MOTT MACDONALD

Investec

Stormwater Management Plan

Wickham Woolstores

3rd July 2017

Mott MacDonald
383 Kent Street
Sydney NSW 2000
PO Box Q1678, QVB
Sydney, NSW 1230
Australia

T +61 (0)2 9098 6800
F +61 (0)2 9098 6810
mottmac.com

Investec
Level 23,
The Chifley Tower,
2 Chifley Square,
NSW 2000
Australia

Stormwater Management Plan

Wickham Woolstores

3rd July 2017

Investec

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	23/06/17	A. Zou G. Hosseini	J. Gilligan S. Reilly	J. Gilligan	Issued for Comments
B	03/07/17	A. Zou	J. Gilligan	J. Gilligan	Issued for DA

Document reference: 366163 | 1 | B

Information class: Standard

Contents

1 Introduction

Mott MacDonald (MM) has been commissioned by Investec Australia Limited to prepare a water cycle management plan for the proposed mixed-use urban domain at Wickham Woolstores. This report will be lodged with Newcastle City Council to support the Development Application (DA). The report details the modelling, procedures and results obtained in developing the water cycle management plan for the site.

1.1 Objectives

This report was prepared by MM and details the procedures and results from analysis undertaken in developing the stormwater management strategy for the Wickham Woolstores development in Newcastle. It supports the masterplan by providing engineering input with respect to an integrated approach to flood risk management and water sensitive urban design (WSUD).

1.2 Scope of Work

The purpose of the analyses was to:

- Undertake a hydrologic, hydraulic and water quality assessment of the proposed development as an integrated approach to flood risk and stormwater management;
- Design a pit and pipe network with necessary discharge controls to restrict the developed flows to the existing flows;
- Design a water quality treatment train to address the pollution reduction targets set out by Newcastle City Council; and
- Undertake a flooding desktop assessment to demonstrate that proposed developments are compliant with Council standards and current Flood Certificate.

The following methodology has been adopted to assess the above scope of work:

- Collate the existing site data;
- Review design controls and requirements set out by Newcastle City Council;
- Undertake a hydrologic catchment analysis to compare existing site flows to proposed developed flows and determine stormwater detention strategies;
- Assess the impact the proposed development has on regional water quality and develop water quality treatment strategies; and
- Undertake hydraulic modelling to assess the impact the proposed development has on surrounding environs and determine appropriate modifications required to minimise the impact on surrounding land.

1.3 Civil Engineering Documentation for Development Application

The following drawings have been prepared as part of the civil engineering documentation for development application:

DA-1001 – Cover Sheet

DA-1002 – General Notes Sheet

DA-1003 – Legends Sheet

DA-1010 – General Arrangement Plan

DA-1012 – Siteworks Grading Plan Sheet 1

DA-1013 – Siteworks Grading Plan Sheet 2

DA-1014 – Siteworks Grading Plan Sheet 3

DA-1015 – Siteworks Grading Plan Sheet 4

DA-1016 – Siteworks Grading Plan Sheet 5

DA-1020 – Typical Road Cross Sections – Sheet 1

DA-1021 – Typical Road Cross Sections – Sheet 2

DA-1030 – Soil and Water Management Plan

DA-1035 – Soil and Water Management notes and Details

DA-1040 – Stormwater Management Plan Sheet 1

DA-1041 – Stormwater Management Plan Sheet 2

DA-1042 – Stormwater Management Plan Sheet 3

DA-1043 – Stormwater Management Plan Sheet 4

DA-1044 – Stormwater Management Plan Sheet 5

DA-1050 – Road Longitudinal Sections Sheet 1

DA-1051 – Road Longitudinal Sections Sheet 2

DA-1060 – Siteworks and Stormwater Drainage Details Sheet 1

DA-1061 – Siteworks and Stormwater Drainage Details Sheet 2

DA-1070 – Above Ground Detention Basin Plan and Section

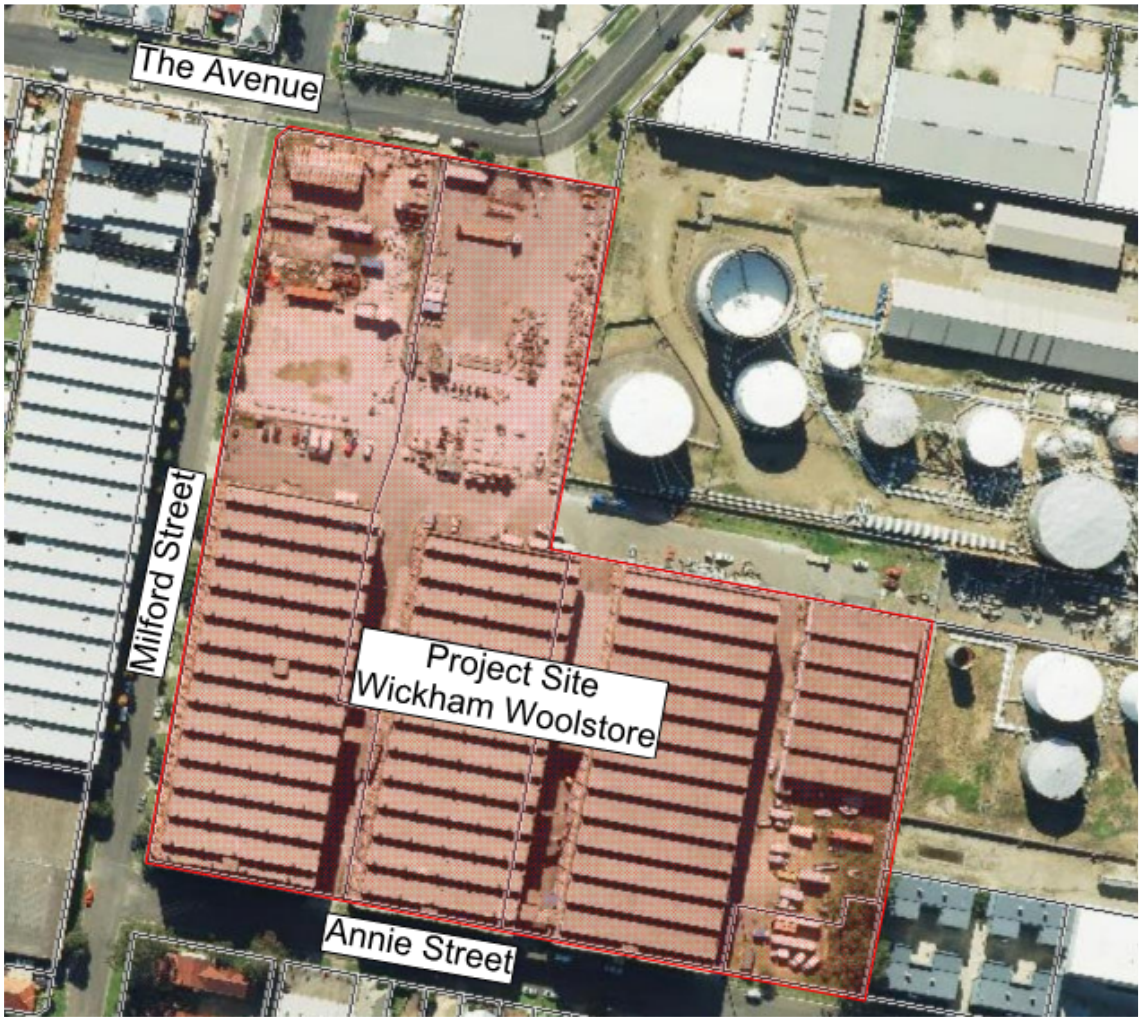
2 The Physical Environment

2.1 The Site

The subject site (Figure 1) is located approximately 5km northwest of Newcastle CBD on Lots 1 – 3 DP346352 and Lot 13 DP830026. The site is bound by The Avenue to its north, Milford Street to its west and Annie Street to its south. It is also directly adjacent to the Caltex Oil Terminal on its northern and eastern boundary.

The site falls within the Newcastle City Council Local Government Area (LGA) and has an area of approximately 3 ha. The existing site is dominated by three (3) mid-20th century heritage listed Woolstores, which have laneways running between them. They are four (4) storeys with concrete framed brick facades, internal timber framing and floors with sawtooth roofs. Bridge additions link the buildings at upper levels across the laneways. The buildings currently contain low-intensity light industrial uses, such as storage and artists' studios.

Figure 1: Site Location



Source: Six Maps NSW

2.2 Proposed Site Layout

The proposed development is a mixed-use development including five (5) mixed-use buildings and a large recreational park to the northern section of the site. Woolstores 1, 2 and Building 5 are residential buildings with internal car parking. Woolstore 3 is mixed use with residential where light amenity is high, retail to ground floor areas and car parking to the interior. Commercial uses take up the remainder of the available Woolstore 3 space. Similarly, Building 4 is a mixed-used building for both retail and artisan production community.

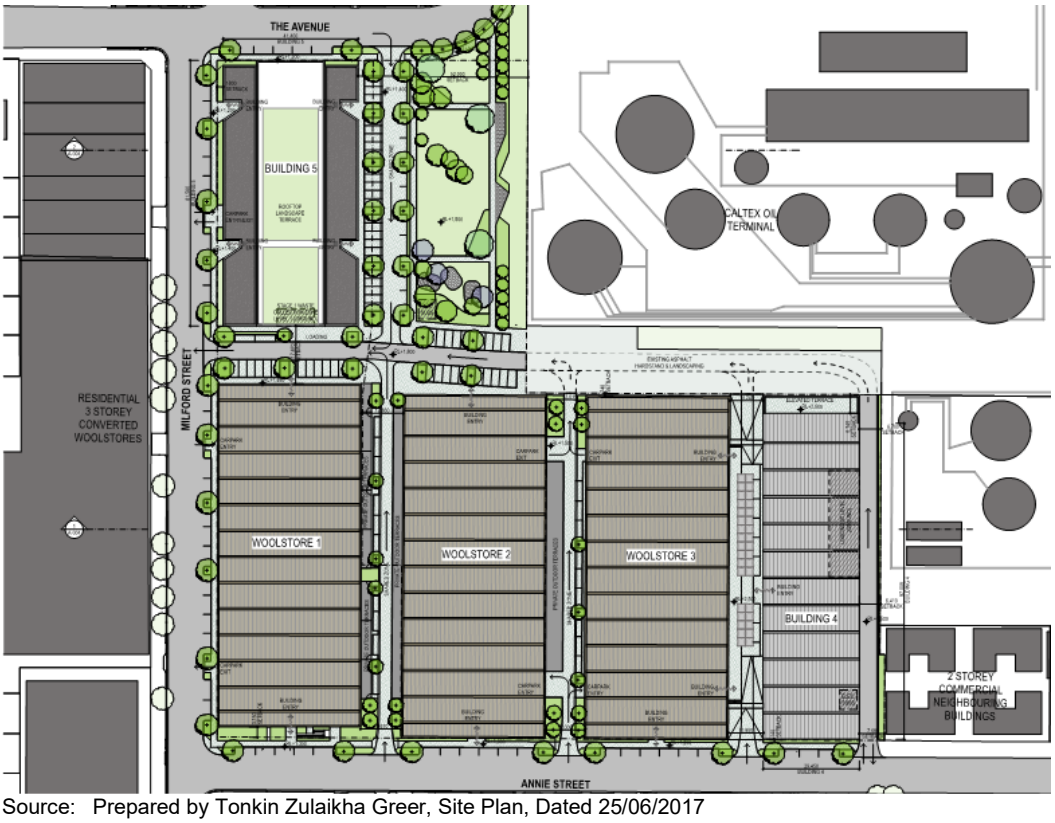
Please refer to Table 1 and Figure 2 below for the preferred masterplan option and an indicative building summary.

Table 1: Building Summary

Building	Apts	Residential Area (GFA)	Retail & Production Area (GFA)	Commercial & Community Area (GFA)	Total GFA	Total Gross Building Area
Woolstore 1	100	11875	0	0	13535	18538
Woolstore 2	99	11875	0	0	11875	18538
Woolstore 3	42	4496	820	5746	11062	17628
Building 4	0	0	1651	2858	4509	7805
Building 5	69	9907	170	0	10077	17224
Total Summary	**310**	**38153**	**2641**	**8604**	**51058**	**79733**

Source: Prepared by Tonkin Zulaikha Greer, Fairweather Jemmot & City Plan Services, Dated 27/06/2017

Figure 2: Site Plan

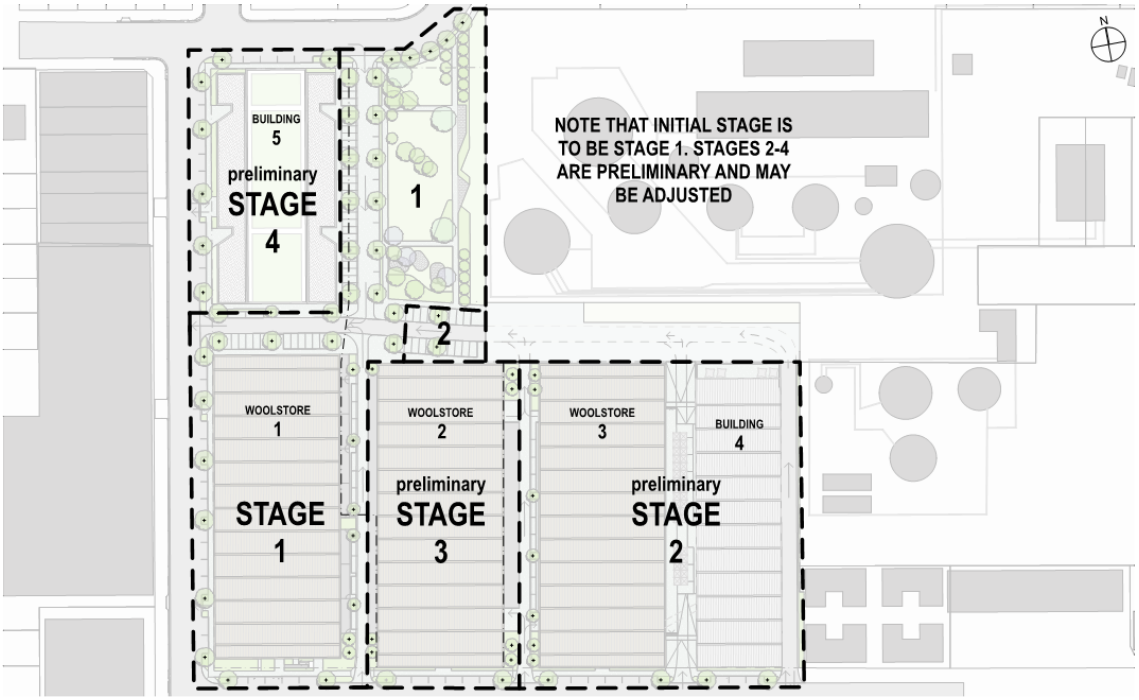


Source: Prepared by Tonkin Zulaikha Greer, Site Plan, Dated 25/06/2017

Note that a staged approach is adopted for the proposed development at Wickham Woolstores. The initial stage is to be stage 1 including the construction of Woolstore 1 and a recreational park whereas stages 2 – 4 are preliminary and subject to future refinement.

