Proposed Subdivision Freeway North Business Park Stage 6

MUSIC Modelling Report

Hunter Land

Revision: 2
Version Date: 17 April 2019

GCA
ENGINEERING SOLUTIONS

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Revision	Description	Author		Review		Approved	
1	Original Issue	A.M	01.04.19	I.H	01.04.19	I.H	01.04.19
2	GPT Amendments	A.M	17.04.19	I.H	17.04.19	I.H	17.04.19
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1.   Executive Summary

This stormwater management plan provides the recommended measures to ensure that the stormwater run-off from the public road reserves of the development of Stage 6 of Freeway North Business Park will satisfy Council pollution retention targets as specified in Element 7.06 of Newcastle City Council's DCP 2012. These targets are as follows:

- · 85% Retention of Total Suspended Solids
- · 65% Retention of Total Phosphorus
- · 45% Retention of Total Nitrogen
- · 90% Retention of Gross Pollutants

The subdivision as a whole has not been addressed in this report as per Stage 5, each lot will provide lot-scale stormwater management plans to meet the pollutant retention targets pursuant to Council requirements. As such, only the proposed public road reserves have been considered.

The recommended stormwater quality measures that form the treatment train are:

- · A Rocla CDS
- · A Bio-retention Basin

Contained within this report is an assessment of the proposed stormwater management plan demonstrating that the abovementioned stormwater quality devices will effectively meet Council's pollutant retention targets.

2. Introduction

2.1 Background

This report is to support a proposed subdivision of Lot 124 DP1180585 located at Canavan Drive Beresfield.

This stormwater management plan has been prepared for Newcastle City Council (NCC) to support the proposed development of Stage 6 of the Freeway North Business Park.

2.2 Site Description

The site is located on the southwestern side of Canavan Drive and to the east of Scotch Dairy Creek.

The site has previously been regraded to meet the requirements of a previous development which did not occur and consists of multiple large 'flat' pad areas. There is an existing pit in the North-western corner of the site which will be the main point of connection for stormwater for the subdivision. This pit outlets via an existing headwall to Scotch Dairy Creek.

2.3 Proposed Development

The proposed subdivision consists of 29 industrial lots ranging between $1500m^2$ and $15062m^2$, and a drainage reserve. The contributing catchment area for the purpose of this stormwater management plan comprises the total road reserve area only which is $15650m^2$. Lots areas will be modelled with the minimum removal targets which each lot needs to achieve.

2.4 Water Quality Treatment Targets

The treatment targets for the proposed development site were adopted from Table 3 of Section 7.06 of NCCs DCP. These targets are shown in.

Table 1: Stormwater Quality Treatment Targets

Pollutant	Stormwater Retention Treatment Target
Total Suspended Solids (TSS)	85% of average annual load
Total Phosphorus (TP)	65% of average annual load
Total Nitrogen (TN)	45% of average annual load
Gross Pollutants (GP)	90% of average annual load

3. Water Quality

3.1 Methodology

It is proposed that each lot within the subdivision will be required to provide their own stormwater treatment trains to meet the targets set by Newcastle City Council. For the road areas it is proposed to provide a Gross Pollutant Trap and Bioretention Basin to ensure the development meets the required targets.

The *Model for Urban Stormwater Improvement Conceptualisation* (MUSIC) published by eWater Limited is the currently accepted best practice tool for estimating the amelioration effects of proposed stormwater treatment trains with regard to water quality in urban development. MUSIC was used to confirm that total outflow from the proposed development will meet the relevant criteria.

The treatment train shall provide sufficient treatment capacity to meet Council's targets (as outlined in Section 2.4) for the proposed public road reserve.

3.2 Stormwater Quality Model

3.2.1 Rainfall and Evapotranspiration

The rainfall data used for the model was obtained from within the MUSIC program under the MUSIC-link data for NCC. The rainfall station is located at Williamtown (Station 61078) with records from 01/01/2002 to 31/12/2006. The long-term average annual rainfall for this data is 974mm per year.

Monthly average Potential Evapotranspiration (PET) values were obtained using the default MUSIC values for Newcastle and are summarised in Table 2. The total annual average PET was 1730mm.

