Hyder

Flood Study and Stormwater Management

SIMTA

SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 3A Concept Plan Application

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SIMTA

Moorebank Intermodal Terminal Facility

Flood Study and Stormwater Management

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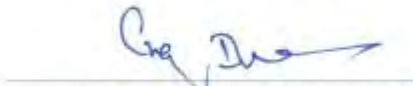
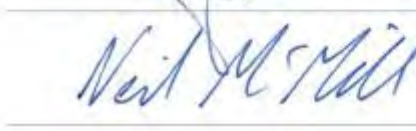
Checker	Greg Ives	
Approver	Neil McMillan	

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Executive summary

This report presents a flooding and stormwater assessment for the Sydney Intermodal Terminal Alliance (SIMTA). The following assessment has been carried out, adopting general principals of broader civil engineering design:

Current civil design

This first stage of the flooding and stormwater assessment has involved an initial quantifying of site runoff, on-site detention requirements and identifying locations of potential flooding impacts on neighbouring land holders, based on the current civil design.

The accompanying current civil design drawings maximise the site developable area and assume that where there may be flooding or stormwater impacts on neighbouring areas (as a consequence of the SIMTA site) negotiation with neighbouring landholders would be conducted.

The initial on-site detention (OSD) volume estimate (discussed in Section 5 of this report) has been subject to revision as discussed in the 'Anzac Creek Floodplain Modelling' and 'Civil Design Options' Sections (6 and 7) of this report.

Anzac Creek floodplain modelling

Following the initial OSD assessment, two dimensional waterway modelling of potential impacts extending along Anzac Creek was carried out. This broader catchment assessment identified the need to increase the initial OSD requirements in the north-eastern portion of the site. It is anticipated that this would be achieved by reconfiguring the concept channel and pond, and raising the north-eastern area ground levels.

Flood flow regime figures for Anzac Creek (which include the additional OSD) are included in Appendix E. These figures indicate that on Anzac Creek, the SIMTA proposal would result in little if any impact on 100 year ARI flooding.

Civil design options

This assessment was carried out to indicate 100 year ARI flood levels along the proposed trunk drainage or OSD channels within the site, and provide civil design options for the purpose of mitigating potential adverse flooding and stormwater impacts on the neighbouring land holders.

Sketches of the areas where the current concept civil design may be modified to limit flood impacts on the local neighbouring properties are included in the accompanying Drawings and are intended to facilitate future design considerations.

1 Introduction

The Sydney Intermodal Terminal Alliance (SIMTA) is a joint venture between Stockland, Qube Logistics and QR National. The SIMTA Moorebank Intermodal Terminal Facility (SIMTA proposal) is proposed to be located on the land parcel currently occupied by the Defence National Storage and Distribution Centre (DNSDC) on Moorebank Avenue, Moorebank, south west of Sydney. SIMTA proposes to develop the DNSDC occupied site into an intermodal terminal facility and warehouse or distribution facility, which will offer container storage and warehousing solutions with direct rail access.

The SIMTA site is located in the Liverpool local government area. It is 27 kilometres west of the Sydney CBD, 16 kilometres south of the Parramatta CBD, five kilometres east of the M5/M7 Interchange, two kilometres from the main north-south rail line and future Southern Sydney Freight Line, and 0.6 kilometres from the M5 motorway.

The SIMTA site, around 83 hectares in area, is currently operating as a Defence storage and distribution centre. The SIMTA site is legally identified as Lot 1 in DP1048263 and zoned as General Industrial under Liverpool City Council LEP 2008. The parcels of land to the south and south-west that would be utilised for the proposed rail corridor are referred to as the rail corridor. The proposed rail corridor covers about 65 hectares and adjoins the Main Southern Railway to the north. Existing land use includes vacant land, golf course, extractive industries, and a waste disposal depot. Native vegetation includes woodland, forest and wetland communities in varying condition. Georges River and Anzac Creek intersect the proposed rail corridor. The proposed rail corridor to the south of the SIMTA site, north of the existing East Hills Rail Line are part of Lot 3001 DP1125930 and Lot 1 DP1125930. To the west of the Georges River, the Glenfield Waste Disposal site comprises several lots that are currently all used for the purposes of the waste facility.

The SIMTA proposal will be undertaken as a staged development and it is intended that an overall Master Plan, for the entire site, be undertaken for the purpose of applying for Concept Plan approval under Part 3A of the *Environmental Planning and Assessment Act 1979*.

The SIMTA proposal will be undertaken as a staged development. An annual operating capacity of 1,000,000 TEU throughput is anticipated in the ultimate stage, when fully developed.

This report comprises a concept stormwater management plan and flood study assessment completed as part of the civil engineering concept designs developed for the proposed intermodal terminal facility. The report is intended to accompany the submission documents for a Concept Plan under Part 3A of the *Environmental Planning and Assessment Act.*

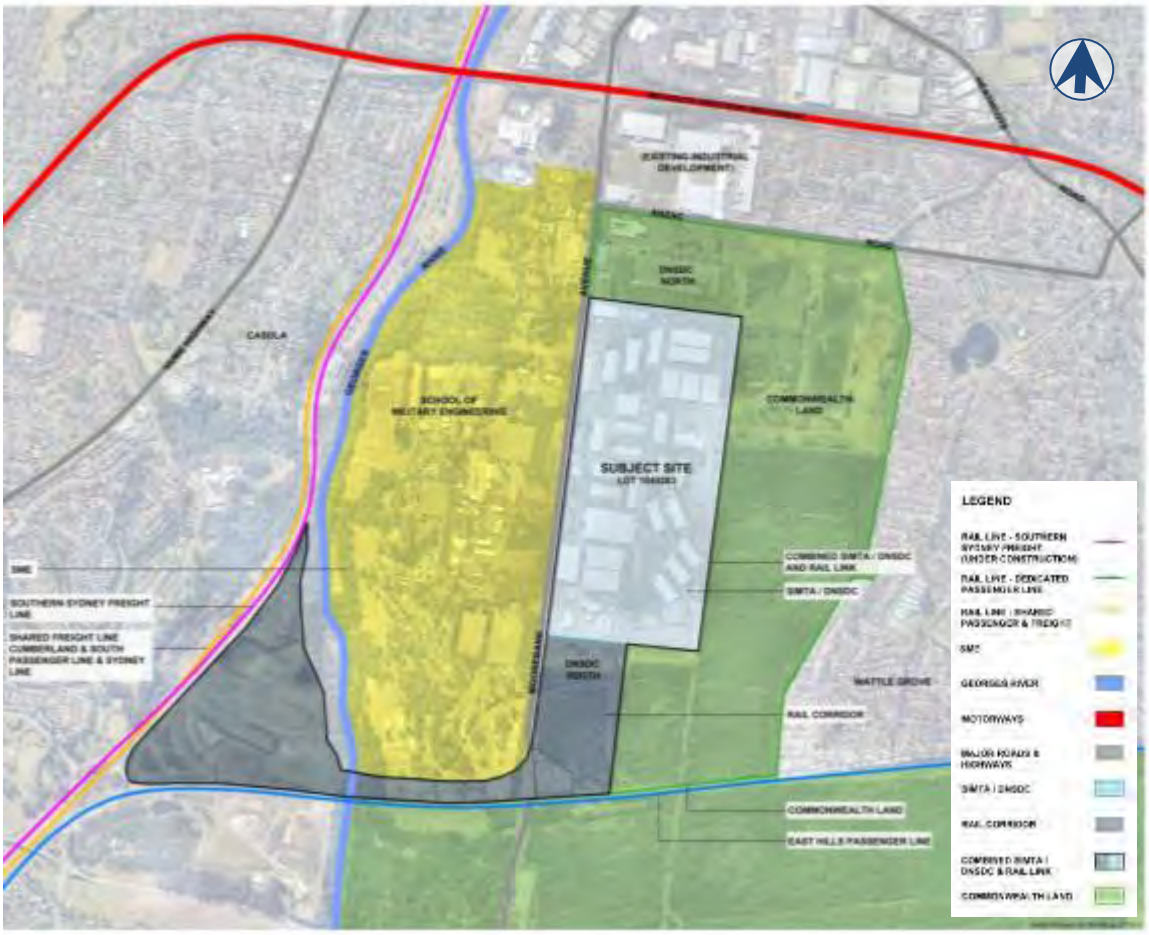

Figure 1: Moorebank intermodal terminal site location plan

2 Database

The following information has formed the database for this flood assessment and stormwater management plan:

- Australian Rainfall and Runoff by the Institute of Engineers Australia (2001).
- NSW Floodplain Management Manual by DIPNR (2005).
- Bureau of Meteorology Rainfall Intensities for the Liverpool City Council Area.
- The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method by Commonwealth Bureau of Meteorology (June 2003).
- Services and Flood Investigation Report for Defence National Storage and Distribution Centre, Moorebank by Cardno Willing (December 2002).
- Anzac Creek Floodplain Risk Management Study and Plan by BMT WBM Pty Ltd (30 May 2008) for Liverpool City Council.
- Georges River Floodplain Risk Management Study & Plan by Bewsher Consulting (May 2004) for Liverpool City Council.
- Practical Consideration of Climate Change Floodplain Risk Management Guideline by DECC (25 October 2007).
- Aerial laser survey provided by AAM Hatch Pty Ltd (May 2008, LiDAR Data Base).
- Ground survey for the site prepared by Hard and Forester (dated 3 August 2010).
- Liverpool City Council documents:
  - Liverpool Development Control Plan 2008.
  - Liverpool Development Control Plan 2008, Flood planning area map – sheet FLD-013, cadastre 31 July 2009.

3 Existing catchments and drainage patterns

The aerial photo in Figure 2, shows that the site currently contains a number of warehouse style facilities connected by internal roads, interspersed with grass and trees. The site fronts onto Moorebank Avenue on its western boundary and Greenhills Road reservation on its eastern boundary. Moorebank Avenue is a formalised two lane road with grassed swales. Greenhills Road is an unformed road reservation that is predominantly used as a utility services corridor.

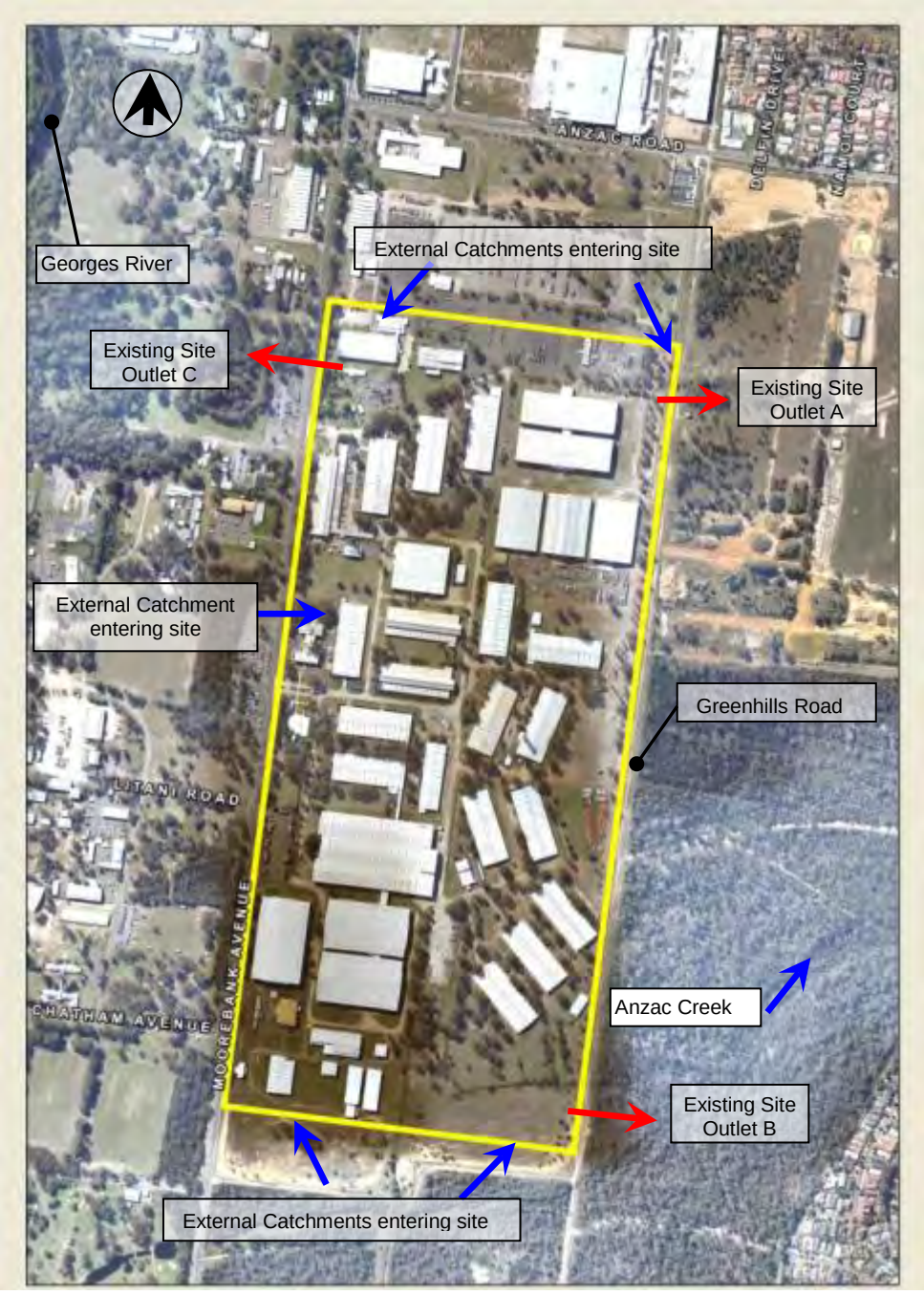

Figure 2: Existing site conditions (indicating external site flow locations)

The site is relatively flat, particularly along the Moorebank Avenue frontage. The levels along Moorebank Avenue range from RL 14 metres to 16 metres. Along the Greenhills Road frontage, the land rises from about RL 14 metres at each end to a localised peak of RL 22 metres about midway along the length.

The site has bushland located to its eastern and southern boundaries with Anzac Creek running from south to north within relatively close proximity to the site. Anzac Creek is predominantly in its natural state within the bush area, however, as it flows north towards Anzac Road, the creek passes through an area of highly disturbed ground owned by Department of Defence. North of Anzac Road the creek runs through the residential area of Wattle Grove.

There are three existing formal stormwater discharge outlets from the site. Two points discharge eastward into Anzac Creek and cross under the Greenhills Road formation via pipes and headwalls. Stormwater from the site is carried through the site via formal open grass lined channels to pipes and headwalls under Greenhills Road. From Greenhills Road to Anzac Creek, the channels are less formalised.

Photos show channelled approaches and piped crossing under Greenhills Avenue from the northern outlet point

Photo shows concrete trapezoidal channel leading into heavily vegetated open channel which then drains to existing outlet on south-eastern corner

There is one discharge westward into the Georges River. Water from the site is collected in a formal concrete lined trapezoidal channel running within the site parallel to Moorebank Avenue. Water is led to a formalised pipe crossing of Moorebank Avenue into a concrete rectangular channel which leads to Georges River.

Photos show the concrete trapezoid within the site and the approach to the pipes crossing under Moorebank Avenue.

Concrete Channel downstream of pipes crossing Moorebank Ave leading to Georges River

There is also a small local external catchment area which discharges into the site midway along the western site boundary from the eastern side of Moorebank Avenue.

Figure 3 indicates the external catchments which enter the site, and the existing catchments within the site that discharge to the three existing culvert outlets. The majority of the external catchments have been identified from aerial laser survey contours and consist of small open areas which fall towards the site boundary.

One catchment is a sealed carpark within the School of Military Engineering on the western side of Moorebank Avenue. Stormwater runoff from the sealed carpark is captured and piped under Moorebank Avenue into the concrete trapezoidal open channel which runs inside the SIMTA site.

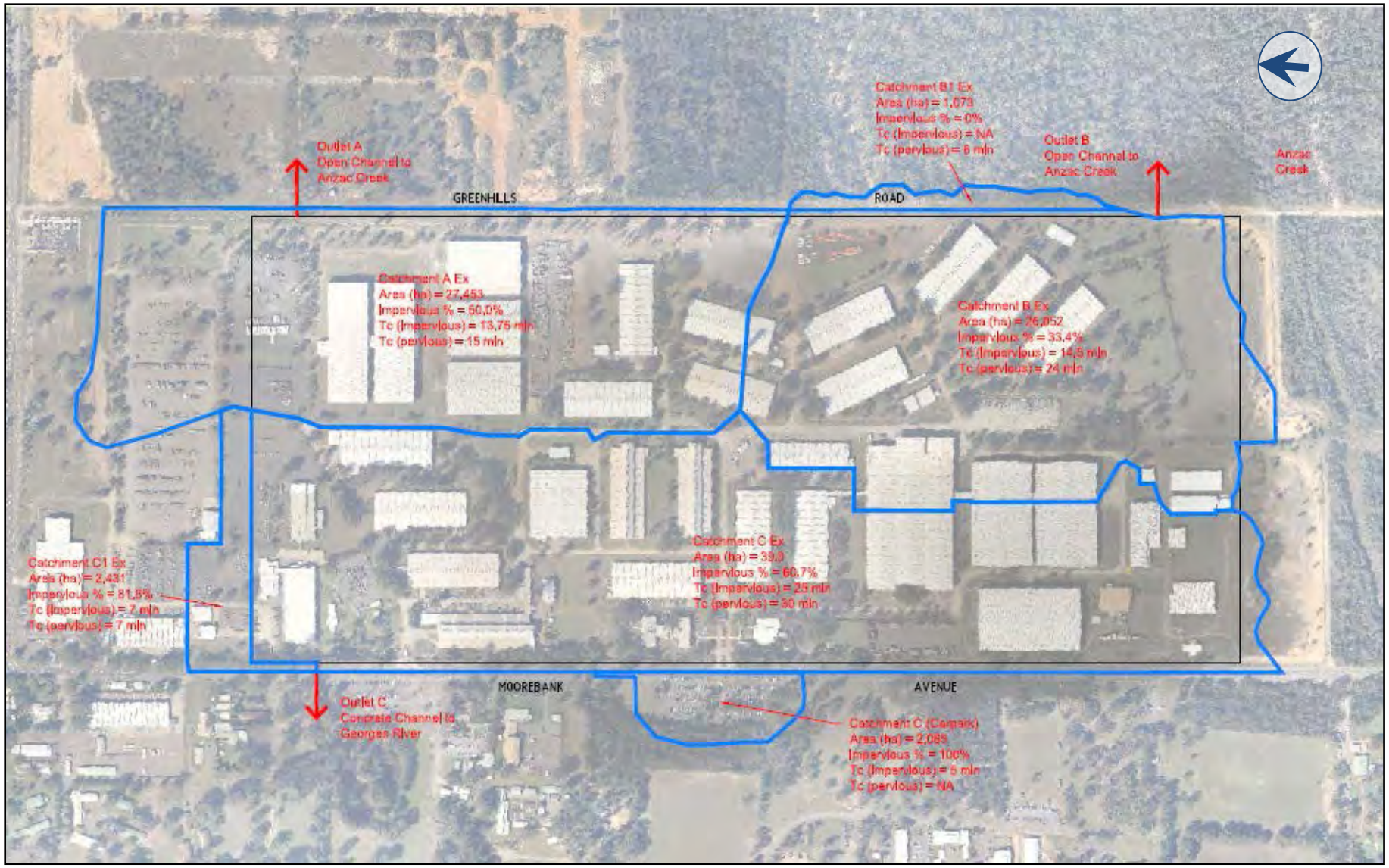

Figure 3: Existing stormwater discharge points and approximate catchments

4 Flooding and stormwater assessment process

The flooding and stormwater assessment process has been carried out in three stages.

4.1 Current civil design

This first stage of the flooding and stormwater assessment (using DRAINS, HEC-RAS and MUSIC software) has involved an initial quantifying of site runoff, on-site detention requirements and identifying locations of potential flooding impacts on neighbouring landholders, based on the current civil design. Current concept design drawings that relate to aspects of flooding and stormwater accompany this report.

The concept civil design drawings (see accompanying Drawings) maximise the site developable area, and assume that where there may be flooding or stormwater impacts on neighbouring areas as a consequence of the SIMTA site, negotiation with neighbouring landholders (with respect to obtaining drainage easements) would be conducted.

4.2 Anzac Creek floodplain modelling

Following the initial OSD assessment, two dimensional (TUFLOW) waterway modelling of potential impacts extending along Anzac Creek was carried out. This broader catchment assessment identifies the need to increase the initial OSD requirements (determined by the DRAINS site modelling) in the north-eastern portion of the site.

4.3 Civil design options

This subsequent assessment was carried out to indicate 100 year ARI flood levels along the proposed trunk drainage/OSD channels within the site, and provide civil design options for the purpose of mitigating potential adverse flooding and stormwater impacts on the neighbouring landholders.

Sketches of the areas where the current concept civil design may be modified to limit flood impacts on the local neighbouring properties are included in the accompanying Drawings.

Each of these three assessment stages are discussed as follows.

5 Current civil design

The initial civil design (provided in the accompanying Drawings) has attempted to maximise the developable site area through an site layout and nominated site platform levels. In conjunction with the initial design site, stormwater runoff was assessed using:

- DRAINS software for quantifying site runoff and estimating on-site detention (OSD) requirements for the mitigation of potential adverse flow impacts on Anzac Creek and the Georges River.
- MUSIC software for developing appropriate water quality controls.

These stormwater management assessments and findings are discussed as follows.

5.1 Water quantity

5.1.1 Existing conditions

Assessment methodology

DRAINS software has been used to develop a rainfall runoff model to assess the performance of the proposed site drainage channels with respect to mitigating potential flow impacts on neighbouring downstream areas.

