLAN

LOT 2, DP1169320
GUNDY ROAD, SCONE

Drawing Title
EROSION AND SEDIMENT PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
ADS	MAR 2021	1:1000	UK	12.03.21

Designed	Project No.	Dwg. No.	Issue
UK	NSW202732	FIGURE 7	C

Feb 15, 2022 - 11:29am

Appendix A - DRAINS Modelling Inputs and Results

Australian Rainfall & Runoff Data Hub - Results

Input Data

Longitude	150.881
Latitude	-32.061
Selected Regions (clear)	
River Region	show
ARF Parameters	show
Storm Losses	show
Temporal Patterns	show
Areal Temporal Patterns	show
BOM IFDs	show
Median Preburst Depths and Ratios	show
10% Preburst Depths	show
25% Preburst Depths	show
75% Preburst Depths	show
90% Preburst Depths	show
Interim Climate Change Factors	show
Probability Neutral Burst Initial Loss (./nsw_specific)	show
Baseflow Factors	show

Data

River Region

Division	South East Coast (NSW)
River Number	10
River Name	Hunter River

Layer Info

Time Accessed	28 April 2021 11:17AM
Version	2016_v1

ARF Parameters

$$ARF = Min\left\{1, \left[1 - a\left(Area^b - c\log_{10}Duration\right)Duration^{-d}\right.\right.$$
$$+ eArea^f Duration^g \left(0.3 + \log_{10}AEP\right)$$
$$\left.\left. + h10^{iArea\frac{Duration}{1440}}\left(0.3 + \log_{10}AEP\right)\right]\right\}$$

Zone	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**
SE Coast	0.06	0.361	0.0	0.317	8.11e-05	0.651	0.0	0.0	0.0

Short Duration ARF

$$ARF = Min\left[1, 1 - 0.287\left(Area^{0.265} - 0.439\log_{10}(Duration)\right).Duration^{-0.36}\right.$$
$$+ 2.26 \text{ x } 10^{-3} \text{ x } Area^{0.226}.Duration^{0.125}\left(0.3 + \log_{10}(AEP)\right)$$
$$\left. + 0.0141 \text{ x } Area^{0.213} \text{ x } 10^{-0.021\frac{(Duration-180)^2}{1440}}\left(0.3 + \log_{10}(AEP)\right)\right]$$

Layer Info

Time Accessed	28 April 2021 11:17AM
Version	2016_v1

Storm Losses

Note: Burst Loss = Storm Loss - Preburst

Note: These losses are only for rural use and are **NOT FOR DIRECT USE** in urban areas

Note: As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub (./nsw_specific) is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. The continuing storm loss information from the ARR Datahub provided below should only be used where relevant under the loss hierarchy (level 5) and where used is to be multiplied by the factor of 0.4.

ID	1819.0
Storm Initial Losses (mm)	34.0
Storm Continuing Losses (mm/h)	1.5

Layer Info

Time Accessed	28 April 2021 11:17AM
Version	2016_v1

Temporal Patterns | Download (.zip) (static/temporal_patterns/TP/ECsouth.zip)

code	ECsouth
Label	East Coast South

Layer Info

Time Accessed	28 April 2021 11:17AM
Version	2016_v2

Areal Temporal Patterns | Download (.zip) (./static/temporal_patterns/Areal/Areal_ECsouth.zip)

code	ECsouth
arealabel	East Coast South

Layer Info

Time Accessed	28 April 2021 11:17AM

Version	2016_v2

BOM IFDs

Click here (http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate_type=dd&latitude=-32.061&longitude=150.881&sdmin=true&sdhr=true&sdday=true&user_label=) to obtain the IFD depths for catchment centroid from the BoM website

Layer Info

Time Accessed	28 April 2021 11:17AM

Median Preburst Depths and Ratios

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	**50**	**20**	**10**	**5**	**2**	**1**
60 (1.0)	0.8 (0.039)	0.9 (0.031)	1.0 (0.028)	1.0 (0.025)	0.8 (0.018)	0.7 (0.014)
90 (1.5)	0.2 (0.009)	0.4 (0.011)	0.4 (0.012)	0.5 (0.012)	0.4 (0.008)	0.3 (0.006)
120 (2.0)	1.1 (0.042)	0.8 (0.023)	0.6 (0.014)	0.4 (0.008)	0.5 (0.009)	0.5 (0.009)
180 (3.0)	1.9 (0.063)	1.4 (0.034)	1.0 (0.022)	0.7 (0.012)	0.5 (0.009)	0.5 (0.007)
360 (6.0)	0.2 (0.005)	2.4 (0.048)	3.8 (0.066)	5.2 (0.079)	6.5 (0.084)	7.5 (0.086)
720 (12.0)	0.0 (0.000)	0.7 (0.010)	1.1 (0.015)	1.5 (0.018)	4.6 (0.045)	6.8 (0.060)
1080 (18.0)	0.0 (0.000)	1.6 (0.021)	2.6 (0.030)	3.6 (0.036)	7.6 (0.064)	10.6 (0.079)
1440 (24.0)	0.0 (0.000)	0.5 (0.005)	0.8 (0.008)	1.0 (0.009)	6.8 (0.050)	11.1 (0.072)
2160 (36.0)	0.0 (0.000)	0.5 (0.005)	0.8 (0.007)	1.1 (0.008)	3.0 (0.019)	4.4 (0.024)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	28 April 2021 11:17AM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

10% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
90 (1.5)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	28 April 2021 11:17AM

Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

25% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
90 (1.5)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	28 April 2021 11:17AM
Version	2018_v1

Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

75% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	12.6 (0.582)	13.3 (0.458)	13.8 (0.402)	14.2 (0.360)	10.0 (0.215)	6.8 (0.131)
90 (1.5)	13.7 (0.558)	12.2 (0.374)	11.2 (0.292)	10.2 (0.233)	11.6 (0.224)	12.6 (0.218)
120 (2.0)	12.6 (0.471)	12.7 (0.360)	12.8 (0.310)	12.9 (0.273)	15.7 (0.282)	17.7 (0.286)
180 (3.0)	12.8 (0.424)	14.3 (0.360)	15.3 (0.330)	16.2 (0.306)	15.5 (0.250)	14.9 (0.216)
360 (6.0)	8.9 (0.236)	15.5 (0.315)	19.9 (0.346)	24.1 (0.366)	37.3 (0.483)	47.2 (0.546)
720 (12.0)	10.6 (0.221)	18.2 (0.288)	23.2 (0.313)	28.0 (0.328)	30.1 (0.298)	31.6 (0.278)
1080 (18.0)	1.5 (0.028)	11.8 (0.159)	18.5 (0.213)	25.0 (0.249)	37.8 (0.315)	47.3 (0.349)
1440 (24.0)	1.6 (0.027)	7.3 (0.089)	11.1 (0.114)	14.8 (0.130)	27.5 (0.203)	37.1 (0.241)
2160 (36.0)	0.0 (0.000)	4.9 (0.051)	8.1 (0.071)	11.2 (0.084)	16.9 (0.105)	21.1 (0.116)
2880 (48.0)	0.0 (0.000)	2.5 (0.024)	4.2 (0.033)	5.8 (0.039)	7.6 (0.042)	8.9 (0.044)
4320 (72.0)	0.0 (0.000)	0.2 (0.002)	0.4 (0.003)	0.5 (0.003)	2.8 (0.014)	4.5 (0.019)

Layer Info

Time Accessed	28 April 2021 11:17AM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

90% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	29.9 (1.378)	35.3 (1.214)	38.8 (1.133)	42.2 (1.070)	35.3 (0.760)	30.2 (0.579)
90 (1.5)	32.3 (1.315)	35.9 (1.101)	38.3 (1.000)	40.6 (0.924)	40.1 (0.776)	39.7 (0.688)
120 (2.0)	36.5 (1.367)	39.2 (1.110)	41.0 (0.991)	42.7 (0.901)	50.9 (0.916)	57.0 (0.920)
180 (3.0)	33.2 (1.101)	36.1 (0.910)	38.0 (0.820)	39.8 (0.751)	58.8 (0.947)	72.9 (1.054)
360 (6.0)	28.3 (0.751)	36.9 (0.749)	42.6 (0.741)	48.1 (0.730)	76.9 (0.994)	98.4 (1.138)
720 (12.0)	24.0 (0.500)	48.3 (0.765)	64.5 (0.870)	79.9 (0.937)	71.5 (0.707)	65.2 (0.573)
1080 (18.0)	15.4 (0.279)	32.1 (0.435)	43.2 (0.496)	53.8 (0.534)	87.2 (0.727)	112.2 (0.828)
1440 (24.0)	15.6 (0.255)	28.8 (0.350)	37.6 (0.385)	45.9 (0.406)	66.2 (0.488)	81.3 (0.529)
2160 (36.0)	15.3 (0.219)	28.5 (0.297)	37.1 (0.325)	45.5 (0.342)	55.0 (0.343)	62.1 (0.341)
2880 (48.0)	0.2 (0.002)	9.9 (0.093)	16.3 (0.129)	22.4 (0.152)	33.0 (0.185)	40.8 (0.201)
4320 (72.0)	2.1 (0.025)	6.6 (0.056)	9.5 (0.067)	12.3 (0.074)	22.4 (0.111)	29.9 (0.129)

Layer Info

Time Accessed	28 April 2021 11:17AM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

Interim Climate Change Factors

	RCP 4.5	RCP6	RCP 8.5
2030	**0.869 (4.3%)**	0.783 (3.9%)	**0.983 (4.9%)**
2040	**1.057 (5.3%)**	1.014 (5.1%)	**1.349 (6.8%)**
2050	**1.272 (6.4%)**	1.236 (6.2%)	**1.773 (9.0%)**
2060	**1.488 (7.5%)**	1.458 (7.4%)	**2.237 (11.5%)**
2070	**1.676 (8.5%)**	1.691 (8.6%)	**2.722 (14.2%)**
2080	**1.810 (9.2%)**	1.944 (9.9%)	**3.209 (16.9%)**
2090	**1.862 (9.5%)**	2.227 (11.5%)	**3.679 (19.7%)**

Layer Info

Time Accessed	28 April 2021 11:18AM
Version	2019_v1
Note	ARR recommends the use of RCP4.5 and RCP 8.5 values. These have been updated to the values that can be found on the climate change in Australia website.

Probability Neutral Burst Initial Loss

min (h)\AEP(%)	50.0	20.0	10.0	5.0	2.0	1.0
60 (1.0)	21.5	11.3	10.3	10.6	10.8	10.1
90 (1.5)	21.4	11.8	10.9	11.5	11.5	9.5
120 (2.0)	20.9	11.9	11.1	11.4	10.3	8.3
180 (3.0)	20.9	12.7	11.5	12.0	10.1	9.1
360 (6.0)	21.8	13.9	11.6	11.0	9.6	4.3
720 (12.0)	22.3	15.0	13.3	12.7	11.7	7.8
1080 (18.0)	25.3	18.0	16.0	14.1	12.4	6.1
1440 (24.0)	25.7	19.6	18.7	17.8	14.4	8.4
2160 (36.0)	26.7	20.8	20.2	19.2	18.0	8.9
2880 (48.0)	29.8	25.1	24.1	25.9	21.5	11.6
4320 (72.0)	30.1	26.3	26.7	29.9	24.4	15.2

Layer Info

Time Accessed	28 April 2021 11:18AM
Version	2018_v1
Note	As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub (./nsw_specific) is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. Probability neutral burst initial loss values for NSW are to be used in place of the standard initial loss and pre-burst as per the losses hierarchy.

Baseflow Factors

Downstream	9596
Area (km2)	782.601152
Catchment Number	9422
Volume Factor	0.168431
Peak Factor	0.02334

Layer Info

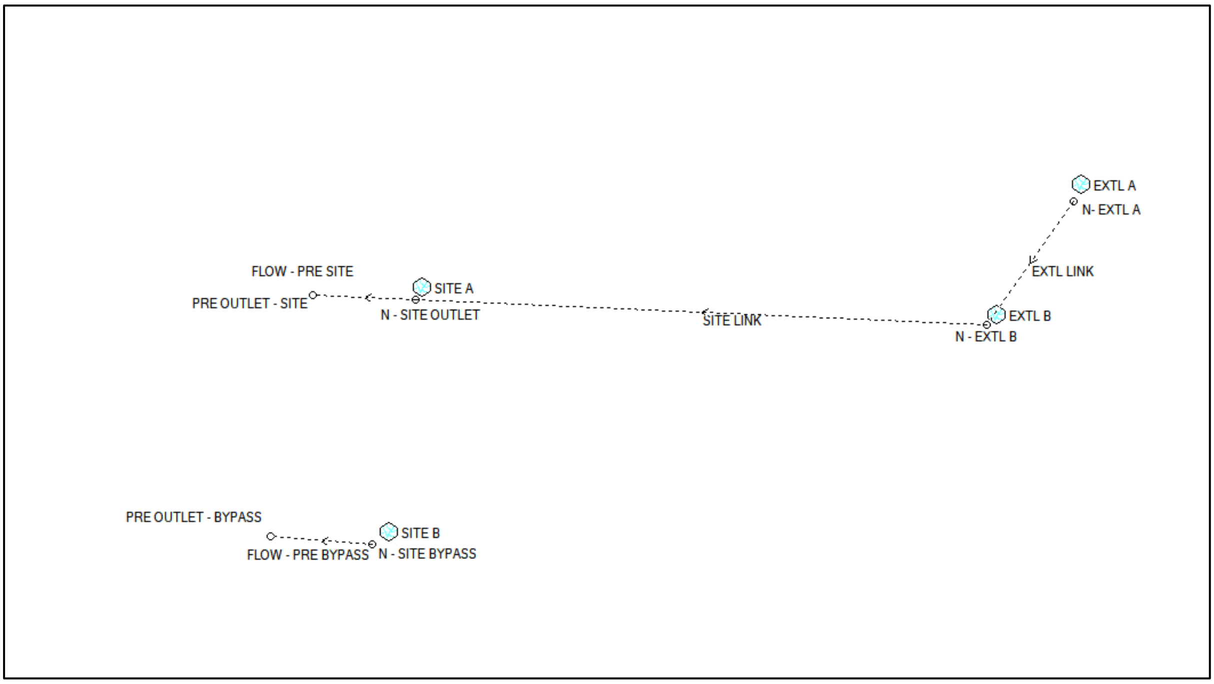
Time Accessed	28 April 2021 11:18AM
Version	2016_v1

