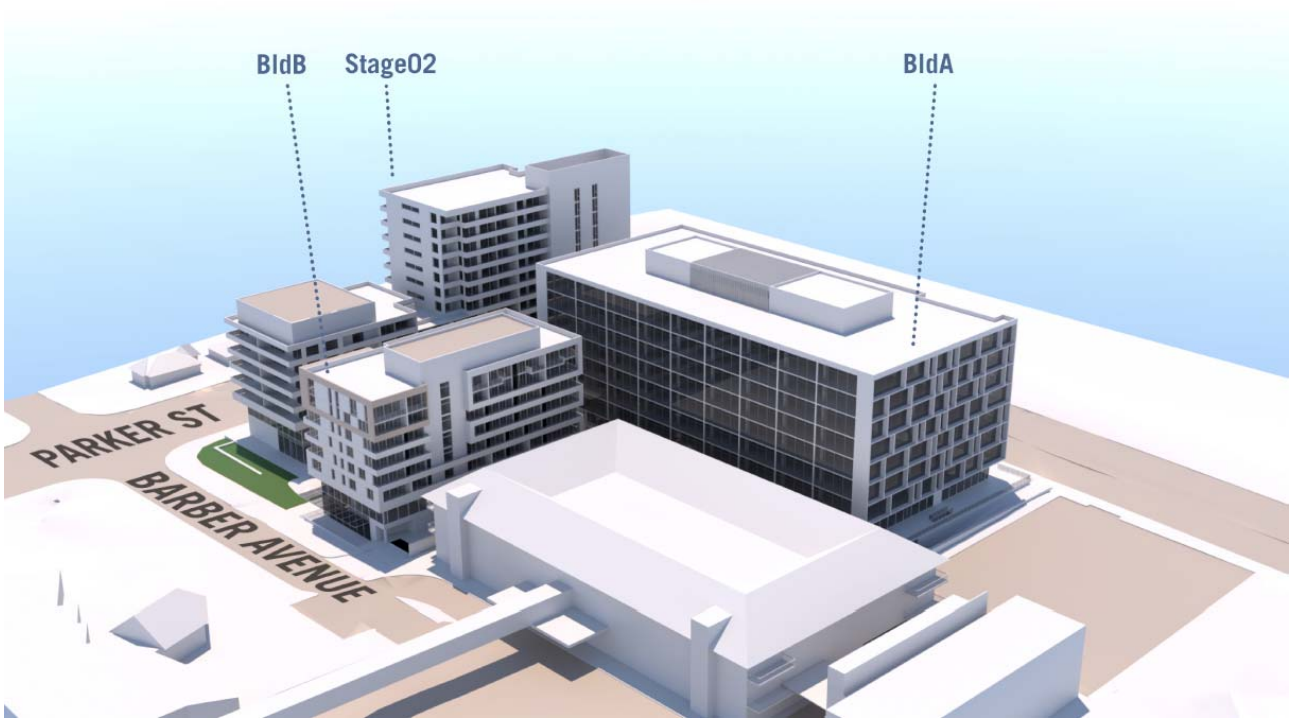
Turner + Associates

Barber Avenue, Kingswood

Stormwater Management and Utilities Report

Mixed Use Development



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Mixed Use Development

Author Heath Mallen

Approver Garry Wall

Report No AA003330-5001

Date 24 September 2010

CONTENTS

Executive Summary

Preliminary investigations have been carried out to ascertain the stormwater management measures required for the proposed development of a 1.15ha block of land adjacent to the Nepean Private Hospital at Kingswood in Sydney's west. Positioned at the top of the local catchment, the site is not impacted by any external flows as the Great Western Highway forms an effective flow boundary to the north. The site drains to two separate points of discharge to the south east through the Nepean Private Hospital and to the south west on Barber Ave which it is proposed is maintained in the developed condition.

In accordance with Penrith City Council development controls and the NSW Floodplain Development Manual onsite detention (OSD) of stormwater flows is required to ensure that downstream flooding conditions are not worsened as a result of this development. Using the DRAINS software package, OSD volumes have been modelled and it has been determined that a total of 122 cu.m of storage is required to detain developed flows to match those in the existing condition. Further investigations are required at the detailed design stage to develop an appropriate stormwater drainage network to convey stormwater flows from the site without risking localised flooding.

Preliminary investigations have been undertaken to determine the capacity of existing utilities to supply the site. Existing sewer, water and gas infrastructure has sufficient capacity to supply the site however a new dedicated electrical feeder from the Kingswood zone substation is required.

1 Introduction

Hyder has been commissioned by Turner & Associates to provide a concept stormwater plan and erosion and sediment control plan for the proposed development of the site bounded by the Great Western Highway, Parker Street and Barber Avenue at Kingswood in western Sydney. The 1.15ha development will be constructed in two stages. Stage 1 is the subject of this report – an area of 5,850sq.m comprised by Lot 100 DP701623 adjacent to the Nepean Private Hospital.

This report investigates the following:

Stormwater Management

- Existing stormwater network
- Proposed connection points
- Water quality control considerations

Utilities

- Preliminary enquiries with utility service providers regarding access to, and capacity of local utilities to service the proposed development.

1.1 Locality

The site is comprised of an existing car park that services a church on the site and is located in the Penrith City Council Local Government Area. The church which is located to the north of Nepean Private Hospital is accessed directly from the Great Western Highway whilst the car park is accessed from Barber Avenue.

Figure 1 - Site Location

2 Base Data

The following information has been used for the investigations described in this report:

- Turner and Associates Architects drawings EA00 – EA61.
- Ground survey prepared by Matthew Freeburn – Land, Engineering and Mining Surveyors, drawing name 32031-.3D.
- Observations made during a site inspection completed on 3rd August 2010.
- Correspondence with Council via telephone on 27th July 2010 and via email on 25th August 2010 indicating Council's requirements for stormwater management and water quality control. Council provided general advice only and did not provide detailed technical specifications regarding stormwater management or water quality controls. Detailed technical requirements were not available on Council's website either. At the time of writing this report Council had not made available any development controls for the management of stormwater. Council's only advice was that the development does not exacerbate local flooding issues.
- Roads and Traffic Authority drawing depicting existing stormwater on Barber Avenue received from RTA on 23rd July 2010, Refer to Appendix A for a copy of the RTA drawing.
- Australian Rainfall and Runoff (2000)

3 Flooding and stormwater

The site is located at the very top of the local catchment and is not subject to any significant impact by external stormwater flows. In a telephone discussion with Penrith City Council on 27th July 2010 it was confirmed that the site is not flood prone and as such further analysis of flood impacts on the site was not required.

3.1 Design Standards

Investigations have been undertaken in accordance with the following objectives:

- Peak stormwater discharge from the developed site between and inclusive of the 2 year ARI 5 minute storm event and the 100 year ARI 24 hour event shall not exceed the peak discharges from the existing site.
- Correspondence from council via email on 25th August 2010 provided typical requirements for OSD storage volumes and permitted site discharge flows from this type of development (refer to Appendix B). It was noted however that Council generally only requires that proposed developments such as this ensure that peak existing discharges are not increased and hence local flooding is not worsened. Council did not require that flows from the developed site be detained to match pre European levels. This was confirmed in a phone conversation with Council on 27th July 2010.
- Any stormwater discharge from a pipe network of the site to Council's drainage system shall not exceed the 1 in 20 year peak flow under post development condition. This flow shall be discharged by gravity either directly into the Council's Drainage System or via a private drainage easement through adjoining property (or properties).

- The stormwater management system shall be designed to detain the 1 in 100 year peak flows and volume.
- An overflow system shall be incorporated into the design, such that the overflow only comes into operation for storm events in excess of the 1 in 100 year peak flows
- Calculations showing how the detention systems have been designed are to be submitted for approval.
- Stormwater that leaves the site shall be conveyed directly into the existing pipe network present in the street. All pipe work leaving the site shall be connected into the street stormwater system via a standard gully pit.
- Water sensitive urban design (WSUD) measures shall be sized for the 1 in 6 month peak flow for the site and shall ensure that 80% of suspended solids, 45% of total phosphorus (P) and 45% of total nitrogen (N) is removed from stormwater flows.

3.2 Existing Stormwater Drainage

At present, the site of Stage 1 as depicted by the architectural drawings covers an area of land approximately 5,850m^2 in size. As depicted in Figure 2 the existing site is split into two main catchments that drain to separate discharge points to the East and West of the site. Upstream of the site, it is bounded by the Great Western Highway to the North and Parker St to the West where the kerb and gutter acts as a flow boundary and effectively prevents these external catchments from affecting the site. The only external catchment affecting the site is the potential for some minor roof gutter overflow from the Nepean Private Hospital site which can be channelled to Barber Ave to the south without difficulty.

The West catchment which covers approximately 3,700m^2 of the site includes the car park, half of the church roof and two residential houses drain to the south west corner of the site to a 375mm dia RCP in Barber Avenue. The remaining 2,150m^2 includes the remainder of the church roof, a residential house and grassed area that drains to the south eastern corner of the site.

Figure 2 - Existing Stormwater Catchments

For the East catchment, to the north of the hospital building, it was not possible during a recent site inspection to identify exactly where the piped discharge from the site is located. It is expected that half of the church roof and the residential building are piped from the site whilst the rest of the pervious turfed areas drain via overland flow to the south-eastern corner of the site. There is also no evidence on existing survey plans of any formalised easements created for the benefit of draining the site although it appears most likely that the piped drainage system connects to the hospital system to the south-east of the site.

3.3 Proposed Stormwater Drainage

A stormwater drainage concept plan has been prepared for the proposed development and is included in Appendix C. A summary of the proposed stormwater drainage system is provided below.

- In accordance with the NSW Floodplain Development Manual and generally accepted engineering practice, it is not advisable to divert stormwater flows from one catchment to another as this may lead to an increase in the impacts of flooding on downstream property where flows have increased. For this reason discharge rates from the East and West catchments will be maintained in the developed condition.

- Drainage from the roof areas of Stage one will be collected in two onsite detention storage tanks located within the building structure that will discharge separately from the East and West catchments. A combined total of approximately 122 cubic metres storage is to be provided to detain developed peak flows up to the 100 year ARI event. Preliminary calculations have been undertaken using the DRAINS software package to determine the required level of detention storage however detailed modelling will be required to size the detention storage once a more thorough design of the development is undertaken (refer to Appendix D for summary of DRAINS modelling).

- Drainage from the podium level areas is to be captured by separate pit and pipe systems and conveyed to the identified outlets for the East and West catchments. This system shall be sized to drain all storms up to and including the peak 20 year ARI event.

- Podium drainage from the West catchment is to be captured and conveyed to the existing drainage system within Barber Avenue. Podium drainage from the East catchment is to be conveyed to the south eastern corner of the site where legal connection to the existing Hospital drainage system within the car park will shall be made via an easement for drainage. Further detailed investigations of the hospital drainage network are to be undertaken to identify the most appropriate connection point and the location of the required easement. It is understood that a water retention system is incorporated into the design of the existing hospital stormwater network. Detailed design is to investigate and provide appropriate measures to ensure that the downstream drainage network is not impacted by an increase in peak flows at any particular location in the network due to the proposed development.

- The present conceptual layout of the development is not sufficiently developed to allow for a detailed assessment of the characteristics of overland flow in the 100 year ARI event and further modelling will be required to determine the impact of major event flows on adjacent floor levels. Flow paths within the external podium areas must be provided to ensure that the flows from the 100 year event can be safely channelled from the site without inundating habitable floor space. Overland flow paths shall be required to be of sufficient capacity to cope with a blockage of the OSD system and the podium drainage network. Finished floor levels shall be set above the calculated 100 year ARI water level within the development in accordance with Council requirements.

4 Water Quality Measures

4.1 Construction Phase Measures

An erosion and sediment control plan has been prepared for the proposed development and included in Appendix C of this report. This plan will be further developed at the detailed design stage and confirmed and updated by the civil contractor to match ultimate construction staging requirements.

4.2 Post Construction Phase Measures

At present, the existing car park drains via a direct piped connection to Barber Avenue with no treatment of gross pollutants, suspended solids or nutrients. In accordance with Council's requirement that EPA water quality standards be adopted, the proposed development shall need to incorporate a suite of water quality controls that can ensure the following pollutant reduction targets are achieved:

Suspended solids: 80% reduction

Total Nitrogen (N): 45% reduction

Total Phosphorus (P): 45% reduction

In the developed condition, the roof areas will drain to detention tanks which will incorporate sediment sumps to remove suspended solids from stormwater flows. Stormwater from paved podium areas will be intercepted by trash screens and/or gross pollutant traps at the outlets. It is expected that rain water tanks for reuse of rain water in non potable applications in cooling towers and for the flushing of toilets will also be employed. These rain water tanks shall be sized to remove a significant proportion of suspended solids and associated adsorbed nutrients.

5 Utilities Investigations

5.1 Water

A 250mm diameter Sydney Water water main is located along the northern side of Barber Avenue. Sydney Water has indicated in the Section 73 Feasibility that this water main is to be used to supply potable water to the development. Refer to marked up Sydney Water Hydroplot located in Appendix E

Sydney Water has indicated within the Section 73 Feasibility Study, that the existing water main has sufficient capacity to cater for the proposed development. Refer to Appendix E for a copy of the Sydney Water Feasibility Study Letter

5.2 Sewer

There is a network of 150mm diameter sewer mains surrounding the proposed property boundary. Sydney Water has indicated in the Section 73 Feasibility Study that the preferred sewer connection point is to directly north of the existing Nepean Private Hospital. Refer to marked up Sydney Water Hydroplot located in Appendix E

Sydney Water has indicated within the Section 73 Feasibility Study, that the sewer connection point has sufficient capacity to cater for the proposed development. Refer to Appendix E for a copy of the Sydney Water Feasibility Study Letter

5.3 Gas

A 50mm diameter medium pressure gas main is located in Barber Avenue. It is envisaged that gas supply to the proposed development will be supplied via this gas main. Refer to marked up Gas diagram located in Appendix E

Jemena gas authority have indicated that gas supply is available for the site, however a formal submission needs to be made during detailed design to confirm the capacity in the existing gas main. Refer to Appendix E for a copy of the Jemena Advice Letter.

5.4 Electricity

The mixed use Stage 1 development at Parker Street and Barber Avenue, Kingswood will be provided with HV reticulated underground cable to allow future interconnection of Indoor substations for Building A and Kiosk substation for Building B serving the developments.

Maximum Demand for the proposed Stage 1 (Building A & B) is as follows:

Building A – 2710 KVA served by indoor substation

Building B- 990 KVA served by kiosk substation

Based on Integral Energy’s desktop assessment, a new dedicated feeder from Kingswood Zone Substation will be required for the development. Please find attached supply offer from Integral energy in Appendix E

5.5 Communications

The mixed use Stage 1 development at Parker Street and Barber Avenue, Kingswood will be provided with underground communication services. Communication services will enter into the site from Barber Avenue allowing future interconnection to the Main distribution Frames for Building A and B. Pits will be strategically located in compliance with the communication authority

Telstra are obligated under their universal services to provide base telephony services to the development via their existing infrastructure.

A formal application has been registered with Telstra Smart community for stage 1 development. The Registration number provided by Telstra smart community is 12041771.

6 Conclusion

A stormwater drainage concept plan has been developed to demonstrate that compliance with Council's drainage design objectives can be achieved within the proposed site layout.

An onsite detention storage arrangement, incorporated within the building footprint, was modelled utilising the DRAINS package. Two separate detention storage tanks with a total volume of 122 cubic meters are required to limit post development discharges from the site to less than pre developed flow rates.

Further investigations and detailed design is required to provide for the safe carriage of overland flows generated within the site during major storm events and to ensure that the finished floor levels of habitable floor space are at a sufficient height above defined flow paths to avoid inundation

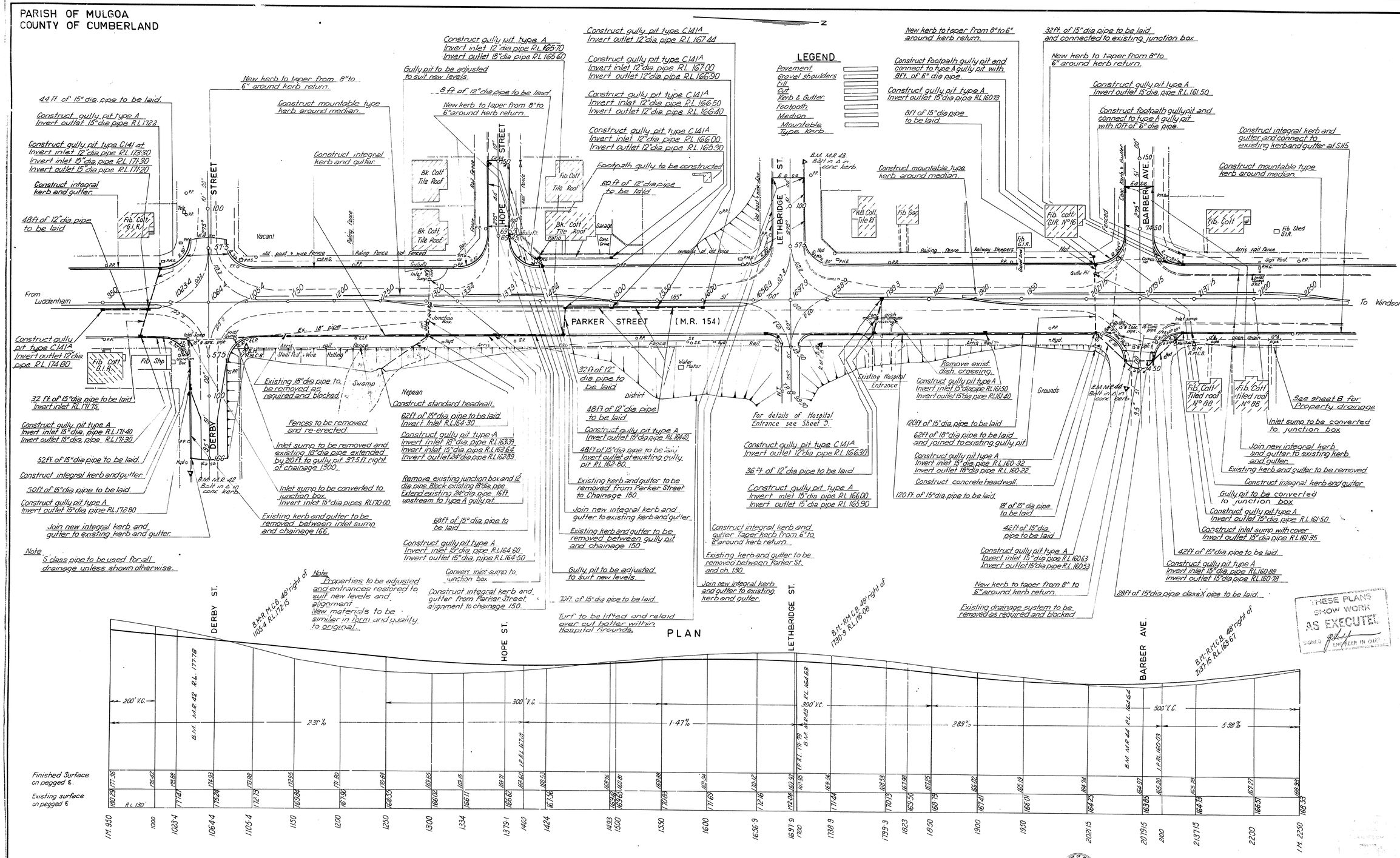
Further investigation is also required to identify the capacity of the drainage network servicing the Nepean Private Hospital and at what location a legal piped connection draining from the Eastern catchment of the proposed development can be made.

Sediment and erosion control during the construction phase will be managed generally in accordance with the plan included in Appendix C, however this will be further refined when construction requirements (including staging of excavation) are better understood.

Preliminary enquiries with utility service providers have shown that there is sufficient capacity in water, sewer and gas infrastructure to supply the site. Integral energy has indicated that a new dedicated feeder from the Kingswood zone substation will be required to supply power to the site. Telstra are obligated to provide base telephony services to the development via their existing infrastructure. An application has been official registered.

