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REPORT

TOWNSVILLE CITY COUNCIL

TOWNSVILLE FLOOD HAZARD ASSESSMENT STUDY

Phase 2 Report
Volume 1 – Flood Hazard Assessment

December 2005
Job No. 80301202.01

Townsville Flood Hazard Assessment Study

Phase 2 Report

Volume 1 – Flood Hazard Assessment

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
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Executive Summary

Executive Summary

Townsville City Council received funding under the Natural Disaster Risk Management Studies Program to undertake a Disaster Risk Management Study specific to flooding including a preliminary assessment of storm surge in coastal areas. Primary objectives of the Study included:

- quantifying flood inundation in Townsville and Magnetic Island
- a preliminary assessment of storm surge inundation in Pallarenda and Cungulla
- determining the flood hazards and the vulnerability of community and infrastructure, and
- identifying possible risk mitigation measures and strategies to allow proper and effective management of the identified risks.

The Project Plan identified three distinct yet inter-related phases to the Study. This report addresses Phase 2, which require a comprehensive flood hazard assessment of Townsville and Magnetic Island, using both 1-D and 2-D hydraulic modelling techniques. The study has culminated in detailed inundation mapping of design flood events ranging from 2 Year ARI to Probable Maximum Flood (PMF), and a simplistic assessment of storm surge inundation of coastal areas.

The following sections provide a brief overview of the investigations undertaken in Phase 2:

Available Data
The reliability of results from flood investigations is highly dependent on the extent and accuracy of available data, either for calibration of models or determination of causes of historical flood behaviour. Significant effort was made in gathering relevant information (topographic data, design and as-constructed plans, cadastral data and ground survey, rainfall and stream gauging records, tide and surge data, results of previous investigations and anecdotal flood levels) to assist in determining the extent of flooding throughout the Study Area.

Of particular relevance to the Study was the assessment of overflows from the Bohle River (sourced from the Bohle River Floodplain Management Study). These were determined to occur in events greater that the 10 Year ARI flood event in the Bohle River. During the course of the investigation, additional historical flood level data was sourced for calibration purposes, primarily through a Flood Questionnaire. Fifty-one (51) responses were received from residents detailing flood levels for the 1998 and 2002 flood events. ***An important finding of the review of previous studies was that the local catchment (downstream of the Ross River Dam) can potentially produce a significantly greater runoff peak than the larger dam catchment once routed through the Dam***. As such, the Study has only focused on local catchment flooding.

Hydrology Modelling
The runoff / routing model RAFTS was used to simulate the hydrological response of the local catchments of Townsville and Magnetic Island. A range of design event durations were run through the RAFTS model and the critical duration event for the Townsville floodplain was found to be between 2 and 6 hours, whereas for Magnetic Island event durations ranging from 45 minutes to 2 hours were critical. The Magnetic Island RAFTS model could not be calibrated due to insufficient data, however the Townsville floodplain model required a joint hydrologic/hydraulic calibration for the February 2002 and January 1998 flood events (the models were also verified for the March 1990 flood). Comparison of recorded rainfall

Executive Summary

with the Townsville design intensity data suggested that the 2002 event was similar to a 5 Year ARI event. The January 1998 event was found to be greater than the 100 Year ARI event, and potentially as high as 500 Year ARI for the critical duration period (6 hours).

Hydraulic Modelling – MIKE11 and MIKE21

For Magnetic Island, dynamic MIKE11 modelling was undertaken for the full range of design events (2, 5, 10, 20, 50, 100 and PMF) at each of the four bays. MIKE11 and MIKE21 modelling of the Townsville floodplain was undertaken, with MIKE11 modelling focussing on the lower end flood events (2-20 Year ARI) confined to the major open channel drainage paths. The MIKE11 hydraulic model was calibrated to the February 2002 event and run for two verification events; January 1998 and March 1990. The MIKE21 model was calibrated to the January 1998 event, and used to predict flood extents and depths for the design events (50 Year ARI up to the PMF). MIKE21 modelling permitted greater representation of the wider floodplain areas and subsequently provides more accurate results for the less frequent rainfall events (ie. greater than 50 Year ARIs).

Storm Surge and Tidal Inundation Maps

Static tidal surge modelling was undertaken for 50 and 100 Year ARI events by applying published static surge levels along the shoreline off Pallarenda and Cungulla. Inundation maps, developed in isolation from freshwater flooding, indicated that significant numbers of properties (particularly at Pallarenda and Cungulla) were impacted by storm surge propagating inland via existing drainage paths. Normal tide inundation maps for Mean High Water Spring (MHWS) and Highest Astronomical Tide (HAT) have also been developed; however negligible impact was predicted. For Townsville, dynamic surge propagation was modelled using MIKE21 for the recorded levels from Cyclone Althea (1971). A synthetic scenario was also modelled representing the surge from Cyclone Althea coincident with a high tide.

Flood Inundation Maps

Flood inundation maps prepared for Magnetic Island indicate that relatively frequent rainfall events (5 Year ARI) can produce flows that exceed the capacity of several of the major drainage paths within the four bays modelled, resulting in overtopping of roads and inundation of a number of properties (however, widespread inundation is not common). In Townsville, inundation mapping has been undertaken using ArcView GIS for both the MIKE11 and MIKE21 modelling results. The two sets of inundation plans overlap and exhibit differences symptomatic of the modelling approach (MIKE21 model was calibrated to a very large event and the 2-Dimensional modelling results are therefore more accurate for design event of 50 Year ARI and greater). ***The representation of the Townsville floodplain on a 20 m grid does not allow the smaller drainage channels to be adequately represented***.

The inundation mapping undertaken for this Phase 2 Report has been used in the assessment of hazard, community vulnerability and estimation of flood damages (detailed in the Phase 3 Report).

1 Introduction

1 Introduction

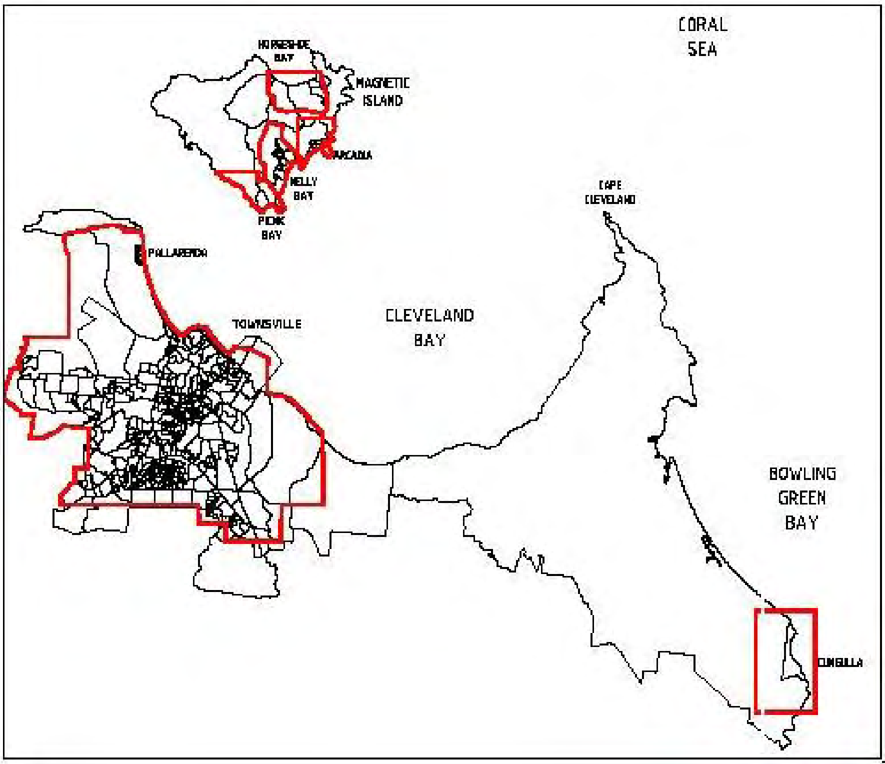
1.1 Study Area

The Study Area, comprised of twelve (12) sub-areas, is shown graphically in **Figure 1** below. The most significant zone within the Study Area is that described as the Townsville floodplain and combines the sub-areas of the City, South Townsville, Fairfield, Annandale, Mt Louisa and Sandfly Creek. The assessment of flood risk in these sub-areas cannot be undertaken in isolation, as drainage paths typically traverse the boundaries as defined.

The Study area also incorporates the four major bays of Magnetic Island, namely Horseshoe Bay, Arcadia, Nelly Bay and Picnic Bay (these bays are considered distinct catchments to be considered separately). Also included in the Study Area are the two coastal communities of Pallarenda and Cungulla. A reduced level of investigation is required at Cungulla and Pallarenda, in recognition that flooding is of a lesser concern than the threat of elevated ocean levels (storm surge).

Significant catchments contribute to the drainage systems within the Study Area that are themselves located outside the Study Area boundary (most notably Stuart Creek and Louisa Creek). These systems have been included in the assessment to ensure that all contributing flows are accounted for.

Figure 1
Study Area



1 Introduction

1.2 Scope of the Study

Townsville City Council received funding under the Natural Disaster Risk Management Studies Program to undertake a Disaster Risk Management Study specific to flooding and storm surge. Primary objectives of the Study included:

- quantifying flood and surge inundation in Townsville, Magnetic Island and Cungulla,
- determining the flood hazards and the vulnerability of community and infrastructure, and
- identifying possible risk mitigation measures and strategies to allow proper and effective management of the identified risks.

The Project Plan identified three distinct yet inter-related phases to the Study as follows:

Phase 1 – Digital Terrain Model (DTM) Preparation
Undertaken under a separate consultancy (Schlencker Mapping Pty Ltd), Phase 1 involved provision of detailed ground surface data (0.2 m contours) covering the greater part of Townsville, four inhabited bays of Magnetic Island, and the coastal communities of Pallarenda and Cungulla (in all, twelve separate sub-areas). Each sub-area was provided progressively on a priority basis, as well as an overall combined DTM of the Townsville floodplain.

Phase 2 – Flood Study
A comprehensive flood study of Townsville and Magnetic Island, using both 1-D and 2-D hydraulic modelling techniques, culminating in inundation mapping of design flood events ranging from 2 Year ARI to Probable Maximum Flood (PMF). Includes tidal and storm surge inundation assessment in coastal areas including Magnetic Island, Pallarenda and Cungulla. Using the results of the flood analysis, hazard mapping of flood and surge inundation to identify vulnerable areas and engineering lifelines.

Phase 3 – Vulnerability Assessment and Mitigation Options
Using a risk based approach to ranking and prioritising the identified hazards, possible mitigation options and strategies to be identified and investigated. Phase 3 culminates in recommendation and implementation of strategies for the management of the identified flood risks.

This Draft Report presents the findings of Phase 2 – Flood Study.

1 Introduction

1.3 Acknowledgments

Maunsell Australia Pty Ltd (MAPL) gratefully acknowledge the following agencies and individuals that provided information and advice during the course of the Study:

- Townsville City Council who provided flood records, flood damage details, flood level survey, free access to all relevant documentation and general GIS support.
- The Steering Committee comprising engineering staff and Council representatives, and the Study Advisory Group representing the wider community and emergency service providers.
- The Bureau of Meteorology (BoM) for provision of rainfall data inputs to the hydrologic modelling, and for providing stream-gauging (ALERT) data used to calibrate the hydraulic models.
- Schlencker Mapping Pty Ltd for provision of the DTM and ongoing support during the project.

2 Available Data

2 Available Data

2.1 General

The reliability of results from flood investigations is highly dependent on the extent and accuracy of available data, either for calibration of models or determination of causes of historical flood behaviour. Sources of data that are often utilised in studies of this nature include:

- Topographic maps and aerial photography
- Design and as-constructed plans
- Cadastral data and ground survey
- Rainfall and stream gauging records
- Tide and surge data
- Results of previous investigations
- Anecdotal flood levels and recollections of flood behaviour

The following sections detail relevant data that was sourced for the Study, in categories as listed above. In each case, the data has been appraised for its accuracy and suitability for use in the Study.

2.2 Topography and Aerial Photography

The following topographic and aerial photography data was used during the Study:

- 1:25000 Topographic Image Maps, Mount Louisa (8259-31), Magnetic (8259-13), Townsville (8259-24), Antill Plains (8259-23) and Laudham Park (8259-32).
- 1:50000 Topographic Survey Maps, Alice River (8259-III), Magnetic (8259-I) and Townsville (8259-II).
- Rectified 1:35000 photo mosaic of Townsville (circa 2000), with resolution of 1, 2 and 4 m (refer to **Figure 2**).

The topographic maps were primarily used to define catchment boundaries outside the urban area of Townsville (i.e. Stuart Creek catchment) and for Magnetic Island. The rectified photo-mosaic was used as a background for all flood and surge inundation mapping.

2.3 Design Data and GIS Layers

The following design information and GIS data was supplied by Council:

- Stormwater drainage networks, nodes and pits (refer to **Figure 3**), including pipe sizes and invert levels.
- Urban catchment and suburb boundaries for Townsville, used as the basis for defining RAFTS hydrologic model catchment boundaries
- Property and land use (zoning) database, used as input to the assessment of flood damages.
- GIS layer of flood levels collected in 1998 after the major flood event that occurred in January 1998 (ex-Tropical Cyclone Sid).
- Flood inundation map generated by Council for the March 1990 flood.

2 Available Data

Figure 2
Example of Rectified Photo Mosaic

Source: TCC Land Information Unit

Figure 3
Example of Stormwater Network GIS Layer

Source: TCC Land Information Unit

2 Available Data

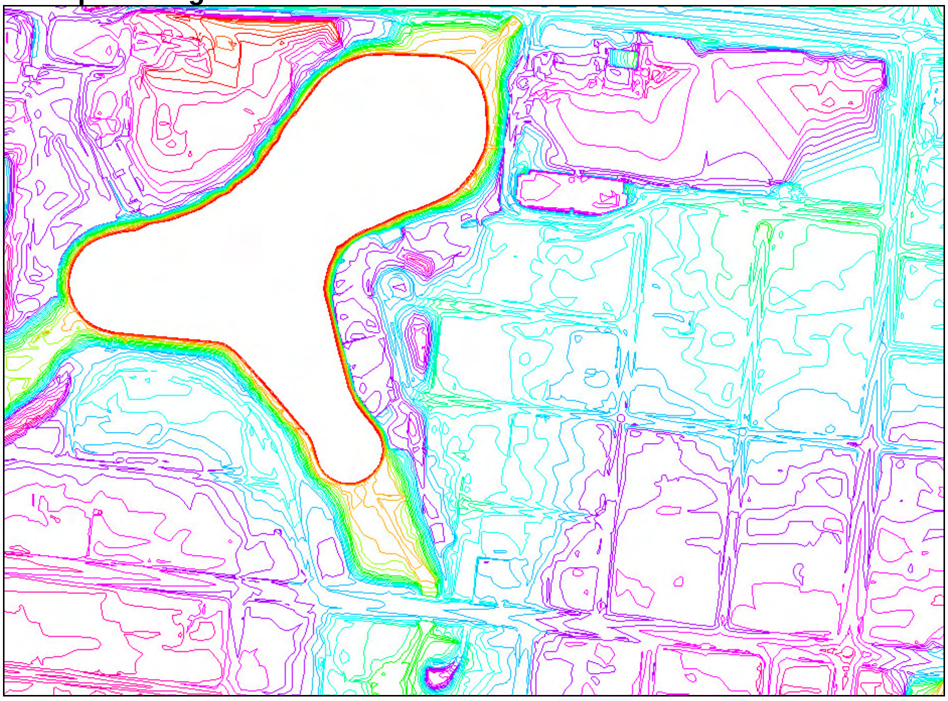
2.4 Survey and Ground Data

Council collected the following survey data during the course of the Study:

- Survey of all major drainage structures, bridges and culverts for which GIS data was incomplete or missing (including road crown levels).
- Additional flood levels for the February 2002 and January 1998 flood events, based on the public responses to a Flood Questionnaire circulated by Council.
- Survey of channel constrictions in Louisa Creek, which assisted in the calibration of the hydraulic model.

Phase 1 of the Study also involved development (by others) of detailed Digital Terrain Models for the Study Area. An example of the digital contours derived from 1:4000 aerial photography is shown in **Figure 4** below. The digital contours and spot heights were used as input to the hydraulic models (cross-sections for MIKE11 and Digital Elevation Model for MIKE21).

Figure 4
Example of Digital Contour Data



Source: Schlencker Mapping Pty Ltd

2 Available Data

2.5 Rainfall Data

2.5.1 Recorded Rainfall

Rainfall records were obtained for three historical calibration events; March 1990, January 1998 and February 2002. Selection of these events was based primarily upon the availability of recorded flood levels (and inundation patterns) for model calibration. Rainfall data was obtained from the Bureau of Meteorology (BoM), for both daily and pluviograph (continuous recording) sites. It should be noted that the number of gauging stations in Townsville has increased dramatically since the ALERT system was installed in 2000/2001; however, parts of the Study Area like Magnetic Island remain ungauged.

A summary of the rainfall data sourced for each event is summarised in **Table 1**.

Table 1
Summary of Available Rainfall Data

Event	Pluviograph Data	Daily Rainfall Data
March 1990	032040 Townsville Aero 22/3/90 09:00 → 31/3/90 09:00	32057 Oonoonba 32134 Kirwan
January 1998	032040 Townsville Aero 8/1/98 09:00 → 22/1/98 09:00	Serene Valley* Kelso* Rasmussen* Cranbrook* Mundingburra* Railway Estate* West End*
February 2002	532020 - Ross River Dam Alert 532029 - Aplin Weir Alert 532030 - Black Weir Alert 532031 - Townsville Alert 532032 - Mount Louisa Alert 532034 - Alligator Creek 532035 - Stuart Creek Alert 532036 - Stuart Alert 532037 - Mysterton Alert 532039 - Kirwan Alert 12/2/02 - 20:30 → 16/2/02 20:30	Not Required

* Unofficial gauges – data sourced from BoM Publication “Severe Weather and Flooding, North Queensland, January 1998”.

Representative pluviograph (hourly) temporal patterns for each event are presented in **Figure 5** to **Figure 7**. Each event is very different, and as such they constitute a good spread (both in terms of duration and magnitude) to achieve a robust model calibration. The 1998 temporal pattern is characterised by a very intense 1-hour period of rainfall occurring on the evening of January 10th. The recent event of February 2002 consisted of numerous smaller peaks, which are reflected in stream gauging records.

2 Available Data

Figure 5
March 1990 Rainfall (1 Hour Intervals – Townsville AMO)

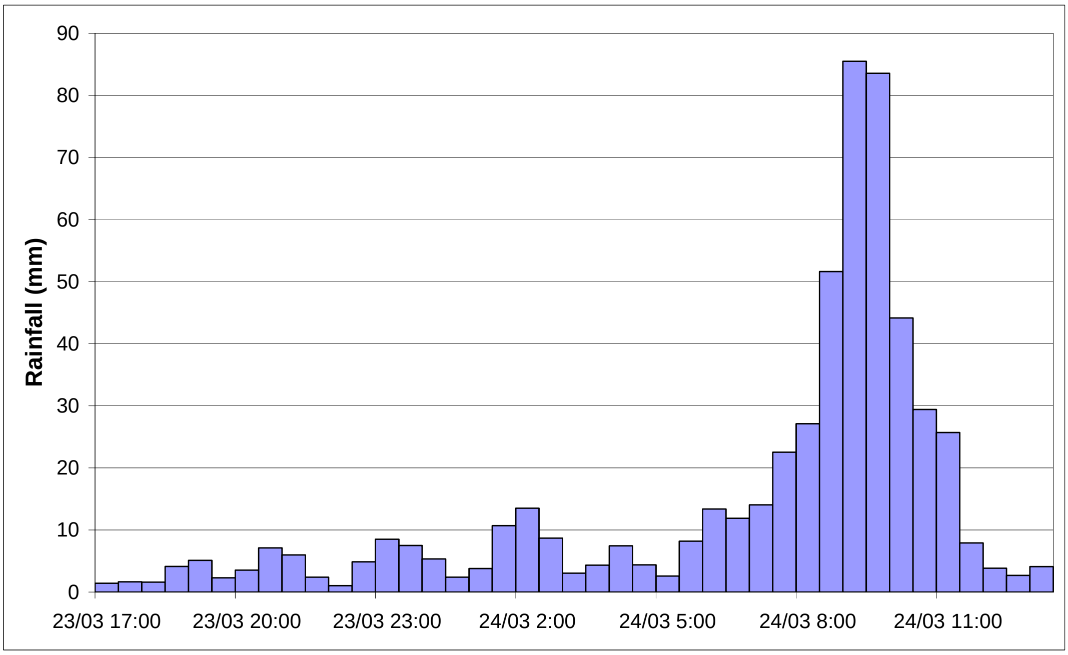
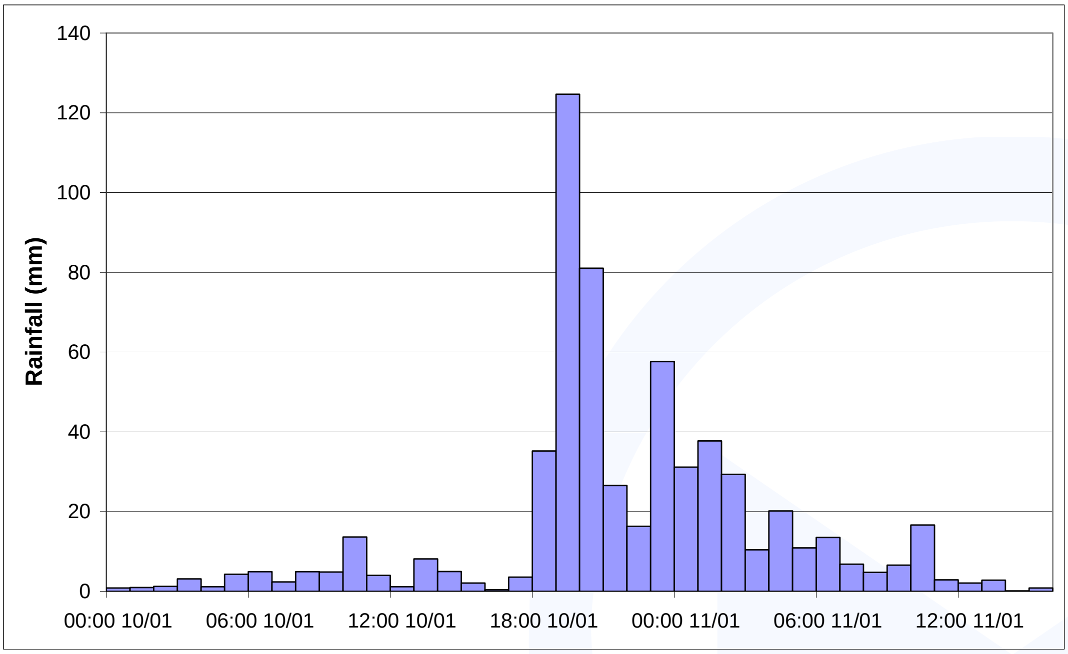
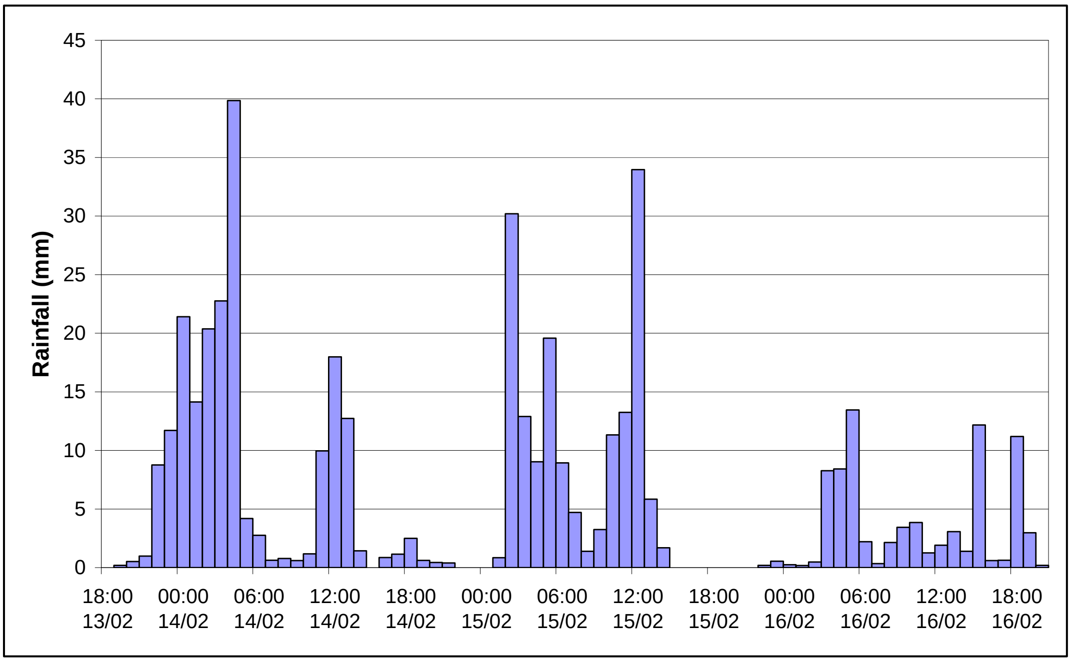


Figure 6
January 1998 Rainfall (1 Hour Intervals – Townsville AMO)



2 Available Data

Figure 7
February 2002 Rainfall (1 Hour Intervals – Townsville Alert)



2.5.2 Design Intensity Data

Design rainfall estimates were sourced from AR&R (1987, Vol. 2), based on the statistical assessment of rainfall depths undertaken by the BoM in the mid 1980's. It is recognised that large events since and the recent wetter than average wet seasons are probably affecting the Annual Exceedance Probabilities (AEP's) of the design rainfall intensities. However, in the absence of more recent data, they remain the best estimate currently available.

Townsville

Intensity Frequency Duration (IFD) input parameters determined for the Townsville floodplain area are shown in **Table 2**. Representative design rainfall intensities are presented in **Table 3** for 5, 20 & 50 Year ARI and selected durations ranging from 1 to 72 hours. It is recognised that across Townsville there is discernible variability in the IFD input parameters as described in Volume 2 of AR&R (1987), particularly in the Mount Stuart area. However, the selected parameters are considered suitable for global application across the area comprising the Townsville floodplain.

Magnetic Island

Intensity Frequency Duration (IFD) input parameters determined for Magnetic Island are shown in **Table 4**. Representative design rainfall intensities are presented in **Table 5** for 5, 20 & 50 Year ARI events and selected durations ranging from 1 hour to 72 hours. This single IFD data set was applied to all four (4) Magnetic Island bays modelled; Horseshoe Bay, Picnic Bay, Nelly Bay and Arcadia.

2 Available Data

Table 2
IFD Input Parameters for the Townsville Floodplain

Parameter	Value
Latitude (degrees S)	19°17’
Longitude (degrees E)	146°47’
1 hour, 2 year Intensity (mm/h)	55
12 hour, 2 year Intensity (mm/h)	11.7
72 hour, 2 year Intensity (mm/h)	3.85
1 hour, 50 year Intensity (mm/h)	110
12 hour, 50 year Intensity (mm/h)	24.5
72 hour, 50 year Intensity (mm/h)	9.40
Average Regional Skewness	0.05
Geographic Factor F2	3.93
Geographic Factor F50	17.1

Table 3
Design Intensities for the Townsville Floodplain

Duration	Rainfall Intensity (mm/h)		
	5 Year ARI	20 Year ARI	50 Year ARI
1 hour	72	94	112
3 hours	36.7	48.6	58
4.5 hours	28.7	38.1	45.3
6 hours	23.9	31.7	37.8
9 hours	18.7	24.9	29.7
72 hours	5.45	7.74	9.53

Table 4
IFD Input Parameters for Magnetic Island

Parameter	Value
Latitude (degrees S)	19°09’
Longitude (degrees E)	146°49’
1 hour, 2 year Intensity (mm/h)	53
12 hour, 2 year Intensity (mm/h)	11.0
72 hour, 2 year Intensity (mm/h)	3.50
1 hour, 50 year Intensity (mm/h)	112
12 hour, 50 year Intensity (mm/h)	22.5
72 hour, 50 year Intensity (mm/h)	8.80
Average Regional Skewness	0.05
Geographic Factor F2	3.93
Geographic Factor F50	17.0

Table 5
Design Intensities for Magnetic Island

Duration	Rainfall Intensity (mm/h)		
	5 Year ARI	20 Year ARI	50 Year ARI
1 hour	70	95	113
3 hours	35.1	47.0	56
4.5 hours	27.0	36.1	43.0
6 hours	22.5	30.0	35.7
9 hours	17.3	23.1	27.4
72 hours	4.98	7.20	8.92

2.5.3 Probable Maximum Precipitation (PMP)

Estimation of the Probable Maximum Flood (PMF) was required as a benchmark event for purposes of Emergency Planning and Risk Assessment. For short duration events (up to 6hrs), point rainfall estimates for the Probable Maximum Precipitation (PMP) were determined using Bulletin 53, a Bureau of Meteorology publication from 1994. These shorter duration PMP estimates are applicable to areas where the critical response time of catchments is less than 6 hours. Temporal patterns for application within runoff/routing programs were also sourced from Bulletin 53.

Magnetic Island

For Magnetic Island, separate PMP rainfall estimates were made for each bay (refer to **Table 6**), with values varying with catchment area. Typically, catchment time of concentration on Magnetic Island varies between 45 minutes and 2 hours (critical durations are highlighted bold in table), reflecting the relatively steep catchments (at least in the upper reaches).

Table 6
Short Duration PMP Rainfall Estimates for Magnetic Island

Duration	Picnic Bay (mm)	Nelly Bay (mm)	Arcadia (mm)	Horseshoe Bay (mm)
30 min	300	280	300	270
45 min	380	351	**370**	340
1 hour	**440**	410	440	400
1.5 hours	570	**530**	560	**510**
2 hours	760	705	750	690
6 hours	1070	990	1060	970

Townsville Floodplain

For the Townsville floodplain, PMP rainfall estimates were made for a representative catchment area of 10 km^2 (refer to **Table 7**). In Townsville, individual catchments range in size; however, 10 km^2 was adopted to give the worst-case result at critical locations like the Lakes detention basins. In Townsville, catchment time of concentration varies between 1 and 6 hours, and total rainfall depths are generally lower reflecting the smoother terrain.

Table 7
Short Duration PMP Rainfall Estimates for Townsville Floodplain

Duration	Townsville Floodplain (mm)
30 min	260
45 min	340
1 hour	400
1.5 hours	510
2 hours	590
6 hours	950

2 Available Data

2.6 Surge and Tide Data

2.6.1 Static Surge Modelling

Statistical storm surge heights for the Townsville Region were sourced from the Beach Protection Authority publication "Storm Tide Statistics" (January, 1985).

The levels contained in the report were developed from statistical simulation of cyclones based on 40 years of recorded data. The BPA Report includes plots of surge tide level in AHD 'vs' Average Recurrence Interval (ARI) for 8 sites around Townsville. An example of the graphs contained in the report is shown in **Figure 8**, for Pallarenda (Site 3). Based on the graphical information at each site, a set of static surge levels was determined for all the coastal sub-areas identified in the Project Brief. These are summarised for both 50 and 100 Year ARI in **Table 8** below, and were adopted for the purposes of static surge modelling.

Figure 8
Storm Tide Statistics for Pallarenda (source: BPA, 1985)

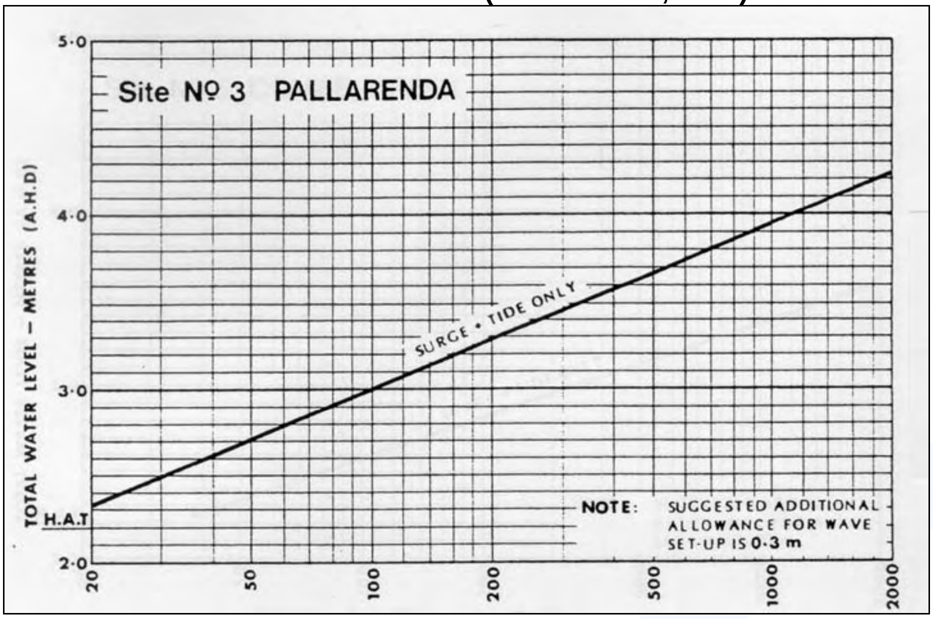


Table 8
Summary of Storm Tide Statistics for Townsville Region

Site	Name	50 Year ARI Water Level (m AHD)		100 Year ARI Water Level (m AHD)	
		Surge + Tide	Including Wave Setup	Surge + Tide	Including Wave Setup
1	Townsville	2.75	2.95	3.05	3.25
3	Pallarenda	2.70	3.00	3.00	3.30
4	Cape Cleveland	2.25	2.75	2.45	2.95
5	Combe Creek#	2.35	2.55	2.60	2.80
7	Magnetic Is. East	2.75	3.15	3.05	3.45
8	Magnetic Is. North*	2.75	2.95	3.05	3.25

Cungulla is approximately halfway between Combe Creek and Cape Cleveland.

* Adopted for Horseshoe Bay only.

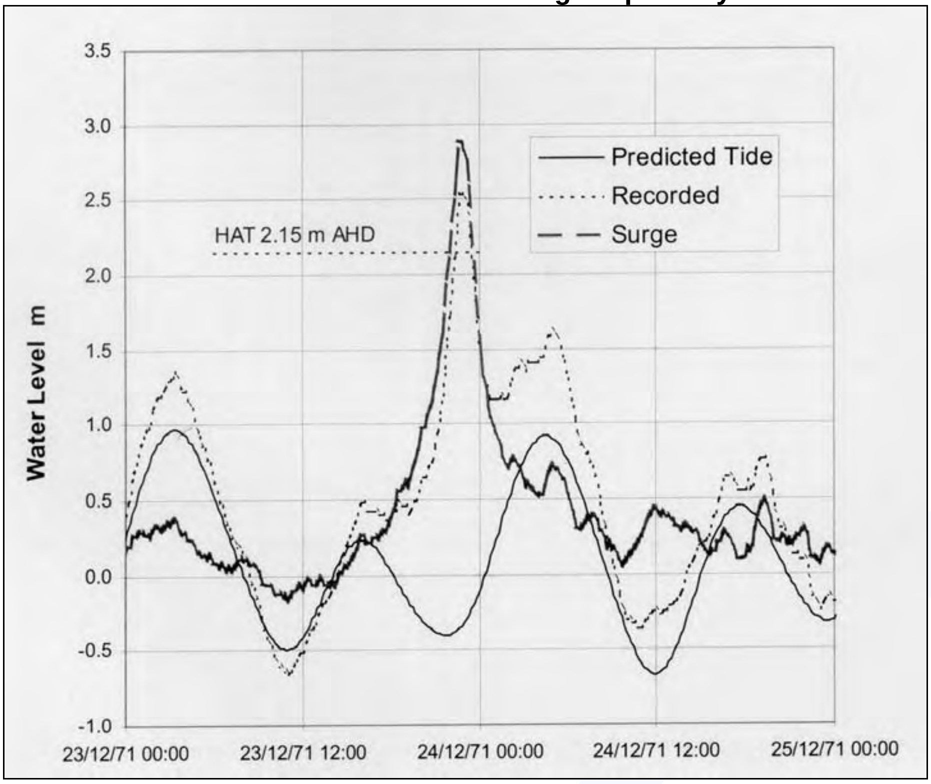
2 Available Data

The BPA report is not the latest assessment of storm surge along the Queensland coastline. In March 2001, the BoM published Stage 1 of a report titled “Queensland Climate Change and Community Vulnerability to Tropical Cyclones”, a comprehensive ocean hazards assessment. At the time of preparation of this report, Stage 2 of the BoM Study (comprising updated storm tide statistics) had not yet been released.

2.6.2 Simplified Surge Propagation Modelling

The recorded temporal pattern of tide level from Cyclone Althea was adopted as the basis for simplified surge propagation modelling. The recorded levels at Townsville harbour are shown in **Figure 9** along with the predicted tide and resulting surge amplitude (recorded minus predicted).

Figure 9
Tidal Record at Townsville Harbour During Tropical Cyclone Althea



Source: Bureau of Meteorology publication, “Queensland Climate Change and Community Vulnerability to Tropical Cyclones”, March 2001

In Althea, a surge of nearly 3 m was recorded; however, it can be seen that the peak surge was almost coincident with a low tide, and evidence suggests that there was significant attenuation of surge amplitude with distance from the point of landfall (north of Townsville near Rollingstone). The recorded level at Townsville harbour of RL 2.53 m AHD could therefore have been much worse if Althea had hit closer to Townsville or coincident with a high tide.

Using the data contained in **Figure 9**, a ‘what if’ water level time series was developed representing the peak surge coincident with a high tide (Mean High Water

Spring). This worst case scenario results in a peak water level of more than RL 4.0 m AHD, which is equivalent to a 1000 Year ARI water level based on the BPA assessment from 1985.

2.6.3 Tide Modelling

Higher than average tides cause nuisance flooding in some parts of Townsville, and can significantly reduce the efficiency of some drainage systems (like Woolcock Canal). Flood modelling was therefore undertaken for two static receiving tide conditions representing Mean High Water Spring (MHWS = RL 1.21 m AHD) and Highest Astronomical Tide (HAT = RL 2.15 m AHD) to determine the sensitivity of flood inundation levels to tidal conditions.

2.7 Historical Flood Records

2.7.1 General

As previously stated, historical flood levels in the Townsville area have been surveyed for three recent flood events; March 1990, January 1998 and February 2002.

Flood level data for the March 1990 event has been collated by Townsville City Council in the form of a plan of flooding extent (Drawing No. 45095), a copy of which is included in **Appendix A**. Following the January 1998 flood, Townsville City Council surveyed more than 200 flood levels across the city (supplied as a GIS point layer), to supplement some recorded debris levels on the weirs along the Ross River.

The February 2002 flood event occurred shortly after the Study commenced, and various data was collected, including observations made by Maunsell personnel during the event and a small number of Council surveyed flood heights (unfortunately a number of marked heights were removed before being able to be surveyed). The ALERT stream gauges at Louisa Creek, Stuart Creek and Mysterton also had continuous recordings of the event (the gauge at Aplin Weir was not operational during the 2002 flood event).

2.7.2 Stream Gauging

Continuous stream gauging records for the three operating ALERT stream gauging sites in Townsville during the February 2002 flood event were sourced from the BoM (refer to **Figure 10**, **Figure 13**, and **Figure 14**). These graphs show that the Louisa Creek and Mysterton gauges exhibit similar patterns of water level rise and fall over the nearly 4 days of record. The Stuart Creek gauge shows a completely different pattern and timing to peak, which is symptomatic of the variable rainfall experienced south of Townsville.

The stream gauging records for the February 2002 event comprise the primary calibration data set for the hydraulic modelling of 'in bank' flows. However, initial estimates of the size of the event suggests that it was approximately equivalent to a 5 Year ARI flood. Additional calibration was undertaken to the larger events of 1990 and 1998 to ensure a robust model calibration for application to the full range of design storms.

