Proposed Aged Care Facility

Lot 1113 DP752038,
Barnes Rd, Frenchs Forest

Stormwater Concept Plan

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For
Dukor 24 P/L

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Contents

1.0 Introduction

This firm has been engaged by Dukor 24 P/L to develop a stormwater drainage concept plan for a proposed aged care facility located off Barnes Road, Frenches Forest. The proposal involves expanding the capacity of an approved residential aged care facility on the site from 10 beds within the existing dwelling house, to a 45 bed facility contained within the existing building and proposed additional buildings on the site which is Lot 1113 in DP752038. This report considers the impact of the proposed development on the local drainage systems and describes measures proposed to be adopted to address these impacts.

2.0 Description of the Site

The site, known as Lot 1113 in DP752038, Barnes Rd, Frenchs Forest overlooks a valley in the Shire of Warringah bounded by Warringah Rd in the south, the Wakehurst Parkway in the west and Brooker Ave in the east. The valley collects the stormwater runoff from approximately 110 hectares of catchment via a tributary of Middle Creek which runs up the valley. While the western portion of this catchment is generally in a natural state, the eastern and southern areas of the catchment have been developed for residential and industrial uses, which in the whole have tended to be uncontrolled with respect to stormwater drainage discharges. That is, the development of these catchments has been allowed to proceed without the consideration of the increase in stormwater flows and velocities which will occur as a result of that development. The result of this has been that the Middle Creek tributary now receives substantially more stormwater in a given storm event than would have naturally been discharged from the undeveloped upstream catchments.

The north-eastern corner of the site is traversed by the Middle Creek tributary which has been substantially altered from natural conditions over the past 50 years. Warringa Council have prepared a policy document titled “Warringah Creek Management Study 2004” (WCMS) which nominates this creek as being significant with associated riparian and no development zones. The Middle Creek Tributary originates in a gully draining the intersection of Oxford Falls Road with Iris Street located to the south of the site.

3.0 Modelling of Design Stormwater Quantity Flows

3.1 Model Program

The flows off the catchments upstream of the site have been modelled using the XP-Rafts computer model. This computer based hydrological model was jointly developed by SMEC and Willing and Partners and continues to be developed by Willing and Partners. The program is considered to be industry standard and has a user friendly interface capable of simulating rainfall runoff by explicitly taking into

account the sub-catchment size, the slope, percentage of impervious area, soil type (loss rates), detention basins, etc.

3.2 Model Calibration

A model of the drainage catchments in the area was prepared with catchment areas and slopes being determined from topographic maps and ground truthed by observations on site. The catchment plan is detailed in sheet 1 of the drawings prepared by JMD Ref:12253(B)E1, hereinafter referred to as the JMD Drawings. An assessment of the % impervious was carried out for each catchment with 1.5mm and 0mm being adopted as initial and continuing (respectively) losses for impervious surfaces. For the residential areas upstream of the site the % impervious was assessed at 60%. 15mm and 2.5mm were the adopted initial and continuing loss rates for pervious surfaces within the catchment. XP-Rafts provides an option to model older catchments as "old urban". Selection of this option increases the storage in a catchment to account for delays in flows which results from the lack of formal over-land flow paths. An inspection of the catchments upstream of the site revealed that no significant flow paths had been provided for flow in excess of the road system capacity and so the "old urban" option was selected for catchments with significant percentages of residential development.

The catchments located on the valley floor have not been developed and a % impervious of 10% was adopted for most of these catchments other than ones in the vicinity of the site where an estimate of the existing % impervious area was computed from survey and aerial photography data. Catchments located on the sides of the escarpment were observed to be generally in a natural state and a % impervious of 0% was used where no or insignificant levels of development had occurred. A summary of the catchment areas in the vicinity of the site and which are impacted by the proposed development, as computed is provided in sheet 1 of the JMD drawings.

Previous inquiries with Council revealed that there are no records of flooding in the vicinity of the site. Given the lack of recorded flow data, it was not possible to calibrate the model results against such records. The results of the modelling were compared to the flow rates documented in work-as-executed drawings for Barnes Rd (Drg No 3CY-562.3 prepared by Lovegrove Oxley Associates Pty Ltd dated 12-7-94) obtained from Warringah Council and were found to be comparable. The resultant flow rates are therefore considered to be a reasonable assessment of the design flow rates through the site.

3.3 Model Results

For each recurrence interval, various storm durations were modelled. The 90 minute duration storm found to consistently produce the largest peak flows and so this event was adopted as the design storm event.

The site is located within Catchment 5/2. An assessment of current, pre-developed conditions has revealed that the site has a total area of 3.371ha with 0.503ha of that area being covered in impervious surfaces (roof, pavements, etc – refer Sheet 2 of the

JMD Drawings). The proposed development of the site results in an increase in the area of impervious surfaces on site such that post development, approximately 0.893ha of the site will be impervious. The proposed impervious surfaces for the development are indicated in sheet 3 of the JMD Drawings.

The model for the site was then modified to account for the above changes in the catchments resulting from the proposed development and the results compared to those from the existing conditions model. It was discovered that the flows off catchment 5/2 were increased so on-site detention is required to be provided to ensure no adverse impact on the downstream catchments as a result of the proposed development. In order to address this small increase, it is proposed that all stormwater discharges from the developed site will be directed to the north-east corner of the site via piped drainage and surface swales/flow paths where a small detention basin will be constructed as indicated on sheet 3 of the JMD drawings. It should be noted that the basin will be located so as to be entirely outside of the riparian zone of the Middle Creek tributary.

As required by Council's planning documentation, the site was assessed for performance under PMF conditions. For the purposes of this study, an approximation of the pmf flows has been adopted. Previous studies by this firm have shown that a two hour storm with an intensity equal to three times the 100 year intensity is a reasonable approximation of the PMF flood event. For the purposes of this analysis, this storm event was applied to the developed scenario XP-Rafts model with all hydrologic losses set to zero to estimate the impact of the PMF flood. The topography of the site and location of the proposed development on the localised spur means that the PMF flows will not significantly impact on the operation of the site.

4.0 Modelling of Stormwater Quality

4.1 Water Quality Goals

4.1.1 Relevant Documentation

Healthy Rivers Commission, 2002

The site is within the Narrabeen Lakes catchment, which is recognised as being in "Healthy Modified Condition" according to the Independent Inquiry into Coastal Lakes (Healthy Rivers Commission, 2002). Nevertheless, it is still considered a sensitive catchment due to the level of urban development within the catchment area.

Narrabeen Lakes Estuary Management Plan, 2002

The Narrabeen Lakes Estuary Management Plan (2002) identified specific management options for the entire catchment. Relevant aspects of this Plan for the site in question include:

- The need to manage water quality, sediment loads and flood levels, particularly in Middle Creek.
- The creeks on this site were not identified as being in need of rehabilitation
- The installation of a Gross Pollutant Trap or similar structure was recommended for the Middle Creek Tributary.
- The need for flood management in Middle Creek, which includes installing wetlands along it and its tributaries to enhance water quality and regulate flows.

Warringah Creek Management Study, 2004

The Warringah Creek Management Study from March 2004 refers to Middle Creek and its tributaries. In this study, Middle Creek is classified under Group C. Key features of Group C creeks in this study include:

- Catchments are well above catchment development thresholds.
- Ecosystems are already substantially modified.
- Weed growth is a threat to remnant and replanted native vegetation.
- Water quality is at or above acceptable limits, resulting in periodic stress symptoms such as fish kills, nuisance algal growth and high turbidity.

The proposed development does not impact on the existing creek environment.

Northern Beaches Stormwater Management Plan, 1999

For new urban developments, the Northern Beaches Stormwater Management Plan 1999 presents a series of targets:

Short Term:

- Investigate impacts of urban consolidation on stormwater quality.
- Reduce nutrient loads discharged to creeks and streams by 45%.
- 50% retention of average annual load for suspended solids.
- Retention of sediment coarser than 0.125 mm for the 3-month ARI peak flow.
- Retention of litter greater than 50 mm for flows to the 3-month ARI peak flow.
- No visible oils for flows up to the 3 month ARI peak flow.
- During construction, meet the requirements of Department of Housing 1998 (now superseded by Landcom, 2004 - The Blue Book).
- During construction, limit the application, generation and migration of toxic substances to the maximum extent practicable.

Long Term:

- Reduce nutrient loads discharged to creeks and streams by 30%.
- Achieve suspended sediment loads which protect aquatic ecosystems and maintain natural creek bed regimes.
- Reduce gross solid loads in creeks and streams by 70%.
- Have improved, where possible, public access to riparian areas.
- Have maximised stormwater reuse within ecological, social and economic value constraints.

Note that the above lists are summaries of the items most relevant to water quality targets.

In Australia, the national guidelines for managing water quality in ambient waterways are known as the 'ANZECC guidelines' published by ANZECC (the Australian and New Zealand Environment Conservation Council) in 2000. The numerical trigger values in the ANZECC guidelines are derived and designed for assessing ambient waters only - they are not meant as regulatory design or discharge standards.

In this case we understand the water quality of the Middle Creek Tributary fails the trigger values, probably as a result of the heavily urbanised catchment upstream of this site. This is why strict water quality goals will be adopted.

DECCW have a list of water quality objectives for Sydney's Northern Beaches Lagoons, including Narrabeen Lakes. Many of these mirror those given in the Warringah Creek Management Study, 2004 (or vice-versa).

DECC Managing Urban Stormwater: Environmental Targets, 2007a

In their consultation draft (October 2007a) titled Managing Urban Stormwater: Environmental Targets, DECC and the Sydney Metropolitan CMA state that developments should include stormwater treatment measures that aim to achieve:

- 90% reduction in the average annual gross pollutant (> 5mm) load.
- 85% reduction in the average annual total suspended solids (TSS) load.
- 65% reduction in the average annual total phosphorus (TP) load.
- 45% reduction in the average annual total nitrogen (TN) load.

Based on the above, the following water quality goals will be adopted for the site. They form the foundation of the MUSIC modelling presented below.

(i) Achieve a neutral or beneficial effect on water quality in the pre versus post development scenarios;

(ii) Adopt the water quality targets for reductions in TSS, TP, TN and gross pollutants as specified in DECC, 2007a (these exceed those in the Northern Beaches Stormwater Management Plan 1999)

4.2 Proposed Water Quality Measures

A series of water quality measures will be adopted as part of the development:

4.2.1 Construction-Phase Soil and Water Management

A Construction-Phase Soil and Water Management Plan (SWMP) will be required to address issues of erosion and sediment control for each stage of the proposed development. It will be prepared by a certified professional in erosion and sediment control (CPESC) and to the requirements of Landcom (2004) (The Blue Book).

4.2.2 Rainwater Re-Use

It is proposed that a stormwater collection tank be incorporated into the proposed development. The water collected in this tank will be reticulated back through the development for re-use in toilet flushing and laundry use. In their recently released document titled “Using MUSIC in Sydney’s Drinking Water Catchment” the Sydney Catchment Authority recommends the adoption of a reuse figure of 0.125kL per day per 1-2bedroom dwelling. The proposed development is for about 45 dwelling units and so a reuse figure of 7.5kL per day has been adopted as a reasonable figure. For the purposes of this investigation, a tank volume of 150kL has been assumed. This figure is considered to be a minimum only.

4.2.3 Bioretention Basins (Raingardens)

A bioretention basin (rain garden) will be used to collect and treat all runoff from landscaped areas around the proposed development. The rain garden will be built to the requirements of DECC , 2007b with the size of the rain garden determined using the MUSIC program as discussed below.

4.3 Water Quality Modelling

4.3.1 Introduction

Water Quality Modelling was undertaken to demonstrate the effectiveness of the Stormwater Management Plan. Calculations are derived using a computer model called MUSIC (Model for Urban Stormwater Improvement Conceptualisation) developed by the CRC for Catchment Hydrology (now part of eWater). MUSIC contains algorithms based on the known performance characteristics of common stormwater quality improvement structures used in Australia. These data are derived from research undertaken by eWater and others. Proprietary treatment systems can also be modelled, as long as their performance has been independently verified by third party research.

MUSIC uses a series of source nodes, one for each type of land use. The nodes are calibrated as described in the document titled "Using MUSIC in Sydney's Drinking Water Catchment" from SCA (2012), as this document represents the latest NSW-specific modelling recommendations and adopts a conservative approach. While this site is not within a SCA Catchment area, this institution has invested significant resources and time into the development of the MUSIC program and are considered to be leaders in the use of the program.

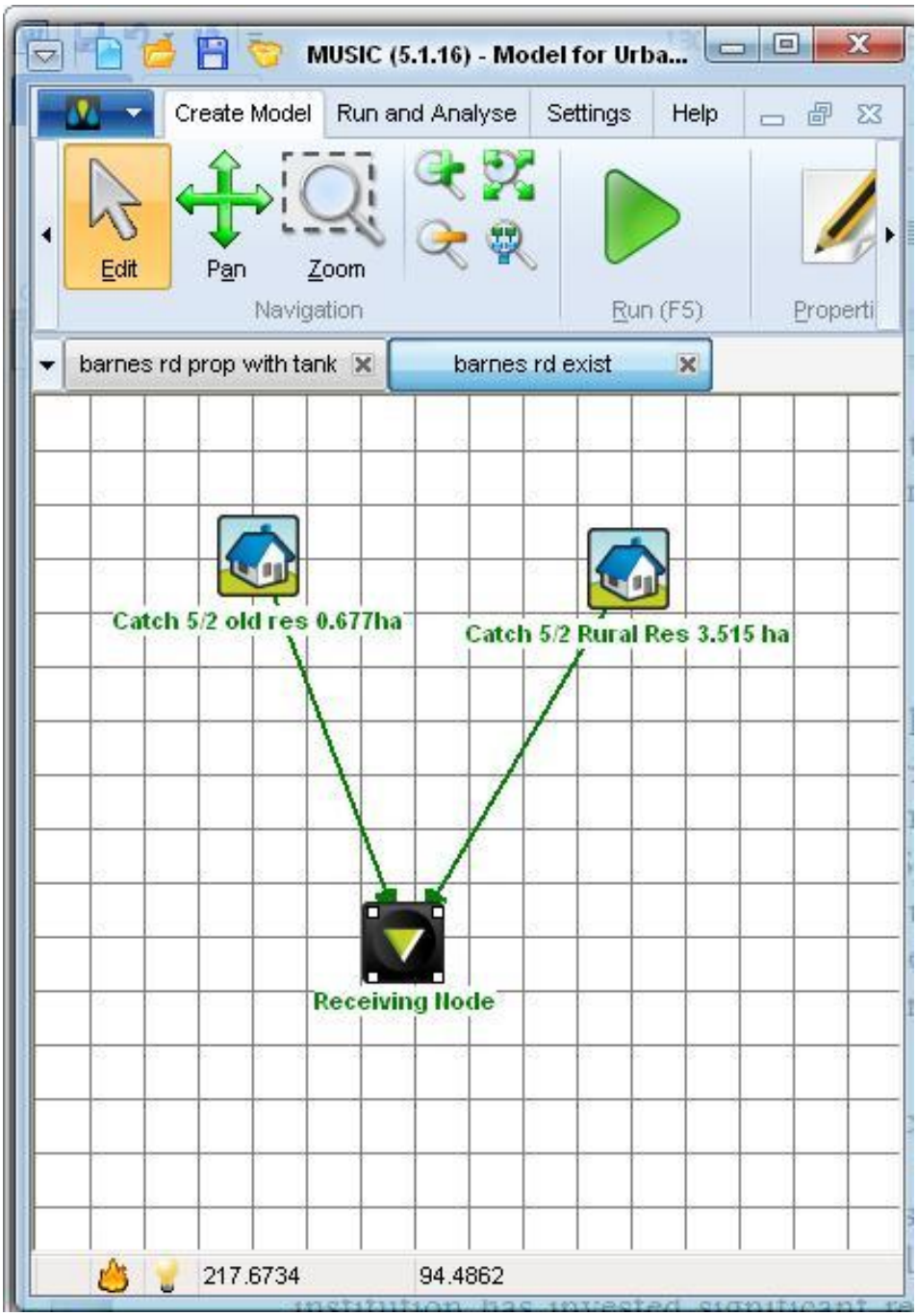
4.3.2 Climate Data

The creation of a MUSIC model requires an associated meteorological data file using 6 minute pluviograph data from the Bureau of Meteorology. The data used for this investigation is that for Sydney.

4.3.3 Pre-Development Conditions

The pre-developed model has been created to represent condition on site as determined from a review of the supplied survey data and is depicted in Figure 4.1 below. The nodes representing the existing residential land above the site which discharges stormwater onto the site and current site rural-residential land uses were calibrated using the recommendations documented in the document titled "Using MUSIC in Sydney's Drinking Water Catchment". The figures of % impervious adopted for the land uses were as described

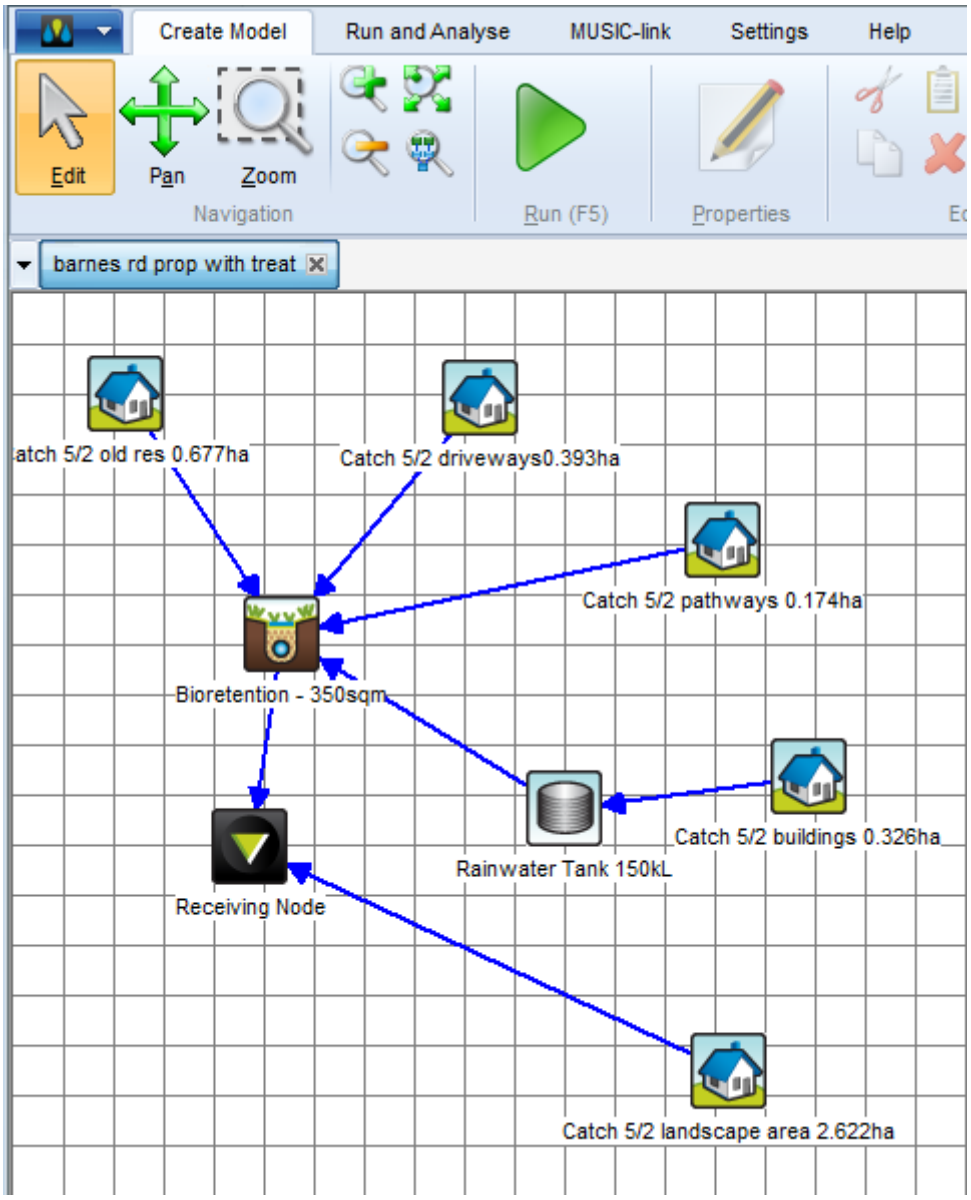
Figure 4.1 – MUSIC model for Pre-Development Conditions



4.3.4 Post-Development Conditions

The post-development model was created in a similar fashion to the pre-developed model with nodes for the various land uses being created and calibrated to reflect the extent of development. Again the % impervious for the developed site was adjusted to reflect the proposed changes on site as described in Section 3.2 above. The final model adopted for the post-development condition is depicted in Figure 4.2 below.