Appendix A – Existing Stormwater Network

PARISH OF MULGOA
COUNTY OF CUMBERLAND



PLAN

LONGITUDINAL SECTION

0154 358R02919

THESE PLANS SHOW WORK AS EXECUTED
SIGNED ... ENGINEER IN CHARGE

DIVISIONAL OFFICE COPY

Scales	Plan Feet 0 40 80 120; Long. Section Hor. ft 0 40 80 120; Vert. ft 0 10 20 30
Datum	Standard
Surveyed by	R. Dryza
Field Book	154 F 2912
Level Book	154 L 2834, 56.
Designed	R.L.M. & J.S.
Checked	J.S. & R.L.M.
Passed	G.A.Lee
Designed for	Miles per hour
Formation width	15ft & Variable
Pavement width	2/33ft Carriageways & Var.
Normal crossfall	2.5% & Variable
Boxing depth	18 inches

These drawings have been taken to the site of the work and compared with the situation and are recommended.
Divisional Engineer
Date 6.6.69

Approved on behalf of the Department of Main Roads, N.S.W.
Engineer in Chief
Date 27.8.69

DEPARTMENT OF MAIN ROADS, N.S.W.
MAIN ROAD No. 154 CITY OF PENRITH
RECONSTRUCTION OF PARKER STREET
KINGSWOOD
1M. 950 — 1M. 2250

File No.	No. of Sheets	Sheet No.
406.172	9	5

Regn. No. ~~154 C 2919~~

M.E.6.

MICROBOX

Appendix B – Council Correspondence

Heath Mallen

From: Hausfeld Eric [ehausfeld@penrithcity.nsw.gov.au]
Sent: 25 August 2010 5:53 PM
To: Heath Mallen
Subject: Re: Request for information regarding Part 3a development of land bounded by Great Western Highway and P...

Categories: Barber Ave

Penrith City Council

Civic Centre, 601 High Street, PENRITH NSW 2750
Telephone: (02) 4732 7777 Fax: (02) 4732 7958
e-mail: ***pencit@penrithcity.nsw.gov.au***

Our Ref: IMS 2660809
Contact: Eric Hausfeld
Telephone: (02) 4732 7772
Date: 25 August 2010

Attention: Heath Mallen

As discussed on the telephone Council has previously provided comments to the Department of Planning. Council's general requirement in relation to stormwater is that the proposal will not exacerbate local flooding.

Council's standard OSD requirements for this type of development is 280cbm/ hectare storage and 120 L/s PSD. In terms of water quality the Council adopts the EPA's current requirements for pollution retention rates.

Please note these comments are made without reference to any plans as none have been provided.

Regards

Eric Hausfeld
Development Engineering Coordinator
Penrith City Council

601 High St Penrith
PO Box 60 Penrith NSW 2751
P 02 4732 7772
F 02 4732 7958
M 0419418535
E ehausfeld@penrithcity.nsw.gov.au

Appendix C – Concept Stormwater & Sediment and Erosion Control Plan

EROSION AND SEDIMENT CONTROL NOTES

GENERAL INSTRUCTIONS

1. THE SITE SUPERINTENDENT/ENGINEER WILL ENSURE THAT ALL SOIL AND WATER MANAGEMENT WORKS ARE LOCATED AS DOCUMENTED.
2. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH
   a. LOCAL AUTHORITY REQUIREMENTS
   b. EPA REQUIREMENTS
   c. NSW DEPARTMENT OF HOUSING MANUAL "MANAGING URBAN STORMWATER, SOILS AND CONSTRUCTION", 4th EDITION, MARCH 2004.
3. MAINTAIN THE EROSION CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.
4. WHEN STORMWATER PITS ARE CONSTRUCTED, PREVENT SITE RUNOFF ENTERING UNLESS SEDIMENT FENCES ARE ERECTED AROUND PITS.
5. CONTRACTOR IS TO ENSURE ALL EROSION & SEDIMENT CONTROL DEVICES ARE MAINTAINED IN GOOD WORKING ORDER AND OPERATE EFFECTIVELY. REPAIRS AND OR MAINTENANCE SHALL BE UNDERTAKEN AS REQUIRED, PARTICULARLY FOLLOWING STORM EVENTS.

LAND DISTURBANCE

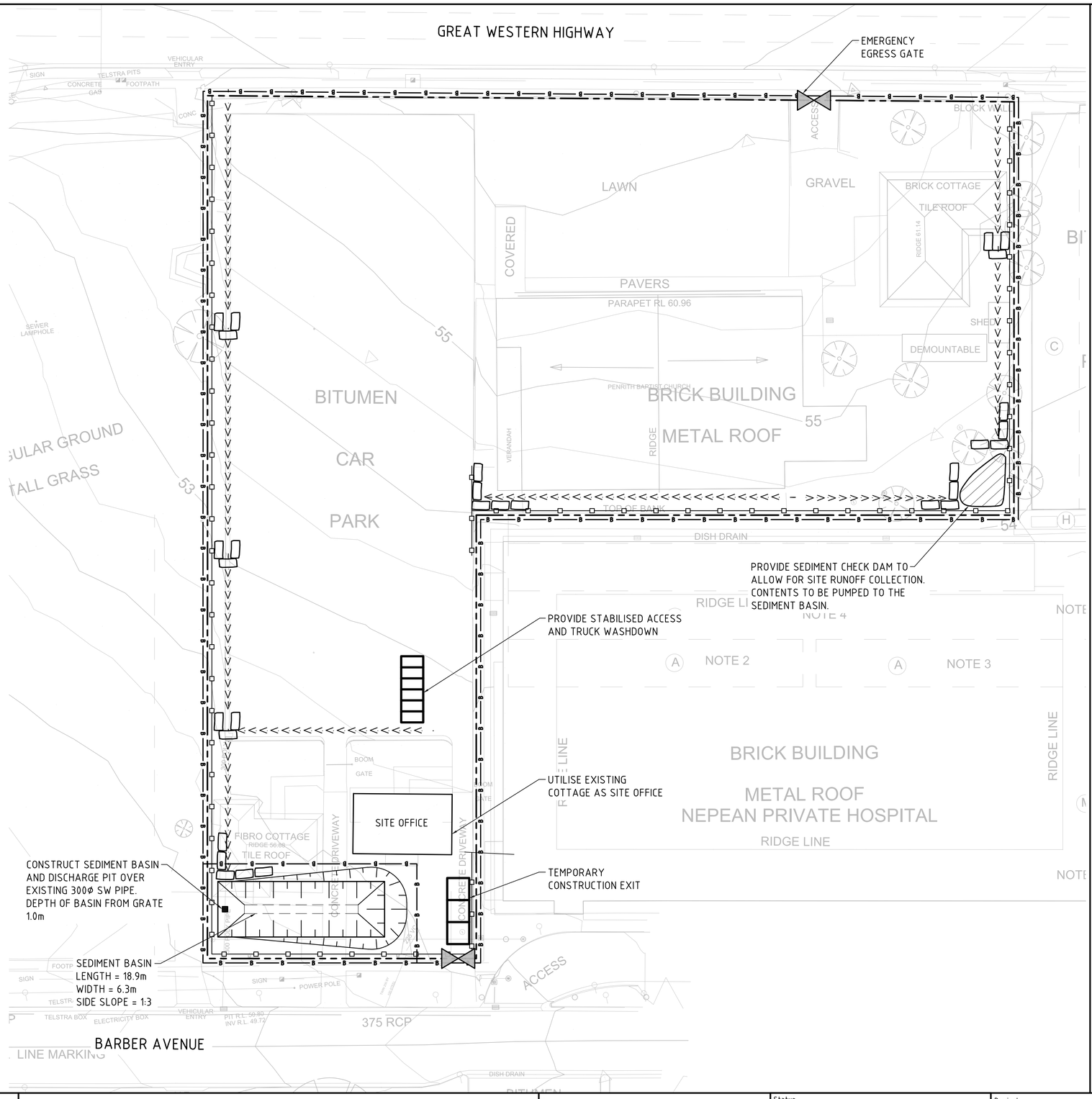
6. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE WILL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:
   (A) INSTALL A WIND FENCE ALONG THE BOUNDARIES AS SHOWN ON PLAN. REFER DETAIL.
   (B) INSTALL A SEDIMENT FENCE ALONG THE BOUNDARIES AS SHOWN ON PLAN. REFER DETAIL.
   (C) CONSTRUCT STABILISED CONSTRUCTION ENTRANCE TO LOCATION AS DETERMINED BY SUPERINTENDENT/ENGINEER. REFER DETAIL.
   (D) INSTALL SEDIMENT BASIN AS SHOWN ON PLAN
   (E) INSTALL SEDIMENT TRAPS AS SHOWN ON PLAN.
   (F) UNDERTAKE SITE DEVELOPMENT WORKS IN ACCORDANCE WITH THE ENGINEERING PLANS. WHERE POSSIBLE, PHASE DEVELOPMENT SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF WORKABLE SIZE.

EROSION CONTROL

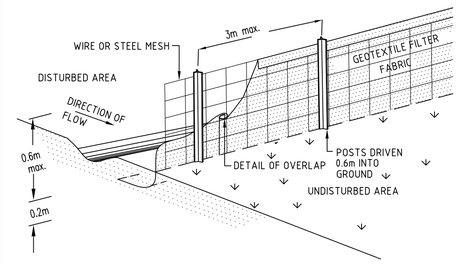
7. DURING WINDY WEATHER, LARGE, UNPROTECTED AREAS WILL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL.
8. FINAL SITE LANDSCAPING WILL BE UNDERTAKEN AS SOON AS POSSIBLE AND WITHIN 20 WORKING DAYS FROM COMPLETION OF CONSTRUCTION ACTIVITIES.

SEDIMENT CONTROL

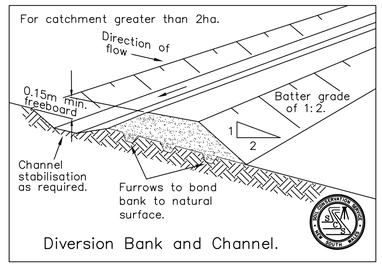
9. STOCKPILES WILL NOT BE LOCATED WITHIN 2 METRES OF HAZARD AREAS, INCLUDING LIKELY AREAS OF CONCENTRATED OR HIGH VELOCITY FLOWS SUCH AS WATERWAYS. WHERE THEY ARE BETWEEN 2 AND 5 METRES FROM SUCH AREAS, SPECIAL SEDIMENT CONTROL MEASURES SHOULD BE TAKEN TO MINIMISE POSSIBLE POLLUTION TO DOWNSLOPE WATERS, E.G. THROUGH INSTALLATION OF SEDIMENT FENCING.
10. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) WILL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.
11. WATER WILL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS IT IS RELATIVELY SEDIMENT FREE, I.E. THE CATCHMENT AREA HAS BEEN PERMANENTLY LANDSCAPED AND/OR ANY LIKELY SEDIMENT HAS BEEN FILTERED THROUGH AN APPROVED STRUCTURE.
12. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES WILL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE REHABILITATED.
13. SEDIMENT BASINS TO BE MANAGED ACCORDING TO THE BLUE BOOK WITH WATER ONLY DISCHARGED ONCE IT MEETS DECs WATER QUALITY STANDARDS.
14. BANKS TO BE DESILTED ONCE 30% OF THE BASIN CAPACITY IS REDUCED BY SEDIMENT BUILD UP.
15. ONCE EXCAVATION FOR BASEMENT BEGINS AND BULK EARTHWORKS LEVEL IS BELOW THAT OF THE DISCHARGE POINT THE CONTRACTOR WILL NEED TO PUMP STORMWATER OUT OF THE EXCAVATION. WATER IS TO BE DISCHARGED IN ACCORDANCE WITH THE 'BLUE BOOK' TO EXISTING SYSTEM IN BARBER AVE.



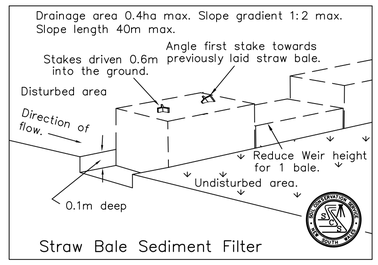
STANDARD DETAILS



SEDIMENT FENCE



Diversion Bank and Channel.



Straw Bale Sediment Filter

LEGEND

- BARRIER FENCE
- SEDIMENT FENCE (SD 6-8)
- EARTH BANK (SD 5-5)
- STRAW BALE SEDIMENT FILTER (SD 6-7)

Issue	Description	Date
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Client: TURNER + ASSOCIATES

Status: **PRELIMINARY** NOT TO BE USED FOR CONSTRUCTION

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Original Size	A1	Designed	HM
Height Datum	AHD	Checked	HM
Grid		Approved	GW

Filename:

Project: BARBER AVE, KINGSWOOD

Title: EROSION AND SEDIMENT CONTROL PLAN

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Drawing No.	Project No.	Issue
C020	AA003330	P1

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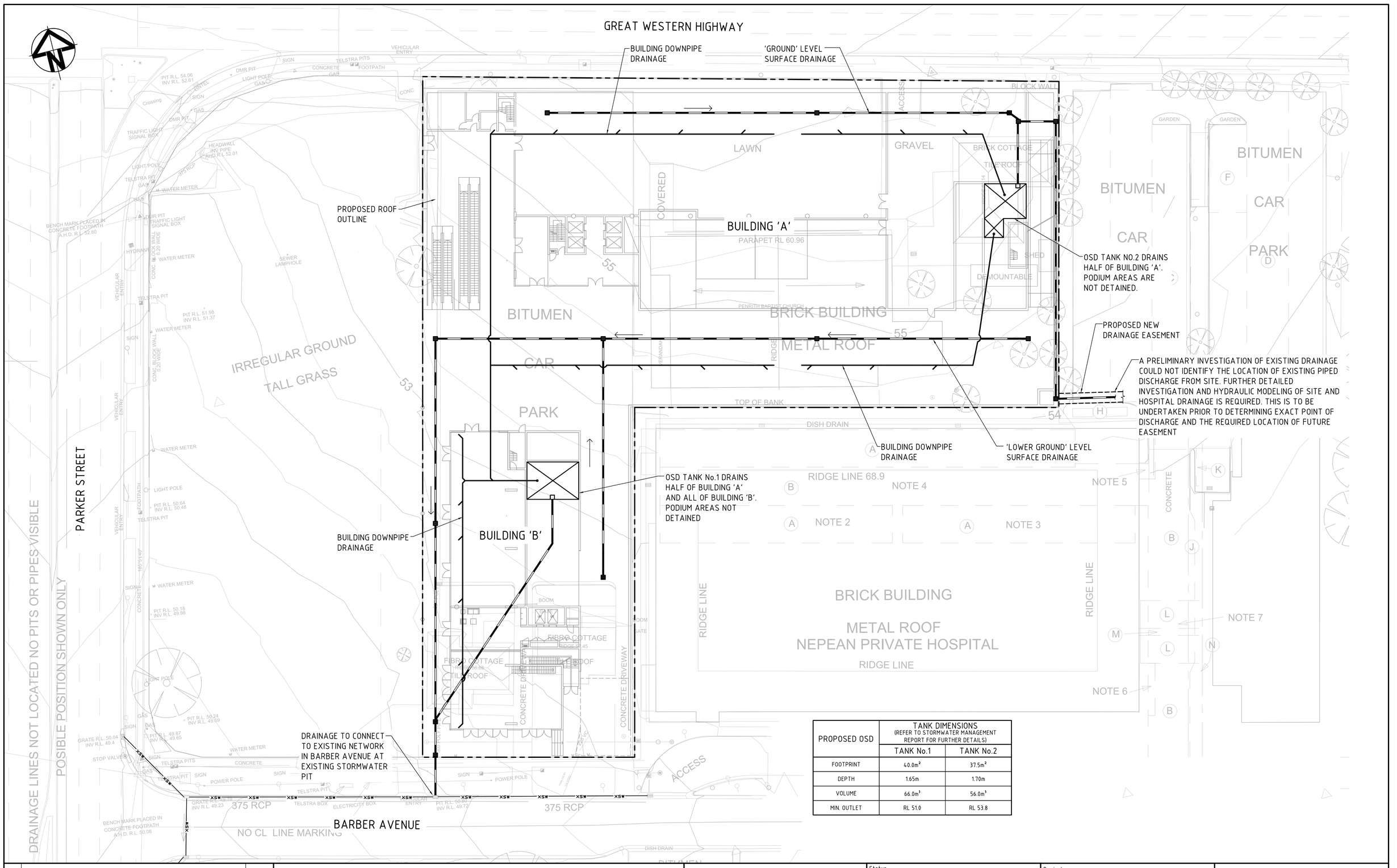

PROPOSED OSD	TANK DIMENSIONS (REFER TO STORMWATER MANAGEMENT REPORT FOR FURTHER DETAILS)	
	TANK No.1	TANK No.2
FOOTPRINT	40.0m²	37.5m²
DEPTH	1.65m	1.70m
VOLUME	66.0m³	56.0m³
MIN. OUTLET	RL 51.0	RL 53.8

Issue	Description	Date
P1	ISSUED FOR INFORMATION	24/09/10

0 5 10 15 20 25m

1 : 250

Client: TURNER + ASSOCIATES

Status: **PRELIMINARY** NOT TO BE USED FOR CONSTRUCTION

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Grid		Approved	GW

Filename:

Project: BARBER AVE, KINGSWOOD

Title: CONCEPT STORMWATER MANAGEMENT PLAN

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Fax: +61 (0)2 8907 9001
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Drawing No.	Project No.	Issue
C030	— AA003330	— P1

100mm on Original

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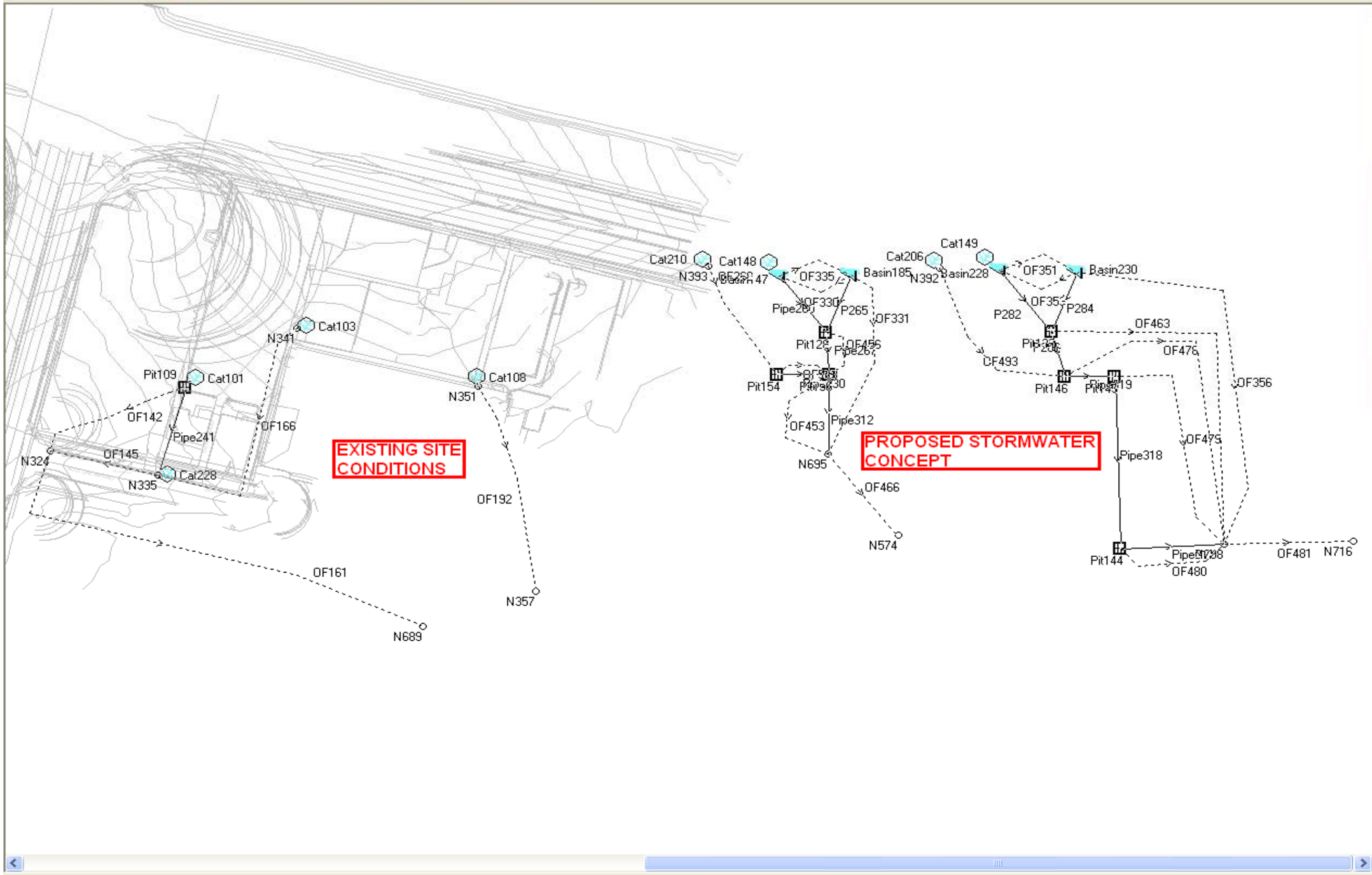
Appendix D – DRAINS Modelling

