Proposed Industrial Subdivision, Freeway North Business Park, Weakleys Drive, Beresfield

Stormwater Drainage Report

Hunter Land Pty Ltd

FINAL

Revision: 3
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Geoff Craig & Associates Pty Ltd
ABN 92 086 017 745

1 Hartley Drive
Thornton NSW 2322

PO Box 2153
Greenhills NSW 2323
Australia

T: (02) 4964 1811
F: (02) 4964 1822

Revision	Description	Author		Review		Approved	
1	Revised development	AA	03.09.08	GC	03.09.08	GC	03.09.08
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3	Revised development	AA	13.10.10	AS	13.10.10	IH	13.10.10

Contents

List of tables

List of figures

List of appendices

Glossary

Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 500 m^3/s has an AEP of 5%, it means that there is a 5% chance (or one-in-twenty) of a 500 m^3/s or larger event occurring in any one year.
Average Recurrence Interval (ARI)	The long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge greater than or equal to the 20 year ARI flood event will occur on average once every 20 years.
flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding a tsunami.
floodplain	Area of land which is subject to inundation by floods up to and including the probable maximum flood event.

List of acronyms

ARI	Annual Recurrence Interval
ARR	Australian Rainfall and Runoff (Engineers Australia, 1997)
AEP	Annual Exceedance Probability
GCA	Geoff Craig and Associates Pty Limited
NOW	Department of Environment and Climate Change NSW; Office of Water
PB	Parsons Brinckerhoff Australia Pty Limited
PPK	PPK Environment and Infrastructure Pty Limited (now Parsons Brinckerhoff Australia Pty Limited)
PRM	Probabilistic Rational Method (in accordance with ARR)
SQID	Stormwater Quality Improvement Device

1. Introduction

1.1 Background and proposed development

Geoff Craig & Associates Pty Ltd (GCA) was engaged to review the stormwater management plan for Freeway North Business Park, a Development Application approved industrial subdivision located in Beresfield.

The approved Freeway North Business Park development is bounded by the New England Highway to the north and Weakleys Drive to the east. The site comprises Lot 14 DP 1091199, Lot 14 DP 207961 and Lot E DP 388733. The ultimate development site is approximately 86.6 ha in area. A locality plan is shown on Figure 1, and a site plan is shown on Figure 2.

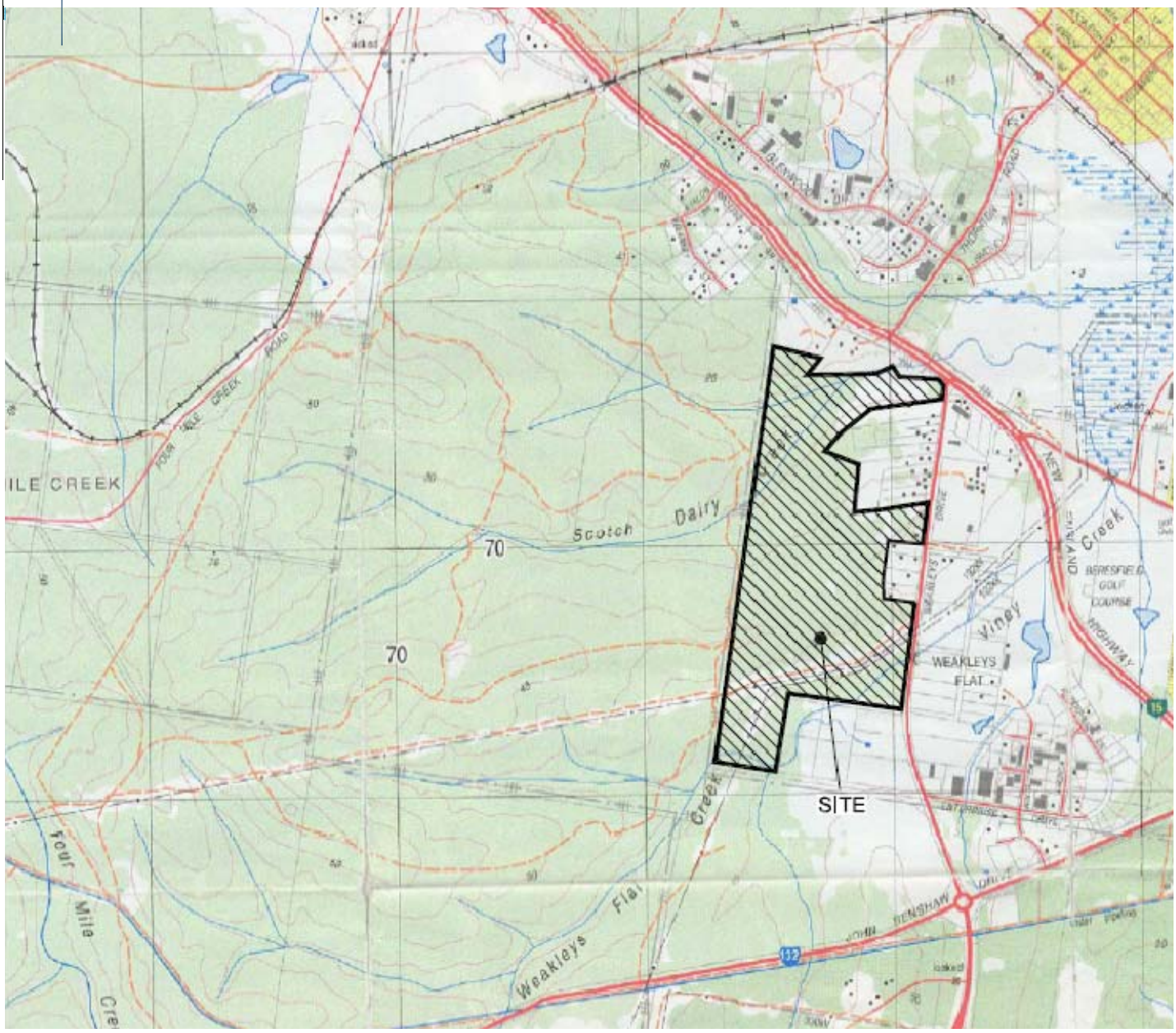
This report documents an alternative drainage strategy proposed for the development following a more detailed drainage assessment prior to Construction Certificate. Both stormwater runoff flow rates (i.e. provision of on-site detention) and stormwater runoff quality was considered during preparation of the alternative drainage strategy.

1.2 Existing drainage catchments

The site can be divided into three main local drainage catchments based on the predominant existing drainage directions, described below. Also refer to Figure 3 for a local catchment plan.

- Catchment 1 - The majority of the runoff from the site flows toward the north western side of the catchment and drains into Scotch Dairy Creek. Catchment 1 has a gentle north-westerly grade with surface slopes typically in the order of 2% to 4%. Scotch Dairy Creek drains beneath the New England Highway to the north via triple 2700mm wide x 2700mm high reinforced concrete box culverts.
- Catchment 2 - A small portion of the site currently drains to an existing gully situated north of the Weakleys Drive Bridge. The existing gully is drained by an existing 600mm diameter concrete pipe beneath Weakleys Drive, with an existing inlet headwall invert level of R.L 6.236 AHD. The gully connects in with Viney Creek approximately 100m downstream of Weakleys Drive
- Catchment 3 - The runoff from the southern portion of the site flows into Viney Creek. Catchment 3 contains slopes typically in the order of 7% to 10%. Viney Creek drains beneath Weakleys Drive via an existing road bridge structure, and then a further 100m downstream collects stormwater runoff from the gully described in 'Catchment 2' above.

GCA ENGINEERING SOLUTIONS



Client: HUNTER LAND PTY LTD
Project: PROPOSED INDUSTRIAL SUBDIVISION
Location: WEAKLEYS DRIVE BERESFIELD

PROJECT NUMBER: 07307C dF01r3
DATE: 12.10.10

LOCALITY PLAN

FIGURE 1

LEGEND

PROPOSED DEVELOPMENT SITE

STAGE BOUNDARY

103 STAGE 1 LOT NUMBER

203 STAGE 2 LOT NUMBER

303 STAGE 3 LOT NUMBER

GCA ENGINEERING SOLUTIONS

N

LOT 1
DP 838310
(DONALDSON COAL PTY LTD)

PARISH DRIVE

KILLARNEY STREET

DRAINAGE RESERVE

8
DP226431

9
DP390543

NEW ENGLAND HIGHWAY

ROAD 1

ROAD 2

ROAD 3

ROAD 4

124

9
DP509255

316

EXISTING CULVERT

22
DP532814

16
DP510628

15

13 DP203406

12 DP416248

11 DP506747

10 DP416248

8 DP396036

7

D DP388733

16 DP1091199

15 DP1091199

WEAKLEYS DRIVE

EXISTING Φ600 RCP

EXISTING BRIDGE

24
DP1070843

20
DP1025870

60
DP523177

PROPOSED ROUNDABOUT

63
DP620288

0 80 160 240 320 400 m

SCALE 1:4000 (A3)

Client: HUNTER LAND PTY LTD

Project: PROPOSED INDUSTRIAL SUBDIVISION

Location: WEAKLEYS DRIVE BERESFIELD

PROJECT NUMBER: 07307C dFO2r3
DATE: 12.10.10

SITE PLAN

FIGURE 2

GCA ENGINEERING SOLUTIONS

LEGEND

- CATCHMENT 1
- CATCHMENT 2
- CATCHMENT 3

LOT 1
DP 838310
(DONALDSON COAL PTY LTD)

PARISH DRIVE
KILLARNEY STREET
NEW ENGLAND HIGHWAY
VINEY CREEK
SCOTCH DAIRY CREEK
DRAINAGE RESERVE
ROAD 1
ROAD 2
ROAD 3
ROAD 4
WEAKLEYS DRIVE
EXISTING CULVERT
EXISTING BRIDGE
EXISTING Φ600 RCP
PROPOSED ROUNDABOUT

8 DP226431
9 DP390543
9 DP509255
8 DP396036
7 DP388733
D DP1091199
16 DP1091199
15 DP1091199
13 DP203406
12 DP416248
11 DP506747
10 DP416248
22 DP532814
16 DP510628
15 DP510628
24 DP1070843
20 DP1025870
60 DP523177
63 DP620288

Client: HUNTER LAND PTY LTD
Project: PROPOSED INDUSTRIAL SUBDIVISION
Location: WEAKLEYS DRIVE BERESFIELD

PROJECT NUMBER: 07307C dF03r3
DATE: 12.10.10

0 80 160 240 320 400 m
SCALE 1:4000 (A3)

LOCAL CATCHMENT PLAN

FIGURE 3

1.3 Information sources

The following information was used for this study:

- Survey of the site provided by Harper Somers O'Sullivan.
- Subdivision Layout prepared by Geoff Craig and Associates Pty. Ltd, Project No. 09304L, Drawing L01 r10.
- Report by Parsons Brinckerhoff Australia Pty Limited on Freeway Business Park, "Flood Modelling and Stormwater Management Strategy", March 2007.
- Report by PPK Environment and Infrastructure Pty Limited on Freeway Business Park, "Stormwater Management Plan", February 2002.
- SPEL Stormceptor Class 1 stormwater quality device information, provided by SPEL Environmental.

1.4 Stormwater management plan objectives

The core objectives of the revised stormwater management plan were to:

- ensure that post development peak flow rates are equal to or less than pre-development peak flow rates for the critical design storm events from 1 year Average Recurrence Interval (ARI) to 100 year ARI, proposing on-site stormwater detention if necessary
- propose appropriate stormwater quality treatment devices are prior to discharge of stormwater runoff from the development into the downstream water courses.

1.5 Structure of this report

This report is structured in four sections, summarised below.

Section 1 Introduction, which provides information on the study background, study objectives, the proposed development, and a description of the drainage catchments.

Section 2 A brief description of previous studies of stormwater drainage and flooding completed (by others) for the proposed Freeway Business Park development.

Section 3 Revised stormwater management plan including the results from DRAINS stormwater modelling to confirm the performance of the proposed approach to drainage.

Section 4 Summary and conclusions.

2. Previous studies

Previous reports by Parsons Brinckerhoff Australia Pty Ltd on Freeway North Business Park, "Flood Modelling and Stormwater Management Strategy", and PPK Environment & Infrastructure Pty Ltd on Freeway Business Park, "Stormwater Management Plan", concluded that development within Catchment 1 (to Scotch Dairy Creek) and Catchment 3 (to Viney Creek) would result in a decrease in the post-development flow rates downstream compared to pre-development flow rates. This conclusion was based on the XP-RAFTS model prediction that the development would facilitate local peak runoff flow rates leaving the site prior to the arrival of the larger flood peak from the upstream catchment areas. Based on this observation the PB and PPK reports concluded that detention storage within Catchments 1 and 3 was not required.

The PB report proposed an end of line Gross Pollutant Traps (GPTs) and sand filters to provide treatment of stormwater runoff from both Catchments 1 and 3 prior to discharge into Viney and Scotch Dairy Creeks. The treatment train was to be designed to treat the design 3 month ARI flow rate.

The PB report stated that development in Catchment 2 (Weakleys Drive) was expected to result in a substantial increase in peak flow rates at the existing 600mm diameter culvert under Weakleys Drive. To address this PB recommended that part of Catchment 2 be diverted towards Viney Creek. An appropriately sized stormwater detention structure was then to be provided for the residual portion of Catchment 2 that would continue to drain to the existing 600mm RCP. PB proposed that the on-site detention structure could serve dual purpose as a water quality treatment device for Catchment 2, in conjunction with a GPT.

3. Revised stormwater management plan

3.1 Proposed stormwater management devices

The revised stormwater management plan is shown on Figure 4 and is also described further below. Subsequent sections of this report provide the results from stormwater modelling to confirm the performance of the revised stormwater management plan with respect to stormwater runoff flow rates.

Catchment 1:

- Stormwater is to be conveyed directly to Scotch Dairy Creek. No on-site detention is proposed, which is consistent with the approved PB stormwater management strategy.
- A proprietary stormwater quality improvement device (SQID) (SPEL Stormceptor Class 1 or approved equivalent) is proposed for stormwater quality control prior to discharge of the street drainage system into Scotch Dairy Creek.
- Lots 124 and 307 will drain directly to Scotch Dairy Creek and will provide water quality treatment devices as part of the local development stormwater management plan. This report recommends that SPEL Stormceptor Class1 (or approved equivalent) SQIDs are provided, which would be consistent with stormwater quality management for the remainder of the development.

Catchment 2:

- Catchment 2 will be regraded so that discharge can be achieved directly to Viney Creek. This will eliminate the previously proposed on-site detention structure, avoiding additional capital cost and unnecessarily burdening Council with ongoing maintenance. The existing 600mm diameter concrete pipe culvert under Weakley's Drive will be decommissioned by grout injection, in accordance with standard RTA practice.
- A SQID (SPEL Stormceptor Class 1 or approved equivalent) is proposed for stormwater quality control prior to discharge into Viney Creek.

Catchment 3:

- Stormwater is to be conveyed directly to Viney Creek. No on-site detention is proposed, which is consistent with the previously approved PB stormwater management strategy.
- A SQID (SPEL Stormceptor Class 1 or approved equivalent) is proposed for stormwater quality control prior to discharge into Viney Creek.
- Lots 201 and 202 will drain directly to Viney Creek and will provide water quality treatment devices as part of the local development stormwater management plan. This report recommends that SPEL Stormceptor Class1 (or approved equivalent) SQID are provided, which would be consistent with stormwater quality management for the remainder of the development.

All SQIDs will treat, at a minimum, the runoff from the 3 month ARI design storm event. Flows in excess of the 3 month ARI storm event will bypass the devices. Alternatively, continuous simulation (incorporating historical rainfall data) may be used to determine the design water quality flow rate, with the target of treating 90% of the surface runoff (by volume) during the model period. The alternative water quality treatment approach will give rise to several benefits over the previous strategy involving simple GPT's and sand filters, including:

- Increased ability of the stormwater treatment system to remove oils and hydrocarbons without requiring significant maintenance.
- Reduced footprint of the stormwater quality treatment infrastructure, avoiding the need to construct large stormwater treatment structures adjacent to the natural creek lines.
- Consolidation of the stormwater quality treatment infrastructure into a single device at each drainage outlet (note that a standard GPT would have been required in addition to the 'sand filters' under the previous proposal). This reduces ongoing future maintenance requirements for Council.
- Reducing the risk of substantial rehabilitation and reconstructive works that can be required with time as sand filters become clogged or the landscaping measures become degraded.