DRAINS models have been developed to represent existing site conditions and post development site conditions to enable a comparison of discharges under the two development conditions.

For existing conditions the model catchments and impervious areas have been based on aerial photography, aerial laser survey for areas external to the site boundary, and ground survey for the site and for specific areas such as details downstream of the site discharge points. A site inspection to verify certain surveyed features was undertaken during the course of this study. However, due to the very flat terrain surrounding the site, as shown in the ALS data, it is recommended that further detailed survey be obtained during the tender design/detailed design stages of the SIMTA proposal to better define external catchment boundaries and levels along Greenhills Road and Moorebank Avenue

A sub-catchment plan that represents the layout adopted for the existing conditions DRAINS model is included in Appendix A.

The model parameters include:

- Paved area and Supplementary area depression storage is one millimetre, and pervious area depression storage is five millimetres.
- Soil type is 3.0.
- Antecedent moisture condition is 3.0 (rather wet).
- Stage/discharge for the three site outlets (two eastward under Greenhills Road, and one westward under Moorebank Avenue) defined by HEC-RAS modelling of the culvert outlets and associated downstream channels. Model inputs and outputs are included in Appendix B.

The DRAINS model has been run for storm durations of five minute to 24 hours for the two year, five year, 10 year, 20 year, 50 year and 100 year ARIs, and 15 minute to six hours for probable maximum precipitation (PMP) events. A summary of the model input data is included in Appendix A.

Results

A summary of peak flows discharging from the three site sub-areas is presented in Table 1. A summary of model outputs are included in Appendix A. Sub-catchment flows leaving the site are included in Appendix A for a range of storm durations.

5.1.2 Post development conditions

Stormwater management objectives

The overall stormwater design of the proposed intermodal development seeks to:

- Adopt recognised standards reflecting current practices adopted for similar facilities around the world.
- Comply with recognised Australian Standards and Liverpool City Council's Development Control Plan 2008.
- Assist with achieving a balance between cut and fill earthworks to negate import or export of earth to/from the site.
- Provide site levels which are above localised flood levels but do not impact upon capacity of existing floodplains.
- Provide adequate grades for surface drainage which do not impact on the operational requirements of the facility.
- Provide drainage facilities which minimise requirements for in-ground pipework and provide facilities for stormwater detention and Water Sensitive Urban Design (WSUD).

Assessment methodology

The existing conditions DRAINS model was adjusted to represent the post development site conditions as outlined in the concept plan included in the accompanying drawings. In particular the adjustments have included:

- Changes to sub-catchment boundaries. A sub-catchment plan that represents the layout adopted for the proposed conditions DRAINS model is included in the accompanying drawings.
- Adopting a 100 per cent impervious percentage within the site (to be reviewed at future design stages).
- Reduced flow travel times representative of the SIMTA proposal.
- Detention storages to mitigate potential flow increases. Detention storage details are included in the accompanying design drawings.

DRAINS model input data is included in Appendix A.

Figure 4 shows the post development catchment areas. Note that the existing catchments which are external to the site and identified as currently flowing into the site have been included within the post development catchments.

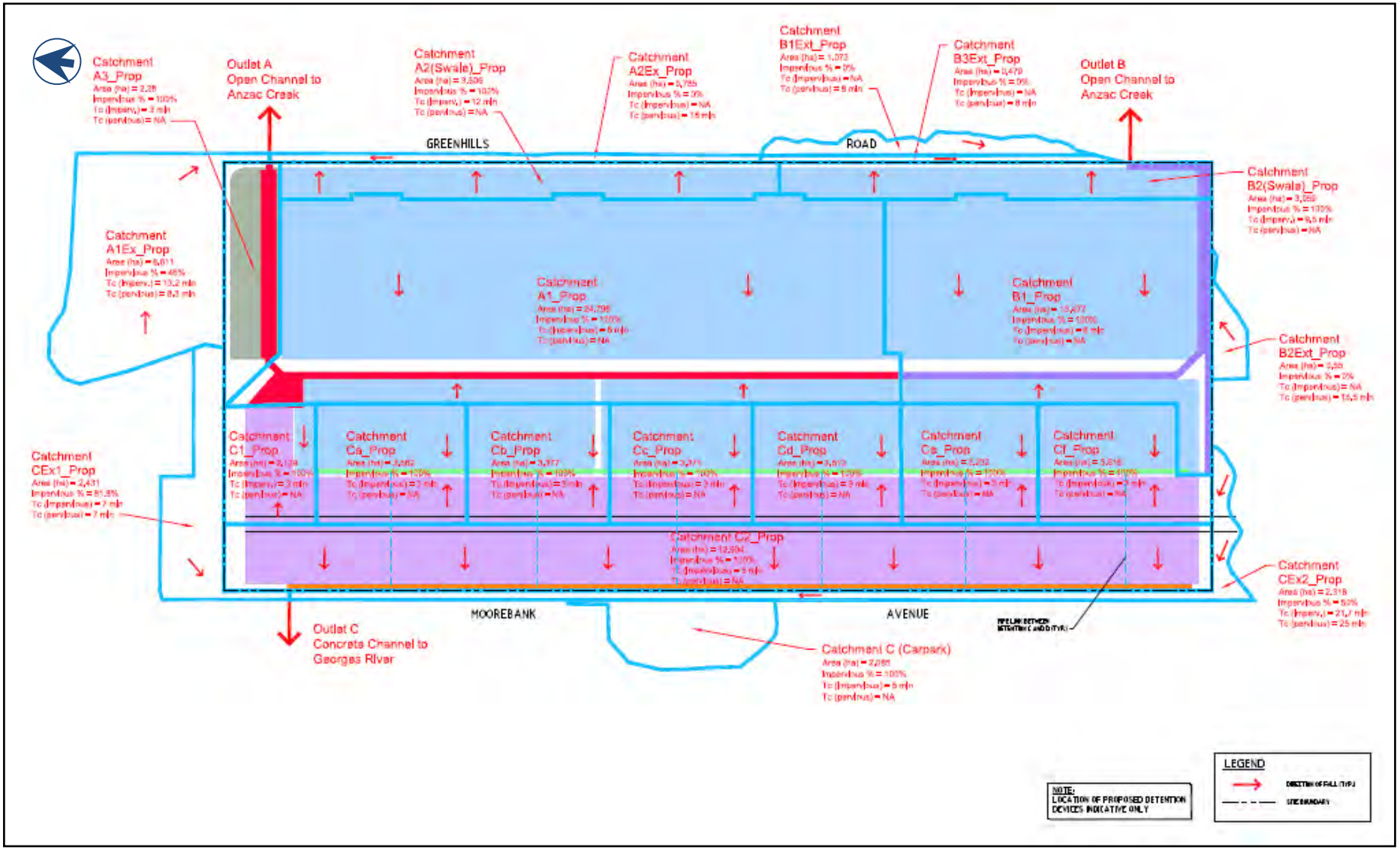

Figure 4: Post development catchment boundaries (including local external catchments)

Results

Table 1 provides a summary of peak flows just downstream of the site for a range of recurrence intervals. Flow results for a fuller range of storm durations range of durations is provided in Appendix A. Table 2 provides a summary of key detention storage parameters and their performance. Storage details are provided in the accompanying design drawings. Table 3 summaries peak flows on catchments neighbouring the site, and that will require management through the site as discussed in the following comments section of this report. DRAINS model output data is included in Appendix A.

Table 1: Comparison of peak flow estimates (m^3/s)

Discharge Location	Site Condition	Catchment Area (ha)	DRAINS Model Label	Flow at Downstream of Greenhills Rd / Moorebank Ave			
				2yr	20yr	100yr	PMF
Outlet A NE Corner of Site (Greenhills Road)	Existing	27.45	OF17	2.42	6.24	8.33	50
	Developed	38.08	OF64	1.72	2.93	3.54	56
Outlet B SE Corner of Site (Greenhills Road)	Existing	27.13	OF9	0.40	1.11	2.63	31
	Developed	18.64	OF51	0.39	0.86	2.01	27
Outlet C NW Corner of Site (Moorebank Avenue)	Existing	42.33	OF30	5.74	10.20	12.70	62
	Developed	40.22	OF102	3.43	8.35	7.82	104

Table 2: Summary of detention storage parameters and performance

Basin [Invert mAHD]	Parameters				Performance				
	Catch Area (ha)	Outlet Diameter		Outlet Weir	ARI	Peak Inflow (m^3/s)	Peak outflow (m^3/s)	Water Level (mAHD)	Volume (m^3)
		Low Level (mm)	High Level (mm)	Level (mAHD)					
A (in NE Cnr) [14.00]	30.68	250 & 475	490	14.40 & 15.75	2yr	8.53	0.71	14.96	12300
					100yr	4.95	1.95	15.91	27000
B (in SE Cnr) [14.00]	17.02	250	670	15.85	2yr	4.66	0.18	15.12	10000
					100yr	2.73	1.85	15.91	17060
D (in NW Cnr) [14.00]	38.15	730	760	15.45	2yr	10.9#	2.89	15.27	6930
					100yr	20.2#	7.82	15.90	10230

# Indicates inflow into lower portion of storage (Basin D) only (not inflows to model Basins C1 to C6)

Table 3: External catchment and flows potentially impacting on the site

Catchment Location	Catchment Area (ha)	DRAINS Model Label	Flow (m^3/s)		
			20yr	100yr	PMF
Northern Boundary and NE Corner of Site	6.61	OF60	2.34	2.81	13
Northern Boundary and NW Corner of Site	2.43	OF131	1.03	1.23	6
Southern Boundary and SE Corner of Site	0.55	OF47	0.13	0.17	0.9
Southern Boundary and SW Corner of Site	2.32	OF104	0.51	0.66	3.5
Mid-Eastern Site Boundary	2.09	OF487	0.99	1.23	5.2

Comments

Site detention storage

This initial assessment of peak flows leaving the site (summarised in Table 1) and the comparison graphs in Appendix A indicate that the proposed detention storages should adequately mitigate potential site runoff flow increases for a range of storm durations. However, in addition to the DRAINS modelling, a regional catchment wide analysis has been carried out to assess potential impacts on flow regimes on the broader Anzac Creek waterway as discuss in the Anzac Creek flood assessment section of this report (Section 6).

Management of external catchments

In general, maximising the developable site area would potentially impact on local neighbouring property, this includes:

- Impeding and diverting flows that currently enter the site along its northern and southern boundaries, and on its western boundary from a local carpark area (identified in Figures 3 and 4).
- Increasing flows along Moorebank Avenue.
- Increasing flooding across Greenhills.Road.

While these local adverse impacts may be open to negotiation with the various stakeholders, civil design options to avoid impacting on neighbouring property are discussed in Section 7 of this report.

Potential climate change sensitivity assessment

The DRAINS model which represents the post development site was re-run with a 20 per cent increase in 100 year ARI rainfall intensities to represent potential climate change sensitivity with respect to site discharges. The modelling results indicate that in a 100 year ARI event:

- Site water levels may increase by around 0.2 metres.

- Maximum site discharges from the two eastern outlets would not exceed existing condition maximum 100 year ARI discharges. For the single western outlet, the model indicates an increase in site discharge (compared to the existing condition) of 14.7-cubic-metres per second compared with 12.7-cubic-metres per second, however, additional survey information along Moorebank Avenue (to allow more accurately spill levels and length), may alter this result.

DRAINS model inputs and outputs are included in Appendix A.

5.2 Water quality

5.2.1 Stormwater quality objectives and treatment targets

The stormwater runoff quality objectives and treatment targets for the SIMTA proposal have been determined according to the Liverpool Development Control Plan 2008 (general controls and controls applicable to Moorebank Defence Lands). These include the following.

Objectives

- To prevent adverse impact on receiving environments which may be caused by the flow from the SIMTA site.
- Prevent bed and bank erosion and instability of waterways.
- Provide sufficient flows to support aquatic environments and ecological processes.
- To make certain that Water Sensitive Urban Design principles are appropriately applied to the SIMTA site.

Performance targets

- Ninety per cent reduction in the post development average annual gross pollutant load.
- Eighty per cent reduction in the post development average annual load of Total Suspended Solids load.
- Forty-five per cent reduction in the post development average annual load of Total Phosphorus load.
- Forty-five per cent reduction in the post development average annual load of Total Nitrogen load.
- Maximise water conservation through the use of water efficient devices and re-use of rainwater for non-potable water demands.

5.2.2 Proposed stormwater quality measures

A number of stormwater quality measures are proposed to be implemented as part of the SIMTA proposal to meet the set treatment targets. These include the following.

Rainwater tanks

Rainwater tanks are required to meet the water conservation controls set by Liverpool City Council's Liverpool Development Control Plan (2008) for development in Moorebank Defence Lands and also to satisfy sustainability building requirements.

Rainwater tanks will be used to collect roof water from the site's warehouses to be used for non-potable water demands for toilet flushing and for outdoor use. All rainwater tanks are assumed to have a first-flush device to capture gross pollutants and sediments which may have accumulated on the roof. Rainwater tanks also provide stormwater treatment through settling and harvesting in addition to their main purpose of providing alternative source of water for non-potable water uses.

Initial sizing for the proposed rainwater tanks is based on providing the estimated non-potable water demands for a period of 20 days. The non-potable water demands for the proposed warehouses were about 60 per cent of the total water use of these buildings. The population for each warehouse was around one person per 20-squared-metres using an average of 20 litres per person per day (VIC EPA Code of Practice for Small Wastewater Treatment Plants (1997). The proposed rainwater tank sizes for the various catchments of the site are presented in Table 4.

Pre-treatment

Buffer strips

Buffer strips are source control measures used to pre-treat stormwater runoff before it reaches the main treatment measures such as rain gardens and bio-swales. Buffer strips are vegetated areas adjacent to drainage lines that intercept diffused stormwater runoff from impervious areas before it reaches the treatment measures, thus removing coarse to medium sized suspended solids and associated nutrients. Buffered areas for the various catchments of the site are presented in Table 4.

Gross pollutant traps

A gross pollutant trap is a treatment device designed to capture coarse sediment, trash and vegetation matter carried in the stormwater. No removal of suspended solids and nutrients has been assumed to be associated with GPTs.

Bio-retention systems

Rain gardens

Rain gardens are bio-retention systems that comprise a combination of vegetation and filter substrate, which provide treatment of stormwater through filtration, extended detention and some biological uptake. They are very effective in stormwater pollutant removal, especially when associated with a submerged zone, which provides a permanent pool of water at the bottom of the system that helps to maintain a healthy plant community. Rain gardens are proposed to treat runoff from the majority of the site in an integrated structure that provides for OSD storage in addition to water quality treatment.

Bio-swales

Bio-swales are bio-retention systems that perform similarly to rain gardens but are generally associated with a longitudinal gradient. Thus they provide runoff conveyance in addition to the water quality treatment through filtration, extended detention and biological uptake. The proposed bio-swales for the Moorebank site have fairly flat gradient. Thus they provide extended detention during their normal operation, with excess runoff discharging to overflow pits. No OSD storage will be provided as part of the proposed bio-swales.

Lining

In general, bio-retention systems are lined either to protect adjacent structures or if the site has known salinity hazards. There are no known risk associated with salinity on the Moorebank site as indicated by the salinity hazard risk map of NSW produced by the Department of Environment and Climate Change. However, as the site's soils are predominantly clays and sandy clays associated with shrinkage and differential settlement, lining of the bio-retention systems may be required when they located next to footings of structures such as retaining walls and buildings.

The proposed rain garden and bio-swale areas for the various catchments of the site are presented in Table 4. Typical details are presented in the drawings associated with this report.

Table 4: Proposed stormwater quality treatment measures for the site

Catchment	Rainwater Tank (kL)	Buffer Area (m^2)	Rain Garden/ filter area (m^2)	Bio-swale/ filter area (m^2)
A1 (27.178 ha)	2083	1963	6960/4640	
A2 (3.506 ha)	0	525		1656/1035
B1 (13.477 ha)	1132	808	3200/4800	
B2 (3.059 ha)	0	459		1152/720
C (35.714 ha)	857	1714	5000/5000	

Rain garden and bio-swale areas are "average", the area is measured at half of the extended detention depth.
Refer to Drawing CP022 for WSUD catchment plan.

5.2.3 Assessment methodology

Assessment of the performance of the proposed stormwater quality measures has been undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC V4.0). A MUSIC model for the SIMTA site has been developed assuming that the site has industrial land use with imperviousness shown in Table 5. The MUSIC model layout and key modelling parameters are included in Appendix C.

Table 5: MUSIC model land use for the site

Catchment	Land use	Land Use area (ha)	Land use imperviousness
A1 (27.178 ha)	Roof	17.359	100%
	Pavement to buffer	3.930	100%
	Pavement to GPT	5.892	100%
A2 (3.506 ha)	Roof	0	
	Pavement to buffer	3.506	100%
	Pavement to GPT	0	
B1 (13.477 ha)	Roof	9.434	100%
	Pavement to buffer	1.617	100%
	Pavement to GPT	2.426	100%

Catchment	Land use	Land Use area (ha)	Land use imperviousness
B2 (3.059 ha)	Roof	0	
	Pavement to buffer	3.059	100%
	Pavement to GPT	0	
C (35.714 ha)	Roof	7.143	100%
	Pavement to buffer	11.428	100%
	Pavement to GPT	17.143	100%

5.2.4 Results and comments

Based on the proposed stormwater quality measures the treatment performance for each catchment and the whole site is presented in Table 6.

In summary, the water quality assessment methodology and treatment performance of the proposed WSUD measures is understood to comply with the treatment targets according to the Liverpool Development Control Plan (2008).

Table 6: Treatment performance summary for the site

Catchment	Pollutant reduction			
	Gross pollutants (%)	TSS (%)	TP (%)	TN (%)
A	100	91.7	76.8	61
B	100	94.0	80.8	67.8
C	100	86.6	71.6	46.4
Total site	100	89.1	74.7	55.9
Treatment targets	*90*	*80*	*45*	*45*

6 Anzac Creek floodplain modelling

Following the initial DRAINS modelling of on-site detention (OSD) the Post Development site flow hydrographs were used as inputs into a TUFLOW model of Anzac Creek to identify potential impacts extending along Anzac Creek, and if necessary revised OSD requirements. This assessment process and findings are discussed as follows.

6.1 Background

Existing condition flow regimes along Anzac Creek have been previously determined by Liverpool City Council in the process of conducting their Anzac Creek Floodplain Risk Management Study and Plan (by BMT WBM Pty Ltd, 30 May 2008), and the Georges River Floodplain Risk Management Study & Plan (by Bewsher Consulting, May 2004). The council modelling indicates that only the 100 year ARI and larger events along Anzac Creek impact on the subject site, as such only the 100 year ARI and PMF events have been assessed, although this has also included examining potential Climate Change flow regimes.

The RAFTS catchment rainfall runoff model files developed for the abovementioned studies were obtained from council. The provided files were re-run by Hyder and the hydrographs for both the 100 year ARI nine-hour event and PMF nine hour event used in the studies were replicated.

Council also provided to Hyder the 100 year ARI nine hour event and PMF one hour event TUFLOW model files. The provided files were re-run by Hyder and the council's 100-year nine hour results were reproduced. PMF TUFLOW results were not provided by council, nonetheless the provided files were used in developing an adjusted 'existing conditions' Anzac Creek model, as described in Section 6.2.

Council provided a number of TUFLOW run files incorporating various degrees of blockage for structural elements across the system. For the purposes of this regional assessment, the 25 per cent scenario was adopted as a base and amended for this study as described following. The modelling process and results are described as follows.

6.2 Existing conditions

6.2.1 Hydrology

Council's RAFTS model catchments were adjusted to exclude the subject site, which has been more accurately defined in the site drainage assessment DRAINS software (as discussed in the earlier sections of this report). Hence hydrographs generated from the RAFTS and DRAINS models have been used as flow inputs for TUFLOW modelling to define flow regimes as discussed below. RAFTS model input data and output are included in Appendix D.

6.2.2 Flow regimes

The 100 year ARI nine hour duration hydrographs from the DRAINS and adjusted RAFTS models have been used to assess flow regimes along Anzac Creek, in accordance with the files provided by council, in TUFLOW. Similarly, an adjusted existing conditions PMF one hour event model has also been assessed in TUFLOW using DRAINS and adjusted RAFTS hydrograph inputs.

The adjusted existing condition TUFLOW model flow regime figures (for 100 year and PMF conditions) are included in Appendix E. The 100 year results were compared with that of Council's and flood level variations found to generally vary by less than 0.025 metres.

The adjusted existing conditions model has been adopted as a base for comparing potential impacts in Anzac Creek due to the SIMTA site development.

6.3 Post development conditions

6.3.1 Hydrology

Hydrographs generated from the SIMTA site development conditions DRAINS model of the site have been used as input into the TUFLOW modelling, in conjunction with existing conditions RAFTS model hydrographs which represent the Anzac Creek catchment areas external to the subject site.

6.3.2 Flow regimes

Using the 100 year ARI nine hour event hydrographs from the initial proposed conditions DRAINS modelling, TUFLOW modelling indicated potential water level increases of up to around 0.05 metres. As such on-site storage in the north-eastern portion of the site was increased from 28,500-cubic-metres to 35,000-cubic-metres in the DRAINS modelling, and the TUFLOW model re-run and the potential flood level increases were seen to be reduced.

The TUFLOW model was then also re-run for the PMF one hour event. The modelling results for these assessments are included in Appendix E.

With respect to potential flood impacts on the Anzac Creek floodplain the results indicate that:

- Flood level increases would be limited to less than five millimetres in the100 year ARI nine hour event. (Management of local catchment flows directly neighbouring the site are discussed in the 'Civil Design Options', Section 7, of this report.)
- For the PMF one hour event, the proposed site raising would result in flood level increases of up to 0.25 metres immediately south of the site. Since this area to the south is largely undeveloped there is little current implication for this neighbouring area. Further downstream, to the north of the southern site boundary, flood level increases are limited to no more than five millimetres.

