WATER CYCLE MANAGMENT PLAN

WET ‘N’ WILD SYDNEY

November 2010

Report No. X10212.01-01

Prepared for Project Aquatic Investments Pty Ltd

BROWN CONSULTING

Engineers & Managers

PEOPLE & PROJECTS

COMMERCIAL IN CONFIDENCE

DOCUMENT CONTROL

X10212.01-01

Issue	Date	Issue Details	Author	Checked	Approved
A	Dec 2010	Internal Draft	RCJ	RP	
B	Dec 2010	Project Team Review	RCJ	RP	RP
C	Jan 2010	Draft Post Project Team Review	RCJ		
D	Feb 2010	Draft Post WSPT Review	RCJ		

WATER CYCLE MANAGMENT PLAN
WET 'N' WILD SYDNEY
AS PART OF PART 3A APPLICATION

RESERVOIR ROAD, PROSPECT, NSW

FOR PROJECT AQUATIC INVESTMENTS LTD

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff
DWE	Department of Water and Energy
DEM	Digital Elevation Model
DTM	Digital Terrain Model
FPDM	Floodplain Development Manual
FPL	Flood Planning Level
FPMM	Floodplain Management Manual
FPRMS	Floodplain Risk Management Study
FSL	Flood Surface Level
GIS	Geographic Information System
ha	Hectare (Area = 10,000m^2)
LEP	Local Environmental Plan
LGA	Local Government Area
MGA	Map Grid Australia
m^3/s	Cubic meters per second
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
RCP	Reinforced Concrete Pipe
RCBC	Reinforced Concrete Box Culvert
RTA	Roads and Traffic Authority of NSW
SEPP	State Environmental Planning Policy
SMP	Stormwater Management Plan
TIN	Triangular Irregular Network

EXECUTIVE SUMMARY

Introduction

Prospect Aquatic Investments Pty Ltd proposes to develop a "*Wet 'n' Wild Theme Park and entertainment facility*" at a site in Prospect, NSW. The site is in the Blacktown City Council Local Government Area (LGA). The development will include pools rides, outdoor sports and events facilities and all other facilities required to make the development attractive to visitors and for the running of the park.

Site Description

The site is approximately 25.5 ha. There are relatively flat areas in the south west and south east corners of the site and in the north at approximately the middle of the northern boundary. The site forms a natural amphitheatre facing north with typical slopes of 5% with slopes as steep as 10% in some locations.

Objectives

The objectives of this report are to show how the development of a Wet 'n' Wild Theme Park and entertainment facility can incorporate storm water use to limit its impact on the potable supply; water quantity management to limit its impact on flooding issues and stream morphology and both water quantity and quality measures that ensure the downstream aquatic environment is not adversely affected.

Water Quality

The Blacktown City Council Development Control Plan (DCP) 2006 sets required percentage reductions in post development average annual loads of various pollutants.

Water Quantity

The site is in the upper reaches of the Parramatta River Catchment. The Upper Parramatta River Catchment Trust has determined the level of onsite detention required in the catchment to protect the environment of the river and its tributaries and the land adjacent from flooding.

Water Reuse

No water reuse targets have been defined in legislation covering the site. However, water conservation has been noted in the Director General's Notice of Requirements as a key issue.

Stormwater Management Plan

The heart of the stormwater management for the site is a detention structure to attenuate flows off the site and a constructed water treatment wetland to remove contaminants from flows from the site. These two devices will be combined and are proposed to be constructed in the central northern area of the site. The detention structure will double as a reservoir for rainwater reuse.

The management of stormwater from the proposed development has a significant difference from other developments. If rainfall onto pools is sufficient to cause overflow, those flows will contain high levels of chlorine. This will be managed by minimising the potential for overflows and directing some overflow water to the sanitary sewer.

Quality

Stormwater quality control for the site will be achieved using Gross Pollutant Traps (GPTs), treatment swales and a constructed wetland. The GPTs will be located on stormwater mains prior to discharge into the wetland. Car park areas will be directed to water treatment swales which will be integrated into the carpark areas.

Quantity

Storage sufficient to meet the UPRCT requirements will be provided by the works to form the water treatment wetland and water reuse pond and the construction of the retention structure.

Modelling

The computer packages *CatchmentSIM* and *XP-Rafts* were used to develop and model the Hydrology and Hydraulics of the existing and developed site and *MUSIC* used to carry out water quality and water balance modelling. Water balances modelling for the pools was carried out in *Microsoft Excel*.

Modelling Results

The significant modelling results are that the flow from the developed site in the 2 year ARI is less than the UPRCT low flow requirement, the 100 year ARI from the site is less than the UPRCT 100 year ARI and the total storage in the 100 year ARI is a very close match.

The percentage reductions of contaminants running off the developed site are all in excess of the Blacktown City Council Requirements and in addition to this the contaminant load off site is less for all but nitrogen than in the existing, pre development situation.

Rain Water Reuse Plan

It is intended to capture and use as much rainwater as feasible on site. The proposed uses for the captured rainwater include irrigation, toilet flushing and wash down of paved areas and equipment.

Irrigation

Irrigation water will be taken from the reuse pond. The landscape plan for the park calls for "lush tropical" planting in the centre of the park, plant species selected will be match as much as possible to the western Sydney climate. Plantings species will gradually change as you moving to the park boundaries. At the boundaries vegetation will match that outside the park, which will require no irrigation.

Drip irrigation will be used to minimise losses in the application of water. The percentage of irrigation water sourced from rainwater is 95%. During typical years 100% of irrigation water will be sourced from reuse water only the inclusion of drought years in the water balance modelling brings the figure down to 95%.

Toilet Flushing

Roof runoff will be used as toilet flushing and wash down water with only minor treatment to ensure that it does not contain suspended sediments that may make it aesthetically unacceptable and to ensure that *E. coli* is <1 cfu/mg as required by DEF guidelines.

Roof water will be captured in tanks located under building floors. These same roof areas are also where the majority of the parks toilets will be located minimising the need for a non-potable reticulation system.

A 250kL tank and a 0.58ha harvestable roof area can supply 67% of toilet flushing and wash down demand, when efficient water using devices are used.

Flooding

In large event up to and including the 100 year ARI there will be a substantial reduction in flows off site, this will also mean lowered flood levels in these events.

The lowest floor level of park infrastructure and water level of pools are approximately 79m AHD, well above the PMF flood level meaning the park itself will be unaffected by the flooding.

Pools

Rain water from the reuse pond has not been considered as a source for pool makeup water, as the pool water will be in primary contact with park visitors and thus will be provided by the potable supply.

The bulk of water lost from pools is water carried out on the bodies and swimwear of people coming and going from the pools and evaporation. Water losses will be managed as much as possible by the use of devices such as run out troughs rather than splash pools from slides, but some losses are unavoidable as they are part of the nature of a water park.

Pool filters used in the park will be the most water efficient currently available, the majority will use a perlite filter media. The use of efficient filters wherever possible is expected to save approximately 20Ml of water per annum.

Pool Overflows

Pools will not overflow directly, but via the skimmers. Overflows are only expected to occur once every 1.4 years.

It is proposed that overflows from the pools in the first instance be directed to the sewer system, but that the flow to the sewer be restricted so the Sydney Water Sanitary Sewer network is not overloaded, any excess will be directed to the stormwater system.

A mass balance calculation for chlorine was carried out to establish the concentrations of chlorine in water leaving the site. The calculations show that with a flow of 14l/s directed to the sewer system all runoff to the stormwater system up to and including 100 year ARI event will contain a safe level of chlorine for discharge to the creek.

Summary

Given the demand supplied by reused water the parks demand on the Sydney Water potable supply is expected to be 102.2 Ml per annum. If no use of rainwater were carried out, high rate sand filters were used instead of perlite and water efficient appliances were not specified the parks water demand on the potable supply would be 154.9 ML per annum. Meaning a well designed park can potentially use only two thirds the water of a park which does not consider water efficiency would, whilst remaining feasible.

Blacktown City Council requirements for contaminant reduction in stormwater can be met and annual loads of contaminant will be less or comparable to those from the pre development site.

Flows off site and the volume of OSD provided will met the UPRCT's requirements.

Water Cycle Management Plan

Wet ‘n’ Wild Sydney

1 INTRODUCTION

Prospect Aquatic Investments Pty Ltd proposes to develop a “*Wet ‘n’ Wild Theme Park and entertainment facility*” at a site in Prospect, NSW. The site is located between the M4 Motorway and Reservoir Road just north of the Prospect Reservoir. Prospect is in Western Sydney, and the site is in an area known as the Western Sydney Parklands and is in the Blacktown City Council Local Government Area (LGA).

Figure 1 Locality Sketch

1.1 PROPOSED DEVELOPMENT

The site is to be a water theme park with rides, pools and attractions but will also include facilities for food service, merchandising, outdoor sports etc.

The water park features of the development are a large wave pool and beach area, two continuous rivers, multiple slides and children's pools. Rides and attractions have been designed so that there are attractions which will appeal to families with young children through to thrill rides for teenagers.

Large areas of car parking are required, some carparking will be sealed and some will be turf, or reinforced turf. In addition to the 'operational' areas, the facility will retain areas of ecological and heritage value and set aside space for water quality and quantity management.

The proposed development includes facilities for first aid, hosting outdoor events, locker and changing rooms and back of house facilities for the operational activities of the park.

See Figure 2 on the following page for a overall site plan.

For a full description of the proposed development please refer to the environmental assessment carried out by JBA Planning.

Figure 2 Sketch Plan of Proposed Development

1.2 SITE DESCRIPTION

The site is approximately 25.5 ha and is legally described as Lot 1 DP 1045771. There are relatively flat areas in the south west and south east corners of the site and in the north at approximately the middle of the northern boundary. The site forms a natural amphitheatre facing north with typical slopes of 5% with slopes as steep as 10% in some locations.

The majority of the site is covered in exotic grasses and is currently used for grazing. There are two small areas of Cumberland Plain Woodland. One area of woodland is in the south east corner of the site and has been assessed as being of high value. The second area is in the centre north of the site and has been assessed as low value. The assessment of the site ecology was carried out by EcoLogical Australia and is covered in detail in their report which is included in the Part 3A application.

The Blacktown Creek is shown on topographical maps of the area as originating on the site. On inspection the creek is ephemeral[1] with no defined bed. Blacktown Creek continues to be ephemeral after leaving the site until it reaches the Lancelot Street water quality control pond.

1.2.1 Saline Soils

The site is shown on the map, "*Department of Infrastructure, Planning and Natural Resources, Salinity Potential in Western Sydney 2002*" as having a moderate salinity potential. Immediately to the north of the M4 Motorway surrounding the line of Blacktown Creek the map shows high salinity potential and immediately to the east of watch house road close to the intersection with Reservoir Road is an area of known salinity.

Though the site itself is considered of only moderate risk, the adjacent high risk and known areas of salinity make it clear that designs must not lift groundwater levels and bring increased salinity to topsoils.

A copy of the salinity map can be seen in Appendix A. For further information on the salinity issues on the site refer to the Salinity Management Report by RCA Australia which is included in the Part 3A application.

[1] Ephemeral streams flow only during and after intense rain.

1.3 OBJECTIVES

The objectives of this report are to show how the development of a Wet 'n' Wild Theme Park and entertainment facility can incorporate storm water use to limit its impact on the potable supply; water quantity management to limit its impact on flooding issues and stream morphology and both water quantity and quality measures that ensure the downstream aquatic environment is not adversely affected.

Analysis of the water cycle in the park is also required. Water cycle analysis has been undertaken to determine the water demands of the pools, of the parks facilities and irrigation and how much water from alternative sources is available to be captured and reused within the park. Flows to the sanitary sewer will also be calculated as part of the analysis.

1.3.1 Water Quality

The development falls within the LGA of the Blacktown City Council. The Blacktown City Council Development Control Plan (DCP) 2006 contains required percentage reductions in post development average annual loads of various pollutants which are shown in Table 1 below.

Table 1 Water Quality Objectives

Pollutant	% post development average annual load reduction
Gross pollutants	90
Total Suspended Solids	85
Total Phosphorous	65
Total Nitrogen	45
Total Hydrocarbons	90

1.3.2 Water Quantity

The site is in the upper reaches of the Parramatta River Catchment. In the Parramatta River Catchment the Blacktown City Councils DCP refers Water Quantity requirements to work carried out by the Upper Parramatta River Catchment Trust (UPRCT). The Trust has determined the level of onsite detention required in the catchment to protect the environment of the river and its tributaries and the land adjacent from flooding. The latest work carried out by the Trust is presented in the "On-site Stormwater Detention Handbook, Fourth Edition December 2005".

The water quantity requirements set out in the trusts handbook are shown in Table 2 below.

Table 2 Water Quantity Objectives

Parameter	UPRCT Target	Site Target
Low Flow Outlet	40 l/s/ha	1,022 l/s
High Flow Outlet	150 l/s/ha	3,831 l/s
100 year ARI flow	40 l/s/ha + 150 l/s/ha	4,853 l/s
Onsite Extended Detention	300 m^3/ha	7,662 m^3
Onsite Flood Detention	155 m^3/ha	3,959 m^3
Total Onsite detention	300 m^3/ha + 155 m^3/ha	11,621 m^3

The low flow outlet is intended to match the 1.5 year ARI flow from the natural catchment of the upper Parramatta River. The significance of the 1.5 year ARI flow is that events between 1 and 2 year ARI are considered to be ‘channel forming flows’. ‘Channel forming flows’ are the flows that are critical in the morphology of a watercourse and as a result, the in channel and riparian habitats formed by the watercourse.

1.3.3 Water Reuse

No water reuse targets have been defined in legislation covering the site. However, water conservation has been noted in the Director General’s Notice of Requirements as a key issue.

Further to the comments contained in the Notice of Requirements are objectives laid out in the Environmental Management Guidelines of the Western Sydney Parklands Trust. These include:

- Minimising water consumption overall by maximising water use efficiency
- Minimise use of mains water
- Use locally available water sources and recycle where possible

Water is a valuable resource and because of this it is in a society’s interest to use water efficiently and make best use of all available sources.

2 HYDROLOGY & HYDRAULICS OF THE EXISTING SITE

2.1 HYDROLOGY

The site is at the top of its catchment, with Reservoir Road and Watch House Road having been constructed on the ridge lines that separate the site from the south and east. This means that no part of the site drains to Sydney Water's Prospect Reservoir to the south. The topography of the site generally separates it from land to the west, apart from approximately 0.8ha of the site which drains to the west. The remainder of the site discharges to the north. Discharges to the north are divided into two sub-catchments, one in the north west of the site of approximately 4.1ha and the remainder which is approximately 20.6ha.

There are three existing dams on site, these have been considered to be full at the start of rainfall events in modelling calculations, and provide no detention to the existing flow from the site.

A strip of RTA land between the sites northern boundary and the M4 centre line was included in the model. As this land drains to the same culverts as the development site, which are currently the flow control for water passing under the M4 this land must be considered in order to fully understand flows through the culverts and ponding at the culvert entrances. This additional area of catchment is approximately 2.1ha.

Areas of Reservoir Road and Watch House Road also drain to the development site and have been included in the calculations.

2.2 HYDRAULICS

Due to the topography of the site the majority of runoff drains to the middle of the northern boundary. The Blacktown Creek is shown on topographical maps of the area as originating on the site and flowing off site at this location. On inspection of the site the creek is ephemeral and essentially a grassy swale with no defined bed and bank.

Figure 3 below is a photo taken from the northern boundary of the site looking back up the course of the Blacktown Creek. This photo was taken on the 13th of October 2010, rain did not fall in the area on the 13th but significant rain had fallen on the 3rd and 4th of the month and light rain had fallen on the days between then and the 13th meaning that the area was wetter than typical when this photo was taken. The absence of riparian plant species also point to the ephemeral nature of the creek.

Figure 3 Blacktown Creek – Ephemeral Nature

Figure 4 Blacktown Creek – Heavily Modified

Figure 4 above shows a small pond on the creek. The ramps on either side of the pond and in the top right of figure 4 are part of a motor-cross track that has been constructed on the site with this pond being a 'water hazard' rather than a natural feature.

Once flows leave the site they must pass under the M4. There are two culverts carrying flows from the site under the M4, a 1.75m diameter culvert carries the Blacktown Creek and a 900mm diameter culvert carries flows from the 4.1ha north western sub-catchment.

2.3 MODELLING

The computer packages *CatchmentSIM*[2] and *XP-Rafts*[3] were used to develop and model the Hydrology and Hydraulics of the Existing site.

Blacktown City Council lists in its Drainage Design Manual 2005 parameters to be used in *XP-Rafts* in its LGA, they are in section 10.2 of the manual. These parameters are for the Australian Representative Basins Model (ARBM) method of runoff calculation were used in the *XP-Rafts* modelling for the site and are shown below in Table 3.

[2] CatchmentSIM is a standalone GIS application designed to utilize terrain information to delineate catchments and prepare hydrologic models
[3] XP-Rafts is a computer model developed to carry out runoff routing for hydrologic and hydraulic analysis of drainage and conveyance systems

Table 3 Rafts Parameter from Blacktown City Council

Parameter	Value
Capacity of Impervious Area Storage	1.5mm
Interception Storage Capacity	1.5mm
Depression Storage Capacity	5mm
Capacity – Upper Soil Zone Storage	25mm
Capacity – Lower Soil Zone Storage	100mm
Maximum Potential Evapotranspiration from Upper Soil Zone	10mm/day
Maximum Potential Evapotranspiration from Lower Soil Zone	10mm/day
Proportion of Evapotranspiration from USC	0.7
Initial Impervious Area Storage	0.5mm
Initial Interception Storage	0.5mm
Initial Depression Storage (pervious)	0mm
Initial Upper Soil Zone Storage	20mm
Initial Lower Soil Zone Storage	80mm
Initial Groundwater Storage	0mm
Groundwater Recession Factor	1mm
Sorptivity of Dry Soil	3mm/min-0.5
Saturated Hydraulic Conductivity	0.33mm/min
Lower Soil Drainage Factor	0.05
Constant Rate Groundwater Recession Factor	0.94
Rate of Potential Evaporation from "A" Class Pan	0.7
Proportion of Rainfall intercepted by Vegetation	0.7

The contour data for the site comes from a survey carried out by Bee & Lethbridge Surveyors, which was entered into *CatchmentSIM* which was then used to delineate the sub-catchments of the site and calculate the sub-catchment slopes and areas. This data was then exported to *XP-Rafts* to carry out the hydraulic and hydrologic modelling.

In addition to the input data provided by the Blacktown City Council and calculated in *CatchmentSIM,* each sub-catchment requires percentage imperviousness and roughness values. For all the sub-catchments in the predevelopment model a percentage imperviousness of 5% was used and a roughness of 0.035. These values represent the imperviousness due to road and roof areas and the roughness of pastoral grasses.

Though the permissible discharge and storage requirements are set by the Upper Parramatta River Catchment Trust, the predevelopment site has been modelled to provide a robust comparison between pre and post development flows, so that any effects the development may cause can be seen. The structure of the XP-Rafts model is shown in Figure 5.

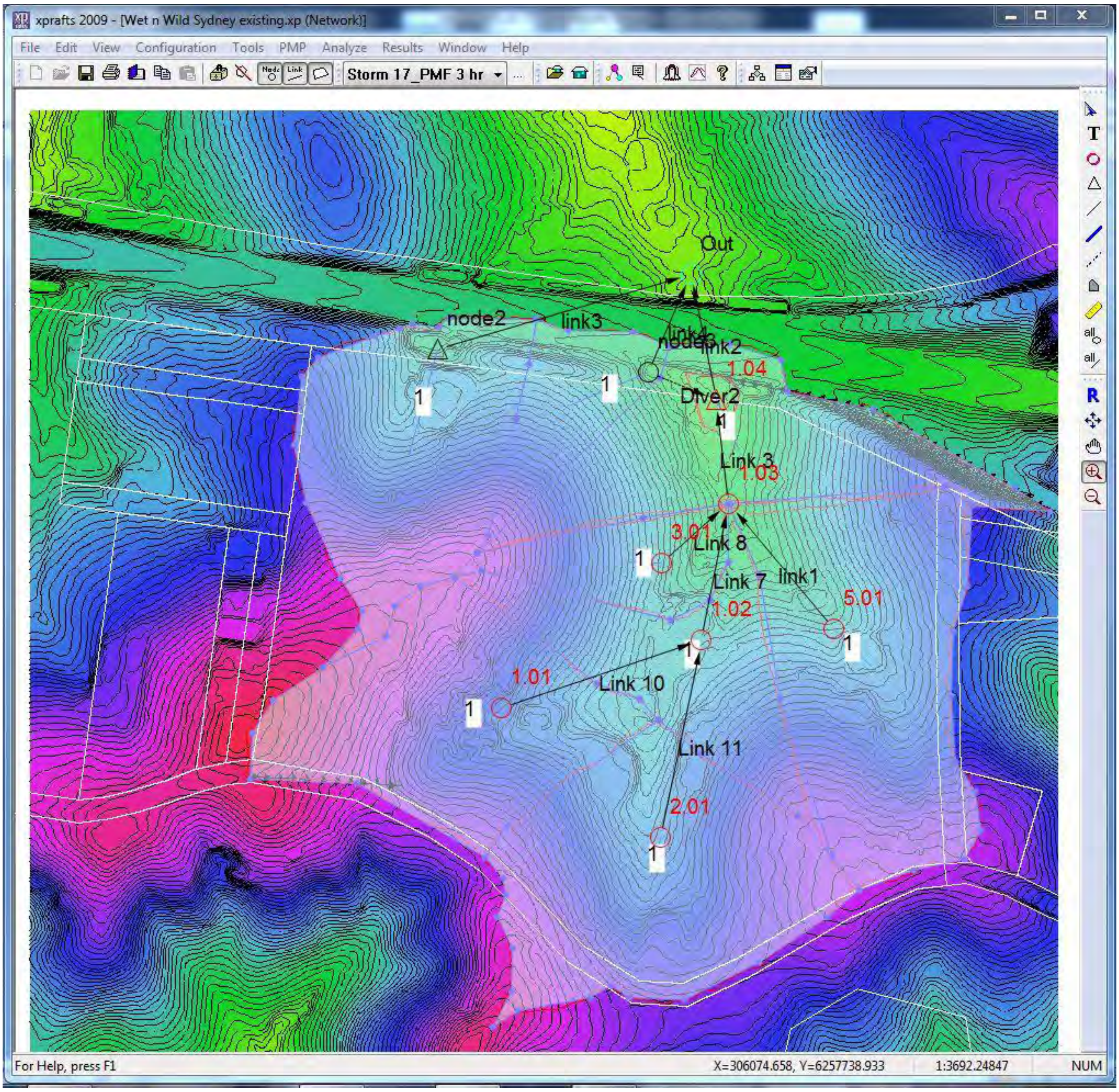

Figure 5 Pre development XP-Rafts Model Layout

The results of the *XP-Rafts* modelling of the pre development site are summarised in Table 4 below. The UPRCT targets are included for comparison. Note that the flows shown include the additional 2.1ha of RTA land that drains through the culverts under the M4.

