Section 75W Modifications Report

Project Application No. 06_0199

Freeway North Business Park

Prepared by:

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Disclaimers

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1 Introduction

Major Project 06_0199 was approved by the Minister for Planning on 28 September 2008. The Concept Plan and Project Application subject of the approval covered the construction of a 90 Lot Industrial Business Park subdivision, with associated services and infrastructure, on Lot 14 DP 1091199, Lot 14 DP 207961 and Lot E DP 38873 Beresfield, in the Local Government Area of Newcastle City. The project site is referred to as the Freeway North Business Park. The approved subdivision plan or "Indicative Lot Layout" as per the conditions of approval of MP NO.06_0199 is contained in Appendix 1 and involved 4 stages of subdivision with lot sizes ranging from approximately 1800m^2 to 2ha.

At the time of lodgement of the Major Project Application the demand for large industrial parcels greater than 1.5 to 2 hectares was not envisaged. Since approval of the concept plan and project application, Aldi, a large supermarket company, has expressed interest in utilizing part of the subject site as a regional distribution warehouse. Such a warehouse requires a significant area of land, approximately 15 hectares, and therefore presents the need for an alternative to the existing approved subdivision layout.

The following information provides a summary of the proposed amendments as they relate to the approved subdivision layout, and an assessment of the key impacts in relation to project staging, traffic (RTA Requirements) and drainage.

2 Proposed Modification

2.1 Road and Lot Layout

In order to accommodate the Aldi Regional Distribution Warehouse on the land, amendments to both the road and lot layout will be required. These are illustrated in the proposed subdivision & staging plan contained in Appendix 2.

The proposed site for the Aldi Regional Distribution Warehouse (proposed Lot 124) is approximately 15ha and incorporates the following lots, as per the approved subdivision plan:

- Part 18-26, Part 49, 50-58, Part 59, Part 60, 61-62, Part 63, 66-67, Part 68 and Part 69, 71, 86-88 and part of the road reserve of Road 4 and Road 6.

In addition, the following amendments to the road layout of the approved subdivision plan are proposed:

- Road 3 is relocated such that it aligns with Road 2 and continues along the alignment of the approved Road 2 (now referred to on the modified subdivision plan as Parish Drive).
- Road 4, to the west of approved Road 3, is incorporated into proposed Lot 124 (i.e. the Aldi Regional Distribution Warehouse site). Part of Road 6 is incorporated into proposed Lot 124 and the western extremity deleted.
- Road 1 (now referred to on the modified subdivision plan as Canavan Drive) and Road 5 (Elwell Close) remain in their original positions.

As a result of the revised road layout and amalgamation of lots, some minor reconfiguration of the surrounding allotments will also be required. This includes the removal of the detention basin (shown as drainage reserve on the approved layout in Appendix 1) as it is no longer required as detailed in section 2.4 of this report and within the Stormwater Drainage Report in Appendix 4). Such reconfiguration will have no additional environmental impact to the already approved industrial subdivision.

2.2 Staging

Staging of Freeway North Business Park was approved over four stages to ensure that a logical development of the site is achieved with the appropriate release of land as required. As a result of the proposed modification to the approved industrial subdivision, it is now intended to develop the site over 3 stages. A modified Staging Plan has been prepared and is contained in Appendix 2. The modified Staging Plan includes:

Stage 1 – Lots 101 – 124 (Lot 124 being the 15ha allotment for the proposed Aldi Distribution Warehouse)

Stage 2 – Lots 201 – 217, with Lot 217 being a drainage reserve and dedicated to Council.

Stage 3 – Lots 301 – 317, with Lot 317 being a drainage reserve and dedicated to Council.

Recent consultation with the RTA has confirmed that roadworks may be staged as consistent with the above proposed staging. Staging of the roadworks will allow for a subdivision certificate for Stage 1 of the development to be released after completion of the roundabout and its approaches and departures to the satisfaction of the RTA, thereby allowing for development of the proposed Aldi Regional Distribution Warehouse to proceed at an early time.

The proposed staging as identified in Appendix 2 will result in a more orderly development of the site and the suitable release of land as required.

2.3 Road Improvements (RTA Requirements)

There will be no net additional impact in relation to traffic associated with the proposal. The proposal will result in the "amalgamation" of several allotments of land in comparison to the existing approval. The existing road layout and proposed future works to the surrounding road network are sufficient to accommodate the traffic associated with the distribution centre. We understand that the RTA has provided advice to the Department of Planning that they would not require the provision of any additional information for the proposed Aldi distribution centre application.

As a result of the proposed modification to the subdivision layout the following upgrades will be constructed in accordance with the RTA's requirements:

- A two lane roundabout at the Weakleys Drive/ subdivision access intersection,
- a left in / left out intersection to the south of this intersection; and
- additional lanes on Weakleys Drive connecting to the New England Highway / Weakleys Drive interchange.

These works will be constructed under the RTA's Works Authorisation Deed in stages, to meet the requirements of the proposed Aldi Regional Distribution Warehouse and the Freeway North Business Park subdivision. A copy of relevant RTA correspondence dated 22 June 2010 is contained in Appendix 3.

With regard to the above, there are a number of conditions imposed by the RTA within MP NO.06_0199 for the Freeway North Business Park Part 3A Approval that are not consistent with the detail design and proposed staging of the works in Weakleys Drive. Therefore a revised set of conditions has been prepared by the RTA and are contained in Appendix 3 as part of this Part 3A modification.

2.4 Drainage

Geoff Craig & Associates Pty Ltd has prepared a revised stormwater drainage report for the Freeway North Business Park site. The drainage report was prepared due to the change in flow regime resulting from a modified subdivision layout. The report addresses both water quality and water quantity requirements for the proposed development.

The site comprises 3 drainage catchments. Catchment 1 drains to the north west into Scotch Dairy Creek. Catchment 2 currently drains under Weakleys drive via a 600 mm culvert, while Catchment 3 drains to the south into Viney Creek.

The report proposes to divert the developed Catchment 2 towards Viney Creek (a detailed catchment plan is included in Figure 3 of the Stormwater Drainage Report in Appendix 4). The change in flow regime proves that the addition of flow from Catchment 2 does not increase the existing peak flow in the 100 year ARI event because Catchment 2 is located immediately upstream of the existing bridge in Weakleys Drive. For this reason, the provision of a detention basin in Stage 1 of the subdivision to cater for flows from Catchment 3 is no longer required.

A previous report by Parsons Brinckerhoff Australia Pty Ltd on Freeway North Business Park, "Flood Modelling and Stormwater Management Strategy", which was contained in the "Freeway North Business Park Concept Plan and Environmental Assessment" lodged with the Department of Planning, demonstrated that development within Catchment 1 (Scotch Dairy Creek) and Catchment 3 (Viney Creek) results in a decrease in the post-development flow rates in the downstream catchment compared to the pre-development flow rates. Hence, the provision of detention storage within these two catchments is not required.

A combination of treatment devices including gross pollutant traps and sand filters for water quality control are proposed for Catchment's 1, 2 and 3.

The stormwater drainage report clearly demonstrates that there are no impediments to developing the site with respect to provision of suitable water quality measures.

Part B2.of the Department of Planning's Conditions of Approval – Road, Drainage and Pavement Works – will remain the same whereby subdivision work for each stage must not be commenced until a Construction Certificate for the relevant work has been issued by Council or an accredited certifier.

3 Assessment and Recommendations

Having assessed the proposed amendments to the approved industrial subdivision it is considered that the proposed development will have no negative impacts upon the previously approved industrial subdivision in accordance with the requirements of Section 75W for the Director-General's and Minister's consideration.

Assessment of the proposed modification has revealed that the nature of the Project will not be altered but merely seeks to amend the subdivision layout in order to allow for a large industrial parcel to accommodate an Aldi Regional Distribution Warehouse. As a result of the modification a revised set of conditions relating to the RTA's roadworks requirements has been included with this submission.

It is recommended that the Department of Planning approve the following:

- the modifications to the subdivision and internal road network for the Freeway North Business Park identified in Appendix 2
- the proposed staging as identified in Appendix 2
- RTA's revised roadworks conditions to facilitate the above
- the amended Statement of Commitments as contained in Appendix 5.

4 Consistency with the Project Approval

Despite the changes to the subdivision layout, the nature of the industrial subdivision remains the same as that approved by Major Project 06_0199. Proposed Lot 124 will be used for industrial purposes as permitted upon the site. Environmental effects associated with the Aldi development upon the site are addressed in the Environmental Assessment undertaken by ADW Johnson.

In our opinion the proposed modification of the subdivision (amalgamation of Lots) does not alter the nature of approved Major Project 06_0199. The modification seeks to amend the staging and the release of subdivision certificates in accordance with RTA approval. The proposed modification poses no additional environmental impact and is therefore considered consistent with the Approved Project.

5 Conclusion

In our opinion the modifications to Major Project 06_0199 and the approved Statement of Commitments is minor. The conditions proposed to be modified do not have an effect on the overall development as approved.