It is anticipated that the OSD storage increase could be achieved by reconfiguring the concept channel as outlined in Figure 5, reconfiguring the pond (located in the northern area of the site), and raising the north-eastern area ground levels by around 0.2 metres (as indicated in the design option drawings).

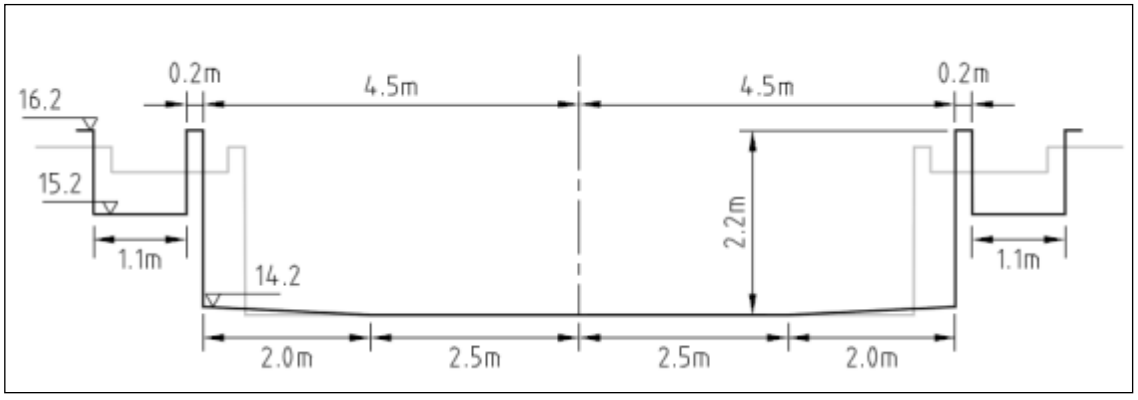

Figure 5: Typical channel section for increased NE site detention

7 Civil design options

This assessment was carried out to indicate civil design options for the purpose of mitigating potential adverse flooding and stormwater impacts on the local land holders that immediately neighbour the site. In particular, modelling of existing and post development site conditions (and the immediately surrounding areas):

- Quantifies within site flood levels along the SIMTA site development main trunk drainage channels.
- Flow regimes in the vicinity of the north-eastern corner of the site.

For this assessment the lumped catchments adopted in the initial DRAINS model were further subdivided into smaller local catchment areas. The DRAINS model discharges were then incorporated into a TUFLOW model of the site and its immediate surrounds. These 'site only' DRAINS and TUFLOW models firstly represented existing development conditions, and were then adjusted to represent the 'alternative post development' developable area conditions.

Sketches of the areas where the initial civil design are to be modified to limit flood impacts on the local neighbouring properties are included in the accompanying Drawings, and are intended as a guide for future design decisions and detailing.

While the accompanying Drawings indicate options to mitigate adverse flood impacts on the neighbouring properties in events up to 100 year ARI, the design options would not, however, offset potential flood increases in all larger events, as indicated in the probable maximum flood results figures included in Appendix G.

7.1 Existing and proposed conditions modelling

7.1.1 DRAINS

Details of the further catchment subdividing of the initial DRAINS model is provided in Appendix F and the 100 year ARI hydrographs then served as inputs for the site-based TUFLOW model.

7.1.2 TUFLOW

A TUFLOW model was developed to represent the site itself, first for existing conditions then for a representation of the proposed site development. Sufficient model detail has been provided to specifically represent flow regimes:

- In the north-eastern corner of the site where the neighbouring property and Greenhills Road flows enter the site via an open channel before discharging under Greenhills Road via culvert "Outlet A".
- Within the site itself along the proposed main channel systems.

The TUFLOW model input data and result figures are included in Appendix G. The 100 year ARI results figures indicate that:

- In the north-eastern corner of the site (where the neighbouring property and Greenhills Road flows enter the site via an open channel before discharging under Greenhills Road via culvert "Outlet A") the existing open channel is to be retained to avoid potential adverse flood impacts on Greenhills Road the neighbouring areas to the north and east.
- Adopting bridge crossings that span the main channels, there is less than a 0.1 metres water surface gradient along the proposed main channels in the site.

- To accommodate minor internal site drainage systems for up to 100 year capacity consideration further consideration of site levels will be necessary.
- Platform levels in the south-eastern portion of the site are likely to require raising by around 0.4 metres (due to the 100 year ARI flood levels of up to 16.3 metres AHD in the channel/OSD, and the outlet to the Greenhills Road system, 'Outlet B', being partially submerged under 100 year ARI conditions).

7.2 Management of external catchments

In general, maximising the developable site area (represented by the accompanying concept civil drawings, and discussed previously in Section 5 of this report) would potentially impact on neighbouring property flooding and require negotiation with neighbouring landholders (with respect to obtaining drainage easements).

The specific locations of potential impact are discussed below, and indicative 'civil design options' sketches of the areas where the current concept civil design may be modified to limit flood impacts on the local neighbouring properties are included in the accompanying Drawings.

7.2.1 Southern site boundary

Along the southern boundary of the site the concept civil design provides for a buffer about two metres wide at existing ground levels between the raised development platform and the site boundary. This southern buffer width requires widening as indicated in the accompanying Drawings. Such widening is to allow for the following.

- Under existing conditions the external south-western catchment discharges into the site. The proposed site filling requires a flow path to be provided that would convey flows westward to a Moorebank Avenue southbound carriageway drainage system.
- Under existing conditions the external south eastern catchment discharges into the site. The proposed site filling requires a flow path to be provided that would convey flows eastward to the existing Greenhills Road ('Outlet B') culvert.

7.2.2 Western site boundary

The existing drainage system serves the western portion of the site also several external catchment areas (the southern external catchment discussed above, a local carpark area to the west of Moorebank, and Moorebank Avenue itself). This existing channel is to be replaced under the current concept civil design by internal site drainage systems. In addition, it is likely that a new channel/culvert system (located within the site) will be necessary to convey runoff from the neighbouring areas along the western site boundary to the existing twin box culverts at "Outlet C" near the north-western corner of the site. Indicative sketches are included in the accompanying Drawings.

7.2.3 Northern site boundary

Along the northern boundary of the site, areas of neighbouring land discharge into the site and are to be conveyed within the site via channel or culvert systems to the existing north-western and north-eastern outlets ("Outlets C" and "Outlet A" respectively). Indicative sketches are included in the accompanying Drawings.

7.2.4 Eastern site boundary

In the north-east corner of the site, current civil design builds over an existing open channel (replacing it with a culvert) that conveys flows to the existing Greenhills Road culvert ("Outlet A"). To avoid adverse flood impacts on neighbouring property it will be necessary to retain the exiting open channel. Indicative sketches are included in the accompanying Drawings.

The accompanying Drawings also include sketches which indicate the management of neighbouring property flows that discharge to the south-eastern culvert ("Outlet B"), and a two metre wide stormwater corridor along the eastern boundary to allow the capture of Greenhills Road runoff.

8 Evacuation and refuge

A flood emergency response plan for the site will be necessary.

The TUFLOW site model results for Anzac Creek (see Appendix E, SIMTA site development) indicates that filling will raise the site above the regional PMF flood levels.

The site is located within upper catchment areas and, as recognised in the NSW Floodplain Management Manual (April 2005, Section L6.2), there would be little if any available warning time for people to undertake action. As such, in developing an evacuation and refuge plan it should include a refuge within the proposed buildings until hazardous flows have subsided and safe evacuation is possible.

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Appendix A

Initial DRAINS model input and output – existing and proposed conditions

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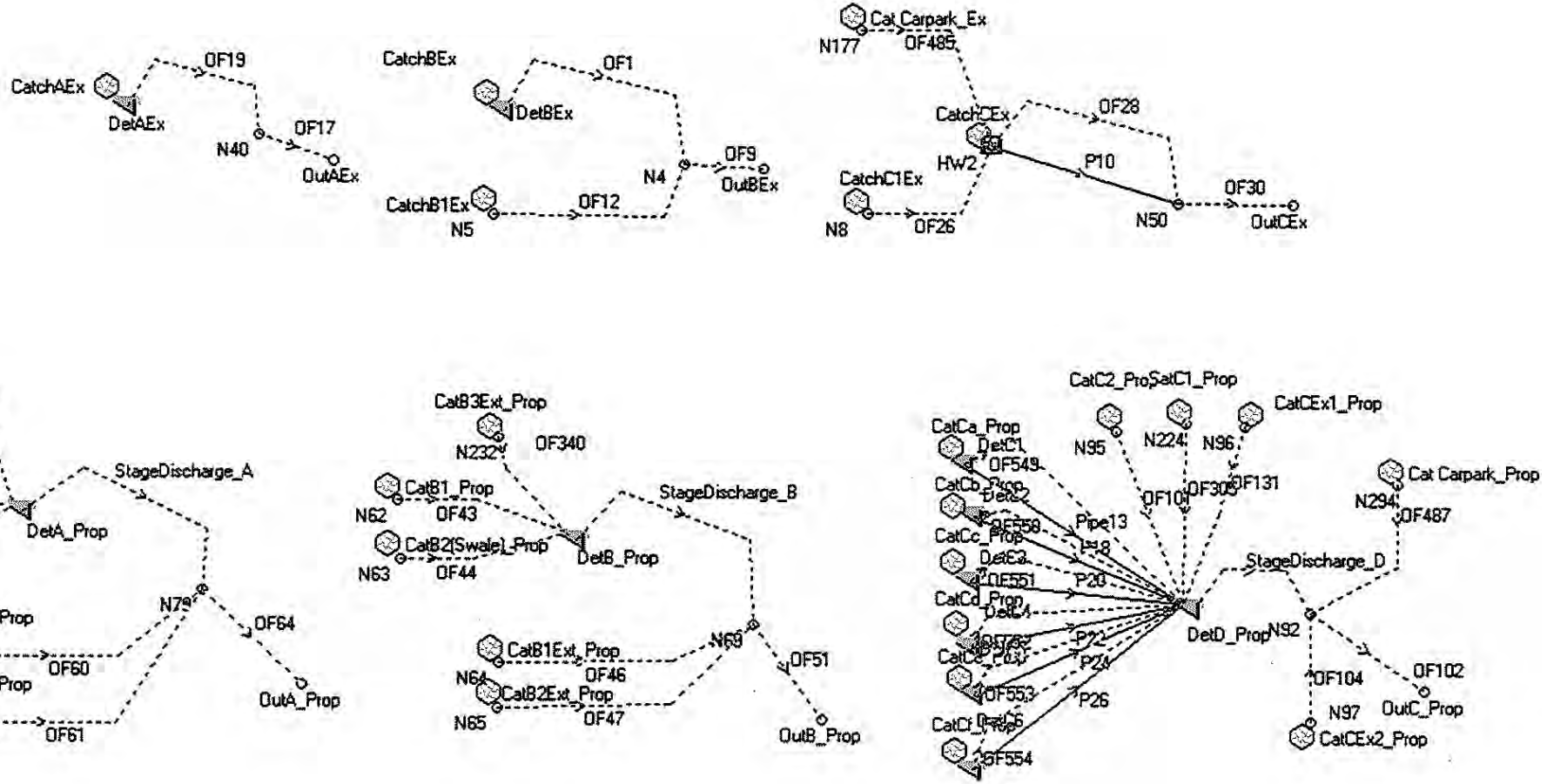
CatchAEx
DetAEx
OF19
N40
OF17
OutAEx
CatchBEx
DetBEx
OF1
N4
OF9
OutBEx
CatchB1Ex
N5
OF12
Cat Carpark_Ex
N177
OF485
CatchCEx
OF28
HW2
P10
CatchC1Ex
N8
OF26
N50
OF30
OutCEx
Cat_A3_Prop
N169
OF205
CatA1_Prop
N75
OF58
CatA2[Swale]_Prop
N76
OF59
DetA_Prop
StageDischarge_A
N79
OF64
OutA_Prop
CatA1Ex_Prop
N77
OF60
CatA2Ex_Prop
N78
OF61
CatB3Ext_Prop
N232
OF340
CatB1_Prop
N62
OF43
CatB2[Swale]_Prop
N63
OF44
DetB_Prop
StageDischarge_B
N69
OF51
OutB_Prop
CatB1Ext_Prop
N64
OF46
CatB2Ext_Prop
N65
OF47
CatC2_ProSatC1_Prop
CatCEx1_Prop
CatCa_Prop
N95
N224
N96
OF549
OF131
OF10
OF305
Cat Carpark_Prop
N294
OF487
Pipe13
CatCc_Prop
OF558
OF551
P23
CatCd_Prop
P21
P24
P26
OF553
OF554
DetD_Prop
N92
StageDischarge_D
OF104
OF102
N97
OutC_Prop
CatCEx2_Prop

DRAINS Model Name and File Path:	F:\AA003210\D-Calculations\C-Civil\Stormwater\DRAINS\Moorebank.drn
DRAINS Version:	2010.09 - 5 August 2010
Modeller's Name:	Chris McClelland
Description:	Moorebank OSD

DATA

PIT / NODE DETAILS			Version 9																			
Name	Type	Family	Size	Ponding Volume	Pressure Change	Surface Elev (m)	Max Pond Depth (m)		Base Inflow	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss							
				(cu.m)	Coeff. Ku				(cu.m/s)													
N4	Node					14			0		755.938	215.845		33								
N5	Node								0		500	150		34								
N8	Node								0		1000	150		37								
OutBEx	Node					13			0		861.978	209.629		1051047								
N40	Node					14			0		186.986	258.088		4370447								
OutAEx	Node								0		280.589	226.888		4370448								
OutCEx	Node								0		1568.098	160.549		5647966								
N57	Node								0		519.483	217.78		12060722								
N62	Node								0		372.322	-233.435		13086144								
N63	Node								0		375.778	-312.823		13086145								
N64	Node								0		505.378	-451.163		13086146								
N65	Node								0		503.65	-511.643		13086147								
N69	Node								0		845.794	-401.051		13086153								
OutB_Prop	Node								0		937.378	-528.923		13086154								
N75	Node								0		-353.438	-210.971		14111581								
N76	Node								0		-356.894	-306.011		14111582								
N77	Node								0		-189.278	-442.523		14111583								
N78	Node								0		-192.734	-532.379		14111584								
N79	Node								0		111.394	-354.396		14111585								
OutA_Prop	Node								0		242.722	-480.539		14111586								
N92	Node					16			0		1591.586	-387.112		15137076								
OutC_Prop	Node								0		1743.309	-491.164		15137077								
N95	Node								0		1331.362	-142.543		15137086								
N96	Node								0		1503.471	-136.322		15137090								
N97	Node								0		1591.586	-533.112		15137091								
N169	Node								0		-296.422	-113.077		46853709								
N177	Node								0		990.8	397.15		51463360								
N224	Node								0		1425.586	-133.112		56906726								
N232	Node								0		507.444	-149.02		73934574								
HW2	Headwall				0.5	14.2			0		1164.783	240.386		83086008								
N50	Node					16			0		1414.308	162.277		5647965								
N294	Node								0		1705.992	-214.147		84070742								

DETENTION BASIN DETAILS																						
Name	Elev	Volume	Init Vol. (cu.m)	Outlet Type	K	Dia(mm)	Centre RL		Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m)	id						
DetBEx	13.24	0	0	None							514.018	288.421	No			48						
	13.3	0.015																				
	13.4	0.19																				
	13.5	4.388																				
	13.6	23.299																				
	13.7	70.52																				
	13.8	162.39																				
	13.9	326.236																				
	14	598.986																				
	14.1	1061.17																				
	14.2	1822.46																				
	14.3	2998.53																				
	14.4	4603.56																				
	14.5	6635.68																				
	14.6	9172.45																				
	14.7	12192.7																				
	14.8	15734.5																				
	14.82	16517.8																				
DetAEx	13	0	0	None							10.018	295.909	No			4370434						
	13.1	0.457																				
	13.2	7.16																				
	13.3	26.646																				
	13.4	71.296																				
	13.5	153.944																				
	13.6	292.6																				
	13.7	516.484																				
	13.8	880.951																				
	13.9	1439.4																				
	14	2241.32																				
	14.1	3343.31																				
	14.2	4761.79																				
DetB_Prop	14	0	0	None							609.058	-288.731	No			13086138						
	16	17843																				
DetA_Prop	14	0	0	None							-130.806	-249.09	No			14111587						
	14.1	977.948																				
	14.2	2048.82																				
	14.3	3209.08																				
	14.4	4467.21																				
	14.5	5793.01																				

	14.6	7148.15																				
	14.7	8527.31																				
	14.8	9930.54																				
	14.9	11357.9																				
	15	12809.4																				
	15.1	14285																				
	15.2	15784.9																				
	15.3	17309.1																				
	15.4	18857.5																				
	15.5	20430.3																				
	15.6	22027.5																				
	15.7	23649.2																				
	15.8	25295.3																				
	15.9	26893.9																				
	16	28517.1																				
DetC1	15	0	0	Culvert	0.5						1129.186	-186.779	No			15137024						
	15.5	200																				
	16	600																				
DetD_Prop	14	0	0	None							1491.586	-382.043	No			15137030						
	16	12437																				
DetC2	15	0	0	Culvert	0.5						1141.282	-257.627	No			15137025						
	15.5	200																				
	16	600																				
DetC3	15	0	0	Culvert	0.5						1136.098	-344.027	No			15137026						
	15.5	200																				
	16	600																				
DetC4	15	0	0	Culvert	0.5						1136.098	-432.155	No			15137027						
	15.5	200																				
	16	600																				
DetC5	15	0	0	Culvert	0.5						1141.282	-496.091	No			15137028						
	15.5	200																				
	16	600																				
DetC6	15	0	0	Culvert	0.5						1137.828	-596.315	No			15137029						
	15.5	200																				
	16	600																				

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor
CatchB1Ex	N5	1.073	0	100	0	3	8	0										0			
CatchC1Ex	N8	2.431	81.8	18.2	0	7	7	0										0			
CatchBEx	DetBEx	26.052	33.4	66.6	0	14.5	24	0										0			
CatchAEx	DetAEx	27.453	50	50	0	13.75	15	0										0			
CatB1_Prop	N62	13.477	100	0	0	6	3	0										0			
CatB2(Swale)_Prop	N63	3.059	100	0	0	9.5	8.5	0										0			
CatB1Ext_Prop	N64	1.073	0	100	0	5	8	0										0			
CatB2Ext_Prop	N65	0.55	0	100	0	8.5	15.5	0										0			
CatA1_Prop	N75	24.798	100	0	0	6	3	0										0			
CatA2(Swale)_Prop	N76	3.506	100	0	0	12	11	0										0			
CatA1Ex_Prop	N77	6.611	46	54	0	13.2	8.3	0										0			
CatA2Ex_Prop	N78	0.785	0	100	0	0	18	0										0			
CatCa_Prop	DetC1	3.562	100	0	0	3	0	0										0			
CatCb_Prop	DetC2	3.377	100	0	0	3	0	0										0			
CatCc_Prop	DetC3	3.371	100	0	0	3	0	0										0			
CatCd_Prop	DetC4	3.513	100	0	0	3	0	0										0			
CatCe_Prop	DetC5	3.232	100	0	0	3	0	0										0			
CatCf_Prop	DetC6	3.616	100	0	0	3	0	0										0			
CatC2_Prop	N95	12.904	100	0	0	3	0	0										0			
CatCEx1_Prop	N96	2.431	81.8	18.2	0	7	7	0										0			
CatCEx2_Prop	N97	2.318	50	50	0	21.7	25	0										0			
Cat_A3_Prop	N169	2.38	100	0	0	3	0	0										0			
Cat Carpark_Ex	N177	2.085	100	0	0	5	0	0										0			
CatC1_Prop	N224	2.139	100	0	0	3	0	0										0			
CatB3Ext_Prop	N232	0.479	0	100	0	0	8	0										0			
CatchCEx	HW2	39.9	60.7	39.3	0	25	30	0										0			
Cat Carpark_Prop	N294	2.085	100	0	0	5	0	0										0			

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
Pipe13	DetC1	DetD_Prop	160	15	14	0.63	Box Culverts	1.2W x 0.45H		0.3	Existing	2	DetC1	0					
P18	DetC2	DetD_Prop	160	15	14	0.63	Box Culverts	1.2W x 0.45H		0.3	Existing	2	DetC2	0					
P20	DetC3	DetD_Prop	160	15	14	0.63	Box Culverts	1.2W x 0.45H		0.3	Existing	2	DetC3	0					
P22	DetC4	DetD_Prop	160	15	14	0.63	Box Culverts	1.2W x 0.45H		0.3	Existing	2	DetC4	0					
P24	DetC5	DetD_Prop	160	15	14	0.63	Box Culverts	1.2W x 0.45H		0.3	Existing	2	DetC5	0					
P26	DetC6	DetD_Prop	160	15	14	0.63	Box Culverts	1.2W x 0.45H		0.3	Existing	2	DetC6	0					
P10	HW2	N50	21	11.45	11.4	0.24	Box Culverts	2W x 1.8H		0.3	Existing	2	HW2	0					

DETAILS of SERVICES CROSSING PIPES

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

DRAINS Model Name and File Path:	F:\AA003210\D-Calculations\C-Civil\Stormwater\DRAINS\Moorebank.drn
DRAINS Version:	2010.09 - 5 August 2010
Modeller's Name:	Chris McClelland
Description:	Moorebank OSD

