PAD 4 STORMWATER CONCEPT PLAN EASTERN LANDS ERSKINE PARK






JULY 2006

Report No. W03033.12-06C

Prepared for CSR Limited

BROWN CONSULTING

Engineers & Managers

PEOPLE & PROJECTS

COMMERCIAL IN CONFIDENCE

All intellectual property rights, including copyright, in designs developed and documents created by the group of companies listed below remain the property of those companies. Any use made of such design or document without the prior written approval of the Group will constitute an infringement of the rights of the companies which reserves all legal rights and remedies in respect of any such infringement.

The information, including any intellectual property, contained in this report is confidential and proprietary to the Group. It may only be used by the person to whom it is provided for the stated purpose for which it is provided and must not be imparted to any third person without the prior written approval of the Group. The Group reserves all legal rights and remedies in relation to any infringement of its rights in respect of its confidential information.

©

Brown Consulting (NSW) Pty Ltd

July 2006

DOCUMENT CONTROL

W03033.12-06

Issue	Date	Issue Details	Author	Checked	Approved
A	Jun 06	Draft Report	DH	RP	
B	Jun 06	Project Application	DH	RP	
C	July 06	Project Application - Revised Site Layout	DH	DR	

Brown Consulting (NSW) Pty Ltd
Engineers & Managers ABN 30 109 434 513
Telephone 02 **9900 1000** Facsimile 02 **9900 1099** E-mail **macquarie@brownconsulting.com.au**
Level 2, 82 Waterloo Road Macquarie Park PO Box 1484 Macquarie Centre North Ryde NSW 2113

PAD 4 STORMWATER CONCEPT PLAN
EASTERN LANDS, ERSKINE PARK

FOR CSR LIMITED

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
DIPNR	Department of Infrastructure, Planning and Natural Resources
DLWC	Department of Land and Water Conservation NSW
DNR	Department of Natural Resources
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

PAD 4 STORMWATER CONCEPT PLAN
EASTERN LANDS

ERSKINE PARK

FOR CSR LIMITED

1 INTRODUCTION

Brown Consulting has been commissioned to develop a stormwater concept plan for a proposed industrial development on CSR's property located within the Erskine Park Employment Area, see **Figure 1.1**. This concept plan covers stormwater quality and quantity management issues to support the project application for the earthworks, subdivision and associated infrastructure works to create a building pad, followed by the construction of a warehouse, car parks and truck parking areas forming the industrial development on Building Pad 4.

This report should be read in conjunction with the following reports:

- Brown Consulting (2006). *South Eastern Creek Realignment – Hydrology and Hydraulics, CSR Eastern Lands Erskine Park*, for CSR Limited. (Report No. W03033.12-05B)
- Brown Consulting (2006). *Stormwater Concept Plan, Eastern Lands Erskine Park*, for CSR Limited. (Report No. W03033.12-04B)

These reports have been submitted with the project application.

1.1 OBJECTIVES

The Stormwater Masterplan for the development has considered the objectives of the Development Control Plan for the Erskine Park Employment Area. To meet the objectives of the DCP, this report:

- Describes the operation of the stormwater management for Pad 4.

- Provides a concept sizing for an on-site detention (OSD) system to reduce the developed peak flows off the proposed development site at Pad 4 to ensure no increase in the flows downstream of the development.
- Provides a conceptual stormwater management system that will reduce the post-developed pollutant loads to meet the requirements of the DCP for the area.
- Describes the management of major and minor overland flows from the development.
- Provides a concept sediment and erosion control plan for the bulk earthworks.

Figure 1.1 Locality Plan (Source: UBD 2004)

1.2 DESCRIPTION OF STUDY AREA

The land to which the applications relate is located off Lenore Lane at Erskine Park, within the Penrith City Council local government area. The land is described as Pad 4 in proposed Lot 23, see **Appendix A** for lot plan. Pad 4 is located in the western half of proposed Lot 23.

The development area on Pad 4 will occupy an area of approximately 8.65 Ha. The associated creekworks spread onto the adjoining Crown road reserve to the south of the site (refer to report *South Eastern Creek Realignment* (Brown Consulting 2006)).

1.3 PREVIOUS STUDIES

The following studies have been undertaken for the site and adjoining properties. These studies have been reviewed as part of the preparation of this Plan.

- Boyden & Partners (1999). *Review of Stormwater Drainage & Water Management Systems Erskine Park Employment Area*, for Penrith City Council.
- Robinson GRC Consulting (2001). *Erskine Park Industrial Subdivision Drainage Requirements*, for CSR Limited.
- Buckton Lysenko (2002). *Stormwater Management Plan Comprising Creek Realignment Proposal for the Stramit Warehouse and Office Development at Corner Erskine Park Road and Mamre Road, Erskine Park,* for McRoss Developments Pty Ltd.
- Buckton Lysenko (2003). *Flood Study for Watercourse "A" for Industrial Development at Corner Erskine Park Road and Mamre Road, Erskine Park Incorporating Bridge Structure,* for Walker Corporation.
- WP Brown & Partners (2004). *Stormwater Masterplan*, for CSR Limited.
- Brown Consulting (2004). *Concept Stormwater Management Plan, Proposed Industrial Development Lot 93 Lenore Lane, Erskine Park*, for CSR Limited.
- Brown Consulting (2005). *Concept Stormwater Management Plan, Proposed Warehouse and Distribution Facility, Erskine Park*, for Walker Corporation.
- Brown Consulting (2005). *Stormwater Concept Plan, Proposed Woolworths Distribution Centre, CSR Lands Erskine Park*, for Australand.
- Brown Consulting (2006). *Stormwater Concept Plan, Eastern Lands Erskine Park*, for CSR Limited. (Report No. W03033.12-04B)

2 MANAGEMENT OF MINOR AND MAJOR FLOWS

The concept stormwater management plan for Pad 4 is shown in the drawings in **Appendix A**. The site has been divided into 7 main sub-catchments and the management of the discharges varies between sub-catchments. The sub-catchments generally refer to the proposed building roof area and to the drainage of the car and truck parking areas, which have been kept separate.

Council's DCP for the area allows for the water collected from the roof to be discharged from the site to the creeks without treatment. Flows from the developed site do need to be attenuated however to ensure post-developed flows do not exceed pre-developed flows. As such, roof runoff will be directed to the on-site detention tank, whilst all other runoff will be directed first to a water quality improvement device (such as an infiltration basin or bio-filtration swale), then to the detention tank or direct to the western swale.

The runoff from the site will be discharged to the swale to the west of the site, which itself discharges to the creek system at the southern boundary of the site. The peak flow discharged from the site does not exceed the existing rate from the site as detailed in **Section 3**.

2.1 MINOR FLOW MANAGEMENT

Runoff from the Pad 4 development area for storms up to the 20 year ARI will be collected by the following systems:

- For the truck parking/ manoeuvring areas, and the overflow car park area, a combination pit and pipe system discharging to the bio-retention basin;
- For the car parking areas to the east of the warehouse, a combination pit and pipe system discharging initially to two bio-filtration swales within the car park area, then to the OSD tank beneath the overflow car park;
- The roof water will be directed to the OSD tank at the south-western corner of the site.

The runoff from the site will be discharged to the swale to the west of the site, which itself discharges to the creek system at the southern boundary of the site.

Details of the proposed drainage system are shown in **Appendix A.**

2.2 MAJOR FLOW MANAGEMENT

Major flows are considered those flows in excess of the 20 year ARI peak flow. Such flows from the truck parking and manoeuvring areas will be directed by pipe and overland to the western corner of the truck area. A sag point at this corner will allow water to pond and enter the pipe system before being conveyed to the bio-retention basin, where detention is provided to help reduce the total site peak flows to pre-development levels, and where water quality improvement occurs.

Major flows from the car parking areas to the east of the warehouse will be directed by pipe and overland using the internal access-way along the southern boundary to the OSD tank, where detention is provided to reduce the peak flows to pre-development levels. The potential exists for these overland flows in the largest events to also be directed to the bio-retention basin. Major flows from the overflow car park area would similarly be directed to the bio-retention basin that lies adjacent to it, and could also be directed to the underlying OSD tank in the largest events. Both the tank and basin will attenuate flows from the site.

Stormwater flows from the roof areas will be directed to the OSD tank in the south-west corner of the site. The downpipes and drainage network for this system will need to be sized to convey the 100 year ARI flows to the tank.

It is proposed to provide a reconstructed creek system for the part of the overall development site (pads 4, 5 and 7 and the road drainage) draining to the southern boundary of the site. This is covered in detail in the report *South Eastern Creek Realignment, Erskine Park* by Brown Consulting.

3 CONCEPT OSD SYSTEM DESIGN

3.1 PRE-DEVELOPED FLOWS

The pre-developed site flows for Pad 4 have been determined using the *DRAINS* computer package with RAFTS type hydrology. These flows were established to enable comparison between existing and developed site flows.

Table 3.1 below summarises the pre-development catchment characteristics adopted to determine these flows.

Table 3.1 Pre-Development Catchment Characteristics

Variable	Pad 4
Area (ha)	7.76
Slope (%)	1.9
% Imp	5
Manning 'n'	0.035

Table 3.2 below summarises the peak flows from Pad 4 for the pre-development scenario.