Additional information on the SPEL SQIDs is provided in Section 3.3.

LEGEND

- CATCHMENT BOUNDARY
- PROPOSED STORMWATER PIPES
- PROPOSED STORMWATER PITS
- SPLITTER PIT
- SPEL STORMCEPTOR
- 103 STAGE 1 LOT NUMBER
- 203 STAGE 2 LOT NUMBER
- 303 STAGE 3 LOT NUMBER

0 80 160 240 320 400 m

SCALE 1:4000 (A3)

N

LOT 1
DP 838310
(DONALDSON COAL PTY LTD)

ONSITE STORMWATER QUALITY CONTROLS TO BE PROVIDED ON LOTS 124 AND 307 AS PART OF LOCAL STORMWATER MANAGEMENT PLAN, TO BE ASSESSED AT THE LOT DA STAGE.

PARISH DRIVE

KILLARNEY STREET

NEW ENGLAND HIGHWAY

VINEY CREEK

SCOTCH DAIRY CREEK

DRAINAGE RESERVE

ROAD 1

ROAD 2

ROAD 3

ROAD 4

8 DP226431

9 DP390543

9 DP509255

PROPOSED SPLITTER PIT (IF REQUIRED)

PROPOSED SPEL STORMCEPTOR

EXISTING CULVERT

PROPOSED SPEL STORMCEPTOR ACCESS TRACK TO BE PROVIDED FOR COUNCIL MAINTENANCE (LOCATION TBC)

ONSITE STORMWATER QUALITY CONTROL TO BE PROVIDED ON LOTS 201 AND 202 AS PART OF LOCAL STORMWATER MANAGEMENT PLAN, TO BE ASSESSED AT THE LOT DA STAGE.

EXISTING BRIDGE

OVERLAND FLOW PATH FOR FLOW GREATER THAN 10YEAR ARI

EXISTING Φ600 RCP

WEAKLEYS DRIVE

20 DP1025870

24 DP1070843

60 DP523177

63 DP620288

PROPOSED ROUNDABOUT

16 DP510628

22 DP528214

13 DP203406

12 DP416248

11 DP506147

10 DP416248

8 DP396036

7

D DP388733

16 DP1091199

15 DP1091199

Client: HUNTER LAND PTY LTD

Project: PROPOSED INDUSTRIAL SUBDIVISION

Location: WEAKLEYS DRIVE BERESFIELD

PROJECT NUMBER: 07307C dF05r3
DATE: 12.10.10

GCA ENGINEERING SOLUTIONS

REVISED STORMWATER MANAGEMENT PLAN

FIGURE 4

3.2 Stormwater modelling

Hydrological assessment for Viney Creek Catchment was carried out for four different scenarios using *DRAINS – Urban Drainage Model*, to ensure that the proposed diversion of Catchment 2 into Viney Creek would not increase existing peak flow rates at the bridge structure under Weakleys Drive.

Note that runoff from the local drainage catchment (to be diverted under this alternative drainage strategy) currently enters Viney Creek less than 100m downstream of Weakleys Drive. Hence, this modelling exercise was undertaken only to ensure that no additional flooding will occur on the upstream side of the bridge structure at Weakleys Drive.

The modelling process involved four steps which are described in greater detail below. The first three steps essentially involved reconstruction of the PPK / PB RAFTS models in DRAINS, and comparison of the resulting predicted peak flow rates with the previous studies to ensure consistency. The final (fourth) step involved modification to the DRAINS catchment model to assess the impacts of the proposed diversion of Catchment 2 into Viney Creek on existing peak flow rates.

Preparation of the four GCA DRAINS models involved:

1) Reconstruction of a 'natural' (i.e. completely undeveloped) catchment scenario model in DRAINS, using the model subcatchment data provided in the PPK report for the 'natural catchment scenario'.

   Although PPK/PB used the RAFTS stormwater model, DRAINS has the ability to implement the RAFTS hydrological routing routine, and so the two models are generally interchangeable.

   The resulting DRAINS model flow rates were compared with the PPK RAFTS model flow rates, to ensure consistency.

2) Update of the 'natural state' DRAINS model to include the existing developed areas in Beresfield and Thornton. The resulting DRAINS model flow rates were compared with the PPK / PB RAFTS model flow rates to again ensure consistency.

   The flow rates from the DRAINS existing state model were used to assess the impacts of the proposed diversion on existing (baseline) peak flow rates at the Weakleys Drive bridge.

3) Update of the 'existing scenario' DRAINS model to include the development of the Freeway Business Park but without the diversion of local 'Catchment 2' into Viney Creek. Again, these flow rates were compared against PPK / PB model results, to ensure that the developed scenario results were consistent with previous drainage studies for the development.

4) Update of the 'existing scenario' DRAINS model to include the development of the Freeway Business Park with the diversion of local 'Catchment 2' into Viney Creek.

   These model results were compared against the results from the existing scenario DRAINS model (model (2) above) to ensure that peak flow rates at Weakleys Drive bridge would not increase following diversion of the local development catchment.

3.2.1 Design rainfall

The four DRAINS models were run using *Australian Rainfall and Runoff* (ARR, Engineers Australia, 1997) design storms of varying durations from 5 minutes to 4.5 hours, for ARI's of 10, 20, 50 and 100 years. The Intensity-Frequency-Duration (IFD) data used to estimate the design rainfall intensities is provided below.

Catchment Latitude = 32.93 ^{o} S

Catchment Longitude = 151.75 ^{o} E

Catchment Skewness = 0.03

2-year ARI,	1 hour intensity =	35.00 mm/hr
	12 hour intensity =	7.00 mm/hr
	72 hour intensity =	2.30 mm/hr
50-year ARI,	1 hour intensity =	67.00 mm/hr
	12 hour intensity =	14.00 mm/hr
	72 hour intensity =	4.90 mm/hr

The critical storm duration for each ARI was selected as the duration that produced the highest DRAINS model peak flow rate at the existing Weakleys Drive bridge.

3.2.2 Model parameters

Table 1 summarises the catchment storage and loss parameter values adopted in the DRAINS models. The parameter values are consistent with those adopted by PPK and PB in the previous studies.

Table 1: Storage and loss parameter values adopted in the DRAINS hydrological models

Parameter	Value
Storage Multiplier, Bx	1.4
Pervious Area Initial Loss (mm)	15.0
Pervious Area Continuing Loss (mm)	5.0
Impervious Area Initial Loss (mm)	1.5
Impervious Area Continuing Loss (mm)	0.0

3.2.1 Model subcatchment data

Full DRAINS model subcatchment data is provided in Appendix B. Subcatchment roughness values used in the DRAINS models are summarised in Table 2. The DRAINS model subcatchment plan for the area upstream of the site is shown on Figure 5.

Note that the modelling in this study only considers the portion of the catchment draining to Viney Creek, as the impacts of the development on Scotch Dairy Creek were previously assessed by PB / PPK.

Table 2: Roughness parameter values adopted in the DRAINS models

Model / surface type	Manning 'n' value
Natural and models / pervious areas	0.1
Existing model / impervious areas	0.015
Developed models / pervious areas	0.06
Developed models / impervious areas	0.015

3.2.1 Model results

The DRAINS models for Viney Creek Catchment were run for various design storm durations. The following three results summary tables are provided below:

- Table 3: Comparison of DRAINS-predicted peak flow rates with PPK RAFTS-estimated peak flow rates for natural (completely undeveloped) catchment conditions.
- Table 4: Comparison of DRAINS-predicted peak flow rates with PPK RAFTS-estimated peak flow rates for existing catchment conditions (with impervious areas associated with existing background development).
- Table 5: Comparison of DRAINS-predicted peak flow rates with PPK RAFTS-estimated peak flow rates for developed catchment conditions (with Freeway Business Park) but without the local drainage diversion to Viney Creek as proposed in the revised development stormwater management plan.

Table 3: Model results for 'natural' state

ARI (years)	Peak Flow Rate at Weakleys Drive bridge (Natural State – PPK report) (m^3/s)	Peak Flow Rate at Weakleys Drive bridge (Natural State – GCA DRAINS model) (m^3/s)
10	45.40	44.50
20	58.77	58.10
50	74.35	74.50
100	88.26	88.90

Table 4: Model results for 'existing' state

ARI (years)	Peak Flow rate at Weakleys Drive bridge (Existing State – PPK report) (m3/s)	Peak Flow rate at Weakleys Drive bridge (Existing State – GCA DRAINS model) (m3/s)
10	47.69	45.90
20	61.43	60.20
50	77.03	77.10
100	91.20	92.20

Table 5: Model results for 'developed' state prior to diversion of Catchment 2 to Viney Creek (upstream of Weakleys Drive bridge)

ARI (years)	Peak Flow rate at Weakleys Drive bridge (Developed State – PPK report) (m3/s)	Peak Flow rate at Weakleys Drive bridge (Developed State – GCA DRAINS model) (m3/s)
10	47.21	45.90
20	60.58	60.40
50	75.95	76.90
100	89.79	91.80

The flow rate comparisons in Tables 3, 4 and 5 demonstrate that the DRAINS models were producing peak flow rate estimates that were very close to those estimated by PPK. This validates the reconstruction of the PPK/PB RAFTS hydrological models in DRAINS.

The DRAINS model-predicted peak discharges for the developed state *(with the local drainage diversion to Viney Creek)* are compared with the predicted existing peak flow rates in Table 6.

Table 6: Model results for 'developed' state with the diversion of Catchment 2 to Viney Creek (upstream of Weakleys Drive bridge)

ARI (years)	Peak Flow rate at Weakleys Drive bridge (Existing State – GCA DRAINS model) (m3/s)	Peak Flow rate at Weakleys Drive bridge (Developed with Diversion – GCA DRAINS model) (m3/s)	Relative change on existing conditions (%)
10	45.9	46.4	+1.0%
20	60.2	60.7	+0.8%
50	77.1	77.2	+0.1%
100	92.2	92.1	-0.1%

The DRAINS model results summarised in Table 6 illustrate that the proposed diversion of Catchment 2 into Viney Creek prior to Weakleys Drive bridge will not have an appreciable impact on flow rates for 10yr ARI through to 100yr ARI. The most important event from a flooding perspective is generally the 100yr ARI event, where the DRAINS model predicted that the flow rates could even reduce (due to local peak vs regional flood peak as discussed in Section 2). In surface water hydrology terms, the post-diversion flow rates in Table 6 can be considered as approximately equivalent to pre-diversion flow rates, such that the diversion will not adversely impact flooding in Viney Creek on existing conditions.

It is therefore proposed to drain local Catchments 2 and 3 directly to Viney Creek (prior to Weakleys Drive bridge) without provision of on-site detention, on the basis that no material increase in existing peak flow rates is expected to arise from the activity for 1 year ARI to 100 year ARI.

The DRAINS model results for the 10, 20, 50 and 100 year ARIs are provided in Appendix B.

3.3 Proposed stormwater water quality improvement devices

SPEL Stormceptor Class 1 Stormwater quality improvement devices (SQIDs) (or approved equivalent) are proposed to treat stormwater runoff conveyed by the local street drainage system in Catchments 1, 2 and 3, prior to discharge into Viney Creek and Scotch Dairy Creek. Four lots (124, 201, 201, & 307) will drain directly to these creeks and separate on-lot water quality controls are proposed for these lots, to be assessed further at the lot DA stage.

The SPEL units are effective at reducing total petroleum hydrocarbons (TPH), total suspended solids (TSS), heavy metals, nutrients (particulate) as well as gross pollutants. The manufacturer has provided the expected removal rates shown in Table 6. Note that all removal rates, figures and facts in this letter have been provided by the manufacturer based on laboratory tests and results from in-situ testing of units in service carried out by N.A.T.A. accredited laboratories.

Table 7: SPEL Stormceptor Class 1 pollutant removal rates

Pollutant	Removal rate
Total Suspended Solids (TSS)	>96% from 9µm particulate size
Total Petroleum Hydrocarbons (TPH)	<1.87mg/l or 99.99% from tested ingress of 5,000mg/l
Total Phosphorus (TP)	>45% particulate
Total Nitrogen (TN)	>45% particulate
Heavy Metals	>90%
Gross Pollutants	99.9% >3mm

Independent N.A.T.A. test results of in-situ SPEL Stormceptor Class 1 devices operating in streetscape subdivisional, car parks, switchyards and petrol service station type applications support the reductions in the annual average loads of the pollutants from Table 6 for wide ranges of flow events from 2.0 – 350 l/s design treatable flow rate. These devices have now been widely accepted by many Councils in NSW, and are even the device preferred by some in the greater Sydney region.

The SPEL Stormceptor has achieved hydrocarbons Certification to European Standard EN BS 858.1 (2006) for Separator systems for Light Liquids (e.g. oil and petrol). This standard defines nominal sizes, principles of design, performance requirements, marking, testing and quality control for separator systems for light liquids (hydrocarbons). Key to this performance standard is that the total petroleum-hydrocarbon (TPH) discharge concentration must not exceed 5.0mg/l from a minimum test ingress of 5,000mg/l. SPEL Stormceptor Class 1 are independently tested at HR Wallingford, U.K. and have achieved results averaging between 0.4 - 1.86mg/1 under test conditions, far exceeding the standard. Note that the NSW EPA and the Australian Runoff Quality (Engineers Australia, 2006) recognises the European Standard EN BS 858.1 as there is no Australian reference standard for this certification.

Further information on the SPEL Stormceptor SQIDs, including the results of field testing by N.A.T.A. accredited laboratories, are provided in Appendix E.

4. Summary and conclusions

This stormwater drainage report proposes an alternative drainage strategy for the development that results in the southern part of the site draining to Viney Creek (prior to Weakleys Drive bridge) and the northern part of the side draining to Scotch Dairy Creek.

DRAINS modelling has demonstrated that there will be no material increase in flow rates prior to Weakleys Drive bridge as a result of the local catchment diversion to Viney Creek. For this reason on-site detention is not required for the southern part of the development draining to Viney Creek.

The local drainage catchment to Scotch Dairy Creek remains unchanged from previous assessments by PB and PPK where on-site detention was not proposed. Therefore, the proposal to drain the northern portion of the development directly to Scotch Dairy Creek without the provision of on-site detention has been maintained in the revised stormwater management plan.

SPEL Stormceptor Class 1 stormwater quality improvement devices (or approved equivalent) have been proposed for the street drainage system prior to discharge into Scotch Dairy Creek and Viney Creek. Based on the natural topography, at least four lots within the development are likely to drain directly to Scotch Dairy Creek / Viney Creek. These four lots, any other lot deemed unable to connect to the street drainage system in future *(as part of subdivision Construction Certificate design)*, will provide on-site water quality treatment (SPEL or equivalent) as part of the future lot development.