As presently worded the proposed modification to the Department of Planning's Conditions of Approval only relate to *B1. Weakleys Drive intersection and RTA Roadworks* requirements. It is proposed to revise the conditions to allow for development to occur in 3 Stages as opposed to the 4 stages previously approved.

To provide clarity to the modifications sought an amended Statement of Commitments is contained in Appendix 5.

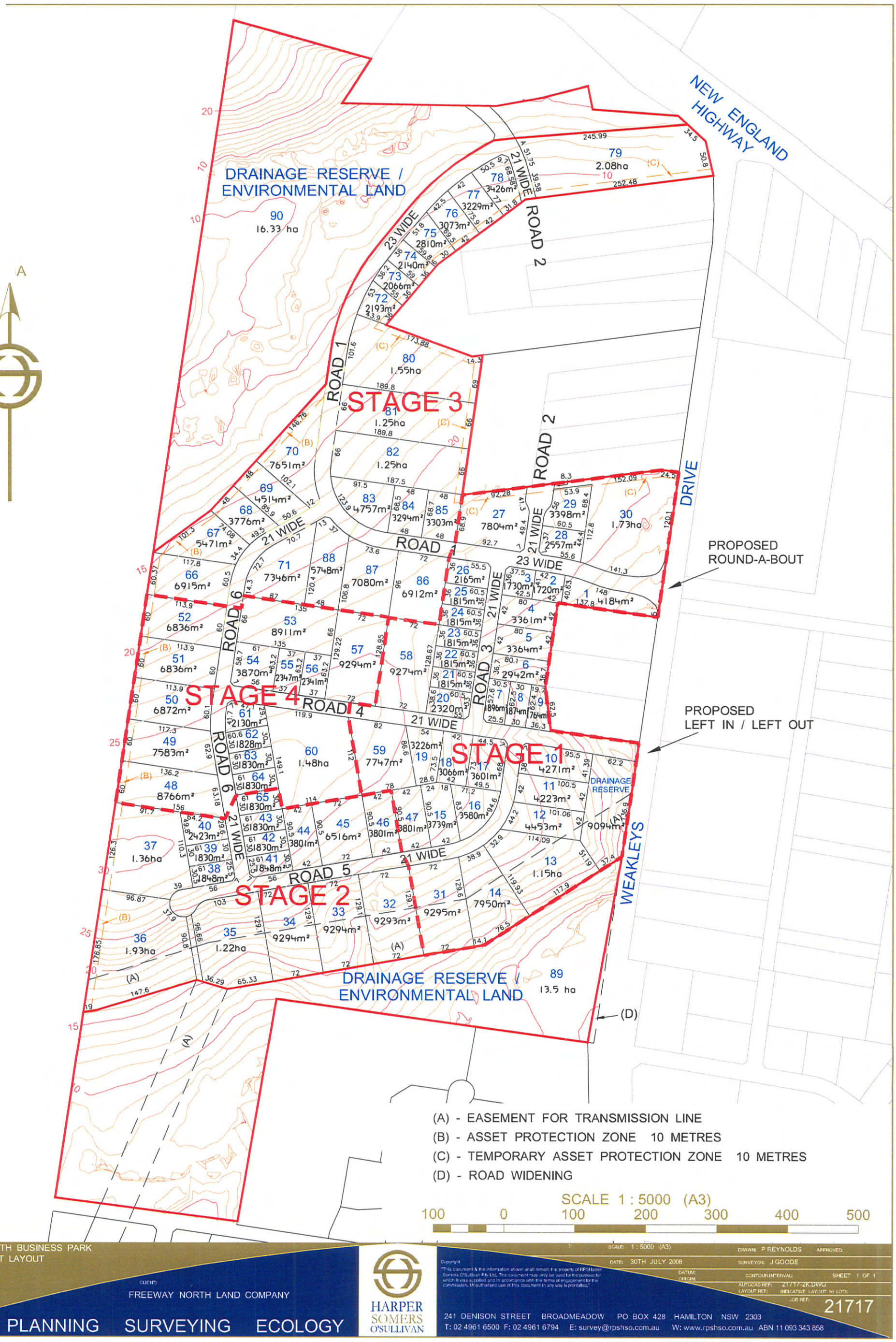
Appendix 1

Approved Subdivision Plan

Department of Planning

***Freeway North Project Approval (MP No. 06_0199)**, approved on **29 September 2008** by the Minister, in accordance with the Environmental Planning & Assessment Act 1979, subject to conditions of approval.*

Signed:



TITLE: FREEWAY NORTH BUSINESS PARK
INDICATIVE LOT LAYOUT

CLIENT: FREEWAY NORTH LAND COMPANY

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1 : 5000 (A3) DRAWN: P REYNOLDS APPROVED:
DATE: 30TH JULY 2008 SURVEYOR: J GOODE
DATUM: CONTOUR INTERVAL: SHEET 1 OF 1
ORIGIN: AUTOCAD REF: 21717-2K.DWG
LAYOUT REF: INDICATIVE LAYOUT 90 LOTS
JOB REF: 21717

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
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Appendix 2

Proposed Subdivision & Staging Plan

MGA

208
1.99 ha
(1.24 ha)

209
1.06 ha

210
1.8 ha

207
1.31 ha
(6324m²)

211
9849m²

206
1.05 ha
(4592m²)

212
9470m²

205
9288m²
(4320m²)

213
8292m²

204
9288m²
(4320m²)

214
5103m²

203
9171m²
(3782m²)

215
5125m²

202
9605m²
(3576m²)

216
7182m²

201
1.189 ha
(6283m²)

217
DRAINAGE
RESERVE

109
5331m²

108
1.91 ha
(1.29 ha)

124
15 ha

317
DRAINAGE
RESERVE

307
9634m²

308
5934m²

303
4757m²

304
1.25 ha

305
1.25 ha

306
1.55 ha

302
3294m²

301
3303m²

119
3140m²

120
3454m²

309
2193m²

310
2067m²

311
2140m²

312
2810m²

313
3073m²

314
3229m²

315
3426m²

316
2.6 ha

110 2109m² | 111 2100m² | 112 2100m² | 113 1800m² | 114 1800m² | 115 1500m² | 116 1500m² | 117 1500m² | 118 1837m²

107 2056m² | 106 1917m² | 105 1800m² | 104 1800m² | 103 2100m² | 102 2225m²

101
4099m²

121
2758m²

122
3379m²

123
1.829ha

22 DP532814 | 16 DP510628 | 15 DP510628

CANAVAN DRIVE

ELWELL CLOSE

PARISH DRIVE

BOWDEN WAY

CANAVAN DRIVE

WEAKLEYS DRIVE

WWPS

6
DP226431

1
DP390543

9
DP509255

DP203406 | DP416248 | DP506747 | DP416248 | DP396036 | DP388733 | DP1091199 | DP1091199

27 DP1070843 | 28 | 29 DP1070843 | 24 DP1070843 | 20 DP1025870 | 60 DP523177

NEW ENGLAND HIGHWAY

STAGE 1
STAGE 2
STAGE 3

0 50 100 200
SCALE 1 : 4000 (A3)

NOTE :

ALL DIMENSIONS , AREAS AND EASEMENTS ARE SUBJECT TO FINAL SURVEY

TITLE:	PROPOSED SUBDIVISION PLAN LOT 14 DP 1091199	LOCATION:	WEAKLEYS DRIVE BERESFIELD	DATUM: PROJECTION:	MGA	DATE: PURPOSE:	1ST JULY 2010 SUBDIVISION
AUTOCAD REF: VERSION (PLAN BY):	21717 - 2T PROPOSED SUBDIVISION						

CLIENT: FREEWAY NORTH LAND COMPANY
JOB REF: 21717

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
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Appendix 3

RTA Correspondence

325RZ1; 2
10/909
SH

RECEIVED
23 JUN 2010
BY:.....

RTA

Hunter Land Pty Ltd
PO Box 42
THORNTON NSW 2322

Attention: Michael O'Sullivan

WEAKLEYS DRIVE (HW9) – PART 3A PROJECT APPLICATION, FREEWAY NORTH BUSINESS PARK – (MP06_199)

Dear Mr O'Sullivan Michael

I refer to your letter dated 13 May 2010 and 9 June 2010 regarding RTA requirements for the Freeway North Business Park.

It is noted that you propose to submit a modification to the Department of Planning's conditions of approval, to enable Hunter Land Pty Ltd to deliver the required road works on Weakleys Drive in stages to meet your subdivision/development needs.

The RTA would not object to the modification of the Conditions of Consent, generally as you have proposed in your letter dated 9 June 2010. The following preliminary advice is provided to enable you to make the submission:

B1. Weakleys Drive intersection and RTA Roadwork's requirements.

1. A roundabout and associated works shall be designed and constructed in accordance with the RTA's Road Design and relevant Austroads guidelines at the proposed new access to the Freeway North Business Park on Weakleys Drive between Balook Drive and the New England Highway, approximately in the location identified in Newcastle Council's Development Control Plan for the area, to the satisfaction of the RTA. The following shall be included, as a minimum, as part of the works.

    - A roundabout shall be designed and constructed as a two (2) lane dual circulating roundabout.

