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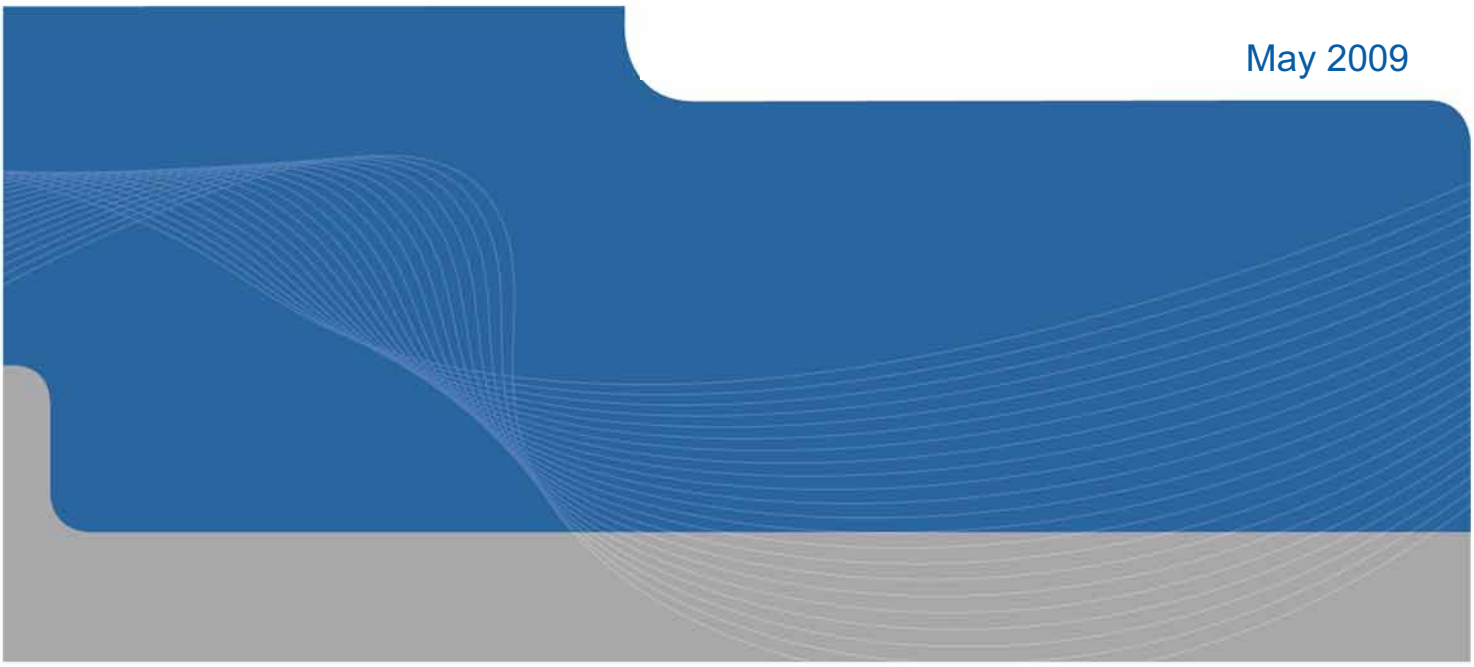
Thakral Holdings Limited

Report for Pacific Bay Western Lands

Services, Water Sensitive Urban Design and Flooding Assessment

May 2009



INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

The Director General issued his requirements in relation to an application to develop approximately 170 dwellings at Pacific Bay (Western Lands) on the Pacific Highway at West Korora, Coffs Harbour. Section 7 of the requirements related to Water Cycle Management. In response to those requirements GHD has prepared a Water Cycle Management Plan to detail how flooding, increased discharge and water quality shall be addressed within the proposed development.

In terms of post development discharge, it is proposed to provide a single large detention basin. The proposed basin reduces post development discharge to a level at or below the pre development flows. In the larger storm events peak discharge has been reduced, improving the flooding situation at the Pacific Highway.

Flood modelling was undertaken to assess the extent of flooding under existing development conditions for the 100-year ARI event, and the 100-year ARI event with rainfall intensities increasing by 30% to provide a sensitivity analysis on the potential impacts of climate change. For all flood modelling a culvert blockage factor of 50% was applied to the culverts under the Pacific Highway. The proposed detention strategy results in no adverse flooding impacts from the development downstream of the Pacific Highway, with the flood peak reducing by 0.9 m^3/s. The filling necessary to provide 0.5 m freeboard above the existing 100-year ARI flood level, and not have the development inundated in the 100-year ARI event results in local flood level increases where battering and fill constricts the flooding in two main areas upstream of the highway. Affluxes in the Caravan Park are generally less than 0.02 m with some areas no longer being flood affected due to the development constraining flow to certain parts of the floodplain upstream.

With respect to water quality, a number of Stormwater Quality Improvement Devices have been proposed. The construction and installation of the devices shall significantly reduce the pollutant runoff from the developed site. It should be noted that while Nitrogen and Phosphorus removal efficiencies under the proposal are each in excess of 50%, there is a marginal increase on nutrient concentrations resulting from the development.

Investigations have been undertaken regarding servicing. There is no impediment to development due to servicing.

Should development proceed in accordance with the measures proposed within the report, there will be minimal adverse impact on the environment resulting from the development.

1. Introduction

1.1 Background

GHD has been engaged by Thakral Holdings Limited to address the Director General's Environmental Assessment Requirements (DGR's) dated 29 August 2008 relating to Water Cycle Management and flooding at the Pacific Bay Resort. The DGR's have been issued in relation to a Concept Plan for the subdivision of land, including approximately 170 dwellings (Western Lands). The site is located adjacent to the Pacific Highway, West Korora in the Coffs Harbour Council local government area.

1.2 Objectives

The objective of this report is to comment on and address the items listed in the DGR's relating to services, water infrastructure, surface/stormwater management and flooding. The relevant DGR requirements are:

- Address potential impacts on surface and groundwater quality, including Jordan's Creek, and on groundwater dependant ecosystems;
- Address and outline measures for an integrated Water Cycle Management Plan (including stormwater concept) based upon Water Sensitive Urban Design principles, and include both construction and operational management measures; and
- Liaise with the Department of Water and Energy and Department of Primary Industries (Fisheries) regarding requirements for water use, water management and work within and adjacent to watercourses, in particular Jordan's Creek, and measures to ensure free passage of fish;
- Provide an assessment of any flood risk on site and prepare a strategic Floodplain Risk Management Plan in consideration of any relevant provisions of the NSW Floodplain Development (2005). The assessment should determine: the flood hazard in the area; address the impact of flooding on the proposed development, address the impact of development (including filling) on flood behaviour of the site and adjacent lands; and address adequate egress and safety in a flood event.
- Assess the potential impacts of sea level rise and an increase in rainfall intensity on the flood regime of the site and adjacent lands with consideration *of Practical Consideration of Climate Change – Floodplain Risk Management Guideline (DECC, October 2007).*
- In consultation with relevant agencies, address the existing capacity and requirements of the development for sewerage, water, electricity, telecommunications, waste disposal and gas. Identify whether infrastructure works will be staged.

2. Site Characteristics

2.1 Location

The site comprises Lot 1 DP 592173, Lot 2 DP 226560, Lots 3, 4 & 5 DP 820652 and Lot 23 DP 716144 and is located west of the Pacific Highway, West Korora. The majority of the site is located on the northern bank of Jordan's Creek, which has a catchment area of 185 Ha at the Pacific Highway crossing. The catchment plan is shown in Appendix A.

Currently, the site has minimal development upon it, apart from an existing caravan park as well as a sports field and associated buildings. The proposed ultimate development includes the creation of approximately 170 residential dwellings within an area of approximately 19 Ha.

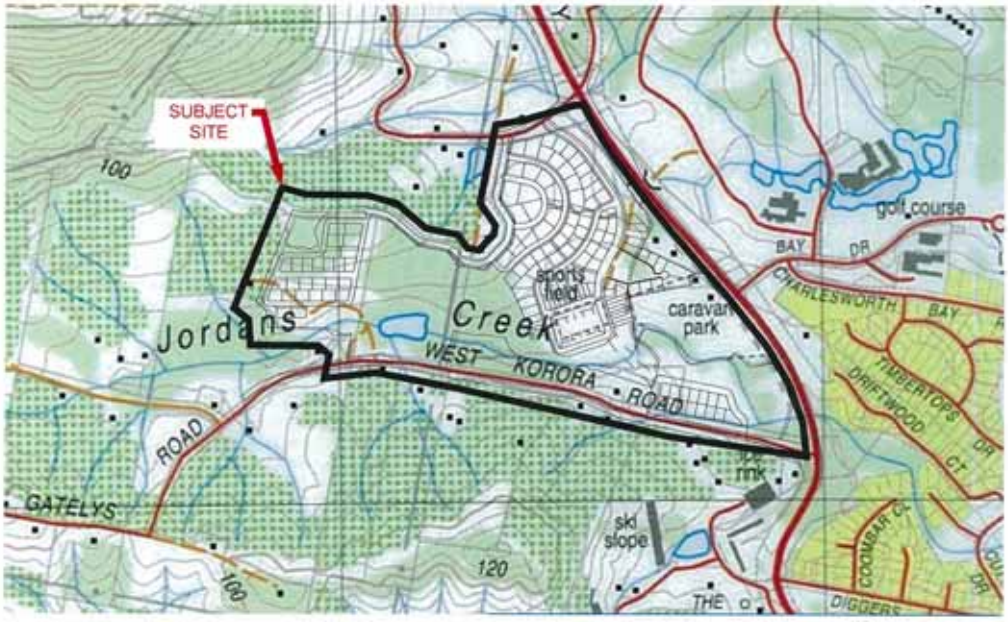


Figure 1 Site Location

(Source: NSW Topographic Map Series)

2.2 Site Topography

The topography of the site is undulating. The upper areas of the site are steep with gradients in excess of 15%. The lower areas located adjacent to Jordans Creek are flatter and comprise the floodplain. In general, the site slopes towards Jordans Creek and the Pacific Highway.

2.3 Watercourse

The majority of the site is located on the northern bank of Jordans Creek. Jordans Creek drains the elevated areas extending approximately 2km west of the Pacific Highway and discharges to the ocean at Diggers Beach. The average creek grade is approximately 2%.

3. Water, Sewer, Power and Telecommunication Services

Investigations were undertaken into the availability of water, sewer, power and telecommunications services to the site.

The site and surrounding region is currently being investigated for rezoning. If the area is rezoned, Coffs Harbour City Council will be required to provide services to the proposed development. The developer will be required to adhere to the conditions of rezoning approval, and may be required to contribute to any proposed upgrades to the existing system and trunk services.

3.1 Water and Fire Water Supply

Coffs Harbour City Council provided their requirements as to the location of connections for the proposed development into both their potable water supply and their Sewer system. Council advised that Council trunk water supply mains are located along the western frontage of the site, adjacent to the Pacific Highway. There is an existing feeder main for the existing water reservoir on Lot 3, DP 596492, south of the proposed development.

Lot 5, DP 820652 and Lot 23, DP 716144 should be satisfactorily serviced by the water supply main, but special consideration will be required when servicing Lot 2, DP 226560 as some of the proposed lots will be above the 55m contour line. These lots may require a booster pump and high-level reservoir to provide satisfactory pressure and fire fighting requirements.

The water reticulation will be designed to provide water service to all allotments and will be looped for security of supply and optimisation of flows and pressure. The internal mains will be linked to the trunk main at locations determined by Coffs Harbour City Council.

Fire hydrants will be located at appropriate intervals to give the allotments coverage from a distance of 60 metres from any one hydrant.

Control valving will be planned to enable main shutdown of discrete areas with minimum impact on adjacent areas. Scour valves (or hydrants) will be placed at the end point of any dead end legs and at the low points of the mains, to maintain clean water supply conditions.

Final sizing of the internal water main network and trunk main will be undertaken during the detailed design for each stage and after confirmation from Council as to their preferred connection point to the reticulation system, and details of their proposed augmentation of the existing reticulation system. Pressure and flow calculations for domestic and fire fighting purposes will be undertaken across the site, in order to determine pipe sizing.

3.2 Sewer System

Council advised that the site would be erquired to connect to the existing 225dia sewer with the Pacific Bay Resort and near West Korora Road. From the 'Coffs Harbour and Sawtell Sewerage Augmentation Options Report' (SKM 1998), a number of the sewer pump stations in the immediate area of the site are

currently under-capacity. Therefore, the proposed development may necessitate the upgrade of a portion of the existing facilities prior to obtaining Certificates of Occupancy, and will be required to make contributions to the future upgrades to the system.

The internal sewer reticulation will consist of 150mm gravity mains that will be designed to service all allotments and connect into the existing reticulation network at locations to be determined by Coffs Harbour City Council.

It is anticipated that a pump station will be required to service Lot 2, DP 226560, due to the long distance and relatively flat grade on West Korora Road between this portion and the remainder of the development. It is proposed that this phase be developed as community title because of the steep topography, and due to some of the proposed lots being above the serviceable 55m contour elevation. Copies of Council's correspondence can be found in Appendix I.

3.3 Power Supply

After consultation in regards to power supply, Country Energy have provided the following written response :

"Country Energy wishes to advise that satisfactory Country Energy infrastructure exists to cater for the above subdivision. This advice is subject to the following condition:

- *As the magnitude of the electrical load and the nature of the development proposed for occupation on the newly created allotments is not known at this time, all connection costs associated with providing adequate capacity to each allotment will be determined when your subdivision application is received."*

It is thus concluded that power supply to the site can be met.

3.4 Telecommunications

Contact has been made with the telecommunications authority, Telstra, with respect to this development, and the intent to develop has been registered with Telstra Smart Community, Registration # 12023529. GHD is awaiting written confirmation of Telstra's intent to pre-provide telecommunications network infrastructure for the proposed development.

4. Water Sensitive Urban Design Strategy

4.1 Potable Supply Reduction Measures

It is proposed that each new dwelling on the development site:

- Will be required to install rainwater tanks. The rainwater tanks will be connected for toilets, laundry and outdoor water supply. A rainwater tank of at least 3000 Litres with mains water top up will be required to provide adequate supply to these water uses; and
- Will be required to provide in-dwelling water efficient fixtures with 6 star rating and 4 star rated toilets.

It is expected that the combination of water efficient fixtures and non potable supply to the remaining fixtures will reduce the demand on the potable water supply by greater than 40%.

4.2 Detention of Increased Runoff

Development of the site has the potential to increase the volume and peak flow rate of runoff from the site. To throttle this increase, it is proposed to provide a single precinct scale detention facility. This facility will be co-located on the playing field. The storage at this location (9250 m^3) can be used to offset increases in runoff from the entire development, and areas not draining to the playing field will be discharged directly.

GHD understand that the golf course located on the eastern side of the Pacific Highway abstracts water from the culvert under the highway. Thus it will be important to maintain existing conditions at this location.

To test the effectiveness of the single precinct scale detention facility, a DRAINS stormwater model was configured to simulate pre- and post-development flows. The 5, 20 and 100-year ARI design storm events were simulated. The model was configured to convey minor flows (20-year ARI) within the pipe network and flows exceeding that were conveyed above ground within the road network. A number of pipe sections passing between properties were designed to convey the full 100-year ARI event within the pipe network. The stormwater network layout along with the DRAINS data and results can be found in Appendix B.

The results listed in Table 1 below show that the available storage provided by the playing field is sufficient to throttle discharges for event up to and including the 100-year ARI event.

Table 1 Detention Modelling Results (Total Development Site Discharge)

Recurrence Interval (years ARI)	Entire Site Pre-Development Discharge. (m^3/sec)	Entire Site Post Development Discharge (m^3/sec)	Post Development Storage Used (m^3)
5	5.18	5.17	1800
20	7.50	6.76	3000
100	9.6	8.26	4500

4.3 Stormwater Quality Management Strategy

Urban development has the potential to increase and alter stormwater pollutant and hydraulic loads. Lots, roads, buildings, car parks and pathways accumulate a range of pollutants during dry periods and transport them rapidly to receiving waters during rainfall events. These can cause adverse impacts on downstream water bodies and ecosystems, unless appropriate mitigation measures are implemented.

Studies suggest that pollutant loads delivered to receiving waters from minor rainfall events (less than the 3-month ARI event) constitute in excess of 90% of the average annual volume of stormwater discharge (Wong, 1997 cited in Austroads, 2003). Thus by providing water quality treatment measures for these minor events, a significant portion of the annual load can be captured and treated.

The Stormwater Quality Management Strategy is shown in Appendix C.

4.3.1 Stormwater Quality Objectives

Construction Phase

The pollutants listed in Table 2 are typically produced during the construction phase. To minimise the adverse impacts of construction activities on the surrounding environment, the contractor will be required to implement and maintain an Erosion and Sediment Control Plan as part of an overall Environmental Management Plan for the construction works. The Erosion and Sediment Control Plan will be prepared based on relevant Council and other statutory guidelines and submitted to Council for approval. Appropriate management measures will be included in the plan.

Table 2 Typical Construction Phase Pollutants

Pollutant	Sources
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts
Sediment	Unprotected exposed soils and stockpiles during earthworks and building
Hydrocarbons	Fuel and oil spills, leaks from construction equipment
Toxic Materials	Cement slurry, asphalt prime, solvents, cleaning agents, washwaters (eg. from tile works)
pH Altering Substances	Acid sulfate soils, cement slurry and washwaters.

Operational Phase

Attachment 3 of the DGR's provided a list of the relevant technical and policy guidelines for use in the preparation of the Environmental Assessment. For water the schedule refers to the Water Quality Guidelines for the protection of aquatic ecosystems for upland rivers (ANZECC 2000). This document provides trigger levels for a number of pollutant indicators. Table 3 below provides a summary of the trigger values:

Table 3 Pollutants of Concern

Aquatic Ecosystems	
Indicator	Numerical criteria (trigger values)
Total phosphorus	Upland rivers: 20 µg/L
Total nitrogen	Upland rivers: 250 µg/L
Turbidity	Upland rivers: 2–25 NTU
Salinity (electrical conductivity)	Upland rivers: 30–350 µS/cm Lowland rivers: 125–2200 µS/cm
Dissolved oxygen	Upland rivers: 90–110%
pH	Upland rivers: 6.5–8.0

From the list in Table 3, typical pollutants associated with stormwater are Total Phosphorus (TP), Total Nitrogen (TN) and Turbidity of the receiving waters. In addition to the above list, residential development also has the potential to generate:

- Litter;
- Hydrocarbons; and
- Sediments.

Communication with Council officers from Coffs Harbour City Council was undertaken to review the water quality objectives that they would expect on this site. Council advised that they would be prepared to look at a treatment train, with effectiveness criteria based on a percentage removal for pollutants. To this end it was agreed that the target for TN & TP should be a removal of 45% and 90% removal for Total Suspended Solids (TSS).

4.3.2 Stormwater Quality Treatment Train

A stormwater treatment train (hierarchy of treatment devices) has been selected based on the constraints, opportunities, likely pollutants, and pollutant sources, of the site. The following stormwater treatment devices are proposed for the site:

- Rainwater tanks with treated first flush devices;
- Gross pollutant traps; and
- Bio-retention swales.

The constraints of the site particularly the slope of the upper catchment limit the use of swales and other surface flow treatments. Appendix C shows a SQID layout concept plan.

Rainwater tanks

Rainwater collected from the roofs of the lots can be stored within above or below ground tanks and reused for toilets, laundry and outdoor water supply. These tanks could be located underground to minimise land take and be fitted with potable water top up. It is proposed that at least half of each residence roof area within the site be drained via rainwater tanks. All tanks would be fitted with first flush devices to minimise pollutants from entering the tank system and compromising the operation due to clogging and blockage.

Gross pollutant traps

Gross Pollutant Traps (GPT's) remove litter and coarse to medium sediments. Some GPT's can also remove oils and greases. A Humeceptor GPT is proposed to capture solid pollutants, free oils, fine sediments and attached nutrients from the stormwater. The device will be located immediately upstream of stormwater discharge points. The Humeceptor units operate by screening flows, which filter out gross pollutant and allows oil and grease removal as stormwater passes under collection baffle. Gross pollutants are collected via screen filtration and sedimentation in the wet sump.

Table 6 below lists the pollutant removal efficiencies quoted by the manufacturer.

Table 4 Humeceptor STC GPT

Pollutants	Pollutant removal efficiency	Description
Gross pollutants	98.0%	Anthropogenic materials such as cans, bottles, plastic bags, and packing materials (generally > 1.2mm in diameter)
Vegetation	98.0%	Organic material, such as leaves and grass clippings (generally >211μm
Sediment	98.0%	Solid materials > 211μm, both mineral and organic
	90.0%	Solid materials > 152μm, both mineral and organic
	51.0%	Solid materials > 90μm, both mineral and organic
Total Suspended Solis (TSS)	91.0%	Fine inorganic solids suspended in water
Total Phosphorous (TP)	30.0%	Total phosphorous in suspended solids and organic materials
Total nitrogen (TN)	30.0%	Total nitrogen in organic and inorganic forms
Hydrocarbons	Up to 97.0%	Free floating oils that do not emulsify in aqueous solutions

Bio-retention Basins and Swales

Bio-retention basins and swales use a soil matrix to act as a filter to remove fine and medium sediment

and the attached pollutants. The soil matrix also provides a media for the attachment of micro-organisms and plants to assimilate dissolved pollutants such as metals and nutrients. Discharges from the bio-retention will be either into the underlying aquifer through the natural sandy soils or through a sub-soil pipe that collects stormwater and conveys it to the stormwater pits.

A large bio-retention basin is proposed at the downstream end of the pit and pipe drainage system where the current playing field is currently located. The existing playing field already has the drainage layer and pipe network installed and as such, little or no modification to the field is necessary for it to act as a bio retention system. A secondary bio-retention basin is to be located in a portion of the park area located upstream of the playing field. Figure 2 shows a typical cross-section of a Bio-retention device.

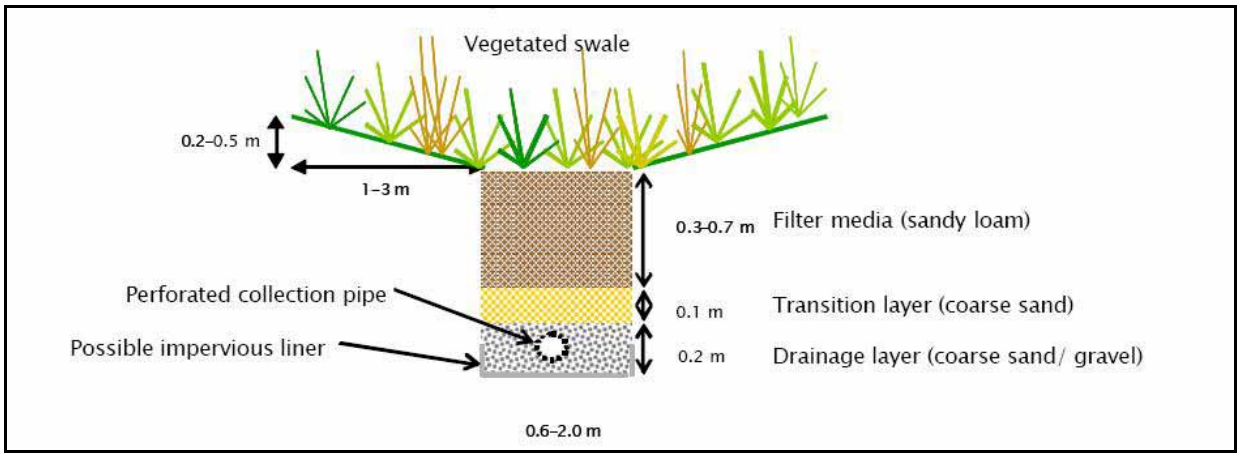


Figure 2 Typical section of a Bio-retention system

Source: Brisbane City Council: Draft Water Sensitive Urban Design Engineering Guidelines, August 2005

4.3.3 Stormwater Quality Strategy Assessment

To test the effectiveness of the strategy a MUSIC (Version 3.01) model was configured. MUSIC is a model for urban stormwater improvement conceptualisation. MUSIC simulates both quantity and quality of stormwater generated from catchments including urban, rural and forested land uses based on published research and data collected. MUSIC uses historical climate data to estimate the effectiveness of a stormwater quality treatment network and has options for the incorporation of a range of treatment devices, such as swales, bio-retention areas, wetlands, gross pollutant traps, sediment basins, ponds and filter strips.

Historical climate data used for this assessment was obtained from the Bureau of Meteorology for the 42 year period (1 November 1960 to 11 February 2002) of 6 minute data.

The model was set up to best represent the proposed development based on the drainage network sub-catchments, land use and proposed SQIDs. A sketch of the layout of the MUSIC model used to determine pollutant removal efficiencies for the proposed stormwater quality treatment measures is provided in Appendix C.

Source node pollutant generation parameters were taken from the Gold Coast Council's MUSIC

Modelling Guidelines 2006, with the exception of Nitrogen which was reset to default. The device treatment capabilities were adopted from literature provided by the manufacturer for the proprietary units proposed to be used. For the rest, the default values found within MUSIC were adopted.