Appendix A

DRAINS Model Data

Natural Catchment Data

PIT / NODE DETAILS Version 9

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
A1	Node					35		0		799.857	-1597.98		29
BLACK1	Node					17		0		1491.781	-1159.2		205
BLACK2	Node					14		0		1503.836	-951.864		229
EO	Node					10		0		1513.479	-763.815		256
EOB	Node					18		0		1130.148	-720.419		266
WF1	Node					18		0		821.555	-949.453		287
OUT	Node					0		0		1807.607	128.213		328
A2	Node					25		0		1004.782	-1482.26		145
A3	Node					20		0		1310.965	-1330.37		170
A4	Node					17		0		1351.95	-1084.46		178
A5	Node					14		0		1349.539	-881.948		179
A6	Node					10		0		1351.95	-698.721		180
WF2	Node					10		0		1004.782	-621.572		284
WF3	Node					8		0		1156.668	-344.321		290
WF4	Node					5		0		1349.539	-79.123		181
WF5	Node					3		0		1503.836	29.367		301

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area	Impervious Area	Avg Slope(%)	Hydrological Model
CatA1	A1	95.44	0	6	Newcastle RAFTS
CatBlack1	BLACK1	58.125	0	5	Newcastle RAFTS
CatBlack2	BLACK2	48.72	0	5	Newcastle RAFTS
CatE0	EO	40	0	5	Newcastle RAFTS
CatEOB	EOB	17.5	0	5	Newcastle RAFTS
CatWF1	WF1	265.7	0	6	Newcastle RAFTS
CatA2	A2	124.49	0	6	Newcastle RAFTS
CatA3	A3	218.53	0	6	Newcastle RAFTS
CatWF2	WF2	179.9	0	5	Newcastle RAFTS
CatWF3	WF3	143.6	0	5	Newcastle RAFTS
CatWF4	WF4	142.7	0	5	Newcastle RAFTS
CatWF5	WF5	33.2	0	5	Newcastle RAFTS

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	Safe Depth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %
OFBlack1	BLACK1	A4	6				overflow	0.3	0.3	0.4	1	0
OFBlack2	BLACK2	A5	6				overflow	0.3	0.3	0.4	1	0
OFEO	EO	A6	6				overflow	0.3	0.3	0.4	1	0
OFEOB	EOB	A6	6				overflow	0.3	0.3	0.4	1	0
DUMMYOU	WF5	OUT	6				overflow	0.3	0.3	0.4	1	0

Name	From	To	Length (m)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	Safe Depth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %
OFA1	A1	A2	500				overflow	0.3	0.3	0.4	1	0
OFWF1	WF1	WF2	600				overflow	0.3	0.3	0.4	1	0
OFA2	A2	A3	1100				overflow	0.3	0.3	0.4	1	0
OFA3	A3	A4	700				overflow	0.3	0.3	0.4	1	0
OFA4	A4	A5	350				overflow	0.3	0.3	0.4	1	0
OFA5	A5	A6	300				overflow	0.3	0.3	0.4	1	0
OFA6	A6	WF4	900				overflow	0.3	0.3	0.4	1	0
OFWF2	WF2	WF3	1000				overflow	0.3	0.3	0.4	1	0
OFWF3	WF3	WF4	500				overflow	0.3	0.3	0.4	1	0
OFWF5	WF4	WF5	450				overflow	0.3	0.3	0.4	1	0

Existing Catchment Data

PIT / NODE DETAILS Version 9

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
A1	Node					35		0		799.857	-1597.98		29
BLACK1	Node					17		0		1491.781	-1159.2		205
BLACK2	Node					14		0		1503.836	-951.864		229
EO	Node					10		0		1513.479	-763.815		256
EOB	Node					18		0		1130.148	-720.419		266
WF1	Node					18		0		821.555	-949.453		287
OUT	Node					0		0		1807.607	128.213		328
A2	Node					25		0		1004.782	-1482.26		145
A3	Node					20		0		1310.965	-1330.37		170
A4	Node					17		0		1351.95	-1084.46		178
A5	Node					14		0		1349.539	-881.948		179
A6	Node					10		0		1351.95	-698.721		180
WF2	Node					10		0		1004.782	-621.572		284
WF3	Node					8		0		1156.668	-344.321		290
WF4	Node					5		0		1349.539	-79.123		181
WF5	Node					3		0		1503.836	29.367		301

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area	Impervious Area	Avg Slope(%)	Hydrological Model
CatA1	A1	95.44	1	6	Newcastle RAFTS
CatBlack1	BLACK1	58.125	0	5	Newcastle RAFTS
CatBlack2	BLACK2	48.72	0	5	Newcastle RAFTS
CatE0	EO	40	0	5	Newcastle RAFTS
CatEOB	EOB	17.5	0	5	Newcastle RAFTS
CatWF1	WF1	265.7	1	6	Newcastle RAFTS
CatA2	A2	124.49	1	6	Newcastle RAFTS
CatA3	A3	218.53	1	6	Newcastle RAFTS
CatWF2	WF2	179.9	1	5	Newcastle RAFTS
CatWF3	WF3	143.6	1	5	Newcastle RAFTS
CatWF4	WF4	142.7	0	5	Newcastle RAFTS
CatWF5	WF5	33.2	0	5	Newcastle RAFTS

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	Safe Depth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %
OFBlack1	BLACK1	A4	6				overflow	0.3	0.3	0.4	1	0
OFBlack2	BLACK2	A5	6				overflow	0.3	0.3	0.4	1	0
OFEO	EO	A6	6				overflow	0.3	0.3	0.4	1	0
OFEOB	EOB	A6	6				overflow	0.3	0.3	0.4	1	0
DUMMYOU	WF5	OUT	6				overflow	0.3	0.3	0.4	1	0

Name	From	To	Length (m)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	Safe Depth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %
OFA1	A1	A2	500				overflow	0.3	0.3	0.4	1	0
OFWF1	WF1	WF2	600				overflow	0.3	0.3	0.4	1	0
OFA2	A2	A3	1100				overflow	0.3	0.3	0.4	1	0
OFA3	A3	A4	700				overflow	0.3	0.3	0.4	1	0
OFA4	A4	A5	350				overflow	0.3	0.3	0.4	1	0
OFA5	A5	A6	300				overflow	0.3	0.3	0.4	1	0
OFA6	A6	WF4	900				overflow	0.3	0.3	0.4	1	0
OFWF2	WF2	WF3	1000				overflow	0.3	0.3	0.4	1	0
OFWF3	WF3	WF4	500				overflow	0.3	0.3	0.4	1	0
OFWF5	WF4	WF5	450				overflow	0.3	0.3	0.4	1	0

Developed Catchment Without Diversion Data

PIT / NODE DETAILS Version 9

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
A1	Node					35		0		799.857	-1597.98		29
BLACK1	Node					17		0		1491.781	-1159.2		205
BLACK2	Node					14		0		1503.836	-951.864		229
EO	Node					10		0		1513.479	-763.815		256
EOB	Node					18		0		1130.148	-720.419		266
WF1	Node					18		0		821.555	-949.453		287
OUT	Node					0		0		1807.607	128.213		328
A2	Node					25		0		1004.782	-1482.26		145
A3	Node					20		0		1310.965	-1330.37		170
A4	Node					17		0		1351.95	-1084.46		178
A5	Node					14		0		1349.539	-881.948		179
A6	Node					10		0		1351.95	-698.721		180
WF2	Node					10		0		1004.782	-621.572		284
WF3	Node					8		0		1156.668	-344.321		290
WF4	Node					5		0		1349.539	-79.123		181
WF5	Node					3		0		1503.836	29.367		301

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area	Impervious Area	Avg Slope(%)	Hydrological Model
CatA1	A1	95.44	1	6	Newcastle RAFTS
CatBlack1	BLACK1	58.125	0	5	Newcastle RAFTS
CatBlack2	BLACK2	48.72	0	5	Newcastle RAFTS
CatE0	EO	40	0	5	Newcastle RAFTS
CatEOB	EOB	17.5	0	5	Newcastle RAFTS
CatWF1	WF1	265.7	1	6	Newcastle RAFTS
CatA2	A2	124.49	1	6	Newcastle RAFTS
CatA3	A3	218.53	1	6	Newcastle RAFTS
CatWF2	WF2	179.9	1	5	Newcastle RAFTS
CatWF3	WF3	143.6	1	5	Newcastle RAFTS
CatWF4	WF4	142.7	43	2	Newcastle RAFTS
CatWF5	WF5	33.2	0	5	Newcastle RAFTS

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	Safe Depth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %
OFBlack1	BLACK1	A4	6				overflow	0.3	0.3	0.4	1	0
OFBlack2	BLACK2	A5	6				overflow	0.3	0.3	0.4	1	0
OFEO	EO	A6	6				overflow	0.3	0.3	0.4	1	0
OFEOB	EOB	A6	6				overflow	0.3	0.3	0.4	1	0
DUMMYOUT	WF5	OUT	6				overflow	0.3	0.3	0.4	1	0

Name	From	To	Length (m)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	Safe Depth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %
OFA1	A1	A2	500				overflow	0.3	0.3	0.4	1	0
OFWF1	WF1	WF2	600				overflow	0.3	0.3	0.4	1	0
OFA2	A2	A3	1100				overflow	0.3	0.3	0.4	1	0
OFA3	A3	A4	700				overflow	0.3	0.3	0.4	1	0
OFA4	A4	A5	350				overflow	0.3	0.3	0.4	1	0
OFA5	A5	A6	300				overflow	0.3	0.3	0.4	1	0
OFA6	A6	WF4	900				overflow	0.3	0.3	0.4	1	0
OFWF2	WF2	WF3	1000				overflow	0.3	0.3	0.4	1	0
OFWF3	WF3	WF4	500				overflow	0.3	0.3	0.4	1	0
OFWF5	WF4	WF5	450				overflow	0.3	0.3	0.4	1	0

Developed Catchment With Diversion Data

PIT / NODE DETAILS Version 9

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
A1	Node					35		0		799.857	-1597.98		29
BLACK1	Node					17		0		1491.781	-1159.2		205
BLACK2	Node					14		0		1503.836	-951.864		229
EO	Node					10		0		1513.479	-763.815		256
EOB	Node					18		0		1130.148	-720.419		266
WF1	Node					18		0		821.555	-949.453		287
OUT	Node					0		0		1807.607	128.213		328
A2	Node					25		0		1004.782	-1482.26		145
A3	Node					20		0		1310.965	-1330.37		170
A4	Node					17		0		1351.95	-1084.46		178
A5	Node					14		0		1349.539	-881.948		179
A6	Node					10		0		1351.95	-698.721		180
WF2	Node					10		0		1004.782	-621.572		284
WF3	Node					8		0		1156.668	-344.321		290
WF4	Node					5		0		1349.539	-79.123		181
WF5	Node					3		0		1503.836	29.367		301

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area	Impervious Area	Avg Slope(%)	Hydrological Model
CatA1	A1	95.44	1	6	Newcastle RAFTS
CatBlack1	BLACK1	58.125	0	5	Newcastle RAFTS
CatBlack2	BLACK2	48.72	0	5	Newcastle RAFTS
CatE0	EO	40	0	5	Newcastle RAFTS
CatEOB	EOB	17.5	0	5	Newcastle RAFTS
CatWF1	WF1	265.7	1	6	Newcastle RAFTS
CatA2	A2	124.49	1	6	Newcastle RAFTS
CatA3	A3	218.53	1	6	Newcastle RAFTS
CatWF2	WF2	179.9	1	5	Newcastle RAFTS
CatWF3	WF3	143.6	1	5	Newcastle RAFTS
CatWF4	WF4	142.7	47.8	2	Newcastle RAFTS
CatWF5	WF5	49.5	36.4	2	Newcastle RAFTS

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	Safe Depth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %
OFBlack1	BLACK1	A4	6				overflow	0.3	0.3	0.4	1	0
OFBlack2	BLACK2	A5	6				overflow	0.3	0.3	0.4	1	0
OFEO	EO	A6	6				overflow	0.3	0.3	0.4	1	0
OFEOB	EOB	A6	6				overflow	0.3	0.3	0.4	1	0
DUMMYOU	WF5	OUT	6				overflow	0.3	0.3	0.4	1	0

Name	From	To	Length (m)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	Safe Depth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %
OFA1	A1	A2	500				overflow	0.3	0.3	0.4	1	0
OFWF1	WF1	WF2	600				overflow	0.3	0.3	0.4	1	0
OFA2	A2	A3	1100				overflow	0.3	0.3	0.4	1	0
OFA3	A3	A4	700				overflow	0.3	0.3	0.4	1	0
OFA4	A4	A5	350				overflow	0.3	0.3	0.4	1	0
OFA5	A5	A6	300				overflow	0.3	0.3	0.4	1	0
OFA6	A6	WF4	900				overflow	0.3	0.3	0.4	1	0
OFWF2	WF2	WF3	1000				overflow	0.3	0.3	0.4	1	0
OFWF3	WF3	WF4	500				overflow	0.3	0.3	0.4	1	0
OFWF5	WF4	WF5	450				overflow	0.3	0.3	0.4	1	0

Appendix B

DRAINS Model Results

Natural 10 year ARI Result

DRAINS results prepared 13 April, 2010 from Version 2009.07

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	3.555	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatBlack1	2.223	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatBlack2	1.946	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatE0	1.671	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatEOB	0.876	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatWF1	7.897	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatA2	4.385	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatA3	6.819	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF2	5.346	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF3	4.51	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF4	4.494	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF5	1.436	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.00 impervious + 1368 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 160 mm/h, Zone 1	182387.3	0.00 (0.0%)	0.00 (0.0%)	0.00 (0.0%)
AR&R 10 year, 10 minutes storm, average 123 mm/h, Zone 1	280420.5	10439.68 (3.7%)	-58178.45 (0.0%)	68618.13 (24.5%)
AR&R 10 year, 15 minutes storm, average 103 mm/h, Zone 1	352235.5	26483.05 (7.5%)	-109876.76 (0.0%)	136359.81 (38.7%)
AR&R 10 year, 20 minutes storm, average 90 mm/h, Zone 1	410371.5	41140.58 (10.0%)	-149491.13 (0.0%)	190631.70 (46.5%)
AR&R 10 year, 25 minutes storm, average 81 mm/h, Zone 1	461668	54638.17 (11.8%)	-183060.86 (0.0%)	237699.03 (51.5%)
AR&R 10 year, 30 minutes storm, average 73 mm/h, Zone 1	499285.3	63091.44 (12.6%)	-206612.47 (0.0%)	269703.91 (54.0%)
AR&R 10 year, 45 minutes storm, average 59 mm/h, Zone 1	605298.1	103714.64 (17.1%)	-259340.58 (0.0%)	363055.22 (60.0%)
AR&R 10 year, 1 hour storm, average 50 mm/h, Zone 1	683952.5	145262.84 (21.2%)	-282703.63 (0.0%)	427966.47 (62.6%)
AR&R 10 year, 1.5 hours storm, average 39 mm/h, Zone 1	800224.4	223989.41 (28.0%)	-286418.94 (0.0%)	510408.34 (63.8%)
AR&R 10 year, 2 hours storm, average 32.5 mm/h, Zone 1	889138.3	294965.97 (33.2%)	-279047.84 (0.0%)	574013.81 (64.6%)
AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1	1030033	419537.09 (40.7%)	-232647.09 (0.0%)	652184.19 (63.3%)
AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1	1188025	543828.55 (45.8%)	-183438.52 (0.0%)	727267.06 (61.2%)

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
OFA1	3.555	3.577	4.777	0.157	0.3	12.03	1.9	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFBlack1	2.223	2.223	4.777	0.118	0.19	12.02	1.57	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFBlack2	1.946	1.946	4.777	0.108	0.16	12.02	1.5	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFEO	1.671	1.671	4.777	0.099	0.14	12.02	1.4	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFEOB	0.876	0.876	4.777	0.067	0.07	12.01	1.09	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFWF1	7.897	8.037	4.777	0.255	0.67	12.05	2.62	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA2	7.95	8.071	4.777	0.256	0.67	12.05	2.62	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA3	14.876	14.876	4.777	0.373	1.24	12.07	3.32	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA4	17.016	17.016	4.777	0.404	1.41	12.08	3.5	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFA5	18.938	18.938	4.777	0.432	1.57	12.09	3.64	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFA6	21.4	21.4	4.777	0.465	1.78	12.09	3.82	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFWF2	13.382	13.67	4.777	0.353	1.14	12.07	3.22	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF3	18.124	18.124	4.777	0.42	1.51	12.08	3.58	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF5	43.271	43.271	4.777	0.719	3.58	12.14	4.98	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
DUMMYOU	44.509	44.509	4.777	0.732	3.69	12.15	5.04	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1