    - Two (2) lane approaches and departures shall be provided on all legs of the roundabout or as determined by the RTA.

    - The northern leg of the roundabout on Weakleys Drive shall be extended through to the two-lane section of the New England Highway/Weakleys Drive interchange. Two (2) lanes northbound and southbound shall be provided between the proposed roundabout and the interchange along Weakleys Drive. A raised concrete median shall be included in the upgrade of the road.

- The southern approach leg of the roundabout on Weakleys Drive shall be extended from the roundabout to the south of the proposed left in/left out access to the Freeway North Business Park. The two (2) lane (northbound) approach shall be extended south beyond the left in/left out intersection to an extent to ensure safe merging/diverging of traffic northbound on Weakleys Drive.

- The southern departure leg (southbound) of the roundabout shall be designed and constructed as two (2) lanes to a length of 200 metres from the roundabout, excluding tapers.

- The above works may be staged, with the approval of the RTA, but must include the roundabout and the approaches/departures in Stage 1 construction. The remainder of the works (Stages 2 & 3) must be completed immediately after Stage 1 – there shall be no cessation of works.

2. The proposed left in/left out intersection to the subject site on Weakleys Drive between the proposed roundabout and Balook Drive shall be designed and constructed in accordance with the RTA's Road Design Guide and relevant Austroads guidelines with an exclusive left turn declaration lane outside of the proposed two lane section of Weakleys Drive.

3. There shall be no direct vehicular access to any of the proposed lots off Weakleys Drive. All vehicular access to the proposed lots shall be via two proposed intersections on Weakleys Drive and internal local road network.

4. A subdivision certificate is not to be released until the proponent has fully constructed all road works on Weakleys drive to the satisfaction of the RTA, unless the works are staged to the satisfaction of the RTA or the subdivision certificate relates to road widening in Weakleys Drive. If the RTA agrees to stage the works, a subdivision certificate for Stage 1 of the development may be released after completion of the roundabout and its approaches and departures to the satisfaction of the RTA. No further subdivision certificate is to be released for any stage of the development until the proponent has fully constructed all remaining road works in Weakleys Drive to the satisfaction of the RTA. A subdivision certificate for road widening in Weakleys Drive may be released prior to completion of any works.

5. All works associated with the proposed development shall be undertaken at full cost to the developer, to the satisfaction of the RTA.

6. The proponent is required to enter into a Works Authorisation Deed (WAD) with the RTA. In this regard the proponent is required to submit detailed design plans and all the relevant information, as may be required in the RTA's WAD documentation, for each specific change to the State road network, for the RTA's assessment and final decision concerning the work.

Please note that these requirements may be subject to change at the time the modification is referred to the RTA by the consent authority.

Please contact me on (02) 4924 0240 if you have any queries.

Yours sincerely

Dave Young
Manager, Land Use Development
Hunter Operations and Engineering Services

22 June 2010

Cc. Mr James Cross
Newcastle City Council

Appendix 4

Stormwater Drainage Report

PROPOSED INDUSTRIAL SUBDIVISION

FREEWAY NORTH BUSINESS PARK

WEAKLEYS DRIVE, BERESFIELD

STORMWATER DRAINAGE REPORT

APRIL 2010

Geoff Craig & Associates Pty Ltd
Consulting Engineers & Project Managers
A.B.N. 92 086 017 745

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Thornton NSW 2322

Phone: 4964 1811
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Thornton NSW 2322

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1 INTRODUCTION

1.1 BACKGROUND

Geoff Craig & Associates Pty Ltd has been engaged to revise a stormwater drainage report for a Development Application approved industrial subdivision located off Weakleys Drive Beresfield, to be known as Freeway North Business Park. The drainage report was revised due to the change in flow regime. This report addresses both water quality and water quantity requirements for the proposed development.

1.2 STUDY AREA

The proposed development is bounded by the New England Highway to the north and Weakleys Drive to the east. The site comprises Lot 14 DP 207961, Lot E DP 388733 and Lot 23 DP 532814. The ultimate development site is approximately 86.6 ha in area. The locality layout and site plan is shown in **Figure 1** and **Figure 2** respectively in **Appendix A**.

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, refer **Figure 3**). Catchment 1 has a gentle north-westerly grade and contains slopes typically in the order of 2% to 4%. Scotch Dairy Creek drains beneath the New England Highway via triple 2700mm wide x 2700mm high reinforced concrete box culverts.

A small portion of the site drains to an existing gully situated to the north of the Weakleys Drive Bridge in its existing state (Catchment 2, refer **Figure 3**). 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 existing 600mm diameter concrete pipe is proposed to be grout filled and this would change the flow regime for Catchment 2. The runoff from Catchment 2 will then flow into Viney Creek and drain beneath Weakleys Drive via an existing bridge structure.

The runoff from the southern portion of the site (Catchment 3, refer **Figure 3**) 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 bridge structure. **Figure 3**, in **Appendix A,** shows the location of the catchment boundaries.

1.3 SCOPE OF WORK

1.3.1 Water Quantity (Detention)

1. To design the subdivision such that the Post Development flow is limited to 100% of the Pre Development flow for Average Recurrence Intervals (ARI) from 1 to 100 years for Catchment 2 and Catchment 3 when Catchment 2 flow is diverted to Viney Creek, in accordance with Flood Modelling and Stormwater Management Strategy, Freeway North Business Park, March 2007 by Parsons Brinckerhoff Australia Pty Ltd and Stormwater Management Plan, Freeway Business park, February 2002 by PPK Environment & Infrastructure Pty Ltd.
2. To calculate the pre-developed and post-developed flowrates from the site in order to determine detention requirements.

1.3.2 Water Quality

1. To provide adequate water quality control facilities for the site to minimise the effects of the development on the receiving waterway and to ensure that the existing level of water quality present on the site is not detrimentally affected by the proposed subdivision development.

1.3.3 Conveyance of Major Flows through the Site

1. To ensure that major flows are conveyed through the site with minimal impact on the proposed allotments.

2 METHODOLOGY

2.1 PROPOSED METHODOLOGY

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 (Scotch Dairy Creek) and Catchment 3 (Viney Creek) results in a decrease in the post-development flow rates in the downstream catchment compared to the pre-development flow rates (Table 3.4, Page 8, Flood Modelling and Stormwater Management Strategy by Parsons Brinckerhoff and Table 4.1, Page 14, Stormwater Management Plan by PPK). Hence, the provision of detention storage within the two catchments is not required. However, the PB report stated that there is a need for water quality measures and it proposed an end of line Gross Pollutant Trap (GPT) and sand filter for both Catchments 1 and 3, with the treatment train capable of treating runoff from the 3 month ARI storm event.

For Catchment 2 (Weakleys Drive), it is evident from the report by Parsons Brinckerhoff Australia Pty Ltd on Freeway North Business Park, "Flood Modelling and Stormwater Management Strategy", that the development in the catchment will result in substantial increase in peak flows at Weakleys Drive existing 600mm diameter pipe culvert (Table 3.5, Page 8, Stormwater Management Strategy by Parsons Brinckerhoff).

The report by Parsons Brinckerhoff Australia Pty Ltd on Freeway North Business Park, "Flood Modelling and Stormwater Management Strategy", suggested that the increase in peak flows in Catchment 2 could be manage by diverting part of the developed catchment towards Viney Creek and/or a provision of detention storage within Catchment 2. It is proposed to divert the developed Catchment 2 towards Viney Creek and this can be easily achieved by site regrading the existing low point in the natural surface to direct flows south toward Viney Creek. The existing 600mm diameter concrete pipe culvert would be then grout filled in accordance with current RTA directions.

The report by Parsons Brinckerhoff Australia Pty Ltd on Freeway North Business Park, "Flood Modelling and Stormwater Management Strategy", proposed a combination of treatment devices including gross pollutant traps and sand filters for water quality control for Catchment 1 and Catchment 3.

The provision of a Gross Pollutant Trap is proposed, to treat, at a minimum, the runoff from the 3 month ARI storm event with flows in excess of the 3 month ARI storm event bypassing the device.

2.2 PROPOSED WATER QUANTITY MEASURES

Hydrological assessment for Viney Creek Catchment was carried out for four different scenarios using the DRAINS – Urban Drainage Model. The data provided in the report by PPK Environment & Infrastructure Pty Ltd on Freeway Business Park, "Stormwater Management Plan" was utilised. Drainage layouts were adopted for flows calculated at the outlet of the existing bridge. Firstly, the catchment was modelled in the natural state to calibrate the runoff. Secondly, as an existing catchment where the model includes the addition of existing roads (John Renshaw Drive and Blackhill Road) within the catchment prior to development of Freeway Business Park. Thirdly, the developed scenario which utilised the same catchment but allowed for future development on the proposed site. Fourthly, the developed scenario which included Catchment 2 being diverted into Viney Creek upstream of the existing bridge under Weakleys Drive. In DRAINS the RAFTS model was used to determine the 10, 20, 50 and 100 year ARI peak flows for the catchment in its "natural", "existing", "developed", and "developed with diversion" states.