Table 3.2 Pre-Development Peak Flows

ARI (Years)	Flow (m^3/s)
5	0.84
20	1.24
100	1.89

3.2 POST-DEVELOPED FLOWS

For the post-developed scenario the same pad area adopted for the pre-developed flows was adopted, however the fraction impervious was increased to 90% impervious as per Table 4 of the "Penrith City Council Guidelines for Engineering Works for Subdivision and Developments." The slope was also reduced to 1% as this is the estimated finished grade on all pipes and surfaces for the post-development scenario, and the roughness was reduced to 0.015.

Table 3.3 below summarises the peak flow of the site for the post-developed scenario. The results of the *DRAINS* run have been attached in **Appendix C**.

Table 3.3 Post-Development Peak Flows

ARI (Years)	Flow (m^3/s)
5	2.62
20	3.48
100	4.32

As the post-development peak flows exceed the pre-developed flows, On-Site Stormwater Detention will need to be provided.

3.3 POST-DEVELOPED FLOWS WITH OSD SYSTEM

All runoff from non-roof areas will be directed to a water quality device before being discharged from the site. The truck parking and overflow car park areas will drain to the bio-retention basin in the south-west of the site, whilst the other car park areas will drain to central bio-filtration swales then to the OSD tank. The bio-retention basin will store small storm volumes (up to 1 year ARI), with the stored water passing through a bio-filtration medium before being released to the drainage swale to the west of the site. Any flows in excess of the volume of this water quality basin will pass through a high level overflow pipe into Swale 2 to the west of the site.

All roof area runoff will be conveyed directly to the OSD tank. This OSD tank will be equipped with a high early discharge chamber, and both the tank and the bio-retention basin will form the OSD for the site.

The proposed OSD has been designed to limit the post-developed flows to the pre-development flows summarised in **Table 3.2**. This design was undertaken in the DRAINS program.

Table 3.4 below summarises the design characteristics adopted for the OSD tank, whilst **Table 4.2** summarises the design characteristics of the basin. The *DRAINS* results for the basin

are attached in **Appendix B**, and the peak flows for the 5, 20, and 100 year ARI are summarised in **Table 3.5**.

Table 3.4 Pad 4 OSD Tank Characteristics

Variable	Detention
Base RL	45.50
Low Level Outlet RL	45.50
Orifice Diameter (mm)	600
Top RL	47.00
Base Area (m^2)	866
Tank Vol (m^3)	1300

Table 3.5 demonstrates that the proposed OSD tank and basin will satisfactorily reduce the post-developed flows to the pre-developed flows.

Table 3.5 Post-Development Peak Flows with OSD

ARI (Years)	Flow (m^3/s)
5	0.78
20	0.82
100	1.45

4 STORMWATER TREATMENT

4.1 STORMWATER QUALITY OBJECTIVES

The stormwater treatment objectives for the proposed bio-retention basin have been adopted from the "Erskine Park Employment Area" DCP. The identified target pollutant removal efficiencies from this document are summarised below in **Table 4.1**.

Table 4.1 Pollutant Removal Objectives

Nutrient	Pollutant Removal Criteria (%)
Total Phosphorous	45
Total Nitrogen	45
Total Suspended Solids	80

4.2 STORMWATER TREATMENT STRATEGY

The stormwater treatment strategy for the site includes; bio-retention basins, litter pits and bio-filtration swales. In addition, stormwater reuse will be undertaken to reduce potable water demand. This will take the form of rainwater tanks that will be allocated to the site for potential use for irrigation, toilet flushing and other non-potable uses, possibly such as truck washing.

The clean water from the roof area of the Pad 4 site will be directed to the OSD tank rather than the water quality basin. All other runoff from Pad 4 will be directed to water quality devices before being discharged.

4.3 PAD 4 WATER QUALITY BASIN

The proposed water quality basin has been sized using the MUSIC water quality program. The model data and results have been attached in **Appendix C** and a summary of the designed basin details is shown below in **Table 4.2**.

Table 4.2 Pad 4 Bio-Filtration Basin Details

Parameter	
Basin Base Area (m^2)	520
Bio-filter Area (m^2)	520
Base Level (m AHD)	45.5
Depth of Ponding (m) when overflow begins	1.3
Volume 1 Year ARI (m^3)	600
Peak Flow 1 Year ARI (m^3/s)	0.38
Volume of Filtration Basin (m^3) at Overflow Level	700
Filter Depth (m)	0.6

The basin has been designed to store greater than the 1 Year ARI storm event and drain this via a subsoil drainage system under the bio-filter layer. All flows which exceed the 1 Year ARI will overflow to the grass buffer strip to the west, then across the buffer strip to the swale.

The basin has been run through the *MUSIC* program to assess whether the design will meet the requirements spelled out in the "Erskine Park Employment Area – Development Control Plan" shown in **Table 4.1**. The input data and results of this model have been attached in **Appendix C. Table 4.3** below compares the post-treatment annual pollutant loads with the pre-treatment pollutant loads calculated in the *MUSIC* model, and the calculated removal efficiency these represent.

Table 4.3 Comparison of Pre-treatment and Post-treatment Pollutant Loads for the Developed Site from the MUSIC Model

Site	Loads (kg/y)		
	TSS	TP	TN
Pre-treatment	1620	4.3	31.8
Post-treatment	132	0.88	11.3
Removal Efficiency	91.8%	79.8%	64.5%

Table 4.3 above demonstrates that the treatment train designed will adequately meet the requirements of the Erskine Park Employment Area DCP, and reduce the post-development pollutant loads by more than the amounts shown in **Table 4.1**.

5 SOIL & WATER MANAGEMENT DURING CONSTRUCTION

Sedimentation and erosion controls will be constructed prior to commencement of any work to minimise the discharge of sediment from the site. The controls will be designed and installed in accordance with the requirements of the NSW Department of Housing 'Soils & Construction' manual.

5.1 TEMPORARY SEDIMENT & EROSION CONTROLS

The engineering bulk earthworks drawings show the concept sediment and erosion control plan for the development.

- A single all weather access way at the front of the property consisting of 50-75mm aggregate or similar material at a minimum thickness of 150mm, laid over geo-fabric and constructed prior to commencement of works.
- A shaker pad will be used at the entrance to the site to remove clay from vehicles leaving the site so as to maintain public roads in a clean condition.
- This sediment control basin should be located where the proposed water quality basin is to be constructed immediately to the west of the site. Once the majority of the site has been constructed the basin should then be converted to its ultimate use as a water quality control basin.
- Disturbed areas will be rehabilitated with indigenous plant species, landscaped and treated by approved methods of erosion mitigation such as mulching, revegetation with native grasses or other suitable stabilising processes within fifteen days of the completion of works.
- All runoff and erosion controls will be installed before any works are carried out at the site.
- Upslope clean surface runoff will be diverted via diversion drains and sediment fencing around the disturbed areas.
- Installing *SoilLocker* at the down-slope of the disturbed areas to capture sediment and debris escaping from the site.

- *SoilLocker* shall be installed on the boundary of the creek buffer area.
- Topsoil stockpiling stripped from the construction site shall be diverted away from drainage lines, stormwater inlets and be suitably covered by impervious membrane material and screened by sediment fencing.
- Sediment end erosion controls shall be inspected weekly or after each storm event for litter, sediment, and organic waste accumulation. All sediment/debris shall be removed within two (2) working days.

5.2 SEDIMENT BASIN CONCEPT DESIGN

The sediment basin has been designed to capture the first 25mm runoff from the 75th percentile, 5-day rainfall event, as per the NSW Department of Housing Guidelines. An additional 50% capacity has been provided for storage of sediment.

The concept design is based on the equation: $V = 10.C_v.A.R_{5day\ 75th\%\ ile}$

As recommended by the *NSW Department of Housing (1998)*, a volumetric runoff coefficient (C_v) of 0.5 has been adopted for the construction phase. The outlet to each of the basins will be a slow control discharge. A spillway will be incorporated into the basin design for an overflow.

5.3 SEDIMENT BASIN FLOCCULATION & DISCHARGE WATER QUALITY CRITERIA

Runoff captured in the sediment basin will be treated with an approved flocculating agent before discharging water, as the catchment contains soils that are classified as fine dispersible, which do not readily settle from suspension. The flocculation should ensure that discharges contain no more than 50 mg/L of suspended solids or 30 NTU before being discharged. Furthermore, dewatering should preferably be over existing stable, grassed areas and not directly into the creek.

6 CONCLUSION

This Stormwater Concept Plan describes the management of stormwater within Pad 4. The report sets out the basic stormwater parameters that need to be met by the future development of the site.

The proposal satisfies the requirements for stormwater quality and quantity control identified by Penrith Council in the DCP for the area.