20100906-OSD-[FINAL].drn - DRAINS

File Edit Project View Draw Run Help



For Help, press F1

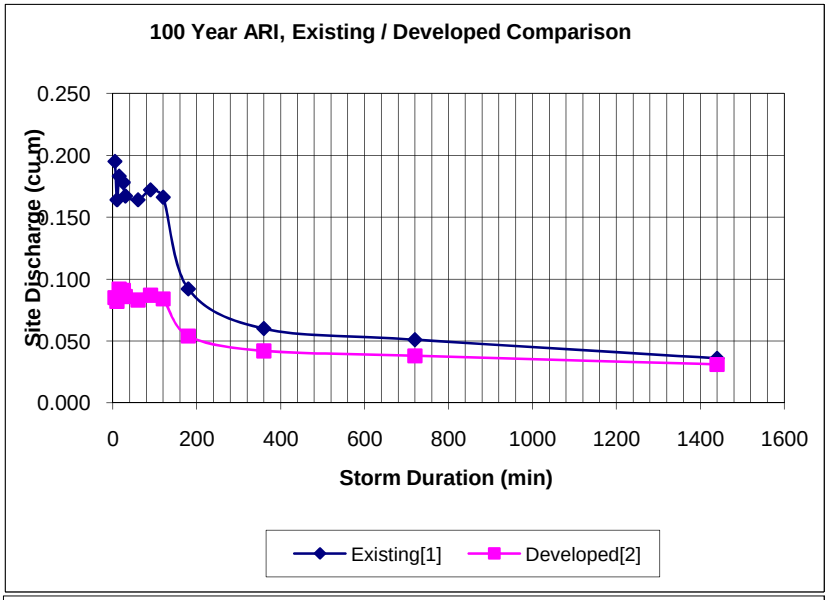
OSD Tank #1 - Site Discharge Impacts

For: Turner + Associates
At: Barber Avenue, Kingswood

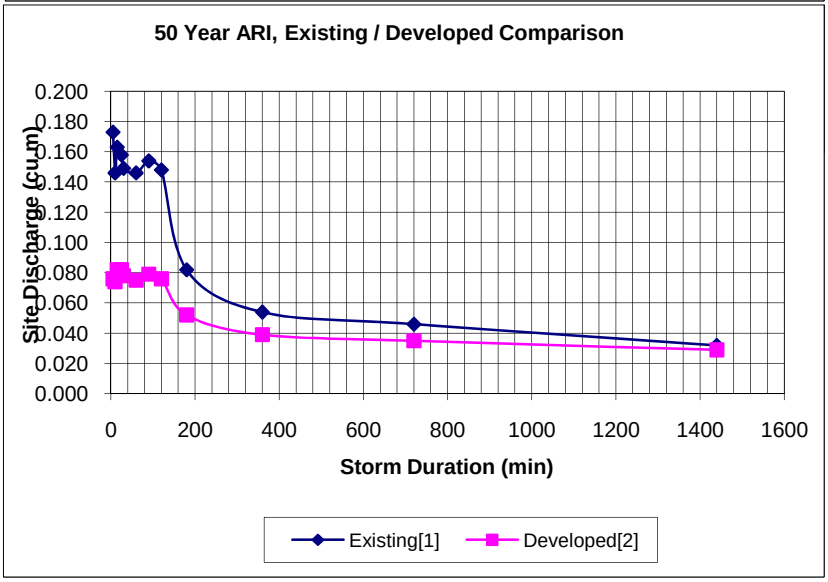
Contract No. AA003330
Prepared by: HM
DATE: 8-Sep-10

Drains Model: F:\AA003330\D-Calculations\Stormwater\4000-AA003330-NSC-01_100907_DrainsVerions2010-01-OUTPUT.xls
Drains Version: 2010-01

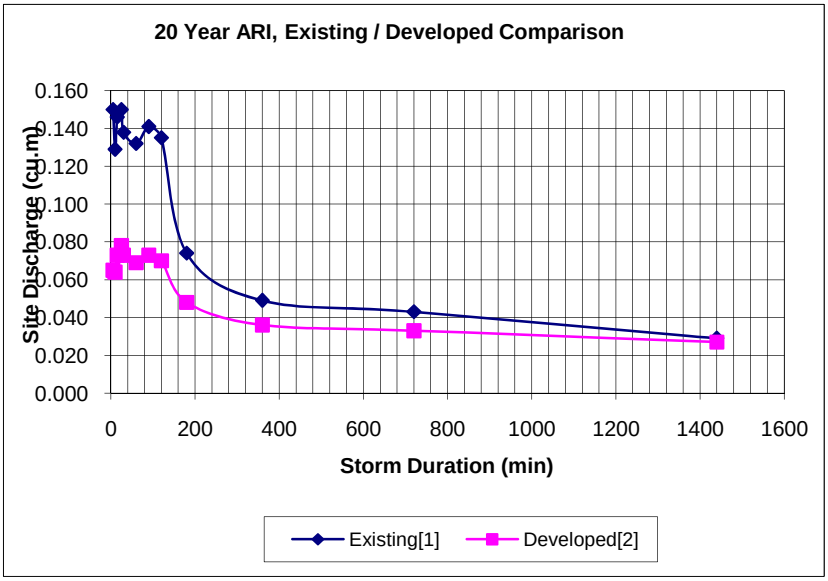
	100yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	***0.195***	0.085	-0.110
10	0.164	0.082	-0.082
15	0.183	***0.092***	-0.091
25	0.178	0.091	-0.087
30	0.167	0.086	-0.081
60	0.164	0.083	-0.081
90	0.172	0.087	-0.085
120	0.166	0.084	-0.082
180	0.092	0.054	-0.038
360	0.060	0.042	-0.018
720	0.051	0.038	-0.013
1440	0.036	0.031	-0.005
Max	0.195	0.092	-0.103



	50yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	0.173	0.076	-0.097
10	0.146	0.074	-0.072
15	0.163	0.082	-0.081
25	0.158	0.082	-0.076
30	0.149	***0.078***	-0.071
60	0.146	0.075	-0.071
90	0.154	0.079	-0.075
120	0.148	0.076	-0.072
180	0.082	0.052	-0.030
360	0.054	0.039	-0.015
720	0.046	0.035	-0.011
1440	0.032	0.029	-0.003
Max	0.173	0.082	-0.091



	20yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	***0.150***	0.065	-0.085
10	0.129	0.064	-0.065
15	0.146	0.073	-0.073
25	***0.150***	***0.078***	-0.072
30	0.138	0.073	-0.065
60	0.132	0.069	-0.063
90	0.141	0.073	-0.068
120	0.135	0.070	-0.065
180	0.074	0.048	-0.026
360	0.049	0.036	-0.013
720	0.043	0.033	-0.010
1440	0.029	0.027	-0.002
Max	0.150	0.078	-0.072



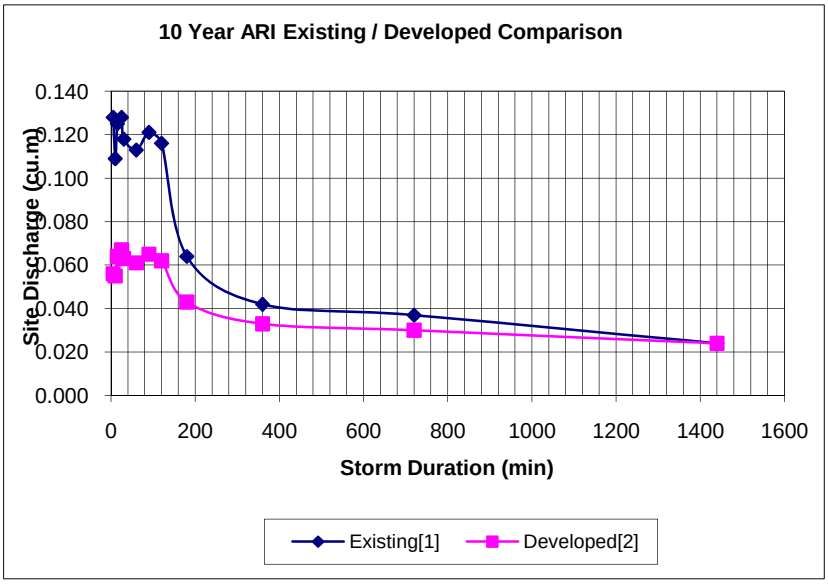
OSD Tank #1 - Site Discharge Impacts

For: Turner + Associates
At: Barber Avenue, Kingswood

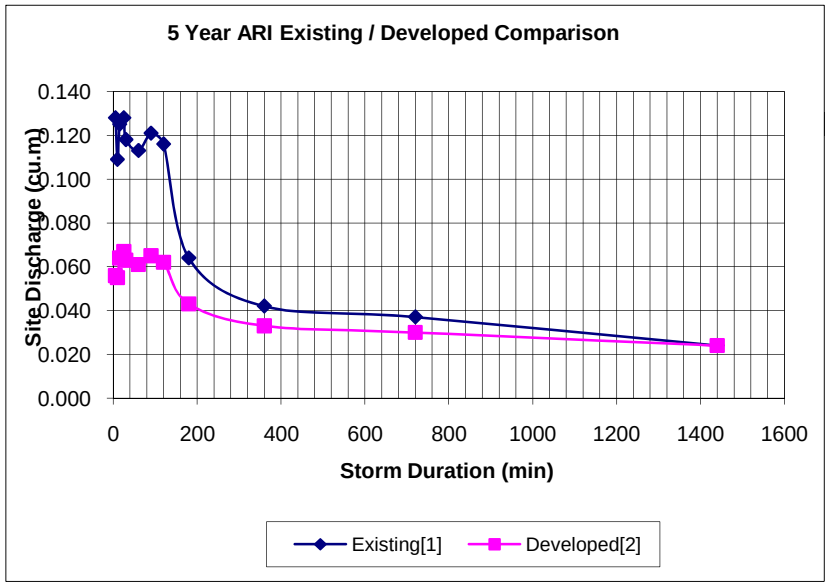
Contract No. AA003330
Prepared by: HM
DATE: 8-Sep-10

Drains Model: F:\AA003330\D-Calculations\Stormwater\4000-AA003330-NSC-01_100907_DrainsVerions2010-01-OUTPUT.xls
Drains Version: 2010-01

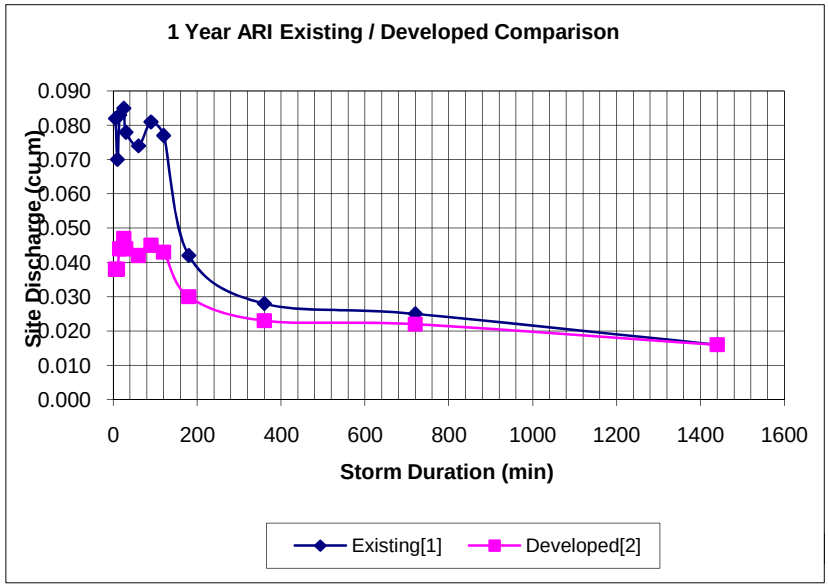
	10yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	***0.128***	0.056	-0.072
10	0.109	0.055	-0.054
15	0.125	0.064	-0.061
25	***0.128***	***0.067***	-0.061
30	0.118	0.063	-0.055
60	0.113	0.061	-0.052
90	0.121	0.065	-0.056
120	0.116	0.062	-0.054
180	0.064	0.043	-0.021
360	0.042	0.033	-0.009
720	0.037	0.030	-0.007
1440	0.024	0.024	0.000
Max	0.128	0.067	-0.061



	5yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	***0.128***	0.056	-0.072
10	0.109	0.055	-0.054
15	0.125	0.064	-0.061
25	***0.128***	***0.067***	-0.061
30	0.118	0.063	-0.055
60	0.113	0.061	-0.052
90	0.121	0.065	-0.056
120	0.116	0.062	-0.054
180	0.064	0.043	-0.021
360	0.042	0.033	-0.009
720	0.037	0.030	-0.007
1440	0.024	0.024	0.000
Max	0.128	0.067	-0.061



	2yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	0.082	0.038	-0.044
10	0.070	0.038	-0.032
15	0.083	0.044	-0.039
25	***0.085***	***0.047***	-0.038
30	0.078	0.044	-0.034
60	0.074	0.042	-0.032
90	0.081	0.045	-0.036
120	0.077	0.043	-0.034
180	0.042	0.030	-0.012
360	0.028	0.023	-0.005
720	0.025	0.022	-0.003
1440	0.016	0.016	0.000
Max	0.085	0.047	-0.038



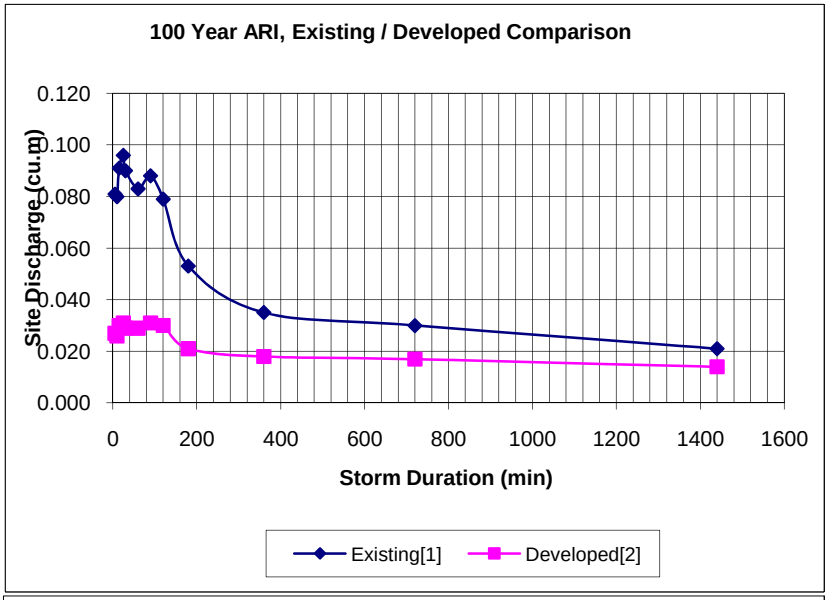
OSD Tank #2 - Site Discharge Impacts

For: Turner + Associates
At: Barber Avenue, Kingswood

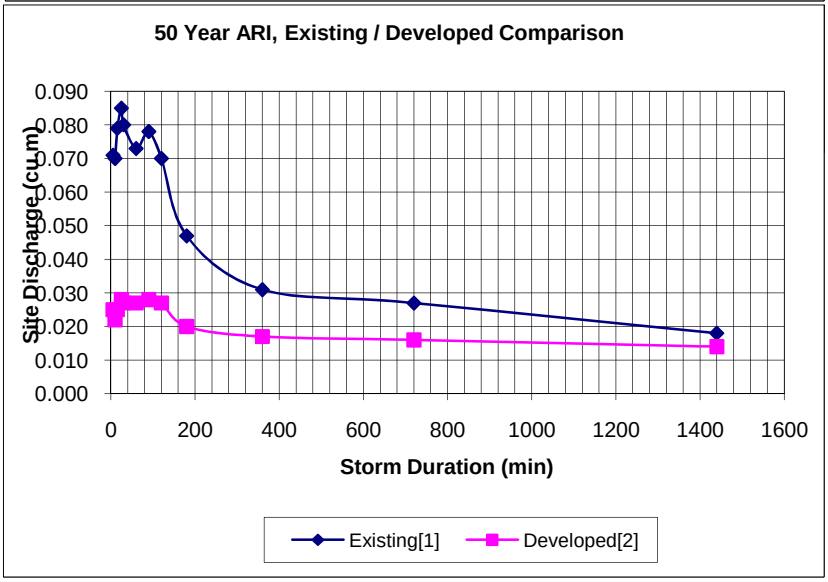
Contract No. AA003330
Prepared by: HM
DATE: 8-Sep-10

Drains Model: F:\AA003330\D-Calculations\Stormwater\4000-AA003330-NSC-01_100907_DrainsVerions2010-01-OUTPUT.xls
Drains Version: 2010-01

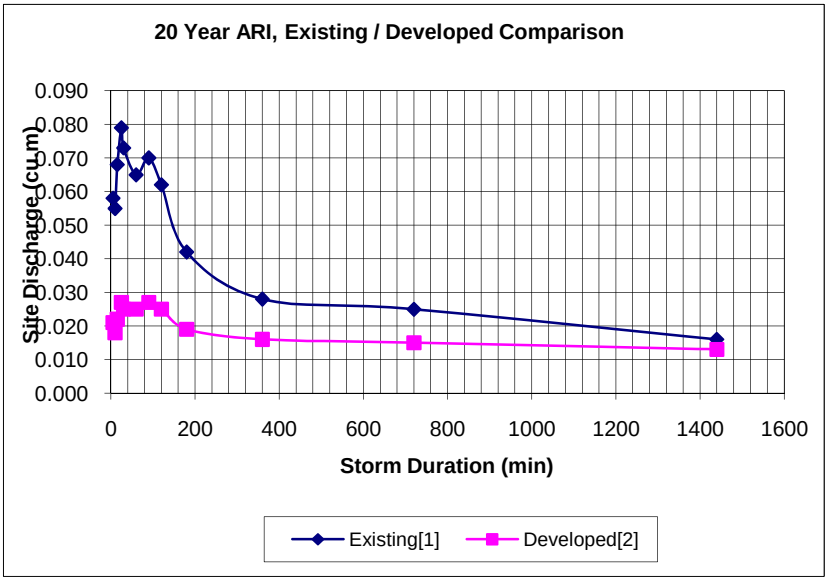
	100yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	0.081	0.027	-0.054
10	0.080	0.026	-0.054
15	0.091	0.030	-0.061
25	***0.096***	***0.031***	-0.065
30	0.090	0.029	-0.061
60	0.083	0.029	-0.054
90	0.088	***0.031***	-0.057
120	0.079	0.030	-0.049
180	0.053	0.021	-0.032
360	0.035	0.018	-0.017
720	0.030	0.017	-0.013
1440	0.021	0.014	-0.007
Max	0.096	0.031	-0.065