2 Available Data

Figure 10
February 2002 Stream Gauge Record – Stuart Creek Alert

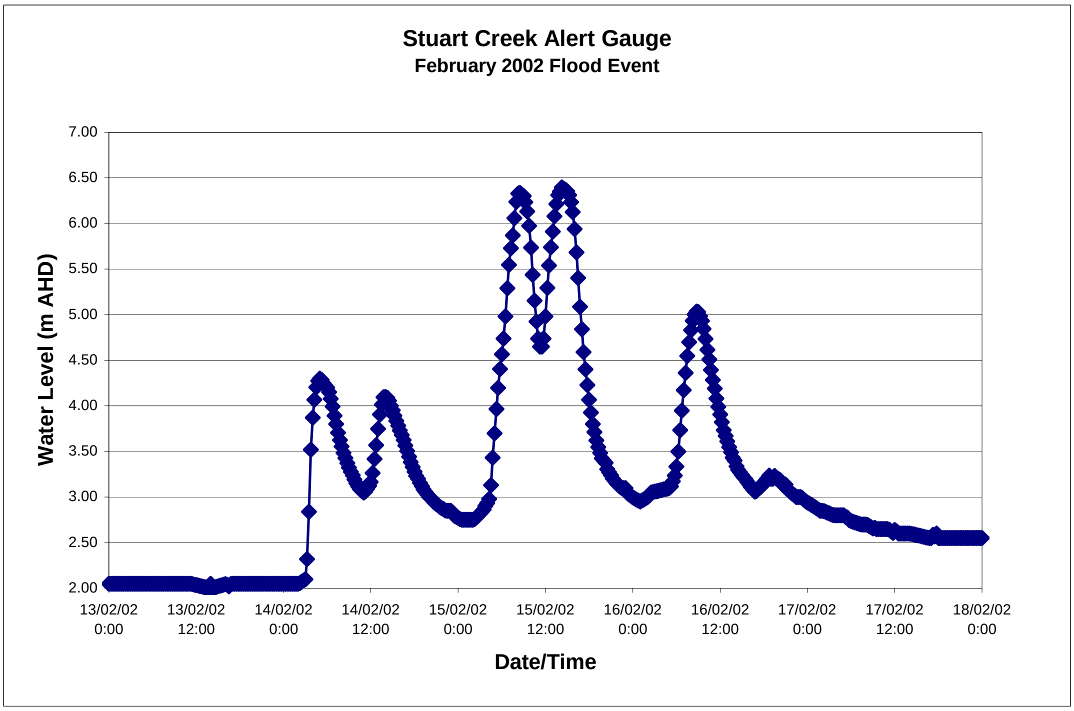
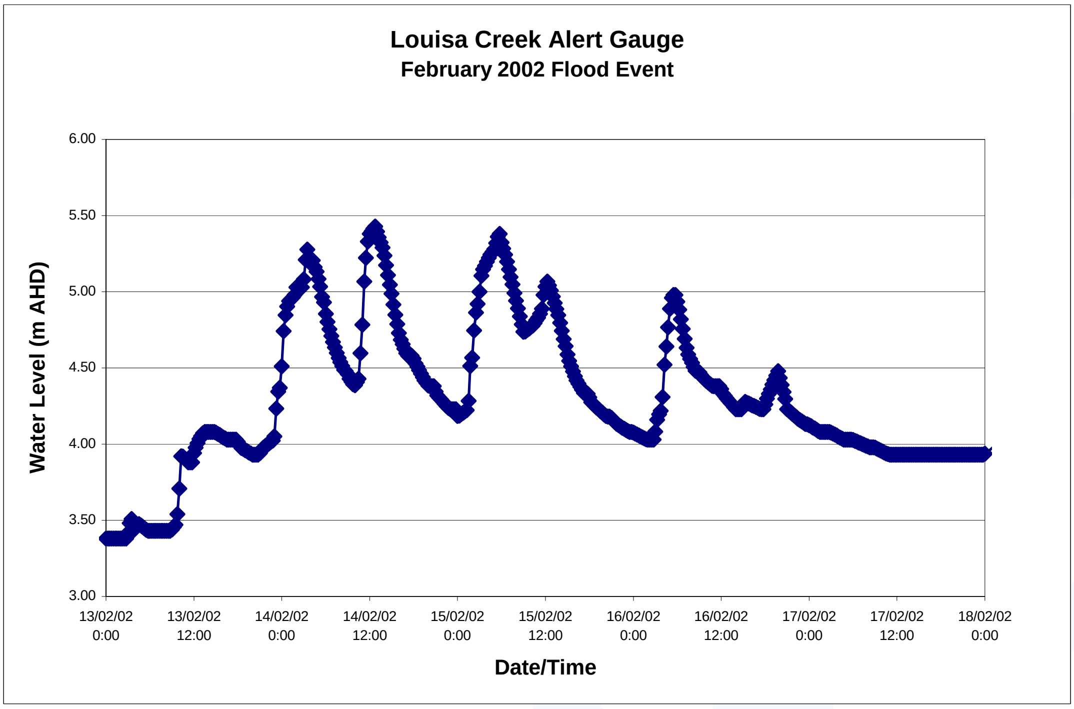
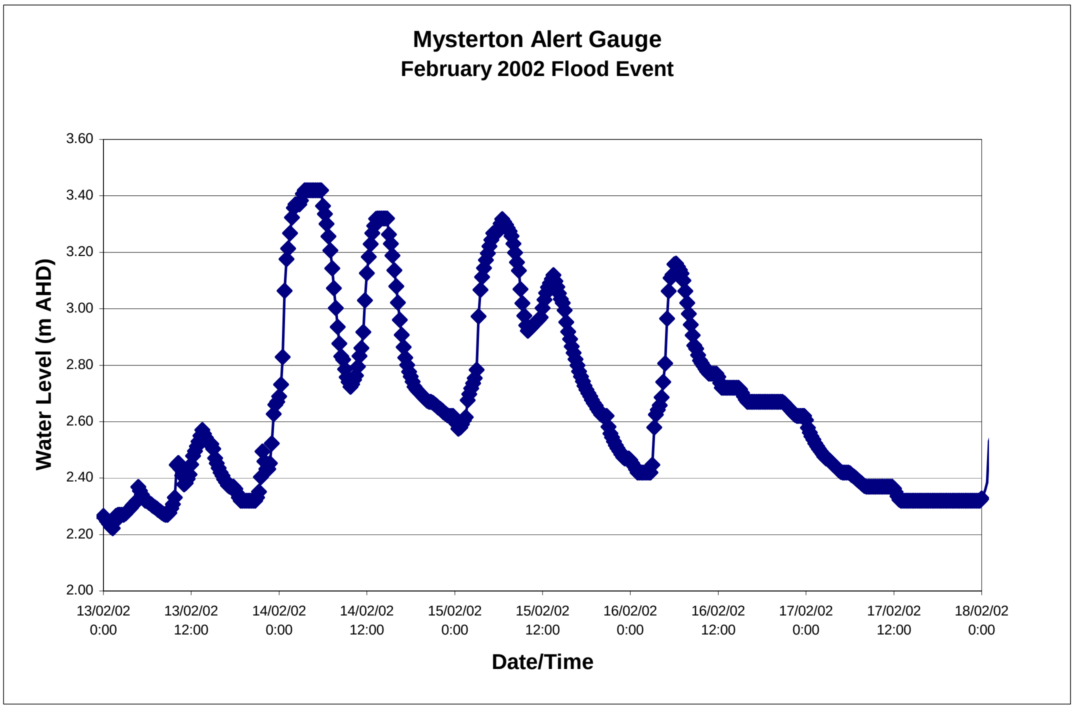


Figure 11
February 2002 Stream Gauge Record – Louisa Creek Alert



2 Available Data

Figure 12
February 2002 Stream Gauge Record – Mysterton Alert



2.7.3 Flood Questionnaire

A flood questionnaire was prepared and forwarded by Council to a target group of residents in the Townsville region to obtain additional anecdotal information and representative flood level information for recent flood events. The questionnaire requested details of historical flood events, specifically the height of floodwaters above ground or floor level, and the extent of flooding within properties (refer to **Appendix B** for a blank copy of the questionnaire).

Fifty-one (51) responses were received from residents and the information contained in these questionnaires was collated. A number of levels for both the 1998 and 2002 flood events were subsequently identified for survey, which was arranged independently by Council to supplement the 1998 flood level data set for calibration purposes. In the interest of confidentiality, surveyed flood levels are not presented for individual locations or addresses.

2.8 Previous Studies

2.8.1 Townsville Port Access Hydraulic Assessment (2000)

Halliburton KBR Pty Ltd (previously Kinhill Pty Ltd) prepared this study in 2000. The study was undertaken for Queensland Transport to investigate the potential impacts of constructing a road/rail corridor across the tidal flats southeast of Ross River.

Hydrologic estimates were prepared using the runoff-routing software RORB. A two-dimensional hydraulic model was developed for the study area using the software DELFT-FLS, covering an area of approximately 46 km^2 and bounded by Bowen Road Bridge to the west, Bruce Highway to the south, Boundary Street to the north and Cleveland Bay to the east.

The model was calibrated for tidal inundation and flood inundation using recorded flood heights from January 1998. Outputs from the Halliburton Study of relevance to the current study included mapped inundation extents for calibration and design events, and calibrated roughness values for vegetation types on the floodplain. Peak discharge results are presented in **Table 9** for several key locations for the 100 Year ARI design flood event.

Table 9
100-Year ARI Results – Townsville Port Access Study

Location	Catchment Area (km^2)	100 Year ARI Peak Flow (m^3/s)	Critical Storm Duration
Ross River at Bowen Road Bridge	47*	826	72 hours
Annandale Drain at outlet to Ross River	12	230	3 hours
Gordon Creek u/s Stuart Drive	6.7	173	3 hours

* Area does not include catchment of Ross River Dam

2.8.2 Kirwan-Bohle Drainage Diversion, Louisa Creek Flood Study (1999)

The Louisa Creek Flood Study combined several studies that were undertaken by McIntyre & Associates Pty Ltd to assess flooding in Louisa Creek, using both RORB and HEC-RAS. Hydrology results from this study were used to verify the RAFTS model flows generated in Louisa Creek for a range of design events. The peak discharge results from the previous assessment of hydrology in Louisa Creek are reproduced in **Table 10**, at Bayswater Road for a 2-hour duration storm using runoff coefficients of between 0.76 and 0.92.

Table 10
Peak Discharge Results – Louisa Creek Flood Study

Design Event	Peak Discharge (m^3/s)
5 Year ARI	61.0
20 Year ARI	88.5
50 Year ARI	114.6

2.8.3 Stuart Creek Flood Study (1997)

Maunsell undertook a study of the Stuart Creek design flows in October 1997. The report, titled "Stuart Creek Flood Study" was commissioned by Queensland Rail and involved detailed RORB modelling of the Stuart Creek catchment upstream of the Bruce Highway (an area of approximately 60 km^2). **Table 11** presents the RORB peak discharge for the 6-hour design event (20, 50 and 100 Year ARI) at the Bruce Highway.

Table 11
Peak Discharge Results – Stuart Creek Flood Study

Design Event	RORB Peak Discharge (m^3/s)
20 Year ARI	401
50 Year ARI	497
100 Year ARI	583

2.8.4 Bohle River Floodplain Management Study (2000)

This study by Maunsell McIntyre Pty Ltd was commissioned by Thuringowa City Council to establish flood mitigation strategies necessary to ensure acceptable flood immunity for existing and future development, including development limits adjacent to the Bohle River.

The hydraulic modelling of the Townsville floodplain involved building on the model developed for the Bohle River Floodplain Management Study such that the influence of flooding in the adjacent Bohle River could be accounted for. It is known that the Bohle River overflows to Louisa Creek near the intersection of Dalrymple Rd and Thuringowa Drive in larger flood events, and that flood levels in the tidal reaches of the Bohle River influence tailwater conditions in the Town Common area.

The Bohle River MIKE11 model was run for the same range of events as for the Townsville modelling, and the overflow hydrographs extracted at the overflow location for insertion as point sources into both MIKE11 and MIKE21 models of the Townsville floodplain. The Bohle River has a critical duration at Dalrymple Road of 6 hours, and the peak discharge overflowing to Louisa creek is presented in **Table 12**.

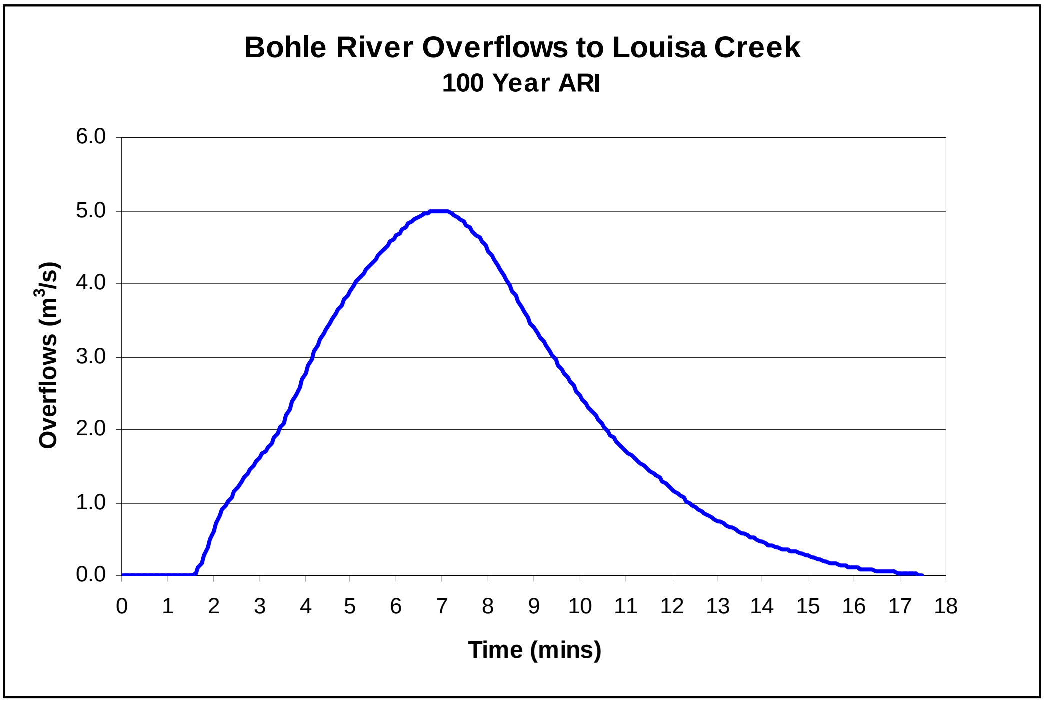
Table 12
Peak Discharge Results – Bohle River Overflows to Louisa Creek

Design Event	MIKE11 Peak Discharge (m^3/s)
2 Year ARI	-
5 Year ARI	-
10 Year ARI	-
20 Year ARI	2.53
50 Year ARI	3.68
100 Year ARI	5.00
PMF	429

The shape of the overflow hydrograph is shown in **Figure 13** (consistent shape was observed for all ARI's modelled, even the PMF).

2 Available Data

Figure 13
100-Year ARI Overflow Hydrograph from Bohle River



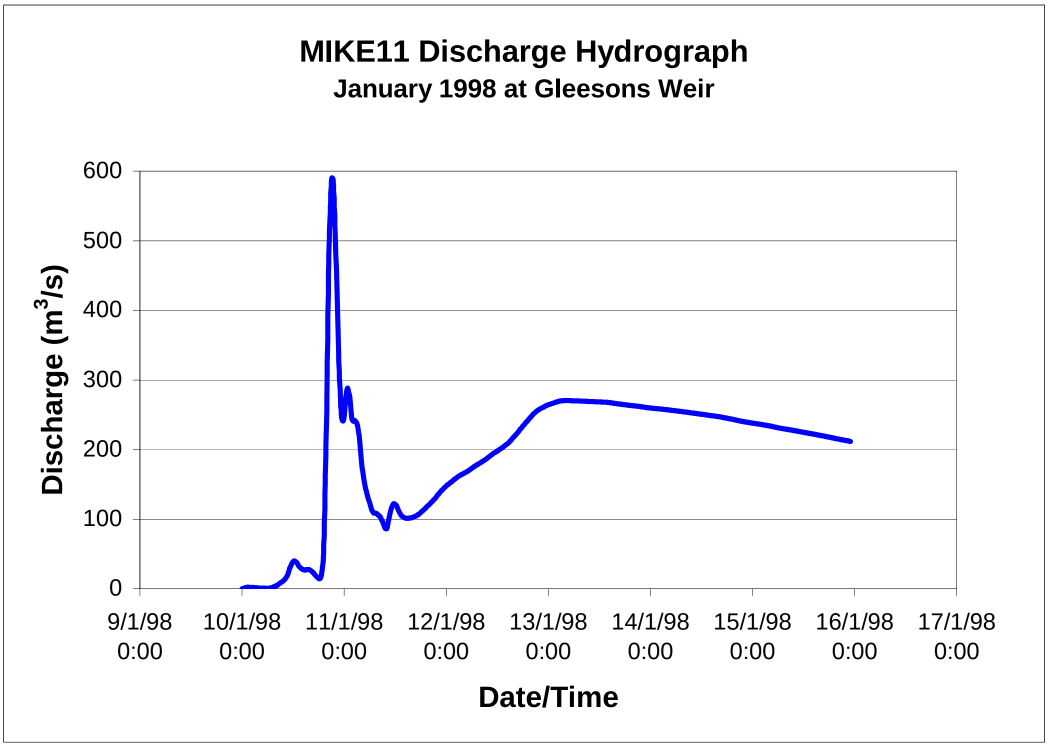
2.8.5 Ross River Dam Design Hydrology (2003)

Sinclair Knight Merz is currently reviewing the hydrology of Ross River Dam to account for the changes introduced by the CRC-Forge method, and possible upgrade of the Dam. Whilst this report is not finalised, preliminary results suggest that the impact of spillway discharges on local catchment flooding in Ross River (catchment downstream of the Dam) is not significant.

Whilst many of the drainage paths in Townsville empty into the Ross River and their performance is affected to varying degrees by the tailwater conditions experienced, the time to peak of the local catchment and flows from the Ross River Dam are very different. This was the case in January 1998, when the local catchment downstream of the Dam produced a peak discharge in the river of approximately 600 m^3/s at Gleesons Weir, and spillway discharges from the Ross River Dam peaked at approximately 260 m^3/s more than 2 days later. The differences in discharge characteristics (and magnitude) between the 'local' catchment and spillway releases during the January 1998 event are shown in **Figure 14**.

2 Available Data

Figure 14
January 1998 Discharge Hydrograph at Gleesons Weir



The 1998 assessment of Ross River Dam hydrology (also undertaken by Sinclair Knight Merz) reported the 100 Year ARI peak spillway discharge to be 390 m^3/s. Under possible upgrade scenarios being considered for the Dam, this estimate could increase to 650 m^3/s. This increased estimate is similar to that expected from the local catchment and considering the predicted lag for spillway flows, coincident 'local' catchment and spillway releases were not modelled. This scenario is believed to be highly unlikely and introduces issues of joint probability much rarer than 1 in 100 years, which is beyond the scope of this study.

2.8.6 Ross River Dambreak Studies

In 1990, Sinclair Knight Merz produced inundation maps for various Dambreak scenarios for Ross River Dam. Maunsell is currently updating the Dambreak modelling for NQ Water, however, inundation mapping was not finalised at the time of preparation of this report. In the context of Disaster Risk Management, consequences from Dambreak upstream of a large population centre should be considered. However, assessment of Dambreak is beyond the scope of this investigation.

3 Hydrology Modelling

3 Hydrology Modelling

3.1 Modelling Tools

Hydrologic modelling is the process of determining runoff generated from rain falling on a catchment. Factors affecting the volume and peak of runoff generated include:

- size and slope of the catchment and adjoining channels;
- the level of development (fraction impervious) and types of catchment land use;
- the condition of the catchment (dry or saturated) at commencement of the rainfall;
- intensity and temporal pattern of the rainfall; and
- the ability of the catchment and other features to store runoff.

Simplistic methods exist to estimate the amount of runoff from a catchment (i.e. peak flow methods like the Rational Method). However, with large and complex catchments, the use of modelling software is required to accurately predict their response to rainfall over time and the interaction between sub-catchments.

For this Study, the RAFTS hydrologic model was adopted. RAFTS is a runoff/routing modelling program similar to other commercially available programs such as URBS and RORB, and is the industry bench mark for catchments of this nature, a mix of urban and rural (undeveloped). Each node in RAFTS represents a sub-catchment, with individual parameters reflecting catchment data as listed above. The nodes are connected by links with an associated lag time, reflecting the length or grade of a channel between inflow locations.

In Queensland, the preferred loss model in RAFTS is the Initial Loss / Continuing Loss model. This loss model assumes an Initial Loss (in millimetres) at commencement of a rainfall event (representing the state of the catchment and its ability to absorb rainfall), and a uniform Continuing Loss (in millimetres/hour) for each hour after commencement. Different loss models are typically applied to different land use types (urban and undeveloped), and assigning fraction impervious for developed areas results in significantly different catchment response.

The following sections outline in more detail the results of the hydrology investigations, including the process undertaken and assumptions made, for each of the specific areas assessed.

3 Hydrology Modelling

3.2 Magnetic Island

3.2.1 Catchment Analysis

Magnetic Island comprises four main bays; Picnic Bay, Nelly Bay, Arcadia (Geoffrey and Alma Bays) and Horseshoe Bay. The bay catchments all exhibit steep forested zones within the upper reaches, and relatively flat residential areas towards the bottom of the catchment. Typical of tropical islands in Northern Queensland, a significant proportion of the catchments are covered in thickly wooded bushland and eucalyptus forest.

Impervious areas (roads, car parks, rooftops, etc) represent only a small proportion of the total catchment area. Horseshoe Bay, the largest of the four bays and the least populated, has a large area of designated swampy land that performs a major storage/detention function.

Each of the four separate catchments was broken into sub-catchments based on natural topographic relief; Council-supplied pipe network maps and comprehensive site investigations were also undertaken. Each sub-catchment was entered into RAFTS with its own set of catchment parameters. The selection and density of sub-catchments reflects the complexity of the drainage system, and the requirement to obtain hydrographs at all key drainage locations to be included in the hydraulic modelling.

The range of values adopted for each catchment parameter, for each of the four bay catchments is detailed in **Table 13** below. In general, adopted Manning's 'n' roughness values ranged from 0.025 for roads to 0.150 for thick forest. Picnic Bay has the highest proportion of impervious (developed) area compared to the whole of catchment (12%), and Nelly Bay has the steepest average slope (28%). Catchment maps for each of the four Magnetic Island catchments are contained in **Appendix C**.

Table 13
Ranges for Catchment Parameters in RAFTS Models of Magnetic Island

Catchment	Parameter	Sub-Catchment Minimum Value	Sub-Catchment Maximum Value	Catchment Average Value
Picnic Bay	Area (ha)	3.76	22.87	8.69
	Slope (%)	0.6	31.4	19.9
	Impervious Fraction (%)	0	40.0	12.0
	Catchment Roughness (n)	0.025	0.100	0.074
Nelly Bay	Area (ha)	3.68	68.6	21.9
	Slope (%)	0.9	40.0	28.0
	Impervious Fraction (%)	0.0	36.0	3.9
	Catchment Roughness (n)	0.025	0.100	0.097
Geoffrey and Alma Bays (Arcadia)	Area (ha)	1.99	41.30	10.62
	Slope (%)	2.0	44.0	22.8
	Impervious Fraction (%)	0.0	32.0	7.1
	Catchment Roughness (n)	0.025	0.100	0.087
Horseshoe Bay	Area (ha)	2.9	63.30	24.75
	Slope (%)	0.07	43.3	19.0
	Impervious Fraction (%)	0	40.0	1.0
	Catchment Roughness (n)	0.025	0.150	0.097

3.2.2 Adopted RAFTS Loss Models

For Magnetic Island, various Initial Loss/Uniform Continuing Loss models were adopted. For the majority of the undeveloped areas, an Initial Loss (IL) value of 25 mm was assumed, with a Uniform Continuing Loss (CL) of 2.5 mm/h. These values are consistent with the acceptable range recommended in AR&R (1998) for Queensland catchments, and have been widely applied to similar catchments in North Queensland. For the impervious portion of the catchment, an alternative set of loss parameters were adopted, namely IL = 1 mm and CL = 1 mm/h.

An alternative loss model was adopted for some small catchments on the coastal foreshore. Inspection of aerial photography and observations made in the field suggested that porous dunal sediments were underlying some areas near the beach. To represent the greater losses to ground expected in these areas, loss parameters of IL = 50 mm and CL = 5 mm/h were applied.

3.2.3 RAFTS Model Verification

No stream gauging information was available for Magnetic Island, making calibration of the RAFTS model impossible. However, verification of the model results was possible using peak flow methods like the Rational Method, for catchments identified as having minimal channel storage. Another method of verification involves checking flows against key drainage structures (i.e. culverts), theoretically designed for flows of a given Average Recurrence Interval (ARI). However, this method was not adopted due to insufficient data.

The Rational Method was first used to determine if the assumed value of channel flow velocity in RAFTS (between nodes) was accurate. Typically, a uniform channel velocity is assumed to determine the link time (in minutes) between nodes in RAFTS, based on the distance between the outlets of successive sub-catchments. It is recognised that channel velocity will vary with slope and vegetative state, as well as non-linearly with discharge. However, it is considered acceptable practice to adopt an average or uniform value where these factors do not vary considerably across the catchment being modelled.

A separate assessment of the Time of Concentration (t_c) for each bay was undertaken, based on the entire catchment contributing to the beach outfall location of the larger creeks. The modified Bransby-Williams formula was used:

$$t_c = \frac{58.5L}{A^{0.1}S^{0.2}}$$, where

L = mainstream length (km);
A = catchment area (km^2); and
S = mainstream slope (m/km).

It was found that to achieve similar timing to peak between the RAFTS hydrograph and the Rational Method approximation at this location, an average channel velocity in RAFTS of 0.7 m/s was required for all bays except Picnic Bay, which required an average channel velocity in RAFTS of 0.5 m/s. These values are within the acceptable range of 0.3 to 0.7 m/s presented in Australian Rainfall & Runoff (AR&R,

1998), and reflects the relatively steep grade of catchments and drainage paths within the Study Area.

Comparisons have been made between the Rational Method and RAFTS for each bay for both 5 and 50 Year ARI (refer to **Table 14**). For the Rational Method computations, a runoff coefficient of 0.70 was adopted for the 5 Year ARI calculations and 0.80 for 50 Year ARI calculations. These values were based on methodology presented AR&R (1998) for catchments with similar grade and land use, and are consistent with the general trend for runoff coefficients to increase with ARI. For Horseshoe Bay, lower runoff coefficients of 0.6 and 0.7 were adopted for 5 and 50 Year ARI respectively.

Table 14
Comparison of Peak Flows from RAFTS and Rational Method

Catchment Description	Peak Discharge (m^3/s)					
	5 Year ARI			50 Year ARI		
	Rational Method	RAFTS	Discrepancy	Rational Method	RAFTS	Discrepancy
Picnic Bay: Main Unnamed Gully	10	12	20.0%	22	23	4.6%
Nelly Bay: Gustav Creek at Sooning Street	69	66	-4.3%	127	128	0.8%
Geoffrey Bay: Petersen Creek at Marine Parade	21	26	23.4%	38	42	10.5%
Horseshoe Bay: Main Unnamed Gully	35	34	-2.9%	66	69	4.6%

It can be seen that the RAFTS results are consistently within ±25% of the Rational Method estimates, with the average error closer to 9% (for the limited sample of locations presented). The results suggest that the RAFTS flows are of the correct order of magnitude (slightly conservative), and validate the selection of catchment parameters and losses in the RAFTS model.

3.2.4 Design Modelling

A range of design event durations was run through the RAFTS model to determine the critical duration event for individual catchments within each bay. Consistently, it was found that the critical duration event was between 45 minutes and 2 hours, depending on the ARI and the size of catchment being assessed. This highlights that the populated areas are susceptible to short duration, high intensity (flash) flooding.

The storm events that produced the worst overall result for each of the four bays are provided in **Table 15** below. Design event results are reported for the critical durations listed for various key locations within each catchment (refer to **Table 16**).

3 Hydrology Modelling

Table 15
Critical Duration Events for Magnetic Island

Catchment	Storm Duration
Picnic Bay	1.0 hr
Nelly Bay	1.5 hrs
Geoffrey and Alma Bays (Arcadia)	45 mins
Horseshoe Bay	1.5 hrs

Table 16
RAFTS Peak Discharge Results For Key Locations on Magnetic Island

Bay	Location	Peak Discharge (m^3/s)						
		2 Yr ARI	5 Yr ARI	10 Yr ARI	20 Yr ARI	50 Yr ARI	100 Yr ARI	PMF
Picnic Bay	Unnamed Creek at Birt Street	14.3	19.5	22.0	26.0	31.1	34.7	166.2
	Unnamed Creek at Outlet	19.2	26.4	29.6	35.2	42.1	47.5	223.4
Nelly Bay	Gustav Creek at Elena St	32.3	56.0	70.0	89.2	109.0	127.4	462.3
	Gustav Creek at Sooning Street	38.7	66.4	82.5	104.2	128.4	149.7	576.4
Geoffrey Bay	Petersen Creek at Hayles Avenue	14.3	19.5	22.0	26	31.1	34.7	166.2
	Petersen Creek at Marine Parade	19.2	26.4	29.6	35.2	42.1	47.5	223.4
Horseshoe Bay	Endeavour Creek at Beach Outlet	46.6	78.7	96.7	120.6	151.3	176.3	733.4
	Swamp Crossing of Horseshoe Bay Rd	17.7	30.1	37.3	48.0	60.0	70.7	278.0

Hydrographs for each sub-catchment were exported in a format suitable for input to the MIKE11 hydraulic model. Results of the hydraulic modelling of Magnetic Island are provided in **Section 4**.

3.3 Townsville Flood Plain

3.3.1 Catchment Analysis

The local government area of Townsville is mostly located on the Ross River floodplain (also known as the Townsville coastal plains). The Study Area, which is generally the mainland urbanised area of Townsville and its contributing catchments, can be characterised as being mostly very flat with substantial areas of urbanisation. A number of watercourses drain the area, the more significant being Ross River, Stuart Creek, Gordon Creek, Mindham Park Drain, Ross Creek, Rowes Bay Canal and Louisa Creek.

The Ross River is the largest watercourse in the Study Area; however, flows in Ross River are regulated by the Ross River Dam, located more than 10 km upstream of the Townsville City boundary. Prior to construction of the dam in the early 1970s, riverine flooding was a major problem for Townsville, however, that risk has now been greatly reduced. The catchment of the Ross River downstream of the Dam is mostly comprised of the west and north slopes of Mount Stuart on the right bank, with some urbanised areas (namely the suburbs of Douglas and Annandale). Minimal inflows are received from the left bank since the left bank is perched for most of its length. Gordon Creek and Stuart Creek join the Ross River near to its mouth, and the lower tidal floodplain comprises large areas of saltpan and mangrove stands.

The catchment of Stuart Creek is predominantly non-urbanised. The upper part of the catchment is bounded on most sides by mountain ranges, made up by the east flank of Mount Stuart and also Mount Elliot. The catchment varies from steep and forested, to flatter areas that are lightly forested, with the lower reach very flat and meandering through mangroves and saltpan. The suburbs of Stuart and Roseneath are located within the catchment.

The Gordon Creek catchment extends from the northern slopes of Mount Stuart and includes the suburbs of Wulguru, Idalia and Oonoonba. The lower catchment is low-lying and has substantial areas of saltpan and mangroves, with increasing areas being reclaimed for urban development, namely the Fairfield Waters development.

A significant portion of the Townsville urbanised area drains towards Ross Creek. The natural catchment area includes the suburbs of the city, West End, Hyde Park, Hermit Park, Mysterton, Mundingburra, Pimlico, Gulliver, Currajong, Aitkenvale, Vincent and Cranbrook, as well as parts of many other suburbs. The catchment is almost fully urbanised, with the only notable non-urbanised part being the southern slope of Castle Hill. Apart from Castle Hill, the entire catchment is very flat, with typical slopes of less than 0.5%.

A major drainage path within the Ross Creek catchment is the Mindham Park drain. Mindham Park drain is generally a wide, grassed swale that acts as a series of cascading detention basins due to a number of road crossings. Another noteworthy aspect of the Ross Creek catchment is the lack of defined overland drainage paths. Large areas (including whole suburbs) are serviced only by a limited capacity pipe network, with no nearby drainage paths for surcharge flows. This has meant that many suburbs within the catchment are susceptible to local flooding.

3 Hydrology Modelling

Council has undertaken works in the past to alleviate local flooding problems by diverting stormwater via pipes towards either Ross River or Louisa Creek, usually in a direction opposite to the natural fall of the land. As a result, large portions of the suburbs of Cranbrook, Aitkenvale, Vincent and Mundingburra have their primary drainage directed towards other watercourses. Another feature of the Ross Creek catchment is the Lakes and Woolcock Canal system. Two man-made lakes provide some stormwater detention benefits, with outflows conveyed by concrete-lined canal to Ross Creek.

Rowes Bay Canal (also known as Captain's Creek) drains parts of the suburbs of West End, Garbutt and the majority of Belgian Gardens. In addition to these urbanised areas, the catchment is also made up of the western and northwestern slopes of Castle Hill and the undeveloped low-lying areas near the airport. The canal is bounded by levee banks along its lower reach, and is an outlet for overflows from the Woolcock Lakes system during major flood events.

The Louisa Creek catchment includes the urbanised areas of Heatley, Mount Louisa, Bohle and parts of Garbutt. The catchment ranges from the steep and forested slopes of Mount Louisa, to the gently sloping forested and urbanised lower slopes, to the flat floodplain and swampy Town Common area that Louisa Creek discharges to. Significant areas of the suburbs within the catchment are serviced only by pipe network. Historically, Louisa Creek was reported to receive overflows from the Bohle River during major flood events, however, this is considered less likely to occur now that the floodplain between Bohle River and Louisa Creek (south of Mount Louisa) has been developed.

For the purposes of this study, Council supplied its own sub-catchment breakdown of the urbanised Townsville area as a GIS layer. These sub-catchment boundaries appear to have been defined based on the stormwater pipe network. In some areas, these were not in agreement with the topography, particularly in the Ross Creek catchment where stormwater has been diverted to Ross River and Louisa Creek via pipes. Since overflows from these diversion pipes would still act to follow the natural fall of land, the definition of the catchment areas was found to be complicated in areas.

Generally, the catchment areas for each watercourse were defined with respect to the primary drainage system (i.e. the pipe network). The Council-defined catchments were reviewed and adjusted based on field observations, inspection of ground contours and the pipe schematisation. Generally, alterations that were made were combining smaller catchments into larger catchments for simplicity, the inclusion of natural topographic boundaries so that overflows could be modelled, and the output of hydrographs at required locations, such as upstream of major road crossings. It was also necessary to define sub-catchments for the non-urbanised areas of the slopes of Mount Stuart, the Stuart Creek catchment and Mount Louisa.

The general details for each catchment are given in **Table 17**, while average characteristics of sub-catchments for each catchment (based on the primary drainage network) are shown in **Table 18**. Catchment maps for the Townsville floodplain are contained in **Appendix C**.

3 Hydrology Modelling

Table 17
Summary of Sub-Catchments for Townsville Floodplain

Catchment	Catchment Area (ha)	No of Sub-Catchments
Ross River	6,686	121
Stuart Creek	6,506	25
Gordon Creek	2,078	55
Ross Creek	1,983	94
Rowes Bay Canal	729	22
North Ward*	371	21
Louisa Creek	1,392	62
Northern Slopes of Mount Louisa*	1,262	37
Total	**21,007**	**437**

* Numerous drainage paths

Table 18
Ranges for Catchment Parameters in RAFTS Models of Townsville Floodplain

Catchment	Parameter	Sub-catchment Minimum Value	Sub-catchment Maximum Value	Catchment Average Value
Ross River	Area (ha)	6.68	269.89	55.26
	Slope (%)	0.05	16.3	6.99
	Impervious Fraction (%)	0	60	10.2
	Catchment Roughness (n)	0.025	0.08	0.064
Stuart Creek	Area (ha)	44	503.3	260.25
	Slope (%)	0.06	15	3.78
	Impervious Fraction (%)	0	7.5	0.2
	Catchment Roughness (n)	0.025	0.08	0.070
Gordon Creek	Area (ha)	5.05	256.3	37.79
	Slope (%)	0.1	17.8	4.55
	Impervious Fraction (%)	0	40	7.7
	Catchment Roughness (n)	0.025	0.08	0.054
Ross Creek	Area (ha)	2.42	100.45	21.10
	Slope (%)	0.1	10	1.16
	Impervious Fraction (%)	0	70	35.3
	Catchment Roughness (n)	0.025	0.045	0.035
Rowes Bay Canal	Area (ha)	2.27	127.36	33.14
	Slope (%)	0.1	8.5	1.96
	Impervious Fraction (%)	0	60	20.5
	Catchment Roughness (n)	0.025	0.05	0.042
North Ward	Area (ha)	4.5	47.4	17.66
	Slope (%)	0.47	21	6.63
	Impervious Fraction (%)	14	57.6	32.1
	Catchment Roughness (n)	0.025	0.06	0.039
Louisa Creek	Area (ha)	4.22	147.41	22.45
	Slope (%)	0.08	11.3	1.07
	Impervious Fraction (%)	0	50	21.9
	Catchment Roughness (n)	0.025	0.07	0.044
Northern Slopes of Mount Louisa	Area (ha)	5.06	122.77	34.10
	Slope (%)	0.11	11.5	2.14
	Impervious Fraction (%)	0	40	5.3
	Catchment Roughness (n)	0.025	0.07	0.057

3.3.2 RAFTS Model Calibration and Verification

Calibration generally involves fitting parameters to reproduce a recorded flow pattern, and then verification is undertaken by checking model performance using these parameters against another recorded event. For RAFTS, calibration is generally achieved by varying the values of initial loss and continuing loss, although the storage coefficient used in the storage-discharge relationship may also be adjusted.

Ideally, the stream gauging stations from which data is available have had a rating curve developed, which provides a conversion from measured stream heights to stream flow. Stream height data was available for one flood event, February 2002. However, due to the relatively recent installation of these gauges, none of the gauges for which data was available have had a rating curve developed for the site. Therefore, the measured stream heights were unable to be converted to flows. Unfortunately, the Aplin Weir gauge (for which a conversion could have been undertaken using the weir parameters developed in previous hydraulic studies), was not operational during the February 2002 event.

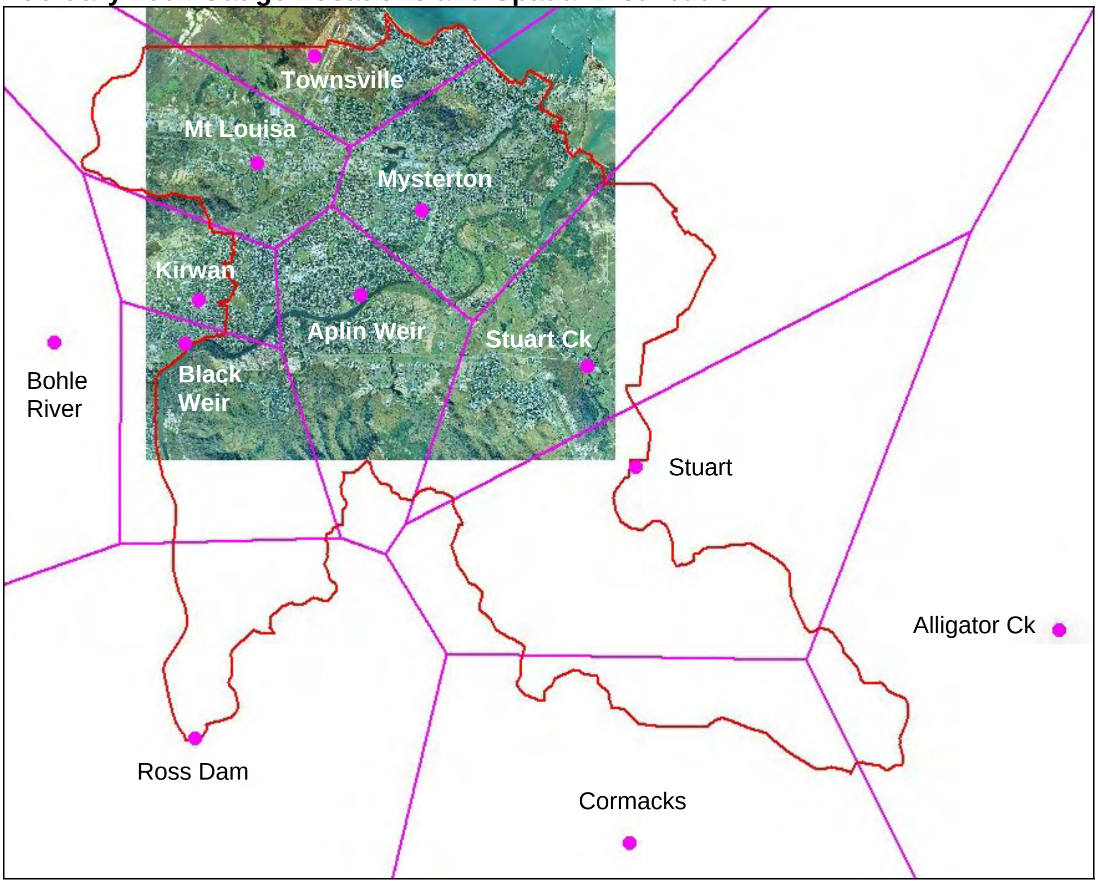
It is preferable for the hydrologic and hydraulic components of the study to be calibrated individually, as a number of combinations of flow rates and channel configurations might result in the same peak flood level estimate. However, due to the lack of rating curves for the 2002 flood records, and the format of the calibration data for the 1998 and 1990 events (levels only), a joint hydrologic/hydraulic calibration was the only option available. Some details of the calibration process for the hydrologic model are discussed below (specifically rainfall inputs), however, a more comprehensive discussion is provided in **Section 4**.

The February 2002 event was used as the primary calibration event, with January 1998 and March 1990 events used for verification. In February 2002, with the installation of the ALERT network, pluviograph data was available for in excess of one dozen gauges in and around Townsville City (refer to **Table 1** for the gauges used in this study). For the January 1998 and March 1990 events, the Townsville Airport gauge provided the only pluviograph record for the event. Daily rainfall totals (24 hours to 9 am) were recorded at a number of locations throughout the city during both events (refer to **Table 1**). Using a pro-rata basis of these daily totals compared with the total recorded at the Townsville Airport, synthetic pluviograph records were developed for each location where daily totals were recorded.

The spatial and temporal variability of rainfall across the Townsville region can be significant. Pluviograph inputs were assigned to each sub-catchment using the method of Thiessen’s polygons. In this approach, the areas closest to each rainfall gauge adopt the rainfall recorded at that gauge. While this method results in constant rainfall regions with discontinuities between regions, it was seen as the preferred method of interpolation as it does not involve ‘smoothing’ of the pluviograph peaks and troughs in the regions between gauges. The station locations and catchment allocation for the 2002, 1998 and 1990 events are shown in **Figure 15**, **Figure 16** and **Figure 17** respectively.

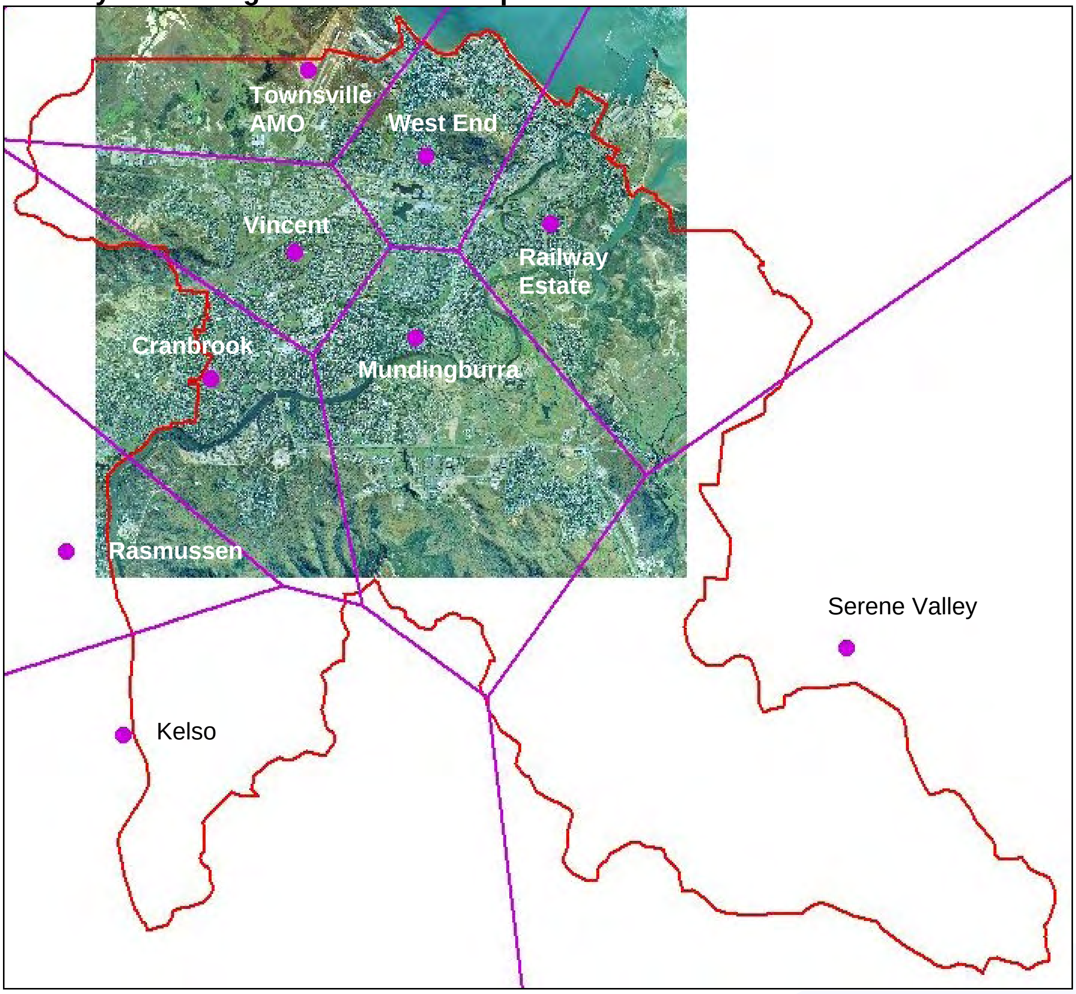
3 Hydrology Modelling

Figure 15
February 2002 Gauge Locations and Spatial Distribution



For the February 2002 flood event, a variable initial loss value was adopted across the Townsville area in order to provide the best match at the various gauging locations (refer to **Section 4** for more detail). For the southern predominantly rural catchments of Stuart Creek and Ross River, an initial loss value of 100 mm was adopted, with 60 mm adopted north of Mount Stuart (standard continuing losses of 2.5 mm/h were adopted throughout). The February 2002 flood event was considered a 'drought breaker' for the city. It occurred after a prolonged dry period that had caused even semi-permanent wetlands, such as the one erected at the Pony Club, adjacent to the Bowen Road Bridge, to dry up.