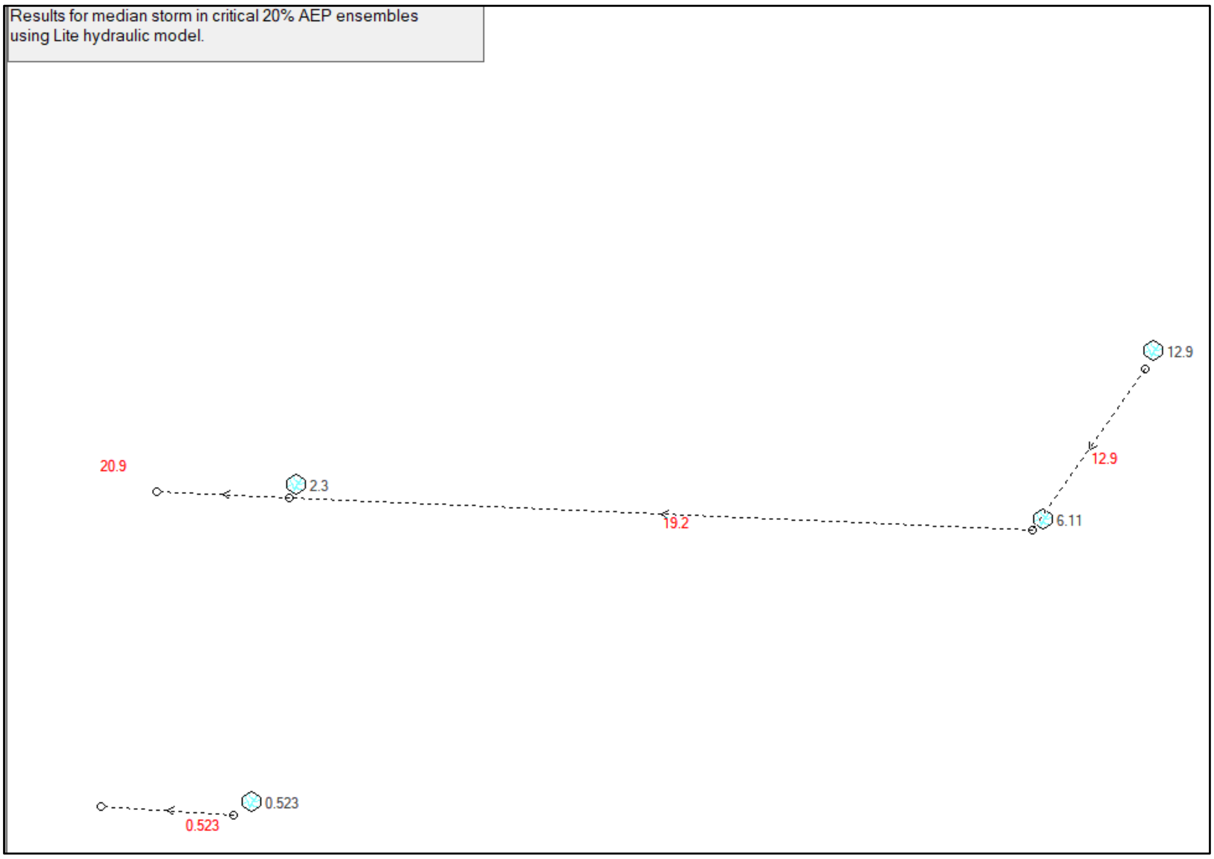
Download TXT (downloads/fa902ff3-4ff8-4c9e-b95a-5fecb90d8ccd.txt)

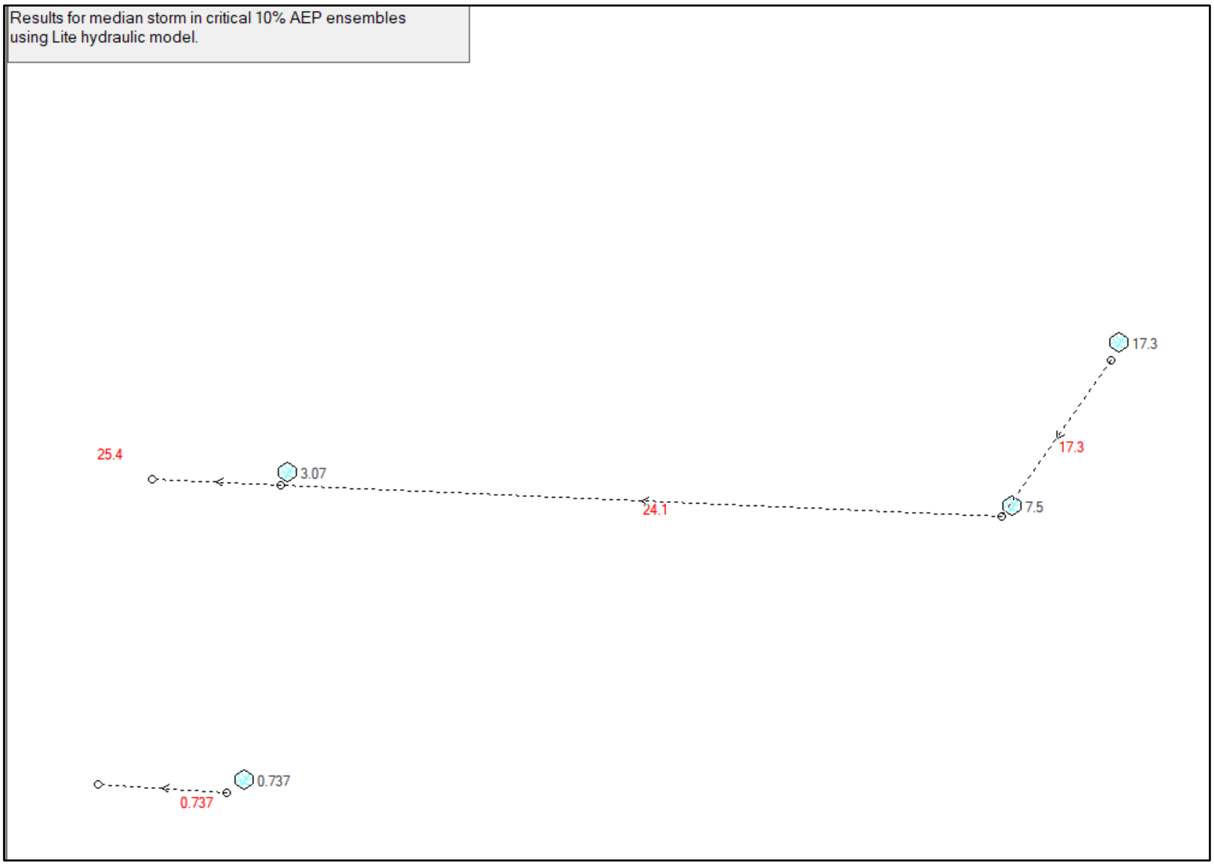
Download JSON (downloads/d30aa547-b72d-4ea2-9267-8a585922734d.json)

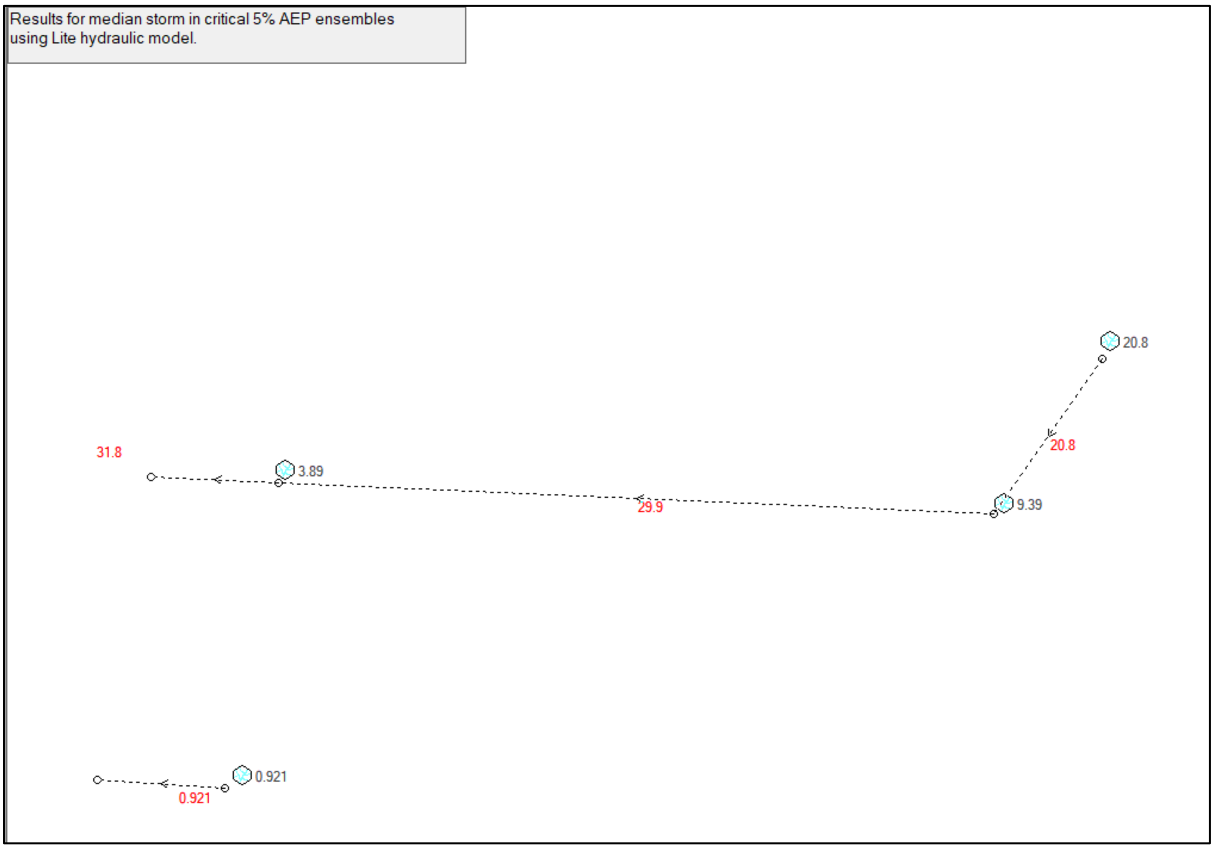
Generating PDF... (downloads/ee57cd19-1454-4809-bcd3-c6dfb3f41e88.pdf)