Please refer to Figure 3 below for the staging plan for Wickham Woolstores.

Figure 3: Staging Plan



Source: Prepared by Tonkin Zulaikha Greer, Staging Plan, Dated 25/06/2017

2.3 Site Grading

The proposed site grading has been undertaken to drain the site to its north towards The Avenue and to its south towards Annie Street. The design intention is to ensure the existing pipe capacity downstream of the proposed development is not undermined.

The pit and pipe network has been designed to intercept the flows, ensuring safe overland flow conveyance in the dish drains, and to divert the majority of the site flows towards the on-site detention basins if applicable.

The grading has been undertaken with consideration to optimise the future earthworks and provide flood protection freeboard to the proposed residential buildings.

The proposed grading has been designed to match the existing levels of The Avenue, Milford Street and Annie Street.

2.4 Pavements

The internal site pavement has been provided as per Landscape Layout. Please refer to drawings MMD-366163-C-DR-00-DA-1030 – 1034 for the proposed pavement layout in Wickham Woolstores.

The pavement profile is subject to future refinement at detailed design stage once the geotechnical information becomes available.

2.5 Soil and Erosion Control during Construction

As indicated on the Concept Soil and Water Management Plans MMD-366163-C-DR-00-DA-1020 – 1021, several control measures are proposed during the construction to manage soil and erosion runoff on-site. The control measures will be confirmed by the construction contractor and are likely to include:

- Temporary sediment fencing at the site boundary;
- Temporary sandbag sediment traps around kerb inlet pits;
- Temporary geotextile filter fabric sediment traps around surface inlet pits and junction pits;
- Temporary maintained site access; and
- Temporary sediment basins.

2.6 Stormwater Management

As part of the DA documentation, a MUSIC and a DRAINS model have been included to ensure the stormwater design is compliant with Newcastle City Council's requirements.

This report will assess the stormwater modelling and design control requirements in detail in the following sections. The pit and pipe network (the minor system) was designed to cater for the 20-year ARI event without creating significant ponding or flows in traficable areas, where as the major system is designed to the 100-year ARI to allow for overflows in extreme events to convey stormwater to the dsicharge point of the site.

2.7 Utility Services

Utility services including sewer, potable water, gas, telecommunications and electrical will be documented in the detailed design stage for the proposed development. At this stage, we have identified the potential conflicts between the proposed stormwater infrastructure and the existing utilities in the street. Further investigation is to be undertaken during detailed design stage.

3 Design Controls

This Stormwater Management Report was prepared in conjunction with relevant standards and requirements of various agencies. The documents used as part of the design control are detailed within this section.

3.1 Australian Rainfall and Runoff – Volume 1 (2001)

Prepared by the Institution of Engineers, Australia Australian Rainfall and Runoff – *A Guide to Flood Estimation* was written to "provide Australian designers with the best available information on design flood estimation". It contains procedures for estimating stormwater runoff for a range of catchments and rainfall events and design methods for urban stormwater drainage systems.

3.2 Newcastle City Council Control Documents

3.2.1 Newcastle Development Control Plan 2012

The *Newcastle Development Control Plan (DCP) 2012* provides the necessary controls for the redevelopment of the site. This DCP provides detailed provisions relating to matters of significance to the City of Newcastle to be considered by Council.

As part of the DCP, Section 7.06 provide detailed stormwater controls for the following:

- Stormwater collection;
- Flooding and runoff regimes;
- Storage;
- Storage drawdown;
- Site discharge controls;
- Pollutants;
- Overflow disposal;
- Existing drainage systems; and
- Installation and maintenance requirements.

3.2.2 Council's Technical Manual – Stormwater and Water Efficiency for Development

In conjunction with Council's DCP, Council's Technical Manual sets out the requirements for the design of stormwater drainage for urban and rural areas. The manual outlines a broad strategy of the design and development of land within the Newcastle local government area, including:

- Stormwater collection;
- Site discharge controls – large scale development; and
- Overflow disposal.

4 Water Quantity Modelling

The assessment of water quantity was completed through hydrological modelling. Computer-based models of the existing and developed catchments were constructed using DRAINS. Design storms were applied to these models to give estimates of the 1, 2, 5, 10, 20 and 100-year ARI discharges which are examined in the following sections. Assessment of these models then allowed the sizing and configuration of a proposed detention basin and the documentation of their requirements.

4.1 DRAINS Parameters

4.1.1 Hydrological Model

In order to assess the performance of the proposed pit and pipe network, the following Hydrological Model has been established in Table 2.

Table 2: Hydrological Model Specification

Item	Input
Paved (Impervious) Area Depression Storage	1 mm
Supplementary Area Depression Storage	0 mm
Grassed (Pervious) Area Depression Storage	5 mm
Soil Type	3

Note that type 3 (or type C) soil is defined in DRAINS as the soil with slow infiltration rates.

4.1.2 Rainfall Data

According to Figure 3.2 of ARR87, the proposed development is situated within Zone 2 – Murray Darling with Antecedent Moisture Condition (AMC) is 3. Please find below definitions of AMC value and its relationship to rainfall storage in Table 3.

Table 3: Antecedent Moisture Condition

AMC	Description	Total Rainfall in 5 days preceding the storm (mm)
1	Completely Dry	0
2	Rather Dry	0 to 12.5
3	Rather Wet	12.5 to 25
4	Saturated	Over 25

Source: DRAINS Manual

A AMC value of 3 means that the moisture content of the soil is higher and will generate higher runoff rates due to lower infiltration. This is set up to provide a more conservative approach to the hydraulic design.

4.1.2.1 Intensity-Frequency-Duration (IFD)

IFD data is obtained from Council's Technical Manual Appendix 1. Design storms events selected for DRAINS modelling include 1, 2, 5, 10, 20, 50 and 100 years. Please find DRAINS inputs in Table 4.

Table 4: IFD Data

Duration	1 Year	2 Year	5 Year	10 Year	20 Year	50 Year	100 Year
5 mins	85.51	109.9	141.42	158.38	181.93	212.69	236.05
10 mins	65.52	84.27	108.65	121.8	140.03	163.86	181.98
15 mins	54.73	70.44	90.93	102.01	117.34	137.4	152.65
20 mins	47.68	61.38	79.32	89.03	102.46	120.03	133.4
25 mins	42.6	54.86	70.95	79.67	91.72	107.49	119.5
30 mins	38.73	49.89	64.56	72.52	83.52	97.91	108.88
45 mins	31.04	40	51.86	58.3	67.19	78.83	87.7
60 mins	26.35	33.98	44.1	49.61	57.2	67.15	74.74
90 mins	20.49	26.43	34.34	38.65	44.58	52.36	58.29
2 hours	17.08	22.04	28.65	32.25	37.22	43.73	48.69

Source: Newcastle City Council's Technical Manual Appendix 1

4.1.3 Major and Minor Design Storm

The water quantity was modelled in relation to the requirements of Newcastle City Council's Technical manual in conjunction with Section 7.06 Stormwater. The following criteria were considered in the modelling and design process:

- The piped drainage is to be designed for the minor system 20-year ARI storm event; and
- Detention is required to attenuate flows where the developed flows are in excess of natural flows. The detention is to be designed to perform in the full range of flood events up to the 100-year ARI storm event.

4.1.4 Hydraulic Roughness Parameters

Manning's values were applied to the model based on pipe material used. A manning's 'n' of 0.013 was applied to all reinforced concrete pipes.

4.1.5 Pipes

Proposed pipes were graded at a minimum slope of 1% for pipe diameters up to 150mm and 0.5% for diameters of 225mm and larger. Based on Council's standard drawings A200, a desirable minimum cover of 400mm over the pipe is required, concrete encasement of pipe work is to occur under all pavement where minimum required cover cannot be achieved.

4.1.6 Overland Flow Paths

Typical cross-sections based on the gutter shape and pavement type were input to DRAINS representing the overland flow paths. Slopes were derived from the proposed pit surface levels.

4.1.7 Tailwater Levels

Newcastle City Council has no information available regarding tailwater levels of the existing stormwater pits in the street. In this regard, the following assumptions have been made for the civil design:

- Tailwater level for 100 year is 150mm above the surface level of the existing pit;
- Tailwater level for 50 year is 75mm above the surface level of the existing pit;
- Tailwater level for 20 year is at the surface level of the existing pit;
- Tailwater for 10 year is 75mm below the surface level of the existing pit; and
- Tailwater levels for 1, 2 and 5 year are 150mm below the surface level of the existing pit.

4.2 Existing Scenario

4.2.1 Existing Catchment

The total catchment area being conveyed downstream to the site in the current scenario is approximately 3 ha. Based on the detailed survey prepared by Monteath & Powys, the existing project site can be divided into two (2) catchments, the Northern and the Southern.

In addition, upstream catchments have also been identified within the adjacent easement that is generating additional stormwater runoff through the site. According to the survey, the easement is designated for construction a street or railway line benefiting the project site (Lots 1, 2 and 3 DP346352).

Figure 4 indicates the existing catchment plan and direction of flows whereas Table 5 summarizes the existing catchment conditions.

Figure 4: Existing Catchment Analysis

Table 5: Existing Catchment Analysis

Catchment	Sub-catchment	Area (sqm)	% of Impervious
Northern Catchment	1	96.26	17%
	2	3285.69	100%
	3	1993.36	97%
	4 (Bypass)	1306.70	97%
	Sub-total	**6682.00**	**97%**
Southern Catchment	5	11348.89	99%
	6	6334.67	100%
	7	7561.30	94%
	8 (Bypass)	402.08	15%
	Sub-total	**25646.94**	**96%**

4.2.2 DRAINS Results for Existing Scenario

The existing scenario DRAINS model was built using the parameters specified in Section 4.1 of this report.

The discharge rates in Table 6 were computed for the 20-year ARI (minor) and 100-year ARI (major), as per Newcastle City Council's Technical manual.

Table 6: Existing Scenario Discharge Rates

Storm Event	Discharge Rate (m^3/s)	
	Northern Catchment	Southern Catchment
Minor (20-year ARI)	0.33	1.26
Major (100-year ARI)	0.41	1.56

4.3 Developed Scenario

According to Newcastle City Council's standards, the stormwater runoff generated from the proposed development needs to be managed to ensure downstream drainage systems are not compromised. Analysis has been undertaken to identify the need of stormwater detention on-site.

4.3.1 Developed Catchment

Based on the Architectural layout prepared by Tonkin Zulaikha Greer Architects and Fairweather Architecture, Figure 5 indicates the proposed catchments for the subject site. Please find a summary of proposed catchment conditions in Table 7.

A strip of grated drains is to be provided at the eastern and southern boundaries of the easement area to prevent surface stormwater bypass. Note that the current sitework gradings were designed to meet the existing levels along The Avenue, Milford Street, Annie Street and the existing easement.

Figure 5: Proposed Catchment Analysis

Table 7: Proposed Catchment Analysis

Catchment	Sub-catchment	Area (sqm)	% of Impervious
Northern Catchment	1	14.58	0%
	2	7289.57	61%
	3	1776.29	94%
	4 (Bypass)	353.15	84%
	Sub-total	**9433.58**	**68%**
Southern Catchment	5	10667.30	97%
	6	5711.96	98%
	7	6510.32	97%
	Sub-total	**22889.58**	**97%**

4.3.2 DRAINS Results for Developed Scenario

The proposed pit and pipe network was designed to convey the 20-year ARI storm event using the DRAINS parameters specified in Section 4.1. A detailed catchment plan is shown in Figure 6 of the proposed stormwater drainage network. The layout of the developed scenario has been modelled in DRAINS as indicated in Figure 7.