7 REFERENCES

Boyden & Partners (1999). *Review of Stormwater Drainage & Water Management Systems Erskine Park Employment Area.*

Brisbane City Council (2003). *Guidelines for Pollutant Export Modelling in Brisbane Version 7.*

Brown Consulting (NSW) (2004). *Concept Stormwater Management Plan, Proposed Industrial Subdivision Lot 93 Lenore Lane, Erskine Park.*

Brown Consulting (NSW) (2005). *Stormwater Concept Plan, Proposed Woolworths Distribution Centre, CSR Lands Erskine Park.*

Buckton Lysenko (2002). *Stormwater Management Plan Comprising Creek Realignment Proposal for the Stramit Warehouse and Office Development at Corner Erskine Park Road and Mamre Road, Erskine Park.*

Buckton Lysenko (2003). *Flood Study for Watercourse "A" for Industrial Development at Corner Erskine Park Road and Mamre Road, Erskine Park Incorporating Bridge Structure.*

Department of Housing (1998). *Managing Urban Stormwater: Soils and Construction.*

Duncan H.P. (1999). *Urban Stormwater Quality: A Statistical Overview,* CRC for Catchment Hydrology.

Engineers Australia (2003). *Australian Runoff Quality (Draft).*

Melbourne Water (2004). *WSUD Engineering Procedures: Stormwater.*

NSW EPA (1997a). *Managing Urban Stormwater: Council Handbook – Draft.*

NSW EPA (1997b). *Managing Urban Stormwater: Treatment Techniques.*

Penrith City Council (2003). *Erskine Park Employment Area Development Control Plan*

Penrith City Council (1997) *Guidelines for Engineering Works For Subdivisions and Developments*

Robinson GRC Consulting (2001). *Erskine Park Industrial Subdivision Drainage Requirements.*

UBD 2004, *UBD Australian Cities 2004 on Disk*

Upper Parramatta River Catchment Trust (2004). *Water Sensitive Urban Design Technical Guidelines for Western Sydney.*

WP Brown & Partners (2004). *Stormwater Masterplan, Proposed Industrial Subdivision Mamre Road and Lenore Lane, Erskine Park.*

8 APPENDICES

Appendix A **Drawings**

Appendix B **Post-Development Flows with Detention - Pad 4**

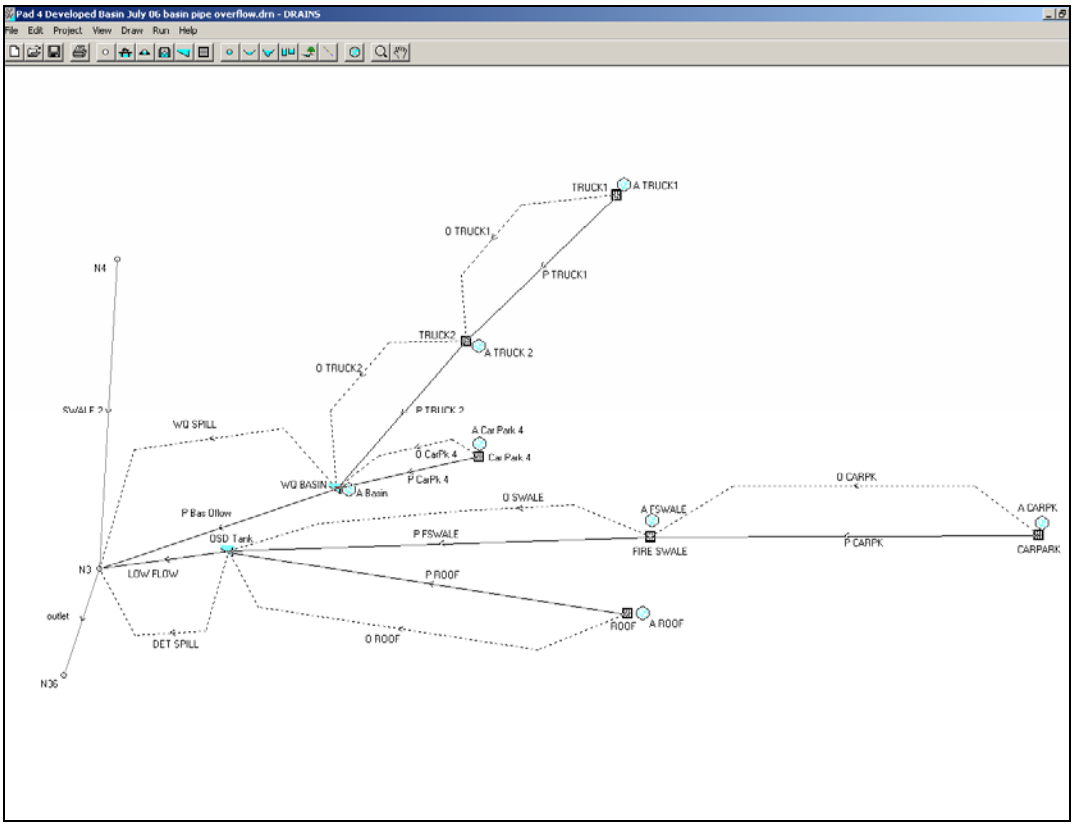
Appendix C **Water Quality Results Pad 4**