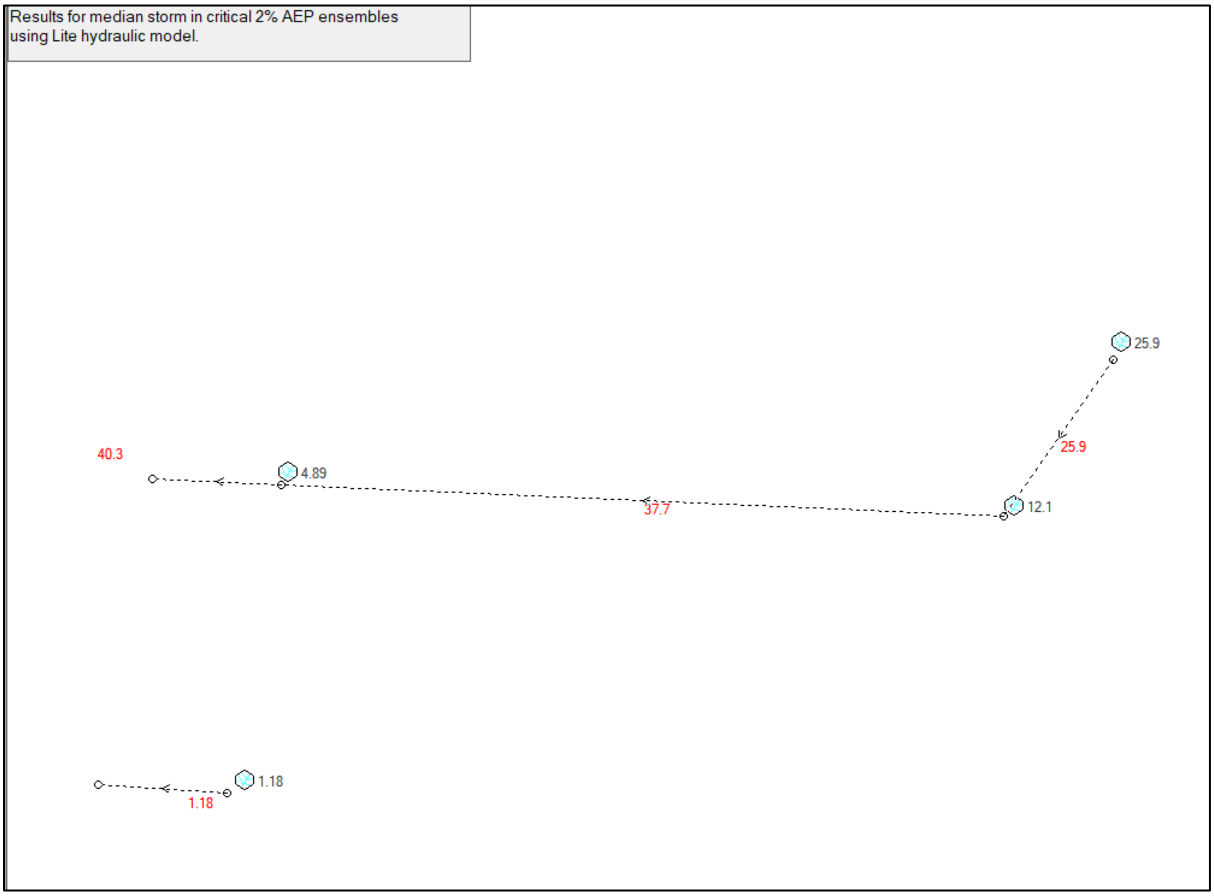
DRAINS PREDEVELOPED SCHEMATICS

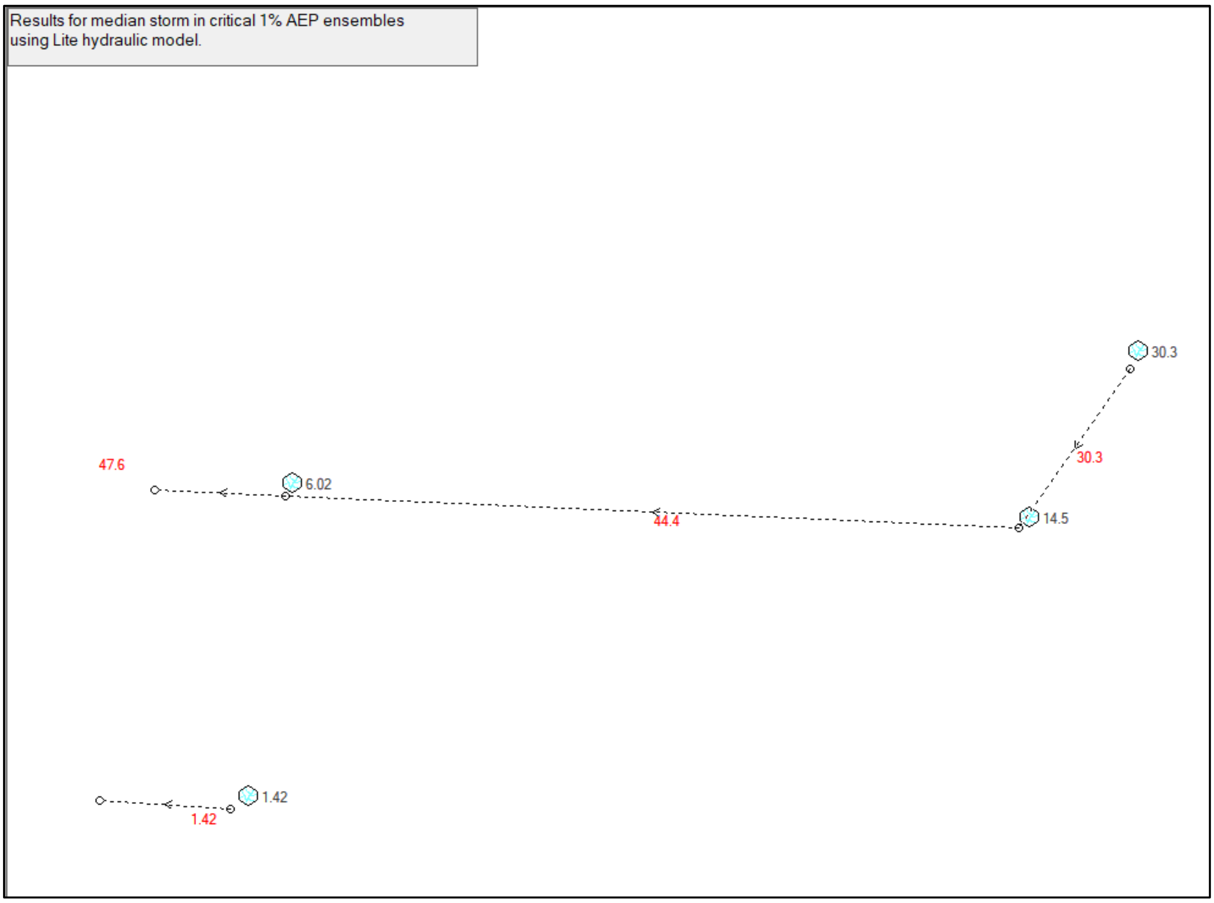




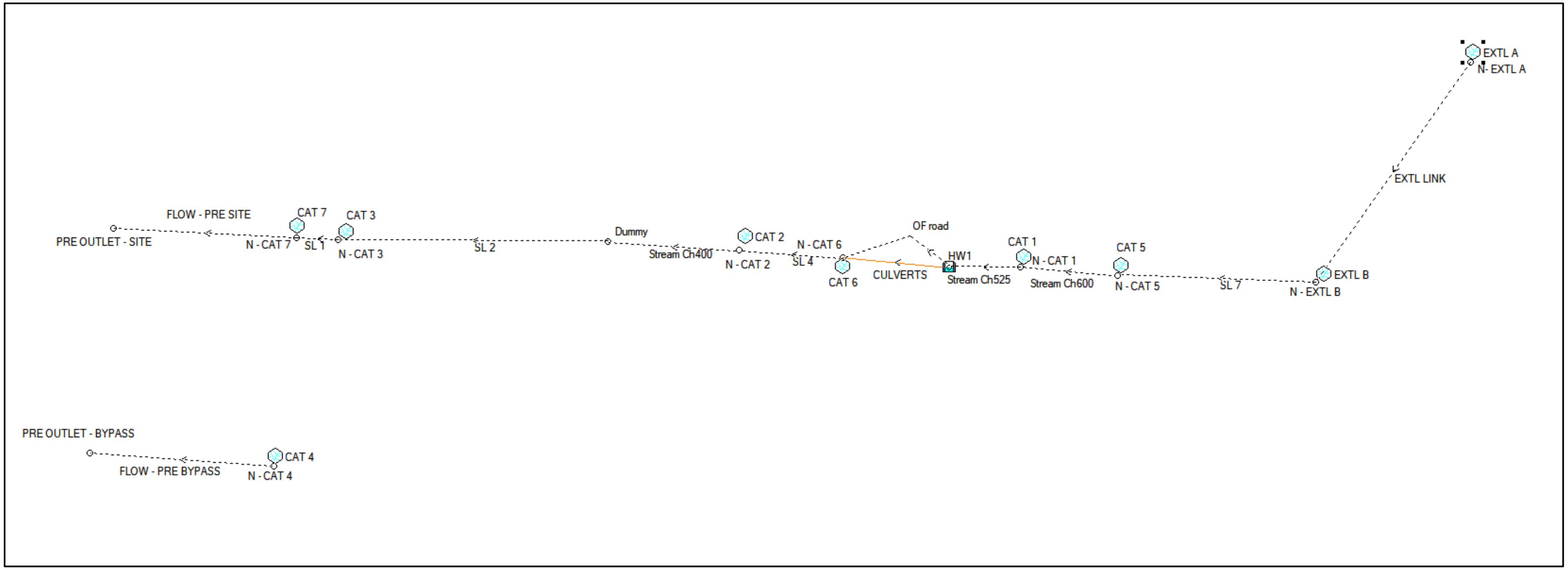

Results for median storm in critical 10% AEP ensembles
using Lite hydraulic model.
17.3
17.3
25.4
3.07
7.5
24.1
0.737
0.737

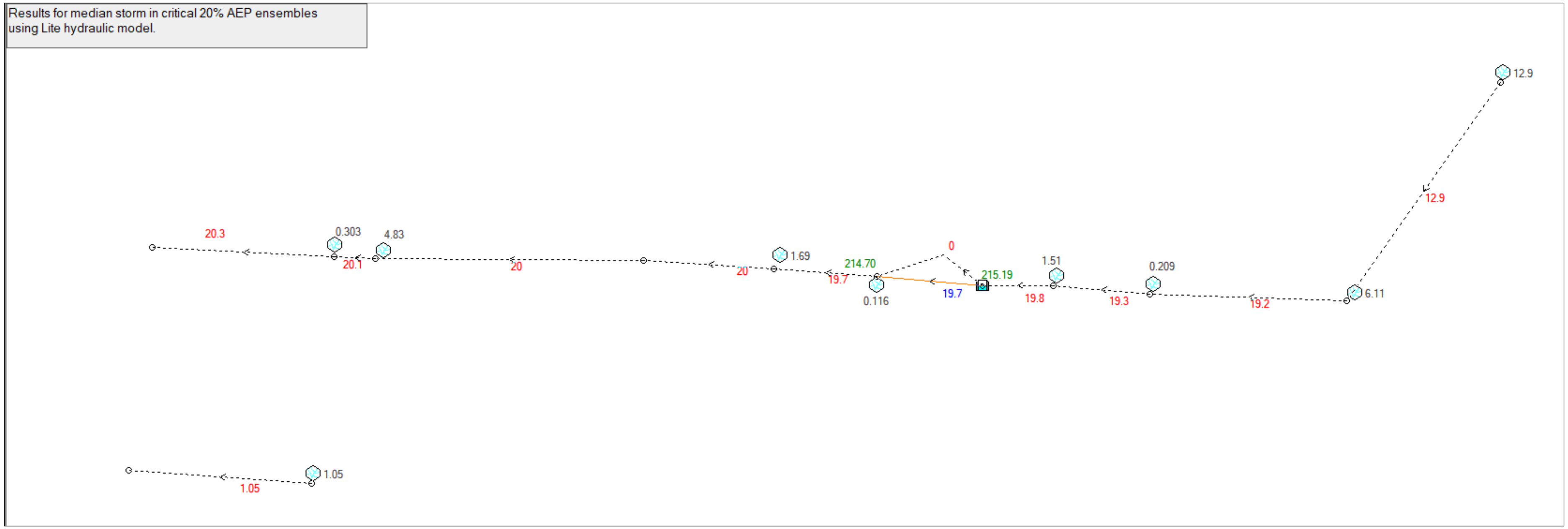

Results for median storm in critical 5% AEP ensembles
using Lite hydraulic model.
20.8
20.8
31.8
3.89
9.39
29.9
0.921
0.921


Results for median storm in critical 2% AEP ensembles
using Lite hydraulic model.
25.9
25.9
40.3
4.89
37.7
12.1
1.18
1.18

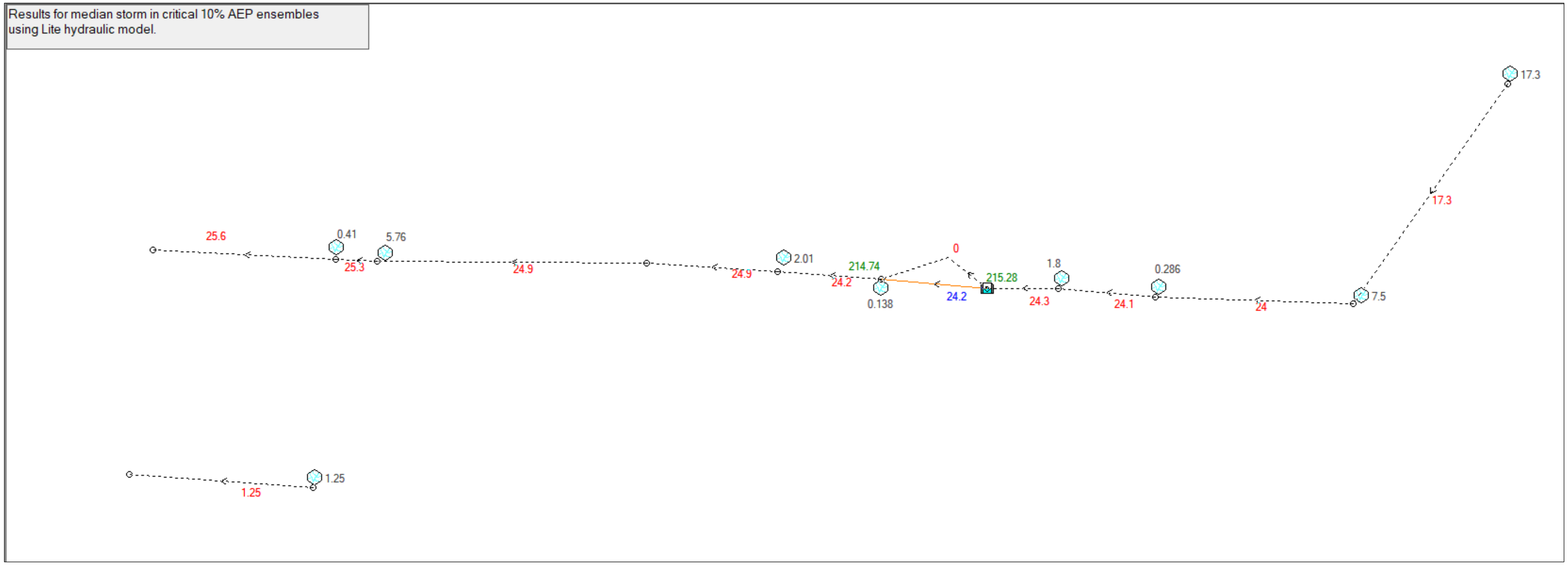

Results for median storm in critical 1% AEP ensembles
using Lite hydraulic model.
30.3
30.3
47.6
6.02
44.4
14.5
1.42
1.42