Table 4 Existing site modelling results and UPRCT targets

Parameter	Flow passing the M4	UPRCT Site Target
1 year ARI flow	800 l/s	
1.5 year (UPRCT Low flow)[4]		1,022 l/s
2 year ARI flow	1,005 l/s	
20 year ARI flow	5,145 l/s	
100 year ARI flow	7,118 l/s	4,853 l/s
PMF flow	22,409 l/s	
100 year ARI onsite detention	320 m^3	11,621 m^3

The results in Table 4 show that the low flow target set by the UPRCT is very close to the existing flow from the site in similar events, the UPRCT high flow target is however much less than the existing flow. There is some detention of water in the 100 year ARI pre development case at the entrance to the 1.75m diameter culvert under the M4. Most of this ponding occurs on RTA land in the M4 corridor. Approximately 3000m^2 of land within the development site is inundated. This area of inundation is in the Cumberland Plain woodland on the northern boundary of the site.

[4] 1.5 year ARI flows have not been calculated as XP-Rafts does not calculate for part years

3 STORMWATER MANAGMENT PLAN

The proposed heart of the stormwater management of the site is a detention structure to attenuate flows off the site and a constructed water treatment wetland to remove contaminants from flows from the site. These two devices will be combined and are proposed to be constructed in the central northern area of the site. This location is where the area of low value Cumberland Plain woodland is located. The concept of the wetland and detention basin has minimised the number of trees lost as much as possible while achieving sufficient treatment area and detention volume.

The management of stormwater from the proposed development has a significant difference from typical commercial developments. If rainfall onto pools is sufficient to cause overflow, those flows will contain high levels of chlorine. This will be managed by minimising the potential for overflows and directing some water to the sanitary sewer.

A schematic showing the various elements of the stormwater management system and how they fit together can be seen in Figure 6 below.

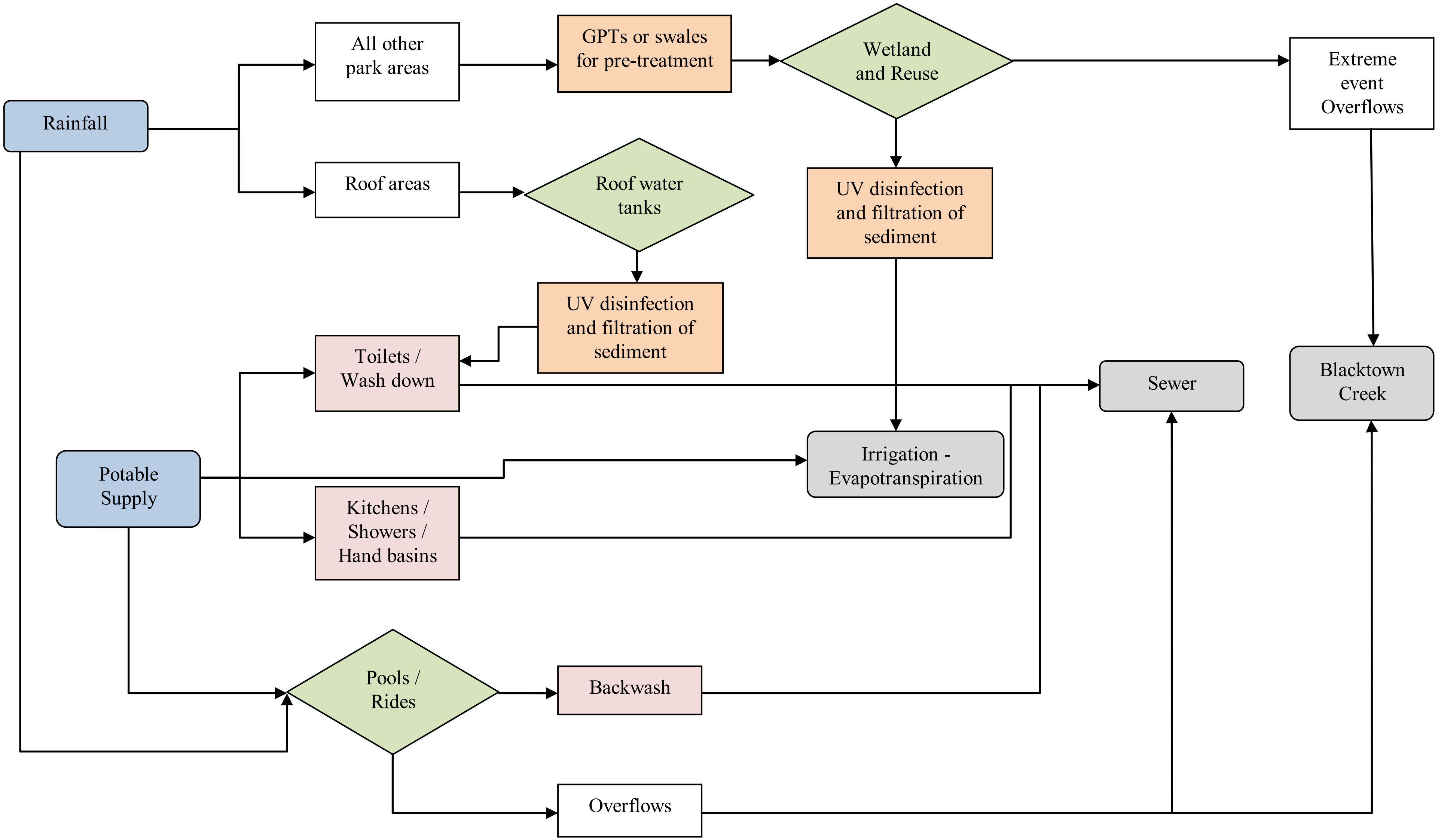

Figure 6 Stormwater System Schematic

3.1 QUALITY

Stormwater quality control for the site will be achieved using Gross Pollutant Traps (GPTs), treatment swales and a constructed wetland. The GPTs will be located on stormwater mains prior to discharge into the wetland. Car park areas will be directed to water treatment swales which will be integrated into the carpark areas.

Runoff from the grassed carparks will not have formal pre-treatment as they will only have vehicle traffic on peak operating days and if managed correctly should not produce high levels of contaminant. This management includes practices such as the removal of all grass clippings which if allowed to runoff would carry large amounts of nutrients to the wetland and maintenance of good grass cover to stop sediments being eroded and carried to the wetland.

3.1.1 Wetland and Reuse Pond Design

The wetland design is based on the principles presented in 'Managing Urban Stormwater: Treatment Techniques', Auckland Regional Council Technical Publication 10 and the NSW EPA publication. The reuse pond was designed to ensure that anybody mistakenly entering it can easily climb out and to allow for dense planting along its edge to discourage entry.

The wetland will have an inlet pond volume of 200m^3 which will act as a flow splitter to direct low flows to the wetland and allow high flows to bypass directly to the reuse pond so that they do not damage the plantings in the Macrophyte zone. The Macrophyte zone of the wetland will have an area of 3000m^2 and will discharge to the reuse pond.

The reuse pond will have a volume of 3500m^3 at the level of its overflow weir, side slopes of 1 in 5 above the top water line will extend 2 metres into the pond to allow for people who do enter it to walk out. The pond edge then slopes down at 1 in 2 to maximise its reuse volume.

See the drawings in Appendix B for further details of the proposed wetland and reuse pond.

3.1.2 Swale Design

The swales in the carparks will treat water by passing it through a dense vegetation buffer. They will be graded at approximately 3%, have an overall width of 1.5m and a bed level 100mm below the carpark edge level.

The high level of compaction of the subsoil's in the carpark area due to the extensive earthworks required to form the carpark and provide a suitably firm base for the carpark construction are expected to render the subsoil's virtually impervious. This should be confirmed during swale construction and any additional compaction required carried out ensuring the swales have an impervious base.

Details of the proposed swales can be seen in Appendix B.

3.1.3 Modelling

MUSIC[5] was used to model the sites treatment system and to calculate existing contaminant runoff. The MUSIC model layout for the water quality calculations can be seen in Figure 7 below.

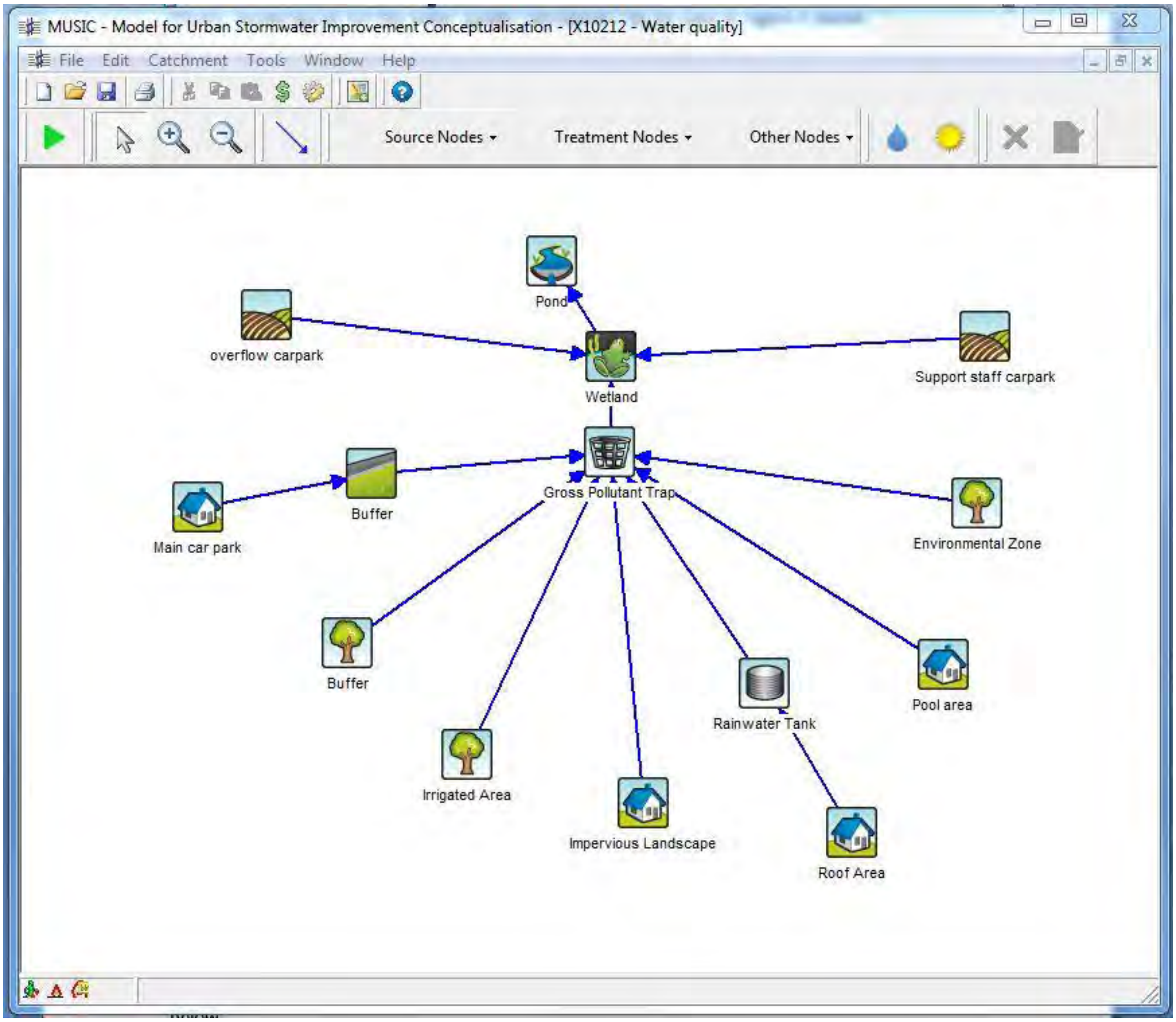

Figure 7 MUSIC Layout – Water Quality

The input data for the music model was taken from the Liverpool rainfall station as recommended in Blacktown City Councils WSUD Handbook. The data is in 6 minute time steps for the years 1967 to

[5] Model for Urban Stormwater Improvement and Conceptualisation – A commercially available computer model

1976 inclusive. Evaporation data used was the average potential evapotranspiration for the Sydney area given in the Blacktown City Council WSUD handbook.

The same model but with the treatment nodes removed and the source nodes changed to agricultural land, apart from the environmental zone which remained as forest, was used to estimate existing runoff loadings.

The areas and percentage imperviousness of the various sub catchments used were as shown in Table 5 below.

Table 5 Post development Imperviousness and Roughness

Sub catchment	Area [ha]	Imperviousness
Car park	4	100%
Overflow grass car park	3	75%
Heritage site	0.43	25%
Pervious landscaping	6.4	10%
Impervious landscape	5.7	100%
Pool area	1.4	100%
Environmental and detention zone	2.8	20%
Roof area	0.58	100%
Support staff grass car park	1.2	75%

The contaminant runoff from the pre and post development site as calculated by the MUSIC model is summarised in Table 6 below. Also included in Table 6 are the treatment efficiencies achieved and the treatment efficiencies required in the Blacktown City Council WSUD Handbook.

Table 6 Treatment Efficiency and Contaminant Loads

Pollutant	Pre development Load kg/year	Post development Load kg/year	% reduction[6] requirement	% reduction[6] achieved
Gross pollutants	581	0	90	100
Total Suspended Solids	8,720	2960	85	87.2
Total Phosphorous	18.6	13.5	65	73.4
Total Nitrogen	148	179	45	49.6

Table 6 shows that the percentage reduction of contaminants running off the developed site are all in excess of the Blacktown City Council Requirements and that in addition to this the contaminant load off site is less for all but nitrogen than in the existing, pre development, situation.

Blacktown City Council requirements also require a reduction in hydrocarbons from the developed site of 90%. MUSIC does not model reductions in hydrocarbon, however studies on the reduction of hydrocarbons in wetlands show very good results. The key process for removal of hydrocarbons in wetlands is volatilisation though they will also be removed by bacteria metabolising them and releasing them as CO_2 and water. The retention time and large amount of organic matter in wetlands provide time and surface area for hydrocarbons to separate from water and be retained while volatilisation and metabolism occur.

3.2 QUANTITY

The water quantity requirements as discussed in Section 1.2.2 have been set for the site by the UPRCT. Storage sufficient to meet the requirements will be provided by the works to form the water treatment wetland and water reuse pond and the construction of the retention structure. The proposed retention structure is a sandstone retaining wall with a 1 to 1 face slope on either side with a compacted clay core between them it is to be 9 metres wide at its base and 3m tall at its highest point.

Modelling of the quantity of runoff from the site and its results are detailed in Section 5, Hydrology and Hydraulics of the Development Site.

See the drawings in Appendix B for further details of the proposed wetland and reuse pond.

[6] This is not a percentage reduction from pre development load to post development load, it is the percentage reduction from the contaminants produced on site post development to those released from site after treatment

3.2.1 Reticulation

20 year ARI rainfall will be captured in swales and pits and from these be contained in pipes before release to the inlet pond of the water treatment wetland. Flows in excess of the 20 year ARI up to and including 100 year ARI events will be contained in overland flow channels where they will not pose undue risk to park visitors. Overland flows will have a velocity depth product less than 0.4 as required by Blacktown City Council's DCP.

Flows calculated in the *XP-Rafts* modelling of the developed site, detailed in Section 5, have been used to determining the layout of the trunk drainage network. Drawings in Appendix B show details of the proposed reticulation network and overland flow paths.

4 RAIN WATER USE PLAN

It is intended to capture and use as much rainwater as feasible on site. The proposed uses for the captured rainwater include irrigation, toilet flushing and wash down of paved areas and equipment. The required water quality for these use are presented in the NSW Department of Environment and Conservation (DEC) publication *Managing Urban Stormwater: Harvesting and Reuse*.

This site differs from typical commercial developments in that it has a small roof area and high water use. This makes the challenge of harvesting rain water for use much greater as it is roof water which is generally most fit for purpose for use.

4.1 IRRIGATION

Irrigation water will be taken from the reuse pond. This water would likely be sufficiently clean to irrigate directly in locations with access control, with expected *E. Coli* levels of 100-5000 cfu/100ml. As the facility is designed to allow access to irrigated areas UV sterilisation prior to irrigation is required to achieve the <1 cfu/100ml required by the DEC (2006) requirements. The reuse pond will have access control by way of dense riparian and marginal planting and will not require further treatment other than that provided by the wetland.

The landscape plan for the park calls for "lush tropical" planting in the centre of the park, plant species selected will be match as much as possible to the western Sydney climate. The plants selected will be species which require as little watering as possible and that have foliage as similar as possible to that of tropical species. Plantings species will gradually change as you moving to the park boundaries. At the boundaries vegetation will match that outside the park, which will require no irrigation.

4.2 TOILET FLUSHING

Roof runoff can be used as toilet flushing water with only minor treatment to ensure that it does not contain suspended sediments that may make it aesthetically unacceptable and to ensure that *E. coli* is <1 cfu/mg.

Roof water will be captured in roof water tanks located under building floors. These same roof areas are also where the majority of the parks toilets will be located minimising the need for a non-potable reticulation system.

5 HYDROLOGY AND HYDRAULICS OF THE DEVELOPED SITE

5.1 HYDROLOGY

The developed site is substantially less pervious than the pre development site. Because of this increased imperviousness a greater volume of runoff will result from rainfall on the site as much less water can infiltrate to ground. In addition to the greater volume of runoff the smooth impermeable surfaces allow runoff at much higher velocities.

The water detention structure described in Section 3.2 is capable of reducing the rate of runoff to acceptable levels and the water reuse described in Section 4 will decrease the volume of runoff from the site. Rain water will be used either by evapotranspiration by vegetation after irrigation or directed to the sewer via toilet flushing.

5.2 HYDRAULICS

As discussed in Section 3.2.1 water will be collected in pits and swales and then conveyed via pipes to the water treatment wetland. The hydraulics of the pipe network have not been investigated in detail as there may be design changes in the site as the development progresses to final design which will alter the sub catchments within the site.

5.3 MODELLING

The site was modelled in *XP-Rafts* following Blacktown City Council requirements as described in Section 2, an area of RTA land was included in the model for consistency with the pre development modelling. The site was split into sub catchments that best represent the post development land use and the imperviousness and roughness of these uses. The sub catchments can be seen in Figure 5 and on a plan in Appendix B which also has a table with the breakdown of area, slope, roughness and imperviousness for the catchments.

The modelling results are summarised in Table 7 below. Note that the developed storage does not include water storage against the M4 embankment and considers the reuse storage pond to be 100% full at the start of a rainfall event. It is very unlikely that the reuse storage will be 100% full at the start of a rainfall event and as a result the modelling is considered to be conservative.

Table 7 Developed site modelling results and UPRCT targets

Parameter	From developed site	Flow passing M4 post development	Flow passing M4 pre development	UPRCT Site Target
1 year ARI flow	545 l/s	566 l/s	800 l/s	
1.5 year (low flow)				1,022 l/s
2 year ARI flow	830 l/s	885 l/s	1,005 l/s	
20 year ARI flow	2,153 l/s	2,435 l/s	5,145 l/s	
100 year ARI flow	3,101 l/s	3,468 l/s	7,118 l/s	4,853 l/s
PMF flow	27,622 l/s	29,790 l/s	22,409 l/s	
100 year ARI onsite detention	11,390 m^3			11,621 m^3

The significant results given in Table 7 are the flow from the developed site in the 2 year ARI being less than the UPRCT low flow requirement, the 100 year ARI from the site being less than the UPRCT 100 year ARI and the total storage in the 100 year ARI being a very close match.

5.3.1 Flooding

Table 7 above shows that in large event up to and including the 100 year ARI there will be a substantial reduction in flows passing the M4, this will also mean lowered flood levels in these events.

Flood levels within the site in the PMF event of 77.2m AHD are predicted by the modelling. The lowest floor level of park infrastructure and water level of pools are approximately 79m AHD, well above the PMF flood level meaning the park itself is unaffected by flooding in the PMF. The M4 may experience flows over its surface of 100 to 200mm deeper than in the existing PMF event.

The flow passing over the M4 in the pre development PMF is approximately 300mm deep with a flow of 7.6m^3/s. This depth and quantity of water flowing over the road surface in the pre development case is a traffic hazard and though there is an increase in the post development flow it is no new hazard is created.

6 SITE WATER BALANCE

Water balances have been carried out for pool water, and non potable water reuse. Literature investigation and calculations have been carried out to determine the breakdown of water uses on site and to determine irrigation, toilet flushing and wash down demands. Calculations can be seen in Appendices H and I.

The water balance calculations were carried out using rainfall data from the Blacktown Rainfall station and evaporation data from the Prospect Reservoir meteorological station for the years 1970 to 1993 inclusive. The average annual rainfall over this period was 867mm and the average evaporation was 1545mm per year, this is notably higher than average Sydney potential evapotranspiration of 1260mm per year which is often used. This period of data has been selected by the Blacktown City Council for use in water balance calculations in its LGA as detailed in their WSUD[7] Handbook (2008).