DRAINS results prepared 02 September, 2010 from Version 2010.09

RESULTS 2 YEAR ARI

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW2	12.34	5.744			1.86	0	None
N50	11.97		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
CatchB1Ex	0.185	0	0.185	3	8	0	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
CatchC1Ex	0.617	0.542	0.076	7	7	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatchBEx	2.76	1.56	1.313	14.5	24	0	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
CatchAEx	4.115	3.019	1.136	13.75	15	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatB1_Prop	3.805	3.805	0	6	3	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatB2(Swale)_Prop	0.785	0.785	0	9.5	8.5	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatB1Ext_Prop	0.185	0	0.185	5	8	0	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
CatB2Ext_Prop	0.06	0	0.06	8.5	15.5	0	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
CatA1_Prop	7.002	7.002	0	6	3	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatA2(Swale)_Prop	0.819	0.819	0	12	11	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatA1Ex_Prop	1.165	0.682	0.512	13.2	8.3	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatA2Ex_Prop	0.076	0	0.076	0	18	0	AR&R 2 year, 1 hour storm, average 33.7 mm/h, Zone 1
CatCa_Prop	1.078	1.078	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
CatCb_Prop	1.022	1.022	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
CatCc_Prop	1.021	1.021	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
CatCd_Prop	1.064	1.064	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
CatCe_Prop	0.979	0.979	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
CatCf_Prop	1.095	1.095	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
CatC2_Prop	3.907	3.907	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
CatCEx1_Prop	0.617	0.542	0.076	7	7	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatCEx2_Prop	0.268	0.197	0.087	21.7	25	0	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
Cat_A3_Prop	0.721	0.721	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
Cat Carpark_Ex	0.618	0.618	0	5	0	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
CatC1_Prop	0.648	0.648	0	3	0	0	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
CatB3Ext_Prop	0.083	0	0.083	0	8	0	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
CatchCEx	4.757	3.863	0.998	25	30	0	AR&R 2 year, 1 hour storm, average 33.7 mm/h, Zone 1
Cat Carpark_Prop	0.618	0.618	0	5	0	0	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1

Outflow Volumes for Total Catchment (142 impervious + 56.3 pervious = 198 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff	Impervious Ru cu.m (Runoff	Pervious Runoff cu.m (Runoff %)
AR&R 2 year, 5 min	18008.62	11568.16 (64.	11472.57 (89.	95.59 (1.9%)
AR&R 2 year, 10 mi	27591.18	19238.41 (69.	18332.42 (92.	906.00 (11.6%)
AR&R 2 year, 15 mi	34595.5	25419.27 (73.	23418.14 (94.	2001.13 (20.3%)
AR&R 2 year, 20 mi	40445.04	30511.70 (75.	27534.07 (95.	2977.62 (25.9%)
AR&R 2 year, 25 mi	45186.76	34650.07 (76.	30928.55 (95.	3721.52 (29.0%)
AR&R 2 year, 30 mi	49366.74	38067.76 (77.	33920.91 (96.	4146.84 (29.6%)
AR&R 2 year, 45 mi	59180.61	46349.80 (78.	40946.35 (96.	5403.45 (32.1%)
AR&R 2 year, 1 hou	66813.62	52769.25 (79.	46410.55 (97.	6358.70 (33.5%)
AR&R 2 year, 1.5 ho	78213.57	61817.24 (79.	54571.59 (97.	7245.65 (32.6%)
AR&R 2 year, 2 hou	87234.42	69022.24 (79.	61029.34 (97.	7992.91 (32.2%)
AR&R 2 year, 3 hou	100517.83	79483.61 (79.	70537.84 (98.	8945.77 (31.3%)
AR&R 2 year, 4.5 ho	115982.09	90767.91 (78.	81608.90 (98.	9159.01 (27.8%)

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
Pipe13	1.018	1.5	15.29	15.273	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
P18	0.964	1.4	15.284	15.273	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
P20	0.962	1.4	15.284	15.273	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
P22	1.004	1.5	15.288	15.273	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
P24	0.921	1.4	15.283	15.273	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
P26	1.034	1.5	15.292	15.273	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
P10	5.744	2.5	12.017	11.967	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1

CHANNEL DETAILS

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

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
OF9	0.4	0.4	0.256	0.06	0.04	15.94	0.75	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF12	0.185	0.185	0.256	0.044	0.03	12.89	0.59	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF26	0.617	0.617	0.256	0.071	0.06	18.28	0.84	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF40	0	0	0.256	0	0	0	0	
OF1	0.279	0.279	0.256	0.052	0.03	14.33	0.67	AR&R 2 year, 3 hours storm, average 16.9 mm/h, Zone 1
OF19	2.424	2.424	0.256	0.125	0.15	29.06	1.21	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
OF17	2.424	2.424	0.256	0.125	0.15	29.06	1.21	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
StageDischarge_B	0.155	0.155	0.256	0.041	0.02	12.17	0.57	AR&R 2 year, 4.5 hours storm, average 13 mm/h, Zone 1
OF43	3.805	3.805	0.256	0.15	0.2	34.08	1.36	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF44	0.785	0.785	0.256	0.079	0.07	19.72	0.9	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF46	0.185	0.185	0.256	0.044	0.03	12.89	0.59	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF47	0.06	0.06	0.256	0.029	0.01	9.73	0.42	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF51	0.3	0.3	0.256	0.053	0.04	14.69	0.68	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF58	7.002	7.002	0.256	0.193	0.31	42.53	1.58	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF59	0.819	0.819	0.256	0.08	0.07	20.08	0.9	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1

OF60	1.185	1.185	0.256	0.094	0.09	22.77	0.99	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF61	0.076	0.076	0.256	0.032	0.01	10.38	0.45	AR&R 2 year, 1 hour storm, average 33.7 mm/h, Zone 1
OF64	1.72	1.72	0.256	0.109	0.12	25.82	1.1	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
StageDischarge_A	0.656	0.656	0.256	0.073	0.06	18.64	0.85	AR&R 2 year, 4.5 hours storm, average 13 mm/h, Zone 1
StageDischarge_D	2.895	2.895	0.256	0.135	0.17	31.03	1.25	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF102	3.427	3.427	0.256	0.144	0.19	32.83	1.32	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
OF101	3.907	3.907	0.256	0.152	0.21	34.44	1.36	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
OF131	0.617	0.617	0.256	0.071	0.06	18.28	0.84	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF104	0.268	0.268	0.256	0.051	0.03	14.15	0.67	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
OF205	0.721	0.721	0.256	0.076	0.07	19.18	0.88	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
OF485	0.618	0.618	0.256	0.071	0.06	18.28	0.84	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF305	0.648	0.648	0.256	0.073	0.06	18.64	0.84	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
OF340	0.083	0.083	0.256	0.033	0.02	10.56	0.46	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF28	0	0	0.256	0	0	0	0	
OF30	5.744	5.744	0.256	0.178	0.27	39.65	1.5	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
OF487	0.618	0.618	0.256	0.071	0.06	18.28	0.84	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q	Max Q	Max Q
			Total	Low Level	High Level
DetBEx	14.41	4876.2	0.279	0	0.279
DetAEx	14.03	2581.4	2.424	0	2.424
DetB_Prop	14.87	7769.8	0.155	0	0.155
DetA_Prop	14.85	10678.8	0.656	0	0.656
DetC1	15.4	158.6	1.018	1.018	0
DetD_Prop	15.27	6864.5	2.895	0	2.895
DetC2	15.38	152.9	0.964	0.964	0
DetC3	15.38	152.7	0.962	0.962	0
DetC4	15.39	157.1	1.004	1.004	0
DetC5	15.37	148.3	0.921	0.921	0
DetC6	15.4	160.2	1.034	1.034	0

CONTINUITY CHECK for AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1

Node	Inflow	Outflow	Storage Chan	Difference
	(cu.m)	(cu.m)	(cu.m)	%
N4	2738.29	2738.29	0	0
N5	154.26	154.26	0	0
N8	918.79	918.79	0	0
DetBEx	6196.01	2587.93	3610.15	0
OutBEx	2734.38	2734.38	0	0
DetAEx	7860.27	7860.33	0	0
N40	7860.33	7860.33	0	0
OutAEx	7860.33	7860.33	0	0
OutCEx	14438.72	14438.72	0	0
N57	0	0	0	0
DetB_Prop	7179.35	1219.52	5960.83	0
N62	5795.11	5795.11	0	0
N63	1315.37	1315.37	0	0
N64	154.26	154.26	0	0
N65	78.4	78.4	0	0
N69	1450.19	1450.19	0	0
OutB_Prop	1448.18	1448.18	0	0
N75	10663.14	10663.14	0	0
N76	1507.58	1507.58	0	0
N77	1820.55	1820.55	0	0
N78	111.59	111.59	0	0
N79	7309.26	7309.25	0	0
OutA_Prop	7301.13	7301.13	0	0
DetA_Prop	13194.12	5385.22	7813	0
DetC1	1531.66	1530.95	0.72	0
DetD_Prop	16271.57	15231.24	1042.43	0
DetC2	1452.11	1451.4	0.71	0
DetC3	1449.53	1448.82	0.71	0
DetC4	1510.59	1509.88	0.71	0
DetC5	1389.76	1389.05	0.71	0
DetC6	1554.88	1554.16	0.72	0
N92	16785.89	16785.68	0	0
OutC_Prop	16781.74	16781.74	0	0
N95	5548.72	5548.72	0	0
N96	918.79	918.79	0	0
N97	662.22	662.22	0	0
N169	1023.4	1023.4	0	0
N177	896.55	896.55	0	0
N224	919.77	919.77	0	0
N232	68.87	68.87	0	0
HW2	14438.71	14438.72	0	0
N50	14438.72	14438.72	0	0
N294	896.55	896.55	0	0

Run Log for Moorebank.dm run at 17:01:26 on 2/9/2010

The maximum flow exceeded the safe value in the following overflow routes: OF487, OF485, OF305, OF205, OF131, OF104, OF102, OF101, StageDischarge_D, OF64, StageDischarge_A, OF60,

DRAINS results prepared 02 September, 2010 from Version 2010.09

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW2	12.06	3.217			2.14	0	None
N50	11.78		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q	Paved Max Q	Grassed Max Q	Paved Tc	Grassed Tc	Supp. Tc	Due to Storm

	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)							
CatchB1Ex	0.07	0	0.07	3	8	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatchC1Ex	0.208	0.179	0.029	7	7	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatchBEx	1.753	0.684	1.069	14.5	24	0	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1						
CatchAEx	2.117	1.235	0.882	13.75	15	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatB1_Prop	1.213	1.213	0	6	3	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatB2(Swale)_Prop	0.275	0.275	0	9.5	8.5	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatB1Ext_Prop	0.07	0	0.07	5	8	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatB2Ext_Prop	0.035	0	0.035	8.5	15.5	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatA1_Prop	2.232	2.232	0	6	3	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatA2(Swale)_Prop	0.316	0.316	0	12	11	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatA1Ex_Prop	0.507	0.274	0.233	13.2	8.3	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatA2Ex_Prop	0.048	0	0.048	0	18	0	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1						
CatCa_Prop	0.321	0.321	0	3	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatCb_Prop	0.304	0.304	0	3	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatCc_Prop	0.303	0.303	0	3	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatCd_Prop	0.316	0.316	0	3	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatCe_Prop	0.291	0.291	0	3	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatCf_Prop	0.325	0.325	0	3	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatC2_Prop	1.161	1.161	0	3	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatCEx1_Prop	0.208	0.179	0.029	7	7	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatCEx2_Prop	0.163	0.091	0.071	21.7	25	0	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1						
Cat_A3_Prop	0.214	0.214	0	3	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
Cat Carpark_Ex	0.188	0.188	0	5	0	0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatC1_Prop	0.193	0.193	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatB3Ext_Prop	0.031	0	0.031	0	8	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						
CatchCEx	2.87	1.904	0.966	25	30	0.0	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1						
Cat Carpark_Prop	0.188	0.188	0	5	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1						

Outflow Volumes for Total Catchment (142 Impervious + 56.3 pervious = 198 total ha)

Storm	Total Rainfall	Total Runoff	Impervious Ru	Pervious Runoff
	cu.m	cu.m (Runoff	cu.m (Runoff %	cu.m (Runoff %)
AR&R 2 year, 6 hou	128472.47	100604.63 (7	90548.96 (98.	10055.67 (27.5%)
AR&R 2 year, 9 hou	148457.06	117073.04 (7	104858.02 (98	12215.03 (29.0%)
AR&R 2 year, 12 ho	164635.09	130169.91 (7	116433.61 (98	13736.30 (29.4%)
AR&R 2 year, 18 ho	190924.36	146875.19 (7	135258.25 (99	11416.94 (21.0%)
AR&R 2 year, 24 ho	211741.67	160682.31 (7	150162.25 (99	10520.06 (17.5%)

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)	
Pipe13	0.321	1.5	15.09	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
P18	0.304	1.5	15.087	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
P20	0.303	1.5	15.086	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
P22	0.316	1.5	15.089	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
P24	0.291	1.4	15.084	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
P26	0.325	1.5	15.09	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
P10	3.217	2.1	11.831	11.781	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1

CHANNEL DETAILS

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

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
OF9	0.32	0.32	7.665	0.054	0.04	14.9	0.71	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF12	0.07	0.07	7.665	0.031	0.01	10.2	0.44	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF26	0.208	0.208	7.665	0.046	0.03	13.3	0.61	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF40	0	0	7.665	0	0	0.0	0	
OF1	0.286	0.286	7.665	0.053	0.04	14.5	0.67	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF19	1.28	1.28	7.665	0.097	0.1	23.3	1.02	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF17	1.28	1.28	7.665	0.097	0.1	23.3	1.02	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
StageDischarge_B	0.18	0.18	7.665	0.044	0.03	12.7	0.59	AR&R 2 year, 12 hours storm, average 6.92 mm/h, Zone 1
OF43	1.213	1.213	7.665	0.095	0.09	23.0	1	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF44	0.275	0.275	7.665	0.052	0.03	14.3	0.67	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF46	0.07	0.07	7.665	0.031	0.01	10.2	0.44	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF47	0.035	0.035	7.665	0.024	0.01	7.9	0.37	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF51	0.246	0.246	7.665	0.049	0.03	13.8	0.65	AR&R 2 year, 12 hours storm, average 6.92 mm/h, Zone 1
OF58	2.232	2.232	7.665	0.121	0.14	28.2	1.19	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF59	0.316	0.316	7.665	0.054	0.04	14.9	0.7	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF60	0.507	0.507	7.665	0.066	0.05	17.2	0.79	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF61	0.048	0.048	7.665	0.026	0.01	8.8	0.41	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF64	1.16	1.16	7.665	0.093	0.09	22.6	0.99	AR&R 2 year, 12 hours storm, average 6.92 mm/h, Zone 1
StageDischarge_A	0.712	0.712	7.665	0.076	0.07	19.2	0.87	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
StageDischarge_D	2.42	2.42	7.665	0.125	0.16	29.1	1.2	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF102	2.718	2.718	7.665	0.132	0.18	30.3	1.24	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF101	1.161	1.161	7.665	0.093	0.09	22.6	0.99	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF131	0.208	0.208	7.665	0.046	0.03	13.3	0.61	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF104	0.163	0.163	7.665	0.042	0.02	12.4	0.58	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF205	0.214	0.214	7.665	0.046	0.03	13.3	0.63	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF485	0.188	0.188	7.665	0.044	0.03	12.9	0.59	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF305	0.193	0.193	7.665	0.044	0.03	12.9	0.61	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF340	0.031	0.031	7.665	0.023	0.01	7.63	0.36	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF28	0	0	7.665	0	0	0	0	
OF30	3.217	3.217	7.665	0.141	0.18	32.11	1.3	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF487	0.188	0.188	7.665	0.044	0.03	12.89	0.59	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q	Max Q	Max Q
			Total	Low Level	High Level
DetBEx	14.44	5477.2	0.286	0	0.286
DetAEx	13.95	1865.5	1.28	0	1.28
DetB_Prop	15.12	10003.7	0.18	0	0.18

DetA_Prop	14.96	12294.1	0.712	0	0.712							
DetC1	15.18	73.4	0.321	0.321	0							
DetD_Prop	15	5388.2	2.42	0	2.42							
DetC2	15.18	70.8	0.304	0.304	0							
DetC3	15.18	70.7	0.303	0.303	0							
DetC4	15.18	72.7	0.316	0.316	0							
DetC5	15.17	68.8	0.291	0.291	0							
DetC6	15.19	74.1	0.325	0.325	0							
CONTINUITY CHECK for AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1												
Node	Inflow	Outflow	Storage Chan	Difference								
	(cu.m)	(cu.m)	(cu.m)	%								
N4	5908.5	5908.5	0	0								
N5	192.6	192.6	0	0								
N8	1348.14	1348.14	0	0								
DetBEx	8645.3	5719.64	2927.67	0								
OutBEx	5904.76	5904.76	0	0								
DetAEx	11214.22	11214.25	0	0								
N40	11214.25	11214.25	0	0								
OutAEx	11214.25	11214.25	0	0								
OutCEx	20919.38	20919.38	0	0								
N57	0	0	0	0								
DetB_Prop	10635.92	3011.81	7625.3	0								
N62	8598.28	8598.28	0	0								
N63	1951.65	1951.65	0	0								
N64	192.6	192.6	0	0								
N65	98.42	98.42	0	0								
N69	3300.56	3300.55	0	0								
OutB_Prop	3298.29	3298.29	0	0								
N75	15821.16	15821.16	0	0								
N76	2236.83	2236.83	0	0								
N77	2580.85	2580.85	0	0								
N78	140.32	140.32	0	0								
N79	15036.61	15036.64	0	0								
OutA_Prop	15028.91	15028.91	0	0								
DetA_Prop	19576.53	12323.19	7257.09	0								
DetC1	2272.56	2271.95	0.61	0								
DetD_Prop	24129.7	23534.2	597.04	0								
DetC2	2154.49	2153.92	0.6	0								
DetC3	2150.67	2150.09	0.6	0								
DetC4	2241.27	2240.69	0.61	0								
DetC5	2062.03	2061.42	0.6	0								
DetC6	2307.02	2306.4	0.61	0								
N92	25808.08	25808.09	0	0								
OutC_Prop	25805.72	25805.72	0	0								
N95	8232.74	8232.74	0	0								
N96	1348.14	1348.14	0	0								
N97	946.02	946.02	0	0								
N169	1518.43	1518.43	0	0								
N177	1330.24	1330.24	0	0								
N224	1364.68	1364.68	0	0								
N232	85.98	85.98	0	0								
HW2	20919.36	20919.38	0	0								
N50	20919.38	20919.38	0	0								
N294	1330.24	1330.24	0	0								
Run Log for Moorebank.drn run at 17:01:52 on 2/9/2010												
The following detention basins have little effect (less than 2%) in reducing peak discharge: DetC6, DetC5, DetC4, DetC3, DetC2, DetC1 You might consider upsizing these, or removing them												

CHANNEL DETAILS																						
Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Rodded									
				(m)	(m)	(m)	(%)	(m)	(1:?)	(1:?)	n	(m)										
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 Storms	Minor Storms	DxV	Slope	Contributing										
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%										
OF9	N4	OutBEx	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		1051048								
OF12	N5	N4	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		1575195								
OF26	N8	HW2	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		5647957								
OF40	DetBEx	N57	0.1	14.82	10	1.7	Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		12060721								
OF1	DetBEx	N4	0.1	13.24			Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		70								
OF19	DetAEx	N40	0.1	13			Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		4370450								
OF17	N40	OutAEx	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		4370449								
StageDischarge_B	DetB_Prop	N69	0.1	14			Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		13086155								
OF43	N62	DetB_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		13086141								
OF44	N63	DetB_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		13086142								
OF46	N64	N69	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		13086156								
OF47	N65	N69	4.75				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		13086157								
OF51	N69	OutB_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		13086163								
OF58	N75	DetA_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		14111588								
OF59	N76	DetA_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		14111589								
OF60	N77	N79	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		14111590								
OF61	N78	N79	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		14111591								
OF64	N79	OutA_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		14111594								
StageDischarge_A	DetA_Prop	N79	0.1	14			Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		14111593								
StageDischarge_D	DetD_Prop	N92	0.1	14			Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		15137075								
OF102	N92	OutC_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		15137087								
OF101	N95	DetD_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		15137085								
OF131	N96	DetD_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		20006340								
OF104	N97	N92	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		15137089								
OF205	N169	DetA_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		46853710								
OF485	N177	HW2	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		84070745								
OF305	N224	DetD_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		66906727								
OF340	N232	DetB_Prop	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		73934575								
OF28	HW2	N50	0.1	14.2	20	1.6	Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		5647953								
OF30	N50	OutCEx	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		5647967								
OF487	N294	N92	0.1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0		84070747								