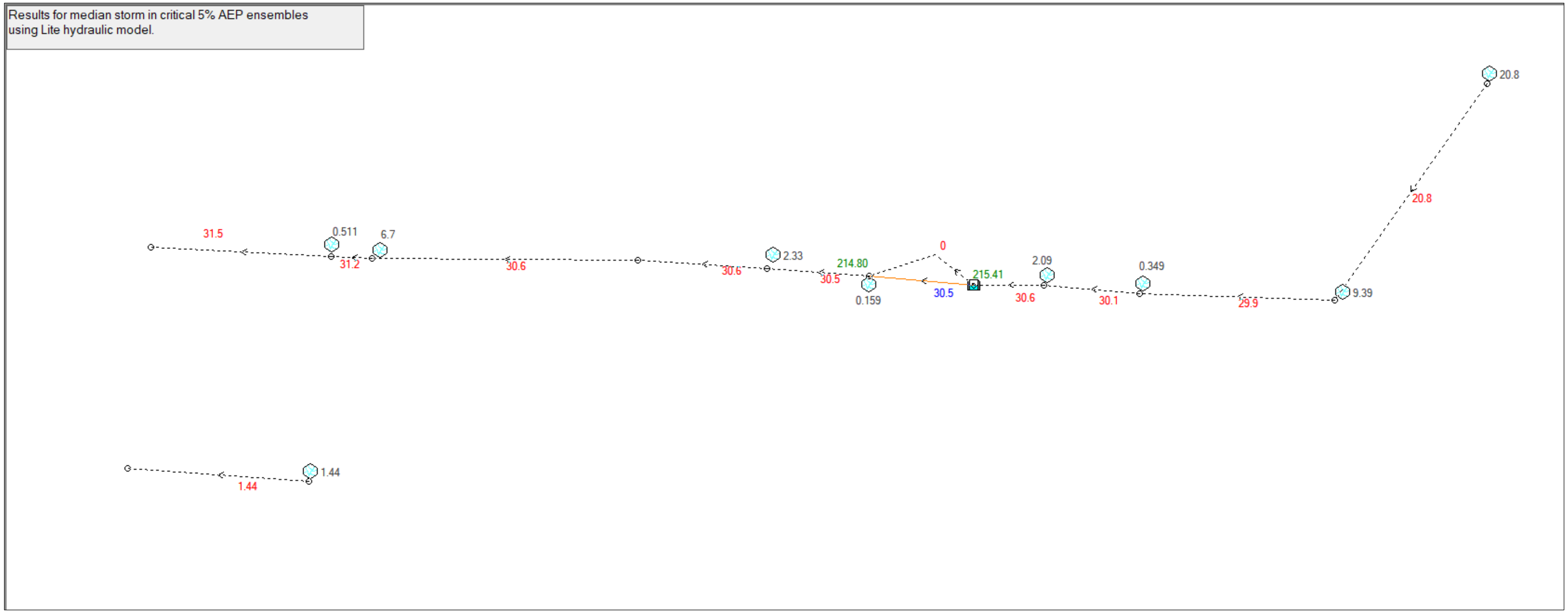
DRAINS POST DEVELOPED SCHEMATICS

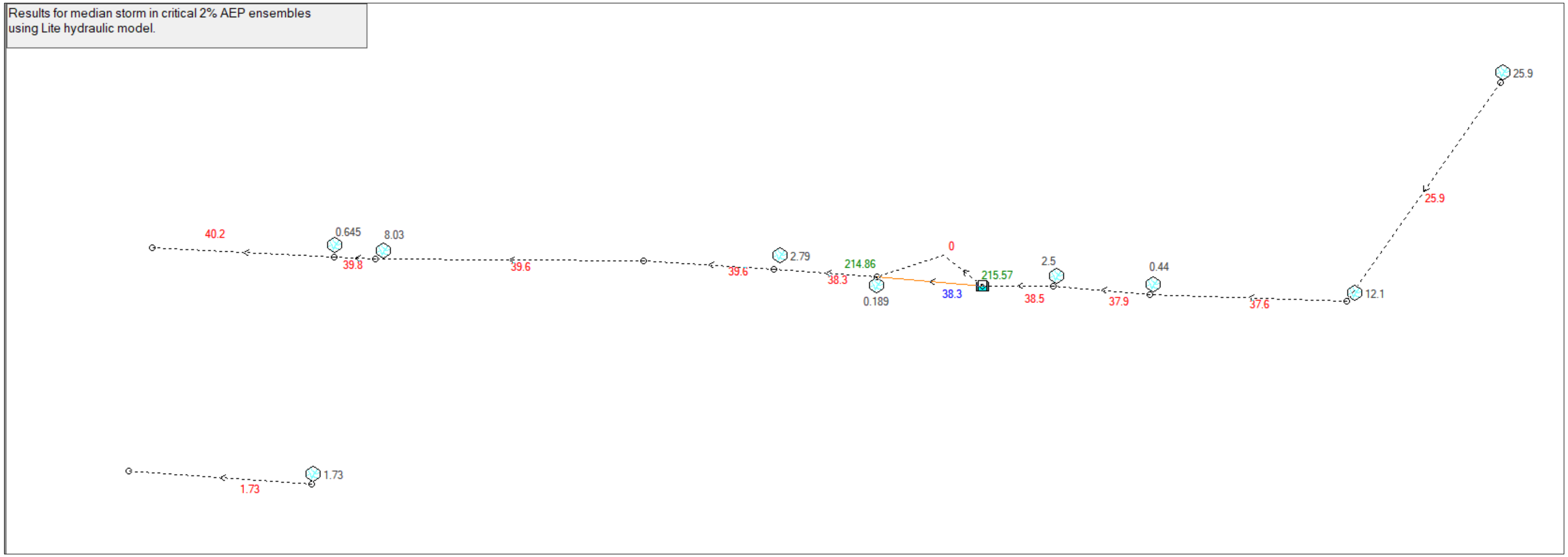




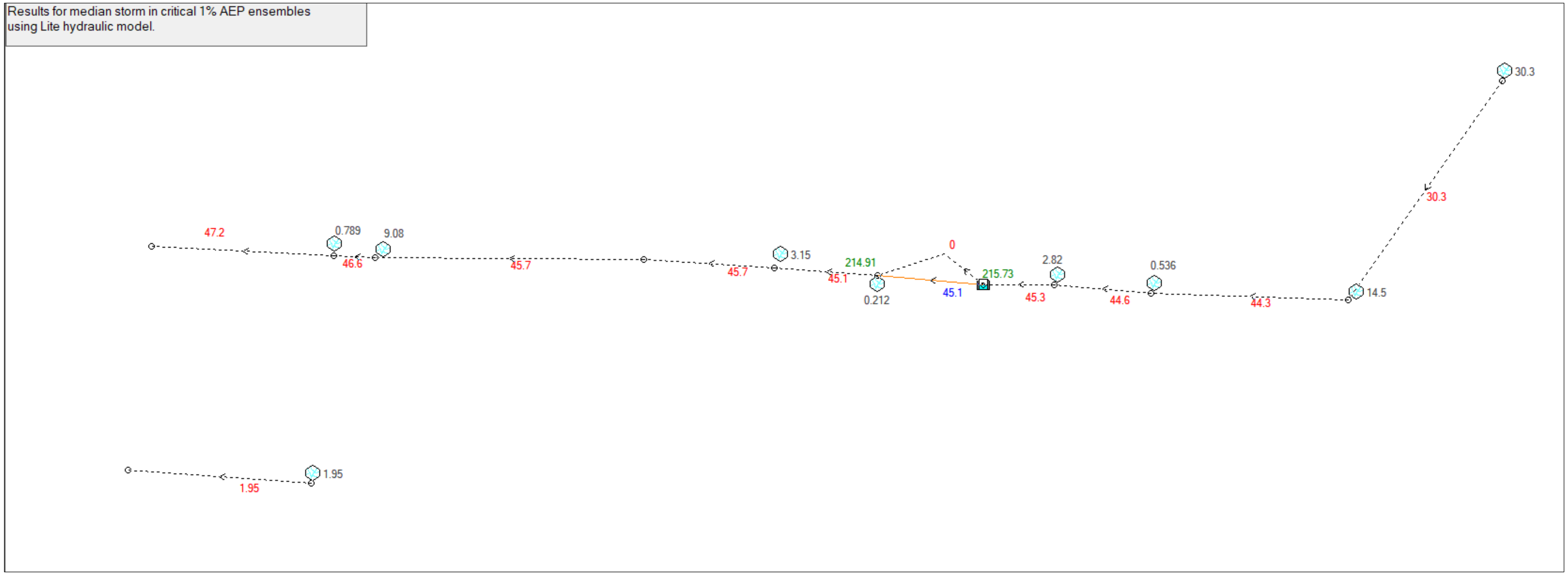
Results for median storm in critical 20% AEP ensembles
using Lite hydraulic model.
12.9
12.9
20.3
0.303
4.83
20.1
20
1.69
20
19.7
214.70
0
215.19
1.51
0.209
0.116
19.7
19.8
19.3
19.2
6.11
1.05
1.05


Results for median storm in critical 10% AEP ensembles
using Lite hydraulic model.
17.3
17.3
25.6
0.41
5.76
25.3
24.9
24.9
2.01
214.74
0
215.28
1.8
0.286
24.2
0.138
24.2
24.3
24.1
24
7.5
1.25
1.25

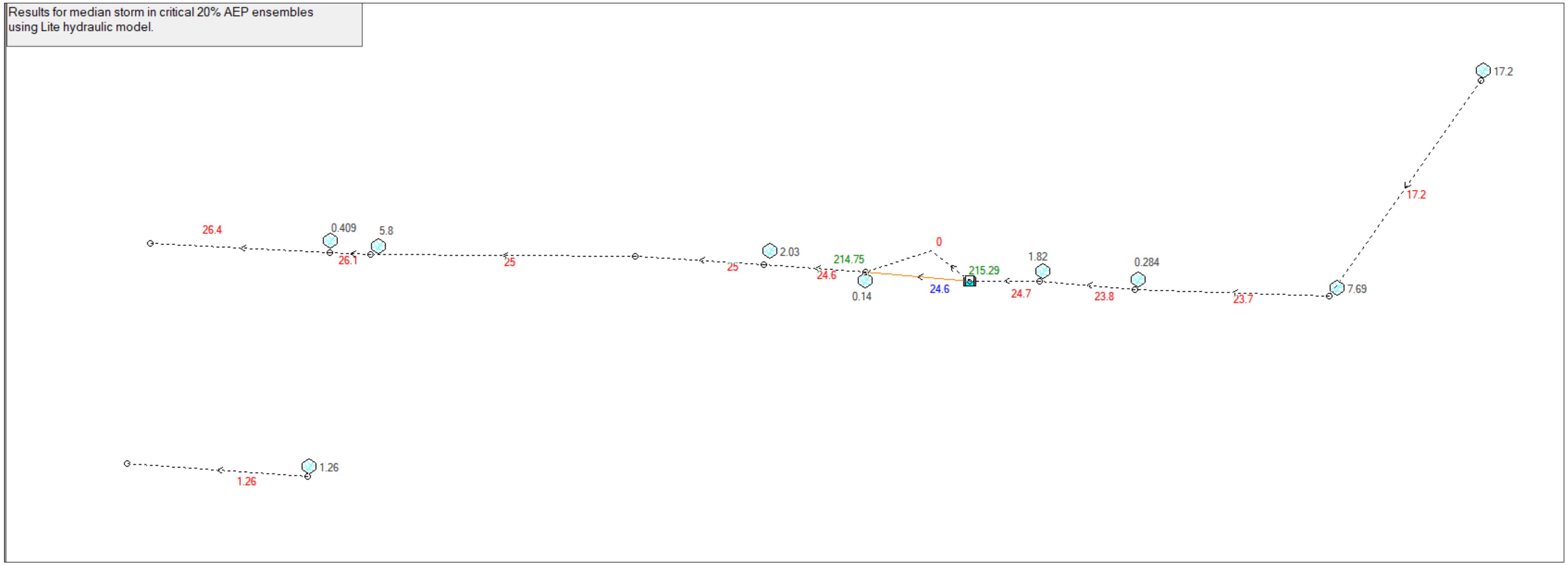

Results for median storm in critical 5% AEP ensembles
using Lite hydraulic model.
20.8
20.8
31.5
0.511
6.7
31.2
30.6
30.6
2.33
214.80
0
30.5
215.41
2.09
0.349
0.159
30.5
30.6
30.1
29.9
9.39
1.44
1.44

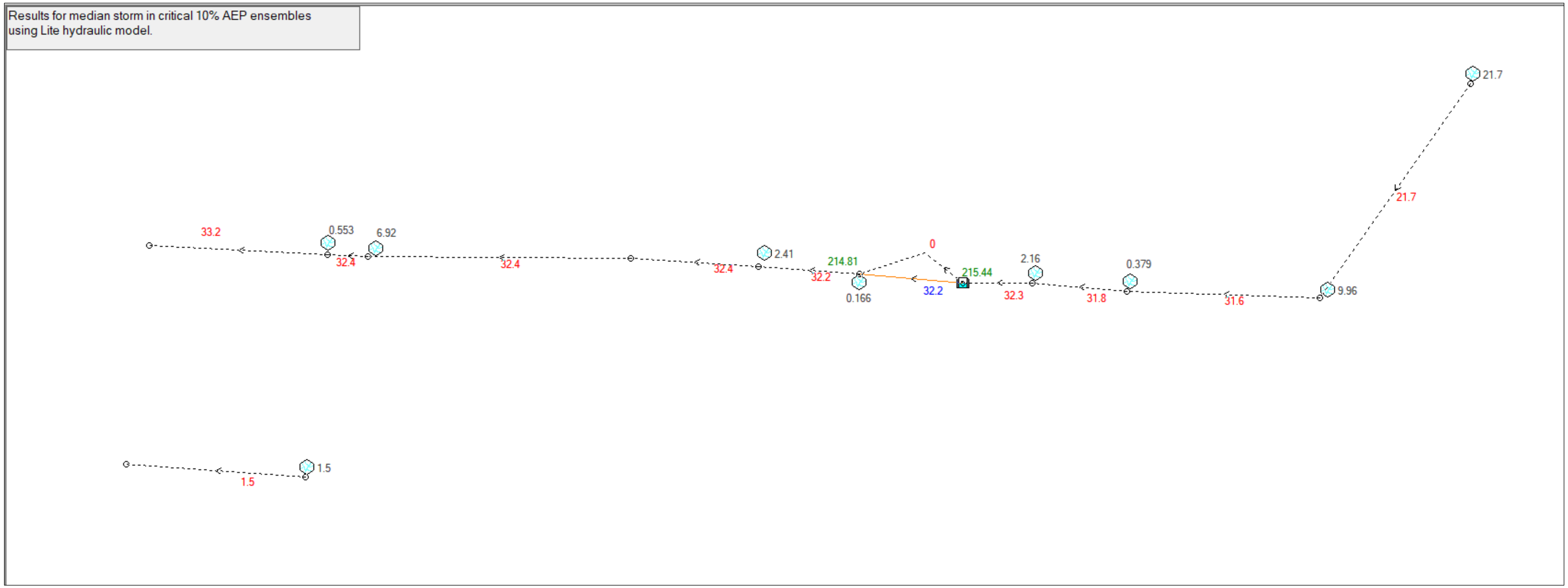


Results for median storm in critical 2% AEP ensembles
using Lite hydraulic model.
25.9
25.9
40.2
0.645
8.03
39.8
39.6
39.6
2.79
214.86
38.3
0.189
0
215.57
38.3
2.5
0.44
38.5
37.9
37.6
12.1
1.73
1.73