This model was then evaluated for design storms with durations varying from 5 minutes to 4.5 hours, and Average Recurrence Interval of 10 to 100 years. The relevant Intensity Frequency Duration (IFD) data was obtained from the tables supplied in "*Australian Rainfall and Runoff*" and is listed below.

Latitude = 32.93 ^{o} S

Longitude = 151.75 ^{o} E

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 was then selected for each ARI, based on the peak discharge from the site. The flows were calculated at the outlet of the existing bridge.

2.2.1 Modelling

The following parameters were utilised in the model:

Storage Multiplier, Bx	= 1.4
Pervious Area Initial Loss	= 15mm
Pervious Area Continuing Loss	= 5mm
Impervious Area Initial Loss	= 1.5mm
Impervious Area Continuing Loss	= 0mm

2.2.1.1 Natural and Existing State

The following data was utilised for the natural and exsiting catchment:

Impervious Percentage	= 0%
Pervious Manning's n	= 0.1

A copy of the data spreadsheets from DRAINS used for the analysis has been included in **Appendix B**.

2.2.1.2 Developed State

The following data was utilised for the existing catchment:

<u>Proposed Industrial Lot Area</u>	
Impervious Percentage	= 85%
Pervious Manning's n	= 0.06
Impervious Manning's n	= 0.015

A copy of the data spreadsheets from DRAINS used for the analysis has been included in **Appendix B**.

2.2.1.3 Developed with Diversion State

The following data was utilised for the existing catchment:

Proposed Industrial Lot Area

Impervious Percentage	= 85%
Pervious Manning's n	= 0.06
Impervious Manning's n	= 0.015

A copy of the data spreadsheets from DRAINS used for the analysis has been included in **Appendix B**.

2.3 PROPOSED WATER QUALITY MEASURES

A GPT and sand filter are to be placed prior to the outlet of Catchments 1, 2 and 3 and it is proposed that individual allotments within Catchments 1, 2 and 3 will be required to provide sediment / nutrient / oil and grease removal during their individual development phase. This will ensure that specific usages on individual allotments will provide pre-treatment at the source with differing levels of treatment depending on the source of potential pollutants.

The sand filter sizing criteria has been determined utilising the EPA's "Managing Urban Stormwater – Treatment Techniques" publication and the Engineers Australia publication "Australia Runoff Quality". The sizing calculation and criteria are contained in **Appendix D**.

3 RESULTS

3.1 WATER QUANTITY

The model for Viney Creek Catchment was run for various design storm durations. The peak discharges for the various ARIs in its natural state and from the report by PPK Environment & Infrastructure Pty Ltd on Freeway Business Park, "Stormwater Management Plan" (Table 2.2, Page 4) for model calibration are shown below in **Table 1**.

Table 1 – Peak Flows in Natural State

ARI	Peak Flow (Natural State – PPK report) (m^3/s)	Peak Flow (Natural State – 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

The peak discharges for the various ARIs in its existing state are shown in **Table 2**.

Table 2 – Peak Flows in Existing State

ARI	Peak Flow (Existing State – PPK report) (m^3/s)	Peak Flow (Existing State – DRAINS model) (m^3/s)
10	47.69	45.90
20	61.43	60.20
50	77.03	77.10
100	91.20	92.20

The peak discharges for the various ARIs in its developed state are shown in **Table 3**.

Table 3 – Peak Flows in Developed State

ARI	Peak Flow (Developed State – PPK report) (m^3/s)	Peak Flow (Developed State – DRAINS model) (m^3/s)
10	47.21	45.90
20	60.58	60.40
50	75.95	76.90
100	89.79	91.80

The developed with diversion state was modelled with the inclusion of Catchment 2 in the developed state model. The peak discharges for the various ARIs in its developed with diversion state and in comparison with the existing state are shown in **Table 4.**

Table 4 – Peak Flows in Developed with Diversion State

ARI	Peak Flow (Existing State – DRAINS model) (m^3/s)	Peak Flow (Developed with Diversion State – DRAINS model) (m^3/s)	Percentage Change (%)
10	45.90	46.40	+1.0%
20	60.20	60.70	+0.8%
50	77.10	77.20	+0.1%
100	92.20	92.10	-0.1%

Table 4 illustrates that the proposed changes in flow regime of Catchment 2 results in a decrease in peak flow for 100 year ARI and a small increase in peak flow for 10, 20 and 50 year ARI (under 1%) at the existing bridge in Weakleys Drive. This is to be expected given that the development of Catchment 2 is located immediately upstream of the existing bridge in Weakleys Drive. The introduction of impervious surfaces in Catchment 2 increases the rate of runoff from the lower portion of the catchment allowing runoff to pass under the existing bridge prior to the overall catchment flood peak. The slight flowrate increase of less than 1% is considered insignificant in the 10, 20, and 50 year ARI event, and with a flowrate decrease in the 100 year event, the provision of a detention basin in Catchment 2 is not required.

The DRAINS output spreadsheets for the 10 year and 100 year ARIs for the catchment in the natural, existing, developed and developed with diversion states are shown in **Appendix C**.

3.2 WATER QUALITY

A GPT and sand filter are to be placed prior to the outlet of Catchments 1, 2 and 3 and it is proposed that individual allotments within Catchments 1, 2 and 3 will be required to provide sediment / nutrient / oil and grease removal during their individual development phase. This will ensure that specific usages on individual allotments will provide pre-treatment at the source with differing levels of treatment depending on the source of potential pollutants.

4 SUMMARY AND CONCLUSIONS

This stormwater drainage report for the development to be known as Freeway North Business Park proposes to divert the developed Catchment 2 towards Viney Creek. The change in flow regime proves that the addition of flow from Catchment 2 does not increase the existing peak flow in the 100 year ARI event because Catchment 2 is located immediately upstream of the existing bridge in Weakleys Drive. For this reason, the provision of a detention basin is not required.

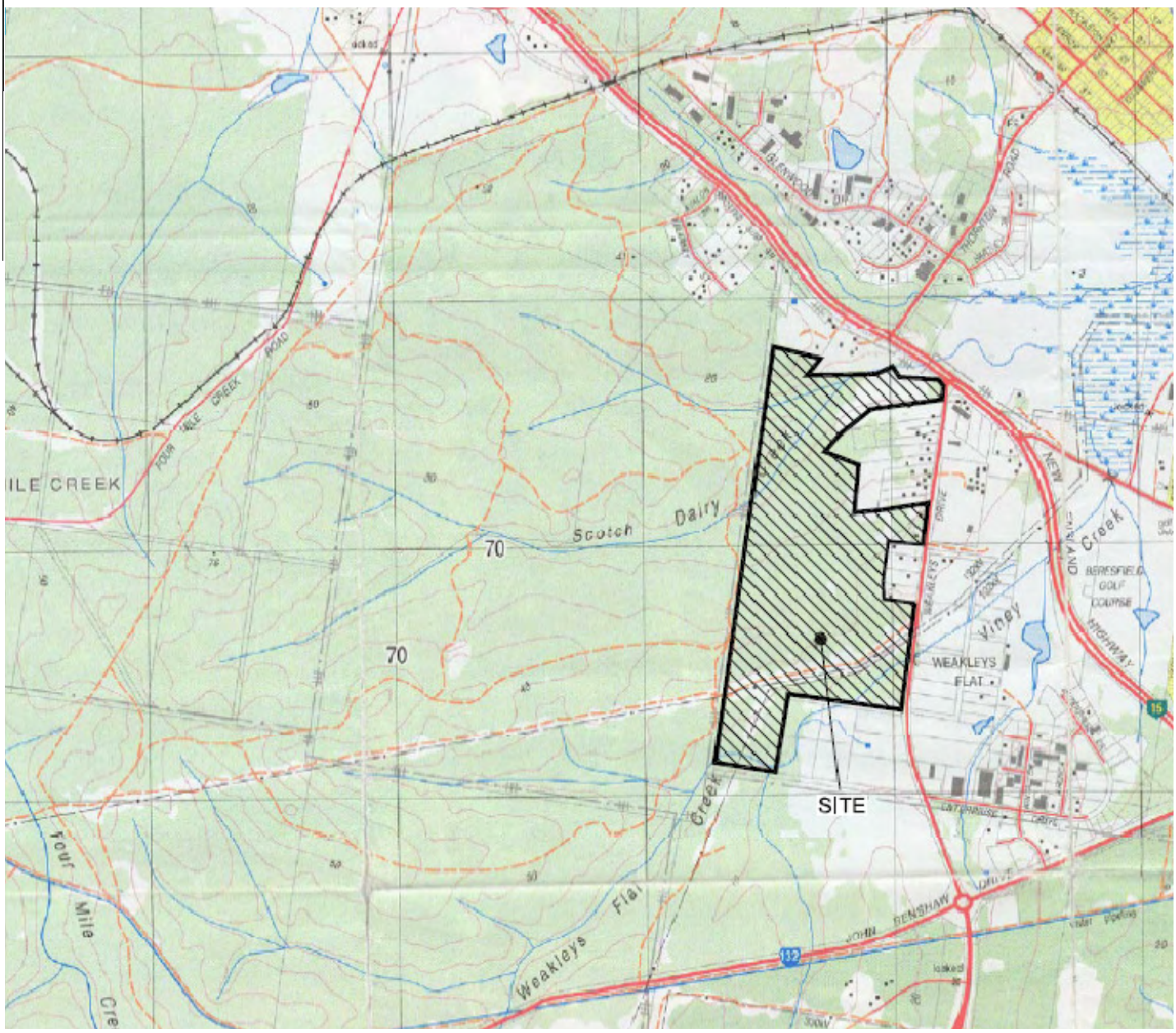
A previous report by Parsons Brinckerhoff Australia Pty Ltd on Freeway North Business Park, "Flood Modelling and Stormwater Management Strategy", demonstrated that development within Catchment 1 (Scotch Dairy Creek) and Catchment 3 (Viney Creek) results in a decrease in the post-development flow rates in the downstream catchment compared to the pre-development flow rates. Hence, the provision of detention storage within these two catchments is not required.