The simulation results (Table 5) show that the proposed treatment train provides a removal efficiency of 49% for Total Nitrogen, an 67% reduction in Total Phosphorus and 95% reduction in Total Suspended Solids. Coffs Harbour Council indicated that they would be requiring a minimum of 45% reduction in TN & TP and a 90% reduction is TSS. As the table demonstrates, these requirements have been met and exceeded by the proposed treatment train.

Table 5 Stormwater Quality Treatment Efficiency

	Pre Development	Post Development	Percentage Reduction	Targets
Flow (ML/yr)	186	181	3	
Total Suspended Solids (kg/yr)	37800	1760	95	90
Total Phosphorus (kg/yr)	76	25	67	45
Total Nitrogen (kg/yr)	528	269	49	45
Gross Pollutants (kg/yr)	4200	0	100	

4.3.4 Groundwater Assessment

Groundwater was encountered during the geotechnical investigations on the site in both the hill slope and low lying areas. The geotechnical report recommended that the drainage on the hill slope be of good quality to ensure a minimum of water enters the ground. This was to reduce the risk of ground creep. Based on the geotechnical advice, the adopted drainage concept is to minimise charging of the ground with runoff and to convey storm flows within a pit and pipe system. This will reduce the groundwater within the hillslope and reduce the risk of ground movement.

The proposed development will have minimal impact on the quality of groundwater as the drainage strategy aims to minimise the amount of rainfall and runoff entering the soil landscape.

The proposed development makes up less than 10% of the overall catchment draining to Jordan's Creek at the Pacific Highway. The proposed development consists of approximately 18.5Ha while the Catchment is 185Ha. A large portion of the catchment is unsuitable for urban development and hence is unlikely to be developed in the future. Based on this, it is unlikely that this development will have a major impact on the base flows within Jordan's Creek. It should also be noted that during the geotechnical investigation, the creek was flowing without any recent precipitation. This shows that the overall catchment produces sufficient ground water to maintain base flows within Jordan's Creek.

It is unlikely that the proposed development will have an impact on groundwater quantity or quality and hence is unlikely to have a detrimental impact on groundwater dependant ecosystems.

4.4 Flooding Assessment

4.4.1 Previous Studies

A flood model and report in August 2003 (Bewsher Consulting) predicted flood levels on the site. This report determined a flood level for the 100-year ARI and PMF events. Both the hydrology and hydraulics models used in this study were reviewed and adopted (after a number of modifications) for use in the current study. The hydraulic model was developed in TUFLOW.

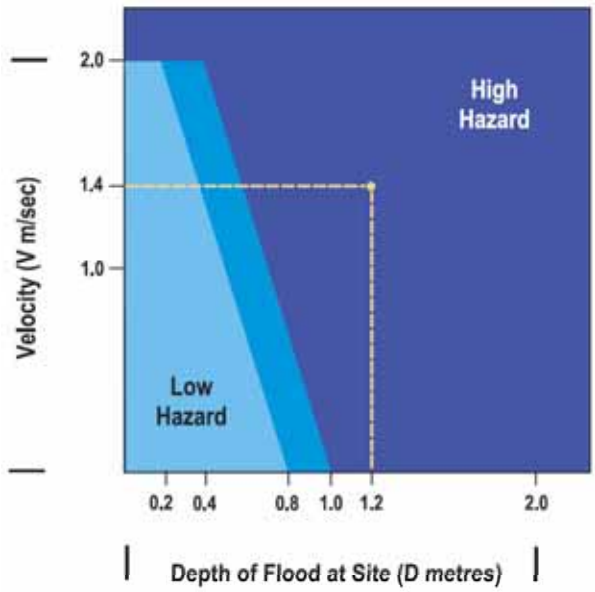
4.4.2 Flood Hazard Categorisation

For this study the NSW Floodplain Development Manual was used to categorise the flood risk at the site. The manual provides two categories in the determination of flood hazard categories:

- **High Hazard:** Possible danger to personal safety; evacuation by trucks difficult; able-bodied adults would have difficulty wading to safety, potential for significant structural damage to buildings; and
- **Low Hazard:** Should it be necessary, trucks could evacuate people and their possessions; able-bodied adults would have little difficulty in wading to safety.

For the purpose of this study, these two categories have been expanded to include a third "Intermediate Hazard" category. The categories were determined in accordance with Figure 3 below.

Figure 3 Provisional Hydraulic Hazard Categories (Source: NSW Floodplain Development Manual)



4.4.3 Existing Conditions Flood Model

A number of checks were carried out to verify the elevations, roughness's and other parameters adopted in the TUFLOW model. Checks of the model elevations showed that these reflect the survey provided, except that the playing field was not present in the topographic data. Review of the materials layer and recent aerial photography revealed some discrepancies, which were addressed. The adopted materials layer can be found in Figure A1 in Appendix D, along with the TUFLOW tmf file.

The Pacific Highway configuration in the model was corrected, which subsequently showed that the Pacific Highway is effectively the downstream control when a 50% culvert blockage is applied and the highway is overtopped. Although Coffs Harbour City Council's Development Control Plan is silent on the issue of culvert blockage, it is our understanding that Coffs Harbour City Council requires the adoption of 50% blockage for all culverts with a minimum diagonal opening of 6m and complete blockage for culverts with a diagonal opening less than 2m. The Pacific Highway culverts all have an opening greater than 2m and less than 6m. Accordingly a blockage factor of 50% was applied for flood modelling.

The modified model was simulated to provide a baseline of the 100-year ARI event flood conditions. At this stage the PMF (Probable Maximum Flood) has not been simulated due to time constraints. Flood modelling results for the 100-year ARI event are provided in Appendix E. The appendix shows the existing condition event flood extent, flood level contours, flood depths, flood hazard and flow velocities. The results in Appendix E show:

- The site in its pre-developed state experiences flooding during a 100-year ARI event. Areas that are submerged include the playing field (up to 1 m flow depth), the location of the proposed lots to the East of the playing field (up to approximately 0.5 m flow depth), and the location of the proposed lots on the southern side of Jordan's Creek (up to approximately 1.5m flow depth);
- Flow velocities (in the order of 3 m/s) are experienced on the playing field, at several locations along Jordan's Creek, and at the location of the proposed lots on the southern side of Jordan's Creek; and
- A high flood hazard is experienced along the length of Jordan's Creek and on the playing field. The location of the proposed lots to the South of Jordan's Creek is also exposed to regions classified as high hazard.

4.4.4 Development Conditions

A developed conditions flood model was configured, by representing the landform (and minor filling on the edge of the floodplain) in the TUFLOW model. The fill platforms were set above the existing 100-year ARI flood levels. The proposed landform includes a ring road around the existing playing field, which was configured in the model.

To reflect the proposed detention strategy, the run-off from the outlet of the detention basin, which throttles flood peaks to predevelopment levels, was configured as a point source boundary condition. A preliminary simulation showed unacceptable increases in flood levels on the property on the southern bank of Jordan's Creek, after configuring the post-development in the flood model. On a closer inspection of the channel profile in this location, a constriction in the channel was noted at the South-Western corner of the playing field. It was subsequently proposed to excavate the channel in this location, providing an increased flow area. The proposed excavation would maintain the channel invert, however widen the cross-section near the channel invert. The mapped results for the developed case

include this proposed excavation.

The proposed channel excavation was discussed with representatives from Coffs Harbour City Council, Department of Primary Industries – Fisheries, Department of Water and Energy and Catchment Management Authority.

The following will be implemented to satisfy various government agency requirements:

- The integrity of Jordan's Creek is to be maintained. This includes preventing any erosion at the commencement of the flood bypass and where any floodwaters re-enter the creek. There are two relatively deep pools (c. 20m in length, up to 0.5m in depth) located approximately behind the equipment shed and again upstream of the powerline crossing. These pools will be retained to provide suitable fish and invertebrate habitat.
- Revegetation is to commence from the top of the excavated channel and extend for 30m to provide the core riparian zone (minimum 20m) and a vegetated buffer (10m), the vegetated buffer can satisfy as the APZ if the regeneration planting comprises rainforest taxa.
- There will not be opportunity for any fish to enter the excavated channel during a high flow and become stranded as waters recede.
- The bottom of the excavation will be slightly sloped to ensure no water is retained once flood levels subside.

Details and typical cross sections at the proposed excavation is provided in Appendix H.

At this stage, the future bridge across the creek has been included in the proposed development conditions model, and this bridge would need to be designed so as not to adversely affect flood levels in adjoining lots. Final design details of the bridge were not available, however the following details were assumed when inputting the proposed bridge into the hydraulic model:

- Total length of the deck: 50 metres;
- Single Central Pier: 2 metre width;
- Two equal spans of 25 metres;
- Deck thickness: 800 millimetres; and
- Obvert of deck approximately 1.7 metres above invert of creek.

Once the design of the development has been finalised the PMF (Probable Maximum Flood) should be simulated to define the extent of flood prone land and associated classifications.

All developed flood modelling results are provided in Appendix F. The appendix shows the developed condition event flood extent, flood level contours, flood depths, flood hazard and flow velocities for the 100-year ARI event. The results in Appendix F show:

- With the development and associated channel excavation, local flood level increases of between 0.075 and 0.1 m occur at the southern bank of Jordan's Creek, adjacent to the site boundary. This is due to filling in the development area. However, as the bank is steep at this location the associated change in flood extent is minimal;
- Upstream areas (such as the Caravan Park to the east of the development) are less inundated as the

drainage path from the north will be routed through the playing field detention basin. Parts of the Caravan Park can be seen to experience flood level increases that are less than 0.02 m and these are generally considered within the modelling accuracy;

- The proposed lots are above the 100-year ARI event flood levels;
- Flow velocities are experienced on the playing field (up to 0.5m/s), and at several locations along Jordans Creek (up to 3m/s); and
- The flow velocities on the playing field are reduced by up to 2.5 m/s as compared to the existing case. The flow velocities along Jordan's creek are similar for the developed and existing cases, except at the South-West corner of the playing field where velocities are increased by up to 1 m/s due to the development ; and
- A high flood hazard is experienced along the length of Jordans Creek and on the playing field; and
- A smaller proportion of the playing field is classified as high hazard as compared to the existing case. The hazard levels along Jordan's creek are similar for the developed and existing cases, except at the South-West corner of the playing field where there is a larger proportion of the creek exposed to a high hazard for the developed case.

4.4.5 Evacuation Strategy

During storm events greater than the design flood, evacuation of the site would be possible for lots on the north side of Jordan's Creek by traversing up the collector Road to Bruxnor Park Road. For dwellings located on the southern side of Jordan's Creek evacuation would be to the south by accessing West Korora Road and on to the Pacific Highway.

4.4.6 Consideration of Climate Change

It is widely accepted that rainfall intensities will increase, resulting in higher peak flows and volumes due to the effects of climate change. A sensitivity analysis was carried out in line with DECC's Practical Consideration of Climate Change. A 30% increase in rainfall intensities and volumes was adopted and the IFD intensities were increased accordingly. The RAFTS model was re-simulated for the 100-year ARI climate change event. All flood modelling results are provided in Appendix G. The appendix shows the developed condition with climate change flood extent, flood level contours, flood depths, flood hazard and flow velocities. The results in Appendix G show:

- The adopted climate change conditions result in flood levels up to 0.4m higher than for current conditions. None of the proposed lots become inundated with this increase in flood levels; and
- The increase in the flood extents is minor, with the most notable increase at the location of the caravan park, where the flood extents extend approximately up to 20 metres.

There is no impact on water levels upstream of the Pacific Highway as a result of sea level rise that may occur over the predicted range. The design water level on the downstream side of the Pacific Highway is approximately RL 11.5m AHD. This is less than one kilometre from the outlet of Jordan's Creek into the Pacific Ocean. The effect of the rise in sea level would be absorbed within the lower reaches of the creek and have no effect on the western side of the Pacific Highway.

4.5 Maintenance and Monitoring Requirements

Routine maintenance of the proposed infrastructure is required to minimise the potential for untreated stormwater discharging from the site. Maintenance requirements for the proposed stormwater management facilities at the site are:

- Rainwater tanks should be maintained by the lot owners in accordance with the manufacturers requirement;
- The Humeceptor GPT should be checked regularly at initial development stage, as there are higher levels of sediment and litter loads due to significant disturbance and the nature of the site construction. The unit should be checked at monthly intervals and immediately after significant rain events. Once the construction phase is completed routine maintenance should be subject to the manufacturer's guidelines. It is important that the GPT unit be maintained to minimise the incidence of failure due to debris reducing the effectiveness of the system. Utilising a maintenance log will assist in providing long term maintenance requirements;
- Maintenance of bio-retention devices is critical in ensuring that filtering capacity of the system will not be reduced. This will be primarily achieved by maintaining complete vegetation covering of the soil throughout the length or area of the system, and prevent conduct of activities that could compact the soil and limit the infiltration rate of water through it. Other maintenance works will include:
  - Watering, replanting and weeding to maintain vegetation cover especially during establishment;
  - Removal of litter and debris removal;
  - Routine inspection of inlet point, surcharge pits and field inlet pits;
  - Routine inspection and repairing any damage to the profile;
  - Removal and management of invasive plants;
  - Inspection after all storm events to verify that they are working as intended.
  - Removal of dead vegetation and replaced with plants of equivalent size and species;
  - Checking for channelling or erosion; and
  - Monitoring of ponding areas in the filter material.
  - When necessary the top layer of the filter media can be removed and replaced.

4.5.1 Maintenance Frequency

The proposed maintenance frequency for the proposed treatment devices is detailed in Table 7. This table is provided as a guide and should be updated as more detailed performance information from the site is obtained through the maintenance log.

Table 7 Stormwater Maintenance Frequency

Element	Inspection Frequency	Maintenance Frequency	Maintenance Activities
GPT	Monthly After every major runoff event.	Litter sump is full	Remove captured pollutant and dispose in an appropriate manner.
Bio- retention	Monthly After every major runoff event.	Water ponding for over 24 hours after a storm event.	Watering, replanting and weeding to maintain vegetation cover especially during establishment; Removal of litter and debris removal; Routine inspection of inlet point, surcharge pits and field inlet pits; Routine inspection and repairing any damage to the profile; Removal and management of invasive plants; Inspection after all storm events to verify that they are working as intended. Removal of dead vegetation and replaced with plants of equivalent size and species; Checking for channelling or erosion; and Monitoring of ponding areas in the filter material.

4.5.2 Maintenance Record

A record of all maintenance checks for all stormwater controls onsite should be kept. The maintenance record will also provides verification that maintenance procedures are being carried out and the maintenance report should include details of the following;

- The date of maintenance;
- The name of the persons performing the maintenance;
- Type of maintenance actions performed for each water quality device; and
- The state of the device including an estimate of the type and weight of litter removed and the amount of sediment captured where appropriate.

5. Conclusion

The DGR's have been issued in relation to a Concept Plan for the subdivision of land, including approximately 170 dwellings (Western Lands) adjacent to the Pacific Highway, West Korora in the Coffs Harbour Council local government area. This report comments on and addresses the items listed in the DGR's relating to services, water infrastructure, surface/stormwater management and flooding.

Investigations were undertaken into the availability of water, sewer, power and telecommunications services to the site. Findings were:

- A Council trunk water supply main is located along the western frontage of the site, adjacent to the Pacific Highway. There is an existing feeder main for the existing water reservoir, south of the proposed development. Lots should be satisfactorily serviced by the water supply main, but special consideration will be required when servicing Lot 2 as some of the proposed lots will be above the 55m contour line. These lots may require a booster pump and high-level reservoir to provide satisfactory pressure and fire fighting requirements;
- The proposed development may necessitate the upgrade of a portion of the existing sewer facilities prior to obtaining Certificates of Occupancy, and will be required to make contributions to the future upgrades to the system. It is anticipated that a pump station will be required to service Lot 2;
- On advice from Country Energy, it is concluded that power supply to the site can be met; and
- Contact has been made with the telecommunications authority, Telstra, with respect to this development, and the intent to develop has been registered with Telstra Smart Community. GHD is awaiting written confirmation of Telstra's intent to pre-provide telecommunications network infrastructure for the proposed development.

In terms of Water Sensitive Urban Design, it is proposed that:

- Water efficient fixtures and non potable supply to the remaining fixtures will reduce the demand on the potable water supply by greater than 40%;
- Increased volume and peak flow rate of runoff from the developed site will be throttled by a single precinct scale detention facility. This facility will be co-located on the playing field. The storage at this location (9250 m^3) can be used to offset increases in runoff from the entire development, and areas not draining to the playing field will be discharged directly. The effectiveness of this strategy has been tested using DRAINS stormwater modelling which showed that design criteria were met;
- To minimise the adverse impacts of construction activities on the surrounding environment, the contractor will be required to implement and maintain an Erosion and Sediment Control Plan as part of an overall Environmental Management Plan for the construction works. The Erosion and Sediment Control Plan will be prepared based on relevant Council and other statutory guidelines and submitted to Council for approval;
- A stormwater treatment train (hierarchy of treatment devices) has been selected based on the constraints, opportunities, likely pollutants, and pollutant sources, of the site. Stormwater treatment devices proposed for the site include rainwater tanks with treated first flush devices, gross pollutant traps and bio-retention swales. To test the effectiveness of the strategy a MUSIC (Version 3.01)

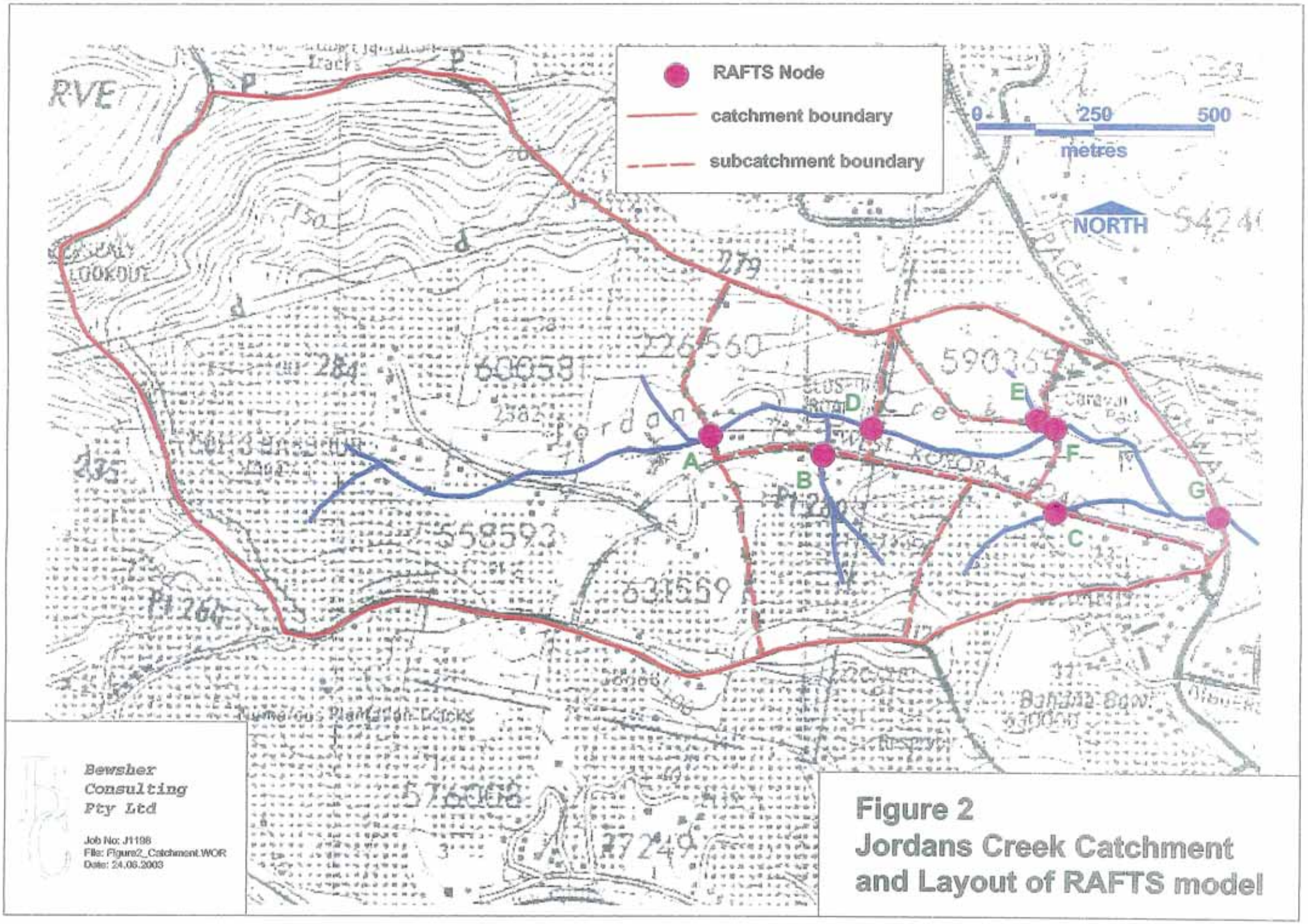
model was configured, which showed that the proposed treatment train provides a removal efficiency of 49% for Total Nitrogen, an 67% reduction in Total Phosphorus and 95% reduction in Total Suspended Solids satisfying Coffs Harbour Council requirements;

- The updated and modified TUFLOW model was simulated to provide a baseline of the 100-year ARI event flood conditions. At this stage the PMF has not been simulated, to define flood extents, depths, levels, velocity and hazard. The findings were:
- The site in its pre-developed state experiences flooding during a 100-year ARI event. Areas that are submerged include the playing field (up to 1 m flow depth), the location of the proposed lots to the East of the playing field (up to approximately 0.5 m flow depth), and the location of the proposed lots on the southern side of Jordans Creek (up to approximately 1.5m flow depth). Flow velocities (in the order of 3 m/s) are experienced on the playing field, at several locations along Jordans Creek, and at the location of the proposed lots on the southern side of Jordans Creek; and
- With the development and associated channel excavation, local flood level increases of between 0.075 and 0.1 m occur at the southern bank of Jordans Creek, adjacent to the site boundary. This is due to filling in the development area. However, as the bank is steep at this location the associated change in flood extent is minimal.
- In the post-development state upstream areas (such as the Caravan Park to the east of the development) are less inundated as the drainage path from the north will be routed through the playing field detention basin. Parts of the Caravan Park can be seen to experience flood level increases that are less than 0.02 m and these are generally considered within the modelling accuracy. The proposed lots are above the 100-year ARI event flood levels.
- With the development and associated channel excavation flow velocities are experienced on the playing field (up to 0.5m/s), and at several locations along Jordans Creek (up to 3m/s). The flow velocities on the playing field are reduced by up to 2.5 m/s as compared to the existing case. The flow velocities along Jordan's creek are similar for the developed and existing cases, except at the South-West corner of the playing field where velocities are increased by up to 1 m/s due to the development; and
- Routine maintenance of the proposed infrastructure is required to minimise the potential for untreated stormwater discharging from the site. A number of maintenance recommendations are offered in the report.

In summary, it is believed the site can be adequately serviced and stormwater quality, quantity and flooding can be managed to satisfy the requirements of Coffs Harbour City Council and the Floodplain Development Manual.