The water balance calculations for the pools were carried out using *Microsoft Excel,* a description of the calculations can be found in Appendix G. The calculations for roof water reuse and irrigation reuse were carried out using MUSIC. Figure 8 below is a screen shot of the MUSIC model layout.

[7] Water Sensitive Urban Design

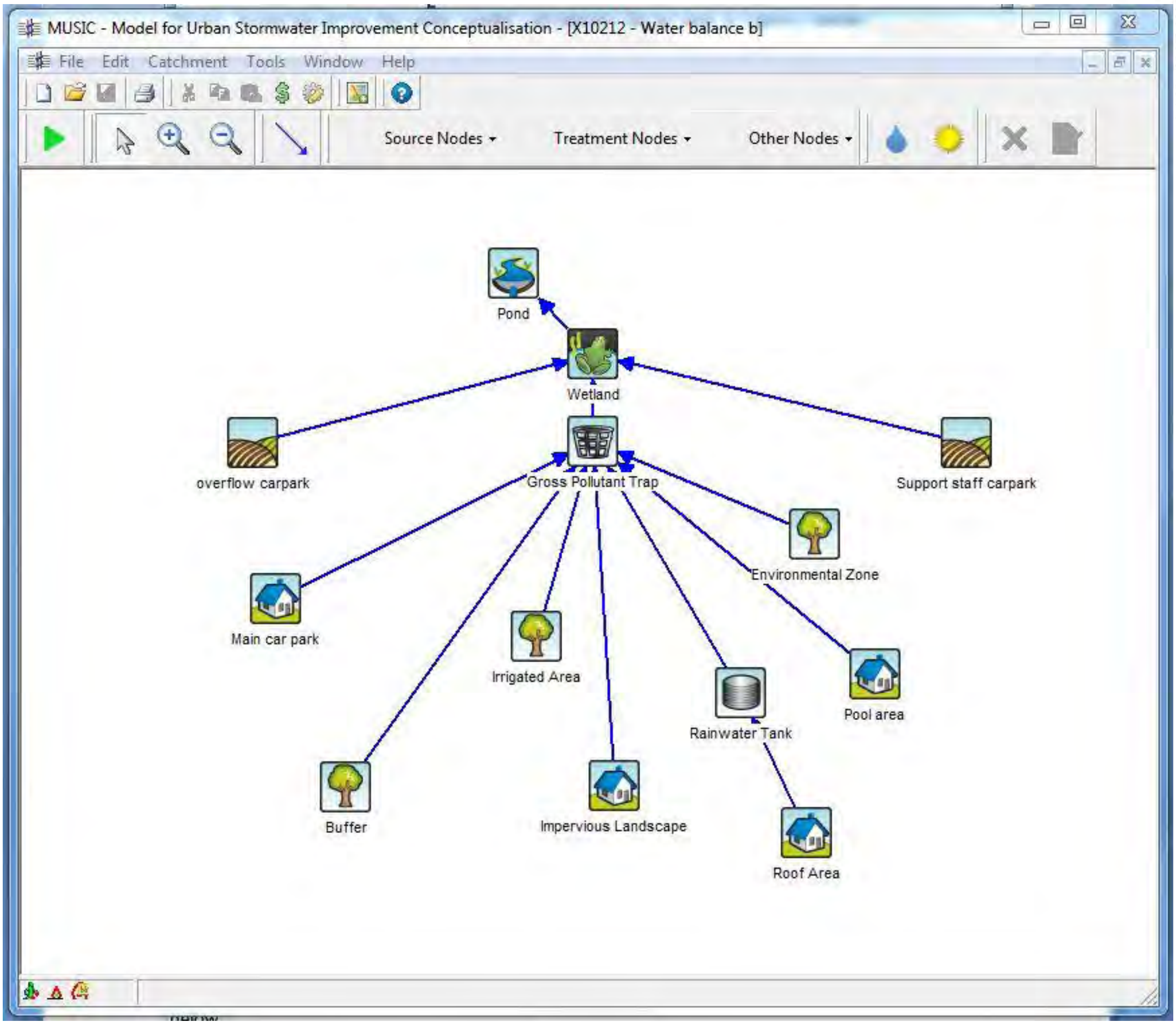

Figure 8 MUSIC Layout – Water Balances

The reuse of grey water on site is not considered to be a viable option. The reasons for this are that a large amount of reuse demand can be supplied by harvesting stormwater and that stormwater is more fit for purpose than grey water. Grey water can be irrigated after treatment but as the intention is for all landscaped areas of the park to be accessible to visitors to the park treatment before it can be irrigated in a public area are more costly than for stormwater. For a development this size a treatment plant for grey water would require a buffer zone for odour, this would be a problem for both the land area that it would remove from operation and if any errant odour did drift to public areas would be a major problem for park of this type.

6.1 SITE WATER USES

Not considering the water used for pools and irrigation, the sites water uses are confined to common activities for which there have been studies quantifying usage. Water uses include toilet flushing, showering before and after swimming, kitchen operations and outdoor wash down.

Water usage for these activities, and expected frequency of use was taken from available literature. A comparison was made between typical current usage from literature, which includes a range of inefficient and efficient devices and usage given water saving devices that are commercially available. Water efficient devices that were considered for use in the park include low flow toilets, waterless urinals, low flow shower heads and taps, low flow spray heads for washing down outdoor areas and water efficient appliances in kitchens. See Tables 8 and 9 below for the expected breakdown of water use for park visitors (excluding consideration for pools and irrigation). It is forecast that 930,000 visitors will attend the park each year.

Table 8 Expected water use per visit - Current Literature

Use	L/visitor	ML/year
Toilet flushing[8]	7.7	7.2
Hand Basins	2	1.9
Bathing[9]	12	11.2
Kitchen[10]	17.5	16.3
Wash down[11]	0.05	0.05
Total	39.1	36.5

Table 9 Expected water use per visit - Efficient Devices

Use	L/visitor	ML/year
Toilet flushing	3.5	3.3
Hand Basins	1.5	1.4
Bathing	9	8.4
Kitchen	14	13.0
Wash down	0.05	0.05
Total	28.1	26.1

[8] Assuming park visitors are 50% female and 50% male and males use one full flush to ever 5 urinal uses – DEFRA 2007
[9] One 30 second Shower Pre Swimming and one 1 minute shower post swimming – DEFRA 2007
[10] The average commercial kitchen uses 35l of water per meal – Melbourne City Council 2007
[11] See the calculation in Appendix D for the estimation

Prospect Aquatic Investment Pty Ltd's forecast for usage of the park on the peak day is an attendance of 11,000 visitors. Given the expected use for efficient devices and assuming a 10 hour operating day and peak instantaneous flow during the day of 2 times the average over the day, peak flows of 17.1 l/s are expected (excluding consideration for pools and irrigation).

6.2 ROOF WATER REUSE

As discussed in Section 4.2, roof water will be reused to provide water for toilet flushing and wash down water. Excluding irrigation these are the sites non-potable water uses. The demand for toilet flushing and wash down water given efficient device use were investigated with the water balance model. The demand was spread evenly over the 8 month operating season. The results were plotted on the graph shown in Figure 9 below.

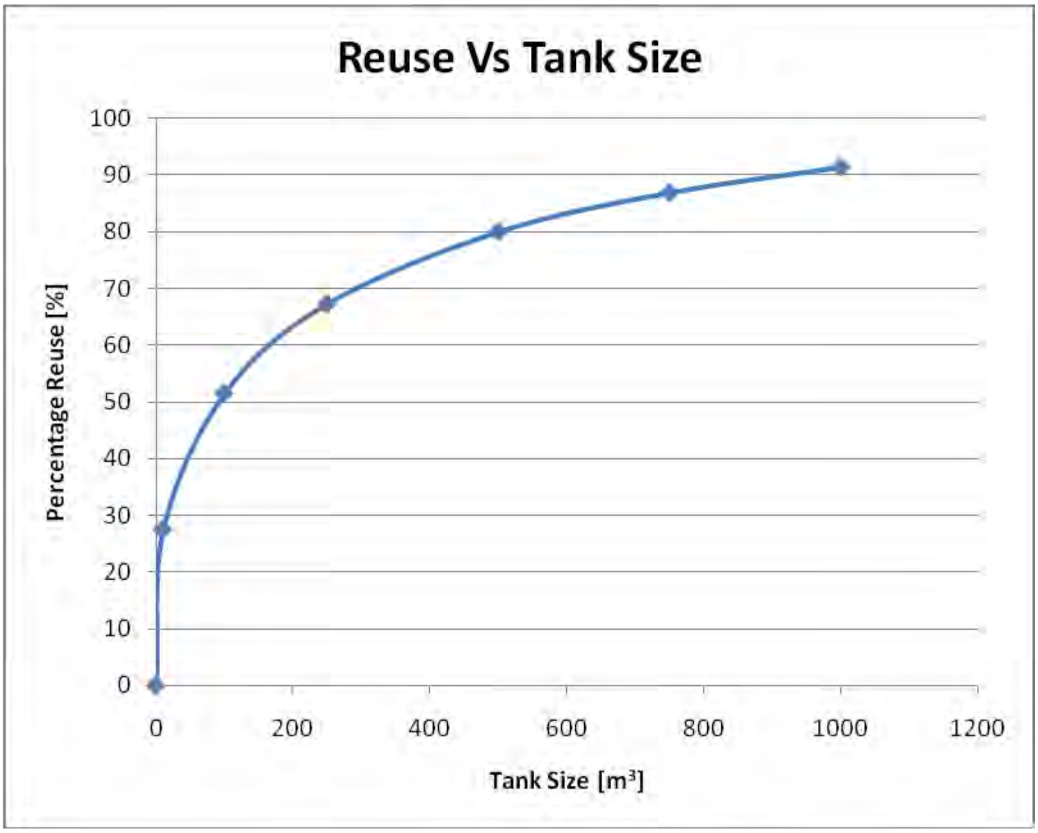

Figure 9 Reuse Percentage Vs Tank Size

Figure 9 shows that a 250kL tank and a 0.58ha harvestable roof area can supply 67% of toilet flushing and wash down demand, when efficient devices are used. It can be seen that the gradient of the graph starts to flatten off at around 200 to 250 m^3. After this point tank size, and hence capital expenditure, required to increase the reuse percentage becomes much larger for the percentage gain in reuse achieved. For this reason 250m^3 has been selected as a good balance between reuse and cost.

Information from the Quantity Surveyor working on the development shows that a 250kl tank could cost in the order of $150k – $250k. Supplying 67% of demand leaves a 1.14Ml per annum demand on the potable water supply. Figure 9 shows that doubling the storage capacity would save 80% or a further 0.46 Ml per annum, saving this small amount of additional water does not justify doubling the capital expenditure on tank construction.

Water used for wash down in the park will drain back to the stormwater system and ultimately return to the reuse pond. The model does not take this recirculation into account and considers water reused as wash down to be lost to the system. Meaning the MUSIC water balance model is conservative in its estimation of reuse.

6.3 IRRIGATION REUSE

As discussed in Section 4.1, water will be taken from the reuse pond for irrigation. Drip irrigation will be used to minimise losses in the application of the water.

Table 10 Irrigation Demand and Reuse

Irrigation demand	Reuse Volume	Percentage reuse
21.0 Ml per annum	3500m^3	95%

The percentage reuse comes to 95% due to the data set used in the calculations including drought years. During typical years 100% of irrigation water will be sourced from reuse water. In drought years where water restrictions are likely some plantings will be allowed to die rather than take water from the potable supply, meaning that even in drought years there still may not be any water taken from the potable supply.

Irrigation demand has been calculated using the planting zones specified by the landscape architect working on the park. With the areas of different planting types, which require different amounts of water, considered in calculate demand. The zoning considered can be seen in Appendix I along with calculations of demand.

6.4 POOLS

A water balance for pools was carried out to determine what the pool make up water requirement on the potable supply will be. Rain water from the reuse pond has not been considered as a source for pool makeup water, as the pool water will be in primary contact with park visitors and thus will be provided by the potable supply.

6.4.1 Pool Makeup Water

The pools have been designed so that the vast majority of direct rainfall on them will be captured in the freeboard of the pools and balance tanks required for the operation of rides, minimising as much as possible the demand for makeup water. As stated previously, no other runoff will be allowed to enter the pools, as pool water must be of a potable standard to ensure that there is no risk to parks visitors.

Any decrease in evaporation due to shading or the use of pool covers has not been considered.

The results of the pool water balance calculations is summarised in Table 11 below.

Table 11 Pool Makeup Water Requirements

Annual Demand	Average Flow[12]	Peak Flow[12]
77.4 ML	11 l/s	43 l/s

The bulk of water lost from pools is water carried out on the bodies and swimwear of people coming and going from the pools and evaporation. Evaporation loss per square metre of pool surface will be substantially greater than that of a normal water body due to the water surface constantly being broken in the wave pool and slides and due by the people using the pools. There are also water sprays and fountains proposed for some parts of the park. Some pools will also be heated increasing evaporation.

These water losses will be managed as much as possible by the use of devices such as run out troughs rather than splash pools from slides, but some losses are unavoidable as they are part of the nature of a water park. To simulate these losses the rate of evaporation applied to the water surface of the pools has been quadrupled from the historical average of prospect reservoir of 4.2mm per day up to 16.9mm per day. This quadrupling gives losses from pools that are in the range experienced at other water parks that include slides and wave pools.

[12] Assumes the pools must be maintained to at least the minimum level for operation of skimmers during operating hours i.e. cannot be allowed to drop and refill slowly over night

Pool filters used in the park will be the most water efficient currently available, the majority will use a perlite filter media. Backwash volumes from perlite filters are approximately 5% of that from high rate sand filters commonly used. There are certain situations where perlite filters are not appropriate such as for pools with high water temperatures or in water features, in these cases high rate sand filters will be used. The use of perlite filters wherever possible is expected to save approximately 20Ml per annum. Annual demand with sand filters would be 97.4Ml per annum.

6.4.2 Pool Overflows

There are two freeboard values associated with the pools. The first freeboard value is the range over which pool levels can fluctuate whilst allowing the pool skimmers to operate. This is referred to as the 'operational' freeboard for the purposes of this report. The second is above this to the pool edge.

The operational free board can vary from as little as 10mm in children's pools to as much as 130mm in wave pools, free board above this to the pool edge varies from 100 to 250mm, again depending on pool such as wave pools having large freeboards. This large depth of freeboard means the pools will not overflow directly but via the skimmers. A weighted average of operational freeboard by pool area was calculated to give a typical value for the pools.

Table 12 Areas of various pool types

Pool type	Area [m^2]	Operational Freeboard [mm]
Wave and River Pools	10376	130
Splash pools from slides	484	80
Children's / low movement pools	3147	10
Weighted average		100

The graph in Figure 10 below shows that given the operational free board in the pools there would have been 17 events where pool levels would have risen sufficiently to overflow the skimmers and have caused a discharge over the 24 years of data used in the water balance calculations. This is an average of approximately 0.7 events per year or once every 1.4 years.

Events occur in both the winter months when the park is closed and during the operating season. The events that cause overflows are longer duration events, in the order of 24 – 48 hours. Short duration high intensity events don't drop a sufficient total depth of water to cause overflows.

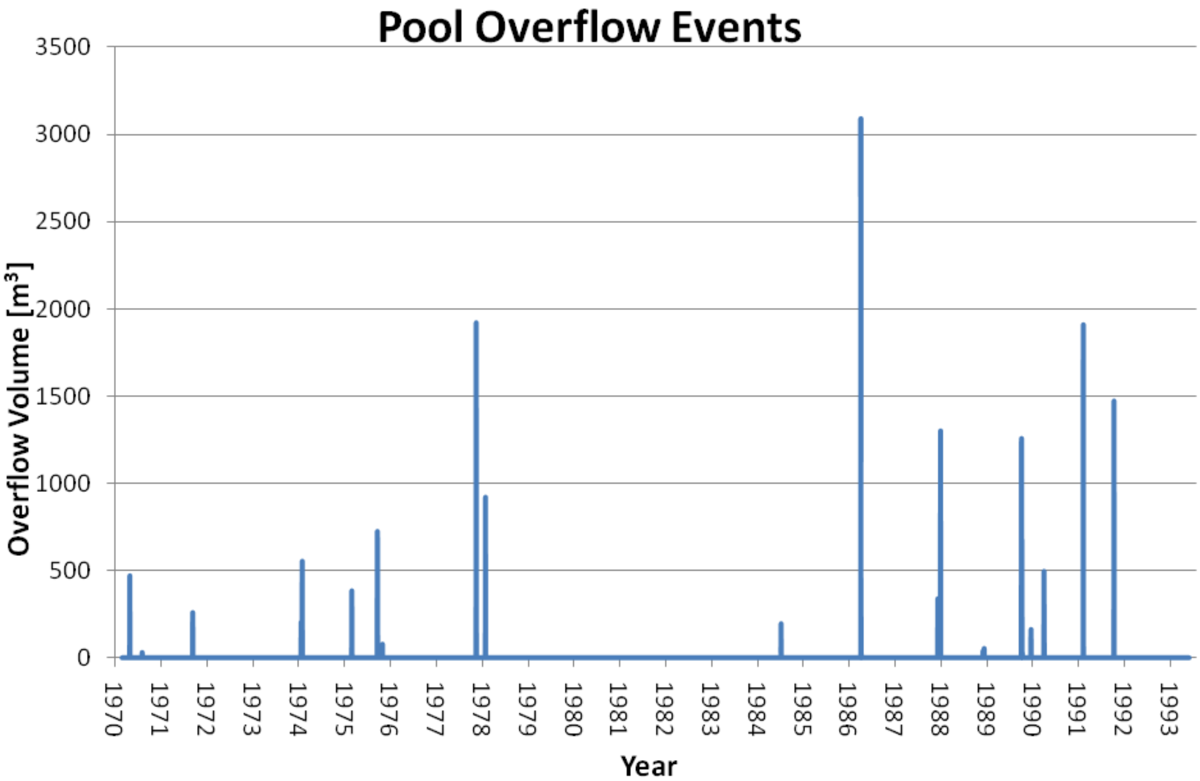

Figure 10 Overflows from the pools

During the continuous heavy rainfall required to cause overflows there is expected to be very low attendance at the park. With low attendance, flows from the park to the sewer via toilet flushing, food preparation, backwashing etc will be minimal leaving capacity for pool overflows in the sewer.

As pool water is chlorinated for disinfection, it cannot be released directly to the stormwater system unless the level of dilution with runoff from other areas of the park is sufficient to bring chlorine concentrations down to a suitable level for the downstream aquatic environment.

It is proposed that overflows from the pools in the first instance be directed to the sewer system, but that the flow to the sewer be restricted so as not to overload the Sydney Water Sanitary Sewer network, and any excess be directed to the stormwater system.

Table 13 gives typical pool chlorine concentration and chlorine concentrations for the protection of highly modified aquatic environments.

Table 13 Chlorine Concentrations

Parameter	Concentration[13] mg/l
Typical Pool Concentration	1.0 – 1.5
ANZECC[14] 80% Protection	0.013[15]

The Blacktown Creek is a highly modified for the majority of its length and is either piped, concrete lined or its banks have been cut to form a channel with the highest hydraulic efficiency rather than aquatic habitat. As a result of these modifications the creek provides no, or very limited habitat for aquatic life.

The first downstream location on the creek that could be considered a habitat for aquatic life is the Lancelot street water quality control pond. The pond is a constructed flood detention pond with a constructed water treatment wetland and has a catchment area of approximately 303ha. This additional catchment area will insure that any overflow water that reaches the Lancelot Street pond will be substantially more dilute than when it leaves the park.

[13] Total Chlorine
[14] The Australian and New Zealand Environment and Conservation Council – Percentage values are the percentage of fresh water aquatic species that will not be effected by the given concentration
[15] Total Chlorine

Figure 11 Blacktown Creek and Lancelot St Pond

A mass balance calculation for chlorine was carried out to establish the concentrations of chlorine in water leaving the site. Runoff volumes calculated by the *XP-Rafts* model of the post development site were used in the calculations. The calculations show that with a flow of 14l/s directed to the sewer system all runoff to the stormwater system up to and including 100 year ARI event will contain less than

0.013mg/l of chlorine. The results of the calculations are summarised in Table 14 below. Details of the calculations can be found in Appendix J.

Table 14 Chlorine Concentrations in Runoff

Event ARI	24 hour duration event	48 hour duration event
2 year	0	0
5 year	0	0
10 year	0	0
100 year	0.012	0.006

The 0 values in Table 14 are due to their being no overflows exceeding the 14l/s directed to the sewer system in those events.

7 CLIMATE CHANGE

The latest predictions on the expected impacts of climate change in NSW to 2050 are given in the 'NSW Climate Impact Profile' by the Department of Environment, Climate Change and Water NSW.

There are two key points in the report that relating to the proposed development. The first is that though there is expected to be some increase in rainfall during the parks summer operation season it will be balanced with increased evaporation due to higher temperatures. Meaning water balances are not likely to be significantly affected. The second is that increased rainfall may come in higher intensities, for this reason rainfall intensities in the runoff model were increased by 10% to investigate the possible impacts on site runoff. The results of this investigation can be seen in Table 15 below.

Table 15 Climate Change Runoff results and UPRCT targets

Parameter	Developed site no Climate Change	Developed site with 10% increased rainfall due to Climate Change	UPRCT Site Target
1 year ARI flow	545 l/s	653 l/s	
1.5 year ARI flow			1,022 l/s
2 year ARI flow	830 l/s	974 l/s	
100 year ARI flow	3,101 l/s	3,612 l/s	4,853 l/s
100 year ARI onsite detention	11,390 m^3	12,244 m^3	11,621 m^3

The data in Table 15 shows that the system will continue to operate as required given the latest climate change predictions. This is due to there being freeboard in the detention area in the 100 year ARI event and a factor of safety in the retention and outlet design.