CONTINUITY CHECK for AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	41230.25	41230.25	0	0
BLACK1	25409.15	25409.15	0	0
BLACK2	21680.49	21680.49	0	0
EO	18115.43	18115.43	0	0
EOB	8431.01	8431.01	0	0
WF1	99206.76	99206.76	0	0
OUT	522582.3	522582.3	0	0
A2	92838.2	92838.24	0	0
A3	176085.3	176085.5	0	0
A4	202159.4	202159.2	0	0
A5	222059	222059.1	0	0
A6	247213	247212.6	0	0
WF2	166332.1	166332.1	0	0
WF3	221911	221910.9	0	0
WF4	518698.7	518698.9	0	0
WF5	530975.9	530975.9	0	0

Natural 20 year ARI Result

DRAINS results prepared 13 October, 2010 from Version 2010.10

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	4.621	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatBlack1	2.885	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatBlack2	2.513	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatE0	2.154	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatEOB	1.112	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatWF1	10.371	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatA2	5.684	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatA3	8.913	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF2	7.026	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF3	5.898	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF4	5.869	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF5	1.865	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.00 impervious + 1368 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 183 mm/h, Zone 1	208605.5	0.00 (0.0%)	0.00 (0.0%)	0.00 (0.0%)
AR&R 20 year, 10 minutes storm, average 141 mm/h, Zone 1	321457.7	19828.34 (6.2%)	-88105.49 (0.0%)	107933.83 (33.6%)
AR&R 20 year, 15 minutes storm, average 118 mm/h, Zone 1	403532	41383.38 (10.3%)	-145146.95 (0.0%)	186530.33 (46.2%)
AR&R 20 year, 20 minutes storm, average 103 mm/h, Zone 1	469647.4	60137.73 (12.8%)	-188746.39 (0.0%)	248884.13 (53.0%)
AR&R 20 year, 25 minutes storm, average 92 mm/h, Zone 1	524363.6	75651.25 (14.4%)	-223504.50 (0.0%)	299155.75 (57.1%)
AR&R 20 year, 30 minutes storm, average 84 mm/h, Zone 1	574520.1	89053.61 (15.5%)	-254502.05 (0.0%)	343555.66 (59.8%)
AR&R 20 year, 45 minutes storm, average 68 mm/h, Zone 1	697631.6	142800.66 (20.5%)	-311467.88 (0.0%)	454268.53 (65.1%)
AR&R 20 year, 1 hour storm, average 58 mm/h, Zone 1	793384.9	199272.34 (25.1%)	-336329.03 (0.0%)	535601.38 (67.5%)
AR&R 20 year, 1.5 hours storm, average 44.9 mm/h, Zone 1	921284.1	298635.63 (32.4%)	-330815.50 (0.0%)	629451.13 (68.3%)
AR&R 20 year, 2 hours storm, average 37.4 mm/h, Zone 1	1023193	388369.75 (38.0%)	-317818.19 (0.0%)	706187.94 (69.0%)
AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1	1185974	544124.75 (45.9%)	-259792.50 (0.0%)	803917.25 (67.8%)
AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1	1372693	701302.78 (51.1%)	-206122.78 (0.0%)	907425.56 (66.1%)

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
OFA1	4.621	4.664	4.777	0.184	0.39	12.04	2.11	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFBlack1	2.885	2.885	4.777	0.137	0.24	12.03	1.75	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFBlack2	2.513	2.513	4.777	0.126	0.21	12.03	1.65	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFEO	2.154	2.154	4.777	0.115	0.18	12.02	1.56	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFEOB	1.112	1.112	4.777	0.078	0.09	12.02	1.19	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFWF1	10.371	10.582	4.777	0.302	0.88	12.06	2.91	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA2	10.343	10.526	4.777	0.301	0.87	12.06	2.9	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA3	19.31	19.31	4.777	0.437	1.6	12.09	3.67	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA4	21.913	21.913	4.777	0.472	1.82	12.09	3.85	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA5	24.346	24.346	4.777	0.503	2.02	12.1	4.01	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA6	27.363	27.363	4.777	0.541	2.27	12.11	4.19	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF2	17.601	18.018	4.777	0.418	1.5	12.08	3.58	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF3	23.883	23.883	4.777	0.498	1.98	12.1	3.98	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF5	56.589	56.589	4.777	0.851	4.68	12.17	5.5	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
DUMMYOU	58.158	58.158	4.777	0.866	4.81	12.17	5.56	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1

CONTINUITY CHECK for AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	52599.36	52599.36	0	0
BLACK1	32406.26	32406.26	0	0
BLACK2	27600.89	27600.89	0	0
EO	23038.59	23038.59	0	0
EOB	10645.01	10645.01	0	0
WF1	128807.5	128807.5	0	0
OUT	675341.9	675341.9	0	0
A2	119013.4	119013.2	0	0
A3	227398.5	227398.2	0	0
A4	256859.4	256859	0	0
A5	282708.4	282708.3	0	0
A6	314950.1	314950	0	0
WF2	216781.5	216781.3	0	0
WF3	289991.2	289991.7	0	0
WF4	668891	668892.3	0	0
WF5	685184.9	685184.6	0	0

Natural 50 year ARI Result

DRAINS results prepared 13 October, 2010 from Version 2010.10

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	6.016	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatBlack1	3.748	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatBlack2	3.25	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatE0	2.773	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatEOB	1.422	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
CatWF1	13.499	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatA2	7.394	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatA3	11.54	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatWF2	9.145	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatWF3	7.628	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatWF4	7.589	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatWF5	2.39	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.00 impervious + 1368 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 50 year, 5 minutes storm, average 214 mm/h, Zone 1	243943.1	3994.80 (1.6%)	-29085.65 (0.0%)	33080.46 (13.6%)
AR&R 50 year, 10 minutes storm, average 165 mm/h, Zone 1	376173.9	34817.98 (9.3%)	-126521.45 (0.0%)	161339.44 (42.9%)
AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1	471927.3	63536.23 (13.5%)	-189943.19 (0.0%)	253479.42 (53.7%)
AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1	551721.8	88974.47 (16.1%)	-240705.50 (0.0%)	329679.97 (59.8%)
AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1	615557.3	108390.22 (17.6%)	-280389.41 (0.0%)	388779.63 (63.2%)
AR&R 50 year, 30 minutes storm, average 98 mm/h, Zone 1	670273.4	124246.41 (18.5%)	-313732.38 (0.0%)	437978.78 (65.3%)
AR&R 50 year, 45 minutes storm, average 79 mm/h, Zone 1	810483.8	193526.00 (23.9%)	-372494.25 (0.0%)	566020.25 (69.8%)
AR&R 50 year, 1 hour storm, average 67 mm/h, Zone 1	916496.4	262854.25 (28.7%)	-394437.63 (0.0%)	657291.88 (71.7%)
AR&R 50 year, 1.5 hours storm, average 53 mm/h, Zone 1	1087484	403990.03 (37.1%)	-390222.41 (0.0%)	794212.44 (73.0%)
AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1	1201021	513303.16 (42.7%)	-368763.78 (0.0%)	882066.94 (73.4%)
AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1	1395263	707272.91 (50.7%)	-303297.91 (0.0%)	1010570.81 (72.4%)
AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1	1612760	900142.16 (55.8%)	-243548.47 (0.0%)	1143690.63 (70.9%)

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
OFA1	6.016	6.097	4.777	0.216	0.51	12.04	2.34	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFBlack1	3.748	3.748	4.777	0.161	0.31	12.03	1.94	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFBlack2	3.25	3.25	4.777	0.148	0.27	12.03	1.83	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFEO	2.773	2.773	4.777	0.134	0.23	12.03	1.72	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFEOB	1.422	1.422	4.777	0.089	0.12	12.02	1.33	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
OFWF1	13.499	13.499	4.777	0.351	1.12	12.07	3.2	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFA2	13.49	13.765	4.777	0.355	1.14	12.07	3.22	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA3	25.124	25.124	4.777	0.514	2.08	12.1	4.06	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA4	28.821	28.821	4.777	0.559	2.39	12.11	4.28	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA5	32.016	32.016	4.777	0.597	2.65	12.12	4.45	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA6	35.982	35.982	4.777	0.641	2.98	12.13	4.65	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFWF2	22.318	22.318	4.777	0.478	1.85	12.1	3.88	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFWF3	29.423	29.423	4.777	0.566	2.44	12.11	4.31	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFWF5	72.322	72.322	4.777	0.993	5.98	12.2	6.02	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
DUMMYOU	74.478	74.478	4.777	1	6.16	12.2	6.16	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

CONTINUITY CHECK for AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	54439.84	54439.84	0	0
BLACK1	33651.56	33651.56	0	0
BLACK2	28836.95	28836.95	0	0
EO	24218.45	24218.45	0	0
EOB	11421.69	11421.69	0	0
WF1	127249.9	127249.9	0	0
OUT	663555.6	663555.6	0	0
A2	122420.8	122420.8	0	0
A3	230353.6	230353.6	0	0
A4	259483.7	259483.9	0	0
A5	286131	286131	0	0
A6	319754.1	319753.9	0	0
WF2	212961.4	212961.5	0	0
WF3	280683.7	280684.2	0	0
WF4	663269.6	663270.3	0	0
WF5	679689.5	679689.4	0	0

Natural 100 year ARI Result

DRAINS results prepared 13 April, 2010 from Version 2009.07

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	7.133	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatBlack1	4.433	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatBlack2	3.844	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatE0	3.282	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatEOB	1.7	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
CatWF1	16.094	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatA2	8.812	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatA3	13.699	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatWF2	10.901	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatWF3	9.052	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatWF4	9.002	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatWF5	2.82	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.00 impervious + 1368 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 237 mm/h, Zone 1	270161.3	8694.16 (3.2%)	-49510.32 (0.0%)	58204.49 (21.5%)
AR&R 100 year, 10 minutes storm, average 182 mm/h, Zone 1	414931.2	46707.48 (11.3%)	-152400.83 (0.0%)	199108.31 (48.0%)
AR&R 100 year, 15 minutes storm, average 153 mm/h, Zone 1	523223.7	81958.27 (15.7%)	-222024.92 (0.0%)	303983.19 (58.1%)
AR&R 100 year, 20 minutes storm, average 134 mm/h, Zone 1	610997.5	111910.31 (18.3%)	-276296.97 (0.0%)	388207.28 (63.5%)
AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1	683952.5	135664.84 (19.8%)	-320456.75 (0.0%)	456121.59 (66.7%)
AR&R 100 year, 30 minutes storm, average 109 mm/h, Zone 1	745508.3	154947.06 (20.8%)	-357225.22 (0.0%)	512172.28 (68.7%)
AR&R 100 year, 45 minutes storm, average 88 mm/h, Zone 1	902817.3	238957.25 (26.5%)	-418613.25 (0.0%)	657570.50 (72.8%)
AR&R 100 year, 1 hour storm, average 75 mm/h, Zone 1	1025929	324945.53 (31.7%)	-440878.97 (0.0%)	765824.50 (74.6%)
AR&R 100 year, 1.5 hours storm, average 58 mm/h, Zone 1	1190077	474775.63 (39.9%)	-421291.00 (0.0%)	896066.63 (75.3%)
AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1	1335076	615028.38 (46.1%)	-399773.50 (0.0%)	1014801.88 (76.0%)
AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1	1551204	838753.16 (54.1%)	-326214.47 (0.0%)	1164967.63 (75.1%)
AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1	1797427	1062598.00 (59.1%)	-263460.75 (0.0%)	1326058.75 (73.8%)

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
OFA1	7.133	7.255	4.777	0.24	0.6	12.05	2.52	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFBlack1	4.433	4.433	4.777	0.178	0.37	12.04	2.07	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFBlack2	3.844	3.844	4.777	0.164	0.32	12.03	1.96	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFEO	3.282	3.282	4.777	0.149	0.27	12.03	1.83	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFEOB	1.7	1.7	4.777	0.1	0.14	12.02	1.41	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
OFWF1	16.094	16.094	4.777	0.391	1.34	12.08	3.42	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFA2	16.066	16.416	4.777	0.395	1.36	12.08	3.45	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA3	29.967	29.967	4.777	0.573	2.49	12.11	4.34	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA4	34.367	34.367	4.777	0.623	2.85	12.12	4.57	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA5	38.163	38.163	4.777	0.665	3.16	12.13	4.75	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA6	42.832	42.832	4.777	0.715	3.55	12.14	4.96	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFWF2	26.776	26.776	4.777	0.535	2.22	12.11	4.16	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFWF3	35.465	35.465	4.777	0.636	2.94	12.13	4.62	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFWF5	86.439	86.439	4.777	1	7.14	12.2	7.14	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
DUMMYOL	88.943	88.943	4.777	1	7.35	12.2	7.35	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

CONTINUITY CHECK for AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	64132.73	64132.73	0	0
BLACK1	39571.23	39571.23	0	0
BLACK2	33833.83	33833.83	0	0
EO	28347.76	28347.76	0	0
EOB	13261.89	13261.89	0	0
WF1	151827.2	151827.2	0	0
OUT	789113.8	789113.8	0	0
A2	144754.4	144754.3	0	0
A3	273868.4	273867.8	0	0
A4	308837.9	308838.1	0	0
A5	340374.3	340374.2	0	0
A6	379856.4	379855.7	0	0
WF2	252223.5	252223.3	0	0
WF3	331379	331378.4	0	0
WF4	787587	787585.1	0	0
WF5	807135.5	807135.3	0	0

Existing 10 year ARI Result

DRAINS results prepared 13 April, 2010 from Version 2009.07

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	3.737	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatBlack1	2.223	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatBlack2	1.946	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatE0	1.671	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatEOB	0.876	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatWF1	8.313	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatA2	4.575	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatA3	7.16	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF2	5.628	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF3	4.732	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF4	4.494	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF5	1.436	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1

Outflow Volumes for Total Catchment (10.3 impervious + 1358 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 160 mm/h, Zone 1	182387.3	0.00 (0.0%)	0.00 (0.0%)	0.00 (0.0%)
AR&R 10 year, 10 minutes storm, average 123 mm/h, Zone 1	280420.5	10926.70 (3.9%)	-57176.00 (-2714.0%)	68102.70 (24.5%)
AR&R 10 year, 15 minutes storm, average 103 mm/h, Zone 1	352235.5	27724.22 (7.9%)	-107611.13 (-4066.6%	135335.34 (38.7%)
AR&R 10 year, 20 minutes storm, average 90 mm/h, Zone 1	410371.5	43072.50 (10.5%)	-146126.98 (-4739.8%	189199.48 (46.5%)
AR&R 10 year, 25 minutes storm, average 81 mm/h, Zone 1	461668	57199.47 (12.4%)	-178714.02 (-5152.7%	235913.48 (51.5%)
AR&R 10 year, 30 minutes storm, average 73 mm/h, Zone 1	499285.3	66058.83 (13.2%)	-201619.48 (-5375.1%	267678.31 (54.0%)
AR&R 10 year, 45 minutes storm, average 59 mm/h, Zone 1	605298.1	108585.73 (17.9%)	-251738.39 (-5535.9%	360324.13 (60.0%)
AR&R 10 year, 1 hour storm, average 50 mm/h, Zone 1	683952.5	152002.06 (22.2%)	-272747.69 (-5308.1%	424749.75 (62.6%)
AR&R 10 year, 1.5 hours storm, average 39 mm/h, Zone 1	800224.4	233925.28 (29.2%)	-272637.44 (-4535.0%	506562.72 (63.8%)
AR&R 10 year, 2 hours storm, average 32.5 mm/h, Zone 1	889138.3	307154.44 (34.5%)	-262531.31 (-3930.2%	569685.75 (64.6%)
AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1	1030033	433435.55 (42.1%)	-213852.64 (-2763.6%	647288.19 (63.3%)
AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1	1188025	557077.03 (46.9%)	-164750.66 (-1845.9%	721827.69 (61.2%)