Appendix A

Catchment Plan



Bewsher Consulting Pty Ltd

Job No: J1198
File: Figure2_Catchment.WOR
Date: 24.06.2003

Figure 2
Jordans Creek Catchment and Layout of RAFTS model

Appendix B

Drains Model Files

PIT / NODE DETAILS Version 9

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss
Pit1/11	OnGrade	NSW Dept	2.4 m lintel (all grades)		4	45.997		0	0	312238.6	1650313	No	1	1 x Ku
Pit1/10	OnGrade	NSW Dept	2.4 m lintel (all grades)		3.3	45.701		0	0	312233.2	1650317	No	2	1 x Ku
Pit1/9	OnGrade	NSW Dept	2.4 m lintel (all grades)		2.8	39.919		0	0	312241.7	1650361	No	3	1 x Ku
Pit1/8	OnGrade	NSW Dept	2.4 m lintel (all grades)		3	33.019		0	0	312251.6	1650412	No	4	1 x Ku
Pit1/7	OnGrade	NSW Dept	2.4 m lintel (all grades)		1	32.011		0	0	312269.1	1650433	No	5	1 x Ku
Pit1/6	OnGrade	NSW Dept	2.4 m lintel (all grades)		1	31.236		0	0	312312.2	1650452	No	6	1 x Ku
Pit1/5	OnGrade	NSW Dept	2.4 m lintel (all grades)		2.5	29.132		0	0	312351.2	1650478	No	7	1 x Ku
Pit1/4	OnGrade	AVJ IAP	AVJ IAP 900x900		1.7	30.387		0	0	312397.8	1650452	No	8	1 x Ku
Pit1/3	OnGrade	AVJ IAP	AVJ IAP 900x900		1	30.736		0	0	312407.7	1650442	No	9	1 x Ku
Pit1/2	OnGrade	AVJ IAP	AVJ IAP 900x900		1.7	27.725		0	0	312444.7	1650408	No	10	1 x Ku
Pit1/1	Node					26.731		0		312450	1650400		11	
Pit2/3	OnGrade	NSW Dept	2.4 m lintel (all grades)		4.4	41.331		0	0	312251.9	1650342	No	12	1 x Ku
Pit2/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		3	41.331		0	0	312252.7	1650346	No	13	1 x Ku
Pit2/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.3	40.24		0	0	312247.2	1650357	No	14	1 x Ku
Pit3/3	OnGrade	NSW Dept	2.4 m lintel (all grades)		4.3	35.739		0	0	312260.8	1650384	No	15	1 x Ku
Pit3/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		3	35.738		0	0	312261.9	1650390	No	16	1 x Ku
Pit3/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		2.5	34.378		0	0	312255.8	1650401	No	17	1 x Ku
Pit6/10	Sag	NSW Dept	2.4 m lintel	10	2.1	46.023	0.15	0	0	312331.8	1650289	No	18	1 x Ku
Pit6/9	Sag	NSW Dept	2.4 m lintel	10	4	46.036	0.15	0	0	312335.8	1650288	No	19	1 x Ku
Pit6/8	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.4	37.382		0	0	312374.3	1650283	No	20	1 x Ku
Pit6/7	OnGrade	NSW Dept	2.4 m lintel (all grades)		0	37.385		0	0	312380.2	1650282	No	21	1 x Ku
Pit6/6	OnGrade	NSW Dept	2.4 m lintel (all grades)		2	28.311		0	0	312436.1	1650267	No	22	1 x Ku
Pit6/5	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.2	27.266		0	0	312445.2	1650282	No	23	1 x Ku
Pit6/4	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.7	25.058		0	0	312468.3	1650292	No	24	1 x Ku
Pit6/3	Sag	WC GKIP	4.2m GKIP	15	3.3	24.807	0.15	0	0	312472.6	1650305	No	25	1 x Ku
Pit6/2	Sag	WC GKIP	4.2m GKIP	15	1.7	24.808	0.15	0	0	312480.4	1650310	No	26	1 x Ku
Pit6/1	Node					22.427		0		312490.8	1650313		27	
Pit7/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		4	28.301		0	0	312442	1650266	No	28	1 x Ku
Pit8/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		2.3	25.058		0	0	312470.6	1650287	No	29	1 x Ku
Pit9/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	31.031		0	0	312413.1	1650391	No	30	1 x Ku
Pit9/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		3.1	27.569		0	0	312439.9	1650353	No	31	1 x Ku
Pit10/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	28.042		0	0	312443.6	1650364	No	32	1 x Ku
Pit11/22	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	48.418		0	0	312215.4	1650168	No	34	1 x Ku
Pit11/21	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.1	47.66		0	0	312228.4	1650164	No	35	1 x Ku
Pit11/20	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.1	47.66		0	0	312232.6	1650168	No	36	1 x Ku
Pit11/19	OnGrade	NSW Dept	2.4 m lintel (all grades)		0.4	45.53		0	0	312243.6	1650157	No	37	1 x Ku
Pit11/18	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.1	42.554		0	0	312257.9	1650159	No	38	1 x Ku
Pit11/17	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	36.596		0	0	312297.4	1650195	No	39	1 x Ku
Pit11/16	Sag	NSW Dept	3.0 m lintel	15	3.4	34.227	0.15	0	0	312339.3	1650221	No	40	1 x Ku
Pit11/15	Sag	NSW Dept	3.0 m lintel	15	0.2	34.23	0.15	0	0	312342.9	1650217	No	41	1 x Ku
Pit11/14	OnGrade	AVJ IAP	AVJ IAP 900x900		2	28.079		0	0	312358.8	1650196	No	42	1 x Ku
Pit11/13	OnGrade	AVJ IAP	AVJ IAP 900x900		1	25.255		0	0	312377.8	1650175	No	43	1 x Ku
Pit11/12	Sag	WC GKIP	4.2m GKIP	20	2	25.184	0.15	0	0	312381.5	1650174	No	44	1 x Ku
Pit11/11	Sag	WC GKIP	4.2m GKIP	20	0.2	25.195	0.15	0	0	312386.5	1650170	No	45	1 x Ku
Pit11/10	OnGrade	AVJ IAP	AVJ IAP 900x900		0	21.906		0	0	312411.1	1650159	No	46	1 x Ku
Pit11/9	OnGrade	NSW Dept	2.4 m lintel (all grades)		3.4	22.884		0	0	312445.7	1650147	No	47	1 x Ku
Pit11/8	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.6	21.548		0	0	312440.9	1650107	No	48	1 x Ku
Pit11/7	OnGrade	NSW Dept	2.4 m lintel (all grades)		0.8	21.153		0	0	312434.5	1650098	No	49	1 x Ku
Pit11/6	OnGrade	NSW Dept	2.4 m lintel (all grades)		0.4	21.115		0	0	312434.8	1650091	No	50	1 x Ku
Pit11/5	OnGrade	Capture all	Capture all		2	18.351		0	0	312434.7	1650077	No	51	1 x Ku
Pit11/3	Sag	NSW Dept	2.4 m lintel	15	0	20.319	0.15	0	0	312453.2	1650017	No	53	1 x Ku
Pit11/2	Sag	NSW Dept	2.4 m lintel	15	1.8	20.319	0.15	0	0	312455.1	1650011	No	54	1 x Ku
Pit11/1	Node					17.409		0		312483	1649977		55	
Pit12/2	Sag	WC GKIP	3.6m GKIP	10	3.1	48.363	0.15	0	0	312226.7	1650186	No	56	1 x Ku
Pit12/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.5	48.363		0	0	312231.1	1650182	No	57	1 x Ku
Pit14/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	21.016		0	0	312455.3	1650080	No	58	1 x Ku
Pit15/4	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	23.034		0	0	312333.8	1650072	No	60	1 x Ku
Pit15/3	OnGrade	NSW Dept	2.4 m lintel (all grades)		2.3	21.509		0	0	312342.7	1650045	No	61	1 x Ku
Pit15/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.5	20.958		0	0	312358.4	1649999	No	62	1 x Ku
Pit15/1	OnGrade	Capture all	Capture all		0.8	19.535		0	0	312368.8	1650002	No	63	1 x Ku
Pit16/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.5	21.6		0	0	312336.2	1650046	No	64	1 x Ku
Pit17/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.7	20.957		0	0	312352.7	1649997	No	65	1 x Ku
Pit19/3	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	25.613		0	0	312467.7	1650192	No	69	1 x Ku
Pit19/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		0.7	25.496		0	0	312474.5	1650186	No	70	1 x Ku
Pit19/1	OnGrade	Capture all	Capture all		5.9	26		0	0.3	312483.6	1650179	No	433	1 x Ku
Pit18/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		3.2	23.458		0	0	312458.1	1650155	No	68	1 x Ku
Pit20/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	26.365		0	0	312485.6	1650207	No	72	1 x Ku
Pit20/1	Node					25.931		0		312485.5	1650188		73	
Pit21/3	OnGrade	NSW Dept	2.4 m lintel (all grades)		4.9	25.934		0	0	312554.5	1650157	No	74	1 x Ku
Pit21/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.9	25.838		0	0	312550.7	1650156	No	75	1 x Ku
Pit100	OnGrade	Capture all	Capture all		5.9	25.8		0	0.3	312540.9	1650152	No	429	1 x Ku
Pit22/3	OnGrade	NSW Dept	2.4 m lintel (all grades)		3.7	24.52		0	0	312501.3	1650128	No	77	1 x Ku
Pit22/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		2.3	24.324		0	0	312502.4	1650132	No	78	1 x Ku
Pit102	OnGrade	Capture all	Capture all		1.7	24		0	0.3	312502.1	1650137	No	431	1 x Ku
Pit23/6	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	19.787		0	0	312597.3	1649923	No	80	1 x Ku
Pit23/5	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.5	19.576		0	0	312600.9	1649928	No	81	1 x Ku
Pit23/4	OnGrade	NSW Dept	2.4 m lintel (all grades)		2	15.227		0	0	312701	1649909	No	82	1 x Ku
Pit23/3	OnGrade	NSW Dept	2.4 m lintel (all grades)		1	14.593		0	0	312717.5	1649896	No	83	1 x Ku
Pit23/2	Sag	WC GKIP	3.0m GKIP	15	2	14.063	0.15	0	0	312725.6	1649872	No	84	1 x Ku
Pit23/1	Node					13.848		0		312730	1649873		85	
Pit24/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		4.9	15.33		0	0	312697	1649903	No	86	1 x Ku
Pit25/1	Sag	WC GKIP	3.6m GKIP	15	2.2	14.074	0.15	0	0	312720.4	1649868	No	87	1 x Ku
Pit26/5	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	21.867		0	0	312601.3	1649852	No	88	1 x Ku
Pit26/4	OnGrade	NSW Dept	2.4 m lintel (all grades)		2.4	21.717		0	0	312605	1649857	No	89	1 x Ku
Pit26/3	OnGrade	NSW Dept	2.4 m lintel (all grades)		3.8	15.913		0	0	312702.2	1649838	No	90	1 x Ku
Pit26/2	OnGrade	NSW Dept	2.4 m lintel (all grades)		2.9	14.299		0	0	312746.1	1649830	No	91	1 x Ku
Pit26/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		1	14.064		0	0	312745.7	1649847	No	92	1 x Ku
Pit27/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	16.063		0	0	312698.5	1649832	No	93	1 x Ku
Pit30/4	OnGrade	AVJ IAP	AVJ IAP 600x600		2.7	37.797		0	0	312281.3	1650136	No	94	1 x Ku
Pit30/3	OnGrade	AVJ IAP	AVJ IAP 600x600		3.9	34.873		0	0	312298.3	1650154	No	95	1 x Ku
Pit30/2	OnGrade	AVJ IAP	AVJ IAP 600x600		1.5	32.678		0	0	312313.9	1650169	No	96	1 x Ku
Pit30/1	OnGrade	AVJ IAP	AVJ IAP 600x600		0.1	29.901		0	0	312334.1	1650181	No	97	1 x Ku
Pit31/3	OnGrade	AVJ IAP	AVJ IAP 600x600		2.7	33.385		0	0	312396.6	1650244	No	98	1 x Ku
Pit31/2	OnGrade	AVJ IAP	AVJ IAP 600x600		4.5	30.224		0	0	312382.7	1650220	No	99	1 x Ku
Pit31/1	OnGrade	AVJ IAP	AVJ IAP 600x600		0.6	28.167		0	0	312363.7	1650200	No	100	1 x Ku
Pit32/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	27.102		0	0	312339.4	1650148	No	101	1 x Ku
Pit33/5	OnGrade	AVJ IAP	AVJ IAP 600x600		1.8	23.776		0	0	312355.1	1650112	No	102	1 x Ku
Pit33/4	OnGrade	AVJ IAP	AVJ IAP 600x600		2.3	23.291		0	0	312371.8	1650117	No	103	1 x Ku
Pit33/3	OnGrade	AVJ IAP	AVJ IAP 600x600		2.2	22.751		0	0	312388	1650123	No	104	1 x Ku
Pit33/2	OnGrade	AVJ IAP	AVJ IAP 600x600		0.3	22.212		0	0	312404.3	1650128	No	105	1 x Ku
Pit33/1	OnGrade	AVJ IAP	AVJ IAP 900x900		5.5	22.211		0	0	312406.5	1650132	No	106	1 x Ku
Pit40/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.8	35.449		0	0	312360.5	1650244	No	107	1 x Ku
Pit90/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		1.8	26.843		0	0	312408.1	1650201	No	108	1 x Ku
Pit95/1	OnGrade	NSW Dept	2.4 m lintel (all grades)		5.9	36.586		0	0	312301	1650190	No	109	1 x Ku
N229	Node					29		0		312371.2	1650493		12433421	

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Init Vol. (cu	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Leng	id
Basin11/4	0	0	0	Culvert	0.5					312449	1650029	No			395
	16.73	1	8.365												
	16.74	6	0.035												
	17.8	6	6.36												
	17.9	13	0.95												
	18	73	4.3												
	18.1	169	12.1												
	18.2	326	24.75												
	18.3	576	45.1												
	18.4	933	75.45												
	18.5	1309	112.1												
	18.6	1688	149.85												
	18.7	2060	187.4												
	18.8	2418	223.9												
	18.9	2753	258.55												
	19	3066	290.95												
	19.1	3393	322.95												

	19.2	3749	357.1
	19.3	4112	393.05
	19.4	4481	429.65
	19.5	4851	466.6
	19.6	5216	503.35
	19.7	5530	537.3
	19.8	5777	565.35
	19.9	5945	586.1
	20	6032	598.85
	20.1	6095	606.35
	20.2	6159	612.7
	20.3	6223	619.1
	20.4	6287	625.5
	20.5	6351	631.9

Basin2	0	0	0	Culvert	0.5						312464.6	1650152	No					375				
	21	1																				
	21.8	2																				
	22	20																				
	23	400																				
	24	500																				

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
Cat1/11	Pit1/11	0.14	60	40	0	5	5	5										0			
Cat1/10	Pit1/10	0.049	60	40	0	5	5	5										0			
Cat1/9	Pit1/9	0.031	60	40	0	5	5	5										0			
Cat1/8	Pit1/8	0.038	60	40	0	5	5	5										0			
Cat1/7	Pit1/7	0.123	60	40	0	5	5	5										0			
Cat1/6	Pit1/6	0.462	60	40	0	5	5	0										0			
Cat1/5	Pit1/5	0.164	60	40	0	5	5	5										0			
Cat1/4	Pit1/4	0.09	60	40	0	5	5	5										0			
Cat1/3	Pit1/3	0.104	60	40	0	5	5	5										0			
Cat1/2	Pit1/2	0.087	60	40	0	5	5	5										0			
Cat2/3	Pit2/3	0.292	60	40	0	5	5	5										0			
Cat2/2	Pit2/2	0.045	60	40	0	5	5	5										0			
Cat2/1	Pit2/1	0.013	60	40	0	5	5	5										0			
Cat3/3	Pit3/3	0.295	60	40	0	5	5	5										0			
Cat3/2	Pit3/2	0.058	60	40	0	5	5	5										0			
Cat3/1	Pit3/1	0.016	60	40	0	5	5	5										0			
Cat6/10	Pit6/10	0.085	60	40	0	5	5	5										0			
Cat6/9	Pit6/9	0.285	60	40	0	5	5	5										0			
Cat6/8	Pit6/8	0.2848	60	40	0	5	5	5										0			
Cat6/7	Pit6/7	0.069	60	40	0	5	5	5										0			
Cat6/6	Pit6/6	0.0953	60	40	0	5	5	5										0			
Cat6/5	Pit6/5	0.0734	60	40	0	5	5	5										0			
Cat6/4	Pit6/4	0.2066	60	40	0	5	5	5										0			
Cat6/3	Pit6/3	0.4048	60	40	0	5	5	5										0			
Cat6/2	Pit6/2	0.131	60	40	0	5	5	5										0			
Cat78	Pit7/1	0.025	60	40	0	5	5	5										0			
Cat8/1	Pit8/1	0.1166	60	40	0	5	5	5										0			
Cat9/2	Pit9/2	0.265	60	40	0	5	5	5										0			
Cat9/1	Pit9/1	0.31	60	40	0	5	5	5										0			
Cat10/2	Pit10/2	0.07	60	40	0	5	5	5										0			
Cat11/22	Pit11/22	0.192	60	40	0	5	5	5										0			
Cat11/21	Pit11/21	0.008	60	40	0	5	5	5										0			
Cat11/20	Pit11/20	0.012	60	40	0	5	5	5										0			
Cat11/19	Pit11/19	0.011	60	40	0	5	5	5										0			
Cat11/18	Pit11/18	0.011	60	40	0	5	5	5										0			
Cat11/17	Pit11/17	0.11	60	40	0	5	5	5										0			
Cat11/16	Pit11/16	0.263	60	40	0	5	5	0										0			
Cat11/14	Pit11/14	0.0695	60	40	0	5	5	5										0			
Cat11/12	Pit11/12	0.2845	60	40	0	5	5	5										0			
Cat11/10	Pit11/10	0.065	60	40	0	5	5	5										0			
Cat11/9	Pit11/9	0.288	60	40	0	5	5	5										0			
Cat11/8	Pit11/8	0.169	60	40	0	5	5	5										0			
Cat11/7	Pit11/7	0.358	60	40	0	5	5	5										0			
Cat11/6	Pit11/6	0.069	60	40	0	5	5	5										0			
Cat11/5	Pit11/5	0.185	10	90	0	5	5	5										0			
Cat11/4	Basin11/4	0.185	10	90	0	5	5	5										0			
Cat11/3	Pit11/3	0.158	60	40	0	5	5	5										0			
Cat11/2	Pit11/2	0.426	60	40	0	5	5	5										0			
Cat12/2	Pit12/2	0.422	60	40	0	5	5	5										0			
Cat12/1	Pit12/1	0.049	60	40	0	5	5	5										0			
Cat14/2	Pit14/2	0.154	60	40	0	5	5	5										0			
Cat15/4	Pit15/4	0.036	60	40	0	5	5	5										0			
Cat15/3	Pit15/3	0.02	60	40	0	5	5	5										0			
Cat15/2	Pit15/2	0.038	60	40	0	5	5	5										0			
Cat15/1	Pit15/1	0.185	10	90	0	5	5	5										0			
Cat16/1	Pit16/1	0.36	60	40	0	5	5	5										0			
Cat17/2	Pit17/2	0.21	60	40	0	5	5	5										0			
Cat19/3	Pit19/3	0.208	60	40	0	5	5	5										0			
Cat19/2	Pit19/2	0.01	60	40	0	5	5	5										0			
Cat Park	Basin2	0.294	20	80	0	5	5	5										0			
Cat18/1	Pit18/1	0.035	60	40	0	5	5	5										0			
Cat20/2	Pit20/2	0.095	60	40	0	5	5	5										0			
Cat21/3	Pit21/3	0.331	60	40	0	5	5	5										0			
Cat21/2	Pit21/2	0.044	60	40	0	5	5	5										0			
Cat22/3	Pit22/3	0.49	60	40	0	5	5	5										0			
Cat22/2	Pit22/2	0.0534	60	40	0	5	5	5										0			
Cat23/6	Pit23/6	0.1192	60	40	0	5	5	5										0			
Cat23/5	Pit23/5	0.112	60	40	0	5	5	5										0			
Cat23/4	Pit23/4	0.0715	60	40	0	5	5	5										0			
Cat23/2	Pit23/2	0.056	60	40	0	5	5	5										0			
Cat24/1	Pit24/1	0.67	60	40	0	5	5	5										0			
Cat125/1	Pit25/1	0.278	60	40	0	5	5	5										0			
Cat26/5	Pit26/5	0.104	60	40	0	5	5	5										0			
Cat26/4	Pit26/4	0.0365	60	40	0	5	5	5										0			
Cat36/3	Pit26/3	0.07	60	40	0	5	5	5										0			
Cat26/2	Pit26/2	0.02	60	40	0	5	5	5										0			
Cat26/1	Pit26/1	0.02	60	40	0	5	5	5										0			
Cat27/1	Pit27/1	0.219	60	40	0	5	5	5										0			
Cat30/4	Pit30/4	0.065	60	40	0	5	5	5										0			
Cat30/3	Pit30/3	0.06	60	40	0	5	5	5										0			
Cat30/2	Pit30/2	0.056	60	40	0	5	5	5										0			
Cat30/1	Pit30/1	0.057	60	40	0	5	5	5										0			
Cat31/3	Pit31/3	0.063	60	40	0	5	5	5										0			
Cat31/2	Pit31/2	0.06	60	40	0	5	5	5										0			
Cat31/1	Pit31/1	0.061	60	40	0	5	5	5										0			
Cat32/1	Pit32/1	0.0169	60	40	0	5	5	5										0			
Cat33/5	Pit33/5	0.065	60	40	0	5	5	5										0			
Cat33/4	Pit33/4	0.065	60	40	0	5	5	5										0			
Cat33/3	Pit33/3	0.065	60	40	0	5	5	5										0			
Cat33/1	Pit33/1	0.065	60	40	0	5	5	5										0			
Cat40/1	Pit40/1	0.161	60	40	0	5	5	5										0			
Cat90/1	Pit90/1	0.129	60	40	0	5	5	5										0			
Cat95/1	Pit95/1	0.057	60	40	0	5	5	5										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
P Pit1/11	Pit1/11	Pit1/10	6.419	44.413	44.168	3.82	Concrete, r	375	375	0.01	New	1	Pit1/11
P Pit1/10	Pit1/10	Pit1/9	44.549	44.148	38.515	12.64	Concrete, u	375	375	0.01	New	1	Pit1/10
P Pit1/9	Pit1/9	Pit1/8	52.821	38.368	31.62	12.78	Concrete, u	375	375	0.01	New	1	Pit1/9
P Pit1/8	Pit1/8	Pit1/7	26.964	30.729	29.885	3.13	Concrete, u	525	525	0.01	New	1	Pit1/8
P Pit1/7	Pit1/7	Pit1/6	46.977	29.865	29.395	1	Concrete, u	600	600	0.01	New	1	Pit1/7
P Pit1/6	Pit1/6	Pit1/5	46.788	29.375	27.332	4.37	Concrete, u	600	600	0.01	New	1	Pit1/6
P Pit1/5	Pit1/5	Pit1/4	53.252	27.281	26.749	1	Concrete, u	750	750	0.01	New	1	Pit1/5