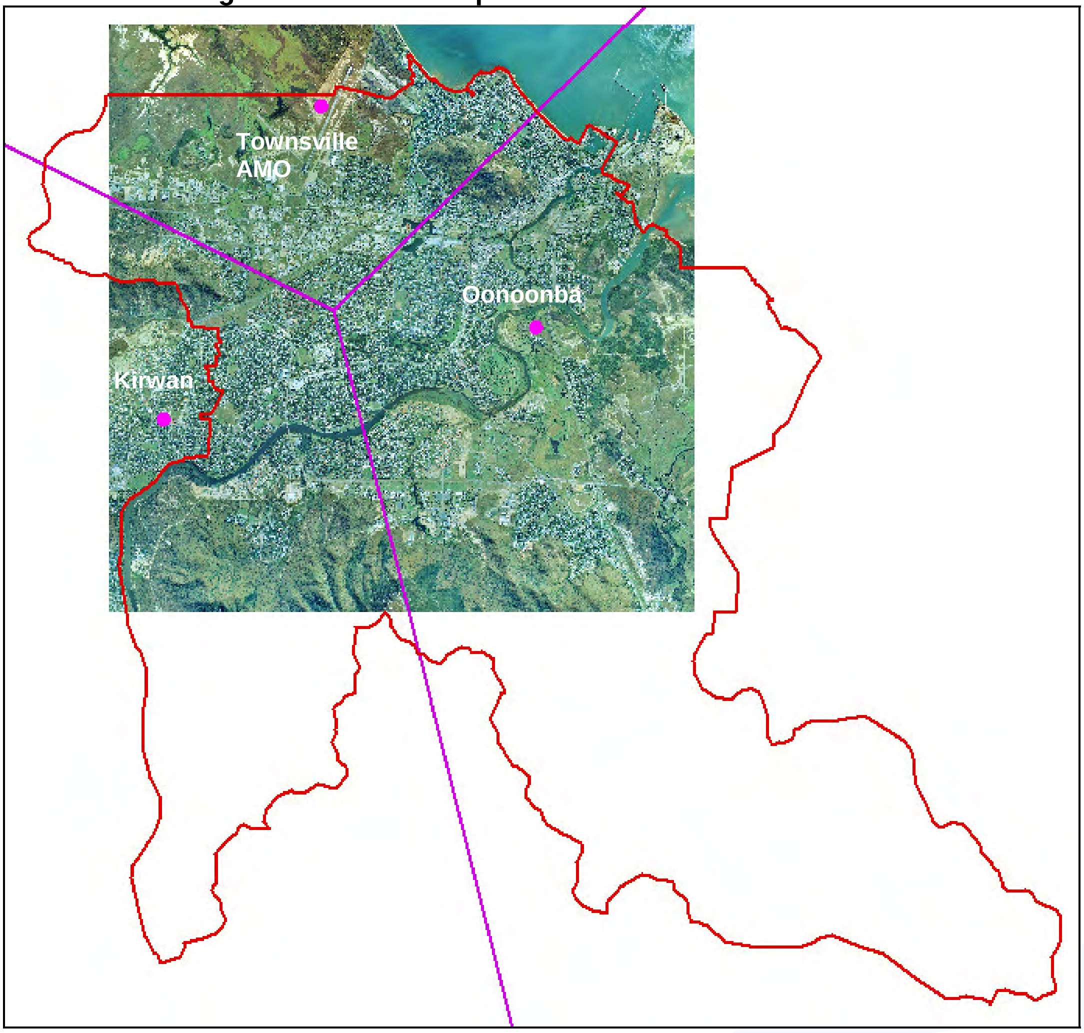
Figure 16
January 1998 Gauge Locations and Spatial Distribution



For the January 1998 flood event, the adopted simulation period of heavy rainfall started after a day of light intermittent rainfall that resulted in a wet catchment at the start of the event. Accordingly, an initial loss of 0 mm gave a good match with the recorded stream gauging (refer to **Section 4** for more detail). Standard continuing losses of 2.5 mm/h were also adopted for the January 1998 flood event.

3 Hydrology Modelling

Figure 17
March 1990 Gauge Locations and Spatial Distribution



For the March 1990 flood event, an initial loss of 0 mm also gave a good match with the recorded stream gauging (refer to **Section 4** for more detail). Similar to the other two events, standard continuing losses of 2.5 mm/h were adopted.

3 Hydrology Modelling

In addition to the calibration of flows, RAFTS design discharge results were compared to results from previous studies at as many locations as possible, including along Louisa Creek and Stuart Creek. Comparisons of the RAFTS results with reported values from previous studies (for similar critical durations) are presented in **Table 19**, **Table 20** and **Table 25**.

The results compare very favourably, adding confidence to the RAFTS results. It should be noted that the RAFTS reporting location on Stuart creek is upstream of the location reported from the Stuart Creek.

Table 19
RAFTS Peak Discharge Comparison – Louisa Creek at Bayswater Road

Design Event	Louisa Creek Flood Study (m^3/s)	RAFTS Peak (m^3/s)
5 Year ARI	61.0	60
20 Year ARI	88.5	86
50 Year ARI	114.6	100

Table 20
RAFTS Peak Discharge Comparison – Stuart Creek

Design Event	Stuart Creek Flood Study (m^3/s)	RAFTS Peak (m^3/s)
20 Year ARI	401*	380#
50 Year ARI	497*	470#
100 Year ARI	583*	540#

* Bruce Highway, # At Southwood Road

Table 21
RAFTS Peak Discharge Comparison – Townsville Port Access Study

100 Year ARI Design Event	Townsville Port Access Study (m^3/s)	RAFTS Peak (m^3/s)
Ross River at Bowen Road Bridge	826	835
Annandale Drain at outlet to Ross River	230	191
Gordon Creek u/s Stuart Drive	173	161

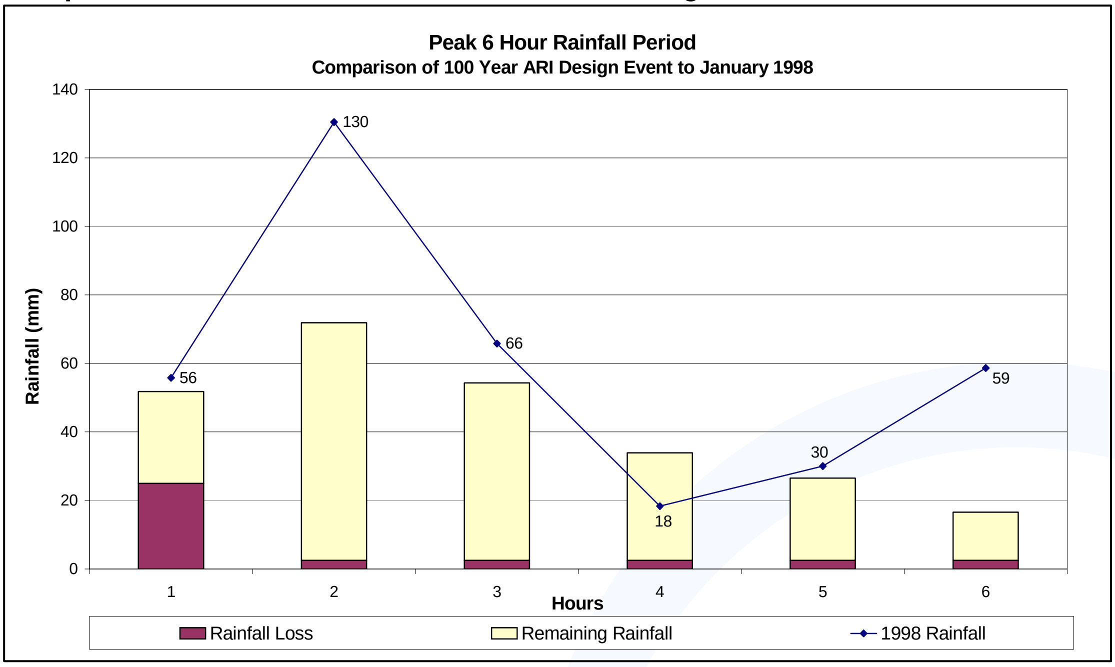
3.3.3 Design Modelling

The selection of appropriate design event loss parameters for the Townsville flood Plain followed the methodology as described for Magnetic Island. For the pervious parts of the catchment, the adopted loss rates were 25 mm for the Initial Loss, and 2.5 mm/hr for Continuing Loss. For the impervious portion of each sub-catchment, the loss parameters adopted were 1 mm for Initial Loss and 1 mm/hr for Continuing Loss.

A range of design event durations was run through the RAFTS model to determine the critical duration event for individual catchments. Consistently, it was found that the critical duration event was between 2 and 6 hours, depending on the ARI and the size of catchment being assessed. As such, both the 2 and 6-hour design storms were run for the full range of ARI's (2 Year ARI to PMP rainfall). Hydrographs for each sub-catchment were exported in a format suitable for input to both MIKE11 and MIKE21 hydraulic models. In the MIKE11 model, the major underground trunk drainage system was modelled discretely, and the size of each pipe system determined the amount of flow it carried (balance surcharges to become overland flow). In MIKE21 there is no opportunity to represent the pipe capacity, so a different set of hydrology inputs were derived, which accounted for the pipe system carrying nominal capacity (2 Year ARI flows). This difference in approach for accommodating pipe flows has in some locations where the actual pipe capacity varies from the 2 Year ARI flows resulted in small differences between flows between the MIKE11 and MIKE21 models.

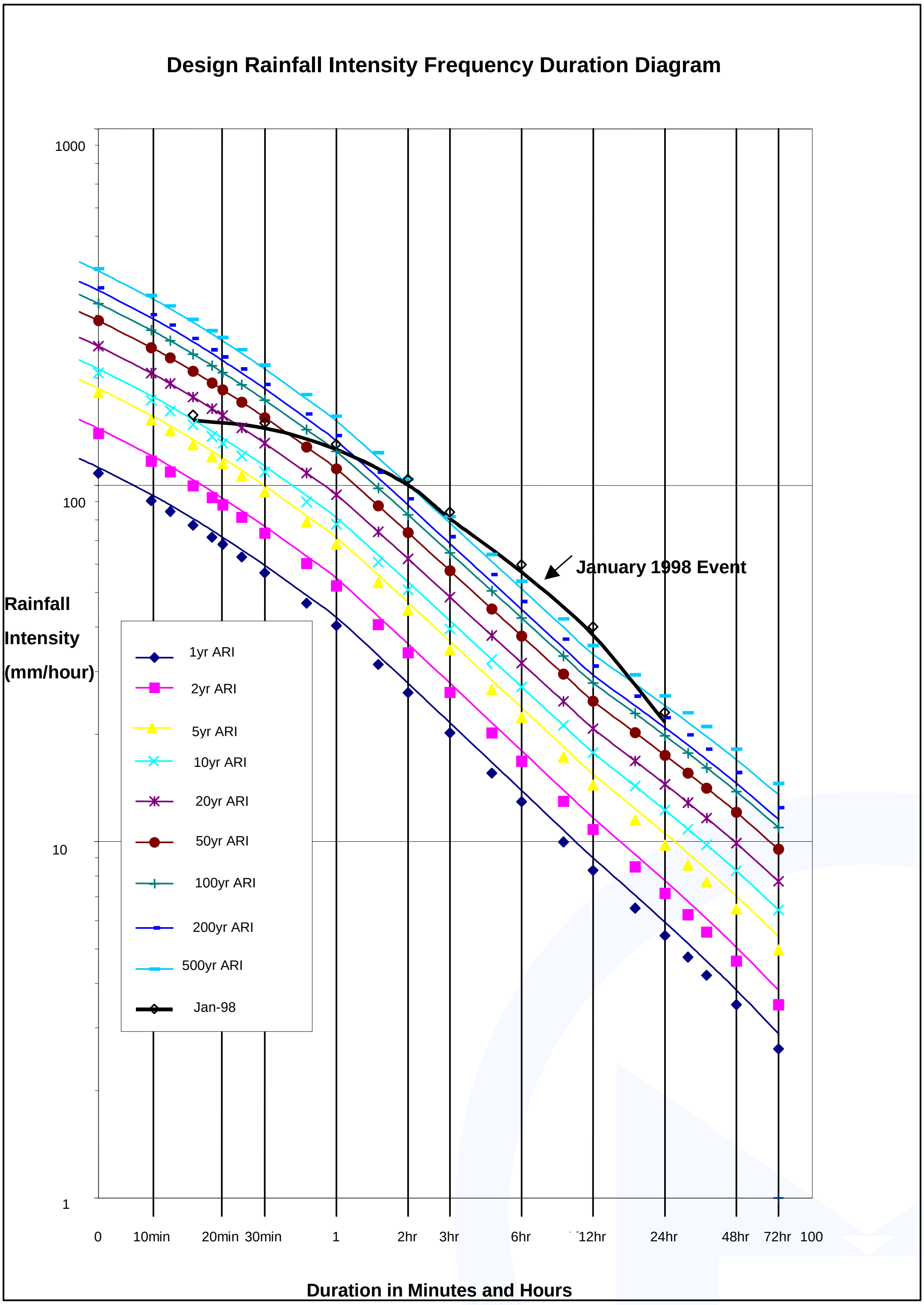
The design hydrology of the Townsville floodplain needs to be put into perspective, particularly since the January 1998 event is a reference event for Council and the local community. **Figure 18** presents a comparison of the worst 6-hour period recorded at the Townsville AMO gauge for the January 1998 event, with the 100 Year ARI design temporal pattern. The graph shows that the 1998 event was considerably more intense than the adopted design temporal pattern for the 100 Year ARI, particularly considering that significant rainfall fell before and after this peak burst. The graph also demonstrates that the adopted design loss model will reduce the impact of the design temporal pattern, particularly in the first hour.

Figure 18
Comparison of 1998 Rainfall and 100 Year ARI Design Rainfall



An alternative presentation of the data is shown in **Figure 19**, specifically a comparison of the rainfall Intensity Frequency Duration (IFD) data. This graph reproduces the results in Figure A2 of the BoM publication “Severe Weather and Flooding, North Queensland, January 1998”, that ranked the 1998 event as greater than 100 Year ARI for durations between 1 hour and 24 hours. For the 6 hour duration, the January 1998 event is estimated to be greater than the 500 Year ARI event; however, extrapolation of IFD data beyond 100 Year ARI is cautioned. On the basis of the above, it is likely that the 100 Year ARI flood inundation map and that for the January 1998 flood will exhibit significant differences.

Figure 19
Comparison of 1998 Intensities Recorded at Townsville AMO and Design Intensities



4 Hydraulic Modelling

4 Hydraulic Modelling

4.1 Modelling Tools

MIKE11 (1-Dimensional)
The 1-Dimensional fully dynamic model MIKE11 was used to model the natural and constructed sections of the major drainage paths of the Townsville floodplain and Magnetic Island, including areas where drainage is a combination of piped drainage and overland flow. MIKE11 model development typically involves the following general steps:

- Defining the network of individual drains and flow paths, and the connections between branches.
- Inputting the physical geometry of the model, including cross sections, culverts and weirs.
- Applying roughness values (Manning's 'n') to each cross-section or reach.
- Determining suitable boundary conditions, initial conditions and downstream controls for each branch.

Plans of drains and easements, observations made during field inspections, aerial photography and topographical maps were all used to define the network of major drainage paths in MIKE11. Overflow channels were inserted at locations based on site inspections and general information on flooding behaviour collected during the course of the Study. Additional overflows and link channels were added during the development of the model in locations where modelling results indicated that primary channels would surcharge. Details of drainage structures were taken from the survey, design plans and GIS information.

The accuracy of MIKE11 model results is dependent on the spatial resolution of the model (distance between cross-sections); however, it is considered that a similar degree of accuracy as that of the underlying survey can be achieved. MIKE11 produces graphical and text results, allowing flood levels and discharges (peak values and hydrographs) to be easily interrogated for any location in the model.

MIKE21 (2-Dimensional)
2-Dimensional modelling is most suited to areas of wide overbank flow where the flow paths are less defined, and where flows may be crossing catchment boundaries. In some areas of Townsville, this flow regime only occurs for the rarer events (50 Year ARI and larger), however, other areas experience widespread flooding and cross-catchments flows in events as small as 5 Year ARI.

2-Dimensional modelling of the Townsville floodplain was undertaken using MIKE21. MIKE21 simulates water level variations and flows in response to a variety of forcing functions, using a finite difference scheme resolved on a rectangular grid covering the area of interest. MIKE21 model development typically involves the following general steps:

- Specification of model geometry using a Digital Elevation Model, created from importing spot level or contour data. The primary input data required by MIKE 21 is an accurate representation of the topography of the area, including road alignments, embankments, levees and other important features of the floodplain.

- Selection of a suitable grid resolution for the Study Area, to ensure the modelling objectives can be achieved. In urban areas, there are often small drains and channels that are too small in width to be adequately represented in a coarse grid.
- Applying boundary data similar to MIKE11, including time series of flow or water level for the upstream and downstream boundaries of the area of interest. Catchment inflows are specified as discrete source points through out the model at locations representative of the sub-catchment outlet.
- Development of a roughness map, with roughness coefficients varying for different channel reaches and floodplain areas. Roughness maps are generally based on field observations, inspection of aerial photography and assessment of land use and zoning plans. Variations of model roughness form the basis of model calibration.
- Insertion of hydraulic structures. The hydraulic structures are represented as inserted 1-Dimensional hydraulic structure elements, with parameters taken from 1-D models like MIKE 11.
- Selection of a suitable eddy viscosity coefficient and time step for simulation. The eddy parameter is important in determining the behaviour of flow splitting and determining velocity distributions (variations of model eddy are an important but secondary calibration parameter in 2-D modelling) and time step influences the stability of the model and its runtime.

MIKE21 provides various outputs including water surface level, water depth and flow speed for every grid location in the model (ideal for hazard mapping and flood damages assessment), standard GIS grid formats for MapInfo and ArcView GIS for presentation and mapping purposes, and animations of flooding suitable for assessment of evacuation times.

The two dimensional MIKE21 model of the Townsville floodplain was developed using topographic information based on the digital contours supplied by Schlencker Mapping. The topography was manually adjusted in areas to represent the larger scale surface drainage components including the offshore bathymetry along the coastline.

Boundary conditions were obtained by extraction of the relevant surface flow hydrographs from the one dimensional MIKE11 model and the RAFTS rainfall / runoff model. Model roughness parameters were developed on the basis of land use information provided by Townsville City Council, and along with the Eddy Viscosity parameter were refined in the calibration process.

Additional information on the development and calibration of the MIKE11 and MIKE21 hydraulic models is provided in the following sections.

4 Hydraulic Modelling

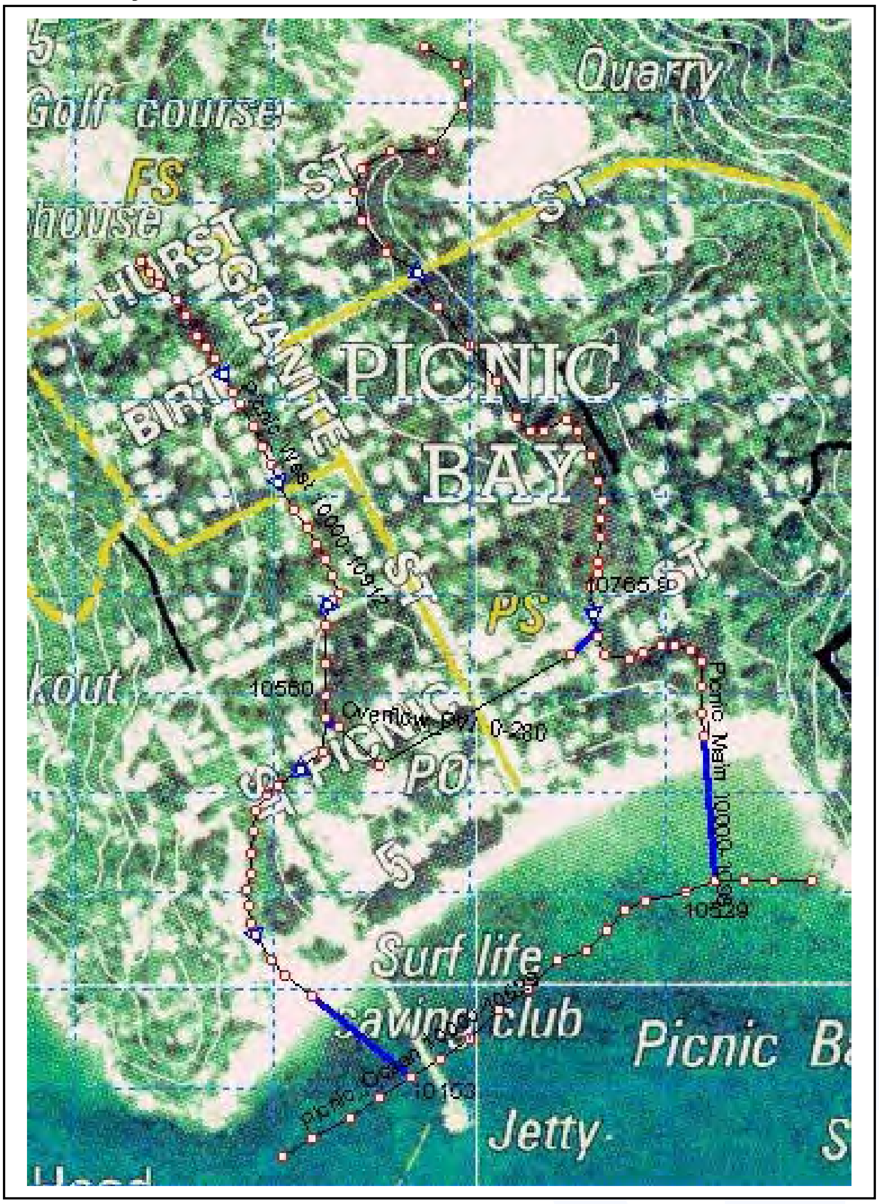
4.2 MIKE11 Assessment – Magnetic Island

4.2.1 Model Development

Picnic Bay

Picnic Bay has two distinct drainage paths. The primary drainage path is an unnamed creek starting east of the golf course, with an outlet towards the eastern end of the main beach. A second drainage path drains the area west of Granite Street, and outlets through a constructed channel to the west of the Picnic Bay jetty. The model delineation for Picnic Bay is shown in **Figure 20**.

Figure 20
Picnic Bay MIKE11 Network



4 Hydraulic Modelling

Nelly Bay

Nelly Bay incorporates the large stretch of beach from the western end of Nelly Bay Road to the safe harbour currently being constructed in the eastern corner of the bay. The major drainage path is Gustav Creek, which drains directly into the Nelly Bay Harbour development. Other unnamed drainage paths include one that runs between Yates St and Lilac St, discharging at the beach north-east of the helipad, and another that runs along the base of the hill at the southern end of the bay, discharging at the old Shark World development. The model delineation for Nelly Bay is shown in **Figure 21**.

Figure 21
Nelly Bay MIKE11 Network

4 Hydraulic Modelling

Arcadia – Geoffrey Bay and Alma Bay

Arcadia incorporates both Geoffrey Bay and Alma Bay. Petersen Creek is the most significant drainage path which outlets to Geoffrey Bay. A number of smaller separate drainage paths also discharge into the Bay and have been included in the hydraulic model. Drainage within Alma Bay is concentrated in a constructed channel that discharges to the northern end of the Bay. The model delineation for Arcadia is shown in **Figure 22**.

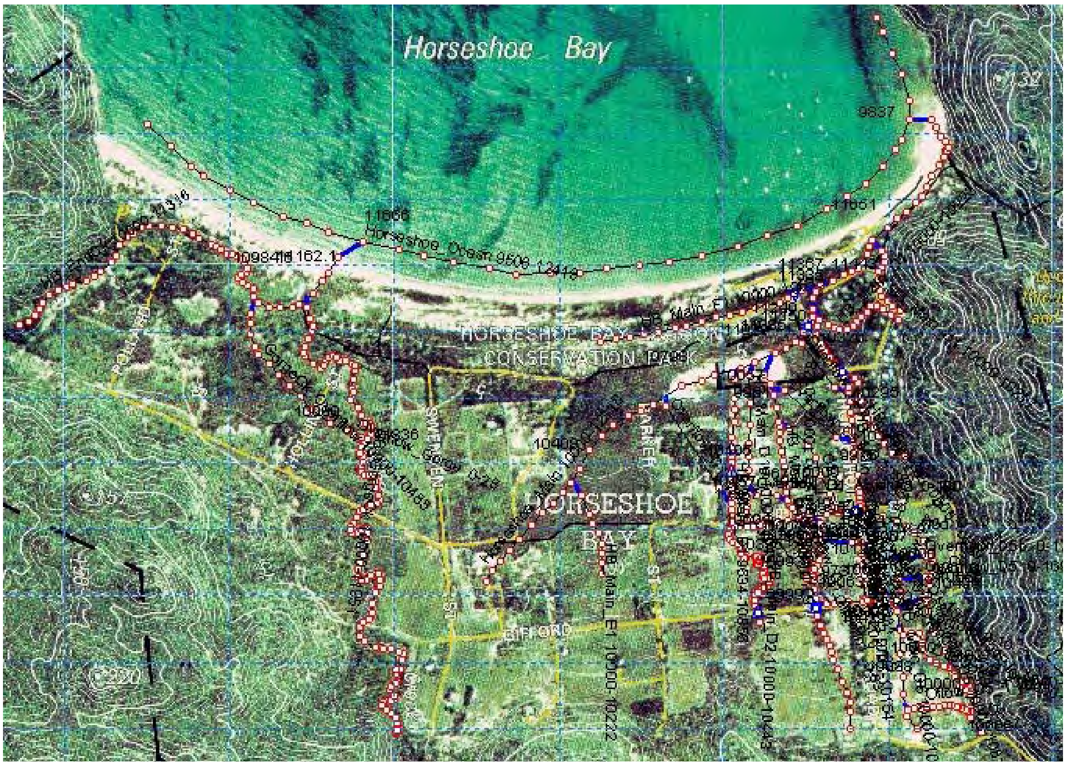
Figure 22
Arcadia (Geoffrey Bay and Alma Bay) MIKE11 Network

Horseshoe Bay

Horseshoe Bay is divided into two main drainage zones. The first zone covers the drainage paths provided by Endeavour Ck and Gorge Ck towards the western end of the bay. The second zone includes the low-lying swamp area east of Swensen Street that drains towards the eastern beach outlet, and a complicated network of drainage paths in the developed areas along Horseshoe Bay Road. The model delineation for Horseshoe Bay is shown in **Figure 23**.

4 Hydraulic Modelling

Figure 23
Horseshoe Bay MIKE11 Network



Each of the models includes an 'ocean' branch to allow different tidal conditions to be modelled. For the purposes of the design flood level assessment, the Mean High Water Spring (MHWS) level of 1.21 m AHD was adopted as the design tide event at the downstream end of the model sections to suitably account for the tidal influence on the existing drainage system.

The channel and floodplain roughness values adopted for each bay were based on aerial photography and the observed vegetative state during site inspection. Generally, cross-sections were assigned Manning's 'n' roughness between 0.05 and 0.09; with concrete drainage structures assigned a roughness of 0.013.

Due to the lack of historical flood records for Magnetic Island, the MIKE11 models could not be calibrated; however, the model results were reviewed by Council on a number of occasions and found to adequately represent local flooding and reflect known historical flooding patterns.

4.2.2 Model Results

For Magnetic Island, dynamic MIKE11 modelling was undertaken for the full range of design events (2, 5, 10, 20, 50, 100 and Probable Maximum Flood) at each of the four bays. Tabulated results of peak design flood level, discharge and velocity for the range of ARI's modelled are contained in **Appendix D**, for key locations described in **Drawings 80301202/DM1 – DM4**, also included in **Appendix D**. Levels at intermediate locations can be determined by assuming a linearly varying profile between points. Flood inundation mapping for Magnetic Island is further discussed in **Section 5**; however, the following general comments are made regarding flooding patterns and drainage immunity.

Picnic Bay

Relatively frequent rainfall events (5 Year ARI) produce flows that exceed the unnamed drainage path that runs roughly parallel to and between Granite Street and Yule Street. The culverts at Picnic Street have insufficient capacity, causing localised flooding in the area. At Picnic Street, flood waters overtop the road and inundate the low-lying areas both upstream and downstream, extending east of Granite Street in events greater than the 50 Year ARI. Butler's Creek to the east of Granite Street generally has a high capacity; however, Birt Street and Picnic Street road crossings are both inundated in the 10 Year ARI event.

Nelly Bay

A 5 Year ARI event results in localised flooding of properties adjacent to the drainage path that runs between Lilac Street and Yates Street. Gustav Creek, the main drainage route for floodwaters within the Nelly Bay area, generally contains the majority of floodwater however localised flooding occurs within the Gustav Creek floodplain. For events in excess of 10 Year ARI, localised inundation occurs in the area surrounding the Sooning Street shops and Warboys Street. Gustav Creek generally has a high capacity; however, Elena Street and Barton Street road crossings are inundated in 20 and 10 Year ARI events respectively.

Arcadia

Significant localised flooding occurs along Petersen Creek due to relatively frequent events (up to 5 yr ARI events), particularly within areas adjacent to Mirimar Crescent before affecting properties built within low-lying areas downstream of Hayles Avenue. Some properties adjacent to Marine Parade are affected by floodwaters in events greater than 10 Year ARI. In the 100 Year ARI, Marine Parade is immune to flooding; however, some isolated inundation is predicted in the area around Arcadia Resort.

Horseshoe Bay

Flood waters resulting from small events (up to 5 Year ARI) cause some surcharge of the existing drainage along Apjohn St, running down Corica Crescent causing localised flooding. The channel adjacent to the intersection of Corica Crescent and Horseshoe Bay Road also has minimal capacity. The Horseshoe Bay Road crossing of the swamp is inundated in a 2 Year ARI event, and the limited capacity culverts on Gifford Street cause the road to also be overtopped in 2 Year ARI event, causing inundation of properties in low-lying areas upstream.

4 Hydraulic Modelling

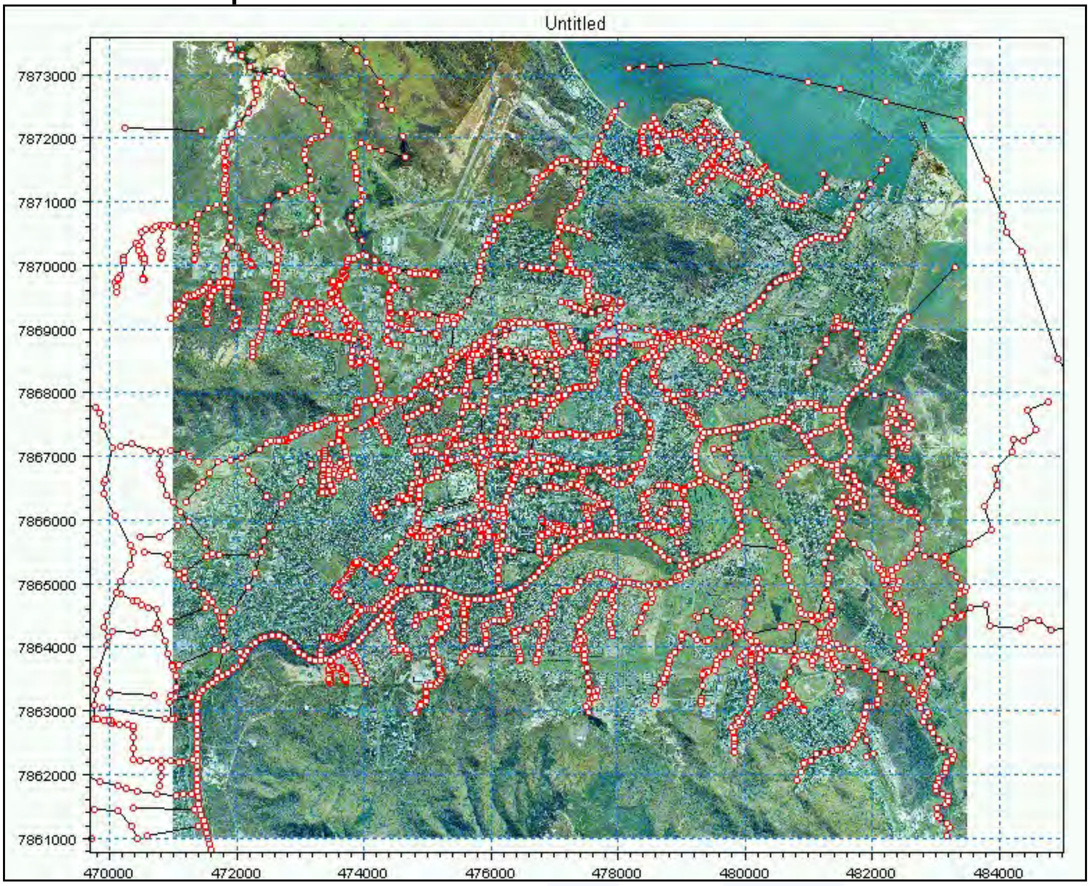
4.3 MIKE11 Assessment – Townsville Floodplain

4.3.1 Model Development

Detailed MIKE11 hydraulic modelling was undertaken for all areas within the defined Townsville floodplain, excluding the Sandfly Creek sub-area. The MIKE11 modelling focused on the lower end flood events (2 – 20 Year ARI) within the major open channel drainage paths. In areas with no defined open channel drainage systems (primary drainage via underground pipes), both the trunk pipe drainage system and overland flow paths were modelled in MIKE11.

The complex network of pipes, channels and overland flow paths modelled in MIKE11 is shown in **Figure 24**. Similar to the modelling of Magnetic Island bays, MHWS was adopted for the ocean boundary level in the design flood assessment. Manning's 'n' roughness values ranged from 0.02 for roads and 0.04 for well maintained grassed areas, through to 0.05 for overland flow paths and 0.08 for densely vegetated banks of natural creeks. Cross-sectional geometry was extracted from the digital contours provided, and pipe and drainage culvert details were sourced from the GIS database and supplementary survey. At every culvert location, a weir was modelled to account for road overtopping.

Figure 24
Townsville Floodplain MIKE11 Network

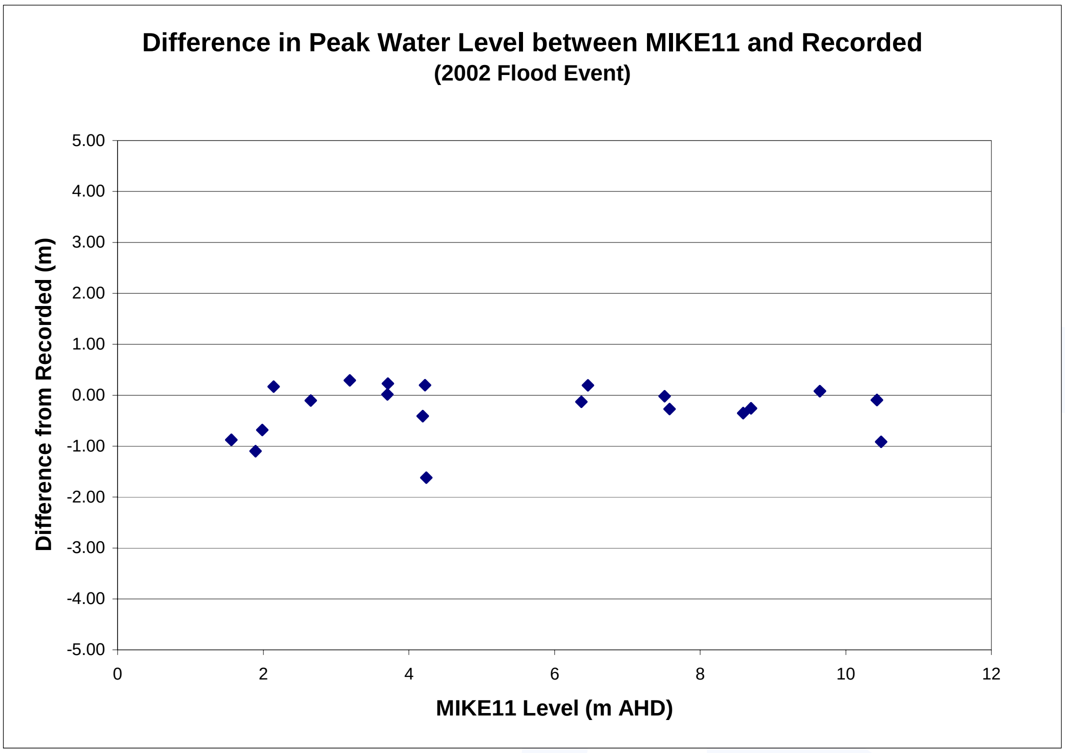


4.3.2 Model Calibration

The MIKE11 model of the Townsville floodplain was undertaken primarily for the February 2002 event. This event was characterised by a series of successive peaks over a period of several days, and represents a good calibration event, as the MIKE11 model needs to accurately predict both the peak discharge and the rise and fall behaviour of flows in defined channels. Comparing the recorded rainfall totals from **Figure 7** with the IFD relationship presented in **Figure 19**, the February 2002 event has been estimated to be in the order of a 5 Year ARI flood event.

During the event, inundation of gardens was recorded and levels in defined drainage paths did cause significant inundation of open space areas. Responses to the Flood Questionnaire identified approximately 20 locations where flood levels were of interest and these were surveyed to supplement to stream gauging record for the event. A plot of the discrepancy between the MIKE11 model and surveyed levels is shown in **Figure 25**. The plot shows no bias with absolute levels, and generally a good agreement was achieved.

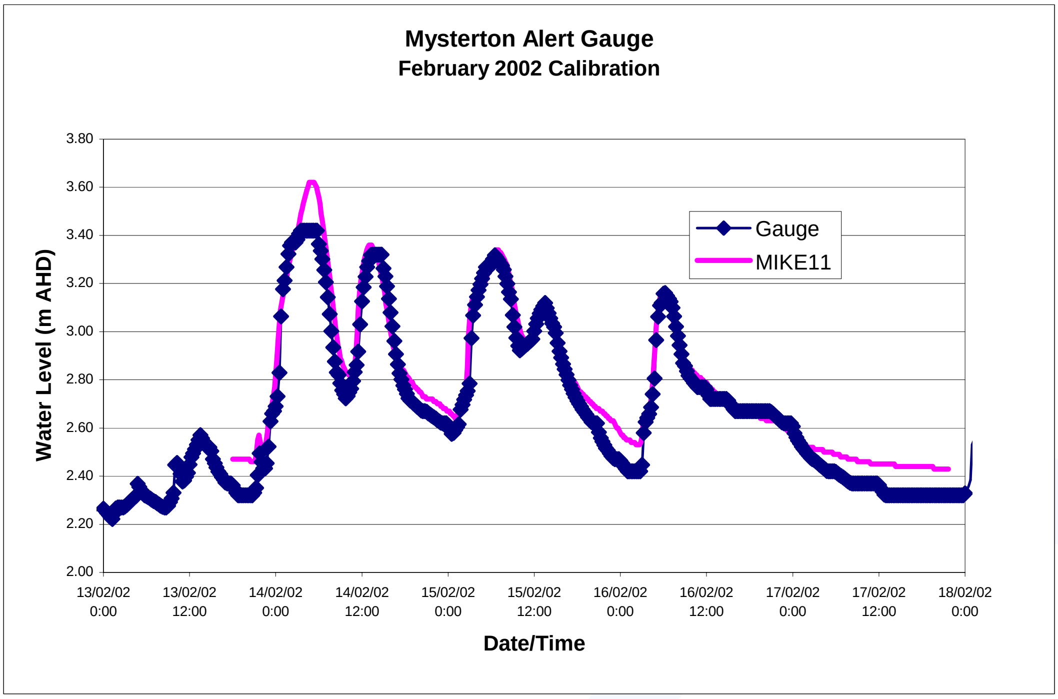
Figure 25
2002 MIKE11 Calibration – Comparison of Surveyed Levels



At the locations where direct comparison could be made, the average difference between the MIKE11 model and the surveyed levels was 0.00 m. At a number of locations, the model underestimates the surveyed levels; however, it is noted that these occur where the recorded level is not 'on-stream' but located laterally distant to the main channel branch modelled. In these cases, the records appear to reflect local flow conditions, tributaries to the main channel that were not modelled or flow in kerb and channel.

In the Townsville floodplain, there were three stream gauge locations at which continuous records were available for the February 2002 event. The comparison of the MIKE11 predicted flood behaviour with the recorded levels at these three locations are shown in **Figure 26**, **Figure 27** and **Figure 28** below. The calibration shown was achieved without varying significantly the adopted channel roughness values and runoff inflow hydrographs; however, as outlined in previous sections, the process was iterative with respect to selection of RAFTS Initial Loss values to match the timing of the first significant peak in the record. For the February 2002 event, an Initial Loss value of 60 mm was adopted universally except for the Stuart Creek catchment where a higher value of 100 mm was selected.

Figure 26
2002 MIKE11 Calibration – Mysterton Alert Gauge



Initially, the calibration at the Louisa Creek gauge was difficult to achieve, but after reviewing the input hydrology and channel geometry, a site inspection identified that the cross-sectional geometry in the model (and digital contour mapping) was not representative of the creek channel immediately downstream of the gauge location. Downstream of the Bayswater Road culverts, a significant sedimentation zone had developed that was affecting the gauge record (particularly the trough level between successive peaks). This constriction was surveyed and added to the model, resulting in the much improved comparison in **Figure 27**. The calibration to the Stuart Creek record was complicated by the significant spatial and temporal variability of rainfall recorded in and around the catchment. As a result, the comparison in **Figure 28** shows some discrepancy in timing and magnitude of predicted and recorded peaks.