	50yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	0.071	0.025	-0.046
10	0.070	0.022	-0.048
15	***0.079***	0.025	-0.054
25	0.085	0.028	-0.057
30	0.080	***0.027***	-0.053
60	0.073	***0.027***	-0.046
90	0.078	0.028	-0.050
120	0.070	***0.027***	-0.043
180	0.047	0.020	-0.027
360	0.031	0.017	-0.014
720	0.027	0.016	-0.011
1440	0.018	0.014	-0.004
Max	0.085	0.028	-0.057



	20yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	0.058	0.021	-0.037
10	0.055	0.018	-0.037
15	0.068	0.022	-0.046
25	***0.079***	***0.027***	-0.052
30	0.073	0.025	-0.048
60	0.065	0.025	-0.040
90	0.070	***0.027***	-0.043
120	0.062	0.025	-0.037
180	0.042	0.019	-0.023
360	0.028	0.016	-0.012
720	0.025	0.015	-0.010
1440	0.016	0.013	-0.003
Max	0.079	0.027	-0.052



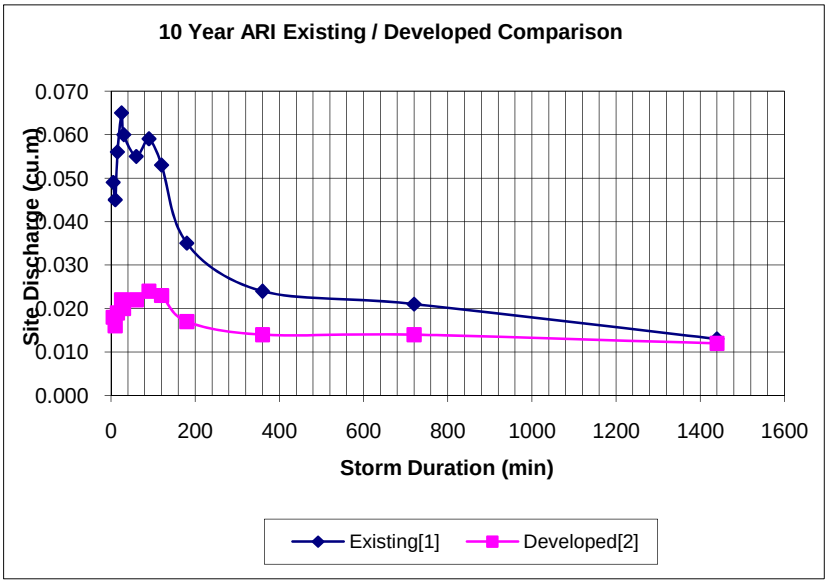
OSD Tank #2 - Site Discharge Impacts

For: Turner + Associates
At: Barber Avenue, Kingswood

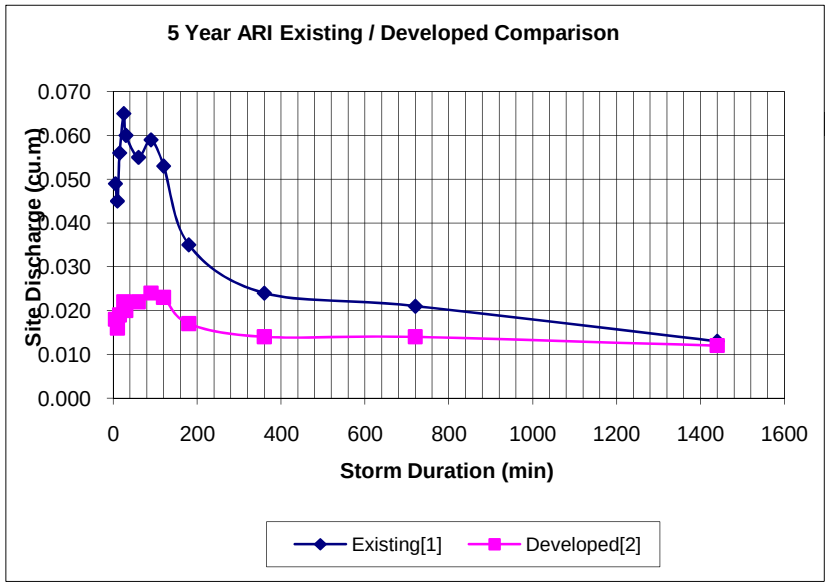
Contract No. AA003330
Prepared by: HM
DATE: 8-Sep-10

Drains Model: F:\AA003330\D-Calculations\Stormwater\4000-AA003330-NSC-01_100907_DrainsVerions2010-01-OUTPUT.xls
Drains Version: 2010-01

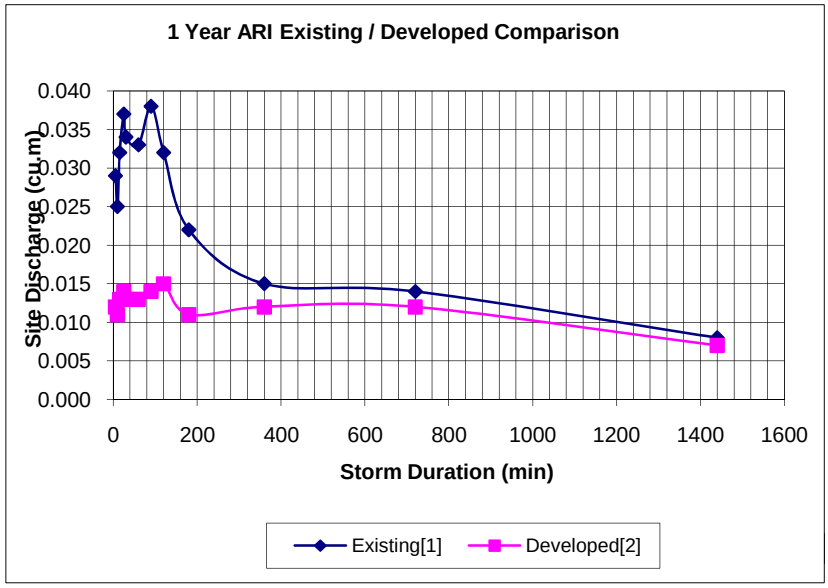
	10yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	0.049	0.018	-0.031
10	0.045	0.016	-0.029
15	0.056	0.019	-0.037
25	***0.065***	0.022	-0.043
30	0.060	0.020	-0.040
60	0.055	0.022	-0.033
90	0.059	***0.024***	-0.035
120	0.053	0.023	-0.030
180	0.035	0.017	-0.018
360	0.024	0.014	-0.010
720	0.021	0.014	-0.007
1440	0.013	0.012	-0.001
Max	0.065	0.024	-0.041



	5yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	0.049	0.018	-0.031
10	0.045	0.016	-0.029
15	0.056	0.019	-0.037
25	***0.065***	0.022	-0.043
30	0.060	0.020	-0.040
60	0.055	0.022	-0.033
90	0.059	***0.024***	-0.035
120	0.053	0.023	-0.030
180	0.035	0.017	-0.018
360	0.024	0.014	-0.010
720	0.021	0.014	-0.007
1440	0.013	0.012	-0.001
Max	0.065	0.024	-0.041



	2yr ARI Total		
Storm Dur. (min)	Existing[1]	Developed[2]	[2] - [1]
5	0.029	0.012	-0.017
10	0.025	0.011	-0.014
15	0.032	0.013	-0.019
25	0.037	0.014	-0.023
30	0.034	0.013	-0.021
60	0.033	0.013	-0.020
90	***0.038***	0.014	-0.024
120	0.032	***0.015***	-0.017
180	0.022	0.011	-0.011
360	0.015	0.012	-0.003
720	0.014	0.012	-0.002
1440	0.008	0.007	-0.001
Max	0.038	0.015	-0.023



OSD SUMMARY

DATE: 8-Sep-10

For: **Turner + Associates** **Contract No. AA003330**
At: **Barber Avenue, Kingswood** **Prepared by: HM**
Checked by:

	Tank #1 (west catchment)	Tank #2 (east catchment)
Storage Area (sq.m) =	40	37.5
Volume (cu.m) =	66	56.25
Tank Invert RL =	51	53.8
Low flow orifice =	72.5mm	55.0mm
IL =	51	53.8
High flow orifice =	40.0mm	60
IL =	52	54.25
Internal weir crest RL =	52.15	54.5
Crest Length =	10	10
Emergency weir RL =	52.65	55.5
Crest Length =	5	4.8
Height of weir =	1.65	1.7
Top of tank wall RL =	52.87	55.5 (pit in podium slab SSL)

Emergency Overflow Weirs

	Free flowing outlet pipe	Tank #1 Total outlet blockage & tank full			Free flowing outlet pipe	Tank #2 Total outlet blockage & tank full		
ARI	TWL in tank	TWL in tank	Flow over emergency weir cu.m/s	Depth over emergency weir (m)	TWL in tank	TWL in tank	Flow over emergency weir cu.m/s	Depth over emergency weir (m)
10	52.34	52.7	0.097	0.05	54.65	55.54	0.06	0.04
20	52.41	52.71	0.112	0.06	54.7	55.54	0.07	0.04
100	52.55	52.72	0.146	0.07	54.79	55.55	0.091	0.05

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

DESIGN 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	Part Full Shock Loss
Pit109	Sag	600x600 IA	600x600 IA	0.463	4.5	52.022	0.15	0	0	288131.6	6262350	No	8423819	1 x Ku
N335	Node					50.8		0		288122.8	6262319		8423877	
N324	Node					49.9		0		288088.4	6262328		8423833	
N341	Node							0		288167.4	6262371		8423907	
N351	Node							0		288225.4	6262351		8423950	
N357	Node							0		288243.7	6262280		8423970	
N392	Node							0		288372.8	6262391		12594276	
N393	Node					10		0		288299.1	6262392		12594281	
Pit128	OnGrade	Unlimited fa	Unlimited Ongrade		5	51.175		0	0	288336.5	6262369	No	23450149	1 x Ku
Pit138	OnGrade	NSW RTA	SA1		1.5	51.025		0	0	288337.4	6262355	No	1.3E+08	1 x Ku
N695	Node					50.8		0		288337.2	6262327		1.3E+08	
Pit132	OnGrade	NSW RTA	SF1		1.5	55.5		0	0	288408.5	6262370	No	31467178	1 x Ku
Pit146	OnGrade	NSW RTA	SA3		2.5	55.5		0	0	288412.9	6262354	No	1.43E+08	1 x Ku
Pit145	OnGrade	NSW RTA	SA1		2.5	55.5		0	0	288428.8	6262354	No	1.43E+08	1 x Ku
Pit144	OnGrade	NSW RTA	SA1		2.5	54		0	0	288430.6	6262294	No	1.43E+08	1 x Ku
N708	Node					53.704		0		288464	6262296		1.43E+08	
N574	Node							0		288359.2	6262298		52507797	
N599	Node							0		288562.5	6262358		79175474	
N600	Node							0		288594.1	6262357		79175475	
N601	Node							0		288667	6262358		79175476	
N602	Node							0		288697.1	6262360		79175477	
N603	Node							0		288584.2	6262342		79175478	
N605	Node							0		288685.5	6262348		79175480	
N607	Node							0		288632.1	6262336		82658925	
N608	Node							0		288632.1	6262322		82658929	
N689	Node							0		288207.2	6262268		1.29E+08	
N716	Node							0		288505.3	6262297		1.43E+08	
Pit154	Sag	NSW RTA	SA3	10	0	51.025	0.1	0	0	288320.9	6262355	No	1.46E+08	1 x Ku

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Init Vol. (cu	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Leng
Basin147	51	40	0	Orifice		72.5	51.0363			288321.6	6262389	No		
	52.2	40												
	53	40												
Basin185	51	0.5	0	Orifice		40	52.02			288344.5	6262389	No		
	51.2	0.5												
	53	0.5												
Basin228	53.8	37.5	0	Orifice		55	53.828			288392	6262391	No		
	55.3	37.5												
	55.301	1.44												
	55.5	1.44												
	55.501	50												
Basin230	53.8	0.5	0	Orifice		60	54.28			288416.7	6262390	No		
	56	0.5												

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %
Cat101	Pit109	0.1979	88	12	0	4	11	0						
Cat228	N335	0.1072	61	39	0	2	4	0						
Cat103	N341	0.0465	100	0	0	3	0	0						
Cat108	N351	0.2151	41	59	0	2.5	10	15						
Cat206	N392	0.0405	100	0	0	3	0	0						
Cat210	N393	0.1532	100	0	0	5	0	0						
Cat148	Basin147	0.2521	100	0	0	5	0	0						
Cat149	Basin228	0.1569	100	0	0	5	0	0						
Cat199														

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg
Pipe241	Pit109	N335	30.142	51.422	50.066	4.5	Concrete (i	300	300	0.03	New	1	Pit109	0
Pipe260	Basin147	Pit128	1	51	50.12	88	Concrete (i	525	525	0.3	NewFixed	1	Basin147	0
Pipe267	Pit128	Pit138	25	50.12	49.87	1	Concrete (i	300	300	0.3	New	1	Pit128	0
Pipe312	Pit138	N695	15	49.87	49.72	1	Concrete (i	300	300	0.3	New	1	Pit138	0
P265	Basin185	Pit128	1	51	50.12	88	Concrete (i	525	525	0.3	NewFixed	1	Basin185	0
P282	Basin228	Pit132	1	53.84	53.83	1	Concrete (i	525	525	0.3	NewFixed	1	Basin228	0
P286	Pit132	Pit146	10	53.83	53.73	1	Concrete (i	300	300	0.3	New	1	Pit132	0
Pipe319	Pit146	Pit145	5	53.73	53.68	1	Concrete (i	300	300	0.3	New	1	Pit146	0
Pipe318	Pit145	Pit144	40	53.68	53.28	1	Concrete (i	300	300	0.3	New	1	Pit145	0
Pipe317	Pit144	N708	18	53.28	53.1	1	Concrete (i	300	300	0.3	New	1	Pit144	0
P284	Basin230	Pit132	1	53.84	53.83	1	Concrete (i	525	525	0.3	NewFixed	1	Basin230	0
Pipe330	Pit154	Pit138	1	49.88	49.87	1	Concrete (i	300	300	0.3	New	1	Pit154	0

DETAILS of SERVICES CROSSING PIPES

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

CHANNEL DETAILS

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

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

DESIGN DATA

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)	SafeDepth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %		id
OF142	Pit109	N324	1				Grassed sv	0.5	0.4	1	4	0		8423874
OF145	N335	N324	0.1				Dummy us	0.2	0.05	0.6	1	0		8423878
OF161	N324	N689	0.1				Dummy us	0.2	0.05	0.6	1	0		8423909
OF166	N341	N335	1				Dummy us	0.2	0.05	0.6	1	0		8423916
OF192	N351	N357	0.1				Dummy us	0.2	0.05	0.6	1	0		8423956
OF493	N392	Pit146	0.1				Dummy us	0.2	0.05	0.6	1	0		1.43E+08
OF268	N393	Pit154	0.1				Dummy us	0.2	0.05	0.6	1	0		12594284
OF335	Basin147	Basin185	0.1	52.15	10	1.7	Dummy us	0.2	0.05	0.6	1	0		23450175
OF456	Pit128	Pit138	0.1				Dummy us	0.2	0.05	0.6	1	0		1.3E+08
OF453	Pit138	N695	0.1				Dummy us	0.2	0.05	0.6	1	0		1.3E+08
OF466	N695	N574	0.1				Dummy us	0.2	0.05	0.6	1	0		1.31E+08
OF331	Basin185	N695	0.1	52.65	5	1.7	Dummy us	0.2	0.05	0.6	1	0		23450166
OF330	Basin185	Basin147	0.1	52.15	10	1.7	Pathway 4	0.3	0.15	0.6	1	0		23450165
OF351	Basin228	Basin230	0.1	54.5	10	1.7	Dummy us	0.2	0.05	0.6	1	0		31467167
OF463	Pit132	N708	0.1				Dummy us	0.2	0.05	0.6	1	0		1.3E+08
OF478	Pit146	N708	0.1				Dummy us	0.2	0.05	0.6	1	0		1.43E+08
OF479	Pit145	N708	0.1				Dummy us	0.2	0.05	0.6	1	0		1.43E+08
OF480	Pit144	N708	0.1				Dummy us	0.2	0.05	0.6	1	0		1.43E+08
OF481	N708	N716	0.1				Dummy us	0.2	0.05	0.6	1	0		1.43E+08
OF356	Basin230	N708	0.1	55.5	5	1.7	Dummy us	0.2	0.05	0.6	1	0		31467180
OF353	Basin230	Basin228	0.1	54.5	10	1.7	Dummy us	0.2	0.05	0.6	1	0		31467170
OF401		N605												
OF402		N605												
OF411		N607												
OF414		N608												
OF503	Pit154	Pit138	0.1				Dummy us	0.2	0.05	0.6	1	0		1.46E+08

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
2 YEAR ARI

DRAINS results prepared 08 September, 2010 from Version 2010.01

PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond	Max Surfac	Max Pond	Min	Overflow	Constraint	
		HGL	Flow Arrivir	Volume	Freeboard	(cu.m/s)		
			(cu.m/s)	(cu.m)	(m)			
Pit109	51.83	52.02	0.048	0	0.2	0	None	
N335	50.14		0.037					
Pit128	50.3		0		0.88	0	None	
Pit138	50.13		0		0.89	0	None	
N695	49.85		0					
Pit132	53.94		0		1.56	0	None	
Pit146	53.89		0.011		1.61	0	None	
Pit145	53.84		0		1.66	0	None	
Pit144	53.44		0		0.56	0	None	
N708	53.17		0					
Pit154	50.13	51.07	0.04	2.6	0.89	0	None	

SUB-CATCHMENT DETAILS							
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)	
Cat101	0.048	0.047	0.001	4	11	0	AR&R 2 year, 5 minutes storm, average 96.8 mm/h, Zone 1
Cat228	0.025	0.017	0.008	2	4	0	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1
Cat103	0.013	0.013	0	3	0	0	AR&R 2 year, 5 minutes storm, average 96.8 mm/h, Zone 1
Cat108	0.038	0.021	0.016	2.5	10	15	AR&R 2 year, 1.5 hours storm, average 23.2 mm/h, Zone 1
Cat206	0.011	0.011	0	3	0	0	AR&R 2 year, 5 minutes storm, average 96.8 mm/h, Zone 1
Cat210	0.04	0.04	0	5	0	0	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1
Cat148	0.065	0.065	0	5	0	0	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1
Cat149	0.041	0.041	0	5	0	0	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.98 impervious + 0.19 pervious = 1.17 total ha)

Storm	Total Rainf	Total Runo	Impervious	Pervious Runoff
	cu.m	cu.m (Runo	cu.m (Runo	cu.m (Runoff %)
AR&R 2 year, 5 mir	94.33	71.11 (75.4	69.04 (87.6	2.08 (13.4%)
AR&R 2 year, 10 m	143.45	116.33 (81	110.07 (91	6.26 (26.5%)
AR&R 2 year, 15 m	179.8	149.82 (83	140.43 (93	9.38 (31.7%)
AR&R 2 year, 25 m	232.91	197.73 (84	184.80 (95	12.93 (33.7%)
AR&R 2 year, 30 m	253.76	215.49 (84	202.22 (95	13.26 (31.8%)
AR&R 2 year, 1 hou	343.8	295.93 (86	277.45 (96	18.49 (32.7%)
AR&R 2 year, 1.5 h	406.95	350.78 (86	330.20 (97	20.58 (30.7%)
AR&R 2 year, 2 hou	458.4	396.47 (86	373.19 (97	23.28 (30.9%)
AR&R 2 year, 3 hou	536.75	464.44 (86	438.64 (97	25.80 (29.2%)
AR&R 2 year, 6 hou	708.66	613.93 (86	582.24 (98	31.68 (27.2%)
AR&R 2 year, 12 ho	926.16	810.39 (87	764.03 (98	46.36 (30.4%)
AR&R 2 year, 24 ho	1178.76	1009.20 (8	975.07 (99	34.14 (17.6%)