APPENDIX A

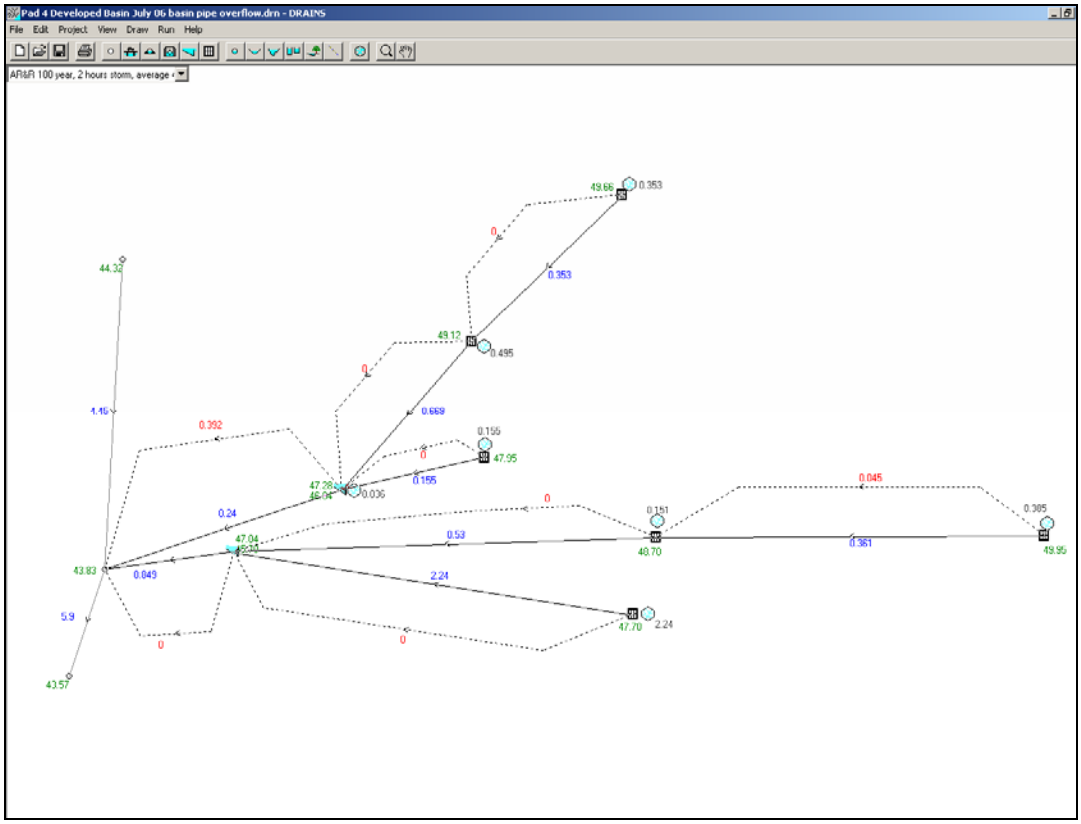
DRAWINGS

APPENDIX B

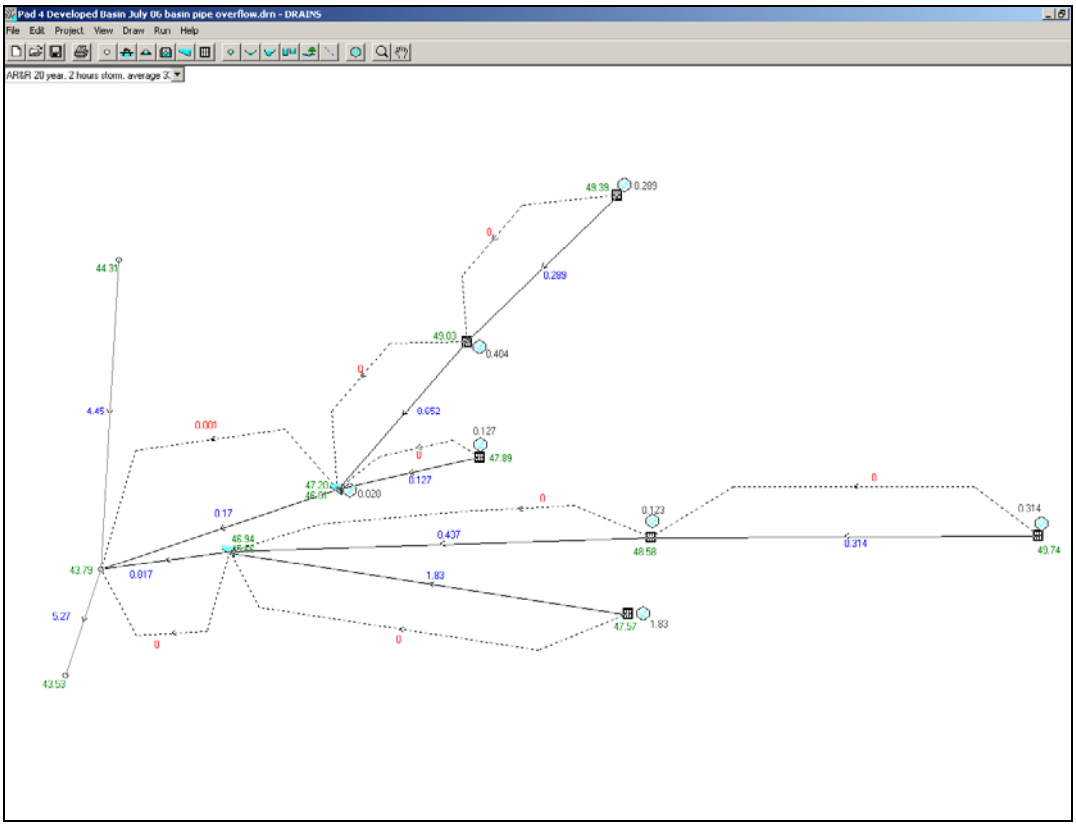
Post-Development Flows with Detention Pad 4



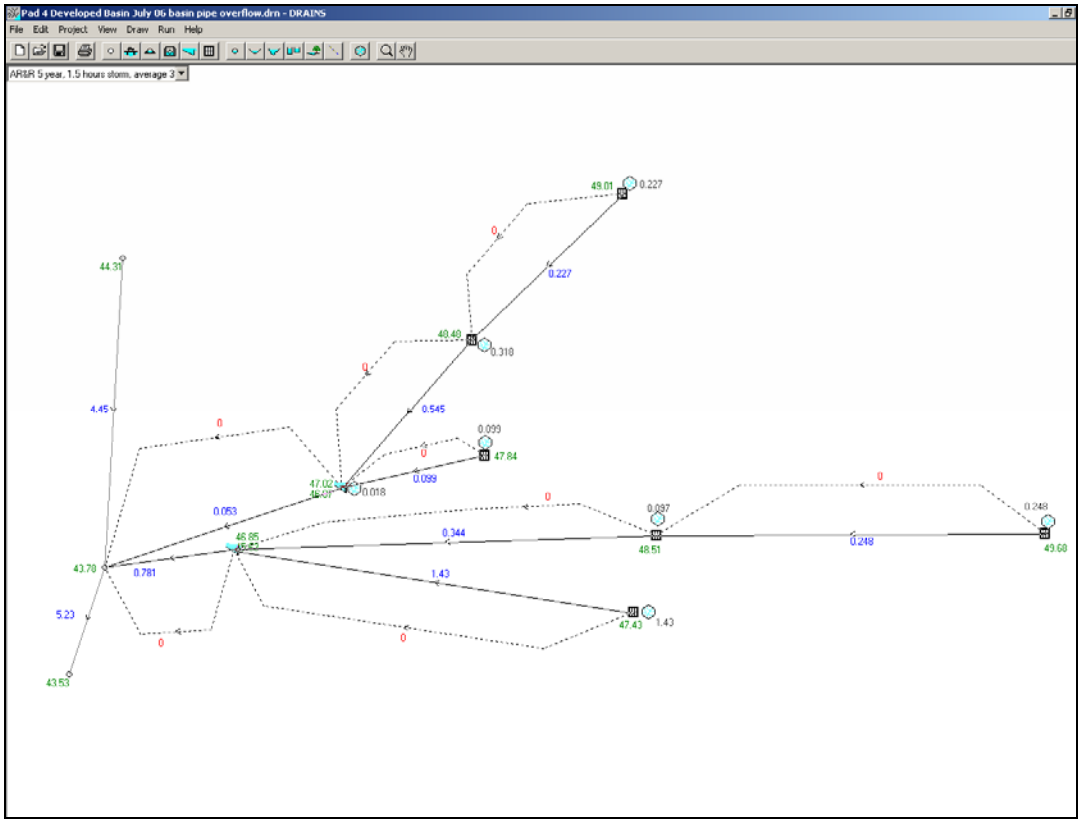
***DRAINS* MODEL FOR DEVELOPED SITE WITH BASIN AND OSD TANK**



100 YEAR ARI RESULTS



20 YEAR ARI RESULTS



5 YEAR ARI RESULTS

DRAINS DATA

PIT / NODE DETAILS			Version 9																
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full					
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor			lid		Shock Loss					
				(cu.m)	Coeff. Ku			(cu.m/s)											
N4	Node					46.5		4.45		295828.8	6256007		130						
N3	Node					46		0		295813.7	6255742		129						
N36	Node					46		0		295783.2	6255650		38293						
CARPARK	OnGrade	UNLIMITED	UNLIMITED	INLET	1.5	49.95		0	0	296617.4	6255770	No	139	1 x Ku					
FIRE SWALE	OnGrade	UNLIMITED	UNLIMITED	INLET	1.5	48.7		0	0	296285.3	6255769	No	141	1 x Ku					
TRUCK1	OnGrade	UNLIMITED	UNLIMITED	INLET	1.5	49.93		0	0	296256.5	6256062	No	143	1 x Ku					
TRUCK2	Sag	UNLIMITED	UNLIMITE	100	1.5	49	0.2	0	0	296127.6	6255937	No	144	1 x Ku					
ROOF	OnGrade	UNLIMITED	UNLIMITED	INLET	1.5	48.5		0	0	296265.6	6255704	No	152	1 x Ku					
Car Park 4	OnGrade	UNLIMITED	UNLIMITED	INLET	1.5	48.5		0	0	296138.9	6255837	No	1801972	1 x Ku					
DETENTION BASIN DETAILS																			
Name	Elev	Volume	Init Vol. (cu	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Leng	id				
OSD Tank	45.5	0	0	Orifice		600	45.8			295924.4	6255757	Yes	46.5	3	127				
	46.5	866																	
	47	1300																	
WQ BASIN	45.5	0	0	Culvert	0.5					296016.9	6255810	No			126				
	46.5	540																	
	47	810																	
SUB-CATCHMENT DETAILS																			
Name	Pit or	Total	Impervious	Avg	Hydrological														
	Node	Area	Area	Slope(%)	Model														
A CARPK	CARPARK	0.783	73.3	0.5	EP RAFTS														
A FSWALE	FIRE SWALE	0.306	90	0.5	EP RAFTS														
A TRUCK1	TRUCK1	0.7122	95	0.5	EP RAFTS														
A TRUCK 2	TRUCK2	0.9978	95	0.5	EP RAFTS														
A Basin	WQ BASIN	0.1	10	0.5	EP RAFTS														
A ROOF	ROOF	4.4577	100	2	EP RAFTS														
A Car Park 4	Car Park 4	0.31	95	0.5	EP RAFTS														
PIPE DETAILS																			
Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	Rl	Chg	RL	etc
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)	(m)	(m)
P CARPK	CARPARK	FIRE SWAL	250	49.05	47.8	0.5	Concrete, r	525	525	0.3	New	1	CARPARK	0					
P FSWALE	FIRE SWALE	OSD Tank	250	47.8	46.55	0.5	Concrete, r	600	600	0.3	NewFixed	1	FIRE SWA	0					
LOW FLOW	OSD Tank	N3	25	45	44.875	0.5	Concrete, r	675	675	0.3	NewFixed	1	OSD Tank	0					
P TRUCK1	TRUCK1	TRUCK2	185	48.525	47.6	0.5	Concrete, r	600	600	0.3	New	1	TRUCK1	0					
P TRUCK 2	TRUCK2	WQ BASIN	185	47.525	46.6	0.5	Concrete, r	600	600	0.3	NewFixed	1	TRUCK2	0					
P Bas Oflow	WQ BASIN	N3	50	46.8	43.5	6.6	Concrete, r	600	600	0.3	NewFixed	1	WQ BASIN	0					
P ROOF	ROOF	OSD Tank	50	46.5	46	1	Concrete, r	1500	1524	0.3	NewFixed	1	ROOF	0					
P CarPk 4	Car Park 4	WQ BASIN	50	47.5	47	1	Concrete, r	450	450	0.3	NewFixed	1	Car Park 4	0					
DETAILS of SERVICES CROSSING PIPES																			
Pipe	Chg	Bottom	Height of S	Chg	Bottom	Height of S	Chg	Bottom	Height of S	etc									
	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	etc									
CHANNEL DETAILS																			
Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Roofed						
				(m)	(m)	(m)	(%)	(m)	(1:?)	(1:?)	n	(m)							
SWALE 2	N4	N3	Prismatic	100	43.55	43.05	0.5	3	4	4	0.05	1.4	No						
outlet	N3	N36	Prismatic	10	43.05	43	0.5	3	4	4	0.05	1.4	No						
OVERFLOW ROUTE DETAILS																			
Name	From	To	Travel	Spill	Crest	Weir	Cross	Safe Depth	SafeDepth	Safe	Bed	D/S Area		id					
			Time	Level	Length	Coeff. C	Section	Major Stor	Minor Stor	DxV	Slope	Contributing							
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%							
O CARPK	CARPARK	FIRE SWAL	1				Dummy us	0.2	0.05	0.6	1	0		528217					
O SWALE	FIRE SWALE	OSD Tank	1				Dummy us	0.2	0.05	0.6	1	0		528221					
DET SPILL	OSD Tank	N3	0.5	47	2	1.7	Dummy us	0.2	0.05	0.6	1	0		161					
O TRUCK1	TRUCK1	TRUCK2	1				Dummy us	0.2	0.05	0.6	1	0		528213					
O TRUCK2	TRUCK2	WQ BASIN	1				Dummy us	0.2	0.05	0.6	1	0		528219					
WQ SPILL	WQ BASIN	N3	0.1	47.2	10	1.7	Dummy us	0.2	0.05	0.6	1	0		160					
O ROOF	ROOF	OSD Tank	2				Dummy us	0.2	0.05	0.6	1	0		262853					
O CarPk 4	Car Park 4	WQ BASIN	1				Dummy us	0.2	0.05	0.6	1	0		1801980					