4 Hydraulic Modelling

Figure 27
2002 MIKE11 Calibration – Louisa Creek Alert Gauge

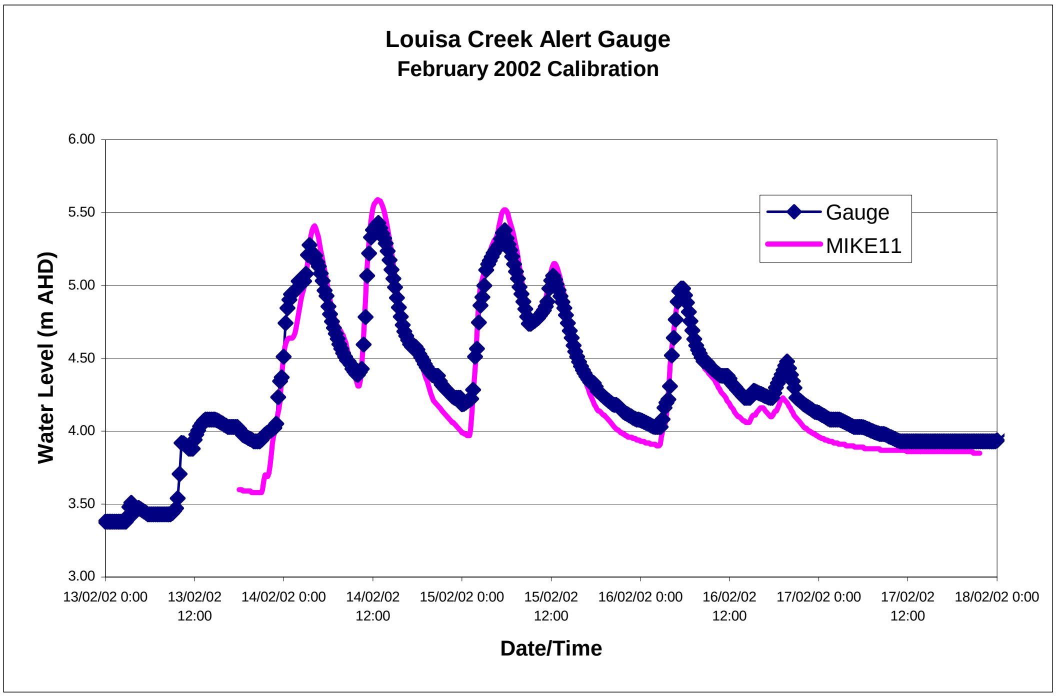
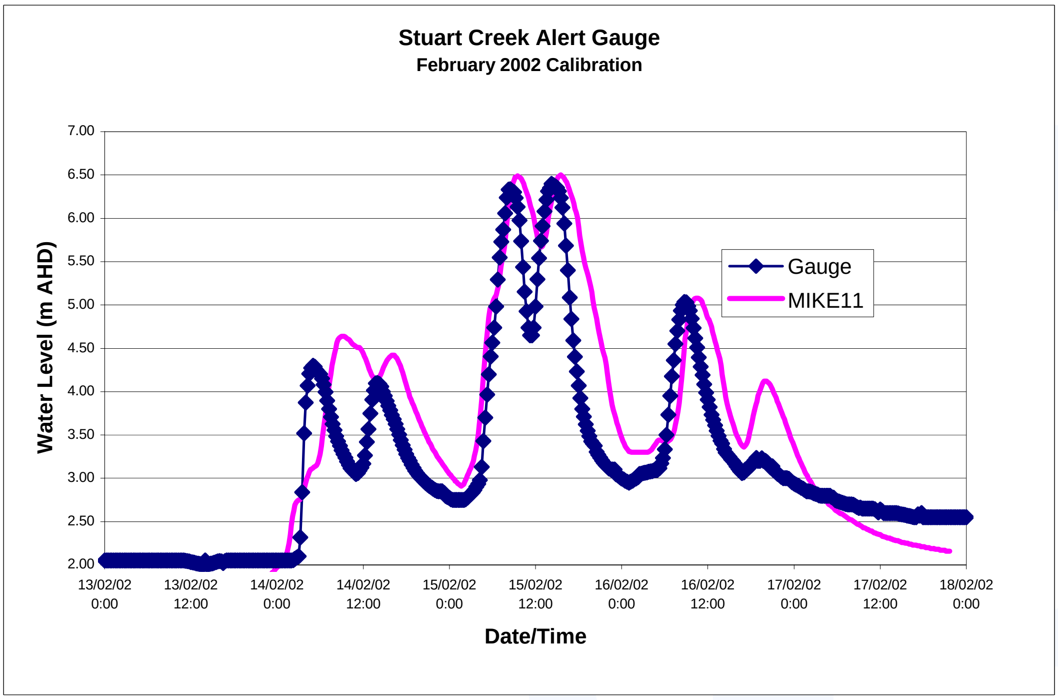


Figure 28
2002 MIKE11 Calibration – Stuart Creek Alert Gauge



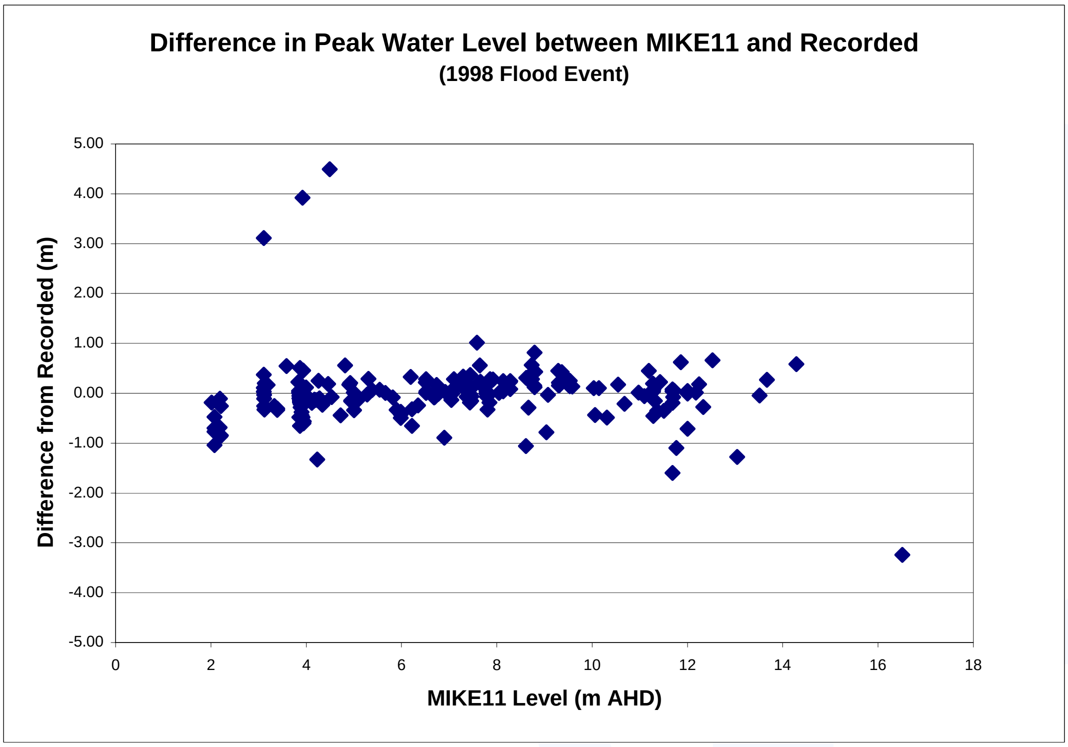
Overall, the calibrated MIKE11 model accurately predicts the behaviour of in-bank channel flows in the February 2002 event. However, as with most calibrations, it should be noted that comparisons could only be made at a small number of discrete locations, and the impact of local site conditions was highlighted by the difficulty experienced in achieving a calibration at the Louisa Creek gauging location. Not-withstanding the above, the model is believed to be generally robust and suitable for assessment of flood inundation patterns and drainage upgrade requirements.

4.3.3 Model Verification

The calibrated MIKE11 model was run for two verification events; January 1998 and March 1990. For the January 1998 event, Council provided a significant number of surveyed levels in a GIS layer, and additional levels were surveyed during the course of this Study reflecting new locations identified in the responses to the Flood Questionnaire.

A plot of the discrepancy between the MIKE11 model and surveyed levels for January 1998 is shown in **Figure 29**, using an Initial Loss of 0 mm in the RAFTS assessment of hydrology. At the locations where direct comparison could be made, the average difference between the MIKE11 model and the surveyed levels was 0.16 m (on average, MIKE11 slightly overestimates recorded levels). This is symptomatic of using MIKE11 to model an event with a significant overland flow component. Whilst significant care was taken to identify locations where flows surcharged the defined channel banks, it is not possible in MIKE11 to simulate truly two-dimensional flow.

Figure 29
1998 MIKE11 Verification – Comparison of Surveyed Levels

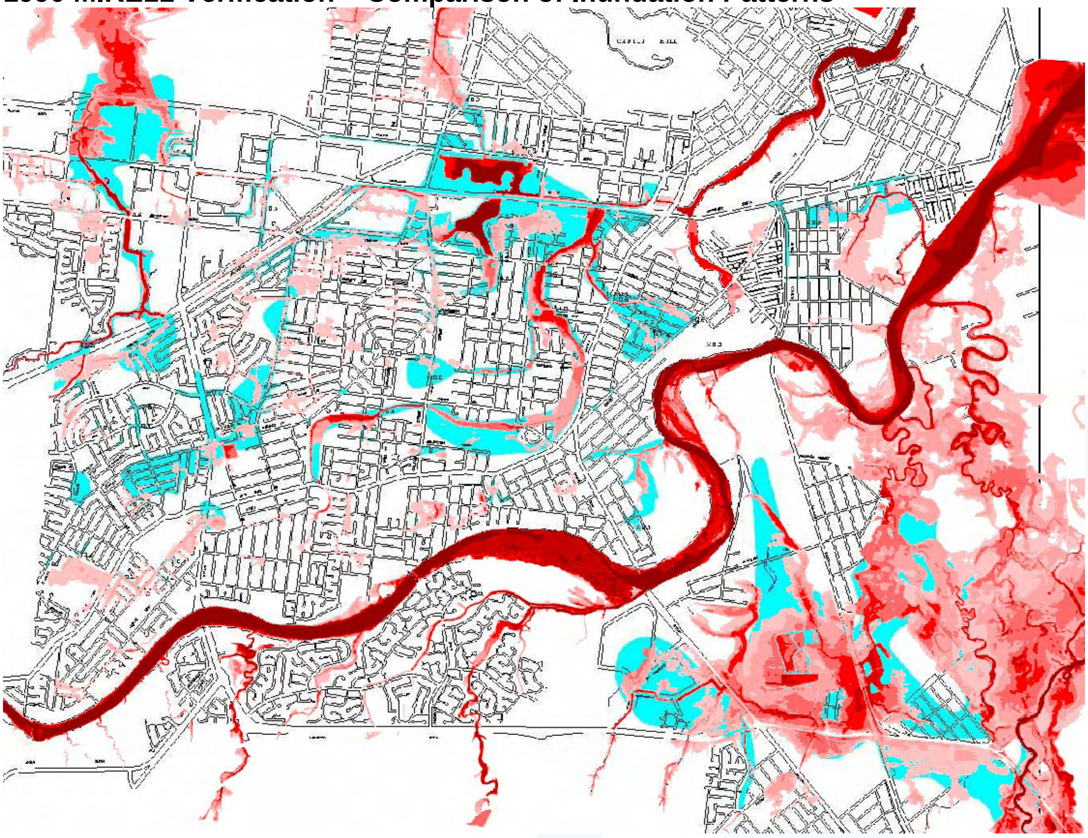


4 Hydraulic Modelling

The performance of the MIKE11 model in simulating the January 1998 flood event provides additional confidence that the model can be applied to the assessment of a range of design storms (from 2-100 Year ARI), particularly in future assessments of drainage capacity or upgrade requirements. However, in this Study the model was only used to assess flows up to 20 Year ARI, for reasons outlined above relation to overland flow patterns. The MIKE21 model (refer to following sections) was calibrated for the 1998 flood event, and is therefore better suited for the assessment of the rarer design events (particularly 100 Year ARI and the PMF).

Limited flood level data was available for the March 1990 flood event; however, Council has developed a flood inundation map for the event (refer Drawing No. 45095 in **Appendix A**). This map was used as a secondary check of the performance of the MIKE11 model, and the comparison in flood inundation patterns (MIKE11 and recorded) is shown in **Figure 30**. The MIKE11 flood map for the March 1990 event is shown as red, overlaid on the cyan inundation pattern from Drawing No. 45095.

Figure 30
1990 MIKE11 Verification – Comparison of Inundation Patterns



It is important to note that the MIKE11 model includes up to date drainage structures, and a geometry based on aerial photography from 2000. The inundation pattern mapped by Council for the 1990 event is also schematic and shaded boundaries do not necessarily reflect the extent of inundation. The main differences in the two inundation patterns can for the most part be accounted for by assessing the differences in the primary drainage infrastructure between the year 1990 and 2000.

A good example is the Lakes 2 detention basin, which was constructed in 1995 and would have had a significant impact on reducing flooding in the immediate area and upstream systems including Mindham Park drain. Other drainage improvements include upgraded culverts at Bayswater Road crossing of Louisa Creek, various diversions including the Nathan Street diversion that has reduced inundation in Heatley and Vincent. Considering the difficulties in comparing the inundation patterns, **Figure 30** generally shows a good comparison, particularly around Cluden and Oonoonba.

Comparison of the recorded rainfall totals from **Figure 5** with the IFD relationship presented in **Figure 19**, the March 1990 event has been estimated to be between a 20 and 100 Year ARI flood event. Considering the rainfall recorded in Townsville since 1987 (when the design rainfall intensities for the whole of Australia were derived), it is likely that when the design intensities for region are revisited the ranking of both the 1990 and 1998 flood events will be reduced.

4.3.4 Model Results

Dynamic MIKE11 modelling for the Townsville floodplain was undertaken for 2, 5, 10 and 20 Year ARI events, in addition to the calibration events described above. Tabulated results of peak design flood level, discharge and velocity for the range of ARI's modelled are contained in **Appendix D**, for key locations described in **Drawings 80301202/DT1 – DT15**, also included in **Appendix D**. Levels at intermediate locations can be determined by assuming a linearly varying profile between points. Inundation mapping for the Townsville floodplain is discussed in detail in **Section 5**; however, the following general comments are made regarding flooding patterns and drainage immunity in each of 5 sub-areas modelled.

Mount Louisa Sub-area

The majority of flooding within this zone occurs to the north of Ingham Rd in the low-lying areas of the Town Common and Mt St John Sewage Treatment Plant. Floodwaters back up the Calvary Drain at both the railway line and behind Woolcock Street. Louisa Creek appears to have sufficient capacity for a 20 Year ARI flood except in the lower reaches near Blakeys Crossing where floodwaters spread out downstream of Woolcock Street. Some ponding and inundation of properties occurs at the corner of Bayswater Rd and Duckworth St, as well as some inundation from open channels surcharging south of Dalrymple Rd. The Townsville Airport is relatively flood free in events up to the 20 Year ARI.

City Sub-area

A significant overland flow path is evident through Cranbrook, Heatley, Vincent and Currajong. Floodwaters during a 20 Year ARI flood event do not connect the Rowes Bay Canal system to the Lakes 2 detention basin (drainage still in different directions) and flows are generally contained within the Mindham Park drainage system, causing some impact on adjacent and low-lying property in the area. A number of areas within North Ward show inundation, namely at the intersections of the Howitt Street and Cook Street, Landsborough Street and Warburton Street, Mitchell Street and Oxley Street and the length of Mitchell Street between Kennedy Street and Burke Street. Some areas served by inadequate pipe drainage systems experience surcharging and overland flows (like along Albert Street). Other inundated areas include Arthur Fadden Park, the intersection of Love Lane and Briarfield Street and the Charles Street / Nathan Street intersection.

South Townsville Sub-area
Land surrounding Ross Island is inundated with floodwaters beginning to impact on Boundary Street, Seventh Street and Ninth Street.

Fairfield Sub-area
Fairfield includes the areas of Oonoonba, Wulguru and some parts of Stuart Creek. Significant inundation north of the Bruce Highway occurs during a 2 Year ARI flood event, with floodwaters surrounding the service station opposite the race course (significant inundation of the race course carpark). Floodwaters from Gordon Creek and Stuart Creek approach Oonoonba and Cluden but no significant inundation results. Floodwaters back up behind Stuart Drive near behind the racecourse, and some surcharging of the drainage systems within Lavarack Barracks to the east towards the service station/caravan park on University Road. Some inundation of the development at the southern end of Minehane Street (Cluden) is evident; however, the Cluden levees are not surcharged. The Pony Club lagoon surcharges into parts of the old Idalia suburb.

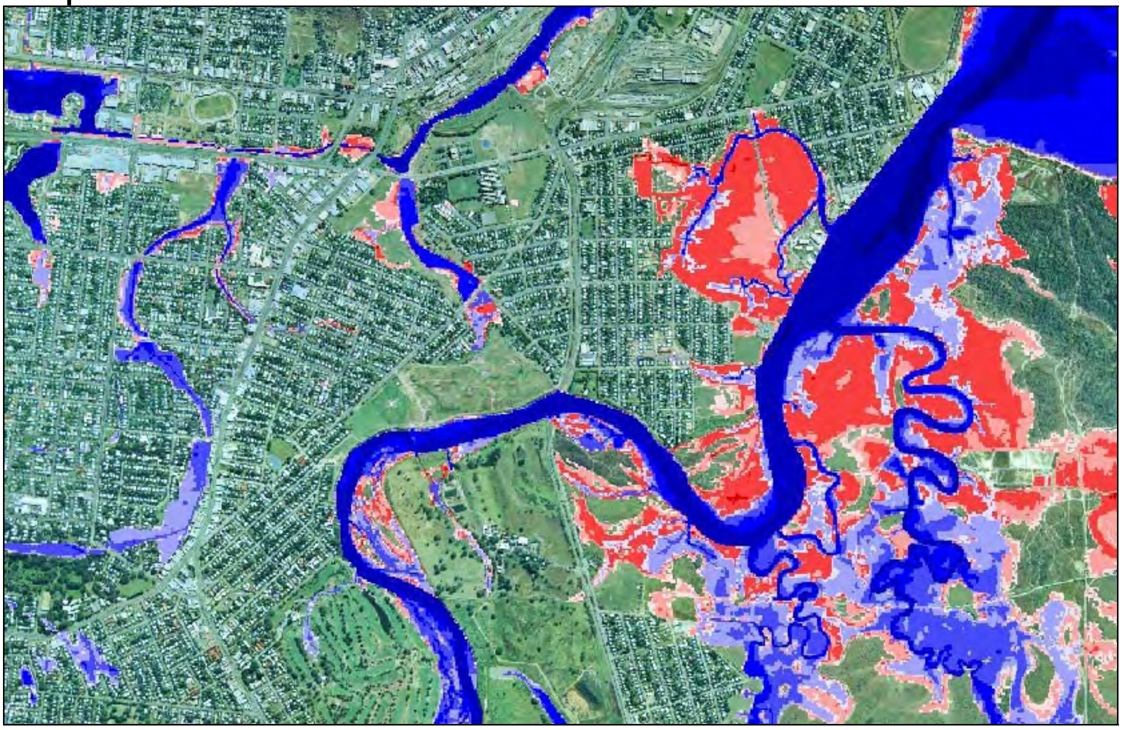
Annandale Sub-area
The Annandale area is generally flood free with the drainage systems within this area exhibiting relatively high capacity. Access to the hospital is flood free for events greater than the 20 Year ARI, and some inundation of the Palmetum is evident.

4.3.5 Sensitivity Assessment

A sensitivity assessment of flood inundation to tidal level was also undertaken. The ocean tailwater level in the model was adjusted to Highest Astronomical Tide (HAT) to determine the susceptibility of low-lying areas to tide and the impact on high tides on drainage systems within the City (MIKE11 modelling results for the 2 Year ARI design flood with varied ocean water level are presented in **Appendix D**, detailing the locations where differences occur and the magnitude of the difference). The flood inundation maps for each case were also compared to assess the increase in inundated area, as shown in **Figure 31**. The flood map for the MHWS case is shown as blue, overlaid on the red inundation pattern for the HAT case.

In general, water levels within areas of Ross Creek, Ross River, Woolcock Canal, Goondi Creek and Ryan Street Canal all experienced increases in excess of 0.7 m whilst the Mindham Park and Hermit Park drainage systems experienced increases in water level of more than 0.5 m for the 2 Year ARI flood event. Widespread inundation of the low-lying areas around Goondi Creek is evident, and inundation of the Ross River and Ross Creek tidal zones also occurs. The HAT impact extends up the Hermit Park drainage system to Campbell St and the Mindham Park drainage system up to Bayswater Terrace. Areas around Woolcock Street are inundated due to the reduced pipe capacity, with tides impacting on flood levels in the Lakes system and Woolcock Canal.

Figure 31
Comparison of 2-Year ARI Inundation due to Increased Tide Level



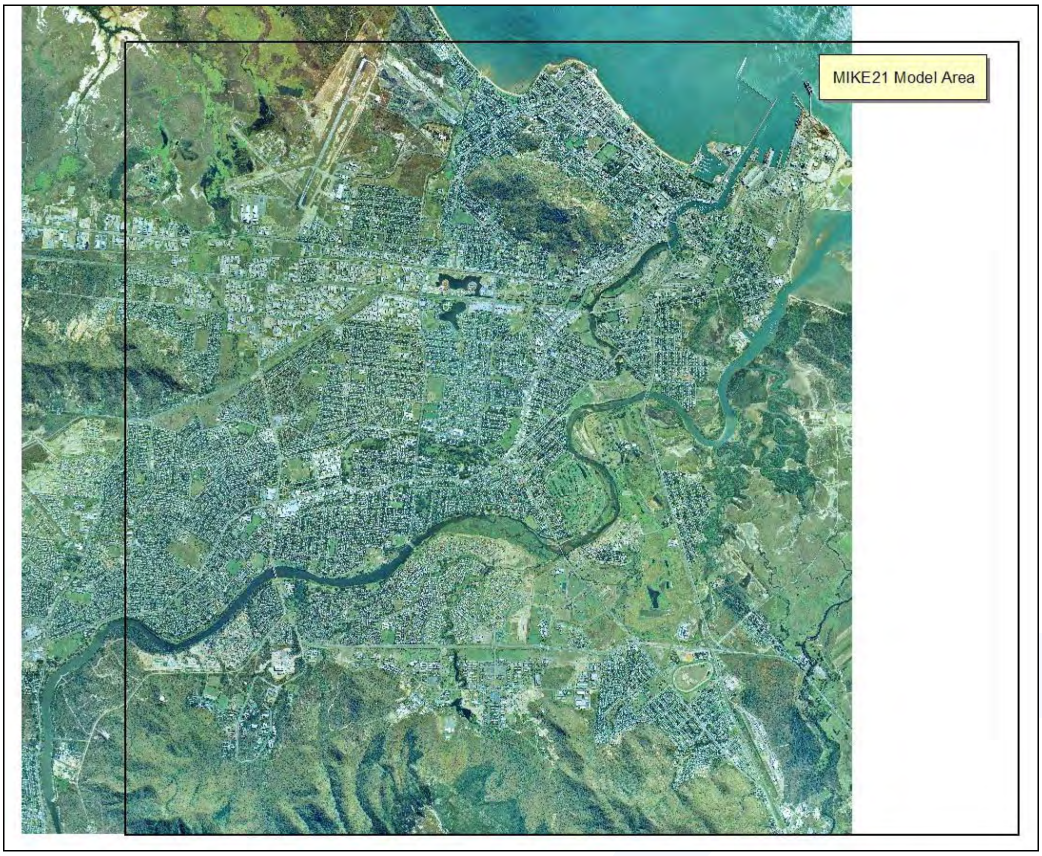
4 Hydraulic Modelling

4.4 MIKE21 Assessment – Townsville Floodplain

4.4.1 Model Development

Detailed MIKE21 hydraulic modelling was undertaken for the urban area of Townsville including the north and south banks of the Ross River and its associated floodplain. The MIKE21 2D model included Stuart Creek in the South and Louisa Creek in the North with the associated overflows from the Bohle River. The model area is shown below in **Figure 32**.

Figure 32
Townsville MIKE21 Flood Model Extent



Topography

The first stage in the development of the two-dimensional model was the selection of a suitable grid mesh and the generation of the topography within this grid. The model cell resolution was selected on the basis of adequate resolution of the overland flow paths and the major surface drainage features, while minimising the number of grid points and associated model simulation times.

Care was taken to ensure that model boundaries were located far enough from the areas of interested so that boundary effects would not impact on the model results. The bathymetry attributes are presented in **Table 22** below.

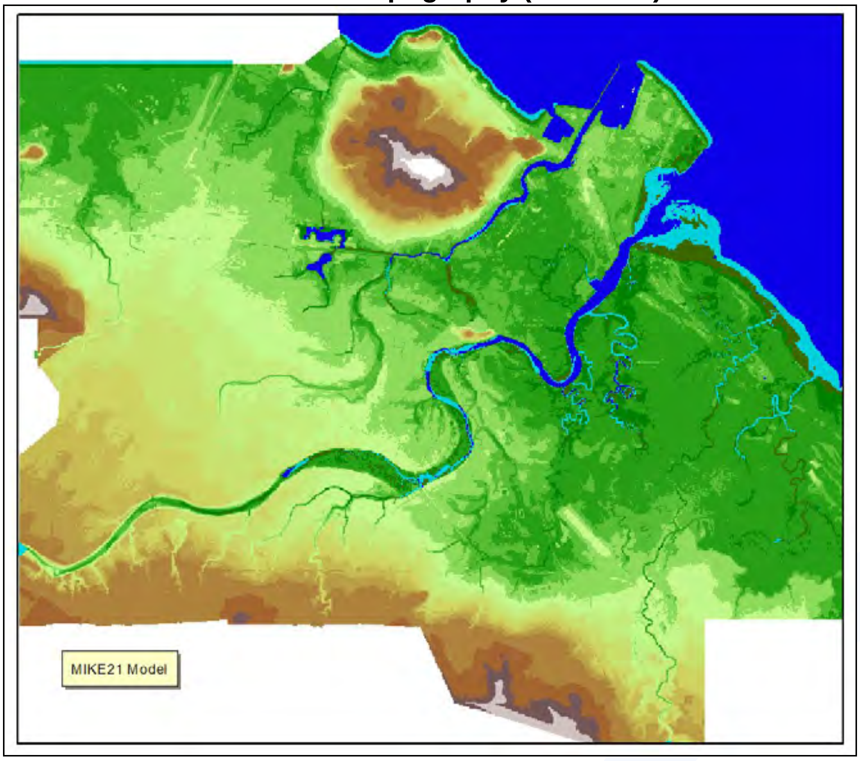
4 Hydraulic Modelling

Table 22
Model Grid Mesh Details

Description	Grid Dimensions
Grid dimension	20 m
No. grid cells in y-direction	671
No. grid cells in x-direction	592
Total Computational Cells	397,232
Grid rotation (degrees clockwise)	0 degress

The model topography was derived by overlaying the adopted grid mesh onto a Digital Elevation Model (DEM) developed from the digital mapping supplied. The derived model bathymetry is detailed in **Figure 33**.

Figure 33
Townsville MIKE21 Model Topography (20m Grid)

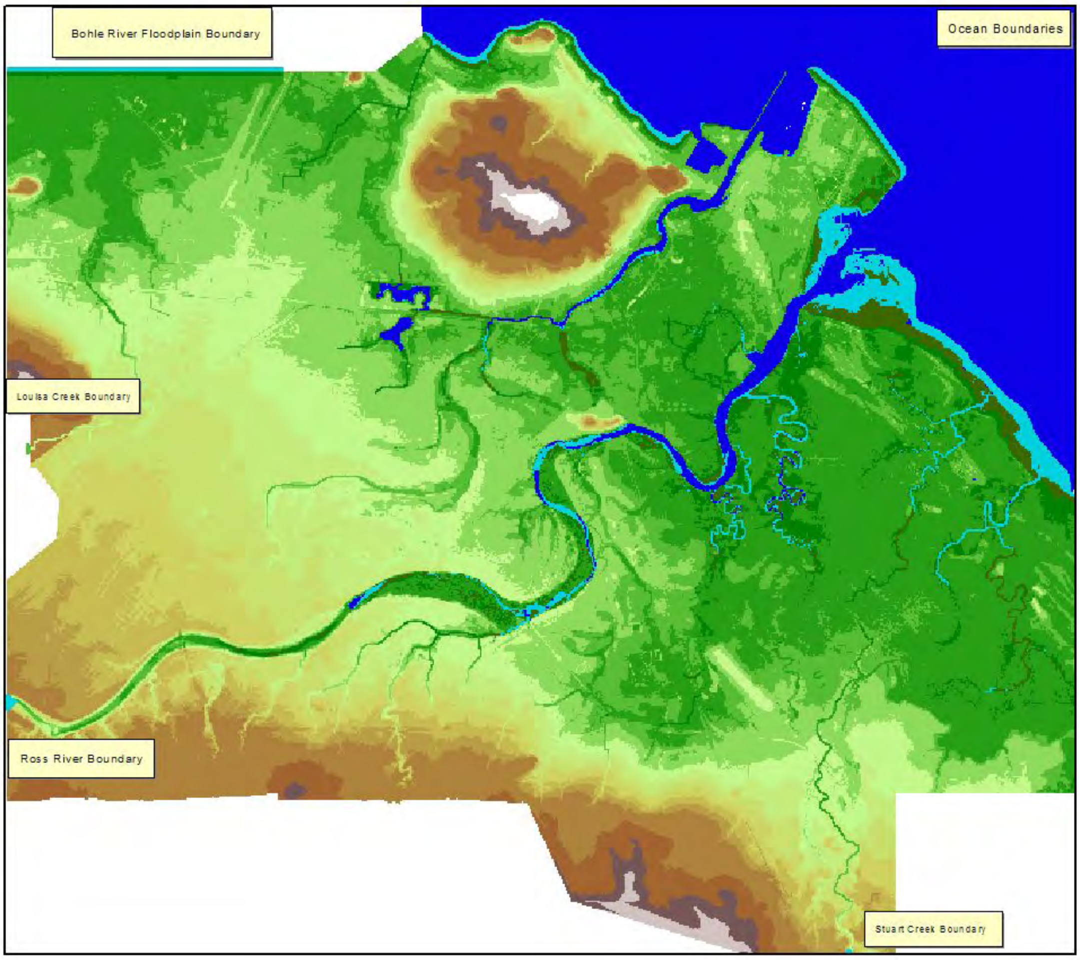


The model topography required some manual editing to ensure that connectivity of the surface drainage features was maintained. The connectivity of surface drainage systems can be lost when interpolation of the DEM on the 20-metre grid mesh produces smoothing of surface features. Specific editing of the grid was required in the areas of Louisa Creek, Stuart Creek, Ross River, Ross Creek and some of the other small tributaries to the Ross River and Ross Creek.

Boundary Conditions
The model boundary conditions were developed as discharge hydrographs at the upstream boundaries of Stuart Creek, Louisa Creek and the Ross River. The downstream boundary condition was developed as a constant water level at the ocean (MHWS) and an artificial condition for outflows into the Bohle River floodplain

representative of design levels from the Bohle River MIKE11 model. The location of model boundary conditions is detailed in **Figure 34** below.

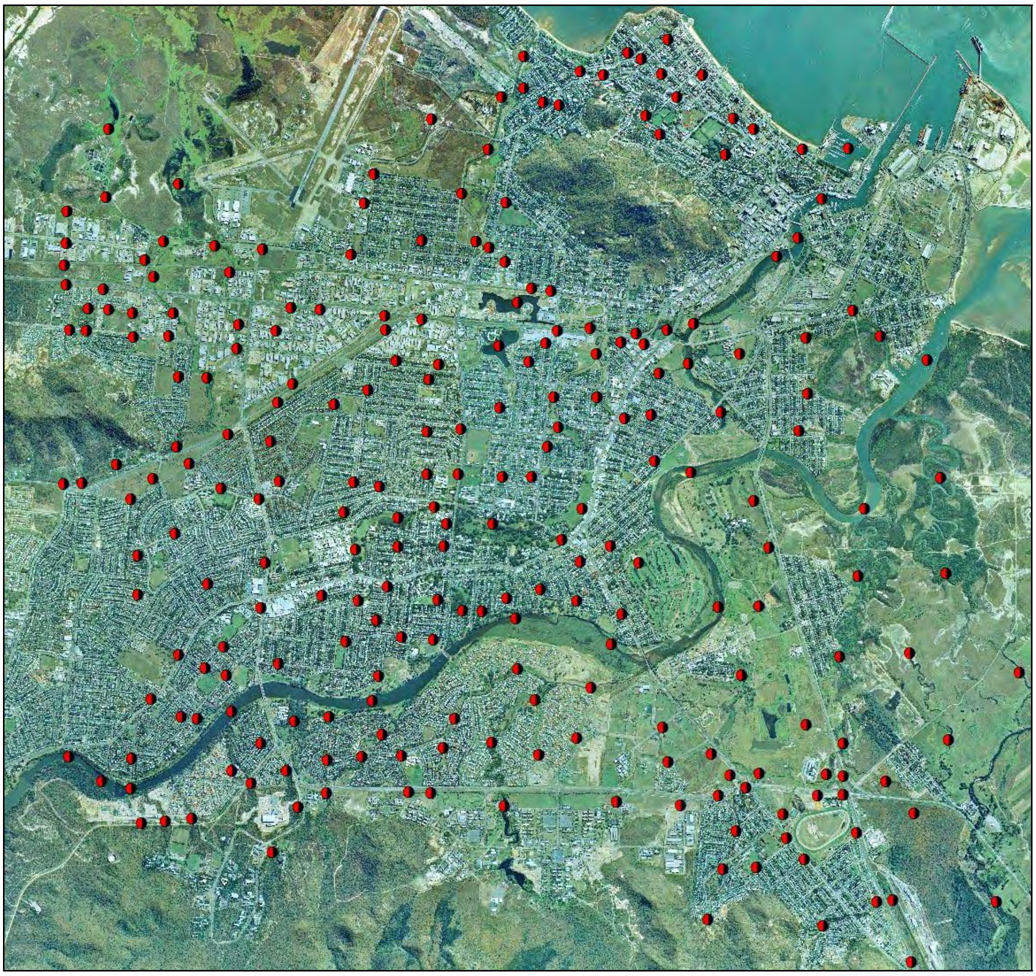
Figure 34
Townsville MIKE21 Model Boundary Locations



Local catchment flows within the model domain were modelled as a series of lateral or source inflow points. The model was developed with 247 sources from rainfall / runoff routing model RATFS and MIKE11 inflow locations (like for Ross River). The locations of the source flows are detailed in **Figure 35.**

4 Hydraulic Modelling

Figure 35
Location of Source Point Inflow Locations



It should be noted that there were originally more than 600 RAFTS sub-catchments which have been lumped together to create the 247 inflow locations shown above in order to fit within the constraints of the MIKE21 modelling system (maximum allowable 256 source points). As a result there will be locations on the floodplain that are known to suffer from localised flood inundation that will not be represented in the MIKE21 model results, because no source point has been applied in the local area.

Hydraulic Structures
The two-dimensional hydraulic model included the most important (largest) hydraulic structures that were located in the open channel flow system. A total of 47 hydraulic structures were included in the model at various locations as detailed in **Figure 36**. In some cases the bridge structures located on the Ross River and within Ross Creek were not modelled due to limited hydraulic impacts. The minimal hydraulic impacts occurred when there was relatively little reduction in the flow area. Pier losses associated with the bridge were represented in the model as increased roughness values representing the increased energy losses through the structure.

4 Hydraulic Modelling

The hydraulic structures in the MIKE21 model were modelled as one-dimensional structures that fully solve culvert hydraulic equations. These one-dimensional structures were modelled in a MIKE11 model that was dynamically coupled to the MIKE21 model.

Figure 36
Location of Hydraulic Structures in the MIKE21 Model

Model Parameters

There are two model calibration parameters that must be defined for two-dimensional hydraulic models. The parameters are associated with assumptions made in the governing equation of hydraulic models. The first and more familiar parameter is the roughness associated with bed friction. The second parameter is the eddy viscosity parameters associated with the assumptions of sub grid scale turbulence.

The eddy viscosity parameter describes the degree of turbulence that exists at scales smaller than the model grid scale of 20m. Turbulence on the horizontal plane with a scale larger than 20m can be represented by flows in the model from one grid cell to the next. The eddy viscosity parameter is critical for describing the simulated transverse distribution of flow velocities in the creeks and rivers and is also important in describing the bifurcation of flows at junctions. Due to the complexity of the urban environment it is not possible to calibrate the eddy viscosity parameter. The eddy viscosity parameter is generally adopted as a constant value based on experience from previous modelling studies and calibrations. In this study, a constant eddy viscosity value of 2.0 was adopted.

The model roughness generally reflects the types of development and vegetation that exists within the floodplain. Consequently it is appropriate to develop roughness maps that reflect the land use zoning within the model area. The roughness distributions adopted for this study were based on land use zoning information provided by Council and are detailed in **Figure 37**. The specific roughness values adopted for each zone type are detailed in **Table 23**.

Figure 37
MIKE21 Model Roughness Distribution Map

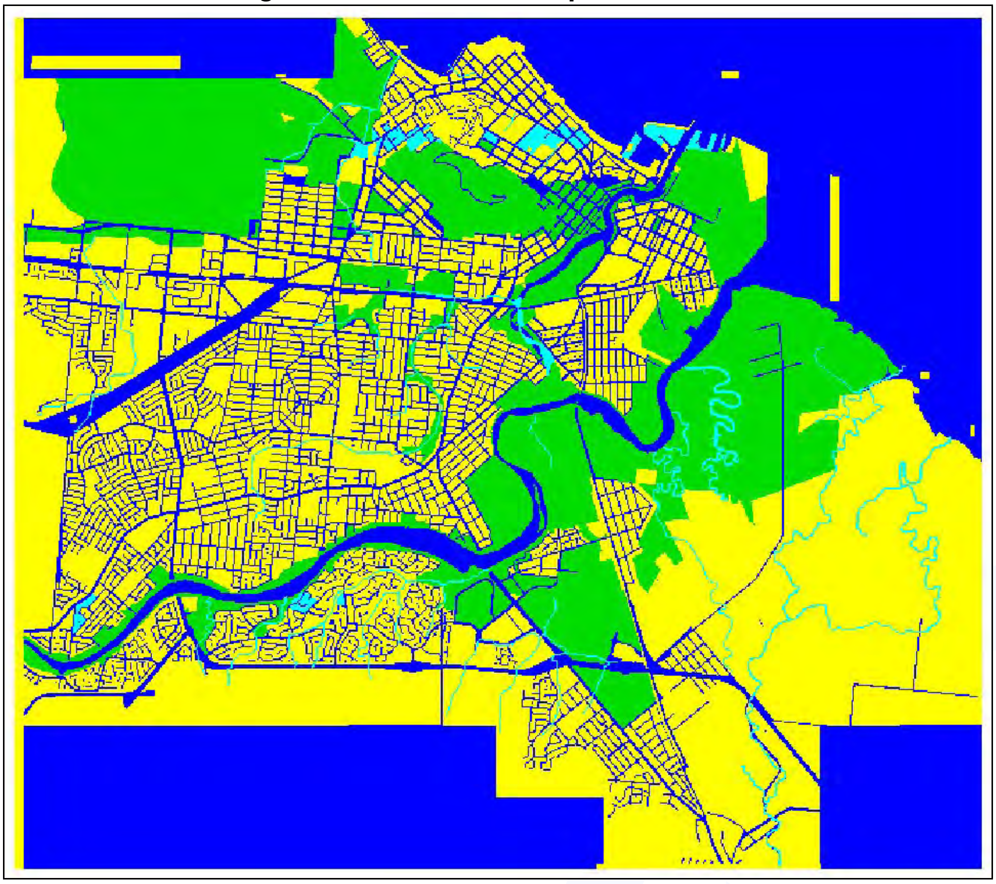


Table 23
Adopted Roughness Values in MIKE21 Model

Land Use	Roughness (Manning's n)
Major Water Course	0.020
Minor Tributary or Water Course	0.028
Roads	0.020
Urban Development	0.050
Heavily Vegetated Flood Plains	0.050
Open Space and Tidal Flats	0.031

4 Hydraulic Modelling

Simulation Parameters

The model simulation time step is generally limited by the Courant conditions. The Courant condition is a function of the water depth and the flow velocities at any time step. The Townsville MIKE21 model was developed with a maximum simulation time step of 2 seconds. The model simulation results were saved at 10-minute intervals.

4.4.2 Model Calibration

The MIKE21 surface flow model was calibrated to a series of reported flood levels from the 1998 flood event. The 1998 flood event is the largest local catchment flooding event on record with a considerable number of peak flood levels surveyed throughout the Townsville area. Council provided peak flood level records for more than 200 locations across Townsville. Many of the flood records were approximate estimates of height above kerb or ground levels, whilst other records were obtained from flood marks, which are considered to be more reliable estimates. In some cases the flood records appear to be affected by local flow conditions because of some discrepancy in peak heights between neighbouring records.

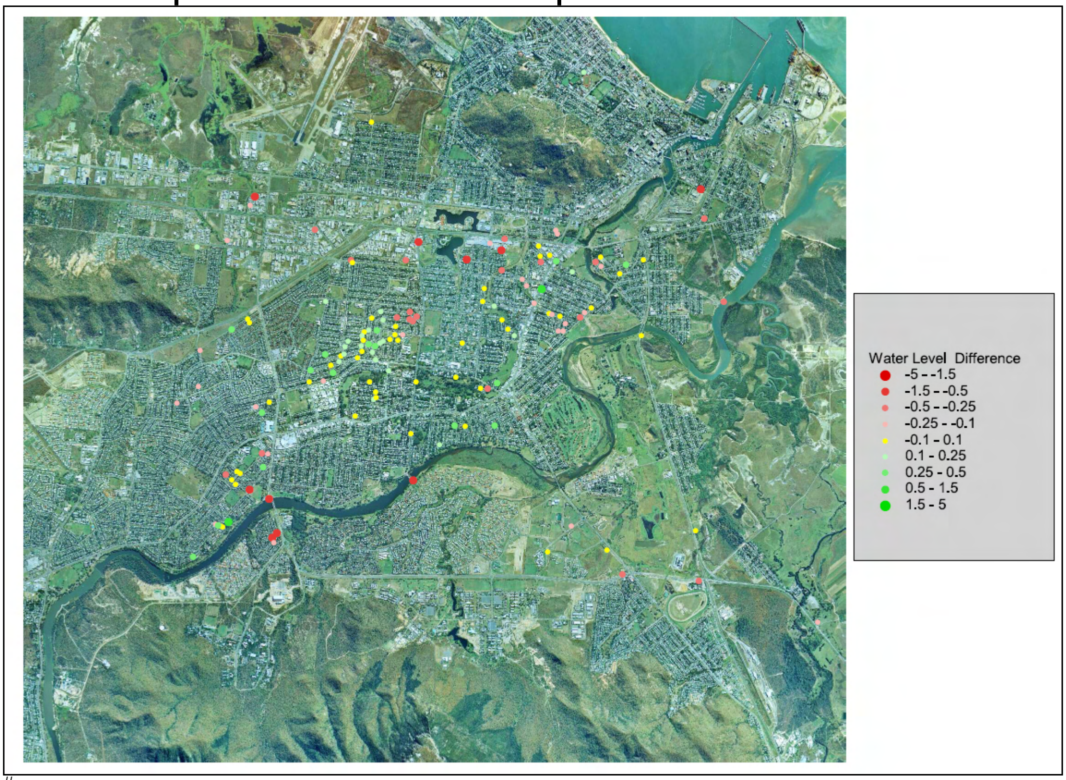
The 1998 calibration event was simulated using a constant ocean level boundary condition of 1.21 m AHD, which was approximately the peak tide at the commencement of the 1998 event. The constant level boundary condition is slightly conservative, as a tidal boundary would allow the floodwaters to flow out of the system during an ebb tidal cycle. The boundary conditions for the MIKE21 surface flow model were developed for a simulation period from 18:00 on 10 January 1998 through to 06:00 on 11 January 1998.