Figure 4.2 - MUSIC model for Proposed Development Conditions



4.3.5 Results of Modeling

The results from the model for the post-developed conditions were compared to those from the pre-developed conditions. The outputs as mean annual loads are documented in Table 4.1 below. Column 2 of Table 4.1 documents the water quality outcomes under current conditions.

Column 3 of Table 4.1 documents the water quality outcomes for the proposed developed conditions without any treatment measures.
Column 5 of Table 4.1 documents the target water quality outcomes resulting from the application of the target reductions listed in Column 4 to Column 3.
Column 6 of Table 4.1 documents the water quality outcomes for the proposed developed conditions with the final proposed treatment measures.

Column 7 documents the % reductions which will be achieved if proposed water quality measures are adopted and implemented (comparison of columns 6 to 3) Column 8 is a comparison between the proposed developed site with treatment measures compared to the existing conditions (used to test for NorBE).

Untreated Annual Loads	Results existing Conditions	Results Developed Conditions no Treatment	Target Reductions	Target Results	Results for Developed with Tank and 350sqm Rain Garden	% reductions achieved developed untreated compared to developed treated	% reductions achieved compared to existing conditions
Flow (ML/yr)	27.3	30.8			27.4		
Peak Flow (m3/s)	1.13E+00	1.13E+00			9.37E-01		
Total Suspended Solids (kg/yr)	2.71E+03	4.68E+03	80%	936	1.04E+03	78%	62%
Total Phosphorus (kg/yr)	5.69	12.5	65%	4.375	3.33	73%	41%
Total Nitrogen (kg/yr)	50.9	61.4	45%	33.77	32.5	47%	36%
Gross Pollutants (kg/yr)	481	463			1.41	100%	100%

Table 4.1 – Summary of outputs from MUSIC Models.

Initially the rainwater tank as discussed in section 4.2.2 was added to the system. While this resulted in improvements to the water quality outcomes, it did not satisfy the target reductions.

The bio-retention garden, was then added to improve the performance of the treatment train for the development. This filter basin will be constructed at the lower extent of the development immediately upstream of the proposed detention basin (refer sheet 3 of the JMD Drawings) . All stormwater flows from the upper portion of the site will be directed by pipes or swale drain to the rain garden where the low flows will be filtered and then discharged to the detention basin. The modelling demonstrated (Refer Columns 6 & 7 of Table 4.1) that a rain garden with a minimum filter bed area of 350m² (0.5m deep with 200mm extended detention depth) in conjunction with the 150kL (minimum) rain water tank will be required to meet the target reductions.

Column 8 of Table 4.1 is a comparison of the treated development flows compared to the site discharges under current conditions. In order to demonstrate a Neutral or Beneficial Effect (NorBE) for a particular development, it is usual practice to require the treated flows to achieve a 10% improvement over those from current conditions. The % reduction results in Column 8 demonstrate that the proposed treatment train will more than satisfy NorBE requirements.

5.0 Conclusion

This firm has been engaged by Dukor 24 P/L to develop a stormwater drainage concept plan for a proposed aged care facility located off Barnes Road, Frenches Forest. The proposal is to convert and extend an existing dwelling on Lot 1113 in DP752038 to provide an aged care facility. This report documents the findings of an investigation into the impacts of the proposed development on the local drainage systems and describes measures proposed to be adopted to address these impacts.

The investigation determined that the development as proposed will result in a small increase in the peak stormwater runoff flows and stormwater pollutant loads due to an increase in the area of impervious surfaces. It is proposed that the increase in stormwater runoff from the site will be addressed by the construction of a small detention basin in the north-east corner of the site. This basin will be formed in earthworks with a discharge control pit as detailed in sheet 3 of the JMD Drawings.

Water quality impacts resulting from the proposed development were assessed using the MUSIC computer program. The investigation revealed that the proposed development will result in a small increase in the pollutant loads from the site and that a combination of the following treatment measures will effectively manage the pollutants to result in a net reduction in annual pollutant loads of at least 80% for total suspended solids, 65% Total Phosphorus and 45% Total Nitrogen:-

- A 150kL(min) rain water tank collecting roof water flows with stored water being reused for toilet flushing and laundry purposes, and
- A bio-retention basin incorporating a minimum of 350m² of filter media (0.5m deep) with an extended detention depth above the filter media of 200mm.

The proposed stormwater strategy is documented in sheet 3 of the appended drawings prepared by JMD Ref:12253(B)E1.

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Appendix A

XP-Rafts Output for Existing Conditions

Run started at: 16th April 2013 7:27:20

##

RUNTIME RESULTS

##

Max. no. of links allowed = 2000
Max. no. of routng increments allowed = 25000
Max. no. of rating curve points = 25000
Max. no. of storm temporal points = 25000
Max. no. of channel subreaches = 25
Max link stack level = 25
Input Version number = 650

##

Results for period from 0: 0.0 19/ 4/1905
to 5: 0.0 19/ 4/1905

##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 2.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 66.98
TOTAL OF SECOND SUB-AREAS (ha) = 39.92
TOTAL OF ALL SUB-AREAS (ha) = 106.91

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Perm #1	Perm #2	B #1	B #2	Link No.
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	1.000
catch1/1	1.209	4.832	3.000	3.000	0.000	100.0	.030	.012	.0230	.0021	2.000
catch1/2	1.625	6.498	3.000	3.000	0.000	100.0	.030	.012	.0268	.0025	2.001
catch1/3	3.272	4.908	5.000	5.000	0.000	100.0	.030	.012	.0299	.0016	2.002
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0242	.0013	2.003
junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	3.001
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	2.004
catch1/6	3.475	0.3861	20.00	20.00	0.000	100.0	.100	.012	.0334	.0002	2.005
catch1/8	9.283	0.3020	10.00	5.000	0.000	100.0	.080	.012	.0647	.0003	1.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.002
catch5/2	3.283	0.9090	16.00	15.00	0.000	100.0	.100	.012	.0363	.0003	4.000
catch1/9	2.597	0.2890	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.002
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0044	.0005	3.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0087	.0005	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0113	.0006	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	3.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/7	32.600	15.00	1.500	2.500	0.000	30.942	47.400	2.306	27.00	0.000
catch1/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	1.769	30.00	0.000
catch1/2	32.600	15.00	1.500	2.500	0.000	30.942	47.400	4.125	28.00	0.000
catch1/3	32.600	15.00	1.500	2.500	0.000	30.942	47.400	6.141	29.00	0.000
catch1/4	32.600	15.00	1.500	2.500	0.000	30.942	47.400	3.179	30.00	0.000
junctA	32.600	1.500	0.000	0.000	0.000	47.400	0.000	5.011	29.00	0.000
catch2/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	7.735	30.00	0.000
catch1/5	32.600	15.00	1.500	2.500	0.000	30.942	47.400	5.995	30.00	0.000
catch1/6	32.600	15.00	1.500	2.500	0.000	30.942	47.400	6.470	30.00	0.000

catch1/8	32.600	15.00	1.500	2.500	0.000	30.942	47.400	8.423	32.00	0.000
junctB	32.600	1.500	0.000	0.000	0.000	47.400	0.000	5.493	28.00	0.000
catch5/2	32.600	15.00	1.500	2.500	0.000	30.942	47.400	0.5235	30.00	0.000
catch1/9	32.600	15.00	1.500	2.500	0.000	30.942	47.400	8.993	34.00	0.000
catch2/2	32.600	15.00	1.500	2.500	0.000	30.942	47.400	5.882	28.00	0.000
catch3/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	0.1832	30.00	0.000
catch4/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	0.6864	30.00	0.000
catch2/3	32.600	15.00	1.500	2.500	0.000	30.942	47.400	5.840	28.00	0.000
catch6/1	32.600	15.00	0.000	2.500	0.000	30.942	0.000	1.207	47.00	0.000
catch5/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	1.619	28.00	0.000
catch2/4	32.600	15.00	0.000	2.500	0.000	30.942	0.000	0.2543	40.00	0.000
catch1/10	32.600	15.00	1.500	2.500	0.000	30.942	47.400	15.841	34.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/7	1.13	.0350	0.1953	2.237	1.0	0.000	0.000	0.000
catch1/1	2.75	.0120	0.0582	1.779	1.0	0.000	0.000	0.000
catch1/2	3.55	.0120	0.1078	4.264	1.0	0.000	0.000	0.000
catch1/3	1.89	.0120	0.0570	1.197	1.0	0.000	0.000	0.000
catch1/4	2.24	.0500	0.1367	3.110	1.0	0.000	0.000	0.000
junctA	4.99	.0110	0.0898	4.985	1.0	0.000	0.000	0.000
catch2/1	4.00	.0110	0.1234	5.493	1.0	0.000	0.000	0.000
catch1/5	2.41	.0500	0.2484	6.080	1.0	0.000	0.000	0.000
catch1/6	1.32	.0350	0.4062	5.919	1.0	0.000	0.000	0.000
catch1/8	1.40	.0350	0.4719	8.042	1.0	0.000	0.000	0.000
junctB	4.09	.0110	0.1242	5.648	1.0	0.000	0.000	0.000
catch5/2	0.476	.0300	0.0139	0.5353	1.0	0.000	0.000	0.000
catch1/9	1.04	.0350	0.5719	8.490	1.0	0.000	0.000	0.000
catch2/2	5.33	.0110	0.0785	4.655	1.0	0.000	0.000	0.000
catch3/1	0.744	.0500	0.0244	0.1835	1.0	0.000	0.000	0.000
catch4/1	1.23	.0500	0.0543	0.6756	1.0	0.000	0.000	0.000
catch2/3	1.16	.0300	0.0625	5.885	1.0	0.000	0.000	0.000
catch6/1	0.591	.0500	0.2016	1.206	1.0	0.000	0.000	0.000
catch5/1	0.661	.0350	0.0301	1.607	1.0	0.000	0.000	0.000
catch2/4	0.348	.0300	.00903	0.2544	1.0	0.000	0.000	0.000

##
Results for period from 0: 0.0 19/ 4/1905
to 5: 0.0 19/ 4/1905
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 5.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 66.98
TOTAL OF SECOND SUB-AREAS (ha) = 39.92
TOTAL OF ALL SUB-AREAS (ha) = 106.91

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	1.000
catch1/1	1.209	4.832	3.000	3.000	0.000	100.0	.030	.012	.0188	.0017	2.000
catch1/2	1.625	6.498	3.000	3.000	0.000	100.0	.030	.012	.0219	.0020	2.001
catch1/3	3.272	4.908	5.000	5.000	0.000	100.0	.030	.012	.0244	.0013	2.002
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0198	.0011	2.003
junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	3.001

catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	2.004
catch1/6	3.475	0.3861	20.00	20.00	0.000	100.0	.100	.012	.0334	.0002	2.005
catch1/8	9.283	0.3020	10.00	5.000	0.000	100.0	.080	.012	.0647	.0003	1.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.002
catch5/2	3.283	0.9090	16.00	15.00	0.000	100.0	.100	.012	.0363	.0003	4.000
catch1/9	2.597	0.2890	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.002
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0036	.0004	3.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0071	.0004	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0092	.0005	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	3.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/7	43.200	15.00	1.500	2.500	0.000	46.633	63.300	3.308	30.00	0.000
catch1/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	2.467	30.00	0.000
catch1/2	43.200	15.00	1.500	2.500	0.000	46.633	63.300	5.773	30.00	0.000
catch1/3	43.200	15.00	1.500	2.500	0.000	46.633	63.300	8.663	29.00	0.000
catch1/4	43.200	15.00	1.500	2.500	0.000	46.633	63.300	4.276	30.00	0.000
junctA	43.200	1.500	0.000	0.000	0.000	63.300	0.000	7.533	29.00	0.000
catch2/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	11.449	29.00	0.000
catch1/5	43.200	15.00	1.500	2.500	0.000	46.633	63.300	11.115	30.00	0.000
catch1/6	43.200	15.00	1.500	2.500	0.000	46.633	63.300	11.739	31.00	0.000
catch1/8	43.200	15.00	1.500	2.500	0.000	46.633	63.300	15.276	32.00	0.000
junctB	43.200	1.500	0.000	0.000	0.000	63.300	0.000	5.510	27.00	0.000
catch5/2	43.200	15.00	1.500	2.500	0.000	46.633	63.300	0.8604	30.00	0.000
catch1/9	43.200	15.00	1.500	2.500	0.000	46.633	63.300	16.114	34.00	0.000
catch2/2	43.200	15.00	1.500	2.500	0.000	46.633	63.300	5.917	27.00	0.000
catch3/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	0.2858	30.00	0.000
catch4/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	1.007	30.00	0.000
catch2/3	43.200	15.00	1.500	2.500	0.000	46.633	63.300	6.430	31.00	0.000
catch6/1	43.200	15.00	0.000	2.500	0.000	46.633	0.000	2.015	42.00	0.000
catch5/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	1.810	27.00	0.000
catch2/4	43.200	15.00	0.000	2.500	0.000	46.633	0.000	0.4196	34.00	0.000
catch1/10	43.200	15.00	1.500	2.500	0.000	46.633	63.300	25.601	34.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/7	1.30	.0350	0.2422	3.202	1.0	0.000	0.000	0.000
catch1/1	3.14	.0120	0.0711	2.481	1.0	0.000	0.000	0.000
catch1/2	3.95	.0120	0.1320	5.797	1.0	0.000	0.000	0.000
catch1/3	1.85	.0120	0.0570	1.177	1.0	0.000	0.000	0.000
catch1/4	2.51	.0500	0.1641	4.180	1.0	0.000	0.000	0.000
junctA	6.00	.0110	0.1148	7.665	1.0	0.000	0.000	0.000
catch2/1	4.01	.0110	0.1234	5.510	1.0	0.000	0.000	0.000
catch1/5	2.51	.0500	0.4016	11.056	1.0	0.000	0.000	0.000
catch1/6	1.49	.0350	0.5531	11.371	1.0	0.000	0.000	0.000
catch1/8	1.55	.0350	0.6188	14.659	1.0	0.000	0.000	0.000
junctB	4.04	.0110	0.1242	5.577	1.0	0.000	0.000	0.000
catch5/2	0.574	.0300	0.0188	0.8706	1.0	0.000	0.000	0.000
catch1/9	1.29	.0350	0.7094	15.798	1.0	0.000	0.000	0.000
catch2/2	5.29	.0110	0.0785	4.619	1.0	0.000	0.000	0.000
catch3/1	0.860	.0500	0.0320	0.2784	1.0	0.000	0.000	0.000
catch4/1	1.43	.0500	0.0684	0.9898	1.0	0.000	0.000	0.000
catch2/3	1.19	.0300	0.0664	6.409	1.0	0.000	0.000	0.000

catch6/1	0.722	.0500	0.2750	2.013	1.0	0.000	0.000	0.000
catch5/1	0.700	.0350	0.0322	1.823	1.0	0.000	0.000	0.000
catch2/4	0.425	.0300	0.0122	0.4196	1.0	0.000	0.000	0.000

##
Results for period from 0: 0.0 19/ 4/1905
to 10: 0.0 19/ 4/1905
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 10.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 66.98
TOTAL OF SECOND SUB-AREAS (ha) = 39.92
TOTAL OF ALL SUB-AREAS (ha) = 106.91