A combination of treatment devices including gross pollutant traps and sand filters for water quality control are proposed for Catchment's 1, 2 and 3.

This stormwater drainage report clearly demonstrates that there are no impediments to developing the site with respect to provision of suitable water quality measures.

APPENDIX A - FIGURES

Geoff Craig & Associates Pty Ltd
Consulting Engineers & Project Managers



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500

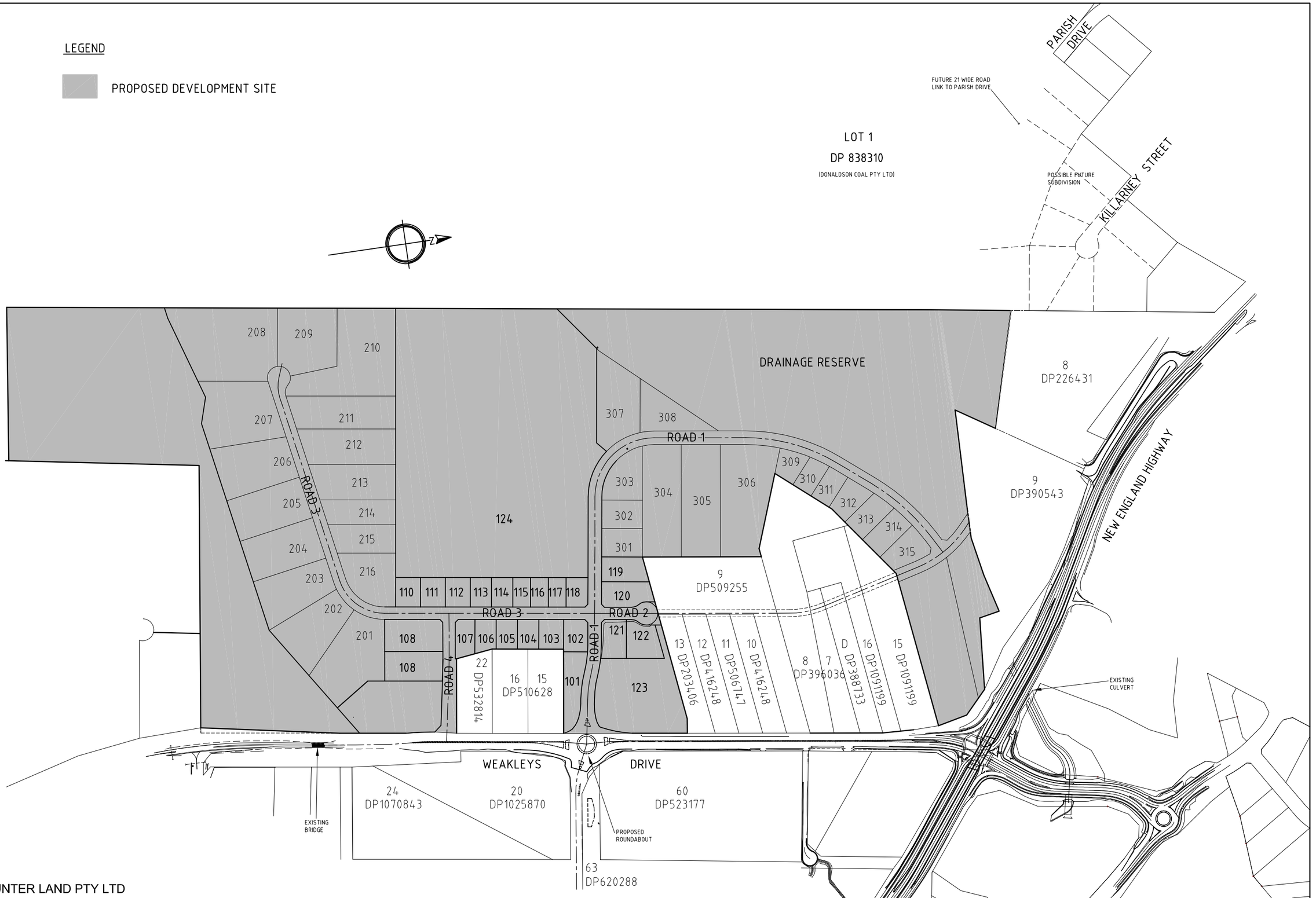
Client: HUNTER LAND PTY LTD
Project: PROPOSED INDUSTRIAL SUBDIVISION
Location: WEAKLEYS DRIVE BERESFIELD

PROJECT NUMBER: 07307C dF01r2
DATE: 13.04.10

LOCALITY PLAN
FIGURE 1

LEGEND

PROPOSED DEVELOPMENT SITE



Client: HUNTER LAND PTY LTD

Project: PROPOSED INDUSTRIAL SUBDIVISION

Location: WEAKLEYS DRIVE BERESFIELD

PROJECT NUMBER: 07307C dFO2r2
DATE: 13.04.10

Geoff Craig & Associates Pty Ltd
Consulting Engineers & Project Managers

SITE PLAN

FIGURE 2

LEGEND

CATCHMENT 1

CATCHMENT 2

CATCHMENT 3

LOT 1
DP 838310
(DONALDSON COAL PTY LTD)

PARISH DRIVE

FUTURE 21 WIDE ROAD LINK TO PARISH DRIVE

POSSIBLE FUTURE SUBDIVISION

KILLARNEY STREET

DRAINAGE RESERVE

SCOTCH DAIRY CREEK

VINEY CREEK

ROAD 1

ROAD 2

ROAD 3

ROAD 4

8 DP226431

9 DP390543

9 DP509255

NEW ENGLAND HIGHWAY

EXISTING CULVERT

WEAKLEYS DRIVE

24 DP1070843

20 DP1025870

60 DP523177

63 DP620288

EXISTING BRIDGE

PROPOSED ROUNDABOUT

Client: HUNTER LAND PTY LTD

Project: PROPOSED INDUSTRIAL SUBDIVISION

Location: WEAKLEYS DRIVE BERESFIELD

PROJECT NUMBER: 07307C dFO3r2
DATE: 13.04.10

Geoff Craig & Associates Pty Ltd
Consulting Engineers & Project Managers

DETAILED CATCHMENT PLAN

FIGURE 3

LEGEND

VINEY CREEK CATCHMENT

FREEWAY NORTH BUSINESS PARK

FREEWAY & FREEWAY SOUTH BUSINESS PARK

A1 DRAINS NODE

DRAINS OVERFLOW ROUTE

A1 A2 A3 A4 A5 A6 WF1 WF2 WF3 WF4 WF5 EOB EO BLACK 1 BLACK 2

FREEWAY AND FREEWAY SOUTH BUSINESS PARK

FREEWAY NORTH BUSINESS PARK

Viney Creek

Blue Gum Creek

Four Mile Creek

Scotch Dairy Creek

Weakleys Flat Creek

Woods Gully

IRONBARK MINE SUBSIDENCE DISTRICT

MAITLAND

Client: HUNTER LAND PTY LTD

Project: PROPOSED INDUSTRIAL SUBDIVISION

Location: WEAKLEYS DRIVE BERESFIELD

PROJECT NUMBER: 07307C dFO4r2
DATE: 13.04.10

Geoff Craig & Associates Pty Ltd
Consulting Engineers & Project Managers

1:25000 0 500 1000 1500 500

DRAINS NODAL LAYOUT

FIGURE 4

APPENDIX B - DRAINS DATA SPREADSHEET

Natural Catchment

DRAINS Data Spreadsheet

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

DRAINS Data Spreadsheet

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

DRAINS Data Spreadsheet

Developed 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	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 with Diversion Catchment

DRAINS Data Spreadsheet

Future 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	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 C - DRAINS RESULTS SPREADSHEET

Natural Catchment

DRAINS Results Spreadsheet

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 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 Catchment

DRAINS Results Spreadsheet

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 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
DUMMYOU	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 Catchment

DRAINS Results Spreadsheet

Developed 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 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 Catchment

DRAINS Results Spreadsheet

Future 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

Future 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 D - SAND FILTER DESIGN