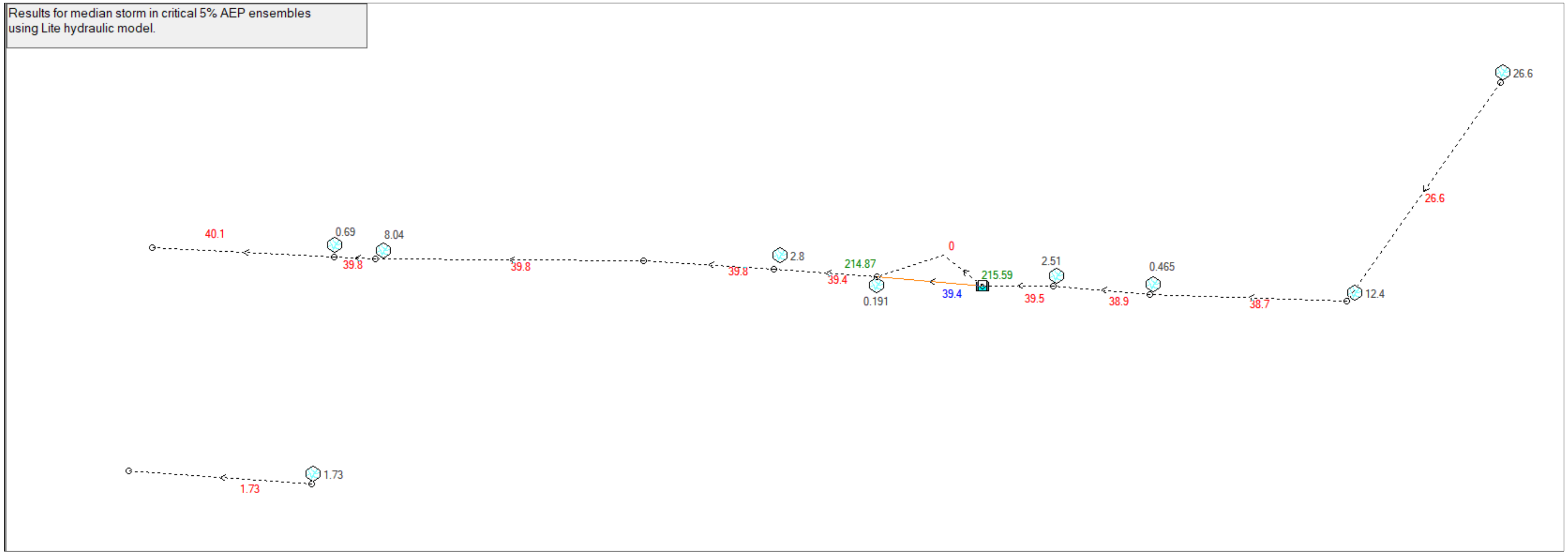

Results for median storm in critical 1% AEP ensembles
using Lite hydraulic model.
30.3
30.3
47.2
0.789
9.08
46.6
45.7
3.15
45.7
214.91
0
45.1
215.73
2.82
0.536
0.212
45.1
45.3
44.6
44.3
14.5
1.95
1.95

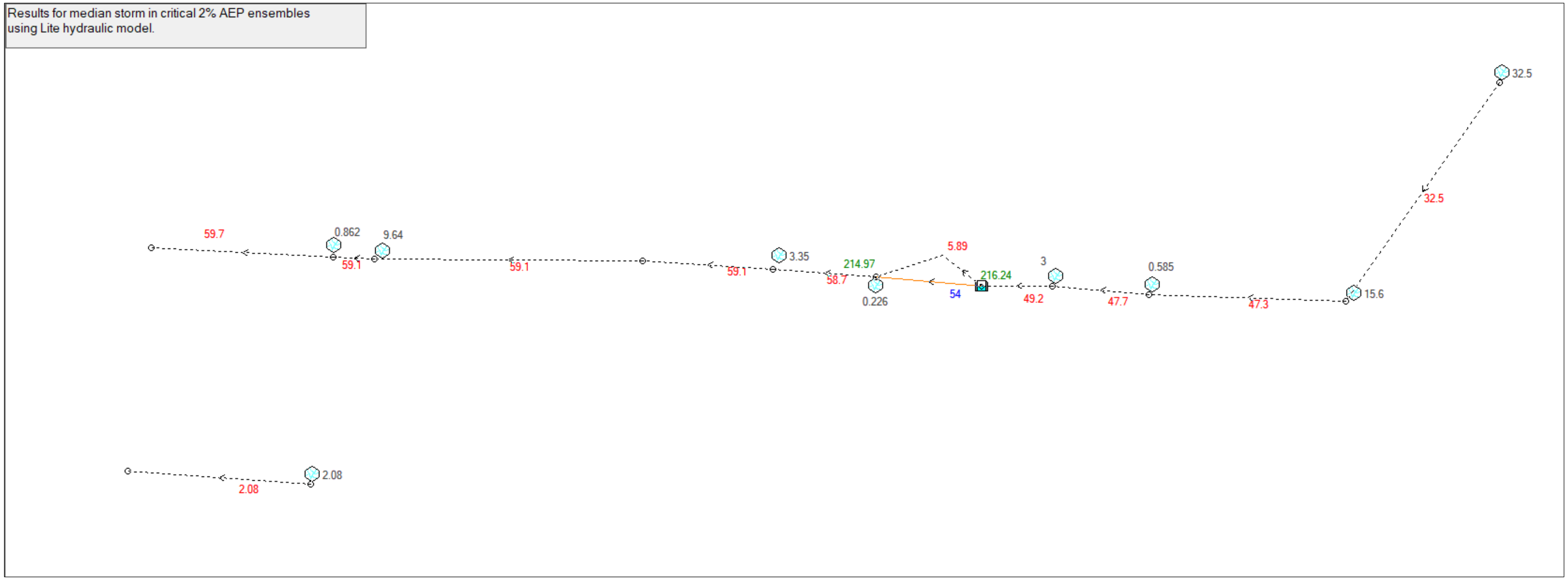
DRAINS POST DEVELOPED SCHEMATICS (WITH CLIMATE CHANGE FACTOR)

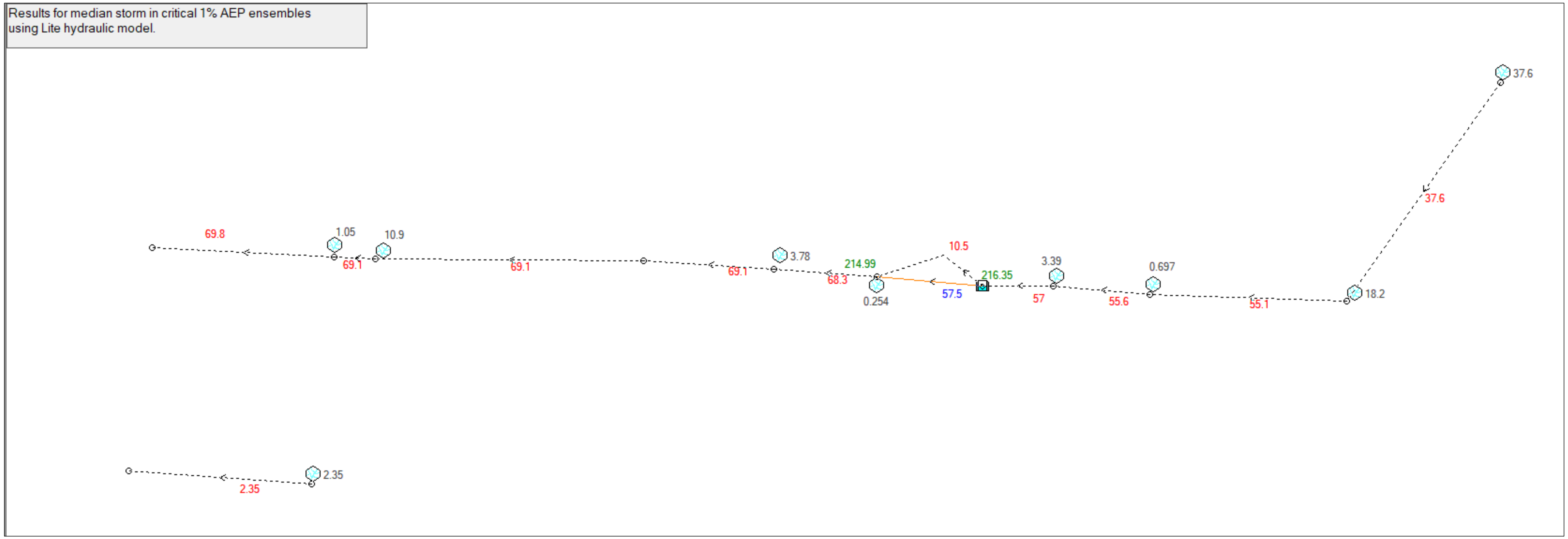




Results for median storm in critical 10% AEP ensembles
using Lite hydraulic model.
21.7
21.7
33.2
0.553
6.92
32.4
32.4
2.41
32.4
214.81
0
32.2
215.44
2.16
0.379
0.166
32.2
32.3
31.8
31.6
9.96
1.5
1.5


Results for median storm in critical 5% AEP ensembles
using Lite hydraulic model.
26.6
26.6
40.1
0.69
8.04
39.8
39.8
2.8
39.8
39.4
214.87
0
215.59
2.51
0.465
0.191
39.4
39.5
38.9
38.7
12.4
1.73
1.73

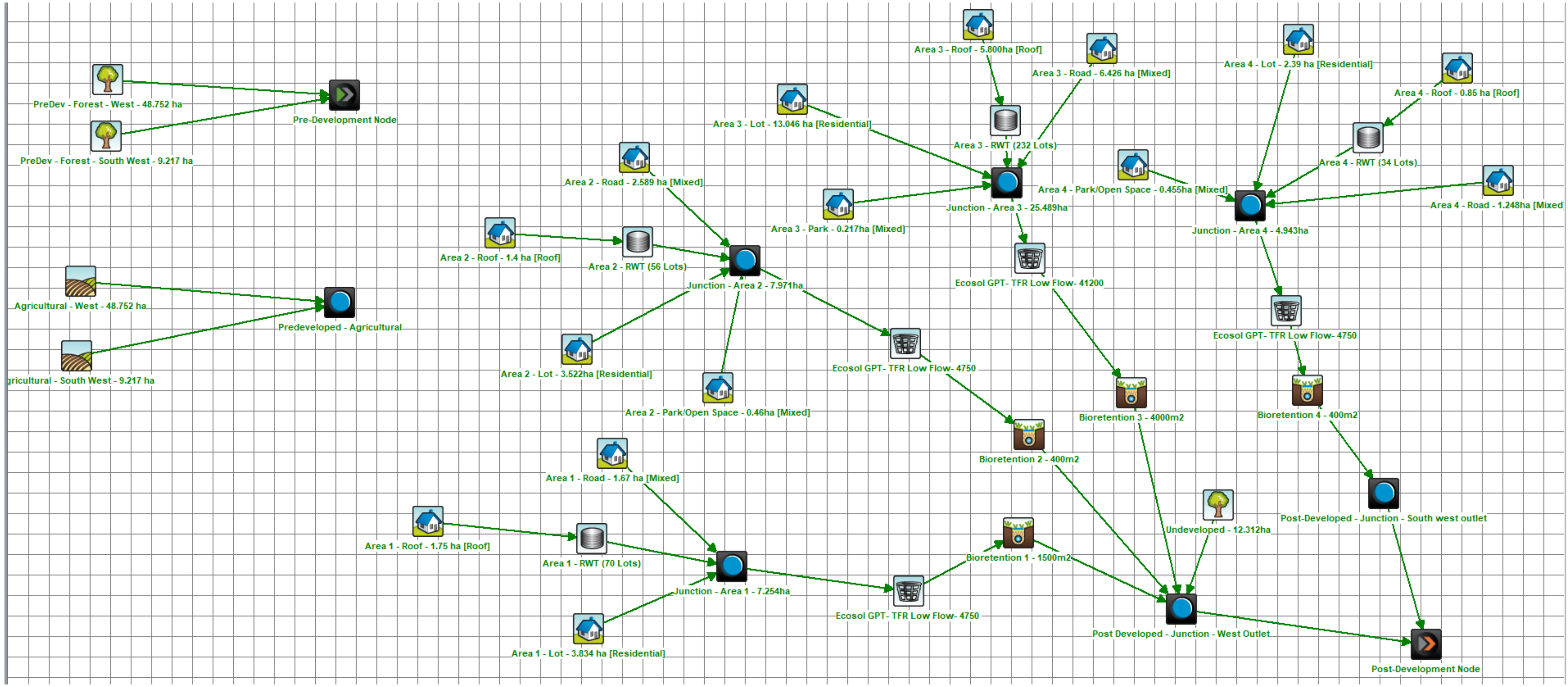

Results for median storm in critical 2% AEP ensembles
using Lite hydraulic model.
32.5
32.5
59.7
0.862
9.64
59.1
59.1
59.1
3.35
58.7
214.97
5.89
216.24
54
0.226
3
49.2
0.585
47.7
47.3
15.6
2.08
2.08