Table 2: Monthly Average Potential Evapotranspiration Values

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evapotranspiration (mm/month)	214	174	152	114	84	75	81	112	141	171	189	223

3.2.2 Timestep

The model was run with a time step of 6 minutes as this was the time step of the rainfall data used from the Williamtown station. The rainfall data was adopted from the default NCC MUSIC-link data within the MUSIC program.

3.2.3 Land Use

The following land use type was used in MUSIC to simulate the developed state:

· Roads - comprising road reserve area. This was assigned a "Sealed Roads" surface type.

· Lots - comprising lot area. This was assigned a "Industrial Lots" surface type

3.2.4 Hydrology

Hydrology parameters used in the model for the land use were adopted from the default NCC MUSIC nodes within the program. It should be noted however, that the impervious area percentage was adjusted to better represent the road reserve. A summary of these parameters is shown in Table 3.

Table 3: MUSIC Hydrology Parameters

Parameter	Roads	Lots
Surface Type Classification	Sealed Roads	Industrial
Impervious Area		
Impervious Percentage	70%	90%
Rainfall Threshold (mm/day)	1.0	1.0
Pervious Area		
Soil Storage Capacity (mm)	170	170
Initial Storage (% of Capacity)	30	30
Field Capacity (mm)	70	70
Infiltration Capacity Coefficient - a	210	210
Infiltration Capacity Exponent - b	4.70	4.70
Ground Water Properties		
Initial Depth (mm)	10	10
Daily Recharge Rate (%)	50	50
Daily Base Flow Rate (%)	5	5
Daily Seepage Rate (%)	0	0

3.2.5 Pollutant Concentrations

The pollutant concentration parameter values for the developed state were adopted from the default NCC MUSIC nodes within the program and are summarised in Table 4.

Table 4: Base Flow and Storm Flow Pollutant Concentration Parameters

Land Use	Total Suspended Solids (TSS) $\log_{10}$ mg/L		Total Phosphorus (TP) $\log_{10}$ mg/L		Total Nitrogen (TN) $\log_{10}$ mg/L	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Roads – Base flow	1.20	0.17	-0.85	0.19	0.11	0.12
Roads – Storm flow	2.43	0.32	-0.30	0.25	0.34	0.19
Lots – Base flow	1.20	0.17	-0.85	0.19	0.11	0.12
Lots – Storm flow	2.15	0.32	-0.60	0.25	0.30	0.19

3.3   Treatment Node Parameters

3.3.1   Treatment Train Removal Efficiencies

Lot Controls

A generic treatment node was used to model the minimum removal targets required by each lot as most outlet to the road drainage network. The parameters for these nodes are summarised in Table 5.

Table 5: Lot Treatment Parameters

Pollutant	Stormwater Removal Efficiency
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	65%
Total Nitrogen (TN)	45%

Gross Pollutant Trap – Rocla CDS 2018

MUSIC Treatment Nodes were supplied by Rocla for the proposed CDS Gross Pollutant Trap (GPT). The adopted model parameters for the Rocla GPT are summarised in 6.

Table 6: Supplied Rocla CDS Treatment Parameters

Parameter	Value
High Flow Bypass	0.55 m^3/s
Total Suspended Solids (TSS) Removal Rate	70%
Total Phosphorus (TP) Removal Rate	30%
Total Nitrogen (TN) Removal Rate	0%
Gross Pollutants (GP) Removal Rate	98%

Bio-retention Basin

The basin was modelled using the Bio-retention Basin treatment node in MUSIC. Table 7 shows the key parameters used in the modelling.

Table 7: Bio-retention Basin Treatment Parameters

State	Bio-retention Basin
Inlet Properties	
Low Flow By-pass (m^3/s)	0.000
High Flow By-pass (m^3/s)	0.550
Storage Properties	
Extended Detention Depth (m)	0.30
Surface Area (m^2)	300
Filter and Media Properties	
Filter Area (m^2)	280
Unlined Filter Media Perimeter (m)	0.01
Saturated Hydraulic Conductivity (mm/hr)	180
Filter Depth (m)	0.40
TN Content of Filter Media (mg/kg)	800
Orthophosphate Content of Filter Media (mg/kg)	45.0
Filter and Media Properties	
Exfiltration Rate (mm/hr)	0.00

3.4   MUSIC Model Results

The average annual pollutant loadings for developed conditions are shown in Table 8, including the effectiveness of the proposed treatment train in retaining the various pollutants.