PIT / NODE DETAILS				Version 8									
Name	Max HGL	Max Pond	Max Surfa	Max Pond	Min	Overflow	Constraint						
		HGL	Flow Arrivi	Volume	Freeboard	(cu.m/s)							
			(cu.m/s)	(cu.m)	(m)								
N4	44.32		0										
N3	43.83		0										
N36	43.57		0										
CARPARK	49.95		0.385		0	0.045	Outlet System						
FIRE SWALE	48.7		0.189		0	0	Outlet System						
TRUCK1	49.66		0.353		0.27	0	None						
TRUCK2	49.12	49.12	0.495	44.7	-0.12	0	Outlet System						
ROOF	47.7		2.24		0.8	0	None						
Car Park 4	47.95		0.155		0.55	0	None						
SUB-CATCHMENT DETAILS													
Name	Max	Due to Storm											
	Flow												
	(cu.m/s)												
A CARPK	0.385	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1											
A FSWALE	0.151	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1											
A TRUCK1	0.353	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1											
A TRUCK 2	0.495	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1											
A Basin	0.036	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1											
A ROOF	2.24	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1											
A Car Park 4	0.155	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1											
PIPE DETAILS													
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm								
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)									
P CARPK	0.361	1.7	49.762	48.7	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
P FSWALE	0.53	2.2	48.431	47.035	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
LOW FLOW	0.849	2.5	45.696	45.467	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
P TRUCK1	0.353	1.2	49.545	49.121	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
P TRUCK 2	0.669	2.4	48.701	47.281	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
P Bas Oflow	0.24	5	46.935	43.827	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
P ROOF	2.24	3.9	47.036	47.035	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
P CarPk 4	0.155	2.1	47.71	47.281	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
CHANNEL DETAILS													
Name	Max Q	Max V	Chainage	Max	Due to Storm								
	(cu.m/s)	(m/s)	(m)	HGL (m)									
SWALE 2	4.45	1.8			AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
outlet	5.901	2			AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1								
OVERFLOW ROUTE DETAILS													
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm					
O CARPK	0.045	0.045	7.665	0.026	0.01	8.83	0.38	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1					
O SWALE	0	0	7.665	0	0	0	0						
DET SPILL	0	0	7.665	0	0	0	0						
O TRUCK1	0	0	7.665	0	0	0	0						
O TRUCK2	0	0	7.665	0	0	0	0						
WQ SPILL	0.392	0.392	7.665	0.06	0.04	15.94	0.73	AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1					
O ROOF	0	0	7.665	0	0	0	0						
O CarPk 4	0	0	7.665	0	0	0	0						
DETENTION BASIN DETAILS													
Name	Max WL	MaxVol	Max Q	Max Q	Max Q								
			Total	Low Level	High Level								
OSD Tank	47.04	1272.7	0.849	0.849	0								
WQ BASIN	47.28	961.7	0.632	0.24	0.392								
CONTINUITY CHECK for AR&R 100 year, 2 hours storm, average 44.3 mm/h, Zone 1													
Node	Inflow	Outflow	Storage Cl	Difference									
	(cu.m)	(cu.m)	(cu.m)	%									
N4	0	49394.85	0	0									
N3	55248.28	55114.18	0	0.2									
N36	55114.18	55114.18	0	0									
CARPARK	655.98	656.01	0	0									
FIRE SWALE	918.6	918.49	0	0									
OSD Tank	4814.21	4778.57	48.32	-0.3									
TRUCK1	618.78	618.78	0	0									
TRUCK2	1485.24	1481.92	0	0.2									
WQ BASIN	1824.02	1074.92	750.23	-0.1									
ROOF	3895.71	3895.71	0	0									
Car Park 4	269.47	269.47	0	0									
Run Log for Pad 4 Developed Basin July 06 basin pipe overflow.drn run at 11:30:44 on 5/7/2006													
No water upwelling from any pit.													
Freeboard was less than 0.15m at TRUCK2, FIRE SWALE, CARPARK													
To see more detailed results select the Edit/Copy Results to Spreadsheet menu item, and paste them into a spreadsheet.													

PIT / NODE DETAILS				Version 8										
Name	Max HGL	Max Pond	Max Surfa	Max Pond	Min	Overflow	Constraint							
		HGL	Flow Arrivi	Volume	Freeboard	(cu.m/s)								
			(cu.m/s)	(cu.m)	(m)									
N4	44.31		0											
N3	43.79		0											
N36	43.53		0											
CARPARK	49.74		0.314		0.21	0	None							
FIRE SWALE	48.58		0.123		0.12	0	None							
TRUCK1	49.39		0.289		0.54	0	None							
TRUCK2	49.03	49.03	0.404	8	-0.03	0	Outlet System							
ROOF	47.57		1.825		0.93	0	None							
Car Park 4	47.89		0.127		0.61	0	None							
SUB-CATCHMENT DETAILS														
Name	Max	Due to Storm												
	Flow													
	(cu.m/s)													
A CARPK	0.314	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1												
A FSWALE	0.123	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1												
A TRUCK1	0.289	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1												
A TRUCK 2	0.404	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1												
A Basin	0.028	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1												
A ROOF	1.825	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1												
A Car Park 4	0.127	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1												
PIPE DETAILS														
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm									
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)										
P CARPK	0.314	1.6	49.505	48.583	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
P FSWALE	0.437	2	48.223	46.973	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
LOW FLOW	0.817	2.5	45.661	45.456	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
P TRUCK1	0.289	1	49.316	49.032	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
P TRUCK 2	0.652	2.3	48.625	47.202	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
P Bas Oflow	0.17	4.7	46.912	43.786	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
P ROOF	1.825	3.7	46.976	46.944	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
P CarPk 4	0.127	2	47.688	47.202	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
CHANNEL DETAILS														
Name	Max Q	Max V	Chainage	Max	Due to Storm									
	(cu.m/s)	(m/s)	(m)	HGL (m)										
SWALE 2	4.45	1.8			AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
outlet	5.267	1.9			AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1									
OVERFLOW ROUTE DETAILS														
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm						
O CARPK	0	0	0.256	0	0	0	0							
O SWALE	0	0	0.256	0	0	0	0							
DET SPILL	0	0	0.256	0	0	0	0							
O TRUCK1	0	0	0.256	0	0	0	0							
O TRUCK2	0	0	0.256	0	0	0	0							
WQ SPILL	0.001	0.001	0.256	0.007	0	2.25	0.15	AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1						
O ROOF	0	0	0.256	0	0	0	0							
O CarPk 4	0	0	0.256	0	0	0	0							
DETENTION BASIN DETAILS														
Name	Max WL	MaxVol	Max Q	Max Q	Max Q									
			Total	Low Level	High Level									
OSD Tank	46.94	0	0.817	0.817	0									
WQ BASIN	47.2	0	0.171	0.17	0.001									
CONTINUITY CHECK for AR&R 20 year, 2 hours storm, average 33.6 mm/h, Zone 1														
Node	Inflow	Outflow	Storage Cl	Difference										
	(cu.m)	(cu.m)	(cu.m)	%										
N4	0	49394.85	0	0										
N3	53626.63	53492.63	0	0.2										
N36	53492.63	53492.63	0	0										
CARPARK	489.07	489.07	0	0										
FIRE SWALE	686.44	685.79	0	0.1										
OSD Tank	3630.38	3601.72	41.31	-0.3										
TRUCK1	467.06	467.06	0	0										
TRUCK2	1120.9	1121.71	0	-0.1										
WQ BASIN	1376.91	630.09	747.69	-0.1										
ROOF	2944.59	2944.59	0	0										
Car Park 4	203.39	203.39	0	0										
Run Log for Pad 4 Developed Basin July 06 basin pipe overflow.drn run at 11:28:57 on 5/7/2006														
No water upwelling from any pit.														
Freeboard was less than 0.15m at TRUCK2, FIRE SWALE														
To see more detailed results select the Edit/Copy Results to Spreadsheet menu item, and paste them into a spreadsheet.														