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
OFA1	3.737	3.759	4.777	0.162	0.31	12.03	1.94	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFBlack1	2.223	2.223	4.777	0.118	0.19	12.02	1.57	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFBlack2	1.946	1.946	4.777	0.108	0.16	12.02	1.5	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFEO	1.671	1.671	4.777	0.099	0.14	12.02	1.4	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFEOB	0.876	0.876	4.777	0.067	0.07	12.01	1.09	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFWF1	8.313	8.456	4.777	0.263	0.7	12.05	2.67	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA2	8.319	8.443	4.777	0.263	0.7	12.05	2.67	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFA3	15.521	15.521	4.777	0.382	1.29	12.08	3.37	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA4	17.366	17.366	4.777	0.41	1.44	12.08	3.52	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA5	19.254	19.254	4.777	0.436	1.6	12.09	3.67	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA6	21.599	21.599	4.777	0.468	1.79	12.09	3.83	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF2	14.076	14.377	4.777	0.365	1.19	12.07	3.27	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF3	19.079	19.079	4.777	0.434	1.58	12.09	3.65	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF5	44.668	44.668	4.777	0.734	3.7	12.15	5.04	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
DUMMYOL	45.915	45.915	4.777	0.747	3.8	12.15	5.09	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1

CONTINUITY CHECK for AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	34115.84	34115.84	0	0
BLACK1	20452.8	20452.8	0	0
BLACK2	17620.33	17620.33	0	0
EO	14883.23	14883.23	0	0
EOB	7159.57	7159.57	0	0
WF1	77929.68	77929.68	0	0
OUT	403890.7	403890.7	0	0
A2	75986.71	75986.78	0	0
A3	141348.5	141348.7	0	0
A4	160314.8	160314.7	0	0
A5	176184.8	176185.1	0	0
A6	196693.1	196693	0	0
WF2	130254.9	130255	0	0
WF3	173407.2	173407	0	0
WF4	405370.8	405371.5	0	0
WF5	414716.2	414715.6	0	0

Existing 20 year ARI Result

DRAINS results prepared 13 October, 2010 from Version 2010.10

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	4.835	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatBlack1	2.885	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatBlack2	2.513	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatE0	2.154	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatEOB	1.112	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatWF1	10.862	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatA2	5.945	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatA3	9.291	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF2	7.359	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF3	6.144	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF4	5.869	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF5	1.865	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1

Outflow Volumes for Total Catchment (10.3 impervious + 1358 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 183 mm/h, Zone 1	208605.5	0.00 (0.0%)	0.00 (0.0%)	0.00 (0.0%)
AR&R 20 year, 10 minutes storm, average 141 mm/h, Zone 1	321457.7	20747.44 (6.5%)	-86375.45 (-3576.6%)	107122.89 (33.6%)
AR&R 20 year, 15 minutes storm, average 118 mm/h, Zone 1	403532	43292.56 (10.7%)	-141836.75 (-4678.6%	185129.31 (46.2%)
AR&R 20 year, 20 minutes storm, average 103 mm/h, Zone 1	469647.4	62938.69 (13.4%)	-184075.58 (-5217.1%	247014.27 (53.0%)
AR&R 20 year, 25 minutes storm, average 92 mm/h, Zone 1	524363.6	79172.73 (15.1%)	-217738.45 (-5527.2%	296911.19 (57.1%)
AR&R 20 year, 30 minutes storm, average 84 mm/h, Zone 1	574520.1	93204.48 (16.2%)	-247771.11 (-5740.5%	340975.59 (59.8%)
AR&R 20 year, 45 minutes storm, average 68 mm/h, Zone 1	697631.6	149439.56 (21.4%)	-301420.56 (-5751.1%	450860.13 (65.1%)
AR&R 20 year, 1 hour storm, average 58 mm/h, Zone 1	793384.9	208385.19 (26.3%)	-323187.50 (-5422.2%	531572.69 (67.5%)
AR&R 20 year, 1.5 hours storm, average 44.9 mm/h, Zone 1	921284.1	311424.84 (33.8%)	-313290.34 (-4526.5%	624715.19 (68.3%)
AR&R 20 year, 2 hours storm, average 37.4 mm/h, Zone 1	1023193	403519.41 (39.4%)	-297362.97 (-3868.4%	700882.38 (69.0%)
AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1	1185974	560524.67 (47.3%)	-237380.77 (-2664.3%	797905.44 (67.8%)
AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1	1372693	716312.27 (52.2%)	-184313.98 (-1787.3%	900626.25 (66.1%)

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
OFA1	4.835	4.886	4.777	0.189	0.41	12.04	2.15	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFBlack1	2.885	2.885	4.777	0.137	0.24	12.03	1.75	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFBlack2	2.513	2.513	4.777	0.126	0.21	12.03	1.65	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFEO	2.154	2.154	4.777	0.115	0.18	12.02	1.56	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFEOB	1.112	1.112	4.777	0.078	0.09	12.02	1.19	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFWF1	10.862	11.093	4.777	0.311	0.92	12.06	2.96	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA2	10.816	11.004	4.777	0.31	0.91	12.06	2.95	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFA3	20.159	20.159	4.777	0.449	1.67	12.09	3.73	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA4	22.838	22.838	4.777	0.485	1.9	12.1	3.91	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA5	25.309	25.309	4.777	0.516	2.1	12.1	4.07	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA6	28.377	28.377	4.777	0.554	2.35	12.11	4.25	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF2	18.447	18.891	4.777	0.431	1.57	12.09	3.64	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF3	25.012	25.012	4.777	0.512	2.08	12.1	4.05	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF5	58.637	58.637	4.777	0.871	4.85	12.17	5.57	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
DUMMYOL	60.267	60.267	4.777	0.885	4.99	12.18	5.63	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1

CONTINUITY CHECK for AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	43561.6	43561.6	0	0
BLACK1	26183.68	26183.68	0	0
BLACK2	22495.7	22495.7	0	0
EO	18944.2	18944.2	0	0
EOB	9016.84	9016.84	0	0
WF1	101526	101526	0	0
OUT	526565.4	526565.4	0	0
A2	97696.57	97696.49	0	0
A3	183380.2	183380.2	0	0
A4	205769.6	205769.6	0	0
A5	226387.3	226387.8	0	0
A6	252625.5	252625.3	0	0
WF2	170409.6	170409.1	0	0
WF3	227622.8	227622.7	0	0
WF4	527123.4	527123.1	0	0
WF5	539634.4	539633.9	0	0

Existing 50 year ARI Result

DRAINS results prepared 13 October, 2010 from Version 2010.10

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	6.264	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatBlack1	3.748	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatBlack2	3.25	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatE0	2.773	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatEOB	1.422	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
CatWF1	14.057	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatA2	7.739	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatA3	11.984	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatWF2	9.522	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatWF3	7.933	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatWF4	7.589	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatWF5	2.39	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

Outflow Volumes for Total Catchment (10.3 impervious + 1358 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 50 year, 5 minutes storm, average 214 mm/h, Zone 1	243943.1	4178.82 (1.7%)	-28653.12 (-1563.5%)	32831.93 (13.6%)
AR&R 50 year, 10 minutes storm, average 165 mm/h, Zone 1	376173.9	36436.79 (9.7%)	-123690.54 (-4376.8%	160127.33 (42.9%)
AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1	471927.3	66494.16 (14.1%)	-185081.33 (-5220.3%	251575.48 (53.7%)
AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1	551721.8	93097.55 (16.9%)	-234108.64 (-5648.1%	327206.19 (59.8%)
AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1	615557.3	113428.66 (18.4%)	-272428.94 (-5891.0%	385857.59 (63.2%)
AR&R 50 year, 30 minutes storm, average 98 mm/h, Zone 1	670273.4	130008.50 (19.4%)	-304676.69 (-6050.5%	434685.19 (65.3%)
AR&R 50 year, 45 minutes storm, average 79 mm/h, Zone 1	810483.8	202433.69 (25.0%)	-359337.00 (-5901.5%	561770.69 (69.8%)
AR&R 50 year, 1 hour storm, average 67 mm/h, Zone 1	916496.4	274679.84 (30.0%)	-377671.28 (-5485.2%	652351.13 (71.7%)
AR&R 50 year, 1.5 hours storm, average 53 mm/h, Zone 1	1087484	420533.03 (38.7%)	-367702.09 (-4500.7%	788235.13 (73.0%)
AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1	1201021	532102.97 (44.3%)	-343330.78 (-3805.1%	875433.75 (73.4%)
AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1	1395263	726645.09 (52.1%)	-276339.97 (-2636.3%	1002985.06 (72.4%)
AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1	1612760	917376.34 (56.9%)	-217713.66 (-1796.9%	1135090.00 (70.9%)

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
OFA1	6.264	6.358	4.777	0.221	0.53	12.04	2.39	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFBlack1	3.748	3.748	4.777	0.161	0.31	12.03	1.94	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFBlack2	3.25	3.25	4.777	0.148	0.27	12.03	1.83	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFEO	2.773	2.773	4.777	0.134	0.23	12.03	1.72	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFEOB	1.422	1.422	4.777	0.089	0.12	12.02	1.33	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
OFWF1	14.057	14.057	4.777	0.36	1.17	12.07	3.25	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFA2	14.097	14.382	4.777	0.365	1.19	12.07	3.28	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA3	26.278	26.278	4.777	0.528	2.18	12.11	4.13	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA4	30.007	30.007	4.777	0.574	2.49	12.11	4.34	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA5	33.233	33.233	4.777	0.611	2.76	12.12	4.51	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA6	37.249	37.249	4.777	0.656	3.09	12.13	4.71	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFWF2	23.286	23.286	4.777	0.49	1.93	12.1	3.95	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFWF3	30.717	30.717	4.777	0.581	2.55	12.12	4.38	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFWF5	74.971	74.971	4.777	1	6.2	12.2	6.2	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
DUMMYOU	77.133	77.133	4.777	1	6.37	12.2	6.37	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

CONTINUITY CHECK for AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	55909.81	55909.81	0	0
BLACK1	33651.56	33651.56	0	0
BLACK2	28836.95	28836.95	0	0
EO	24218.45	24218.45	0	0
EOB	11421.69	11421.69	0	0
WF1	132537.5	132537.5	0	0
OUT	682593.3	682593.3	0	0
A2	126046.9	126046.8	0	0
A3	238368.7	238369.3	0	0
A4	267774.2	267774.2	0	0
A5	294451.4	294452.1	0	0
A6	328099.2	328099.2	0	0
WF2	220980.3	220980.2	0	0
WF3	291019.1	291019.3	0	0
WF4	682082.2	682082.3	0	0
WF5	698529.5	698529.5	0	0

Existing 100 year ARI Result

DRAINS results prepared 13 April, 2010 from Version 2009.07

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	7.41	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatBlack1	4.433	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatBlack2	3.844	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatE0	3.282	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatEOB	1.7	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
CatWF1	16.68	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatA2	9.189	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatA3	14.274	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatWF2	11.298	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatWF3	9.443	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatWF4	9.002	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatWF5	2.82	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

Outflow Volumes for Total Catchment (10.3 impervious + 1358 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 237 mm/h, Zone 1	270161.3	9096.89 (3.4%)	-48670.34 (-2398.0%)	57767.23 (21.5%)
AR&R 100 year, 10 minutes storm, average 182 mm/h, Zone 1	414931.2	48880.31 (11.8%)	-148732.53 (-4771.3%	197612.84 (48.0%)
AR&R 100 year, 15 minutes storm, average 153 mm/h, Zone 1	523223.7	85744.84 (16.4%)	-215954.63 (-5493.9%	301699.47 (58.1%)
AR&R 100 year, 20 minutes storm, average 134 mm/h, Zone 1	610997.5	117092.41 (19.2%)	-268198.72 (-5842.8%	385291.13 (63.5%)
AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1	683952.5	141956.47 (20.8%)	-310738.75 (-6047.5%	452695.22 (66.7%)
AR&R 100 year, 30 minutes storm, average 109 mm/h, Zone 1	745508.3	162116.66 (21.7%)	-346209.63 (-6181.5%	508326.28 (68.7%)
AR&R 100 year, 45 minutes storm, average 88 mm/h, Zone 1	902817.3	249854.38 (27.7%)	-402777.94 (-5938.4%	652632.31 (72.8%)
AR&R 100 year, 1 hour storm, average 75 mm/h, Zone 1	1025929	339314.69 (33.1%)	-420749.88 (-5459.0%	760064.56 (74.6%)
AR&R 100 year, 1.5 hours storm, average 58 mm/h, Zone 1	1190077	493675.47 (41.5%)	-395666.41 (-4425.5%	889341.88 (75.3%)
AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1	1335076	636461.31 (47.7%)	-370702.56 (-3696.0%	1007163.88 (76.0%)
AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1	1551204	860067.72 (55.4%)	-296151.53 (-2541.3%	1156219.25 (75.1%)
AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1	1797427	1081259.91 (60.2%)	-234901.34 (-1739.6%	1316161.25 (73.8%)

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
OFA1	7.41	7.543	4.777	0.246	0.63	12.05	2.55	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFBlack1	4.433	4.433	4.777	0.178	0.37	12.04	2.07	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFBlack2	3.844	3.844	4.777	0.164	0.32	12.03	1.96	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFEO	3.282	3.282	4.777	0.149	0.27	12.03	1.83	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFEOB	1.7	1.7	4.777	0.1	0.14	12.02	1.41	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
OFWF1	16.68	16.68	4.777	0.399	1.39	12.08	3.47	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFA2	16.723	17.108	4.777	0.406	1.42	12.08	3.5	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA3	31.313	31.313	4.777	0.588	2.6	12.12	4.41	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA4	35.732	35.732	4.777	0.639	2.96	12.13	4.63	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA5	39.547	39.547	4.777	0.68	3.28	12.14	4.82	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA6	44.251	44.251	4.777	0.73	3.67	12.15	5.02	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFWF2	27.793	27.793	4.777	0.546	2.31	12.11	4.22	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFWF3	36.844	36.844	4.777	0.651	3.05	12.13	4.69	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFWF5	89.684	89.684	4.777	1	7.41	12.2	7.41	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
DUMMYOL	92.24	92.24	4.777	1	7.62	12.2	7.62	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

CONTINUITY CHECK for AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	65714.31	65714.31	0	0
BLACK1	39571.23	39571.23	0	0
BLACK2	33833.83	33833.83	0	0
EO	28347.76	28347.76	0	0
EOB	13261.89	13261.89	0	0
WF1	157689.3	157689.3	0	0
OUT	811328.3	811328.3	0	0
A2	148672.9	148672.5	0	0
A3	282634.4	282634.8	0	0
A4	317715.6	317715.7	0	0
A5	349270.3	349270.5	0	0
A6	388770.9	388770.6	0	0
WF2	261935.2	261934.9	0	0
WF3	344142.3	344142.7	0	0
WF4	809357.6	809359.1	0	0
WF5	828966.1	828966.1	0	0

Developed without Diversion 10 year ARI Result

DRAINS results prepared 13 April, 2010 from Version 2009.07

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	3.737	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatBlack1	2.223	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatBlack2	1.946	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatE0	1.671	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatEOB	0.876	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatWF1	8.313	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatA2	4.575	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatA3	7.16	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF2	5.628	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF3	4.732	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF4	21.802	AR&R 10 year, 2 hours storm, average 32.5 mm/h, Zone 1
CatWF5	1.436	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1

Outflow Volumes for Total Catchment (71.6 impervious + 1296 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 160 mm/h, Zone 1	182387.3	6148.39 (3.4%)	6148.39 (64.4%)	0.00 (0.0%)
AR&R 10 year, 10 minutes storm, average 123 mm/h, Zone 1	280420.5	24333.76 (8.7%)	-40690.87 (-277.1%)	65024.63 (24.5%)
AR&R 10 year, 15 minutes storm, average 103 mm/h, Zone 1	352235.5	46714.74 (13.3%)	-82503.78 (-447.3%)	129218.52 (38.7%)
AR&R 10 year, 20 minutes storm, average 90 mm/h, Zone 1	410371.5	66384.02 (16.2%)	-114263.79 (-531.7%)	180647.81 (46.5%)
AR&R 10 year, 25 minutes storm, average 81 mm/h, Zone 1	461668	84079.47 (18.2%)	-141171.20 (-583.9%)	225250.67 (51.5%)
AR&R 10 year, 30 minutes storm, average 73 mm/h, Zone 1	499285.3	95521.36 (19.1%)	-160058.42 (-612.1%)	255579.78 (54.0%)
AR&R 10 year, 45 minutes storm, average 59 mm/h, Zone 1	605298.1	144614.14 (23.9%)	-199424.77 (-629.1%)	344038.91 (60.0%)
AR&R 10 year, 1 hour storm, average 50 mm/h, Zone 1	683952.5	191596.80 (28.0%)	-213959.14 (-597.3%)	405555.94 (62.6%)
AR&R 10 year, 1.5 hours storm, average 39 mm/h, Zone 1	800224.4	276058.61 (34.5%)	-207613.83 (-495.4%)	483672.44 (63.8%)
AR&R 10 year, 2 hours storm, average 32.5 mm/h, Zone 1	889138.3	349863.70 (39.3%)	-194074.48 (-416.8%)	543938.19 (64.6%)
AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1	1030033	474347.78 (46.1%)	-143683.16 (-266.4%)	618030.94 (63.3%)
AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1	1188025	596337.83 (50.2%)	-92857.61 (-149.2%)	689195.44 (61.2%)