Table 8: Effectiveness of the Proposed Treatment Train in Reducing Pollutants

Pollutant	Developed Source Generation	Export After Treatment	Treatment Train Effectiveness[1]	NCC Treatment Effectiveness Target
TSS (kg/yr)	26500	2700	89.8%	85%
TP (kg/yr)	43.2	14.4	66.5%	65%
TN (kg/yr)	295	146	50.6%	45%
GP (kg/yr)	3720	33.6	99.2%	90%

From Table 8 it can be seen that the proposed treatment train is expected to be effective in reducing post-developed average annual pollutant loads in accordance with Council requirements.

4. Conclusions and Recommendations

The proposed stormwater treatment train outlined below is recommended to treat the stormwater run-off from the proposed Stage 6 road reserves of the Freeway North Business Park:

· A Gross Pollutant Trap as a treatment device for gross pollutants and coarse sediment prior to discharge to the bioretention basin.

· A bioretention basin located in the north-western corner of the development as a treatment device for nutrients and fine sediment prior to discharging to Scotch Dairy Creek,

MUSIC modelling results indicated that the above combination is capable of achieving Council's retention targets outlined in Newcastle City Council DCP 2012, Element 7.06.

It is noted that it is proposed that each lot within the subdivision will be required to provide their own stormwater treatment trains to meet the targets set by Newcastle City Council.

Figures

LEGEND

—— -PROPOSED STORMWATER

━ ━ ━ -CATCHMENT BOUNDARY

BIORETENTION BASIN
INVERT LEVEL = R.L. 15.60
TOP WATER LEVEL = R.L. 15.90
TOP OF BANK LEVEL = R.L. 16.00
MIN FILTER AREA = 300m²
MIN FILTER MEDIA DEPTH = 0.40

GROSS POLLUTANT TRAP
ROCLA CDS 2018
TFR = 0.550m³/s

CANAVAN DRIVE

ROAD 2

ROAD 1

ELWELL CLOSE

625 626 627 628 629 630

602 601

623 613 611 603

622 614

621 615 612 610 604

620 616 609 605

617 608 606

619 618 607

ALL LOTS WILL BE REQUIRED TO
PROVIDE CONTROLS WHICH MEET
THE POLLUTANT REMOVAL
TARGETS OUTLINED BY NCC
TSS = 85%
TP = 65%
TN = 45%