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1 (%)	#2	Perm #1	#2	B #1	#2	Link No.
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	1.000
catch1/1	1.209	4.832	3.000	3.000	0.000	100.0	.030	.012	.0207	.0019	2.000
catch1/2	1.625	6.498	3.000	3.000	0.000	100.0	.030	.012	.0241	.0022	2.001
catch1/3	3.272	4.908	5.000	5.000	0.000	100.0	.030	.012	.0269	.0015	2.002
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0218	.0012	2.003
junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	3.001
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	2.004
catch1/6	3.475	0.3861	20.00	20.00	0.000	100.0	.100	.012	.0334	.0002	2.005
catch1/8	9.283	0.3020	10.00	5.000	0.000	100.0	.080	.012	.0647	.0003	1.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.002
catch5/2	3.283	0.9090	16.00	15.00	0.000	100.0	.100	.012	.0363	.0003	4.000
catch1/9	2.597	0.2890	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.002
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0040	.0004	3.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0078	.0004	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0101	.0006	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	3.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/7	49.500	15.00	1.500	2.500	0.000	56.042	72.750	3.881	30.00	0.000
catch1/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	2.837	30.00	0.000
catch1/2	49.500	15.00	1.500	2.500	0.000	56.042	72.750	6.606	30.00	0.000
catch1/3	49.500	15.00	1.500	2.500	0.000	56.042	72.750	9.929	29.00	0.000
catch1/4	49.500	15.00	1.500	2.500	0.000	56.042	72.750	4.752	30.00	0.000
junctA	49.500	1.500	0.000	0.000	0.000	72.750	0.000	8.799	29.00	0.000
catch2/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	13.001	29.00	0.000
catch1/5	49.500	15.00	1.500	2.500	0.000	56.042	72.750	13.671	29.00	0.000
catch1/6	49.500	15.00	1.500	2.500	0.000	56.042	72.750	14.779	30.00	0.000
catch1/8	49.500	15.00	1.500	2.500	0.000	56.042	72.750	19.092	32.00	0.000
junctB	49.500	1.500	0.000	0.000	0.000	72.750	0.000	5.490	13.00	0.000
catch5/2	49.500	15.00	1.500	2.500	0.000	56.042	72.750	1.078	30.00	0.000
catch1/9	49.500	15.00	1.500	2.500	0.000	56.042	72.750	20.850	33.00	0.000
catch2/2	49.500	15.00	1.500	2.500	0.000	56.042	72.750	5.869	29.00	0.000
catch3/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	0.3240	30.00	0.000
catch4/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	1.151	30.00	0.000
catch2/3	49.500	15.00	1.500	2.500	0.000	56.042	72.750	6.870	30.00	0.000

catch6/1	49.500	15.00	0.000	2.500	0.000	56.042	0.000	2.533	41.00	0.000	
catch5/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	1.890	29.00	0.000	
catch2/4	49.500	15.00	0.000	2.500	0.000	56.042	0.000	0.5487	32.00	0.000	
catch1/10	49.500	15.00	1.500	2.500	0.000	56.042	72.750	31.551	33.00	0.000	

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/7	1.38	.0350	0.2672	3.756	1.0	0.000	0.000	0.000
catch1/1	3.30	.0120	0.0773	2.838	1.0	0.000	0.000	0.000
catch1/2	4.16	.0120	0.1438	6.657	1.0	0.000	0.000	0.000
catch1/3	1.92	.0120	0.0588	1.258	1.0	0.000	0.000	0.000
catch1/4	2.63	.0500	0.1742	4.644	1.0	0.000	0.000	0.000
junctA	6.30	.0110	0.1227	8.591	1.0	0.000	0.000	0.000
catch2/1	4.00	.0110	0.1234	5.490	1.0	0.000	0.000	0.000
catch1/5	2.59	.0500	0.4531	13.838	1.0	0.000	0.000	0.000
catch1/6	1.56	.0350	0.6094	14.384	1.0	0.000	0.000	0.000
catch1/8	1.72	.0350	0.6688	18.917	1.0	0.000	0.000	0.000
junctB	4.07	.0110	0.1242	5.620	1.0	0.000	0.000	0.000
catch5/2	0.627	.0300	0.0215	1.089	1.0	0.000	0.000	0.000
catch1/9	1.41	.0350	0.7781	20.299	1.0	0.000	0.000	0.000
catch2/2	5.49	.0110	0.0785	4.792	1.0	0.000	0.000	0.000
catch3/1	0.925	.0500	0.0346	0.3234	1.0	0.000	0.000	0.000
catch4/1	1.50	.0500	0.0742	1.131	1.0	0.000	0.000	0.000
catch2/3	1.23	.0300	0.0688	6.848	1.0	0.000	0.000	0.000
catch6/1	0.727	.0500	0.3375	2.524	1.0	0.000	0.000	0.000
catch5/1	0.710	.0350	0.0330	1.896	1.0	0.000	0.000	0.000
catch2/4	0.474	.0300	0.0144	0.5501	1.0	0.000	0.000	0.000

##
Results for period from 0: 0.0 19/ 4/1905
to 10: 0.0 19/ 4/1905
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 20.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 66.98
TOTAL OF SECOND SUB-AREAS (ha) = 39.92
TOTAL OF ALL SUB-AREAS (ha) = 106.91

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	1.000
catch1/1	1.209	4.832	3.000	3.000	0.000	100.0	.030	.012	.0254	.0023	2.000
catch1/2	1.625	6.498	3.000	3.000	0.000	100.0	.030	.012	.0296	.0027	2.001
catch1/3	3.272	4.908	5.000	5.000	0.000	100.0	.030	.012	.0330	.0018	2.002
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0267	.0015	2.003
junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	3.001
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	2.004
catch1/6	3.475	0.3861	20.00	20.00	0.000	100.0	.100	.012	.0334	.0002	2.005
catch1/8	9.283	0.3020	10.00	5.000	0.000	100.0	.080	.012	.0647	.0003	1.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.002
catch5/2	3.283	0.9090	16.00	15.00	0.000	100.0	.100	.012	.0363	.0003	4.000
catch1/9	2.597	0.2890	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.002
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0049	.0005	3.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0095	.0005	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0124	.0007	6.000

catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	3.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/7	57.600	15.00	1.500	2.500	0.000	68.150	84.900	4.703	30.00	0.000
catch1/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	3.251	28.00	0.000
catch1/2	57.600	15.00	1.500	2.500	0.000	68.150	84.900	7.593	28.00	0.000
catch1/3	57.600	15.00	1.500	2.500	0.000	68.150	84.900	11.405	29.00	0.000
catch1/4	57.600	15.00	1.500	2.500	0.000	68.150	84.900	5.233	30.00	0.000
junctA	57.600	1.500	0.000	0.000	0.000	84.900	0.000	10.275	29.00	0.000
catch2/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	13.683	30.00	0.000
catch1/5	57.600	15.00	1.500	2.500	0.000	68.150	84.900	16.626	30.00	0.000
catch1/6	57.600	15.00	1.500	2.500	0.000	68.150	84.900	18.518	30.00	0.000
catch1/8	57.600	15.00	1.500	2.500	0.000	68.150	84.900	24.326	31.00	0.000
junctB	57.600	1.500	0.000	0.000	0.000	84.900	0.000	5.478	13.00	0.000
catch5/2	57.600	15.00	1.500	2.500	0.000	68.150	84.900	1.371	30.00	0.000
catch1/9	57.600	15.00	1.500	2.500	0.000	68.150	84.900	26.417	32.00	0.000
catch2/2	57.600	15.00	1.500	2.500	0.000	68.150	84.900	5.916	29.00	0.000
catch3/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	0.3690	30.00	0.000
catch4/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	1.320	30.00	0.000
catch2/3	57.600	15.00	1.500	2.500	0.000	68.150	84.900	7.256	30.00	0.000
catch6/1	57.600	15.00	0.000	2.500	0.000	68.150	0.000	3.182	40.00	0.000
catch5/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	2.073	30.00	0.000
catch2/4	57.600	15.00	0.000	2.500	0.000	68.150	0.000	0.6985	31.00	0.000
catch1/10	57.600	15.00	1.500	2.500	0.000	68.150	84.900	39.452	33.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/7	1.44	.0350	0.3031	4.452	1.0	0.000	0.000	0.000
catch1/1	3.50	.0120	0.0840	3.271	1.0	0.000	0.000	0.000
catch1/2	4.43	.0120	0.1562	7.692	1.0	0.000	0.000	0.000
catch1/3	1.85	.0120	0.0570	1.173	1.0	0.000	0.000	0.000
catch1/4	2.73	.0500	0.1852	5.117	1.0	0.000	0.000	0.000
junctA	6.43	.0110	0.1227	8.765	1.0	0.000	0.000	0.000
catch2/1	3.99	.0110	0.1234	5.478	1.0	0.000	0.000	0.000
catch1/5	2.73	.0500	0.5000	17.297	1.0	0.000	0.000	0.000
catch1/6	1.67	.0350	0.6609	18.006	1.0	0.000	0.000	0.000
catch1/8	1.89	.0350	0.7250	24.056	1.0	0.000	0.000	0.000
junctB	4.14	.0110	0.1234	5.688	1.0	0.000	0.000	0.000
catch5/2	0.678	.0300	0.0248	1.359	1.0	0.000	0.000	0.000
catch1/9	1.57	.0350	0.8500	26.222	1.0	0.000	0.000	0.000
catch2/2	5.33	.0110	0.0785	4.650	1.0	0.000	0.000	0.000
catch3/1	0.969	.0500	0.0373	0.3656	1.0	0.000	0.000	0.000
catch4/1	1.60	.0500	0.0805	1.301	1.0	0.000	0.000	0.000
catch2/3	1.25	.0300	0.0711	7.206	1.0	0.000	0.000	0.000
catch6/1	0.711	.0500	0.4047	3.171	1.0	0.000	0.000	0.000
catch5/1	0.752	.0350	0.0350	2.126	1.0	0.000	0.000	0.000
catch2/4	0.523	.0300	0.0166	0.7019	1.0	0.000	0.000	0.000

##

Results for period from 0: 0.0 19/ 4/1905
to 10: 0.0 19/ 4/1905

##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 50.

BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 66.98
TOTAL OF SECOND SUB-AREAS (ha) = 39.92
TOTAL OF ALL SUB-AREAS (ha) = 106.91

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	1.000
catch1/1	1.209	4.832	3.000	3.000	0.000	100.0	.030	.012	.0282	.0026	2.000
catch1/2	1.625	6.498	3.000	3.000	0.000	100.0	.030	.012	.0329	.0030	2.001
catch1/3	3.272	4.908	5.000	5.000	0.000	100.0	.030	.012	.0367	.0020	2.002
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0297	.0016	2.003
junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	3.001
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	2.004
catch1/6	3.475	0.3861	20.00	20.00	0.000	100.0	.100	.012	.0334	.0002	2.005
catch1/8	9.283	0.3020	10.00	5.000	0.000	100.0	.080	.012	.0647	.0003	1.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.002
catch5/2	3.283	0.9090	16.00	15.00	0.000	100.0	.100	.012	.0363	.0003	4.000
catch1/9	2.597	0.2890	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.002
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0054	.0006	3.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0106	.0006	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0138	.0008	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	3.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/7	68.400	15.00	1.500	2.500	0.000	84.308	101.10	5.396	30.00	0.000
catch1/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	3.597	28.00	0.000
catch1/2	68.400	15.00	1.500	2.500	0.000	84.308	101.10	8.387	28.00	0.000
catch1/3	68.400	15.00	1.500	2.500	0.000	84.308	101.10	12.640	29.00	0.000
catch1/4	68.400	15.00	1.500	2.500	0.000	84.308	101.10	5.643	30.00	0.000
junctA	68.400	1.500	0.000	0.000	0.000	101.10	0.000	11.510	29.00	0.000
catch2/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	14.336	30.00	0.000
catch1/5	68.400	15.00	1.500	2.500	0.000	84.308	101.10	19.205	30.00	0.000
catch1/6	68.400	15.00	1.500	2.500	0.000	84.308	101.10	21.143	30.00	0.000
catch1/8	68.400	15.00	1.500	2.500	0.000	84.308	101.10	28.388	31.00	0.000
junctB	68.400	1.500	0.000	0.000	0.000	101.10	0.000	5.502	12.00	0.000
catch5/2	68.400	15.00	1.500	2.500	0.000	84.308	101.10	1.652	30.00	0.000
catch1/9	68.400	15.00	1.500	2.500	0.000	84.308	101.10	31.107	32.00	0.000
catch2/2	68.400	15.00	1.500	2.500	0.000	84.308	101.10	5.972	30.00	0.000
catch3/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	0.4047	30.00	0.000
catch4/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	1.457	30.00	0.000
catch2/3	68.400	15.00	1.500	2.500	0.000	84.308	101.10	7.598	30.00	0.000
catch6/1	68.400	15.00	0.000	2.500	0.000	84.308	0.000	3.881	38.00	0.000
catch5/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	2.247	30.00	0.000
catch2/4	68.400	15.00	0.000	2.500	0.000	84.308	0.000	0.8383	31.00	0.000
catch1/10	68.400	15.00	1.500	2.500	0.000	84.308	101.10	45.448	33.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/7	1.38	.0350	0.3563	5.147	1.0	0.000	0.000	0.000
catch1/1	3.64	.0120	0.0891	3.610	1.0	0.000	0.000	0.000
catch1/2	4.62	.0120	0.1656	8.504	1.0	0.000	0.000	0.000

catch1/3	1.88	.0120	0.0570	1.195	1.0	0.000	0.000	0.000
catch1/4	2.83	.0500	0.1938	5.552	1.0	0.000	0.000	0.000
junctA	6.43	.0110	0.1227	8.775	1.0	0.000	0.000	0.000
catch2/1	4.01	.0110	0.1234	5.502	1.0	0.000	0.000	0.000
catch1/5	2.73	.0500	0.5359	19.670	1.0	0.000	0.000	0.000
catch1/6	1.79	.0350	0.6906	20.926	1.0	0.000	0.000	0.000
catch1/8	2.01	.0350	0.7656	28.222	1.0	0.000	0.000	0.000
junctB	3.99	.0110	0.1242	5.520	1.0	0.000	0.000	0.000
catch5/2	0.746	.0300	0.0277	1.673	1.0	0.000	0.000	0.000
catch1/9	1.66	.0350	0.9063	30.762	1.0	0.000	0.000	0.000
catch2/2	5.20	.0110	0.0785	4.543	1.0	0.000	0.000	0.000
catch3/1	1.02	.0500	0.0395	0.4099	1.0	0.000	0.000	0.000
catch4/1	1.67	.0500	0.0852	1.446	1.0	0.000	0.000	0.000
catch2/3	1.27	.0300	0.0734	7.540	1.0	0.000	0.000	0.000
catch6/1	0.721	.0500	0.4547	3.875	1.0	0.000	0.000	0.000
catch5/1	0.778	.0350	0.0365	2.297	1.0	0.000	0.000	0.000
catch2/4	0.560	.0300	0.0185	0.8361	1.0	0.000	0.000	0.000

##
Results for period from 0: 0.0 19/ 4/1905
to 10: 0.0 19/ 4/1905
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 66.98
TOTAL OF SECOND SUB-AREAS (ha) = 39.92
TOTAL OF ALL SUB-AREAS (ha) = 106.91

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Perm #1	Perm #2	B #1	B #2	Link No.
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	1.000
catch1/1	1.209	4.832	3.000	3.000	0.000	100.0	.030	.012	.0282	.0026	2.000
catch1/2	1.625	6.498	3.000	3.000	0.000	100.0	.030	.012	.0329	.0030	2.001
catch1/3	3.272	4.908	5.000	5.000	0.000	100.0	.030	.012	.0367	.0020	2.002
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0297	.0016	2.003
junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	3.001
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	2.004
catch1/6	3.475	0.3861	20.00	20.00	0.000	100.0	.100	.012	.0334	.0002	2.005
catch1/8	9.283	0.3020	10.00	5.000	0.000	100.0	.080	.012	.0647	.0003	1.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.002
catch5/2	3.283	0.9090	16.00	15.00	0.000	100.0	.100	.012	.0363	.0003	4.000
catch1/9	2.597	0.2890	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.002
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0054	.0006	3.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0106	.0006	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0138	.0008	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	3.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/7	77.000	15.00	1.500	2.500	0.000	97.208	114.00	6.259	30.00	0.000
catch1/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	4.067	30.00	0.000
catch1/2	77.000	15.00	1.500	2.500	0.000	97.208	114.00	9.517	28.00	0.000
catch1/3	77.000	15.00	1.500	2.500	0.000	97.208	114.00	14.405	29.00	0.000
catch1/4	77.000	15.00	1.500	2.500	0.000	97.208	114.00	6.278	30.00	0.000

junctA	77.000	1.500	0.000	0.000	0.000	114.00	0.000	13.275	29.00	0.000
catch2/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	15.222	30.00	0.000
catch1/5	77.000	15.00	1.500	2.500	0.000	97.208	114.00	22.786	30.00	0.000
catch1/6	77.000	15.00	1.500	2.500	0.000	97.208	114.00	24.429	30.00	0.000
catch1/8	77.000	15.00	1.500	2.500	0.000	97.208	114.00	33.501	31.00	0.000
junctB	77.000	1.500	0.000	0.000	0.000	114.00	0.000	5.604	12.00	0.000
catch5/2	77.000	15.00	1.500	2.500	0.000	97.208	114.00	1.949	30.00	0.000
catch1/9	77.000	15.00	1.500	2.500	0.000	97.208	114.00	36.738	32.00	0.000
catch2/2	77.000	15.00	1.500	2.500	0.000	97.208	114.00	6.101	12.00	0.000
catch3/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	0.4582	30.00	0.000
catch4/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	1.646	30.00	0.000
catch2/3	77.000	15.00	1.500	2.500	0.000	97.208	114.00	8.066	30.00	0.000
catch6/1	77.000	15.00	0.000	2.500	0.000	97.208	0.000	4.589	36.00	0.000
catch5/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	2.458	30.00	0.000
catch2/4	77.000	15.00	0.000	2.500	0.000	97.208	0.000	0.9908	31.00	0.000
catch1/10	77.000	15.00	1.500	2.500	0.000	97.208	114.00	52.594	32.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/7	1.38	.0350	0.3969	5.978	1.0	0.000	0.000	0.000
catch1/1	3.82	.0120	0.0961	4.088	1.0	0.000	0.000	0.000
catch1/2	4.82	.0120	0.1797	9.633	1.0	0.000	0.000	0.000
catch1/3	2.00	.0120	0.0598	1.329	1.0	0.000	0.000	0.000
catch1/4	2.98	.0500	0.2063	6.232	1.0	0.000	0.000	0.000
junctA	6.30	.0110	0.1227	8.595	1.0	0.000	0.000	0.000
catch2/1	4.08	.0110	0.1234	5.604	1.0	0.000	0.000	0.000
catch1/5	2.74	.0500	0.5781	22.723	1.0	0.000	0.000	0.000
catch1/6	1.93	.0350	0.7266	24.736	1.0	0.000	0.000	0.000
catch1/8	2.14	.0350	0.8156	33.384	1.0	0.000	0.000	0.000
junctB	4.16	.0110	0.1258	5.822	1.0	0.000	0.000	0.000
catch5/2	0.798	.0300	0.0307	1.978	1.0	0.000	0.000	0.000
catch1/9	1.76	.0350	0.9688	36.170	1.0	0.000	0.000	0.000
catch2/2	5.20	.0110	0.0785	4.544	1.0	0.000	0.000	0.000
catch3/1	1.06	.0500	0.0426	0.4575	1.0	0.000	0.000	0.000
catch4/1	1.77	.0500	0.0918	1.647	1.0	0.000	0.000	0.000
catch2/3	1.30	.0300	0.0758	7.990	1.0	0.000	0.000	0.000
catch6/1	0.735	.0500	0.4953	4.580	1.0	0.000	0.000	0.000
catch5/1	0.804	.0350	0.0387	2.512	1.0	0.000	0.000	0.000
catch2/4	0.600	.0300	0.0204	0.9899	1.0	0.000	0.000	0.000