P Pit1/4	Pit1/4	Pit1/3	13.852	26.729	26.59	1	Concrete, u	750	750	0.01	New	1	Pit1/4
P Pit1/3	Pit1/3	Pit1/2	50.115	26.57	25.945	1.25	Concrete, u	750	750	0.01	New	1	Pit1/3
P Pit1/2	Pit1/2	Pit1/1	9.435	25.818	24.94	9.31	Concrete, u	750	750	0.01	New	1	Pit1/2
P Pit2/3	Pit2/3	Pit2/2	4	39.774	39.734	1	Concrete, u	375	375	0.01	New	1	Pit2/3
P Pit2/2	Pit2/2	Pit2/1	12.397	39.714	38.827	7.15	Concrete, u	375	375	0.01	New	1	Pit2/2
P Pit2/1	Pit2/1	Pit1/9	6.492	38.655	38.388	4.11	Concrete, u	375	375	0.01	New	1	Pit2/1
P Pit3/3	Pit3/3	Pit3/2	5.998	34.182	34.122	1	Concrete, r	375	375	0.01	New	1	Pit3/3
P Pit3/2	Pit3/2	Pit3/1	12.902	34.102	32.963	8.83	Concrete, u	375	375	0.01	New	1	Pit3/2
P Pit3/1	Pit3/1	Pit1/8	11.939	32.736	31.501	10.34	Concrete, u	375	375	0.01	New	1	Pit3/1
P Pit6/10	Pit6/10	Pit6/9	4	44.704	44.664	1	Concrete, u	150	150	0.01	New	1	Pit6/10
P Pit6/9	Pit6/9	Pit6/8	38.949	43.876	35.224	22.21	Concrete, u	375	375	0.01	New	1	Pit6/9
P Pit6/8	Pit6/8	Pit6/7	6.001	35.204	35.144	1	Concrete, r	375	375	0.01	New	1	Pit6/8
P Pit6/7	Pit6/7	Pit6/6	57.712	35.124	26.24	15.39	Concrete, u	525	525	0.01	New	1	Pit6/7
P Pit6/6	Pit6/6	Pit6/5	16.951	26.22	25.44	4.6	Concrete, u	600	600	0.01	New	1	Pit6/6
P Pit6/5	Pit6/5	Pit6/4	25.462	25.162	23.11	8.06	Concrete, u	750	750	0.01	New	1	Pit6/5
P Pit6/4	Pit6/4	Pit6/3	13.517	23.09	22.882	1.54	Concrete, u	750	750	0.01	New	1	Pit6/4
P Pit6/3	Pit6/3	Pit6/2	8.999	22.765	22.675	1	Concrete, u	750	750	0.01	New	1	Pit6/3
P Pit6/2	Pit6/2	Pit6/1	10.808	22.655	20.845	16.75	Concrete, u	750	750	0.01	New	1	Pit6/2
P Pit7/1	Pit7/1	Pit6/6	6.068	26.754	26.693	1.01	Concrete, u	375	375	0.01	New	1	Pit7/1
P Pit8/1	Pit8/1	Pit6/4	6	23.501	23.441	1	Concrete, u	375	375	0.01	New	1	Pit8/1
P Pit9/2	Pit9/2	Pit9/1	46.439	29.5	26.12	7.28	Concrete, u	375	375	0.01	New	1	Pit9/2
P Pit9/1	Pit9/1	Pit6/3	58.079	25.501	22.785	4.68	Concrete, u	375	375	0.01	New	1	Pit9/1
P Pit10/2	Pit10/2	Pit9/1	11.04	26.458	26.032	3.86	Concrete, u	525	525	0.01	New	1	Pit10/2
P Pit11/22	Pit11/22	Pit11/21	13.47	46.946	46.234	5.29	Concrete, u	375	375	0.01	New	1	Pit11/22
P Pit11/21	Pit11/21	Pit11/20	6	46.103	46.043	1	Concrete, u	375	375	0.01	New	1	Pit11/21
P Pit11/20	Pit11/20	Pit11/19	15.548	45.983	43.987	12.84	Concrete, u	525	525	0.01	New	1	Pit11/20
P Pit11/19	Pit11/19	Pit11/18	14.383	43.579	40.709	19.95	Concrete, u	600	600	0.01	New	1	Pit11/19
P Pit11/18	Pit11/18	Pit11/17	53.552	40.515	34.693	10.87	Concrete, u	600	600	0.01	New	1	Pit11/18
P Pit11/17	Pit11/17	Pit11/16	49.587	33.893	31.601	4.62	Concrete, u	750	750	0.01	New	1	Pit11/17
P Pit11/16	Pit11/16	Pit11/15	6	31.581	31.521	1	Concrete, u	750	750	0.01	New	1	Pit11/16
P Pit11/15	Pit11/15	Pit11/14	25.885	31.501	26.098	20.87	Concrete, r	825	825	0.01	New	1	Pit11/15
P Pit11/14	Pit11/14	Pit11/13	28.559	25.176	22.463	9.5	Concrete, r	900	900	0.01	New	1	Pit11/14
P Pit11/13	Pit11/13	Pit11/12	3.815	22.443	22.405	1	Concrete, r	900	900	0.01	New	1	Pit11/13
P Pit11/12	Pit11/12	Pit11/11	6.227	22.385	22.323	1	Concrete, r	900	900	0.01	New	1	Pit11/12
P Pit11/11	Pit11/11	Pit11/10	27.267	22.112	18.844	11.99	Concrete, u	900	900	0.01	New	1	Pit11/11
P Pit11/10	Pit11/10	Pit11/9	36.548	18.824	18.458	1	Concrete, r	1050	1070	0.01	New	1	Pit11/10
P Pit11/9	Pit11/9	Pit11/8	40.275	18.438	18.036	1	Concrete, u	1050	1070	0.01	New	1	Pit11/9
P Pit11/8	Pit11/8	Pit11/7	11.036	18.016	17.905	1.01	Concrete, u	1050	1070	0.01	New	1	Pit11/8
P Pit11/7	Pit11/7	Pit11/6	6.245	17.885	17.823	0.99	Concrete, u	1050	1070	0.013	New	1	Pit11/7
P Pit11/6	Pit11/6	Pit11/5	14.666	17.004	16.96	0.3	Concrete, r	1050	1070	0.01	New	1	Pit11/6
P Pit11/5	Pit11/5	Basin11/4	50.063	16.935	16.77	0.33	Concrete, u	450	450	0.013	NewFixed	1	Pit11/5
P Pit11/4	Basin11/4	Pit11/3	12.496	16.741	16.7	0.33	Concrete, r	450	450	0.01	NewFixed	1	Basin11/4
P Pit11/3	Pit11/3	Pit11/2	6	16.678	16.66	0.3	Concrete, u	750	750	0.01	New	1	Pit11/3
P Pit11/2	Pit11/2	Pit11/1	45.084	16.635	16.5	0.3	Concrete, u	750	750	0.01	New	1	Pit11/2
P Pit12/2	Pit12/2	Pit12/1	6	46.806	46.746	1	Concrete, u	375	375	0.01	New	1	Pit12/2
P Pit12/1	Pit12/1	Pit11/20	13.25	46.726	46.231	3.74	Concrete, u	375	375	0.01	New	1	Pit12/1
P Pit14/2	Pit14/2	Pit11/5	20.772	19.356	16.96	11.53	Concrete, u	375	375	0.01	New	1	Pit14/2
P Pit15/4	Pit15/4	Pit15/3	27.988	21.253	19.822	5.11	Concrete, u	375	375	0.01	New	1	Pit15/4
P Pit15/3	Pit15/3	Pit15/2	49.188	19.802	19.31	1	Concrete, u	375	375	0.01	New	1	Pit15/3
P Pit15/2	Pit15/2	Pit15/1	10.95	18.9	17.478	12.99	Concrete, u	525	525	0.01	New	1	Pit15/2
P Pit15/1	Pit15/1	Basin11/4	84.76	17.458	16.76	0.82	Concrete, u	600	600	0.01	NewFixed	1	Pit15/1
P Pit16/1	Pit16/1	Pit15/3	6.528	20.034	19.959	1.15	Concrete, u	375	375	0.01	New	1	Pit16/1
P Pit17/2	Pit17/2	Pit15/2	6	19.401	19.341	1	Concrete, u	375	375	0.01	New	1	Pit17/2
P Pit19/3	Pit19/3	Pit19/2	9.374	24.047	23.945	1.09	Concrete, u	375	375	0.01	New	1	Pit19/3
P Pit19/2	Pit19/2	Pit19/1	11.583	23.925	23.81	0.99	Concrete, u	375	375	0.01	New	1	Pit19/2
P109	Pit19/1	Basin2	10	22.5	22	5	Concrete, r	525	525	0.013	NewFixed	1	Pit19/1
P Pit18/2	Basin2	Pit18/1	6.756	21.894	21.827	0.99	Concrete, u	750	750	0.01	NewFixed	1	Basin2
P Pit18/1	Pit18/1	Pit11/9	14.83	21.807	21.33	3.22	Concrete, u	750	750	0.01	New	1	Pit18/1
P Pit20/2	Pit20/2	Pit20/1	18.571	24.603	24.187	2.24	Concrete, u	375	375	0.01	New	1	Pit20/2
P117	Pit20/1	Pit19/1	11.583	23.925	23.81	0.99	Concrete, u	375	375	0.01	New	1	Pit20/1
P Pit21/3	Pit21/3	Pit21/2	4.102	24.371	24.283	2.15	Concrete, u	375	375	0.01	New	1	Pit21/3
P Pit21/2	Pit21/2	Pit100	10.541	24.263	24.158	1	Concrete, u	375	375	0.01	New	1	Pit21/2
Pipe103	Pit100	Basin2	10	22.5	22	5	Concrete, r	525	525	0.013	NewFixed	1	Pit100
P Pit22/3	Pit22/3	Pit22/2	4.001	22.956	22.866	2.25	Concrete, u	375	375	0.01	New	1	Pit22/3
P Pit22/2	Pit22/2	Pit102	5.37	22.744	22.691	0.99	Concrete, u	375	375	0.01	New	1	Pit22/2
P110	Pit102	Basin2	10	22.5	22	5	Concrete, r	525	525	0.013	NewFixed	1	Pit102
P Pit23/6	Pit23/6	Pit23/5	6.527	18.212	18.034	2.73	Concrete, u	375	375	0.01	New	1	Pit23/6
P Pit23/5	Pit23/5	Pit23/4	101.972	17.513	13.226	4.2	Concrete, u	375	375	0.01	New	1	Pit23/5
P Pit23/4	Pit23/4	Pit23/3	20.799	13.206	12.878	1.58	Concrete, u	525	525	0.01	New	1	Pit23/4
P Pit23/3	Pit23/3	Pit23/2	25.524	12.838	12.346	1.93	Concrete, u	600	600	0.01	New	1	Pit23/3
P Pit23/2	Pit23/2	Pit23/1	4.703	11.623	11.576	1	Concrete, u	750	750	0.01	New	1	Pit23/2
P Pit24/1	Pit24/1	Pit23/4	7.044	13.716	13.576	1.99	Concrete, u	375	375	0.01	New	1	Pit24/1
P Pit25/1	Pit25/1	Pit23/2	6.018	12.517	12.457	1	Concrete, u	375	375	0.01	New	1	Pit25/1
P Pit26/5	Pit26/5	Pit26/4	6.527	20.297	20.172	1.92	Concrete, u	375	375	0.01	New	1	Pit26/5
P Pit26/4	Pit26/4	Pit26/3	99.144	20.152	14.47	5.73	Concrete, u	375	375	0.01	New	1	Pit26/4
P Pit26/3	Pit26/3	Pit26/2	44.634	13.838	12.174	3.73	Concrete, u	375	375	0.01	New	1	Pit26/3
P Pit26/2	Pit26/2	Pit26/1	16.961	12.154	11.984	1	Concrete, u	525	525	0.01	New	1	Pit26/2
P Pit26/1	Pit26/1	Pit23/2	32.113	11.964	11.643	1	Concrete, u	600	600	0.01	New	1	Pit26/1
P Pit27/1	Pit27/1	Pit26/3	6.677	14.476	14.367	1.63	Concrete, u	375	375	0.01	New	1	Pit27/1
P Pit30/4	Pit30/4	Pit30/3	24.429	36.338	33.539	11.46	uPVC, not r	150	154	0.01	New	1	Pit30/4
P Pit30/3	Pit30/3	Pit30/2	21.677	33.402	31.315	9.63	uPVC, not r	225	242	0.01	New	1	Pit30/3
P Pit30/2	Pit30/2	Pit30/1	23.496	31.18	28.527	11.29	uPVC, not r	225	242	0.01	New	1	Pit30/2
P Pit30/1	Pit30/1	Pit11/14	28.972	28.212	26.48	5.98	Concrete, r	375	375	0.01	New	1	Pit30/1
P Pit31/3	Pit31/3	Pit31/2	27.437	31.719	28.684	11.06	uPVC, not r	150	154	0.01	New	1	Pit31/3
P Pit31/2	Pit31/2	Pit31/1	27.434	28.664	26.895	6.45	uPVC, not r	225	242	0.01	New	1	Pit31/2
P Pit31/1	Pit31/1	Pit11/14	6.266	26.573	26.493	1.28	Concrete, r	375	375	0.01	New	1	Pit31/1
P Pit32/1	Pit32/1	Pit11/12	49.561	25.464	23.573	3.82	uPVC, not r	150	154	0.01	New	1	Pit32/1
P Pit33/5	Pit33/5	Pit33/4	17.594	22.387	21.925	2.63	uPVC, not r	150	154	0.01	New	1	Pit33/5
P Pit33/4	Pit33/4	Pit33/3	17.078	21.881	21.371	2.99	uPVC, not r	225	242	0.01	New	1	Pit33/4
P Pit33/3	Pit33/3	Pit33/2	17.194	21.351	20.893	2.66	uPVC, not r	225	242	0.01	New	1	Pit33/3
P Pit33/2	Pit33/2	Pit33/1	4.454	20.739	20.694	1.01	Concrete, r	375	375	0.01	New	1	Pit33/2
P Pit33/1	Pit33/1	Pit11/10	26.874	20.674	20.406	1	Concrete, r	375	375	0.01	New	1	Pit33/1
P Pit40/1	Pit40/1	Pit11/16	30.69	34.086	32.894	3.88	uPVC, not r	150	154	0.01	New	1	Pit40/1
P Pit90/1	Pit90/1	Pit11/12	38.116	25.226	23.609	4.24	uPVC, not r	150	154	0.01	New	1	Pit90/1
P Pit95/1	Pit95/1	Pit11/17	6	35.039	34.979	1	Concrete, u	375	375	0.01	New	1	Pit95/1

DETAILS of SERVICES CROSSING PIPES

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

CHANNEL DETAILS

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

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major (m)	Storm	Safe Depth Minor (m)	Storm	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id	U/S IL	D/S IL	Length (m)
OF106	Pit1/11	Pit2/1	2				Dummy us	0.2		0.05		0.6	1	0	4897513			
OF118	Pit1/10	Pit1/9	2				Dummy us	0.2		0.05		0.6	1	0	4897525			
OF120	Pit1/9	Pit1/8	1.5				Dummy us	0.2		0.05		0.6	1	0	4897527			
OF125	Pit1/8	Pit1/7	1.5				Dummy us	0.2		0.05		0.6	1	0	4897532			
OF127	Pit1/7	Pit1/6	1				Dummy us	0.2		0.05		0.6	1	0	4897534			
OF129	Pit1/6	Pit1/5	1				Dummy us	0.2		0.05		0.6	1	0	4897536			
OF187	Pit1/5	N229	1				Dummy us	0.2		0.05		0.6	1	0	12433423			
OF108	Pit2/3	Pit2/2	0.5				Dummy us	0.2		0.05		0.6	1	0	4897515			
OF110	Pit2/2	Pit2/1	1				Dummy us	0.2		0.05		0.6	1	0	4897517			
OF112	Pit2/1	Pit3/1	2				Dummy us	0.2		0.05		0.6	1	0	4897519			
OF114	Pit3/3	Pit3/1	1				Dummy us	0.2		0.05		0.6	1	0	4897521			
OF116	Pit3/2	Pit3/1	1				Dummy us	0.2		0.05		0.6	1	0	4897523			
OF123	Pit3/1	Pit1/7	1				Dummy us	0.2		0.05		0.6	1	0	4897530			
OF82	Pit6/8	Pit40/1	1				Dummy us	0.2		0.05		0.6	1	0	4897485			
OF84	Pit6/7	Pit11/15	2				Dummy us	0.2		0.05		0.6	1	0	4897491			
OF86	Pit6/6	Pit6/5	0.5				Dummy us	0.2		0.05		0.6	1	0	4897493			
OF90	Pit6/5	Pit6/4	1				Dummy us	0.2		0.05		0.6	1	0	4897497			
OF92	Pit6/4	Pit6/3	0.5				Dummy us	0.2		0.05		0.6	1	0	4897499			
OF96	Pit6/3	Pit6/2	0.1				Dummy us	0.2		0.05		0.6	1	0	4897503			
OF195	Pit6/2	Pit6/1	1				Dummy us	0.2		0.05		0.6	1	0	18677690			
OF88	Pit7/1	Pit8/1	1				Dummy us	0.2		0.05		0.6	1	0	4897495			

OF94	Pit8/1	Pit6/3	1	Dummy use	0.2	0.05	0.6	1	0	4897501
OF100	Pit9/2	Pit9/1	1	Dummy use	0.2	0.05	0.6	1	0	4897507
OF102	Pit9/1	Pit6/3	1	Dummy use	0.2	0.05	0.6	1	0	4897509
OF98	Pit10/2	Pit6/2	2	Dummy use	0.2	0.05	0.6	1	0	4897505
OF3	Pit11/22	Pit11/21	1	Dummy use	0.2	0.05	0.6	1	0	4897381
OF5	Pit11/21	Pit95/1	3	Dummy use	0.2	0.05	0.6	1	0	4897383
OF9	Pit11/20	Pit11/19	1	Dummy use	0.2	0.05	0.6	1	0	4897387
OF16	Pit11/19	Pit11/18	0.5	Dummy use	0.2	0.05	0.6	1	0	4897398
OF18	Pit11/18	Pit11/17	1	Dummy use	0.2	0.05	0.6	1	0	4897409
OF22	Pit11/17	Pit11/16	1	Dummy use	0.2	0.05	0.6	1	0	4897423
OF28	Pit11/16	Pit11/15	0.1	Dummy use	0.2	0.05	0.6	1	0	4897429
OF30	Pit11/15	Pit11/14	1	Dummy use	0.2	0.05	0.6	1	0	4897432
OF46	Pit11/14	Pit11/13	1	Dummy use	0.2	0.05	0.6	1	0	4897449
OF49	Pit11/13	Pit11/12	0.2	Dummy use	0.2	0.05	0.6	1	0	4897452
OF51	Pit11/12	Pit11/11	0.1	Dummy use	0.2	0.05	0.6	1	0	4897454
OF53	Pit11/11	Pit11/10	1	Dummy use	0.2	0.05	0.6	1	0	4897456
OF74	Pit11/10	Pit11/8	1	Dummy use	0.2	0.05	0.6	1	0	4897477
OF141	Pit11/9	Pit11/8	1.5	Dummy use	0.2	0.05	0.6	1	0	4897548
OF143	Pit11/8	Pit11/7	0.5	Dummy use	0.2	0.05	0.6	1	0	4897550
OF145	Pit11/7	Pit11/6	0.2	Dummy use	0.2	0.05	0.6	1	0	4897552
OF147	Pit11/6	Pit11/5	0.1	Dummy use	0.2	0.05	0.6	1	0	4897554
OF149	Pit11/5	Basin11/4	1	Dummy use	0.2	0.05	0.6	1	0	4897556
OF193	Pit11/2	Pit11/1	2	Dummy use	0.2	0.05	0.6	1	0	18677688
OF1	Pit12/2	Pit12/1	0.1	Dummy use	0.2	0.05	0.6	1	0	4897379
OF7	Pit12/1	Pit11/20	0.5	Dummy use	0.2	0.05	0.6	1	0	4897385
OF185	Pit14/2	Pit11/1	5	Dummy use	0.2	0.05	0.6	1	0	12433419
OF131	Pit15/4	Pit15/3	1	Dummy use	0.2	0.05	0.6	1	0	4897538
OF135	Pit15/3	Pit15/2	2	Dummy use	0.2	0.05	0.6	1	0	4897542
OF137	Pit15/2	Pit11/3	5	Dummy use	0.2	0.05	0.6	1	0	4897544
OF151	Pit15/1	Basin11/4	1	Dummy use	0.2	0.05	0.6	1	0	4897558
OF133	Pit16/1	Pit17/2	2	Dummy use	0.2	0.05	0.6	1	0	4897540
OF139	Pit17/2	Pit11/2	5	Dummy use	0.2	0.05	0.6	1	0	4897546
OF78	Pit19/3	Pit11/9	1.5	Dummy use	0.2	0.05	0.6	1	0	4897481
OF76	Pit19/2	Pit18/1	1	Dummy use	0.2	0.05	0.6	1	0	4897479
OF80	Pit20/2	Pit19/2	0.5	Dummy use	0.2	0.05	0.6	1	0	4897483
OF171	Pit21/3	Pit21/2	1	Dummy use	0.2	0.05	0.6	1	0	9897420
OF173	Pit21/2	Pit100	0.2	Dummy use	0.2	0.05	0.6	1	0	9897422
OF175	Pit22/3	Pit22/2	0.2	Dummy use	0.2	0.05	0.6	1	0	9897424
OF177	Pit22/2	Pit102	0.2	Dummy use	0.2	0.05	0.6	1	0	9897426
OF153	Pit23/6	Pit24/1	2	Dummy use	0.2	0.05	0.6	1	0	4897560
OF191	Pit23/5	Pit23/4	2	Dummy use	0.2	0.05	0.6	1	0	18677686
OF189	Pit23/2	Pit23/1	0.2	Dummy use	0.2	0.05	0.6	1	0	18677684
OF155	Pit24/1	Pit25/1	1	Dummy use	0.2	0.05	0.6	1	0	4897563
OF183	Pit25/1	Pit23/2	0.2	Dummy use	0.2	0.05	0.6	1	0	12433417
OF157	Pit26/5	Pit27/1	2	Dummy use	0.2	0.05	0.6	1	0	4897577
OF159	Pit26/4	Pit26/3	2	Dummy use	0.2	0.05	0.6	1	0	4897579
OF161	Pit26/3	Pit25/1	2	Dummy use	0.2	0.05	0.6	1	0	4897581
OF167	Pit26/2	Pit26/1	1	Dummy use	0.2	0.05	0.6	1	0	4897587
OF169	Pit26/1	Pit23/2	1	Dummy use	0.2	0.05	0.6	1	0	4897589
OF165	Pit27/1	Pit26/2	1.5	Dummy use	0.2	0.05	0.6	1	0	4897585
OF38	Pit30/4	Pit30/3	0.5	Dummy use	0.2	0.05	0.6	1	0	4897441
OF40	Pit30/3	Pit30/2	0.5	Dummy use	0.2	0.05	0.6	1	0	4897443
OF42	Pit30/2	Pit30/1	0.5	Dummy use	0.2	0.05	0.6	1	0	4897445
OF44	Pit30/1	Pit11/14	0.5	Dummy use	0.2	0.05	0.6	1	0	4897447
OF32	Pit31/3	Pit31/2	0.5	Dummy use	0.2	0.05	0.6	1	0	4897434
OF34	Pit31/2	Pit31/1	0.5	Dummy use	0.2	0.05	0.6	1	0	4897437
OF36	Pit31/1	Pit11/14	0.2	Dummy use	0.2	0.05	0.6	1	0	4897439
OF65	Pit32/1	Pit11/12	1	Dummy use	0.2	0.05	0.6	1	0	4897468
OF55	Pit33/5	Pit33/4	1	Dummy use	0.2	0.05	0.6	1	0	4897458
OF57	Pit33/4	Pit33/3	1	Dummy use	0.2	0.05	0.6	1	0	4897460
OF59	Pit33/3	Pit33/2	1	Dummy use	0.2	0.05	0.6	1	0	4897462
OF61	Pit33/2	Pit33/1	0.2	Dummy use	0.2	0.05	0.6	1	0	4897464
OF63	Pit33/1	Pit11/10	1	Dummy use	0.2	0.05	0.6	1	0	4897466
OF24	Pit40/1	Pit11/16	1	Dummy use	0.2	0.05	0.6	1	0	4897425
OF72	Pit90/1	Pit11/12	1	Dummy use	0.2	0.05	0.6	1	0	4897475
OF26	Pit95/1	Pit11/15	1	Dummy use	0.2	0.05	0.6	1	0	4897427

Results of a simplified bottom up HGL analysis.
This provides a simple analysis that can be checked manually. It is useful where Council insists on a manual check on HGLs.
The HGLs shown here may be different to the more accurate values normally calculated by Drains because it is assumed here that the maximum flows and HGLs throughout the system occur at the same time. In fact, in different parts of the system, they may occur during different storms, or even at different times within the one storm. Also, pipes are assumed to be flowing full (even when the more accurate analysis in DRAINS shows they are not).

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
Cat1/11	0.112	0.069	0.043	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/10	0.039	0.024	0.015	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/9	0.025	0.015	0.01	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/8	0.03	0.019	0.012	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/7	0.098	0.06	0.038	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/6	0.37	0.227	0.143	5	5	0	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/5	0.131	0.081	0.051	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/4	0.072	0.044	0.028	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/3	0.083	0.051	0.032	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/2	0.07	0.043	0.027	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat2/3	0.234	0.143	0.09	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat2/2	0.036	0.022	0.014	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat2/1	0.01	0.006	0.004	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat3/3	0.236	0.145	0.091	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat3/2	0.046	0.029	0.018	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat3/1	0.013	0.008	0.005	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/10	0.068	0.042	0.026	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/9	0.228	0.14	0.088	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/8	0.228	0.14	0.088	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/7	0.055	0.034	0.021	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/6	0.076	0.047	0.029	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/5	0.059	0.036	0.023	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/4	0.165	0.102	0.064	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/3	0.324	0.199	0.125	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/2	0.105	0.064	0.04	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat78	0.02	0.012	0.008	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat8/1	0.093	0.057	0.036	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat9/2	0.212	0.13	0.082	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat9/1	0.248	0.152	0.096	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat10/2	0.056	0.034	0.022	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/22	0.154	0.094	0.059	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/21	0.006	0.004	0.002	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/20	0.01	0.006	0.004	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/19	0.009	0.005	0.003	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/18	0.009	0.005	0.003	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/17	0.088	0.054	0.034	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/16	0.21	0.129	0.081	5	5	0	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/14	0.056	0.034	0.021	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/12	0.228	0.14	0.088	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/10	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/9	0.23	0.142	0.089	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/8	0.135	0.083	0.052	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/7	0.286	0.176	0.11	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/6	0.055	0.034	0.021	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/5	0.144	0.015	0.128	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/4	0.144	0.015	0.128	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/3	0.126	0.078	0.049	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/2	0.341	0.209	0.131	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat12/2	0.338	0.207	0.13	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat12/1	0.039	0.024	0.015	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat14/2	0.123	0.076	0.048	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat15/4	0.029	0.018	0.011	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat15/3	0.016	0.01	0.006	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat15/2	0.03	0.019	0.012	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat15/1	0.144	0.015	0.128	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat16/1	0.288	0.177	0.111	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat17/2	0.168	0.103	0.065	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat19/3	0.166	0.102	0.064	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat19/2	0.008	0.005	0.003	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat Park	0.23	0.048	0.181	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat18/1	0.028	0.017	0.011	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat20/2	0.076	0.047	0.029	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat21/3	0.265	0.163	0.102	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat21/2	0.035	0.022	0.014	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat22/3	0.392	0.241	0.151	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat22/2	0.043	0.026	0.016	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat23/6	0.095	0.059	0.037	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat23/5	0.09	0.055	0.035	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat23/4	0.057	0.035	0.022	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat23/2	0.045	0.028	0.017	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat24/1	0.536	0.329	0.207	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat125/1	0.222	0.137	0.086	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat26/5	0.083	0.051	0.032	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat26/4	0.029	0.018	0.011	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat36/3	0.056	0.034	0.022	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat26/2	0.016	0.01	0.006	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat26/1	0.016	0.01	0.006	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat27/1	0.175	0.108	0.068	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat30/4	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat30/3	0.048	0.029	0.019	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat30/2	0.045	0.028	0.017	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat30/1	0.046	0.028	0.018	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat31/3	0.05	0.031	0.019	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat31/2	0.048	0.029	0.019	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat31/1	0.049	0.03	0.019	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat32/1	0.014	0.008	0.005	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat33/5	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat33/4	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat33/3	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat33/1	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat40/1	0.129	0.079	0.05	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat90/1	0.103	0.063	0.04	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat95/1	0.046	0.028	0.018	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1

PIPE DETAILS

Pipe	Flow (cu.m/s)	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Int. Dia (mm)	Rough (mm)	Nom.Capa (cu.m/s)	V (m/sec)	D/S HGL (m)	Friction Loss (m)	U/S HGL (m)

PIT & NODE DETAILS

Node	Headloss Coeff (Ku)	Shock Loss (m)	HGL (m)	Free-board	Overflow (cu.m/s)
Pit11/1			17.7		