Figure 6: Detailed Catchment Plan

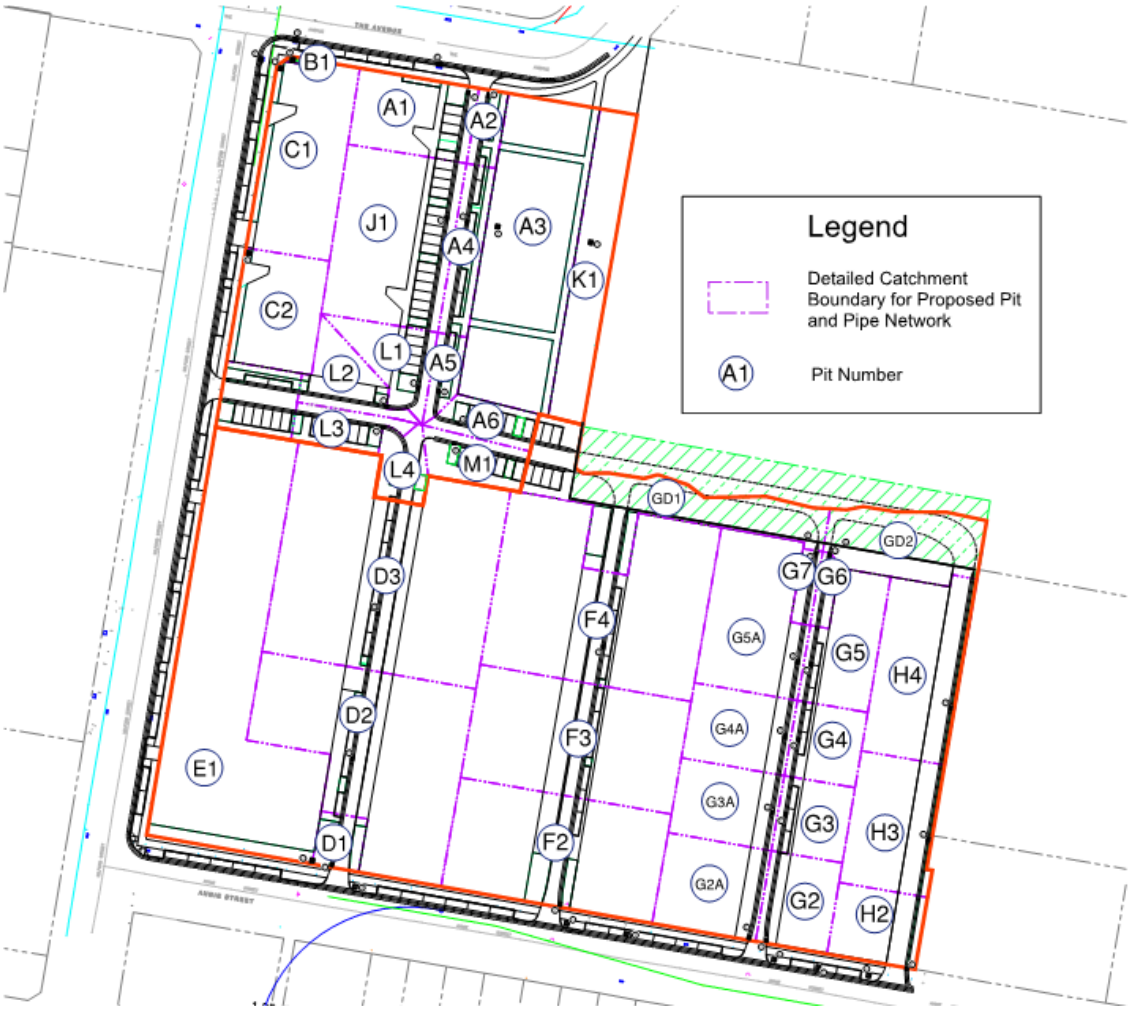
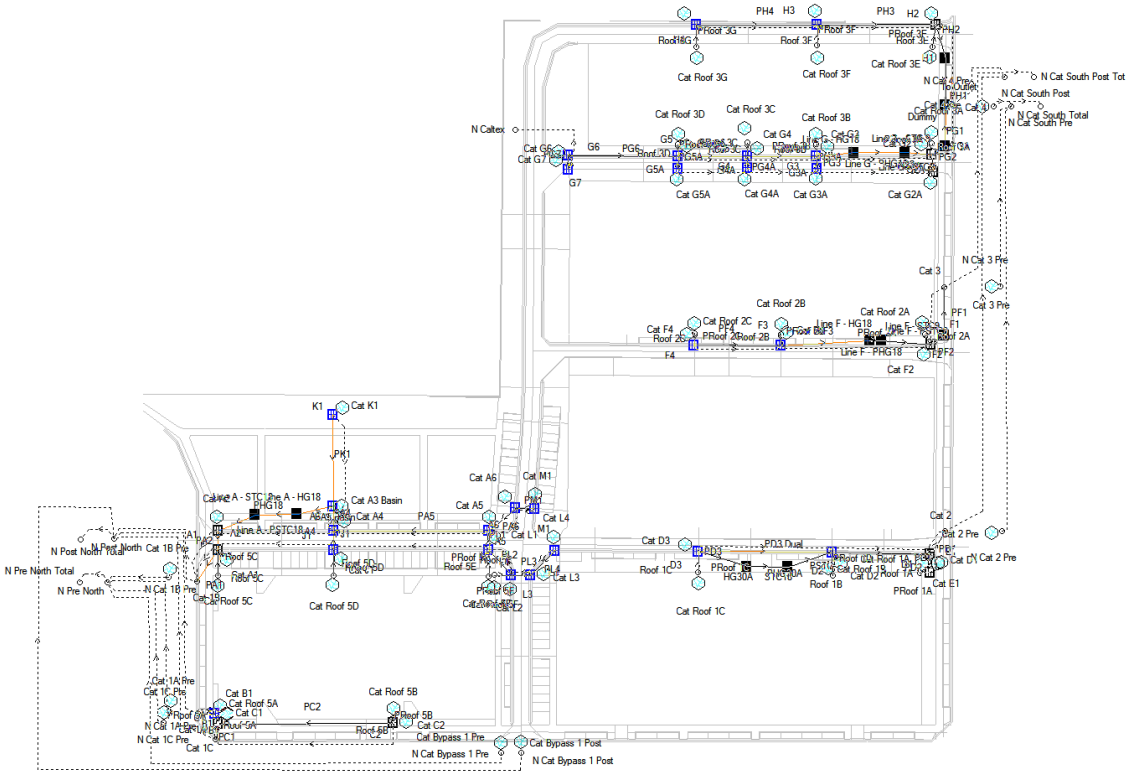


Figure 7: Proposed Stormwater Drainage Layout



The discharge rates in Table 8 were computed for the 20-year ARI (minor) and 100-year ARI (major), as per Newcastle City Council's Technical manual.

Table 8: Developed Scenario Discharge Rates

Storm Event	Discharge Rate (m^3/s)	
	Northern Catchment	Southern Catchment
Minor (20-year ARI)	0.39	1.10
Major (100-year ARI)	0.49	1.23

Comparing to Table 6, the developed discharge rates in Northern Catchment appears to exceed those in the pre-development scenario and have the downstream pipe capacity undermined. In this regard, a site discharge control system is required to meet Council's requirements.

4.3.3 Site Discharge Controls

A combination of measures was considered for the proposed development considering the constrains and opportunities presented on the project site. In general, an above-ground onsite stormwater detention (OSD) basin and rainwater tanks (RWT) are recommended to mitigate the excessive discharge rate.

4.3.3.1 RWT

According to Newcastle City Council's DCP, it is recommended of using RWTs for residential development which the volume of the tank can be used to offset any additional discharge control storage that is required.

Based on the assessment undertaken by the project Hydraulic Engineer, RWTs are to be provided for each building within the project site. Table 9 summarizes the design parameters of RWTs which are subject to future refinement at detailed design stage.

Table 9: RWT Design Parameters

Proposed Development	Roof Area (ha)	% of Roof Bypass	Indicative RWT Size (kL)
Woolstore 1	0.465	57%	40
Woolstore 2	0.465	57%	40
Woolstore 3	0.464	18%	65
Building 4	0.294	5%	55
Building 5	0.334	55%	65

4.3.3.2 OSD

After offseting the volume of Building 5's RWT, an above-ground OSD basin with a totoal volume of 22 kL has been incorporated in the developed scenario. The basin is considred to be placed within the recreational park situated within the Northern catchment.

4.4 DRAINS Results for Developed Scenario with Discharge Controls

The layout of the modified DRAINS model is shown below in Figure 8 whereas the discharge rates have been summarized in Table 10.

Figure 8: Modified DRAINS Layout

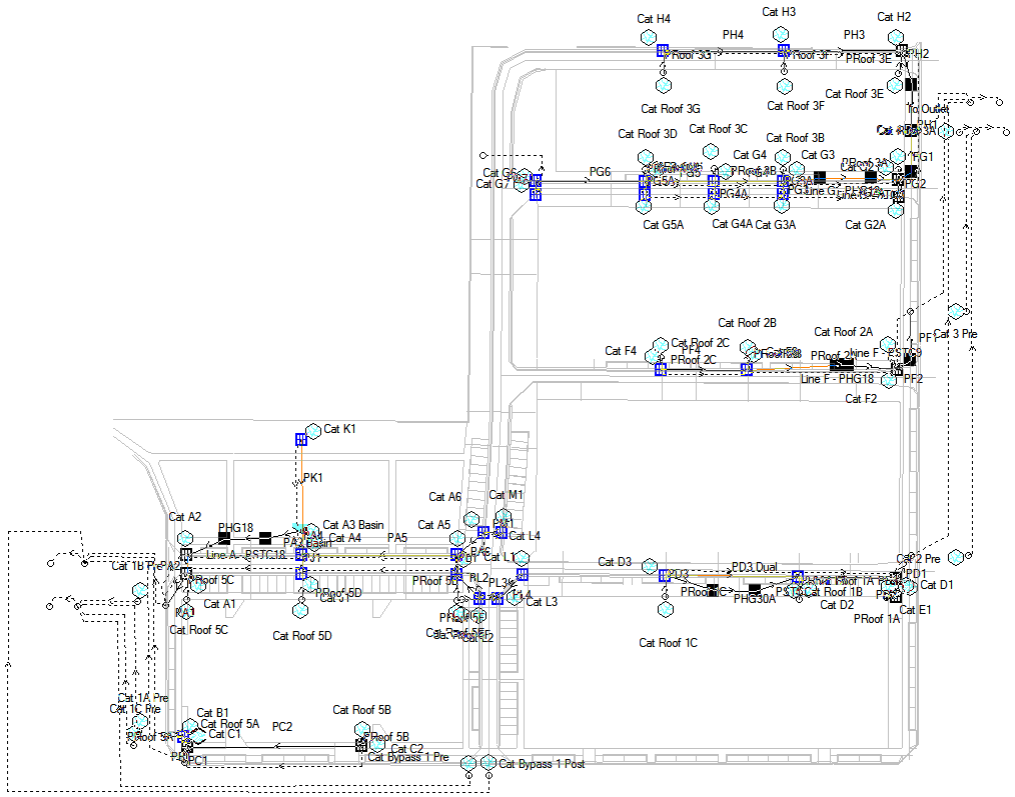


Table 10: Modified Scenario Discharge Rates

Storm Event	Discharge Rate (m^3/s)	
	Northern Catchment	Southern Catchment
Minor (20-year ARI)	0.19	1.10
Major (100-year ARI)	0.23	0.23

Compared to existing scenarios, the discharge rates of the modified stormwater drainage layout appears to be satisfactory.

DRAINS input data and results are attached in Appendix A for reference.

5 Water Quality Modelling

Treatment removal loads were analysed from existing to developed scenarios using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) Version 6 software. MUSIC is a water quality modelling tool which was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales.

5.1 Stormwater Quality Targets

Newcastle City Council has established the water quality targets as indicated in Table 11.

Table 11: Newcastle City Council Water Quality Targets

Pollutant	% Reduction in Pollutant Loads
Gross Pollutants (>5mm)	90%
Total Suspended Solids	85%
Total Phosphorus	65%
Total Nitrogen	45%

The above objectives are expressed as the reduction in pollutant loads required.

5.2 MUSIC Model Parameters

5.2.1 Rainfall Data

The water quality analysis requires historical rainfall data recorded by a pluviograph station. As requested in Council's DCP, the modelling is to be undertaken at a 6-minute time step using Williamstown pluviograph station over the time period 1/1/2002 – 31/12/2006.

5.2.2 Soil Store Parameters

The soil store parameters used within the model were based on the *Draft NSW MUSIC Modelling Guidelines,* as recommended in Council's DCP. Parameters used are summarised in Table 12.

Table 12: MUSIC Parameters – Soil Properties

Parameter	Unit	Recommended Values	Description
Impervious Area			
Rainfall Threshold	mm	0.3	Roofs
		1.5	Sealed roads, driveways, paving and paths
		1	For all land uses
Pervious Area			
Soil Capacity	mm	170	For urban development
Initial Storage	%	30	
Field Capacity	mm	70	
Infiltration Capacity Coefficient	a	210	
Infiltration Capacity Coefficient	b	4.7	

Parameter	Unit	Recommended Values	Description
Groundwater			
Initial Depth	mm	10	For urban development
Daily Recharge Rate	%	50	
Daily Baseflow Rate	%	5	
Deep Seepage	%	0	

Source: *Draft NSW MUSIC Modelling Guidelines (August 2010)*

5.2.3 Pollutant Generation Parameters

The pollutant generation parameters used within the model were based on the *Draft NSW MUSIC Modelling Guidelines,* as recommended in Council's DCP. Parameters used are summarised in Table 13.

Table 13: MUSIC Parameters – Pollutant Generation

Surface Type	Flow Type	TSS		TP		TN	
		Mean	Std Dev	Mean	Std Dev	Mean	Std dev
Roof / Roof Bypass**	Base Flow	n/a	n/a	n/a	n/a	n/a	n/a
	Storm Flow	1.30	0.32	-0.89	0.25	0.30	0.19
Sealed Roads	Base Flow	1.20	0.17	-0.85	0.19	0.11	0.12
	Storm Flow	2.43	0.32	-0.3	0.25	0.34	0.19
Landscaping	Base Flow	1.20	0.17	-0.85	0.19	0.11	0.12
	Storm Flow	2.15	0.32	-0.60	0.25	0.30	0.19

Source: *Draft NSW MUSIC Modelling Guidelines (August 2010)*

**Note the base flow parameters are applied to groundwater flow, whist the storm flow parameters are applied to surface runoff. Base flow concertation parameters are not applicable to where surface is 100% impervious.

5.3 Developed Scenario

5.3.1 Developed Catchment

Based on the landscape layout prepared by JMD Design, the proposed catchments have been further refined based on the surface type. Table 14 summarised the catchment analysis prepared for MUSIC.