Run completed at: 16th April 2013 7:27:25

Appendix B

XP-Rafts Output for Developed Conditions

Run started at: 11th July 2014 11:32:46

##
####
RUNTIME RESULTS
##
####

Max. no. of links allowed = 2000

Max. no. of routng increments allowed = 25000

Max. no. of rating curve points = 25000

Max. no. of storm temporal points = 25000

Max. no. of channel subreaches = 25

Max link stack level = 25

Input Version number = 650

LINK catch1/1 1.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) = 2.667
ESTIMATED PEAK FLOW (CUMECS) = 1.77
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK catch1/2 1.001
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) = 6.253
ESTIMATED PEAK FLOW (CUMECS) = 4.13
ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK catch1/3 1.002
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) = 9.607
ESTIMATED PEAK FLOW (CUMECS) = 6.14
ESTIMATED TIME TO PEAK (MINS) = 29.00

LINK junctA 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.289
ESTIMATED PEAK FLOW (CUMECS) = 5.01
ESTIMATED TIME TO PEAK (MINS) = 29.00

LINK catch2/1 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 8.276
ESTIMATED PEAK FLOW (CUMECS) = 7.74
ESTIMATED TIME TO PEAK (MINS) = 30.00

```
LINK junctB            2.002

ESTIMATED VOLUME (CU METRES*10**3) =          7.887
ESTIMATED PEAK FLOW         (CUMECS) =      5.49
ESTIMATED TIME TO PEAK         (MINS) =     28.00

LINK catch5/2          3.000

ESTIMATED VOLUME (CU METRES*10**3) =          1.509
ESTIMATED PEAK FLOW         (CUMECS) =      0.63
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/7          4.000

ESTIMATED VOLUME (CU METRES*10**3) =          5.572
ESTIMATED PEAK FLOW         (CUMECS) =      2.31
ESTIMATED TIME TO PEAK         (MINS) =     27.00

LINK catch1/4          1.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          8.616
ESTIMATED PEAK FLOW         (CUMECS) =      3.18
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/5          1.004

ESTIMATED VOLUME (CU METRES*10**3) =          10.58
ESTIMATED PEAK FLOW         (CUMECS) =      6.00
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/6          1.005

ESTIMATED VOLUME (CU METRES*10**3) =          11.86
ESTIMATED PEAK FLOW         (CUMECS) =      6.50
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/8          1.006

ESTIMATED VOLUME (CU METRES*10**3) =          20.45
ESTIMATED PEAK FLOW         (CUMECS) =      8.47
ESTIMATED TIME TO PEAK         (MINS) =     32.00

LINK catch1/9          1.007

ESTIMATED VOLUME (CU METRES*10**3) =          22.89
ESTIMATED PEAK FLOW         (CUMECS) =      8.98
ESTIMATED TIME TO PEAK         (MINS) =     34.00

LINK catch2/2          2.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          8.209
ESTIMATED PEAK FLOW         (CUMECS) =      5.88
ESTIMATED TIME TO PEAK         (MINS) =     28.00

LINK catch3/1          5.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          0.2777
ESTIMATED PEAK FLOW         (CUMECS) =      0.18
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch4/1          6.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
```

```
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          0.9894
 ESTIMATED PEAK FLOW         (CUMECS) =      0.69
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch2/3          2.004

 ESTIMATED VOLUME (CU METRES*10**3) =           10.09
 ESTIMATED PEAK FLOW         (CUMECS) =      5.84
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK catch6/1          7.000

 ESTIMATED VOLUME (CU METRES*10**3) =           4.210
 ESTIMATED PEAK FLOW         (CUMECS) =      1.21
 ESTIMATED TIME TO PEAK         (MINS) =     47.00

 LINK catch5/1          8.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.9134
 ESTIMATED PEAK FLOW         (CUMECS) =      1.62
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK catch2/4          9.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.6318
 ESTIMATED PEAK FLOW         (CUMECS) =      0.25
 ESTIMATED TIME TO PEAK         (MINS) =     40.00

 LINK catch1/10         1.008

 ESTIMATED VOLUME (CU METRES*10**3) =           39.75
 ESTIMATED PEAK FLOW         (CUMECS) =     15.85
 ESTIMATED TIME TO PEAK         (MINS) =     34.00



################################################################################
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Results for period from  0: 0.0 19/ 4/1905
                    to  5: 0.0 19/ 4/1905
################################################################################
####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =         2.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      66.41
                              TOTAL OF SECOND SUB-AREAS (ha) =      40.50
                              TOTAL OF ALL SUB-AREAS (ha)    =     106.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
catch1/1   1.209  4.832  3.000 3.000  0.000 100.0  .030 .012  .0230 .0021  1.000

catch1/2   1.625  6.498  3.000 3.000  0.000 100.0  .030 .012  .0268 .0025  1.001

catch1/3   3.272  4.908  5.000 5.000  0.000 100.0  .030 .012  .0299 .0016  1.002
```

junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	2.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	2.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	2.002
catch5/2	2.893	1.299	16.00	15.00	0.000	100.0	.100	.012	.0340	.0004	3.000
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	4.000
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0242	.0013	1.003
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	1.004
catch1/6	3.376	0.4850	20.00	20.00	0.000	100.0	.100	.012	.0329	.0002	1.005
catch1/8	9.195	0.3900	10.00	5.000	0.000	100.0	.080	.012	.0644	.0004	1.006
catch1/9	2.597	0.2885	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.007
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0044	.0005	2.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0087	.0005	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0113	.0006	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	2.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.008

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	1.769	30.00	0.000
catch1/2	32.600	15.00	1.500	2.500	0.000	30.942	47.400	4.125	28.00	0.000
catch1/3	32.600	15.00	1.500	2.500	0.000	30.942	47.400	6.141	29.00	0.000
junctA	32.600	1.500	0.000	0.000	0.000	47.400	0.000	5.011	29.00	0.000
catch2/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	7.735	30.00	0.000
junctB	32.600	1.500	0.000	0.000	0.000	47.400	0.000	5.493	28.00	0.000
catch5/2	32.600	15.00	1.500	2.500	0.000	30.942	47.400	0.6281	30.00	0.000
catch1/7	32.600	15.00	1.500	2.500	0.000	30.942	47.400	2.306	27.00	0.000
catch1/4	32.600	15.00	1.500	2.500	0.000	30.942	47.400	3.179	30.00	0.000
catch1/5	32.600	15.00	1.500	2.500	0.000	30.942	47.400	5.995	30.00	0.000
catch1/6	32.600	15.00	1.500	2.500	0.000	30.942	47.400	6.499	30.00	0.000
catch1/8	32.600	15.00	1.500	2.500	0.000	30.942	47.400	8.467	32.00	0.000
catch1/9	32.600	15.00	1.500	2.500	0.000	30.942	47.400	8.978	34.00	0.000
catch2/2	32.600	15.00	1.500	2.500	0.000	30.942	47.400	5.882	28.00	0.000

catch3/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	0.1832	30.00	0.000
catch4/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	0.6864	30.00	0.000
catch2/3	32.600	15.00	1.500	2.500	0.000	30.942	47.400	5.840	28.00	0.000
catch6/1	32.600	15.00	0.000	2.500	0.000	30.942	0.000	1.207	47.00	0.000
catch5/1	32.600	15.00	1.500	2.500	0.000	30.942	47.400	1.619	28.00	0.000
catch2/4	32.600	15.00	0.000	2.500	0.000	30.942	0.000	0.2543	40.00	0.000
catch1/10	32.600	15.00	1.500	2.500	0.000	30.942	47.400	15.851	34.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
catch5/2	30.00	.6281	31.00	.4939	1508.7	0.0000	111.08	83.025

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
catch5/2	1.0		.6750	0.000	20.000	1.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/1	2.75	.0120	0.0582	1.779	1.0	0.000	0.000	0.000
catch1/2	3.55	.0120	0.1078	4.264	1.0	0.000	0.000	0.000
catch1/3	1.89	.0120	0.0570	1.197	1.0	0.000	0.000	0.000
junctA	4.99	.0110	0.0898	4.985	1.0	0.000	0.000	0.000
catch2/1	4.00	.0110	0.1234	5.493	1.0	0.000	0.000	0.000
junctB	4.09	.0110	0.1242	5.648	1.0	0.000	0.000	0.000
catch5/2	0.454	.0300	0.0135	0.4948	1.0	0.000	0.000	0.000
catch1/7	1.13	.0350	0.1953	2.237	1.0	0.000	0.000	0.000
catch1/4	2.24	.0500	0.1367	3.110	1.0	0.000	0.000	0.000
catch1/5	2.41	.0500	0.2484	6.080	1.0	0.000	0.000	0.000
catch1/6	1.32	.0350	0.4062	5.935	1.0	0.000	0.000	0.000
catch1/8	1.41	.0350	0.4719	8.080	1.0	0.000	0.000	0.000
catch1/9	1.04	.0350	0.5719	8.507	1.0	0.000	0.000	0.000
catch2/2	5.33	.0110	0.0785	4.655	1.0	0.000	0.000	0.000
catch3/1	0.744	.0500	0.0244	0.1835	1.0	0.000	0.000	0.000

catch4/1	1.23	.0500	0.0543	0.6756	1.0	0.000	0.000	0.000
catch2/3	1.16	.0300	0.0625	5.885	1.0	0.000	0.000	0.000
catch6/1	0.591	.0500	0.2016	1.206	1.0	0.000	0.000	0.000
catch5/1	0.661	.0350	0.0301	1.607	1.0	0.000	0.000	0.000
catch2/4	0.348	.0300	.00903	0.2544	1.0	0.000	0.000	0.000

```
 LINK catch1/1          1.000
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          3.622
 ESTIMATED PEAK FLOW         (CUMECS) =      2.47
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch1/2          1.001
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          8.492
 ESTIMATED PEAK FLOW         (CUMECS) =      5.77
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch1/3          1.002
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          13.15
 ESTIMATED PEAK FLOW         (CUMECS) =      8.66
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK junctA            2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          7.442
 ESTIMATED PEAK FLOW         (CUMECS) =      7.53
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK catch2/1          2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          12.97
 ESTIMATED PEAK FLOW         (CUMECS) =     11.45
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK junctB            2.002

 ESTIMATED VOLUME (CU METRES*10**3) =          11.31
 ESTIMATED PEAK FLOW         (CUMECS) =      5.51
 ESTIMATED TIME TO PEAK         (MINS) =     27.00

 LINK catch5/2          3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.164
 ESTIMATED PEAK FLOW         (CUMECS) =      0.97
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch1/7          4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          7.968
 ESTIMATED PEAK FLOW         (CUMECS) =      3.31
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch1/4          1.003
```

```
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          10.28
ESTIMATED PEAK FLOW         (CUMECS) =      4.28
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/5          1.004

ESTIMATED VOLUME (CU METRES*10**3) =          14.19
ESTIMATED PEAK FLOW         (CUMECS) =     11.11
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/6          1.005

ESTIMATED VOLUME (CU METRES*10**3) =          16.08
ESTIMATED PEAK FLOW         (CUMECS) =     11.75
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/8          1.006

ESTIMATED VOLUME (CU METRES*10**3) =          28.56
ESTIMATED PEAK FLOW         (CUMECS) =     15.31
ESTIMATED TIME TO PEAK         (MINS) =     32.00

LINK catch1/9          1.007

ESTIMATED VOLUME (CU METRES*10**3) =          32.12
ESTIMATED PEAK FLOW         (CUMECS) =     15.91
ESTIMATED TIME TO PEAK         (MINS) =     34.00

LINK catch2/2          2.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          11.76
ESTIMATED PEAK FLOW         (CUMECS) =      5.92
ESTIMATED TIME TO PEAK         (MINS) =     27.00

LINK catch3/1          5.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =         0.3848
ESTIMATED PEAK FLOW         (CUMECS) =      0.29
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch4/1          6.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          1.374
ESTIMATED PEAK FLOW         (CUMECS) =      1.01
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch2/3          2.004

ESTIMATED VOLUME (CU METRES*10**3) =          14.10
ESTIMATED PEAK FLOW         (CUMECS) =      6.43
ESTIMATED TIME TO PEAK         (MINS) =     31.00

LINK catch6/1          7.000

ESTIMATED VOLUME (CU METRES*10**3) =          6.297
ESTIMATED PEAK FLOW         (CUMECS) =      2.01
ESTIMATED TIME TO PEAK         (MINS) =     42.00

LINK catch5/1          8.000
```

```
 ESTIMATED VOLUME (CU METRES*10**3) =          1.605
 ESTIMATED PEAK FLOW         (CUMECS) =      1.81
 ESTIMATED TIME TO PEAK         (MINS) =     27.00

 LINK catch2/4          9.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.9467
 ESTIMATED PEAK FLOW         (CUMECS) =      0.42
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK catch1/10         1.008

 ESTIMATED VOLUME (CU METRES*10**3) =          56.57
 ESTIMATED PEAK FLOW         (CUMECS) =     25.36
 ESTIMATED TIME TO PEAK         (MINS) =     34.00



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Results for period from  0: 0.0 19/ 4/1905
                    to  5: 0.0 19/ 4/1905
################################################################################
####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =        90.
                                RETURN PERIOD (YRS)      =         5.
                                BX                       =     1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      66.41
                                TOTAL OF SECOND SUB-AREAS (ha) =      40.50
                                TOTAL OF ALL SUB-AREAS (ha)    =     106.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2      #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)              (%)          (%)
catch1/1   1.209  4.832  3.000 3.000  0.000 100.0  .030 .012  .0188 .0017  1.000

catch1/2   1.625  6.498  3.000 3.000  0.000 100.0  .030 .012  .0219 .0020  1.001

catch1/3   3.272  4.908  5.000 5.000  0.000 100.0  .030 .012  .0244 .0013  1.002

junctA    .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  2.000

catch2/1   3.904  5.856  11.00 11.00  0.000 100.0  .030 .012  .0181 .0010  2.001

junctB    .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  2.002

catch5/2   2.893  1.299  16.00 15.00  0.000 100.0  .100 .012  .0340 .0004  3.000

catch1/7   9.189  5.841  9.300 10.00  0.000 100.0  .100 .012  .0812 .0010  4.000

catch1/4   3.219  4.828  7.500 7.500  0.000 100.0  .030 .012  .0198 .0011  1.003

catch1/5   3.060  1.313  20.00 10.00  0.000 100.0  .100 .025  .0313 .0011  1.004

catch1/6   3.376 0.4850  20.00 20.00  0.000 100.0  .100 .012  .0329 .0002  1.005

catch1/8   9.195 0.3900  10.00 5.000  0.000 100.0  .080 .012  .0644 .0004  1.006

catch1/9   2.597 0.2885  5.000 5.000  0.000 100.0  .030 .012  .0217 .0003  1.007
```

catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0036	.0004	2.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0071	.0004	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0092	.0005	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	2.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.008

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	2.467	30.00	0.000
catch1/2	43.200	15.00	1.500	2.500	0.000	46.633	63.300	5.773	30.00	0.000
catch1/3	43.200	15.00	1.500	2.500	0.000	46.633	63.300	8.663	29.00	0.000
junctA	43.200	1.500	0.000	0.000	0.000	63.300	0.000	7.533	29.00	0.000
catch2/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	11.449	29.00	0.000
junctB	43.200	1.500	0.000	0.000	0.000	63.300	0.000	5.510	27.00	0.000
catch5/2	43.200	15.00	1.500	2.500	0.000	46.633	63.300	0.9750	30.00	0.000
catch1/7	43.200	15.00	1.500	2.500	0.000	46.633	63.300	3.308	30.00	0.000
catch1/4	43.200	15.00	1.500	2.500	0.000	46.633	63.300	4.276	30.00	0.000
catch1/5	43.200	15.00	1.500	2.500	0.000	46.633	63.300	11.115	30.00	0.000
catch1/6	43.200	15.00	1.500	2.500	0.000	46.633	63.300	11.748	30.00	0.000
catch1/8	43.200	15.00	1.500	2.500	0.000	46.633	63.300	15.307	32.00	0.000
catch1/9	43.200	15.00	1.500	2.500	0.000	46.633	63.300	15.910	34.00	0.000
catch2/2	43.200	15.00	1.500	2.500	0.000	46.633	63.300	5.917	27.00	0.000
catch3/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	0.2858	30.00	0.000
catch4/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	1.007	30.00	0.000
catch2/3	43.200	15.00	1.500	2.500	0.000	46.633	63.300	6.430	31.00	0.000
catch6/1	43.200	15.00	0.000	2.500	0.000	46.633	0.000	2.015	42.00	0.000
catch5/1	43.200	15.00	1.500	2.500	0.000	46.633	63.300	1.810	27.00	0.000
catch2/4	43.200	15.00	0.000	2.500	0.000	46.633	0.000	0.4196	34.00	0.000
catch1/10	43.200	15.00	1.500	2.500	0.000	46.633	63.300	25.364	34.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
catch5/2	30.00	.9750	41.00	.6234	2164.0	0.0000	227.96	83.286

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
catch5/2	1.0		.6750	0.000	20.000	1.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/1	3.14	.0120	0.0711	2.481	1.0	0.000	0.000	0.000
catch1/2	3.95	.0120	0.1320	5.797	1.0	0.000	0.000	0.000
catch1/3	1.85	.0120	0.0570	1.177	1.0	0.000	0.000	0.000
junctA	6.00	.0110	0.1148	7.665	1.0	0.000	0.000	0.000
catch2/1	4.01	.0110	0.1234	5.510	1.0	0.000	0.000	0.000
junctB	4.04	.0110	0.1242	5.577	1.0	0.000	0.000	0.000
catch5/2	0.500	.0300	0.0154	0.6233	1.0	0.000	0.000	0.000
catch1/7	1.30	.0350	0.2422	3.202	1.0	0.000	0.000	0.000
catch1/4	2.51	.0500	0.1641	4.180	1.0	0.000	0.000	0.000
catch1/5	2.51	.0500	0.4016	11.056	1.0	0.000	0.000	0.000
catch1/6	1.49	.0350	0.5531	11.381	1.0	0.000	0.000	0.000
catch1/8	1.55	.0350	0.6188	14.682	1.0	0.000	0.000	0.000
catch1/9	1.28	.0350	0.7063	15.560	1.0	0.000	0.000	0.000
catch2/2	5.29	.0110	0.0785	4.619	1.0	0.000	0.000	0.000
catch3/1	0.860	.0500	0.0320	0.2784	1.0	0.000	0.000	0.000
catch4/1	1.43	.0500	0.0684	0.9898	1.0	0.000	0.000	0.000
catch2/3	1.19	.0300	0.0664	6.409	1.0	0.000	0.000	0.000
catch6/1	0.722	.0500	0.2750	2.013	1.0	0.000	0.000	0.000
catch5/1	0.700	.0350	0.0322	1.823	1.0	0.000	0.000	0.000
catch2/4	0.425	.0300	0.0122	0.4196	1.0	0.000	0.000	0.000