P Pit11/2	0.873	45.084	16.635	16.5	0.3	750	0.01	0.792	2	17.7	0.164	17.864	Pit11/2	1.77	0.353	18.217	2.1	0.134
P Pit11/3	0.665	6	16.678	16.66	0.3	750	0.01	0.793	1.5	18.217	0.013	18.229	Pit11/3	0	0	18.229	2.09	
													Basin11/4			18.614		
P Pit11/5	0.204	50.063	16.935	16.77	0.33	450	0.013	0.164	1.3	18.614	0.257	18.871	Pit11/5	2.03	0.171	19.042	-0.69	3.689
P Pit11/6	2.995	14.666	17.004	16.96	0.3	1070	0.01	2.045	3.3	19.042	0.094	19.136	Pit11/6	0.39	0.221	19.357	1.76	0.174
P Pit11/7	2.867	6.245	17.885	17.823	0.99	1070	0.013	2.861	3.5	19.357	0.062	19.419	Pit11/7	0.84	0.436	19.855	1.3	0.271
P Pit11/8	2.735	11.036	18.016	17.905	1.01	1070	0.01	3.744	3	19.855	0.059	19.914	Pit11/8	1.63	0.769	20.683	0.87	0.222
P Pit11/9	2.604	40.275	18.438	18.036	1	1070	0.01	3.729	2.9	20.683	0.196	20.879	Pit11/9	3.38	1.446	22.325	0.56	0.144
P Pit11/10	1.808	36.548	18.824	18.458	1	1070	0.01	3.736	2	22.325	0.086	22.41	Pit11/10	0	0	22.41	-0.5	0.134
P Pit11/11	1.705	27.267	22.112	18.844	11.99	900	0.01	8.147	10.3	22.41	0.143	22.554	Pit11/11	0.2	0.073	22.627	2.57	0
P Pit11/12	1.705	6.227	22.385	22.323	1	900	0.01	2.348	4.1	22.889	0.062	22.951	Pit11/12	2	0.733	23.684	1.5	0
P Pit11/13	1.393	3.815	22.443	22.405	1	900	0.01	2.349	2.2	23.684	0.013	23.697	Pit11/13	0.99	0.242	23.939	1.32	0
P Pit11/14	1.393	28.559	25.176	22.463	9.5	900	0.01	7.253	9	23.939	1.499	25.439	Pit11/14	2	0.489	25.928	2.15	0
P Pit11/15	1.036	25.885	31.501	26.098	20.87	825	0.01	8.525	11.8	26.281	5.403	31.684	Pit11/15	0.15	0.029	31.713	2.52	0
P Pit11/16	0.997	6	31.581	31.521	1	750	0.01	1.447	3.2	31.973	0.06	32.033	Pit11/16	3.36	0.872	32.906	1.32	0.066
P Pit11/17	0.658	49.587	33.893	31.601	4.62	750	0.01	3.111	5.7	32.906	1.219	34.125	Pit11/17	5.93	0.67	34.795	1.8	0.011
P Pit95/1	0.046	6	35.039	34.979	1	375	0.01	0.228	0.5	35.092	0.06	35.152	Pit95/1	5.93	0.052	35.203	1.38	0
P Pit90/1	0.056	38.116	25.226	23.609	4.24	154	0.01	0.044	3	23.763	1.617	25.38	Pit90/1	1.79	0.815	26.195	0.65	0.052
P Pit40/1	0.057	30.69	34.086	32.894	3.88	154	0.01	0.042	3.1	33.048	1.192	34.24	Pit40/1	1.79	0.855	35.095	0.36	0.166
P Pit33/1	0.185	26.874	20.674	20.406	1	375	0.01	0.228	1.7	22.41	0.177	22.587	Pit33/1	5.54	0.792	23.379	-1.17	0.077
P Pit33/2	0.117	4.454	20.739	20.694	1.01	375	0.01	0.229	1.1	23.379	0.012	23.391	Pit33/2	0.33	0.019	23.41	-1.2	0.116
P Pit33/3	0.111	17.194	21.351	20.893	2.66	242	0.01	0.116	2.4	23.41	0.425	23.835	Pit33/3	2.18	0.654	24.489	-1.74	0.064
P Pit33/4	0.078	17.078	21.881	21.371	2.99	242	0.01	0.122	1.7	24.489	0.206	24.695	Pit33/4	2.3	0.336	25.03	-1.74	0.021
P Pit33/5	0.035	17.594	22.387	21.925	2.63	154	0.01	0.034	1.9	25.03	0.487	25.517	Pit33/5	1.79	0.328	25.845	-2.07	0.025
P Pit32/1	0.014	49.561	25.464	23.573	3.82	154	0.01	0.041	2	23.684	1.841	25.525	Pit32/1	5.93	0.159	25.684	1.42	0
P Pit31/1	0.146	6.266	26.573	26.493	1.28	375	0.01	0.258	2.4	26.693	0.08	26.773	Pit31/1	0.65	0.058	26.832	1.34	0
P Pit31/2	0.098	27.434	28.664	26.895	6.45	242	0.01	0.18	4	27.022	1.769	28.791	Pit31/2	4.52	1.055	29.846	0.38	0
P Pit31/3	0.05	27.437	31.719	28.684	11.06	154	0.01	0.071	4.2	29.846	1.968	31.814	Pit31/3	2.7	1.009	32.823	0.56	0
P Pit30/1	0.19	28.972	28.212	26.48	5.98	375	0.01	0.557	4.5	26.632	1.732	28.364	Pit30/1	0.08	0.012	28.376	1.53	0
P Pit30/2	0.145	23.496	31.18	28.527	11.29	242	0.01	0.238	5.5	28.661	2.653	31.314	Pit30/2	1.54	0.779	32.093	0.59	0
P Pit30/3	0.1	21.677	33.402	31.315	9.63	242	0.01	0.22	4.7	32.093	1.423	33.516	Pit30/3	3.87	0.933	34.45	0.42	0
P Pit30/4	0.052	24.429	36.338	33.539	11.46	154	0.01	0.072	4.2	34.45	1.985	36.434	Pit30/4	2.65	1.054	37.488	0.31	0
													Pit23/1			13.7		
P Pit23/2	0.818	4.703	11.623	11.576	1	750	0.01	1.447	1.9	13.7	0.015	13.715	Pit23/2	1.99	0.348	14.063	0	0.481
P Pit26/1	0.233	32.113	11.964	11.643	1	600	0.01	0.798	0.8	14.063	0.027	14.091	Pit26/1	1.01	0.035	14.126	-0.06	0.266
P Pit26/2	0.251	16.961	12.154	11.984	1	525	0.01	0.56	1.2	14.126	0.034	14.16	Pit26/2	2.92	0.201	14.361	-0.06	0.079
P Pit26/3	0.252	44.634	13.838	12.174	3.73	375	0.01	0.44	2.3	14.361	0.545	14.906	Pit26/3	3.76	0.997	15.902	0.01	0.001
P Pit27/1	0.107	6.677	14.476	14.367	1.63	375	0.01	0.291	1	15.902	0.015	15.917	Pit27/1	5.93	0.286	16.203	-0.14	0.086
P Pit26/4	0.103	99.144	20.152	14.47	5.73	375	0.01	0.546	3.9	15.902	4.358	20.26	Pit26/4	2.38	0.106	20.367	1.35	0
P Pit26/5	0.074	6.527	20.297	20.172	1.92	375	0.01	0.315	0.7	20.367	0.053	20.42	Pit26/5	5.93	0.136	20.556	1.31	0.009
P Pit25/1	0.187	6.018	12.517	12.457	1	375	0.01	0.228	1.7	14.063	0.041	14.104	Pit25/1	2.15	0.315	14.419	-0.34	0.468
P Pit23/3	0.355	25.524	12.838	12.346	1.93	600	0.01	1.108	1.3	14.063	0.05	14.114	Pit23/3	0.99	0.079	14.193	0.4	
P Pit23/4	0.355	20.799	13.206	12.878	1.58	525	0.01	0.702	1.6	14.193	0.084	14.277	Pit23/4	2.04	0.279	14.556	0.67	
P Pit24/1	0.136	7.044	13.716	13.576	1.99	375	0.01	0.321	1.2	14.556	0.025	14.581	Pit24/1	4.94	0.383	14.964	0.37	0.407
P Pit23/5	0.158	101.972	17.513	13.226	4.2	375	0.01	0.467	3.8	14.556	3.108	17.664	Pit23/5	5.52	0.579	18.244	1.33	0.012
P Pit23/6	0.081	6.527	18.212	18.034	2.73	375	0.01	0.376	1	18.244	0.085	18.329	Pit23/6	5.93	0.161	18.49	1.3	0.015
P Pit18/1	1.434	14.83	21.807	21.33	3.22	750	0.01	2.595	8	22.325	0.146	22.47	Pit18/1	3.21	1.725	24.196	-0.74	
													Basin2			24.212		
P110	0.428	10	22.5	22	5	525	0.013	0.962	2	24.212	0.099	24.311	Pit102	1.74	0.346	24.658	-0.66	
P Pit22/2	0.262	5.37	22.744	22.691	0.99	375	0.01	0.226	2.4	24.658	0.071	24.729	Pit22/2	2.35	0.673	25.402	-1.08	0.174
P Pit22/3	0.134	4.001	22.956	22.866	2.25	375	0.01	0.342	1.2	25.402	0.014	25.416	Pit22/3	3.7	0.28	25.695	-1.17	0.263
Pipe103	0.288	10	22.5	22	5	525	0.013	0.962	1.3	24.212	0.045	24.257	Pit100	5.93	0.534	24.791	1.01	
P Pit21/2	0.234	10.541	24.263	24.158	1	375	0.01	0.227	2.2	24.791	0.111	24.902	Pit21/2	1.91	0.436	25.337	0.5	0.057
P Pit21/3	0.127	4.102	24.371	24.283	2.15	375	0.01	0.334	1.1	25.337	0.013	25.35	Pit21/3	4.88	0.327	25.677	0.26	0.138
P109	0.194	10	22.5	22	5	525	0.013	0.962	0.9	24.212	0.02	24.233	Pit19/1	5.93	0.243	24.476	1.53	
													Pit20/1			24.486		
P Pit20/2	0.069	18.571	24.603	24.187	2.24	375	0.01	0.341	2.5	24.486	0.23	24.716	Pit20/2	5.93	0.119	24.836	1.53	0.007
P Pit19/2	0.125	11.583	23.925	23.81	0.99	375	0.01	0.227	2.1	24.476	0.035	24.51	Pit19/2	0.72	0.047	24.557	0.94	0
P Pit19/3	0.111	9.374	24.047	23.945	1.09	375	0.01	0.238	1.2	24.557	0.022	24.579	Pit19/3	5.93	0.305	24.884	0.73	0.056
P Pit15/1	0.45	84.76	17.458	16.76	0.82	600	0.01	0.724	1.6	18.614	0.269	18.883	Pit15/1	0.83	0.107	18.99	0.55	0.407
P Pit15/2	0.331	10.95	18.9	17.478	12.99	525	0.01	2.015	1.5	18.99	0.049	19.039	Pit15/2	1.48	0.177	19.216	1.74	0
P Pit17/2	0.128	6	19.401	19.341	1	375	0.01	0.228	1.2	19.54	0.06	19.6	Pit17/2	5.68	0.389	19.989	0.97	0.15
P Pit15/3	0.173	49.188	19.802	19.31	1	375	0.01	0.228	2.3	19.555	0.492	20.047	Pit15/3	2.31	0.29	20.337	1.17	0
P Pit16/1	0.129	6.528	20.034	19.959	1.15	375	0.01	0.244	1.2	20.337	0.021	20.358	Pit16/1	5.48	0.381	20.739	0.86	0.159
P Pit15/4	0.029	27.988	21.253	19.822	5.11	375	0.01	0.515	2.8	20.337	0.971	21.308	Pit15/4	5.93	0.021	21.329	1.71	0
P Pit14/2	0.095	20.772	19.356	16.96	11.53	375	0.01	0.774	5.2	19.042	0.398	19.44	Pit14/2	5.93	0.225	19.665	1.35	0.028
P Pit11/18	0.544	53.552	40.515	34.693	10.87	600	0.01	2.632	7.4	34.876	5.822	40.698	Pit11/18	1.08	0.204	40.902	1.65	0
P Pit11/19	0.536	14.383	43.579	40.709	19.95	600	0.01	3.565	9.7	40.902	2.827	43.729	Pit11/19	0.44	0.081	43.81	1.72	0
P Pit11/20	0.528	15.548	45.983	43.987	12.84	525	0.01	2.003	7.8	44.171	1.996	46.167	Pit11/20	1.07	0.325	46.492	1.17	0
P Pit12/1	0.332	13.25	46.726	46.231	3.74	375	0.01	0.441	3	46.492	0.477	46.969	Pit12/1	1.47	0.68	47.649	0.72	0.043
P Pit12/2	0.258	6	46.806	46.746	1	375	0.01	0.228	2.3	47.649	0.077	47.725	Pit12/2	3.07	0.853	48.578	-0.21	0.106
P Pit11/21	0.152	6	46.103	46.043	1	375	0.01	0.228	1.4	46.492	0.027	46.519	Pit11/21	5.05	0.488	47.006	0.65	0
P Pit11/22	0.107	13.47	46.946	46.234	5.29	375	0.01	0.524	1	47.006	0.053	47.06	Pit11/22	5.93	0.282	47.342	1.08	0.047
													Pit6/1			21.085		
P Pit6/2	1.333	10.808	22.655	20.845	16.75	750	0.01	5.922	10.9	21.085	1.81	22.895	Pit6/2	1.71	0.795	23.69	1.12	0.358
P Pit6/3	1.054	8.999	22.765	22.675	1	750	0.01	1.447	2.4	23.69	0.048	23.738	Pit6/3	3.31	0.962	24.699	0.11	0.667
P Pit9/1	0.307	58.079	25.501	22.785	4.68	375	0.01	0.493	2.8	24.699	1.053	25.752	Pit9/1	3.1	1.221	26.973	0.6	0.191
P Pit10/2	0.055	11.04	26.458	26.032	3.86	525	0.01	1.098	0.3	26.973	0.001	26.974	Pit10/2	5.93	0.019	26.993	1.05	0.001
P Pit9/2	0.12	46.439	29.5	26.12	7.28	375	0.01	0.615	4.4	26.973	2.638	29.611	Pit9/2	5.87	0.355	29.966	1.07	0.092
P Pit6/4	0.537	13.517	23.09	22.882	1.54	750	0.01	1.795	1.2	24.699	0.019	24.718	Pit6/4	1.66	0.125	24.843	0.22	0.29
P Pit8/1	0.058	6	23.501	23.441	1	375	0.01	0.228	0.5	24.843	0.004	24.847	Pit8/1	2.25	0.031	24.878	0.18	0.089
P Pit6/5	0.576	25.462	25.162	23.11	8.06	750	0.01	4.108	7.1	24.843	0.499	25.342	Pit6/5	1.2	0.104	25.446	1.82	0.003
P Pit6/6	0.516	16.951	26.22	25.44	4.6	600	0.01	1.712	5.2	25.669	0.78	26.449	Pit6/6	1.99	0.339	26.787	1.52	0.007
P Pit7/1	0.02	6.068	26.754	26.693	1.01	375	0.01	0.229	0.2	26.787	0.036	26.823	Pit7/1	4	0.007	26.83	1.47	0
P Pit6/7	0.429	57.712	35.124	26.24	15.39	525	0.01	2.193	8	26.787	8.492	35.279	Pit6/7	0	0	35.279	2.11	0.001
P Pit6/8	0.377	6.001	35.204	35.144	1	375	0.01	0.228	3.4	35.519	0.06	35.579	Pit6/8	1.43	0.849	36.428	0.96	0.105
P Pit6/9	0.256	38.949	43.876	35.224	22.21	375	0.01	1.074	8	36.428	7.572	44	Pit6/9	4.02	1.101	45.101	0.94	
P Pit6/10	0.058	4	44.704	44.664	1	150	0.01	0.02	3.3	45.101	0.341	45.442	Pit6/10	2.06	1.126	46.568	-0.54	
													Pit1/1			25.204		
P Pit1/2	1.172	9.435	25.818	24.94	9.31	750	0.01	4.415	8.4	25.204	0.878	26.082	Pit1/2	1.73	0.621	26.703	1.02	
P Pit1/3	1.102	50.115	26.57	25.945	1.25	750	0.01	1.616	2.5	26.703	0.316	27.019	Pit1/3	1.01	0.321	27.34	3.4	
P Pit1/4	1.026	13.852	26.729	26.59	1	750	0.01	1.45	2.3	27.34	0.07	27.41	Pit1/4	1.74	0.479	27.889	2.5	
P Pit1/5	0.975	53.252	27.281	26.749	1	750	0.01	1.446	2.2	27.889	0.242	28.131	Pit1/5	2.5	0.622	28.753	0.38	0.266
P Pit1/6	0.864	46.788	29.375	27.332	4.37	600	0.01	1.668	6	28.753	0.928	29.68	Pit1/6	1.04	0.496	30.176	1.06	0.252
P Pit1/7	0.732	46.977	29.865	29.395	1	600	0.01	0.798	2.6	30.176	0.395	30.571	Pit1/7	0.98	0.335	30.906	1.11	0.024
P Pit1/8	0.647	26.964	30.729	29.885	3.13	525	0.01	0.989	3	30.906	0.361	31.267	Pit1/8	3	1.367	32.634	0.39	0.007
P Pit3/1	0.259	11.939	32.736	31.501	10.34	375	0.01	0.733	2.6	32.634	0.257	32.891	Pit3/1	2.5	0.702	33.593	0.79	0.042
P Pit3/2	0.17	12.902	34.102	32.963	8.83	375	0.01	0.677	5.1	33.593	0.637	34.23	Pit3/2	3	0.362	34.592	1.15	0
P Pit3/3	0.123	5.998	34.182	34.122	1	375	0.01	0.228	1.1	34.592	0.018	34.609	Pit3/3	4.32	0.275	34.885	0.86	0.113
P Pit1/9	0.321	52.821	38.368	31.62	12.78	375	0.01	0.815	6.9	32.634	5.898	38.532	Pit1/9	2.79	1.199	39.731	0.19	0.054
P Pit2/1	0.221	6.492	38.655	38.388	4.11	375	0.01	0.462	2	39.731	0.061	39.792	Pit2/1	1.28	0.261	40.052	0.19	0.058
P Pit2/2	0.222	12.397	39.714	38.827	7.15	375	0.01	0.61	2	40.052	0.118	40.17	Pit2/2	2.96	0.611	40.782	0.55	0.042
P Pit2/3	0.123	4	39.774	39.734	1	375	0.01	0.228	1.1	40.782	0.012	40.793	Pit2/3	4.42	0.28	41.074	0.26	0.11
P Pit1/10	0.129	44.549	44.148	38.515	12.64	375	0.01	0.81	5.7	39.731	4.515	44.245	Pit1/10	3.26	0.228	44.474	1.23	0
P Pit1/11	0.09	6.419	44.413	44.168	3.82	375	0.01	0.445	0.8	44.474	0.053	44.526	Pit1/11	4	0.136	44.662	1.34	0.022

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
OF106	0.022	0.022	7.665	0.02	0.01	6.74	0.32	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF118	0	0	7.665	0	0	0	0	

OF120	0.054	0.054	7.665	0.028	0.01	9.43	0.41	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF125	0.007	0.007	7.665	0.013	0	4.34	0.26	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF127	0.024	0.024	7.665	0.02	0.01	6.74	0.35	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF129	0.252	0.252	7.665	0.05	0.03	13.97	0.65	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF187	0.266	0.266	7.665	0.051	0.03	14.15	0.67	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF108	0.11	0.11	7.665	0.036	0.02	11.27	0.51	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF110	0.042	0.042	7.665	0.026	0.01	8.53	0.39	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF112	0.058	0.058	7.665	0.028	0.01	9.43	0.43	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF114	0.113	0.113	7.665	0.036	0.02	11.27	0.52	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF116	0	0	7.665	0	0	0	0	
OF123	0.042	0.042	7.665	0.026	0.01	8.53	0.38	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF82	0.105	0.105	7.665	0.035	0.02	11.09	0.51	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF84	0.001	0.001	7.665	0.006	0	1.95	0.16	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF86	0.007	0.007	7.665	0.013	0	4.34	0.24	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF90	0.003	0.003	7.665	0.009	0	3.14	0.22	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF92	0.29	0.29	7.665	0.053	0.04	14.51	0.68	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF96	0.667	0.667	7.665	0.074	0.06	18.82	0.85	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF195	0.358	0.358	7.665	0.057	0.04	15.41	0.73	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF88	0	0	7.665	0	0	0	0	
OF94	0.089	0.089	7.665	0.034	0.02	10.74	0.47	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF100	0.092	0.092	7.665	0.034	0.02	10.74	0.49	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF102	0.191	0.191	7.665	0.044	0.03	12.89	0.61	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF98	0.001	0.001	7.665	0.007	0	2.25	0.14	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF3	0.047	0.047	7.665	0.026	0.01	8.83	0.4	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF5	0	0	7.665	0	0	0	0	
OF9	0	0	7.665	0	0	0	0	
OF16	0	0	7.665	0	0	0	0	
OF18	0	0	7.665	0	0	0	0	
OF22	0.011	0.011	7.665	0.016	0	5.24	0.27	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF28	0.066	0.066	7.665	0.03	0.01	10.02	0.44	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF30	0	0	7.665	0	0	0	0	
OF46	0	0	7.665	0	0	0	0	
OF49	0	0	7.665	0	0	0	0	
OF51	0	0	7.665	0	0	0	0	
OF53	0	0	7.665	0	0	0	0	
OF74	0.134	0.134	7.665	0.039	0.02	11.81	0.54	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF141	0.144	0.144	7.665	0.04	0.02	11.99	0.55	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF143	0.222	0.222	7.665	0.047	0.03	13.43	0.63	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF145	0.271	0.271	7.665	0.051	0.03	14.15	0.68	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF147	0.174	0.174	7.665	0.043	0.03	12.53	0.59	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF149	3.689	3.689	7.665	0.149	0.2	33.73	1.34	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF193	0.134	0.134	7.665	0.039	0.02	11.81	0.54	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF1	0.106	0.106	7.665	0.035	0.02	11.09	0.51	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF7	0.043	0.043	7.665	0.026	0.01	8.53	0.39	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF185	0.028	0.028	7.665	0.022	0.01	7.33	0.35	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF131	0	0	7.665	0	0	0	0	
OF135	0	0	7.665	0	0	0	0	
OF137	0	0	7.665	0	0	0	0	
OF151	0.407	0.407	7.665	0.061	0.04	16.12	0.74	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF133	0.159	0.159	7.665	0.042	0.02	12.35	0.57	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF139	0.15	0.15	7.665	0.041	0.02	12.17	0.55	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF78	0.056	0.056	7.665	0.028	0.01	9.43	0.42	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF76	0	0	7.665	0	0	0	0	
OF80	0.007	0.007	7.665	0.013	0	4.34	0.24	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF171	0.138	0.138	7.665	0.039	0.02	11.81	0.56	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF173	0.057	0.057	7.665	0.028	0.01	9.43	0.43	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF175	0.263	0.263	7.665	0.051	0.03	14.15	0.66	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF177	0.174	0.174	7.665	0.043	0.03	12.53	0.59	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF153	0.015	0.015	7.665	0.018	0.01	5.84	0.29	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF191	0.012	0.012	7.665	0.016	0	5.24	0.29	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF189	0.481	0.481	7.665	0.064	0.05	16.84	0.79	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF155	0.407	0.407	7.665	0.061	0.04	16.12	0.74	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF183	0.468	0.468	7.665	0.064	0.05	16.84	0.77	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF157	0.009	0.009	7.665	0.015	0	4.94	0.25	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF159	0	0	7.665	0	0	0	0	
OF161	0.001	0.001	7.665	0.007	0	2.25	0.14	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF167	0.079	0.079	7.665	0.032	0.01	10.38	0.47	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF169	0.266	0.266	7.665	0.051	0.03	14.15	0.66	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF165	0.086	0.086	7.665	0.033	0.02	10.56	0.48	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF38	0	0	7.665	0	0	0	0	
OF40	0	0	7.665	0	0	0	0	
OF42	0	0	7.665	0	0	0	0	
OF44	0	0	7.665	0	0	0	0	
OF32	0	0	7.665	0	0	0	0	
OF34	0	0	7.665	0	0	0	0	
OF36	0	0	7.665	0	0	0	0	
OF65	0	0	7.665	0	0	0	0	
OF55	0.025	0.025	7.665	0.021	0.01	7.03	0.33	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF57	0.021	0.021	7.665	0.019	0.01	6.44	0.34	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF59	0.064	0.064	7.665	0.03	0.01	10.02	0.43	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF61	0.116	0.116	7.665	0.037	0.02	11.45	0.51	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF63	0.077	0.077	7.665	0.032	0.01	10.38	0.46	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF24	0.166	0.166	7.665	0.042	0.02	12.35	0.59	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF72	0.052	0.052	7.665	0.027	0.01	9.13	0.42	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF26	0	0	7.665	0	0	0	0	