Table 14: MUSCI Catchment Analysis

Catchment	Sub-catchment	Total Area (ha)	Roof Area		Sealed Road		Landscaping	
			Total Area (ha)	% of Imperv	Total Area (ha)	% of Imperv	Total Area (ha)	% of Imperv
Northern Catchment	1	0.001	0.000	n/a	0.000	n/a	0.001	0%
	2	0.729	0.171	100%	0.207	85%	0.351	28%
	3	0.178	0.163	100%	0.000	n/a	0.014	26%
	4	0.035	0.000	n/a	0.028	79%	0.007	100%
Southern Catchment	5	1.067	0.697	100%	0.065	82%	0.072	81%
	6	0.571	0.465	100%	0.060	82%	0.047	100%
	7	0.651	0.527	100%	0.277	92%	0.079	100%
	Total	**3.232**	**2.023**	**100%**	**0.637**	**87%**	**0.294**	**51%**

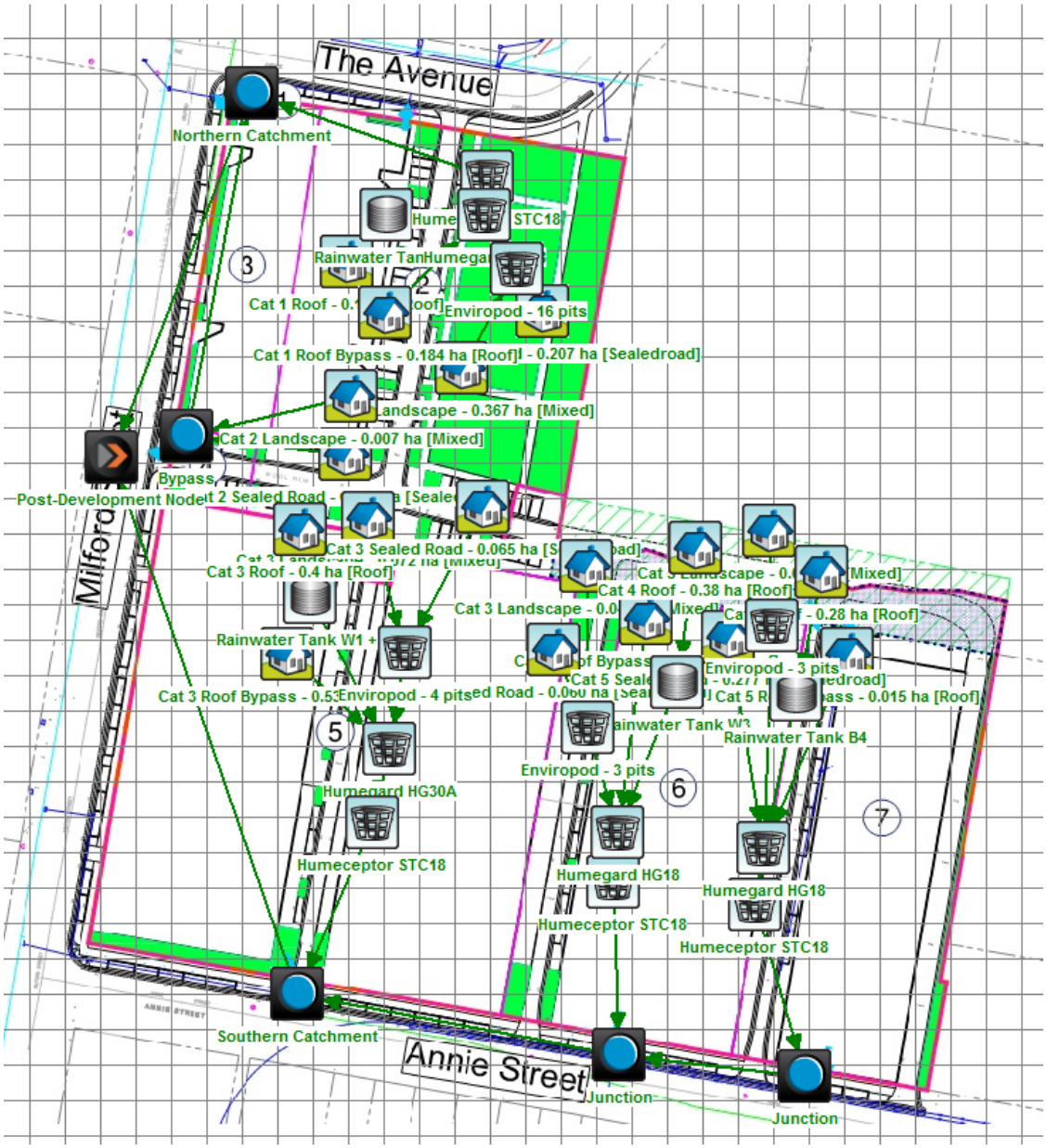
5.3.2 Developed MUSIC Model

A MUSIC model was developed to incorporate a series of treatment devices including the following:

- Enviropod;
- Rainwater Tanks;
- HumeGard; and
- Humeceptor.

Please find Figure 9 for the proposed MUSIC layout.

Figure 9: MUSIC Layout



5.3.2.1 Enviropods®

All surface inlet pits within the project site have been designed to be provided with pit inserts including oil absorbent media. The pit inserts will be beneath the stormwater pit grates and will collect gross pollutants, sediments, oils and grease.

5.3.2.2 Rainwater Tanks

Rainwater tanks have been utilised as a means of water reuse within the project site. Stormwater that discharges directly from roof areas is generally considered as 'clean' water, with the roof water from the buildings modelled to discharge directly to a rainwater harvesting tank. These tanks are to store water for re-use associated with the proposed deployment such as toilet flush. Rainwater tanks have been sized by the project Hydraulic Engineer as indicated in Section 4.3.3.1.

5.3.2.3 HumeGard®

For primary treatment of the stormwater runoff, a HumeGard® Gross Pollutant Trap is to be provided. The HumeGard is a pollution control device specifically designed to remove gross pollutants and coarse sediments in residential and commercial developments. The MUSIC node from Hume's was used for this model.

5.3.2.4 HumeCeptor®

For secondary treatment of the stormwater runoff, a HumeCeptor® Gross Pollutant Trap is to be provided. The HumeCeptor is a pollution control device specifically designed to remove hydrocarbons and fine suspended solids from stormwater runoff generated in residential and commercial developments. The MUSIC node from Hume's was used for this model.

5.4 MUSIC Results

Results of the MUSIC analysis indicate that by including the nominated treatment devices as described in Section 5.3.2, the water quality improvement objectives for total suspended solids and total nitrogen set out in Council's DCP are achieved for the site but not total phosphorus and gross pollutants. Table 15 displays the results of the MUSIC model.

Table 15: MUSIC Model Results

	Total Suspended Solids (kg/yr)	Total Phosphorous (kg/yr)	Total Nitrogen (kg/yr)	Gross Pollutants (kg/yr)
Reductions	90%	63%	60%	94%
Objectives	85%	65%	45%	90%

6 Desktop Flood Study

Based on email correspondence between The City of Newcastle Council and Ghazal Hosseini from Mott MacDonald dated on 1st May 2017, it is understood that the Flood Information Certificate provided by Council has the relating information of the proposed lots. Therefore, the flood modelling is not required for lodgement of the proposed development application.

6.1 Flood management policy and Guidelines

The flood assessment of the proposed development has been completed to comply with the following guideline and previous flood study:

- Newcastle City-wide Floodplain Risk Management Study and Plan, June 2012;
- Throsby, Cottage and CBD Flood Study, August 2008;

6.2 Data

The flood assessment of the subject site has been done based on following present information:

- Site Survey provided by Monteath & Powys dated on 3rd May 2017;
- Proposed Masterplan architectural layout and Woolstore 1 architectural layout provided by Tonkin Zulaikha Greer Architects and Fairweather Architecture dated on 28th March 2017 and 5th June 2017 respectively; and
- Flood Information Certificate provided by Council dated 24th August 2016.

6.3 Flood Evaluation

Based on Council's Flood Information Certificate (FIC), which is based on the Newcastle City-wide Floodplain Risk Management Plan and the Newcastle Development Control Plan, the subject site is not affected by a floodway. However, the FIC indicates that the entire subject site is affected by a flood storage area. This limits ground-level development (not on stilts/piers) to 20% of the total site area.

6.3.1 Flood Storage Area

Estimated flood storage provided for this site is provided in Table 16.

Table 16. Flood Storage Area Calculated

		Maximum allowable area (m^2)	Total Area (m^2)
Total Site Area	31,277 m^2		31,277
Ground-Level Site Coverage	20%	6,255	5,056
Minimum Flood Storage Area	80%		26,221

As shown in Table 16, the proposed ground-level site coverage does not exceed the allowable area provided by Council.

6.3.2 Minimum Floor Level

The estimated 1% Annual Exceedance Probability event level, equivalent to the “Defined Flood Level” in the *Building Code of Australia,* is 2.2m. The minimum floor level for the new development provided in the FIC is **2.5m** AHD.

The highest Property Hazard Category for the development site is P2 for the development site. Based on this category, the flood risk is too great to permit a basement car park on the site. However, parked or moving heavy vehicles are permitted. The proposed carpark floor level is 2.5m AHD, 0.3 m above 1% AEP events.

6.3.3 Onsite Flood Refuge

The development site falls under Life Hazard Category L4. The Newcastle DCP states that an Onsite Flood Refuge area is required for category L4. The minimum Onsite Refuge level is to be the level of the Probably Maximum Flood (PMF). The PMF level is 3.4 AHD for the development site. Based on Council’s DCP, the proposed development includes buildings greater than two stories high and the upper floor area can be used as an onsite refuge area. However, the structure type must be able to withstand the hydraulic loading due to flooding at the PMF level.

Appendices

A. DRAINS Inputs

PIT / NODE DETAILS Version 13

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is
L4	Sag	NSW RTA SSB	Pit	11.619	5.8	1.61	0.15	0	0	-6332260	-682935	No	4747	1 x Ku	No	New
L3	Sag	NSW RTA SSB	Pit	12.857	2	1.57	0.15	0	0	-6332267	-682942	No	4749	1 x Ku	No	New
L2	Sag	NSW RTA SSB	Pit	9.878	0.3	1.57	0.15	0	0	-6332273	-682942	No	4750	1 x Ku	No	New
L1	Sag	NSW RTA SSB	Pit	11.186	0.3	1.49	0.15	0	0	-6332279	-682935	No	4851	1 x Ku	No	New
A5	Sag	NSW RTA SSB	Pit	7.887	0.3	1.49	0.15	0	0	-6332279	-682930	No	4855	1 x Ku	No	New
A4	Sag	NSW RTA SSB	Pit	17.556	0.5	1.34	0.15	0	0	-6332324	-682930	No	4783	1 x Ku	No	New
Line A - HG	OnGrade	Junction Pi	Junction Pit or Manho		1.5	1.64		0	0	-6332335	-682925	Yes	21945728	1 x Ku	No	New
Line A - STC	OnGrade	Junction Pi	Junction Pit or Manho		1.5	1.38		0	0	-6332347	-682925	Yes	21945729	1 x Ku	No	New
A2	OnGrade	NSW RTA SSB	Pit		4	1.11		0	0	-6332358	-682930	No	4781	1 x Ku	No	New
A1	OnGrade	NSW RTA SSB	Pit		1.5	1.11		0	0	-6332358	-682935	No	4782	1 x Ku	No	New
Cat 1B	Node					0.84		0		-6332364	-682944		4798		No	
B1	Sag	NSW Dept.	RM7	0.729	0.5	1.17	0.15	0	0	-6332358	-682982	No	4789	1 x Ku	No	New
Cat 1A	Node					0.98		0		-6332363	-682982		4800		No	
M1	Sag	NSW RTA SSB	Pit	18.756	3.4	1.59	0.15	0	0	-6332266	-682923	No	4793	1 x Ku	No	New
A6	Sag	NSW RTA SSB	Pit	15.342	0.3	1.59	0.15	0	0	-6332272	-682923	No	4753	1 x Ku	No	New
Roof 5A	Node					2.5		0		-6332357	-682984		5275		No	
C1	OnGrade	NSW Dept.	RM7		1.4	1.23		0	0	-6332357	-682985	No	4788	1 x Ku	No	New
Cat 1C	Node					1.01		0		-6332358	-682990		4942		No	
Roof 5B	Node					2.5		0		-6332307	-682984		5276		No	
C2	OnGrade	NSW Dept.	RM7		2.1	1.36		0	0	-6332307	-682985	No	4790	1 x Ku	No	New
Roof 1C	Node					2.5		0		-6332219	-682942		5321		No	
D3	Sag	NSW RTA SSB	Pit	28.731	1.5	1.41	0.15	0	0	-6332219	-682936	No	4746	1 x Ku	No	New
HG30A	OnGrade	Junction Pi	Junction Pit or Manho		1.5	1.53		0	0	-6332205	-682940	Yes	39258670	1 x Ku	No	New
STC18	OnGrade	Junction Pi	Junction Pit or Manho		1.5	1.68		0	0	-6332193	-682940	Yes	39258671	1 x Ku	No	New
D2	Sag	NSW RTA SSB	Pit	24.106	1.5	1.21	0.15	0	0	-6332180	-682936	No	4745	1 x Ku	No	New
D1	OnGrade	NSW RTA SSB	Pit		1	1.31		0	0	-6332152	-682937	No	4748	1 x Ku	No	New
Cat 2	Node					1.08		0		-6332148	-682930		4811		No	
Roof 1A	Node					2.5		0		-6332155	-682942		5326		No	
E1	OnGrade	NSW Dept.	RM7		2.5	1.4		0	0	-6332152	-682942	No	4893	1 x Ku	No	New
Roof 2C	Node					2.5		0		-6332220	-682873		5393		No	
F4	Sag	NSW RTA SSB	Pit	34.006	2	1.41	0.15	0	0	-6332220	-682876	No	4761	1 x Ku	No	New
F3	Sag	NSW RTA SSB	Pit	18.055	1.3	1.37	0.15	0	0	-6332195	-682876	No	4760	1 x Ku	No	New
Line F - HG	OnGrade	Junction Pi	Junction Pit or Manho		1.5	1.47		0	0	-6332169	-682875	Yes	28128576	1 x Ku	No	New
Line F - STC	OnGrade	Junction Pi	Junction Pit or Manho		1.5	1.445		0	0	-6332166	-682875	Yes	28128577	1 x Ku	No	New
F2	OnGrade	NSW RTA SSB	Pit		1.3	1.21		0	0	-6332152	-682876	No	4759	1 x Ku	No	New
F1	OnGrade	Junction Pi	Junction Pit or Manho		0.5	1.17		0	0	-6332148	-682873	Yes	4767	1 x Ku	No	New
Cat 3	Node					1.02		0		-6332148	-682859		4817		No	
Roof 2B	Node					2.5		0		-6332195	-682873		5394		No	
Roof 2A	Node					2.5		0		-6332154	-682873		5395		No	
Roof 3D	Node					2.5		0		-6332225	-682818		5455		No	
G5	Sag	NSW RTA SSB	Pit	10.363	2.6	2.31	0.15	0	0	-6332225	-682821	No	4762	1 x Ku	No	New
G4	Sag	NSW RTA SSB	Pit	10.494	1.3	2.31	0.15	0	0	-6332205	-682821	No	4763	1 x Ku	No	New
G3	Sag	NSW RTA SSB	Pit	13.095	1.1	2.31	0.15	0	0	-6332185	-682821	No	4764	1 x Ku	No	New
Line G - HG	OnGrade	Junction Pi	Junction Pit or Manho		1.5	2.38		0	0	-6332174	-682820	Yes	28128650	1 x Ku	No	New
Line G - STC	OnGrade	Junction Pi	Junction Pit or Manho		1.5	1.89		0	0	-6332159	-682820	Yes	28128651	1 x Ku	No	New
G2	OnGrade	NSW RTA SSB	Pit		1.2	1.31		0	0	-6332151	-682821	No	4766	1 x Ku	No	New
G1	OnGrade	Junction Pi	Junction Pit or Manho		2.5	1.1		0	0	-6332148	-682819	Yes	4769	1 x Ku	No	New
Dummy	OnGrade	Junction Pi	Junction Pit or Manho		2	1.1		0	0	-6332148	-682807	Yes	6373	1 x Ku	No	New
Cat 4	Node					0.94		0		-6332146	-682807		4820		No	
Roof 3C	Node					2.5		0		-6332205	-682818		5456		No	
Roof 3B	Node					2.5		0		-6332185	-682818		5457		No	
Roof 3A	Node					2.5		0		-6332151	-682818		5461		No	
Roof 3E	Node					2.5		0		-6332151	-682790		5608		No	
H2	OnGrade	NSW RTA SSB	Pit		1.8	1.29		0	0	-6332150	-682783	No	4772	1 x Ku	No	New
H1	OnGrade	Junction Pi	Junction Pit or Manho		0.5	1.1		0	0	-6332148	-682793	Yes	4771	1 x Ku	No	New
Roof 3F	Node					2.5		0		-6332185	-682789		5615		No	
H3	Sag	NSW RTA SSB	Pit	9.791	1	1.34	0.15	0	0	-6332185	-682783	No	4773	1 x Ku	No	New
Roof 3G	Node					2.5		0		-6332220	-682790		5619		No	
H4	Sag	NSW RTA SSB	Pit	12.4	1	1.39	0.15	0	0	-6332220	-682783	No	4774	1 x Ku	No	New
Roof 5C	Node					2.5		0		-6332358	-682943		5936		No	
Roof 5D	Node					2.5		0		-6332324	-682943		5937		No	
J1	Sag	NSW RTA SSB	Pit	22.723	-0.7	1.34	0.15	0	0	-6332324	-682935	No	4784	1 x Ku	No	New
Roof 5E	Node					2.5		0		-6332279	-682943		5938		No	
Roof 5F	Node					2.5		0		-6332278	-682943		5939		No	
N Cat 1C Pr	Node					1.01		0		-6332373	-682985		1301572		No	
N Cat 1A Pr	Node					0.98		0		-6332372	-682982		1514766		No	
N Cat 1B Pr	Node					0.84		0		-6332372	-682943		1641602		No	
N Pre North	Node					0.83		0		-6332389	-682945		1641616		No	
N Pre North	Node					0.82		0		-6332397	-682945		1641618		No	
N Post Nor	Node					0.83		0		-6332387	-682932		1879422		No	
N Post Nor	Node					0.82		0		-6332397	-682932		1879423		No	
N Cat 2 Pre	Node					1.08		0		-6332131	-682930		4310294		No	
N Cat 3 Pre	Node					1.02		0		-6332132	-682859		4310311		No	
N Cat 4 Pre	Node					0.94		0		-6332134	-682807		4310327		No	
N Cat Sout	Node					0.8		0		-6332129	-682807		4310345		No	
N Cat Sout	Node					0.79		0		-6332120	-682807		4310347		No	
N Cat Bypa	Node					1		0		-6332276	-682994		4310350		No	
N Cat Bypa	Node					1		0		-6332270	-682994		4310363		No	
N Cat Sout	Node					0.8		0		-6332131	-682798		4635470		No	
N Cat Sout	Node					0.79		0		-6332122	-682799		4635482		No	
K1	Sag	NSW Dept.	RM7	5	1.5	1.33	0.15	0	0	-6332324	-682896	No	14702516	1 x Ku	No	New
G7	Sag	NSW RTA SSB	Pit	8.016	4	1.43	0.15	0	0	-6332256	-682825	No	26893867	1 x Ku	No	New
G6	Sag	NSW RTA SSB	Pit	5.143	4	1.43	0.15	0	0	-6332256	-682821	No	26893873	1 x Ku	No	New
N Caltex	Node					1.42		0		-6332272	-682814		28957917		No	
Roof 1B	Node					2.5		0		-6332180	-682943		38766330		No	
N Roof 1D	Node					2.5		0		-6332156	-682984		40732630		No	
N Roof 2D	Node					2.5		0		-6332224	-682832		40732668		No	
G5A	Sag	NSW RTA SSB	Pit	10.363	2.6	2.31	0.15	0	0	-6332225	-682825	No	26893878	1 x Ku	No	New
N Roof 2E	Node					2.5		0		-6332204	-682833		40732670		No	
G4A	Sag	NSW RTA SSB	Pit	10.494	1.3	2.31	0.15	0	0	-6332205	-682825	No	26893882	1 x Ku	No	New
N Roof 2F	Node					2.5		0		-6332185	-682832		40732672		No	
G3A	Sag	NSW RTA SSB	Pit	13.095	1.1	2.31	0.15	0	0	-6332185	-682825	No	26893936	1 x Ku	No	New
N Roof 2G	Node					2.5		0		-6332154	-682832		40732674		No	
G2A	OnGrade	NSW RTA SSB	Pit		1.2	1.31		0	0	-6332151	-682826	No	26893891	1 x Ku	No	New