LINK catch1/1 1.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) = 4.193
ESTIMATED PEAK FLOW (CUMECS) = 2.84

```
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK catch1/2          1.001
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =           9.830
ESTIMATED PEAK FLOW          (CUMECS) =      6.61
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK catch1/3          1.002
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          15.26
ESTIMATED PEAK FLOW          (CUMECS) =      9.93
ESTIMATED TIME TO PEAK          (MINS) =     29.00

LINK junctA            2.000

ESTIMATED VOLUME (CU METRES*10**3) =           9.344
ESTIMATED PEAK FLOW          (CUMECS) =      8.80
ESTIMATED TIME TO PEAK          (MINS) =     29.00

LINK catch2/1          2.001

ESTIMATED VOLUME (CU METRES*10**3) =          15.74
ESTIMATED PEAK FLOW          (CUMECS) =     13.00
ESTIMATED TIME TO PEAK          (MINS) =     29.00

LINK junctB            2.002

ESTIMATED VOLUME (CU METRES*10**3) =          13.18
ESTIMATED PEAK FLOW          (CUMECS) =      5.49
ESTIMATED TIME TO PEAK          (MINS) =     13.00

LINK catch5/2          3.000

ESTIMATED VOLUME (CU METRES*10**3) =           2.571
ESTIMATED PEAK FLOW          (CUMECS) =      1.24
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK catch1/7          4.000

ESTIMATED VOLUME (CU METRES*10**3) =           9.364
ESTIMATED PEAK FLOW          (CUMECS) =      3.88
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK catch1/4          1.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          11.25
ESTIMATED PEAK FLOW          (CUMECS) =      4.75
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK catch1/5          1.004

ESTIMATED VOLUME (CU METRES*10**3) =          16.53
ESTIMATED PEAK FLOW          (CUMECS) =     13.67
ESTIMATED TIME TO PEAK          (MINS) =     29.00

LINK catch1/6          1.005

ESTIMATED VOLUME (CU METRES*10**3) =          18.78
ESTIMATED PEAK FLOW          (CUMECS) =     14.82
ESTIMATED TIME TO PEAK          (MINS) =     30.00
```

```
LINK catch1/8          1.006

ESTIMATED VOLUME (CU METRES*10**3) =           33.59
ESTIMATED PEAK FLOW          (CUMECS) =     19.12
ESTIMATED TIME TO PEAK          (MINS) =     32.00

LINK catch1/9          1.007

ESTIMATED VOLUME (CU METRES*10**3) =           37.83
ESTIMATED PEAK FLOW          (CUMECS) =     20.40
ESTIMATED TIME TO PEAK          (MINS) =     33.00

LINK catch2/2          2.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =           13.71
ESTIMATED PEAK FLOW          (CUMECS) =      5.87
ESTIMATED TIME TO PEAK          (MINS) =     29.00

LINK catch3/1          5.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          0.4491
ESTIMATED PEAK FLOW          (CUMECS) =      0.32
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK catch4/1          6.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =           1.601
ESTIMATED PEAK FLOW          (CUMECS) =      1.15
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK catch2/3          2.004

ESTIMATED VOLUME (CU METRES*10**3) =           16.23
ESTIMATED PEAK FLOW          (CUMECS) =      6.87
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK catch6/1          7.000

ESTIMATED VOLUME (CU METRES*10**3) =           7.630
ESTIMATED PEAK FLOW          (CUMECS) =      2.53
ESTIMATED TIME TO PEAK          (MINS) =     41.00

WARNING 12 - DRDH = -ve
LINK catch5/1          8.000

ESTIMATED VOLUME (CU METRES*10**3) =           2.114
ESTIMATED PEAK FLOW          (CUMECS) =      1.89
ESTIMATED TIME TO PEAK          (MINS) =     29.00

LINK catch2/4          9.000

ESTIMATED VOLUME (CU METRES*10**3) =           1.136
ESTIMATED PEAK FLOW          (CUMECS) =      0.55
ESTIMATED TIME TO PEAK          (MINS) =     32.00

LINK catch1/10         1.008

ESTIMATED VOLUME (CU METRES*10**3) =           66.73
ESTIMATED PEAK FLOW          (CUMECS) =     31.15
ESTIMATED TIME TO PEAK          (MINS) =     33.00
```

##
####

Results for period from 0: 0.0 19/ 4/1905
                    to 10: 0.0 19/ 4/1905
##
####

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS)   = 90.
RETURN PERIOD (YRS)   = 10.
BX   = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 66.41
TOTAL OF SECOND SUB-AREAS (ha) = 40.50
TOTAL OF ALL SUB-AREAS (ha)   = 106.90

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Perm #1	#2	B #1	#2	Link No.
catch1/1	1.209	4.832	3.000	3.000	0.000	100.0	.030	.012	.0207	.0019	1.000
catch1/2	1.625	6.498	3.000	3.000	0.000	100.0	.030	.012	.0241	.0022	1.001
catch1/3	3.272	4.908	5.000	5.000	0.000	100.0	.030	.012	.0269	.0015	1.002
junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	2.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	2.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	2.002
catch5/2	2.893	1.299	16.00	15.00	0.000	100.0	.100	.012	.0340	.0004	3.000
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	4.000
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0218	.0012	1.003
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	1.004
catch1/6	3.376	0.4850	20.00	20.00	0.000	100.0	.100	.012	.0329	.0002	1.005
catch1/8	9.195	0.3900	10.00	5.000	0.000	100.0	.080	.012	.0644	.0004	1.006
catch1/9	2.597	0.2885	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.007
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0040	.0004	2.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0078	.0004	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0101	.0006	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	2.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.008

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak mins	Link Lag mins
catch1/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	2.837	30.00	0.000
catch1/2	49.500	15.00	1.500	2.500	0.000	56.042	72.750	6.606	30.00	0.000
catch1/3	49.500	15.00	1.500	2.500	0.000	56.042	72.750	9.929	29.00	0.000
junctA	49.500	1.500	0.000	0.000	0.000	72.750	0.000	8.799	29.00	0.000
catch2/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	13.001	29.00	0.000
junctB	49.500	1.500	0.000	0.000	0.000	72.750	0.000	5.490	13.00	0.000
catch5/2	49.500	15.00	1.500	2.500	0.000	56.042	72.750	1.236	30.00	0.000
catch1/7	49.500	15.00	1.500	2.500	0.000	56.042	72.750	3.881	30.00	0.000
catch1/4	49.500	15.00	1.500	2.500	0.000	56.042	72.750	4.752	30.00	0.000
catch1/5	49.500	15.00	1.500	2.500	0.000	56.042	72.750	13.671	29.00	0.000
catch1/6	49.500	15.00	1.500	2.500	0.000	56.042	72.750	14.816	30.00	0.000
catch1/8	49.500	15.00	1.500	2.500	0.000	56.042	72.750	19.121	32.00	0.000
catch1/9	49.500	15.00	1.500	2.500	0.000	56.042	72.750	20.398	33.00	0.000
catch2/2	49.500	15.00	1.500	2.500	0.000	56.042	72.750	5.869	29.00	0.000
catch3/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	0.3240	30.00	0.000
catch4/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	1.151	30.00	0.000
catch2/3	49.500	15.00	1.500	2.500	0.000	56.042	72.750	6.870	30.00	0.000
catch6/1	49.500	15.00	0.000	2.500	0.000	56.042	0.000	2.533	41.00	0.000
catch5/1	49.500	15.00	1.500	2.500	0.000	56.042	72.750	1.890	29.00	0.000
catch2/4	49.500	15.00	0.000	2.500	0.000	56.042	0.000	0.5487	32.00	0.000
catch1/10	49.500	15.00	1.500	2.500	0.000	56.042	72.750	31.148	33.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
catch5/2	30.00	1.235	39.00	.8139	2571.4	0.0000	276.85	83.395

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
catch5/2	1.0		.6750	0.000	20.000	1.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link	Ave.	Ave.	Flow	Max.	No.	Pipe	Pipe	Pipe

Label	Vel. (m/s)	Rough. (n)	Depth (m)	Flow (m^3/s)	of Pipes	Dia. (m)	Slope (%)	Flow (m3^/s)
catch1/1	3.30	.0120	0.0773	2.838	1.0	0.000	0.000	0.000
catch1/2	4.16	.0120	0.1438	6.657	1.0	0.000	0.000	0.000
catch1/3	1.92	.0120	0.0588	1.258	1.0	0.000	0.000	0.000
junctA	6.30	.0110	0.1227	8.591	1.0	0.000	0.000	0.000
catch2/1	4.00	.0110	0.1234	5.490	1.0	0.000	0.000	0.000
junctB	4.07	.0110	0.1242	5.620	1.0	0.000	0.000	0.000
catch5/2	0.554	.0300	0.0182	0.8140	1.0	0.000	0.000	0.000
catch1/7	1.38	.0350	0.2672	3.756	1.0	0.000	0.000	0.000
catch1/4	2.63	.0500	0.1742	4.644	1.0	0.000	0.000	0.000
catch1/5	2.59	.0500	0.4531	13.838	1.0	0.000	0.000	0.000
catch1/6	1.57	.0350	0.6094	14.416	1.0	0.000	0.000	0.000
catch1/8	1.72	.0350	0.6688	18.951	1.0	0.000	0.000	0.000
catch1/9	1.40	.0350	0.7719	19.920	1.0	0.000	0.000	0.000
catch2/2	5.49	.0110	0.0785	4.792	1.0	0.000	0.000	0.000
catch3/1	0.925	.0500	0.0346	0.3234	1.0	0.000	0.000	0.000
catch4/1	1.50	.0500	0.0742	1.131	1.0	0.000	0.000	0.000
catch2/3	1.23	.0300	0.0688	6.848	1.0	0.000	0.000	0.000
catch6/1	0.727	.0500	0.3375	2.524	1.0	0.000	0.000	0.000
catch5/1	0.710	.0350	0.0330	1.896	1.0	0.000	0.000	0.000
catch2/4	0.474	.0300	0.0144	0.5501	1.0	0.000	0.000	0.000

```
 LINK catch1/1          1.000
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =           4.927
 ESTIMATED PEAK FLOW         (CUMECS) =      3.25
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK catch1/2          1.001
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =           11.55
 ESTIMATED PEAK FLOW         (CUMECS) =      7.59
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK catch1/3          1.002
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =           17.96
 ESTIMATED PEAK FLOW         (CUMECS) =     11.40
 ESTIMATED TIME TO PEAK         (MINS) =     29.00
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LINK junctA            2.000

ESTIMATED VOLUME (CU METRES*10**3) =          11.74
ESTIMATED PEAK FLOW         (CUMECS) =     10.27
ESTIMATED TIME TO PEAK         (MINS) =     29.00

LINK catch2/1          2.001

ESTIMATED VOLUME (CU METRES*10**3) =          19.04
ESTIMATED PEAK FLOW         (CUMECS) =     13.68
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK junctB            2.002

ESTIMATED VOLUME (CU METRES*10**3) =          15.26
ESTIMATED PEAK FLOW         (CUMECS) =      5.48
ESTIMATED TIME TO PEAK         (MINS) =     13.00

LINK catch5/2          3.000

ESTIMATED VOLUME (CU METRES*10**3) =          3.071
ESTIMATED PEAK FLOW         (CUMECS) =      1.52
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/7          4.000

ESTIMATED VOLUME (CU METRES*10**3) =          11.22
ESTIMATED PEAK FLOW         (CUMECS) =      4.70
ESTIMATED TIME TO PEAK         (MINS) =     30.00

WARNING 12 - DRDH = -ve
LINK catch1/4          1.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          12.53
ESTIMATED PEAK FLOW         (CUMECS) =      5.23
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/5          1.004

ESTIMATED VOLUME (CU METRES*10**3) =          19.85
ESTIMATED PEAK FLOW         (CUMECS) =     16.63
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/6          1.005

ESTIMATED VOLUME (CU METRES*10**3) =          22.55
ESTIMATED PEAK FLOW         (CUMECS) =     18.55
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/8          1.006

ESTIMATED VOLUME (CU METRES*10**3) =          40.38
ESTIMATED PEAK FLOW         (CUMECS) =     24.36
ESTIMATED TIME TO PEAK         (MINS) =     31.00

LINK catch1/9          1.007

ESTIMATED VOLUME (CU METRES*10**3) =          45.46
ESTIMATED PEAK FLOW         (CUMECS) =     25.91
ESTIMATED TIME TO PEAK         (MINS) =     32.00

LINK catch2/2          2.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          15.87
```

```
 ESTIMATED PEAK FLOW         (CUMECS) =      5.92
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK catch3/1          5.000
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          0.5320
 ESTIMATED PEAK FLOW         (CUMECS) =      0.37
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch4/1          6.000
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          1.896
 ESTIMATED PEAK FLOW         (CUMECS) =      1.32
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch2/3          2.004

 ESTIMATED VOLUME (CU METRES*10**3) =          18.58
 ESTIMATED PEAK FLOW         (CUMECS) =      7.26
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch6/1          7.000

 ESTIMATED VOLUME (CU METRES*10**3) =          9.265
 ESTIMATED PEAK FLOW         (CUMECS) =      3.18
 ESTIMATED TIME TO PEAK         (MINS) =     40.00

 LINK catch5/1          8.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.824
 ESTIMATED PEAK FLOW         (CUMECS) =      2.07
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch2/4          9.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.383
 ESTIMATED PEAK FLOW         (CUMECS) =      0.70
 ESTIMATED TIME TO PEAK         (MINS) =     31.00

 LINK catch1/10         1.008

 ESTIMATED VOLUME (CU METRES*10**3) =          79.67
 ESTIMATED PEAK FLOW         (CUMECS) =     38.98
 ESTIMATED TIME TO PEAK         (MINS) =     33.00



################################################################################
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Results for period from  0: 0.0 19/ 4/1905
                    to 10: 0.0 19/ 4/1905
################################################################################
####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =        20.
                              BX                       =    1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      66.41
                              TOTAL OF SECOND SUB-AREAS (ha) =      40.50
```

TOTAL OF ALL SUB-AREAS (ha) = 106.90

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1 (%)	% Impervious #2	Perm #1	Perm #2	B #1	B #2	Link No.
catch1/1	1.209	4.832	3.000	3.000	0.000	100.0	.030	.012	.0254	.0023	1.000
catch1/2	1.625	6.498	3.000	3.000	0.000	100.0	.030	.012	.0296	.0027	1.001
catch1/3	3.272	4.908	5.000	5.000	0.000	100.0	.030	.012	.0330	.0018	1.002
junctA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	2.000
catch2/1	3.904	5.856	11.00	11.00	0.000	100.0	.030	.012	.0181	.0010	2.001
junctB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	2.002
catch5/2	2.893	1.299	16.00	15.00	0.000	100.0	.100	.012	.0340	.0004	3.000
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	4.000
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0267	.0015	1.003
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	1.004
catch1/6	3.376	0.4850	20.00	20.00	0.000	100.0	.100	.012	.0329	.0002	1.005
catch1/8	9.195	0.3900	10.00	5.000	0.000	100.0	.080	.012	.0644	.0004	1.006
catch1/9	2.597	0.2885	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.007
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0049	.0005	2.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0095	.0005	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0124	.0007	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	2.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.008

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	3.251	28.00	0.000
catch1/2	57.600	15.00	1.500	2.500	0.000	68.150	84.900	7.593	28.00	0.000
catch1/3	57.600	15.00	1.500	2.500	0.000	68.150	84.900	11.405	29.00	0.000
junctA	57.600	1.500	0.000	0.000	0.000	84.900	0.000	10.275	29.00	0.000
catch2/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	13.683	30.00	0.000
junctB	57.600	1.500	0.000	0.000	0.000	84.900	0.000	5.478	13.00	0.000
catch5/2	57.600	15.00	1.500	2.500	0.000	68.150	84.900	1.522	30.00	0.000

catch1/7	57.600	15.00	1.500	2.500	0.000	68.150	84.900	4.703	30.00	0.000
catch1/4	57.600	15.00	1.500	2.500	0.000	68.150	84.900	5.233	30.00	0.000
catch1/5	57.600	15.00	1.500	2.500	0.000	68.150	84.900	16.626	30.00	0.000
catch1/6	57.600	15.00	1.500	2.500	0.000	68.150	84.900	18.546	30.00	0.000
catch1/8	57.600	15.00	1.500	2.500	0.000	68.150	84.900	24.364	31.00	0.000
catch1/9	57.600	15.00	1.500	2.500	0.000	68.150	84.900	25.907	32.00	0.000
catch2/2	57.600	15.00	1.500	2.500	0.000	68.150	84.900	5.916	29.00	0.000
catch3/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	0.3690	30.00	0.000
catch4/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	1.320	30.00	0.000
catch2/3	57.600	15.00	1.500	2.500	0.000	68.150	84.900	7.256	30.00	0.000
catch6/1	57.600	15.00	0.000	2.500	0.000	68.150	0.000	3.182	40.00	0.000
catch5/1	57.600	15.00	1.500	2.500	0.000	68.150	84.900	2.073	30.00	0.000
catch2/4	57.600	15.00	0.000	2.500	0.000	68.150	0.000	0.6985	31.00	0.000
catch1/10	57.600	15.00	1.500	2.500	0.000	68.150	84.900	38.980	33.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
catch5/2	30.00	1.522	31.00	1.093	3070.5	0.0000	326.11	83.503