8 SUMMARY

The peak and annual demands for water and discharging to the sewer network for the proposed park, not considering reductions due to reuse as described in this report, are summarised in Table 16 below.

Table 16 Summary of Demands

Water Use	Peak Water Demand [l/s]	Peak Sewer Discharge [l/s]	Annual Water Demand [Ml/year]	Annual Sewer Discharge [Ml/year]
Pools	43	14	77.4	0.79
Irrigation	10	-	21.0	-
Other park uses	18	17.1	26.1	26.1
Total	71	31.1	124.5	27.0

It should be noted that the peak irrigation demand will never coincide with the peak demand in the pools or from other uses. A realistic peak demand would be closer to 61 l/sec.

Table 17, below shows the amount and percentage of non potable water expected to be supplied by reuse.

Table 17 Summary of Reuse

Water Use	Annual Water Demand [Ml]	Annual demand Supplied by Reuse [Ml]	Percentage supplied by Reuse	Demand Supplied by Sydney Water [Ml]
Irrigation	21.0	19.9	95%	1.1
Toilet Flushing and Wash down	3.6	2.4	67%	1.2
Total	24.6	22.3	90%	2.3

Given the demand supplied by reused water the parks demand on the Sydney Water potable supply is reduced to 102.2 Ml per annum. If no use of rainwater were carried out, high rate sand filters were used instead of perlite and water efficient appliances were not used the parks water demand on the potable supply would be 154.9 ML per annum. Meaning a well designed park can potentially use only two thirds the water of a park which does not consider water efficiency would, whilst remaining feasible.

Chlorine concentrations in the infrequent event of an overflow to the stormwater system will be less than the ANZECC requirements for the type of environment being discharged to and will be even further diluted before coming in contact with any permanent water body.

The results in Table 6 in Section 3.1.3 show that Blacktown City Council requirements for contaminant reduction in stormwater can be met and that annual loads of contaminant will be less or comparable to those from the pre development site.

The results in Table 7 in Section 5.3 show that flows off site and the volume of OSD provided will met the UPRCT's requirements. Further to this the results in Table 15 in Section 7 show that with the predicted effects of climate change to 2050 this will continue to hold true.

9 CONCLUSION

With the use of WSUD techniques for the treatment and reuse of water, a Wet 'n' Wild theme park and entertainment facility can be constructed without adversely effecting the downstream environment and minimising the demand on the potable supply.

Though values for water use have been given in this report it must be remembered that these are projections and have been calculated using historical climate data and are averaged values. This means that in some years water use may well be less and conversely there will be years where water use is higher. Hence these values cannot be used as yearly targets.

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11 GLOSSARY OF TERMS

Australian Height Datum	National survey datum corresponding approximately to mean sea level.
Average Recurrence Interval	Is the long term average number of years between the occurrence of a flood as big as, or larger than the selected flood event.
Catchment	The catchment at a particular point is the area of land which drains to that point.
Development	Existing or proposed works which may or may not impact upon flooding. Typical works are filling of land, and the construction of roads, floodways and buildings.
Discharge	The rate of flow of water measured in terms of volume over time. It is not the velocity of flow which is a measure of how fast the water is moving rather than how much is moving. Discharge and flow are interchangeable.
Digital Terrain Model	A three-dimensional model of the ground surface that can be represented as a series of grids with each cell representing an elevation (DEM) or a series of interconnected triangles with elevations (TIN).
Flood	Above average river or creek flows which overtop banks and inundate floodplains.
Flooding	The State Emergency Service uses the following definitions in flood warnings: *Minor flooding:* causes inconvenience such as closing of minor roads and the submergence of low level bridges *Moderate flooding:* low-lying areas inundated requiring removal of stock and/or evacuation of some houses. Main traffic bridges may be covered. *Major flooding:* extensive rural areas are flooded with properties, villages and towns isolated and/or appreciable urban areas are flooded.
Freeboard	A factor of safety usually expressed as a height above the flood standard. Freeboard tends to compensate for the factors such as wave

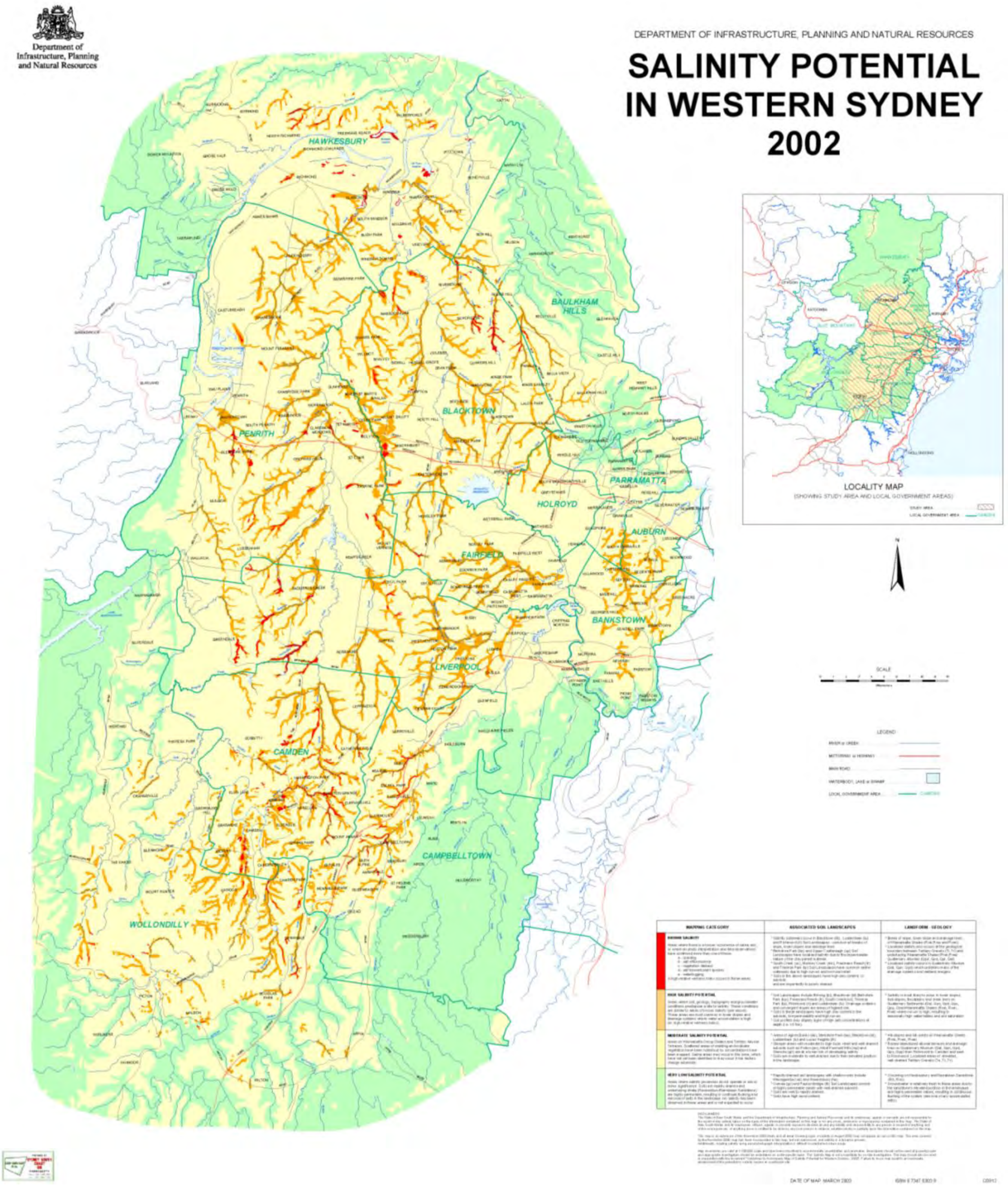
	action, localised hydraulic effects and uncertainties in the design flood levels.
Historical flood	A flood which has actually occurred – Flood of Record.
Hydraulic	The term given to the study of water flow in rivers, estuaries with coastal systems.
Hydrology	The term given to the study of the rain-runoff process in catchments.
Low hazard	Flood depths and velocities are sufficiently low that people and their possessions can be evacuated.
Probable Maximum Flood	An extreme flood deemed to be the maximum flood likely to occur at a particular location.
Probability	A statistical measure of the likely frequency or occurrence of flooding.
Riparian Zone	Areas that are located adjacent to watercourses. Their definition is vague and can be characterised by landform, vegetation, legislation or their function.
Runoff	The amount of rainfall from a catchment which actually ends up as flowing water in the river of creek.
Stage	Equivalent to water level above a specific datum- see flood level.

12 APPENDICES

Appendix A	Salinity Map
Appendix B	Drawings
Appendix C	XP-Rafts Modelling Results – Pre development
Appendix D	XP Rafts Modelling Results – Post development
Appendix E	Music Modelling Results – Water Balance
Appendix F	Music Modelling Results – Water Quality
Appendix G	Excel Water Balance Calculations
Appendix H	Wash Down Estimate
Appendix I	Irrigation Demand Estimate
Appendix J	Chlorine Mass Balance

APPENDIX A

Salinity Map


Department of Infrastructure, Planning and Natural Resources
DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
SALINITY POTENTIAL IN WESTERN SYDNEY 2002
HAWKESBURY
BAULKHAM HILLS
BLACKTOWN
PENRITH
PARRAMATTA
HOLROYD
AUBURN
FAIRFIELD
BANKSTOWN
LIVERPOOL
CAMDEN
CAMPBELLTOWN
WOLLONDILLY
LOCALITY MAP
(SHOWING STUDY AREA AND LOCAL GOVERNMENT AREAS)

APPENDIX B

Drawings

NOTES

BUILDINGS WITH PERMANENT ROOFS WILL HAVE RAIN WATER TANKS UNDER THEIR FLOOR SLABS TO ALLOW FOR STORAGE OF RAINWATER FOR TOILET FLUSHING AND EXTERNAL WASH DOWN

REUSE WATER WILL BE TREATED BY UV STERILIZATION PRIOR TO REUSE

THE PIPED STORMWATER SYSTEM WILL BE CAPABLE OF TAKING FLOWS UP TO AND INCLUDING THE 20 YEAR ARI, THE DIRECTION OF FLOW IN THE PIPED SYSTEM WILL GENERALLY FOLLOW THE OVERLAND FLOW ARROWS

FLOWS IN EXCESS OF THE 20 YEAR ARI WILL TRAVEL OVERLAND AS SHOWN ON THE PLAN. FLOWS WILL REMAIN UNDER A VELOCITY DEPTH PRODUCT OF 0.4

VEGETATED SWALES IN THE CAR PARKS WILL CARRY OUT THE PRIMARY TREATMENT OF CAR PARK RUNOFF, GPTS WILL BE PRIMARY TREATMENT FOR ALL OTHER PARK RUNOFF. THE WATER TREATMENT WETLAND WILL BE THE SECONDARY TREATMENT.

Quality System Quality Endorsed Company

ISU	DES	DRN	DATE	COMMENTS

SCALE	DRAWN	DESIGN
N.T.S	R C J	R C J
	APPROVED	DATE NOVEBER 2010

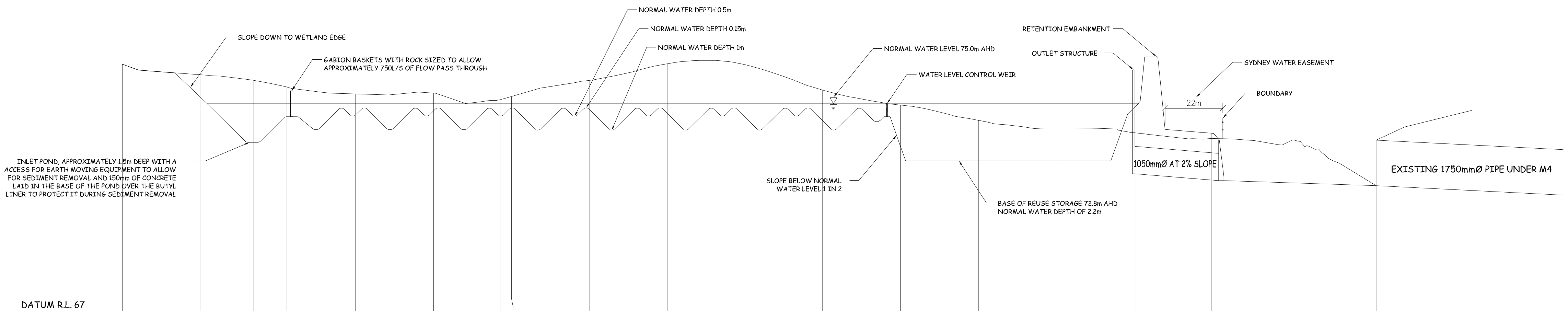
Brown Consulting (NSW) Pty Ltd
Level 2, 2 Burbank Place, Norwest Business Park Baulkham Hills NSW Australia 2153
Telephone: 02 8808 5000 Facsimile: 02 8808 5099
BROWN
Sydney
Canberra
Brisbane
Melbourne
Singapore

PROJECT
WET 'N' WILD - SYDNEY

TITLE
SITE OVERVIEW
FLOW PATHS & DRAINAGE

DRAWING NUMBER X10212-001

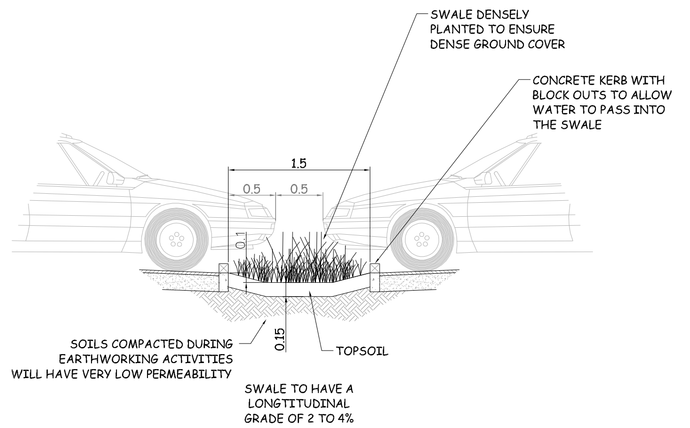
ISSUE



DESIGN LEVEL		75.27	73.50	74.50	74.64	74.79	74.50	74.85						72.80	72.80	75.80		
EXISTING LEVEL	76.519	76.1	75.826	75.593	75.365	75.452	75.11	75.161	75.831	76.464	76.644	75.704	75.067	74.546	74.166	73.93	73.653	71.84
CHAINAGE	0	15	25.378	33.132	45	60	72.811	75	90	105	120	135	150	165	180	195	210	273.3

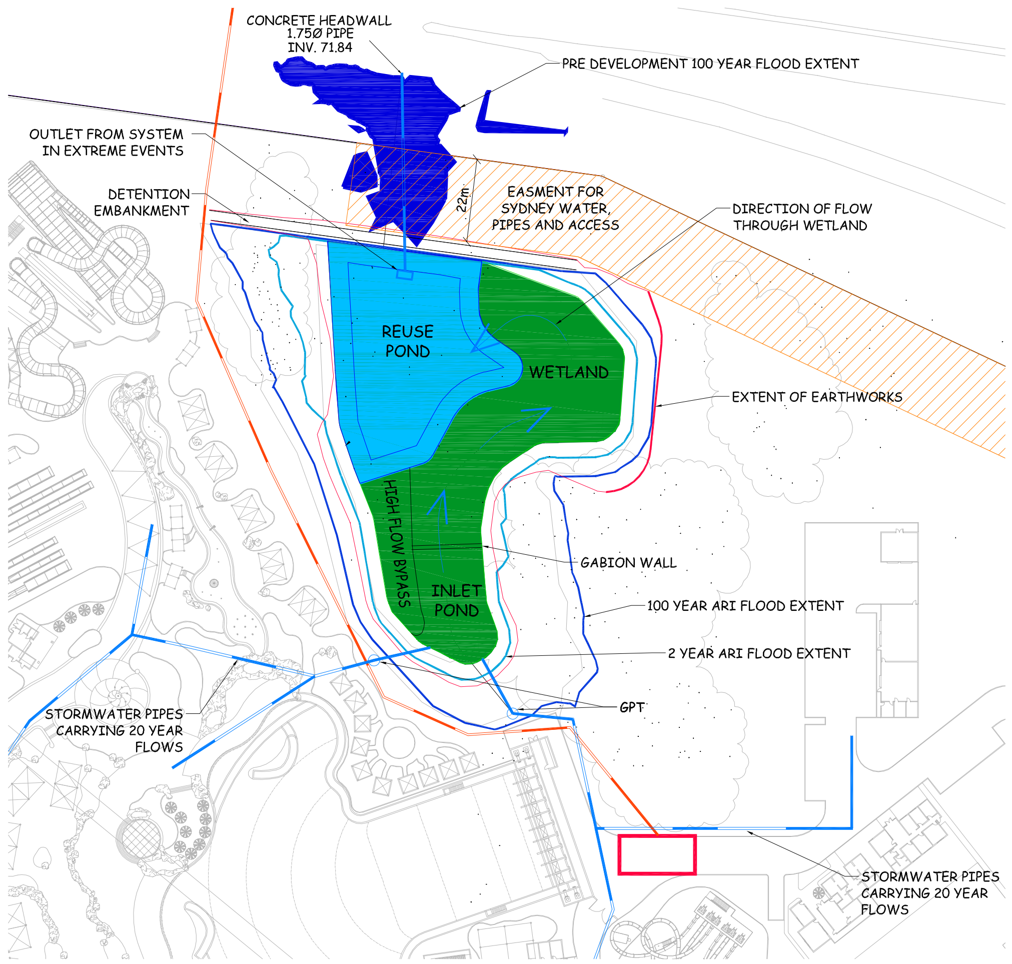
LONGITUDINAL SECTION ALONG CENTRELINE OF WETLAND

SCALE 1:500 (H)
SCALE 1:100 (V)



DETAIL OF SWALES IN CARPARKS

SCALE 1:40



SCALE 1:500

NOTES:

MAXIMUM WALL HEIGHT 3m

6 PLANTS PER m2 IN THE 3000m2 WETLAND

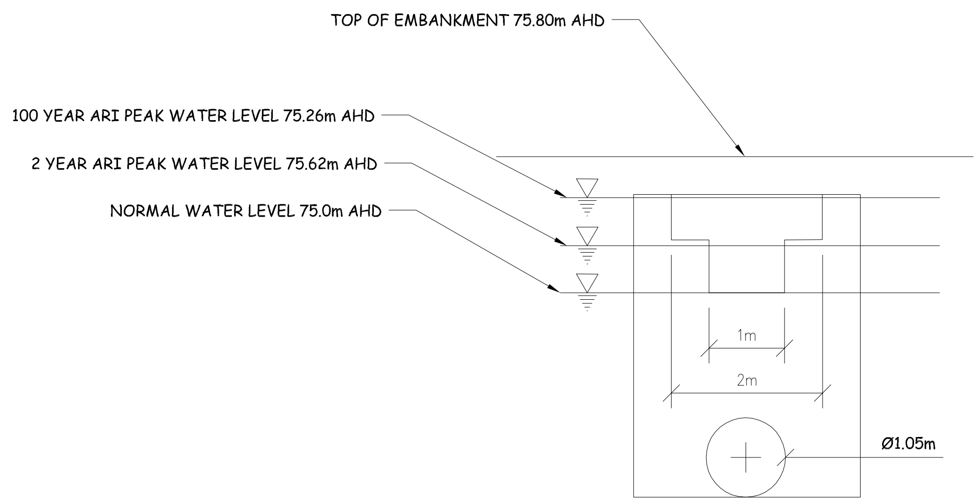
ALL BATTERS ABOVE WATER LEVEL AT 1:5 GRADE

WETLAND AND POND TO BE LINED WITH 2mm BUTYL RUBBER LINING COVERED WITH 300mm COMPACTED LOCAL CLAY

WETLAND TO HAVE 200mm OF ORGANIC SOIL LAID OVER THE COMPACTED CLAYS TO ALLOW FOR PLANT ESTABLISHMENT

MARGINS OF REUSE POND TO BE DENSELY PLANTED TO DISCOURAGE ACCESS

NUMBER OF SURVEYED TREES INSIDE EARTHWORKS AREA OR SUFFICIENTLY CLOSE TO BE EFFECTED - 40



REUSE POND OUTLET DETAIL

SCALE 1:50

BROWN
Brown Consulting (NSW) Pty Ltd
Level 2, 2 Burbank Place Norwest Business Park NSW Australia 2153
Telephone: 02 8808 5000 Facsimile: 02 8808 5099
Sydney
Canberra
Brisbane
Melbourne
Singapore

SCALE (METRES)
0 5 10 15 20 25 30 35 40 45 50
SCALE 1:500 (A1) SCALE 1:1000 (A3)

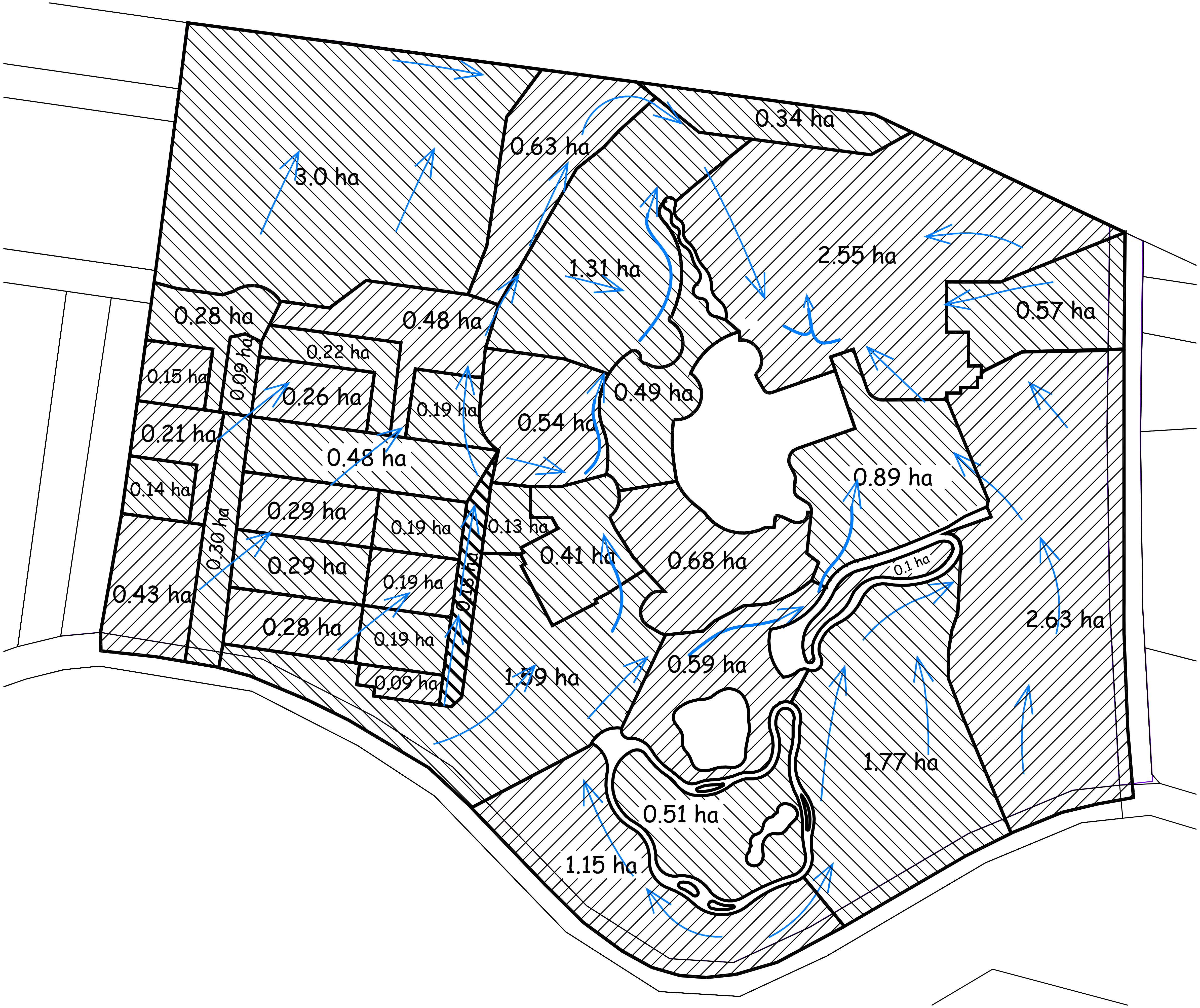
DRAWING TITLE		
WET 'N' WILD - SYDNEY FLOOD DETENTION, WETLAND AND REUSE POND AREA DETAILS		
DRAWING NUMBER	DATE	REVISION
X10212-002	NOVEBER 2010	00

NOTES:

CATCHMENTS AS USED IN THE XP-RAFTS MODEL OF THE POST DEVELOPMENT SITE.