PIT / NODE DETAILS				Version 8						
Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivir (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint			
N4	44.31		0							
N3	43.78		0							
N36	43.53		0							
CARPARK	49.68		0.248		0.27	0	None			
FIRE SWALE	48.51		0.097		0.19	0	None			
TRUCK1	49.01		0.227		0.92	0	None			
TRUCK2	48.48	49	0.318	0	0.52	0	None			
ROOF	47.43		1.434		1.07	0	None			
Car Park 4	47.84		0.099		0.66	0	None			

SUB-CATCHMENT DETAILS										
Name	Max Flow (cu.m/s)	Due to Storm								
A CARPK	0.248	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1								
A FSWALE	0.097	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1								
A TRUCK1	0.227	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1								
A TRUCK 2	0.318	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1								
A Basin	0.018	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1								
A ROOF	1.434	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1								
A Car Park 4	0.099	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1								

PIPE DETAILS										
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm					
P CARPK	0.248	1.8	49.362	48.514	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					
P FSWALE	0.344	2	48.151	46.901	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					
LOW FLOW	0.781	2.4	45.627	45.442	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					
P TRUCK1	0.227	1.8	48.802	48.484	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					
P TRUCK 2	0.545	2.2	48.2	47.087	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					
P Bas Oflow	0.053	3	46.868	43.784	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					
P ROOF	1.434	3.6	46.911	46.847	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					
P CarPk 4	0.099	1.9	47.665	47.165	AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					

CHANNEL DETAILS										
Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	Due to Storm					
SWALE 2	4.45	1.8			AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					
outlet	5.231	1.9			AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1					

OVERFLOW ROUTE DETAILS										
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm		
O CARPK	0	0	0.256	0	0	0	0			
O SWALE	0	0	0.256	0	0	0	0			
DET SPILL	0	0	0.256	0	0	0	0			
O TRUCK1	0	0	0.256	0	0	0	0			
O TRUCK2	0	0	0.256	0	0	0	0			
WQ SPILL	0	0	0.256	0	0	0	0			
O ROOF	0	0	0.256	0	0	0	0			
O CarPk 4	0	0	0.256	0	0	0	0			

DETENTION BASIN DETAILS										
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level					
OSD Tank	46.85	475.9	0.781	0.781	0					
WQ BASIN	47.02	819.6	0.053	0.053	0					

CONTINUITY CHECK for AR&R 5 year, 1.5 hours storm, average 30.3 mm/h, Zone 1										
Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %						
N4	0	41384.94	0	0						
N3	43953.85	43819.83	0	0.3						
N36	43819.83	43819.83	0	0						
CARPARK	321.14	321.14	0	0						
FIRE SWALE	452.59	451.12	0	0.3						
OSD Tank	2426.21	2396.89	39.87	-0.4						
TRUCK1	312.29	312.29	0	0						
TRUCK2	749.46	749.46	0	0						
WQ BASIN	916.86	172.05	744.93	0						
ROOF	1975.09	1975.09	0	0						
Car Park 4	136.04	136.04	0	0						

Run Log for Pad 4 Developed Basin July 06 basin pipe overflow.drn run at 11:31:47 on 5/7/2006

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

To see more detailed results select the Edit/Copy Results to Spreadsheet menu item, and paste them into a spreadsheet.

APPENDIX C

Water Quality Results Pad 4

Source nodes

Location	Truck area	Car Park 4	Car Park 1&2	Car Park 3				
ID	1	3	4	5				
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode				
Total Area (ha)	1.710	0.310	0.455	0.328				
Area Impervious (ha)	1.233	0.224	0.238	0.200				
Area Pervious (ha)	0.477	0.086	0.217	0.128				
Field Capacity (mm)	80	50	50	50				
Pervious Area Infiltration Capacity coefficient - a	200	50	50	50				
Pervious Area Infiltration Capacity exponent - b	1	2	2	2				
Impervious Area Rainfall Threshold (mm/day)	1	1	1	1				
Pervious Area Soil Storage Capacity (mm)	120	150	150	150				
Pervious Area Soil Initial Storage (% of Capacity)	25	25	25	25				
Groundwater Initial Depth (mm)	50	50	50	50				
Groundwater Daily Recharge Rate (%)	25	0.65	0.65	0.65				
Groundwater Daily Baseflow Rate (%)	5	0.85	0.85	0.85				
Groundwater Daily Deep Seepage Rate (%)	0	0	0	0				
Stormflow Total Suspended Solids Mean (log mg/L)	1.92	2.2	2.2	2.2				
Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.44	0.32	0.32	0.32				
Stormflow Total Suspended Solids Estimation Method	Mean	Mean	Mean	Mean				
Stormflow Total Suspended Solids Serial Correlation	0	0	0	0				
Stormflow Total Phosphorus Mean (log mg/L)	-0.59	-0.45	-0.45	-0.45				
Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.36	0.25	0.25	0.25				
Stormflow Total Phosphorus Estimation Method	Mean	Mean	Mean	Mean				
Stormflow Total Phosphorus Serial Correlation	0	0	0	0				
Stormflow Total Nitrogen Mean (log mg/L)	0.25	0.42	0.42	0.42				
Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.32	0.19	0.19	0.19				
Stormflow Total Nitrogen Estimation Method	Mean	Mean	Mean	Mean				
Stormflow Total Nitrogen Serial Correlation	0	0	0	0				
Baseflow Total Suspended Solids Mean (log mg/L)	0.78	1.1	1.1	1.1				
Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.45	0.17	0.17	0.17				
Baseflow Total Suspended Solids Estimation Method	Mean	Mean	Mean	Mean				
Baseflow Total Suspended Solids Serial Correlation	0	0	0	0				
Baseflow Total Phosphorus Mean (log mg/L)	-1.11	-0.82	-0.82	-0.82				
Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.48	0.19	0.19	0.19				
Baseflow Total Phosphorus Estimation Method	Mean	Mean	Mean	Mean				
Baseflow Total Phosphorus Serial Correlation	0	0	0	0				
Baseflow Total Nitrogen Mean (log mg/L)	0.14	0.32	0.32	0.32				
Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.2	0.12	0.12	0.12				
Baseflow Total Nitrogen Estimation Method	Mean	Mean	Mean	Mean				
Baseflow Total Nitrogen Serial Correlation	0	0	0	0				
OUT - Mean Annual Flow (ML/yr)	9.74	1.79	2.18	1.72				
OUT - TSS Mean Annual Load (kg/yr)	754	276	326	261				
OUT - TP Mean Annual Load (kg/yr)	2.37	0.625	0.747	0.594				
OUT - TN Mean Annual Load (kg/yr)	17	4.69	5.66	4.47				
OUT - Gross Pollutant Mean Annual Load (kg/yr)	301	54.5	65.4	52.1				

No Imported Data Source nodes

USTM treatment nodes

Location	Infiltration Basin	Bio-Retention	Bio-Retention					
ID	2	6	7					
Node Type	BioRetentionNode	BioRetentionNode	BioRetentionNode					
Lo-flow bypass rate (cum/sec)	0	0	0					

Hi-flow bypass rate (cum/sec)	100	100	100					
Inlet pond volume								
Area (sqm)	565	135	248					
Extended detention depth (m)	1.5	0	0					
Permanent pool volume (cum)								
Proportion vegetated								
Equivalent pipe diameter (mm)								
Overflow weir width (m)	2	2	2					
Notional Detention Time (hrs)								
Orifice discharge coefficient								
Weir coefficient	1.7	1.7	1.7					
Number of CSTR cells	3	3	3					
Total Suspended Solids k (m/yr)	1000	1000	1000					
Total Suspended Solids C* (mg/L)	12	12	12					
Total Suspended Solids C** (mg/L)								
Total Phosphorus k (m/yr)	500	500	500					
Total Phosphorus C* (mg/L)	0.13	0.13	0.13					
Total Phosphorus C** (mg/L)								
Total Nitrogen k (m/yr)	50	50	50					
Total Nitrogen C* (mg/L)	1.3	1.3	1.3					
Total Nitrogen C** (mg/L)								
Threshold hydraulic loading for C** (m/yr)								
Extraction for Re-use	Off	Off	Off					
Annual Re-use Demand - scaled by daily PET (ML)								
Constant Daily Re-use Demand (kL)								
User-defined Annual Re-use Demand (ML)								
Percentage of User-defined Annual Re-use Demand Jan								
Percentage of User-defined Annual Re-use Demand Feb								
Percentage of User-defined Annual Re-use Demand Mar								
Percentage of User-defined Annual Re-use Demand Apr								
Percentage of User-defined Annual Re-use Demand May								
Percentage of User-defined Annual Re-use Demand Jun								
Percentage of User-defined Annual Re-use Demand Jul								
Percentage of User-defined Annual Re-use Demand Aug								
Percentage of User-defined Annual Re-use Demand Sep								
Percentage of User-defined Annual Re-use Demand Oct								
Percentage of User-defined Annual Re-use Demand Nov								
Percentage of User-defined Annual Re-use Demand Dec								
Filter area (sqm)	500	135	240					
Filter depth (m)	0.6	0.6	0.6					
Filter median particle diameter (mm)	1	5	5					
Saturated hydraulic conductivity (mm/hr)	120	100	100					
Voids ratio	0.3	0.3	0.3					
Length (m)								
Bed slope								
Base Width (m)								
Top width (m)								
Vegetation height (m)								
Proportion of upstream impervious area treated								
Seepage Rate (mm/hr)	35	0	0					
Evap Loss as proportion of PET								
Depth in metres below the drain pipe	0	0	0					
IN - Mean Annual Flow (ML/yr)	11.5	2.18	1.72					
IN - TSS Mean Annual Load (kg/yr)	1.03E+03	326	261					