Results for median storm in critical 1% AEP ensembles
using Lite hydraulic model.
37.6
37.6
69.8
1.05
10.9
69.1
69.1
69.1
3.78
214.99
68.3
0.254
10.5
216.35
57.5
3.39
57
0.697
55.6
55.1
18.2
2.35
2.35

Appendix B - MUSIC Modelling Report

SCONE SUBDIVISION NSW202732

MUSIC MODEL SCHEMATIC – 18 FEBRUARY 2022



SCONE SUBDIVISION NSW202732
MUSIC MODEL REPORT – 18 February 2022

Source nodes
Location,PreDev - Forest - West - 48.752 ha,Area 1 - Road - 1.67 ha,Area 1 - Roof - 1.75 ha,Area 1 - Lot - 3.834 ha,Area 2 - Road - 2.589 ha,Area 3 - Road - 6.426 ha,Area 3 - Roof - 5.800ha,Area 2 - Roof - 1.4 ha,Area 3 - Lot - 13.046 ha,Area 2 - Lot - 3.522ha,Area 4 - Lot - 2.39 ha,Area 4 - Roof - 0.85 ha,Area 4 - Road - 1.248ha,Agricultural - West - 48.752 ha,Area 2 - Park/Open Space - 0.46ha,Area 3 - Park - 0.217ha,Area 4 - Park/Open Space - 0.455ha,PreDev - Forest - South West - 9.217 ha,Agricultural - South West - 9.217 ha,Undeveloped - 12.312ha
ID,1,2,3,4,7,8,9,10,11,12,19,20,21,27,33,34,36,39,40,41
Node Type,ForestSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,AgriculturalSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,ForestSourceNode,AgriculturalSourceNode,ForestSourceNode
Zoning Surface Type,,Mixed,Roof,Residential,Mixed,Mixed,Roof,Roof,Residential,Residential,Residential,Roof,Mixed,,Mixed,Mixed,Mixed,,,
Total Area (ha),48.752,1.67,1.75,3.834,2.589,6.426,5.8,1.4,13.046,3.522,2.39,0.85,1.248,48.752,0.46,0.217,0.455,9.217,9.217,9.217
Area Impervious (ha),16.9031188059702,1.33219888059701,1.75,2.47579119402985,2.07506417910448,5.12617365671642,5.8,1.4,8.5227376119403,2.28759156716418,1.56134776119403,0.85,1.00026268656716,16.843088358209,0.18319328358209,0.0864194402985075,0.181202052238806,3.1956852238806,3.18433593283582,3.1956852238806
Area Pervious (ha),31.8488811940299,0.337801119402985,0,1.35820880597015,0.513935820895522,1.29982634328358,0,0,4.5232623880597,1.23440843283582,0.82865223880597,0,0.247737313432836,31.908911641791,0.27680671641791,0.130580559701493,0.273797947761194,6.0213147761194,6.03266406716418,6.0213147761194
Field Capacity (mm),58,58,58,58,58,58,58,58,58,58,58,58,58,58,80,80,80,58,58,58
Pervious Area Infiltration Capacity coefficient - a,135,135,135,135,135,135,135,135,135,135,135,135,135,135,200,200,200,135,135,135
Pervious Area Infiltration Capacity exponent - b,4,4,3.5,1,4,4,3.5,3.5,1,1,1,4,4,4,1,1,1,4,4,4
Impervious Area Rainfall Threshold (mm/day),1,1,0.3,1,1,1,0.3,0.3,1,1,1,0.3,1,1,1,1,1,1,1,1
Pervious Area Soil Storage Capacity (mm),90,90,90,90,90,90,90,90,90,90,90,90,90,90,120,120,120,90,90,90
Pervious Area Soil Initial Storage (% of Capacity),25,25,25,25,25,25,25,25,25,25,25,25,25,25,25,25,25,25,25,25
Groundwater Initial Depth (mm),10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10
Groundwater Daily Recharge Rate (%),10,10,10,10,10,10,10,10,10,10,10,10,10,10,25,25,25,10,10,10
Groundwater Daily Baseflow Rate (%),10,10,10,10,10,10,10,10,10,10,10,10,10,10,5,5,5,10,10,10
Groundwater Daily Deep Seepage Rate (%),0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

Stormflow Total Suspended Solids Mean (log mg/L),1.6,2.2,1.3,2.15,2.2,2.2,1.3,1.3,2.15,2.15,2.15,1.3,2.2,2.15,2.2,2.2,2.2,1.6,2.15,1.6
Stormflow Total Suspended Solids Standard Deviation (log mg/L),0.2,0.32,0.32,0.32,0.32,0.32,0.32,0.32,0.32,0.32,0.32,0.32,0.32,0.31,0.32,0.32,0.32,0.2,0.31,0.2
Stormflow Total Suspended Solids Estimation Method,Stochastic
Stormflow Total Suspended Solids Serial Correlation,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Stormflow Total Phosphorus Mean (log mg/L),-1.1,-0.45,-0.89,-0.6,-0.45,-0.45,-0.89,-0.89,-0.6,-0.6,-0.6,-0.89,-0.45,-0.22,-0.45,-0.45,-0.45,-1.1,-0.22,-1.1
Stormflow Total Phosphorus Standard Deviation (log mg/L),0.22,0.25,0.25,0.25,0.25,0.25,0.25,0.25,0.25,0.25,0.25,0.25,0.25,0.3,0.25,0.25,0.25,0.22,0.3,0.22
Stormflow Total Phosphorus Estimation Method,Stochastic
Stormflow Total Phosphorus Serial Correlation,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Stormflow Total Nitrogen Mean (log mg/L),-0.05,0.42,0.3,0.3,0.42,0.42,0.3,0.3,0.3,0.3,0.3,0.3,0.42,0.48,0.42,0.42,0.42,-0.05,0.48,-0.05
Stormflow Total Nitrogen Standard Deviation (log mg/L),0.24,0.19,0.19,0.19,0.19,0.19,0.19,0.19,0.19,0.19,0.19,0.19,0.19,0.26,0.19,0.19,0.19,0.24,0.26,0.24
Stormflow Total Nitrogen Estimation Method,Stochastic
Stormflow Total Nitrogen Serial Correlation,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Baseflow Total Suspended Solids Mean (log mg/L),0.78,1.1,0,1.2,1.1,1.1,0,0,1.2,1.2,1.2,0,1.1,1.3,1.1,1.1,1.1,0.78,1.3,0.78
Baseflow Total Suspended Solids Standard Deviation (log mg/L),0.13,0.17,0,0.17,0.17,0.17,0,0,0.17,0.17,0.17,0,0.17,0.13,0.17,0.17,0.17,0.13,0.13,0.13
Baseflow Total Suspended Solids Estimation Method,Stochastic
Baseflow Total Suspended Solids Serial Correlation,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Baseflow Total Phosphorus Mean (log mg/L),-1.52,-0.82,0,-0.85,-0.82,-0.82,0,0,-0.85,-0.85,-0.85,0,-0.82,-1.05,-0.82,-0.82,-0.82,-1.52,-1.05,-1.52
Baseflow Total Phosphorus Standard Deviation (log mg/L),0.13,0.19,0,0.19,0.19,0.19,0,0,0.19,0.19,0.19,0,0.19,0.13,0.19,0.19,0.19,0.13,0.13,0.13

Baseflow Total Phosphorus Estimation Method,Stochastic
Baseflow Total Phosphorus Serial Correlation,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Baseflow Total Nitrogen Mean (log mg/L),-0.52,0.32,0,0.11,0.32,0.32,0,0,0.11,0.11,0.11,0,0.32,0.04,0.32,0.32,0.32,-0.52,0.04,-0.52
Baseflow Total Nitrogen Standard Deviation (log mg/L),0.13,0.12,0,0.12,0.12,0.12,0,0,0.12,0.12,0.12,0,0.12,0.13,0.12,0.12,0.12,0.13,0.13,0.13
Baseflow Total Nitrogen Estimation Method,Stochastic
Baseflow Total Nitrogen Serial Correlation,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Flow based constituent generation - enabled,Off,Off,Off,Off,Off,Off,Off,Off,Off,Off,Off,Off,Off,Off,Off,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),63.6,4.36,6.19,8.25,6.76,16.8,20.5,4.95,28.1,7.58,5.15,3.00,3.26,63.6,0.630,0.297,0.623,12.0,12.0,12.0
OUT - TSS Mean Annual Load (kg/yr),2.79E3,896,160,1.49E3,1.39E3,3.52E3,535,129,5.15E3,1.40E3,949,77.3,673,11.3E3,126,58.6,123,527,2.16E3,523
OUT - TP Mean Annual Load (kg/yr),5.69,1.82,0.941,2.45,2.81,7.02,3.14,0.753,8.21,2.23,1.53,0.454,1.37,47.3,0.256,0.120,0.255,1.08,9.09,1.06
OUT - TN Mean Annual Load (kg/yr),66.0,12.6,13.7,18.1,19.4,48.6,45.0,10.9,60.8,16.6,11.2,6.56,9.43,228,1.80,0.850,1.78,12.5,43.3,12.4
OUT - Gross Pollutant Mean Annual Load (kg/yr),2.63E3,154,207,314,239,593,685,165,1.07E3,288,196,100,115,2.63E3,27.3,12.9,27.0,497,497,497
Rain In (ML/yr),180.955,6.19863,6.49556,14.2309,9.60974,23.8517,21.5282,5.19646,48.4234,13.0728,8.8711,3.15499,4.63227,180.955,1.70741,0.80545,1.68885,34.2112,34.2112,34.2112
ET Loss (ML/yr),117.47,1.83636,0.308961,5.98082,2.84693,7.06615,1.024,0.247169,20.3511,5.49414,3.72827,0.150066,1.37233,117.47,1.07834,0.508695,1.06662,22.2088,22.2088,22.2088
Deep Seepage Loss (ML/yr),0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

Baseflow Out
(ML/yr),1.02218,0.0107737,0,0.1272,0.0167025,0.0414564,0,0,0.432825,0.116
849,0.0792927,0,0.0080513,1.02218,0.0306696,0.014468,0.0303362,0.193252,0
.193252,0.193252
Imp. Stormflow Out
(ML/yr),54.5053,4.26761,6.1866,7.96057,6.61607,16.4214,20.5042,4.94929,27
.0875,7.31275,4.96237,3.00492,3.1892,54.5053,0.587755,0.277267,0.581366,1
0.3047,10.3047,10.3047
Perv. Stormflow Out
(ML/yr),8.06286,0.0849826,0,0.166739,0.131748,0.327005,0,0,0.567364,0.153
17,0.10394,0,0.063508,8.06286,0.0119483,0.00563646,0.0118184,1.52436,1.52
436,1.52436
Total Stormflow Out
(ML/yr),62.5682,4.35259,6.1866,8.1273,6.74782,16.7484,20.5042,4.94929,27.
6549,7.46592,5.06631,3.00492,3.25271,62.5682,0.599703,0.282903,0.593184,1
1.8291,11.8291,11.8291
Total Outflow
(ML/yr),63.5904,4.36337,6.1866,8.2545,6.76453,16.7898,20.5042,4.94929,28.
0877,7.58277,5.1456,3.00492,3.26076,63.5904,0.630373,0.297371,0.62352,12.
0223,12.0223,12.0223
Change in Soil Storage (ML/yr),-0.105562,-0.00111261,0,-0.00447016,-
0.00172491,-0.00428127,0,0,-0.0152106,-0.00410639,-0.00278655,0,-
0.000831479,-0.105562,-0.00130399,-0.000615138,-0.00128981,-0.0199575,-
0.0199575,-0.0199575
TSS Baseflow Out
(kg/yr),6.44837,0.146283,0,2.17619,0.226414,0.564434,0,0,7.41224,2.0007,1
.35853,0,0.109552,21.3486,0.417095,0.196291,0.41227,1.21912,4.03015,1.218
91
TSS Total Stormflow Out
(kg/yr),2779.65,895.957,159.626,1491.33,1385.08,3515.59,534.764,129.422,5
144.22,1395.49,947.533,77.3301,672.77,11309.1,125.842,58.3819,122.144,525
.518,2156.89,521.65
TSS Total Outflow
(kg/yr),2786.1,896.103,159.626,1493.51,1385.3,3516.16,534.764,129.422,515
1.63,1397.49,948.892,77.3301,672.879,11330.4,126.259,58.5782,122.557,526.
737,2160.92,522.869
TP Baseflow Out
(kg/yr),0.0323101,0.00179039,0,0.0197325,0.00278008,0.00690461,0,0,0.0673
739,0.0181541,0.0123185,0,0.00134075,0.0953042,0.00510199,0.00240638,0.00
505805,0.00610851,0.0179762,0.00610466
TP Total Stormflow Out
(kg/yr),5.65539,1.81564,0.941201,2.4264,2.80544,7.01431,3.13979,0.752892,
8.14752,2.21405,1.5167,0.454361,1.37239,47.2099,0.250883,0.117378,0.25007
6,1.0692,9.07035,1.0586
TP Total Outflow
(kg/yr),5.6877,1.81743,0.941201,2.44613,2.80822,7.02121,3.13979,0.752892,
8.2149,2.2322,1.52902,0.454361,1.37373,47.3052,0.255985,0.119784,0.255134
,1.07531,9.08833,1.06471
TN Baseflow Out
(kg/yr),0.322544,0.0233679,0,0.17046,0.0362774,0.0900605,0,0,0.578795,0.1
56428,0.10614,0,0.0174884,1.17216,0.0665213,0.0313872,0.0658373,0.0609798
,0.221555,0.0610099
TN Total Stormflow Out
(kg/yr),65.7171,12.5625,13.6817,17.9196,19.3231,48.4794,44.9831,10.8639,6
0.2647,16.4892,11.1342,6.55916,9.41441,227.226,1.73563,0.818569,1.71545,1
2.4244,43.0376,12.3606
TN Total Outflow
(kg/yr),66.0396,12.5858,13.6817,18.0901,19.3594,48.5694,44.9831,10.8639,6