The calibration results have been presented as thematic map detailing the differences between peak simulated flood level and the records flood level (refer to **Figure 38**). The thematic map is useful in highlighting the spatial variability in the calibration results. In some locations the model produces an excellent calibration (less than 0.1 m difference) while a nearby recorded flood level shows significant difference to the simulated results. In these instances the reliability of the recorded level is likely to have been affected by local flow conditions such as flow blockages.

The overall model calibration result has a good spatial comparison between simulated and recorded levels. Where it was not possible to improve the calibration further the model parameters were adjusted to ensure that a slightly conservative result is achieved. Similar to the presentation of MIKE11 verification results for the January 1998 event, a plot of the discrepancy between the MIKE21 model and surveyed levels for January 1998 is shown in **Figure 39**. At the locations where direct comparison could be made, the model is generally within +/- 0.25 m of the recorded flood levels (average difference of 0.06 m).

4 Hydraulic Modelling

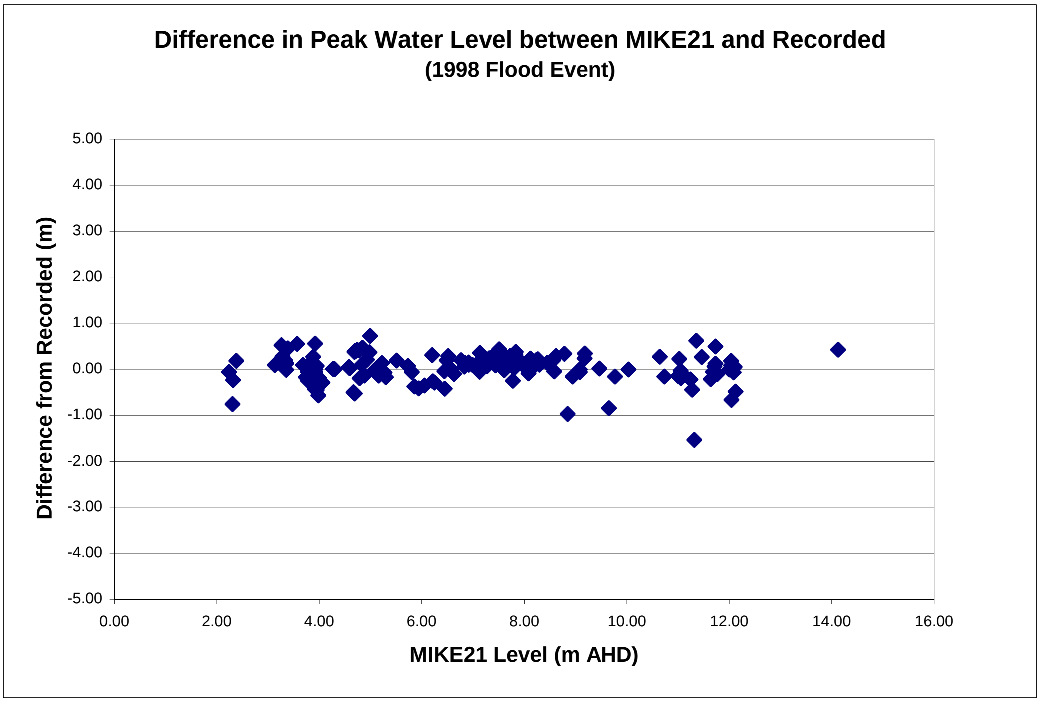
Figure 38
Thematic Map of Peak MIKE21 Level Comparison



Thematic map (circular symbols) indicates magnitude of difference (green indicates MIKE21 predicts higher level).

4 Hydraulic Modelling

Figure 39
1998 MIKE21 Calibration – Comparison of Surveyed Levels



4.4.3 Model Results

The MIKE21 model was used to predict flood extents and depths for the design events of Probable Maximum Flood (PMF), as well as 50 and 100 Year ARI. The models were developed with boundary conditions for each event as detailed previously. A summary of the design discharges input to MIKE21 is presented in **Table 24**.

Table 24
Summary of Maximum Discharges for Design Floods in MIKE21

Design Event	Peak Design Discharges (m^3/s)			
	Ross River (COT Boundary)	Louisa Creek (Overflows from Bohle River)	Stuart Creek	247 Local Sub-catchments
PMF	2633	429	2500	2.7 – 456
100 Year ARI	593	5.0	540	0.7 – 127
50 Year ARI	517	3.7	470	0.5 – 106
20 Year ARI	428	2.5	380	0.4 – 91
10 Year ARI	351	0	310	0.3 – 72
5 Year ARI	296	0	260	0.2 – 59

All design floods were simulated with constant downstream ocean water level conditions of 1.2 m AHD (Mean High Water Spring). The design flood model results are presented in **Appendix E,** based on the mitigation options programmed for completion before July 2004 (refer **section 0**), as a series of maximum flood depth maps. The results were also provided in GIS format to Council so that they can be used to interrogate specific model results at individual locations within the city.

4 Hydraulic Modelling

A discussion of the MIKE21 inundation mapping results (for flooding and storm surge) is included in **Section 5**.

4.5 Mitigation Option Assessment – Townsville Floodplain

Measures for mitigating flood impact were modelled for the Townsville Floodplain using both MIKE11 and MIKE21. The flood mitigation options considered in the modelling were those programmed for completion by the end of the 2003-2004 financial year, (shortly after release of this report). The mitigation options accounted for in the modelling were:

- the Barryman Street pump station;
- the Albany Road pump station;
- the large culvert between Lakes 1 and 2 under Woolcock Street;
- the widening of the Woolcock Street Canal downstream of Park Street;
- the duplication of the Woolcock Street Canal between Sturt and Flinders Streets, including duplicate culverts and tide gates.

Flood inundation maps for the Townsville Floodplain presented in **Appendix E** are based on the Digital Elevation Model developed in Phase 1 of this Study and the mitigation options described above.

5 Flood and Surge Inundation Maps

5 Flood and Surge Inundation Maps

5.1 General

Inundation maps for the flooding scenarios modelled are presented in **Appendix E**, for the Townsville floodplain (based on mitigation options), and Magnetic Island. Inundation maps for storm surge and tidal inundation scenarios for Cungulla and Pallarenda are also shown. The following sections provide summaries of the mapping methodology used and descriptions of the predicted inundation patterns.

5.2 Flood Inundation

MIKE11 GIS is a software package that integrates the MIKE11 modelling program with ArcView Geographic Information Systems (GIS). The software is able to produce flood maps automatically using the results of MIKE11 result files together with a Digital Elevation Model (DEM). MIKE11 GIS produces flood maps by comparing modelling water levels with the DTM to determine the lateral extent (and depths) of the inundation. Other useful information, such as cadastral boundaries and aerial photographs can be viewed simultaneously with the flood maps. Flood mapping is a powerful tool that can be used for model calibration (if flood extent and patterns are known) and to illustrate the impacts of flooding.

Flood mapping was undertaken of MIKE11 peak flood level results on a 2m grid for Magnetic Island, and a 10 m grid for Townsville floodplain areas, Cungulla and Pallarenda. Greater accuracy of flood mapping is achieved when using a smaller grid size although this introduces greater computational effort. The grids adopted for each model was the smallest that could be handled reasonably by the software.

The MIKE21 model of the Townsville floodplain produces inundation (depth) maps by default, in a grid format that can be read by both ArcView GIS and MapInfo systems. MIKE21 also produces water level and flow velocity maps that were used in the assessment of hazard (refer to Phase 3 Report). Flood inundation maps presented for the Townsville floodplain are those for the six (6) hour storm duration only. Both the 2 and 6-hour storm events were assessed in the MIKE11 modelling, but only the 6-hour storm event was modelled using MIKE21.

For the range of ARI's modelled, a comparison of the 2 and 6 hour flood depths showed that only a small number of areas experienced greater than 100 mm difference. As this difference was not perceivable at the scale of mapping adopted in **Appendix E**, and the 6-hour event generally produced a worse result for most areas, only the 6-hour event mapping has been presented.

The following sections highlight the relevant features of each design event flood inundation map. It is important to note that the extent of mapping has been limited to the area covered by both the aerial photography and the digital contour mapping.

5 Flood and Surge Inundation Maps

5.2.1 Magnetic Island

A detailed discussion of the extent of flooding in each of the bays on Magnetic Island (for the range of ARI's modelled) is presented in **Table 25** below.

Table 25
Flood Inundation Mapping Characteristics – Magnetic Island

Catchment	ARI	Description of flooding
Picnic Bay	2-5	▪ Flows exceed the unnamed drainage path that runs parallel to and between Granite Street and Yule Street. ▪ Flooding along Picnic Street occurs due to the insufficient capacity of road culverts at Picnic Street.
	10-20	▪ Birt Street and Picnic Street road crossings are overtopped due to a 10 Year ARI event at Butlers Creek.
	50-100	▪ Flood waters overtop the road and inundate low-lying areas upstream and downstream, extending east to Granite Street.
	PMF	▪ Widespread flooding occurs along the two drainage paths with significant inundation of Picnic Street.
Nelly Bay	2-5	▪ Localised flooding occurs along Gustav Creek. ▪ Some properties adjacent to drainage path between Lilac Street and Yates Street are inundated.
	10-20	▪ Properties built in low-lying areas downstream of Sooning Street are subject to flooding. ▪ Elena Street and Barton Street road crossings are overtopped in the 20 and 10 Year ARI events respectively.
	50-100	▪ Properties along Compass Crescent are subject to flooding with water backing up behind Sooning Street.
	PMF	▪ Widespread flooding with inundation of properties along Murray Street from overflows from Gustav Creek. ▪ Properties downstream of Sooning Street are inundated. ▪ Access along Nelly Bay Road restricted for majority of its length.
Arcadia	2-5	▪ Localised flooding occurs along Petersen Creek, particularly at road crossings and low-lying areas.
	10-20	▪ Build up of floodwater upstream of Marine Parade.
	50-100	▪ Localised flooding around Arcadia Resort.
	PMF	▪ Significant number of properties inundated, and access along Marine Parade restricted.
Horseshoe Bay	2-5	▪ Horseshoe Bay Road overtopped at the swamp crossing. ▪ Flows surcharge the existing drainage along Apjohn Street and cause localised flooding of the urbanised area downstream. ▪ Properties located within the low-lying areas upstream of the road culverts on Gifford Street are subjected to frequent flooding due to the insufficient capacity of the culverts.
	10-20	▪ Further inundation of properties upstream of Gifford Street and adjacent to Corica Crescent.
	50-100	▪ Flooding of properties adjacent to Dent Street.
	PMF	▪ Widespread flooding of all urbanised areas with shops along Henry Lawson Street and properties adjacent to the drainage path in this area inundated. ▪ Significant flooding of residential development upstream of Gifford Street.

The above information was used in the assessment of flood damages (properties inundated), possible flood mitigation scenarios and the assessment of community vulnerability to flooding, all of which are contained in the Phase 3 Report.

5 Flood and Surge Inundation Maps

5.2.2 Townsville Floodplain

A detailed discussion of the extent of flooding in each of the sub-areas comprising the Townsville floodplain (for the range of ARI's modelled) is presented in **Table 26** and **Table 27** below, for the MIKE11 and MIKE21 model results respectively.

Table 26
Flood Inundation Mapping Characteristics – Townsville Floodplain (MIKE11)

Catchment	ARI	Description of flooding
City	2-5	▪ Localised flooding at Barryman Street and Kitchener Street, and build up of floodwaters upstream of Bayswater Road. ▪ Flooding along overland flow path in Mundingburra, particularly at Arthur Fadden Park and the Love Lane / Brairfield Street intersection. ▪ Inundation at Cuthbert Crescent (Vincent), and various sites within North Ward, particularly the intersections of Howitt Street and Cook Street, Landsborough Street and Warburton Street, Mitchell Street and Oxley Street and the length of Mitchell Street between Kennedy Street and Burke Street. ▪ Bayswater Terrace on Mindham Park Drain overtopped (5 Year ARI).
	10-20	▪ Widespread local flooding of overland flow paths through Cranbrook, Heatley, Vincent and Currajong. ▪ Inundation of industrial properties along Peewee Creek, with inundation at the Duckworth Street / Bayswater Road intersection. ▪ Airstrip free from flooding.
Fairfield	2-5	▪ Abbott Street near service station and Bruce Highway at Jurekey Street intersection overtopped (2 Year ARI). ▪ Floodwaters surround service station opposite the racecourse, with significant inundation of racecourse car park. ▪ Properties east of Lavarack Barracks and south of University Drive (Newton Street) subject to localised flooding. ▪ Inundation of development at end of Minehane Street. ▪ Mervyn Crossman Drive overtopped at turnoff to Townsville Hockey.
	10-20	▪ Access along Bruce Highway at Stuart Creek restricted in the 20 Year ARI flood event, as is Stuart Drive just north of University Drive. ▪ Inundation of Mervyn Crossman Drive / Murray Lions Crescent intersection near William Ross School (access to the school restricted).
South Townsville	2-5	▪ No flood inundation evident outside tidal zones
	10-20	▪ Floodwaters contained within drainage systems, although extend to Boundary Street, Ninth Street and Seventh Street.
Mount Louisa	2-5	▪ Louisa Creek of sufficient capacity until constriction at Ingham Road. ▪ Flooding north of Ingham Road in areas around Mt St John STP and Town Common. ▪ Localised flooding upstream of Woolcock Street at Calvary Drain.
	10-20	▪ Widespread flooding of residential properties upstream of Woolcock Street along Calvary drain east to Louisa Creek, in addition to properties along Bayswater Road. ▪ Inundation of some properties along Buchanan Street.
Annandale	2-5	▪ Annandale area generally flood free (some inundation of Palmetum area).
	10-20	▪ Access to the hospital flood free for events greater than 20 Year ARI.

5 Flood and Surge Inundation Maps

Table 27
Flood Inundation Mapping Characteristics – Townsville Floodplain (MIKE21)

Catchment	ARI	Description of flooding
City	50-100	▪ Continuous flooding along Albert Street and Alfred Street (Stockland Plaza) with overland flows reaching Mindham Park drainage system. ▪ Widespread surface flooding through Gulliver and Pimlico. ▪ Surcharge of flows from Mindham Park to Ross Creek. ▪ Lake drainage network surcharged with flows overtopping Kings Road and connecting to Mindham drainage system.
	PMF	▪ Extensive overland flow throughout the majority of suburban areas. ▪ No overflows from Ross River left bank until Bowen Road (inundation of areas upstream of Bowen Road due to local flooding). ▪ Lakes drainage system surcharges north to Rowes Bay Canal, effectively encircling Castle Hill. ▪ Continuous inundation along Mitchell Street to Heatleys Parade. ▪ Eastern taxiway at airport inundated but main runway above floodwaters. ▪ Lower slopes of Castle Hill flood free as are some areas within Pimlico and Mysterton, as well as areas around Charles Street in Heatley.
Fairfield	50-100	▪ Property upstream of Bruce Highway between Stuart Creek and the racecourse inundated. ▪ Major access routes cut at numerous locations. ▪ Murray Sporting Complex inundated. ▪ Inundation of Cluden residential area off Racecourse Road.
	PMF	▪ Continuous inundation between racecourse and Ross River, including all access roads leading into town. ▪ Island of high ground around old drag strip off Abbot Street. ▪ Full length of Bruce Highway to University Drive, including major intersection at Stuart Drive inundated.
South Townsville	50-100	▪ Significant inundation of land and property between Boundary Street and Abbot Street, although Civic Theatre flood free.
	PMF	▪ Ross River completely connected to Ross Creek. ▪ Port area north of Allen Street generally flood free.
Mount Louisa	50-100	▪ Most areas within RAAF base flood free. ▪ Significant inundation of property adjacent to Louisa Creek.
	PMF	▪ Widespread inundation along Louisa Creek caused in part by overflows from the Bohle River system. ▪ Lower slopes of Mount Louisa flood free. ▪ Significant inundation south of Dalrymple Road.
Annandale	50-100	▪ Inundation along Fardon Street, however floodwaters contained within drainage systems. ▪ Access to hospital has flooding immunity greater than 100 Year ARI event.
	PMF	▪ Extensive flooding along all major drainage paths, with connectivity of flows from University Drive to Macarthur Park drain, Annandale Drain and Marabou Drive Drain.
Sandfly Creek	50-100	▪ Inundation of Cleveland Bay Purification Plant.
	PMF	▪ Whole of Sandfly Creek sub area underwater to depths greater than 2m.

The above information was used in the assessment of flood damages (properties inundated), other possible flood mitigation scenarios and the assessment of community vulnerability to flooding, all of which are contained in the Phase 3 Report.

5 Flood and Surge Inundation Maps

5.3 Storm Surge and Tidal Inundation

For some coastal areas the threat of inundation from extreme tides is greater than either river flooding or local runoff. This is particularly relevant for low-lying and exposed areas like Pallarenda and Cungulla for which storm surge and tidal inundation assessments have been undertaken.

As previously discussed, static surge modelling was undertaken for 50 and 100 year ARI events by applying static surge levels along the Pallarenda and Cungulla shorelines. These surge inundation maps have been developed in isolation from freshwater flooding. Normal tide inundation maps for Mean High Water Spring (MHWS) and Highest Astronomical tide have also been undertaken.

The recorded temporal pattern of tide level from Cyclone Althea was adopted as the basis for surge propagation modelling. Two temporal patterns were developed based on this information, being the recorded level during the event and another synthetic time series of water level reflecting the peak surge coincident with a Mean High Water Spring tide, resulting in peak of approximately 4.0 m AHD. It is likely that the results will reflect the surge mapping of RL 4.0 m AHD previously undertaken by Council; however, the propagation of the levels inland will result in a slightly attenuated peak.

Storm surge and tidal inundation maps were developed using MIKE11 GIS and MIKE21 hydraulic models, and are contained in **Appendix E**. The following sections highlight the relevant features of each surge and tide inundation map. It is important to note that the extent of mapping has again been limited to the area covered by both the aerial photography and the digital contour mapping.

It should also be noted that the assessment of storm surge presented in this report is preliminary, as storm surge is far from a static phenomenon. Our experience in cyclone modelling in North Queensland suggests that wind and wave effects have a considerable influence on the level recorded at the beachfront and the ability of the surge to propagate inland.

5 Flood and Surge Inundation Maps

5.3.1 Townsville Floodplain

A detailed discussion of the extent of storm surge and tidal inundation on the Townsville floodplain (for the two alternative Cyclone Althea scenarios) is presented in **Table 28** below.

Table 28
Surge/Tide Inundation Mapping Characteristics – Townsville Floodplain

Storm Surge and Tide Levels	Description
Cyclone Althea	▪ Inundation of Ross Creek extends to Bayswater Road upstream of the Lakes Development and to Bayswater Terrace via Mindham Park drain.
	▪ Surge overtops Boundary Street at two locations, inundating property along Tully Street and extending further to Morey Street.
	▪ Inundation of low-lying areas from Boundary Street to Abbott Street.
	▪ Surge extends to Aplins Weir although contained within Ross River
Cyclone Althea (coincident with high tide)	▪ Connectivity of tidal flows from Ross Creek to Ross River, with complete inundation of Reid Park, although Civic Theatre and 10 Terminal above inundation level.
	▪ Widespread inundation from Ross River to Abbott Street and beyond.
	▪ Inundation of causeway intersection, with flows extending from Mindham Park drain across Charters Towers Road to Queens Road.

For the case of the synthetic scenario above (Cyclone Althea coincident with high tide) the pattern of inundation is similar to that presented in the Storm Surge Action Guide, jointly published by Townsville and Thuringowa City Councils.

The following is an extract from correspondence and documentation provided by the Bureau of Meteorology Severe Weather Centre detailing the impacts of cyclones of the Queensland coast.

"*Althea crossed the coast just north of Townsville with a 106 knot gust being reported at the Townsville Met Office. There were three deaths in Townsville and damage costs in the Townsville region reached $50 million in 1971 dollars. Many houses were damaged or destroyed (including 200 Housing Commission homes) by the winds. On Magnetic Island, 90% of the houses were damaged or destroyed. A 2.9 m storm surge was recorded in Townsville Harbour, however the maximum storm surge of 3.66m was to the north at Toolakea. This storm surge occurred at low tide, however the surge and large waves caused extensive damage along the Strand and at Cape Pallarenda.*"

From a Disaster Risk Management perspective, storm surge and cyclones constitute a significant risk to Townsville. However, the development of risk mitigation strategies and assessment of community vulnerability for storm surge are beyond the scope of this Study.

5.3.2 Pallarenda and Cungulla

A detailed discussion of the extent of storm surge and tidal inundation for Pallarenda and Cungulla on the Townsville floodplain (for the range of events modelled) is presented in **Table 29** and **Table 30** below.

Table 29
Surge/Tide Inundation Mapping Characteristics – Pallarenda

Storm Surge and Tide Levels	Description
MHWS	▪ No impact - tidal inundation confined within existing drainage paths.
HAT	▪ Low-lying areas of Pallarenda inundated however no property affected by tidal inundation.
50yr + Wave Setup	▪ Properties furthermost from the front beach impacted by storm surge propagating along existing drainage path and behind development. Significant number of properties at risk of inundation
100 yr + Wave Setup	▪ Further inundation of property (at both northern and southern ends of developed areas).
Cyclone Althea	▪ Storm surge confined within existing drainage paths
Cyclone Althea (coincident with high tide)	▪ Significant flooding of property and low-lying areas throughout Pallarenda. Storm surge crosses road and potential to restrict access to northern suburbs.

Table 30
Surge/Tide Inundation Mapping Characteristics – Cungulla

Storm Surge and Tide Levels	Description
MHWS	▪ Minor tidal inundation however confined within existing drainage paths.
HAT	▪ Drainage paths full however no inundation of property.
50yr + Wave Setup	▪ Extensive inundation of property, particularly at northern end. Low-lying areas subject to flooding. Local access roads cut at a number of locations.
100yr + Wave Setup	▪ Further inundation of property.
Cyclone Althea	▪ Inundation of low-lying areas. Some properties affected however less than that for the 50 Year ARI surge event.
Cyclone Althea (coincident with high tide)	▪ Entire developed area of Cungulla inundated and significant damage to property expected. Access into Cungulla restricted due to inundation of main access road.

The above information was used in the assessment of possible flood mitigation scenarios and the assessment of community vulnerability to storm surge, all of which are contained in the Phase 3 Report.

6 References

6 References

Beach Protection Authority, Queensland (1985) Storm Tide Statistics, Townsville Region

Bureau of Meteorology (1994) Bulletin 53 – The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method

Bureau of Meteorology (1998) Severe Weather and Flooding, North Queensland, January 1998

Bureau of Meteorology (2001) Queensland Climate Change and Community Vulnerability to Tropical Cyclones

Cardno & Davies Pty Ltd (1998) Fairfield Land Pty Ltd – Hydraulic Addendum to EIS

Halliburton KBR Pty Ltd (2000) Townsville Port Access Hydraulic Assessment

Maunsell Australia Pty Ltd (1997) Stuart Creek Flood Study

Maunsell McIntyre Pty Ltd (2000) Bohle River Floodplain Management Study

McIntyre & Associates Pty Ltd (1999) Kirwan-Bohle Drainage Diversion, Louisa Creek Flood Study

Queensland Government (2002) The Official Tide Tables and Boating Safety Guide

Sinclair Knight Merz (1990) Ross River Dam Safety Review

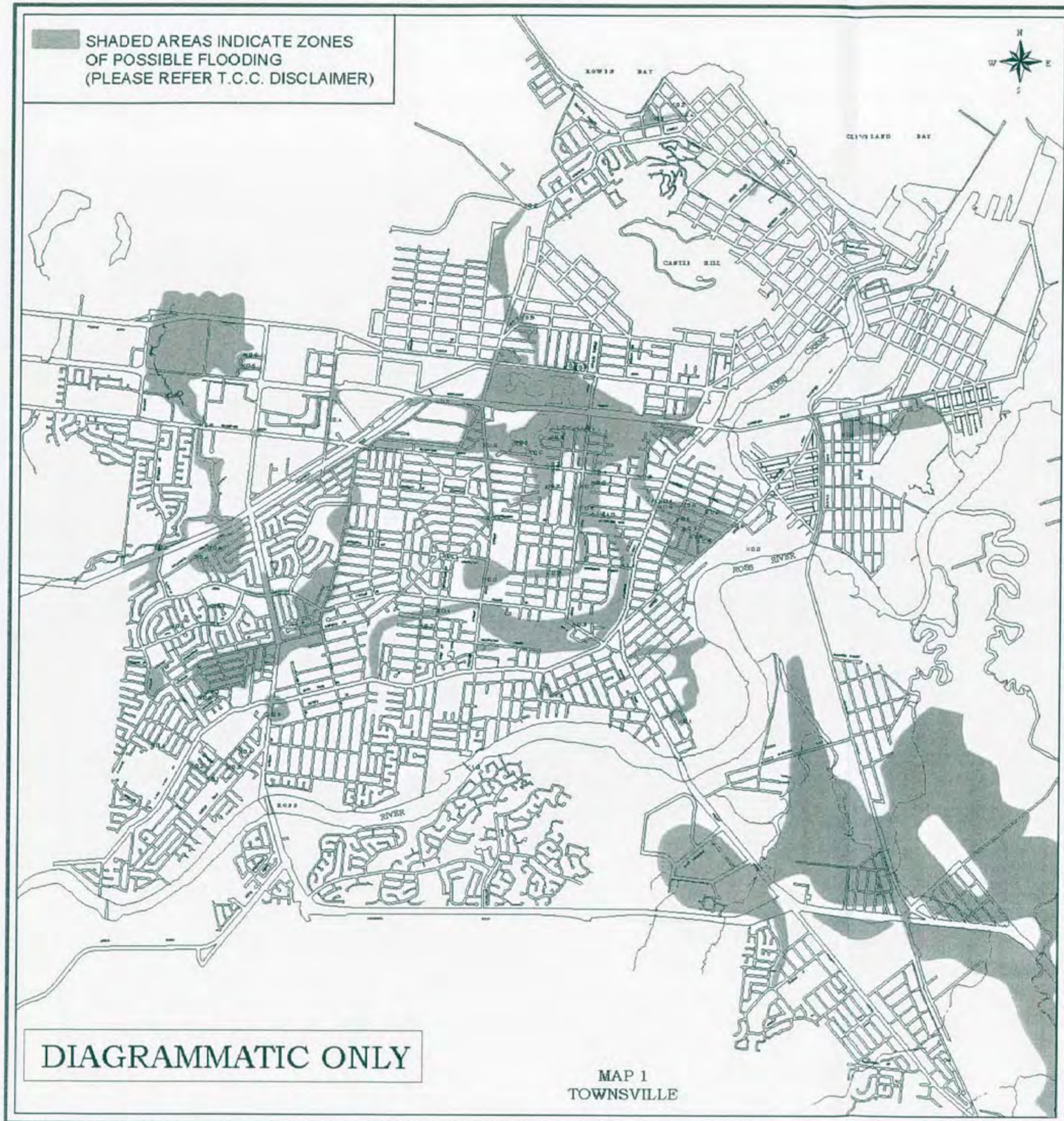
Sinclair Knight Merz (1998) Ross River Dam URBS Calibration and Design Flood Reassessment

The Institution of Engineers, Australia (1987) Australian Rainfall and Runoff, Vol. 2

The Institution of Engineers, Australia (1998) Australian Rainfall and Runoff

Townsville City Council (2001) Townsville Flood Hazard Assessment Project Brief

Appendix A TCC Flood Map (March 1990)



INFORMATION TO ACCOMPANY FLOOD MAPS

- The information contained on the attached flood maps is gathered from records held by Council.
- Whilst every care has been taken in collecting this information, it should only be used as a guide, it is not complete and should not be used to draw conclusions about flooding on individual properties. You should seek advice from adjoining local residents.
- This warning is given because the collection of the information is often done up to one week after the event and is taken from scum lines and debris buildup on fences together with anecdotal advice from affected residents.
- Council is not confident of the completeness of the maps because:-
  - No two storms are of the same duration or intensity.
  - Many short intense storms are relatively local in nature and do not effect a large area.
  - Tidal influences can effect the efficiency of drains at certain times in some parts of the city e.g. Railway Estate, Hyde Park and Pimlico.
  - Despite ongoing maintenance, side inlet pits and grates, can become blocked with debris and fail to function properly.
  - Improvements to the drainage network are continually being undertaken by Council.
- Council endeavours to provide a drainage network comprising 2 components:-
  - An underground system to accommodate flows up to a 1 in 2 year event in residential areas.
  - An above ground system for events greater than this e.g. roads, parks, natural watercourse, etc. This means that many of the streets are meant to channel overground water in heavy rain.
- Very severe storms will produce flooding in areas other than those marked.

STORM SURGE

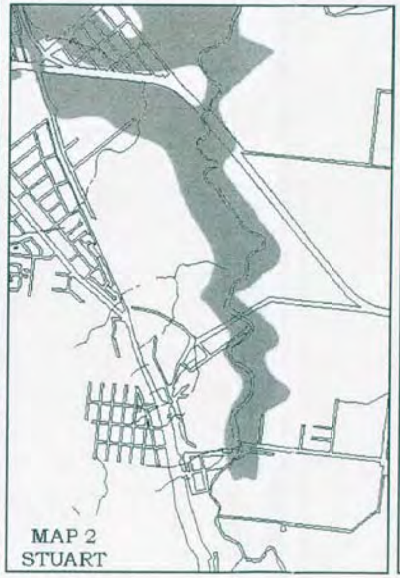
- Storm surge is a rising of the sea level associated with cyclone activity.
- Very limited information is available to enable accurate predictions to be made regarding the extent of storm surge in this city.

Council has produced contour maps, which indicate lower lying areas, which could be subject to storm surge.

Estimates from available information indicate a storm surge to the 4.00m AHD contour equates to about a 1 in 250-year-event.

Council has records of a 3m surge associated with Althea in 1971, however this coincided with a low tide, so it's affect on low-lying areas was limited.

Storm surges associates with Cyclone Justin & Cyclone Sid were of the order of 800mm.



TOWNSVILLE CITY COUNCIL DISCLAIMER

The ground contours on this drawing have been plotted from a range of maps prepared and collected over many years, the original accuracy of which cannot be verified. Significant changes in surface levels have occurred in various locations since the original surveys were completed.

The information shown on this plan was derived from observations and photographic evidence from the flood event and is not guaranteed as accurate or complete, but has been compiled from the best information available at the time.

This plan does not include information derived from the flood event in Townsville in 1998, because the severity of that event caused a very significant level of unreliablity in the collected data.

The variability of rainfall and the unreliability of the core data mean that the information on this plan is no more than a guide.

For more particular flooding details, the Council recommends that you discuss the matter with long standing residents of the particular area you are interested in.

SCALE 1:30000

500 0 500 1000 1500 2000 2500 Meters

TOWNSVILLE CITY AREAS FLOODED MARCH 1990

Date: 10/10/2001

Produced by Land Information Unit

DRAWING NO: 45095

Appendix B Flood Questionnaire

SURVEY FORM
TOWNSVILLE FLOOD ASSESSMENT STUDY

Section A – Locality Details

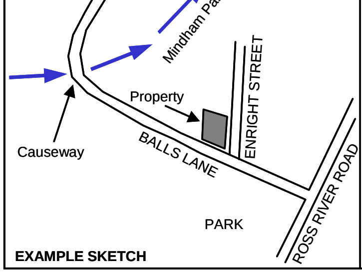
A1 – Address
(*Please complete address details for your property*)

Street Number: __________

Street Name: ___________________________

Suburb: ___________________________

A2 – Location Sketch
(*An area is provided below for you to sketch the location of your house/property relative to the closest roads and drainage features*)



Section B – Flood History
(*Council is seeking details of flood levels from recent flood events in Townsville*)

B1 – Recent Minor Flooding in February 2002

Did floodwater cause inundation of the property? Yes / No / Unknown (*circle*)

If YES, please indicate peak depth ☐ above ground ☐ above floor (*tick one*)

______________ mm / inches (*circle*)

When did the floodwater peak? Date: ___/___/___ Time ____ am / pm (*circle*)

Other comments ____

____

____

____

B2 – April 2000 (Tropical Cyclone Tessi)

Did floodwater cause inundation of the property? Yes / No / Unknown (*circle*)

If YES, please indicate peak depth ☐ above ground ☐ above floor (*tick one*)

______________ mm / inches (*circle*)

When did the floodwater peak? Date: ___/___/___ Time ____ am / pm (*circle*)

Other comments ____

____

____

____

B3 – January 1998 (ex-Tropical Cyclone Sid)

Did floodwater cause inundation of the property? Yes / No / Unknown (*circle*)

If YES, please indicate peak depth ☐ above ground ☐ above floor (*tick one*)

________________ mm / inches (*circle*)

When did the floodwater peak? Date: ___/___/___ Time ____ am / pm (*circle*)

Other comments ____

B4 – Other Event ____

Did floodwater cause inundation of the property? Yes / No / Unknown (*circle*)

If YES, please indicate peak depth ☐ above ground ☐ above floor (*tick one*)

________________ mm / inches (*circle*)

When did the floodwater peak? Date: ___/___/___ Time ____ am / pm (*circle*)

Other comments ____

Section C – Permission Information
(*Council wish to know if you are willing to contribute further to the Study*)

C1 – Survey of Flood Levels

Do you give approval for Council to survey the flood levels detailed in Section B, if required?

☐ YES ☐ NO (*tick one*)

C2 – Further Discussions

Do you give approval for the Engineering consultant to contact you further if required, to discuss or clarify any issues you have raised?

☐ YES ☐ NO (*tick one*)

C3 – Contact Details

If you answered YES to any of the above, please provide contact details below.

Respondents Name: ____________________

Phone Number: ________________________

Appendix C Catchment Maps – Volume 2

Appendix C - Index

(Catchment Maps – Bound Separately)

Plan No.		Description
80301202/CM1		Picnic Bay Catchment Plan
80301202/CM2		Nelly Bay Catchment Plan
80301202/CM3		Geoffery Bay Catchment Plan
80301202/CM4		Horseshoe Bay Catchment Plan
80301202/CT1	A	Overall Plan showing all six Catchments - Townsville Flood Plan
80301202/CT2	A	Bohle Industrial and Louisa Creek Catchment Plan
80301202/CT3	A	Rowes Bay Canal and Townsville City Catchment Plan
80301202/CT4	A	Ross Creek Catchment Plan
80301202/CT5	A	Ross River Catchment Plan
80301202/CT6		Gordon Creek Catchment Plan
80301202/CT7		Stuart Creek Catchment Plan
80301202/CT8	A	Town Common, Pallarenda & Rowes Bay Catchment Plan

Appendix D MIKE Modelling Results – Volume 1 / Volume 2

MIKE11 MODELLING RESULTS: PICNIC BAY

PICNIC BAY						
Branch, Chainage	**2yr ARI**			**5yr ARI**		
	Water Level	**Discharge**	**Velocity**	**Water Level**	**Discharge**	**Velocity**
	(m)	**(m^3/s)**	**(m/s)**	**(m)**	**(m^3/s)**	**(m/s)**
PICNIC_MAIN 10284.10	8.92	5.6	0.50	9.48	9.6	0.56
PICNIC_MAIN 10341.70	8.77	5.8	0.40	9.09	9.9	0.48
PICNIC_MAIN 10568.20	6.65	6.4	0.79	6.78	10.7	0.91
PICNIC_MAIN 10728.50	3.76	7.0	1.08	4.23	11.6	1.12
PICNIC_MAIN 10765.90	3.29	7.2	1.21	3.52	11.9	1.41
PICNIC_MAIN 10876.50	2.32	7.2	0.63	2.49	11.9	0.81
PICNIC_WEST 10150.00	10.57	2.3	0.53	10.76	4.2	0.61
PICNIC_WEST 10168.50	9.66	2.9	1.14	9.82	5.3	1.26
PICNIC_WEST 10273.40	8.28	3.1	9.28	8.41	5.6	10.02
PICNIC_WEST 10297.90	7.60	3.2	0.42	7.67	5.8	0.54
PICNIC_WEST 10410.00	5.93	3.2	0.51	6.01	5.8	0.50
PICNIC_WEST 10454.20	4.85	3.5	0.47	4.91	6.2	0.59
PICNIC_WEST 10560.00	3.50	3.2	1.62	3.70	5.9	1.63
PICNIC_WEST 10830.00	1.84	5.9	0.33	1.84	9.1	0.49
PICNIC_WEST 10850.50	1.90	6.9	0.35	1.90	9.4	0.46

PICNIC BAY						
Branch, Chainage	**10yr ARI**			**20yr ARI**		
	Water Level	**Discharge**	**Velocity**	**Water Level**	**Discharge**	**Velocity**
	(m)	**(m^3/s)**	**(m/s)**	**(m)**	**(m^3/s)**	**(m/s)**
PICNIC_MAIN 10284.10	9.61	12.1	0.58	9.80	15.7	0.64
PICNIC_MAIN 10341.70	9.21	12.5	0.49	9.36	16.1	0.50
PICNIC_MAIN 10568.20	6.84	13.5	0.97	6.92	17.4	1.04
PICNIC_MAIN 10728.50	4.39	14.7	1.15	4.47	18.9	1.35
PICNIC_MAIN 10765.90	3.65	15.0	1.51	3.82	19.4	1.62
PICNIC_MAIN 10876.50	2.58	15.0	0.92	2.69	19.4	1.04
PICNIC_WEST 10150.00	10.81	5.1	0.53	10.86	6.5	0.53
PICNIC_WEST 10168.50	9.88	6.5	1.28	9.97	8.3	1.31
PICNIC_WEST 10273.40	8.44	6.8	9.12	8.49	8.6	7.04
PICNIC_WEST 10297.90	7.70	7.1	0.58	7.74	9.0	0.64
PICNIC_WEST 10410.00	6.03	7.2	0.55	6.05	9.1	0.53
PICNIC_WEST 10454.20	4.94	7.7	0.64	4.98	9.8	0.71
PICNIC_WEST 10560.00	3.80	7.4	1.52	3.89	9.6	1.63
PICNIC_WEST 10830.00	1.87	11.2	0.58	1.97	14.9	0.72
PICNIC_WEST 10850.50	1.90	11.7	0.53	1.93	15.5	0.64

PICNIC BAY						
Branch, Chainage	**50yr ARI**			**100yr ARI**		
	Water Level	**Discharge**	**Velocity**	**Water Level**	**Discharge**	**Velocity**
	(m)	**(m^3/s)**	**(m/s)**	**(m)**	**(m^3/s)**	**(m/s)**
PICNIC_MAIN 10284.10	10.01	19.46	0.68	10.13	23.1	0.71
PICNIC_MAIN 10341.70	9.53	19.95	0.52	9.63	23.7	0.53
PICNIC_MAIN 10568.20	7.00	21.66	1.11	7.07	25.6	1.16
PICNIC_MAIN 10728.50	4.55	23.64	1.53	4.63	28.0	1.62
PICNIC_MAIN 10765.90	3.99	24.27	1.73	4.12	28.7	1.80
PICNIC_MAIN 10876.50	2.80	24.23	1.15	2.90	28.7	1.24
PICNIC_WEST 10150.00	10.88	7.44	0.61	10.89	8.6	0.53
PICNIC_WEST 10168.50	10.03	9.48	1.32	10.06	10.9	1.34
PICNIC_WEST 10273.40	8.54	10.08	4.33	8.55	11.7	3.09
PICNIC_WEST 10297.90	7.78	10.55	0.68	7.78	12.3	0.72
PICNIC_WEST 10410.00	6.09	10.65	0.56	6.10	12.5	0.56
PICNIC_WEST 10454.20	5.02	11.48	0.75	5.03	13.5	0.80
PICNIC_WEST 10560.00	3.97	11.33	1.58	4.00	13.3	1.62
PICNIC_WEST 10830.00	2.09	18.11	0.83	2.15	21.3	0.92
PICNIC_WEST 10850.50	2.03	18.90	0.75	2.08	22.7	0.85

MIKE11 MODELLING RESULTS (cont) : PICNIC BAY

Branch, Chainage	PICNIC BAY		
	PMF		
	Water Level	Discharge	Velocity
	(m)	(m^3/s)	(m/s)
PICNIC_MAIN 10284.10	11.12	86.7	1.28
PICNIC_MAIN 10341.70	10.80	90.6	0.84
PICNIC_MAIN 10568.20	7.94	100.9	1.62
PICNIC_MAIN 10728.50	5.76	112.7	1.62
PICNIC_MAIN 10765.90	5.35	116.6	1.89
PICNIC_MAIN 10876.50	3.82	111.1	1.88
PICNIC_WEST 10150.00	11.09	28.9	0.72
PICNIC_WEST 10168.50	10.47	36.9	1.40
PICNIC_WEST 10273.40	8.85	40.0	1.01
PICNIC_WEST 10297.90	8.05	42.6	1.16
PICNIC_WEST 10410.00	6.37	43.6	0.81
PICNIC_WEST 10454.20	5.33	48.5	1.24
PICNIC_WEST 10560.00	4.55	48.9	0.92
PICNIC_WEST 10830.00	3.44	83.3	1.14
PICNIC_WEST 10850.50	2.97	86.5	1.75