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
catch5/2	1.0		.6750	0.000	20.000	1.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/1	3.50	.0120	0.0840	3.271	1.0	0.000	0.000	0.000
catch1/2	4.43	.0120	0.1562	7.692	1.0	0.000	0.000	0.000
catch1/3	1.85	.0120	0.0570	1.173	1.0	0.000	0.000	0.000
junctA	6.43	.0110	0.1227	8.765	1.0	0.000	0.000	0.000
catch2/1	3.99	.0110	0.1234	5.478	1.0	0.000	0.000	0.000
junctB	4.14	.0110	0.1234	5.688	1.0	0.000	0.000	0.000
catch5/2	0.619	.0300	0.0217	1.084	1.0	0.000	0.000	0.000
catch1/7	1.44	.0350	0.3031	4.452	1.0	0.000	0.000	0.000

catch1/4	2.73	.0500	0.1852	5.117	1.0	0.000	0.000	0.000
catch1/5	2.73	.0500	0.5000	17.297	1.0	0.000	0.000	0.000
catch1/6	1.67	.0350	0.6625	18.030	1.0	0.000	0.000	0.000
catch1/8	1.89	.0350	0.7250	24.095	1.0	0.000	0.000	0.000
catch1/9	1.56	.0350	0.8438	25.751	1.0	0.000	0.000	0.000
catch2/2	5.33	.0110	0.0785	4.650	1.0	0.000	0.000	0.000
catch3/1	0.969	.0500	0.0373	0.3656	1.0	0.000	0.000	0.000
catch4/1	1.60	.0500	0.0805	1.301	1.0	0.000	0.000	0.000
catch2/3	1.25	.0300	0.0711	7.206	1.0	0.000	0.000	0.000
catch6/1	0.711	.0500	0.4047	3.171	1.0	0.000	0.000	0.000
catch5/1	0.752	.0350	0.0350	2.126	1.0	0.000	0.000	0.000
catch2/4	0.523	.0300	0.0166	0.7019	1.0	0.000	0.000	0.000

```
 LINK catch1/1          1.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =           5.908
 ESTIMATED PEAK FLOW         (CUMECS) =      3.60
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK catch1/2          1.001
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =           13.85
 ESTIMATED PEAK FLOW         (CUMECS) =      8.39
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK catch1/3          1.002
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =           21.60
 ESTIMATED PEAK FLOW         (CUMECS) =     12.64
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK junctA            2.000

 ESTIMATED VOLUME (CU METRES*10**3) =           15.04
 ESTIMATED PEAK FLOW         (CUMECS) =     11.51
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK catch2/1          2.001

 ESTIMATED VOLUME (CU METRES*10**3) =           23.59
 ESTIMATED PEAK FLOW         (CUMECS) =     14.34
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK junctB            2.002

 ESTIMATED VOLUME (CU METRES*10**3) =           18.18
 ESTIMATED PEAK FLOW         (CUMECS) =      5.50
 ESTIMATED TIME TO PEAK         (MINS) =     12.00
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```
LINK catch5/2          3.000

ESTIMATED VOLUME (CU METRES*10**3) =          3.756
ESTIMATED PEAK FLOW         (CUMECS) =      1.82
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/7          4.000

ESTIMATED VOLUME (CU METRES*10**3) =          13.66
ESTIMATED PEAK FLOW         (CUMECS) =      5.40
ESTIMATED TIME TO PEAK         (MINS) =     30.00

WARNING 12 - DRDH = -ve
LINK catch1/4          1.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          14.17
ESTIMATED PEAK FLOW         (CUMECS) =      5.64
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/5          1.004

ESTIMATED VOLUME (CU METRES*10**3) =          24.15
ESTIMATED PEAK FLOW         (CUMECS) =     19.21
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/6          1.005

ESTIMATED VOLUME (CU METRES*10**3) =          27.47
ESTIMATED PEAK FLOW         (CUMECS) =     21.18
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch1/8          1.006

ESTIMATED VOLUME (CU METRES*10**3) =          49.29
ESTIMATED PEAK FLOW         (CUMECS) =     28.45
ESTIMATED TIME TO PEAK         (MINS) =     31.00

LINK catch1/9          1.007

ESTIMATED VOLUME (CU METRES*10**3) =          55.53
ESTIMATED PEAK FLOW         (CUMECS) =     30.69
ESTIMATED TIME TO PEAK         (MINS) =     32.00

LINK catch2/2          2.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          18.93
ESTIMATED PEAK FLOW         (CUMECS) =      5.97
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch3/1          5.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          0.6422
ESTIMATED PEAK FLOW         (CUMECS) =      0.40
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK catch4/1          6.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) =          2.289
ESTIMATED PEAK FLOW         (CUMECS) =      1.46
ESTIMATED TIME TO PEAK         (MINS) =     30.00
```

```
 LINK catch2/3          2.004

 ESTIMATED VOLUME (CU METRES*10**3) =          22.01
 ESTIMATED PEAK FLOW         (CUMECS) =      7.60
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch6/1          7.000

 ESTIMATED VOLUME (CU METRES*10**3) =          11.47
 ESTIMATED PEAK FLOW         (CUMECS) =      3.88
 ESTIMATED TIME TO PEAK         (MINS) =     38.00

 LINK catch5/1          8.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.624
 ESTIMATED PEAK FLOW         (CUMECS) =      2.25
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch2/4          9.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.711
 ESTIMATED PEAK FLOW         (CUMECS) =      0.84
 ESTIMATED TIME TO PEAK         (MINS) =     31.00

 LINK catch1/10         1.008

 ESTIMATED VOLUME (CU METRES*10**3) =          97.02
 ESTIMATED PEAK FLOW         (CUMECS) =     45.12
 ESTIMATED TIME TO PEAK         (MINS) =     33.00



################################################################################
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Results for period from  0: 0.0 19/ 4/1905
                    to 10: 0.0 19/ 4/1905
################################################################################
####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =        50.
                              BX                       =    1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      66.41
                              TOTAL OF SECOND SUB-AREAS (ha) =      40.50
                              TOTAL OF ALL SUB-AREAS (ha)    =     106.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
catch1/1   1.209  4.832  3.000 3.000  0.000 100.0  .030 .012  .0282 .0026  1.000

catch1/2   1.625  6.498  3.000 3.000  0.000 100.0  .030 .012  .0329 .0030  1.001

catch1/3   3.272  4.908  5.000 5.000  0.000 100.0  .030 .012  .0367 .0020  1.002

junctA    .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  2.000

catch2/1   3.904  5.856  11.00 11.00  0.000 100.0  .030 .012  .0181 .0010  2.001

junctB    .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  2.002
```

catch5/2	2.893	1.299	16.00	15.00	0.000	100.0	.100	.012	.0340	.0004	3.000
catch1/7	9.189	5.841	9.300	10.00	0.000	100.0	.100	.012	.0812	.0010	4.000
catch1/4	3.219	4.828	7.500	7.500	0.000	100.0	.030	.012	.0297	.0016	1.003
catch1/5	3.060	1.313	20.00	10.00	0.000	100.0	.100	.025	.0313	.0011	1.004
catch1/6	3.376	0.4850	20.00	20.00	0.000	100.0	.100	.012	.0329	.0002	1.005
catch1/8	9.195	0.3900	10.00	5.000	0.000	100.0	.080	.012	.0644	.0004	1.006
catch1/9	2.597	0.2885	5.000	5.000	0.000	100.0	.030	.012	.0217	.0003	1.007
catch2/2	0.3160	0.4740	20.00	5.000	0.000	100.0	.030	.012	.0054	.0006	2.003
catch3/1	0.2720	0.4080	4.500	4.500	0.000	100.0	.030	.012	.0106	.0006	5.000
catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0138	.0008	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	2.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.008

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	3.597	28.00	0.000
catch1/2	68.400	15.00	1.500	2.500	0.000	84.308	101.10	8.387	28.00	0.000
catch1/3	68.400	15.00	1.500	2.500	0.000	84.308	101.10	12.640	29.00	0.000
junctA	68.400	1.500	0.000	0.000	0.000	101.10	0.000	11.510	29.00	0.000
catch2/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	14.336	30.00	0.000
junctB	68.400	1.500	0.000	0.000	0.000	101.10	0.000	5.502	12.00	0.000
catch5/2	68.400	15.00	1.500	2.500	0.000	84.308	101.10	1.817	30.00	0.000
catch1/7	68.400	15.00	1.500	2.500	0.000	84.308	101.10	5.396	30.00	0.000
catch1/4	68.400	15.00	1.500	2.500	0.000	84.308	101.10	5.643	30.00	0.000
catch1/5	68.400	15.00	1.500	2.500	0.000	84.308	101.10	19.205	30.00	0.000
catch1/6	68.400	15.00	1.500	2.500	0.000	84.308	101.10	21.182	30.00	0.000
catch1/8	68.400	15.00	1.500	2.500	0.000	84.308	101.10	28.453	31.00	0.000
catch1/9	68.400	15.00	1.500	2.500	0.000	84.308	101.10	30.685	32.00	0.000
catch2/2	68.400	15.00	1.500	2.500	0.000	84.308	101.10	5.972	30.00	0.000
catch3/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	0.4047	30.00	0.000
catch4/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	1.457	30.00	0.000

catch2/3	68.400	15.00	1.500	2.500	0.000	84.308	101.10	7.598	30.00	0.000
catch6/1	68.400	15.00	0.000	2.500	0.000	84.308	0.000	3.881	38.00	0.000
catch5/1	68.400	15.00	1.500	2.500	0.000	84.308	101.10	2.247	30.00	0.000
catch2/4	68.400	15.00	0.000	2.500	0.000	84.308	0.000	0.8383	31.00	0.000
catch1/10	68.400	15.00	1.500	2.500	0.000	84.308	101.10	45.124	33.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
catch5/2	30.00	1.816	31.00	1.401	3755.6	0.0000	391.20	83.604

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
catch5/2	1.0		.6750	0.000	20.000	1.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/1	3.64	.0120	0.0891	3.610	1.0	0.000	0.000	0.000
catch1/2	4.62	.0120	0.1656	8.504	1.0	0.000	0.000	0.000
catch1/3	1.88	.0120	0.0570	1.195	1.0	0.000	0.000	0.000
junctA	6.43	.0110	0.1227	8.775	1.0	0.000	0.000	0.000
catch2/1	4.01	.0110	0.1234	5.502	1.0	0.000	0.000	0.000
junctB	3.99	.0110	0.1242	5.520	1.0	0.000	0.000	0.000
catch5/2	0.688	.0300	0.0252	1.402	1.0	0.000	0.000	0.000
catch1/7	1.38	.0350	0.3563	5.147	1.0	0.000	0.000	0.000
catch1/4	2.83	.0500	0.1938	5.552	1.0	0.000	0.000	0.000
catch1/5	2.73	.0500	0.5359	19.670	1.0	0.000	0.000	0.000
catch1/6	1.80	.0350	0.6906	20.972	1.0	0.000	0.000	0.000
catch1/8	2.01	.0350	0.7672	28.279	1.0	0.000	0.000	0.000
catch1/9	1.66	.0350	0.9000	30.438	1.0	0.000	0.000	0.000
catch2/2	5.20	.0110	0.0785	4.543	1.0	0.000	0.000	0.000
catch3/1	1.02	.0500	0.0395	0.4099	1.0	0.000	0.000	0.000
catch4/1	1.67	.0500	0.0852	1.446	1.0	0.000	0.000	0.000
catch2/3	1.27	.0300	0.0734	7.540	1.0	0.000	0.000	0.000

```
catch6/1  0.721  .0500 0.4547   3.875   1.0  0.000   0.000    0.000

catch5/1  0.778  .0350 0.0365   2.297   1.0  0.000   0.000    0.000

catch2/4  0.560  .0300 0.0185  0.8361   1.0  0.000   0.000    0.000


 LINK catch1/1          1.000
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =           6.683
 ESTIMATED PEAK FLOW         (CUMECS) =      4.07
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch1/2          1.001
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          15.67
 ESTIMATED PEAK FLOW         (CUMECS) =      9.52
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK catch1/3          1.002
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          24.49
 ESTIMATED PEAK FLOW         (CUMECS) =     14.40
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK junctA            2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          17.85
 ESTIMATED PEAK FLOW         (CUMECS) =     13.27
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK catch2/1          2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          27.14
 ESTIMATED PEAK FLOW         (CUMECS) =     15.22
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK junctB            2.002

 ESTIMATED VOLUME (CU METRES*10**3) =          19.67
 ESTIMATED PEAK FLOW         (CUMECS) =      5.60
 ESTIMATED TIME TO PEAK         (MINS) =     12.00

 LINK catch5/2          3.000

 ESTIMATED VOLUME (CU METRES*10**3) =           4.303
 ESTIMATED PEAK FLOW         (CUMECS) =      2.12
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch1/7          4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          15.57
 ESTIMATED PEAK FLOW         (CUMECS) =      6.26
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK catch1/4          1.003
 WARNING 13 - IBFL SELECTED WITH RET = ZERO
 WARNING 13 - IBFL SELECTED WITH RET = ZERO

 ESTIMATED VOLUME (CU METRES*10**3) =          15.28
 ESTIMATED PEAK FLOW         (CUMECS) =      6.28
```

ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK catch1/5 1.004

ESTIMATED VOLUME (CU METRES*10**3) = 28.41
ESTIMATED PEAK FLOW (CUMECS) = 22.79
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK catch1/6 1.005

ESTIMATED VOLUME (CU METRES*10**3) = 32.24
ESTIMATED PEAK FLOW (CUMECS) = 24.47
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK catch1/8 1.006

ESTIMATED VOLUME (CU METRES*10**3) = 57.20
ESTIMATED PEAK FLOW (CUMECS) = 33.56
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK catch1/9 1.007

ESTIMATED VOLUME (CU METRES*10**3) = 64.36
ESTIMATED PEAK FLOW (CUMECS) = 36.38
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK catch2/2 2.003
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) = 20.52
ESTIMATED PEAK FLOW (CUMECS) = 6.10
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK catch3/1 5.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) = 0.7298
ESTIMATED PEAK FLOW (CUMECS) = 0.46
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK catch4/1 6.000
WARNING 13 - IBFL SELECTED WITH RET = ZERO
WARNING 13 - IBFL SELECTED WITH RET = ZERO

ESTIMATED VOLUME (CU METRES*10**3) = 2.601
ESTIMATED PEAK FLOW (CUMECS) = 1.65
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK catch2/3 2.004

ESTIMATED VOLUME (CU METRES*10**3) = 24.03
ESTIMATED PEAK FLOW (CUMECS) = 8.07
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK catch6/1 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 13.17
ESTIMATED PEAK FLOW (CUMECS) = 4.59
ESTIMATED TIME TO PEAK (MINS) = 36.00

LINK catch5/1 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.145
ESTIMATED PEAK FLOW (CUMECS) = 2.46
ESTIMATED TIME TO PEAK (MINS) = 30.00

```
 LINK catch2/4          9.000

 ESTIMATED VOLUME (CU METRES*10**3) =           1.979
 ESTIMATED PEAK FLOW         (CUMECS) =      0.99
 ESTIMATED TIME TO PEAK         (MINS) =     31.00

 LINK catch1/10         1.008

 ESTIMATED VOLUME (CU METRES*10**3) =           110.8
 ESTIMATED PEAK FLOW         (CUMECS) =     52.28
 ESTIMATED TIME TO PEAK         (MINS) =     32.00



################################################################################
####


Results for period from  0: 0.0 19/ 4/1905
                     to 10: 0.0 19/ 4/1905
################################################################################
####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =       100.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      66.41
                              TOTAL OF SECOND SUB-AREAS (ha) =      40.50
                              TOTAL OF ALL SUB-AREAS (ha)    =     106.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
catch1/1   1.209  4.832  3.000 3.000  0.000 100.0  .030 .012  .0282 .0026  1.000

catch1/2   1.625  6.498  3.000 3.000  0.000 100.0  .030 .012  .0329 .0030  1.001

catch1/3   3.272  4.908  5.000 5.000  0.000 100.0  .030 .012  .0367 .0020  1.002

junctA    .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  2.000

catch2/1   3.904  5.856  11.00 11.00  0.000 100.0  .030 .012  .0181 .0010  2.001

junctB    .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  2.002

catch5/2   2.893  1.299  16.00 15.00  0.000 100.0  .100 .012  .0340 .0004  3.000

catch1/7   9.189  5.841  9.300 10.00  0.000 100.0  .100 .012  .0812 .0010  4.000

catch1/4   3.219  4.828  7.500 7.500  0.000 100.0  .030 .012  .0297 .0016  1.003

catch1/5   3.060  1.313  20.00 10.00  0.000 100.0  .100 .025  .0313 .0011  1.004

catch1/6   3.376 0.4850  20.00 20.00  0.000 100.0  .100 .012  .0329 .0002  1.005

catch1/8   9.195 0.3900  10.00 5.000  0.000 100.0  .080 .012  .0644 .0004  1.006

catch1/9   2.597 0.2885  5.000 5.000  0.000 100.0  .030 .012  .0217 .0003  1.007

catch2/2  0.3160 0.4740  20.00 5.000  0.000 100.0  .030 .012  .0054 .0006  2.003

catch3/1  0.2720 0.4080  4.500 4.500  0.000 100.0  .030 .012  .0106 .0006  5.000
```

catch4/1	0.9700	1.455	10.00	10.00	0.000	100.0	.030	.012	.0138	.0008	6.000
catch2/3	1.929	0.7910	20.00	20.00	0.000	0.000	.100	.012	.0246	.0023	2.004
catch6/1	13.585	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0679	0.000	7.000
catch5/1	0.9780	0.5220	20.00	5.000	0.000	100.0	.100	.012	.0173	.0004	8.000
catch2/4	2.030	0.000	20.00	0.000	0.000	0.000	.100	0.00	.0253	0.000	9.000
catch1/10	2.787	0.3100	5.000	5.000	0.000	100.0	.030	.012	.0225	.0003	1.008

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
catch1/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	4.067	30.00	0.000
catch1/2	77.000	15.00	1.500	2.500	0.000	97.208	114.00	9.517	28.00	0.000
catch1/3	77.000	15.00	1.500	2.500	0.000	97.208	114.00	14.405	29.00	0.000
junctA	77.000	1.500	0.000	0.000	0.000	114.00	0.000	13.275	29.00	0.000
catch2/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	15.222	30.00	0.000
junctB	77.000	1.500	0.000	0.000	0.000	114.00	0.000	5.604	12.00	0.000
catch5/2	77.000	15.00	1.500	2.500	0.000	97.208	114.00	2.122	30.00	0.000
catch1/7	77.000	15.00	1.500	2.500	0.000	97.208	114.00	6.259	30.00	0.000
catch1/4	77.000	15.00	1.500	2.500	0.000	97.208	114.00	6.278	30.00	0.000
catch1/5	77.000	15.00	1.500	2.500	0.000	97.208	114.00	22.786	30.00	0.000
catch1/6	77.000	15.00	1.500	2.500	0.000	97.208	114.00	24.466	30.00	0.000
catch1/8	77.000	15.00	1.500	2.500	0.000	97.208	114.00	33.558	31.00	0.000
catch1/9	77.000	15.00	1.500	2.500	0.000	97.208	114.00	36.376	32.00	0.000
catch2/2	77.000	15.00	1.500	2.500	0.000	97.208	114.00	6.101	12.00	0.000
catch3/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	0.4582	30.00	0.000
catch4/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	1.646	30.00	0.000
catch2/3	77.000	15.00	1.500	2.500	0.000	97.208	114.00	8.066	30.00	0.000
catch6/1	77.000	15.00	0.000	2.500	0.000	97.208	0.000	4.589	36.00	0.000
catch5/1	77.000	15.00	1.500	2.500	0.000	97.208	114.00	2.458	30.00	0.000
catch2/4	77.000	15.00	0.000	2.500	0.000	97.208	0.000	0.9908	31.00	0.000
catch1/10	77.000	15.00	1.500	2.500	0.000	97.208	114.00	52.276	32.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
catch5/2	30.00	2.121	31.00	1.721	4302.5	0.0000	451.79	83.699