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length	id
A3 Basin	0.585	2		Culvert	0.5					-6332324	-682923	No			3139753
	1.302	2													
	1.303	400													
	1.52	400													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor	Rainfall Multiplier
Cat L4	L4	0.0232	92	8	0	5	10	0														
Cat L3	L3	0.0257	84	16	0	5	10	0														
Cat L2	L2	0.0198	93	7	0	5	10	0														
Cat L1	L1	0.0224	90	10	0	5	10	0														
Cat A5	A5	0.0158	86	14	0	5	10	0														
Cat A4	A4	0.0351	86	14	0	5	10	0														
Cat A3 Basi	A3 Basin	0.197	13	87	0	5	10	0														
Cat A2	A2	0.0156	81	19	0	5	10	0														
Cat A1	A1	0.0217	75	25	0	5	10	0														
Cat B1	B1	0.0015	0	100	0	5	10	0														
Cat M1	M1	0.0318	94	6	0	5	10	0														
Cat A6	A6	0.0255	91	9	0	5	10	0														
Cat Roof 5A	Roof 5A	0.1014	100	0	0	5	10	0														
Cat C1	C1	0.0089	27	73	0	5	10	0														
Cat Roof 5B	Roof 5B	0.0619	100	0	0	5	10	0														
Cat C2	C2	0.0054	23	77	0	5	10	0														
Cat Roof 1C	Roof 1C	0.2406	100	0	0	5	10	0														
Cat D3	D3	0.0575	74	26	0	5	10	0														
Cat D2	D2	0.0485	98	2	0	5	10	0														
Cat D1	D1	0.0174	46	54	0	5	10	0														
Cat Roof 1A	Roof 1A	0.1139	100	0	0	5	10	0														
Cat E1	E1	0.0139	0	100	0	5	10	0														
Cat Roof 2C	Roof 2C	0.204	100	0	0	5	10	0														
Cat F4	F4	0.0358	99	1	0	5	100	0														
Cat F3	F3	0.0361	99	1	0	5	10	0														
Cat F2	F2	0.035	72	28	0	5	10	0														
Cat Roof 2B	Roof 2B	0.1325	100	0	0	5	10	0														
Cat Roof 2A	Roof 2A	0.1282	100	0	0	5	10	0														
Cat Roof 3D	Roof 3D	0.0494	100	0	0	5	10	0														
Cat G5	G5	0.01	100	0	0	5	10	0														
Cat G4	G4	0.0102	100	0	0	5	10	0														
Cat G3	G3	0.0104	100	0	0	5	10	0														
Cat G2	G2	0.0129	100	0	0	5	10	0														
Cat Roof 3C	Roof 3C	0.0274	100	0	0	5	10	0														
Cat Roof 3B	Roof 3B	0.0274	100	0	0	5	10	0														
Cat Roof 3A	Roof 3A	0.0328	100	0	0	5	10	0														
Cat Roof 3E	Roof 3E	0.0296	100	0	0	5	10	0														
Cat H2	H2	0.0151	72	28	0	5	10	0														
Cat Roof 3F	Roof 3F	0.0552	100	0	0	5	10	0														
Cat H3	H3	0.0233	84	16	0	5	10	0														
Cat Roof 3G	Roof 3G	0.073	100	0	0	5	10	0														
Cat H4	H4	0.0325	88	12	0	5	10	0														
Cat Roof 5C	Roof 5C	0.0417	100	0	0	5	10	0														
Cat Roof 5D	Roof 5D	0.0952	100	0	0	5	10	0														
Cat J1	J1	0.0454	93	7	0	5	10	0														
Cat Roof 5E	Roof 5E	0.0173	100	0	0	5	10	0														
Cat Roof 5F	Roof 5F	0.0169	100	0	0	5	10	0														
Cat 1C Pre	N Cat 1C P	0.1993	97	3	0	5	10	0														
Cat 1A Pre	N Cat 1A P	0.0096	17	83	0	5	10	0														
Cat 1B Pre	N Cat 1B P	0.3286	100	0	0	5	10	0														
Cat 2 Pre	N Cat 2 Pre	1.1349	99	1	0	5	10	0														
Cat 3 Pre	N Cat 3 Pre	0.6334	100	0	0	5	10	0														
Cat 4 Pre	N Cat 4 Pre	0.7963	90	10	0	5	10	0														
Cat Bypass	N Cat Bypa	0.1307	97	3	0	5	10	0														
Cat Bypass	N Cat Bypa	0.0353	84	16	0	5	10	0														
Cat K1	K1	0.079	0	100	0	5	10	0														
Cat G7	G7	0.1183	100	0	0	5	10	0														
Cat G6	G6	0.0783	100	0	0	5	10	0														
Cat Roof 1B	Roof 1B	0.1684	100	0	0	5	10	0														
Cat Roof 1D	N Roof 1D	0.1738	100	0	0	5	10	0														
Cat Roof 2D	N Roof 2D	0.0908	100	0	0	5	10	0														
Cat G5A	G5A	0.0107	100	0	0	5	10	0														
Cat Roof 2E	N Roof 2E	0.0439	100	0	0	5	10	0														
Cat G4A	G4A	0.0108	100	0	0	5	10	0														
Cat Roof 2F	N Roof 2F	0.0438	100	0	0	5	10	0														
Cat G3A	G3A	0.0109	100	0	0	5	10	0														
Cat Roof 2G	N Roof 2G	0.0531	100	0	0	5	10	0														
Cat G2A	G2A	0.0133	100	0	0	5	10	0														