DRAINS results prepared 07 January, 2009 from Version 2008.08

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surfa Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Pit1/11	44.92		0.112		1.07	0.022	Inlet Capacity
Pit1/10	44.75		0.039		0.95	0	None
Pit1/9	39.92		0.025		0	0.054	Outlet System
Pit1/8	32.9		0.078		0.12	0.007	Inlet Capacity
Pit1/7	31.17		0.116		0.84	0.024	Inlet Capacity
Pit1/6	30.45		0.382		0.79	0.252	Inlet Capacity
Pit1/5	29.13		0.363		0	0.266	Outlet System
Pit1/4	28.32		0.072		2.07		None
Pit1/3	27.78		0.083		2.96		None
Pit1/2	27.17		0.07		0.55		None
Pit1/1	25.2		0				
Pit2/3	41.26		0.234		0.07	0.11	Inlet Capacity
Pit2/2	40.97		0.144		0.36	0.042	Inlet Capacity
Pit2/1	40.24		0.07		0	0.058	Outlet System
Pit3/3	35.12		0.236		0.61	0.113	Inlet Capacity
Pit3/2	34.83		0.046		0.91	0	None
Pit3/1	33.75		0.143		0.63	0.042	Inlet Capacity
Pit6/10	46.13	46.13	0.068	5.6	-0.11		Outlet System
Pit6/9	45.34	46.18	0.228	9.1	0.7		None
Pit6/8	36.53		0.228		0.85	0.105	Inlet Capacity
Pit6/7	35.28		0.055		2.11	0.001	Inlet Capacity
Pit6/6	27.15		0.076		1.16	0.007	Inlet Capacity
Pit6/5	25.87		0.064		1.4	0.003	Inlet Capacity
Pit6/4	25.06		0.166		0	0.29	Outlet System
Pit6/3	24.96	24.96	0.847	15	-0.15	0.667	Outlet System
Pit6/2	24.18	24.96	0.763	15	0.63	0.358	None
Pit6/1	21.09		0.358				
Pit7/1	27.16		0.02		1.14	0	None
Pit8/1	25.06		0.093		0	0.089	Outlet System
Pit9/2	30.23		0.212		0.8	0.092	Inlet Capacity
Pit9/1	27.22		0.323		0.35	0.191	Inlet Capacity
Pit10/2	27.24		0.056		0.8	0.001	Inlet Capacity
Pit11/22	47.63		0.154		0.79	0.047	Inlet Capacity
Pit11/21	47.32		0.052		0.34	0	Inlet Capacity
Pit11/20	46.82		0.051		0.84	0	Inlet Capacity
Pit11/19	44.14		0.009		1.39	0	None
Pit11/18	41.31		0.009		1.24	0	None
Pit11/17	35.31		0.088		1.29	0.011	Inlet Capacity
Pit11/16	33.17	34.38	0.356	15	1.06	0.066	None
Pit11/15	32.02	34.28	0.066	2.7	2.21	0	None
Pit11/14	26.55		0.056		1.53	0	None
Pit11/13	24.24		0		1.01	0	None
Pit11/12	23.99	25.29	0.268	11.8	1.2	0	None
Pit11/11	22.84	25.2	0	0	2.36	0	None
Pit11/10	21.91		0.112		0	0.134	Outlet System
Pit11/9	21.83		0.271		1.06	0.144	Inlet Capacity
Pit11/8	20.19		0.356		1.36	0.222	Inlet Capacity
Pit11/7	19.37		0.403		1.79	0.271	Inlet Capacity
Pit11/6	18.68		0.304		2.43	0.174	Inlet Capacity
Pit11/5	18.35		0.31		0	3.689	Outlet System
Pit11/3	18.23	20.41	0.126	7.2	2.09		None
Pit11/2	18.22	20.47	0.366	15	2.1	0.134	None
Pit11/1	17.7		0.144				
Pit12/2	48.51	48.51	0.338	10	-0.15	0.106	Outlet System
Pit12/1	47.77		0.144		0.59	0.043	Inlet Capacity
Pit14/2	19.95		0.123		1.06	0.028	Inlet Capacity
Pit15/4	21.52		0.029		1.51	0	None
Pit15/3	20.46		0.016		1.05	0	None
Pit15/2	19.75		0.03		1.21	0	None
Pit15/1	19.53		0.144		0	0.407	Outlet System
Pit16/1	20.86		0.288		0.74	0.159	Inlet Capacity
Pit17/2	20.16		0.278		0.8	0.15	Inlet Capacity
Pit19/3	24.65		0.166		0.97	0.056	Inlet Capacity
Pit19/2	24.27		0.014		1.23	0	None
Pit19/1	23.39		0		2.61		None
Pit18/1	23		0.028		0.46		None
Pit20/2	25.1		0.076		1.27	0.007	Inlet Capacity
Pit20/1	24.07		0				
Pit21/3	25.39		0.265		0.54	0.138	Inlet Capacity
Pit21/2	25.06		0.168		0.78	0.057	Inlet Capacity
Pit100	23.75		0.057		2.05		None
Pit22/3	24.52		0.392		0	0.263	Outlet System
Pit22/2	24.27		0.304		0.05	0.174	Inlet Capacity
Pit102	23.57		0.174		0.43		None
Pit23/6	18.75		0.095		1.04	0.015	Inlet Capacity
Pit23/5	18.46		0.09		1.11	0.012	Inlet Capacity
Pit23/4	14.55		0.063		0.67		None
Pit23/3	14.19		0		0.4		None
Pit23/2	14.06	14.21	0.771	15	0	0.481	Outlet System
Pit23/1	13.7		0.481				
Pit24/1	14.96		0.543		0.37	0.407	Inlet Capacity
Pit25/1	14.22	14.22	0.596	15	-0.15	0.468	Outlet System
Pit26/5	20.81		0.083		1.06	0.009	Inlet Capacity
Pit26/4	20.63		0.029		1.09	0	None
Pit26/3	15.83		0.056		0.08	0.001	Inlet Capacity
Pit26/2	14.3		0.098		0	0.079	Outlet System
Pit26/1	14.06		0.091		0	0.266	Outlet System
Pit27/1	16.06		0.179		0	0.086	Outlet System
Pit30/4	37.52		0.052		0.27	0	None
Pit30/3	34.56		0.048		0.31	0	None
Pit30/2	32.18		0.045		0.5	0	None
Pit30/1	28.44		0.046		1.46	0	None
Pit31/3	32.86		0.05		0.52	0	None
Pit31/2	29.95		0.048		0.28	0	None
Pit31/1	26.94		0.049		1.23	0	None
Pit32/1	25.78		0.014		1.33	0	None
Pit33/5	23.78		0.052		0	0.025	Outlet System
Pit33/4	23.29		0.071		0	0.021	Outlet System
Pit33/3	22.75		0.065		0	0.064	Outlet System
Pit33/2	22.21		0.064		0	0.116	Outlet System
Pit33/1	22.21		0.155		0	0.077	Outlet System
Pit40/1	35.45		0.215		0	0.166	Outlet System
Pit90/1	26.84		0.103		0	0.052	Outlet System
Pit95/1	35.39		0.046		1.19	0	None

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Cat1/11	0.112	0.069	0.043	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/10	0.039	0.024	0.015	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/9	0.025	0.015	0.01	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/8	0.03	0.019	0.012	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/7	0.098	0.06	0.038	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/6	0.37	0.227	0.143	5	5	0	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/5	0.131	0.081	0.051	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/4	0.072	0.044	0.028	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/3	0.083	0.051	0.032	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat1/2	0.07	0.043	0.027	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat2/3	0.234	0.143	0.09	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat2/2	0.036	0.022	0.014	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat2/1	0.01	0.006	0.004	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat3/3	0.236	0.145	0.091	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat3/2	0.046	0.029	0.018	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat3/1	0.013	0.008	0.005	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/10	0.068	0.042	0.026	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/9	0.228	0.14	0.088	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/8	0.228	0.14	0.088	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/7	0.055	0.034	0.021	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/6	0.076	0.047	0.029	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/5	0.059	0.036	0.023	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/4	0.165	0.102	0.064	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/3	0.324	0.199	0.125	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat6/2	0.105	0.064	0.04	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat78	0.02	0.012	0.008	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat8/1	0.093	0.057	0.036	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat9/2	0.212	0.13	0.082	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat9/1	0.248	0.152	0.096	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat10/2	0.056	0.034	0.022	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/22	0.154	0.094	0.059	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/21	0.006	0.004	0.002	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/20	0.01	0.006	0.004	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/19	0.009	0.005	0.003	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/18	0.009	0.005	0.003	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/17	0.088	0.054	0.034	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/16	0.21	0.129	0.081	5	5	0	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/14	0.056	0.034	0.021	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/12	0.228	0.14	0.088	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/10	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/9	0.23	0.142	0.089	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/8	0.135	0.083	0.052	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/7	0.286	0.176	0.11	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/6	0.055	0.034	0.021	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/5	0.144	0.015	0.128	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/4	0.144	0.015	0.128	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/3	0.126	0.078	0.049	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat11/2	0.341	0.209	0.131	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat12/2	0.338	0.207	0.13	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat12/1	0.039	0.024	0.015	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat14/2	0.123	0.076	0.048	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat15/4	0.029	0.018	0.011	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat15/3	0.016	0.01	0.006	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat15/2	0.03	0.019	0.012	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat15/1	0.144	0.015	0.128	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat16/1	0.288	0.177	0.111	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat17/2	0.168	0.103	0.065	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat19/3	0.166	0.102	0.064	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat19/2	0.008	0.005	0.003	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat Park	0.23	0.048	0.181	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat18/1	0.028	0.017	0.011	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat20/2	0.076	0.047	0.029	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat21/3	0.265	0.163	0.102	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat21/2	0.035	0.022	0.014	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat22/3	0.392	0.241	0.151	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat22/2	0.043	0.026	0.016	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat23/6	0.095	0.059	0.037	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat23/5	0.09	0.055	0.035	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat23/4	0.057	0.035	0.022	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat23/2	0.045	0.028	0.017	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat24/1	0.536	0.329	0.207	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat125/1	0.222	0.137	0.086	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat26/5	0.083	0.051	0.032	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat26/4	0.029	0.018	0.011	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat36/3	0.056	0.034	0.022	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat26/2	0.016	0.01	0.006	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat26/1	0.016	0.01	0.006	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat27/1	0.175	0.108	0.068	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat30/4	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat30/3	0.048	0.029	0.019	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat30/2	0.045	0.028	0.017	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat30/1	0.046	0.028	0.018	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat31/3	0.05	0.031	0.019	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat31/2	0.048	0.029	0.019	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat31/1	0.049	0.03	0.019	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat32/1	0.014	0.008	0.005	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat33/5	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat33/4	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat33/3	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat33/1	0.052	0.032	0.02	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat40/1	0.129	0.079	0.05	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat90/1	0.103	0.063	0.04	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Cat95/1	0.046	0.028	0.018	5	5	5	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1

Outflow Volumes for Total Catchment (7.49 impervious + 5.65 pervious = 13.1 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Run	Impervious cu.m (Run	Pervious Runoff cu.m (Runoff %)
AR&R 100	13674.96	12398.00 (	7719.18 (9	4678.82 (79.6%)
AR&R 100	16567.74	15057.16 (	9367.74 (9	5689.42 (79.9%)

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
P Pit1/11	0.09	0.8	44.758	44.748	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit1/10	0.129	5.7	44.245	39.919	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit1/9	0.321	6.9	38.532	32.897	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1

P Pit1/8	0.647	3	31.53	31.173	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit1/7	0.732	2.6	30.838	30.447	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit1/6	0.864	6	29.681	29.132	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit1/5	0.975	2.2	28.546	28.32	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit1/4	1.026	2.3	27.848	27.78	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit1/3	1.102	2.5	27.461	27.171	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit1/2	1.172	8.4	26.082	25.204	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit2/3	0.123	1.1	40.979	40.968	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit2/2	0.222	2	40.358	40.24	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit2/1	0.221	2	39.98	39.919	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit3/3	0.123	1.1	34.85	34.832	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit3/2	0.17	5.1	34.23	33.751	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit3/1	0.259	2.6	33.049	32.897	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/10	0.058	3.3	45.521	45.337	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/9	0.256	8	44	36.529	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/8	0.377	3.4	35.68	35.519	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/7	0.429	8	35.279	27.15	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/6	0.516	5.2	26.449	25.869	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/5	0.576	7.1	25.342	25.058	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/4	0.537	1.2	24.971	24.957	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/3	1.054	2.4	24.213	24.176	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit6/2	1.333	10.9	22.895	21.085	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit7/1	0.02	0.2	27.15	27.15	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit8/1	0.058	0.5	25.058	25.058	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit9/2	0.12	4.4	29.611	27.222	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit9/1	0.307	2.8	26.001	24.957	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit10/2	0.055	0.3	27.223	27.222	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/22	0.107	1	47.352	47.323	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/21	0.152	1.4	46.844	46.818	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/20	0.528	7.8	46.167	44.171	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/19	0.536	9.7	43.729	41.309	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/18	0.544	7.4	40.698	35.307	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/17	0.658	5.7	34.125	33.17	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/16	0.997	3.2	32.298	32.023	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/15	1.036	11.8	31.684	26.552	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/14	1.393	9	25.439	24.242	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/13	1.393	2.2	24	23.988	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/12	1.705	4.1	23.254	22.889	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/11	1.705	10.3	22.389	21.906	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/10	1.808	2	21.906	21.826	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/9	2.604	2.9	20.383	20.191	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/8	2.735	3	19.422	19.365	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/7	2.867	3.5	18.955	18.754	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/6	2.995	3.3	18.461	18.351	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/5	0.204	1.3	18.368	19.693	AR&R 100 year, 1 hour storm, average 104 mm/h, Zone 1
P Pit11/4	0.65	4.1	18.503	18.227	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/3	0.665	1.5	18.227	18.215	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit11/2	0.873	2	17.862	17.7	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit12/2	0.258	2.3	47.831	47.77	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit12/1	0.332	3	47.092	46.818	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit14/2	0.095	5.2	19.44	18.351	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit15/4	0.029	2.8	21.308	20.461	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit15/3	0.173	2.3	20.047	19.75	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit15/2	0.331	1.5	19.573	19.535	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit15/1	0.45	1.6	19.537	19.693	AR&R 100 year, 1 hour storm, average 104 mm/h, Zone 1
P Pit16/1	0.129	1.2	20.481	20.461	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit17/2	0.128	1.2	19.768	19.75	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit19/3	0.111	1.2	24.341	24.267	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit19/2	0.125	2.1	24.122	24.007	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P109	0.194	0.9	23.229	23.22	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit18/2	0.719	1.6	23.018	23.002	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit18/1	1.434	8	22.127	21.826	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit20/2	0.069	2.5	24.716	24.3	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P117	0.069	1.8	24.069	23.954	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit21/3	0.127	1.1	25.074	25.062	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit21/2	0.234	2.2	24.638	24.493	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
Pipe103	0.288	1.3	23.243	23.22	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit22/3	0.134	1.2	24.281	24.269	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit22/2	0.262	2.4	23.636	23.571	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P110	0.428	2	23.263	23.22	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit23/6	0.081	1	18.469	18.461	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit23/5	0.158	3.8	17.664	14.554	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit23/4	0.355	1.6	14.274	14.192	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit23/3	0.355	1.3	14.112	14.062	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit23/2	0.818	1.9	13.714	13.7	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit24/1	0.136	1.2	14.578	14.554	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit25/1	0.187	1.7	14.081	14.062	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit26/5	0.074	0.7	20.638	20.631	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit26/4	0.103	3.9	20.26	15.835	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit26/3	0.252	2.3	14.838	14.299	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit26/2	0.251	1.2	14.099	14.064	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit26/1	0.233	0.8	14.063	14.062	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit27/1	0.107	1	15.846	15.835	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit30/4	0.052	4.2	36.434	34.564	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit30/3	0.1	4.7	33.516	32.175	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit30/2	0.145	5.5	31.314	28.661	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit30/1	0.19	4.5	28.364	26.632	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit31/3	0.05	4.2	31.814	29.948	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit31/2	0.098	4	28.791	27.022	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit31/1	0.146	2.4	26.773	26.693	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit32/1	0.014	2	25.525	23.988	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit33/5	0.035	1.9	23.581	23.291	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit33/4	0.078	1.7	22.956	22.751	AR&R 100 year, 1 hour storm, average 104 mm/h, Zone 1
P Pit33/3	0.111	2.4	22.425	22.212	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit33/2	0.117	1.1	22.212	22.211	AR&R 100 year, 1 hour storm, average 104 mm/h, Zone 1
P Pit33/1	0.185	1.7	21.961	21.906	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit40/1	0.057	3.1	34.818	33.17	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit90/1	0.056	3	26.163	23.988	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
P Pit95/1	0.046	0.5	35.307	35.307	AR&R 100 year, 1.5 hours storm, average 84 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
OF106	0.022	0.022	7.665	0.02	0.01	6.74	0.32	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF118	0	0	7.665	0	0	0	0	
OF120	0.054	0.054	7.665	0.028	0.01	9.43	0.41	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF125	0.007	0.007	7.665	0.013	0	4.34	0.26	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF127	0.024	0.024	7.665	0.02	0.01	6.74	0.35	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1

OF129	0.252	0.252	7.665	0.05	0.03	13.97	0.65	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF187	0.266	0.266	7.665	0.051	0.03	14.15	0.67	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF108	0.11	0.11	7.665	0.036	0.02	11.27	0.51	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF110	0.042	0.042	7.665	0.026	0.01	8.53	0.39	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF112	0.058	0.058	7.665	0.028	0.01	9.43	0.43	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF114	0.113	0.113	7.665	0.036	0.02	11.27	0.52	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF116	0	0	7.665	0	0	0	0	
OF123	0.042	0.042	7.665	0.026	0.01	8.53	0.38	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF82	0.105	0.105	7.665	0.035	0.02	11.09	0.51	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF84	0.001	0.001	7.665	0.006	0	1.95	0.16	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF86	0.007	0.007	7.665	0.013	0	4.34	0.24	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF90	0.003	0.003	7.665	0.009	0	3.14	0.22	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF92	0.29	0.29	7.665	0.053	0.04	14.51	0.68	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF96	0.667	0.667	7.665	0.074	0.06	18.82	0.85	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF195	0.358	0.358	7.665	0.057	0.04	15.41	0.73	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF88	0	0	7.665	0	0	0	0	
OF94	0.089	0.089	7.665	0.034	0.02	10.74	0.47	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF100	0.092	0.092	7.665	0.034	0.02	10.74	0.49	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF102	0.191	0.191	7.665	0.044	0.03	12.89	0.61	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF98	0.001	0.001	7.665	0.007	0	2.25	0.14	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF3	0.047	0.047	7.665	0.026	0.01	8.83	0.4	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF5	0	0	7.665	0	0	0	0	
OF9	0	0	7.665	0	0	0	0	
OF16	0	0	7.665	0	0	0	0	
OF18	0	0	7.665	0	0	0	0	
OF22	0.011	0.011	7.665	0.016	0	5.24	0.27	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF28	0.066	0.066	7.665	0.03	0.01	10.02	0.44	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF30	0	0	7.665	0	0	0	0	
OF46	0	0	7.665	0	0	0	0	
OF49	0	0	7.665	0	0	0	0	
OF51	0	0	7.665	0	0	0	0	
OF53	0	0	7.665	0	0	0	0	
OF74	0.134	0.134	7.665	0.039	0.02	11.81	0.54	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF141	0.144	0.144	7.665	0.04	0.02	11.99	0.55	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF143	0.222	0.222	7.665	0.047	0.03	13.43	0.63	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF145	0.271	0.271	7.665	0.051	0.03	14.15	0.68	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF147	0.174	0.174	7.665	0.043	0.03	12.53	0.59	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF149	3.689	3.689	7.665	0.149	0.2	33.73	1.34	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF193	0.134	0.134	7.665	0.039	0.02	11.81	0.54	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF1	0.106	0.106	7.665	0.035	0.02	11.09	0.51	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF7	0.043	0.043	7.665	0.026	0.01	8.53	0.39	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF185	0.028	0.028	7.665	0.022	0.01	7.33	0.35	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF131	0	0	7.665	0	0	0	0	
OF135	0	0	7.665	0	0	0	0	
OF137	0	0	7.665	0	0	0	0	
OF151	0.407	0.407	7.665	0.061	0.04	16.12	0.74	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF133	0.159	0.159	7.665	0.042	0.02	12.35	0.57	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF139	0.15	0.15	7.665	0.041	0.02	12.17	0.55	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF78	0.056	0.056	7.665	0.028	0.01	9.43	0.42	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF76	0	0	7.665	0	0	0	0	
OF80	0.007	0.007	7.665	0.013	0	4.34	0.24	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF171	0.138	0.138	7.665	0.039	0.02	11.81	0.56	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF173	0.057	0.057	7.665	0.028	0.01	9.43	0.43	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF175	0.263	0.263	7.665	0.051	0.03	14.15	0.66	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF177	0.174	0.174	7.665	0.043	0.03	12.53	0.59	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF153	0.015	0.015	7.665	0.018	0.01	5.84	0.29	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF191	0.012	0.012	7.665	0.016	0	5.24	0.29	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF189	0.481	0.481	7.665	0.064	0.05	16.84	0.79	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF155	0.407	0.407	7.665	0.061	0.04	16.12	0.74	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF183	0.468	0.468	7.665	0.064	0.05	16.84	0.77	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF157	0.009	0.009	7.665	0.015	0	4.94	0.25	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF159	0	0	7.665	0	0	0	0	
OF161	0.001	0.001	7.665	0.007	0	2.25	0.14	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF167	0.079	0.079	7.665	0.032	0.01	10.38	0.47	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF169	0.266	0.266	7.665	0.051	0.03	14.15	0.66	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF165	0.086	0.086	7.665	0.033	0.02	10.56	0.48	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF38	0	0	7.665	0	0	0	0	
OF40	0	0	7.665	0	0	0	0	
OF42	0	0	7.665	0	0	0	0	
OF44	0	0	7.665	0	0	0	0	
OF32	0	0	7.665	0	0	0	0	
OF34	0	0	7.665	0	0	0	0	
OF36	0	0	7.665	0	0	0	0	
OF65	0	0	7.665	0	0	0	0	
OF55	0.025	0.025	7.665	0.021	0.01	7.03	0.33	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF57	0.021	0.021	7.665	0.019	0.01	6.44	0.34	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF59	0.064	0.064	7.665	0.03	0.01	10.02	0.43	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF61	0.116	0.116	7.665	0.037	0.02	11.45	0.51	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF63	0.077	0.077	7.665	0.032	0.01	10.38	0.46	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF24	0.166	0.166	7.665	0.042	0.02	12.35	0.59	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF72	0.052	0.052	7.665	0.027	0.01	9.13	0.42	AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1
OF26	0	0	7.665	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin11/4	19.69	4394.8	0.65	0.65	0
Basin2	23.22	310.5	0.719	0.719	0

CONTINUITY CHECK for AR&R 100 year, 1.5 hours storm, average 84 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
Pit1/11	161.34	161.34	0	0
Pit1/10	211.08	211.1	0	0
Pit1/9	648	648.02	0	0
Pit1/8	1117.31	1117.45	0	0
Pit1/7	1267.82	1267.89	0	0
Pit1/6	1800.33	1800.53	0	0
Pit1/5	1989.53	1989.58	0	0
Pit1/4	1985.66	1985.61	0	0
Pit1/3	2105.46	2105.64	0	0
Pit1/2	2205.91	2207	0	0
Pit1/1	2207	2207	0	0
Pit2/3	336.52	336.51	0	0
Pit2/2	388.37	388.37	0	0
Pit2/1	410.08	410.05	0	0
Pit3/3	339.98	339.97	0	0
Pit3/2	348.07	348.08	0	0
Pit3/1	434.13	434.12	0	0
Pit6/10	97.96	97.95	0	0