OF17	2.424	2.424	0.256	0.125	0.15	29.06	1.21	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
StageDischarge_B	0.15	0.15	0.256	0.041	0.02	12.17	0.55	AR&R 2 year, 4.5 hours storm, average 13 mm/h, Zone 1
OF43	3.635	3.635	0.256	0.148	0.2	33.55	1.34	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF44	0.785	0.785	0.256	0.079	0.07	19.72	0.9	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF46	0.185	0.185	0.256	0.044	0.03	12.89	0.59	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF47	0.06	0.06	0.256	0.029	0.01	9.73	0.42	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF51	0.297	0.297	0.256	0.053	0.04	14.69	0.68	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF58	7.046	7.046	0.256	0.194	0.31	42.71	1.58	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF59	0.819	0.819	0.256	0.08	0.07	20.08	0.9	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF60	1.185	1.185	0.256	0.094	0.09	22.77	0.99	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF61	0.076	0.076	0.256	0.032	0.01	10.38	0.45	AR&R 2 year, 1 hour storm, average 33.7 mm/h, Zone 1
OF64	1.687	1.687	0.256	0.108	0.12	25.64	1.09	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
StageDischarge_A	0.644	0.644	0.256	0.072	0.06	18.46	0.86	AR&R 2 year, 4.5 hours storm, average 13 mm/h, Zone 1
OF549	0	0	0.256	0	0	0	0	
StageDischarge_D	2.895	2.895	0.256	0.135	0.17	31.03	1.25	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF550	0	0	0.256	0	0	0	0	
OF551	0	0	0.256	0	0	0	0	
OF552	0	0	0.256	0	0	0	0	
OF553	0	0	0.256	0	0	0	0	
OF554	0	0	0.256	0	0	0	0	
OF102	3.427	3.427	0.256	0.144	0.19	32.83	1.32	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
OF101	3.907	3.907	0.256	0.152	0.21	34.44	1.36	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
OF131	0.617	0.617	0.256	0.071	0.06	18.28	0.84	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF104	0.268	0.268	0.256	0.051	0.03	14.15	0.67	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
OF205	0.721	0.721	0.256	0.076	0.07	19.18	0.88	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
OF485	0.618	0.618	0.256	0.071	0.06	18.28	0.84	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF305	0.648	0.648	0.256	0.073	0.06	18.64	0.84	AR&R 2 year, 5 minutes storm, average 109 mm/h, Zone 1
OF340	0.083	0.083	0.256	0.033	0.02	10.56	0.46	AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1
OF28	0	0	0.256	0	0	0	0	
OF30	5.744	5.744	0.256	0.178	0.27	39.65	1.5	AR&R 2 year, 1.5 hours storm, average 26.3 mm/h, Zone 1
OF487	0.618	0.618	0.256	0.071	0.06	18.28	0.84	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF594	4.88	4.88	0.256	0.167	0.24	37.32	1.44	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF593	3.38	3.38	0.256	0.143	0.19	32.65	1.32	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF590	1.668	1.668	0.256	0.107	0.12	25.46	1.1	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1
OF600	1.258	1.258	0.256	0.096	0.1	23.13	1.02	AR&R 2 year, 25 minutes storm, average 54.7 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
DetBEx	14.41	4876.2	0.279	0	0.279
DetAEx	14.03	2581.4	2.424	0	2.424
DetB_Prop	14.84	7513.2	0.15	0	0.15
DetA_Prop	14.83	11146	0.644	0	0.644
DetC1	15.4	158.6	1.018	1.018	0
DetD_Prop	15.27	6864.6	2.895	0	2.895
DetC2	15.38	152.9	0.964	0.964	0
DetC3	15.38	152.7	0.962	0.962	0
DetC4	15.39	157.1	1.004	1.004	0
DetC5	15.37	148.3	0.921	0.921	0
DetC6	15.4	160.2	1.034	1.034	0

CONTINUITY CHECK for AR&R 2 year, 2 hours storm, average 22 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
N4	2738.34	2738.34	0	0
N5	154.26	154.26	0	0
N8	918.79	918.79	0	0
DetBEx	6196.01	2587.98	3610.1	0
OutBEx	2734.44	2734.44	0	0
DetAEx	7860.27	7860.33	0	0
N40	7860.33	7860.33	0	0
OutAEx	7860.33	7860.33	0	0
OutCEx	14438.72	14438.72	0	0
DetB_Prop	6943.71	1187.58	5757.1	0
N62	5559.47	5559.47	0	0
N63	1315.37	1315.37	0	0
N64	154.26	154.26	0	0
N65	78.4	78.4	0	0
N69	1418.31	1418.31	0	0
OutB_Prop	1416.37	1416.37	0	0
N75	10897.49	10897.5	0	0
N76	1507.58	1507.58	0	0
N77	1820.55	1820.55	0	0
N78	111.59	111.59	0	0
N79	7109.66	7109.65	0	0
OutA_Prop	7101.74	7101.74	0	0
DetA_Prop	13426.48	5185.42	8246.99	0
DetC1	1531.66	1530.95	0.72	0
DetD_Prop	16271.57	15231.24	1042.43	0
DetC2	1452.11	1451.4	0.71	0
DetC3	1449.53	1448.82	0.71	0
DetC4	1510.59	1509.88	0.71	0
DetC5	1389.76	1389.05	0.71	0
DetC6	1554.88	1554.16	0.72	0
N92	16785.89	16785.88	0	0
OutC_Prop	16781.74	16781.74	0	0
N95	5548.72	5548.72	0	0
N96	918.79	918.79	0	0
N97	662.22	662.22	0	0
N169	1023.4	1023.4	0	0
N177	896.55	896.55	0	0
N224	919.77	919.77	0	0
N232	68.87	68.87	0	0
HW2	14438.71	14438.72	0	0

N50	14438.72	14438.72	0	0								
N294	896.55	896.55	0	0								
N320	397.73	397.73	0	0								
N321	1401.36	1401.36	0	0								
N322	150.04	150.04	0	0								
N323	4837	4837	0	0								
N324	168.11	168.11	0	0								
N325	58.52	58.52	0	0								
N326	7512.96	7512.96	0	0								
N327	5178.06	5178.06	0	0								
N328	2540.44	2540.44	0	0								
N329	1916.51	1916.51	0	0								
Run Log for Moorebank_REV02 run at 10:31:20 on 9/8/2011												
The maximum flow exceeded the safe value in the following overflow routes: OF600, OF594, OF593, OF590, OF487, OF485, OF305, OF205, OF131, OF104, OF102, OF101, StageDischarge_D, C												
DRAINS results prepared 09 August, 2011 from Version 2010.09												
PIT / NODE DETAILS				Version 8								
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint					
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)						
			(cu.m/s)	(cu.m)	(m)							
HW2	12.06	3.217			2.14	0	None					
N50	11.78		0									
SUB-CATCHMENT DETAILS												
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm					
	Flow Q	Max Q	Max Q	Tc	Tc	Tc						
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)						
CatchB1Ex	0.07	0	0.07	3	8	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatchC1Ex	0.208	0.179	0.029	7	7	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatchBEx	1.753	0.684	1.069	14.5	24	0.0	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1					
CatchAEx	2.117	1.235	0.882	13.75	15	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatB1_Prop	0.762	0.762	0	6	3	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatB2(Swale)_Prop	0.275	0.275	0	9.5	8.5	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatB1Ext_Prop	0.07	0	0.07	5	8	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatB2Ext_Prop	0.035	0	0.035	8.5	15.5	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatA1_Prop	0.708	0.708	0	6	3	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatA2(Swale)_Prop	0.316	0.316	0	12	11	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatA1Ex_Prop	0.507	0.274	0.233	13.2	8.3	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatA2Ex_Prop	0.048	0	0.048	0	18	0.0	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1					
CatCa_Prop	0.321	0.321	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatCb_Prop	0.304	0.304	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatCc_Prop	0.303	0.303	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatCd_Prop	0.316	0.316	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatCe_Prop	0.291	0.291	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatCf_Prop	0.325	0.325	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatC2_Prop	1.161	1.161	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatCEx1_Prop	0.208	0.179	0.029	7	7	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatCEx2_Prop	0.163	0.091	0.071	21.7	25	0.0	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1					
Cat_A3_Prop	0.214	0.214	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
Cat Carpark_Ex	0.188	0.188	0	5	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatC1_Prop	0.193	0.193	0	3	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatB3Ext_Prop	0.031	0	0.031	0	8	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatchCEx	2.87	1.904	0.966	25	30	0.0	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1					
Cat Carpark_Prop	0.188	0.188	0	5	0	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
Cat1	0.107	0.062	0.045	5	12	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
Cat2	0.355	0.24	0.114	7	15	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
Cat3	0.041	0.024	0.017	4	8	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
Cat4	1.085	0.949	0.136	5	15	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
Cat5	0.046	0.026	0.019	6	8	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
Cat6	0.016	0.009	0.007	6	8	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatA4_Prop	0.489	0.489	0	6	3	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatA5_Prop	0.552	0.552	0	6	3	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatA6_Prop	0.532	0.532	0	6	3	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
CatB3_Prop	0.401	0.401	0	6	3	0.0	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1					
Outflow Volumes for Total Catchment (156 impervious + 61.6 pervious = 218 total ha)												
Storm	Total Rainfall	Total Runoff	Impervious Ru	Pervious Runoff								
	cu.m	cu.m (Runoff	cu.m (Runoff %	cu.m (Runoff %)								
AR&R 2 year, 6 hou	141305.98	110836.58 (78	99842.64 (98.1	10993.94 (27.6%)								
AR&R 2 year, 9 hou	163286.91	128975.79 (79	115622.15 (98	13353.64 (29.0%)								
AR&R 2 year, 12 ho	181081	143399.65 (79	128379.24 (98	15020.40 (29.4%)								
AR&R 2 year, 18 ho	209996.39	161625.47 (77	149142.59 (99	12482.88 (21.1%)								
AR&R 2 year, 24 ho	232893.2	177091.17 (76	165586.45 (99	11504.72 (17.5%)								
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)								
Pipe13	0.321	1.5	15.09	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1							
P18	0.304	1.5	15.087	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1							
P20	0.303	1.5	15.086	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1							
P22	0.316	1.5	15.089	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1							
P24	0.291	1.4	15.084	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1							
P26	0.325	1.5	15.09	14.999	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1							
P10	3.217	2.1	11.831	11.781	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1							
CHANNEL DETAILS												
Name	Max Q	Max V	Chainage	Max	Due to Storm							
	(cu.m/s)	(m/s)	(m)	HGL (m)								
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				
OF9	0.32	0.32	7.665	0.054	0.04	14.87	0.71	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1				

OF12	0.07	0.07	7.665	0.031	0.01	10.2	0.44	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF26	0.208	0.208	7.665	0.046	0.03	13.25	0.61	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF1	0.286	0.286	7.665	0.053	0.04	14.51	0.67	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF19	1.28	1.28	7.665	0.097	0.1	23.31	1.02	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF17	1.28	1.28	7.665	0.097	0.1	23.31	1.02	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
StageDischarge_B	0.176	0.176	7.665	0.044	0.03	12.71	0.58	AR&R 2 year, 24 hours storm, average 4.45 mm/h, Zone 1
OF43	1.164	1.164	7.665	0.093	0.09	22.59	0.99	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF44	0.275	0.275	7.665	0.052	0.03	14.33	0.67	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF46	0.07	0.07	7.665	0.031	0.01	10.2	0.44	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF47	0.035	0.035	7.665	0.024	0.01	7.93	0.37	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF51	0.24	0.24	7.665	0.049	0.03	13.79	0.64	AR&R 2 year, 12 hours storm, average 6.92 mm/h, Zone 1
OF58	2.281	2.281	7.665	0.123	0.14	28.52	1.18	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF59	0.316	0.316	7.665	0.054	0.04	14.87	0.7	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF60	0.507	0.507	7.665	0.066	0.05	17.2	0.79	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF61	0.048	0.048	7.665	0.026	0.01	8.83	0.41	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF64	1.156	1.156	7.665	0.092	0.09	22.41	1	AR&R 2 year, 12 hours storm, average 6.92 mm/h, Zone 1
StageDischarge_A	0.705	0.705	7.665	0.076	0.07	19.18	0.86	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF549	0	0	7.665	0	0	0	0	
StageDischarge_D	2.42	2.42	7.665	0.125	0.15	29.06	1.2	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF550	0	0	7.665	0	0	0	0	
OF551	0	0	7.665	0	0	0	0	
OF552	0	0	7.665	0	0	0	0	
OF553	0	0	7.665	0	0	0	0	
OF554	0	0	7.665	0	0	0	0	
OF102	2.718	2.718	7.665	0.132	0.16	30.31	1.24	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF101	1.161	1.161	7.665	0.093	0.09	22.59	0.99	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF131	0.208	0.208	7.665	0.046	0.03	13.25	0.61	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF104	0.163	0.163	7.665	0.042	0.02	12.35	0.58	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF205	0.214	0.214	7.665	0.046	0.03	13.25	0.63	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF485	0.188	0.188	7.665	0.044	0.03	12.89	0.59	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF305	0.193	0.193	7.665	0.044	0.03	12.89	0.61	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF340	0.031	0.031	7.665	0.023	0.01	7.63	0.36	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF28	0	0	7.665	0	0	0	0	
OF30	3.217	3.217	7.665	0.141	0.18	32.11	1.3	AR&R 2 year, 9 hours storm, average 8.32 mm/h, Zone 1
OF487	0.188	0.188	7.665	0.044	0.03	12.89	0.59	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF594	1.572	1.572	7.665	0.105	0.11	24.92	1.08	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF593	1.084	1.084	7.665	0.09	0.09	22.05	0.97	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF590	0.532	0.532	7.665	0.067	0.05	17.38	0.81	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1
OF600	0.401	0.401	7.665	0.06	0.04	15.94	0.75	AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
DetBEx	14.44	5477.2	0.286	0	0.286
DetAEx	13.95	1865.5	1.28	0	1.28
DetB_Prop	15.08	9649.6	0.176	0	0.176
DetA_Prop	14.95	12952.5	0.705	0	0.705
DetC1	15.18	73.4	0.321	0.321	0
DetD_Prop	15	5388.2	2.42	0	2.42
DetC2	15.18	70.6	0.304	0.304	0
DetC3	15.18	70.7	0.303	0.303	0
DetC4	15.18	72.7	0.316	0.316	0
DetC5	15.17	68.8	0.291	0.291	0
DetC6	15.19	74.1	0.325	0.325	0

CONTINUITY CHECK for AR&R 2 year, 6 hours storm, average 10.8 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
N4	5808.61	5808.6	0	0
N5	192.6	192.6	0	0
N8	1348.14	1348.14	0	0
DetBEx	8645.3	5719.75	2927.56	0
OutBEx	5904.86	5904.86	0	0
DetAEx	11214.22	11214.25	0	0
N40	11214.25	11214.25	0	0
OutAEx	11214.25	11214.25	0	0
OutCEx	20919.38	20919.38	0	0
DetB_Prop	10286.31	2947.99	7339.47	0
N62	8248.66	8248.73	0	0
N63	1951.65	1951.65	0	0
N64	192.6	192.6	0	0
N65	98.42	98.42	0	0
N69	3236.75	3236.75	0	0
OutB_Prop	3234.5	3234.5	0	0
N75	16168.73	16168.84	0	0
N76	2236.83	2236.83	0	0
N77	2580.85	2580.85	0	0
N78	140.32	140.32	0	0
N79	14733.7	14733.74	0	0
OutA_Prop	14726.05	14726.05	0	0
DetA_Prop	19924.3	12020.24	7907.71	0
DetC1	2272.56	2271.95	0.61	0
DetD_Prop	24129.7	23534.2	597.04	0
DetC2	2154.49	2153.92	0.6	0
DetC3	2150.67	2150.09	0.6	0
DetC4	2241.27	2240.69	0.61	0
DetC5	2062.03	2061.42	0.6	0
DetC6	2307.02	2306.4	0.61	0
N92	25808.08	25808.09	0	0
OutC_Prop	25805.72	25805.72	0	0
N95	8232.74	8232.74	0	0
N96	1348.14	1348.14	0	0
N97	946.02	946.02	0	0
N169	1518.43	1518.43	0	0

N177	1330.24	1330.24	0	0								
N224	1364.68	1364.68	0	0								
N232	85.98	85.98	0	0								
HW2	20919.36	20919.38	0	0								
N50	20919.38	20919.38	0	0								
N294	1330.24	1330.24	0	0								
N320	567.13	567.13	0	0								
N321	2021.12	2021.12	0	0								
N322	213.78	213.78	0	0								
N323	7107.89	7107.89	0	0								
N324	239.53	239.53	0	0								
N325	83.38	83.38	0	0								
N326	11147.16	11147.2	0	0								
N327	7682.77	7682.86	0	0								
N328	3769.31	3769.31	0	0								
N329	2843.54	2843.54	0	0								
Run Log for Moorebank_REV02 run at 10:31:48 on 9/8/2011												
The following detention basins have little effect (less than 2%) in reducing peak discharge: DetC6, DetC5, DetC4, DetC3, DetC2, DetC1 You might consider upsizing these, or removing them												

DRAINS Model Name and File Path:	F:\AA003210\D-Calculations\C-Civil\Stormwater\DRAINS\Post PEA\Moorebank_REV02-20110713.dm
DRAINS Version:	2010.09 - 5 August 2010
Modeller's Name:	Chris McClelland
Description:	Moorebank OSD

DRAINS results prepared 09 August, 2011 from Version 2010.09

RESULTS 20 YEAR ARI

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW2	12.76	10.166			1.44	0	None
N50	12.25		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
CatchB1Ex	0.381	0	0.381	3	8	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatchC1Ex	1.032	0.87	0.163	7	7	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatchBEx	5.832	2.538	3.35	14.5	24	0	AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1
CatchAEx	7.717	4.854	3.112	13.75	15	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatB1_Prop	3.84	3.84	0	6	3	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatB2(Swale)_Prop	1.26	1.26	0	9.5	8.5	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatB1Ext_Prop	0.381	0	0.381	5	8	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatB2Ext_Prop	0.132	0	0.132	8.5	15.5	0	AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1
CatA1_Prop	3.567	3.567	0	6	3	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatA2(Swale)_Prop	1.315	1.315	0	12	11	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatA1Ex_Prop	2.342	1.094	1.248	13.2	8.3	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatA2Ex_Prop	0.179	0	0.179	0	18	0	AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1
CatCa_Prop	1.732	1.732	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
CatCb_Prop	1.642	1.642	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
CatCc_Prop	1.639	1.639	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
CatCd_Prop	1.708	1.708	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
CatCe_Prop	1.571	1.571	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
CatCf_Prop	1.758	1.758	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
CatC2_Prop	6.273	6.273	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
CatCEx1_Prop	1.032	0.87	0.163	7	7	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatCEx2_Prop	0.511	0.32	0.211	21.7	25	0	AR&R 20 year, 1.5 hours storm, average 42.7 mm/h, Zone 1
Cat_A3_Prop	1.157	1.157	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
Cat Carpark_Ex	0.992	0.992	0	5	0	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatC1_Prop	1.04	1.04	0	3	0	0	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
CatB3Ext_Prop	0.17	0	0.17	0	8	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatchCEx	8.567	6.236	2.563	25	30	0	AR&R 20 year, 1 hour storm, average 54.4 mm/h, Zone 1
Cat Carpark_Prop	0.992	0.992	0	5	0	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
Cat1	0.511	0.33	0.189	5	12	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
Cat2	1.538	1.167	0.403	7	15	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
Cat3	0.217	0.124	0.093	4	8	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
Cat4	5.457	5.017	0.478	5	15	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
Cat5	0.237	0.133	0.104	6	8	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
Cat6	0.082	0.046	0.036	6	8	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatA4_Prop	2.461	2.461	0	6	3	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatA5_Prop	2.78	2.78	0	6	3	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatA6_Prop	2.678	2.678	0	6	3	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
CatB3_Prop	2.02	2.02	0	6	3	0	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1

Outflow Volumes for Total Catchment (156 impervious + 61.6 pervious = 218 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff	Impervious Ru cu.m (Runoff %	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 m	31801.12	23349.77 (73.	21257.06 (93.	2092.71 (23.3%)
AR&R 20 year, 10 r	48701.14	39129.66 (80.	33385.34 (95.	5744.31 (41.8%)
AR&R 20 year, 15 r	61058.14	50683.12 (83.	42253.21 (96.	8429.90 (48.9%)
AR&R 20 year, 20 r	71379.88	60285.51 (84.	49660.72 (96.	10624.79 (52.7%)
AR&R 20 year, 25 r	79775.38	67927.40 (85.	55685.65 (97.	12241.75 (54.3%)
AR&R 20 year, 30 r	87116.89	74393.13 (85.	60954.32 (97.	13438.81 (54.6%)
AR&R 20 year, 45 r	104834.66	90285.41 (86.	73669.27 (97.	16616.13 (56.1%)
AR&R 20 year, 1 ho	116627.25	102699.03 (88	83567.49 (98.	19131.53 (57.1%)
AR&R 20 year, 1.5	139670.52	121238.64 (8	98669.28 (98.	22569.36 (57.2%)
AR&R 20 year, 2 ho	156134.39	135577.38 (8	110484.45 (98	25092.93 (56.9%)
AR&R 20 year, 3 ho	181866.03	158100.23 (8	128950.34 (98	29149.89 (56.8%)
AR&R 20 year, 4.5	210977.67	182255.05 (8	149844.19 (98	32410.87 (54.4%)

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
Pipe13	1.549	1.4	15.728	15.649	AR&R 20 year, 15 minutes storm, average 112 mm/h, Zone 1
P18	1.489	1.4	15.716	15.649	AR&R 20 year, 15 minutes storm, average 112 mm/h, Zone 1
P20	1.487	1.4	15.716	15.649	AR&R 20 year, 15 minutes storm, average 112 mm/h, Zone 1
P22	1.533	1.4	15.724	15.649	AR&R 20 year, 15 minutes storm, average 112 mm/h, Zone 1
P24	1.449	1.3	15.707	15.649	AR&R 20 year, 15 minutes storm, average 112 mm/h, Zone 1
P26	1.567	1.5	15.731	15.649	AR&R 20 year, 15 minutes storm, average 112 mm/h, Zone 1
P10	10.166	3	12.303	12.253	AR&R 20 year, 1.5 hours storm, average 42.7 mm/h, Zone 1