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
PL4	L4	L3	10.452	1.109	1.057	0.5	Concrete, u	300	300	0.013	New	1	L4		0				
PL3	L3	L2	4.8	1.037	1.013	0.5	Concrete, u	300	300	0.013	New	1	L3		0				
PL2	L2	L1	9.347	0.993	0.946	0.5	Concrete, r	300	300	0.013	New	1	L2		0				
PL1	L1	A5	4.803	0.926	0.902	0.5	Concrete, u	300	300	0.013	New	1	L1		0				
PA5	A5	A4	44.099	0.882	0.662	0.5	Box culvert	1.2W x 0.3H		0.012	Existing	1	A5		0				
PA4	A4	A3 Basin	7.379	0.642	0.605	0.5	Box culvert	1.2W x 0.3H		0.012	Existing	2	A4		0				
PA3 Basin	A3 Basin	Line A - HG	16.071	0.585	0.457	0.8	Concrete, r	300	300	0.013	NewFixed	1	A3 Basin		0				
PHG18	Line A - HG	Line A - STC	10	0.437	0.387	0.5	Concrete, r	300	300	0.013	New	1	Line A - HG		0				
Line A - PST	Line A - STC	A2	5.08	0.367	0.342	0.49	Concrete, r	300	300	0.013	New	2	Line A - STC		0				
PA2	A2	A1	4.8	0.322	0.298	0.5	Box culvert	0.9W x 0.3H		0.012	Existing	1	A2		0				
PA1	A1	Cat 1B	9.676	0.278	0.23	0.5	Concrete, r	300	300	0.013	New	2	A1		0				
PB1	B1	Cat 1A	3.985	0.445	0.425	0.5	Concrete, r	300	300	0.013	New	1	B1		0				
PM1	M1	A6	4.8	0.983	0.959	0.5	Concrete, u	300	300	0.013	New	1	M1		0				
PA6	A6	A5	7.426	0.939	0.902	0.5	Concrete, r	300	300	0.013	New	1	A6		0				
PRoof 5A	Roof 5A	C1	1	0.643	0.633	1	Concrete, r	300	300	0.013	New	1	Roof 5A		0				
PC1	C1	Cat 1C	4.639	0.613	0.59	0.5	Concrete, r	300	300	0.013	New	2	C1		0				
PRoof 5B	Roof 5B	C2	1	0.904	0.894	1	Concrete, r	300	300	0.013	New	1	Roof 5B		0				
PC2	C2	C1	48.245	0.874	0.633	0.5	Concrete, r	300	300	0.013	New	1	C2		0				
PRoof 1C	Roof 1C	D3	2	0.814	0.794	1	Concrete, r	300	300	0.013	New	2	Roof 1C		0				
PD3	D3	HG30A	3.769	0.774	0.755	0.5	Box culvert	0.9W x 0.3H		0.012	NewFixed	1	D3		0				
PHG30A	HG30A	STC18	7.195	0.755	0.71	0.63	Box culvert	0.9W x 0.3H		0.012	NewFixed	1	HG30A		0				
PSTC	STC18	D2	24.731	0.71	0.586	0.5	Box culvert	0.9W x 0.3H		0.012	NewFixed	1	STC18		0				
PD2	D2	D1	27.486	0.566	0.429	0.5	Box culvert	1.2W x 0.3H		0.012	NewFixed	1	D2		0				
PD1	D1	Cat 2	7.772	0.409	0.37	0.5	Box culvert	1.8W x 0.3H		0.012	New	2	D1		0				
PRoof 1A	Roof 1A	E1	1	0.482	0.472	1	Concrete, r	300	300	0.013	New	2	Roof 1A		0				
PE1	E1	D1	4.51	0.452	0.429	0.51	Box culvert	0.6W x 0.3H		0.012	Existing	1	E1		0				
PRoof 2C	Roof 2C	F4	1	0.8	0.79	1	Concrete, r	300	300	0.013	New	2	Roof 2C		0				
PF4	F4	F3	24.1	0.77	0.65	0.5	Box culvert	0.9W x 0.3H		0.012	NewFixed	1	F4		0				
PF3	F3	Line F - HG	24.2	0.63	0.509	0.5	Box culvert	0.9W x 0.3H		0.012	Existing	1	F3		0				
Line F - PH	Line F - HG	Line F - STC	5	0.509	0.484	0.5	Box culvert	0.9W x 0.3H		0.012	NewFixed	1	Line F - HG		0				
Line F - PST	Line F - STC	F2	9	0.465	0.42	0.5	Box culvert	1.2W x 0.3H		0.012	NewFixed	1	Line F - STC		0				
PF2	F2	F1	4.52	0.398	0.375	0.51	Box culvert	0.9W x 0.3H		0.012	NewFixed	2	F2		0				
PF1	F1	Cat 3	14.966	0.355	0.28	0.5	Box culvert	0.9W x 0.3H		0.012	New	2	F1		0				
PRoof 2B	Roof 2B	F3	1	0.66	0.65	1	Concrete, r	300	300	0.013	New	1	Roof 2B		0				
PRoof 2A	Roof 2A	F2	1	0.428	0.418	1	Concrete, r	300	300	0.013	New	1	Roof 2A		0				
PRoof 3D	Roof 3D	G5	1	0.861	0.851	1	Concrete, r	300	300	0.013	New	2	Roof 3D		0				
PG5	G5	G4	19.1	0.831	0.735	0.5	Box culvert	1.8W x 0.3H		0.012	Existing	2	G5		0				
PG4	G4	G3	19.1	0.715	0.619	0.5	Box culvert	1.8W x 0.3H		0.012	Existing	2	G4		0				
PG3	G3	Line G - HG	9.6	0.599	0.551	0.5	Box culvert	1.2W x 0.3H		0.012	Existing	1	G3		0				
Line G - PH	Line G - HG	Line G - STC	10.25	0.55	0.499	0.5	Box culvert	1.2W x 0.3H		0.012	Existing	1	Line G - HG		0				
Line G - STC	Line G - STC	G2	8.55	0.483	0.44	0.5	Box culvert	1.2W x 0.3H		0.012	Existing	1	Line G - STC		0				
PG2	G2	G1	4.656	0.417	0.394	0.49	Box culvert	1.8W x 0.3H		0.012	Existing	2	G2		0				
PG1	G1	Dummy	10.858	0.374	0.32	0.5	Box culvert	1.8W x 0.3H		0.012	Existing	2	G1		0				
To Outlet	Dummy	Cat 4	10	0.3	0.3	0	Box culvert	1.8W x 0.3H		0.012	NewFixed	2	Dummy		0				
PRoof 3C	Roof 3C	G4	1	0.745	0.735	1	Concrete, r	300	300	0.013	New	2	Roof 3C		0				
PRoof 3B	Roof 3B	G3	1	0.629	0.619	1	Concrete, r	300	300	0.013	New	2	Roof 3B		0				
PRoof 3A	Roof 3A	G2	1	0.447	0.437	1	Concrete, r	300	300	0.013	New	1	Roof 3A		0				
PRoof 3E	Roof 3E	H2	1	0.479	0.469	1	Concrete, r	300	300	0.013	New	2	Roof 3E		0				
PH2	H2	H1	9.426	0.449	0.402	0.5	Box culvert	0.6W x 0.3H		0.012	NewFixed	1	H2		0				
PH1	H1	Dummy	12.497	0.382	0.32	0.5	Box culvert	0.6W x 0.3H		0.012	NewFixed	1	H1		0				
PRoof 3F	Roof 3F	H3	1	0.666	0.656	1	Concrete, r	300	300	0.013	New	2	Roof 3F		0				
PH3	H3	H2	33.36	0.636	0.469	0.5	Box culvert	0.6W x 0.3H		0.012	NewFixed	1	H3		0				
PRoof 3G	Roof 3G	H4	1	0.856	0.846	1	Concrete, r	300	300	0.013	New	2	Roof 3G		0				
PH4	H4	H3	34.1	0.826	0.656	0.5	Concrete, r	300	300	0.013	New	2	H4		0				
PRoof 5C	Roof 5C	A1	1	0.308	0.298	1	Concrete, r	300	300	0.013	New	1	Roof 5C		0				
PRoof 5D	Roof 5D	J1	1	0.634	0.624	1	Concrete, r	300	300	0.013	New	1	Roof 5D		0				
PJ1	J1	A4	4.8	0.686	0.662	0.5	Box culvert	1.2W x 0.3H		0.012	Existing	2	J1		0				
PRoof 5E	Roof 5E	L1	2	0.956	0.946	0.5	Concrete, r	300	300	0.013	New	1	Roof 5E		0				
PRoof 5F	Roof 5F	L2	2	1.015	1.013	0.1	Concrete, r	300	300	0.013	New	1	Roof 5F		0				
PK1	K1	A3 Basin	23.883	0.724	0.605	0.5	Box culvert	0.6W x 0.3H		0.012	Existing	1	K1		0				
PG7	G7	G6	2.7	1.018	1.004	0.52	Concrete, u	225	225	0.013	New	1	G7		0				
PG6	G6	G5	26.6	0.984	0.851	0.5	Concrete, r	225	225	0.013	New	3	G6		0				
PRoof 1B	Roof 1B	D2	1	0.596	0.586	1	Concrete, r	300	300	0.013	New	2	Roof 1B		0				
P Roof 1D	N Roof 1D	E1	1	0.482	0.472	1	Concrete, r	300	300	0.013	New	2	N Roof 1D		0				
P Roof 2D	N Roof 2D	G5A	2	0.904	0.884	1	Concrete, r	300	300	0.013	New	2	N Roof 2D		0				
PG5A	G5A	G5	2.7	0.864	0.851	0.48	Concrete, u	300	300	0.013	New	2	G5A		0				
P Roof 2E	N Roof 2E	G4A	1	0.778	0.768	1	Concrete, r	300	300	0.013	New	2	N Roof 2E		0				
PG4A	G4A	G4	2.7	0.748	0.735	0.48	Concrete, u	300	300	0.013	New	2	G4A		0				
P Roof 2F	N Roof 2F	G3A	1	0.662	0.652	1	Concrete, r	300	300	0.013	New	2	N Roof 2F		0				
PG3A	G3A	G3	2.7	0.632	0.619	0.48	Concrete, u	300	300	0.013	New	2	G3A		0				
P Roof 2G	N Roof 2G	G2A	1	0.481	0.471	1	Concrete, r	300	300	0.013	New	2	N Roof 2G		0				
PG2A	G2A	G2	2.7	0.451	0.437	0.52	Concrete, u	300	300	0.013	New	2	G2A		0				

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	Safe Depth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id	
OF L4	L4	L3	0.1				4 m wide p	0.3	0.15	0.4	1	100	6338	10.6
OF L3	L3	L2	0.1				Overflow a	0.05	0	0.6	1	0	3990695	1
OF L2	L2	L1	0.1				7.5 m road	0.3	0.15	0.36	1.77	0	3990697	13
OF L1	L1	J1	0.1				4 m wide p	0.3	0.15	0.4	1	50	6335	5.4
OF A5	A5	A4	0.5				7.5 m road	0.3	0.15	0.36	0.7	0	3990719	42.7
OF A4	A4	A2	0.3				7.5 m road	0.3	0.15	0.36	1.16	0	3990724	32.8
OF A3 Basi	A3 Basin	A4	0.1	1.56	20	1.74	Overflow a	0.05	0	0.6	1	0	3990734	6.4
OF A2	A2	Cat 1B	0.1				4 m wide p	0.3	0.15	0.4	1	50	6328	5.2
OF A1	A1	Cat 1B	0.1				4 m wide p	0.3	0.15	0.4	1	100	6329	10.4
OF Cat 1B I	Cat 1B	N Post Nor	0.1				7.5 m road	0.3	0.15	0.36	1	0	1879414	1
OF B1 - Ou	B1	Cat 1A	0.1				4 m wide p	0.3	0.15	0.4	1	100	5253	4.9
OF Cat 1A I	Cat 1A	N Post Nor	0.1				7.5 m road	0.3	0.15	0.36	1	0	1879416	1
OF M1 - A6	M1	A6	0.1				DD Wool R	0.1	0.05	0.36	1	50	6322	5.2
OF A6	A6	A5	0.1				7.5 m road	0.3	0.15	0.36	1.87	0	3990700	13.4
OF C1 - Ou	C1	Cat 1C	0.1				4 m wide p	0.3	0.15	0.4	4.89	100	5388	4.5
OF Cat 1C I	Cat 1C	N Post Nor	0.1				7.5 m road	0.3	0.15	0.36	1	0	1879419	1
OF C2 - C1	C2	Cat 1C	0.6				4 m wide p	0.3	0.15	0.4	0.27	100	4944	47.3
OF D3 - D2	D3	D2	0.6				DD Lanewa	0.1	0.05	0.36	1	50	5060	37.9
OF D2 - D1	D2	D1	0.4				DD Lanewa	0.1	0.05	0.36	1	50	5062	28
OF D1 - Ou	D1	Cat 2	0.1				4 m wide p	0.3	0.15	0.4	3.03	100	5379	7.6
OF Cat 2 Pc	Cat 2	N Cat Soutl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4635466	1
OF E1 - D1	E1	D1	0.2				4 m wide p	0.3	0.15	0.4	0.59	50	5386	25.4
OF F4 - F3	F4	F3	0.2				4 m wide p	0.3	0.15	0.4	1	50	5124	24.3
OF F3	F3	F2	0.7				DD Lanewa	0.1	0.05	0.36	1	0	28128623	41.4
OF F2 - Out	F2	Cat 3	0.1				4 m wide p	0.3	0.15	0.4	1.17	100	5392	16.3
OF Cat 3 Pc	Cat 3	N Cat Soutl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4635469	1
OF G5 - G4	G5	G4	0.3				DD Lanewa	0.1	0.05	0.36	1	50	5240	19.4
OF G4 - G3	G4	G3	0.3				DD Lanewa	0.1	0.05	0.36	1	50	5241	19.4
OF G3 - G2	G3	G2	0.5				DD Lanewa	0.1	0.05	0.36	1	30	5242	32.5
OF G2 - Ou	G2	Cat 4	0.1				4 m wide p	0.3	0.15	0.4	2.59	100	5468	14.3
OF N Cat 4	Cat 4	N Cat Soutl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4635476	1
OF H2 - Ou	H2	Cat 4	0.2				4 m wide p	0.3	0.15	0.4	1.57	100	5560	22.3
OF H3 - H2	H3	H2	0.5				DD Wool R	0.1	0.05	0.36	1	50	5614	32.7
OF H4 - H3	H4	H3	0.5				DD Wool R	0.1	0.05	0.36	1	50	5626	33.4
OF J1	J1	A1	0.3				7.5 m road	0.3	0.15	0.36	1.2	0	3990742	31.6
OF Cat 1C I	N Cat 1C Pi	N Pre Nortl	0.1				7.5 m road	0.3	0.15	0.36	1	0	1641627	1
OF Cat 1A I	N Cat 1A Pi	N Pre Nortl	0.1				7.5 m road	0.3	0.15	0.36	1	0	1641623	1
OF Cat 1B I	N Cat 1B Pi	N Pre Nortl	0.1				7.5 m road	0.3	0.15	0.36	1	0	1641622	1
OF Pre Nor	N Pre Nortl	N Pre Nortl	0.1				7.5 m road	0.3	0.15	0.36	1	0	1641631	1
OF Post No	N Post Nor	N Post Nor	0.1				7.5 m road	0.3	0.15	0.36	1	0	1879425	1
OF N Cat 2	N Cat 2 Pre	N Cat Soutl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4635457	1
OF N Cat 3	N Cat 3 Pre	N Cat Soutl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4635454	1
OF N Cat 4	N Cat 4 Pre	N Cat Soutl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4635446	1
OF Cat Sou	N Cat Soutl	N Cat Soutl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4635447	1
OF N Cat B	N Cat Bypa	N Pre Nortl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4310353	1
OF Cat Byp	N Cat Bypa	N Post Nor	0.1				7.5 m road	0.3	0.15	0.36	1	0	4310372	1
OF N Cat Sc	N Cat Soutl	N Cat Soutl	0.1				7.5 m road	0.3	0.15	0.36	1	0	4635480	1
OF K1	K1	A3 Basin	0.2				4 m wide p	0.3	0.15	0.4	1	100	14702522	25.2
OF G7	G7	G6	0.1				7.5 m road	0.3	0.15	0.36	1	0	26894193	3.8
OF G6	G6	N Caltex	0.1				7.5 m road	0.3	0.15	0.36	1	0	26894194	9.5
OF G5A	G5A	G4A	0.2				7.5 m road	0.3	0.15	0.36	1	0	26893940	19.1
OF G4A	G4A	G3A	0.2				7.5 m road	0.3	0.15	0.36	1	0	26893941	19.2
OF G3A	G3A	G2A	0.5				DD Lanewa	0.1	0.05	0.36	1	0	26893942	31.9
OF G2A	G2A	G2	0.1				7.5 m road	0.3	0.15	0.36	1	0	26893943	4.6