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
OFA1	3.737	3.759	4.777	0.162	0.31	12.03	1.94	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFBlack1	2.223	2.223	4.777	0.118	0.19	12.02	1.57	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFBlack2	1.946	1.946	4.777	0.108	0.16	12.02	1.5	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFEO	1.671	1.671	4.777	0.099	0.14	12.02	1.4	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFEOB	0.876	0.876	4.777	0.067	0.07	12.01	1.09	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFWF1	8.313	8.456	4.777	0.263	0.7	12.05	2.67	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA2	8.319	8.443	4.777	0.263	0.7	12.05	2.67	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFA3	15.521	15.521	4.777	0.382	1.29	12.08	3.37	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA4	17.366	17.366	4.777	0.41	1.44	12.08	3.52	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA5	19.254	19.254	4.777	0.436	1.6	12.09	3.67	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA6	21.599	21.599	4.777	0.468	1.79	12.09	3.83	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF2	14.076	14.377	4.777	0.365	1.19	12.07	3.27	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF3	19.079	19.079	4.777	0.434	1.58	12.09	3.65	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF5	44.548	44.548	4.777	0.733	3.69	12.15	5.03	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
DUMMYOUT	45.911	45.911	4.777	0.747	3.8	12.15	5.09	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1

CONTINUITY CHECK for AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	34115.84	34115.84	0	0
BLACK1	20452.8	20452.8	0	0
BLACK2	17620.33	17620.33	0	0
EO	14883.23	14883.23	0	0
EOB	7159.57	7159.57	0	0
WF1	77929.68	77929.68	0	0
OUT	445919.5	445919.5	0	0
A2	75986.71	75986.78	0	0
A3	141348.5	141348.7	0	0
A4	160314.8	160314.7	0	0
A5	176184.8	176185.1	0	0
A6	196693.1	196693	0	0
WF2	130254.9	130255	0	0
WF3	173407.2	173407	0	0
WF4	446285.1	446285.6	0	0
WF5	455784.6	455784.8	0	0

Developed without Diversion 20 year ARI Result

DRAINS results prepared 13 October, 2010 from Version 2010.10

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	4.835	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatBlack1	2.885	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatBlack2	2.513	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatE0	2.154	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatEOB	1.112	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatWF1	10.862	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatA2	5.945	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatA3	9.291	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF2	7.359	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF3	6.144	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF4	27.202	AR&R 20 year, 2 hours storm, average 37.4 mm/h, Zone 1
CatWF5	1.865	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1

Outflow Volumes for Total Catchment (71.6 impervious + 1296 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 183 mm/h, Zone 1	208605.5	7278.03 (3.5%)	7278.03 (66.6%)	0.00 (0.0%)
AR&R 20 year, 10 minutes storm, average 141 mm/h, Zone 1	321457.7	37335.93 (11.6%)	-64945.37 (-385.8%)	102281.30 (33.6%)
AR&R 20 year, 15 minutes storm, average 118 mm/h, Zone 1	403532	66045.55 (16.4%)	-110716.90 (-523.9%)	176762.45 (46.2%)
AR&R 20 year, 20 minutes storm, average 103 mm/h, Zone 1	469647.4	90444.48 (19.3%)	-145405.02 (-591.2%)	235849.50 (53.0%)
AR&R 20 year, 25 minutes storm, average 92 mm/h, Zone 1	524363.6	110470.53 (21.1%)	-173020.84 (-630.1%)	283491.38 (57.1%)
AR&R 20 year, 30 minutes storm, average 84 mm/h, Zone 1	574520.1	127883.59 (22.3%)	-197679.75 (-657.0%)	325563.34 (59.8%)
AR&R 20 year, 45 minutes storm, average 68 mm/h, Zone 1	697631.6	191198.59 (27.4%)	-239283.88 (-654.9%)	430482.47 (65.1%)
AR&R 20 year, 1 hour storm, average 58 mm/h, Zone 1	793384.9	253970.52 (32.0%)	-253576.20 (-610.3%)	507546.72 (67.5%)
AR&R 20 year, 1.5 hours storm, average 44.9 mm/h, Zone 1	921284.1	358596.41 (38.9%)	-237894.03 (-493.1%)	596490.44 (68.3%)
AR&R 20 year, 2 hours storm, average 37.4 mm/h, Zone 1	1023193	450668.56 (44.0%)	-218533.50 (-407.8%)	669202.06 (69.0%)
AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1	1185974	604701.03 (51.0%)	-157153.84 (-253.0%)	761854.88 (67.8%)
AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1	1372693	758297.54 (55.2%)	-101622.27 (-141.4%)	859919.81 (66.1%)

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
OFA1	4.835	4.886	4.777	0.189	0.41	12.04	2.15	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFBlack1	2.885	2.885	4.777	0.137	0.24	12.03	1.75	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFBlack2	2.513	2.513	4.777	0.126	0.21	12.03	1.65	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFEO	2.154	2.154	4.777	0.115	0.18	12.02	1.56	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFEOB	1.112	1.112	4.777	0.078	0.09	12.02	1.19	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFWF1	10.862	11.093	4.777	0.311	0.92	12.06	2.96	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA2	10.816	11.004	4.777	0.31	0.91	12.06	2.95	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFA3	20.159	20.159	4.777	0.449	1.67	12.09	3.73	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA4	22.838	22.838	4.777	0.485	1.9	12.1	3.91	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA5	25.309	25.309	4.777	0.516	2.1	12.1	4.07	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA6	28.377	28.377	4.777	0.554	2.35	12.11	4.25	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF2	18.447	18.891	4.777	0.431	1.57	12.09	3.64	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF3	25.012	25.012	4.777	0.512	2.08	12.1	4.05	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF5	58.649	58.649	4.777	0.871	4.85	12.17	5.57	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
DUMMYOUT	60.391	60.391	4.777	0.886	5	12.18	5.64	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1

CONTINUITY CHECK for AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	43561.6	43561.6	0	0
BLACK1	26183.68	26183.68	0	0
BLACK2	22495.7	22495.7	0	0
EO	18944.2	18944.2	0	0
EOB	9016.84	9016.84	0	0
WF1	101526	101526	0	0
OUT	572070.4	572070.4	0	0
A2	97696.57	97696.49	0	0
A3	183380.2	183380.2	0	0
A4	205769.6	205769.6	0	0
A5	226387.3	226387.8	0	0
A6	252625.5	252625.3	0	0
WF2	170409.6	170409.1	0	0
WF3	227622.8	227622.7	0	0
WF4	571290.8	571289	0	0
WF5	583968.8	583968.8	0	0

Developed without Diversion 50 year ARI Result

DRAINS results prepared 13 October, 2010 from Version 2010.10

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	6.264	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatBlack1	3.748	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatBlack2	3.25	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatE0	2.773	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatEOB	1.422	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
CatWF1	14.057	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatA2	7.739	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatA3	11.984	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatWF2	9.522	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatWF3	7.933	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatWF4	32.413	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
CatWF5	2.39	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

Outflow Volumes for Total Catchment (71.6 impervious + 1296 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 50 year, 5 minutes storm, average 214 mm/h, Zone 1	243943.1	14508.87 (5.9%)	-16839.15 (-131.8%)	31348.03 (13.6%)
AR&R 50 year, 10 minutes storm, average 165 mm/h, Zone 1	376173.9	57143.97 (15.2%)	-95746.14 (-486.0%)	152890.11 (42.9%)
AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1	471927.3	94085.63 (19.9%)	-146119.16 (-591.2%)	240204.78 (53.7%)
AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1	551721.8	126237.50 (22.9%)	-186179.84 (-644.4%)	312417.34 (59.8%)
AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1	615557.3	150865.56 (24.5%)	-217551.66 (-674.9%)	368417.22 (63.2%)
AR&R 50 year, 30 minutes storm, average 98 mm/h, Zone 1	670273.4	171072.72 (25.5%)	-243966.31 (-695.0%)	415039.03 (65.3%)
AR&R 50 year, 45 minutes storm, average 79 mm/h, Zone 1	810483.8	250874.91 (31.0%)	-285504.28 (-672.6%)	536379.19 (69.8%)
AR&R 50 year, 1 hour storm, average 67 mm/h, Zone 1	916496.4	326679.66 (35.6%)	-296184.41 (-617.1%)	622864.06 (71.7%)
AR&R 50 year, 1.5 hours storm, average 53 mm/h, Zone 1	1087484	474306.66 (43.6%)	-278308.34 (-488.7%)	752615.00 (73.0%)
AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1	1201021	584952.05 (48.7%)	-250919.77 (-398.9%)	835871.81 (73.4%)
AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1	1395263	775567.44 (55.6%)	-182076.44 (-249.2%)	957643.88 (72.4%)
AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1	1612760	963487.65 (59.7%)	-120290.60 (-142.4%)	1083778.25 (70.9%)

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
OFA1	6.264	6.358	4.777	0.221	0.53	12.04	2.39	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFBlack1	3.748	3.748	4.777	0.161	0.31	12.03	1.94	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFBlack2	3.25	3.25	4.777	0.148	0.27	12.03	1.83	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFEO	2.773	2.773	4.777	0.134	0.23	12.03	1.72	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFEOB	1.422	1.422	4.777	0.089	0.12	12.02	1.33	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
OFWF1	14.057	14.057	4.777	0.36	1.17	12.07	3.25	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFA2	14.097	14.382	4.777	0.365	1.19	12.07	3.28	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA3	26.278	26.278	4.777	0.528	2.18	12.11	4.13	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA4	30.007	30.007	4.777	0.574	2.49	12.11	4.34	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA5	33.233	33.233	4.777	0.611	2.76	12.12	4.51	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA6	37.249	37.249	4.777	0.656	3.09	12.13	4.71	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFWF2	23.286	23.286	4.777	0.49	1.93	12.1	3.95	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFWF3	30.717	30.717	4.777	0.581	2.55	12.12	4.38	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFWF5	74.654	74.654	4.777	1	6.17	12.2	6.17	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
DUMMYOUT	76.931	76.931	4.777	1	6.36	12.2	6.36	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

CONTINUITY CHECK for AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	55909.81	55909.81	0	0
BLACK1	33651.56	33651.56	0	0
BLACK2	28836.95	28836.95	0	0
EO	24218.45	24218.45	0	0
EOB	11421.69	11421.69	0	0
WF1	132537.5	132537.5	0	0
OUT	733193.6	733193.6	0	0
A2	126046.9	126046.8	0	0
A3	238368.7	238369.3	0	0
A4	267774.2	267774.2	0	0
A5	294451.4	294452.1	0	0
A6	328099.2	328099.2	0	0
WF2	220980.3	220980.2	0	0
WF3	291019.1	291019.3	0	0
WF4	731015.1	731013.7	0	0
WF5	747666.1	747666	0	0

Developed without Diversion 100 year ARI Result

DRAINS results prepared 13 April, 2010 from Version 2009.07

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	7.41	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatBlack1	4.433	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatBlack2	3.844	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatE0	3.282	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatEOB	1.7	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
CatWF1	16.68	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatA2	9.189	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatA3	14.274	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatWF2	11.298	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatWF3	9.443	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatWF4	37.544	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
CatWF5	2.82	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

Outflow Volumes for Total Catchment (71.6 impervious + 1296 pervious = 1368 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 237 mm/h, Zone 1	270161.3	21604.70 (8.0%)	-33551.63 (-237.1%)	55156.32 (21.5%)
AR&R 100 year, 10 minutes storm, average 182 mm/h, Zone 1	414931.2	72340.86 (17.4%)	-116340.42 (-535.4%)	188681.28 (48.0%)
AR&R 100 year, 15 minutes storm, average 153 mm/h, Zone 1	523223.7	116805.38 (22.3%)	-171257.84 (-625.0%)	288063.22 (58.1%)
AR&R 100 year, 20 minutes storm, average 134 mm/h, Zone 1	610997.5	154106.83 (25.2%)	-213770.02 (-668.1%)	367876.84 (63.5%)
AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1	683952.5	183783.72 (26.9%)	-248451.00 (-693.6%)	432234.72 (66.7%)
AR&R 100 year, 30 minutes storm, average 109 mm/h, Zone 1	745508.3	207920.88 (27.9%)	-277431.28 (-710.6%)	485352.16 (68.7%)
AR&R 100 year, 45 minutes storm, average 88 mm/h, Zone 1	902817.3	303407.09 (33.6%)	-319726.59 (-676.2%)	623133.69 (72.8%)
AR&R 100 year, 1 hour storm, average 75 mm/h, Zone 1	1025929	396545.03 (38.7%)	-329170.41 (-612.7%)	725715.44 (74.6%)
AR&R 100 year, 1.5 hours storm, average 58 mm/h, Zone 1	1190077	550949.09 (46.3%)	-298189.09 (-478.4%)	849138.19 (75.3%)
AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1	1335076	692827.75 (51.9%)	-268817.50 (-384.5%)	961645.25 (76.0%)
AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1	1551204	911547.83 (58.8%)	-192406.05 (-236.8%)	1103953.88 (75.1%)
AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1	1797427	1129574.92 (62.8%)	-127065.33 (-135.0%)	1256640.25 (73.8%)

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
OFA1	7.41	7.543	4.777	0.246	0.63	12.05	2.55	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFBlack1	4.433	4.433	4.777	0.178	0.37	12.04	2.07	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFBlack2	3.844	3.844	4.777	0.164	0.32	12.03	1.96	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFEO	3.282	3.282	4.777	0.149	0.27	12.03	1.83	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFEOB	1.7	1.7	4.777	0.1	0.14	12.02	1.41	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
OFWF1	16.68	16.68	4.777	0.399	1.39	12.08	3.47	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFA2	16.723	17.108	4.777	0.406	1.42	12.08	3.5	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA3	31.313	31.313	4.777	0.588	2.6	12.12	4.41	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA4	35.732	35.732	4.777	0.639	2.96	12.13	4.63	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA5	39.547	39.547	4.777	0.68	3.28	12.14	4.82	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA6	44.251	44.251	4.777	0.73	3.67	12.15	5.02	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFWF2	27.793	27.793	4.777	0.546	2.31	12.11	4.22	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFWF3	36.844	36.844	4.777	0.651	3.05	12.13	4.69	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFWF5	89.179	89.179	4.777	1	7.37	12.2	7.37	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
DUMMYOUT	91.846	91.846	4.777	1	7.59	12.2	7.59	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

CONTINUITY CHECK for AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	65714.31	65714.31	0	0
BLACK1	39571.23	39571.23	0	0
BLACK2	33833.83	33833.83	0	0
EO	28347.76	28347.76	0	0
EOB	13261.89	13261.89	0	0
WF1	157689.3	157689.3	0	0
OUT	864699.2	864699.2	0	0
A2	148672.9	148672.5	0	0
A3	282634.4	282634.8	0	0
A4	317715.6	317715.7	0	0
A5	349270.3	349270.5	0	0
A6	388770.9	388770.6	0	0
WF2	261935.2	261934.9	0	0
WF3	344142.3	344142.7	0	0
WF4	860845.8	860846.6	0	0
WF5	880681.1	880679.9	0	0