CHANNEL DETAILS

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

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
OF9	0.652	0.652	0.256	0.073	0.06	18.64	0.85	AR&R 20 year, 4.5 hours storm, average 21.5 mm/h, Zone 1
OF12	0.381	0.381	0.256	0.059	0.04	15.76	0.73	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF26	1.032	1.032	0.256	0.088	0.08	21.69	0.96	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF1	0.633	0.633	0.256	0.072	0.06	18.46	0.84	AR&R 20 year, 4.5 hours storm, average 21.5 mm/h, Zone 1
OF19	6.244	6.244	0.256	0.185	0.28	40.91	1.53	AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1
OF17	6.244	6.244	0.256	0.185	0.28	40.91	1.53	AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1
StageDischarge_B	0.21	0.21	0.256	0.046	0.03	13.25	0.62	AR&R 20 year, 4.5 hours storm, average 21.5 mm/h, Zone 1
OF43	5.835	5.835	0.256	0.179	0.27	39.83	1.51	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF44	1.26	1.26	0.256	0.096	0.1	23.13	1.02	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF46	0.381	0.381	0.256	0.059	0.04	15.76	0.73	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF47	0.132	0.132	0.256	0.039	0.02	11.81	0.53	AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1

OF51	0.561	0.561	0.256	0.089	0.06	17.74	0.82	AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1
OF58	11.31	11.31	0.256	0.23	0.42	49.99	1.84	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF59	1.315	1.315	0.256	0.097	0.1	23.49	1.03	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF60	2.342	2.342	0.256	0.123	0.15	28.7	1.2	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF61	0.179	0.179	0.256	0.044	0.03	12.71	0.59	AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1
OF64	2.89	2.89	0.256	0.134	0.17	30.85	1.27	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
StageDischarge_A	0.886	0.886	0.256	0.083	0.08	20.61	0.92	AR&R 20 year, 4.5 hours storm, average 21.5 mm/h, Zone 1
OF549	0	0	0.256	0	0	0	0	
StageDischarge_D	7.154	7.154	0.256	0.194	0.31	42.89	1.59	AR&R 20 year, 1.5 hours storm, average 42.7 mm/h, Zone 1
OF550	0	0	0.256	0	0	0	0	
OF551	0	0	0.256	0	0	0	0	
OF552	0	0	0.256	0	0	0	0	
OF553	0	0	0.256	0	0	0	0	
OF554	0	0	0.256	0	0	0	0	
OF102	8.354	8.354	0.256	0.207	0.34	45.4	1.65	AR&R 20 year, 1.5 hours storm, average 42.7 mm/h, Zone 1
OF101	6.273	6.273	0.256	0.185	0.28	40.91	1.54	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
OF131	1.032	1.032	0.256	0.088	0.08	21.69	0.96	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF104	0.511	0.511	0.256	0.066	0.05	17.2	0.8	AR&R 20 year, 1.5 hours storm, average 42.7 mm/h, Zone 1
OF205	1.157	1.157	0.256	0.092	0.09	22.41	1	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
OF485	0.992	0.992	0.256	0.087	0.08	21.33	0.96	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF305	1.04	1.04	0.256	0.088	0.09	21.69	0.97	AR&R 20 year, 5 minutes storm, average 175 mm/h, Zone 1
OF340	0.17	0.17	0.256	0.043	0.02	12.53	0.58	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF28	0	0	0.256	0	0	0	0	
OF30	10.166	10.166	0.256	0.224	0.39	48.61	1.74	AR&R 20 year, 1.5 hours storm, average 42.7 mm/h, Zone 1
OF487	0.992	0.992	0.256	0.087	0.08	21.33	0.96	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF594	7.833	7.833	0.256	0.202	0.33	44.32	1.63	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF593	5.425	5.425	0.256	0.174	0.26	38.75	1.48	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF590	2.678	2.678	0.256	0.131	0.16	30.13	1.23	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1
OF600	2.02	2.02	0.256	0.116	0.13	27.26	1.15	AR&R 20 year, 25 minutes storm, average 87.8 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
DetBEx	14.69	11800.3	0.633	0	0.633
DetAEx	14.14	3976	6.244	0	6.244
DetB_Prop	15.47	13109.1	0.21	0	0.21
DetA_Prop	15.38	19864.6	0.886	0	0.886
DetC1	15.75	397.6	1.549	1.549	0
DetD_Prop	15.65	8894.7	7.154	0	7.154
DetC2	15.73	385.7	1.489	1.489	0
DetC3	15.73	385.3	1.487	1.487	0
DetC4	15.74	394.4	1.533	1.533	0
DetC5	15.72	376.9	1.449	1.449	0
DetC6	15.75	401.2	1.567	1.567	0

CONTINUITY CHECK for AR&R 20 year, 2 hours storm, average 35.8 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
N4	4022.48	4022.48	0	0
N5	440.09	440.09	0	0
N8	1585.5	1585.5	0	0
DetBEx	13202.29	3587.97	9617.2	0
OutBEx	4016.91	4016.91	0	0
DetAEx	15299.77	15299.78	0	0
N40	15299.78	15299.78	0	0
OutAEx	15299.78	15299.78	0	0
OutCEx	26519.06	26519.06	0	0
DetB_Prop	11483.98	1615.29	9870.06	0
N62	9127.87	9127.87	0	0
N63	2159.65	2159.65	0	0
N64	440.09	440.09	0	0
N65	224.69	224.69	0	0
N69	2277.36	2277.35	0	0
OutB_Prop	2274.65	2274.65	0	0
N75	17892.16	17892.16	0	0
N76	2475.24	2475.24	0	0
N77	3610.76	3610.76	0	0
N78	320.31	320.31	0	0
N79	11221.93	11221.93	0	0
OutA_Prop	11210.53	11210.53	0	0
DetA_Prop	22047.68	7302.25	14751.15	0
DetC1	2514.77	2514.02	0.75	0
DetD_Prop	26795.02	25435.83	1357.83	0
DetC2	2384.16	2383.42	0.75	0
DetC3	2379.93	2379.18	0.75	0
DetC4	2480.18	2479.43	0.75	0
DetC5	2281.79	2281.05	0.74	0
DetC6	2552.89	2552.15	0.75	0
N92	28192.02	28192.02	0	0
OutC_Prop	28186.63	28186.63	0	0
N95	9110.22	9110.22	0	0
N98	1585.5	1585.5	0	0
N97	1289.56	1289.56	0	0
N169	1680.28	1680.28	0	0
N177	1472.01	1472.01	0	0
N224	1510.13	1510.13	0	0
N232	196.46	196.46	0	0
HW2	26519.04	26519.06	0	0
N50	26519.06	26519.06	0	0
N284	1472.01	1472.01	0	0
N320	773.96	773.96	0	0
N321	2611.18	2611.18	0	0
N322	291.87	291.87	0	0
N323	8309.69	8309.69	0	0
N324	327.03	327.03	0	0
N325	113.65	113.65	0	0
N326	12335.22	12335.23	0	0
N327	8501.64	8501.65	0	0
N328	4171.05	4171.05	0	0
N329	3146.64	3146.64	0	0

Run Log for Moorebank_REV02 run at 10:32:58 on 9/8/2011

The maximum flow exceeded the safe value in the following overflow routes: OF600, OF594, OF593, OF590, OF487, OF485, OF305, OF205, OF131, OF104, OF102, OF101, StageDischarge_D, O

DRAINS results prepared 09 August, 2011 from Version 2010.09

PIT / NODE DETAILS

Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW2	12.4	6.295			1.8	0	None
N50	12		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp Tc (min)	Due to Storm
CatchB1Ex	0.139	0	0.139	3	8	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatchC1Ex	0.355	0.298	0.057	7	7	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatchBEx	3.523	1.305	2.218	14.5	24	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatchAEx	3.825	2.059	1.766	13.75	15	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatB1_Prop	1.271	1.271	0	6	3	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatB2(Swale)_Prop	0.459	0.459	0	9.5	8.5	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatB1Ext_Prop	0.139	0	0.139	5	8	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatB2Ext_Prop	0.071	0	0.071	8.5	15.5	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatA1_Prop	1.181	1.181	0	6	3	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatA2(Swale)_Prop	0.526	0.526	0	12	11	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatA1Ex_Prop	0.917	0.456	0.461	13.2	8.3	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatA2Ex_Prop	0.101	0	0.101	0	18	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatCa_Prop	0.534	0.534	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatCb_Prop	0.507	0.507	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatCc_Prop	0.506	0.506	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatCd_Prop	0.527	0.527	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatCe_Prop	0.485	0.485	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatCf_Prop	0.542	0.542	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatC2_Prop	1.936	1.936	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatCEx1_Prop	0.355	0.298	0.057	7	7	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatCEx2_Prop	0.322	0.174	0.148	21.7	25	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat_A3_Prop	0.357	0.357	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat Carpark_Ex	0.313	0.313	0	5	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatC1_Prop	0.321	0.321	0	3	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatB3Ext_Prop	0.062	0	0.062	0	8	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatchCEx	5.627	3.633	1.994	25	30	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat Carpark_Prop	0.313	0.313	0	5	0	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat1	0.194	0.104	0.089	5	12	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat2	0.629	0.4	0.229	7	15	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat3	0.073	0.039	0.034	4	8	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat4	1.854	1.582	0.271	5	15	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat5	0.082	0.044	0.038	6	8	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
Cat6	0.028	0.015	0.013	6	8	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatA4_Prop	0.815	0.815	0	6	3	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatA5_Prop	0.92	0.92	0	6	3	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatA6_Prop	0.886	0.886	0	6	3	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
CatB3_Prop	0.869	0.869	0	6	3	0	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1

Outflow Volumes for Total Catchment (156 impervious + 61.6 pervious = 218 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff	Impervious Ru cu.m (Runoff	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 6 ho	235509.98	202773.54 (8	167447.16 (99	35326.39 (53.1%)
AR&R 20 year, 9 ho	274761.66	232965.29 (8	195623.38 (99	37341.92 (48.1%)
AR&R 20 year, 12 h	306162.97	260278.81 (85	218148.44 (99	42130.17 (48.7%)
AR&R 20 year, 18 h	360722.78	301060.31 (8	257317.38 (99	43742.93 (42.9%)
AR&R 20 year, 24 h	405077.25	331860.18 (8	289138.53 (99	42721.65 (37.4%)

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
Pipe13	0.534	0.5	15.518	15.48	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
P18	0.506	0.5	15.514	15.48	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
P20	0.505	0.5	15.514	15.48	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
P22	0.526	0.5	15.517	15.48	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
P24	0.484	0.4	15.512	15.48	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
P26	0.542	0.5	15.519	15.48	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
P10	6.295	2.6	12.055	12.005	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1

CHANNEL DETAILS

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

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
OF9	1.109	1.109	7.665	0.091	0.09	22.23	0.98	AR&R 20 year, 12 hours storm, average 11.7 mm/h, Zone 1
OF12	0.139	0.139	7.665	0.039	0.02	11.81	0.56	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF26	0.355	0.355	7.665	0.057	0.04	15.41	0.72	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF1	1.075	1.075	7.665	0.089	0.09	21.87	0.98	AR&R 20 year, 12 hours storm, average 11.7 mm/h, Zone 1
OF19	3.46	3.46	7.665	0.145	0.19	33.01	1.32	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF17	3.46	3.46	7.665	0.145	0.19	33.01	1.32	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
StageDischarge_B	0.753	0.753	7.665	0.078	0.07	19.54	0.88	AR&R 20 year, 18 hours storm, average 9.19 mm/h, Zone 1
OF43	1.939	1.939	7.665	0.115	0.13	26.9	1.13	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF44	0.459	0.459	7.665	0.063	0.05	16.66	0.77	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF46	0.139	0.139	7.665	0.039	0.02	11.81	0.56	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF47	0.071	0.071	7.665	0.031	0.01	10.2	0.44	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF51	0.802	0.802	7.665	0.079	0.07	19.9	0.9	AR&R 20 year, 18 hours storm, average 9.19 mm/h, Zone 1
OF58	3.801	3.801	7.665	0.15	0.2	34.08	1.36	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF59	0.526	0.526	7.665	0.067	0.05	17.38	0.8	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF60	0.917	0.917	7.665	0.084	0.08	20.79	0.94	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF61	0.101	0.101	7.665	0.035	0.02	10.91	0.51	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1
OF64	1.766	1.766	7.665	0.11	0.12	26	1.11	AR&R 20 year, 12 hours storm, average 11.7 mm/h, Zone 1
StageDischarge_A	0.96	0.96	7.665	0.086	0.08	21.15	0.94	AR&R 20 year, 12 hours storm, average 11.7 mm/h, Zone 1
OF549	0	0	7.665	0	0	0	0	

StageDischarge_D	5.301	5.301	7.665	0.172	0.25	38.4	1.48	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF550	0	0	7.665	0	0	0	0					
OF551	0	0	7.665	0	0	0	0					
OF552	0	0	7.665	0	0	0	0					
OF553	0	0	7.665	0	0	0	0					
OF554	0	0	7.665	0	0	0	0					
OF102	5.916	5.916	7.665	0.18	0.27	40.01	1.52	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF101	1.936	1.936	7.665	0.115	0.13	26.9	1.13	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF131	0.355	0.355	7.665	0.057	0.04	15.41	0.72	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF104	0.322	0.322	7.665	0.055	0.04	15.05	0.69	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF205	0.357	0.357	7.665	0.057	0.04	15.41	0.72	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF486	0.313	0.313	7.665	0.054	0.04	14.87	0.69	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF305	0.321	0.321	7.665	0.054	0.04	14.87	0.71	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF340	0.062	0.062	7.665	0.029	0.01	9.73	0.44	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF28	0	0	7.665	0	0	0	0					
OF30	6.295	6.295	7.665	0.185	0.28	40.81	1.54	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF487	0.313	0.313	7.665	0.054	0.04	14.87	0.69	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF594	2.621	2.621	7.665	0.13	0.16	29.95	1.22	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF593	1.806	1.806	7.665	0.111	0.12	26.18	1.12	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF590	0.886	0.886	7.665	0.083	0.08	20.61	0.92	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				
OF600	0.669	0.669	7.665	0.074	0.06	18.82	0.85	AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1				

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
DetBEx	14.72	12778.5	1.075	0	1.075
DetAEx	14.07	3022.5	3.46	0	3.46
DetB_Prop	15.87	16849.8	0.753	0	0.753
DetA_Prop	15.58	23523.9	0.96	0	0.96
DetC1	15.53	220.6	0.534	0.534	0
DetD_Prop	15.48	7982.5	5.301	0	5.301
DetC2	15.52	217.3	0.506	0.506	0
DetC3	15.52	217.2	0.505	0.505	0
DetC4	15.52	219.9	0.526	0.526	0
DetC5	15.52	214.7	0.484	0.484	0
DetC6	15.53	221.8	0.542	0.542	0

CONTINUITY CHECK for AR&R 20 year, 6 hours storm, average 18 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
N4	10685.45	10685.45	0	0
N5	615.82	615.82	0	0
N8	2381.69	2381.69	0	0
DetBEx	19264.64	10075.07	9192.23	0
OutBEx	10680.01	10680.01	0	0
DetAEx	22564.03	22564	0	0
N40	22564	22564	0	0
OutAEx	22564	22564	0	0
OutCEx	39522.07	39522.07	0	0
DetB_Prop	17382.14	4089.73	13293.93	0
N62	13833.99	13834.22	0	0
N63	3273.11	3273.11	0	0
N64	615.82	615.82	0	0
N65	315.6	315.6	0	0
N69	5018	5017.98	0	0
OutB_Prop	5014.83	5014.83	0	0
N75	27116.88	27116.9	0	0
N76	3751.43	3751.43	0	0
N77	5302.78	5302.78	0	0
N78	450.42	450.42	0	0
N79	23086.73	23086.71	0	0
OutA_Prop	23074.75	23074.75	0	0
DetA_Prop	33415.02	17345.45	16075.57	0
DetC1	3811.34	3810.68	0.65	0
DetD_Prop	40591.9	39837.63	752.57	0
DetC2	3613.4	3612.74	0.65	0
DetC3	3606.96	3606.32	0.65	0
DetC4	3758.89	3758.25	0.65	0
DetC5	3458.23	3457.6	0.65	0
DetC6	3869.14	3868.47	0.66	0
N92	43970.65	43970.64	0	0
OutC_Prop	43967.65	43967.65	0	0
N95	13807.34	13807.34	0	0
N96	2381.69	2381.69	0	0
N97	1905.04	1905.04	0	0
N169	2546.6	2546.6	0	0
N177	2230.95	2230.95	0	0
N224	2288.74	2288.74	0	0
N232	274.91	274.91	0	0
HW2	39522.08	39522.07	0	0
N50	39522.07	39522.07	0	0
N284	2230.95	2230.95	0	0
N320	1140.85	1140.85	0	0
N321	3876.56	3876.56	0	0
N322	429.89	429.89	0	0
N323	12498.13	12498.13	0	0
N324	461.67	461.67	0	0
N325	167.68	167.68	0	0
N326	18694.93	18695.02	0	0
N327	12884.85	12884.95	0	0
N328	6321.49	6321.49	0	0
N329	4768.99	4768.99	0	0

Run Log for Moorebank_REV02 run at 10:33:19 on 9/8/2011

The following detention basins have little effect (less than 2%) in reducing peak discharge: DetC6, DetC5, DetC4, DetC3, DetC2, DetC1 You might consider upsizing these, or removing them

DRAINS Model Name and File Path:	F:\AA003210\D-Calculations\C-Civil\Stormwater\DRAINS\Post PEA\Moorebank_REV02-20110713.drn
DRAINS Version:	2010.09 - 5 August 2010
Modeller's Name:	Chris McClelland
Description:	Moorebank OSD

DRAINS results prepared 09 August, 2011 from Version 2010.09

RESULTS 100 YEAR ARI

PIT / NODE DETAILS (Version 8)

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW2	13.38	12.746			0.82	0	None
N50	13.28		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
CatchB1Ex	0.465	0	0.465	3	8	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatchC1Ex	1.231	1.034	0.197	7	7	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatchBEx	7.538	3.077	4.462	14.5	24	0	AR&R 100 year, 2 hours storm, average 46.1 mm/h, Zone 1
CatchAEx	9.881	5.94	4.252	13.75	15	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatB1_Prop	4.547	4.547	0	6	3	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatB2(Swale)_Prop	1.51	1.51	0	9.5	8.5	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatB1Ext_Prop	0.465	0	0.465	5	8	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatB2Ext_Prop	0.17	0	0.17	8.5	15.5	0	AR&R 100 year, 1 hour storm, average 69.7 mm/h, Zone 1
CatA1_Prop	4.224	4.224	0	6	3	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatA2(Swale)_Prop	1.595	1.595	0	12	11	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatA1Ex_Prop	2.868	1.335	1.531	13.2	8.3	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatA2Ex_Prop	0.231	0	0.231	0	18	0	AR&R 100 year, 1.5 hours storm, average 54.9 mm/h, Zone 1
CatCa_Prop	2.216	2.216	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatCb_Prop	2.101	2.101	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatCc_Prop	2.098	2.098	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatCd_Prop	2.186	2.186	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatCe_Prop	2.011	2.011	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatCf_Prop	2.25	2.25	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatC2_Prop	8.029	8.029	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatCEx1_Prop	1.231	1.034	0.197	7	7	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatCEx2_Prop	0.656	0.391	0.288	21.7	25	0	AR&R 100 year, 1.5 hours storm, average 54.9 mm/h, Zone 1
Cat_A3_Prop	1.481	1.481	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
Cat Carpark_Ex	1.228	1.228	0	5	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatC1_Prop	1.331	1.331	0	3	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
CatB3Ext_Prop	0.208	0	0.208	0	8	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatchCEx	10.983	7.698	3.592	25	30	0	AR&R 100 year, 1 hour storm, average 69.7 mm/h, Zone 1
Cat Carpark_Prop	1.228	1.228	0	5	0	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
Cat1	0.618	0.378	0.248	5	12	0	AR&R 100 year, 25 minutes storm, average 112 mm/h, Zone 1
Cat2	1.839	1.346	0.548	7	15	0	AR&R 100 year, 25 minutes storm, average 112 mm/h, Zone 1
Cat3	0.253	0.142	0.11	4	8	0	AR&R 100 year, 25 minutes storm, average 112 mm/h, Zone 1
Cat4	6.471	6.212	0.259	5	15	0	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
Cat5	0.276	0.153	0.124	6	8	0	AR&R 100 year, 25 minutes storm, average 112 mm/h, Zone 1
Cat6	0.096	0.053	0.043	6	8	0	AR&R 100 year, 25 minutes storm, average 112 mm/h, Zone 1
CatA4_Prop	2.914	2.914	0	6	3	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatA5_Prop	3.292	3.292	0	6	3	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatA6_Prop	3.171	3.171	0	6	3	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
CatB3_Prop	2.392	2.392	0	6	3	0	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1

Outflow Volumes for Total Catchment (156 impervious + 61.6 pervious = 218 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff	Impervious Ru cu.m (Runoff %	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 m	40705.43	32100.10 (78.	27647.31 (94.	4452.79 (38.7%)
AR&R 100 year, 10	62511.91	52822.48 (84.	43296.53 (96.	9525.95 (54.0%)
AR&R 100 year, 15	78503.32	67964.89 (86.	54772.67 (97.	13192.22 (59.5%)
AR&R 100 year, 20	91587.23	80290.73 (87.	64162.38 (97.	16128.35 (62.4%)
AR&R 100 year, 25	101763.58	89556.05 (88.	71465.52 (97.	18090.52 (63.0%)
AR&R 100 year, 30	111213.05	98245.21 (88.	78246.95 (98.	19998.26 (63.7%)
AR&R 100 year, 45	134273.41	119478.42 (89	94796.08 (98.	24682.35 (65.1%)
AR&R 100 year, 1 h	151991.16	135745.67 (89	107511.19 (98	28234.48 (65.8%)
AR&R 100 year, 1.5	179576.36	160892.24 (89	127307.49 (98	33584.75 (66.2%)
AR&R 100 year, 2 h	201055.77	180304.16 (89	142721.55 (98	37582.62 (66.2%)
AR&R 100 year, 3 h	234855.8	210569.45 (89	166978.94 (99	43590.51 (65.7%)
AR&R 100 year, 4.5	272799.09	243546.58 (89	194210.94 (99	49335.64 (64.1%)