MIKE11 MODELLING RESULTS: NELLY BAY

Branch, Chainage	NELLY BAY					
	2yr ARI			5yr ARI		
	Water Level	Discharge	Velocity	Water Level	Discharge	Velocity
	(m)	(m^3/s)	(m/s)	(m)	(m^3/s)	(m/s)
NELLY_MAIN 10422.10	6.28	30.8	1.23	6.97	53.8	1.62
NELLY_MAIN 10468.50	6.28	31.3	1.01	6.91	54.7	1.26
NELLY_MAIN 10682.20	5.86	39.4	0.70	6.35	65.8	0.89
NELLY_MAIN 10720.00	5.61	40.3	1.90	6.09	67.4	2.08
NELLY_MAIN 10994.20	4.26	39.8	1.11	4.57	66.7	1.13
NELLY_MAIN 11186.00	2.49	41.1	1.04	3.03	68.5	1.04
NELLY_MAIN 11246.00	1.30	54.7	1.58	1.27	68.9	1.99
NB_MAIN_PS 10007.30	11.45	3.1	0.94	11.78	5.5	0.98
NB_MAIN_PS 10045.50	11.38	3.1	0.55	11.59	5.5	0.59
NB_MAIN_PS 10227.90	9.17	9.9	1.83	9.38	14.5	1.83
NB_MAIN_PS 10462.90	6.73	9.8	0.70	7.07	14.3	0.79
NB_MAIN_MANDALAY 10007.60	7.96	2.2	1.12	8.38	3.9	1.35
NB_MAIN_MANDALAY 10026.40	7.96	2.2	1.12	8.38	3.9	1.35
NB_R1 10479.00	1.68	5.9	1.02	2.03	10.5	1.29
NB_R1 10522.00	1.24	6.0	1.65	1.37	11.2	2.53
NB_L3 10012.70	5.16	1.3	0.54	5.52	2.2	0.62
NB_L3 10034.80	5.09	1.3	0.44	5.38	1.8	0.50
NB_L3 10480.00	2.09	1.3	0.52	2.19	1.7	0.58
NB_L3 10492.90	1.70	1.3	0.86	1.75	1.8	1.00
NB_L2 10391.00	5.12	7.8	0.72	5.53	13.9	0.86
NB_L2 10453.00	4.97	7.9	0.43	5.14	14.7	0.47
NB_L2 10738.00	2.88	7.7	0.27	3.09	13.9	0.41
NB_L1 10002.00	7.08	2.1	0.43	7.24	3.6	0.48
NB_L1 10027.00	7.07	2.1	0.36	7.22	3.6	0.52
NB_L1 10483.00	3.16	2.5	0.25	3.64	4.4	0.32
NB_L1 10789.00	3.16	0.6	0.32	3.64	1.0	0.29
NB_L1 10829.00	3.16	0.1	0.01	3.63	1.0	0.08
NB_MAIN_ELENA ST 10044.00	16.67	3.2	0.90	17.51	5.6	0.95
NB_MAIN_ELENA ST 10100.00	15.12	3.2	1.57	15.51	5.5	1.85

Branch, Chainage	NELLY BAY					
	10yr ARI			20yr ARI		
	Water Level	Discharge	Velocity	Water Level	Discharge	Velocity
	(m)	(m^3/s)	(m/s)	(m)	(m^3/s)	(m/s)
NELLY_MAIN 10422.10	7.33	66.8	1.73	7.90	83.9	1.73
NELLY_MAIN 10468.50	7.17	67.9	1.38	7.59	85.0	1.44
NELLY_MAIN 10682.20	6.55	80.5	0.97	6.88	102.9	0.99
NELLY_MAIN 10720.00	6.33	82.6	2.11	6.65	106.6	2.17
NELLY_MAIN 10994.20	4.68	81.3	1.20	4.80	100.0	1.31
NELLY_MAIN 11186.00	3.33	83.8	1.04	3.63	103.2	1.05
NELLY_MAIN 11246.00	1.27	84.3	2.34	1.32	103.8	2.68
NB_MAIN_PS 10007.30	11.96	7.0	1.01	12.21	9.1	1.02
NB_MAIN_PS 10045.50	11.67	7.0	0.62	11.75	9.0	0.62
NB_MAIN_PS 10227.90	9.49	17.1	1.83	9.69	20.9	1.83
NB_MAIN_PS 10462.90	7.23	16.8	0.83	7.45	20.0	0.88
NB_MAIN_MANDALAY 10007.60	8.58	5.0	1.46	8.86	6.3	1.55
NB_MAIN_MANDALAY 10026.40	8.58	5.0	1.45	8.86	6.3	1.55
NB_R1 10479.00	2.21	13.1	1.39	2.48	17.1	1.47
NB_R1 10522.00	1.42	13.2	2.70	1.49	17.1	3.15
NB_L3 10012.70	5.59	2.6	0.58	5.64	3.5	0.75
NB_L3 10034.80	5.41	2.5	0.50	5.45	3.4	0.51
NB_L3 10480.00	2.23	2.0	0.60	2.29	2.2	0.63
NB_L3 10492.90	1.77	2.0	1.07	1.79	2.3	1.15
NB_L2 10391.00	5.63	16.4	0.91	5.80	22.0	1.01
NB_L2 10453.00	5.18	17.2	0.50	5.28	23.2	0.55
NB_L2 10738.00	3.18	16.7	0.45	3.33	21.8	0.53
NB_L1 10002.00	7.32	4.6	0.54	7.42	6.2	0.64
NB_L1 10027.00	7.30	4.5	0.61	7.39	6.1	0.75
NB_L1 10483.00	3.86	5.5	0.35	4.11	7.0	0.39
NB_L1 10789.00	3.86	1.8	0.30	4.10	3.0	0.35
NB_L1 10829.00	3.83	1.8	0.13	4.06	3.0	0.18
NB_MAIN_ELENA ST 10044.00	18.12	7.0	0.98	18.33	9.3	0.97
NB_MAIN_ELENA ST 10100.00	15.71	6.9	1.97	15.99	9.2	2.14

MIKE11 MODELLING RESULTS (cont) : NELLY BAY

NELLY BAY						
Branch, Chainage	50yr ARI			100yr ARI		
	Water Level	Discharge	Velocity	Water Level	Discharge	Velocity
	(m)	(m^3/s)	(m/s)	(m)	(m^3/s)	(m/s)
NELLY_MAIN 10422.10	8.18	102.6	1.70	8.40	123.2	1.67
NELLY_MAIN 10468.50	7.86	104.2	1.43	8.08	125.1	1.50
NELLY_MAIN 10682.20	7.01	121.9	1.04	7.20	145.3	1.09
NELLY_MAIN 10720.00	6.90	125.2	2.18	7.08	149.1	2.21
NELLY_MAIN 10994.20	4.94	124.3	1.43	5.07	147.8	1.53
NELLY_MAIN 11186.00	3.92	129.4	1.05	4.10	154.0	1.05
NELLY_MAIN 11246.00	1.43	130.2	3.03	1.54	155.1	3.28
NB_MAIN_PS 10007.30	12.47	11.0	1.03	12.58	13.0	1.04
NB_MAIN_PS 10045.50	11.82	11.0	0.61	11.88	13.0	0.64
NB_MAIN_PS 10227.90	9.84	24.3	1.83	9.98	27.3	1.83
NB_MAIN_PS 10462.90	7.63	23.4	0.93	7.83	26.1	0.96
NB_MAIN_MANDALAY 10007.60	9.08	7.3	1.59	9.27	8.4	1.65
NB_MAIN_MANDALAY 10026.40	9.08	7.3	1.58	9.27	8.4	1.64
NB_R1 10479.00	2.70	20.1	1.48	3.01	23.9	1.48
NB_R1 10522.00	1.54	20.2	3.48	1.61	23.9	3.82
NB_L3 10012.70	5.68	4.3	0.68	5.71	5.1	0.73
NB_L3 10034.80	5.48	4.1	0.50	5.50	5.0	0.63
NB_L3 10480.00	2.37	2.7	0.67	2.52	3.6	0.73
NB_L3 10492.90	1.83	2.8	1.26	1.90	3.7	1.43
NB_L2 10391.00	5.90	25.8	1.06	5.99	30.1	1.09
NB_L2 10453.00	5.34	27.5	0.60	5.40	32.0	0.63
NB_L2 10738.00	3.43	26.3	0.58	3.52	31.3	0.64
NB_L1 10002.00	7.50	7.5	0.68	7.58	9.0	0.72
NB_L1 10027.00	7.46	7.4	0.87	7.53	8.9	0.98
NB_L1 10483.00	4.35	8.3	0.42	4.51	9.7	0.44
NB_L1 10789.00	4.35	5.0	0.34	4.50	6.4	0.30
NB_L1 10829.00	4.34	4.9	0.22	4.49	6.3	0.23
NB_MAIN_ELENA ST 10044.00	18.44	11.0	0.95	18.54	13.0	0.99
NB_MAIN_ELENA ST 10100.00	16.18	11.0	2.25	16.37	12.9	2.36

NELLY BAY			
Branch, Chainage	PMF		
	Water Level	Discharge	Velocity
	(m)	(m3/s)	(m/s)
NELLY_MAIN 10422.10	10.32	452.8	1.57
NELLY_MAIN 10468.50	10.27	464.0	1.68
NELLY_MAIN 10682.20	9.50	534.1	1.47
NELLY_MAIN 10720.00	9.40	551.7	2.23
NELLY_MAIN 10994.20	6.49	547.3	2.48
NELLY_MAIN 11186.00	5.51	580.7	1.37
NELLY_MAIN 11246.00	2.65	620.3	4.88
NB_MAIN_PS 10007.30	13.15	38.0	1.07
NB_MAIN_PS 10045.50	12.39	38.0	0.84
NB_MAIN_PS 10227.90	10.81	76.6	1.83
NB_MAIN_PS 10462.90	9.77	75.5	1.13
NB_MAIN_MANDALAY 10007.60	11.20	23.0	2.50
NB_MAIN_MANDALAY 10026.40	11.33	22.9	2.50
NB_R1 10479.00	4.06	75.2	1.48
NB_R1 10522.00	2.40	73.6	5.01
NB_L3 10012.70	5.89	14.0	0.86
NB_L3 10034.80	5.69	14.0	1.03
NB_L3 10480.00	4.73	22.0	0.77
NB_L3 10492.90	2.38	22.7	1.65
NB_L2 10391.00	6.72	111.8	1.17
NB_L2 10453.00	6.11	122.3	1.13
NB_L2 10738.00	4.52	120.4	1.32
NB_L1 10002.00	8.36	27.0	0.97
NB_L1 10027.00	8.07	27.0	2.04
NB_L1 10483.00	6.32	26.8	0.63
NB_L1 10789.00	6.30	50.0	0.48
NB_L1 10829.00	6.29	49.8	0.30
NB_MAIN_ELENA ST 10044.00	19.05	37.0	1.29
NB_MAIN_ELENA ST 10100.00	17.99	37.0	2.93

MIKE11 MODELLING RESULTS: ARCADIA

	ARCADIA					
Branch, Chainage	**2yr ARI**			**5yr ARI**		
	Water Level	**Discharge**	**Velocity**	**Water Level**	**Discharge**	**Velocity**
	(m)	**(m^3/s)**	**(m/s)**	**(m)**	**(m^3/s)**	**(m/s)**
GEOFFREY_MAIN 10196.00	5.83	9.9	0.88	5.97	14.0	0.91
GEOFFREY_MAIN 10357.00	4.06	13.8	1.01	4.37	19.0	1.13
GEOFFREY_MAIN 10413.00	3.88	14.0	0.88	3.99	19.3	1.06
GEOFFREY_MAIN 10449.00	3.70	13.9	1.27	3.76	19.2	1.26
GEOFFREY_MAIN 10607.00	3.04	15.5	0.47	3.11	21.2	0.53
GEOFFREY_MAIN 10681.00	2.34	17.8	0.56	2.52	24.5	0.63
GEOFFREY_MAIN 10714.00	2.31	17.8	0.42	2.46	24.4	0.52
GB_MAIN_MCCABE CR 10106.00	3.54	2.5	0.57	3.59	3.3	0.63
GB_MAIN_MCCABE CR 10287.00	2.49	2.3	0.46	2.61	3.1	0.47
GB_MAIN_HAYLES 10148.00	5.25	1.9	1.67	5.39	2.6	1.56
GB_MAIN_HAYLES 10187.00	4.49	2.3	1.58	4.59	3.0	1.73
GB_R1 10006.00	3.47	0.3	0.17	3.49	0.3	0.21
ALMA_MAIN 10021.00	8.00	2.1	0.47	8.05	2.8	0.49
ALMA_MAIN 10081.00	5.07	3.1	2.04	5.15	4.2	2.22
ALMA_MAIN 10240.00	2.48	3.6	0.29	2.57	4.8	0.32
ALMA_MAIN 10359.00	2.20	4.1	1.05	2.27	5.6	1.10
GB_R2 10023.00	2.90	1.9	0.61	3.14	2.6	0.83

	ARCADIA					
Branch, Chainage	**10yr ARI**			**20yr ARI**		
	Water Level	**Discharge**	**Velocity**	**Water Level**	**Discharge**	**Velocity**
	(m)	**(m^3/s)**	**(m/s)**	**(m)**	**(m^3/s)**	**(m/s)**
GEOFFREY_MAIN 10196.00	6.01	16.0	0.94	6.07	19.0	1.00
GEOFFREY_MAIN 10357.00	4.50	21.3	1.14	4.75	25.3	1.15
GEOFFREY_MAIN 10413.00	4.03	21.6	1.13	4.08	25.7	1.25
GEOFFREY_MAIN 10449.00	3.79	21.5	1.27	3.83	25.5	1.29
GEOFFREY_MAIN 10607.00	3.14	23.8	0.55	3.19	28.2	0.58
GEOFFREY_MAIN 10681.00	2.58	27.3	0.64	2.69	32.0	0.66
GEOFFREY_MAIN 10714.00	2.50	27.3	0.57	2.56	32.0	0.64
GB_MAIN_MCCABE CR 10106.00	3.62	3.7	0.72	3.65	4.3	0.85
GB_MAIN_MCCABE CR 10287.00	2.66	3.4	0.48	2.77	3.8	0.50
GB_MAIN_HAYLES 10148.00	5.44	2.8	1.62	5.52	3.4	1.66
GB_MAIN_HAYLES 10187.00	4.62	3.3	1.77	4.69	4.0	1.86
GB_R1 10006.00	3.50	0.4	0.23	3.52	0.5	0.27
ALMA_MAIN 10021.00	8.07	3.1	0.49	8.11	3.7	0.49
ALMA_MAIN 10081.00	5.18	4.7	2.29	5.24	5.7	2.41
ALMA_MAIN 10240.00	2.61	5.4	0.34	2.67	6.4	0.36
ALMA_MAIN 10359.00	2.30	6.3	1.12	2.34	7.5	1.16
GB_R2 10023.00	3.20	2.9	0.79	3.28	3.3	0.78

	ARCADIA					
Branch, Chainage	**50yr ARI**			**100yr ARI**		
	Water Level	**Discharge**	**Velocity**	**Water Level**	**Discharge**	**Velocity**
	(m)	**(m^3/s)**	**(m/s)**	**(m)**	**(m^3/s)**	**(m/s)**
GEOFFREY_MAIN 10196.00	6.13	22.0	1.05	6.17	25.0	1.11
GEOFFREY_MAIN 10357.00	4.88	30.2	1.16	4.95	34.0	1.16
GEOFFREY_MAIN 10413.00	4.14	30.7	1.37	4.19	34.6	1.45
GEOFFREY_MAIN 10449.00	3.88	30.5	1.34	3.92	34.4	1.33
GEOFFREY_MAIN 10607.00	3.24	33.7	0.62	3.28	37.8	0.65
GEOFFREY_MAIN 10681.00	2.82	37.8	0.66	2.92	42.0	0.67
GEOFFREY_MAIN 10714.00	2.62	37.7	0.72	2.67	41.9	0.78
GB_MAIN_MCCABE CR 10106.00	3.68	4.9	0.99	3.71	5.5	0.74
GB_MAIN_MCCABE CR 10287.00	2.88	4.3	0.50	2.96	4.6	0.52
GB_MAIN_HAYLES 10148.00	5.60	4.0	1.14	5.65	4.4	1.41
GB_MAIN_HAYLES 10187.00	4.76	4.7	1.96	4.80	5.2	2.01
GB_R1 10006.00	3.54	0.6	0.31	3.55	0.7	0.34
ALMA_MAIN 10021.00	8.14	4.3	0.52	8.17	4.7	0.53
ALMA_MAIN 10081.00	5.29	6.6	2.51	5.33	7.4	2.58
ALMA_MAIN 10240.00	2.73	7.6	0.38	2.78	8.5	0.40
ALMA_MAIN 10359.00	2.37	8.9	1.20	2.40	10.0	1.24
GB_R2 10023.00	3.37	3.8	0.82	3.43	4.2	0.99

MIKE11 MODELLING RESULTS (cont) : ARCADIA

ARCADIA			
Branch, Chainage		**PMF**	
	Water Level	**Discharge**	**Velocity**
	(m)	**(m3/s)**	**(m/s)**
GEOFFREY_MAIN 10196.00	7.18	120.0	1.79
GEOFFREY_MAIN 10357.00	5.97	163.0	1.15
GEOFFREY_MAIN 10413.00	5.40	165.8	2.36
GEOFFREY_MAIN 10449.00	5.14	164.0	1.43
GEOFFREY_MAIN 10607.00	4.72	174.3	0.75
GEOFFREY_MAIN 10681.00	4.59	208.7	0.59
GEOFFREY_MAIN 10714.00	4.06	208.4	1.08
GB_MAIN_MCCABE CR 10106.00	4.60	13.9	1.13
GB_MAIN_MCCABE CR 10287.00	4.59	26.4	0.28
GB_MAIN_HAYLES 10148.00	6.82	19.0	1.43
GB_MAIN_HAYLES 10187.00	5.63	22.1	2.07
GB_R1 10006.00	3.81	3.2	0.46
ALMA_MAIN 10021.00	8.50	20.0	0.67
ALMA_MAIN 10081.00	6.04	31.0	3.08
ALMA_MAIN 10240.00	3.79	37.2	0.55
ALMA_MAIN 10359.00	2.84	45.1	1.67
GB_R2 10023.00	4.65	17.9	1.72

MIKE11 MODELLING RESULTS: HORSESHOE BAY

Branch, Chainage	HORSESHOE BAY					
	2yr ARI			5yr ARI		
	Water Level	Discharge	Velocity	Water Level	Discharge	Velocity
	(m)	(m3/s)	(m/s)	(m)	(m3/s)	(m/s)
HB_ENDCK 10213.60	4.38	30.9	0.65	4.63	53.5	0.77
HB_ENDCK 10415.00	2.76	30.1	0.39	3.00	52.2	0.42
HB_ENDCK 10609.80	2.65	27.8	0.31	2.85	49.5	0.37
HB_ENDCK 10933.60	2.19	26.4	0.26	2.41	46.9	0.32
HB_ENDCK 11196.40	2.01	38.5	0.29	2.15	71.6	0.29
HB_GORGECK 10297.00	9.67	12.2	0.43	10.03	21.2	0.48
HB_GORGECK 10625.00	8.96	15.9	0.77	9.29	26.9	0.98
HB_GORGECK 10999.00	6.94	17.3	0.71	7.22	28.8	0.69
HB_GORGECK 11336.00	5.04	18.1	1.06	5.52	28.2	1.07
HB_GORGECK 11620.00	3.91	18.0	4.68	4.09	28.5	6.93
HB_MAIN_C1 10009.00	9.53	0.8	0.62	9.56	1.5	0.74
HB_MAIN_C2 10340.00	4.87	3.1	0.27	5.03	5.5	0.21
HB_MAIN_C2 10367.00	4.44	3.1	0.40	4.61	5.5	0.52
HB_MAIN_D1 9965.00	13.74	2.2	0.62	13.85	4.1	0.61
HB_MAIN_D1 9999.00	12.55	2.1	0.60	12.61	4.1	0.65
HB_MAIN_D1 10222.00	8.99	2.1	0.08	9.07	3.7	0.09
HB_MAIN_D1 10321.00	8.46	5.3	0.63	8.51	7.9	0.63
HB_MAIN_D1 10483.00	6.48	6.8	1.45	6.63	11.7	1.72
HB_MAIN_D1 10623.00	4.35	6.8	1.06	4.54	11.7	1.28
HB_MAIN_D1 10714.00	3.55	6.8	1.52	3.76	11.7	1.46
HB_MAIN_D2 10015.00	13.78	5.5	0.38	14.35	9.7	0.17
HB_MAIN_D2 10031.00	12.36	5.5	0.52	12.51	9.7	0.61
HB_MAIN_D2 10410.00	9.07	5.4	0.43	9.17	9.4	0.53
HB_MAIN_D3 10009.00	11.64	6.1	1.25	11.91	8.9	1.22
HB_MAIN_D3 10022.00	11.44	6.1	1.22	11.67	8.9	1.29
HB_MAIN_D3 10154.00	9.35	4.7	15.53	9.35	6.9	23.01
HB_MAIN_D4 9775.00	6.87	1.3	0.41	6.92	2.5	0.44
HB_MAIN_D4 9992.00	3.99	6.6	1.03	4.03	9.1	1.03
HB_MAIN_D5 10093.00	25.22	3.6	0.80	25.48	6.5	1.00
HB_MAIN_D5 10442.00	20.07	4.4	0.80	20.23	7.8	0.80
HB_MAIN_D5 10814.00	13.13	2.7	0.31	13.18	3.8	0.35
HB_MAIN_D6 10139.00	22.23	0.4	0.42	22.23	0.4	0.42
HB_MAIN_D6 10375.00	17.98	0.6	0.24	18.07	0.6	0.24
HB_MAIN_F1 10591.00	1.70	0.1	0.32	1.93	0.1	0.36
HB_MAIN_F1 10618.00	1.70	0.0	0.01	1.93	0.1	0.04
HORSESHOE_MAIN 10188.00	5.59	1.2	0.37	5.62	2.2	0.46
HORSESHOE_MAIN 10516.00	2.92	3.7	0.26	3.10	6.2	0.28
HORSESHOE_MAIN 10865.00	2.91	0.0	0.00	3.10	0.0	0.00
HORSESHOE_MAIN 11150.00	2.92	0.0	0.00	3.10	1.2	0.00
HORSESHOE_MAIN 11264.00	2.27	2.9	0.80	2.81	4.8	0.83
HORSESHOE_MAIN 11303.00	2.19	2.9	0.67	2.52	4.7	0.67
HORSESHOE_MAIN 11397.00	1.78	4.1	0.51	2.02	6.8	0.51
HORSESHOE_MAIN 11520.00	1.61	4.0	0.53	1.82	6.4	0.57
HORSESHOE_MAIN 11651.00	1.46	4.0	0.15	1.64	6.2	0.19

MIKE11 MODELLING RESULTS (cont) : HORSESHOE BAY

HORSESHOE BAY						
Branch, Chainage	**10yr ARI**			**20yr ARI**		
	Water Level	**Discharge**	**Velocity**	**Water Level**	**Discharge**	**Velocity**
	(m)	**(m3/s)**	**(m/s)**	**(m)**	**(m3/s)**	**(m/s)**
HB_ENDCK 10213.60	4.75	66.5	0.83	4.90	84.1	0.89
HB_ENDCK 10415.00	3.11	64.9	0.43	3.24	82.3	0.43
HB_ENDCK 10609.80	2.95	61.8	0.40	3.08	78.3	0.44
HB_ENDCK 10933.60	2.52	58.7	0.34	2.65	74.1	0.36
HB_ENDCK 11196.40	2.23	90.8	0.29	2.31	112.8	0.31
HB_GORGECK 10297.00	10.20	26.1	0.50	10.42	32.9	0.52
HB_GORGECK 10625.00	9.52	32.6	1.03	9.67	42.2	1.07
HB_GORGECK 10999.00	7.35	34.6	0.68	7.50	44.9	0.69
HB_GORGECK 11336.00	5.60	34.5	1.08	5.73	46.4	1.09
HB_GORGECK 11620.00	4.22	34.7	7.91	4.45	45.1	9.97
HB_MAIN_C1 10009.00	9.57	1.8	0.79	9.57	2.2	0.81
HB_MAIN_C2 10340.00	5.09	6.8	0.20	5.17	8.8	0.24
HB_MAIN_C2 10367.00	4.68	6.8	0.59	4.76	8.8	0.68
HB_MAIN_D1 9965.00	13.88	5.8	0.83	13.91	7.9	0.54
HB_MAIN_D1 9999.00	12.65	5.8	0.68	12.70	7.8	0.72
HB_MAIN_D1 10222.00	9.12	4.7	0.10	9.18	6.3	0.12
HB_MAIN_D1 10321.00	8.53	8.9	0.63	8.55	10.0	0.63
HB_MAIN_D1 10483.00	6.71	14.6	1.83	6.81	18.7	1.95
HB_MAIN_D1 10623.00	4.64	14.6	1.36	4.76	18.7	1.46
HB_MAIN_D1 10714.00	3.86	14.5	1.41	3.98	18.6	1.35
HB_MAIN_D2 10015.00	14.44	12.0	0.10	14.53	16.0	0.19
HB_MAIN_D2 10031.00	12.58	12.0	0.79	12.68	16.0	0.70
HB_MAIN_D2 10410.00	9.21	11.9	0.59	9.28	15.4	0.65
HB_MAIN_D3 10009.00	12.04	10.7	1.23	12.17	13.1	1.24
HB_MAIN_D3 10022.00	11.75	10.7	1.33	11.82	13.1	1.42
HB_MAIN_D3 10154.00	9.35	8.2	27.12	9.35	9.9	32.80
HB_MAIN_D4 9775.00	6.95	3.8	0.46	7.00	5.9	0.51
HB_MAIN_D4 9992.00	4.07	11.1	1.03	4.12	14.7	1.03
HB_MAIN_D5 10093.00	25.61	8.2	1.06	25.77	11.0	1.16
HB_MAIN_D5 10442.00	20.31	10.0	0.80	20.37	13.2	0.80
HB_MAIN_D5 10814.00	13.20	4.3	0.36	13.23	5.2	0.37
HB_MAIN_D6 10139.00	22.23	0.4	0.42	22.23	0.4	0.42
HB_MAIN_D6 10375.00	18.12	0.6	0.24	18.19	0.6	0.24
HB_MAIN_F1 10591.00	2.04	0.1	0.36	2.14	0.1	0.35
HB_MAIN_F1 10618.00	2.06	0.2	0.04	2.20	0.2	0.03
HORSESHOE_MAIN 10188.00	5.64	2.8	0.50	5.67	3.6	0.51
HORSESHOE_MAIN 10516.00	3.18	7.6	0.29	3.28	9.7	0.31
HORSESHOE_MAIN 10865.00	3.18	0.0	0.00	3.28	0.1	0.00
HORSESHOE_MAIN 11150.00	3.18	2.0	0.01	3.28	3.9	0.01
HORSESHOE_MAIN 11264.00	3.01	5.7	0.82	3.13	7.9	0.78
HORSESHOE_MAIN 11303.00	2.58	5.7	0.65	2.73	7.9	0.58
HORSESHOE_MAIN 11397.00	2.14	8.4	0.51	2.29	10.6	0.51
HORSESHOE_MAIN 11520.00	1.93	7.8	0.62	2.06	9.6	0.67
HORSESHOE_MAIN 11651.00	1.73	7.6	0.21	1.85	9.4	0.23

MIKE11 MODELLING RESULTS (cont) : HORSESHOE BAY

Branch, Chainage	HORSESHOE BAY					
	50yr ARI			100yr ARI		
	Water Level	Discharge	Velocity	Water Level	Discharge	Velocity
	(m)	(m3/s)	(m/s)	(m)	(m3/s)	(m/s)
HB_ENDCK 10213.60	5.07	107.4	0.97	5.17	119.8	1.00
HB_ENDCK 10415.00	3.37	104.2	0.43	3.48	118.2	0.43
HB_ENDCK 10609.80	3.21	97.9	0.47	3.32	114.9	0.48
HB_ENDCK 10933.60	2.79	94.5	0.39	2.88	111.7	0.41
HB_ENDCK 11196.40	2.41	143.1	0.37	2.48	166.9	0.42
HB_GORGECK 10297.00	10.62	39.8	0.52	10.79	46.5	0.53
HB_GORGECK 10625.00	9.78	51.5	1.09	9.87	59.9	1.10
HB_GORGECK 10999.00	7.63	54.8	0.68	7.73	64.0	0.69
HB_GORGECK 11336.00	5.84	57.9	1.11	5.91	67.6	1.12
HB_GORGECK 11620.00	4.59	57.5	10.84	4.69	67.3	12.49
HB_MAIN_C1 10009.00	9.58	2.6	0.86	9.59	3.1	0.91
HB_MAIN_C2 10340.00	5.25	11.2	0.28	5.32	13.2	0.31
HB_MAIN_C2 10367.00	4.85	11.2	0.79	4.91	13.2	0.87
HB_MAIN_D1 9965.00	13.93	9.8	1.11	13.96	11.8	0.90
HB_MAIN_D1 9999.00	12.73	9.8	0.76	12.75	11.8	0.79
HB_MAIN_D1 10222.00	9.21	8.0	0.14	9.24	9.6	0.15
HB_MAIN_D1 10321.00	8.59	11.8	0.63	8.63	13.7	0.63
HB_MAIN_D1 10483.00	6.89	22.8	2.05	6.98	27.2	2.13
HB_MAIN_D1 10623.00	4.86	22.7	1.54	4.97	26.9	1.61
HB_MAIN_D1 10714.00	4.09	22.7	1.38	4.16	26.8	1.40
HB_MAIN_D2 10015.00	14.57	19.0	0.15	14.62	23.0	0.17
HB_MAIN_D2 10031.00	12.74	19.0	0.74	12.83	23.0	0.78
HB_MAIN_D2 10410.00	9.33	18.7	0.71	9.38	22.2	0.77
HB_MAIN_D3 10009.00	12.26	15.1	1.24	12.31	16.6	1.23
HB_MAIN_D3 10022.00	11.88	15.1	1.46	11.93	16.6	1.46
HB_MAIN_D3 10154.00	9.35	11.5	38.38	9.35	13.0	43.37
HB_MAIN_D4 9775.00	7.02	7.5	0.54	7.04	8.6	0.56
HB_MAIN_D4 9992.00	4.16	17.8	1.05	4.19	19.9	1.08
HB_MAIN_D5 10093.00	25.88	13.0	1.23	25.97	15.0	1.28
HB_MAIN_D5 10442.00	20.42	15.9	0.83	20.46	18.4	0.86
HB_MAIN_D5 10814.00	13.25	5.9	0.39	13.26	6.3	0.40
HB_MAIN_D6 10139.00	22.23	0.4	0.42	22.23	0.4	0.42
HB_MAIN_D6 10375.00	18.25	0.6	0.24	18.29	0.6	0.24
HB_MAIN_F1 10591.00	2.24	0.1	0.33	2.42	0.2	0.37
HB_MAIN_F1 10618.00	2.34	0.0	0.00	2.46	0.5	0.02
HORSESHOE_MAIN 10188.00	5.69	4.5	0.53	5.71	5.3	0.56
HORSESHOE_MAIN 10516.00	3.36	12.0	0.33	3.43	14.2	0.34
HORSESHOE_MAIN 10865.00	3.36	1.2	0.00	3.43	1.9	0.01
HORSESHOE_MAIN 11150.00	3.36	6.0	0.02	3.43	8.4	0.03
HORSESHOE_MAIN 11264.00	3.19	10.4	0.68	3.25	13.3	0.59
HORSESHOE_MAIN 11303.00	2.81	10.4	0.48	2.89	13.3	0.42
HORSESHOE_MAIN 11397.00	2.44	12.9	0.51	2.56	14.7	0.51
HORSESHOE_MAIN 11520.00	2.19	11.5	0.72	2.30	13.3	0.77
HORSESHOE_MAIN 11651.00	1.97	11.2	0.26	2.07	13.1	0.28

MIKE11 MODELLING RESULTS (cont) : HORSESHOE BAY

HORSESHOE BAY			
Branch, Chainage	**PMF**		
	Water Level	**Discharge**	**Velocity**
	(m)	**(m3/s)**	**(m/s)**
HB_ENDCK 10213.60	6.27	469.8	1.32
HB_ENDCK 10415.00	4.79	464.2	0.51
HB_ENDCK 10609.80	4.60	462.5	0.82
HB_ENDCK 10933.60	4.00	461.8	0.79
HB_ENDCK 11196.40	3.41	703.8	1.09
HB_GORGECK 10297.00	12.02	159.6	0.57
HB_GORGECK 10625.00	10.68	221.4	1.18
HB_GORGECK 10999.00	8.81	248.8	0.82
HB_GORGECK 11336.00	6.71	268.2	1.18
HB_GORGECK 11620.00	5.84	242.9	28.44
HB_MAIN_C1 10009.00	9.71	9.1	1.40
HB_MAIN_C2 10340.00	6.04	46.3	0.65
HB_MAIN_C2 10367.00	5.61	46.2	1.77
HB_MAIN_D1 9965.00	14.20	40.8	0.69
HB_MAIN_D1 9999.00	12.96	40.7	1.10
HB_MAIN_D1 10222.00	9.54	37.2	0.36
HB_MAIN_D1 10321.00	9.07	52.4	0.88
HB_MAIN_D1 10483.00	7.67	99.4	2.16
HB_MAIN_D1 10623.00	6.12	84.1	1.77
HB_MAIN_D1 10714.00	5.31	84.0	2.04
HB_MAIN_D2 10015.00	14.99	75.0	0.42
HB_MAIN_D2 10031.00	13.52	75.0	1.09
HB_MAIN_D2 10410.00	9.87	74.8	1.35
HB_MAIN_D3 10009.00	12.96	38.9	1.26
HB_MAIN_D3 10022.00	12.30	39.0	1.64
HB_MAIN_D3 10154.00	9.54	41.4	104.34
HB_MAIN_D4 9775.00	7.21	23.2	0.74
HB_MAIN_D4 9992.00	5.30	50.7	1.42
HB_MAIN_D5 10093.00	26.98	48.5	1.70
HB_MAIN_D5 10442.00	20.92	56.6	1.11
HB_MAIN_D5 10814.00	13.45	15.1	0.56
HB_MAIN_D6 10139.00	22.30	0.8	0.43
HB_MAIN_D6 10375.00	18.77	4.9	0.23
HB_MAIN_F1 10591.00	4.30	3.1	0.48
HB_MAIN_F1 10618.00	4.30	5.2	0.19
HORSESHOE_MAIN 10188.00	5.87	18.5	0.68
HORSESHOE_MAIN 10516.00	5.31	48.7	0.50
HORSESHOE_MAIN 10865.00	5.31	29.0	0.04
HORSESHOE_MAIN 11150.00	5.30	65.4	0.10
HORSESHOE_MAIN 11264.00	5.27	79.2	0.33
HORSESHOE_MAIN 11303.00	4.48	79.5	0.26
HORSESHOE_MAIN 11397.00	4.36	91.7	0.51
HORSESHOE_MAIN 11520.00	4.09	92.8	0.99
HORSESHOE_MAIN 11651.00	3.59	93.0	0.54

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 2yr 2hr**	**Water Level 2yr 6hr**	**Discharge 2yr 2hr**	**Discharge 2yr 6hr**	**Velocity 2yr 2hr**	**Velocity 2yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
AIRPORT DRAIN 10053.00	4.71	4.628	0.004	0.003	0.001	0.001
AIRPORT DRAIN 10789.90	3.224	3.098	3.544	2.542	0.499	0.417
AIRPORT DRAIN 11383.00	2.563	2.66	9.648	6.985	0.55	0.379
AIRPORT DRAIN 11435.50	2.557	2.657	10.395	7.665	0.361	0.253
AIRPORT DRAIN 11741.60	2.443	2.655	7.429	6.294	0.457	0.414
AIRPORT DRAIN 12216.50	2.442	2.655	1.743	2.409	0.243	0.388
AIRPORT DRAIN 12465.40	2.435	2.649	3.386	4.747	0.089	0.084
AIRPORT DRAIN 12999.00	2.421	2.624	3.667	5.288	0.196	0.226
ANGUS AV DRAIN 10091.00	8.888	8.81	3.831	2.677	0.503	0.422
ANGUS AV DRAIN 10455.40	8.464	8.483	8.31	6.126	1.425	1.247
ANNANDALE DRAIN 10005.00	11.303	11.196	3.692	2.8	0.604	0.542
ANNANDALE DRAIN 10072.00	10.45	10.378	3.652	2.784	0.985	0.926
ANNANDALE DRAIN 10434.80	7.491	7.394	4.375	3.253	0.494	0.405
ANNANDALE DRAIN 10505.30	7.473	7.382	4.772	3.714	0.452	0.398
ANNANDALE DRAIN 11020.00	6.116	6.057	5.043	4.076	0.444	0.414
ANNANDALE DRAIN 11539.10	5.341	5.286	12.251	10.857	0.539	0.511
ANNANDALE DRAIN 11604.20	5.281	5.234	12.776	11.457	0.707	0.672
ANNANDALE DRAIN 12439.30	4.042	4.127	13.132	11.982	0.725	0.737
ANNANDALE DRAIN 12704.00	3.95	4.028	49.988	56.302	0.768	0.813
ANNANDALE DRAIN 12792.20	3.729	3.754	49.983	56.232	0.888	0.945
ANNANDALE DRAIN 13249.20	3.158	3.142	50.994	59.153	1.46	1.899
ANNANDALE GDNS DRAIN 10095.50	5.85	5.746	25.347	20.236	0.944	0.931
ANNANDALE GDNS DRAIN 9295.00	11.257	11.196	24.345	20.689	0.594	0.548
ANNANDALE GDNS DRAIN 9995.08	6.379	6.176	24.932	19.945	1.137	1.15
BAIN ST DRAIN 10000.00	4.244	4.097	9.8	7.772	0.905	0.868
BAIN ST DRAIN 10233.20	3.191	3.057	11.412	8.93	0.897	0.814
BAIN ST DRAIN 10301.20	2.711	2.599	11.302	8.931	1.326	1.242
BALLS LA DRAIN 10000.00	3.976	4.008	0.061	0.079	0.016	0.018
BALLS LA DRAIN 10071.10	3.66	3.673	0.078	0.103	0.227	0.254
BELGIAN GDNS DRAIN 10005.00	8.388	8.35	3	2.709	0.592	0.56
BELGIAN GDNS DRAIN 10085.20	8.157	8.144	3	2.75	0.674	0.629
BELGIAN GDNS DRAIN 10455.50	3.584	3.565	3.526	3.318	2.512	2.5
BOWEN RD DRAIN 10084.50	3.47	3.406	2.047	1.594	0.425	0.361
BOWEN RD DRAIN 10153.80	3.391	3.345	2.048	1.585	0.411	0.341
BOWEN RD DRAIN 10740.00	2.581	2.602	3.331	2.899	0.942	0.762
BROOKS ST DRAIN 10000.00	2.26	2.266	0.385	0.388	0.114	0.061
BROOKS ST DRAIN 9870.00	2.564	2.531	0	0	0	0
CENTRE FAIRFIELD DRAIN 10000.00	2.914	3.028	0.846	3.924	0.019	0.036
CLUDEN CREEK 10010.00	3.564	3.74	23.784	43.739	0.115	0.185
CLUDEN CREEK 10098.30	3.322	3.72	23.787	43.675	0.537	0.507
CLUDEN CREEK 9100.40	4.408	4.801	24.174	44.04	0.435	0.431
CLUDEN DRAIN 10007.50	9.961	9.888	16.459	15.326	1.099	1.079
CLUDEN DRAIN 10100.80	9.707	9.665	18.113	16.799	0.766	0.733
CLUDEN DRAIN 10907.20	4.662	4.617	18.761	17.635	1.307	1.275
CLUDEN DRAIN 10982.20	4.445	4.41	18.753	17.631	0.881	0.863
CLUDEN DRAIN 11533.30	3.533	3.613	41.186	36.124	0.559	0.532
CLUDEN DRAIN 11574.30	3.446	3.576	40.979	35.953	0.948	0.963
CLUDEN DRAIN 12142.10	3.318	3.512	23.386	24.31	0.292	0.275
CLUDEN DRAIN 12399.30	3.308	3.505	17.295	19.643	0.17	0.17
CLUDEN DRAIN 13184.20	2.667	2.89	9.832	11.021	0.232	0.228
CLUDEN DRAIN 13382.50	2.647	2.846	11.005	17.261	0.071	0.07
CLUDEN DRAIN 9331.00	16.384	16.357	15	14	1.165	1.134
CRANBROOK CREEK 10145.20	10.379	10.259	4.655	3.397	0.768	0.717
CRANBROOK CREEK 10577.90	7.705	7.643	5.518	4.153	0.847	0.762
CREEKWOOD E 10010.00	12.496	12.389	2.4	1.9	0.912	0.866
CREEKWOOD E 10104.00	12.255	11.853	11.239	1.898	0.645	1.039
CREEKWOOD E 10495.00	7.289	7.388	3.618	3.002	0.88	0.738
CREEKWOOD W 10010.00	11.864	11.762	2.4	1.9	0.645	0.598
CREEKWOOD W 10144.50	10.054	10.003	2.397	1.897	0.958	0.919
DOUGLAS CREEK 10081.90	12.886	12.939	3	3.3	0.562	0.57
DOUGLAS CREEK 10161.80	12.013	12.039	3	3.3	0.91	0.914
DOUGLAS CREEK 10642.10	8.315	8.345	3.531	3.871	0.903	0.929
FAIRFIELD DRAIN 10235.60	2.788	2.353	0.167	0.321	0.14	0.036
FAIRFIELD DRAIN 10802.00	2.788	2.353	0.149	0.064	0.076	0.055
FAIRFIELD DRAIN 10875.90	2.781	2.358	0.037	0.015	0.045	0.027