SAND FILTER DESIGN CALCULATIONS

Volume of Stormwater to be Filtered

Volume, V= $Q_{3months}$ (m^3/s) × $t_{c\ 1\ year}$ (mins) × 60 secs

where $Q_{3months}$ = $0.25 \times Q_{1year}$

$t_{c\ 1year}$ = adoption of 1 year ARI time of concentration

Surface Area Required for Sand Filter

$$A = \frac{Vd}{Kt(h+d)}$$ (EPA's Managing Urban Stormwater – Treatment Techniques pg63)

Where A = surface area of filter (m^2)

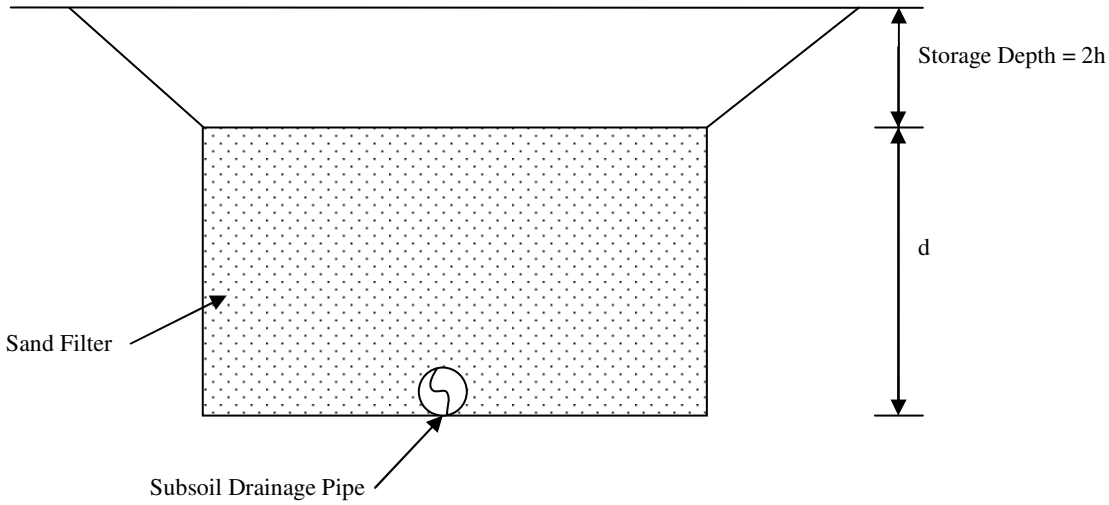
V = volume to be infiltrated (m^3)

K = hydraulic conductivity (m/h)

t = drainage time (h)

h = average head above filter [half the storage depth] (m)

d = depth of filter (m)



Sand Filter Typical Section

Appendix 5

Amended Statement of Commitments

STATEMENT OF COMMITMENTS

In response to submissions received during the public exhibition period, the Statement of Commitments contained in the exhibited Environmental Assessment Report has been reviewed and amended.

The following commitments are made by Hunter Land Holdings Pty Limited to manage and minimise potential impacts arising from the Freeway North Business Park.

A.1 Commitments restricting the terms of approval

A.1.1 The proposed development, including its staging, will be carried out strictly in accordance with the details set out on the approved subdivision plans prepared by RPS, dated 30th June 2010, ref:21717- 2T, except as otherwise provided by this Statement of Commitments.

A.1.2 The proposed development will implement the design principles and guidelines as outlined in Newcastle City Council's Development Control Plan 2005 (DCP 2005) except as otherwise provided by the Statement of Commitments.

A.1.3 Prior to the issue of a Construction Certificate for a particular stage, all general commitments, and all specific commitments relating to the Construction Certificate for the particular stage will be complied with.

A.1.4 Prior to the endorsement of a Subdivision Certificate for a particular stage, all general commitments, and all specific commitments relating to the Subdivision Certificate for the particular stage will be complied with.

A.2 Commitments comprising payment of a monetary contribution, dedication of land/carrying out of off site works

A.2.1 Dedication to Council, and at no cost to Council, that land along Weakleys Drive identified by the Roads and Traffic Authority as required for Road Widening including lands required for construction of the proposed Round-a-bout.

A.2.2 All internal proposed roads in the subdivision are to be dedicated as Public Road with the approved road names being indicated on the plan lodged with the Subdivision Certificate application.

A.2.3 The proposed reserves are to be dedicated to the public as Drainage Reserves upon completion of the rehabilitation works as set out in the Vegetation Management Plan.

A.2.4 A Positive Covenant is to be created in the first stage of the subdivision over that part of Parish Road located within the Drainage Reserve to be dedicated in Stage 3 that is proposed to form a future link with Parish Drive to the west. The positive covenant will ensure that the land may not be used for any purpose other than future road and that Council may acquire the land at any time at no cost to Council.A.2.5 A Conservation Agreement under Part 4 Division 12 of the National Parks and Wildlife Act 1974, between the Minister administering the

National Parks and Wildlife Act 1974 and Hunter Land Eco Trades Pty Ltd "the owner" will be entered into over the land known as Lots 2 to 4 DP 1061633. Execution of a Voluntary Conservation Agreement for Lots 2 to 4 DP 1061633 is required to offset vegetation removal on Freeway North and Freeway South Business Parks lands.

A.3 Commitments comprising details in documentation for a Construction Certificate and prior to commencement of works.

A.3.1 Road infrastructure including pavement, kerb and gutter, drainage, services, landscaping and street trees, street lighting, signage and markings will be provided to each stage of the subdivision, in accordance with the Council's requirements, except as otherwise provided by the Statement of Commitments. Comprehensive engineering design plans being submitted for approval being composed of the following minimum details:

a) Details of Earthworks

Plans will indicate the full extent of any earthworks proposed (cut and fill). All topsoil and unsuitable material will be nominated to be removed prior to placement of fill. All topsoil removed will be stockpiled for reuse on the development site.

Maximum nominated thickness of fill layer	- 150mm in road reserve areas - 300 mm in other areas
Maximum nominated compaction of fill	-100% standard in road reserve areas - 95% standard in other areas

Compaction of earthworks associated with gully crossings will be carried out under Level 1 supervision as per AS3798-1996 'Guidelines on earthworks for commercial and residential developments' and a report submitted to the Principal Certifying Authority with documentation accompanying the respective Subdivision Certificate application.

b) Road Design Plans

Plans, longitudinal sections and cross sections for the proposed subdivision roads will comply with the following requirements and will be annotated accordingly:

Road design requirements:

Road Hierarchy	Reserve Width	Carriageway	Footpath	Kerb Type
Road 1	23.0m	14.0m	None	Upright (Barrier)
Road 2	21.0m	12.0m	None	Upright (Barrier)
Road 3	21.0m	12.0m	None	Upright (Barrier)
Road 4	21.0m	12.0m	None	Upright (Barrier)
Road 5	21.0m	12.0m	None	Upright (Barrier)
Road 6	21.0m	12.0m	None	Upright (Barrier)

Standard design vehicle for all roads will be a B-Double vehicle (Austroad) or equivalent including bus routes. Road 1 is an identified bus route.

Plans will be accompanied by a pavement design report prepared and certified by a practising geotechnical engineer. Traffic Loadings are to be determined for a minimum design life of 20yrs and are to be a minimum of $5x10^6$ ESA's for all roads.

Roads will be designed generally with a desirable maximum grade of 12% and an absolute maximum grade of 16%.

Side road intersections with a through road will have at least 10 metre vertical curves.

Staged longitudinal sections to extend suitable distances at endpoints to permit connection to future stage works and provide for temporary turning bays.

All roads will be Benkelman Beam tested prior to prime sealing with a maximum permissible deflection of 1mm on subdivision roads being allowed or otherwise at the discretion of the PCA.

All roads will be primer sealed prior to asphalting.

The minimum wearing surface of all internal roads will be a 40mm compacted thickness layer of asphaltic concrete (AC 14).

Road name plates will be provided at all intersections

c) Stormwater Drainage Plan

The stormwater drainage design will incorporate a 1 in 10 year recurrence interval piped stormwater drainage system, with overland flow up to a 1 in 100 year recurrence interval event contained within road reserves and/or drainage reserves, and will comply with the following requirements, with the plans annotated accordingly:

Stormwater from the site will be treated and discharged in accordance with the Stormwater Drainage Report by Geoff Craig and Associates dated April 2010.

Drainage pipes will generally be located under kerb and gutter.

Sub-soil drainage will be located generally on the high side of all roads and on both sides of roads in cut and also at other locations at the discretion of the PCA. Where a subsoil drain is required, it will be installed under kerb and gutter and extend at least 500mm below the bottom of pavement.

All stormwater pipes will be rubber ring jointed reinforced concrete.

The determination, extent, depth and velocity of 100 year overland flow paths will be shown.

Pedestrian and vehicular stability and safety will be maintained for the critical storm events up to the 100 year ARI in accordance with the velocity depth product requirements set out in 'Stability of Cars *and Children in Flooded* Streets' Keller and Mitsch 1994.

All lots and/or building envelopes will be above adjacent 100 year ARI flood levels.