PIPE DETAILS					
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)	
Pipe241	0.048	3.4	51.497	50.141	AR&R 2 year, 5 minutes storm, average 96.8 mm/h, Zone 1
Pipe260	0.012	17.5	51.008	50.3	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
Pipe267	0.013	1.2	50.182	50.134	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
Pipe312	0.047	1.6	50	49.85	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1
P265	0.001	55.2	51.001	50.3	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
P282	0.005	0.2	53.936	53.936	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
P286	0.009	0.9	53.889	53.889	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
Pipe319	0.015	0.6	53.839	53.839	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
Pipe318	0.015	1.3	53.747	53.439	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
Pipe317	0.015	1.3	53.347	53.167	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
P284	0.004	0.1	53.936	53.936	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1
Pipe330	0.038	0.6	50.134	50.134	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1

CHANNEL DETAILS					
Name	Max Q	Max V	Chainage	Max	Due to Storm
	(cu.m/s)	(m/s)	(m)	HGL (m)	

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DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
2 YEAR ARI

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	
OF142	0	0	1.347	0	0	0	0		
OF145	0.085	0.085	0.256	0.033	0.02	10.56	0.47	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1	
OF161	0.085	0.085	0.256	0.033	0.02	10.56	0.47	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1	
OF166	0.013	0.013	0.256	0.016	0	5.24	0.3	AR&R 2 year, 5 minutes storm, average 96.8 mm/h, Zone 1	
OF192	0.038	0.038	0.256	0.025	0.01	8.23	0.37	AR&R 2 year, 1.5 hours storm, average 23.2 mm/h, Zone 1	
OF493	0.011	0.011	0.256	0.016	0	5.24	0.26	AR&R 2 year, 5 minutes storm, average 96.8 mm/h, Zone 1	
OF268	0.04	0.04	0.256	0.025	0.01	8.23	0.39	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1	
OF335	0.002	0.002	0.256	0.009	0	2.84	0.19	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1	
OF456	0	0	0.256	0	0	0	0		
OF453	0	0	0.256	0	0	0	0		
OF466	0.047	0.047	0.256	0.026	0.01	8.83	0.4	AR&R 2 year, 25 minutes storm, average 47.8 mm/h, Zone 1	
OF331	0	0	0.256	0	0	0	0		
OF330	0	0	0.565	0	0	0	0		
OF351	0.13	0.13	0.256	0.038	0.02	11.63	0.54	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1	
OF463	0	0	0.256	0	0	0	0		
OF478	0	0	0.256	0	0	0	0		
OF479	0	0	0.256	0	0	0	0		
OF480	0	0	0.256	0	0	0	0		
OF481	0.015	0.015	0.256	0.018	0.01	5.84	0.29	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1	
OF356	0	0	0.256	0	0	0	0		
OF353	0.126	0.126	0.256	0.038	0.02	11.63	0.53	AR&R 2 year, 2 hours storm, average 19.6 mm/h, Zone 1	
OF503	0	0	0.256	0	0	0	0		

DETENTION BASIN DETAILS									
Name	Max WL	MaxVol	Max Q	Max Q	Max Q				
			Total	Low Level	High Level				
Basin147	52.15	46.2	0.014	0.012	0.002				
Basin185	52.14	0.7	0.001	0.001	0				
Basin228	54.54	27.8	0.135	0.005	0.13				
Basin230	54.54	0.5	0.13	0.004	0.126				

CONTINUITY CHECK for AR&R 2 year, 1.5 hours storm, average 23.2 mm/h, Zone 1									
Node	Inflow	Outflow	Storage Ch	Difference					
	(cu.m)	(cu.m)	(cu.m)	%					
Pit109	61.4	61.38	0	0					
N335	103.68	103.68	0	0					
N324	103.68	103.68	0	0					
N341	15.72	15.72	0	0					
N351	43.37	43.37	0	0					
N357	43.37	43.37	0	0					
N392	13.69	13.69	0	0					
N393	51.78	51.78	0	0					
Basin147	85.21	77.7	7.53	0					
Pit128	77.7	77.69	0	0					
Pit138	129.47	129.45	0	0					
N695	129.45	129.43	0	0					
Basin185	0	0	0	0					
Basin228	148.08	138.09	9.97	0					
Pit132	42.74	42.73	0	0					
Pit146	56.42	56.41	0	0					
Pit145	56.41	56.4	0	0					
Pit144	56.4	56.39	0	0					
N708	56.39	56.38	0	0					
Basin230	102.57	102.28	0.3	0					
N574	129.41	129.41	0	0					
N689	103.68	103.68	0	0					
N716	56.37	56.37	0	0					
Pit154	51.78	51.78	0	0					

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DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
2 YEAR ARI

Run Log for 20100906 run at 08:59:29 on 8/9/2010

No water upwelling from any pit. Freeboard was adequate at all pits.

The following detention basins have little effect (less than 2%) in reducing peak discharge: Basin230, Basin228 You might consider upsizing these, or removing them from the m

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
5 YEAR ARI

DRAINS results prepared 08 September, 2010 from Version 2010.01

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivin (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Pit109	51.9	52.02	0.063	0	0.12	0	None
N335	50.16		0.049				
Pit128	50.75		0		0.43	0	None
Pit138	50.74		0		0.28	0	None
N695	50.65		0				
Pit132	53.94		0		1.56	0	None
Pit146	53.93		0.014		1.57	0	None
Pit145	53.88		0		1.62	0	None
Pit144	53.57		0		0.43	0	None
N708	53.55		0				
Pit154	50.74	51.07	0.052	3.3	0.28	0	None

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Cat101	0.063	0.059	0.004	4	11	0	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1
Cat228	0.033	0.022	0.011	2	4	0	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1
Cat103	0.016	0.016	0	3	0	0	AR&R 5 year, 5 minutes storm, average 126 mm/h, Zone 1
Cat108	0.055	0.03	0.025	2.5	10	15	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1
Cat206	0.014	0.014	0	3	0	0	AR&R 5 year, 5 minutes storm, average 126 mm/h, Zone 1
Cat210	0.052	0.052	0	5	0	0	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1
Cat148	0.085	0.085	0	5	0	0	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1
Cat149	0.053	0.053	0	5	0	0	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.98 impervious + 0.19 pervious = 1.17 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Runc	Impervious cu.m (Runc	Pervious Runoff cu.m (Runoff %)
AR&R 5 year, 5 min	122.79	99.15 (80.7	92.81 (90.5	6.34 (31.4%)
AR&R 5 year, 10 m	187.3	159.85 (85	146.70 (93	13.15 (42.7%)
AR&R 5 year, 15 m	234.46	204.06 (87	186.11 (95	17.96 (46.5%)
AR&R 5 year, 25 m	303.56	267.69 (88	243.83 (96	23.87 (47.8%)
AR&R 5 year, 30 m	330.36	291.64 (88	266.22 (96	25.43 (46.8%)
AR&R 5 year, 1 hou	449.05	399.76 (89	365.37 (97	34.39 (46.5%)
AR&R 5 year, 1.5 h	529.74	472.21 (89	432.78 (97	39.42 (45.2%)
AR&R 5 year, 2 hou	594.06	530.25 (89	486.52 (98	43.74 (44.7%)
AR&R 5 year, 3 hou	698.13	624.48 (89	573.50 (98	50.98 (44.4%)
AR&R 5 year, 6 hou	919.15	820.37 (89	758.18 (98	62.19 (41.1%)
AR&R 5 year, 12 ho	1192.79	1062.55 (8	986.72 (99	75.83 (38.6%)
AR&R 5 year, 24 ho	1560.45	1365.04 (8	1294.38 (9	70.66 (27.5%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe241	0.063	3.5	51.512	50.156	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1
Pipe260	0.012	17	51.008	50.75	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1
Pipe267	0.014	0.2	50.744	50.742	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1
Pipe312	0.059	0.8	50.687	50.65	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1
P265	0.002	45.6	51.001	50.75	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1
P282	0.005	0.2	53.943	53.943	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1
P286	0.01	0.5	53.928	53.928	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1
Pipe319	0.022	0.6	53.877	53.877	AR&R 5 year, 1.5 hours storm, average 30.2 mm/h, Zone 1
Pipe318	0.022	1.3	53.764	53.573	AR&R 5 year, 1.5 hours storm, average 30.2 mm/h, Zone 1
Pipe317	0.022	0.3	53.561	53.554	AR&R 5 year, 1.5 hours storm, average 30.2 mm/h, Zone 1
P284	0.004	0.1	53.943	53.943	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1
Pipe330	0.049	0.7	50.742	50.742	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1

CHANNEL DETAILS

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

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DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
5 YEAR ARI

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	
OF142	0	0	1.347	0	0	0	0		
OF145	0.112	0.112	0.256	0.036	0.02	11.27	0.51	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1	
OF161	0.112	0.112	0.256	0.036	0.02	11.27	0.51	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1	
OF166	0.016	0.016	0.256	0.018	0.01	5.84	0.32	AR&R 5 year, 5 minutes storm, average 126 mm/h, Zone 1	
OF192	0.055	0.055	0.256	0.028	0.01	9.43	0.41	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1	
OF493	0.014	0.014	0.256	0.017	0.01	5.54	0.31	AR&R 5 year, 5 minutes storm, average 126 mm/h, Zone 1	
OF268	0.052	0.052	0.256	0.027	0.01	9.13	0.41	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1	
OF335	0.772	0.772	0.256	0.079	0.07	19.72	0.89	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1	
OF456	0	0	0.256	0	0	0	0		
OF453	0	0	0.256	0	0	0	0		
OF466	0.059	0.059	0.256	0.029	0.01	9.73	0.42	AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1	
OF331	0	0	0.256	0	0	0	0		
OF330	0.77	0.77	0.565	0.171	0.27	4	1.59	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1	
OF351	0.597	0.597	0.256	0.07	0.06	18.1	0.83	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1	
OF463	0	0	0.256	0	0	0	0		
OF478	0	0	0.256	0	0	0	0		
OF479	0	0	0.256	0	0	0	0		
OF480	0	0	0.256	0	0	0	0		
OF481	0.022	0.022	0.256	0.02	0.01	6.74	0.32	AR&R 5 year, 1.5 hours storm, average 30.2 mm/h, Zone 1	
OF356	0	0	0.256	0	0	0	0		
OF353	0.593	0.593	0.256	0.07	0.06	18.1	0.83	AR&R 5 year, 2 hours storm, average 25.4 mm/h, Zone 1	
OF503	0	0	0.256	0	0	0	0		

DETENTION BASIN DETAILS					
Name	Max WL	MaxVol	Max Q	Max Q	Max Q
			Total	Low Level	High Level
Basin147	52.28	51.2	0.784	0.012	0.772
Basin185	52.28	0.8	0.772	0.002	0.77
Basin228	54.61	30.4	0.603	0.005	0.597
Basin230	54.61	0.5	0.598	0.004	0.593

CONTINUITY CHECK for AR&R 5 year, 25 minutes storm, average 62.3 mm/h, Zone 1				
Node	Inflow	Outflow	Storage Ch	Difference
	(cu.m)	(cu.m)	(cu.m)	%
Pit109	46.4	46.39	0	0
N335	79.55	79.55	0	0
N324	79.55	79.55	0	0
N341	11.61	11.61	0	0
N351	37.71	37.71	0	0
N357	37.71	37.71	0	0
N392	10.11	10.11	0	0
N393	38.24	38.24	0	0
Basin147	96.26	83.93	12.29	0
Pit128	49.99	49.95	0	0.1
Pit138	88.13	88.2	0	-0.1
N695	88.2	88.18	0	0
Basin185	34.93	34.33	0.6	0
Basin228	163.28	151.05	12.21	0
Pit132	26.63	26.62	0	0
Pit146	36.73	36.72	0	0
Pit145	36.72	36.7	0	0
Pit144	36.7	36.69	0	0
N708	36.69	36.68	0	0
Basin230	128.98	128.68	0.3	0
N574	88.16	88.16	0	0
N689	79.55	79.55	0	0
N716	36.67	36.67	0	0
Pit154	38.24	38.18	0	0.2

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DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
5 YEAR ARI

Run Log for 20100906 run at 09:04:32 on 8/9/2010

No water upwelling from any pit.

Freeboard was less than 0.15m at Pit109

The maximum flow exceeded the safe value in the following overflow routes: OF353, OF351, OF335, OF330

The following detention basins have little effect (less than 2%) in reducing peak discharge: Basin230, Basin228, Basin185, Basin147 You might consider upsizing these, or rem

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
10 YEAR ARI

DRAINS results prepared 08 September, 2010 from Version 2010.01

PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond	Max Surfac	Max Pond	Min	Overflow	Constraint	
		HGL	Flow Arrivi	Volume	Freeboard	(cu.m/s)		
			(cu.m/s)	(cu.m)	(m)			
Pit109	51.96	52.02	0.072	0	0.06	0	None	
N335	50.16		0.056					
Pit128	50.93		0		0.25	0	None	
Pit138	50.92		0		0.11	0	None	
N695	50.8		0					
Pit132	53.95		0		1.55	0	None	
Pit146	53.94		0.016		1.56	0	None	
Pit145	53.89		0		1.61	0	None	
Pit144	53.73		0		0.27	0	None	
N708	53.7		0					
Pit154	50.92	51.08	0.059	3.7	0.11	0	None	

SUB-CATCHMENT DETAILS							
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)	
Cat101	0.072	0.067	0.005	4	11	0	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1
Cat228	0.038	0.025	0.013	2	4	0	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1
Cat103	0.019	0.019	0	3	0	0	AR&R 10 year, 5 minutes storm, average 144 mm/h, Zone 1
Cat108	0.065	0.034	0.032	2.5	10	15	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1
Cat206	0.016	0.016	0	3	0	0	AR&R 10 year, 5 minutes storm, average 144 mm/h, Zone 1
Cat210	0.059	0.059	0	5	0	0	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1
Cat148	0.097	0.097	0	5	0	0	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1
Cat149	0.06	0.06	0	5	0	0	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.98 impervious + 0.19 pervious = 1.17 total ha)

Storm	Total Rainf	Total Runo	Impervious	Pervious Runoff
	cu.m	cu.m (Runo	cu.m (Runo	cu.m (Runoff %)
AR&R 10 year, 5 m	140.33	116.58 (83	107.46 (91	9.12 (39.5%)
AR&R 10 year, 10 r	213.42	185.84 (87	168.52 (94	17.32 (49.3%)
AR&R 10 year, 15 r	266.62	236.02 (88	212.97 (95	23.05 (52.5%)
AR&R 10 year, 25 r	345.46	309.35 (89	278.83 (96	30.51 (53.7%)
AR&R 10 year, 30 r	375.96	337.07 (89	304.32 (96	32.76 (52.9%)
AR&R 10 year, 1 ho	511.03	461.40 (90	417.15 (97	44.25 (52.6%)
AR&R 10 year, 1.5	603.41	545.56 (90	494.33 (98	51.24 (51.6%)
AR&R 10 year, 2 ho	675.91	611.61 (90	554.90 (98	56.71 (51.0%)
AR&R 10 year, 3 ho	792.85	718.52 (90	652.58 (98	65.95 (50.5%)
AR&R 10 year, 6 ho	1038.43	938.06 (90	857.79 (98	80.27 (47.0%)
AR&R 10 year, 12 h	1333.12	1198.33 (8	1103.96 (9	94.37 (43.0%)
AR&R 10 year, 24 h	1790.59	1581.60 (8	1486.26 (9	95.33 (32.3%)

PIPE DETAILS					
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)	
Pipe241	0.072	3.7	51.519	50.163	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1
Pipe260	0.013	16.8	51.009	50.925	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1
Pipe267	0.015	0.2	50.919	50.916	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1
Pipe312	0.067	0.9	50.847	50.8	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1
P265	0.002	43.2	51.001	50.925	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1
P282	0.005	0.2	53.951	53.951	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1
P286	0.01	0.4	53.939	53.939	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1
Pipe319	0.024	0.6	53.888	53.888	AR&R 10 year, 1.5 hours storm, average 34.4 mm/h, Zone 1
Pipe318	0.024	1.3	53.769	53.726	AR&R 10 year, 1.5 hours storm, average 34.4 mm/h, Zone 1
Pipe317	0.024	0.3	53.712	53.704	AR&R 10 year, 1.5 hours storm, average 34.4 mm/h, Zone 1
P284	0.005	0.1	53.951	53.951	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1
Pipe330	0.056	0.8	50.916	50.916	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1

CHANNEL DETAILS					
Name	Max Q	Max V	Chainage	Max	Due to Storm
	(cu.m/s)	(m/s)	(m)	HGL (m)	

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
10 YEAR ARI

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	
OF142	0	0	1.347	0	0	0	0		
OF145	0.128	0.128	0.256	0.038	0.02	11.63	0.54	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1	
OF161	0.128	0.128	0.256	0.038	0.02	11.63	0.54	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1	
OF166	0.019	0.019	0.256	0.018	0.01	6.14	0.33	AR&R 10 year, 5 minutes storm, average 144 mm/h, Zone 1	
OF192	0.065	0.065	0.256	0.03	0.01	10.02	0.43	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1	
OF493	0.016	0.016	0.256	0.018	0.01	5.84	0.32	AR&R 10 year, 5 minutes storm, average 144 mm/h, Zone 1	
OF268	0.059	0.059	0.256	0.029	0.01	9.73	0.41	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1	
OF335	1.384	1.384	0.256	0.099	0.1	23.85	1.05	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1	
OF456	0	0	0.256	0	0	0	0		
OF453	0	0	0.256	0	0	0	0		
OF466	0.067	0.067	0.256	0.03	0.01	10.02	0.44	AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1	
OF331	0	0	0.256	0	0	0	0		
OF330	1.383	1.383	0.565	0.224	0.45	4	1.99	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1	
OF351	0.967	0.967	0.256	0.086	0.08	21.15	0.95	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1	
OF463	0	0	0.256	0	0	0	0		
OF478	0	0	0.256	0	0	0	0		
OF479	0	0	0.256	0	0	0	0		
OF480	0	0	0.256	0	0	0	0		
OF481	0.024	0.024	0.256	0.02	0.01	6.74	0.35	AR&R 10 year, 1.5 hours storm, average 34.4 mm/h, Zone 1	
OF356	0	0	0.256	0	0	0	0		
OF353	0.962	0.962	0.256	0.086	0.08	21.15	0.94	AR&R 10 year, 2 hours storm, average 28.9 mm/h, Zone 1	
OF503	0	0	0.256	0	0	0	0		

DETENTION BASIN DETAILS									
Name	Max WL	MaxVol	Max Q	Max Q	Max Q				
			Total	Low Level	High Level				
Basin147	52.34	53.6	1.397	0.013	1.384				
Basin185	52.34	0.8	1.385	0.002	1.383				
Basin228	54.65	31.9	0.972	0.005	0.967				
Basin230	54.65	0.6	0.967	0.005	0.962				

CONTINUITY CHECK for AR&R 10 year, 25 minutes storm, average 70.9 mm/h, Zone 1									
Node	Inflow	Outflow	Storage Ch	Difference					
	(cu.m)	(cu.m)	(cu.m)	%					
Pit109	53.45	53.44	0	0					
N335	92.09	92.09	0	0					
N324	92.09	92.09	0	0					
N341	13.27	13.27	0	0					
N351	45.23	45.23	0	0					
N357	45.23	45.23	0	0					
N392	11.56	11.56	0	0					
N393	43.73	43.73	0	0					
Basin147	449.85	433.86	16.01	0					
Pit128	55.37	55.32	0	0.1					
Pit138	98.99	99.06	0	-0.1					
N695	99.06	99.04	0	0					
Basin185	380.71	380.11	0.6	0					
Basin228	455.25	441.3	13.96	0					
Pit132	30.55	30.54	0	0					
Pit146	42.1	42.08	0	0					
Pit145	42.08	42.07	0	0					
Pit144	42.07	42.06	0	0					
N708	42.06	42.04	0	0					
Basin230	417.98	417.7	0.3	0					
N574	99.01	99.01	0	0					
N689	92.09	92.09	0	0					
N716	42.03	42.03	0	0					
Pit154	43.73	43.67	0	0.1					

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
10 YEAR ARI

Run Log for 20100906 run at 09:07:01 on 8/9/2010

No water upwelling from any pit.