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 2yr 2hr**	**Water Level 2yr 6hr**	**Discharge 2yr 2hr**	**Discharge 2yr 6hr**	**Velocity 2yr 2hr**	**Velocity 2yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
FAIRFIELD DRAIN 11402.40	2.665	2.893	0.208	0.228	0.005	0.004
FAIRFIELD DRAIN 12207.00	2.665	2.892	1.69	2.362	0.022	0.022
FAIRFIELD DRAIN 12296.10	2.641	2.835	3.132	4.865	0.024	0.026
GLENDALE DR DRAIN 10000.00	6.858	6.803	1.2	0.769	0.808	0.597
GLENDALE DR DRAIN 10158.10	6.382	6.334	1.013	0.742	0.817	0.707
GLENDALE DR DRAIN 10403.10	4.787	4.72	1.787	1.31	0.652	0.538
GLENDALE DR DRAIN 10442.50	4.778	4.711	2.028	1.494	0.468	0.367
GOONDI CREEK 10000.00	1.525	1.503	3.446	2.131	0.423	0.291
GOONDI CREEK 10865.20	1.356	1.365	2.902	2.755	0.055	0.052
GORDON CREEK 10000.00	2.64	2.833	12.113	21.871	0.352	0.46
GORDON CREEK 10883.20	1.937	2.061	12.376	22.19	0.115	0.167
GORDON CREEK 11594.00	1.688	1.849	24.4	37.838	0.198	0.216
GORDON CREEK 11820.40	1.644	1.809	24.044	37.949	0.183	0.216
GORDON CREEK 14080.00	1.265	1.313	21.411	34.317	0.073	0.117
GRAMMAR DRAIN 10000.00	16.333	16.308	4.3	3.808	2.041	2.051
GRAMMAR DRAIN 10290.00	11.458	11.45	5.035	4.647	0.454	0.424
HAROLD ST DRAIN 10000.00	6.064	5.972	7.2	6.011	2.954	3.043
HAROLD ST DRAIN 10372.70	2.709	2.724	6.881	5.575	0.843	0.814
HERMIT DRAIN 10000.00	2.06	1.97	1	0.626	0.559	0.467
HERMIT DRAIN 10505.00	1.88	1.778	2.862	2.274	0.482	0.421
HERMIT DRAIN 10578.50	1.716	1.757	2.473	1.959	0.344	0.308
HERMIT DRAIN 10921.00	1.691	1.748	3.327	2.786	0.208	0.191
HERMIT DRAIN 10992.30	1.684	1.718	4.002	3.416	0.281	0.248
HONEYSUCKLE DR DRAIN 10005.00	11.118	11.015	4.9	4.2	0.875	0.841
HONEYSUCKLE DR DRAIN 10102.00	10.374	10.32	4.9	4.2	1.274	1.19
HONEYSUCKLE DR DRAIN 10583.70	6.705	6.66	5.612	4.977	1.374	1.311
JUREKEY ST DRAIN 10000.00	6.123	6.024	3.908	2.331	0.893	0.754
JUREKEY ST DRAIN 10506.00	4.034	4.042	2.425	1.902	0.416	0.398
JUREKEY ST DRAIN 10563.40	3.72	3.742	12.343	12.773	0.625	0.617
KINGS RD DRAIN 10094.60	3.846	3.765	2.107	1.847	0.539	0.356
KINGS RD DRAIN 10455.00	3.483	3.411	3.323	2.902	0.45	0.435
KINGS RD DRAIN 10514.00	3.335	3.258	3.313	2.906	0.446	0.413
KINGS RD DRAIN 10582.60	3.319	3.238	3.325	2.944	0.316	0.309
KINGS RD DRAIN 10632.60	3.276	3.212	3.359	2.969	0.829	0.763
KINGS RD DRAIN 10880.00	3.221	3.186	3.433	2.958	0.391	0.389
KINGS RD DRAIN 10990.00	3.001	3.112	3.495	3.02	0.299	0.311
LAKES TWO 10138.90	1.943	2.09	0.376	0.503	0.002	0.004
LAKES TWO 10793.10	1.943	2.09	7.77	8.734	0.023	0.025
LOUISA-CK 10083.60	2.399	2.562	6.948	15.674	0.16	0.18
LOUISA-CK 3007.82	8.866	8.958	2.611	3.226	0.31	0.288
LOUISA-CK 3979.59	8.372	8.362	7.705	6.92	0.216	0.203
LOUISA-CK 4055.00	8.361	8.352	9.179	8.082	0.324	0.294
LOUISA-CK 4926.69	6.938	6.954	21.009	21.162	0.559	0.531
LOUISA-CK 5388.98	5.837	5.877	21.342	22.06	0.642	0.618
LOUISA-CK 5823.04	5.112	5.186	20.976	22.149	0.231	0.236
LOUISA-CK 5915.00	5.087	5.14	21.173	22.403	0.341	0.348
LOUISA-CK 6590.00	3.677	3.733	25.123	26.89	0.862	0.875
LOUISA-CK 6671.00	3.67	3.726	24.864	26.878	0.225	0.235
LOUISA-CK 6999.00	3.439	3.521	24.655	29.502	0.153	0.155
LOUISA-CK 7046.00	3.417	3.493	24.453	29.467	0.258	0.254
LOUISA-CK 7410.00	2.964	3.034	24.073	29.857	0.257	0.243
LOUISA-CK 7459.85	2.78	2.959	23.946	29.801	0.17	0.166
L_RAIL EST 0.00	2.143	2.019	0	1.977	0	0.534
L_RAIL EST 636.00	2.092	2.092	0	0	0	0
MACARTHUR PARK DRAIN 10805.50	10.937	10.951	36.313	36.884	0.427	0.429
MACARTHUR PARK DRAIN 10912.30	10.274	10.289	36.271	36.84	1.6	1.603
MACARTHUR PARK DRAIN 11757.10	7.332	7.356	36.526	37.459	1.314	1.334
MACARTHUR PARK DRAIN 11836.80	6.741	6.752	36.845	37.941	1.104	1.119
MACARTHUR PARK DRAIN 12400.20	4.672	4.711	36.965	38.456	1.128	1.118
MACARTHUR PARK DRAIN 9954.04	12.917	12.919	32.182	32.604	1.157	1.156
MARABOU DRAIN 10005.00	13.034	12.977	9.794	8.7	0.816	0.772
MARABOU DRAIN 10115.20	12.984	12.936	9.781	8.699	0.49	0.461
MARABOU DRAIN 10658.20	9.148	9.092	10.386	9.386	0.647	0.639
MARABOU DRAIN 10721.30	8.923	8.876	10.76	9.754	0.695	0.678
MARABOU DRAIN 11349.20	7.468	7.465	10.577	10.148	0.375	0.365

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 2yr 2hr**	**Water Level 2yr 6hr**	**Discharge 2yr 2hr**	**Discharge 2yr 6hr**	**Velocity 2yr 2hr**	**Velocity 2yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
MINDHAM DRAIN 10082.00	7.346	7.255	2.913	2.112	0.49	0.548
MINDHAM DRAIN 10367.00	7.179	7.002	6.709	4.741	0.812	0.705
MINDHAM DRAIN 10697.50	6.529	6.389	14.536	10.64	1.403	1.222
MINDHAM DRAIN 11267.50	5.836	5.723	13.168	10.348	1.015	0.96
MINDHAM DRAIN 11805.60	5.664	5.486	17.085	14.612	0.692	0.667
MINDHAM DRAIN 11850.00	5.497	5.369	17.045	14.605	0.992	0.975
MINDHAM DRAIN 12236.00	5.18	4.925	18.419	15.872	0.555	0.596
MINDHAM DRAIN 12307.00	4.972	4.915	18.242	15.776	0.716	0.669
MINDHAM DRAIN 13050.30	4.462	4.408	20.248	16.956	0.329	0.318
MINDHAM DRAIN 13238.40	4.39	4.258	21.58	18.692	0.583	0.543
MINDHAM DRAIN 13324.40	4.032	3.993	21.432	18.623	2.375	1.148
MINDHAM DRAIN 13746.00	3.622	3.62	21.355	18.727	0.62	0.504
MINDHAM DRAIN 14214.00	3.485	3.505	19.112	18.544	0.27	0.26
MINDHAM DRAIN 14268.10	3.303	3.334	19.265	18.837	0.794	0.758
MINDHAM DRAIN 14900.00	3.001	3.112	17.998	18.928	0.209	0.21
MINDHAM DRAIN 14952.80	2.665	2.753	19.612	22.771	0.328	0.337
MINDHAM DRAIN 15376.00	2.347	2.566	19.239	22.709	0.389	0.406
MINDHAM DRAIN 15448.10	1.877	1.947	19.294	22.897	0.604	0.621
MINDHAM DRAIN 15976.20	1.684	1.715	19.204	23.533	0.253	0.3
MINDHAM DRAIN 16181.20	1.657	1.673	19.894	25.896	0.28	0.358
MT LOUISA DRAIN 10000.00	12.418	12.396	1.196	0.938	0.615	0.568
MT LOUISA DRAIN 10336.10	6.205	6.134	1.217	0.987	0.6	0.447
MT LOUISA DRAIN 10596.50	6.046	6.023	1.666	1.464	0.144	0.133
MT LOUISA DRAIN 10902.70	3.898	3.888	2.349	2.226	0.653	0.642
MT LOUISA DRAIN 11081.00	3.685	3.738	3.919	3.175	0.519	0.363
MT LOUISA DRAIN 11192.40	3.671	3.727	3.663	3.103	0.301	0.268
MT ST JOHN 10000.00	2.162	2.258	1.354	1.1	0.269	0.178
MT ST JOHN 11694.50	2.033	2.109	1.48	3.535	0.1	0.114
N DALRYMPLE DRAIN 10000.00	7.447	7.378	1.346	0.866	0.521	0.447
N DALRYMPLE DRAIN 10806.00	6.067	6.033	1.285	0.998	0.424	0.381
N DALRYMPLE DRAIN 10903.20	6.047	6.02	1.142	1.046	0.444	0.375
N DALRYMPLE DRAIN 11570.00	4.122	4.124	2.343	2.128	0.585	0.566
N DALRYMPLE DRAIN 11659.90	4.115	4.117	2.078	1.838	0.148	0.107
N DALRYMPLE DRAIN 11885.90	3.58	3.509	2.749	3.38	0.261	0.291
N DALRYMPLE DRAIN 12361.60	3.162	2.99	7.187	5.891	1.216	1.192
OF_AITKENVALE 10000.00	11.579	11.579	0	0	0	0
OF_AITKENVALE 10305.80	10.841	10.841	0	0.378	0	0.206
OF_AITKENVALE 10678.20	10.357	10.357	0	1.292	0	0.19
OF_AITKENVALE 11027.90	9.48	9.372	0	0.001	0	0.003
OF_AITKENVALE 11238.00	9.08	9.08	0	0	0	0
OF_AITKENVALE 11491.00	7.346	7.255	0	0.048	0	4.316
OF_ANDERS2 9612.00	7.844	7.873	0	0.1	0	0.024
OF_ANDERS2 9982.00	7.04	7.04	0	0	0	0
OF_ANDERSON1 9606.00	7.444	7.444	0	0	0	0
OF_A-VALE2 10000.00	9.433	9.433	0	0	0.004	0
OF_A-VALE2 10445.00	8.658	8.65	0.028	0.028	0.027	0.027
OF_BUCHANAN 10000.00	6.899	6.899	0	0	0	0
OF_BUCHANAN 10432.00	5.975	5.975	0.01	0.01	0.004	0.004
OF_BUCHANAN 10754.30	4.123	4.188	0.02	0.024	0.24	0.239
OF_CASTLETOWN 10000.00	3.394	3.221	0.522	0	0.451	0
OF_CASTLETOWN 10413.60	2.334	2.265	0.048	0	0.042	0
OF_CASTLETOWN 10473.30	2.334	2.28	0.009	-0.001	0.046	-0.002
OF_CAUSEWAY 10000.00	2.365	2.365	0	0	0	0
OF_CAUSEWAY 10346.20	2.46	2.46	0.179	0.179	0.149	0.15
OF_CRANBROOK 10000.00	14.218	14.194	1.086	0.427	0.47	0.992
OF_CRANBROOK 10736.10	12.222	12.206	0.225	0.173	0.505	0.441
OF_CURRAJONG 10000.00	11.547	11.404	0.64	0.013	0.548	0.102
OF_CURRAJONG 10155.60	11.379	11.3	0.108	0	0.119	0
OF_CURRAJONG 10583.10	10.276	10.27	0	0	0	0
OF_CURRAJONG 10914.60	9.98	9.98	0	0	0	0
OF_CURRAJONG 11244.50	9.452	9.45	0	0	0	0
OF_CURRAJONG 11760.90	8.854	8.854	0	0	0	0
OF_CURRAJONG 12545.50	8.248	8.248	0.022	0.022	0.04	0.04
OF_CURRAJONG 13148.60	7.34	7.308	0.009	0.009	0.014	0.014
OF_CURRAJONG 14053.00	5.496	5.496	1.344	1.344	0.307	0.307

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 2yr 2hr**	**Water Level 2yr 6hr**	**Discharge 2yr 2hr**	**Discharge 2yr 6hr**	**Velocity 2yr 2hr**	**Velocity 2yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
OF_CURRAJONG 14803.50	4.668	4.631	0.617	0.641	0.627	0.751
OF_CURRA2 9118.00	7.603	7.603	0	0	0	0
OF_CURRA2 9639.14	6.667	6.667	0.001	0.001	0	0
OF_CURRA2 9937.22	6.072	6.072	0.056	0	0.074	0
OF_CURRA2 10304.30	5.437	5.385	0.048	0.001	0.086	0.003
OF_CURRA2 10975.00	4.451	4.426	0.39	0.027	0.279	0.026
OF_FULHAM 10000.00	10.941	10.941	0	0	0	0
OF_FULHAM 10211.00	11.282	11.265	0.009	0.006	0.027	0.018
OF_FULHAM 10553.20	10.21	10.18	0.984	0.84	0.098	0.077
OF_FULHAM 10852.00	9.454	9.425	0.046	0.01	0.14	0.03
OF_GREGORY 10000.00	10.324	10.322	0.138	0.121	0.143	0.125
OF_GREGORY 10417.30	7.631	7.623	0.069	0.01	0.066	0.012
OF_GREGORY 10783.00	6.459	6.459	0	0	0	0
OF_GREGORY 10880.00	5.62	5.62	0	0	0	0
OF_GULLIVER 9576.00	8.443	8.443	0	0	0	0
OF_GULLIVER 10000.00	7.539	7.539	0	9.341	0	54.37
OF_GULLIVER 10289.00	7.221	7.222	0.001	0.001	0.001	0.001
OF_GULLIVER 10706.40	6.85	6.85	0	0	0	0
OF_GULLIVER 11300.20	5.973	5.926	1.418	0.822	1.44	1.496
OF_GULLIVER 11728.00	5.42	5.386	0.483	0.058	0.125	0.015
OF_GULLIVER 12119.00	3.656	3.614	0.952	0.462	0.399	0.405
OF_HOWITT 9338.00	6.473	6.473	0	0	0	0
OF_HOWITT 9961.80	3.701	3.701	0.04	0	0.114	0
OF_HOWITT 10388.00	2.861	2.853	0.773	0.608	0.035	0.03
OF_HUGH ST 10000.00	5.322	5.297	0.216	0.07	0.144	0.065
OF_HUGH ST 10479.10	4.966	4.924	0.174	0.174	0.126	0.126
OF_HUTCHINS 10000.00	9.092	9	0.216	0	0	0
OF_HUTCHINS 10406.00	8.354	8.217	0.006	0	0	0
OF_HUTCHINS 10716.00	7.643	7.568	0.19	0.175	0	0.873
OF_LAKES1 10191.70	2.532	2.532	0	0	0	0
OF_LAKES1 10309.50	2.607	2.607	0	0	0	0
OF_LAKES1 10568.00	2.334	2.265	0.021	0.005	0.004	0.001
OF_LANDSBOROUGH 10000.00	24.573	24.573	0	0	0	0
OF_LANDSBOROUGH 10470.00	9.551	9.551	0.02	0.02	0.005	0.005
OF_LANDSBOROUGH 10781.10	6.237	6.237	0.11	0.11	0.235	0.235
OF_LANDSBOROUGH 11162.00	2.947	2.947	0.11	0.093	0.061	0.052
OF_MUNDINGBURRA 10848.40	7.25	7.25	0.011	0	0.017	0
OF_MUNDINGBURRA 11416.30	6.76	6.76	0	0	0	0
OF_MUNDINGBURRA 11907.00	6.117	6.117	0.002	0.002	0.001	0.001
OF_MUND2 10000.00	6.302	6.302	0	0	0	0
OF_MUND2 10345.00	6.117	6.117	0	0	0	0
OF_NOONGAH ST 10000.00	6.6	6.6	0	0	0	0
OF_NOONGAH ST 10363.00	5.778	5.65	1.595	0.011	0.786	0.005
OF_PIMLICO 9560.00	8.63	8.63	0.001	0.001	0.003	0.003
OF_PIMLICO 9867.58	7.865	7.862	0.001	0.001	0.004	0.004
OF_PIMLICO 11676.80	6.151	6.15	0	0	0	0
OF_PRIMROSEST 10000.00	2.708	2.704	0.212	0.142	0.088	0.059
OF_PRIMROSEST 10628.00	3.045	3.045	0	0	0	0
OF_QUEENS 10000.00	3.084	2.974	0.377	0.071	0.132	0.182
OF_QUEENS 10533.10	3.079	3.181	0	0	0	0
OF_QUEENS 10836.00	3.3	3.34	0	0	0	0
OF_ROSSL2 10261.60	3.983	3.984	0	0	0	0
OF_ROSSL2 10670.00	2.625	2.66	0	0.889	0	0.203
OF_STOCKLAND 10697.00	12.323	12.322	0.275	0.169	0.16	0.099
OF_STOCKLAND 11080.20	11.434	11.435	0.387	0.386	0.406	0.406
OF_STOCKLAND 11400.40	11.097	11.099	0.007	0.007	0.063	0.07
OF_STOCKLAND 12000.00	10.766	10.763	0.009	0.008	0.001	0.001
OF_STOCKLAND 12519.00	10.299	10.22	0	-0.026	0	-0.012
OF_STOCKLAND 13123.00	8.57	8.57	0	2.253	0	2.8
OF_SWEET ST 10000.00	5.294	5.258	2.868	1.83	0.46	0.33
OF_SWEET ST 10340.00	4.882	4.866	1.924	1.486	0.634	0.574
OF_VINCENT 10183.30	8.844	8.73	0.063	0	0.245	0
OF_VINCENT 10839.00	7.34	7.308	0.001	0.005	0.001	0.01
OF_WARBUTONST 10000.00	9.855	9.855	-0.01	-0.01	-0.021	-0.021
OF_WARBUTONST 10410.00	7.631	7.623	0.01	0.013	0.006	0.007

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 2yr 2hr**	**Water Level 2yr 6hr**	**Discharge 2yr 2hr**	**Discharge 2yr 6hr**	**Velocity 2yr 2hr**	**Velocity 2yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
OON BREAKOUT 10910.00	1.461	1.633	0.974	1.135	0.036	0.041
PALMETUM CREEK 10033.30	8.846	8.791	2.302	1.688	1.009	0.871
PALMETUM CREEK 9944.00	9.233	8.943	2.897	1.701	0.48	0.376
PEEWEE CK 10151.90	5.082	4.998	4.052	3.176	0.421	0.481
PEEWEE CK 10413.00	4.689	4.661	4.659	4.256	0.164	0.104
PEEWEE CK 10509.70	4.466	4.412	6.732	5.672	0.355	0.329
PEEWEE CK 10844.30	3.515	3.505	8.078	7.477	0.327	0.3
PEEWEE CK 10989.40	3.383	3.377	7.758	7.448	0.358	0.289
PEEWEE CK 11532.00	2.964	3.034	1.39	1.175	0.05	0.565
PERCY ST - INGHAM RD DRAIN 10091.3(	2.763	2.743	0.165	0.173	0.373	0.411
PERCY ST - INGHAM RD DRAIN 10581.4(	2.544	2.768	6.121	6.787	0.554	0.554
PERCY ST - INGHAM RD DRAIN 10660.9(	1.944	2.091	6.12	6.786	0.701	1.793
RACECOURSE 1 DRAIN 10000.00	4.531	4.531	0.167	0.169	0.043	0.053
RACECOURSE 1 DRAIN 10042.00	3.809	3.795	1.139	1.163	0.214	0.2
RAIL YARDS CREEK 10000.00	38.25	38.229	6.546	6.092	1.619	1.575
RAIL YARDS CREEK 10265.70	26.123	26.091	6.481	5.924	1.016	0.955
RAIL YARDS CREEK 10310.40	25.158	25.137	6.496	5.885	1.408	1.391
RAIL YARDS CREEK 10837.30	15.971	15.895	9.789	8.641	0.797	0.756
RAIL YARDS CREEK 10894.70	15.816	15.769	12.014	10.454	0.939	0.896
RAIL YARDS CREEK 11286.50	11.753	11.602	16.01	13.119	1.056	1.043
RAIL YARDS CREEK 11344.80	10.975	10.885	16.262	13.18	1.62	1.537
RAIL YARDS CREEK 12585.20	4.965	4.962	15.312	12.296	0.497	0.445
RIVERSIDE CREEK 10144.90	11.445	11.39	2.999	2.27	0.924	0.865
RIVERSIDE CREEK 10512.30	7.173	7.18	3.911	3.09	0.431	0.419
RIVERSIDE CREEK 10588.80	7.163	7.174	4.521	3.65	0.376	0.364
ROSS CREEK 10000.00	1.5	1.51	2.3	1.531	0.054	0.034
ROSS CREEK 10146.70	1.403	1.435	1.228	1.35	0.018	0.02
ROSS CREEK 10277.30	1.364	1.406	1.293	1.218	0.009	0.008
ROSS CREEK 11010.00	1.363	1.406	2.731	2.501	0.024	0.022
ROSS CREEK 11087.20	1.287	1.317	3.473	3.249	0.027	0.024
ROSS CREEK 11427.80	1.272	1.278	38.096	51.803	0.425	0.572
ROSS CREEK 11913.60	1.259	1.254	38.181	52.682	0.231	0.316
ROSS CREEK 12528.80	1.251	1.242	40.186	54.041	0.158	0.212
ROSS CREEK 12713.00	1.245	1.236	44.514	56.324	0.13	0.165
ROSS CREEK 13131.30	1.233	1.225	51.617	58.447	0.229	0.259
ROSS CREEK 13264.20	1.228	1.221	53.581	58.769	0.203	0.223
ROSS CREEK 13890.10	1.225	1.218	60.287	60.365	0.078	0.078
ROSS RIVER 21732.00	9.313	9.376	96.528	113.138	0.211	0.244
ROSS RIVER 22660.00	7.045	7.173	97.139	115.148	0.241	0.276
ROSS RIVER 23317.00	7.034	7.157	96.71	118.256	0.201	0.238
ROSS RIVER 23736.00	7.027	7.148	95.79	118.355	0.208	0.247
ROSS RIVER 24334.00	7.02	7.139	100.152	128.335	0.177	0.219
ROSS RIVER 24374.00	7.013	7.131	100.146	128.298	0.162	0.201
ROSS RIVER 25058.00	7.007	7.122	100.563	128.919	0.176	0.22
ROSS RIVER 26593.00	6.994	7.101	134.125	168.738	0.231	0.282
ROSS RIVER 26690.00	2.401	2.667	134.037	168.681	0.313	0.368
ROSS RIVER 27504.00	2.303	2.577	129.071	165.478	0.554	0.571
ROSS RIVER 28123.00	2.199	2.493	120.982	157.768	0.476	0.485
ROSS RIVER 29070.00	2.089	2.4	143.099	191.105	0.365	0.421
ROSS RIVER 29142.00	2.082	2.393	142.506	190.449	0.379	0.439
ROSS RIVER 30115.00	1.928	2.225	136.852	185.676	0.764	0.8
ROSS RIVER 30752.00	1.808	2.083	134.678	183.691	0.609	0.672
ROSS RIVER 31457.00	1.643	1.883	135.871	186.865	0.64	0.75
ROSS RIVER 32211.00	1.516	1.707	135.781	187.232	0.695	0.857
ROSS RIVER 33120.00	1.401	1.54	136.69	188.746	0.559	0.726
ROSS RIVER 33210.00	1.386	1.516	136.977	189.33	0.393	0.515
ROSS RIVER 34636.00	1.265	1.313	138.219	191.05	0.375	0.501
ROSS RIVER 35506.00	1.232	1.253	141.82	198.155	0.358	0.496
ROSS RIVER 36466.00	1.217	1.222	143.814	201.671	0.207	0.29
ROSS RIVER 37339.00	1.214	1.216	147.089	208.01	0.172	0.243
ROWES BAY CANAL 10000.00	3.031	3.012	2.73	2.517	0.784	0.725
ROWES BAY CANAL 10256.00	2.757	2.811	3.003	2.887	0.39	0.361
ROWES BAY CANAL 10315.10	2.729	2.777	2.681	2.722	0.218	0.204
ROWES BAY CANAL 10959.10	2.641	2.693	7.445	6.462	0.291	0.282
ROWES BAY CANAL 11383.10	2.536	2.648	8.31	7.863	0.132	0.12

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

Branch, Chainage	Water Level 2yr 2hr (m)	Water Level 2yr 6hr (m)	Discharge 2yr 2hr (m^3/s)	Discharge 2yr 6hr (m^3/s)	Velocity 2yr 2hr (m/s)	Velocity 2yr 6hr (m/s)
ROWES BAY CANAL 11438.80	2.53	2.644	10.274	9.536	0.159	0.143
ROWES BAY CANAL 11726.00	2.494	2.637	9.6	9.616	0.129	0.127
ROWES BAY CANAL 12201.00	2.342	2.461	6.544	9.698	0.314	0.365
ROWES BAY CANAL 12751.80	1.85	1.913	9.037	11.267	0.349	0.406
ROWES BAY CANAL 12811.40	1.829	1.889	9.031	11.267	0.638	0.708
RYAN ST CANAL 10085.60	1.784	1.712	5.344	4.512	0.872	0.844
RYAN ST CANAL 10348.00	1.426	1.363	5.262	4.523	1.472	1.405
RYAN ST CANAL 10380.40	1.239	1.232	5.791	4.959	0.399	0.345
S DALRYMPLE DRAIN 1 10000.00	7.783	7.784	0.134	0.134	0.374	0.369
S DALRYMPLE DRAIN 1 10646.90	6.651	6.786	0.134	0.135	0.07	0.066
S DALRYMPLE DRAIN 1 11010.40	6.34	6.348	0.372	0.447	0.024	0.076
S DALRYMPLE DRAIN 2 10000.00	5.692	5.752	0	0.1	0.097	0.099
S DALRYMPLE DRAIN 2 10571.00	3.602	3.621	0.322	0.27	0.215	0.208
STUART CREEK 10369.30	9.506	10.2	129.512	169.989	0.987	1.043
STUART CREEK 11823.80	8.125	8.554	117.131	143.071	1.095	1.095
STUART CREEK 13185.20	6.092	6.369	112.53	128.522	0.878	0.81
STUART CREEK 13250.10	6.067	6.274	108.06	153.514	0.975	0.985
TOMKINS ST DRAIN 10350.00	2.647	2.847	2.009	1.926	0.387	0.326
UNIVERSITY CREEK 11532.00	13.515	13.392	39.429	32.806	1.451	1.379
UNIVERSITY CREEK 11599.80	13.118	13.029	39.659	33.093	1.436	1.363
UNIVERSITY CREEK 12009.10	11.076	10.932	39.554	33.234	1.442	1.419
UNIVERSITY CREEK 12107.10	10.267	10.186	39.657	33.489	1.097	1.114
UNIVERSITY CREEK 12752.50	8.857	8.794	37.189	33.355	0.791	0.756
VENNARD ST DRAIN 10236.20	6.368	6.321	0.91	0.683	0.341	0.331
WOOLCOCK CANAL 10115.20	2.714	2.673	2.821	2.366	1.004	0.948
WOOLCOCK CANAL 10461.60	2.252	2.219	3.672	3.24	0.367	0.377
WOOLCOCK CANAL 10530.90	1.983	2.109	4.347	3.857	0.406	0.381
WOOLCOCK CANAL 10860.00	1.983	2.108	2.747	2.794	0.005	0.005
WOOLCOCK CANAL 11230.70	1.979	2.104	12.499	13.21	0.507	0.56
WOOLCOCK CANAL 11304.90	1.944	2.091	11.984	12.951	0.093	0.095
WOOLCOCK CANAL 11657.50	1.935	2.08	14.457	18.096	0.431	0.488
WOOLCOCK CANAL 11716.90	1.826	1.943	14.695	18.203	1.332	1.473
WOOLCOCK CANAL 12256.60	1.566	1.546	15.304	19.169	1.093	1.35
WOOLCOCK CANAL 12773.00	1.382	1.423	34.831	30.562	1.416	1.215
WOOLCOCK CANAL 12839.00	1.373	1.413	34.833	30.563	1.361	1.197
WOOLCOCK CANAL 12987.00	1.357	1.354	34.895	31.284	1.445	1.26
WOOLCOCK CANAL 13050.00	1.291	1.32	34.9	31.285	0.302	0.265
WOOLCOCK ST DRAIN 10000.00	5.529	5.426	0.01	0.007	0.011	0.01
WOOLCOCK ST DRAIN 10284.90	5.047	5.018	1.903	1.704	1.048	0.997
WOOLCOCK ST DRAIN 10748.00	4.719	4.681	2.525	2.116	0.395	0.258
WOOLCOCK ST DRAIN 11083.00	4.689	4.661	2.769	2.333	0.188	0.161
WULGURU DRAIN 10000.00	21.302	21.244	7.346	5.9	1.969	1.915
WULGURU DRAIN 10185.60	19.648	19.502	7.358	5.889	0.727	0.667
WULGURU DRAIN 10241.10	18.767	18.712	7.368	5.894	1.41	1.4
WULGURU DRAIN 10893.90	11.694	11.456	9.928	7.714	0.961	0.936
WULGURU DRAIN 10948.00	10.628	10.515	11.569	8.929	2.376	2.204
WULGURU DRAIN 11679.00	3.646	3.542	12.671	9.453	1.109	1
WULGURU DRAIN 11734.10	3.634	3.538	12.854	9.539	0.684	0.602
WYNBERG DR DRAIN 10000.00	7.53	7.505	3.804	3.5	0.798	0.776
WYNBERG DR DRAIN 10121.00	7.219	7.208	3.746	3.5	1.049	1.013
WYNBERG DR DRAIN 10435.60	5.137	5.14	3.57	3.499	1.198	1.173
WYNBERG DR DRAIN 10644.30	4.045	4.138	5.269	4.839	1.136	1.064

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 5yr 2hr**	**Water Level 5yr 6hr**	**Discharge 5yr 2hr**	**Discharge 5yr 6hr**	**Velocity 5yr 2hr**	**Velocity 5yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
AIRPORT DRAIN 10053.00	4.682	4.682	0.004	0.004	0.001	0.001
AIRPORT DRAIN 10789.90	3.235	3.235	3.546	3.546	0.502	0.502
AIRPORT DRAIN 11383.00	2.857	2.861	9.662	9.662	0.491	0.491
AIRPORT DRAIN 11435.50	2.852	2.855	10.874	10.874	0.264	0.264
AIRPORT DRAIN 11741.60	2.851	2.854	9.142	9.143	0.443	0.443
AIRPORT DRAIN 12216.50	2.85	2.854	3.034	3.026	0.368	0.368
AIRPORT DRAIN 12465.40	2.847	2.851	7.073	7.009	0.059	0.067
AIRPORT DRAIN 12999.00	2.82	2.825	7.811	7.73	0.247	0.246
ANGUS AV DRAIN 10091.00	8.999	9.036	3.76	3.758	0.483	0.49
ANGUS AV DRAIN 10455.40	8.95	8.987	7.627	7.539	1.314	1.299
ANNANDALE DRAIN 10005.00	11.569	11.505	6.078	5.496	0.675	0.672
ANNANDALE DRAIN 10072.00	10.6	10.562	6.032	5.447	1.126	1.107
ANNANDALE DRAIN 10434.80	7.725	7.636	7.186	6.119	0.652	0.601
ANNANDALE DRAIN 10505.30	7.686	7.607	7.849	6.623	0.558	0.532
ANNANDALE DRAIN 11020.00	6.369	6.235	8.279	6.87	0.508	0.511
ANNANDALE DRAIN 11539.10	5.652	5.513	19.856	16.028	0.635	0.588
ANNANDALE DRAIN 11604.20	5.533	5.424	20.782	16.996	0.866	0.798
ANNANDALE DRAIN 12439.30	4.367	4.409	20.674	18.233	0.805	0.806
ANNANDALE DRAIN 12704.00	4.239	4.271	80.959	86.393	0.996	1.04
ANNANDALE DRAIN 12792.20	4.099	4.09	80.93	86.319	1.039	1.062
ANNANDALE DRAIN 13249.20	3.562	3.486	83.859	91.153	1.453	1.874
ANNANDALE GDNS DRAIN 10095.50	6.034	5.998	42.205	37.114	1.034	0.991
ANNANDALE GDNS DRAIN 9295.00	11.46	11.435	40.363	37.877	0.751	0.727
ANNANDALE GDNS DRAIN 9995.08	6.704	6.624	41.521	36.355	1.125	1.144
BAIN ST DRAIN 10000.00	4.432	4.243	11.276	9.525	0.924	0.897
BAIN ST DRAIN 10233.20	3.341	3.2	14.273	11.569	0.967	0.901
BAIN ST DRAIN 10301.20	2.853	2.742	14.168	11.437	1.293	1.313
BALLS LA DRAIN 10000.00	4.03	4.062	0.098	0.116	0.02	0.02
BALLS LA DRAIN 10071.10	3.765	3.817	0.128	0.155	0.26	0.294
BELGIAN GDNS DRAIN 10005.00	8.643	8.643	4.784	4.784	0.742	0.742
BELGIAN GDNS DRAIN 10085.20	8.247	8.247	4.704	4.704	0.942	0.942
BELGIAN GDNS DRAIN 10455.50	3.711	3.711	5.609	5.609	2.397	2.397
BOWEN RD DRAIN 10084.50	3.597	3.523	2.917	2.385	0.523	0.463
BOWEN RD DRAIN 10153.80	3.461	3.419	2.927	2.383	0.534	0.46
BOWEN RD DRAIN 10740.00	2.849	2.893	4.677	4.171	1.01	0.798
BROOKS ST DRAIN 10000.00	2.322	2.308	0.646	0.648	0.135	0.074
BROOKS ST DRAIN 9870.00	2.595	2.558	0	0	0	0
CENTRE FAIRFIELD DRAIN 10000.00	3.071	3.217	6.592	13.701	0.058	0.096
CLUDEN CREEK 10010.00	3.742	3.841	43.754	61.198	0.185	0.241
CLUDEN CREEK 10098.30	3.721	3.817	43.762	61.26	0.521	0.525
CLUDEN CREEK 9100.40	4.801	4.908	44.578	61.48	0.52	0.467
CLUDEN DRAIN 10007.50	10.593	10.336	27.969	23.022	1.23	1.187
CLUDEN DRAIN 10100.80	10.035	9.907	30.566	25.302	1.029	0.927
CLUDEN DRAIN 10907.20	5.174	4.972	31.373	26.458	1.488	1.452
CLUDEN DRAIN 10982.20	4.783	4.663	31.37	26.454	1.038	0.985
CLUDEN DRAIN 11533.30	3.923	3.9	65.167	54.051	0.642	0.621
CLUDEN DRAIN 11574.30	3.654	3.764	64.932	53.716	1.055	0.986
CLUDEN DRAIN 12142.10	3.557	3.708	37.484	31.56	0.324	0.315
CLUDEN DRAIN 12399.30	3.55	3.703	24.764	27.756	0.159	0.168
CLUDEN DRAIN 13184.20	2.866	3.154	11.069	11.544	0.243	0.233
CLUDEN DRAIN 13382.50	2.823	3.132	16.032	31.767	0.083	0.075
CLUDEN DRAIN 9331.00	16.66	16.539	26	21	1.423	1.321
CRANBROOK CREEK 10145.20	10.508	10.408	5.804	4.801	0.769	0.755
CRANBROOK CREEK 10577.90	7.761	7.799	7.142	5.979	0.914	0.846
CREEKWOOD E 10010.00	12.79	12.637	3.899	3.1	0.976	0.966
CREEKWOOD E 10104.00	12.355	11.962	9.578	3.096	0.704	1.136
CREEKWOOD E 10495.00	7.454	7.597	5.779	4.99	0.973	0.875
CREEKWOOD W 10010.00	12.137	11.995	3.9	3.1	0.704	0.706
CREEKWOOD W 10144.50	10.179	10.113	3.878	3.098	1.016	0.986
DOUGLAS CREEK 10081.90	13.277	13.272	5.191	5.167	0.586	0.588
DOUGLAS CREEK 10161.80	12.185	12.183	5.172	5.143	0.979	0.938
DOUGLAS CREEK 10642.10	8.499	8.497	6.044	6.003	1.066	1.062
FAIRFIELD DRAIN 10235.60	3.017	2.892	0.311	0.43	0.159	0.047
FAIRFIELD DRAIN 10802.00	3.017	2.892	0.248	0.178	0.093	0.111
FAIRFIELD DRAIN 10875.90	2.902	3.153	0.249	0.118	0.067	0.048

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 5yr 2hr (m)**	**Water Level 5yr 6hr (m)**	**Discharge 5yr 2hr (m^3/s)**	**Discharge 5yr 6hr (m^3/s)**	**Velocity 5yr 2hr (m/s)**	**Velocity 5yr 6hr (m/s)**
FAIRFIELD DRAIN 11402.40	2.87	3.159	0.481	0.546	0.008	0.008
FAIRFIELD DRAIN 12207.00	2.868	3.159	2.455	4.664	0.024	0.023
FAIRFIELD DRAIN 12296.10	2.813	3.121	4.824	9.906	0.038	0.033
GLENDALE DR DRAIN 10000.00	6.916	6.868	1.654	1.2	0.776	0.685
GLENDALE DR DRAIN 10158.10	6.44	6.401	1.447	1.151	0.902	0.804
GLENDALE DR DRAIN 10403.10	4.884	4.829	2.566	2.01	0.761	0.656
GLENDALE DR DRAIN 10442.50	4.87	4.819	2.929	2.295	0.544	0.423
GOONDI CREEK 10000.00	1.558	1.54	4.792	3.131	0.426	0.341
GOONDI CREEK 10865.20	1.427	1.481	3.424	3.786	0.058	0.061
GORDON CREEK 10000.00	2.81	3.116	20.626	36.741	0.452	0.501
GORDON CREEK 10883.20	2.043	2.218	21.119	36.88	0.163	0.225
GORDON CREEK 11594.00	1.832	1.998	36.17	55.363	0.212	0.246
GORDON CREEK 11820.40	1.791	1.953	36.24	55.869	0.21	0.255
GORDON CREEK 14080.00	1.336	1.427	31.297	54.908	0.107	0.179
GRAMMAR DRAIN 10000.00	16.434	16.434	6.822	6.822	2.026	2.026
GRAMMAR DRAIN 10290.00	11.503	11.503	8.048	8.048	0.672	0.672
HAROLD ST DRAIN 10000.00	6.474	6.474	11.306	11.306	3.099	3.099
HAROLD ST DRAIN 10372.70	2.863	2.871	10.268	10.258	0.971	0.997
HERMIT DRAIN 10000.00	2.216	2.112	1.4	0.906	0.625	0.498
HERMIT DRAIN 10505.00	2.011	2.021	3.883	3.162	0.508	0.449
HERMIT DRAIN 10578.50	1.919	2.011	3.336	2.674	0.379	0.332
HERMIT DRAIN 10921.00	1.919	2.006	4.362	3.784	0.225	0.212
HERMIT DRAIN 10992.30	1.912	1.954	5.31	4.556	0.331	0.293
HONEYSUCKLE DR DRAIN 10005.00	11.529	11.312	8.057	6.31	0.981	0.937
HONEYSUCKLE DR DRAIN 10102.00	10.594	10.484	8.084	6.363	1.55	1.41
HONEYSUCKLE DR DRAIN 10583.70	6.925	6.838	9.166	7.535	1.615	1.5
JUREKEY ST DRAIN 10000.00	6.212	6.115	5.417	3.561	0.948	0.834
JUREKEY ST DRAIN 10506.00	4.159	4.134	3.297	2.905	0.42	0.401
JUREKEY ST DRAIN 10563.40	3.917	3.888	21.16	18.908	0.759	0.657
KINGS RD DRAIN 10094.60	4.052	3.94	2.85	2.139	0.406	0.494
KINGS RD DRAIN 10455.00	3.707	3.6	4.362	3.813	0.46	0.447
KINGS RD DRAIN 10514.00	3.538	3.507	4.333	3.818	0.474	0.43
KINGS RD DRAIN 10582.60	3.53	3.503	4.373	3.845	0.319	0.309
KINGS RD DRAIN 10632.60	3.47	3.479	4.431	3.873	0.888	0.811
KINGS RD DRAIN 10880.00	3.44	3.468	4.547	3.884	0.393	0.391
KINGS RD DRAIN 10990.00	3.206	3.359	4.453	3.927	0.288	0.316
LAKES TWO 10138.90	2.19	2.379	0.512	0.698	0.003	0.003
LAKES TWO 10793.10	2.19	2.379	8.592	9.644	0.024	0.026
LOUISA-CK 10083.60	2.704	2.706	28.033	28.253	0.218	0.219
LOUISA-CK 3007.82	9.212	9.212	4.44	4.417	0.327	0.329
LOUISA-CK 3979.59	8.712	8.724	9.773	9.734	0.242	0.243
LOUISA-CK 4055.00	8.693	8.707	11.543	11.487	0.365	0.367
LOUISA-CK 4926.69	7.292	7.296	30.804	30.952	0.584	0.583
LOUISA-CK 5388.98	6.241	6.245	32.403	32.545	0.687	0.684
LOUISA-CK 5823.04	5.614	5.617	32.607	32.722	0.298	0.299
LOUISA-CK 5915.00	5.516	5.518	33.034	33.141	0.414	0.415
LOUISA-CK 6590.00	3.91	3.91	39.624	39.66	1.104	1.104
LOUISA-CK 6671.00	3.899	3.9	39.592	39.67	0.219	0.217
LOUISA-CK 6999.00	3.714	3.715	43.82	43.84	0.181	0.181
LOUISA-CK 7046.00	3.651	3.651	43.78	43.799	0.284	0.284
LOUISA-CK 7410.00	3.148	3.151	44.419	44.412	0.238	0.237
LOUISA-CK 7459.85	3.139	3.142	44.913	44.898	0.194	0.194
L_RAIL EST 0.00	2.256	2.298	0	2.72	0	0.735
L_RAIL EST 636.00	2.092	2.092	0	0	0	0
MACARTHUR PARK DRAIN 10805.50	11.438	11.417	58.248	57.259	0.466	0.46
MACARTHUR PARK DRAIN 10912.30	10.891	10.88	58.215	57.157	1.67	1.674
MACARTHUR PARK DRAIN 11757.10	7.788	7.781	58.446	57.786	1.149	1.094
MACARTHUR PARK DRAIN 11836.80	6.938	6.935	58.945	58.59	1.376	1.372
MACARTHUR PARK DRAIN 12400.20	5.007	5.023	59.187	59.191	1.251	1.236
MACARTHUR PARK DRAIN 9954.04	13.34	13.253	49.167	45.441	1.179	1.193
MARABOU DRAIN 10005.00	13.325	13.173	16	13	0.982	0.935
MARABOU DRAIN 10115.20	13.213	13.102	15.999	13	0.624	0.569
MARABOU DRAIN 10658.20	9.517	9.355	17.011	13.963	0.661	0.662
MARABOU DRAIN 10721.30	9.036	8.982	17.583	14.497	0.812	0.775
MARABOU DRAIN 11349.20	7.624	7.581	18.394	15.505	0.528	0.473