0.8435,16.6456,11.2404,6.55916,9.4319,228.398,1.80215,0.849957,1.78129,12.4854,43.2591,12.4216
GP Total Outflow (kg/yr),2629.29,154.151,206.707,313.958,238.98,593.158,685.086,165.366,1068.31,288.409,195.711,100.401,115.198,2629.29,27.3766,12.9146,27.079,497.091,497.091,497.091

No Imported Data Source nodes

USTM treatment nodes
Location,Area 1 - RWT (70 Lots),Area 3 - RWT (232 Lots),Area 2 - RWT (56 Lots),Area 4 - RWT (34 Lots),Bioretention 2 - 400m2,Bioretention 1 - 1500m2,Bioretention 3 - 4000m2,Bioretention 4 - 400m2
ID,5,13,14,22,23,24,26,35
Node Type,RainWaterTankNode,RainWaterTankNode,RainWaterTankNode,RainWaterTankNode,BioRetentionNodeV4,BioRetentionNodeV4,BioRetentionNodeV4,BioRetentionNodeV4
Lo-flow bypass rate (cum/sec),0,0,0,0,0,0,0,0
Hi-flow bypass rate (cum/sec),0.35,1.16,0.28,0.17,100,100,100,100
Inlet pond volume,0,0,0,0, , , ,
Area (sqm),126,417.6,100.8,61.2,480,1800,4800,480
Initial Volume (m^3),0,0,0,0, , , ,
Extended detention depth (m),0.05,0.05,0.05,0.05,0.3,0.3,0.3,0.3
Number of Rainwater tanks,70,232,56,34, , , ,
Permanent Pool Volume (cubic metres),210,696,168,102, , , ,
Proportion vegetated,0,0,0,0, , , ,
Equivalent Pipe Diameter (mm),837,1523,748,583, , , ,
Overflow weir width (m),10,10,10,10,5,5,5,5
Notional Detention Time (hrs),4.79E-3,4.80E-3,4.80E-3,4.80E-3, , , ,
Orifice Discharge Coefficient,0.6,0.6,0.6,0.6, , , ,
Weir Coefficient,1.7,1.7,1.7,1.7,1.7,1.7,1.7,1.7
Number of CSTR Cells,2,2,2,2,3,3,3,3
Total Suspended Solids - k (m/yr),400,400,400,400,8000,8000,8000,8000
Total Suspended Solids - C* (mg/L),12,12,12,12,20,20,20,20
Total Suspended Solids - C** (mg/L),12,12,12,12, , , ,
Total Phosphorus - k (m/yr),300,300,300,300,6000,6000,6000,6000
Total Phosphorus - C* (mg/L),0.13,0.13,0.13,0.13,0.13,0.13,0.13,0.13
Total Phosphorus - C** (mg/L),0.13,0.13,0.13,0.13, , , ,
Total Nitrogen - k (m/yr),40,40,40,40,500,500,500,500
Total Nitrogen - C* (mg/L),1.4,1.4,1.4,1.4,1.4,1.4,1.4,1.4
Total Nitrogen - C** (mg/L),1.4,1.4,1.4,1.4, , , ,
Threshold Hydraulic Loading for C** (m/yr),3500,3500,3500,3500, , , ,
Horizontal Flow Coefficient, , , , ,3,3,3,3
Reuse Enabled,On,On,On,On,Off,Off,Off,Off
Max drawdown height (m),1.66666666666667,1.66666666666667,1.66666666666667,1.66666666666667, , , ,
Annual Demand Enabled,On,On,On,On,Off,Off,Off,Off
Annual Demand Value (ML/year),24.01,79.576,19.208,11.662, , , ,
Annual Demand Distribution,PET,PET,PET,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,On,On,On,On,Off,Off,Off,Off
Daily Demand Value (ML/day),0.0658,0.21808,0.05264,0.03196, , , ,
Custom Demand Enabled,Off,Off,Off,Off,Off,Off,Off,Off
Custom Demand Time Series File, , , , , , , ,
Custom Demand Time Series Units, , , , , , , ,
Filter area (sqm), , , , ,400,1500,4000,400
Filter perimeter (m), , , , ,80,80,80,80
Filter depth (m), , , , ,0.4,0.4,0.4,0.4
Filter Median Particle Diameter (mm), , , , , , , ,
Saturated Hydraulic Conductivity (mm/hr), , , , ,100,100,100,100
Infiltration Media Porosity, , , , ,0.35,0.35,0.35,0.35
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,Vegetated with Effective Nutrient Removal Plants,Vegetated with Effective Nutrient Removal Plants
Total Nitrogen Content in Filter (mg/kg), , , , ,800,800,800,800
Orthophosphate Content in Filter (mg/kg), , , , ,55,55,55,55
Is Base Lined?, , , , ,Yes,Yes,Yes,Yes
Is Underdrain Present?, , , , ,Yes,Yes,Yes,Yes
Is Submerged Zone Present?, , , , ,No,No,No,No
Submerged Zone Depth (m), , , , , , , ,
B for Media Soil Texture,-9999,-9999,-9999,-9999,13,13,13,13
Proportion of upstream impervious area treated, , , , , , , ,
Exfiltration Rate (mm/hr),0,0,0,0,0,0,0,0
Evaporative Loss as % of PET,0,0,0,0,100,100,100,100
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, , , , ,0.61,0.61,0.61,0.61
S*, , , , ,0.37,0.37,0.37,0.37
Sw, , , , ,0.11,0.11,0.11,0.11
Sh, , , , ,0.05,0.05,0.05,0.05
Emax (m/day), , , , ,0.008,0.008,0.008,0.008
Ew (m/day), , , , ,0.001,0.001,0.001,0.001
IN - Mean Annual Flow (ML/yr),6.19,20.5,4.95,3.00,16.4,14.4,51.1,9.90
IN - TSS Mean Annual Load (kg/yr),160,535,129,77.3,1.28E3,1.04E3,4.00E3,731
IN - TP Mean Annual Load (kg/yr),0.941,3.14,0.753,0.454,4.03,3.31,12.0,2.37
IN - TN Mean Annual Load (kg/yr),13.7,45.0,10.9,6.56,40.9,34.6,123,24.3
IN - Gross Pollutant Mean Annual Load (kg/yr),207,685,165,100,27.4,20.5,99.4,10.8
OUT - Mean Annual Flow (ML/yr),1.79,5.93,1.43,0.870,15.8,12.3,45.3,9.28
OUT - TSS Mean Annual Load (kg/yr),43.0,147,34.9,20.4,304,63.0,299,112

OUT - TP Mean Annual Load (kg/yr),0.270,0.898,0.215,0.129,2.39,1.70,6.26,1.33
OUT - TN Mean Annual Load (kg/yr),3.94,12.8,3.13,1.87,22.7,12.3,47.1,11.4
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.317,1.05,0.254,0.154,0.00,0.00,0.00,0.00
Flow In (ML/yr),6.18488,20.5117,4.94944,3.0048,16.3963,14.4,51.06,9.88836
ET Loss (ML/yr),0,0,0,0,0.6338,2.10171,5.79568,0.619142
Infiltration Loss (ML/yr),0,0,0,0,0,0,0,0
Low Flow Bypass Out (ML/yr),0,0,0,0,0,0,0,0
High Flow Bypass Out (ML/yr),0.0167255,0.055433,0.0133804,0.00812381,0,0,0,0
Orifice / Filter Out (ML/yr),1.7718,5.87557,1.41722,0.860187,9.98655,11.6644,41.5292,7.1547
Weir Out (ML/yr),0.00176905,0.00255444,0.00163281,0.0012624,5.77001,0.624385,3.69601,2.11258
Transfer Function Out (ML/yr),0,0,0,0,0,0,0,0
Reuse Supplied (ML/yr),4.39749,14.5699,3.51896,2.13606,0,0,0,0
Reuse Requested (ML/yr),47.9198,160.084,38.6567,23.3229,0,0,0,0
% Reuse Demand Met,9.17678,9.1014,9.1031,9.1586,0,0,0,0
% Load Reduction,71.0537,71.0723,71.0626,71.0606,3.90175,14.6613,11.4273,6.28097
TSS Flow In (kg/yr),159.626,534.765,129.422,77.3301,1280.45,1036.67,3993.18,730.216
TSS ET Loss (kg/yr),0,0,0,0,0,0,0,0
TSS Infiltration Loss (kg/yr),0,0,0,0,0,0,0,0
TSS Low Flow Bypass Out (kg/yr),0,0,0,0,0,0,0,0
TSS High Flow Bypass Out (kg/yr),0.327256,1.11906,0.293118,0.122422,0,0,0,0
TSS Orifice / Filter Out (kg/yr),42.6333,145.407,34.5345,20.2734,30.4745,38.6256,135.269,22.3036
TSS Weir Out (kg/yr),0.0438775,0.0584947,0.0353357,0.0302898,273.312,24.3563,163.294,90.1428
TSS Transfer Function Out (kg/yr),0,0,0,0,0,0,0,0
TSS Reuse Supplied (kg/yr),80.7659,268.481,65.1894,39.307,0,0,0,0
TSS Reuse Requested (kg/yr),0,0,0,0,0,0,0,0
TSS % Reuse Demand Met,0,0,0,0,0,0,0,0
TSS % Load Reduction,73.0593,72.589,73.0626,73.5859,76.2749,93.9246,92.5232,84.6009
TP Flow In (kg/yr),0.941201,3.13979,0.752893,0.454361,4.02719,3.30464,11.9797,2.36859
TP ET Loss (kg/yr),0,0,0,0,0,0,0,0
TP Infiltration Loss (kg/yr),0,0,0,0,0,0,0,0
TP Low Flow Bypass Out (kg/yr),0,0,0,0,0,0,0,0
TP High Flow Bypass Out (kg/yr),0.00295812,0.0118826,0.00163554,0.000870147,0,0,0,0
TP Orifice / Filter Out (kg/yr),0.266761,0.88585,0.213427,0.128168,1.32656,1.59054,5.63199,0.956792
TP Weir Out (kg/yr),0.000265152,0.000358957,0.000229867,0.000161073,1.05754,0.106031,0.615379,0.372822
TP Transfer Function Out (kg/yr),0,0,0,0,0,0,0,0
TP Reuse Supplied (kg/yr),0.623448,2.07253,0.498972,0.302034,0,0,0,0
TP Reuse Requested (kg/yr),0,0,0,0,0,0,0,0
TP % Reuse Demand Met,0,0,0,0,0,0,0,0

TP % Load
Reduction,71.3149,71.3965,71.4046,71.5646,40.7999,48.6609,47.8503,43.8647
TN Flow In
(kg/yr),13.6817,44.9829,10.8639,6.55917,40.8596,34.5597,122.9,24.2723
TN ET Loss (kg/yr),0,0,0,0,0,0,0,0
TN Infiltration Loss (kg/yr),0,0,0,0,0,0,0,0
TN Low Flow Bypass Out (kg/yr),0,0,0,0,0,0,0,0
TN High Flow Bypass Out
(kg/yr),0.0523528,0.11612,0.0267132,0.0138261,0,0,0,0
TN Orifice / Filter Out
(kg/yr),3.88476,12.7239,3.09761,1.84887,9.09134,10.9375,38.8312,6.52909
TN Weir Out
(kg/yr),0.00385786,0.00520012,0.00349465,0.00240638,13.6071,1.39001,8.247
44,4.83566
TN Transfer Function Out (kg/yr),0,0,0,0,0,0,0,0
TN Reuse Supplied (kg/yr),9.31209,30.7721,7.40871,4.49669,0,0,0,0
TN Reuse Requested (kg/yr),0,0,0,0,0,0,0,0
TN % Reuse Demand Met,0,0,0,0,0,0,0,0
TN % Load
Reduction,71.1954,71.4441,71.2091,71.565,44.4476,64.33,61.6935,53.178
GP Flow In
(kg/yr),206.707,685.086,165.366,100.401,27.3694,20.4569,99.3783,10.7986
GP ET Loss (kg/yr),0,0,0,0,0,0,0,0
GP Infiltration Loss (kg/yr),0,0,0,0,0,0,0,0
GP Low Flow Bypass Out (kg/yr),0,0,0,0,0,0,0,0
GP High Flow Bypass Out (kg/yr),0.31747,1.05219,0.253976,0.1542,0,0,0,0
GP Orifice / Filter Out (kg/yr),0,0,0,0,0,0,0,0
GP Weir Out (kg/yr),0,0,0,0,0,0,0,0
GP Transfer Function Out (kg/yr),0,0,0,0,0,0,0,0
GP Reuse Supplied (kg/yr),0,0,0,0,0,0,0,0
GP Reuse Requested (kg/yr),0,0,0,0,0,0,0,0
GP % Reuse Demand Met,0,0,0,0,0,0,0,0
GP % Load Reduction,99.8464,99.8464,99.8464,99.8464,100,100,100,100
PET Scaling Factor, , , , ,2.1,2.1,2.1,2.1

Generic treatment nodes
Location,Ecosol GPT- TFR Low Flow- 4750 ,Ecosol GPT- TFR Low Flow- 4750
,Ecosol GPT- TFR Low Flow- 4750 ,Ecosol GPT- TFR Low Flow- 41200
ID,29,30,31,32
Node Type,GPTNode,GPTNode,GPTNode,GPTNode
Lo-flow bypass rate (cum/sec),0,0,0,0
Hi-flow bypass rate (cum/sec),0.219,0.219,0.219,0.561
Flow Transfer Function
Input (cum/sec),0,0,0,0
Output (cum/sec),0,0,0,0
Input (cum/sec),10,10,10,10
Output (cum/sec),10,10,10,10
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), , , ,