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
Pipe13	1.77	1.6	15.986	15.896	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
P18	1.693	1.6	15.972	15.896	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
P20	1.69	1.6	15.972	15.896	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
P22	1.749	1.6	15.982	15.896	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
P24	1.634	1.5	15.963	15.896	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
P26	1.793	1.7	15.99	15.896	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
P10	12.746	1.8	13.294	13.28	AR&R 100 year, 1.5 hours storm, average 54.9 mm/h, Zone 1

CHANNEL DETAILS

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

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
OF9	1.626	1.626	0.256	0.106	0.12	25.28	1.09	AR&R 100 year, 3 hours storm, average 35.9 mm/h, Zone 1
OF12	0.465	0.465	0.256	0.063	0.05	16.66	0.78	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF26	1.231	1.231	0.256	0.095	0.1	22.95	1.01	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF1	1.572	1.572	0.256	0.105	0.11	24.92	1.08	AR&R 100 year, 3 hours storm, average 35.9 mm/h, Zone 1
OF19	8.334	8.334	0.256	0.207	0.34	45.4	1.65	AR&R 100 year, 2 hours storm, average 46.1 mm/h, Zone 1

OF17	8.334	8.334	0.256	0.207	0.34	45.4	1.65	AR&R 100 year, 2 hours storm, average 46.1 mm/h, Zone 1
StageDischarge_B	0.744	0.744	0.256	0.077	0.07	19.36	0.89	AR&R 100 year, 4.5 hours storm, average 27.8 mm/h, Zone 1
OF43	6.913	6.913	0.256	0.192	0.3	42.35	1.58	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF44	1.51	1.51	0.256	0.103	0.11	24.57	1.07	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF46	0.465	0.465	0.256	0.063	0.05	16.66	0.78	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF47	0.17	0.17	0.256	0.043	0.02	12.53	0.58	AR&R 100 year, 1 hour storm, average 69.7 mm/h, Zone 1
OF51	0.795	0.795	0.256	0.079	0.07	19.9	0.89	AR&R 100 year, 4.5 hours storm, average 27.8 mm/h, Zone 1
OF58	13.45	13.45	0.256	0.23	0.5	49.99	2.19	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF59	1.595	1.595	0.256	0.106	0.11	25.1	1.08	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF60	2.808	2.808	0.256	0.133	0.17	30.67	1.25	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF61	0.231	0.231	0.256	0.048	0.03	13.61	0.64	AR&R 100 year, 1.5 hours storm, average 54.9 mm/h, Zone 1
OF64	3.507	3.507	0.256	0.146	0.19	33.19	1.32	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
StageDischarge_A	1.127	1.127	0.256	0.091	0.09	22.23	0.99	AR&R 100 year, 4.5 hours storm, average 27.8 mm/h, Zone 1
OF549	0	0	0.256	0	0	0	0	
StageDischarge_D	7.816	7.816	0.256	0.202	0.33	44.32	1.62	AR&R 100 year, 2 hours storm, average 46.1 mm/h, Zone 1
OF550	0	0	0.256	0	0	0	0	
OF551	0	0	0.256	0	0	0	0	
OF552	0	0	0.256	0	0	0	0	
OF553	0	0	0.256	0	0	0	0	
OF554	0	0	0.256	0	0	0	0	
OF102	9.195	9.195	0.256	0.215	0.36	47.02	1.69	AR&R 100 year, 1.5 hours storm, average 54.9 mm/h, Zone 1
OF101	8.029	8.029	0.256	0.203	0.33	44.68	1.64	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
OF131	1.231	1.231	0.256	0.095	0.1	22.95	1.01	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF104	0.656	0.656	0.256	0.073	0.06	18.64	0.85	AR&R 100 year, 1.5 hours storm, average 54.9 mm/h, Zone 1
OF205	1.481	1.481	0.256	0.103	0.11	24.57	1.05	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
OF485	1.228	1.228	0.256	0.095	0.1	22.95	1.01	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
OF305	1.331	1.331	0.256	0.098	0.1	23.67	1.02	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
OF340	0.208	0.208	0.256	0.046	0.03	13.25	0.61	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF28	0	0	0.256	0	0	0	0	
OF30	12.746	12.746	0.256	0.23	0.48	49.99	2.07	AR&R 100 year, 1.5 hours storm, average 54.9 mm/h, Zone 1
OF487	1.228	1.228	0.256	0.095	0.1	22.95	1.01	AR&R 100 year, 5 minutes storm, average 224 mm/h, Zone 1
OF594	9.311	9.311	0.256	0.216	0.37	47.2	1.7	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF593	6.428	6.428	0.256	0.186	0.29	41.27	1.55	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF590	3.171	3.171	0.256	0.14	0.18	31.93	1.29	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1
OF600	2.392	2.392	0.256	0.124	0.15	28.68	1.21	AR&R 100 year, 20 minutes storm, average 126 mm/h, Zone 1

DETENTION BASIN DETAILS								
Name	Max WL	MaxVol	Max Q	Max Q	Max Q			
			Total	Low Level	High Level			
DetBEx	14.74	13507.4	1.572	0	1.572			
DetAEx	14.19	4567.1	8.334	0	8.334			
DetB_Prop	15.87	16647.1	0.744	0	0.744			
DetA_Prop	15.76	26773.9	1.127	0	1.127			
DetC1	16.01	606.6	1.77	1.77	0			
DetD_Prop	15.9	10227.8	7.816	0	7.816			
DetC2	15.99	592.8	1.693	1.693	0			
DetC3	15.99	592.4	1.69	1.69	0			
DetC4	16	602.8	1.749	1.749	0			
DetC5	15.98	582.8	1.634	1.634	0			
DetC6	16.01	610.9	1.793	1.793	0			

CONTINUITY CHECK for AR&R 100 year, 1 hour storm, average 69.7 mm/h, Zone 1								
Node	Inflow	Outflow	Storage Chan	Difference				
	(cu.m)	(cu.m)	(cu.m)	%				
N4	3835.19	3835.18	0	0				
N5	497.8	497.8	0	0				
N8	1571.57	1571.57	0	0				
DetBEx	13909.94	3343.26	10569.69	0				
OutBEx	3829.31	3829.31	0	0				
DetAEx	15759.35	15759.39	0	0				
N40	15759.39	15759.39	0	0				
OutAEx	15759.39	15759.39	0	0				
OutCEx	26769.13	26769.13	0	0				
DetB_Prop	11205.98	1108.41	10098.94	0				
N62	8882.22	8882.22	0	0				
N63	2101.53	2101.53	0	0				
N64	497.8	497.8	0	0				
N65	253.49	253.49	0	0				
N69	1856.99	1856.99	0	0				
OutB_Prop	1854.29	1854.29	0	0				
N75	17410.64	17410.64	0	0				
N76	2408.62	2408.62	0	0				
N77	3744.73	3744.73	0	0				
N78	360.94	360.94	0	0				
N79	9257.3	9257.31	0	0				
OutA_Prop	9245.25	9245.25	0	0				
DetA_Prop	21454.32	5163.68	16296.67	0				
DetC1	2447.09	2445.91	1.19	0				
DetD_Prop	26100.04	24155.4	1946.41	0				
DetC2	2320	2318.81	1.19	0				
DetC3	2315.88	2314.69	1.19	0				
DetC4	2413.43	2412.24	1.19	0				
DetC5	2220.38	2219.2	1.19	0				
DetC6	2484.19	2483	1.19	0				
N92	26905.66	26905.66	0	0				
OutC_Prop	26897.93	26897.93	0	0				
N95	8865.05	8865.05	0	0				
N96	1571.57	1571.57	0	0				
N97	1325.57	1325.57	0	0				
N169	1635.06	1635.06	0	0				
N177	1432.39	1432.39	0	0				
N224	1469.49	1469.49	0	0				
N232	222.22	222.22	0	0				
HW2	26769.13	26769.13	0	0				

N50	26769.13	26769.13	0	0								
N294	1432.39	1432.39	0	0								
N320	797.66	797.66	0	0								
N321	2653.85	2653.85	0	0								
N322	300.97	300.97	0	0								
N323	8219.99	8219.99	0	0								
N324	337.22	337.22	0	0								
N325	117.4	117.4	0	0								
N326	12003.26	12003.26	0	0								
N327	8272.85	8272.86	0	0								
N328	4058.79	4058.79	0	0								
N329	3061.96	3061.96	0	0								
Run Log for Moorebank_REV02 run at 10:34:38 on 9/8/2011												
The maximum flow exceeded the safe value in the following overflow routes: OF600, OF594, OF593, OF590, OF487, OF485, OF305, OF205, OF131, OF104, OF102, OF101, StageDischarge_D, (												
DRAINS results prepared 09 August, 2011 from Version 2010.09												
PIT / NODE DETAILS				Version 8								
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint					
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)						
			(cu.m/s)	(cu.m)	(m)							
HW2	13.32	7.698			0.88	0	None					
N50	13.28		0									
SUB-CATCHMENT DETAILS												
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm					
	Flow Q	Max Q	Max Q	Tc	Tc	Tc						
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)						
CatchB1Ex	0.173	0	0.173	3	8	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatchC1Ex	0.431	0.36	0.071	7	7	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatchBEx	4.356	1.575	2.782	14.5	24	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatchAEx	4.693	2.484	2.209	13.75	15	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatB1_Prop	1.533	1.533	0	6	3	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatB2(Swale)_Prop	0.554	0.554	0	9.5	8.5	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatB1Ext_Prop	0.173	0	0.173	5	8	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatB2Ext_Prop	0.088	0	0.088	8.5	15.5	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatA1_Prop	1.424	1.424	0	6	3	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatA2(Swale)_Prop	0.634	0.634	0	12	11	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatA1Ex_Prop	1.126	0.55	0.576	13.2	8.3	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatA2Ex_Prop	0.126	0	0.126	0	18	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatCa_Prop	0.645	0.645	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatCb_Prop	0.611	0.611	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatCc_Prop	0.61	0.61	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatCd_Prop	0.636	0.636	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatCe_Prop	0.585	0.585	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatCf_Prop	0.654	0.654	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatC2_Prop	2.335	2.335	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatCEx1_Prop	0.431	0.36	0.071	7	7	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatCEx2_Prop	0.395	0.21	0.186	21.7	25	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat_A3_Prop	0.431	0.431	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat Carpark_Ex	0.377	0.377	0	5	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatC1_Prop	0.387	0.387	0	3	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatB3Ext_Prop	0.077	0	0.077	0	8	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatchCEx	6.889	4.383	2.506	25	30	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat Carpark_Prop	0.377	0.377	0	5	0	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat1	0.237	0.126	0.112	5	12	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat2	0.769	0.483	0.286	7	15	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat3	0.09	0.047	0.042	4	8	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat4	2.249	1.909	0.34	5	15	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat5	0.1	0.053	0.047	6	8	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Cat6	0.035	0.018	0.016	6	8	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatA4_Prop	0.983	0.983	0	6	3	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatA5_Prop	1.11	1.11	0	6	3	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatA6_Prop	1.069	1.069	0	6	3	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
CatB3_Prop	0.807	0.807	0	6	3	0	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1					
Outflow Volumes for Total Catchment (156 impervious + 61.6 pervious = 218 total ha)												
Storm	Total Rainfall	Total Runoff	Impervious Ru	Pervious Runoff								
	cu.m	cu.m (Runoff	cu.m (Runoff %	cu.m (Runoff %)								
AR&R 100 year, 6 h	304854.63	270784.26 (88	217212.31 (99	53571.97 (62.2%)								
AR&R 100 year, 9 h	3307316	313204.46 (9	254771.72 (10	58432.74 (6.3%)								
AR&R 100 year, 12	400367	350135.02 (87	285758.69 (99	64376.34 (56.9%)								
AR&R 100 year, 18	474945.16	408699.81 (86	339291.97 (99	69407.84 (51.8%)								
AR&R 100 year, 24	539056.13	456777.45 (84	385271.72 (99	71505.73 (47.0%)								
PIPE DETAILS												
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm							
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)								
Pipe13	0.631	0.6	15.566	15.504	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1							
P18	0.598	0.6	15.56	15.504	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1							
P20	0.597	0.6	15.559	15.504	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1							
P22	0.623	0.6	15.564	15.504	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1							
P24	0.572	0.5	15.555	15.504	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1							
P26	0.641	0.6	15.568	15.504	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1							
P10	7.698	1.1	13.285	13.28	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1							
CHANNEL DETAILS												
Name	Max Q	Max V	Chainage	Max	Due to Storm							
	(cu.m/s)	(m/s)	(m)	HGL (m)								
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				
OF9	2.626	2.626	7.665	0.13	0.16	29.95	1.23	AR&R 100 year, 9 hours storm, average 18.2 mm/h, Zone 1				

OF12	0.173	0.173	7.665	0.043	0.03	12.53	0.59	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF26	0.431	0.431	7.665	0.062	0.05	18.3	0.76	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF1	2.537	2.537	7.665	0.128	0.16	29.59	1.21	AR&R 100 year, 9 hours storm, average 18.2 mm/h, Zone 1
OF19	4.585	4.585	7.665	0.162	0.23	36.42	1.43	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF17	4.585	4.585	7.665	0.162	0.23	36.42	1.43	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
StageDischarge_B	1.842	1.842	7.665	0.112	0.13	26.36	1.13	AR&R 100 year, 12 hours storm, average 15.3 mm/h, Zone 1
OF43	2.34	2.34	7.665	0.123	0.15	28.7	1.19	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF44	0.554	0.554	7.665	0.069	0.06	17.74	0.81	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF46	0.173	0.173	7.665	0.043	0.03	12.53	0.59	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF47	0.068	0.068	7.665	0.034	0.02	10.74	0.47	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF51	2.002	2.002	7.665	0.116	0.13	27.26	1.14	AR&R 100 year, 12 hours storm, average 15.3 mm/h, Zone 1
OF58	4.586	4.586	7.665	0.162	0.23	36.42	1.43	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF59	0.634	0.634	7.665	0.072	0.06	18.46	0.84	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF60	1.126	1.126	7.665	0.091	0.09	22.23	0.99	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF61	0.126	0.126	7.665	0.036	0.02	11.63	0.53	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF64	2.7	2.7	7.665	0.131	0.16	30.13	1.24	AR&R 100 year, 9 hours storm, average 18.2 mm/h, Zone 1
StageDischarge_A	1.925	1.925	7.665	0.114	0.13	26.72	1.14	AR&R 100 year, 12 hours storm, average 15.3 mm/h, Zone 1
OF549	0	0	7.665	0	0	0	0	
StageDischarge_D	6.735	6.735	7.665	0.19	0.3	41.99	1.56	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF550	0	0	7.665	0	0	0	0	
OF551	0	0	7.665	0	0	0	0	
OF552	0	0	7.665	0	0	0	0	
OF553	0	0	7.665	0	0	0	0	
OF554	0	0	7.665	0	0	0	0	
OF102	7.507	7.507	7.665	0.198	0.32	43.6	1.61	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF101	2.335	2.335	7.665	0.123	0.15	28.7	1.19	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF131	0.431	0.431	7.665	0.062	0.05	16.3	0.76	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF104	0.395	0.395	7.665	0.06	0.04	15.94	0.74	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF205	0.431	0.431	7.665	0.062	0.05	16.3	0.76	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF485	0.377	0.377	7.665	0.059	0.04	15.76	0.72	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF305	0.387	0.387	7.665	0.059	0.04	15.76	0.74	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF340	0.077	0.077	7.665	0.032	0.01	10.38	0.46	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF28	0	0	7.665	0	0	0	0	
OF30	7.698	7.698	7.665	0.201	0.32	44.14	1.61	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF487	0.377	0.377	7.665	0.059	0.04	15.76	0.72	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF594	3.162	3.162	7.665	0.14	0.18	31.93	1.29	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF593	2.179	2.179	7.665	0.12	0.14	27.98	1.17	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF590	1.069	1.069	7.665	0.089	0.09	21.87	0.98	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1
OF600	0.807	0.807	7.665	0.079	0.07	19.9	0.91	AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q	Max Q	Max Q
			Total	Low Level	High Level
DetBEx	14.77	14734	2.537	0	2.537
DetAEx	14.1	3385.6	4.585	0	4.585
DetB_Prop	15.9	16986.2	1.842	0	1.842
DetA_Prop	15.86	28749	1.925	0	1.925
DetC1	15.58	264.1	0.631	0.631	0
DetD_Prop	15.5	8112.2	6.735	0	6.735
DetC2	15.57	258	0.598	0.598	0
DetC3	15.57	257.8	0.597	0.597	0
DetC4	15.58	262.5	0.623	0.623	0
DetC5	15.57	253.4	0.572	0.572	0
DetC6	15.58	266	0.641	0.641	0

CONTINUITY CHECK for AR&R 100 year, 6 hours storm, average 23.3 mm/h, Zone 1

Node	Inflow	Outflow	Storage Chan	Difference
	(cu.m)	(cu.m)	(cu.m)	%
N4	18364.09	18364.06	0	0
N5	934.22	934.22	0	0
N6	3145.34	3145.34	0	0
DetBEx	27171.37	17435.48	9738.29	0
OutBEx	18358.44	18358.44	0	0
DetAEx	30999.16	30999.08	0	0
N40	30999.08	30999.08	0	0
OutAEx	30999.08	30999.08	0	0
OutCEx	53292.53	53292.53	0	0
DetB_Prop	22608.23	6945.49	15664.28	0
N62	17945.34	17945.38	0	0
N63	4245.87	4245.87	0	0
N64	934.22	934.22	0	0
N65	478.68	478.68	0	0
N69	8354.63	8354.63	0	0
OutB_Prop	8351.38	8351.38	0	0
N75	35175.95	35176.05	0	0
N76	4866.35	4866.35	0	0
N77	7329.11	7329.11	0	0
N78	683.11	683.11	0	0
N79	29406.41	29406.47	0	0
OutA_Prop	29392.53	29392.53	0	0
DetA_Prop	43346.28	21408.19	21944.58	0
DetC1	4944.05	4943.38	0.69	0
DetD_Prop	52711.73	51825.04	885.07	0
DetC2	4687.28	4686.58	0.69	0
DetC3	4678.94	4678.26	0.69	0
DetC4	4876.12	4875.35	0.69	0
DetC5	4486.04	4485.33	0.69	0
DetC6	5019.05	5018.32	0.7	0
N92	57332.42	57332.39	0	0
OutC_Prop	57328.88	57328.88	0	0
N95	17910.6	17910.6	0	0
N96	3145.34	3145.34	0	0
N97	2616.88	2616.88	0	0
N169	3303.44	3303.44	0	0

N177	2893.97	2893.97	0	0								
N224	2968.94	2968.94	0	0								
N232	417.05	417.05	0	0								
HW2	53292.54	53292.53	0	0								
N50	53292.53	53292.53	0	0								
N294	2893.97	2893.97	0	0								
N320	1567.38	1567.38	0	0								
N321	5252.78	5252.78	0	0								
N322	590.64	590.64	0	0								
N323	16478.26	16478.26	0	0								
N324	661.79	661.79	0	0								
N325	230.38	230.38	0	0								
N326	24250.82	24251.12	0	0								
N327	16714.37	16714.35	0	0								
N328	8200.33	8200.33	0	0								
N329	6186.29	6186.29	0	0								
Run Log for Moorebank_REV02 run at 10:35:07 on 9/8/2011												
The maximum flow exceeded the safe value in the following overflow routes: OF30												
The following detention basins have little effect (less than 2%) in reducing peak discharge: DetD_Prop You might consider upsizing these, or removing them from the model.												