SOME CATCHMENTS ARE TRAPPED BY RIVER RIDES OR PROXIMITY TO POOLS, THESE CATCHMENTS WILL BE DRAINED BY PIPE SYSTEMS CAPABLE OF CARRYING 100 YEAR ARI FLOWS

THE PRIMARY PIPE NETWORK WILL BE CAPABLE OF CARRYING 20 YEAR ARI FLOWS



Brown Consulting (NSW) Pty Ltd Level 2, 2 Burbank Place Norwest Business Park NSW Australia 2153 Telephone: 02 8808 5000 Facsimile: 02 8808 5099 BROWN Sydney Canberra Brisbane Melbourne Singapore	SCALE (METRES) NOT TO SCALE	DRAWING TITLE WET 'N' WILD - SYDNEY CATCHMENTS USED IN POST DEVELOPMENT XP-RAFTS MODELING	
		DRAWING NUMBER X10212-003	DATE NOVEBER 2010 / REVISION 00

APPENDIX C

XP-Rafts Results – Pre development

Only 100 year ARI results have been included to save paper wastage

Run started at: 12th January 2011 10:45:33

##
RUNTIME RESULTS
##

LINK 1.01 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.127
ESTIMATED PEAK FLOW (CUMECS) = 0.93
ESTIMATED TIME TO PEAK (MINS) = 18.00

LINK 2.01 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.286
ESTIMATED PEAK FLOW (CUMECS) = 1.0
ESTIMATED TIME TO PEAK (MINS) = 19.00

LINK 1.02 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.088
ESTIMATED PEAK FLOW (CUMECS) = 2.5
ESTIMATED TIME TO PEAK (MINS) = 18.00

LINK 3.01 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3334
ESTIMATED PEAK FLOW (CUMECS) = 0.40
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 5.01 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.302
ESTIMATED PEAK FLOW (CUMECS) = 1.0
ESTIMATED TIME TO PEAK (MINS) = 19.00

LINK 1.03 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.723
ESTIMATED PEAK FLOW (CUMECS) = 3.9
ESTIMATED TIME TO PEAK (MINS) = 18.00

LINK node3 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3353
ESTIMATED PEAK FLOW (CUMECS) = 0.47
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 1.04 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 5.748
ESTIMATED PEAK FLOW (CUMECS) = 4.7
ESTIMATED TIME TO PEAK (MINS) = 17.00

iosd llkta 0 11
LINK node2 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.9982
ESTIMATED PEAK FLOW (CUMECS) = 1.2

```
ESTIMATED TIME TO PEAK       (MINS) =          16.00

iosd llkta      0      12
LINK Out           1.000

ESTIMATED VOLUME (CU METRES*10**3) =             7.671
ESTIMATED PEAK FLOW       (CUMECS) =             5.9
ESTIMATED TIME TO PEAK       (MINS) =          18.00



##########################################################################################
Wet n wild Sydney

Results for period from  0: 0.0  1/ 1/1990
             to  5: 0.0  1/ 1/1990
##########################################################################################


                  ROUTING INCREMENT (MINS) =      1.00
                  STORM DURATION (MINS)    =      20.
                  RETURN PERIOD (YRS)      =     100.
                  BX                       =    1.0000
                  TOTAL OF FIRST SUB-AREAS  (ha) =     29.03
                  TOTAL OF SECOND SUB-AREAS (ha) =      0.00
                  TOTAL OF ALL SUB-AREAS (ha)    =     29.03


   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)          (%)         (%)
1.01      4.700  0.000  4.290 0.000  5.000 0.000  .035 0.00  .0286 0.000  1.000
2.01      5.390  0.000  4.120 0.000  5.000 0.000  .035 0.00  .0314 0.000  2.000
1.02      2.790  0.000  3.760 0.000  5.000 0.000  .035 0.00  .0233 0.000  1.001
3.01      1.400  0.000  5.400 0.000  5.000 0.000  .035 0.00  .0136 0.000  3.000
5.01      5.450  0.000  4.000 0.000  5.000 0.000  .035 0.00  .0320 0.000  4.000
1.03      .00001  0.000  3.680 0.000  5.000 0.000  .035 0.00  0.000 0.000  1.002
node3     1.390  0.000  5.000 0.000  5.000 0.000  .025 0.00  .0111 0.000  5.000
1.04      3.770  0.000  2.830 0.000  5.000 0.000  .035 0.00  .0314 0.000  1.003
node2     4.140  0.000  5.000 0.000  5.000 0.000  .025 0.00  .0196 0.000  6.000
Out      .00001  0.000  2.000 0.000  5.000 0.000  .025 0.00  0.000 0.000  1.004


 Link    Average Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
       (mm/h)    ( mm )     (mm/h)       ( mm )     (m^3/s)  Peak  mins
1.01      116.48 0.000 0.000  0.000 0.000  24.003  0.000  0.9343  18.00 0.000
2.01      116.48 0.000 0.000  0.000 0.000  24.003  0.000   1.015  19.00 0.000
1.02      116.48 0.000 0.000  0.000 0.000  24.003  0.000   2.543  18.00 0.000
3.01      116.48 0.000 0.000  0.000 0.000  24.003  0.000  0.4012  16.00 0.000
5.01      116.48 0.000 0.000  0.000 0.000  24.003  0.000   1.010  19.00 0.000
1.03      116.48 0.000 0.000  0.000 0.000  24.003  0.000   3.898  18.00 0.000
node3     116.48 0.000 0.000  0.000 0.000  24.003  0.000  0.4687  15.00 0.000
1.04      116.48 0.000 0.000  0.000 0.000  24.003  0.000   4.704  17.00 0.000
node2     116.48 0.000 0.000  0.000 0.000  24.003  0.000   1.178  16.00 0.000
Out       116.48 0.000 0.000  0.000 0.000  24.003  0.000   5.901  18.00 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	Vol. Used	Stage Used
1.04	17.00	4.703	19.00	4.628	5748.1	0.0000	127.61	73.434
node2	16.00	1.177	17.00	1.150	998.21	0.0000	31.180	76.563

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

LINK 1.01 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.290
ESTIMATED PEAK FLOW (CUMECS) = 0.98
ESTIMATED TIME TO PEAK (MINS) = 20.00

LINK 2.01 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.478
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 21.00

LINK 1.02 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.531
ESTIMATED PEAK FLOW (CUMECS) = 2.7
ESTIMATED TIME TO PEAK (MINS) = 20.00

LINK 3.01 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3875
ESTIMATED PEAK FLOW (CUMECS) = 0.43
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 5.01 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.496
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 21.00

LINK 1.03 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 5.415
ESTIMATED PEAK FLOW (CUMECS) = 4.1
ESTIMATED TIME TO PEAK (MINS) = 20.00

LINK node3 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3826
ESTIMATED PEAK FLOW (CUMECS) = 0.50
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.04 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 6.570
ESTIMATED PEAK FLOW (CUMECS) = 4.9
ESTIMATED TIME TO PEAK (MINS) = 20.00

```
iosd llkta     0     11
LINK node2         2.000

ESTIMATED VOLUME (CU METRES*10**3) =            1.144
ESTIMATED PEAK FLOW       (CUMECS) =            1.2
ESTIMATED TIME TO PEAK      (MINS) =          16.00

iosd llkta     0     12
LINK Out           2.000

ESTIMATED VOLUME (CU METRES*10**3) =            8.687
ESTIMATED PEAK FLOW       (CUMECS) =            6.1
ESTIMATED TIME TO PEAK      (MINS) =          20.00



##########################################################################################
Wet n wild Sydney

Results for period from  0: 0.0  1/ 1/1990
             to  5: 0.0  1/ 1/1990
##########################################################################################


                   ROUTING INCREMENT (MINS) =      1.00
                   STORM DURATION (MINS)    =      25.
                   RETURN PERIOD (YRS)      =      100.
                   BX                       =    1.0000
                   TOTAL OF FIRST SUB-AREAS  (ha) =     29.03
                   TOTAL OF SECOND SUB-AREAS (ha) =      0.00
                   TOTAL OF ALL SUB-AREAS (ha)    =     29.03


   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)          (%)          (%)
1.01       4.700  0.000  4.290 0.000  5.000 0.000  .035 0.00  .0286 0.000  1.000
2.01       5.390  0.000  4.120 0.000  5.000 0.000  .035 0.00  .0314 0.000  2.000
1.02       2.790  0.000  3.760 0.000  5.000 0.000  .035 0.00  .0233 0.000  1.001
3.01       1.400  0.000  5.400 0.000  5.000 0.000  .035 0.00  .0136 0.000  3.000
5.01       5.450  0.000  4.000 0.000  5.000 0.000  .035 0.00  .0320 0.000  4.000
1.03      .00001  0.000  3.680 0.000  5.000 0.000  .035 0.00  0.000 0.000  1.002
node3      1.390  0.000  5.000 0.000  5.000 0.000  .025 0.00  .0111 0.000  5.000
1.04       3.770  0.000  2.830 0.000  5.000 0.000  .035 0.00  .0314 0.000  1.003
node2      4.140  0.000  5.000 0.000  5.000 0.000  .025 0.00  .0196 0.000  6.000
Out       .00001  0.000  2.000 0.000  5.000 0.000  .025 0.00  0.000 0.000  1.004