IN - TP Mean Annual Load (kg/yr)	3	0.747	0.594					
IN - TN Mean Annual Load (kg/yr)	21.7	5.66	4.47					
IN - Gross Pollutant Mean Annual Load (kg/yr)	355	65.4	52.1					
OUT - Mean Annual Flow (ML/yr)	4.82	2.2	1.76					
OUT - TSS Mean Annual Load (kg/yr)	33.3	63.5	35.3					
OUT - TP Mean Annual Load (kg/yr)	0.361	0.304	0.213					
OUT - TN Mean Annual Load (kg/yr)	4.92	3.64	2.75					
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0	0	0					

No Generic treatment nodes

Other nodes

Location	Junction	Receiving Node						
ID	8	9						
Node Type	JunctionNode	ReceivingNode						
IN - Mean Annual Flow (ML/yr)	8.78	8.78						
IN - TSS Mean Annual Load (kg/yr)	132	132						
IN - TP Mean Annual Load (kg/yr)	0.878	0.878						
IN - TN Mean Annual Load (kg/yr)	11.3	11.3						
IN - Gross Pollutant Mean Annual Load (kg/yr)	0	0						
OUT - Mean Annual Flow (ML/yr)	8.78	0						
OUT - TSS Mean Annual Load (kg/yr)	132	0						
OUT - TP Mean Annual Load (kg/yr)	0.878	0						
OUT - TN Mean Annual Load (kg/yr)	11.3	0						
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0	0						

Links

Location	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source node ID	1	4	5	2	6	7	3	8
Target node ID	2	6	7	8	8	8	2	9
Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
Muskingum K								
Muskingum theta								
IN - Mean Annual Flow (ML/yr)	9.74	2.18	1.72	4.82	2.2	1.76	1.79	8.78
IN - TSS Mean Annual Load (kg/yr)	754	326	261	33.3	63.5	35.3	276	132
IN - TP Mean Annual Load (kg/yr)	2.37	0.747	0.594	0.361	0.304	0.213	0.625	0.878
IN - TN Mean Annual Load (kg/yr)	17	5.66	4.47	4.92	3.64	2.75	4.69	11.3
IN - Gross Pollutant Mean Annual Load (kg/yr)	301	65.4	52.1	0	0	0	54.5	0
OUT - Mean Annual Flow (ML/yr)	9.74	2.18	1.72	4.82	2.2	1.76	1.79	8.78
OUT - TSS Mean Annual Load (kg/yr)	754	326	261	33.3	63.5	35.3	276	132
OUT - TP Mean Annual Load (kg/yr)	2.37	0.747	0.594	0.361	0.304	0.213	0.625	0.878
OUT - TN Mean Annual Load (kg/yr)	17	5.66	4.47	4.92	3.64	2.75	4.69	11.3
OUT - Gross Pollutant Mean Annual Load (kg/yr)	301	65.4	52.1	0	0	0	54.5	0

LANDSCAPE LEGEND

LARGE TREE
- FRAXINUS AMERICANA 100L
- EUCALYPTUS MACULATA 5L
- EUCALYPTUS MICROCURYS 5L

SMALL TREE
- CASURINA CUNNINGHAM
- BANKSIA INTEGRIFOLA 5L

PAVERS

CONCRETE PAVING

SEEDED GRASS TO LANDSCAPE ARCHITECT SPECIFICATION

SOUTHERN CREEK ZONE - Planting in accordance with VMP by GHD

5M SETBACK
SEWER EASEMENT
DETENTION BASIN
RIGHT OF ACCESS + DRAINAGE EASEMENT
FIRE TRAIL ACCESS ROUTE
FIRE TRAIL ACCESS ROUTE
OVERFLOW PARKING
104 CARS
61,750
181,750
120,000
7,000
343,360
TEMPL
RL 49.95
RL 49.90
RL 49.80
RL 50.00
RL 48.65
AWNING OVER
GRADIENT 1:20
GRADIENT 1:16
GATEHOUSE
RL 51.55
RL 49.90
45 CARS
RL 51.50
RL 49.85
RL 51.00
FOYER
RL 50.00
OFFICE OVER
AMENITIES
BREAKOUT SPACE
115 CARS
ESFR
RIGHT OF ACCESS EASEMENT
5M SETBACK
RIGHT OF ACCESS + DRAINAGE EASEMENT
Southern Creek Zone - Planting in accordance with VMP by GHD

NOTES:

COPYRIGHT © ALL RIGHTS RESERVED. THIS DRAWING MAY NOT BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS IN PART OR IN WHOLE WITHOUT PERMISSION OF MORRIS BRAY ARCHITECTS PTY. LTD.

ALL LEVELS AND DIMENSIONS TO BE VERIFIED PRIOR TO COMMENCEMENT OF WORK.
USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.

ALL WORK TO COMPLY WITH CURRENT REGULATIONS AND S.A.A. STANDARDS.

No.	DATE	REVISION / ISSUE DETAILS
P08	04.07.06	ISSUED FOR FINAL APPROVAL BY CLIENT
P07	27.06.06	ISSUED FOR APPROVAL BY CLIENT
P06	26.06.06	TRUCK QUEUING AREA AMENDED
P05	23.06.06	HARDSTAND RAMPS AMMENDED
P04	23.06.06	ISSUED FOR APPROVAL BY CLIENT
P03	22.06.06	ISSUED TO CONSULTANTS
P02	09.06.06	ISSUED FOR APPROVAL BEFORE DA SUBMISSION
P01	07.06.06	ISSUED FOR APPROVAL BY CLIENT

ARCHITECTS
morrisbray architects
Morris Bray Architects
186-188 Willoughby Rd
Crows Nest NSW 2067 Australia
ABN 16 001 268 211
NSW Architects Registration Board Nominated Architects: Terry Morris 3354 Garry Bray 3555
[P] +612 9439 6622
[F] +612 9436 4873
[E] info@morrisbray.com.au
[W] www.morrisbray.com.au

CLIENT
CSR
Locked Bag 6
Chatswood NSW 2057
phone : (02) 9235 800
fax : (02) 9235 8073
email: info@csr.com.au

PROJECT MANAGER
Project Manager
STREET ADDRESS
SUBURB STATE AND POSTCODE
phone : (02) 0000 0000
fax : (02) 0000 0000
email: emailaddress

PROJECT:
Proposed Industrial Building
Pad 4, Lenore Lane
Erskine Park, NSW

DRAWING TITLE:
Siteplan

SCALE:	DRAWN BY:	DATE:	CHECKED:	QA:	JOB No:	DRAWING NUMBER:	ISSUE:
1:500	MB	4/07/2006			06056	DA-03	P08

A1

THIS DRAWING HAS BEEN REDUCED

PRELIMINARY

REV	DATE	DESCRIPTION	BY	VER	APP
		AMENDMENTS			
02	06/07/06	ISSUE FOR PROJECT APPLICATION-REISSUED LEYOUT	DH	RAP	
01	23/06/06	ISSUE FOR PROJECT APPLICATION	DH	RAP	

Disclaimer and Copyright:
ALL DIMENSIONS TO BE CHECKED ON SITE BY SUPERINTENDANT PRIOR TO CONSTRUCTION. USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE.
ACEA
© 2005 Brown Consulting Pty Ltd

BROWN
Brown Consulting (NSW) Pty Ltd
Level 2, 82 Waterloo Road Macquarie Park NSW Australia 2113
Telephone: 02 9900 1000 Facsimile: 02 9900 1099
Sydney
Canberra
Brisbane
Melbourne
Singapore

VERIFICATION	INITIALS	SIGNATURE	DATE
DRAFTING			
DESIGN			
VERIFY			
APPROVED			

Client: CSR LIMITED

Project: PROPOSED INDUSTRIAL DEVELOPMENT

Drawing: OVERALL ENGINEERING PLAN

Drawn by: AK	Sheet: 1 OF 4
Design by: AK / WA	Scale: 1:2000
Project No: W03033.12	
Drawing No: DA401	Rev: 02

A1

THIS DRAWING HAS BEEN REDUCED

TRUCK 2 AREA:
1.0ha

TRUCK 1 AREA:
0.71ha

TEMPLAR ROAD

TRUCK AREA DRAINED BY LOCAL PAVEMENT DRAINAGE (20 YEAR DESIGN STANDARD)

BASIN AREA:
0.082ha

ROOF AREA:
4.46ha

PAD 4

OVERFLOW CAR PARK AREA:
0.31ha

CAR PARK AREA:
0.77ha

BIO-FILTRATION SWALES FOR CAR PARK RUNOFF AREA:
0.039ha

CAR PARK DRAINED BY LOCAL PAVEMENT DRAINAGE (20 YEAR DESIGN STANDARD)