Developed with Diversion 10 year ARI Result

DRAINS results prepared 13 April, 2010 from Version 2009.07

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	3.737	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatBlack1	2.223	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatBlack2	1.946	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatE0	1.671	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatEOB	0.876	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
CatWF1	8.313	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatA2	4.575	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatA3	7.16	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF2	5.629	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF3	4.731	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
CatWF4	24.74	AR&R 10 year, 2 hours storm, average 32.5 mm/h, Zone 1
CatWF5	8.022	AR&R 10 year, 2 hours storm, average 32.5 mm/h, Zone 1

Outflow Volumes for Total Catchment (96.5 impervious + 1288 pervious = 1384 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 160 mm/h, Zone 1	184560.7	9015.70 (4.9%)	9015.70 (70.1%)	0.00 (0.0%)
AR&R 10 year, 10 minutes storm, average 123 mm/h, Zone 1	283762	29879.87 (10.5%)	-34715.00 (-175.5%)	64594.86 (24.5%)
AR&R 10 year, 15 minutes storm, average 103 mm/h, Zone 1	356432.8	54248.14 (15.2%)	-74116.33 (-298.3%)	128364.47 (38.7%)
AR&R 10 year, 20 minutes storm, average 90 mm/h, Zone 1	415261.5	75436.80 (18.2%)	-104016.98 (-359.3%)	179453.78 (46.5%)
AR&R 10 year, 25 minutes storm, average 81 mm/h, Zone 1	467169.3	94433.45 (20.2%)	-129328.42 (-397.1%)	223761.88 (51.5%)
AR&R 10 year, 30 minutes storm, average 73 mm/h, Zone 1	505234.8	106826.17 (21.1%)	-147064.53 (-417.5%)	253890.70 (54.0%)
AR&R 10 year, 45 minutes storm, average 59 mm/h, Zone 1	612510.8	158106.42 (25.8%)	-183658.39 (-430.1%)	341764.81 (60.0%)
AR&R 10 year, 1 hour storm, average 50 mm/h, Zone 1	692102.6	206267.95 (29.8%)	-196607.86 (-407.5%)	402875.81 (62.6%)
AR&R 10 year, 1.5 hours storm, average 39 mm/h, Zone 1	809760	291847.83 (36.0%)	-188629.42 (-334.1%)	480477.25 (63.8%)
AR&R 10 year, 2 hours storm, average 32.5 mm/h, Zone 1	899733.3	366353.95 (40.7%)	-173988.61 (-277.4%)	540342.56 (64.6%)
AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1	1042306	491867.30 (47.2%)	-122079.95 (-168.0%)	613947.25 (63.3%)
AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1	1202182	615512.39 (51.2%)	-69121.11 (-82.5%)	684633.50 (61.2%)

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
OFA1	3.737	3.759	4.777	0.162	0.31	12.03	1.94	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFBlack1	2.223	2.223	4.777	0.118	0.19	12.02	1.57	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFBlack2	1.946	1.946	4.777	0.108	0.16	12.02	1.5	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFEO	1.671	1.671	4.777	0.099	0.14	12.02	1.4	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFEOB	0.876	0.876	4.777	0.067	0.07	12.01	1.09	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFWF1	8.313	8.456	4.777	0.263	0.7	12.05	2.67	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA2	8.32	8.443	4.777	0.263	0.7	12.05	2.67	AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1
OFA3	15.521	15.521	4.777	0.382	1.29	12.08	3.37	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA4	17.366	17.366	4.777	0.41	1.44	12.08	3.52	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA5	19.255	19.255	4.777	0.436	1.6	12.09	3.67	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFA6	21.6	21.6	4.777	0.468	1.79	12.09	3.83	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF2	14.078	14.378	4.777	0.365	1.19	12.07	3.28	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF3	19.08	19.08	4.777	0.434	1.58	12.09	3.65	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
OFWF5	44.501	44.501	4.777	0.732	3.69	12.15	5.04	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1
DUMMYOUT	46.39	46.39	4.777	0.751	3.84	12.15	5.11	AR&R 10 year, 4.5 hours storm, average 19.3 mm/h, Zone 1

CONTINUITY CHECK for AR&R 10 year, 3 hours storm, average 25.1 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	34116.81	34116.81	0	0
BLACK1	20453.78	20453.78	0	0
BLACK2	17621.42	17621.42	0	0
EO	14884.48	14884.48	0	0
EOB	7160.46	7160.46	0	0
WF1	77929.96	77929.96	0	0
OUT	463631.3	463631.3	0	0
A2	75988.09	75988.17	0	0
A3	141350.1	141350.3	0	0
A4	160317.1	160317.2	0	0
A5	176188.7	176188.6	0	0
A6	196698.7	196698.7	0	0
WF2	130264.2	130264.1	0	0
WF3	173398.2	173398.8	0	0
WF4	448303	448303.8	0	0
WF5	473318.7	473318	0	0

Developed with Diversion 20 year ARI Result

DRAINS results prepared 13 October, 2010 from Version 2010.10

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	4.835	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatBlack1	2.885	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatBlack2	2.513	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatE0	2.154	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatEOB	1.112	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
CatWF1	10.862	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatA2	5.945	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatA3	9.291	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF2	7.359	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF3	6.144	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
CatWF4	30.293	AR&R 20 year, 2 hours storm, average 37.4 mm/h, Zone 1
CatWF5	9.985	AR&R 20 year, 2 hours storm, average 37.4 mm/h, Zone 1

Outflow Volumes for Total Catchment (96.5 impervious + 1288 pervious = 1384 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 183 mm/h, Zone 1	211091.3	10629.54 (5.0%)	10629.54 (72.2%)	0.00 (0.0%)
AR&R 20 year, 10 minutes storm, average 141 mm/h, Zone 1	325288.2	44005.84 (13.5%)	-57599.42 (-254.0%)	101605.27 (33.6%)
AR&R 20 year, 15 minutes storm, average 118 mm/h, Zone 1	408340.5	74874.86 (18.3%)	-100719.25 (-353.8%)	175594.11 (46.2%)
AR&R 20 year, 20 minutes storm, average 103 mm/h, Zone 1	475243.8	100941.53 (21.2%)	-133349.19 (-402.5%)	234290.72 (53.0%)
AR&R 20 year, 25 minutes storm, average 92 mm/h, Zone 1	530611.9	122308.72 (23.1%)	-159309.03 (-430.6%)	281617.75 (57.1%)
AR&R 20 year, 30 minutes storm, average 84 mm/h, Zone 1	581366.1	140942.39 (24.2%)	-182469.73 (-450.2%)	323412.13 (59.8%)
AR&R 20 year, 45 minutes storm, average 68 mm/h, Zone 1	705944.7	206606.70 (29.3%)	-221030.80 (-449.1%)	427637.50 (65.1%)
AR&R 20 year, 1 hour storm, average 58 mm/h, Zone 1	802838.9	270666.98 (33.7%)	-233525.48 (-417.2%)	504192.47 (67.5%)
AR&R 20 year, 1.5 hours storm, average 44.9 mm/h, Zone 1	932262.1	376268.97 (40.4%)	-216278.34 (-332.8%)	592547.31 (68.3%)
AR&R 20 year, 2 hours storm, average 37.4 mm/h, Zone 1	1035386	469135.36 (45.3%)	-195644.14 (-271.0%)	664779.50 (69.0%)
AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1	1200106	624274.08 (52.0%)	-132545.05 (-158.4%)	756819.13 (67.8%)
AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1	1389050	779827.01 (56.1%)	-74416.24 (-76.8%)	854243.25 (66.1%)

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
OFA1	4.835	4.886	4.777	0.189	0.41	12.04	2.15	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFBlack1	2.885	2.885	4.777	0.137	0.24	12.03	1.75	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFBlack2	2.513	2.513	4.777	0.126	0.21	12.03	1.65	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFEO	2.154	2.154	4.777	0.115	0.18	12.02	1.56	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFEOB	1.112	1.112	4.777	0.078	0.09	12.02	1.19	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFWF1	10.862	11.093	4.777	0.311	0.92	12.06	2.96	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA2	10.816	11.004	4.777	0.31	0.91	12.06	2.95	AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1
OFA3	20.16	20.16	4.777	0.449	1.67	12.09	3.73	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA4	22.838	22.838	4.777	0.485	1.9	12.1	3.91	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA5	25.309	25.309	4.777	0.516	2.1	12.1	4.07	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFA6	28.377	28.377	4.777	0.554	2.35	12.11	4.25	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF2	18.448	18.891	4.777	0.431	1.57	12.09	3.64	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF3	25.012	25.012	4.777	0.512	2.08	12.1	4.05	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
OFWF5	58.591	58.591	4.777	0.87	4.85	12.17	5.57	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1
DUMMYOUT	60.714	60.714	4.777	0.889	5.02	12.18	5.65	AR&R 20 year, 4.5 hours storm, average 22.3 mm/h, Zone 1

CONTINUITY CHECK for AR&R 20 year, 3 hours storm, average 28.9 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	43562.07	43562.07	0	0
BLACK1	26184.77	26184.77	0	0
BLACK2	22496.86	22496.86	0	0
EO	18945.38	18945.38	0	0
EOB	9017.38	9017.38	0	0
WF1	101526.3	101526.3	0	0
OUT	591878.6	591878.6	0	0
A2	97697.52	97697.45	0	0
A3	183381.2	183381.2	0	0
A4	205771.9	205772	0	0
A5	226390.9	226391.1	0	0
A6	252630.5	252630.2	0	0
WF2	170410.2	170409.8	0	0
WF3	227623.8	227623.6	0	0
WF4	573354.9	573354.1	0	0
WF5	603566.3	603566	0	0

Developed with Diversion 50 year ARI Result

DRAINS results prepared 13 October, 2010 from Version 2010.10

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	6.264	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatBlack1	3.748	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatBlack2	3.25	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatE0	2.773	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatEOB	1.423	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
CatWF1	14.057	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatA2	7.739	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatA3	11.984	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatWF2	9.522	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
CatWF3	7.933	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
CatWF4	35.677	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
CatWF5	11.836	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1

Outflow Volumes for Total Catchment (96.5 impervious + 1288 pervious = 1384 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 50 year, 5 minutes storm, average 214 mm/h, Zone 1	246849.9	18956.50 (7.7%)	-12184.33 (-70.8%)	31140.83 (13.6%)
AR&R 50 year, 10 minutes storm, average 165 mm/h, Zone 1	380656.4	65230.42 (17.1%)	-86649.20 (-326.5%)	151879.63 (42.9%)
AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1	477550.8	104563.92 (21.9%)	-134053.30 (-402.6%)	238617.22 (53.7%)
AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1	558296.1	138646.48 (24.8%)	-171706.14 (-441.1%)	310352.63 (59.8%)
AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1	622892.3	164801.75 (26.5%)	-201180.41 (-463.3%)	365982.16 (63.2%)
AR&R 50 year, 30 minutes storm, average 98 mm/h, Zone 1	678260.4	186324.03 (27.5%)	-225972.03 (-477.9%)	412296.06 (65.3%)
AR&R 50 year, 45 minutes storm, average 79 mm/h, Zone 1	820141.6	268589.47 (32.7%)	-264244.59 (-462.1%)	532834.06 (69.8%)
AR&R 50 year, 1 hour storm, average 67 mm/h, Zone 1	927417.4	345685.06 (37.3%)	-273062.25 (-422.3%)	618747.31 (71.7%)
AR&R 50 year, 1.5 hours storm, average 53 mm/h, Zone 1	1100443	494717.14 (45.0%)	-252923.86 (-329.7%)	747641.00 (73.0%)
AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1	1215332	606175.23 (49.9%)	-224170.20 (-264.6%)	830345.44 (73.4%)
AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1	1411889	798248.75 (56.5%)	-153064.88 (-155.5%)	951313.63 (72.4%)
AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1	1631978	988460.34 (60.6%)	-88155.79 (-77.5%)	1076616.13 (70.9%)

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
OFA1	6.264	6.358	4.777	0.221	0.53	12.04	2.39	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFBlack1	3.748	3.748	4.777	0.161	0.31	12.03	1.94	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFBlack2	3.25	3.25	4.777	0.148	0.27	12.03	1.83	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFEO	2.773	2.773	4.777	0.134	0.23	12.03	1.72	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFEOB	1.423	1.423	4.777	0.089	0.12	12.02	1.33	AR&R 50 year, 2 hours storm, average 43.9 mm/h, Zone 1
OFWF1	14.057	14.057	4.777	0.36	1.17	12.07	3.25	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFA2	14.097	14.382	4.777	0.365	1.19	12.07	3.28	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA3	26.279	26.279	4.777	0.528	2.18	12.11	4.13	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA4	30.007	30.007	4.777	0.574	2.49	12.11	4.34	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA5	33.234	33.234	4.777	0.611	2.76	12.12	4.51	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFA6	37.249	37.249	4.777	0.656	3.09	12.13	4.71	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
OFWF2	23.287	23.287	4.777	0.49	1.93	12.1	3.95	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFWF3	30.717	30.717	4.777	0.581	2.55	12.12	4.38	AR&R 50 year, 4.5 hours storm, average 26.2 mm/h, Zone 1
OFWF5	74.551	74.551	4.777	1	6.16	12.2	6.16	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1
DUMMYOUT	77.174	77.174	4.777	1	6.38	12.2	6.38	AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

CONTINUITY CHECK for AR&R 50 year, 3 hours storm, average 34 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	55910.25	55910.25	0	0
BLACK1	33652.45	33652.45	0	0
BLACK2	28837.98	28837.98	0	0
EO	24219.59	24219.59	0	0
EOB	11422.5	11422.5	0	0
WF1	132537.6	132537.6	0	0
OUT	756153.7	756153.7	0	0
A2	126047.9	126047.9	0	0
A3	238370.2	238370.5	0	0
A4	267776.5	267776.4	0	0
A5	294454.5	294455.1	0	0
A6	328104.2	328104.2	0	0
WF2	220980.9	220980.8	0	0
WF3	291020	291020.3	0	0
WF4	733144.6	733143.3	0	0
WF5	770367.1	770367.4	0	0

Developed with Diversion 100 year ARI Result

DRAINS results prepared 13 April, 2010 from Version 2009.07

SUB-CATCHMENT DETAILS

Name	Max Flow (cu.m/s)	Due to Storm
CatA1	7.41	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatBlack1	4.433	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatBlack2	3.844	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatE0	3.282	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatEOB	1.7	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
CatWF1	16.68	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatA2	9.19	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatA3	14.274	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatWF2	11.298	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
CatWF3	9.443	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
CatWF4	41.269	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
CatWF5	13.73	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1

Outflow Volumes for Total Catchment (96.5 impervious + 1288 pervious = 1384 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 237 mm/h, Zone 1	273380.5	26798.29 (9.8%)	-27993.48 (-146.9%)	54791.77 (21.5%)
AR&R 100 year, 10 minutes storm, average 182 mm/h, Zone 1	419875.5	81385.41 (19.4%)	-106048.80 (-362.3%)	187434.22 (48.0%)
AR&R 100 year, 15 minutes storm, average 153 mm/h, Zone 1	529458.4	128484.02 (24.3%)	-157675.17 (-427.2%)	286159.19 (58.1%)
AR&R 100 year, 20 minutes storm, average 134 mm/h, Zone 1	618278.2	167872.67 (27.2%)	-197572.67 (-458.3%)	365445.34 (63.5%)
AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1	692102.6	199257.44 (28.8%)	-230120.34 (-476.9%)	429377.78 (66.7%)
AR&R 100 year, 30 minutes storm, average 109 mm/h, Zone 1	754391.8	224842.14 (29.8%)	-257302.27 (-489.2%)	482144.41 (68.7%)
AR&R 100 year, 45 minutes storm, average 88 mm/h, Zone 1	913575.4	322889.38 (35.3%)	-296125.13 (-464.9%)	619014.50 (72.8%)
AR&R 100 year, 1 hour storm, average 75 mm/h, Zone 1	1038154	417433.38 (40.2%)	-303485.44 (-419.3%)	720918.81 (74.6%)
AR&R 100 year, 1.5 hours storm, average 58 mm/h, Zone 1	1204258	572913.03 (47.6%)	-270611.03 (-322.3%)	843524.06 (75.3%)
AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1	1350984	715966.41 (53.0%)	-239321.72 (-254.1%)	955288.13 (76.0%)
AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1	1569689	936397.28 (59.7%)	-160260.84 (-146.4%)	1096658.13 (75.1%)
AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1	1818845	1157102.87 (63.6%)	-91226.26 (-71.9%)	1248329.13 (73.8%)