 Link    Average Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
        (mm/h)    ( mm )      (mm/h)       ( mm )     (m^3/s)  Peak  mins
1.01      104.40 0.000 0.000  0.000 0.000  27.508  0.000  0.9841  20.00 0.000
2.01      104.40 0.000 0.000  0.000 0.000  27.508  0.000   1.076  21.00 0.000
1.02      104.40 0.000 0.000  0.000 0.000  27.508  0.000   2.664  20.00 0.000
3.01      104.40 0.000 0.000  0.000 0.000  27.508  0.000  0.4274  16.00 0.000
5.01      104.40 0.000 0.000  0.000 0.000  27.508  0.000   1.071  21.00 0.000
1.03      104.40 0.000 0.000  0.000 0.000  27.508  0.000   4.076  20.00 0.000
node3     104.40 0.000 0.000  0.000 0.000  27.508  0.000  0.5039  16.00 0.000
1.04      104.40 0.000 0.000  0.000 0.000  27.508  0.000   4.875  20.00 0.000
```

node2	104.40	0.000	0.000	0.000	0.000	27.508	0.000	1.213	16.00	0.000
Out	104.40	0.000	0.000	0.000	0.000	27.508	0.000	6.064	20.00	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	Vol. Used	Stage Used
1.04	20.00	4.874	21.00	4.807	6570.0	0.0000	148.65	73.474
node2	16.00	1.213	18.00	1.189	1143.7	0.0000	33.297	76.597

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

LINK 1.01 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.434
ESTIMATED PEAK FLOW (CUMECS) = 0.95
ESTIMATED TIME TO PEAK (MINS) = 22.00

LINK 2.01 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.637
ESTIMATED PEAK FLOW (CUMECS) = 1.0
ESTIMATED TIME TO PEAK (MINS) = 23.00

LINK 1.02 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.919
ESTIMATED PEAK FLOW (CUMECS) = 2.5
ESTIMATED TIME TO PEAK (MINS) = 22.00

LINK 3.01 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.4286
ESTIMATED PEAK FLOW (CUMECS) = 0.39
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 5.01 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.657
ESTIMATED PEAK FLOW (CUMECS) = 1.0
ESTIMATED TIME TO PEAK (MINS) = 23.00

LINK 1.03 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 6.005
ESTIMATED PEAK FLOW (CUMECS) = 3.9
ESTIMATED TIME TO PEAK (MINS) = 22.00

LINK node3 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.4232
ESTIMATED PEAK FLOW (CUMECS) = 0.47
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.04 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 7.268
ESTIMATED PEAK FLOW (CUMECS) = 4.6
ESTIMATED TIME TO PEAK (MINS) = 22.00

iosd llkta 0 11
LINK node2 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.264
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 16.00

iosd llkta 0 12
LINK Out 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 9.560
ESTIMATED PEAK FLOW (CUMECS) = 5.8
ESTIMATED TIME TO PEAK (MINS) = 19.00

##
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 30.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.03
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 29.03

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2	Slope #1 (%)	Slope #2	% Impervious #1 (%)	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
1.01	4.700	0.000	4.290	0.000	5.000	0.000	.035	0.00	.0286	0.000	1.000
2.01	5.390	0.000	4.120	0.000	5.000	0.000	.035	0.00	.0314	0.000	2.000
1.02	2.790	0.000	3.760	0.000	5.000	0.000	.035	0.00	.0233	0.000	1.001
3.01	1.400	0.000	5.400	0.000	5.000	0.000	.035	0.00	.0136	0.000	3.000
5.01	5.450	0.000	4.000	0.000	5.000	0.000	.035	0.00	.0320	0.000	4.000
1.03	.00001	0.000	3.680	0.000	5.000	0.000	.035	0.00	0.000	0.000	1.002
node3	1.390	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0111	0.000	5.000
1.04	3.770	0.000	2.830	0.000	5.000	0.000	.035	0.00	.0314	0.000	1.003
node2	4.140	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0196	0.000	6.000
Out	.00001	0.000	2.000	0.000	5.000	0.000	.025	0.00	0.000	0.000	1.004

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
1.01	95.157	0.000	0.000	0.000	0.000	30.470	0.000	0.9453	22.00	0.000
2.01	95.157	0.000	0.000	0.000	0.000	30.470	0.000	1.043	23.00	0.000

1.02	95.157	0.000	0.000	0.000	0.000	30.470	0.000	2.549	22.00	0.000
3.01	95.157	0.000	0.000	0.000	0.000	30.470	0.000	0.3939	16.00	0.000
5.01	95.157	0.000	0.000	0.000	0.000	30.470	0.000	1.044	23.00	0.000
1.03	95.157	0.000	0.000	0.000	0.000	30.470	0.000	3.884	22.00	0.000
node3	95.157	0.000	0.000	0.000	0.000	30.470	0.000	0.4681	16.00	0.000
1.04	95.157	0.000	0.000	0.000	0.000	30.470	0.000	4.627	22.00	0.000
node2	95.157	0.000	0.000	0.000	0.000	30.470	0.000	1.128	16.00	0.000
Out	95.157	0.000	0.000	0.000	0.000	30.470	0.000	5.757	19.00	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	Vol. Used	Stage Used
1.04	22.00	4.627	23.00	4.598	7268.0	0.0000	124.20	73.427
node2	16.00	1.128	17.00	1.116	1263.7	0.0000	29.562	76.536

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

LINK 1.01 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.771
ESTIMATED PEAK FLOW (CUMECS) = 0.96
ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK 2.01 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.035
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 29.00

LINK 1.02 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.859
ESTIMATED PEAK FLOW (CUMECS) = 2.6
ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK 3.01 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5275
ESTIMATED PEAK FLOW (CUMECS) = 0.36
ESTIMATED TIME TO PEAK (MINS) = 21.00

LINK 5.01 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.058
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK 1.03 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 7.444
ESTIMATED PEAK FLOW (CUMECS) = 4.0
ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK node3 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5240
ESTIMATED PEAK FLOW (CUMECS) = 0.41
ESTIMATED TIME TO PEAK (MINS) = 20.00

LINK 1.04 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 8.998
ESTIMATED PEAK FLOW (CUMECS) = 4.8
ESTIMATED TIME TO PEAK (MINS) = 28.00

iosd llkta 0 11
LINK node2 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.560
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 21.00

iosd llkta 0 12
LINK Out 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 11.67
ESTIMATED PEAK FLOW (CUMECS) = 5.7
ESTIMATED TIME TO PEAK (MINS) = 29.00

##
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 45.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.03
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 29.03

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Pern #1	#2	B #1	#2	Link No.
1.01	4.700	0.000	4.290	0.000	5.000	0.000	.035	0.00	.0286	0.000	1.000
2.01	5.390	0.000	4.120	0.000	5.000	0.000	.035	0.00	.0314	0.000	2.000
1.02	2.790	0.000	3.760	0.000	5.000	0.000	.035	0.00	.0233	0.000	1.001
3.01	1.400	0.000	5.400	0.000	5.000	0.000	.035	0.00	.0136	0.000	3.000
5.01	5.450	0.000	4.000	0.000	5.000	0.000	.035	0.00	.0320	0.000	4.000
1.03	.00001	0.000	3.680	0.000	5.000	0.000	.035	0.00	0.000	0.000	1.002
node3	1.390	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0111	0.000	5.000
1.04	3.770	0.000	2.830	0.000	5.000	0.000	.035	0.00	.0314	0.000	1.003
node2	4.140	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0196	0.000	6.000
Out	.00001	0.000	2.000	0.000	5.000	0.000	.025	0.00	0.000	0.000	1.004

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
1.01	76.726	0.000	0.000	0.000	0.000	37.558	0.000	0.9624	28.00	0.000
2.01	76.726	0.000	0.000	0.000	0.000	37.558	0.000	1.087	29.00	0.000
1.02	76.726	0.000	0.000	0.000	0.000	37.558	0.000	2.617	28.00	0.000
3.01	76.726	0.000	0.000	0.000	0.000	37.558	0.000	0.3604	21.00	0.000
5.01	76.726	0.000	0.000	0.000	0.000	37.558	0.000	1.093	30.00	0.000
1.03	76.726	0.000	0.000	0.000	0.000	37.558	0.000	3.990	28.00	0.000
node3	76.726	0.000	0.000	0.000	0.000	37.558	0.000	0.4104	20.00	0.000
1.04	76.726	0.000	0.000	0.000	0.000	37.558	0.000	4.779	28.00	0.000
node2	76.726	0.000	0.000	0.000	0.000	37.558	0.000	1.071	21.00	0.000
Out	76.726	0.000	0.000	0.000	0.000	37.558	0.000	5.750	29.00	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	Vol. Used	Stage Used
1.04	28.00	4.778	30.00	4.750	8998.4	0.0000	141.88	73.461
node2	21.00	1.070	22.00	1.058	1560.2	0.0000	27.135	76.497

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

LINK 1.01 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.927
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK 2.01 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.207
ESTIMATED PEAK FLOW (CUMECS) = 1.2
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 1.02 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 5.273
ESTIMATED PEAK FLOW (CUMECS) = 3.0
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK 3.01 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5736
ESTIMATED PEAK FLOW (CUMECS) = 0.42
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK 5.01 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.232
ESTIMATED PEAK FLOW (CUMECS) = 1.2
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 1.03 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 8.078
ESTIMATED PEAK FLOW (CUMECS) = 4.6
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK node3 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5689
ESTIMATED PEAK FLOW (CUMECS) = 0.48
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK 1.04 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 9.770
ESTIMATED PEAK FLOW (CUMECS) = 5.5
ESTIMATED TIME TO PEAK (MINS) = 31.00

iosd llkta 0 11
LINK node2 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.695
ESTIMATED PEAK FLOW (CUMECS) = 1.2
ESTIMATED TIME TO PEAK (MINS) = 27.00

iosd llkta 0 12
LINK Out 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 12.65
ESTIMATED PEAK FLOW (CUMECS) = 6.7
ESTIMATED TIME TO PEAK (MINS) = 31.00

##
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 60.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.03
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 29.03

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2	Slope #1 (%)	Slope #2	% Impervious #1 (%)	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
1.01	4.700	0.000	4.290	0.000	5.000	0.000	.035	0.00	.0286	0.000	1.000
2.01	5.390	0.000	4.120	0.000	5.000	0.000	.035	0.00	.0314	0.000	2.000
1.02	2.790	0.000	3.760	0.000	5.000	0.000	.035	0.00	.0233	0.000	1.001
3.01	1.400	0.000	5.400	0.000	5.000	0.000	.035	0.00	.0136	0.000	3.000
5.01	5.450	0.000	4.000	0.000	5.000	0.000	.035	0.00	.0320	0.000	4.000

1.03 .00001 0.000 3.680 0.000 5.000 0.000 .035 0.00 0.000 0.000 1.002
node3 1.390 0.000 5.000 0.000 5.000 0.000 .025 0.00 .0111 0.000 5.000
1.04 3.770 0.000 2.830 0.000 5.000 0.000 .035 0.00 .0314 0.000 1.003
node2 4.140 0.000 5.000 0.000 5.000 0.000 .025 0.00 .0196 0.000 6.000
Out .00001 0.000 2.000 0.000 5.000 0.000 .025 0.00 0.000 0.000 1.004

Link Label	Average Intensity (mm/h)	Init. Loss #1	Init. Loss #2 (mm)	Cont. Loss #1	Cont. Loss #2 (mm/h)	Excess Rain #1	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
1.01	65.434	0.000	0.000	0.000	0.000	40.869	0.000	1.114	31.00	0.000
2.01	65.434	0.000	0.000	0.000	0.000	40.869	0.000	1.233	32.00	0.000
1.02	65.434	0.000	0.000	0.000	0.000	40.869	0.000	3.024	31.00	0.000
3.01	65.434	0.000	0.000	0.000	0.000	40.869	0.000	0.4214	26.00	0.000
5.01	65.434	0.000	0.000	0.000	0.000	40.869	0.000	1.233	32.00	0.000
1.03	65.434	0.000	0.000	0.000	0.000	40.869	0.000	4.612	31.00	0.000
node3	65.434	0.000	0.000	0.000	0.000	40.869	0.000	0.4777	26.00	0.000
1.04	65.434	0.000	0.000	0.000	0.000	40.869	0.000	5.546	31.00	0.000
node2	65.434	0.000	0.000	0.000	0.000	40.869	0.000	1.224	27.00	0.000
Out	65.434	0.000	0.000	0.000	0.000	40.869	0.000	6.682	31.00	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
1.04	31.00	5.545	33.00	5.419	9769.8	0.0000	227.76	73.612
node2	27.00	1.224	28.00	1.204	1695.3	0.0000	35.095	76.611

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

LINK 1.01 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.240
ESTIMATED PEAK FLOW (CUMECS) = 1.2
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK 2.01 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.572
ESTIMATED PEAK FLOW (CUMECS) = 1.3
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK 1.02 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 6.143
ESTIMATED PEAK FLOW (CUMECS) = 3.3
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK 3.01 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6679
ESTIMATED PEAK FLOW (CUMECS) = 0.47
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK 5.01 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.601
ESTIMATED PEAK FLOW (CUMECS) = 1.3
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 1.03 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 9.412
ESTIMATED PEAK FLOW (CUMECS) = 5.1
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK node3 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6626
ESTIMATED PEAK FLOW (CUMECS) = 0.52
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK 1.04 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 11.36
ESTIMATED PEAK FLOW (CUMECS) = 6.3
ESTIMATED TIME TO PEAK (MINS) = 31.00

iosd llkta 0 11
LINK node2 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.974
ESTIMATED PEAK FLOW (CUMECS) = 1.4
ESTIMATED TIME TO PEAK (MINS) = 31.00

iosd llkta 0 12
LINK Out 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 14.68
ESTIMATED PEAK FLOW (CUMECS) = 7.1
ESTIMATED TIME TO PEAK (MINS) = 34.00

##
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.03
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 29.03

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)	(%)	(%)								
1.01	4.700	0.000	4.290	0.000	5.000	0.000	.035	0.00	.0286	0.000	1.000
2.01	5.390	0.000	4.120	0.000	5.000	0.000	.035	0.00	.0314	0.000	2.000
1.02	2.790	0.000	3.760	0.000	5.000	0.000	.035	0.00	.0233	0.000	1.001
3.01	1.400	0.000	5.400	0.000	5.000	0.000	.035	0.00	.0136	0.000	3.000
5.01	5.450	0.000	4.000	0.000	5.000	0.000	.035	0.00	.0320	0.000	4.000
1.03	.00001	0.000	3.680	0.000	5.000	0.000	.035	0.00	0.000	0.000	1.002
node3	1.390	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0111	0.000	5.000
1.04	3.770	0.000	2.830	0.000	5.000	0.000	.035	0.00	.0314	0.000	1.003
node2	4.140	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0196	0.000	6.000
Out	.00001	0.000	2.000	0.000	5.000	0.000	.025	0.00	0.000	0.000	1.004

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
1.01	51.407	0.000	0.000	0.000	0.000	47.614	0.000	1.219	31.00	0.000
2.01	51.407	0.000	0.000	0.000	0.000	47.614	0.000	1.331	31.00	0.000
1.02	51.407	0.000	0.000	0.000	0.000	47.614	0.000	3.313	31.00	0.000
3.01	51.407	0.000	0.000	0.000	0.000	47.614	0.000	0.4700	31.00	0.000
5.01	51.407	0.000	0.000	0.000	0.000	47.614	0.000	1.323	32.00	0.000
1.03	51.407	0.000	0.000	0.000	0.000	47.614	0.000	5.105	31.00	0.000
node3	51.407	0.000	0.000	0.000	0.000	47.614	0.000	0.5159	30.00	0.000
1.04	51.407	0.000	0.000	0.000	0.000	47.614	0.000	6.259	31.00	0.000
node2	51.407	0.000	0.000	0.000	0.000	47.614	0.000	1.361	31.00	0.000
Out	51.407	0.000	0.000	0.000	0.000	47.614	0.000	7.118	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	Vol. Used	Stage Used
1.04	31.00	6.259	35.00	5.704	11360.2	0.0000	313.68	73.693
node2	31.00	1.361	32.00	1.282	1974.2	0.0000	45.366	76.679

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

LINK 1.01 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.656
ESTIMATED PEAK FLOW (CUMECS) = 1.2
ESTIMATED TIME TO PEAK (MINS) = 41.00

LINK 2.01 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.044
ESTIMATED PEAK FLOW (CUMECS) = 1.3
ESTIMATED TIME TO PEAK (MINS) = 42.00

LINK 1.02 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 7.278
ESTIMATED PEAK FLOW (CUMECS) = 3.3
ESTIMATED TIME TO PEAK (MINS) = 41.00

LINK 3.01 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7919
ESTIMATED PEAK FLOW (CUMECS) = 0.47
ESTIMATED TIME TO PEAK (MINS) = 40.00

LINK 5.01 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.079
ESTIMATED PEAK FLOW (CUMECS) = 1.3
ESTIMATED TIME TO PEAK (MINS) = 42.00

LINK 1.03 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 11.15
ESTIMATED PEAK FLOW (CUMECS) = 5.1
ESTIMATED TIME TO PEAK (MINS) = 41.00

LINK node3 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7857
ESTIMATED PEAK FLOW (CUMECS) = 0.49
ESTIMATED TIME TO PEAK (MINS) = 38.00

LINK 1.04 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 13.45
ESTIMATED PEAK FLOW (CUMECS) = 6.2
ESTIMATED TIME TO PEAK (MINS) = 41.00

iosd llkta 0 11
LINK node2 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.337
ESTIMATED PEAK FLOW (CUMECS) = 1.4
ESTIMATED TIME TO PEAK (MINS) = 40.00

iosd llkta 0 12
LINK Out 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 17.26
ESTIMATED PEAK FLOW (CUMECS) = 7.1
ESTIMATED TIME TO PEAK (MINS) = 43.00

##
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 120.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.03
TOTAL OF SECOND SUB-AREAS (ha) = 0.00

TOTAL OF ALL SUB-AREAS (ha) = 29.03

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.
1.01	4.700	0.000	4.290	0.000	5.000	0.000	.035	0.00	.0286	0.000	1.000
2.01	5.390	0.000	4.120	0.000	5.000	0.000	.035	0.00	.0314	0.000	2.000
1.02	2.790	0.000	3.760	0.000	5.000	0.000	.035	0.00	.0233	0.000	1.001
3.01	1.400	0.000	5.400	0.000	5.000	0.000	.035	0.00	.0136	0.000	3.000
5.01	5.450	0.000	4.000	0.000	5.000	0.000	.035	0.00	.0320	0.000	4.000
1.03	.00001	0.000	3.680	0.000	5.000	0.000	.035	0.00	0.000	0.000	1.002
node3	1.390	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0111	0.000	5.000
1.04	3.770	0.000	2.830	0.000	5.000	0.000	.035	0.00	.0314	0.000	1.003
node2	4.140	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0196	0.000	6.000
Out	.00001	0.000	2.000	0.000	5.000	0.000	.025	0.00	0.000	0.000	1.004

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
1.01	43.167	0.000	0.000	0.000	0.000	56.440	0.000	1.223	41.00	0.000
2.01	43.167	0.000	0.000	0.000	0.000	56.440	0.000	1.336	42.00	0.000
1.02	43.167	0.000	0.000	0.000	0.000	56.440	0.000	3.313	41.00	0.000
3.01	43.167	0.000	0.000	0.000	0.000	56.440	0.000	0.4658	40.00	0.000
5.01	43.167	0.000	0.000	0.000	0.000	56.440	0.000	1.331	42.00	0.000
1.03	43.167	0.000	0.000	0.000	0.000	56.440	0.000	5.081	41.00	0.000
node3	43.167	0.000	0.000	0.000	0.000	56.440	0.000	0.4894	38.00	0.000
1.04	43.167	0.000	0.000	0.000	0.000	56.440	0.000	6.164	41.00	0.000
node2	43.167	0.000	0.000	0.000	0.000	56.440	0.000	1.352	40.00	0.000
Out	43.167	0.000	0.000	0.000	0.000	56.440	0.000	7.118	43.00	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	Vol. Used	Stage Used
1.04	41.00	6.164	45.00	5.717	13449.8	0.0000	318.04	73.697
node2	40.00	1.351	41.00	1.290	2337.3	0.0000	46.465	76.686

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

LINK 1.01 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.330
ESTIMATED PEAK FLOW (CUMECS) = 0.94
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK 2.01 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.822
ESTIMATED PEAK FLOW (CUMECS) = 1.0
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK 1.02 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 9.133
ESTIMATED PEAK FLOW (CUMECS) = 2.5
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK 3.01 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.9929
ESTIMATED PEAK FLOW (CUMECS) = 0.32
ESTIMATED TIME TO PEAK (MINS) = 45.00

LINK 5.01 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.862
ESTIMATED PEAK FLOW (CUMECS) = 1.0
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK 1.03 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 13.99
ESTIMATED PEAK FLOW (CUMECS) = 3.9
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK node3 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.9858
ESTIMATED PEAK FLOW (CUMECS) = 0.32
ESTIMATED TIME TO PEAK (MINS) = 45.00

LINK 1.04 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 16.75
ESTIMATED PEAK FLOW (CUMECS) = 4.7
ESTIMATED TIME TO PEAK (MINS) = 46.00

iosd llkta 0 11
LINK node2 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.932
ESTIMATED PEAK FLOW (CUMECS) = 0.93
ESTIMATED TIME TO PEAK (MINS) = 45.00

iosd llkta 0 12
LINK Out 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 21.51
ESTIMATED PEAK FLOW (CUMECS) = 5.7
ESTIMATED TIME TO PEAK (MINS) = 46.00

##
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 2: 0.0 3/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 180.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.03
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 29.03

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2	Slope #1 (%)	Slope #2	% Impervious #1 (%)	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
1.01	4.700	0.000	4.290	0.000	5.000	0.000	.035	0.00	.0286	0.000	1.000
2.01	5.390	0.000	4.120	0.000	5.000	0.000	.035	0.00	.0314	0.000	2.000
1.02	2.790	0.000	3.760	0.000	5.000	0.000	.035	0.00	.0233	0.000	1.001
3.01	1.400	0.000	5.400	0.000	5.000	0.000	.035	0.00	.0136	0.000	3.000
5.01	5.450	0.000	4.000	0.000	5.000	0.000	.035	0.00	.0320	0.000	4.000
1.03	.00001	0.000	3.680	0.000	5.000	0.000	.035	0.00	0.000	0.000	1.002
node3	1.390	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0111	0.000	5.000
1.04	3.770	0.000	2.830	0.000	5.000	0.000	.035	0.00	.0314	0.000	1.003
node2	4.140	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0196	0.000	6.000
Out	.00001	0.000	2.000	0.000	5.000	0.000	.025	0.00	0.000	0.000	1.004

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
1.01	33.651	0.000	0.000	0.000	0.000	70.869	0.000	0.9350	46.00	0.000
2.01	33.651	0.000	0.000	0.000	0.000	70.869	0.000	1.041	46.00	0.000
1.02	33.651	0.000	0.000	0.000	0.000	70.869	0.000	2.547	46.00	0.000
3.01	33.651	0.000	0.000	0.000	0.000	70.869	0.000	0.3151	45.00	0.000
5.01	33.651	0.000	0.000	0.000	0.000	70.869	0.000	1.041	46.00	0.000
1.03	33.651	0.000	0.000	0.000	0.000	70.869	0.000	3.892	46.00	0.000
node3	33.651	0.000	0.000	0.000	0.000	70.869	0.000	0.3184	45.00	0.000
1.04	33.651	0.000	0.000	0.000	0.000	70.869	0.000	4.679	46.00	0.000
node2	33.651	0.000	0.000	0.000	0.000	70.869	0.000	0.9335	45.00	0.000
Out	33.651	0.000	0.000	0.000	0.000	70.869	0.000	5.663	46.00	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	Vol. Used	Stage Used
1.04	46.00	4.678	47.00	4.571	16748.8	0.0000	121.00	73.421
node2	45.00	.9335	45.00	.9258	2931.7	0.0000	21.566	76.406

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

LINK 1.01 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.750
ESTIMATED PEAK FLOW (CUMECS) = 0.75
ESTIMATED TIME TO PEAK (MINS) = 120.00

LINK 2.01 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 5.444
ESTIMATED PEAK FLOW (CUMECS) = 0.86
ESTIMATED TIME TO PEAK (MINS) = 120.00

LINK 1.02 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 13.01
ESTIMATED PEAK FLOW (CUMECS) = 2.1
ESTIMATED TIME TO PEAK (MINS) = 120.00

LINK 3.01 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.414
ESTIMATED PEAK FLOW (CUMECS) = 0.23
ESTIMATED TIME TO PEAK (MINS) = 120.00

LINK 5.01 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 5.505
ESTIMATED PEAK FLOW (CUMECS) = 0.87
ESTIMATED TIME TO PEAK (MINS) = 120.00

LINK 1.03 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 19.93
ESTIMATED PEAK FLOW (CUMECS) = 3.2
ESTIMATED TIME TO PEAK (MINS) = 120.00

LINK node3 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.404
ESTIMATED PEAK FLOW (CUMECS) = 0.23
ESTIMATED TIME TO PEAK (MINS) = 120.00

LINK 1.04 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 23.77
ESTIMATED PEAK FLOW (CUMECS) = 3.8
ESTIMATED TIME TO PEAK (MINS) = 120.00

iosd llkta 0 11
LINK node2 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.183
ESTIMATED PEAK FLOW (CUMECS) = 0.68
ESTIMATED TIME TO PEAK (MINS) = 120.00

iosd llkta 0 12
LINK Out 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 30.84
ESTIMATED PEAK FLOW (CUMECS) = 4.6
ESTIMATED TIME TO PEAK (MINS) = 121.00

##
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 2: 0.0 3/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 360.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.03
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 29.03

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.
1.01	4.700	0.000	4.290	0.000	5.000	0.000	.035	0.00	.0286	0.000	1.000
2.01	5.390	0.000	4.120	0.000	5.000	0.000	.035	0.00	.0314	0.000	2.000
1.02	2.790	0.000	3.760	0.000	5.000	0.000	.035	0.00	.0233	0.000	1.001
3.01	1.400	0.000	5.400	0.000	5.000	0.000	.035	0.00	.0136	0.000	3.000
5.01	5.450	0.000	4.000	0.000	5.000	0.000	.035	0.00	.0320	0.000	4.000
1.03	.00001	0.000	3.680	0.000	5.000	0.000	.035	0.00	0.000	0.000	1.002
node3	1.390	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0111	0.000	5.000
1.04	3.770	0.000	2.830	0.000	5.000	0.000	.035	0.00	.0314	0.000	1.003
node2	4.140	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0196	0.000	6.000
Out	.00001	0.000	2.000	0.000	5.000	0.000	.025	0.00	0.000	0.000	1.004

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
1.01	21.944	0.000	0.000	0.000	0.000	101.00	0.000	0.7529	120.0	0.000
2.01	21.944	0.000	0.000	0.000	0.000	101.00	0.000	0.8587	120.0	0.000
1.02	21.944	0.000	0.000	0.000	0.000	101.00	0.000	2.062	120.0	0.000
3.01	21.944	0.000	0.000	0.000	0.000	101.00	0.000	0.2304	120.0	0.000
5.01	21.944	0.000	0.000	0.000	0.000	101.00	0.000	0.8659	120.0	0.000
1.03	21.944	0.000	0.000	0.000	0.000	101.00	0.000	3.158	120.0	0.000
node3	21.944	0.000	0.000	0.000	0.000	101.00	0.000	0.2318	120.0	0.000
1.04	21.944	0.000	0.000	0.000	0.000	101.00	0.000	3.790	120.0	0.000
node2	21.944	0.000	0.000	0.000	0.000	101.00	0.000	0.6822	120.0	0.000
Out	21.944	0.000	0.000	0.000	0.000	101.00	0.000	4.638	121.0	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
1.04	120.0	3.790	121.0	3.769	23773.4	0.0000	69.634	73.245
node2	120.0	.6822	120.0	.6798	4182.9	0.0000	14.405	76.246

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

```
LINK 1.01        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         6.417
ESTIMATED PEAK FLOW      (CUMECS) =        0.71
ESTIMATED TIME TO PEAK      (MINS) =      420.00

LINK 2.01        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         7.359
ESTIMATED PEAK FLOW      (CUMECS) =        0.81
ESTIMATED TIME TO PEAK      (MINS) =      420.00

LINK 1.02        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         17.59
ESTIMATED PEAK FLOW      (CUMECS) =         1.9
ESTIMATED TIME TO PEAK      (MINS) =      420.00

LINK 3.01        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         1.911
ESTIMATED PEAK FLOW      (CUMECS) =        0.21
ESTIMATED TIME TO PEAK      (MINS) =      420.00

LINK 5.01        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         7.441
ESTIMATED PEAK FLOW      (CUMECS) =        0.82
ESTIMATED TIME TO PEAK      (MINS) =      420.00

LINK 1.03        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         26.94
ESTIMATED PEAK FLOW      (CUMECS) =         3.0
ESTIMATED TIME TO PEAK      (MINS) =      420.00

LINK node3        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         1.898
ESTIMATED PEAK FLOW      (CUMECS) =        0.21
ESTIMATED TIME TO PEAK      (MINS) =      420.00