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover	Cover (m)
PL4	Concrete, c	300	0.6	0.17
PL3	Concrete, c	300	0.6	0.2
PL2	Concrete, r	300	0.45	0.21
PL1	Concrete, c	300	0.6	0.23
PA5	Box culvert	0	0.6	0.11
PA4	Box culvert	0	0.6	-0.52
PA3 Basin	Concrete, r	300	0.45	-0.33
PHG18	Concrete, r	300	0.45	0.66
Line A - PS1	Concrete, r	300	0.45	0.44
PA2	Box culvert	0	0.6	0.29
PA1	Concrete, r	300	0.45	0.28
PB1	Concrete, r	300	0.45	0.22
PM1	Concrete, c	300	0.6	0.28
PA6	Concrete, r	300	0.45	0.26
PRoof 5A	Concrete, r	300	0.45	0.27
PC1	Concrete, r	300	0.45	0.09
PRoof 5B	Concrete, r	300	0.45	0.13
PC2	Concrete, r	300	0.45	0.15
PRoof 1C	Concrete, r	300	0.45	0.28
PD3	Box culvert	0	0.6	0.14
PHG30A	Box culvert	0	0.6	0.27
PSTC	Box culvert	0	0.6	0.12
PD2	Box culvert	0	0.6	0.14
PD1	Box culvert	0	0.6	0.21
PRoof 1A	Concrete, r	300	0.45	0.6
PE1	Box culvert	0	0.6	0.38
PRoof 2C	Concrete, r	300	0.45	0.29
PF4	Box culvert	0	0.6	0.14
PF3	Box culvert	0	0.6	0.24
Line F - PH(	Box culvert	0	0.6	0.46
Line F - PS1	Box culvert	0	0.6	0.29
PF2	Box culvert	0	0.6	0.29
PF1	Box culvert	0	0.6	0.24
PRoof 2B	Concrete, r	300	0.45	0.39
PRoof 2A	Concrete, r	300	0.45	0.46
PRoof 3D	Concrete, r	300	0.45	1.13
PG5	Box culvert	0	0.6	0.98
PG4	Box culvert	0	0.6	1.09
PG3	Box culvert	0	0.6	1.21
Line G - PH	Box culvert	0	0.6	0.89
Line G - ST(	Box culvert	0	0.6	0.37
PG2	Box culvert	0	0.6	0.21
PG1	Box culvert	0	0.6	0.23
To Outlet	Box culvert	0	0.6	0.14
PRoof 3C	Concrete, r	300	0.45	1.24
PRoof 3B	Concrete, r	300	0.45	1.36
PRoof 3A	Concrete, r	300	0.45	0.54
PRoof 3E	Concrete, r	300	0.45	0.49
PH2	Box culvert	0	0.6	0.2
PH1	Box culvert	0	0.6	0.22
PRoof 3F	Concrete, r	300	0.45	0.35
PH3	Box culvert	0	0.6	0.2
PRoof 3G	Concrete, r	300	0.45	0.21
PH4	Concrete, r	300	0.45	0.23
PRoof 5C	Concrete, r	300	0.45	0.48
PRoof 5D	Concrete, r	300	0.45	0.39
PJ1	Box culvert	0	0.6	0.15
PRoof 5E	Concrete, r	300	0.45	0.21
PRoof 5F	Concrete, r	300	0.45	0.23
PK1	Box culvert	0	0.6	-0.52
PG7	Concrete, c	225	0.6	0.16
PG6	Concrete, r	225	0.45	0.19
PRoof 1B	Concrete, r	300	0.45	0.29
P Roof 1D	Concrete, r	300	0.45	0.6
P Roof 2D	Concrete, r	300	0.45	1.09
PG5A	Concrete, c	300	0.6	1.11
P Roof 2E	Concrete, r	300	0.45	1.21
PG4A	Concrete, c	300	0.6	1.23
P Roof 2F	Concrete, r	300	0.45	1.33
PG3A	Concrete, c	300	0.6	1.35
P Roof 2G	Concrete, r	300	0.45	0.51
PG2A	Concrete, c	300	0.6	0.53

This model has no pipes with non-return valves

B. DRAINS Results

DRAINS results prepared from Version 2017.10

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
L4	1.25	1.63	0.011	0	0.36	0	Inlet Capacity
L3	1.21	1.59	0.012	0	0.36	0	Inlet Capacity
L2	1.18	1.59	0.01	0	0.39	0	Inlet Capacity
L1	1.14	1.51	0.011	0	0.35	0	Inlet Capacity
A5	0.99	1.5	0.007	0	0.5	0	Inlet Capacity
A4	1.02	1.36	0.017	0.1	0.32	0	Inlet Capacity
Line A - HG18	1.19		0		0.45		None
Line A - STC18	0.93		0		0.45		None
A2	0.93		0.007		0.18	0	None
A1	0.92		0.01		0.19	0	None
Cat 1B	0.84		0				
B1	0.98	1.17	0.001	0	0.19	0	None
Cat 1A	0.98		0				
M1	1.12	1.61	0.015	0.1	0.47	0	Inlet Capacity
A6	1.07	1.61	0.012	0	0.52	0	Inlet Capacity
Roof 5A	1.05		0.05				
C1	1.05		0.003		0.18	0	None
Cat 1C	1.01		0				
Roof 5B	1.13		0.031				
C2	1.13		0.002		0.23	0	None
Roof 1C	1.26		0.12				
D3	1.25	1.44	0.026	0.2	0.16	0	Inlet Capacity
HG30A	1.23		0		0.3		None
STC18	1.2		0		0.48		None
D2	1.16	1.24	0.024	0.2	0.05	0	Inlet Capacity
D1	1.09		0.007		0.22	0	None
Cat 2	1.08		0				
Roof 1A	1.19		0.057				
E1	1.18		0.005		0.22	0	None
Roof 2C	1.25		0.101				
F4	1.25	1.43	0.018	0.1	0.16	0	Inlet Capacity
F3	1.21	1.39	0.018	0.1	0.16	0	Inlet Capacity
Line F - HG18	1.14		0		0.33		None
Line F - STC9	1.09		0		0.35		None
F2	1.06		0.016		0.15	0.001	Inlet Capacity
F1	1.04		0		0.13		None
Cat 3	1.02		0.001				
Roof 2B	1.22		0.066				
Roof 2A	1.07		0.064				
Roof 3D	1.11		0.025				
G5	1.11	2.32	0.005	0	1.2	0	Inlet Capacity
G4	1.11	2.32	0.005	0	1.2	0	Inlet Capacity
G3	1.1	2.32	0.005	0	1.21	0	Inlet Capacity
Line G - HG18	1.07		0		1.31		None
Line G - STC 9	1.02		0		0.87		None
G2	0.98		0.006		0.33	0	None
G1	0.97		0		0.13		None
Dummy	0.96		0		0.14		None
Cat 4	0.94		0				
Roof 3C	1.11		0.014				
Roof 3B	1.1		0.014				
Roof 3A	0.98		0.016				
Roof 3E	1.03		0.015				
H2	1.03		0.007		0.26	0	None
H1	0.98		0		0.12		None
Roof 3F	1.07		0.027				
H3	1.07	1.36	0.011	0	0.27	0	Inlet Capacity
Roof 3G	1.1		0.036				
H4	1.1	1.41	0.016	0	0.29	0	Inlet Capacity
Roof 5C	0.92		0.021				
Roof 5D	1.08		0.047				
J1	1.06	1.37	0.022	0.1	0.28	0	Inlet Capacity
Roof 5E	1.14		0.009				
Roof 5F	1.18		0.008				
K1	1.01	1.37	0.027	0.6	0.32	0	Inlet Capacity
G7	1.49	1.53	0.059	2.3	0	0	Outlet System
G6	1.28	1.47	0.039	0.1	0.15	0	Inlet Capacity
Roof 1B	1.16		0.084				
N Roof 1D	1.19		0.086				
N Roof 2D	1.13		0.045				
G5A	1.13	2.32	0.005	0	1.18	0	Inlet Capacity
N Roof 2E	1.11		0.022				
G4A	1.11	2.32	0.005	0	1.2	0	Inlet Capacity
N Roof 2F	1.11		0.022				
G3A	1.11	2.32	0.005	0	1.2	0	Inlet Capacity
N Roof 2G	0.98		0.026				
G2A	0.98		0.007		0.33	0	None

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Cat L4	0.011	0.011	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat L3	0.012	0.011	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat L2	0.01	0.009	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat L1	0.011	0.01	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat A5	0.007	0.007	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat A4	0.017	0.015	0.002	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat A3 Basin	0.07	0.013	0.058	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat A2	0.007	0.006	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat A1	0.01	0.008	0.002	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat B1	0.001	0	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat M1	0.015	0.015	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat A6	0.012	0.012	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 5A	0.05	0.05	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat C1	0.003	0.001	0.002	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 5B	0.031	0.031	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat C2	0.002	0.001	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 1C	0.12	0.12	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat D3	0.026	0.021	0.005	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat D2	0.024	0.024	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat D1	0.007	0.004	0.003	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 1A	0.057	0.057	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat E1	0.005	0	0.005	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 2C	0.101	0.101	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat F4	0.018	0.018	0	5	100	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat F3	0.018	0.018	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat F2	0.016	0.013	0.003	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 2B	0.066	0.066	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 2A	0.064	0.064	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 3D	0.025	0.025	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G5	0.005	0.005	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G4	0.005	0.005	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G3	0.005	0.005	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G2	0.006	0.006	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 3C	0.014	0.014	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 3B	0.014	0.014	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 3A	0.016	0.016	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 3E	0.015	0.015	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat H2	0.007	0.005	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 3F	0.027	0.027	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat H3	0.011	0.01	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 3G	0.036	0.036	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat H4	0.016	0.014	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 5C	0.021	0.021	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 5D	0.047	0.047	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat J1	0.022	0.021	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 5E	0.009	0.009	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 5F	0.008	0.008	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat 1C Pre	0.098	0.096	0.002	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat 1A Pre	0.003	0.001	0.003	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat 1B Pre	0.163	0.163	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat 2 Pre	0.562	0.558	0.004	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat 3 Pre	0.315	0.315	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat 4 Pre	0.383	0.356	0.027	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Bypass 1 Pre	0.064	0.063	0.001	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Bypass 1 Post	0.017	0.015	0.002	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat K1	0.027	0	0.027	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G7	0.059	0.059	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G6	0.039	0.039	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 1B	0.084	0.084	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 1D	0.086	0.086	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 2D	0.045	0.045	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G5A	0.005	0.005	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 2E	0.022	0.022	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G4A	0.005	0.005	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 2F	0.022	0.022	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G3A	0.005	0.005	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat Roof 2G	0.026	0.026	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Cat G2A	0.007	0.007	0	5	10	0	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1