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Output (cum/sec), , , ,
Input (cum/sec), , , ,
Output (cum/sec), , , ,
Input (cum/sec), , , ,
Output (cum/sec), , , ,
Gross Pollutant Transfer Function
Enabled,True,True,True,True
Input (kg/ML),0,0,0,0
Output (kg/ML),0,0,0,0
Input (kg/ML),1000,1000,1000,1000
Output (kg/ML),20,20,20,20
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,True,True
Input (mg/L),0,0,0,0
Output (mg/L),0,0,0,0
Input (mg/L),1000,1000,1000,1000
Output (mg/L),999,999,999,999
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,True,True
Input (mg/L),0,0,0,0
Output (mg/L),0,0,0,0
Input (mg/L),1000,1000,1000,1000
Output (mg/L),710,710,710,710
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,True,True
Input (mg/L),0,0,0,0
Output (mg/L),0,0,0,0
Input (mg/L),1000,1000,1000,1000
Output (mg/L),390,390,390,390
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,Off,Off
TSS Flow based Efficiency, , , ,
TP Flow based Efficiency Enabled,Off,Off,Off,Off
TP Flow based Efficiency, , , ,
TN Flow based Efficiency Enabled,Off,Off,Off,Off
TN Flow based Efficiency, , , ,
GP Flow based Efficiency Enabled,Off,Off,Off,Off
GP Flow based Efficiency, , , ,
IN - Mean Annual Flow (ML/yr),9.90,16.4,14.4,51.1
IN - TSS Mean Annual Load (kg/yr),1.76E3,2.94E3,2.43E3,8.87E3
IN - TP Mean Annual Load (kg/yr),3.29,5.51,4.53,16.3
IN - TN Mean Annual Load (kg/yr),24.3,40.9,34.6,123
IN - Gross Pollutant Mean Annual Load (kg/yr),338,555,468,1.67E3
OUT - Mean Annual Flow (ML/yr),9.90,16.4,14.4,51.1
OUT - TSS Mean Annual Load (kg/yr),731,1.28E3,1.04E3,4.00E3
OUT - TP Mean Annual Load (kg/yr),2.37,4.03,3.31,12.0
OUT - TN Mean Annual Load (kg/yr),24.3,40.9,34.6,123
OUT - Gross Pollutant Mean Annual Load (kg/yr),10.8,27.4,20.5,99.4
Flow In (ML/yr),9.88836,16.3963,14.4,51.06
ET Loss (ML/yr),0,0,0,0
Infiltration Loss (ML/yr),0,0,0,0
Low Flow Bypass Out (ML/yr),0,0,0,0
High Flow Bypass Out (ML/yr),0.38389,1.28263,1.00622,5.1964

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Orifice / Filter Out (ML/yr),0,0,0,0
Weir Out (ML/yr),0,0,0,0
Transfer Function Out (ML/yr),9.50485,15.1151,13.3939,45.8693
Reuse Supplied (ML/yr),0,0,0,0
Reuse Requested (ML/yr),0,0,0,0
% Reuse Demand Met,0,0,0,0
% Load Reduction,-0.00381161,-0.00873694,-0.00100612,-0.0110252
TSS Flow In (kg/yr),1763.38,2941.9,2431.04,8867.15
TSS ET Loss (kg/yr),0,0,0,0
TSS Infiltration Loss (kg/yr),0,0,0,0
TSS Low Flow Bypass Out (kg/yr),0,0,0,0
TSS High Flow Bypass Out (kg/yr),69.6738,218.17,145.249,877.331
TSS Orifice / Filter Out (kg/yr),0,0,0,0
TSS Weir Out (kg/yr),0,0,0,0
TSS Transfer Function Out (kg/yr),660.578,1062.31,891.428,3116.09
TSS Reuse Supplied (kg/yr),0,0,0,0
TSS Reuse Requested (kg/yr),0,0,0,0
TSS % Reuse Demand Met,0,0,0,0
TSS % Load Reduction,58.588,56.4742,57.3567,54.9638
TP Flow In (kg/yr),3.28399,5.50655,4.53004,16.2412
TP ET Loss (kg/yr),0,0,0,0
TP Infiltration Loss (kg/yr),0,0,0,0
TP Low Flow Bypass Out (kg/yr),0,0,0,0
TP High Flow Bypass Out (kg/yr),0.127551,0.404419,0.305323,1.54951
TP Orifice / Filter Out (kg/yr),0,0,0,0
TP Weir Out (kg/yr),0,0,0,0
TP Transfer Function Out (kg/yr),2.24117,3.62299,2.99964,10.4314
TP Reuse Supplied (kg/yr),0,0,0,0
TP Reuse Requested (kg/yr),0,0,0,0
TP % Reuse Demand Met,0,0,0,0
TP % Load Reduction,27.8705,26.8615,27.0434,26.2314
TN Flow In (kg/yr),24.296,40.8969,34.5917,123.012
TN ET Loss (kg/yr),0,0,0,0
TN Infiltration Loss (kg/yr),0,0,0,0
TN Low Flow Bypass Out (kg/yr),0,0,0,0
TN High Flow Bypass Out (kg/yr),0.901739,3.13482,2.43658,12.5367
TN Orifice / Filter Out (kg/yr),0,0,0,0
TN Weir Out (kg/yr),0,0,0,0
TN Transfer Function Out (kg/yr),23.3709,37.7248,32.1243,110.369
TN Reuse Supplied (kg/yr),0,0,0,0
TN Reuse Requested (kg/yr),0,0,0,0
TN % Reuse Demand Met,0,0,0,0
TN % Load Reduction,0.0961404,0.0912074,0.0893198,0.0861319
GP Flow In (kg/yr),337.869,554.667,468.117,1674.25
GP ET Loss (kg/yr),0,0,0,0
GP Infiltration Loss (kg/yr),0,0,0,0
GP Low Flow Bypass Out (kg/yr),0,0,0,0
GP High Flow Bypass Out (kg/yr),4.20503,16.8759,11.5081,68.2205
GP Orifice / Filter Out (kg/yr),0,0,0,0
GP Weir Out (kg/yr),0,0,0,0
GP Transfer Function Out (kg/yr),6.59373,10.4952,8.94777,31.155
GP Reuse Supplied (kg/yr),0,0,0,0
GP Reuse Requested (kg/yr),0,0,0,0
GP % Reuse Demand Met,0,0,0,0
GP % Load Reduction,98.7554,96.9575,97.5416,95.9253
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Other nodes

Location,Post-Development Node,Junction - Area 1 - 7.254ha,Junction - Area 2 - 7.971ha,Junction - Area 3 - 25.489ha,Junction - Area 4 - 4.943ha,Pre-Development Node,Predeveloped - Agricultural,Post-Developed - Junction - South west outlet,Post Developed - Junction - West Outlet
ID,6,15,16,17,18,25,28,37,38
Node Type,PostDevelopmentNode,JunctionNode,JunctionNode,JunctionNode,JunctionNode,PreDevelopmentNode,JunctionNode,JunctionNode,JunctionNode
IN - Mean Annual Flow (ML/yr),94.7,14.4,16.4,51.1,9.90,75.6,75.6,9.28,85.4
IN - TSS Mean Annual Load (kg/yr),1.30E3,2.43E3,2.94E3,8.87E3,1.76E3,3.31E3,13.5E3,112,1.19E3
IN - TP Mean Annual Load (kg/yr),12.7,4.53,5.51,16.3,3.29,6.76,56.4,1.33,11.4
IN - TN Mean Annual Load (kg/yr),106,34.6,40.9,123,24.3,78.5,272,11.4,94.6
IN - Gross Pollutant Mean Annual Load (kg/yr),497,468,555,1.67E3,338,3.12E3,3.12E3,0.00,497
OUT - Mean Annual Flow (ML/yr),94.7,14.4,16.4,51.1,9.90,75.6,75.6,9.28,85.4
OUT - TSS Mean Annual Load (kg/yr),1.30E3,2.43E3,2.94E3,8.87E3,1.76E3,3.31E3,13.5E3,112,1.19E3
OUT - TP Mean Annual Load (kg/yr),12.7,4.53,5.51,16.3,3.29,6.76,56.4,1.33,11.4
OUT - TN Mean Annual Load (kg/yr),106,34.6,40.9,123,24.3,78.5,272,11.4,94.6
OUT - Gross Pollutant Mean Annual Load (kg/yr),497,468,555,1.67E3,338,3.12E3,3.12E3,0.00,497
% Load Reduction,26.3,23.4,17.6,22.2,17.7,51.5E-12,51.5E-12,22.9,26.7
TSS % Load Reduction,92.4,4.57,3.11,4.19,3.12,-261E-15,-2.78E-12,93.8,92.3
TN % Load Reduction,63.4,22.0,15.9,20.7,16.2,-1.61E-12,439E-15,60.8,63.7
TP % Load Reduction,63.0,12.9,8.89,12.1,9.00,2.34E-12,-4.40E-12,63.1,63.0
GP % Load Reduction,89.4,30.6,22.9,29.0,22.9,4.50E-12,4.50E-12,100,88.3

Links
Location,Drainage Link
Source node ID,10,14,7,12,3,2,4,5,9,11,13,8,19,20,22,1,27,18,16,15,17,32,30,31,33,34,36,21,29,35,26,23,24,39,40,38,37,41
Target node ID,14,16,16,16,5,15,15,15,13,17,17,17,18,22,18,25,28,29,30,31,32,26,23,24,16,17,18,18,35,37,38,38,38,25,28,6,6,38
Muskingum-Cunge Routing,Not Routed

Muskingum K, ,
Muskingum theta, ,
IN - Mean Annual Flow (ML/yr),4.95,1.43,6.76,7.58,6.19,4.36,8.25,1.79,20.5,28.1,5.93,16.8,5.15,3.00,0.870,63.6,63.6,9.90,16.4,14.4,51.1,51.1,16.4,14.4,0.630,0.297,0.623,3.26,9.90,9.28,45.3,15.8,12.3,12.0,12.0,85.4,9.28,12.0
IN - TSS Mean Annual Load (kg/yr),129,34.9,1.39E3,1.40E3,160,896,1.49E3,43.0,535,5.15E3,147,3.52E3,949,77.3,20.4,2.79E3,11.3E3,1.76E3,2.94E3,2.43E3,8.87E3,4.00E3,1.28E3,1.04E3,126,58.6,123,673,731,112,299,304,63.0,527,2.16E3,1.19E3,112,523
IN - TP Mean Annual Load (kg/yr),0.753,0.215,2.81,2.23,0.941,1.82,2.45,0.270,3.14,8.21,0.898,7.02,1.53,0.454,0.129,5.69,47.3,3.29,5.51,4.53,16.3,12.0,4.03,3.31,0.256,0.120,0.255,1.37,2.37,1.33,6.26,2.39,1.70,1.08,9.09,11.4,1.33,1.06
IN - TN Mean Annual Load (kg/yr),10.9,3.13,19.4,16.6,13.7,12.6,18.1,3.94,45.0,60.8,12.8,48.6,11.2,6.56,1.87,66.0,228,24.3,40.9,34.6,123,123,40.9,34.6,1.80,0.850,1.78,9.43,24.3,11.4,47.1,22.7,12.3,12.5,43.3,94.6,11.4,12.4
IN - Gross Pollutant Mean Annual Load (kg/yr),165,0.254,239,288,207,154,314,0.317,685,1.07E3,1.05,593,196,100,0.154,2.63E3,2.63E3,338,555,468,1.67E3,99.4,27.4,20.5,27.3,12.9,27.0,115,10.8,0.00,0.00,0.00,0.00,497,497,497,0.00,497
OUT - Mean Annual Flow (ML/yr),4.95,1.43,6.76,7.58,6.19,4.36,8.25,1.79,20.5,28.1,5.93,16.8,5.15,3.00,0.870,63.6,63.6,9.90,16.4,14.4,51.1,51.1,16.4,14.4,0.630,0.297,0.623,3.26,9.90,9.28,45.3,15.8,12.3,12.0,12.0,85.4,9.28,12.0
OUT - TSS Mean Annual Load (kg/yr),129,34.9,1.39E3,1.40E3,160,896,1.49E3,43.0,535,5.15E3,147,3.52E3,949,77.3,20.4,2.79E3,11.3E3,1.76E3,2.94E3,2.43E3,8.87E3,4.00E3,1.28E3,1.04E3,126,58.6,123,673,731,112,299,304,63.0,527,2.16E3,1.19E3,112,523
OUT - TP Mean Annual Load (kg/yr),0.753,0.215,2.81,2.23,0.941,1.82,2.45,0.270,3.14,8.21,0.898,7.02,1.53,0.454,0.129,5.69,47.3,3.29,5.51,4.53,16.3,12.0,4.03,3.31,0.256,0.120,0.255,1.37,2.37,1.33,6.26,2.39,1.70,1.08,9.09,11.4,1.33,1.06
OUT - TN Mean Annual Load (kg/yr),10.9,3.13,19.4,16.6,13.7,12.6,18.1,3.94,45.0,60.8,12.8,48.6,11.2,6.56,1.87,66.0,228,24.3,40.9,34.6,123,123,40.9,34.6,1.80,0.850,1.78,9.43,24.3,11.4,47.1,22.7,12.3,12.5,43.3,94.6,11.4,12.4
OUT - Gross Pollutant Mean Annual Load (kg/yr),165,0.254,239,288,207,154,314,0.317,685,1.07E3,1.05,593,196,100,0.154,2.63E3,2.63E3,338,555,468,1.67E3,99.4,27.4,20.5,27.3,12.9,27.0,115,10.8,0.00,0.00,0.00,0.00,497,497,497,0.00,497

Catchment Details
Catchment Name,NSW202732_DA MUSIC - LIDELL DATA_UK1_090222
Timestep,6 Minutes
Start Date,23/08/1964
End Date,31/03/1995 11:54:00 PM
Rainfall Station, 61212 LIDDELL
ET Station,User-defined monthly PET
Mean Annual Rainfall (mm), 372
Mean Annual ET (mm), 1606