Interallotment drainage lines will be provided to service all lots not falling to public drainage systems. Interallotment drainage lines will be designed to cater for all water off the lot in the 1 in 10 year event, including water off pervious yard areas

The stormwater drainage facilities for each particular stage will be designed to ensure that all proposed drainage lines and outlets (both temporary and permanent) are covered by suitable easements.

The proposed development will not increase upstream or downstream flooding for floods over a range of storms from 1:1 to 1:100 year events.

A.3.2 Prior to any works commencing, Hunter Land Holdings will prepare an Environmental Management Plan (EMP) and such to be designed and implemented to manage all environmental aspects associated with the construction. The EMP will be maintained on site during all site works and be made available to Authorised Officers upon request.

The EMP will include but not be limited to:

a) A site management program, identifying and addressing issues such as environmental health and safety, site security, and traffic management.

b) A water management program detailing all erosion and sediment control, management of soil stockpiles, control and management of surface water and controls for the reworking of the existing water course.

c) A vegetation management plan, including detailed measures for rehabilitating the 7(b) conservation areas before they are dedicated to Newcastle City Council.

A.3.3 Prior to any site works commencing, Landscape Plans will be prepared for the relevant stage and submitted to the certifying authority for approval. Each landscape plan will indicate existing vegetation to be retained and removed, existing topography, adjacent development and open space, revegetation methods, access points and 'links' to open space, plant species, locations and landscape design principles. The Plan will also comply with the following:

a) Areas of restricted access and fence detail to be erected during construction and areas proposed for storage/stockpile of plant and materials will be identified;

b) Specify establishment methods for all new plantings and maintenance scheduling for all new plants;

c) Specify a weed eradication program and reporting methods

d) Street trees will be provided with a nominated minimum 100 litre pot size, or as otherwise approved by Council and protected with tree guards.

A.3.4 Prior to any site works commencing an Aboriginal Heritage Management Plan will be prepared in consultation with the Aboriginal stakeholders (Mindaribba Local Aboriginal Land Council and Lower Hunter Wonnarua). The plan will guide management of the Aboriginal heritage resource "in lieu" of a Section 90 consent.

The AHMP will include:

a) Method for the collection and recording of known sites in the development area.

b) Details of any proposed conservation area or final resting place of the artefacts and how those artefacts will be conserved after collection and relocation.

c) Site management details identifying and addressing actions required in the event previously unrecorded artefacts are discovered during works.

d) Prior to the civil earthworks commencing in proposed stages 1 and 3 clearing works will be undertaken within road reserves located in survey areas W15 and W20. These works will include clearing of existing trees and monitored grader scrapes of the topsoil along the centerline of the proposed road reserve under the supervision of nominated Land Council representatives and a qualified archaeologist.

A.3.5 All subdivision and associated works are to be designed in accordance with the Statement of Commitments and relevant publications. These publications include:

- AUSTROADS, *Guide to Traffic Engineering Practice;*
- Department *of* Housing, *Road Manual* 1987;
- *Roads and* Traffic Authority, *Road Design Guide;*
- Roads and Traffic Authority, Interim *Guide to* Signs and Markings;
- *Pavement* Design - A Guide to the *Structural* Design of Road Pavements,
- *A Guide to the Design of New Pavements for Light Traffic* - APRG Report No. 21;
- Newcastle City Council, Development *Control Plan* 2005.
- *Landcom's - Managing Urban Stormwater*
- Institution of Engineers, Australian *Rainfall and Runoff 1987*
- Environment Protection Authority, Managing *Urban Stormwater-Treatment* Techniques;

A.3.6 Plans of any proposed traffic management devices, linemarking and signposting works on existing or proposed public roads will be submitted to Council and approved by the Newcastle City Traffic Committee prior to the issue of a Construction Certificate for such work.

A.3.7 Prior to the commencement of any works, the developer will provide written notification to the adjoining landowners of the intention to start works, providing details of the scheduling of works and nominating a contact person. A legible prominent sign stating the name of the developer and contractor and a 24 hour contact telephone number will be displayed onsite during the construction period.

A.3.8 Prior to the commencement of any works, tree protection fencing, erosion and sediment control measures nominated as being required during construction in the approved Environmental Management Plan, will be installed on site and inspected by the Principal Certifying Authority.

A.4 Commitments to be resolved prior to Endorsement of Subdivision Plan.

A.4.1 A Subdivision Certificate application will be submitted in respect of each stage of the development, accompanied by the appropriate fee. Each application will be supported by a Survey Plan of Subdivision prepared by a Registered Surveyor accompanied by an Instruments prepared under s88B of the Conveyancing Acts as appropriate.

A.4.2 The appropriate notation will be placed on the plan of subdivision and an instrument under Section 88B of the Conveyancing Act will be submitted to Council setting out the terms of easements and/or rights of carriageway and/or restrictions as to user required for the subdivision, in respect of the following where applicable:

a) Interallotment drainage lines in favour of upstream properties utilising the lines;
b) Easements for Asset Protection Zones(APZ's);
c) Restrictions on the Use of Land over temporary APZ's if required;
d) Rights of carriageway in favour of the property serviced;
e) Easements for services in favour of the property serviced and/or the appropriate utility provider; and
f) Stormwater lines in favour of Council.

A.4.3 Written evidence of arrangements being made with the Hunter Water Corporation Limited, or other approved supplier, for the provision of individual water supply and sewerage services to all lots within each stage, will be submitted to the Principal Certifying Authority prior to certification of the Subdivision Plan in respect of that stage.

A.4.4 Written evidence of arrangements being made with Energy Australia, or other approved supplier, for the provision of electricity supply to all lots and street lighting within each stage, will be submitted to the Principal Certifying Authority prior to certification of the Subdivision Plan in respect of that stage.

A.4.5 Written evidence of arrangements being made with Telstra, or other approved supplier, for the provision of underground telephone services to all lots within each stage, will be submitted to the Principal Certifying Authority prior to certification of the Subdivision Plan in respect of that stage.

A.4.6 Certified works-as-executed (WAE) plans and documentation will be lodged with the Principal Certifying Authority on completion of works for each stage. The required WAE plans will be provided on a full copy stamped Construction Certificate drawings and will include:

- Details of any alterations made to the approved plans;
- The location and type of service conduits;
- The location and extent of any temporary Asset Protection Zones
- Details of all kerbs and gutters, pits and pipelines and drainage swales; and
- Certification by a Registered Surveyor that all pipes, services and access driveways within proposed lots are totally within their respective easements.

Where the WAE plans indicate variations between the works as installed and the approved plans, the Principal Certifying Authority is to determine whether the works are acceptable or require reconstruction.

A.4.7 Proposed street names will be submitted to Council (the Road Authority) for approval prior to the lodgement of any Subdivision Certificate applications involving new roads. Evidence of approval will be submitted with the corresponding Subdivision Certificate application.

A.4.8 A geotechnical assessment prepared by a suitably qualified geotechnical engineer will be submitted with the corresponding Subdivision Certificate application which:

a) gives the location, extent and suitability of any fill placed on site;
b) provides testing results of construction in relation to earthworks and road works.

A.4.9 A fauna presence/relocation report prepared by a suitably qualified person on the results of inspections made on trees prior to removal will be submitted with the corresponding Subdivision Certificate application.

A.4.10 The Developer will make good any damage caused to a public road or associated structures, including drains and kerb and gutter, as well as to private property, resulting from the subdivision works prior to certification of the Subdivision Certificate.

A.4.11 An Asset Protection Zone (APZ) 10 wide will be created along the Western Boundary of Lots 124, 208 to 210, 307 and 308in accordance with the report by Ecohub 18th December 2006 and the principles of Planning for Bushfire Protection 2006.

A.4.12 At the completion of the relevant stage, a Temporary Asset Protection Zone (APZ) 10 wide is to be provided along the rear boundary of Lots 119 to 123 , Lots 304 to 306 and Lots 309 to 316accordance with the report by Ecohub 18th December 2006 and the principles of Planning for Bushfire Protection 2006. The Temporary Asset Protection Zone (APZ) may be removed wholly or in part after preparation of a report from a suitably qualified consultant stating the hazard no longer exists and the report endorsed by NSW Rural Fire Service or the approval Authority.