LINK 1.04        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         32.11
ESTIMATED PEAK FLOW      (CUMECS) =         3.5
ESTIMATED TIME TO PEAK      (MINS) =      420.00

iosd llkta     0     11
LINK node2        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         5.652
ESTIMATED PEAK FLOW      (CUMECS) =        0.62
ESTIMATED TIME TO PEAK      (MINS) =      420.00

iosd llkta     0     12
LINK Out        10.000

ESTIMATED VOLUME (CU METRES*10**3) =         42.76
ESTIMATED PEAK FLOW      (CUMECS) =         4.4
ESTIMATED TIME TO PEAK      (MINS) =      420.00
```

##
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 2: 0.0 3/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 720.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.03
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 29.03

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	Catch. Area #2	Slope (%) #1	Slope #2	% Impervious (%) #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
1.01	4.700	0.000	4.290	0.000	5.000	0.000	.035	0.00	.0286	0.000	1.000
2.01	5.390	0.000	4.120	0.000	5.000	0.000	.035	0.00	.0314	0.000	2.000
1.02	2.790	0.000	3.760	0.000	5.000	0.000	.035	0.00	.0233	0.000	1.001
3.01	1.400	0.000	5.400	0.000	5.000	0.000	.035	0.00	.0136	0.000	3.000
5.01	5.450	0.000	4.000	0.000	5.000	0.000	.035	0.00	.0320	0.000	4.000
1.03	.00001	0.000	3.680	0.000	5.000	0.000	.035	0.00	0.000	0.000	1.002
node3	1.390	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0111	0.000	5.000
1.04	3.770	0.000	2.830	0.000	5.000	0.000	.035	0.00	.0314	0.000	1.003
node2	4.140	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0196	0.000	6.000
Out	.00001	0.000	2.000	0.000	5.000	0.000	.025	0.00	0.000	0.000	1.004

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
1.01	14.338	0.000	0.000	0.000	0.000	136.57	0.000	0.7053	420.0	0.000
2.01	14.338	0.000	0.000	0.000	0.000	136.57	0.000	0.8079	420.0	0.000
1.02	14.338	0.000	0.000	0.000	0.000	136.57	0.000	1.932	420.0	0.000
3.01	14.338	0.000	0.000	0.000	0.000	136.57	0.000	0.2106	420.0	0.000
5.01	14.338	0.000	0.000	0.000	0.000	136.57	0.000	0.8165	420.0	0.000
1.03	14.338	0.000	0.000	0.000	0.000	136.57	0.000	2.959	420.0	0.000
node3	14.338	0.000	0.000	0.000	0.000	136.57	0.000	0.2091	420.0	0.000
1.04	14.338	0.000	0.000	0.000	0.000	136.57	0.000	3.540	420.0	0.000
node2	14.338	0.000	0.000	0.000	0.000	136.57	0.000	0.6228	420.0	0.000
Out	14.338	0.000	0.000	0.000	0.000	136.57	0.000	4.350	420.0	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
1.04	420.0	3.540	420.0	3.537	32107.9	0.0000	56.323	73.190
node2	420.0	.6228	420.0	.6228	5652.0	0.0000	12.813	76.210

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
1.04	1.0	1.000		0.000	80.000	0.2000
node2	1.0	1.000		0.000	20.000	0.2000

Run completed at: 12th January 2011 10:45:36

APPENDIX D

XP-Rafts Results – Post development

Only 100 year ARI results have been included to save paper wastage

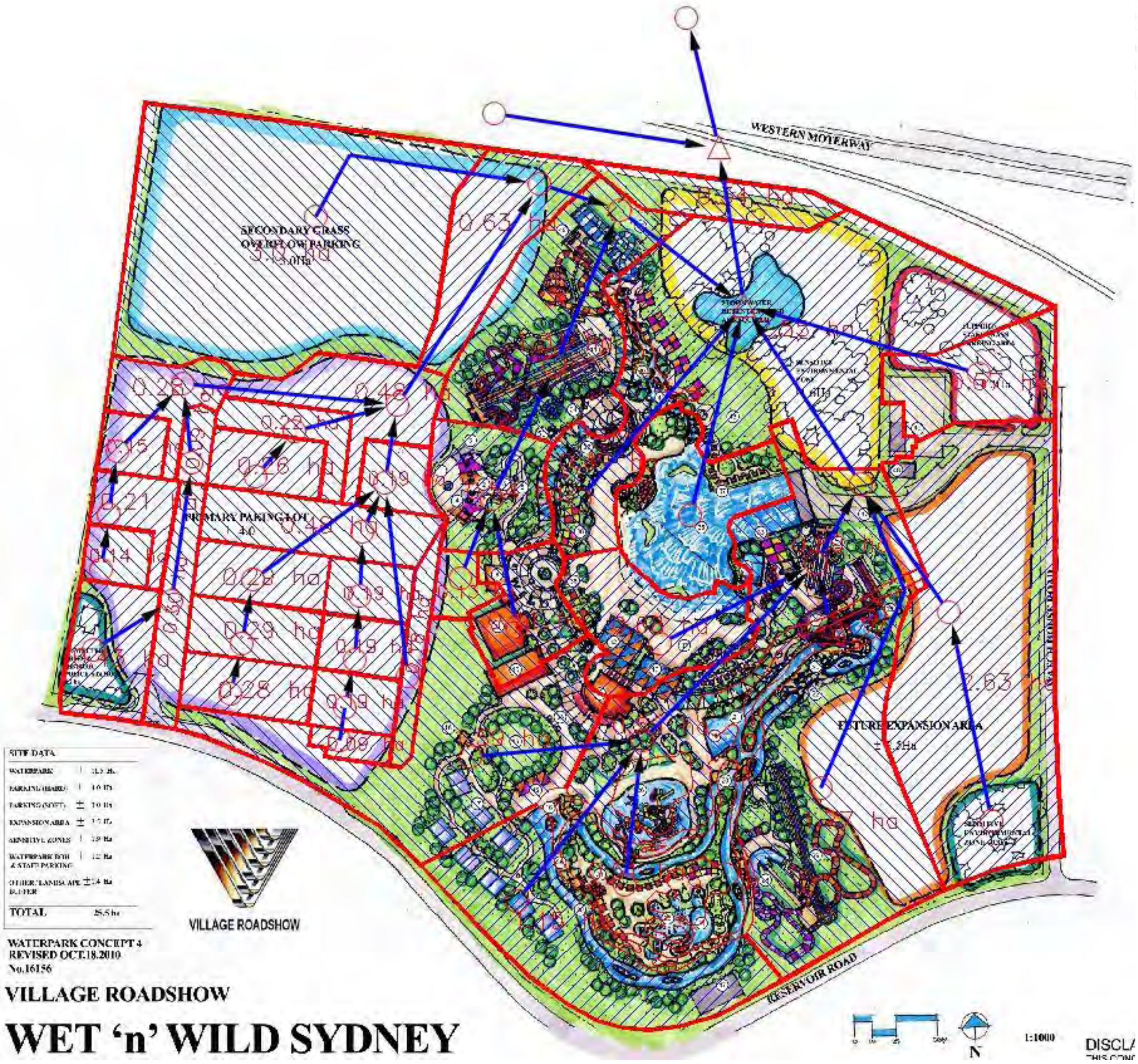


Figure 12 XP-Rafts layout developed scenario

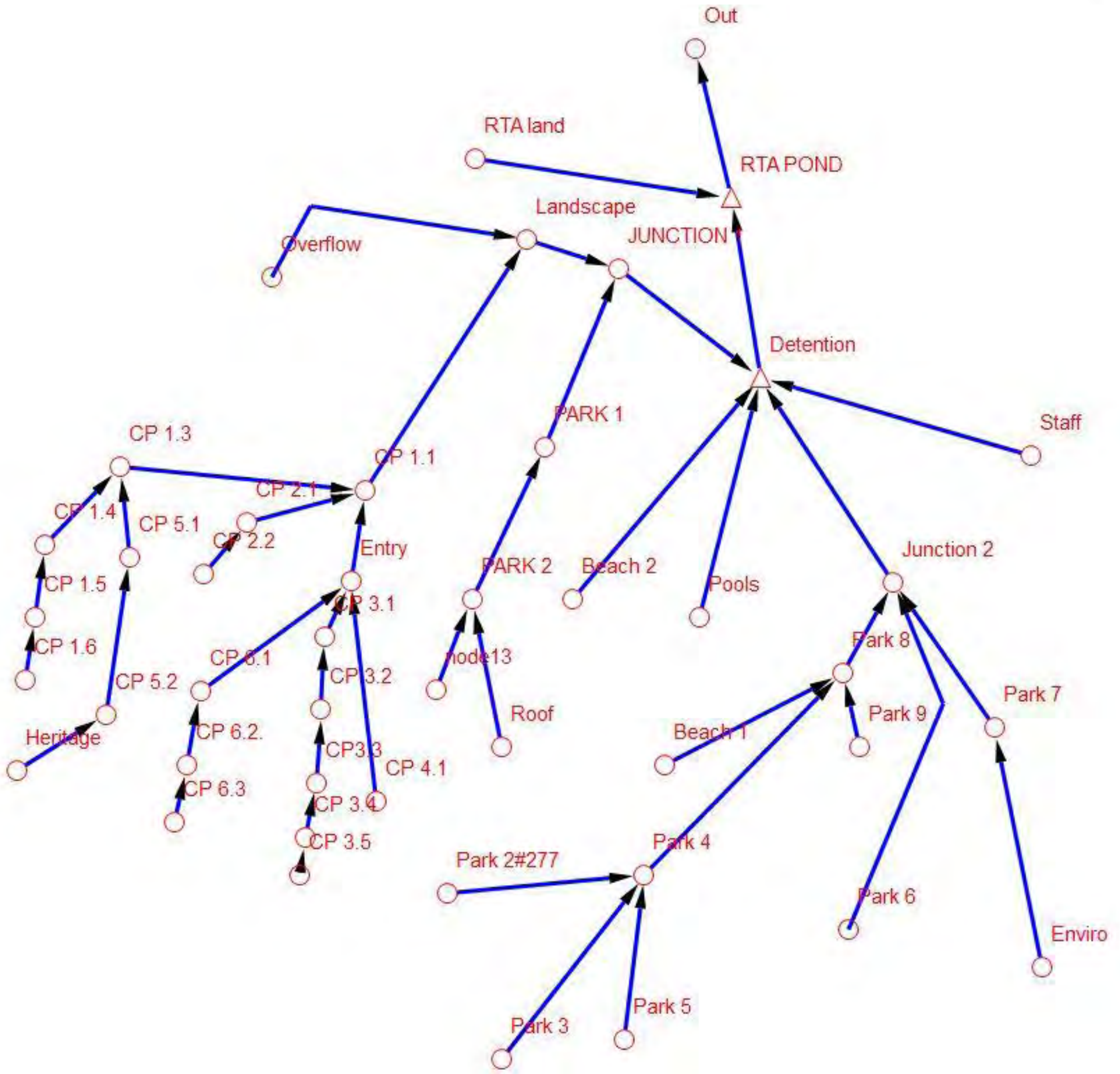


Figure 12 XP-Rafts layout developed scenario – Nodes names

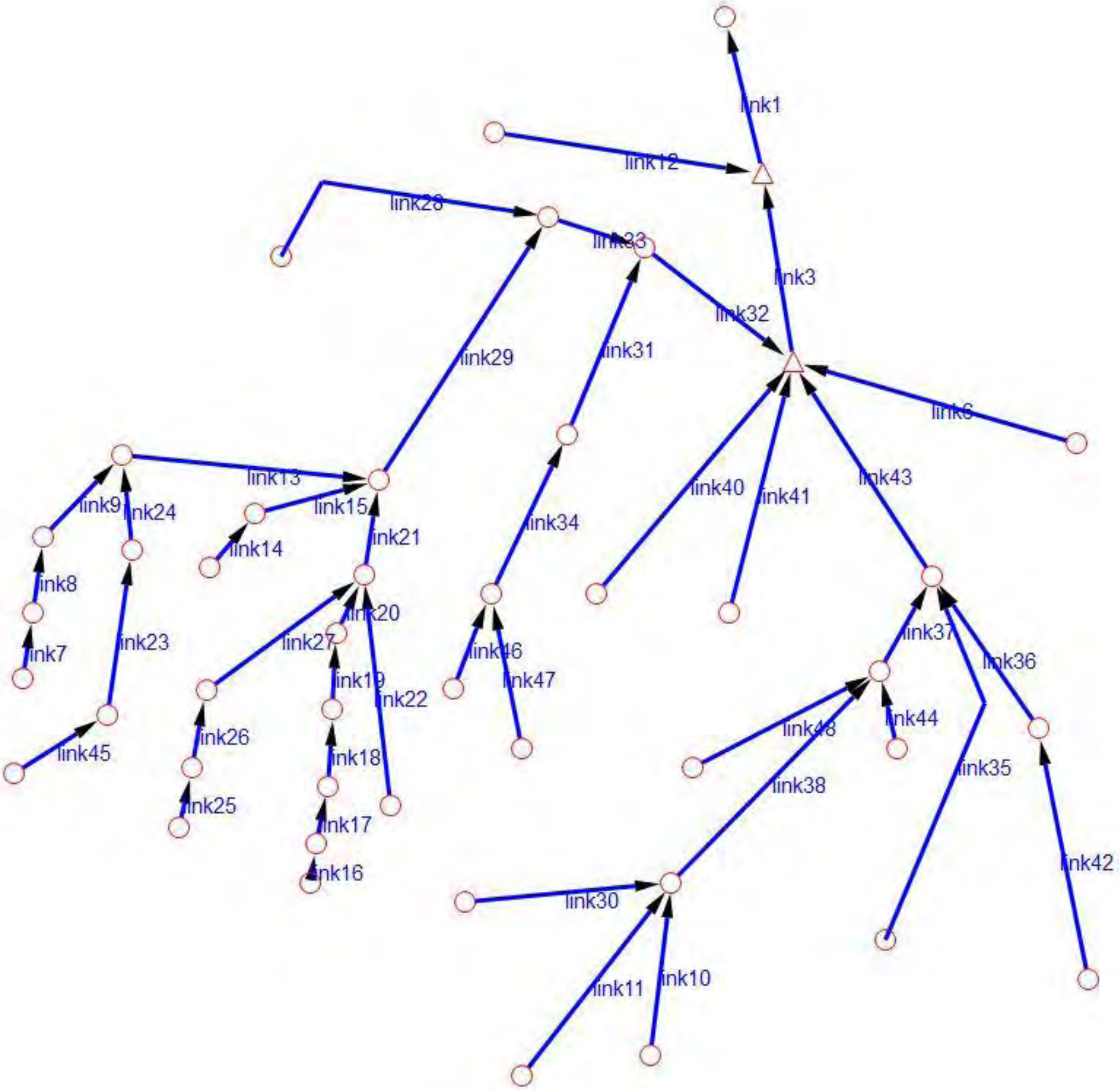


Figure 12 XP-Rafts layout developed scenario – Links names

Run started at: 12th January 2011 10:42:46

##
RUNTIME RESULTS
##

LINK Staff 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1946
ESTIMATED PEAK FLOW (CUMECS) = 0.29
ESTIMATED TIME TO PEAK (MINS) = 9.00

LINK node13 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3126E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.48E-01
ESTIMATED TIME TO PEAK (MINS) = 13.00

LINK Roof 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1541
ESTIMATED PEAK FLOW (CUMECS) = 0.22
ESTIMATED TIME TO PEAK (MINS) = 7.00

LINK PARK 2 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3502
ESTIMATED PEAK FLOW (CUMECS) = 0.51
ESTIMATED TIME TO PEAK (MINS) = 10.00

LINK PARK 1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7032
ESTIMATED PEAK FLOW (CUMECS) = 1.0
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK Overflow 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.024
ESTIMATED PEAK FLOW (CUMECS) = 1.5
ESTIMATED TIME TO PEAK (MINS) = 10.00

LINK CP 1.6 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5287E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.76E-01
ESTIMATED TIME TO PEAK (MINS) = 7.00

LINK CP 1.5 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1323
ESTIMATED PEAK FLOW (CUMECS) = 0.18
ESTIMATED TIME TO PEAK (MINS) = 9.00

LINK CP 1.4 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1890
ESTIMATED PEAK FLOW (CUMECS) = 0.25
ESTIMATED TIME TO PEAK (MINS) = 11.00

LINK Heritage 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1155
ESTIMATED PEAK FLOW (CUMECS) = 0.17
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK CP 5.2 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2288
ESTIMATED PEAK FLOW (CUMECS) = 0.29
ESTIMATED TIME TO PEAK (MINS) = 14.00

LINK CP 5.1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2629
ESTIMATED PEAK FLOW (CUMECS) = 0.32
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK CP 1.3 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5579
ESTIMATED PEAK FLOW (CUMECS) = 0.62

ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK CP 2.2 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.9821E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.14
ESTIMATED TIME TO PEAK (MINS) = 8.00

LINK CP 2.1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1814
ESTIMATED PEAK FLOW (CUMECS) = 0.25
ESTIMATED TIME TO PEAK (MINS) = 10.00

LINK CP 3.5 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3398E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.49E-01
ESTIMATED TIME TO PEAK (MINS) = 7.00

LINK CP 3.4 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1058
ESTIMATED PEAK FLOW (CUMECS) = 0.15
ESTIMATED TIME TO PEAK (MINS) = 9.00

LINK CP3.3 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1777
ESTIMATED PEAK FLOW (CUMECS) = 0.23
ESTIMATED TIME TO PEAK (MINS) = 11.00

LINK CP 3.2 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2495
ESTIMATED PEAK FLOW (CUMECS) = 0.31
ESTIMATED TIME TO PEAK (MINS) = 11.00

LINK CP 3.1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.4309
ESTIMATED PEAK FLOW (CUMECS) = 0.50
ESTIMATED TIME TO PEAK (MINS) = 11.00

LINK CP 4.1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6798E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.10
ESTIMATED TIME TO PEAK (MINS) = 7.00

LINK CP 6.3 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1058
ESTIMATED PEAK FLOW (CUMECS) = 0.15
ESTIMATED TIME TO PEAK (MINS) = 8.00

LINK CP 6.2. 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2154
ESTIMATED PEAK FLOW (CUMECS) = 0.30
ESTIMATED TIME TO PEAK (MINS) = 10.00

LINK CP 6.1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3251
ESTIMATED PEAK FLOW (CUMECS) = 0.42
ESTIMATED TIME TO PEAK (MINS) = 11.00

LINK Entry 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.8961
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 13.00

LINK CP 1.1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.817
ESTIMATED PEAK FLOW (CUMECS) = 2.0
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Landscape 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.993

ESTIMATED PEAK FLOW (CUMECS) = 3.4
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK JUNCTION 1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.696
ESTIMATED PEAK FLOW (CUMECS) = 4.3
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Beach 2 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1780
ESTIMATED PEAK FLOW (CUMECS) = 0.25
ESTIMATED TIME TO PEAK (MINS) = 9.00

LINK Pools 1.000
WARNING 8 - LOSSES POSS. EXCEED RAIN

ESTIMATED VOLUME (CU METRES*10**3) = 0.000
ESTIMATED PEAK FLOW (CUMECS) = 0.0
ESTIMATED TIME TO PEAK (MINS) = 1.00

LINK Park 6 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5404
ESTIMATED PEAK FLOW (CUMECS) = 0.83
ESTIMATED TIME TO PEAK (MINS) = 10.00

LINK Enviro 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7185E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.90E-01
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Park 7 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.8675
ESTIMATED PEAK FLOW (CUMECS) = 1.2
ESTIMATED TIME TO PEAK (MINS) = 10.00

LINK Park 5 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1816
ESTIMATED PEAK FLOW (CUMECS) = 0.26
ESTIMATED TIME TO PEAK (MINS) = 8.00

LINK Park 3 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3260
ESTIMATED PEAK FLOW (CUMECS) = 0.54
ESTIMATED TIME TO PEAK (MINS) = 10.00

LINK Park 2#277 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.4505
ESTIMATED PEAK FLOW (CUMECS) = 0.73
ESTIMATED TIME TO PEAK (MINS) = 10.00

LINK Park 4 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.168
ESTIMATED PEAK FLOW (CUMECS) = 1.8
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK Park 9 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3414E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.51E-01
ESTIMATED TIME TO PEAK (MINS) = 9.00

LINK Beach 1 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2471
ESTIMATED PEAK FLOW (CUMECS) = 0.35
ESTIMATED TIME TO PEAK (MINS) = 9.00

LINK Park 8 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.754
ESTIMATED PEAK FLOW (CUMECS) = 2.4
ESTIMATED TIME TO PEAK (MINS) = 14.00

LINK Junction 2 1.000

```
ESTIMATED VOLUME (CU METRES*10**3) =        3.162
ESTIMATED PEAK FLOW      (CUMECS) =         4.0
ESTIMATED TIME TO PEAK      (MINS) =       16.00

LINK Detention      1.000

ESTIMATED VOLUME (CU METRES*10**3) =        7.896
ESTIMATED PEAK FLOW      (CUMECS) =         9.3
ESTIMATED TIME TO PEAK      (MINS) =       17.00

iosd llkta      0      60
LINK RTA land      1.000

ESTIMATED VOLUME (CU METRES*10**3) =        0.5056
ESTIMATED PEAK FLOW      (CUMECS) =         0.41
ESTIMATED TIME TO PEAK      (MINS) =       18.00

LINK RTA POND      1.000

ESTIMATED VOLUME (CU METRES*10**3) =        8.518
ESTIMATED PEAK FLOW      (CUMECS) =         2.3
ESTIMATED TIME TO PEAK      (MINS) =       27.00

iosd llkta      0      63
LINK Out      1.000

ESTIMATED VOLUME (CU METRES*10**3) =        8.304
ESTIMATED PEAK FLOW      (CUMECS) =         2.3
ESTIMATED TIME TO PEAK      (MINS) =       29.00


##########################################################################################
Wet n wild Sydney

Results for period from  0: 0.0  1/ 1/1990
             to  2: 0.0  3/ 1/1990
##########################################################################################