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
catch5/2	1.0		.6750	0.000	20.000	1.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

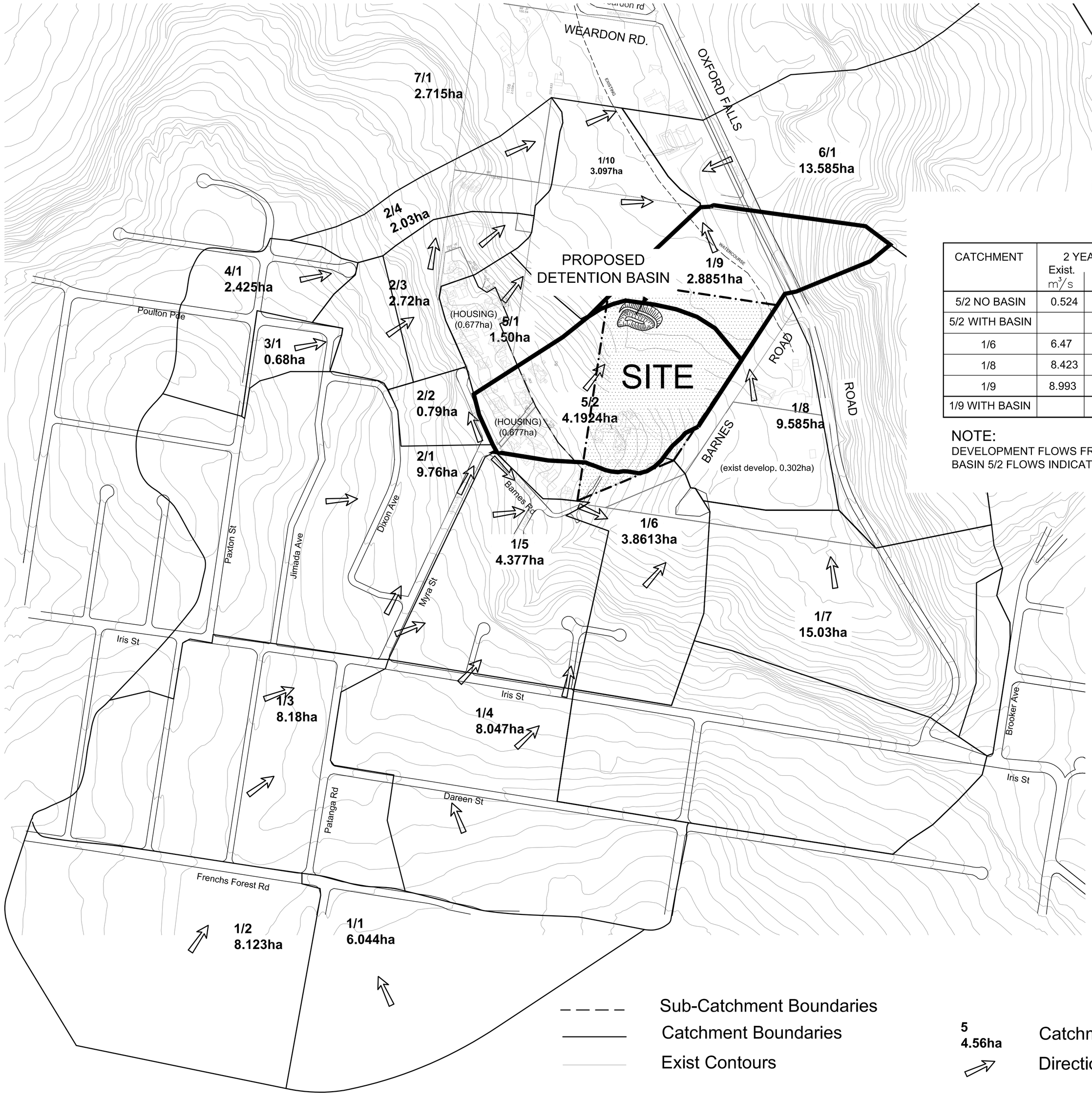
Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
catch1/1	3.82	.0120	0.0961	4.088	1.0	0.000	0.000	0.000
catch1/2	4.82	.0120	0.1797	9.633	1.0	0.000	0.000	0.000
catch1/3	2.00	.0120	0.0598	1.329	1.0	0.000	0.000	0.000
junctA	6.30	.0110	0.1227	8.595	1.0	0.000	0.000	0.000
catch2/1	4.08	.0110	0.1234	5.604	1.0	0.000	0.000	0.000
junctB	4.16	.0110	0.1258	5.822	1.0	0.000	0.000	0.000
catch5/2	0.736	.0300	0.0285	1.697	1.0	0.000	0.000	0.000
catch1/7	1.38	.0350	0.3969	5.978	1.0	0.000	0.000	0.000
catch1/4	2.98	.0500	0.2063	6.232	1.0	0.000	0.000	0.000
catch1/5	2.74	.0500	0.5781	22.723	1.0	0.000	0.000	0.000
catch1/6	1.94	.0350	0.7266	24.775	1.0	0.000	0.000	0.000
catch1/8	2.14	.0350	0.8156	33.432	1.0	0.000	0.000	0.000
catch1/9	1.76	.0350	0.9625	35.919	1.0	0.000	0.000	0.000
catch2/2	5.20	.0110	0.0785	4.544	1.0	0.000	0.000	0.000
catch3/1	1.06	.0500	0.0426	0.4575	1.0	0.000	0.000	0.000
catch4/1	1.77	.0500	0.0918	1.647	1.0	0.000	0.000	0.000
catch2/3	1.30	.0300	0.0758	7.990	1.0	0.000	0.000	0.000
catch6/1	0.735	.0500	0.4953	4.580	1.0	0.000	0.000	0.000
catch5/1	0.804	.0350	0.0387	2.512	1.0	0.000	0.000	0.000
catch2/4	0.600	.0300	0.0204	0.9899	1.0	0.000	0.000	0.000

Run completed at: 11th July 2014 11:32:50

mik open 0

Appendix C

Drawings by JMD Ref:12253(B)E1



XPRAFTS CATCHMENT ANALYSIS

CATCHMENT	2 YEAR		5 YEAR		10 YEAR		20 YEAR		50 YEAR		100 YEAR		PMF
	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Dev. m^3/s
5/2 NO BASIN	0.524	0.547	0.86	0.89	1.08	1.12	1.37	1.41	1.65	1.70	1.95	1.99	7.25
5/2 WITH BASIN		0.49		0.62		0.814		1.09		1.40		1.72	
1/6	6.47	6.50	11.74	11.75	14.78	14.82	18.52	18.55	21.14	21.18	24.43	24.47	90.7
1/8	8.423	8.47	15.28	15.31	19.09	19.12	24.33	24.36	28.39	28.45	33.50	33.56	128.4
1/9	8.993	9.05	16.11	16.18	20.85	20.92	26.42	26.50	31.11	31.22	36.74	36.84	139.2
1/9 WITH BASIN		8.98		15.91		20.40		25.91		30.69		36.38	

NOTE:
DEVELOPMENT FLOWS FROM CATCHMENTS 1/9 REDUCED BY ADDITION OF BASIN 5/2
BASIN 5/2 FLOWS INDICATE CONTROL DISCHARGE FROM DETENTION BASIN

CATCHMENT SUMMARY

CURRENT CONDITIONS

CATCHMENT	AREA (ha)	% IMPERVIOUS	AREA IMPERVIOUS (ha)	AREA PERVIOUS (ha)	TOTAL CATCHMENT AREA (ha)
5/2 OLD RESIDENTIAL	0.677	60.000	0.406	0.271	
5/2 RURAL RESIDENT.	3.515	N/A	0.503	3.012	4.192
1/6 RURAL RES.	3.8610	10	0.3861	3.4750	3.8610
1/8 RURAL RES.	9.5850	N/A	0.3020	9.2830	9.5850
1/9 RURAL RES	2.8850	10	0.2890	2.5970	2.8850
POST DEVELOPMENT CONDITIONS					
5/2 OLD RESIDENTIAL	0.677	60.000	0.406	0.271	
5/2 RURAL RES.	3.5150	N/A	0.8930	2.6220	4.192
1/6 RURAL RES.	3.7620	N/A	0.3861	3.3760	
1/6 BARNES RD	0.0990	100	0.0990	0	3.8610
1/8 RURAL RES.	9.4970	N/A	0.3020	9.1950	
1/8 BARNES RD	0.0880	100	0.0880	0	9.5850
1/9 RURAL RES.	2.8850	10	0.2890	2.5970	2.8850

Issue	App	Date	Description
A	T.H.	11-07-2014	ORIGINAL ISSUE

Client: DUKOR 24 Pty. Limited
Designed by : T.H.
Date of Drawing : 11-07-2014
Ratio (A1) : 1:2500
Datum : AHD
Origin of Levels :
Date of Survey :

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
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Engineering
Project Management
Licensed Water Service Co ordinators
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P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : LOT 1113 DP752038 BARNES RD - PROPOSED AGED CARE FACILITY
Sheet 1 of 3 sheets
STORMWATER STRATEGY - LOCAL CATCHMENT PLAN
Ref: 12253(B)E1
Locality : FRENCHS FOREST
L.G.A. : WARRINGAH
CAD Ref: S:\DATA\OXFORD FALLS\12253(B)\ENG\CAD\E1-SWD STRAT\12253(B)E1_CATCHMENT

TOTAL IMPERVIOUS AREA

- EXISTING CONDITIONS 5032 m²

EXISTING IMPERVIOUS SURFACE - ROADS/TRACKS

EXISTING IMPERVIOUS SURFACE - BUILDINGS & TENNIS COURT

0 10 20 30 40 50

SCALE :- 1 : 500
Metres

Issue	App	Date	Description
A	T.H.	11-07-2014	ISSUED FOR DA

Client: DUKOR 24 Pty. Limited

Designed by : T.H.

Date of Drawing : 11-07-2014

Ratio (A1) : 1:500

Datum : AHD

Origin of Levels :

Date of Survey :

Development Consultants

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Project : LOT 1113 DP752038 BARNES RD - PROPOSED AGED CARE FACILITY

Sheet 2 of 3 sheets

STORMWATER STRATEGY - PLAN OF EXISTING SURFACE CONDITIONS

Ref: 12253(B)E1

Locality : FRENCHS FOREST

L.G.A. : WARRINGAH

CAD Ref: S:\DATA\OXFORD FALLS\12253(B)\ENG\CAD\E1-SWD STRAT\12253(B)E1_EXIST

TOTAL IMPERVIOUS AREA

- POST DEVELOPMENT CONDITIONS 8930 m³

TAILOUT CONSTRUCTION TO BE CLEAR OF CREEK RIPARIAN ZONE

FORM GRASSED DIVERSION SWALE TO INTERCEPT ALL UPSTREAM STORMWATER RUNOFF & DIRECT FLOWS TO RAIN GARDEN & DETENTION BASIN

PROPOSED ACCESS ROAD TO BE DRAINED TO PROPOSED RAIN GARDEN

EXISTING BUILDING STRUCTURES TO BE RETAINED

ALL ROOF DISCHARGES TO BE INTERCEPTED BY PIPELINE & DRAINED TO 150kL STORAGE TANK. OVERFLOWS FROM TANK TO BE DIRECTED TO PROPOSED RAIN GARDEN AND DETENTION BASIN.

PROPOSED BUILDING EXTENSION & ROOF OVER

PROPOSED CAR PARKING AREA

40m OFFSET TO LINE OF APPROXIMATE TOP OF BANK EXISTING TRIBUTARY

LINE OF APPROXIMATE TOP OF BANK EXISTING TRIBUTARY

BASIN CONTROL OUTLET PIT
LOW LEVEL 5 YEAR ORIFICE PIPE OUTLET
HIGH LEVEL 100 YEAR WEIR OUTLET
OUTLET PIPE TO BE SIZED TO DISCHARGE 100 YEAR PREDEVELOPED FLOWS

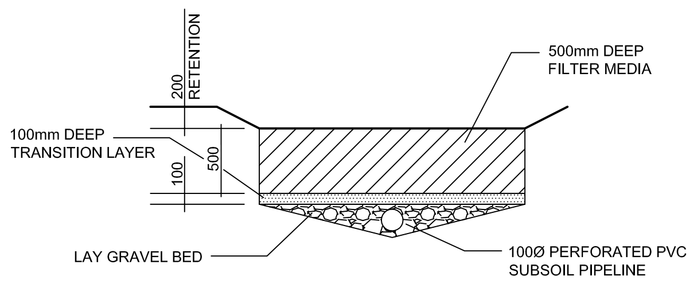
3m WIDE BASIN EMBANKMENT TO CONTAIN POST DEVELOPMENT STORAGE VOLUME & 20% ADDITIONAL STORAGE FREEBOARD.

FORM RAINGARDEN (Min. BED AREA 350 m²) DISCHARGE DIRECTED TO OSD BASIN

FORM GRASSED DIVERSION SWALE TO INTERCEPT ALL UPSTREAM STORMWATER RUNOFF & DIRECT FLOWS TO RAIN GARDEN AND DETENTION BASIN

ALL STORMWATER FLOWS DIRECTED TO RAINGARDEN

STORMWATER FROM NEW DRIVEWAYS TO BE DIRECTED TO DETENTION BASIN



RAINGARDEN TYPICAL SECTION

NOT TO SCALE

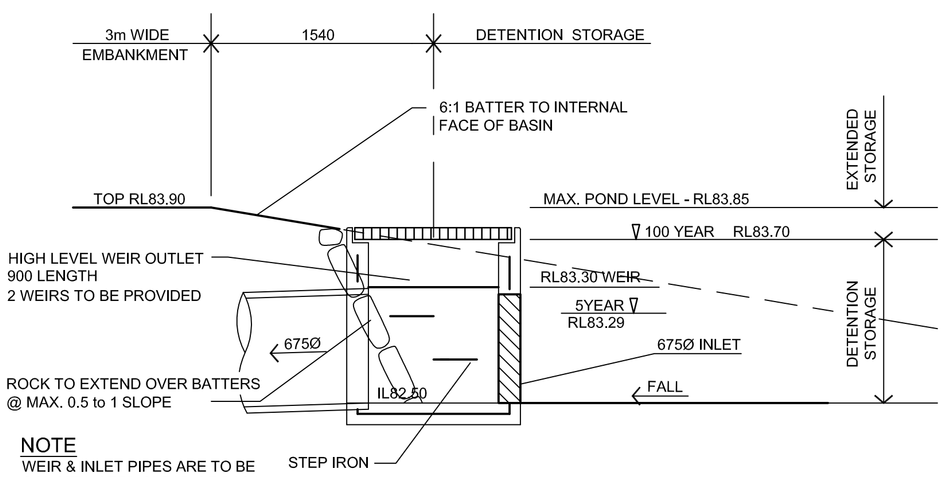
STORMWATER DETENTION BASIN

MAXIMUM PRE-DEVELOPED DISCHARGE

5 YEAR	860 l/sec
100 YEAR	1949 l/sec

BASIN CONFIGURATION

FLOOR	3x25	76m²	RL82.50
BATTER SLOPES	6:1		
5 YEAR WATER LEVEL			RL83.29
100 YEAR WATER LEVEL			RL83.70



NOTE
WEIR & INLET PIPES ARE TO BE CONSTRUCTED CLEAR OF BASIN EMBANKMENT

DISCHARGE CONTROL PIT DETAIL

NOT TO SCALE

IMPERVIOUS PAVED SURFACES RESULTING FROM NEW DEVELOPMENT (OTHER THAN BUILDINGS)

0 10 20 30 40 50

SCALE :- 1 : 500
Metres

Issue	App	Date	Description
A	T.H.	11-07-2014	ISSUED FOR DA

Client: DUKOR 24 Pty. Limited

Designed by : T.H.