EXISTING
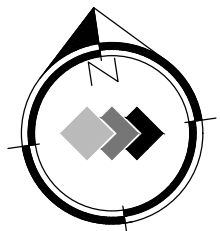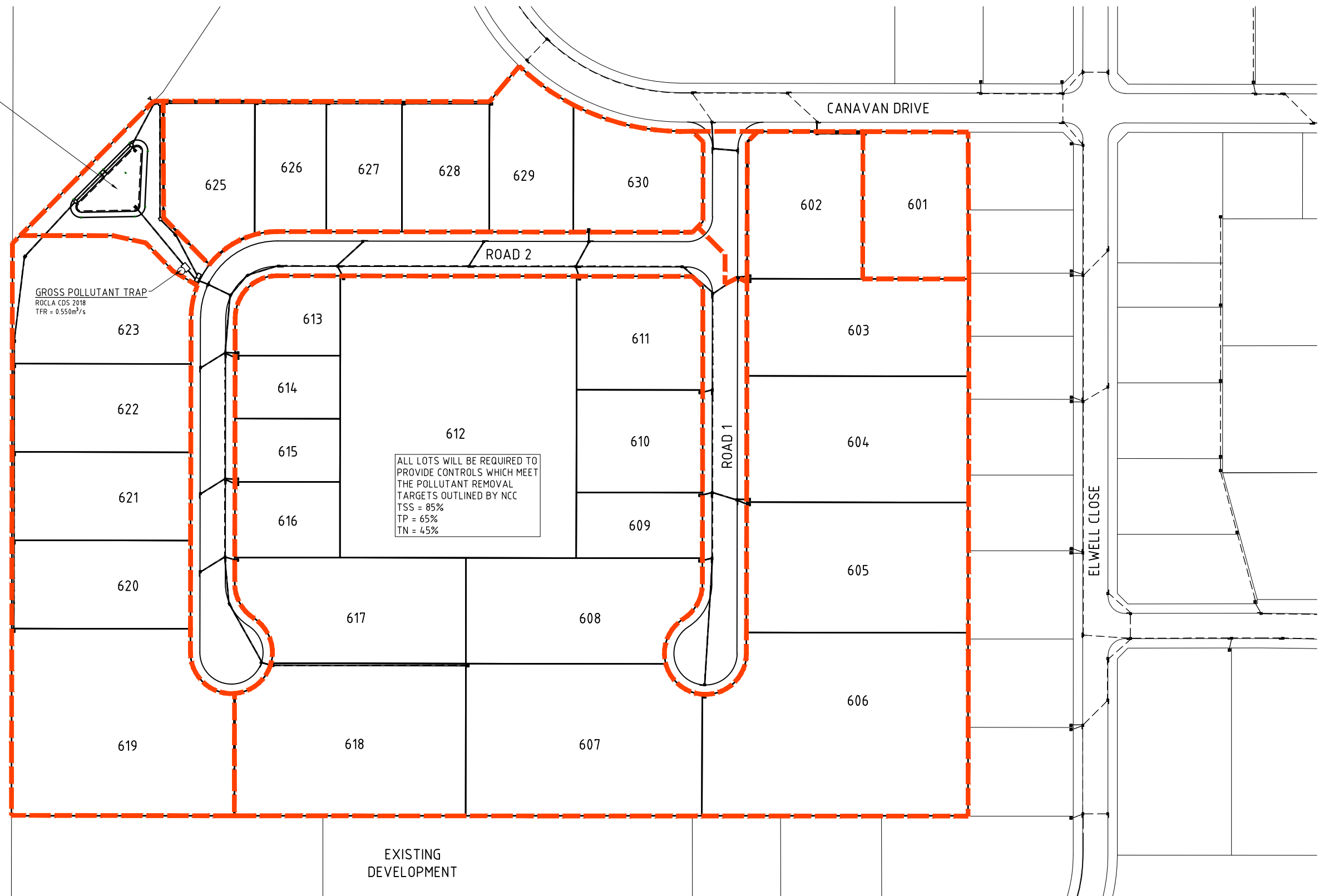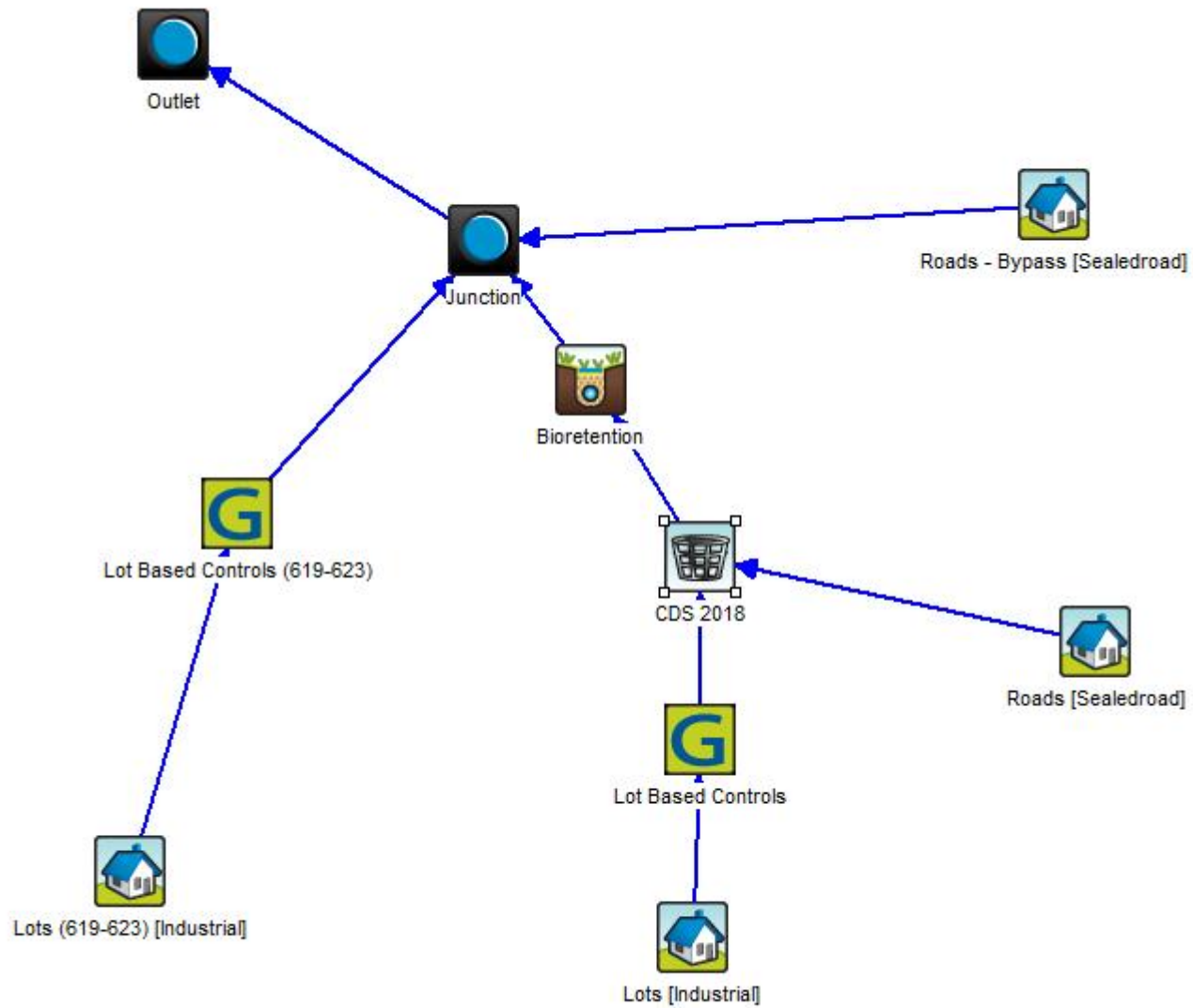DEVELOPMENT