DRAINS Model Name and File Path:	F:\AA003210\D-Calculations\C-Civil\Stormwater\DRAINS\Post PEA\Moorebank_REV02-20110713.drn
DRAINS Version:	2010.09 - 5 August 2010
Modeller's Name:	Chris McClelland
Description:	Moorebank OSD

DRAINS results prepared 09 August, 2011 from Version 2010.09

RESULTS
Climate Change

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW2	13.19	15.598			1.01	0	None
N50	12.56		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
CatchB1Ex	0.573	0	0.573	3	8	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatchC1Ex	1.482	1.239	0.243	7	7	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatchBEx	9.21	3.691	5.519	14.5	24	0	AR&R 102 year, 2 hours storm, average 55.3 mm/h, Zone 1
CatchAEx	12.204	7.118	5.403	13.75	15	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatB1_Prop	5.455	5.455	0	6	3	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
CatB2(Swale)_Prop	1.81	1.81	0	9.5	8.5	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatB1Ext_Prop	0.573	0	0.573	5	8	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatB2Ext_Prop	0.215	0	0.215	8.5	15.5	0	AR&R 102 year, 1 hour storm, average 83.6 mm/h, Zone 1
CatA1_Prop	5.068	5.068	0	6	3	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
CatA2(Swale)_Prop	1.912	1.912	0	12	11	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatA1Ex_Prop	3.423	1.6	1.687	13.2	8.3	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatA2Ex_Prop	0.289	0	0.289	0	18	0	AR&R 102 year, 1 hour storm, average 83.6 mm/h, Zone 1
CatCa_Prop	2.662	2.662	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatCb_Prop	2.523	2.523	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatCc_Prop	2.519	2.519	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatCd_Prop	2.625	2.625	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatCe_Prop	2.415	2.415	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatCf_Prop	2.702	2.702	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatC2_Prop	9.642	9.642	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatCEx1_Prop	1.482	1.239	0.243	7	7	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatCEx2_Prop	0.814	0.47	0.369	21.7	25	0	AR&R 102 year, 1.5 hours storm, average 65.9 mm/h, Zone 1
Cat_A3_Prop	1.778	1.778	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
Cat Carpark_Ex	1.488	1.488	0	5	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatC1_Prop	1.598	1.598	0	3	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
CatB3Ext_Prop	0.256	0	0.256	0	8	0	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
CatchCEx	13.487	9.233	4.589	25	30	0	AR&R 102 year, 1 hour storm, average 83.6 mm/h, Zone 1
Cat Carpark_Prop	1.488	1.488	0	5	0	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
Cat1	0.762	0.452	0.312	5	12	0	AR&R 102 year, 25 minutes storm, average 134 mm/h, Zone 1
Cat2	2.246	1.611	0.692	7	15	0	AR&R 102 year, 25 minutes storm, average 134 mm/h, Zone 1
Cat3	0.312	0.177	0.135	4	8	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
Cat4	7.877	7.531	0.347	5	15	0	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
Cat5	0.339	0.189	0.151	6	8	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
Cat6	0.118	0.066	0.053	6	8	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
CatA4_Prop	3.497	3.497	0	6	3	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
CatA5_Prop	3.95	3.95	0	6	3	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
CatA6_Prop	3.804	3.804	0	6	3	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
CatB3_Prop	2.87	2.87	0	6	3	0	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1

Outflow Volumes for Total Catchment (156 impervious + 61.6 pervious = 218 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff	Impervious Ru cu.m (Runoff %	Pervious Runoff cu.m (Runoff %)
AR&R 102 year, 5 m	48882.86	40233.50 (82	33515.75 (95.	6717.75 (48.7%)
AR&R 102 year, 10	74868.91	65129.53 (87	52164.57 (97	12964.96 (61.3%)
AR&R 102 year, 15	94313.03	83699.96 (88	66118.59 (97	17581.36 (66.0%)
AR&R 102 year, 20	109759.3	98384.88 (89	77203.63 (98	21181.25 (68.3%)
AR&R 102 year, 25	121752.85	109465.23 (89	85810.67 (98	23654.56 (68.8%)
AR&R 102 year, 30	133019.53	119964.68 (90	93696.34 (98	26088.34 (69.5%)
AR&R 102 year, 45	161095.38	146237.80 (90	114044.66 (98	32193.14 (70.8%)
AR&R 102 year, 1 h	182302.19	165987.45 (9	129263.70 (98	36723.75 (71.3%)
AR&R 102 year, 1.5	215557.06	196809.39 (9	153129.33 (99	43680.06 (71.8%)
AR&R 102 year, 2 h	241179.64	220327.19 (9	171517.27 (99	48809.93 (71.7%)
AR&R 102 year, 3 h	281957.75	257485.74 (9	200779.45 (99	56706.29 (71.2%)
AR&R 102 year, 4.5	327751.44	298350.03 (9	233645.61 (99	64704.42 (69.9%)

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
Pipe13	1.988	1.8	16.202	16.009	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
P18	1.942	1.8	16.182	16.009	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
P20	1.94	1.8	16.181	16.009	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
P22	1.975	1.8	16.198	16.009	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
P24	1.916	1.8	16.167	16.009	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
P26	2.001	1.9	16.205	16.009	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
P10	15.598	3.4	12.82	12.558	AR&R 102 year, 1.5 hours storm, average 65.9 mm/h, Zone 1

CHANNEL DETAILS

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

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
OF9	2.679	2.679	0.256	0.131	0.16	30.13	1.23	AR&R 102 year, 2 hours storm, average 55.3 mm/h, Zone 1
OF12	0.573	0.573	0.256	0.07	0.06	17.92	0.82	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF28	1.482	1.482	0.256	0.103	0.11	24.57	1.05	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF1	2.585	2.585	0.256	0.129	0.16	29.77	1.22	AR&R 102 year, 2 hours storm, average 55.3 mm/h, Zone 1
OF19	11.119	11.119	0.256	0.23	0.42	49.99	1.81	AR&R 102 year, 2 hours storm, average 55.3 mm/h, Zone 1

OF17	11.119	11.119	0.256	0.23	0.42	49.99	1.81	AR&R 102 year, 2 hours storm, average 55.3 mm/h, Zone 1
StageDischarge_B	1.27	1.27	0.256	0.097	0.1	23.31	1.01	AR&R 102 year, 4.5 hours storm, average 33.4 mm/h, Zone 1
OF43	8.288	8.288	0.256	0.206	0.34	45.22	1.65	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
OF44	1.81	1.81	0.256	0.111	0.12	26.18	1.12	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF46	0.573	0.573	0.256	0.07	0.06	17.92	0.82	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF47	0.215	0.215	0.256	0.046	0.03	13.25	0.63	AR&R 102 year, 1 hour storm, average 83.6 mm/h, Zone 1
OF51	1.379	1.379	0.256	0.099	0.1	23.85	1.04	AR&R 102 year, 4.5 hours storm, average 33.4 mm/h, Zone 1
OF58	16.119	16.119	0.256	0.23	0.6	49.99	2.62	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF59	1.912	1.912	0.256	0.114	0.13	26.72	1.13	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF60	3.423	3.423	0.256	0.144	0.19	32.83	1.32	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF61	0.289	0.289	0.256	0.053	0.04	14.51	0.68	AR&R 102 year, 1 hour storm, average 83.6 mm/h, Zone 1
OF64	4.235	4.235	0.256	0.158	0.22	35.52	1.39	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
StageDischarge_A	1.928	1.928	0.256	0.115	0.13	26.9	1.13	AR&R 102 year, 4.5 hours storm, average 33.4 mm/h, Zone 1
OF549	0.056	0.056	0.256	0.028	0.01	9.43	0.42	AR&R 102 year, 2 hours storm, average 55.3 mm/h, Zone 1
StageDischarge_D	14.48	14.48	0.256	0.23	0.54	49.99	2.36	AR&R 102 year, 1.5 hours storm, average 65.9 mm/h, Zone 1
OF550	0	0	0.256	0	0	0	0	
OF551	0	0	0.256	0	0	0	0	
OF552	0	0	0.256	0	0	0	0	
OF553	0	0	0.256	0	0	0	0	
OF554	0.159	0.159	0.256	0.042	0.02	12.35	0.56	AR&R 102 year, 2 hours storm, average 55.3 mm/h, Zone 1
OF102	16.437	16.437	0.256	0.23	0.61	49.99	2.67	AR&R 102 year, 1.5 hours storm, average 65.9 mm/h, Zone 1
OF101	9.642	9.642	0.256	0.22	0.38	47.91	1.71	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
OF131	1.482	1.482	0.256	0.103	0.11	24.57	1.05	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF104	0.814	0.814	0.256	0.08	0.07	20.08	0.9	AR&R 102 year, 1.5 hours storm, average 65.9 mm/h, Zone 1
OF205	1.778	1.778	0.256	0.11	0.12	26	1.12	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
OF485	1.488	1.488	0.256	0.103	0.11	24.57	1.06	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
OF305	1.598	1.598	0.256	0.106	0.11	25.1	1.08	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
OF340	0.256	0.256	0.256	0.05	0.03	13.97	0.66	AR&R 102 year, 20 minutes storm, average 151 mm/h, Zone 1
OF28	0	0	0.256	0	0	0	0	
OF30	15.596	15.598	0.256	0.23	0.58	49.99	2.54	AR&R 102 year, 1.5 hours storm, average 65.9 mm/h, Zone 1
OF487	1.488	1.488	0.256	0.103	0.11	24.57	1.06	AR&R 102 year, 5 minutes storm, average 269 mm/h, Zone 1
OF594	11.159	11.159	0.256	0.23	0.42	49.99	1.82	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
OF593	7.706	7.706	0.256	0.201	0.32	44.14	1.62	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
OF590	3.804	3.804	0.256	0.15	0.2	34.08	1.36	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1
OF600	2.87	2.87	0.256	0.134	0.17	30.85	1.26	AR&R 102 year, 15 minutes storm, average 173 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
DetBEx	14.77	14785.6	2.585	0	2.585
DetAEx	14.22	5059.9	11.119	0	11.119
DetB_Prop	15.88	16793	1.27	0	1.27
DetA_Prop	15.87	28837.3	1.928	0	1.928
DetC1	16.25	802.5	2.044	1.988	0.056
DetD_Prop	16.01	10835.7	14.48	0	14.48
DetC2	16.23	781.9	1.942	1.942	0
DetC3	16.23	781.2	1.94	1.94	0
DetC4	16.25	797.8	1.975	1.975	0
DetC5	16.21	765.9	1.916	1.916	0
DetC6	16.26	805	2.16	2.001	0.159

CONTINUITY CHECK for AR&R 102 year, 1 hour storm, average 83.6 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
N4	7070.92	7070.92	0	0
N5	646.36	646.36	0	0
N8	1909.27	1909.27	0	0
DetBEx	17508.87	6431.15	11081.07	0
OutBEx	7064.28	7064.28	0	0
DetAEx	19563	19563.11	0	0
N40	19563.11	19563.11	0	0
OutAEx	19563.11	19563.11	0	0
OutCEx	32919.43	32919.43	0	0
DetB_Prop	13494.63	1250.8	12245.35	0
N62	10679.35	10679.35	0	0
N63	2526.73	2526.73	0	0
N64	646.36	646.36	0	0
N65	329.43	329.43	0	0
N69	2223.59	2223.59	0	0
OutB_Prop	2220.59	2220.59	0	0
N75	20933.32	20933.32	0	0
N76	2895.96	2895.96	0	0
N77	4661.59	4661.59	0	0
N78	469.25	469.25	0	0
N79	10841.75	10841.74	0	0
OutA_Prop	10828.37	10828.37	0	0
DetA_Prop	25795.15	5724.26	20077.59	0
DetC1	2942.22	2940.83	1.39	0
DetD_Prop	31400.79	29295.13	2080.25	0.1
DetC2	2789.4	2788.02	1.39	0
DetC3	2784.45	2783.07	1.39	0
DetC4	2901.74	2900.36	1.39	0
DetC5	2669.64	2668.25	1.39	0
DetC6	2986.82	2985.44	1.39	0
N92	32655.34	32655.34	0	0
OutC_Prop	32647.08	32647.08	0	0
N95	10658.71	10658.71	0	0
N96	1909.27	1909.27	0	0
N97	1646.24	1646.24	0	0
N169	1965.88	1965.88	0	0
N177	1722.21	1722.21	0	0
N224	1766.81	1766.81	0	0
N232	288.54	288.54	0	0
HW2	32919.44	32919.43	0	0

N50	32919.43	32919.43	0	0								
N294	1722.21	1722.21	0	0								
N320	990.05	990.05	0	0								
N321	3270.52	3270.52	0	0								
N322	373.52	373.52	0	0								
N323	9977.67	9977.67	0	0								
N324	416.52	416.52	0	0								
N325	145.7	145.7	0	0								
N326	14431.86	14431.87	0	0								
N327	9946.69	9946.69	0	0								
N328	4880.01	4880.01	0	0								
N329	3681.48	3681.48	0	0								
Run Log for Moorebank_REV02 run at 14:08:29 on 9/8/2011												
The maximum flow exceeded the safe value in the following overflow routes: OF600, OF594, OF593, OF590, OF487, OF485, OF305, OF205, OF131, OF104, OF102, OF101, StageDischarge_D, C												
DRAINS results prepared 09 August, 2011 from Version 2010.09												
PIT / NODE DETAILS				Version 8								
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint					
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)						
			(cu.m/s)	(cu.m)	(m)							
HW2	12.68	9.326			1.52	0	None					
N50	12.2		0									
SUB-CATCHMENT DETAILS												
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm					
	Flow Q	Max Q	Max Q	Tc	Tc	Tc						
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)						
CatchB1Ex	0.213	0	0.213	3	8	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatchC1Ex	0.52	0.432	0.088	7	7	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatchBEx	5.314	1.892	3.422	14.5	24	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatchAEx	5.7	2.985	2.715	13.75	15	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatB1_Prop	1.842	1.842	0	6	3	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatB2(Swale)_Prop	0.665	0.665	0	9.5	8.5	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatB1Ext_Prop	0.213	0	0.213	5	8	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatB2Ext_Prop	0.109	0	0.109	8.5	15.5	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatA1_Prop	1.712	1.712	0	6	3	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatA2(Swale)_Prop	0.762	0.762	0	12	11	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatA1Ex_Prop	1.369	0.661	0.707	13.2	8.3	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatA2Ex_Prop	0.155	0	0.155	0	18	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatCa_Prop	0.775	0.775	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatCb_Prop	0.734	0.734	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatCc_Prop	0.733	0.733	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatCd_Prop	0.764	0.764	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatCe_Prop	0.703	0.703	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatCf_Prop	0.786	0.786	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatC2_Prop	2.806	2.806	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatCEx1_Prop	0.52	0.432	0.088	7	7	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatCEx2_Prop	0.481	0.252	0.228	21.7	25	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat_A3_Prop	0.518	0.518	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat Carpark_Ex	0.453	0.453	0	5	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatC1_Prop	0.465	0.465	0	3	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatB3Ext_Prop	0.095	0	0.095	0	8	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatchCEx	8.352	5.267	3.086	25	30	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat Carpark_Prop	0.453	0.453	0	5	0	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat1	0.288	0.151	0.137	5	12	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat2	0.932	0.58	0.352	7	15	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat3	0.109	0.057	0.052	4	8	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat4	2.711	2.294	0.417	5	15	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat5	0.122	0.064	0.058	6	8	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Cat6	0.042	0.022	0.02	6	8	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatA4_Prop	1.181	1.181	0	6	3	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatA5_Prop	1.334	1.334	0	6	3	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatA6_Prop	1.285	1.285	0	6	3	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
CatB3_Prop	0.969	0.969	0	6	3	0	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1					
Outflow Volumes for Total Catchment (156 impervious + 61.6 pervious = 218 total ha)												
Storm	Total Rainfall	Total Runoff	Impervious Ru	Pervious Runoff								
	cu.m	cu.m (Runoff	cu.m (Runoff %	cu.m (Runoff %)								
AR&R 102 year, 6 h	366348.84	331903.44 (90	261351.63 (99	70551.81 (68.2%)								
AR&R 102 year, 9 h	427843.13	383158.98 (89	305481.31 (99	77677.67 (64.3%)								
AR&R 102 year, 12	481487.06	429691.20 (89	343953.34 (99	85737.85 (63.1%)								
AR&R 102 year, 18	569149.13	500128.20 (87	406857.28 (98	93270.92 (58.0%)								
AR&R 102 year, 24	648960.81	563771.91 (86	464126.28 (99	99645.63 (54.4%)								
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)								
Pipe13	0.682	0.6	15.719	15.648	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1							
P18	0.642	0.6	15.712	15.648	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1							
P20	0.641	0.6	15.711	15.648	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1							
P22	0.672	0.6	15.717	15.648	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1							
P24	0.611	0.6	15.706	15.648	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1							
P26	0.694	0.6	15.722	15.648	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1							
P10	9.326	2.9	12.251	12.201	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1							
CHANNEL DETAILS												
Name	Max Q	Max V	Chainage	Max	Due to Storm							
	(cu.m/s)	(m/s)	(m)	HGL (m)								
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				
OF9	4.021	4.021	7.665	0.154	0.21	34.8	1.37	AR&R 102 year, 9 hours storm, average 21.8 mm/h, Zone 1				

OF12	0.213	0.213	7.665	0.046	0.03	13.25	0.63	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF26	0.52	0.52	7.665	0.067	0.05	17.36	0.79	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF1	3.886	3.886	7.665	0.152	0.21	34.44	1.36	AR&R 102 year, 9 hours storm, average 21.8 mm/h, Zone 1
OF19	5.583	5.583	7.665	0.176	0.26	39.11	1.5	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF17	5.583	5.583	7.665	0.176	0.26	39.11	1.5	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
StageDischarge_B	2.1	2.1	7.665	0.118	0.14	27.62	1.16	AR&R 102 year, 9 hours storm, average 21.8 mm/h, Zone 1
OF43	2.812	2.812	7.665	0.133	0.17	30.67	1.25	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF44	0.665	0.665	7.665	0.074	0.06	18.82	0.85	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF46	0.213	0.213	7.665	0.046	0.03	13.25	0.63	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF47	0.109	0.109	7.665	0.036	0.02	11.27	0.5	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF51	2.292	2.292	7.665	0.123	0.15	28.52	1.19	AR&R 102 year, 9 hours storm, average 21.8 mm/h, Zone 1
OF58	5.511	5.511	7.665	0.175	0.26	38.93	1.49	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF59	0.762	0.762	7.665	0.078	0.07	19.54	0.89	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF60	1.369	1.369	7.665	0.099	0.1	23.85	1.04	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF61	0.155	0.155	7.665	0.041	0.02	12.17	0.57	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF64	3.487	3.487	7.665	0.145	0.19	33.01	1.33	AR&R 102 year, 9 hours storm, average 21.8 mm/h, Zone 1
StageDischarge_A	2.667	2.667	7.665	0.131	0.16	30.13	1.23	AR&R 102 year, 9 hours storm, average 21.8 mm/h, Zone 1
OF549	0	0	7.665	0	0	0	0	
StageDischarge_D	7.153	7.153	7.665	0.194	0.31	42.89	1.59	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF550	0	0	7.665	0	0	0	0	
OF551	0	0	7.665	0	0	0	0	
OF552	0	0	7.665	0	0	0	0	
OF553	0	0	7.665	0	0	0	0	
OF554	0	0	7.665	0	0	0	0	
OF102	8.069	8.069	7.665	0.204	0.33	44.86	1.64	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF101	2.806	2.806	7.665	0.133	0.17	30.67	1.25	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF131	0.52	0.52	7.665	0.067	0.05	17.36	0.79	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF104	0.481	0.481	7.665	0.064	0.05	16.84	0.79	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF205	0.518	0.518	7.665	0.066	0.05	17.2	0.81	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF485	0.453	0.453	7.665	0.063	0.05	16.66	0.76	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF305	0.465	0.465	7.665	0.063	0.05	16.66	0.76	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF340	0.095	0.095	7.665	0.035	0.02	10.91	0.48	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF28	0	0	7.665	0	0	0	0	
OF30	9.326	9.326	7.665	0.216	0.37	47.2	1.71	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF487	0.453	0.453	7.665	0.063	0.05	16.66	0.76	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF594	3.8	3.8	7.665	0.15	0.2	34.08	1.35	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF593	2.619	2.619	7.665	0.13	0.18	29.95	1.22	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF590	1.285	1.285	7.665	0.097	0.1	23.31	1.02	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1
OF600	0.969	0.969	7.665	0.086	0.08	21.15	0.95	AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
DetBEx	14.8	15697.3	3.886	0	3.886
DetAEx	14.13	3736.5	5.583	0	5.583
DetB_Prop	16.02	18015.7	2.1	0	2.1
DetA_Prop	16.07	32685.6	2.667	0	2.667
DetC1	15.74	388.9	0.682	0.682	0
DetD_Prop	15.65	8890.8	7.153	0	7.153
DetC2	15.73	381.1	0.642	0.642	0
DetC3	15.73	380.8	0.641	0.641	0
DetC4	15.73	386.8	0.672	0.672	0
DetC5	15.72	375.3	0.611	0.611	0
DetC6	15.74	391.3	0.694	0.694	0

CONTINUITY CHECK for AR&R 102 year, 6 hours storm, average 28 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
N4	25661.3	25661.28	0	0
N5	1229.91	1229.91	0	0
N8	3828.05	3828.05	0	0
DetBEx	34410.6	24437.07	9976.28	0
OutBEx	25655.59	25655.59	0	0
DetAEx	38654.02	38654.07	0	0
N40	38654.07	38654.07	0	0
OutAEx	38654.07	38654.07	0	0
OutCEx	65719.52	65719.52	0	0
DetB_Prop	27249.21	11570.66	15679.38	0
N62	21591.53	21591.46	0	0
N63	5108.56	5108.56	0	0
N64	1229.91	1229.91	0	0
N65	630.3	630.3	0	0
N69	13427.41	13427.38	0	0
OutB_Prop	13423.93	13423.93	0	0
N75	42322.78	42322.71	0	0
N76	5855.05	5855.05	0	0
N77	9170.48	9170.48	0	0
N78	899.55	899.55	0	0
N79	39825.34	39825.25	0	0
OutA_Prop	39811.16	39811.16	0	0
DetA_Prop	52152.43	29769.29	22390.07	0
DetC1	5948.57	5947.83	0.71	0
DetD_Prop	63465.98	62510.88	953.46	0
DetC2	5639.61	5638.89	0.7	0
DetC3	5629.62	5628.87	0.7	0
DetC4	5866.74	5866.01	0.71	0
DetC5	5397.42	5396.74	0.7	0
DetC6	6038.67	6038.01	0.71	0
N92	69252.44	69252.52	0	0
OutC_Prop	69248.73	69248.73	0	0
N95	21549.71	21549.71	0	0
N96	3828.05	3828.05	0	0
N97	3263.42	3263.42	0	0
N169	3974.55	3974.55	0	0

N177	3481.95	3481.95	0	0								
N224	3572.18	3572.18	0	0								
N232	549.05	549.05	0	0								
HW2	65719.56	65719.52	0	0								
N50	65719.52	65719.52	0	0								
N294	3481.95	3481.95	0	0								
N320	1954.38	1954.38	0	0								
N321	6495.9	6495.9	0	0								
N322	736.45	736.45	0	0								
N323	20034.76	20034.76	0	0								
N324	825.15	825.15	0	0								
N325	287.25	287.25	0	0								
N326	29178	29178.14	0	0								
N327	20110.33	20110.08	0	0								
N328	9866.47	9866.47	0	0								
N329	7443.27	7443.27	0	0								
Run Log for Moorebank_REV02 run at 14:09:08 on 9/8/2011												
The maximum flow exceeded the safe value in the following overflow routes: OF102, OF30												