Freeboard was less than 0.15m at Pit154, Pit138, Pit109

The maximum flow exceeded the safe value in the following overflow routes: OF353, OF351, OF335, OF330

The following detention basins have little effect (less than 2%) in reducing peak discharge: Basin230, Basin228, Basin185, Basin147 You might consider upsizing these, or rem

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
20 YEAR ARI

DRAINS results prepared 08 September, 2010 from Version 2010.01

PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond	Max Surfac	Max Pond	Min	Overflow	Constraint	
		HGL	Flow Arrivin	Volume	Freeboard	(cu.m/s)		
			(cu.m/s)	(cu.m)	(m)			
Pit109	52.02	52.02	0.084	0	0	0	Outlet System	
N335	50.17		0.066					
Pit128	50.97		0		0.21	0	None	
Pit138	50.96		0		0.07	0	None	
N695	50.8		0					
Pit132	53.96		0		1.54	0	None	
Pit146	53.95		0.019		1.55	0	None	
Pit145	53.9		0		1.6	0	None	
Pit144	53.73		0		0.27	0	None	
N708	53.7		0					
Pit154	50.96	51.08	0.068	4.3	0.07	0	None	

SUB-CATCHMENT DETAILS							
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)	
Cat101	0.084	0.077	0.007	4	11	0	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
Cat228	0.045	0.029	0.016	2	4	0	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
Cat103	0.022	0.022	0	3	0	0	AR&R 20 year, 5 minutes storm, average 167 mm/h, Zone 1
Cat108	0.079	0.039	0.039	2.5	10	15	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
Cat206	0.019	0.019	0	3	0	0	AR&R 20 year, 5 minutes storm, average 167 mm/h, Zone 1
Cat210	0.068	0.068	0	5	0	0	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
Cat148	0.112	0.112	0	5	0	0	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
Cat149	0.07	0.07	0	5	0	0	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.98 impervious + 0.19 pervious = 1.17 total ha)

Storm	Total Rainf	Total Runo	Impervious	Pervious Runoff
	cu.m	cu.m (Runo	cu.m (Runo	cu.m (Runoff %)
AR&R 20 year, 5 m	162.74	138.90 (85	126.19 (92	12.71 (47.4%)
AR&R 20 year, 10 r	247.52	219.83 (88	197.02 (95	22.81 (56.0%)
AR&R 20 year, 15 r	309.31	278.51 (90	248.63 (96	29.87 (58.7%)
AR&R 20 year, 25 r	400.03	363.67 (90	324.42 (97	39.25 (59.6%)
AR&R 20 year, 30 r	436.19	397.11 (91	354.63 (97	42.48 (59.2%)
AR&R 20 year, 1 ho	591.72	541.74 (91	484.56 (98	57.18 (58.7%)
AR&R 20 year, 1.5	699.89	641.78 (91	574.93 (98	66.85 (58.0%)
AR&R 20 year, 2 ho	783.5	718.79 (91	644.78 (98	74.01 (57.4%)
AR&R 20 year, 3 ho	919.15	844.22 (91	758.11 (98	86.12 (56.9%)
AR&R 20 year, 6 ho	1206.82	1104.25 (9	998.46 (99	105.80 (53.3%)
AR&R 20 year, 12 h	1543.61	1402.69 (9	1279.87 (9	122.83 (48.3%)
AR&R 20 year, 24 h	2088.08	1862.43 (8	1734.66 (9	127.77 (37.2%)

PIPE DETAILS					
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)	
Pipe241	0.084	3.8	51.528	50.172	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
Pipe260	0.013	16.6	51.009	50.968	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1
Pipe267	0.015	0.2	50.959	50.956	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1
Pipe312	0.078	1.1	50.863	50.8	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
P265	0.002	41.1	51.001	50.968	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1
P282	0.006	0.1	53.962	53.962	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1
P286	0.01	0.4	53.954	53.954	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1
Pipe319	0.027	0.6	53.902	53.902	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
Pipe318	0.027	1.4	53.775	53.732	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
Pipe317	0.027	0.4	53.714	53.704	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1
P284	0.005	0.1	53.962	53.962	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1
Pipe330	0.064	0.9	50.956	50.956	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1

CHANNEL DETAILS					
Name	Max Q	Max V	Chainage	Max	Due to Storm
	(cu.m/s)	(m/s)	(m)	HGL (m)	

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DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
20 YEAR ARI

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	
OF142	0	0	1.347	0	0	0	0		
OF145	0.15	0.15	0.256	0.041	0.02	12.17	0.55	AR&R 20 year, 5 minutes storm, average 167 mm/h, Zone 1	
OF161	0.15	0.15	0.256	0.041	0.02	12.17	0.55	AR&R 20 year, 5 minutes storm, average 167 mm/h, Zone 1	
OF166	0.022	0.022	0.256	0.02	0.01	6.74	0.32	AR&R 20 year, 5 minutes storm, average 167 mm/h, Zone 1	
OF192	0.079	0.079	0.256	0.032	0.01	10.38	0.46	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1	
OF493	0.019	0.019	0.256	0.018	0.01	6.14	0.33	AR&R 20 year, 5 minutes storm, average 167 mm/h, Zone 1	
OF268	0.068	0.068	0.256	0.03	0.01	10.02	0.45	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1	
OF335	2.226	2.226	0.256	0.121	0.14	28.16	1.18	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1	
OF456	0	0	0.256	0	0	0	0		
OF453	0	0	0.256	0	0	0	0		
OF466	0.078	0.078	0.256	0.032	0.01	10.38	0.46	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1	
OF331	0	0	0.256	0	0	0	0		
OF330	2.224	2.224	0.565	0.283	0.68	4	2.38	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1	
OF351	1.47	1.47	0.256	0.102	0.11	24.39	1.06	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1	
OF463	0	0	0.256	0	0	0	0		
OF478	0	0	0.256	0	0	0	0		
OF479	0	0	0.256	0	0	0	0		
OF480	0	0	0.256	0	0	0	0		
OF481	0.027	0.027	0.256	0.021	0.01	7.03	0.36	AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1	
OF356	0	0	0.256	0	0	0	0		
OF353	1.465	1.465	0.256	0.102	0.11	24.39	1.06	AR&R 20 year, 2 hours storm, average 33.5 mm/h, Zone 1	
OF503	0	0	0.256	0	0	0	0		

DETENTION BASIN DETAILS									
Name	Max WL	MaxVol	Max Q	Max Q	Max Q				
			Total	Low Level	High Level				
Basin147	52.41	56.4	2.239	0.013	2.226				
Basin185	52.41	0.8	2.226	0.002	2.224				
Basin228	54.7	33.7	1.475	0.006	1.47				
Basin230	54.7	0.6	1.47	0.005	1.465				

CONTINUITY CHECK for AR&R 20 year, 25 minutes storm, average 82.1 mm/h, Zone 1									
Node	Inflow	Outflow	Storage Ch	Difference					
	(cu.m)	(cu.m)	(cu.m)	%					
Pit109	62.65	62.64	0	0					
N335	108.43	108.43	0	0					
N324	108.43	108.43	0	0					
N341	15.44	15.44	0	0					
N351	55.09	55.09	0	0					
N357	55.09	55.09	0	0					
N392	13.45	13.45	0	0					
N393	50.88	50.88	0	0					
Basin147	1325.99	1304.39	21.63	0					
Pit128	61.54	61.5	0	0.1					
Pit138	112.31	112.38	0	-0.1					
N695	112.38	112.35	0	0					
Basin185	1246.63	1246.05	0.6	0					
Basin228	1038.2	1021.74	16.36	0					
Pit132	35.36	35.34	0	0					
Pit146	48.79	48.78	0	0					
Pit145	48.78	48.76	0	0					
Pit144	48.76	48.75	0	0					
N708	48.75	48.73	0	0					
Basin230	997.01	996.72	0.3	0					
N574	112.32	112.32	0	0					
N689	108.43	108.43	0	0					
N716	48.72	48.72	0	0					
Pit154	50.88	50.82	0	0.1					

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
20 YEAR ARI

Run Log for 20100906 run at 09:09:00 on 8/9/2010

No water upwelling from any pit.

Freeboard was less than 0.15m at Pit154, Pit138, Pit109

The maximum flow exceeded the safe value in the following overflow routes: OF353, OF351, OF335, OF330

The following detention basins have little effect (less than 2%) in reducing peak discharge: Basin230, Basin228, Basin185, Basin147 You might consider upsizing these, or rem

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
50 YEAR ARI

DRAINS results prepared 08 September, 2010 from Version 2010.01

PIT / NODE DETAILS				Version 8												
Name	Max HGL	Max Pond	Max Surfac	Max Pond	Min	Overflow	Constraint									
		HGL	Flow Arrivi	Volume	Freeboard	(cu.m/s)										
			(cu.m/s)	(cu.m)	(m)											
Pit109	52.11	52.17	0.099	0.5	-0.09	0.006	Outlet System									
N335	50.18		0.08													
Pit128	51.04		0		0.13	0	None									
Pit138	51.03		0		0	0.028	Outlet System									
N695	50.95		0.028													
Pit132	53.97		0		1.53	0	None									
Pit146	53.96		0.022		1.54	0	None									
Pit145	53.91		0		1.59	0	None									
Pit144	53.74		0		0.26	0	None									
N708	53.7		0													
Pit154	51.03	51.09	0.079	4.7	0	0	Outlet System									

SUB-CATCHMENT DETAILS																
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm									
	Flow Q	Max Q	Max Q	Tc	Tc	Tc										
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)										
Cat101	0.099	0.095	0.004	4	11	0	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1									
Cat228	0.055	0.036	0.019	2	4	0	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1									
Cat103	0.025	0.025	0	3	0	0	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1									
Cat108	0.085	0.042	0.043	2.5	10	15	AR&R 50 year, 25 minutes storm, average 97 mm/h, Zone 1									
Cat206	0.022	0.022	0	3	0	0	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1									
Cat210	0.079	0.079	0	5	0	0	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1									
Cat148	0.13	0.13	0	5	0	0	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1									
Cat149	0.081	0.081	0	5	0	0	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1									

Outflow Volumes for Total Catchment (0.98 impervious + 0.19 pervious = 1.17 total ha)

Storm	Total Rainf	Total Runo	Impervious	Pervious Runoff
	cu.m	cu.m (Runo	cu.m (Runo	cu.m (Runoff %)
AR&R 50 year, 5 m	191.98	168.04 (87	150.61 (93	17.42 (55.1%)
AR&R 50 year, 10 r	292.74	264.89 (90	234.79 (96	30.10 (62.5%)
AR&R 50 year, 15 r	365.44	334.35 (91	295.52 (96	38.83 (64.6%)
AR&R 50 year, 25 r	472.63	435.64 (92	385.08 (97	50.56 (65.0%)
AR&R 50 year, 30 r	514.54	474.98 (92	420.08 (97	54.89 (64.8%)
AR&R 50 year, 1 ho	699.3	648.62 (92	574.44 (98	74.19 (64.5%)
AR&R 50 year, 1.5	826.18	767.60 (92	680.44 (98	87.16 (64.1%)
AR&R 50 year, 2 ho	926.16	861.17 (93	763.97 (98	97.19 (63.8%)
AR&R 50 year, 3 ho	1084.03	1007.89 (9	895.83 (98	112.07 (62.8%)
AR&R 50 year, 6 ho	1417.31	1311.17 (9	1174.24 (9	136.94 (58.7%)
AR&R 50 year, 12 h	1796.2	1645.80 (9	1491.05 (9	154.75 (52.3%)
AR&R 50 year, 24 h	2489.42	2242.58 (9	2070.51 (9	172.07 (42.0%)

PIPE DETAILS					
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)	
Pipe241	0.094	3.8	51.535	50.179	AR&R 50 year, 15 minutes storm, average 125 mm/h, Zone 1
Pipe260	0.013	1.7	51.041	51.041	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
Pipe267	0.016	0.2	51.03	51.025	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
Pipe312	0.054	0.8	50.981	50.95	AR&R 50 year, 25 minutes storm, average 97 mm/h, Zone 1
P265	0.002	0.3	51.041	51.041	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
P282	0.006	0.1	53.971	53.971	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
P286	0.011	0.4	53.963	53.963	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
Pipe319	0.028	0.6	53.91	53.91	AR&R 50 year, 1.5 hours storm, average 47.1 mm/h, Zone 1
Pipe318	0.028	1.4	53.779	53.735	AR&R 50 year, 1.5 hours storm, average 47.1 mm/h, Zone 1
Pipe317	0.028	0.4	53.715	53.704	AR&R 50 year, 1.5 hours storm, average 47.1 mm/h, Zone 1
P284	0.005	0.1	53.971	53.971	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
Pipe330	0.071	1	51.025	51.025	AR&R 50 year, 15 minutes storm, average 125 mm/h, Zone 1

CHANNEL DETAILS					
Name	Max Q	Max V	Chainage	Max	Due to Storm
	(cu.m/s)	(m/s)	(m)	HGL (m)	

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
50 YEAR ARI

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
OF142	0.006	0.006	1.347	0.045	0.04	0.36	0.77	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1
OF145	0.173	0.173	0.256	0.043	0.03	12.53	0.59	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1
OF161	0.173	0.173	0.256	0.043	0.03	12.53	0.59	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1
OF166	0.025	0.025	0.256	0.021	0.01	7.03	0.34	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1
OF192	0.085	0.085	0.256	0.033	0.02	10.56	0.47	AR&R 50 year, 25 minutes storm, average 97 mm/h, Zone 1
OF493	0.022	0.022	0.256	0.02	0.01	6.74	0.33	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1
OF268	0.079	0.079	0.256	0.032	0.01	10.38	0.47	AR&R 50 year, 5 minutes storm, average 197 mm/h, Zone 1
OF335	3.369	3.369	0.256	0.143	0.19	32.65	1.31	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
OF456	0	0	0.256	0	0	0	0	
OF453	0.028	0.028	0.256	0.022	0.01	7.33	0.35	AR&R 50 year, 25 minutes storm, average 97 mm/h, Zone 1
OF466	0.082	0.082	0.256	0.033	0.02	10.56	0.46	AR&R 50 year, 25 minutes storm, average 97 mm/h, Zone 1
OF331	0	0	0.256	0	0	0	0	
OF330	3.367	3.367	0.565	0.353	0.98	4	2.78	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
OF351	2.076	2.076	0.256	0.117	0.14	27.44	1.16	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
OF463	0	0	0.256	0	0	0	0	
OF478	0	0	0.256	0	0	0	0	
OF479	0	0	0.256	0	0	0	0	
OF480	0	0	0.256	0	0	0	0	
OF481	0.028	0.028	0.256	0.022	0.01	7.33	0.35	AR&R 50 year, 1.5 hours storm, average 47.1 mm/h, Zone 1
OF356	0	0	0.256	0	0	0	0	
OF353	2.071	2.071	0.256	0.117	0.14	27.44	1.16	AR&R 50 year, 2 hours storm, average 39.6 mm/h, Zone 1
OF503	0	0	0.256	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin147	52.49	59.7	3.382	0.013	3.369
Basin185	52.49	0.9	3.369	0.002	3.367
Basin228	54.75	35.6	2.082	0.006	2.076
Basin230	54.75	0.6	2.076	0.005	2.071

CONTINUITY CHECK for AR&R 50 year, 25 minutes storm, average 97 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
Pit109	74.84	74.79	0	0.1
N335	130.05	130.05	0	0
N324	130.05	130.05	0	0
N341	18.33	18.33	0	0
N351	67.97	67.97	0	0
N357	67.97	67.97	0	0
N392	15.96	15.96	0	0
N393	60.39	60.39	0	0
Basin147	3038.81	3008.39	30.27	0
Pit128	68.38	68.33	0	0.1
Pit138	128.65	128.68	0	0
N695	128.68	128.64	0	0
Basin185	2945.9	2945.32	0.6	0
Basin228	2134.1	2114.1	19.96	0
Pit132	41.55	41.53	0	0
Pit146	57.5	57.48	0	0
Pit145	57.48	57.46	0	0
Pit144	57.46	57.45	0	0
N708	57.45	57.43	0	0
Basin230	2087.79	2087.49	0.3	0
N574	128.6	128.6	0	0
N689	130.05	130.05	0	0
N716	57.41	57.41	0	0
Pit154	60.39	60.33	0	0.1

DRAINS file path:	F:\AA003330\D-Calculations\Stormwater\Design Files\20100906-OSD-[FINAL].drn
DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
50 YEAR ARI

Run Log for 20100906 run at 09:20:00 on 8/9/2010

Upwelling occurred at Pit138

Freeboard was less than 0.15m at Pit154, Pit128, Pit109

The maximum flow exceeded the safe value in the following overflow routes: OF353, OF351, OF335, OF330

The following detention basins have little effect (less than 2%) in reducing peak discharge: Basin230, Basin228, Basin185, Basin147 You might consider upsizing these, or rem

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RESULTS
100 YEAR ARI

DRAINS results prepared 08 September, 2010 from Version 2010.01

PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond	Max Surfac	Max Pond	Min	Overflow	Constraint	
		HGL	Flow Arrivi	Volume	Freeboard	(cu.m/s)		
			(cu.m/s)	(cu.m)	(m)			
Pit109	52.12	52.17	0.111	0.5	-0.1	0.017	Outlet System	
N335	50.18		0.09					
Pit128	51.04		0		0.13	0	None	
Pit138	51.03		0		0	0.038	Outlet System	
N695	50.95		0.038					
Pit132	53.98		0		1.52	0	None	
Pit146	53.97		0.025		1.53	0	None	
Pit145	53.92		0		1.58	0	None	
Pit144	53.74		0		0.26	0	None	
N708	53.7		0					
Pit154	51.03	51.09	0.089	5.3	0	0	Outlet System	

SUB-CATCHMENT DETAILS							
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)	
Cat101	0.111	0.106	0.005	4	11	0	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
Cat228	0.062	0.04	0.022	2	4	0	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
Cat103	0.028	0.028	0	3	0	0	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
Cat108	0.096	0.047	0.049	2.5	10	15	AR&R 100 year, 25 minutes storm, average 108.5 mm/h, Zone 1
Cat206	0.025	0.025	0	3	0	0	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
Cat210	0.089	0.089	0	5	0	0	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
Cat148	0.146	0.146	0	5	0	0	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
Cat149	0.091	0.091	0	5	0	0	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.98 impervious + 0.19 pervious = 1.17 total ha)

Storm	Total Rainf	Total Runo	Impervious	Pervious Runoff
	cu.m	cu.m (Runo	cu.m (Runo	cu.m (Runoff %)
AR&R 100 year, 5 r	214.39	190.39 (88	169.34 (94	21.06 (59.7%)
AR&R 100 year, 10	327.43	299.52 (91	263.77 (96	35.74 (66.3%)
AR&R 100 year, 15	408.41	377.23 (92	331.43 (97	45.80 (68.1%)
AR&R 100 year, 25	528.67	491.57 (93	431.89 (97	59.69 (68.6%)
AR&R 100 year, 30	575.34	535.70 (93	470.88 (98	64.81 (68.4%)
AR&R 100 year, 1 h	781.16	730.35 (93	642.82 (98	87.53 (68.1%)
AR&R 100 year, 1.5	922.66	863.92 (93	761.02 (98	102.90 (67.8%)
AR&R 100 year, 2 h	1033.75	968.60 (93	853.84 (98	114.76 (67.5%)
AR&R 100 year, 3 h	1210.33	1133.85 (9	1001.36 (9	132.49 (66.5%)
AR&R 100 year, 6 h	1578.69	1471.54 (9	1309.06 (9	162.48 (62.5%)
AR&R 100 year, 12	1992.66	1837.86 (9	1654.71 (9	183.16 (55.8%)
AR&R 100 year, 24	2806.56	2550.52 (9	2335.47 (9	215.04 (46.6%)