A.4.13 A Restriction as to User will be placed on the plan of subdivision and associated instrument under Section 88B of the Conveyancing Act to ensure

a) No landscaping or vegetation is permitted in the Asset Protection Zone (APZ) unless that landscaping or vegetation meets the requirement of the New South Wales Rural Fire Services guidelines with respect to Asset Protection Zones.

b) No building or structure is permitted within the Asset Protection Zone (APZ) unless that building or structure is constructed of non-combustible materials

A.5 Commitments Detailing Works to be Undertaken in Weakleys Drive

A.5.1 A roundabout and associated works shall be designed and constructed in accordance with the RTA's Road Design Guide and relevant Austroads guidelines at the proposed new access to Freeway North Business Park on Weakleys Drive between Balook Drive and the New England Highway, approximately in the location identified in Newcastle Council's Development Control Plan for the area, to the satisfaction of the RTA. The following shall be included, as a minimum, as part of the works:

a) A roundabout shall be designed and constructed as a two (2)-lane dual circulating roundabout

b) Two (2) lane approaches and departures shall be provided on all legs of the roundabout or as determined by the RTA.

c) The northern leg of the roundabout on Weakleys Drive shall be extended through to the two-lane section of the New England / Weakleys Drive interchange. Two (2) lanes northbound and southbound shall be provided between the proposed roundabout and the interchange along Weakleys Drive. A raised concrete median shall be involved in the upgrade of the road.

d) The southern approach leg of the roundabout on Weakleys Drive shall be extended from the roundabout to the south of the proposed left in/left out access to the Freeway North Business Park. The two (2) lane (northbound) approach shall be extended south beyond the left in/left out intersection to an extent to ensure safe merging /diverging of traffic northbound on Weakleys Drive.

e) The southern departure leg (southbound) of the roundabout shall be constructed as two (2) lanes to a length of 200 metres from the roundabout, excluding tapers.

f) The above works may be staged, with the approval of the RTA, but must include3 the roundabout and the approaches/departures in Stage 1 construction. The remainder of the works (Stages 2 & 3) must be completed immediately after Stage 1 – there shall be no cessation of works.

A.5.2 The proposed left in/left out intersection to the subject site on Weakleys Drive between the proposed roundabout and Balook Drive shall be designed and constructed in accordance with the RTA's Road Design Guide and relevant Austroads guidelines with an exclusive left turn deceleration lane outside of the proposed two lane section of Weakleys Drive.

A.5.3 There shall be no direct vehicular access to any of the proposed lots off Weakleys Drive. All vehicular access to the proposed lots shall be via two proposed intersections on Weakleys Drive and the internal local road network.

A.5.4 A subdivision certificate is not be released until the proponent has fully constructed all road works on Weakleys Drive to the satisfaction of the RTA, unless the works are staged to the satisfaction of the RTA or the subdivision certificate relates to road widening in Weaklesy Drive. If the RTA agrees to stage the works, a subdivision certificate for Stage 1 of the development may be released after completion of the roundabout and its approaches and departures to the satisfaction of the RTA. No further subdivision certificate is to be released for any stage of the development until the proponent has fully constructed all remaining works in Weakleys Drive to the satisfaction of the RTA. A subdivision certificate for road widening in Weakleys Drive may be released prior to completion of any works.

A.5.5 All works associated with the proposed development shall be undertaken at full cost to the developer, to the satisfaction of the RTA.

A.5.6 The proponent is required to enter into a Works Authorisation Deed with the RTA. In this regard the proponent is required to submit detailed design plans and all relevant information, as may be required in the RTA's Works Authorisation Deed documentation, for each specific change to the State road network, for the RTA's assessment and final decision concerning the work.

A.6 General Commitments

A.6.1 A six month defect liability period will apply in respect of each Construction Certificate issued, prior to Council accepting maintenance responsibility for subdivision infrastructure, with the exception of the proposed landscaping. Each defect liability period will commence at the date of registration of the respective plan of subdivision.

In this regard, a cash bond or bank guarantee in an amount equivalent to 2.5% of the construction value of the subdivision works, or an alternative lesser amount as maybe agreed to by Council, together with an endorsed Defects Liability Agreement form, will be submitted to Council prior to certification of the Subdivision Plan in respect of each stage of the development.

A.6.2 A twelve month maintenance period will apply in respect of each applicable stage of the development prior to Council accepting maintenance responsibility for the proposed site landscaping. Each maintenance period will commence at the date of registration of the respective plan of subdivision.

In this regard a cash bond or bank guarantee in an amount equivalent to 2.5% of the contract value of landscaping and associated maintenance, or an alternative lesser amount as may be agreed to by Council, together with the required Landscape Establishment report, will be submitted to Council prior to certification of the Subdivision Plan in respect of each stage of the development.

A.6.3 The developer will be responsible for all adjustments to and/or relocation of public utilities. Any necessary alterations will be at the Developer's expense and to the requirements of the appropriate Authorities.

A.6.4 No work will be undertaken in any public road until a Road Opening Permit has been obtained from Council (the Road Authority).

A.6.5 The routes for import of any fill material or export of any spoil will be submitted to and agreed by Council prior to the commencement of haulage. Any deterioration or failures within public roads that can reasonably be attributable to such operations will be restored to the requirements of, and at no cost to, Council.

A.6.6 A Landscape Establishment Report will be submitted to Council fallowing completion of a twelve month maintenance period commencing from the date of registration of the relevant Subdivision Certificate in respect of each stage, verifying that satisfactory maintenance of the landscape works including street trees, revegetation and weeding, has been undertaken in accordance with the Landscape Management Plan and any necessary rectification measures have been carried out to a high professional standard.

A.6.7 All wetland and natural vegetated areas outside the boundaries of the proposed subdivision will be kept free from disturbance of machinery, parked vehicles and waste material.

A.6.8 Toilet facilities will be provided at or in the vicinity of the site on which work is being carried out at the rate of one toilet for every 20 persons or part of 20 persons employed at the site.

Each toilet provided will be:

a) A standard flushing toilet; and
b) Connected
    - To a public sewer; or
    - If connection to a public sewer is not practicable, to some other sewage management facility approved by the Council.

The required toilet facilities will be in place and operational prior to any other work being undertaken on the site.

A.6.9 Newcastle City Council will be indemnified in respect of any claims for damage to persons or property at all times while the work is in progress up until the

work is completed and the Subdivision Plan registered.

A.6.10 Construction/demolition work noise that is audible at other premises will be restricted to the following times:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No construction/demolition work noise is permitted on Sundays or Public Holidays

A.6.11 The operating noise level of machinery, plant and equipment during the course of any construction works will comply with Chapter 171 of the NSW EPA's Noise Control Manual. Construction operations will be confined to between the hours of 7 am to 6pm Monday to Friday and 8 am to 1 pm Saturday. No construction work will take place on Sundays or Public Holidays. Mechanical rock breaking or blasting will be confined to between 9 am to 3.30 pm Monday to Friday excluding any Public Holiday.

A.6.12 The Applicant will be responsible for meeting all expenses incurred in undertaking the development including expenses incurred in complying with conditions imposed under the terms of consent.

A.6.13 Any imported fill on to the site will be validated to ensure the imported fill is suitable for the proposed land use from a contamination perspective. Imported fill will be certified to verify that the material is not contaminated based upon analysis or the known history of the site from which the material was obtained.

A.6.14 Soil erosion and sedimentation control measures will be maintained at maximum operational capacity until the land is effectively rehabilitated and stabilised after construction.

MGA

208
1.99 ha
(1.24 ha)

209
1.06 ha

210
1.8 ha

207
1.31 ha
(6324m²)

211
9849m²

206
1.05 ha
(4592m²)

212
9470m²

205
9288m²
(4320m²)

213
8292m²

204
9288m²
(4320m²)

214
5103m²

203
9171m²
(3782m²)

215
5125m²

202
9605m²
(3576m²)

216
7182m²

201
1.189 ha
(6283m²)

217
DRAINAGE
RESERVE

109
5331m²

108
1.91 ha
(1.29 ha)

124
15 ha

110
2109m²

111
2100m²

112
2100m²

113
1800m²

114
1800m²

115
1500m²

116
1500m²

117
1500m²

118
1837m²

ELWELL CLOSE

PARISH DRIVE

BOWDEN WAY

107
2056m²

106
1917m²

105
1800m²

104
1800m²

103
2100m²

102
2225m²

101
4099m²

22
DP532814

16
DP510628

15
DP510628

307
9634m²

308
5934m²

317
DRAINAGE
RESERVE

CANAVAN DRIVE

303
4757m²

304
1.25 ha

305
1.25 ha

306
1.55 ha

309
2193m²

310
2067m²

311
2140m²

312
2810m²

313
3073m²

314
3229m²

315
3426m²

302
3294m²

301
3303m²

119
3140m²

120
3454m²

121
2758m²

122
3379m²

123
1.829ha

316
2.6 ha

WWPS

9
DP509255

13
DP203406

12
DP416248

11
DP506747

10
DP416248

8
DP396036

7

D
DP388733

16
DP1091199

15
DP1091199

6
DP226431

1
DP390543

WEAKLEYS DRIVE

NEW ENGLAND HIGHWAY

(A) (B) (C) (D) (E) (G) (H)

STAGE 1
STAGE 2
STAGE 3

0 50 100 200
SCALE 1 : 4000 (A3)

NOTE :

ALL DIMENSIONS , AREAS AND EASEMENTS ARE SUBJECT TO FINAL SURVEY

TITLE: PROPOSED SUBDIVISION PLAN
LOT 14 DP 1091199

LOCATION: WEAKLEYS DRIVE
BERESFIELD

DATUM:
PROJECTION: MGA

DATE: 1ST JULY 2010
PURPOSE: SUBDIVISION

AUTOCAD REF: 21717 - 2T
VERSION (PLAN BY): PROPOSED SUBDIVISION

CLIENT: FREEWAY NORTH LAND COMPANY
JOB REF: 21717

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