Date of Drawing : 11-07-2014

Ratio (A1) : 1:500

Datum : AHD

Origin of Levels :

Date of Survey :

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators

32 Iolanthe Street
P.O. BOX 25
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Project : LOT 1113 DP752038 BARNES RD - PROPOSED AGED CARE FACILITY

Sheet 3 of 3 sheets

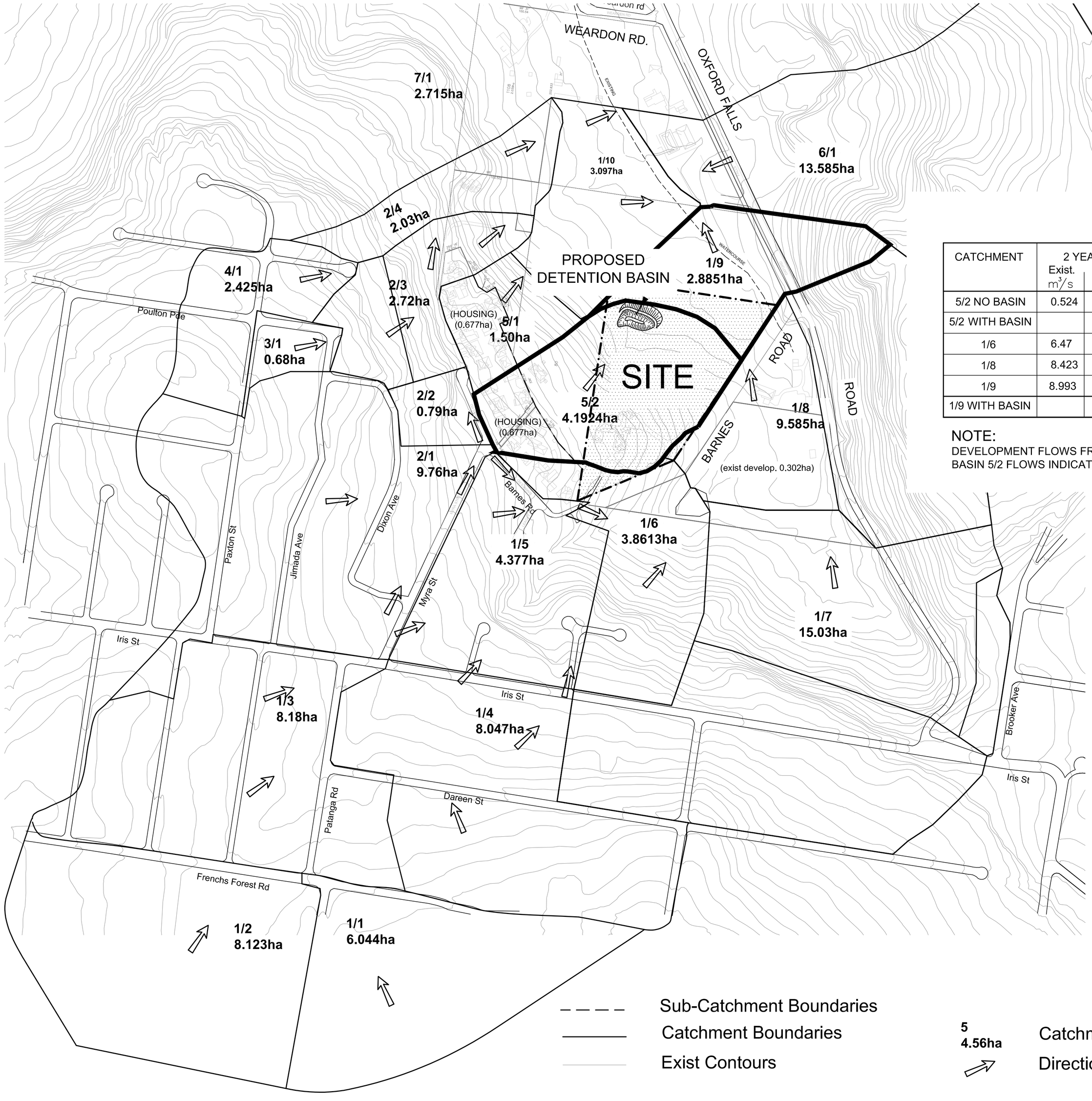
STORMWATER STRATEGY - PLAN OF PROPOSED DEVELOPED CONDITIONS

Ref: 12253(B)E1

Locality : FRENCHS FOREST

L.G.A. : WARRINGAH

CAD Ref: S:\DATA\OXFORD FALLS\12253(B)\ENG\CAD\E1-SWD STRAT\12253(B)E1_PLAN



XPRAFTS CATCHMENT ANALYSIS

CATCHMENT	2 YEAR		5 YEAR		10 YEAR		20 YEAR		50 YEAR		100 YEAR		PMF
	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Exist. m^3/s	Dev. m^3/s	Dev. m^3/s
5/2 NO BASIN	0.524	0.547	0.86	0.89	1.08	1.12	1.37	1.41	1.65	1.70	1.95	1.99	7.25
5/2 WITH BASIN		0.49		0.62		0.814		1.09		1.40		1.72	
1/6	6.47	6.50	11.74	11.75	14.78	14.82	18.52	18.55	21.14	21.18	24.43	24.47	90.7
1/8	8.423	8.47	15.28	15.31	19.09	19.12	24.33	24.36	28.39	28.45	33.50	33.56	128.4
1/9	8.993	9.05	16.11	16.18	20.85	20.92	26.42	26.50	31.11	31.22	36.74	36.84	139.2
1/9 WITH BASIN		8.98		15.91		20.40		25.91		30.69		36.38	

NOTE:
DEVELOPMENT FLOWS FROM CATCHMENTS 1/9 REDUCED BY ADDITION OF BASIN 5/2
BASIN 5/2 FLOWS INDICATE CONTROL DISCHARGE FROM DETENTION BASIN

CATCHMENT SUMMARY

CURRENT CONDITIONS

CATCHMENT	AREA (ha)	% IMPERVIOUS	AREA IMPERVIOUS (ha)	AREA PERVIOUS (ha)	TOTAL CATCHMENT AREA (ha)
5/2 OLD RESIDENTIAL	0.677	60.000	0.406	0.271	
5/2 RURAL RESIDENT.	3.515	N/A	0.503	3.012	4.192
1/6 RURAL RES.	3.8610	10	0.3861	3.4750	3.8610
1/8 RURAL RES.	9.5850	N/A	0.3020	9.2830	9.5850
1/9 RURAL RES	2.8850	10	0.2890	2.5970	2.8850
POST DEVELOPMENT CONDITIONS					
5/2 OLD RESIDENTIAL	0.677	60.000	0.406	0.271	
5/2 RURAL RES.	3.5150	N/A	0.8930	2.6220	4.192
1/6 RURAL RES.	3.7620	N/A	0.3861	3.3760	
1/6 BARNES RD	0.0990	100	0.0990	0	3.8610
1/8 RURAL RES.	9.4970	N/A	0.3020	9.1950	
1/8 BARNES RD	0.0880	100	0.0880	0	9.5850
1/9 RURAL RES.	2.8850	10	0.2890	2.5970	2.8850

Issue	App	Date	Description
A	T.H.	11-07-2014	ORIGINAL ISSUE

Client: DUKOR 24 Pty. Limited
Designed by : T.H.
Date of Drawing : 11-07-2014
Ratio (A1) : 1:2500
Datum : AHD
Origin of Levels :
Date of Survey :

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Project : LOT 1113 DP752038 BARNES RD - PROPOSED AGED CARE FACILITY
Sheet 1 of 3 sheets
STORMWATER STRATEGY - LOCAL CATCHMENT PLAN
Ref: 12253(B)E1
Locality : FRENCHS FOREST
L.G.A. : WARRINGAH
CAD Ref: S:\DATA\OXFORD FALLS\12253(B)\ENG\CAD\E1-SWD STRAT\12253(B)E1_CATCHMENT

TOTAL IMPERVIOUS AREA

- EXISTING CONDITIONS 5032 m²

EXISTING IMPERVIOUS SURFACE - ROADS/TRACKS

EXISTING IMPERVIOUS SURFACE - BUILDINGS & TENNIS COURT

0 10 20 30 40 50

SCALE :- 1 : 500
Metres

Issue	App	Date	Description
A	T.H.	11-07-2014	ISSUED FOR DA

Client: DUKOR 24 Pty. Limited

Designed by : T.H.

Date of Drawing : 11-07-2014

Ratio (A1) : 1:500

Datum : AHD

Origin of Levels :

Date of Survey :

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Project : LOT 1113 DP752038 BARNES RD - PROPOSED AGED CARE FACILITY

Sheet 2 of 3 sheets

STORMWATER STRATEGY - PLAN OF EXISTING SURFACE CONDITIONS

Ref: 12253(B)E1

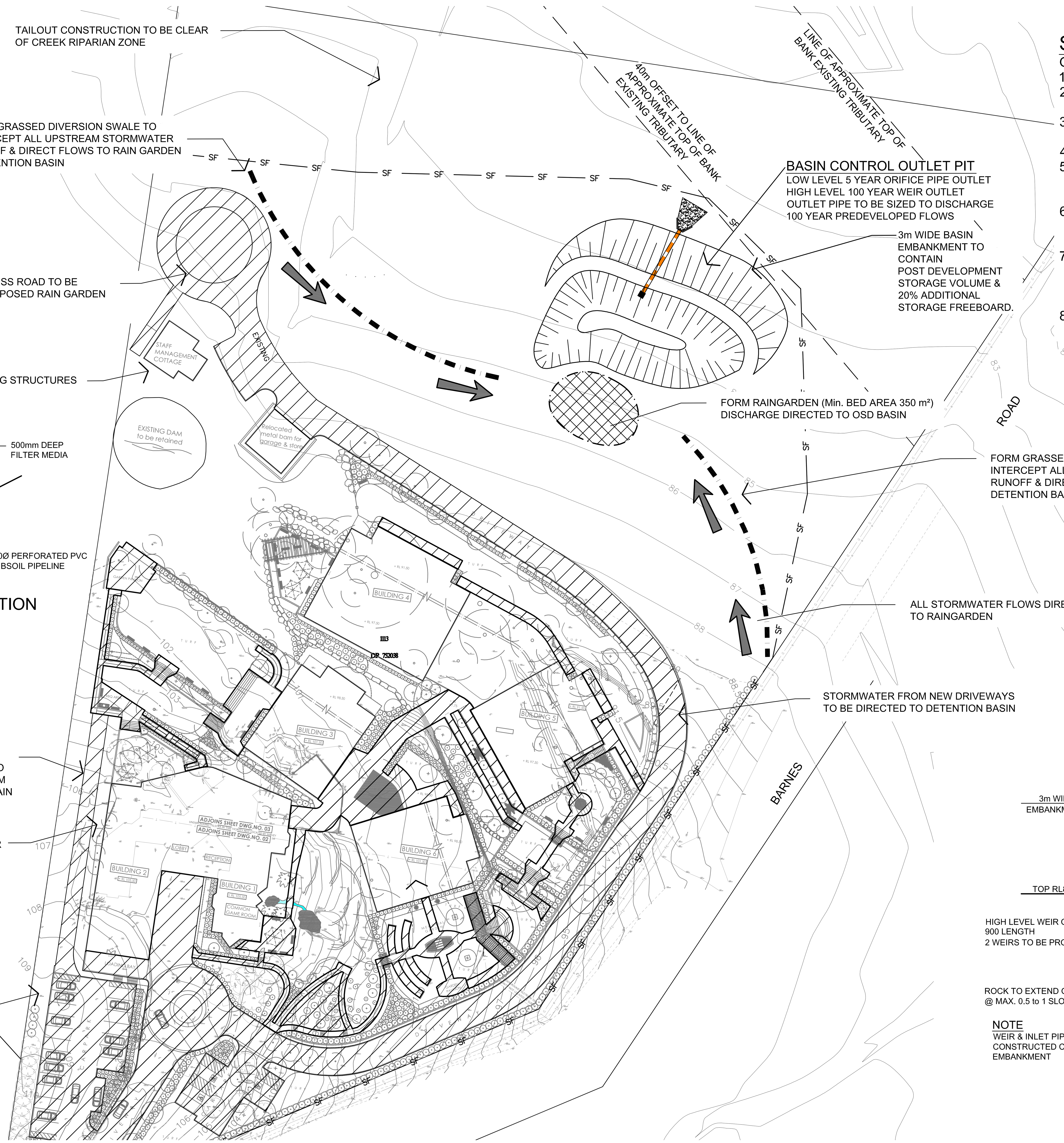
Locality : FRENCHS FOREST

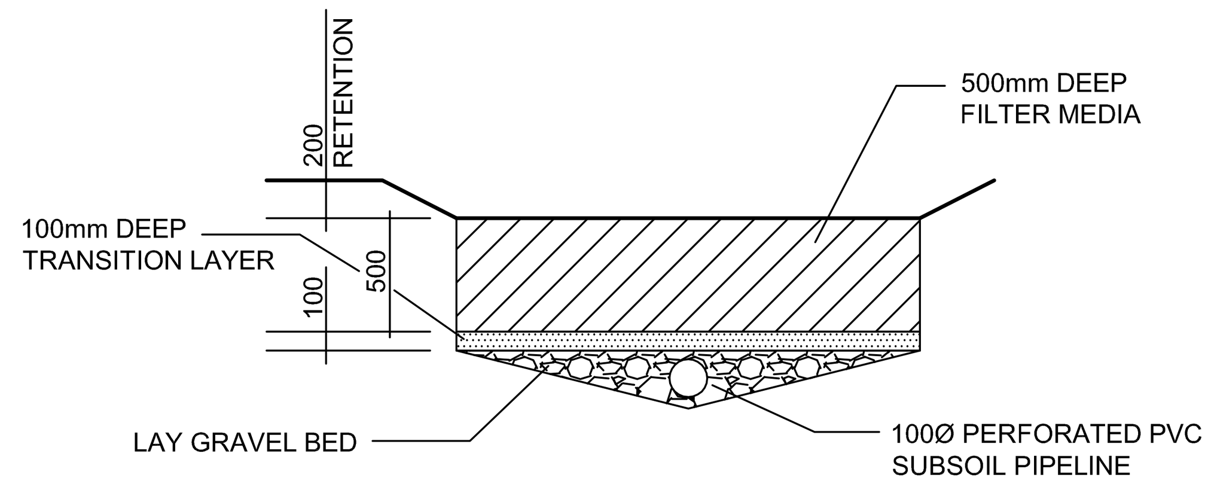
L.G.A. : WARRINGAH

CAD Ref: S:\DATA\OXFORD FALLS\12253(B)\ENG\CAD\E1-SWD STRAT\12253(B)E1_EXIST

TOTAL IMPERVIOUS AREA

- POST DEVELOPMENT CONDITIONS 8930 m³





RAINGARDEN TYPICAL SECTION

NOT TO SCALE

IMPERVIOUS PAVED SURFACES RESULTING FROM NEW DEVELOPMENT (OTHER THAN BUILDINGS)

— SF — DENOTES SILT FENCING

SOIL & WATER STRATEGY

ORDER OF WORKS

1. INSTALL SILT FENCING AS INDICATED
2. CONSTRUCT DETENTION BASIN TO BE USED AS SEDIMENT BASIN DURING CONSTRUCTION, BLOCK OFF OUTLET.
3. AREA NORTH OF BASIN OUTSIDE SEDIMENT FENCE TO REMAIN UNDISTURBED.
4. CONSTRUCT DIVERSION DRAINS
5. PROCEED WITH SITE WORKS, STABILISING DISTURBED AREAS AS SOON AS POSSIBLE AND MAINTAINING DIVERSION DRAINS, BASIN AND SEDIMENT FENCING.
6. INSTALL SANDBAG SEDIMENT TRAPS ALONG INVERTS OF DRAINS AND ROAD EDGES AT CESSATION OF WORKS TO PROTECT AGAINST EROSION OVERNIGHT/OVER WEEKENDS.
7. UPON STABILISATION OF ALL DISTURBED SURFACES, BASIN TO BE CLEANED OF COLLECTED SEDIMENT, STABILISED WITH TURF AND OUTLET STRUCTURE OPENED SO BASIN OPERATES AS DETENTION BASIN.
8. RAIN GARDEN TO BE PROTECTED FROM SEDIMENT DURING CONSTRUCTION.

STORMWATER DETENTION BASIN

MAXIMUM PRE-DEVELOPED DISCHARGE			
5 YEAR	860 l/sec		
100 YEAR	1949 l/sec		
BASIN CONFIGURATION			
FLOOR	3x25	76m²	RL82.50
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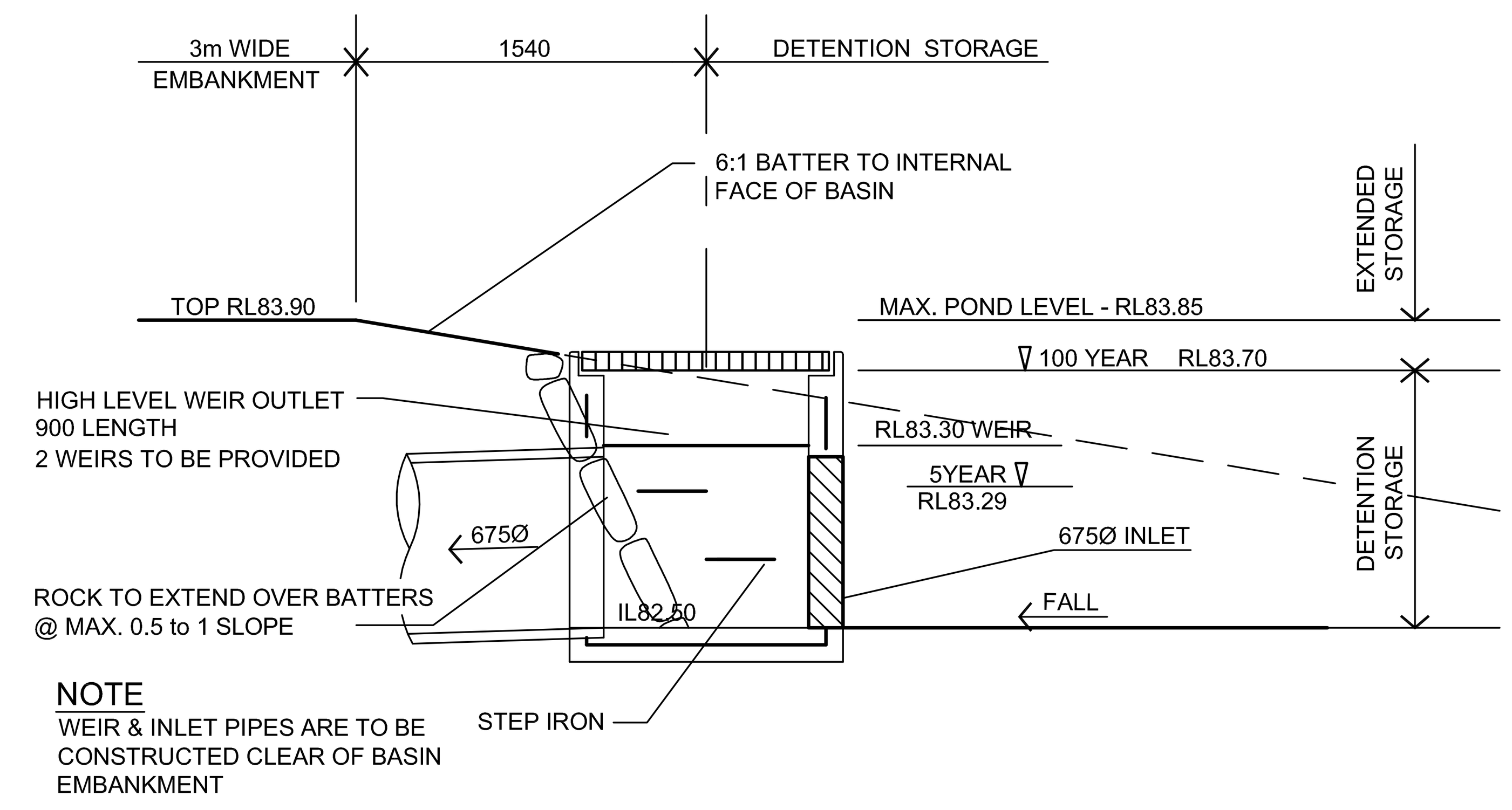

DISCHARGE CONTROL PIT DETAIL

NOT TO SCALE

0 10 20 30 40 50

SCALE :- 1 : 500 Metres

Issue	App	Date	Description
B	T.H.	14-08-2014	SOIL AND WATER MANAGEMENT DETAILS ADDED
A	T.H.	11-07-2014	ISSUED FOR DA

Client: DUKOR 24 Pty. Limited

Designed by : T.H.

Date of Drawing : 11-07-2014

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Project : LOT 1113 DP752038 BARNES RD - PROPOSED AGED CARE FACILITY

STORMWATER STRATEGY - PLAN OF PROPOSED DEVELOPED CONDITIONS & SOIL & WATER MANAGEMENT PLAN

Locality : FRENCHS FOREST

L.G.A. : WARRINGAH

Sheet 3 of 3 sheets

Ref: 12253(B)E1

CAD Ref: S:\DATA\OXFORD FALLS\12253(B)\ENG\CAD\E1-SWD STRAT\12253(B)E1_PLAN