Outflow Volumes for Total Catchment (5.99 impervious + 0.47 pervious = 6.47 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Runc	Impervious cu.m (Runc	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, a	980.15	875.13 (89	848.78 (93	26.35 (36.9%)
AR&R 20 year, 10 minutes storm,	1508.82	1394.50 (9	1338.93 (9	55.57 (50.5%)
AR&R 20 year, 15 minutes storm,	1896.51	1774.69 (9	1698.37 (9	76.32 (55.2%)
AR&R 20 year, 20 minutes storm,	2208.01	2080.25 (9	1987.18 (9	93.08 (57.8%)
AR&R 20 year, 25 minutes storm,	2470.65	2335.41 (9	2230.67 (9	104.74 (58.2%)
AR&R 20 year, 30 minutes storm,	2699.78	2557.94 (9	2443.08 (9	114.87 (58.4%)
AR&R 20 year, 45 minutes storm,	3257.93	3100.99 (9	2960.57 (9	140.42 (59.1%)
AR&R 20 year, 1 hour storm, aver	3698.03	3529.37 (9	3368.59 (9	160.77 (59.7%)
AR&R 20 year, 1.5 hours storm, a	4323.09	4134.82 (9	3948.11 (9	186.71 (59.3%)
AR&R 20 year, 2 hours storm, ave	4812.49	4608.11 (9	4401.86 (9	206.25 (58.8%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
PL4	0.011	0.46	1.219	1.213	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PL3	0.023	0.65	1.186	1.179	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PL2	0.04	0.94	1.168	1.136	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PL1	0.059	1.26	1.117	1.09	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PA5	0.094	0.75	0.986	1.017	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PA4	0.795	1.1	1.017	1.313	AR&R 20 year, 20 minutes storm, average 102 mm/h, Zone 1
PA3 Basin	0.052	0.74	1.057	1.192	AR&R 20 year, 5 minutes storm, average 182 mm/h, Zone 1
PHG18	0.056	0.8	1.15	0.934	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Line A - PSTC18	0.055	0.39	0.931	0.931	AR&R 20 year, 45 minutes storm, average 67.2 mm/h, Zone 1
PA2	0.049	0.18	0.924	0.919	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PA1	0.087	0.61	0.899	0.84	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PB1	0.001	0.01	0.98	0.98	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PM1	0.015	0.75	1.08	1.073	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PA6	0.027	0.98	1.062	1.027	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 5A	0.05	0.71	1.05	1.046	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PC1	0.086	0.61	1.02	1.01	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 5B	0.031	0.54	1.13	1.126	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PC2	0.033	0.58	1.098	1.046	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 1C	0.12	0.85	1.263	1.252	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PD3	0.143	0.53	1.231	1.229	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PHG30A	0.144	0.53	1.208	1.203	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PSTC	0.144	0.53	1.181	1.16	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PD2	0.249	0.69	1.123	1.09	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PD1	0.404	0.37	1.084	1.08	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 1A	0.057	0.4	1.187	1.184	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PE1	0.148	0.82	1.099	1.09	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 2C	0.101	0.72	1.25	1.246	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PF4	0.118	0.44	1.226	1.214	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PF3	0.2	0.74	1.177	1.14	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Line F - PHG18	0.2	0.74	1.098	1.09	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Line F - PSTC9	0.201	0.56	1.067	1.059	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PF2	0.279	0.52	1.041	1.038	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PF1	0.279	0.52	1.031	1.02	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 2B	0.066	0.93	1.218	1.214	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 2A	0.064	0.9	1.065	1.059	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 3D	0.026	0.2	1.112	1.11	AR&R 20 year, 20 minutes storm, average 102 mm/h, Zone 1
PG5	0.158	0.16	1.107	1.107	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PG4	0.201	0.19	1.104	1.104	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PG3	0.244	0.68	1.079	1.066	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Line G - PHG18	0.243	0.68	1.031	1.019	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
Line G - STC9	0.244	0.68	0.985	0.976	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PG2	0.302	0.28	0.971	0.97	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PG1	0.298	0.28	0.961	0.958	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
To Outlet	0.406	0.38	0.945	0.94	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 3C	0.014	0.1	1.107	1.107	AR&R 20 year, 15 minutes storm, average 117 mm/h, Zone 1
PRoof 3B	0.014	0.1	1.105	1.104	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 3A	0.017	0.24	0.977	0.976	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 3E	0.015	0.11	1.028	1.029	AR&R 20 year, 15 minutes storm, average 117 mm/h, Zone 1
PH2	0.11	0.61	0.994	0.983	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PH1	0.11	0.61	0.973	0.958	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 3F	0.028	0.2	1.069	1.067	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PH3	0.089	0.49	1.055	1.029	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 3G	0.038	0.31	1.1	1.099	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PH4	0.052	0.39	1.092	1.067	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 5C	0.022	0.31	0.919	0.919	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 5D	0.062	0.88	1.079	1.064	AR&R 20 year, 20 minutes storm, average 102 mm/h, Zone 1
PJ1	0.69	0.96	1.068	1.017	AR&R 20 year, 1 hour storm, average 57.2 mm/h, Zone 1
PRoof 5E	0.009	0.2	1.137	1.136	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 5F	0.008	0.21	1.18	1.179	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PK1	0.081	0.48	1.007	1.313	AR&R 20 year, 2 hours storm, average 37.2 mm/h, Zone 1
PG7	0.045	1.14	1.296	1.277	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PG6	0.076	0.64	1.208	1.11	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PRoof 1B	0.084	0.6	1.163	1.16	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
P Roof 1D	0.087	0.61	1.188	1.184	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
P Roof 2D	0.044	0.39	1.13	1.13	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PG5A	0.05	0.4	1.112	1.11	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
P Roof 2E	0.022	0.15	1.11	1.108	AR&R 20 year, 5 minutes storm, average 182 mm/h, Zone 1
PG4A	0.027	0.19	1.106	1.107	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
P Roof 2F	0.022	0.16	1.106	1.107	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
PG3A	0.028	0.2	1.105	1.104	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
P Roof 2G	0.026	0.19	0.981	0.98	AR&R 20 year, 20 minutes storm, average 102 mm/h, Zone 1
PG2A	0.034	0.24	0.976	0.976	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF L4	0	0.012	0.908	0.025	0.01	4	0.3	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF L3	0	0	0	0	0	0	0	
OF L2	0	0	0.408	0	0	0	0	
OF L1	0	0.011	0.908	0.024	0.01	4	0.3	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF A5	0	0	0.257	0	0	0	0	
OF A4	0	0	0.331	0	0	0	0	
OF A3 Basin	0	0	0	0	0	0	0	
OF A2	0	0	0.908	0	0	0	0	
OF A1	0	0	0.908	0	0	0	0	
OF Cat 1B Post	0.087	0.087	0.307	0.098	0.09	2.4	0.94	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF B1 - Outlet	0	0	0.908	0	0	0	0	
OF Cat 1A Post	0.001	0.001	0.307	0.017	0.01	0.19	0.32	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF M1 - A6	0	0.006	0.041	0.024	0.01	1.22	0.41	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF A6	0	0	0.42	0	0	0	0	
OF C1 - Outlet	0	0	1.41	0	0	0	0	
OF Cat 1C Post	0.086	0.086	0.307	0.097	0.09	2.38	0.95	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF C2 - C1	0	0	0.472	0	0	0	0	
OF D3 - D2	0	0.012	0.023	0.04	0.02	1.02	0.59	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF D2 - D1	0	0.004	0.023	0.026	0.01	0.64	0.43	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF D1 - Outlet	0	0	1.438	0	0	0	0	
OF Cat 2 Post	0.404	0.404	0.307	0.165	0.2	4.72	1.23	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF E1 - D1	0	0.004	0.698	0.018	0	1.82	0.21	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF F4 - F3	0	0.009	0.908	0.023	0.01	4	0.27	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF F3	0	0	0.023	0	0	0	0	
OF F2 - Outlet	0.001	0.001	0.982	0.009	0	0.94	0.19	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF Cat 3 Post	0.28	0.28	0.307	0.143	0.17	3.92	1.19	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF G5 - G4	0	0.003	0.023	0.023	0.01	0.57	0.38	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF G4 - G3	0	0.003	0.023	0.023	0.01	0.57	0.39	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF G3 - G2	0	0.002	0.023	0.02	0.01	0.5	0.38	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF G2 - Outlet	0	0	1.431	0	0	0	0	
OF N Cat 4 Post	0.406	0.406	0.307	0.165	0.2	4.72	1.23	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF H2 - Outlet	0	0	1.138	0	0	0	0	
OF H3 - H2	0	0.003	0.022	0.025	0.01	0.63	0.43	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF H4 - H3	0	0.005	0.022	0.03	0.01	0.76	0.47	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF J1	0	0	0.336	0	0	0	0	
OF Cat 1C Pre	0.098	0.098	0.307	0.102	0.1	2.53	0.96	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF Cat 1A Pre	0.003	0.003	0.307	0.034	0.02	0.39	0.52	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF Cat 1B Pre	0.163	0.163	0.307	0.12	0.13	3.15	1.06	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF Pre North	0.329	0.329	0.307	0.154	0.18	4.45	1.17	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF Post North	0.189	0.189	0.307	0.126	0.14	3.34	1.09	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF N Cat 2 Pre	0.562	0.562	0.307	0.182	0.25	5.14	1.36	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF N Cat 3 Pre	0.315	0.315	0.307	0.152	0.18	4.36	1.16	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF N Cat 4 Pre	0.383	0.383	0.307	0.162	0.2	4.65	1.21	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF Cat South Pre	1.259	1.259	0.307	0.234	0.41	6.45	1.76	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF N Cat Bypass Pre	0.064	0.064	0.307	0.089	0.08	2.1	0.89	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF Cat Bypass 1 Post	0.017	0.017	0.307	0.058	0.04	1.05	0.74	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF N Cat South Post	1.09	1.09	0.307	0.223	0.38	6.18	1.68	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF K1	0	0.07	0.908	0.044	0.03	4	0.61	AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1
OF G7	0	0	0.307	0	0	0	0	
OF G6	0	0	0.307	0	0	0	0	
OF G5A	0	0	0.307	0	0	0	0	
OF G4A	0	0	0.307	0	0	0	0	
OF G3A	0	0	0.023	0	0	0	0	
OF G2A	0	0	0.307	0	0	0	0	

DETENTION BASIN DETAILS

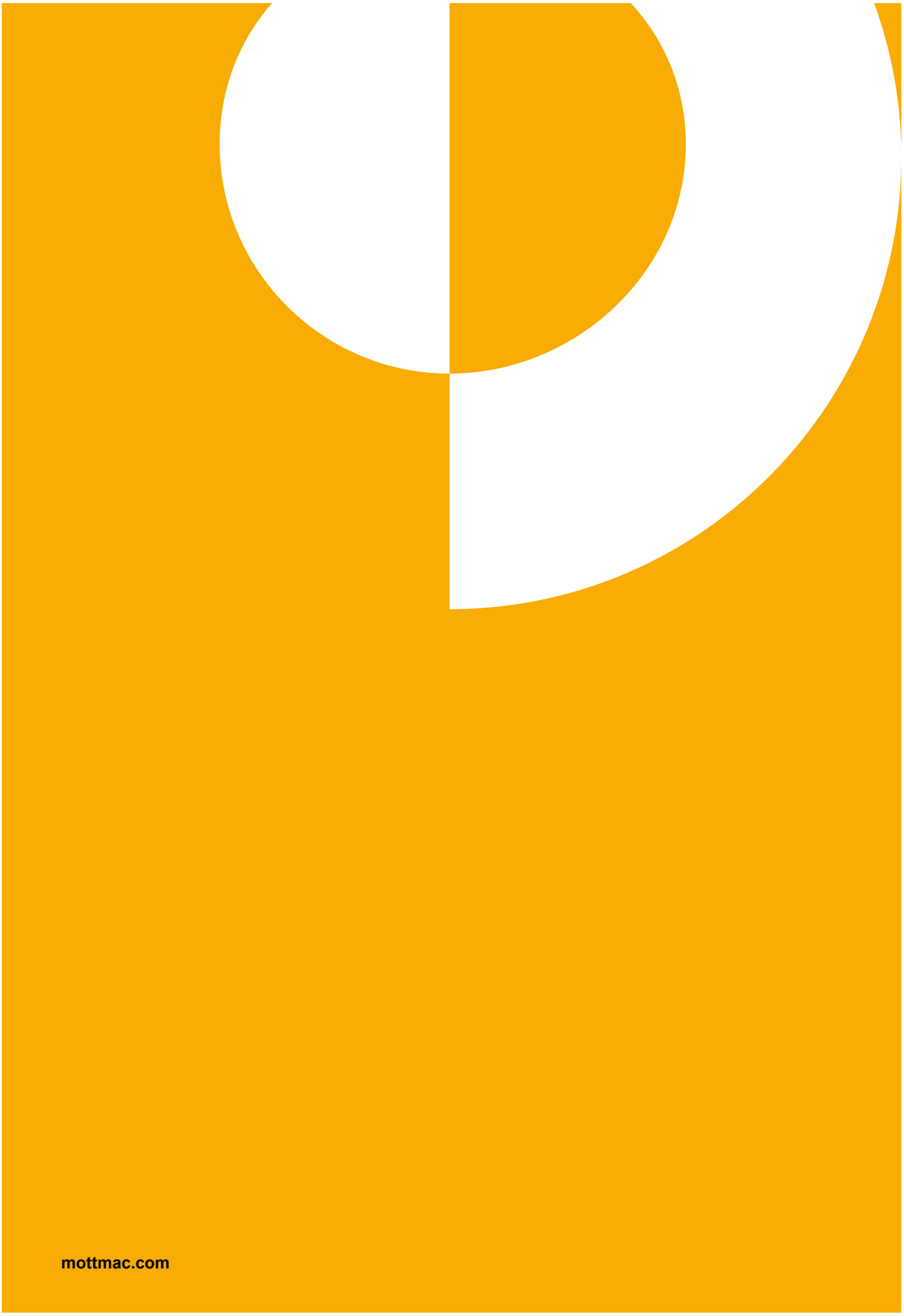
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
A3 Basin	1.31	5.6	0.052	0.052	0

CONTINUITY CHECK for AR&R 20 year, 25 minutes storm, average 91.7 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
L4	8.36	8.36	0	0
L3	17.31	17.31	0	0
L2	30.76	30.76	0	0
L1	45.2	45.19	0	0
A5	71.44	70.2	0	1.7
A4	57	-644.16	0	1230
A3 Basin	-623.6	90.42	3.9	0
Line A - HG18	90.42	120.98	0	-33.8
Line A - STC18	120.98	105.02	0	13.2
A2	110.38	109.25	0	1
A1	134.05	139.89	0	-4.4
Cat 1B	139.89	139.62	0	0.2
B1	0.33	0.33	0	0
Cat 1A	0.33	0.33	0	0
M1	11.55	11.55	0	0
A6	20.7	20.7	0	0
Roof 5A	37.74	37.74	0	0
C1	64.5	64.5	0	0
Cat 1C	64.5	64.49	0	0
Roof 5B	23.04	23.09	0	-0.2
C2	24.47	24.42	0	0.2
Roof 1C	89.54	89.59	0	-0.1
D3	108.75	108.67	0	0.1
HG30A	108.67	108.7	0	0
STC18	108.7	108.68	0	0
D2	189.19	189.26	0	0
D1	304.46	304.52	0	0
Cat 2	304.52	304.51	0	0
Roof 1A	42.39	42.39	0	0
E1	110.12	110.14	0	0
Roof 2C	75.92	75.96	0	0
F4	89.18	89.14	0	0
F3	151.86	151.84	0	0
Line F - HG18	151.84	151.85	0	0
Line F - STC9	151.85	151.84	0	0
F2	211.12	211.06	0	0
F1	210.97	211	0	0
Cat 3	211.1	211.09	0	0
Roof 2B	49.31	49.33	0	0
Roof 2A	47.71	47.72	0	0
Roof 3D	18.38	18.21	0	0.9
G5	132.84	132.93	0	-0.1
G4	167.29	167.13	0	0.1
G3	201.56	201.53	0	0
Line G - HG18	201.53	201.53	0	0
Line G - STC 9	201.53	201.52	0	0
G2	243.28	243.22	0	0
G1	243.22	243.26	0	0
Dummy	326.59	326.54	0	0
Cat 4	326.54	326.54	0	0
Roof 3C	10.2	10.18	0	0.2
Roof 3B	10.2	10.2	0	0
Roof 3A	12.21	12.21	0	0
Roof 3E	11.02	11.02	0	-0.1
H2	83.33	83.3	0	0
H1	83.3	83.33	0	0
Roof 3F	20.54	20.49	0	0.2
H3	67.28	67.32	0	-0.1
Roof 3G	27.17	27.2	0	-0.1
H4	38.71	38.67	0	0.1
Roof 5C	15.52	17.54	0	-13
Roof 5D	35.43	15.92	0	55.1
J1	32.34	-25.52	0	178.9
Roof 5E	6.44	6.44	0	0
Roof 5F	6.29	6.29	0	0.1
N Cat 1C Pre	73.28	73.28	0	0
N Cat 1A Pre	2.38	2.38	0	0
N Cat 1B Pre	122.29	122.29	0	0
N Pre North	246	246	0	0
N Pre North Total	246	246	0	0
N Post North	216.74	216.3	0	0.2
N Post North Total	216.3	216.3	0	0
N Cat 2 Pre	420.66	420.66	0	0
N Cat 3 Pre	235.73	235.73	0	0
N Cat 4 Pre	284.43	284.43	0	0
N Cat South Pre	940.82	940.82	0	0
N Cat South Total	940.82	940.82	0	0
N Cat Bypass 1 Pre	48.05	48.05	0	0
N Cat Bypass 1 Post	12.29	12.29	0	0
N Cat South Post	842.15	842.17	0	0
N Cat South Post Tot	842.17	842.17	0	0

K1	17.57	-27.1	0	254.2
G7	44.03	44.02	0	0
G6	73.16	73.15	0	0
N Caltex	0	0	0	0
Roof 1B	62.67	62.61	0	0.1
N Roof 1D	64.68	64.65	0	0.1
N Roof 2D	33.79	33.83	0	-0.1
G5A	37.81	37.76	0	0.2
N Roof 2E	16.34	16.39	0	-0.3
G4A	20.41	20.38	0	0.1
N Roof 2F	16.3	16.34	0	-0.2
G3A	20.39	20.36	0	0.2
N Roof 2G	19.76	19.69	0	0.3
G2A	24.64	24.76	0	-0.5

Run Log for 366163 170622 Wickham Woolstores Final Current.drn run at 11:42:02 on 3/7/2017{\rtf1\ansi\deff0{\colortbl;\red0\green0\blue0;\red255\green0\blue0;}No water upwelling fr
\par }



mottmac.com