Pit6/9	426.4	426.41	0	0
Pit6/8	754.63	754.63	0	0
Pit6/7	780.07	780.06	0	0
Pit6/6	918.67	918.66	0	0
Pit6/5	1003.25	1003.25	0	0
Pit6/4	1334.62	1334.59	0	0
Pit6/3	2585.47	2585.35	0	0
Pit6/2	2736.37	2736.37	0	0
Pit6/1	2736.37	2736.37	0	0
Pit7/1	28.81	28.81	0	0
Pit8/1	134.38	134.38	0	0
Pit9/2	305.4	305.4	0	0
Pit9/1	743.28	743.27	0	0
Pit10/2	80.67	80.67	0	0
Pit11/22	221.27	221.27	0	0
Pit11/21	230.49	230.5	0	0
Pit11/20	787.16	787.31	0	0
Pit11/19	799.98	800.15	0	0
Pit11/18	812.83	812.83	0	0
Pit11/17	1005.29	1005.32	0	0
Pit11/16	1548.04	1548.03	0	0
Pit11/15	1548.06	1553.27	0	-0.3
Pit11/14	2119.71	2119.71	0	0
Pit11/13	2119.71	2119.99	0	0
Pit11/12	2615.98	2615.91	0	0
Pit11/11	2615.91	2623.98	0	-0.3
Pit11/10	2998.47	2998.08	0	0
Pit11/9	5087.42	5110.9	0	-0.5
Pit11/8	5315.54	5326.4	0	-0.2
Pit11/7	5738.97	5734.88	0	0.1
Pit11/6	5814.41	5815.5	0	0
Pit11/5	6174.15	6173.29	0	0
Basin11/4	7221.49	5212.89	1988.03	0.3
Pit11/3	5394.98	5399.05	0	-0.1
Pit11/2	5969.46	5975.2	0	-0.1
Pit11/1	5984.68	5984.68	0	0
Pit12/2	486.34	486.35	0	0
Pit12/1	542.82	542.84	0	0
Pit14/2	177.48	177.47	0	0
Pit15/4	41.49	41.49	0	0
Pit15/3	386.7	386.7	0	0
Pit15/2	685.75	685.28	0	0.1
Pit15/1	875.92	874.58	0	0.2
Pit16/1	414.89	414.88	0	0
Pit17/2	334.73	334.71	0	0
Pit19/3	239.71	239.71	0	0
Pit19/2	227.94	227.94	0	0
Pit19/1	336.37	336.37	0	0
Basin2	1704.91	1658.49	46.42	0
Pit18/1	1698.83	1742.97	0	-2.6
Pit20/2	109.48	109.48	0	0
Pit20/1	108.43	108.43	0	0
Pit21/3	381.46	381.46	0	0
Pit21/2	432.16	432.11	0	0
Pit100	432.11	432.13	0	0
Pit22/3	564.71	564.7	0	0
Pit22/2	626.25	626.24	0	0
Pit102	626.24	626.26	0	0
Pit23/6	137.37	137.37	0	0
Pit23/5	263.03	263.03	0	0
Pit23/4	801.92	801.67	0	0
Pit23/3	801.67	801.65	0	0
Pit23/2	2046.7	2046.77	0	0
Pit23/1	2046.77	2046.77	0	0
Pit24/1	775.57	775.57	0	0
Pit25/1	639.51	639.46	0	0
Pit26/5	119.86	119.85	0	0
Pit26/4	160.18	160.18	0	0
Pit26/3	464.61	464.63	0	0
Pit26/2	518.01	518.01	0	0
Pit26/1	541.06	541.05	0	0
Pit27/1	254.13	254.13	0	0
Pit30/4	74.91	74.91	0	0
Pit30/3	144.06	144.06	0	0
Pit30/2	208.6	208.6	0	0
Pit30/1	274.29	274.29	0	0
Pit31/3	72.61	72.61	0	0
Pit31/2	141.75	141.75	0	0
Pit31/1	212.05	212.05	0	0
Pit32/1	19.48	19.48	0	0
Pit33/5	74.91	74.87	0	0.1
Pit33/4	149.78	149.76	0	0
Pit33/3	224.67	224.66	0	0
Pit33/2	224.66	224.67	0	0
Pit33/1	299.58	299.58	0	0
Pit40/1	239.63	239.62	0	0
Pit90/1	148.67	148.64	0	0
Pit95/1	65.69	65.69	0	0
N229	107.64	107.64	0	0

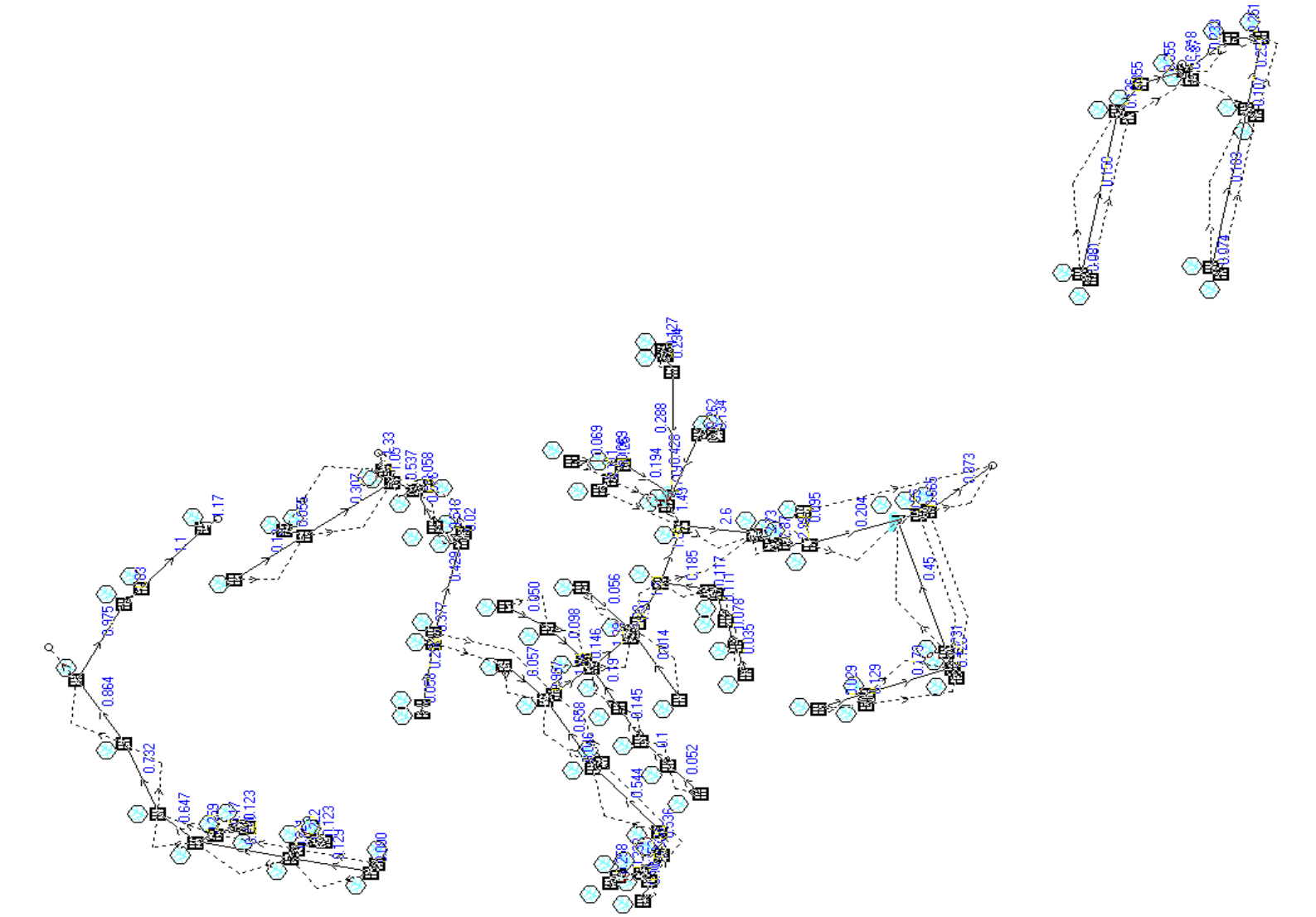
Run Log for 22 run at 11:28:49 on 7/1/2009Water was lost from the system at Pit23/4.

Is this correct? If this water re-enters the system further downstream you should draw an overflow route from this location.

Upwelling occurred at Pit33/2, Pit26/1, Pit15/1, Pit11/5, Pit11/10, Pit8/1, Pit6/4, Pit2/1, Pit1/9
Freeboard was less than 0.15m at Pit90/1, Pit40/1, Pit33/1, Pit33/3, Pit33/4, Pit33/5, Pit27/1, Pit26/2, Pit26/3, Pit25/1, Pit23/2, Pit22/2, Pit22/3, Pit12/2, Pit6/3, Pit6/10, Pit2/3, Pit1/5, Pit1/8

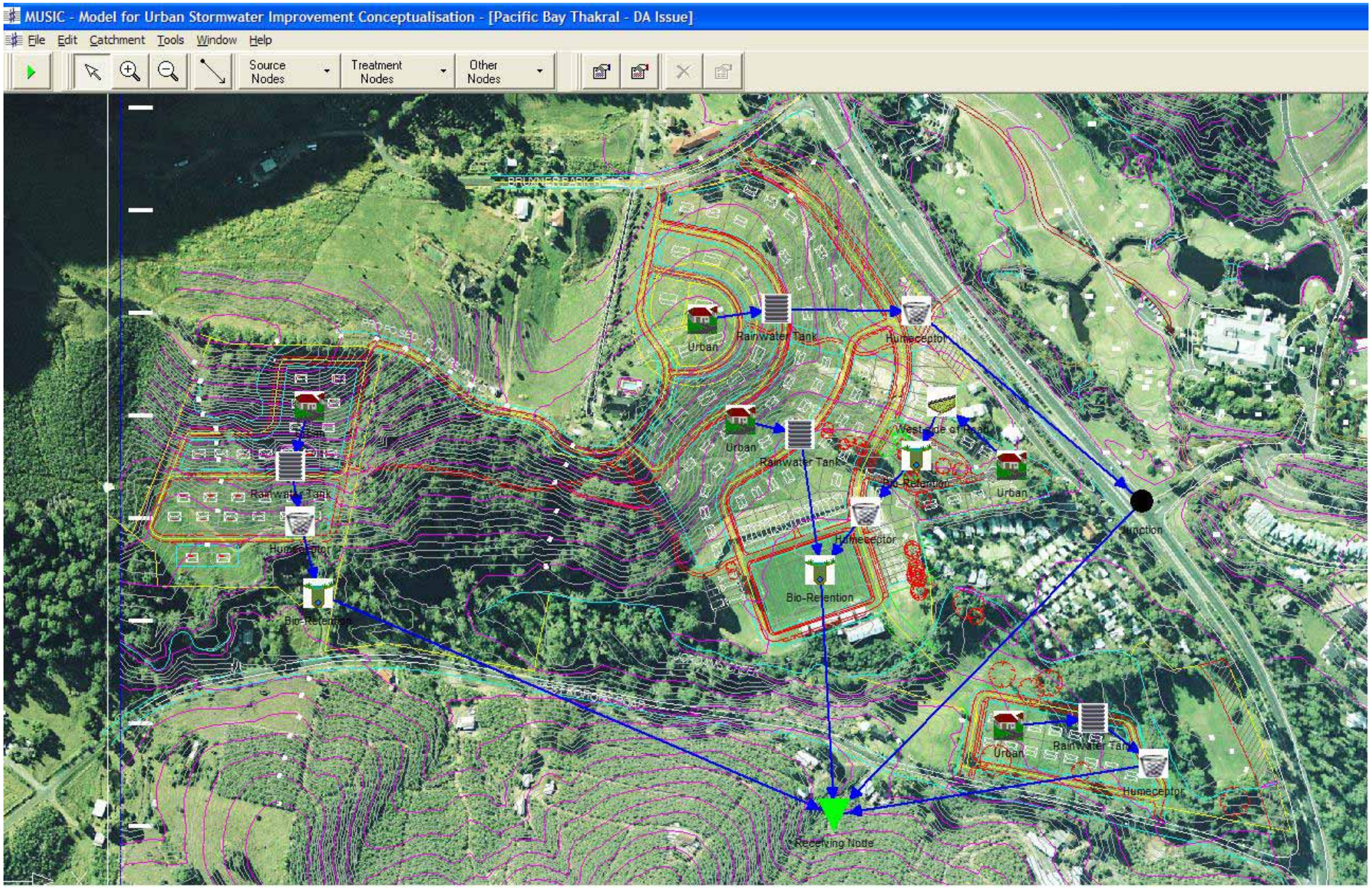
The following overflow routes carried water uphill (adding energy): OF151, OF149
These results may be invalid. You should check for water flowing round in circles at these locations. You may need to reformulate the model.

The low level outflow from the following detention basins may be unstable: Basin2,
A common reason for this is that the low level outlet is large compared with the capacity of the system further downstream.
If this is the case reducing the size/capacity of the outlet should improve stability.



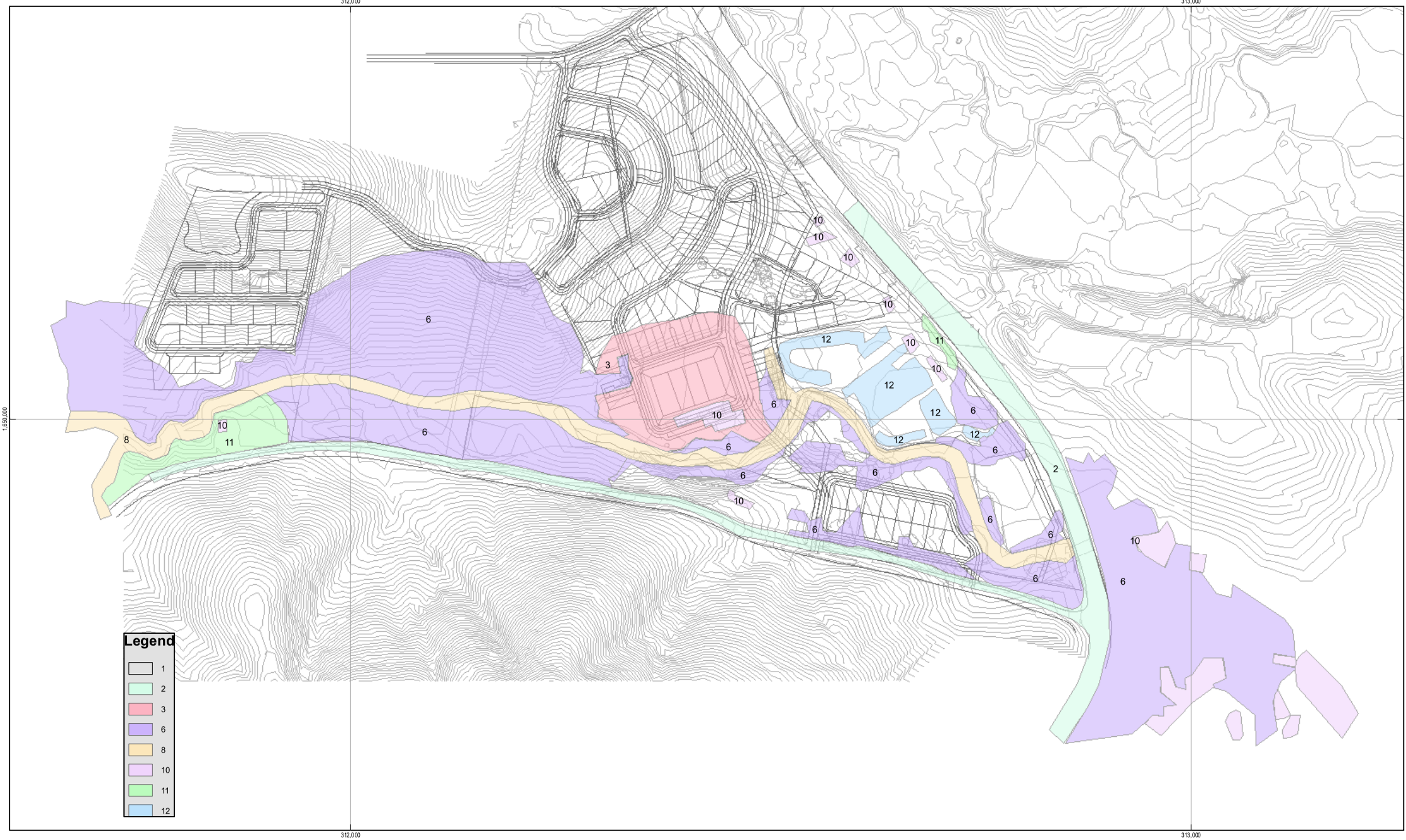
Appendix C

MUSIC Model Layout


MUSIC - Model for Urban Stormwater Improvement Conceptualisation - [Pacific Bay Thakral - DA Issue]
File Edit Catchment Tools Window Help
Source Nodes
Treatment Nodes
Other Nodes
Urban
Rainwater Tank
Humeceptor
Bio-Retention
Junction
Receiving Node

Appendix D

TUFLOW Materials Data



1:4,000 (at A3)

0 20 40 80 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-2

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Refer to TMF for Manning's n

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Thakral

Pacific Bay Western Lands

Flood Modelling

TUFLOW Materials Layer

Job Number	22-13298
Revision	A
Date	05 MAR 2009

G:\22\13298\2\CADD\GIS\Maps\2008.12.09 Revised Flood Maps (all).mxd

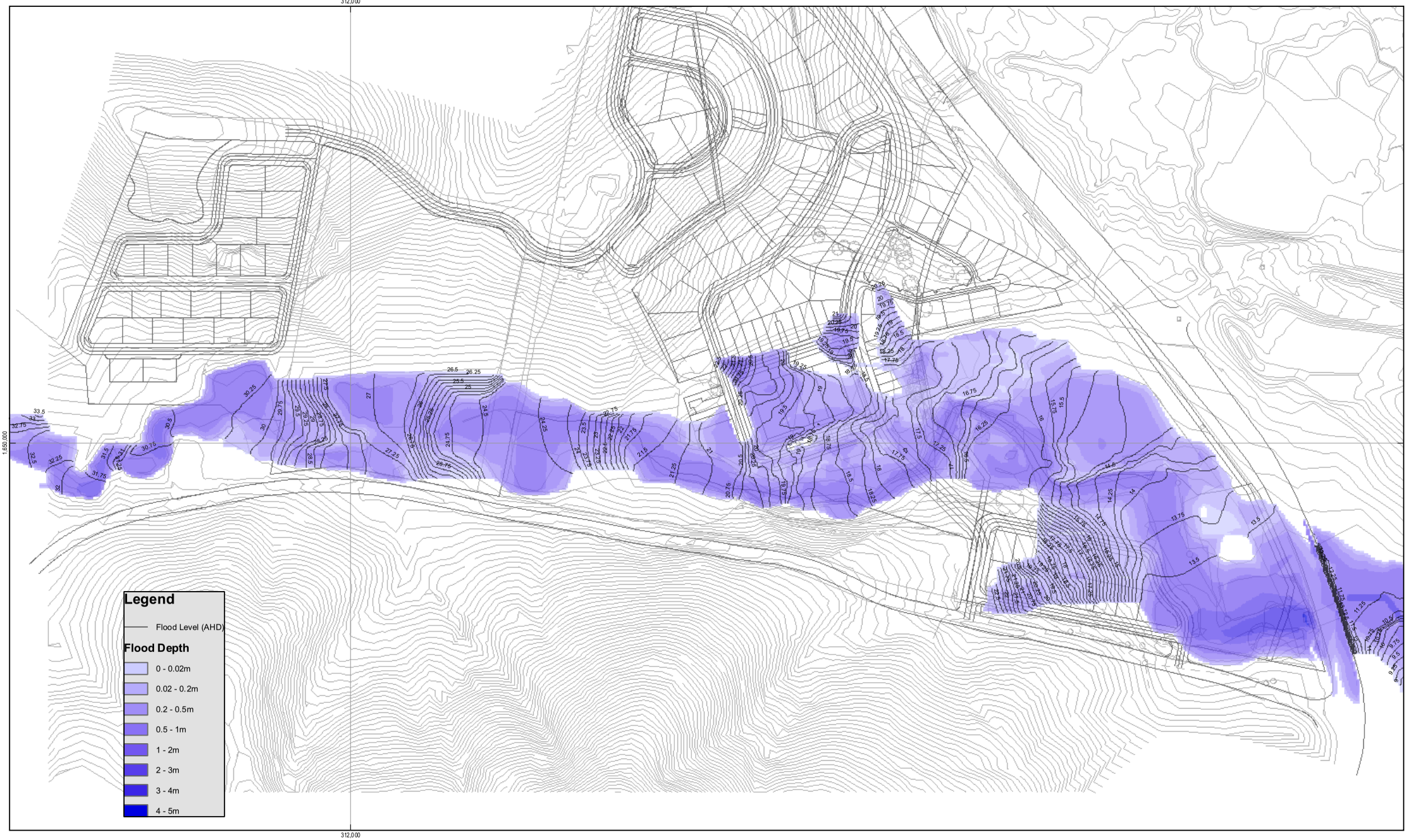
Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mlsquier, rgtowner

2/115 West High Street Coffs Harbour NSW 2450 **T** 61 2 6650 5600 **F** 61 2 6652 6021 **E** **W** www.ghd.com.au

```
! Comments and blank lines are allowed in this file
! First value is the Mat or fric value, the second is the Manning's n value
  1, 0.05   ! Default - rural open area
  2, 0.02   ! Roads  - all road reserve
  3, 0.03   ! Short Grass / Bare Earth
  4, 0.09   ! Rural Res
  5, 2.0    ! Buildings
  6, 0.12   ! Forested
  7, 0.025  ! Water Bodies
  8, 0.10   ! Creek 2D part
  9, 0.08   ! Unmaintained Floodplain
  10, 2.0   ! Building lumped together
  11, 0.07  ! Vegetated Floodplain
  12, 1.0   ! Caravans and Raised Cabins allowing for some blockage
```

Appendix E

Existing Flooding Conditions



1:3,000 (at A3)

0 15 30 60 90

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-2

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Thakral
Pacific Bay Western Lands

100-year ARI Event
Existing Conditions: Flood Levels and Extent

Job Number	22-13298
Revision	A
Date	05 MAR 2009

G:\22\13298\CADD\GIS\Maps\2008.12.09 Revised Flood Maps (all).mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mlsquier, rgtowner

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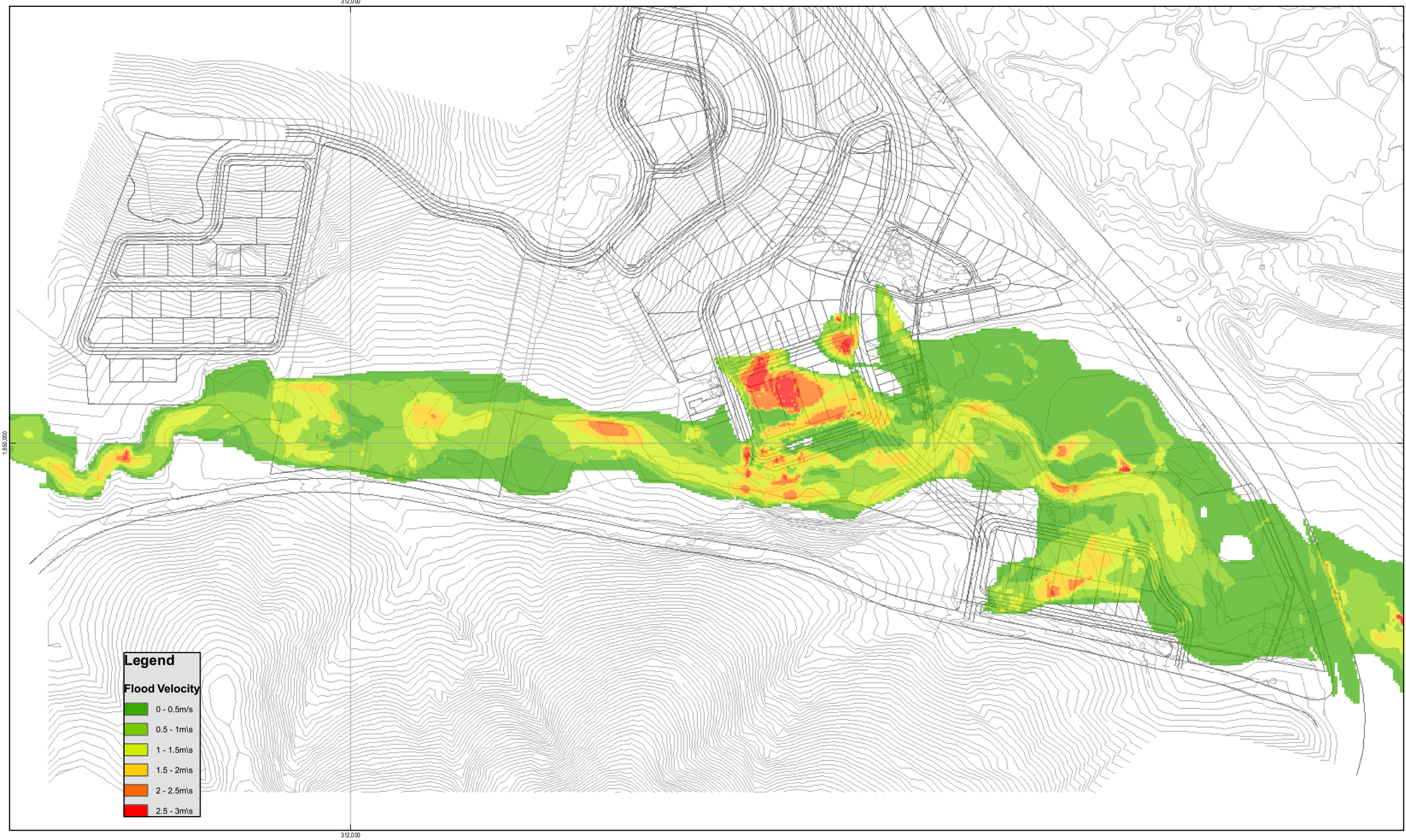

1:3,000 (at A3)

0 15 30 60 90

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-2

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Thakral
Pacific Bay Western Lands