PIPE DETAILS					
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)	
Pipe241	0.095	3.9	51.536	50.18	AR&R 100 year, 1.5 hours storm, average 52.6 mm/h, Zone 1
Pipe260	0.014	1.7	51.042	51.042	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
Pipe267	0.016	0.2	51.03	51.025	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
Pipe312	0.054	0.8	50.981	50.95	AR&R 100 year, 15 minutes storm, average 139.7 mm/h, Zone 1
P265	0.002	0.3	51.042	51.042	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
P282	0.006	0.1	53.982	53.982	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
P286	0.011	0.3	53.975	53.975	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
Pipe319	0.031	0.6	53.921	53.921	AR&R 100 year, 1.5 hours storm, average 52.6 mm/h, Zone 1
Pipe318	0.031	1.4	53.784	53.741	AR&R 100 year, 1.5 hours storm, average 52.6 mm/h, Zone 1
Pipe317	0.031	0.4	53.717	53.704	AR&R 100 year, 1.5 hours storm, average 52.6 mm/h, Zone 1
P284	0.005	0.1	53.982	53.982	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
Pipe330	0.079	1.1	51.025	51.025	AR&R 100 year, 15 minutes storm, average 139.7 mm/h, Zone 1

CHANNEL DETAILS					
Name	Max Q	Max V	Chainage	Max	Due to Storm
	(cu.m/s)	(m/s)	(m)	HGL (m)	

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DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
100 YEAR ARI

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
OF142	0.017	0.017	1.326	0.065	0.06	0.52	0.99	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
OF145	0.185	0.185	7.665	0.044	0.03	12.71	0.61	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
OF161	0.195	0.195	7.665	0.045	0.03	13.07	0.6	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
OF166	0.028	0.028	7.665	0.022	0.01	7.33	0.35	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
OF192	0.096	0.096	7.665	0.035	0.02	10.91	0.48	AR&R 100 year, 25 minutes storm, average 108.5 mm/h, Zone 1
OF493	0.025	0.025	7.665	0.021	0.01	7.03	0.33	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
OF268	0.089	0.089	7.665	0.034	0.02	10.74	0.47	AR&R 100 year, 5 minutes storm, average 220 mm/h, Zone 1
OF335	4.351	4.351	7.665	0.159	0.22	35.88	1.4	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
OF456	0	0	7.665	0	0	0	0	
OF453	0.038	0.038	7.665	0.025	0.01	8.23	0.38	AR&R 100 year, 15 minutes storm, average 139.7 mm/h, Zone 1
OF466	0.092	0.092	7.665	0.034	0.02	10.74	0.49	AR&R 100 year, 15 minutes storm, average 139.7 mm/h, Zone 1
OF331	0	0	7.665	0	0	0	0	
OF330	4.348	4.348	1.931	0.407	1.24	4	3.05	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
OF351	2.652	2.652	7.665	0.13	0.16	29.95	1.24	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
OF463	0	0	7.665	0	0	0	0	
OF478	0	0	7.665	0	0	0	0	
OF479	0	0	7.665	0	0	0	0	
OF480	0	0	7.665	0	0	0	0	
OF481	0.031	0.031	7.665	0.023	0.01	7.63	0.35	AR&R 100 year, 1.5 hours storm, average 52.6 mm/h, Zone 1
OF356	0	0	7.665	0	0	0	0	
OF353	2.647	2.647	7.665	0.13	0.16	29.95	1.24	AR&R 100 year, 2 hours storm, average 44.2 mm/h, Zone 1
OF503	0	0	7.665	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin147	52.55	62.2	4.364	0.014	4.351
Basin185	52.55	0.9	4.351	0.002	4.348
Basin228	54.79	37.3	2.658	0.006	2.652
Basin230	54.79	0.7	2.652	0.005	2.647

CONTINUITY CHECK for AR&R 100 year, 25 minutes storm, average 108.5 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
Pit109	84.31	84.26	0	0.1
N335	146.25	146.25	0	0
N324	146.88	146.88	0	0
N341	20.56	20.56	0	0
N351	78.2	78.2	0	0
N357	78.2	78.2	0	0
N392	17.9	17.9	0	0
N393	67.73	67.73	0	0
Basin147	4944.26	4906.21	37.82	0
Pit128	72.84	72.78	0	0.1
Pit138	140.46	140.49	0	0
N695	140.49	140.45	0	0
Basin185	4841	4840.43	0.6	0
Basin228	3282.29	3259.33	22.89	0
Pit132	46.12	46.1	0	0
Pit146	64	63.98	0	0
Pit145	63.98	63.97	0	0
Pit144	63.97	63.95	0	0
N708	63.95	63.93	0	0
Basin230	3232.06	3231.77	0.3	0
N574	140.41	140.41	0	0
N689	146.88	146.88	0	0
N716	63.91	63.91	0	0
Pit154	67.73	67.68	0	0.1

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DRAINS version:	2010.01 January 2010
Modeller's name:	HM
Description:	Barber Avenue, Kingswood

RESULTS
100 YEAR ARI

Run Log for 20100906 run at 09:16:37 on 8/9/2010

Upwelling occurred at Pit138

Freeboard was less than 0.15m at Pit154, Pit128, Pit109

The maximum flow exceeded the safe value in the following overflow routes: OF330

The following detention basins have little effect (less than 2%) in reducing peak discharge: Basin230, Basin228, Basin185, Basin147 You might consider upsizing these, or rem

Appendix E – Utility Service Provider Correspondence

Case Number: 120842

6 September 2010

AESTHETE NO. 3 PTY LTD
c/- QALCHEK PTY LTD

FEASIBILITY LETTER

Developer:	**AESTHETE NO. 3 PTY LTD**
Your reference:	**PM 7472**
Development:	**Lot 100 DP 701623 11-13 BARBER AVE, Penrith**
Development Description:	**Proposed Two Stage Mixed Development.**
Your application date:	**3 August 2010**

Dear Applicant

This Feasibility Letter (Letter) is a guide only. It provides general information about what Sydney Water's requirements could be if you applied to us for a Section 73 Certificate (Certificate) for your proposed development. **The information is accurate at today's date only.**

If you obtain development consent for that development from your consent authority (this is usually your local Council) they will require you to apply to us for a Section 73 Certificate. You will need to submit a new application (and pay another application fee) to us for that Certificate by using your current or another Water Servicing Coordinator (Coordinator).

Sydney Water will then send you either a:

- Notice of Requirements (Notice) and Works Agreement (Agreement); or
- Certificate.

These documents will be the definitive statement of Sydney Water's requirements.

There may be changes in Sydney Water's requirements between the issue dates of this Letter and the Notice or Certificate. The changes may be:

- if you change your proposed development, e.g. the development description or the plan/ site layout, after today, the requirements in this Letter could change when you submit your new application; and
- if you decide to do your development in stages then you must submit a new application (and pay another application fee) for each stage.

What You Must Do To Get A Section 73 Certificate In The Future.

To get a Section 73 Certificate you must do the following things. You can also find out about this process by visiting www.sydneywater.com.au > Building Developing and Plumbing > Developing Your Land.

1. **Obtain Development Consent from the consent authority for your development proposal.**

2. **Engage a Water Servicing Coordinator (Coordinator).**

   You must engage your current or another authorised Coordinator to manage the design and construction of works that you must provide, at your cost, to service your development. If you wish to engage another Coordinator (at any point in this process) you must write and tell Sydney Water.

   For a list of authorised Coordinators, either visit www.sydneywater.com.au > Building Developing and Plumbing > Developing Your Land or call **13 20 92.**

   The Coordinator will be your point of contact with Sydney Water. They can answer most questions that you might have about the process and developer charges and can give you a quote or information about costs for services/works (including Sydney Water costs).

3. **Major Works Agreement**

   After the Coordinator has submitted your new application, they will receive the Sydney Water Notice and Works Agreement. You will need to sign and lodge **both originals** of that Agreement with your nominated Coordinator.

   The agreement sets out for this development:
   - your responsibilities;
   - Sydney Water's responsibilities; and
   - the Coordinator's responsibilities.

   You must do all the things that we ask you to do in that Agreement. This is because your development does not have sewer services and you must construct and pay for the following works extensions under this Agreement to provide these services.

   After Sydney Water has signed the documents, one of them will be returned to your Coordinator.

   Note: The Coordinator must be fully authorised by us for the whole time of the agreement.

4. Water and Sewer Works

4.1 Water

Your development must have a frontage to a water main that is the right size and can be used for connection.

Sydney Water has assessed your application and found that:

- The existing 225 mm CICL water main in Barber Avenue will serve both Stages 1 and 2 of the proposed development. Each lot in your subdivision must have its own connection to that water main and a water service and meter.

4.2 Sewer

Your development must have a sewer main that is the right size and can be used for connection. That sewer must also have a connection point within your development's boundaries.

Sydney Water has assessed your application and found that:

- The existing 150 mm VC sewer mains within the property will serve the proposed development.

Stage 1:

- **You must disuse and remove the section of the existing sewer main from Point A to Point D.**

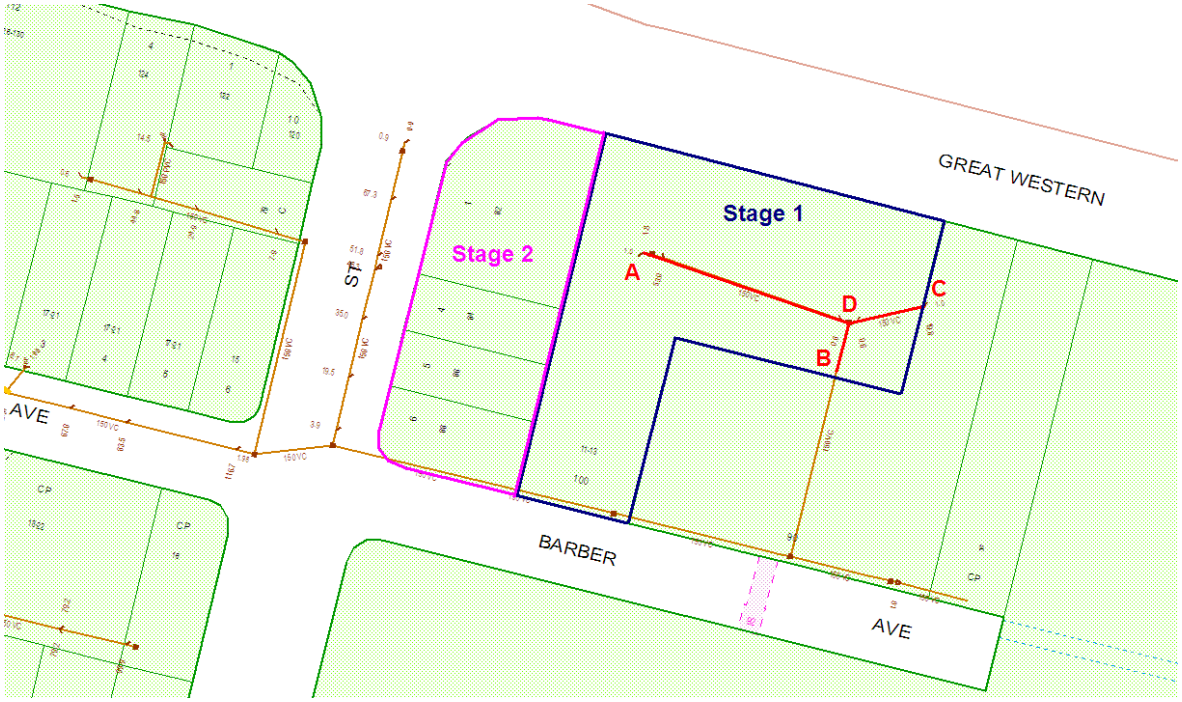
- **You must also construct a sewer extension at B (property connection point) off the existing 150 mm VC sewer main to serve your proposed development**

- **You must deviate the existing sewer main between B and C to serve Lot 90 (PN 5053394) and this must be in accordance with the Sewerage Code of Australia (Sydney Water Edition WSA 02-2009). Refer to your WSC for details of requirements.**

- **Because this work involves construction on a "live" Sydney Water sewer main, you must also lodge a security bond from an acceptable financial institution that will cover Sydney Water's risk for this work and accept the bonding conditions in writing.**

Stage 2:

- **You must construct a sewer extension off the existing 150 mm VC sewer main to serve your proposed development.**



5. Ancillary Matters

5.1 Asset adjustments

After Sydney Water issues this Notice (and more detailed designs are available), Sydney Water may require that the water main/sewer main/stormwater located in the footway/your property needs to be adjusted/deviated. If this happens, you will need to do this work as well as the extension we have detailed above at your cost. The work must meet the conditions of this Notice and you will need to complete it **before we can issue the Certificate**. Sydney Water will need to see the completed designs for the work and we will require you to lodge a security. The security will be refunded once the work is completed.

5.2 Entry onto neighbouring property

If you need to enter a neighbouring property, you must have the written permission of the relevant property owners and tenants. You must use Sydney Water's **Permission to Enter** form(s) for this. You can get copies of these forms from your Coordinator or the Sydney Water website. Your Coordinator can also negotiate on your behalf. Please make sure that you address all the items on the form(s) including payment of compensation and whether there are other ways of designing and constructing that could avoid or reduce their impacts. You will be responsible for all costs of mediation involved in resolving any disputes. Please allow enough time for entry issues to be resolved.

5.3 Costs

Construction of these **future** works will require you to pay project management, survey, design and construction costs **directly to your suppliers**. Additional costs payable to Sydney Water may include:

- water main shutdown and disinfection;
- connection of new water mains to Sydney Water system(s);
- design and construction audit fees;
- contract administration, Operations Area Charge & Customer Redress prior to project finalisation;
- creation or alteration of easements etc; and
- water usage charges where water has been supplied for building activity purposes prior to disinfection of a newly constructed water main.

Note: Payment for any Goods and Services (including Customer Redress) provided by Sydney Water will be required prior to the issue of the Section 73 Certificate or release of the Bank Guarantee or Cash Bond.

Your Coordinator can tell you about these costs.

6. Stamping and Approval of your Building Plans

You must have your building plans stamped and approved **before the Certificate can be issued. Building construction work MUST NOT commence until Sydney Water has granted approval.** Approval is needed because construction/building works may affect Sydney Water's assets (e.g. water and sewer mains).

Your Coordinator can tell you about the approval process including:

- Your provision, if required, of a "Services Protection Report" (also known as a "pegout"). This is needed to check whether the building and engineering plans show accurately where Sydney Water's assets are located in relation to your proposed building work. Your Coordinator will then either approve the plans or make requirements to protect those assets before approving the plans;
- Possible requirements;
- Costs; and
- Timeframes.

You can also find information about this process (including technical specifications) if you either:

- visit www.sydneywater.com.au > Building and Developing > Building and Renovating. Here you can find Sydney Water's *Guidelines for Building Over/Adjacent to Sydney Water Assets*; or
- call 13 20 92.

Notes:

- **The Certificate will not be issued until the plans have been approved and, if required, Sydney Water's assets are altered or deviated;**
- **You can only remove, deviate or replace any of Sydney Water's pipes using temporary pipework if you have written approval from Sydney Water's Urban**

Growth Business. You must engage your Coordinator to arrange this approval; and

- **You must obtain our written approval before you do any work on Sydney Water's systems. Sydney Water will take action to have work stopped on the site if you do not have that approval. We will apply Section 44 of the *Sydney Water Act 1994*.**

OTHER THINGS YOU MAY NEED TO DO

Shown below are other things you need to do that are NOT a requirement for the Certificate. They may well be a requirement of Sydney Water in the future because of the impact of your development on our assets. You must read them before you go any further.

Disused Sewerage Service Sealing

Please do not forget that you must pay to disconnect all disused private sewerage services and seal them at the point of connection to a Sydney Water sewer main. This work must meet Sydney Water's standards in the NSW Code of Practice for Plumbing and Drainage (the Code) and be done by a licensed drainer. The licensed drainer must arrange for an inspection of the work by a Sydney Water plumbing and draining inspector. After Sydney Water's inspector has looked at the work, the drainer can issue the Certificate of Compliance. The Code requires this.

Soffit Requirements

Please be aware that floor levels must be able to meet Sydney Water's soffit requirements for property connection and drainage.

Trade Waste Information

Should this development generate trade wastewater, this notice of requirements does not guarantee the applicant that Sydney Water will accept the trade wastewater to its sewerage system**.** In the event trade wastewater is generated, the property owner is required to submit an application for permission to discharge trade wastewater to the sewerage system before business activities commence. A boundary trap will be required for all developments that discharge trade wastewater where arrestors and special units are installed for trade waste pre-treatment.

If this development type is "***Industrial***" then the property may be part of sewerage catchment subject to a wastewater reuse scheme. This may impact the level of pollutants such as Total Dissolved Solids (TDS) that Sydney Water will accept from the property to the sewerage system. Businesses wishing to discharge wastewater (other than domestic sewage) should first contact a Sydney Water Trade Waste Office.

Prospective Purchasers should be made aware of the above situation under the requirements of vendor disclosure.

For further information please visit the Sydney Water website at: http:// www.sydneywater.com.au/OurSystemsAndOperations/Tradewaste/

To contact a Trade Waste Customer Service Representative please see below for Local Government Areas and their relevant contact number.

For the following LGA's the contact number for a Trade Waste Customer Representative is (02) 9551 4620:

Ashfield, Bankstown, Botany Bay, Burwood, Camden, Campbelltown, Canada Bay, Canterbury, Fairfield, Hurstville, Kiama, Kogarah, Leichhardt, Liverpool, Marrickville, Randwick, Rockdale, Shellharbour, Strathfield, Sutherland, Wingecarribee, Wollondilly, Wollongong

For the following LGA's the contact number for a Trade Waste Customer Representative is (02) 8805 5550:

Auburn, Baulkham Hills, Blacktown, Blue Mountains, Holroyd, Hornsby, Hunters Hill, Kuring-gai, Lane Cove, Manly, Mosman, North Sydney, Parramatta, Penrith, Pittwater, Ryde, Sydney, Warringah, Waverley, Willoughby, Woollahra

Backflow Prevention Information

All properties with a connection to the water supply, must install a backflow prevention containment device. All containment devices must be installed on the outlet side of each master water meter/s supplying the property. In circumstances where there is no master meter/s the backflow prevention containment device shall be installed on the water supply where it enters the property boundary.

Separate hydrant and sprinkler fire services, require the installation of a testable double check detector assembly. The device must be installed close to where the water service crosses the property boundary, upstream of any component of the fire service.

The backflow prevention containment device must be installed as a condition of continued use of the water supply. Failure to install and maintain the device may result in disconnection of the water service. A copy of Sydney Water's Backflow Prevention Policy is available on the Sydney Water Website at:
http://www.sydneywater.com.au/Plumbing/BackflowPrevention/

Fire Fighting

Definition of fire fighting systems is the responsibility of the developer and is not part of the Section 73 process. It is recommended that a consultant should advise the developer regarding the fire fighting flow of the development and the ability of Sydney Water's system to provide that flow in an emergency. Sydney Water's Operating Licence directs that Sydney Water's mains are only required to provide domestic supply at a minimum pressure of 15 m head.

A report supplying modelled pressures called the Statement of Available pressure can be purchased through any Quickcheck agent and may be of some assistance when defining the fire fighting system. The Statement of Available pressure, may advise flow limits that relate to system capacity or diameter of the main and pressure limits according to pressure management initiatives. If mains are required for fire fighting purposes, the mains shall be arranged through

the water main extension process and not the Section 73 process.