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
OFA1	7.41	7.543	4.777	0.246	0.63	12.05	2.55	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFBlack1	4.433	4.433	4.777	0.178	0.37	12.04	2.07	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFBlack2	3.844	3.844	4.777	0.164	0.32	12.03	1.96	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFEO	3.282	3.282	4.777	0.149	0.27	12.03	1.83	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFEOB	1.7	1.7	4.777	0.1	0.14	12.02	1.41	AR&R 100 year, 2 hours storm, average 48.8 mm/h, Zone 1
OFWF1	16.68	16.68	4.777	0.399	1.39	12.08	3.47	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFA2	16.723	17.108	4.777	0.406	1.42	12.08	3.5	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA3	31.313	31.313	4.777	0.588	2.6	12.12	4.41	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA4	35.732	35.732	4.777	0.639	2.96	12.13	4.63	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA5	39.547	39.547	4.777	0.68	3.28	12.14	4.82	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFA6	44.251	44.251	4.777	0.73	3.67	12.15	5.02	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
OFWF2	27.793	27.793	4.777	0.546	2.31	12.11	4.22	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFWF3	36.846	36.846	4.777	0.651	3.05	12.13	4.69	AR&R 100 year, 4.5 hours storm, average 29.2 mm/h, Zone 1
OFWF5	89.077	89.077	4.777	1	7.36	12.2	7.36	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1
DUMMYOUT	92.094	92.094	4.777	1	7.61	12.2	7.61	AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

CONTINUITY CHECK for AR&R 100 year, 3 hours storm, average 37.8 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
A1	65714.78	65714.78	0	0
BLACK1	39571.68	39571.68	0	0
BLACK2	33834.28	33834.28	0	0
EO	28348.27	28348.27	0	0
EOB	13262.87	13262.87	0	0
WF1	157690	157690	0	0
OUT	889843.3	889843.3	0	0
A2	148673.5	148673.4	0	0
A3	282635.1	282635.4	0	0
A4	317716.8	317717	0	0
A5	349271.9	349272.1	0	0
A6	388774.2	388773.8	0	0
WF2	261938.6	261938.2	0	0
WF3	344139	344138.6	0	0
WF4	862990.1	862991.8	0	0
WF5	905546.8	905546.6	0	0

Appendix C

Report by Parsons Brinckerhoff Australia Pty Limited on Freeway north Busienss Park, “Flood Modelling and Stormwater Management Strategy”, March 2007

Appendix D

Report by PPK Environment and Infrastructure Pty Ltd on Freeway Business Park, “Stormwater Management Plan”
February 2002

Appendix E

Information and test data for SPEL Stormceptor Class 1 stormwater quality improvement devices

SPEL STORMCEPTOR CLASS 1™

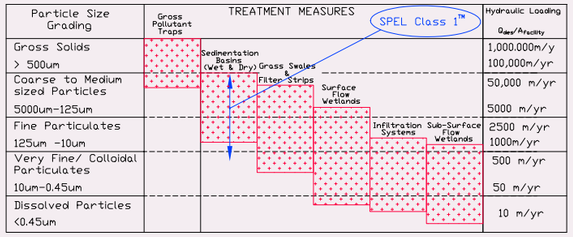
The distinct advantage in stormwater treatment

Water Sensitive Urban Design

Reduction of

- *Fine particulate suspended solids*
- *Silt*
- *Sediment*
- *Nutrients*
- *Hydrocarbons*

SPEL Class 1 takes stormwater treatment to a new dimension in Australia. An accepted and proven performer in the UK for over a decade SPEL Class 1 has undergone rigorous testing to ensure it meets Australian conditions and complies with the objectives set by the regulating authorities.



Pollutant size ranges for various stormwater treatment measures (Ecological Engineering 2003)

SPEL Class 1 is suited as a secondary treatment performer, removing sediment, silt, suspended solids, nutrients, and hydrocarbons. This ensures the tertiary biological treatment phase (if required) of a stormwater treatment chain is not encumbered with such pollutants and can realise long life with fewer maintenance frequencies.

SPEL Stormceptor Class 1

The SPEL Stormceptor Class 1 is a gravity, passive stormwater treatment device that treats stormwater through two chambers. Low velocity flow produces quiescent conditions enabling separation of the pollutants in all flow events. Contaminated water cannot flow directly across the surface before effective separation has taken place.

SPEL Class 1 Treatment Dynamics

Treatment Flow (TFR) (Diagram A)

Treatment flow (TFR) enters the primary chamber where sediment is collected. Flow then passes into the secondary separation chamber (Quiescent Zone) and finally through a high-reticulated coalescing media trapping and separating fine particulate suspended solids, nutrients and hydrocarbons.

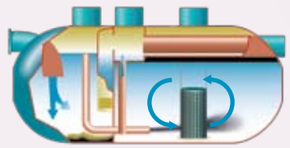


DIAGRAM A - TFR FLOW

Bypass Flow (Diagram B)

In high flow conditions (storm event) flow is through the primary chamber only, bypassing the secondary separation chamber.

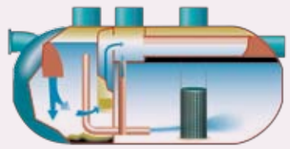


DIAGRAM B - HIGH FLOW

No Scouring or Re-suspension

The SPEL Class 1 function ensures there is no scouring or re-suspension of separated pollutants. This makes it suitable for flood and tidal zones

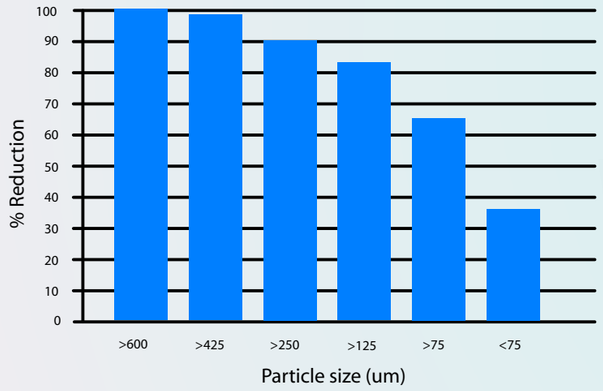
Continual & Optimal Treatment Performance

This unique SPEL Class 1 flow action in conjunction with the two internally sealed chambers and filter media maintains the quiescent conditions in the secondary separation chamber, (no turbulence or agitation)ensuring optimal treatment performance even whilst the device is in `bypass mode`.

SPEL Class 1Treatment Performance

SPEL Class 1 devices have undergone the most rigorous and demanding tests in flow conditions of any treatment device in Australia. Tests conducted by the University of South Australia for Total Suspended Solids (TSS), TSS Particles Size Distribution (PSD), Total Phosphorus (TP) and Total Petroleum Hydrocarbons (TPH).

Total Suspended Solids (Particle Size Distribution)



TSS Particle Size Distribution (PSD) in continuous flow conditions shows a 36% reduction of 8um -75um, to a 90% reduction up to 250um.

Table of TP (Particulate)

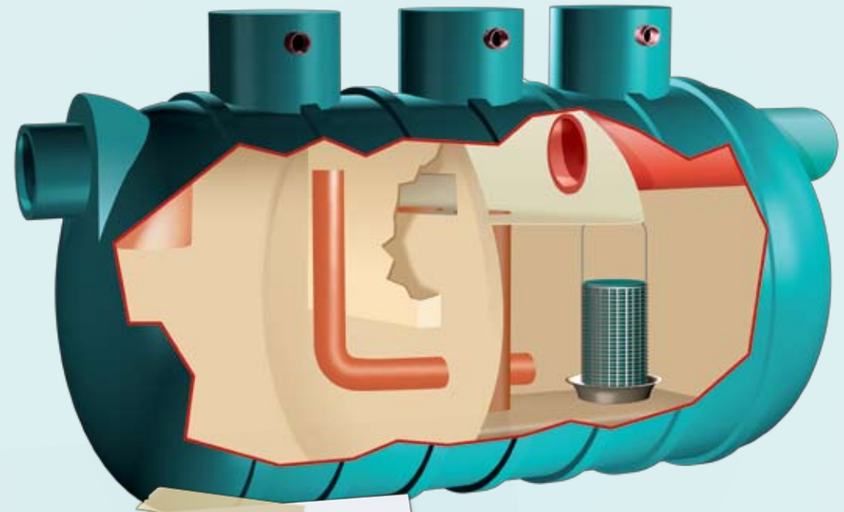
Sample ID	Time (s)	TP ug/l Inflow	TP ug/l Outflow
In 5 C1	300	210	120
In 10 C1	600	200	110
In 13 C1	780	130	110
In 16 C1	960	150	110

Continual flow reduction is 40% in flows of up to 10mins with reduction levels still remaining constant in the longer and rarer continuous event duration.

Table of TPH (BS EN 858.1 test procedure)

Hydrocarbon Fraction	Inflow concentration (mg/L) Total 5699mg/L	Outlet samples TPH fraction concentrations (mg/L)					Calculated mean concentration (mg/L)
		1 t=27min	2 t=28min	3 t=29min	4 t=30min	5 t=31min	
C6-C9	0.15	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C10-C14	125.43	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
C15-C28	5570.62	<0.10	0.162	<0.10	<0.10	<0.10	<0.032
C29-C36	3.42	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

Reduction of fuel/diesel/oils remain a constant level of `no detection` from inflow concentration of >5,000ppm.
This translates to virtually a 100% removal rate.



Independently tested for reducing the average annual loads:

- >85% total suspended solids (TSS)
- TSS particle distribution size 8um-600um
- >40% total phosphorus (TP)
- 99.9% hydrocarbons (TPH)

APPLICATIONS

- *Subdivisions*
- *Car Parks*
- *Industrial/Commercial Blocks*
- *Roads*
- *Tunnels*
- *Transport Corridors*
- *Loading Bays*
- *Aircraft Aprons*
- *Depots*

Metals

Site tests of cadmium, chromium, lead, aluminium and zinc show removal rates >90%.

Total Nitrogen

Site tests show removal rates (particulate)are achievable to 45%, however Nitrogen is a very complex element, with a recent study in Australia *(Taylor et al)* showing that around 80% of TN is in dissolved form, and that it doesn`t vary significantly between dry weather and storm event conditions, therefore tertiary biological treatment is preferred as the most effective treatment solution.

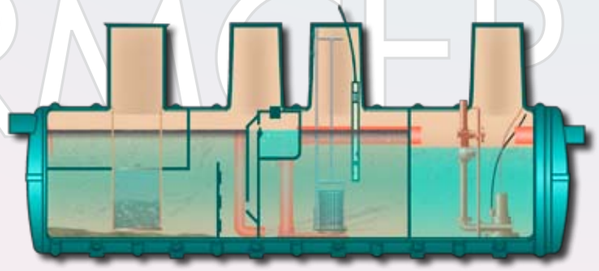
Gross Pollutants

SPEL Class 1 is most effective as a secondary treatment device, however it can effectively retain gross pollutants >1mm size.

Port loading terminal, Gladstone QLD.

SCOPES CREEK, PENRITH CITY COUNCIL, NSW. - Wood lot in the background is irrigated by the treated water by the STORMCEPTOR™.

SPEL STORMCEPTOR™ treating stormwater from various carparks and streets in PERTH CBD - Perth City Council.



Harvesting & Pump Chamber Options (left)

The SPEL Class 1 design allows for augmentation by simply adding a third chamber to the device, so that the treated water can be re-used for irrigation or supply a more enhance filtration process for reuse.

Table 2:	SPEL Puraceptor Class 1

Field Test Results
TRANSFORMER SWITCHYARD

NATA accredited test analysis
Labmark Accreditation No: 13542

Site: Cranbourne Switchyard
Address: Cranbourne, Melbourne VIC
Test date: 05 June 2008

Unit type: Oily/water separator , Full Retention
Model No: SPEL Puraceptor
Certification: European Standard EN BS 858.1
Separation Method: Gravitational coalescing
Flow method: Non-turbulent, underflow
Working Capacity: 100,000 L
Oil Spill Capacity: 70,000L

Pollutant Removal Efficiency

Parameter	Unit	Inflow	Outflow	Reduction %
Total Petroleum Hydrocarbons (TPH)	mg/l	33,318.80	< 0.16	No Detection
Total Suspended Solids (TSS)	mg/l	880	84	90.5
Total Phosphorus (particulate)	mg/l	9.44	<0.1	99.99
Total Nitrogen (particulate)	mg/l	6	< 2.0	>77.8%
Aluminium	mg/l	310	0.51	99.8
Chromium		1	< .005	99.5
Copper		0.85	< 0.005	99.4
Lead		0.57	< 0.005	99.1
Nickel		12	< 0.012	99.9
Zinc		63	< 0.069	99.9

Table 5:	SPEL Class 1

Field Test Results
COAL MINE SWITCHYARD & CAR PARK

NATA accredited test analysis
Labmark Accreditation No: 13542

Site: Teralba Coal Mine
Address: Teralba Newcastle, NSW
Test date: 03 Dec 2008

Unit type: Oily/water separator , Bypass
Model No: SPEL CLASS 1 100/20
Certification: European Standard EN BS 858.1
Separation Method: Gravitational coalescing
Flow method: Non-turbulent, underflow
TFR: 4.0 l/s
Max Flow Rate: 40 l/s Max
Working Capacity: 1000 L

Pollutant Removal Efficiency

Parameter	Unit	Inflow	Outflow	Reduction %
Total Petroleum Hydrocarbons (TPH)	mg/l	91.30	< 0.4	No Trace
Total Suspended Solids (TSS)	mg/l	31	< 5	> 84.0

Table 4:	SPEL Class 1

Field Test Results
COMMERCIAL/INDUSTRIAL SUBDIVISION

NATA accredited test analysis
Labmark Accreditation No: 13542

Site: Lambridge Estate **Penrith City Council**
Address: Cranebrook NSW
Test Period: July 2007- Mar 2008

Unit type: Oily/water separator , Bypass
Model No: SPEL CLASS 1 400/750
Certification: European Standard EN BS 858.1
Separation Method: Gravitational coalescing
Flow method: Non-turbulent, underflow
TFR: 108 l/s
Max Flow Rate: 1,080 l/s
Working Capacity: 39,000 L

Pollutant Removal Efficiency
Average Reduction

Parameter	Unit	Inflow	Outflow	Reduction %
Total Suspended Solids (TSS)	mg/l	1140	16.7	98.5
Total Suspended Solids (TSS) Particulate Size	um	Mean: 138 Median: 86.9	Mean: 14.1 Median: 9.1	
Total Phosphorus (TP)	mg/l	0.31	0.13	58.1
Total Nitrogen (TN)	mg/l	2.2	1.03	53.2

Table 13: **SPEL Stormceptor Class 1**

Field Test Results
HEAVY INDUSTRY
SCRAP METAL & RECYCLE YARD

NATA accredited test analysis
Labmark Accreditation No: 13542

Site: Scrap Metal Merchant
Address: Sydney, NSW
Test 1 E043211 **Date:** 19 June 2009 **Operational 9 months**

SPEL Stormceptor Class 1 300/160
Unit type: Stormwater Treatment , ByPass
Certification: European Standard EN BS 858.1
Separation Method: Gravitational coalescing
Flow method: Non-turbulent, underflow
TFR: 23.1 l/s **Max Flow:** 250 l/s

Pollutant Removal Efficiency

Total Petroleum Hydrocarbons

Results expressed in mg/l

	EQL*			Reduction
		Inflow	Outflow	
C10-C14	0.05	6.9	<0.05	No Trace
C15-C28	0.4	30.2	<0.4	
C29-C36	0.1	2.9	<0.1	

* Sensitivity: Estimated Quantitation Limit