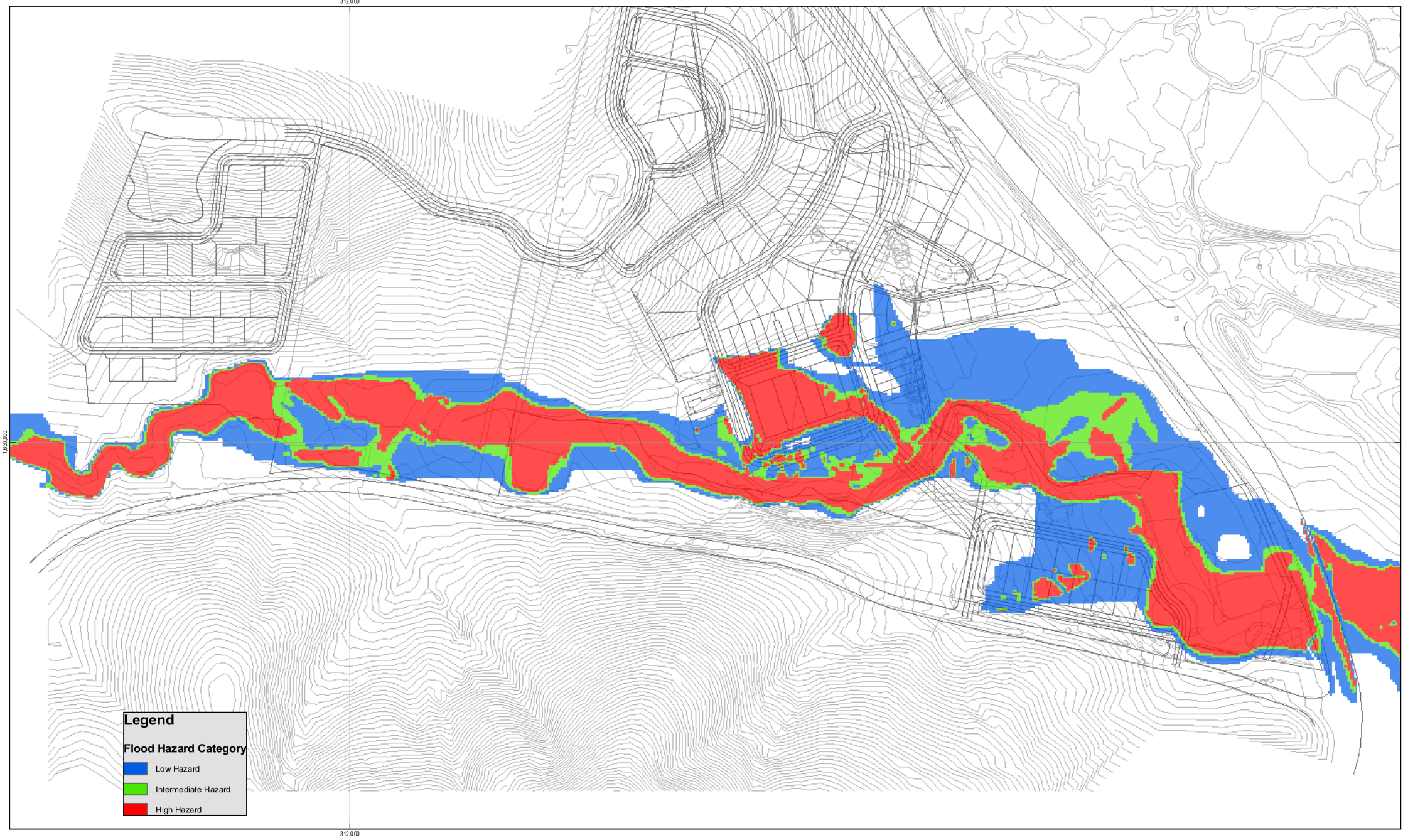
100-year ARI Event
Existing Conditions: Flood Velocities

Job Number	22-13298
Revision	A
Date	05 MAR 2009

G:\22\13298\CADD\GIS\Maps\2008.12.09 Revised Flood Maps (all).mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mlsquier, rgtowner

2/115 West High Street Coffs Harbour NSW 2450 **T** 61 2 6650 5600 **F** 61 2 6652 6021 **E** **W** www.ghd.com.au



1:3,000 (at A3)

0 15 30 60 90

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-2

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Thakral

Pacific Bay Western Lands

100-year ARI Event

Existing Conditions: Flood Hazard Category

Job Number	22-13298
Revision	A
Date	05 MAR 2009

G:\22\13298\CADD\GIS\Maps\2008.12.09 Revised Flood Maps (all).mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mlsquier, rgtowner

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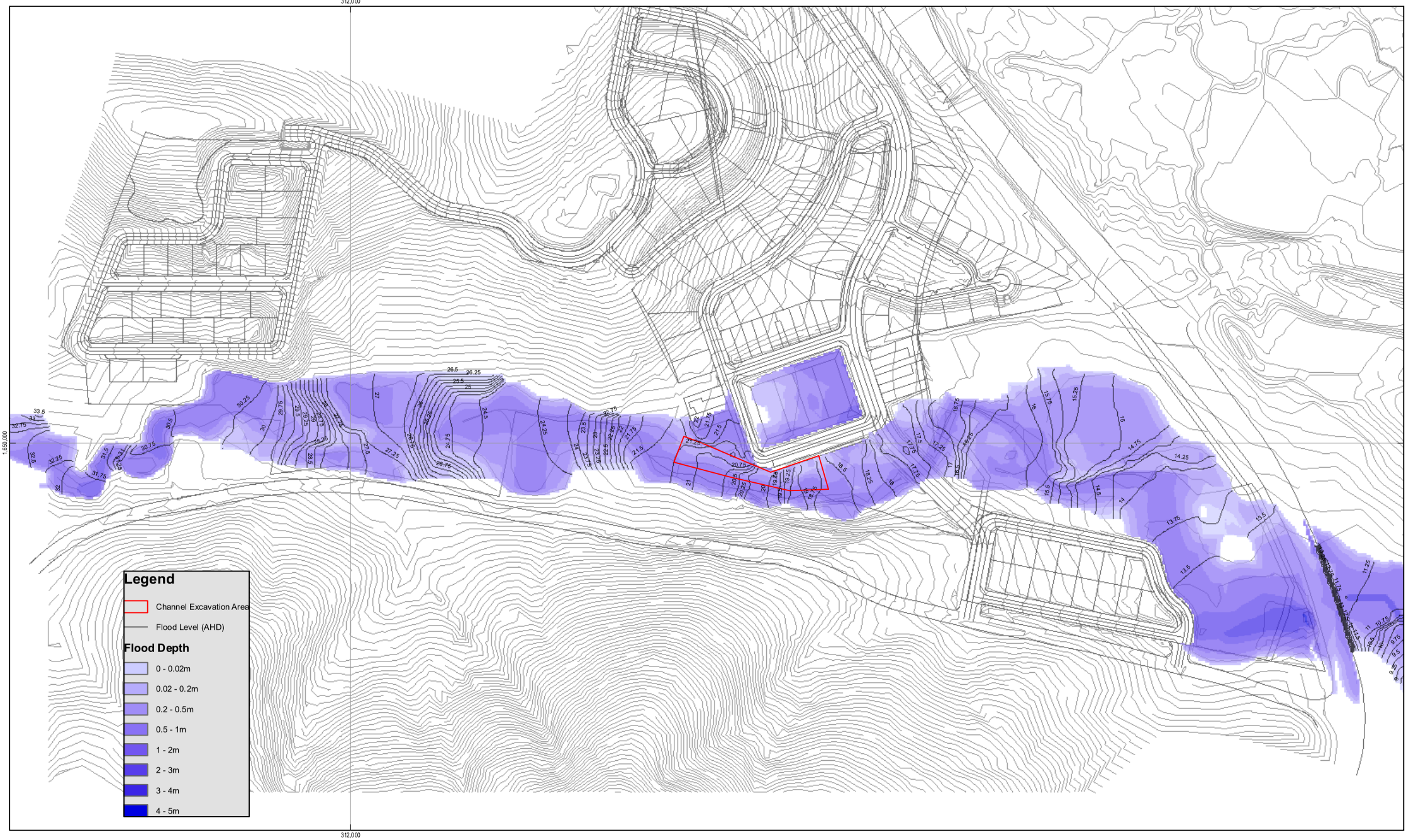
Appendix F

Developed Flooding Conditions



1:3,000 (at A3)

0 15 30 60 90

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-2

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Thakral

Pacific Bay Western Lands

100-year ARI Event

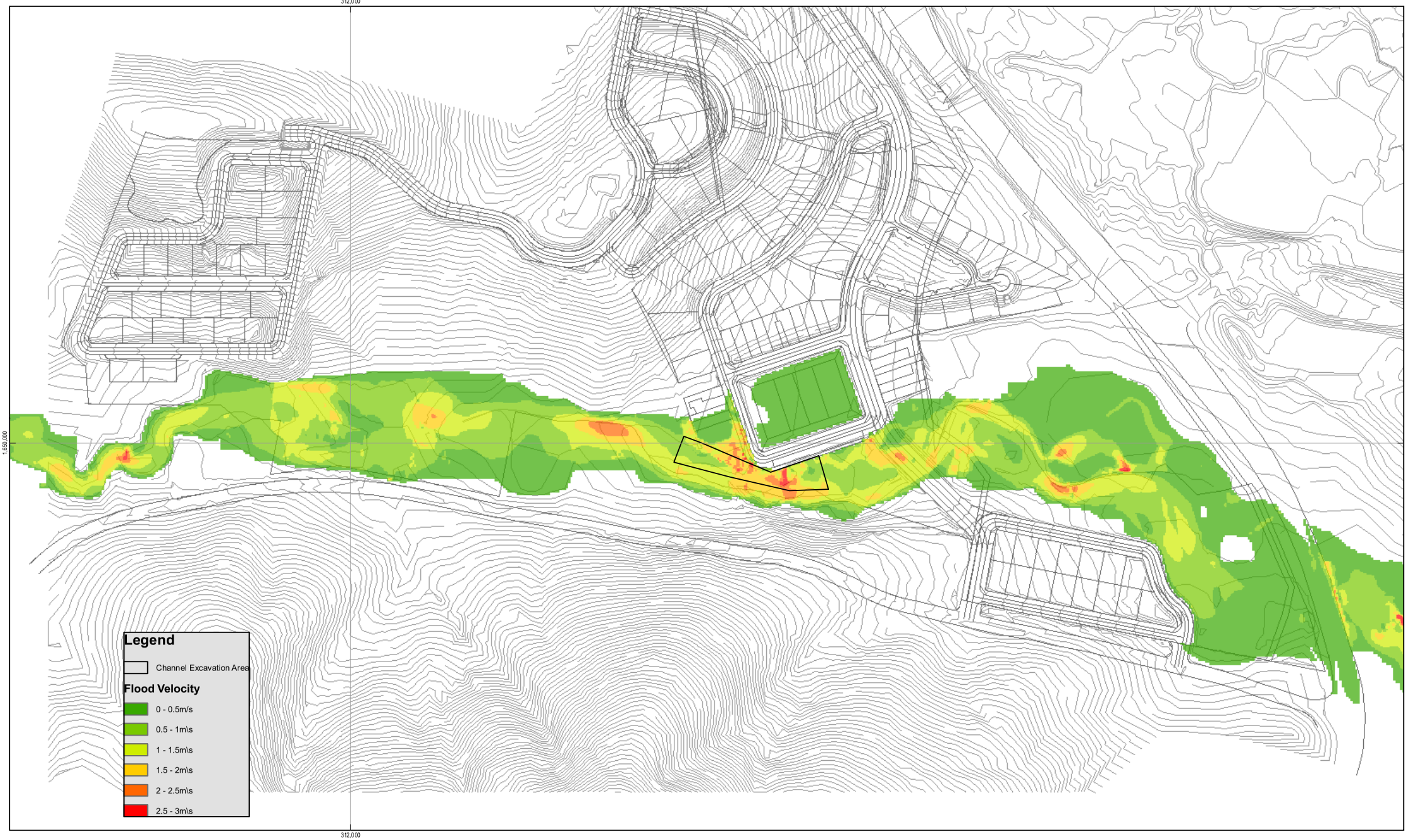
Proposed Development: Flood Levels and Extent

Job Number	22-13298
Revision	A
Date	05 MAR 2009

G:\22\13298\CADD\GIS\Maps\2008.12.09 Revised Flood Maps (all).mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mlsquier, rgtowner

2/115 West High Street Coffs Harbour NSW 2450 **T** 61 2 6650 5600 **F** 61 2 6652 6021 **E** **W** www.ghd.com.au



1:3,000 (at A3)

0 15 30 60 90

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-2

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Thakral
Pacific Bay Western Lands

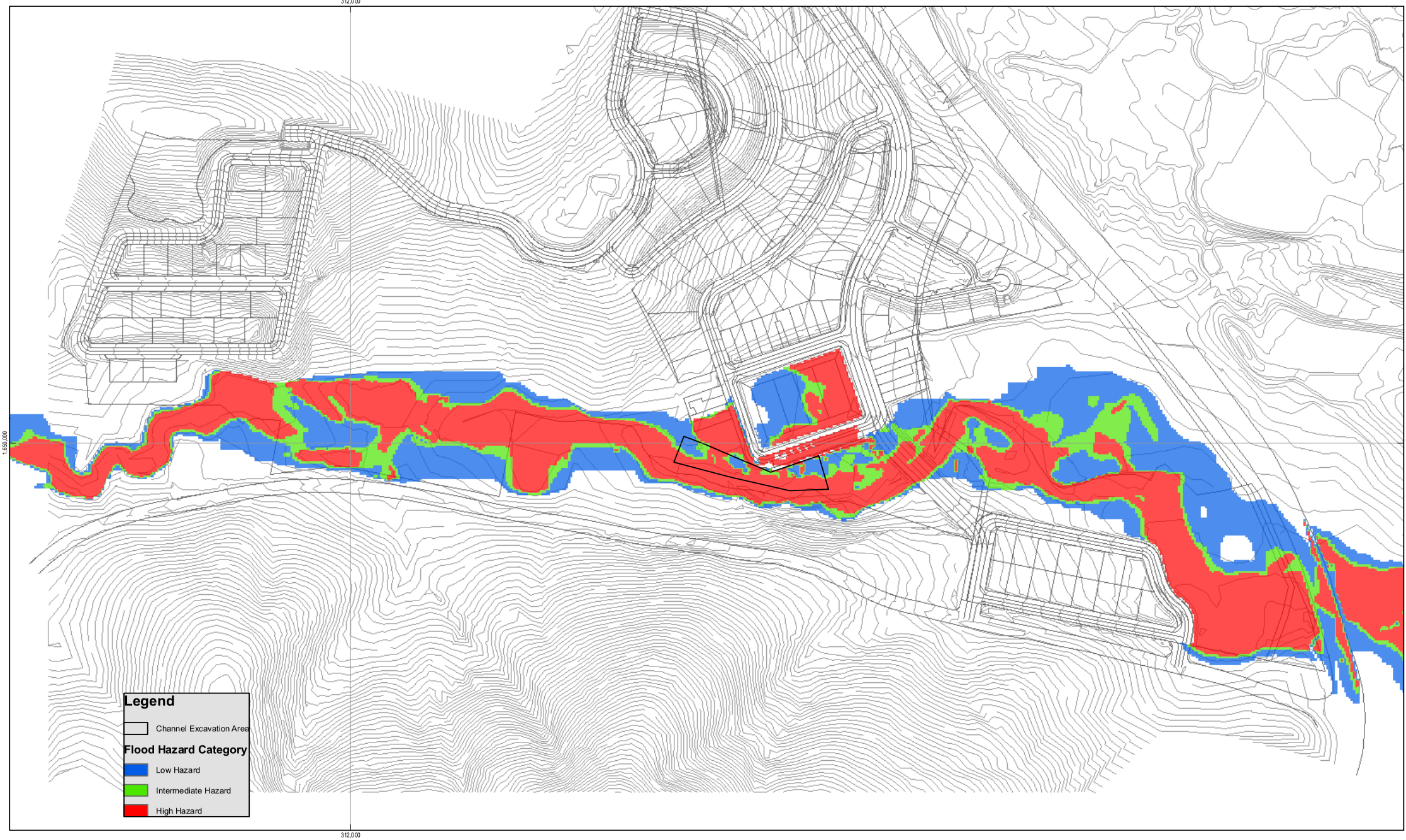
100-year ARI Event
Proposed Development: Flood Velocities

Job Number	22-13298
Revision	A
Date	05 MAR 2009

G:\22\13298\CADD\GIS\Maps\2008.12.09 Revised Flood Maps (all).mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mlsquier, rgtowner

2/115 West High Street Coffs Harbour NSW 2450 **T** 61 2 6650 5600 **F** 61 2 6652 6021 **E** **W** www.ghd.com.au



1:3,000 (at A3)

0 15 30 60 90

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-2

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Pacific Bay Western Lands

100-year ARI Event

Proposed Development: Flood Hazard Category

Job Number	22-13298
Revision	A
Date	05 MAR 2009

G:\22\13298\CADD\GIS\Maps\2008.12.09 Revised Flood Maps (all).mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mlsquier, rgtowner

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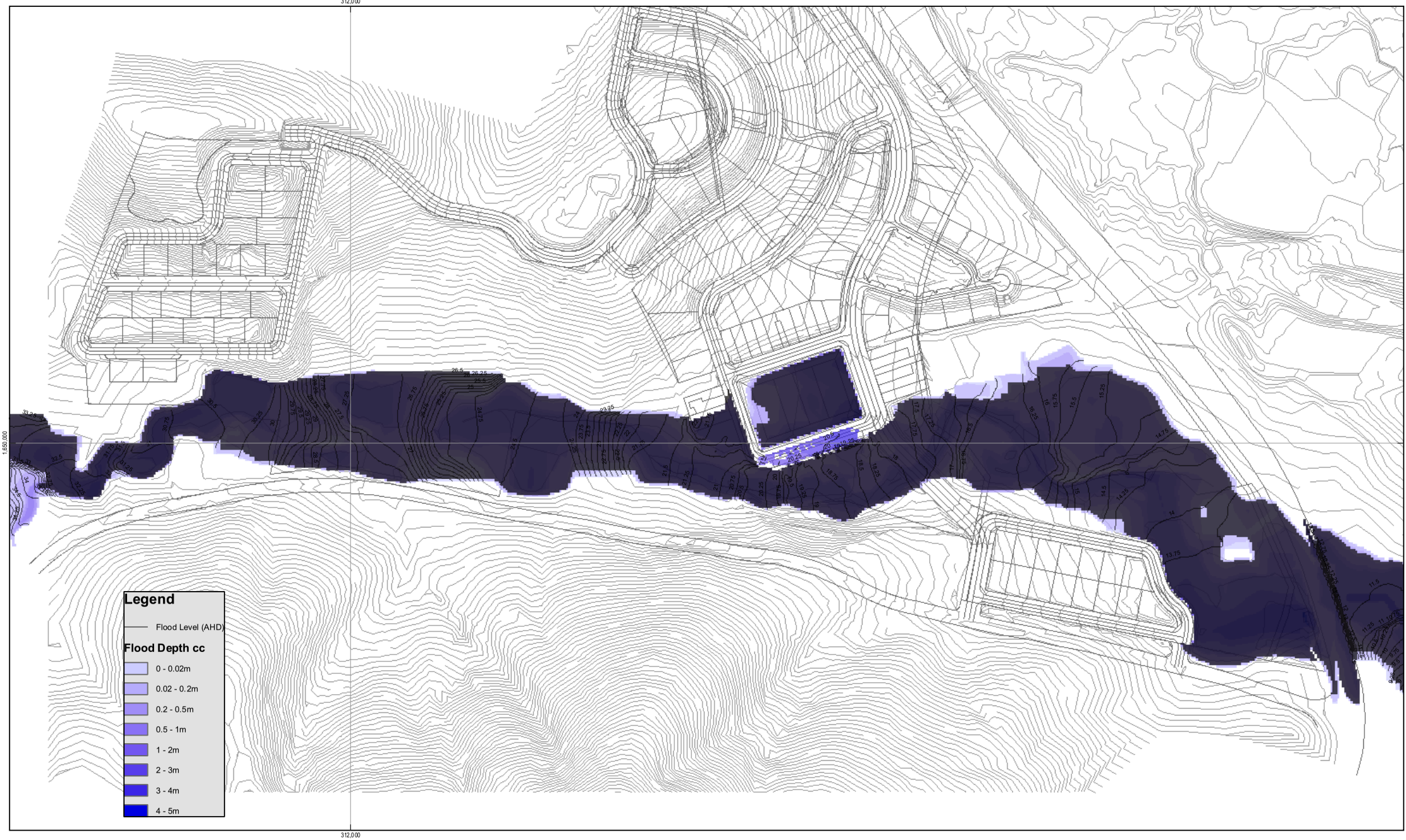
Appendix G

Climate Change and Flooding



1:3,000 (at A3)

0 15 30 60 90

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-2

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N.B. Lighter shades show flood increase due to climate change

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Thakral
Pacific Bay Western Lands

Job Number	22-13298
Revision	A
Date	05 MAR 2009

100-year ARI Climate Change Event
Proposed Development: Flood Levels and Extent

G:\22\13298\CADD\GIS\Maps\2008.12.09 Revised Flood Maps (all).mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mlsquier, rgtowner

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Appendix H

Channel Excavation Details and Typical Cross Sections

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BUSHFIRE RISK MANAGEMENT & ENVIRONMENTAL CONSULTANTS

20 McLachlan Street Maclean, NSW 2463 A.B.N 89 114 025 820
PH 02 **66451088** Fax 02 **66451099**

Gold Coast	148/333 Coulburn Ave	Victoria Point QLD 4165	Ph/Fax: 07 **38209992**	Mobile: **0432515569**
Sunshine Coast	3 Herford Drive	Kureelpa QLD 4560	Ph/Fax: 07 **54764265**	Mobile: **0408538529**

FPA AUSTRALIA Corporate Silver Member

GHD Pty Ltd
PO Box 1340
Coffs Harbour NSW 2450

Friday, 6 February 2009

Attention Phil Pigram,

I had had recent discussions with Nigel Cotsell (Coffs Harbour City Council), Patrick Dwyer (DPI – Fisheries), DWE and CMA officers regarding the proposed excavations along Jordan's Creek to alleviate the flooding issues. I propose a couple of modifications to your initial concept that would satisfy all stakeholders and allow the development to proceed.

The following requirements have been requested by the various government agencies:

- The integrity of Jordan's Creek is to be maintained. This includes preventing any erosion at the commencement of the flood bypass and where any floodwaters re-enters the creek. There are two relatively deep pools (c. 20m in length, up to 0.5m in depth) located approximately behind the equipment shed and again upstream of the powerline crossing. Since we have not considered any aquatic ecology in any environmental assessment, these to pools should be retained to provide suitable fish and invertebrate habitat.

- Revegetation is to commence from the top of the excavated channel and extend for 30m to provide the core riparian zone (minimum 20m) and a vegetated buffer (10m), the vegetated buffer can satisfy as the APZ if the regeneration planting comprises rainforest taxa.

- There should be not opportunity for any fish to enter to excavated channel during a high flow and become stranded as waters recede.

- The bottom of the excavation should be slightly sloped to ensure no water is retained once flood levels subside.

To satisfy these requirements, I would recommend the following actions be incorporated into any concept plan you develop.

For the areas along Jordan's Creek where the stream bank slopes gradually towards the creek, we would request that a 0.50m section of the existing channel bank be retained with a near horizontal bench of 6m in width excavated into the bank at this height and a gradual return to the floodplain near the playing fields over the next 11m. This is illustrated schematically as condition 1 in the attached diagram.

Where the existing channel bank is steep (generally associated with a bend in the channel course; mature Camphor Laurel or other species on top of the bank; scouring of the channel beneath these mature trees; and deposition occurring on the opposite bank) the excavations should commence approximately 3m away from the channel, retaining the existing bank as a narrow instream island.

Excavation should replicate the existing slope of the channel bank for the distal slope before reaching a level where a horizontal bench should be created (Condition 2 in the attached diagram. This bench may need to extend for greater than the 6m suggested for Type 1 cross-sections above to maintain the cross sectional area and flood volume. Depending upon the width and available area, it may become necessary that the return slope to the floodplain near the playing fields be terraced to prevent erosion.

The excavated channel should maintain a similar stream gradient to that existing along Jordan's Creek, where ever possible creating the pool and riffle sequence that currently exists.

The excavated channel should connect to Jordan's Creek rather than allow floodwaters to spill over the land surface. Any connection should not create a constriction resulting in an escalation of flow velocities, but should be achieved over an extended length. At re-entry with Jordan's Creek, the excavated channel should replicate the existing conditions along Jordan's Creek and comprise a bed of cobble-sized clasts with little unconsolidated material forming a matrix; a gravel bar could be established within the mixing zone of the two flows.

If you have any questions in relation to the above, or any other issue, please do not hesitate in contacting the undersigned.

Yours Sincerely

Wayne Hadaway
BushfireSafe (Aust) Pty Ltd

GHD

PO Box 2875 Port Macquarie NSW 2444
T: (02) 6586 8700 F: (02) 6586 8701 E: pqqmail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
3	P. Parker	I. Joliffe		I. Joliffe		6/03/09
4	P. Parker	PP	PP	I. Joliffe	PP	22/05/09
		I. Joliffe.				