ROOF DRAINAGE 100 YEAR STANDARD DIRECT CONNECTION TO OSD TANK

ROAD TO CONVEY OVERLAND FLOWS IN EXCESS OF 20 YEAR ARI STORM

ACCESS ROAD AREA:
0.31ha

0 10 20 30 40 50 60 70 80 90 100
SCALE 1:1000 (A1) SCALE 1:2000 (A3)

PRELIMINARY

REV	DATE	DESCRIPTION	BY	VER	APP
		AMENDMENTS			
02	06/07/06	ISSUE FOR PROJECT APPLICATION-REISSUED LEYOUT	DH	RAP	
01	23/06/06	ISSUE FOR PROJECT APPLICATION	DH	RAP	

Disclaimer and Copyright:
ALL DIMENSIONS TO BE CHECKED ON SITE BY SUPERINTENDANT PRIOR TO CONSTRUCTION. USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE.
ACEA
© 2005 Brown Consulting Pty Ltd

Brown Consulting (NSW) Pty Ltd
Level 2, 82 Waterloo Road Macquarie Park NSW Australia 2113
Telephone: 02 9900 1000 Facsimile: 02 9900 1099
BROWN
Sydney
Canberra
Brisbane
Melbourne
Singapore

VERIFICATION	INITIALS	SIGNATURE	DATE
DRAFTING			
DESIGN			
VERIFY			
APPROVED			

Client: CSR LIMITED

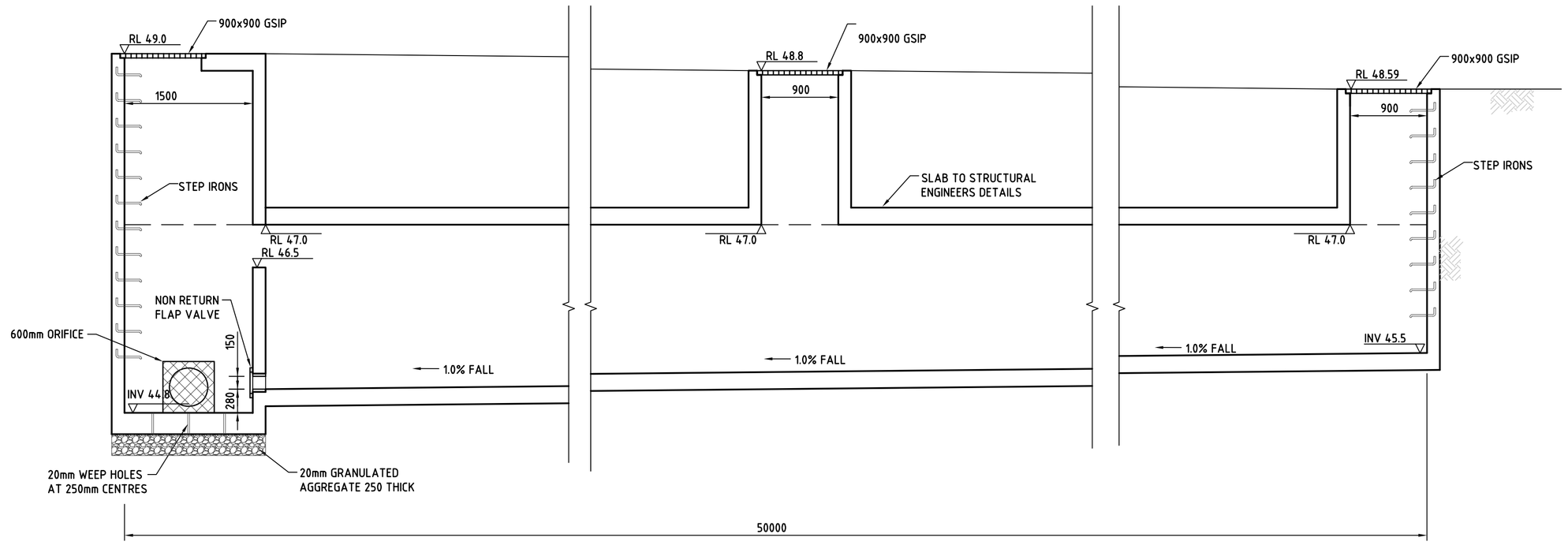
Project: PROPOSED INDUSTRIAL DEVELOPMENT

Drawing: PAD 4 STORMWATER CONCEPT PLAN

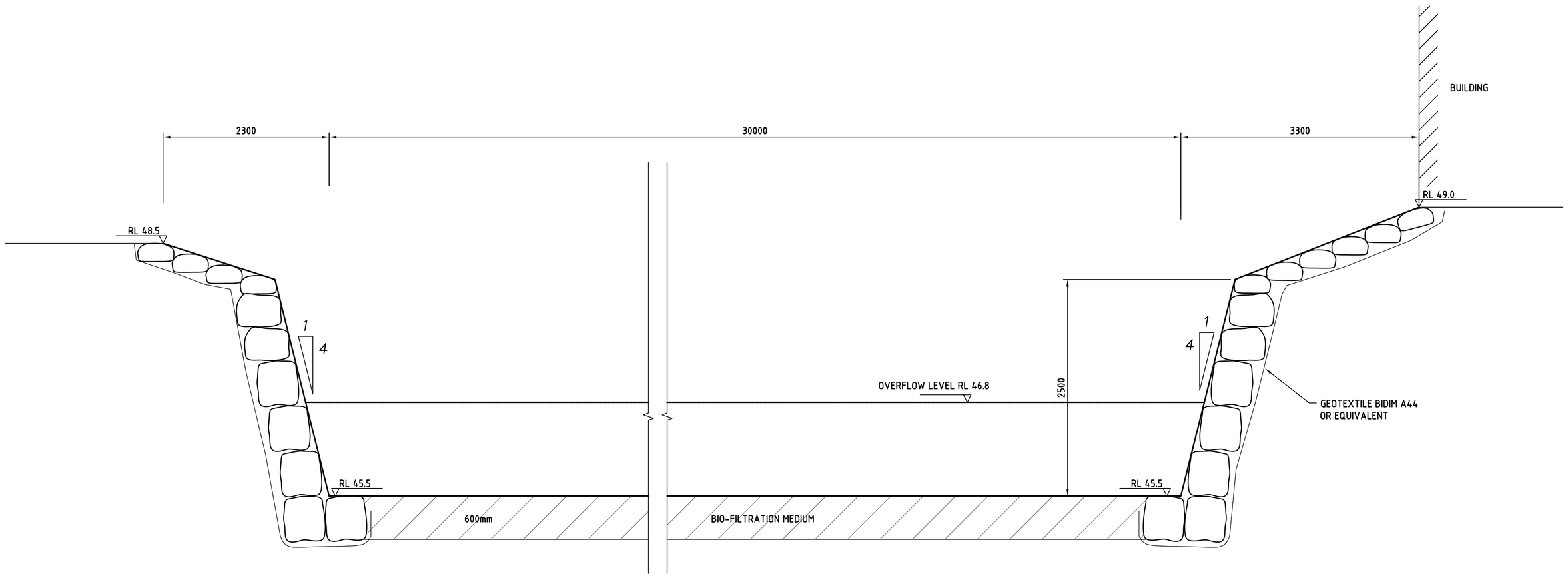
Drawn by: AK	Sheet: 2 OF 4
Design by: AK / WA	Scale: 1:1000
Project No: W03033.12	
Drawing No: DA402	Rev: 02

A1

THIS DRAWING HAS BEEN REDUCED



SECTION 2 (DA403)
SCALE 1:25



SECTION 1 (DA403)
SCALE 1:25

0 0.25 0.5 0.75 1 1.25 1.5 1.75 2 2.25 2.5
SCALE 1:25 (A1) SCALE 1:50 (A3)

PRELIMINARY

REV	DATE	DESCRIPTION	BY	VER	APP
02	06/07/06	ISSUE FOR PROJECT APPLICATION-REISSUED LEYOUT	DH	RAP	
01	23/06/06	ISSUE FOR PROJECT APPLICATION	DH	RAP	

AMENDMENTS

Disclaimer and Copyright:
ALL DIMENSIONS TO BE CHECKED ON SITE BY SUPERINTENDANT PRIOR TO CONSTRUCTION. USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE.
©2005 Brown Consulting Pty Ltd

Brown Consulting (NSW) Pty Ltd
Level 2, 82 Waterloo Road Macquarie Park NSW Australia 2113
Telephone: 02 9900 1000 Facsimile: 02 9900 1099
BROWN
Sydney Canberra Brisbane Melbourne Singapore

VERIFICATION	INITIALS	SIGNATURE	DATE
DRAFTING			
DESIGN			
VERIFY			
APPROVED			

Client: CSR LIMITED

Project: PROPOSED INDUSTRIAL DEVELOPMENT

Drawing: PAD 4 OSD TANK & WQ BASIN LONGITUDINAL SECTIONS 1 & 2

Drawn by: AK	Sheet: 4 OF 4
Design by: AK / WA	Scale: 1:200
Project No: W03033.12	
Drawing No: DA404	Rev: 02