FIGURE 1
STORMWATER MANAGEMENT PLAN

0   40   80   120 m
1:2000

DWG REF: 18280C dF01 r2   DATE: 17.04.19

Appendix A

MUSIC Node Layout

Appendix B

MUSICLink Report

MUSIC-*link* Report

Project Details		Company Details	
Project:	Freeway North Stage 6	**Company:**	GCA Engineering Solutions
Report Export Date:	17/04/2019	**Contact:**	Ian Hill
Catchment Name:	18280 FNBP Stage 7 r3	**Address:**	1 Hartley Drive Thornton NSW 2322
Catchment Area:	14.505ha	**Phone:**	0249641811
Impervious Area*:	88.12%	**Email:**	ian@gca.net.au
Rainfall Station:	61078 WILLIAMTOWN		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1995 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	1125mm		
Evapotranspiration:	1735mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.31		
Study Area:	Newcastle		
Scenario:	Newcastle		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Outlet	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	0.667%	Bio Retention Node	1	Urban Source Node	4
TSS	89.8%	Generic Node	2		
TP	66.5%	GPT Node	1		
TN	50.6%				
GP	99.1%				

Comments

NOTE: A successful self-validation check of your model does not constitute an approved model by The City of Newcastle
MUSIC-*link* now in MUSIC by eWater – leading software for modelling stormwater solutions

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Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	0.55
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
GPT	CDS 2018	Hi-flow bypass rate (cum/sec)	None	None	0.55
Urban	Lots	Area Impervious (ha)	None	None	9.642
Urban	Lots	Area Pervious (ha)	None	None	1.032
Urban	Lots	Total Area (ha)	None	None	10.67
Urban	Lots (619-623)	Area Impervious (ha)	None	None	2.045
Urban	Lots (619-623)	Area Pervious (ha)	None	None	0.219
Urban	Lots (619-623)	Total Area (ha)	None	None	2.265
Urban	Roads	Area Impervious (ha)	None	None	1.021
Urban	Roads	Area Pervious (ha)	None	None	0.438
Urban	Roads	Total Area (ha)	None	None	1.46
Urban	Roads - Bypass	Area Impervious (ha)	None	None	0.073
Urban	Roads - Bypass	Area Pervious (ha)	None	None	0.031
Urban	Roads - Bypass	Total Area (ha)	None	None	0.105

Only certain parameters are reported when they pass validation