        ROUTING INCREMENT (MINS) =      1.00
        STORM DURATION (MINS)    =      20.
        RETURN PERIOD (YRS)      =      100.
        BX                       =    1.0000
        TOTAL OF FIRST SUB-AREAS  (ha) =     28.30
        TOTAL OF SECOND SUB-AREAS (ha) =      0.00
        TOTAL OF ALL SUB-AREAS (ha)    =     28.30
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2	Slope #1 (%)	Slope #2	% Impervious #1 (%)	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
Staff	0.5700	0.000	5.000	0.000	75.00	0.000	.025	0.00	.0014	0.000	1.000
node13	0.1300	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0032	0.000	2.000
Roof	0.4100	0.000	12.00	0.000	100.0	0.000	.002	0.00	0.000	0.000	3.000
PARK 2	0.5400	0.000	3.000	0.000	50.00	0.000	.025	0.00	.0028	0.000	2.001
PARK 1	1.310	0.000	3.000	0.000	25.00	0.000	.025	0.00	.0070	0.000	2.002
Overflow	3.000	0.000	3.000	0.000	75.00	0.000	.025	0.00	.0044	0.000	4.000
CP 1.6	0.1400	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0006	0.000	5.000
CP 1.5	0.2100	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0008	0.000	5.001
CP 1.4	0.1500	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0006	0.000	5.002
Heritage	0.4300	0.000	3.000	0.000	25.00	0.000	.035	0.00	.0050	0.000	6.000
CP 5.2	0.3000	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	6.001
CP 5.1	0.0900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0005	0.000	6.002
CP 1.3	0.2800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	5.003
CP 2.2	0.2600	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	7.000
CP 2.1	0.2200	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0008	0.000	7.001
CP 3.5	0.0900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0005	0.000	8.000
CP 3.4	0.1900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	8.001
CP3.3	0.1900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	8.002
CP 3.2	0.1900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	8.003
CP 3.1	0.4800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0012	0.000	8.004
CP 4.1	0.1800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	9.000
CP 6.3	0.2800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	10.00
CP 6.2.	0.2900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	10.00
CP 6.1	0.2900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	10.00
Entry	0.1900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	8.005
CP 1.1	0.4800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0012	0.000	5.004
Landscape	0.6300	0.000	5.000	0.000	5.000	0.000	.035	0.00	.0093	0.000	4.001
JUNCTION	1.00001	0.000	.0100	0.000	0.000	0.000	.025	0.00	.0006	0.000	2.003

```
Beach 2   0.4900  0.000  2.000 0.000  90.00 0.000  .025 0.00  .0017 0.000  11.00
Pools     1.400  0.000  .0011 0.000  100.0 0.000  .001 0.00  .0047 0.000  12.00
Park 6    1.770  0.000  3.000 0.000  50.00 0.000  .025 0.00  .0052 0.000  13.00
Enviro    0.3000  0.000  3.000 0.000  5.000 0.000  .035 0.00  .0082 0.000  14.00
Park 7    2.330  0.000  3.000 0.000  75.00 0.000  .025 0.00  .0038 0.000  14.00
Park 5    0.5000  0.000  3.000 0.000  90.00 0.000  .025 0.00  .0014 0.000  15.00
Park 3    1.150  0.000  5.000 0.000  35.00 0.000  .025 0.00  .0040 0.000  16.00
Park 2#277 1.590  0.000  5.000 0.000  35.00 0.000  .025 0.00  .0048 0.000  17.00
Park 4    0.5900  0.000  3.000 0.000  85.00 0.000  .025 0.00  .0016 0.000  15.00
Park 9    0.1000  0.000  3.000 0.000  75.00 0.000  .025 0.00  .0007 0.000  18.00
Beach 1   0.6800  0.000  2.000 0.000  90.00 0.000  .025 0.00  .0020 0.000  19.00
Park 8    0.8900  0.000  3.000 0.000  75.00 0.000  .025 0.00  .0023 0.000  15.00
Junction 2.00001  0.000  .0100 0.000  0.000 0.000  .025 0.00  .0006 0.000  13.00
Detention  2.550  0.000  5.000 0.000  20.00 0.000  .035 0.00  .0113 0.000  1.001
RTA land   2.100  0.000  3.000 0.000  5.000 0.000  .035 0.00  .0225 0.000  20.00
RTA POND  0.3400  0.000  3.000 0.000  75.00 0.000  .035 0.00  .0018 0.000  1.002
Out      .00001  0.000  1.000 0.000  0.000 0.000  .025 0.00  0.000 0.000  1.003
```

```
 Link    Average Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1   #2      #1   #2    Inflow  to     Lag
        (mm/h)   ( mm )      (mm/h)        ( mm )     (m^3/s)  Peak  mins
Staff     116.48 0.000 0.000  0.000 0.000  34.188  0.000  0.2907  9.000 2.000
node13    116.48 0.000 0.000  0.000 0.000  24.003  0.000  0.0483  13.00 0.000
Roof      116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.2161  7.000 0.000
PARK 2    116.48 0.000 0.000  0.000 0.000  30.551  0.000  0.5076  10.00 2.000
PARK 1    116.48 0.000 0.000  0.000 0.000  26.913  0.000   1.029  12.00 2.000
Overflow  116.48 0.000 0.000  0.000 0.000  34.188  0.000   1.512  10.00 2.000
CP 1.6    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.0762  7.000 2.000
CP 1.5    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.1849  9.000 2.000
CP 1.4    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.2521  11.00 2.000
Heritage  116.48 0.000 0.000  0.000 0.000  26.913  0.000  0.1721  12.00 2.000
CP 5.2    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.2886  14.00 2.000
CP 5.1    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.3173  15.00 2.000
CP 1.3    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.6177  15.00 2.000
CP 2.2    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.1384  8.000 2.000
CP 2.1    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.2536  10.00 2.000
CP 3.5    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.0487  7.000 2.000
CP 3.4    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.1488  9.000 2.000
CP3.3     116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.2331  11.00 2.000
CP 3.2    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.3134  11.00 2.000
CP 3.1    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.5006  11.00 2.000
CP 4.1    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.1005  7.000 2.000
CP 6.3    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.1499  8.000 2.000
CP 6.2.   116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.3021  10.00 2.000
CP 6.1    116.48 0.000 0.000  0.000 0.000  37.826  0.000  0.4228  11.00 2.000
Entry     116.48 0.000 0.000  0.000 0.000  37.826  0.000   1.078  13.00 2.000
CP 1.1    116.48 0.000 0.000  0.000 0.000  37.826  0.000   2.043  15.00 2.000
Landscape 116.48 0.000 0.000  0.000 0.000  24.003  0.000   3.359  16.00 2.000
JUNCTION 1116.48 0.000 0.000  0.000 0.000  23.276  0.000   4.302  15.00 2.000
Beach 2   116.48 0.000 0.000  0.000 0.000  36.371  0.000  0.2539  9.000 2.000
Pools     116.48 100.0 0.000  0.000 0.000   0.000  0.000   0.000  1.000 2.000
Park 6    116.48 0.000 0.000  0.000 0.000  30.551  0.000  0.8254  10.00 2.000
Enviro    116.48 0.000 0.000  0.000 0.000  24.003  0.000  0.0900  15.00 2.000
Park 7    116.48 0.000 0.000  0.000 0.000  34.188  0.000   1.190  10.00 2.000
Park 5    116.48 0.000 0.000  0.000 0.000  36.371  0.000  0.2582  8.000 2.000
Park 3    116.48 0.000 0.000  0.000 0.000  28.368  0.000  0.5371  10.00 2.000
Park 2#277116.48 0.000 0.000  0.000 0.000  28.368  0.000  0.7281  10.00 2.000
Park 4    116.48 0.000 0.000  0.000 0.000  35.643  0.000   1.754  12.00 2.000
Park 9    116.48 0.000 0.000  0.000 0.000  34.188  0.000  0.0505  9.000 2.000
Beach 1   116.48 0.000 0.000  0.000 0.000  36.371  0.000  0.3496  9.000 0.000
Park 8    116.48 0.000 0.000  0.000 0.000  34.188  0.000   2.381  14.00 2.000
Junction 2116.48 0.000 0.000  0.000 0.000  23.276  0.000   3.954  16.00 2.000
Detention 116.48 0.000 0.000  0.000 0.000  26.186  0.000   9.316  17.00 0.000
RTA land  116.48 0.000 0.000  0.000 0.000  24.003  0.000  0.4091  18.00 2.000
RTA POND  116.48 0.000 0.000  0.000 0.000  34.188  0.000   2.310  27.00 2.000
Out       116.48 0.000 0.000  0.000 0.000  23.276  0.000   2.310  29.00 0.000
```

SUMMARY OF BASIN RESULTS

```
 Link    Time   Peak   Time   Peak     Total   --------- Basin ---------
 Label    to   Inflow   to   Outflow Inflow     Vol.    Vol.   Stage
        Peak  (m^3/s) Peak  (m^3/s)  (m^3)     Avail    Used     Used
Detention 17.00  9.315 28.00   2.028    7895.9   0.0000    9541.6  76.012
RTA POND  27.00  2.309 27.00   2.310    8517.5   0.0000    7.4836  72.965
```

SUMMARY OF BASIN OUTLET RESULTS

```
 Link     No.    S/D    Dia    Width    Pipe    Pipe
 Label    of    Factor                Length   Slope
               (m)    (m)    (m)      (m)     (%)
Detention 1.0    1.000         0.000    20.000  0.2000
```

RTA POND 1.0 1.750 0.000 80.000 0.2000

LINK Staff 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2195
ESTIMATED PEAK FLOW (CUMECS) = 0.29
ESTIMATED TIME TO PEAK (MINS) = 13.00

LINK node13 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3580E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.57E-01
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Roof 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1733
ESTIMATED PEAK FLOW (CUMECS) = 0.21
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK PARK 2 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3957
ESTIMATED PEAK FLOW (CUMECS) = 0.52
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK PARK 1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7984
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Overflow 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.155
ESTIMATED PEAK FLOW (CUMECS) = 1.5
ESTIMATED TIME TO PEAK (MINS) = 14.00

LINK CP 1.6 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5941E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.73E-01
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK CP 1.5 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1486
ESTIMATED PEAK FLOW (CUMECS) = 0.18
ESTIMATED TIME TO PEAK (MINS) = 14.00

LINK CP 1.4 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2124
ESTIMATED PEAK FLOW (CUMECS) = 0.24
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Heritage 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1315
ESTIMATED PEAK FLOW (CUMECS) = 0.20
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK CP 5.2 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2588
ESTIMATED PEAK FLOW (CUMECS) = 0.32
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK CP 5.1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2971
ESTIMATED PEAK FLOW (CUMECS) = 0.34
ESTIMATED TIME TO PEAK (MINS) = 17.00

LINK CP 1.3 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6285
ESTIMATED PEAK FLOW (CUMECS) = 0.61
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK CP 2.2 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1104
ESTIMATED PEAK FLOW (CUMECS) = 0.13
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK CP 2.1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2038
ESTIMATED PEAK FLOW (CUMECS) = 0.25
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK CP 3.5 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3819E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.47E-01
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK CP 3.4 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1189
ESTIMATED PEAK FLOW (CUMECS) = 0.14
ESTIMATED TIME TO PEAK (MINS) = 14.00

LINK CP3.3 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1996
ESTIMATED PEAK FLOW (CUMECS) = 0.23
ESTIMATED TIME TO PEAK (MINS) = 14.00

LINK CP 3.2 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2803
ESTIMATED PEAK FLOW (CUMECS) = 0.31
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK CP 3.1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.4842
ESTIMATED PEAK FLOW (CUMECS) = 0.53
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK CP 4.1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7639E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.94E-01
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK CP 6.3 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.1188
ESTIMATED PEAK FLOW (CUMECS) = 0.14
ESTIMATED TIME TO PEAK (MINS) = 12.00

LINK CP 6.2. 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2420
ESTIMATED PEAK FLOW (CUMECS) = 0.29
ESTIMATED TIME TO PEAK (MINS) = 14.00

LINK CP 6.1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3653
ESTIMATED PEAK FLOW (CUMECS) = 0.42
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Entry 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.007
ESTIMATED PEAK FLOW (CUMECS) = 1.1
ESTIMATED TIME TO PEAK (MINS) = 17.00

LINK CP 1.1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.043
ESTIMATED PEAK FLOW (CUMECS) = 2.0
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK Landscape 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.370
ESTIMATED PEAK FLOW (CUMECS) = 3.6
ESTIMATED TIME TO PEAK (MINS) = 17.00

LINK JUNCTION 1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.168
ESTIMATED PEAK FLOW (CUMECS) = 4.6
ESTIMATED TIME TO PEAK (MINS) = 19.00

LINK Beach 2 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2003
ESTIMATED PEAK FLOW (CUMECS) = 0.25
ESTIMATED TIME TO PEAK (MINS) = 13.00

LINK Pools 2.000
WARNING 8 - LOSSES POSS. EXCEED RAIN

ESTIMATED VOLUME (CU METRES*10**3) = 0.000
ESTIMATED PEAK FLOW (CUMECS) = 0.0
ESTIMATED TIME TO PEAK (MINS) = 1.00

LINK Park 6 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6122
ESTIMATED PEAK FLOW (CUMECS) = 0.85
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Enviro 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.8197E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.98E-01
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK Park 7 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.9792
ESTIMATED PEAK FLOW (CUMECS) = 1.2
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Park 5 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2044
ESTIMATED PEAK FLOW (CUMECS) = 0.26
ESTIMATED TIME TO PEAK (MINS) = 13.00

LINK Park 3 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3702
ESTIMATED PEAK FLOW (CUMECS) = 0.55
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Park 2#277 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5120
ESTIMATED PEAK FLOW (CUMECS) = 0.75
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Park 4 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.323
ESTIMATED PEAK FLOW (CUMECS) = 1.8
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK Park 9 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3850E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.50E-01
ESTIMATED TIME TO PEAK (MINS) = 13.00

LINK Beach 1 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.2780
ESTIMATED PEAK FLOW (CUMECS) = 0.35
ESTIMATED TIME TO PEAK (MINS) = 13.00

LINK Park 8 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.983
ESTIMATED PEAK FLOW (CUMECS) = 2.3
ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK Junction 2 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.575
ESTIMATED PEAK FLOW (CUMECS) = 4.4
ESTIMATED TIME TO PEAK (MINS) = 17.00

LINK Detention 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 8.925
ESTIMATED PEAK FLOW (CUMECS) = 9.7
ESTIMATED TIME TO PEAK (MINS) = 19.00

iosd llkta 0 60
LINK RTA land 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5824
ESTIMATED PEAK FLOW (CUMECS) = 0.43
ESTIMATED TIME TO PEAK (MINS) = 20.00

LINK RTA POND 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 9.639
ESTIMATED PEAK FLOW (CUMECS) = 2.6
ESTIMATED TIME TO PEAK (MINS) = 30.00

iosd llkta 0 63
LINK Out 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 9.428
ESTIMATED PEAK FLOW (CUMECS) = 2.6
ESTIMATED TIME TO PEAK (MINS) = 33.00

###
Wet n wild Sydney

Results for period from 0: 0.0 1/ 1/1990
to 2: 0.0 3/ 1/1990
###

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 25.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 28.30
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 28.30

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.
Staff	0.5700	0.000	5.000	0.000	75.00	0.000	.025	0.00	.0014	0.000	1.000
node13	0.1300	0.000	5.000	0.000	5.000	0.000	.025	0.00	.0032	0.000	2.000
Roof	0.4100	0.000	12.00	0.000	100.0	0.000	.002	0.00	0.000	0.000	3.000
PARK 2	0.5400	0.000	3.000	0.000	50.00	0.000	.025	0.00	.0028	0.000	2.001
PARK 1	1.310	0.000	3.000	0.000	25.00	0.000	.025	0.00	.0070	0.000	2.002
Overflow	3.000	0.000	3.000	0.000	75.00	0.000	.025	0.00	.0044	0.000	4.000
CP 1.6	0.1400	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0006	0.000	5.000
CP 1.5	0.2100	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0008	0.000	5.001
CP 1.4	0.1500	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0006	0.000	5.002
Heritage	0.4300	0.000	3.000	0.000	25.00	0.000	.035	0.00	.0050	0.000	6.000
CP 5.2	0.3000	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	6.001
CP 5.1	0.0900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0005	0.000	6.002
CP 1.3	0.2800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	5.003
CP 2.2	0.2600	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	7.000
CP 2.1	0.2200	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0008	0.000	7.001
CP 3.5	0.0900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0005	0.000	8.000
CP 3.4	0.1900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	8.001
CP3.3	0.1900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	8.002
CP 3.2	0.1900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	8.003
CP 3.1	0.4800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0012	0.000	8.004
CP 4.1	0.1800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	9.000
CP 6.3	0.2800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	10.00
CP 6.2.	0.2900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	10.00
CP 6.1	0.2900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0009	0.000	10.00
Entry	0.1900	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0007	0.000	8.005
CP 1.1	0.4800	0.000	3.000	0.000	100.0	0.000	.025	0.00	.0012	0.000	5.004
Landscape	0.6300	0.000	5.000	0.000	5.000	0.000	.035	0.00	.0093	0.000	4.001
JUNCTION	1.00001	0.000	.0100	0.000	0.000	0.000	.025	0.00	.0006	0.000	2.003
Beach 2	0.4900	0.000	2.000	0.000	90.00	0.000	.025	0.00	.0017	0.000	11.00
Pools	1.400	0.000	.0011	0.000	100.0	0.000	.001	0.00	.0047	0.000	12.00
Park 6	1.770	0.000	3.000	0.000	50.00	0.000	.025	0.00	.0052	0.000	13.00
Enviro	0.3000	0.000	3.000	0.000	5.000	0.000	.035	0.00	.0082	0.000	14.00

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Park 7     2.330  0.000  3.000 0.000  75.00 0.000  .025 0.00  .0038 0.000  14.00
Park 5     0.5000  0.000  3.000 0.000  90.00 0.000  .025 0.00  .0014 0.000  15.00
Park 3     1.150  0.000  5.000 0.000  35.00 0.000  .025 0.00  .0040 0.000  16.00
Park 2#277 1.590  0.000  5.000 0.000  35.00 0.000  .025 0.00  .0048 0.000  17.00
Park 4     0.5900  0.000  3.000 0.000  85.00 0.000  .025 0.00  .0016 0.000  15.00
Park 9     0.1000  0.000  3.000 0.000  75.00 0.000  .025 0.00  .0007 0.000  18.00
Beach 1    0.6800  0.000  2.000 0.000  90.00 0.000  .025 0.00  .0020 0.000  19.00
Park 8     0.8900  0.000  3.000 0.000  75.00 0.000  .025 0.00  .0023 0.000  15.00
Junction 2.00001  0.000  .0100 0.000  0.000 0.000  .025 0.00  .0006 0.000  13.00
Detention  2.550  0.000  5.000 0.000  20.00 0.000  .035 0.00  .0113 0.000  1.001
RTA land   2.100  0.000  3.000 0.000  5.000 0.000  .035 0.00  .0225 0.000  20.00
RTA POND  0.3400  0.000  3.000 0.000  75.00 0.000  .035 0.00  .0018 0.000  1.002
Out       .00001  0.000  1.000 0.000  0.000 0.000  .025 0.00  0.000 0.000  1.003


 Link    Average Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2       #1    #2    Inflow   to     Lag
         (mm/h)   ( mm )      (mm/h)        ( mm )     (m^3/s)  Peak  mins
Staff     104.40 0.000 0.000  0.000 0.000  38.554  0.000  0.2861  13.00 2.000
node13    104.40 0.000 0.000  0.000 0.000  27.508  0.000  0.0567  15.00 0.000
Roof      104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.2088  12.00 0.000
PARK 2    104.40 0.000 0.000  0.000 0.000  34.609  0.000  0.5249  15.00 2.000
PARK 1    104.40 0.000 0.000  0.000 0.000  30.664  0.000   1.100  15.00 2.000
Overflow  104.40 0.000 0.000  0.000 0.000  38.554  0.000   1.489  14.00 2.000
CP 1.6    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.0725  12.00 2.000
CP 1.5    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.1787  14.00 2.000
CP 1.4    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.2444  15.00 2.000
Heritage  104.40 0.000 0.000  0.000 0.000  30.664  0.000  0.1951  15.00 2.000
CP 5.2    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.3225  15.00 2.000
CP 5.1    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.3358  17.00 2.000
CP 1.3    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.6119  16.00 2.000
CP 2.2    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.1334  12.00 2.000
CP 2.1    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.2457  15.00 2.000
CP 3.5    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.0465  12.00 2.000
CP 3.4    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.1438  14.00 2.000
CP3.3     104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.2310  14.00 2.000
CP 3.2    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.3099  15.00 2.000
CP 3.1    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.5305  15.00 2.000
CP 4.1    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.0943  12.00 2.000
CP 6.3    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.1447  12.00 2.000
CP 6.2.   104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.2916  14.00 2.000
CP 6.1    104.40 0.000 0.000  0.000 0.000  42.499  0.000  0.4195  15.00 2.000
Entry     104.40 0.000 0.000  0.000 0.000  42.499  0.000   1.075  17.00 2.000
CP 1.1    104.40 0.000 0.000  0.000 0.000  42.499  0.000   1.988  16.00 2.000
Landscape 104.40 0.000 0.000  0.000 0.000  27.508  0.000   3.626  17.00 2.000
JUNCTION 1104.40 0.000 0.000  0.000 0.000  26.719  0.000   4.571  19.00 2.000
Beach 2   104.40 0.000 0.000  0.000 0.000  40.921  0.000  0.2493  13.00 2.000
Pools     104.40 100.0 0.000  0.000 0.000   0.000  0.000   0.000  1.000 2.000
Park 6    104.40 0.000 0.000  0.000 0.000  34.609  0.000  0.8548  15.00 2.000
Enviro    104.40 0.000 0.000  0.000 0.000  27.508  0.000  0.0983  16.00 2.000
Park 7    104.40 0.000 0.000  0.000 0.000  38.554  0.000   1.203  15.00 2.000
Park 5    104.40 0.000 0.000  0.000 0.000  40.921  0.000  0.2552  13.00 2.000
Park 3    104.40 0.000 0.000  0.000 0.000  32.242  0.000  0.5479  15.00 2.000
Park 2#277104.40 0.000 0.000  0.000 0.000  32.242  0.000  0.7550  15.00 2.000
Park 4    104.40 0.000 0.000  0.000 0.000  40.132  0.000   1.785  15.00 2.000
Park 9    104.40 0.000 0.000  0.000 0.000  38.554  0.000  0.0502  13.00 2.000
Beach 1   104.40 0.000 0.000  0.000 0.000  40.921  0.000  0.3451  13.00 0.000
Park 8    104.40 0.000 0.000  0.000 0.000  38.554  0.000   2.339  16.00 2.000
Junction 2104.40 0.000 0.000  0.000 0.000  26.719  0.000   4.376  17.00 2.000
Detention 104.40 0.000 0.000  0.000 0.000  29.875  0.000   9.693  19.00 0.000
RTA land  104.40 0.000 0.000  0.000 0.000  27.508  0.000  0.4338  20.00 2.000
RTA POND  104.40 0.000 0.000  0.000 0.000  38.554  0.000   2.578  30.00 2.000
Out       104.40 0.000 0.000  0.000 0.000  26.719  0.000   2.593  33.00 0.000


    SUMMARY OF BASIN RESULTS

 Link    Time   Peak   Time   Peak     Total   --------- Basin ---------
 Label    to   Inflow   to   Outflow Inflow     Vol.    Vol.   Stage
       Peak  (m^3/s) Peak  (m^3/s)  (m^3)    Avail    Used     Used
Detention 19.00  9.693 32.00   2.298    8925.5   0.0000   10018.4  76.078
RTA POND  30.00  2.578 31.00   2.592    9638.8   0.0000    7.9864  73.072

    SUMMARY OF BASIN OUTLET RESULTS

  Link    No.    S/D    Dia    Width    Pipe    Pipe
  Label   of    Factor               Length   Slope
            (m)    (m)    (m)     (m)     (%)
Detention 1.0     1.000         0.000     20.000  0.2000
RTA POND  1.0           1.750   0.000     80.000  0.2000


 LINK Staff          3.000
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