Large Water Service Connection

A water main is available to provide your development with a domestic supply. The size of your development means that you will need a connection larger than the standard domestic 20 mm size.

To get approval for your connection, you will need to lodge an application with a Quick Check Agent. You, or your hydraulic consultant, may need to supply the following:

- A plan of the hydraulic layout;
- A list of all the fixtures/fittings within the property;
- A copy of the fireflow pressure inquiry issued by Sydney Water;
- A pump application form (if a pump is required);
- All pump details (if a pump is required).

You will have to pay an application fee.

Sydney Water does not consider whether a water main is adequate for fire fighting purposes for your development. We cannot guarantee that this water supply will meet your Council's fire fighting requirements. The Council and your hydraulic consultant can help.

Private Water Services Connection and Metering

To provide domestic water to the total development you will need to connect to the Sydney Water main. This connection must comply with the *National Plumbing and Drainage Code AS 3500* and *NSW Code of Practice for Plumbing and Drainage*. You may have to include isolation valves on either side of the connection(s) to the Sydney Water main.

For example, a single meter on:

(a) each vertical block of residential units whether subdivided or unsubdivided (e.g. if your development has tower buildings, you must provide a meter for each building off one or more connections to the main);

(b) each mixed development use type whether subdivided or unsubdivided (e.g. if your mixed development has both a residential and a commercial area, you must provide a meter for each area usually off one connection to the main). Note that if there is more than one commercial area, you must provide a separate meter for each commercial area off that connection; and

(c) each non-residential Strata, Stratum or Torrens (within a Community) Title subdivided lot with a demand for water. You will need a separate private water service for each lot.

Note:
Where a number of non-residential units are not subdivided, separate services and metering to each unit is not required as Sydney Water will look to the owner for payment of all rates and charges. For example, a shopping centre where all shops remain in one ownership.

To meet the preceding guidelines, either:

- a single connection to the Sydney Water main may be branched; or
- if you would rather separate connections for each use type/area, you can apply to us for that.

A vertical building may be plumbed with a common riser, with either:

- a ring main on each floor with tee off-takes at each unit; **or**
- individual metered services to each unit that will allow housing of individually tagged meters in the one location.

The location of the meter servicing a residential vertical building generally must be in the commercial area after all commercial off-takes.

Sydney Water will supply enough meters to meet the above guidelines but we will not provide any check meters. All meters **must** be placed in an accessible area that should be either:

- no more than one metre inside the property boundary; **or**
- in a location acceptable to Sydney Water, e.g. in the commercial area after all commercial off-takes.

Disused Water Service Sealing

You must pay to disconnect all disused private water services and seal them at the point of connection to a Sydney Water water main. This work must meet Sydney Water's standards in the NSW Code of Practice for Plumbing and Drainage (the Code) and be done by a licensed plumber. The licensed plumber must arrange for an inspection of the work by a Sydney Water plumbing and draining inspector. After Sydney Water's inspector has looked at the work, the drainer can issue the Certificate of Compliance. The Code requires this.

Other fees and requirements

The requirements in this Notice relate to your Certificate application only. Sydney Water may be involved with other aspects of your development and there may be other fees or requirements. These include:

- plumbing and drainage inspection costs;
- the installation of backflow prevention devices;
- trade waste requirements;
- large water connections and
- council fire fighting requirements. (It will help you to know what the fire fighting requirements are for your development as soon as possible. Your hydraulic consultant can help you here.)

No warranties or assurances can be given about the suitability of this document or any of its provisions for any specific transaction. It does not constitute an approval from Sydney Water and to the extent that it is able, Sydney Water limits its liability to the reissue of this Letter or the return of your application fee. You should rely on your own independent professional advice.

END

A3

Railway

HWY

COX

AVE

Main Western

GREAT WESTERN

Railway

HWY

AVE

Nepean Hospital discharge Hazard refer 'SWC Health & Safety Guide HSG-552'

Nepean Hospital discharge Hazard refer 'SWC Health & Safety Guide HSG-552'

Nepean Hospital discharge Hazard refer 'SWC Health & Safety Guide HSG-552'

Nepean Hospital discharge Hazard refer 'SWC Health & Safety Guide HSG-552'

Sewer Connection Point

Water Connection Point

BARBER

AVE

ST

ST

ST

AVE

DBYD Address: Barber Av Kingswood NSW 2747	DBYD Job No: 243678 DBYD Sequence No: 18929840	 SYDNEY WATER CORPORATION	Scale: 1:1500 Date of Production: 14/07/2010	Plan 1 of 1 N 0m 9m 18m 27m 36m

Natural Gas. The Natural Choice.

15 September 2010

Hyder Consulting P/L
Level 5, 141 Walker St
NTH SYDNEY NSW 2060
Attn. D. Montelvere

Dear Diego

RE: PROPOSED SUBDIVISION OF
1-3 BARBER AVE, KINGSWOOD

Natural Gas is available adjacent to the above subdivision and could be extended to supply any proposed development at this site depending upon it's commercial viability.

Caution should be exercised when carrying out any road works that may expose the Natural Gas mains existing in this location. Contact Dial B4 you Dig ph 1100 to confirm their location.

We appreciate the opportunity to be involved in the forward planning of this development and would like to pursue the potential for the connection to the natural gas network. Should any new home builder require connection to the Natural Gas network, please call our connections team on ph. (02) 9455 1690.

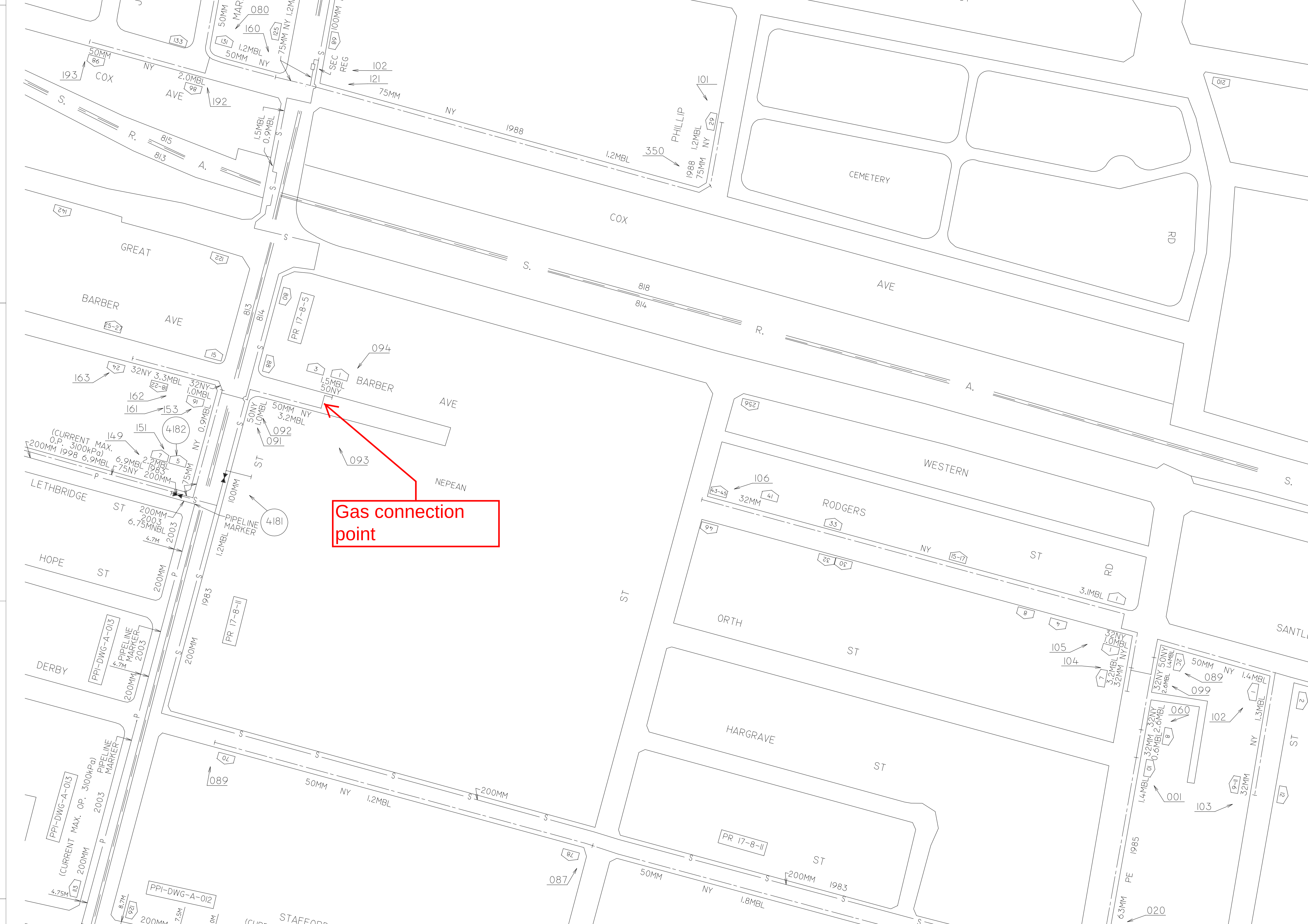
Thank you for your inquiry. If further information or assistance is required, please do not hesitate to contact me on 0402 060 151.

Yours faithfully,

Neale Hilton

Neale Hilton
Network Development Manager

Jemena Gas Networks (NSW) Ltd
ABN 87 003 004 322 Locked Box 2/159 Ridgecrop Drive Castle Hill 2154 Telephone 0402 060 151 Facsimile (02) 9899 3571 www.thenaturalchoice.com.au


Gas connection point
COX AVE
S. R. A.
GREAT BARBER AVE
BARBER AVE
NEPEAN ST
LETHBRIDGE ST
HOPE ST
DERBY
WESTERN
RODGERS
ORTH ST
HARGRAVE ST
PHILLIP
CEMETERY
RD
STAFFORD
SANTL
PIPELINE MARKER
PR 17-8-5
PR 17-8-11
PPI-DWG-A-013
PPI-DWG-A-012
4181
4182
(CURRENT MAX. O.P. 3100kPa)
SEC REG
50MM NY 3.2MBL
1.5MBL 50NY
200MM 1998 6.9MBL
200MM 2003 6.75MNBL
75MM NY 1988 1.2MBL
50MM NY 1.2MBL
50MM NY 1.8MBL

25 August 2010

Integral Energy Ref: UCL5091 – 2010/04090/001
Customer Ref:

Hyder Consulting Pty Ltd
141 Walker Street
NORTH SYDNEY NSW 2060

Attention: Vinothan

Dear Sir

UCL5091 – Connection of Load Application Barber Avenue, KINGSWOOD

Thank you for your application for the above location. Your application has been registered under the above reference number and a preliminary desk top supply offer analysis has been carried out by Integral Energy.

Your next step is to obtain the services of an accredited Level 3 Service Provider to prepare an electrical design or to provide additional information that is required by Integral Energy.

This activity has been classified contestable as per the Network Connections General Terms & Conditions, the funding of this work is your responsibility.

This letter and its attachments are for your information as a base to obtain the services from an Accredited Level 3 Service Provider.

A list of Accredited Level 3 Service Providers is available from Office of Fair Trading, Department of Commerce (02 9895 0008 or Fax (02) 9895 0799 or on the web site www.fairtrading.nsw.gov.au).

A design fee estimate is enclosed your information. The fees amount may change during the design stage and will be confirmed via a payment request at a later date.

Should you have any enquiries regarding your application please do not hesitate to contact our Customer Consultant on (02) 9853 6234.

Yours faithfully

Eugene Lorenzo
Engineer Contestable Works
NETWORK CONNECTIONS - Huntingwood

In Reply Quote: UCL5091
Huntingwood Drive, Huntingwood NSW 2148 Postal Address: PO Box 6366, Blacktown NSW 2148
Telephone: (02) 9853 6234 Facsimile: (02) 9853 6461 integral@integral.com.au.

INTEGRAL energy
The power is in your hands

INTEGRAL energy

25 August 2010

Integral Energy Ref: **UCL5091**

Integral Energy
PO Box 6366
Blacktown NSW 2148

Attention: Eugene Lorenzo

NOTICE OF ADVICE

APPOINTMENT OF ACCREDITED DESIGNER FOR THE PROPOSED DEVELOPMENT AT: *BARBER AVENUE, KINGSWOOD*

**** Please complete and return when a Level 3 Service Provider has been nominated****

Please accept this letter as notification that I intend to proceed with the development described above. I own or am developing the land and works on the land, (and/or where relevant on public land). I intend to supply this development to Integral Energy requirements in accordance with the current General Terms and Conditions :

- Electricity Supply to Developments.

The Level 3 Service Provider appointed is:.....

The Fees will be Paid to Integral Energy Australia by:.....

.....
Signature of Level 3 ASP

.....
Name of Level 3 ASP

.....
Signature of Developer/Representative

.....
Name of Developer/Representative

.....
Date

The signatory warrants that they are authorised to execute this Application on behalf of the Developer.

In Reply Quote: UCL5091
Huntingwood Drive. Huntingwood NSW 2148. Postal Address: PO Box 6366, Blacktown NSW 2148. DX 8148 Blacktown
Telephone: (02) 9853 6234 Facsimile: (02) 9853 6461 ✉ integral@integral.com.au.

APPLICATION NO: UCL5091
DATE: 25 August 2010

SUBJECT: SUPPLY OFFER FOR
Barber Avenue, KINGSWOOD

Integral Energy has carried out a desk top assessment and accordingly prepared this Supply Offer for the above development. This Supply Offer shall lapse where the information requested has not been submitted within three (3) months of issuing this Supply Offer.
The fees applicable for this application are required prior to design certification and are outlined in the Network Connections Contestable Works General Terms & Conditions.

Power Factor is to meet NSW service and installation rule requirements
Your application has been assessed and attached is a supply offer that will assist your accredited designer to develop the most efficient solution to meet yours needs and also comply with Integral Energy's GT&C and standards. Please find below a list of some issues that may need to be addressed by your designer.

- Field verification of practicality of supply option.
- Trench length.
- Cable length.
- Length of cable using existing ducts.
- Length of new ducts required to be installed.
- Substation location shown on a preliminary sketch and HV switchgear numbers.
- Types and number of poles to be replaced or installed.
- Complexity of trenching (ie rock, under-bore, commercial area etc).
- Earthing requirements and complexity taking into account soil type, clay, rock, etc.
- Overhead construction and isolation point requirements.
- Asset Valuation form completed including any extraordinary costing requirements.
- All environmental issues have been addressed in an Environmental Assessment.
- Any generation requirements.
- Any Rail Crossing requirements.

A sketch of the circuit utilising the GIS as a base must be returned with the above information.

INTEGRAL energy

DESIGN FEE ESTIMATE

ABN 59 253 130 878

Applicant (Name) **Hyder Consulting Pty Ltd**
Address: 141 Walker Street
NORTH SYDNEY 2060

Proposed Location: Barber Avenue

KINGSWOOD

Please find below the estimated design fees (GST Inclusive) for this application at this point in time for your information only.

Administration Fee	18-08-2010	$	210.00
Design Certification Fee	18-08-2010	$	1590.00
Design Information Fee	18-08-2010	$	1760.00
Property Tenure Bond	18-08-2010	$	15000.00
Total		$	18560.00

Please also note that if there are any network assets to be placed within the private property there will be easement creation requirement in favour of Integral Energy. Integral Energy is prepared to accept a property tenure bond while the property owner is in the process of creating the easement. Integral Energy will return the property tenure bond after the easement has been registered with the Land and Property Information (NSW).

Please do not make any fee payment at this point in time as the final amount may change.

Once the design fee amount has been finalised Integral Energy will send a request for the fees and property tenure bond payment (if required) to your nominated party as indicated in the returned Notice of Advice from you or your Level 3 Service Provider.

CAP No. : UCL5091 **File No:** 2010/04090/001

Supply Offer

(based on a desktop assessment)

Assessed Load: Stage 1 - 3693kVA
Stage 2 - 1096kVA
Total = 4789kVA (6705A/phase)

Linkage Point and Connection Asset requirements:

As per our General Terms and Conditions section 2 clause A9.1.1, loads of this size will require an Indoor substation.

The Indoor Substation location and accessibility must comply with Integral Energy's Standards MCI0006 and SDI104.

Based on the Stage 1 load, 2x 1500kVA and 1x 1000kVA transformers are required.

For stage 2, a new application will be required and an additional 1x 1000kVA Tx will be required to supply the additional load.

The existing High Voltage Feeder 9034 in Kingswood zone sub is currently overloaded and cannot be used to supply this load.

Therefore to supply this development a new dedicated feeder from Kingswood Zone Sub is required. New feeder is to be doubled up on Circuit Breaker 9032 from Kingswood Zone Sub.

The new sub is to be ringed.

The feeder route should be is as follows:

* Exit west side of Kingswood ZS into Fragar Rd
* Along east side of Fragar Rd
* Along south side of Jamison Rd
* Along eastern side of Parker st
* Along the northern side of Barber st (common trenching can be used)
* turn into new development

The feeder will need to be installed in new trenching to reduce the derating on the new and existing feeders. Type 24 ducts to be installed on all new trenching.

Load can connect after the commissioning of Claremont Meadows ZS as Kingswood ZS has reached firm capacity. Claremont Meadows Zone Sub will off load Kingswood Zone Sub and is expected to be completed on December 2011.

Initial Funding assumptions for purposes of preparing an asset valuation

Integral Energy Supplied Materials:

2x 1500kVA and 1x 1000kVA Transformers

Integral Energy Funded and Constructed:

Nil

Integral Energy Funded and Customer (ASP L1) Constructed – Reimbursement Paid by Integral Energy:

Spare ducts

Reimbursement to be paid to Integral Energy by Customer:

ASP to advise.

Customer Funded Non-Contestable Works:

Monopoly fees.
First termination from the ZS.

Customer Funded Contestable Works:

All other works.

Heath Mallen

From: Heath Mallen
Sent: 24 September 2010 7:18 AM
To: Heath Mallen
Subject: FW: Registration Details - Development name: Barber Avenue Kingswood
Attachments: 12041771.txt; Integral%20Supply%20offer.pdf

From: registration@telstrasmartcommunity.com [mailto:registration@telstrasmartcommunity.com]
Sent: 21 September 2010 1:43 PM
To: Vinothan Selvaratnam
Subject: Registration Details - Development name: Barber Avenue Kingswood

Dear Vinothan Selvaratnam,
Thank you for Registering your Development with Telstra Smart Community.

You will be aware that there have been recent announcements relating to changes to the Government policies on the provision of infrastructure in new developments. These can be viewed at http://www.dbcde.gov.au/broadband/national_broadband_network/policy_statements

These changes to policy will have a significant impact on the way infrastructure is provided in your proposed development.

Telstra will work with Government, NBN Co and stakeholders on the implementation of the new policy on Greenfields estates.

Our key concerns during this period are to make sure services to developers and end customers are maintained and meet our commercial and legal obligations.

Until alternative arrangements are put in place, developers are requested to remain in contact with Telstra through the normal channels. This will enable us to make sure arrangements are made to provide infrastructure under the new policy.

In relation to current commercial negotiations for infrastructure, we anticipate further discussions with developers to make appropriate arrangements taking into account the new policy and the particular circumstances and timing of the development.

We note that there are no changes to Telstra's policy which was announced in March as a result of the Federal Governments proposed Greenfields legislation. Telstra will no longer be deploying copper infrastructure as standard practice.

Telstra will contact you once there is more information available.

We note that you haven't attached any files to your submission. You can revisit your application at any time to attach files electronically and to view the email and postal addresses if you wish to send hardcopy plans.

The details you have provided are attached for your future reference.

You can access your development at: http://www.telstra.com.au/smartcommunity/developers.html
Your Registration Number is: 12041771

The Registration Number above and the password that you provided during the registration process must be used for referencing all stages of this development when using the Telstra Smart Community website to view, edit or add further details to your development.

Following are the details of Telstra's Community Development Consultant for Kingswood:
dev4nsw@team.telstra.com
Locked Bag 16 HAMILTON DC 2303

Regards,
Telstra Urban Development Team