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 5yr 2hr (m)**	**Water Level 5yr 6hr (m)**	**Discharge 5yr 2hr (m^3/s)**	**Discharge 5yr 6hr (m^3/s)**	**Velocity 5yr 2hr (m/s)**	**Velocity 5yr 6hr (m/s)**
MINDHAM DRAIN 10082.00	7.466	7.34	2.943	2.862	0.439	0.447
MINDHAM DRAIN 10367.00	7.357	7.166	7.921	6.59	0.862	0.778
MINDHAM DRAIN 10697.50	6.593	6.533	16.473	14.515	1.452	1.371
MINDHAM DRAIN 11267.50	6.049	5.912	14.65	13.465	1.011	0.988
MINDHAM DRAIN 11805.60	5.934	5.744	20.783	19.148	0.716	0.677
MINDHAM DRAIN 11850.00	5.662	5.526	20.819	19.15	1.036	1.075
MINDHAM DRAIN 12236.00	5.394	5.051	22.586	20.832	0.577	0.708
MINDHAM DRAIN 12307.00	5.061	5.04	22.318	20.643	0.785	0.759
MINDHAM DRAIN 13050.30	4.685	4.687	24.617	24.353	0.356	0.344
MINDHAM DRAIN 13238.40	4.647	4.65	26.69	26.656	0.882	0.604
MINDHAM DRAIN 13324.40	4.096	4.102	26.52	26.511	1.732	1.381
MINDHAM DRAIN 13746.00	3.753	3.808	26.072	26.481	0.707	0.573
MINDHAM DRAIN 14214.00	3.674	3.745	24.794	26.559	0.271	0.274
MINDHAM DRAIN 14268.10	3.456	3.55	24.999	26.982	0.854	0.838
MINDHAM DRAIN 14900.00	3.206	3.358	24.725	26.97	0.21	0.21
MINDHAM DRAIN 14952.80	2.896	3.249	27.248	32.115	0.369	0.378
MINDHAM DRAIN 15376.00	2.795	3.209	26.048	30.996	0.37	0.401
MINDHAM DRAIN 15448.10	2.077	2.151	26.094	31.211	0.572	0.613
MINDHAM DRAIN 15976.20	1.912	1.952	26	32.039	0.27	0.324
MINDHAM DRAIN 16181.20	1.895	1.927	26.784	34.934	0.277	0.362
MT LOUISA DRAIN 10000.00	12.459	12.459	1.731	1.731	0.69	0.69
MT LOUISA DRAIN 10336.10	6.397	6.397	1.665	1.665	0.533	0.533
MT LOUISA DRAIN 10596.50	6.103	6.103	2.172	2.172	0.167	0.167
MT LOUISA DRAIN 10902.70	4.006	4.004	3.136	3.136	0.668	0.668
MT LOUISA DRAIN 11081.00	3.916	3.915	5.708	5.725	0.778	0.769
MT LOUISA DRAIN 11192.40	3.901	3.901	5.468	5.468	0.417	0.424
MT ST JOHN 10000.00	2.36	2.36	1.6	1.6	0.214	0.214
MT ST JOHN 11694.50	2.185	2.185	6.989	6.989	0.152	0.152
N DALRYMPLE DRAIN 10000.00	7.545	7.439	1.846	1.231	0.574	0.474
N DALRYMPLE DRAIN 10806.00	6.145	6.122	1.585	1.492	0.44	0.404
N DALRYMPLE DRAIN 10903.20	6.101	6.087	1.731	1.576	0.484	0.393
N DALRYMPLE DRAIN 11570.00	4.204	4.215	2.597	2.312	0.627	0.545
N DALRYMPLE DRAIN 11659.90	4.195	4.205	2.975	2.773	0.156	0.118
N DALRYMPLE DRAIN 11885.90	3.885	3.811	4.088	4.566	0.309	0.309
N DALRYMPLE DRAIN 12361.60	3.547	3.419	9.797	8.297	1.211	1.21
OF_AITKENVALE 10000.00	11.579	11.579	0	0	0	0
OF_AITKENVALE 10305.80	10.841	10.841	0	0.378	0	0.206
OF_AITKENVALE 10678.20	10.357	10.357	0	1.292	0	0.19
OF_AITKENVALE 11027.90	9.647	9.372	0	0	0	0.002
OF_AITKENVALE 11238.00	9.126	9.08	0.048	0	0.021	0
OF_AITKENVALE 11491.00	7.466	7.34	0.048	0.049	0.3	4.689
OF_ANDERS2 9612.00	7.844	7.873	0	0.1	0.024	0.024
OF_ANDERS2 9982.00	7.04	7.119	0	0.02	0.02	0.012
OF_ANDERSON1 9606.00	7.444	7.444	0	0	0	0
OF_A-VALE2 10000.00	9.433	9.433	0	0.001	0.025	0.004
OF_A-VALE2 10445.00	8.752	8.757	0.032	0.052	0.03	0.046
OF_BUCHANAN 10000.00	6.899	6.899	0.017	0.016	0.033	0.032
OF_BUCHANAN 10432.00	6.065	6.06	0.034	0.027	0.013	0.01
OF_BUCHANAN 10754.30	4.493	4.494	0.038	0.039	0.24	0.239
OF_CASTLETOWN 10000.00	3.446	3.221	0.87	0	0.434	0
OF_CASTLETOWN 10413.60	2.441	2.342	0.103	0.011	0.052	0.007
OF_CASTLETOWN 10473.30	2.441	2.342	0.017	0.003	0.085	0.013
OF_CAUSEWAY 10000.00	2.365	2.367	0.788	0	3.582	0
OF_CAUSEWAY 10346.20	2.46	2.46	0.178	0.179	0.149	0.15
OF_CRANBROOK 10000.00	14.25	14.223	1.722	1.019	0.467	0.901
OF_CRANBROOK 10736.10	12.34	12.326	0.834	0.737	0.919	0.675
OF_CURRAJONG 10000.00	11.557	11.557	0.646	0.646	0.495	0.495
OF_CURRAJONG 10155.60	11.391	11.39	0.133	0.133	0.147	0.146
OF_CURRAJONG 10583.10	10.375	10.376	0.01	0.01	0.046	0.045
OF_CURRAJONG 10914.60	9.98	9.98	0	0	0	0
OF_CURRAJONG 11244.50	9.464	9.456	0	0	0	0
OF_CURRAJONG 11760.90	8.854	8.854	0	0	0	0
OF_CURRAJONG 12545.50	8.257	8.256	0.043	0.042	0.083	0.082
OF_CURRAJONG 13148.60	7.359	7.353	0.032	0.031	0.053	0.05
OF_CURRAJONG 14053.00	5.496	5.496	1.344	1.344	0.307	0.307

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 5yr 2hr**	**Water Level 5yr 6hr**	**Discharge 5yr 2hr**	**Discharge 5yr 6hr**	**Velocity 5yr 2hr**	**Velocity 5yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
OF_CURRAJONG 14803.50	4.686	4.638	0.608	0.637	0.619	0.741
OF_CURRA2 9118.00	7.603	7.603	0	0	0	0
OF_CURRA2 9639.14	6.671	6.667	0.002	0.001	0	0
OF_CURRA2 9937.22	6.072	6.072	0.064	0.064	0.086	0.086
OF_CURRA2 10304.30	5.539	5.485	0.385	0.183	0.293	0.242
OF_CURRA2 10975.00	4.504	4.465	1.629	0.39	0.457	0.175
OF_FULHAM 10000.00	10.941	10.941	0	0	0	0
OF_FULHAM 10211.00	11.317	11.312	0.013	0.013	0.04	0.038
OF_FULHAM 10553.20	10.271	10.26	1.353	1.045	0.129	0.087
OF_FULHAM 10852.00	9.478	9.469	0.138	0.079	0.42	0.241
OF_GREGORY 10000.00	10.33	10.33	0.213	0.213	0.219	0.219
OF_GREGORY 10417.30	7.663	7.663	0.129	0.129	0.107	0.107
OF_GREGORY 10783.00	6.459	6.459	0	0	0	0
OF_GREGORY 10880.00	5.62	5.62	0	0	0	0
OF_GULLIVER 9576.00	8.443	8.443	0	0	0	0
OF_GULLIVER 10000.00	7.539	7.539	0	0	0	0
OF_GULLIVER 10289.00	7.236	7.221	0.002	0.001	0.004	0.001
OF_GULLIVER 10706.40	6.85	6.85	0	0	0	0
OF_GULLIVER 11300.20	6.01	5.979	2.226	1.481	1.489	1.555
OF_GULLIVER 11728.00	5.454	5.431	1.102	0.694	0.285	0.179
OF_GULLIVER 12119.00	3.721	3.676	1.946	1.254	0.484	0.411
OF_HOWITT 9338.00	6.473	6.473	0	0	0	0
OF_HOWITT 9961.80	3.701	3.701	0.042	0.042	0.118	0.118
OF_HOWITT 10388.00	2.869	2.869	1.016	1.016	0.045	0.045
OF_HUGH ST 10000.00	5.388	5.35	0.674	0.3	0.183	0.15
OF_HUGH ST 10479.10	5.013	4.978	0.476	0.269	0.126	0.126
OF_HUTCHINS 10000.00	9.106	9.106	0.203	0.203	0	0.643
OF_HUTCHINS 10406.00	8.545	8.545	0.281	0.28	0	0.046
OF_HUTCHINS 10716.00	7.729	7.73	0.857	0.857	0.67	2.433
OF_LAKES1 10191.70	2.532	2.532	0	0	0	0
OF_LAKES1 10309.50	2.607	2.607	0	0	0	0
OF_LAKES1 10568.00	2.441	2.342	0.378	0.036	0.043	0.007
OF_LANDSBOROUGH 10000.00	24.573	24.573	0	0	0	0
OF_LANDSBOROUGH 10470.00	9.551	9.551	0.02	0.02	0.005	0.005
OF_LANDSBOROUGH 10781.10	6.237	6.237	0.11	0.11	0.235	0.235
OF_LANDSBOROUGH 11162.00	2.948	2.948	0.111	0.111	0.06	0.06
OF_MUNDINGBURRA 10848.40	7.25	7.25	0.079	0.048	0.12	0.072
OF_MUNDINGBURRA 11416.30	6.76	6.76	0	0	0	0
OF_MUNDINGBURRA 11907.00	6.117	6.117	0.002	0.002	0.001	0.001
OF_MUND2 10000.00	6.302	6.302	0	0	0	0
OF_MUND2 10345.00	6.117	6.117	0	0	0	0
OF_NOONGAH ST 10000.00	6.689	6.67	0.091	0.012	0.248	0.032
OF_NOONGAH ST 10363.00	6.025	5.733	1.595	0.047	0.786	0.023
OF_PIMLICO 9560.00	8.63	8.63	0.001	0.001	0.003	0.003
OF_PIMLICO 9867.58	8.076	7.863	0.005	0.001	0.003	0.004
OF_PIMLICO 11676.80	6.177	6.154	0	0	0	0
OF_PRIMROSEST 10000.00	2.733	2.733	0.186	0.186	0.072	0.072
OF_PRIMROSEST 10628.00	3.045	3.045	0	0	0	0
OF_QUEENS 10000.00	3.202	3.15	0.853	0.355	0.149	0.16
OF_QUEENS 10533.10	3.169	3.256	0	0	0	0
OF_QUEENS 10836.00	3.337	3.414	0	0	0	0
OF_ROSSL2 10261.60	4.028	4.001	0.009	0.001	0.011	0.001
OF_ROSSL2 10670.00	2.898	2.952	0.008	1.015	0.01	0.181
OF_STOCKLAND 10697.00	12.426	12.372	1.603	0.792	0.328	0.234
OF_STOCKLAND 11080.20	11.602	11.531	1.439	0.788	0.53	0.406
OF_STOCKLAND 11400.40	11.331	11.296	0.781	0.463	0.566	0.405
OF_STOCKLAND 12000.00	10.844	10.77	0.165	0.018	0.025	0.003
OF_STOCKLAND 12519.00	10.336	10.279	0	0	0	0
OF_STOCKLAND 13123.00	8.57	8.57	0	2.253	0	2.8
OF_SWEET ST 10000.00	5.335	5.299	3.946	2.715	0.569	0.32
OF_SWEET ST 10340.00	4.913	4.894	2.829	2.269	0.717	0.671
OF_VINCENT 10183.30	8.89	8.89	0.173	0.173	0.342	0.345
OF_VINCENT 10839.00	7.359	7.353	0.012	0.01	0.01	0.009
OF_WARBUTONST 10000.00	9.855	9.855	-0.01	-0.01	-0.021	-0.021
OF_WARBUTONST 10410.00	7.663	7.663	0.011	0.011	0.006	0.006

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 5yr 2hr**	**Water Level 5yr 6hr**	**Discharge 5yr 2hr**	**Discharge 5yr 6hr**	**Velocity 5yr 2hr**	**Velocity 5yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
OON BREAKOUT 10910.00	1.716	1.961	1.462	2.165	0.053	0.055
PALMETUM CREEK 10033.30	9.308	9.165	3.406	2.442	1.048	0.93
PALMETUM CREEK 9944.00	9.45	9.328	4.006	2.58	0.48	0.408
PEEWEE CK 10151.90	5.172	5.17	4.281	4.281	0.27	0.717
PEEWEE CK 10413.00	4.772	4.766	6.685	6.648	0.143	0.143
PEEWEE CK 10509.70	4.614	4.6	10.262	9.881	0.402	0.411
PEEWEE CK 10844.30	3.64	3.64	11.461	11.451	0.422	0.408
PEEWEE CK 10989.40	3.499	3.499	11.395	11.41	0.322	0.316
PEEWEE CK 11532.00	3.148	3.151	1.875	1.877	0.14	0.952
PERCY ST - INGHAM RD DRAIN 10091.3	2.855	2.851	0.371	0.574	0.592	0.605
PERCY ST - INGHAM RD DRAIN 10581.4	2.621	2.768	6.35	6.787	0.559	0.554
PERCY ST - INGHAM RD DRAIN 10660.9	2.19	2.38	6.361	6.786	1.784	1.793
RACECOURSE 1 DRAIN 10000.00	4.694	4.631	1.898	1.175	0.227	0.163
RACECOURSE 1 DRAIN 10042.00	3.925	3.87	3.479	2.485	0.338	0.284
RAIL YARDS CREEK 10000.00	38.425	38.388	11	10	1.988	1.914
RAIL YARDS CREEK 10265.70	26.382	26.324	10.991	9.993	1.363	1.333
RAIL YARDS CREEK 10310.40	25.299	25.271	10.977	9.991	1.558	1.524
RAIL YARDS CREEK 10837.30	16.399	16.274	16.015	14.283	0.878	0.873
RAIL YARDS CREEK 10894.70	16	15.958	19.599	17.57	1.127	1.086
RAIL YARDS CREEK 11286.50	12.229	12.086	25.915	23.075	1.063	1.051
RAIL YARDS CREEK 11344.80	11.255	11.169	26.328	23.21	1.747	1.736
RAIL YARDS CREEK 12585.20	5.054	5.026	24.032	20.333	0.601	0.567
RIVERSIDE CREEK 10144.90	11.568	11.512	4.956	4.01	1.069	1.01
RIVERSIDE CREEK 10512.30	7.366	7.465	6.419	5.702	0.66	0.728
RIVERSIDE CREEK 10588.80	7.351	7.459	7.512	8.118	0.699	0.75
ROSS CREEK 10000.00	1.579	1.599	3.254	2.331	0.069	0.047
ROSS CREEK 10146.70	1.546	1.592	1.956	2.041	0.025	0.025
ROSS CREEK 10277.30	1.469	1.55	1.841	1.659	0.012	0.011
ROSS CREEK 11010.00	1.468	1.55	3.681	3.583	0.03	0.028
ROSS CREEK 11087.20	1.315	1.376	4.48	4.545	0.034	0.033
ROSS CREEK 11427.80	1.296	1.311	49.686	68.24	0.55	0.744
ROSS CREEK 11913.60	1.278	1.274	49.838	69.563	0.299	0.414
ROSS CREEK 12528.80	1.267	1.257	52.496	71.6	0.206	0.28
ROSS CREEK 12713.00	1.259	1.249	61.345	74.885	0.179	0.218
ROSS CREEK 13131.30	1.243	1.233	71.867	77.991	0.318	0.345
ROSS CREEK 13264.20	1.238	1.229	74.145	78.462	0.281	0.297
ROSS CREEK 13890.10	1.232	1.225	82.464	80.718	0.106	0.104
ROSS RIVER 21732.00	9.528	9.574	156.391	171.341	0.323	0.35
ROSS RIVER 22660.00	7.353	7.469	157.485	174.106	0.363	0.388
ROSS RIVER 23317.00	7.329	7.442	156.579	179.056	0.302	0.335
ROSS RIVER 23736.00	7.315	7.425	155.033	179.154	0.307	0.343
ROSS RIVER 24334.00	7.302	7.409	163.234	193.583	0.265	0.305
ROSS RIVER 24374.00	7.293	7.399	163.179	193.494	0.245	0.282
ROSS RIVER 25058.00	7.28	7.382	164.04	194.254	0.27	0.312
ROSS RIVER 26593.00	7.25	7.343	219.983	254.24	0.354	0.399
ROSS RIVER 26690.00	2.848	3.137	219.801	254.194	0.459	0.497
ROSS RIVER 27504.00	2.744	3.045	210.895	249.122	0.629	0.634
ROSS RIVER 28123.00	2.656	2.974	197.439	239.814	0.513	0.514
ROSS RIVER 29070.00	2.555	2.887	229.211	288.529	0.48	0.524
ROSS RIVER 29142.00	2.547	2.879	228.206	287.901	0.499	0.546
ROSS RIVER 30115.00	2.368	2.691	218.608	281.86	0.854	0.866
ROSS RIVER 30752.00	2.213	2.522	214.196	278.58	0.723	0.773
ROSS RIVER 31457.00	1.997	2.3	214.632	283.07	0.8	0.844
ROSS RIVER 32211.00	1.798	2.059	213.529	282.57	0.924	1.03
ROSS RIVER 33120.00	1.608	1.816	214.07	284.251	0.8	0.978
ROSS RIVER 33210.00	1.579	1.774	214.488	285.152	0.57	0.704
ROSS RIVER 34636.00	1.336	1.427	215.22	286.03	0.555	0.696
ROSS RIVER 35506.00	1.263	1.304	220.677	298.222	0.551	0.734
ROSS RIVER 36466.00	1.225	1.236	223.981	303.617	0.322	0.435
ROSS RIVER 37339.00	1.217	1.223	230.483	313.559	0.269	0.366
ROWES BAY CANAL 10000.00	3.07	3.089	2.661	2.672	0.688	0.745
ROWES BAY CANAL 10256.00	2.929	2.965	3.563	3.151	0.397	0.372
ROWES BAY CANAL 10315.10	2.906	2.93	3.242	3.03	0.221	0.208
ROWES BAY CANAL 10959.10	2.855	2.864	8.887	8.457	0.304	0.306
ROWES BAY CANAL 11383.10	2.839	2.845	10.068	10.149	0.145	0.141

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 5yr 2hr (m)**	**Water Level 5yr 6hr (m)**	**Discharge 5yr 2hr (m^3/s)**	**Discharge 5yr 6hr (m^3/s)**	**Velocity 5yr 2hr (m/s)**	**Velocity 5yr 6hr (m/s)**
ROWES BAY CANAL 11438.80	2.834	2.841	12.532	12.445	0.177	0.174
ROWES BAY CANAL 11726.00	2.829	2.836	12.621	12.575	0.153	0.133
ROWES BAY CANAL 12201.00	2.646	2.649	14.479	14.395	0.427	0.428
ROWES BAY CANAL 12751.80	2.041	2.042	16.575	16.629	0.525	0.526
ROWES BAY CANAL 12811.40	2.011	2.012	16.578	16.633	0.852	0.853
RYAN ST CANAL 10085.60	1.895	1.895	6.459	6.459	0.864	0.864
RYAN ST CANAL 10348.00	1.535	1.535	6.561	6.561	1.568	1.568
RYAN ST CANAL 10380.40	1.255	1.256	7.292	7.292	0.487	0.486
S DALRYMPLE DRAIN 1 10000.00	7.835	7.827	0.207	0.195	0.383	0.383
S DALRYMPLE DRAIN 1 10646.90	6.768	6.927	0.212	0.186	0.096	0.085
S DALRYMPLE DRAIN 1 11010.40	6.365	6.371	0.741	0.746	0.045	0.044
S DALRYMPLE DRAIN 2 10000.00	5.692	5.752	0	0.1	0.097	0.099
S DALRYMPLE DRAIN 2 10571.00	3.905	3.842	0.462	0.305	0.213	0.213
STUART CREEK 10369.30	10.475	10.724	218.9	259.937	1.13	1.208
STUART CREEK 11823.80	8.635	8.722	166.243	193.784	1.107	1.089
STUART CREEK 13185.20	6.384	6.532	131.336	134.638	0.935	0.957
STUART CREEK 13250.10	6.318	6.424	168.523	204.496	1.003	0.99
TOMKINS ST DRAIN 10350.00	2.823	3.132	2.781	3.012	0.436	0.395
UNIVERSITY CREEK 11532.00	13.976	13.774	64.754	53.561	1.532	1.51
UNIVERSITY CREEK 11599.80	13.399	13.294	65.209	53.928	1.651	1.575
UNIVERSITY CREEK 12009.10	11.602	11.367	65.28	53.311	1.51	1.489
UNIVERSITY CREEK 12107.10	10.564	10.451	65.67	53.489	1.216	1.182
UNIVERSITY CREEK 12752.50	9.319	9.171	61.26	50.268	0.847	0.833
VENNARD ST DRAIN 10236.20	6.385	6.385	0.988	0.988	0.397	0.397
WOOLCOCK CANAL 10115.20	2.812	2.753	3.954	3.173	1.093	1.008
WOOLCOCK CANAL 10461.60	2.366	2.422	5.068	4.395	0.313	0.325
WOOLCOCK CANAL 10530.90	2.258	2.413	6.041	5.261	0.465	0.422
WOOLCOCK CANAL 10860.00	2.258	2.413	3.894	4.246	0.007	0.007
WOOLCOCK CANAL 11230.70	2.253	2.408	16.606	19.661	0.545	0.642
WOOLCOCK CANAL 11304.90	2.191	2.381	16.096	18.98	0.105	0.109
WOOLCOCK CANAL 11657.50	2.182	2.371	17.708	22.928	0.468	0.505
WOOLCOCK CANAL 11716.90	2.036	2.224	18.188	23.023	1.418	1.589
WOOLCOCK CANAL 12256.60	1.749	1.71	18.918	24.147	1.23	1.561
WOOLCOCK CANAL 12773.00	1.478	1.518	44.882	41.057	1.731	1.574
WOOLCOCK CANAL 12839.00	1.469	1.496	44.896	41.061	1.63	1.562
WOOLCOCK CANAL 12987.00	1.343	1.482	44.987	41.968	1.826	1.668
WOOLCOCK CANAL 13050.00	1.316	1.381	44.995	41.96	0.382	0.344
WOOLCOCK ST DRAIN 10000.00	5.759	5.727	0.008	0.008	0.01	0.01
WOOLCOCK ST DRAIN 10284.90	5.14	5.119	2.834	2.637	1.122	1.105
WOOLCOCK ST DRAIN 10748.00	4.83	4.817	3.648	3.441	0.31	0.31
WOOLCOCK ST DRAIN 11083.00	4.772	4.766	3.954	3.764	0.258	0.248
WULGURU DRAIN 10000.00	21.48	21.443	12	11	2.126	2.097
WULGURU DRAIN 10185.60	20.079	19.975	12	10.89	0.847	0.827
WULGURU DRAIN 10241.10	18.873	18.848	12	10.858	1.484	1.436
WULGURU DRAIN 10893.90	12.461	12.119	16.333	14.35	0.956	0.978
WULGURU DRAIN 10948.00	10.89	10.809	18.963	16.539	2.771	2.656
WULGURU DRAIN 11679.00	3.964	3.795	20.603	17.892	1.324	1.321
WULGURU DRAIN 11734.10	3.936	3.762	20.91	18.101	0.852	0.834
WYNBERG DR DRAIN 10000.00	7.66	7.647	5.608	5.4	0.908	0.896
WYNBERG DR DRAIN 10121.00	7.322	7.319	5.551	5.396	1.174	1.149
WYNBERG DR DRAIN 10435.60	5.219	5.233	5.279	5.352	1.335	1.304
WYNBERG DR DRAIN 10644.30	4.371	4.42	7.44	7.275	1.21	1.119

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 10yr 2hr**	**Water Level 10yr 6hr**	**Discharge 10yr 2hr**	**Discharge 10yr 6hr**	**Velocity 10yr 2hr**	**Velocity 10yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
AIRPORT DRAIN 10053.00	4.808	4.716	0.006	0.005	0.001	0.001
AIRPORT DRAIN 10789.90	3.441	3.31	5.63	4.203	0.636	0.546
AIRPORT DRAIN 11383.00	2.729	2.962	14.732	11.353	0.702	0.554
AIRPORT DRAIN 11435.50	2.725	2.955	15.969	12.776	0.405	0.272
AIRPORT DRAIN 11741.60	2.724	2.954	12.676	10.723	0.432	0.46
AIRPORT DRAIN 12216.50	2.724	2.954	2.519	3.737	0.023	0.353
AIRPORT DRAIN 12465.40	2.72	2.951	5.399	8.559	0.083	0.059
AIRPORT DRAIN 12999.00	2.696	2.927	6.007	9.48	0.229	0.273
ANGUS AV DRAIN 10091.00	9.239	9.277	6.154	4.333	0.639	0.525
ANGUS AV DRAIN 10455.40	9.209	9.246	10.963	8.12	1.482	1.304
ANNANDALE DRAIN 10005.00	11.72	11.647	7.469	6.876	0.678	0.685
ANNANDALE DRAIN 10072.00	10.665	10.632	7.314	6.666	1.182	1.166
ANNANDALE DRAIN 10434.80	7.842	7.751	8.704	7.579	0.712	0.675
ANNANDALE DRAIN 10505.30	7.782	7.709	9.515	8.332	0.604	0.584
ANNANDALE DRAIN 11020.00	6.491	6.369	10.072	8.624	0.527	0.534
ANNANDALE DRAIN 11539.10	5.816	5.626	24.296	19.317	0.669	0.634
ANNANDALE DRAIN 11604.20	5.658	5.514	25.419	20.036	0.935	0.854
ANNANDALE DRAIN 12439.30	4.509	4.54	26.046	22.017	0.843	0.847
ANNANDALE DRAIN 12704.00	4.359	4.381	97.795	102.585	1.107	1.144
ANNANDALE DRAIN 12792.20	4.261	4.241	97.774	102.491	1.114	1.133
ANNANDALE DRAIN 13249.20	3.745	3.643	101.808	107.786	1.464	1.875
ANNANDALE GDNS DRAIN 10095.50	6.093	6.063	51.296	46.557	1.1	1.065
ANNANDALE GDNS DRAIN 9295.00	11.564	11.53	49.994	46.956	0.817	0.8
ANNANDALE GDNS DRAIN 9995.08	6.796	6.747	49.933	45.509	1.263	1.159
BAIN ST DRAIN 10000.00	4.469	4.399	11.763	10.389	0.918	0.898
BAIN ST DRAIN 10233.20	3.422	3.291	15.789	13.342	0.992	0.948
BAIN ST DRAIN 10301.20	2.878	2.866	15.721	13.18	1.313	1.312
BALLS LA DRAIN 10000.00	4.056	4.089	0.12	0.14	0.02	0.02
BALLS LA DRAIN 10071.10	3.825	3.888	0.155	0.185	0.272	0.309
BELGIAN GDNS DRAIN 10005.00	8.837	8.804	6.2	5.985	0.822	0.813
BELGIAN GDNS DRAIN 10085.20	8.323	8.303	6.192	5.907	1.126	1.096
BELGIAN GDNS DRAIN 10455.50	3.829	3.795	6.944	6.595	2.41	2.42
BOWEN RD DRAIN 10084.50	3.685	3.591	3.527	2.864	0.572	0.515
BOWEN RD DRAIN 10153.80	3.515	3.469	3.494	2.864	0.597	0.527
BOWEN RD DRAIN 10740.00	3.003	3.043	5.159	4.813	1.526	0.814
BROOKS ST DRAIN 10000.00	2.351	2.324	0.799	0.775	0.136	0.088
BROOKS ST DRAIN 9870.00	2.606	2.572	0	0	0	0
CENTRE FAIRFIELD DRAIN 10000.00	3.154	3.332	11.876	19.988	0.089	0.126
CLUDEN CREEK 10010.00	3.788	3.867	51.545	66.569	0.211	0.258
CLUDEN CREEK 10098.30	3.765	3.842	51.517	66.649	0.536	0.532
CLUDEN CREEK 9100.40	4.866	4.944	52.87	66.74	0.509	0.477
CLUDEN DRAIN 10007.50	10.938	10.569	34.689	27.368	1.256	1.224
CLUDEN DRAIN 10100.80	10.195	10.022	37.948	30.043	1.153	1.02
CLUDEN DRAIN 10907.20	5.486	5.18	38.555	31.532	1.495	1.486
CLUDEN DRAIN 10982.20	4.986	4.787	38.489	31.516	1.07	1.04
CLUDEN DRAIN 11533.30	4.089	4.046	77.829	66.555	0.666	0.648
CLUDEN DRAIN 11574.30	3.756	3.85	77.708	66.213	1.033	1.008
CLUDEN DRAIN 12142.10	3.66	3.786	43.486	37.608	0.336	0.324
CLUDEN DRAIN 12399.30	3.654	3.78	28.052	34.214	0.144	0.155
CLUDEN DRAIN 13184.20	2.978	3.283	11.045	15.591	0.245	0.241
CLUDEN DRAIN 13382.50	2.93	3.27	21.723	39.835	0.09	0.083
CLUDEN DRAIN 9331.00	16.798	16.637	32	25	1.522	1.407
CRANBROOK CREEK 10145.20	10.58	10.484	6.464	5.42	0.774	0.766
CRANBROOK CREEK 10577.90	7.809	7.88	8.075	6.893	0.949	0.88
CREEKWOOD E 10010.00	12.947	12.822	4.8	4.092	0.992	0.99
CREEKWOOD E 10104.00	12.269	12.043	9.395	3.996	0.716	1.157
CREEKWOOD E 10495.00	7.585	7.674	7.02	6.294	1.036	0.932
CREEKWOOD W 10010.00	12.291	12.164	4.8	4.039	0.716	0.717
CREEKWOOD W 10144.50	10.256	10.189	4.734	3.983	1.046	0.986
DOUGLAS CREEK 10081.90	13.545	13.502	6.38	6.197	0.594	0.59
DOUGLAS CREEK 10161.80	12.248	12.238	6.364	6.167	1.007	0.956
DOUGLAS CREEK 10642.10	8.584	8.57	7.381	7.155	1.136	1.124
FAIRFIELD DRAIN 10235.60	3.159	3.038	0.404	0.522	0.162	0.052
FAIRFIELD DRAIN 10802.00	3.159	3.038	0.34	0.222	0.101	0.152
FAIRFIELD DRAIN 10875.90	2.993	3.285	0.324	0.232	0.074	0.057

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 10yr 2hr**	**Water Level 10yr 6hr**	**Discharge 10yr 2hr**	**Discharge 10yr 6hr**	**Velocity 10yr 2hr**	**Velocity 10yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
FAIRFIELD DRAIN 11402.40	2.983	3.287	0.74	0.967	0.01	0.011
FAIRFIELD DRAIN 12207.00	2.982	3.286	3.564	5.735	0.026	0.025
FAIRFIELD DRAIN 12296.10	2.916	3.269	5.36	20.541	0.042	0.056
GLENDALE DR DRAIN 10000.00	6.947	6.898	1.954	1.431	0.82	0.717
GLENDALE DR DRAIN 10158.10	6.466	6.434	1.697	1.4	0.939	0.839
GLENDALE DR DRAIN 10403.10	4.933	4.888	3.025	2.5	0.814	0.731
GLENDALE DR DRAIN 10442.50	4.914	4.876	3.448	2.858	0.549	0.463
GOONDI CREEK 10000.00	1.576	1.573	5.592	3.731	0.559	0.32
GOONDI CREEK 10865.20	1.474	1.538	3.723	4.159	0.06	0.063
GORDON CREEK 10000.00	2.914	3.255	26.12	50.251	0.48	0.517
GORDON CREEK 10883.20	2.103	2.329	26.75	50.352	0.188	0.267
GORDON CREEK 11594.00	1.897	2.087	42.643	68.994	0.222	0.273
GORDON CREEK 11820.40	1.856	2.037	42.74	69.779	0.225	0.289
GORDON CREEK 14080.00	1.387	1.506	40.332	69.802	0.137	0.214
GRAMMAR DRAIN 10000.00	16.507	16.499	8.9	8.292	2.113	2.056
GRAMMAR DRAIN 10290.00	11.56	11.535	10.258	9.664	0.763	0.757
HAROLD ST DRAIN 10000.00	6.638	6.617	15	14.306	3.213	3.126
HAROLD ST DRAIN 10372.70	2.9	2.962	14.478	13.156	1.104	1.073
HERMIT DRAIN 10000.00	2.306	2.198	1.646	1.031	0.641	0.525
HERMIT DRAIN 10505.00	2.077	2.135	4.461	3.66	0.535	0.475
HERMIT DRAIN 10578.50	2.047	2.126	3.755	3.069	0.396	0.341
HERMIT DRAIN 10921.00	2.04	2.122	4.783	4.311	0.22	0.212
HERMIT DRAIN 10992.30	2.034	2.06	5.88	5.173	0.344	0.308
HONEYSUCKLE DR DRAIN 10005.00	11.754	11.559	10	8.305	1.021	0.991
HONEYSUCKLE DR DRAIN 10102.00	10.705	10.61	9.995	8.325	1.681	1.566
HONEYSUCKLE DR DRAIN 10583.70	7.04	6.962	11.346	9.694	1.724	1.626
JUREKEY ST DRAIN 10000.00	6.263	6.166	6.371	4.361	0.975	0.87
JUREKEY ST DRAIN 10506.00	4.207	4.172	3.914	3.417	0.415	0.398
JUREKEY ST DRAIN 10563.40	4.014	3.956	26.478	22.46	0.68	0.664
KINGS RD DRAIN 10094.60	4.175	4.071	3.172	2.639	0.428	0.77
KINGS RD DRAIN 10455.00	3.84	3.759	4.954	4.466	0.462	0.448
KINGS RD DRAIN 10514.00	3.642	3.678	4.887	4.437	0.472	0.43
KINGS RD DRAIN 10582.60	3.636	3.677	4.86	4.43	0.321	0.312
KINGS RD DRAIN 10632.60	3.564	3.651	4.909	4.469	0.905	0.817
KINGS RD DRAIN 10880.00	3.54	3.647	5.055	4.447	0.391	0.386
KINGS RD DRAIN 10990.00	3.307	3.538	4.79	4.386	0.274	0.316
LAKES TWO 10138.90	2.33	2.568	0.604	0.828	0.003	0.004
LAKES TWO 10793.10	2.329	2.568	8.994	10.227	0.025	0.027
LOUISA-CK 10083.60	2.589	2.781	17.916	35.924	0.196	0.236
LOUISA-CK 3007.82	9.282	9.346	4.561	5.071	0.392	0.343
LOUISA-CK 3979.59	8.934	8.887	13.898	11.932	0.295	0.272
LOUISA-CK 4055.00	8.903	8.863	16.747	14.215	0.453	0.416
LOUISA-CK 4926.69	7.446	7.456	36.49	35.853	0.63	0.605
LOUISA-CK 5388.98	6.383	6.447	37.093	37.774	0.743	0.714
LOUISA-CK 5823.04	5.74	5.824	36.248	37.886	0.318	0.323
LOUISA-CK 5915.00	5.62	5.692	36.548	38.399	0.432	0.435
LOUISA-CK 6590.00	3.925	3.996	43.253	45.861	1.202	1.187
LOUISA-CK 6671.00	3.912	3.983	42.842	45.898	0.233	0.226
LOUISA-CK 6999.00	3.72	3.81	44.791	51.214	0.193	0.191
LOUISA-CK 7046.00	3.654	3.725	44.633	51.134	0.309	0.294
LOUISA-CK 7410.00	3.077	3.242	45.046	51.387	0.237	0.236
LOUISA-CK 7459.85	3.036	3.234	45.036	52.246	0.213	0.204
L_RAIL EST 0.00	2.316	2.392	0	2.3	0	0.621
L_RAIL EST 636.00	2.092	2.117	0	0.066	0	0.051
MACARTHUR PARK DRAIN 10805.50	11.675	11.653	71.012	69.355	0.493	0.472
MACARTHUR PARK DRAIN 10912.30	11.019	11.004	70.899	69.247	1.676	1.668
MACARTHUR PARK DRAIN 11757.10	8.017	8.001	70.741	69.412	0.87	1.149
MACARTHUR PARK DRAIN 11836.80	7.031	7.024	71.296	70.402	1.504	1.495
MACARTHUR PARK DRAIN 12400.20	5.208	5.225	71.626	70.911	1.264	1.259
MACARTHUR PARK DRAIN 9954.04	13.595	13.501	61.107	56.199	1.189	1.191
MARABOU DRAIN 10005.00	13.505	13.325	20	16	1.026	1.004
MARABOU DRAIN 10115.20	13.322	13.213	19.996	15.998	0.686	0.624
MARABOU DRAIN 10658.20	9.737	9.526	21.217	17.082	0.663	0.665
MARABOU DRAIN 10721.30	9.112	9.039	21.884	17.742	0.849	0.814
MARABOU DRAIN 11349.20	7.707	7.636	22.755	18.785	0.591	0.532

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 10yr 2hr**	**Water Level 10yr 6hr**	**Discharge 10yr 2hr**	**Discharge 10yr 6hr**	**Velocity 10yr 2hr**	**Velocity 10yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
MINDHAM DRAIN 10082.00	7.561	7.388	3.041	2.955	0.438	0.454
MINDHAM DRAIN 10367.00	7.482	7.245	8.516	7.315	0.842	0.799
MINDHAM DRAIN 10697.50	6.617	6.573	17.249	15.655	1.473	1.405
MINDHAM DRAIN 11267.50	6.174	6.063	16.313	14.303	1.037	1.011
MINDHAM DRAIN 11805.60	6.115	5.95	22.749	22.414	0.727	0.676
MINDHAM DRAIN 11850.00	5.76	5.63	22.913	22.577	1.048	1.132
MINDHAM DRAIN 12236.00	5.522	5.144	24.73	24.35	0.583	0.755
MINDHAM DRAIN 12307.00	5.114	5.126	24.431	24.144	0.811	0.797
MINDHAM DRAIN 13050.30	4.791	4.83	27.553	28.506	0.361	0.356
MINDHAM DRAIN 13238.40	4.758	4.799	30.003	31.192	0.995	0.6
MINDHAM DRAIN 13324.40	4.135	4.159	29.807	31.04	2.17	1.735
MINDHAM DRAIN 13746.00	3.819	3.884	29.163	31.056	0.73	0.607
MINDHAM DRAIN 14214.00	3.749	3.826	28.06	31.099	0.273	0.277
MINDHAM DRAIN 14268.10	3.536	3.7	28.294	31.525	0.872	0.863
MINDHAM DRAIN 14900.00	3.307	3.538	27.621	30.676	0.21	0.211
MINDHAM DRAIN 14952.80	3.105	3.528	30.732	36.176	0.382	0.39
MINDHAM DRAIN 15376.00	3.054	3.503	28.57	33.904	0.357	0.395
MINDHAM DRAIN 15448.10	2.171	2.232	28.615	34.146	0.545	0.615
MINDHAM DRAIN 15976.20	2.034	2.058	28.55	35.154	0.265	0.334
MINDHAM DRAIN 16181.20	2.021	2.038	29.315	38.505	0.267	0.354
MT LOUISA DRAIN 10000.00	12.495	12.488	2.396	2.161	0.745	0.745
MT LOUISA DRAIN 10336.10	6.907	6.672	2.432	2.156	0.657	0.566
MT LOUISA DRAIN 10596.50	6.171	6.136	3.416	2.79	0.226	0.202
MT LOUISA DRAIN 10902.70	4.134	4.085	4.631	3.681	0.684	0.695
MT LOUISA DRAIN 11081.00	3.94	4.012	9.858	8.19	0.902	0.899
MT LOUISA DRAIN 11192.40	3.912	3.984	9.486	7.82	0.541	0.511
MT ST JOHN 10000.00	2.308	2.406	2.308	2	0.288	0.23
MT ST JOHN 11694.50	2.134	2.22	4.805	9.012	0.142	0.17
N DALRYMPLE DRAIN 10000.00	7.603	7.489	2.146	1.5	0.619	0.486
N DALRYMPLE DRAIN 10806.00	6.169	6.149	1.768	1.649	0.442	0.417
N DALRYMPLE DRAIN 10903.20	6.114	6.102	1.961	1.797	0.481	0.409
N DALRYMPLE DRAIN 11570.00	4.235	4.276	2.764	2.432	0.571	0.548
N DALRYMPLE DRAIN 11659.90	4.224	4.264	3.487	3.193	0.146	0.132
N DALRYMPLE DRAIN 11885.90	4.078	4.167	4.964	5.075	0.299	0.321
N DALRYMPLE DRAIN 12361.60	3.868	3.961	10.387	9.61	1.22	1.213
OF_AITKENVALE 10000.00	11.579	11.58	0	0.001	0	0.001
OF_AITKENVALE 10305.80	10.841	10.841	0	0.378	0	0.206
OF_AITKENVALE 10678.20	10.357	10.357	0	1.292	0	0.19
OF_AITKENVALE 11027.90	9.703	9.598	0	0.102	0	0.059
OF_AITKENVALE 11238.00	9.158	9.109	0.14	0.005	0.063	0.002
OF_AITKENVALE 11491.00	7.561	7.388	0.058	0.049	0.31	4.076
OF_ANDERS2 9612.00	7.844	7.873	0	0.1	0.024	0.024
OF_ANDERS2 9982.00	7.04	7.123	0	0.014	0.021	0.008
OF_ANDERSON1 9606.00	7.444	7.444	0	0	0	0
OF_A-VALE2 10000.00	9.433	9.433	0	0.004	0.032	0.013
OF_A-VALE2 10445.00	8.793	8.796	0.042	0.032	0.031	0.03
OF_BUCHANAN 10000.00	7.011	6.991	0.405	0.325	0.517	0.382
OF_BUCHANAN 10432.00	6.183	6.144	0.266	0.068	0.064	0.024
OF_BUCHANAN 10754.30	4.547	4.628	1.091	0.604	0.24	0.239
OF_CASTLETOWN 10000.00	3.471	3.221	1.095	0	0.682	0
OF_CASTLETOWN 10413.60	2.536	2.518	0.135	0.048	0.053	0.012
OF_CASTLETOWN 10473.30	2.536	2.518	0.035	0.01	0.096	0.025
OF_CAUSEWAY 10000.00	2.431	2.365	0.001	0	0.007	0
OF_CAUSEWAY 10346.20	2.46	2.46	0.178	0.179	0.149	0.15
OF_CRANBROOK 10000.00	14.269	14.242	2.144	1.345	1.417	0.433
OF_CRANBROOK 10736.10	12.379	12.369	1.137	1.062	0.948	0.914
OF_CURRAJONG 10000.00	11.67	11.593	1.894	1.015	0.464	0.594
OF_CURRAJONG 10155.60	11.462	11.413	1.607	0.352	0.382	0.314
OF_CURRAJONG 10583.10	10.553	10.472	0.778	0.197	0.593	0.286
OF_CURRAJONG 10914.60	10.177	10.115	0.531	0.171	0.563	0.378
OF_CURRAJONG 11244.50	9.537	9.525	0.467	0.124	0.305	0.139
OF_CURRAJONG 11760.90	9.041	9.029	0.234	0.178	0.143	0.121
OF_CURRAJONG 12545.50	8.485	8.396	0.652	0.241	0.217	0.193
OF_CURRAJONG 13148.60	7.473	7.417	0.536	0.222	0.15	0.201
OF_CURRAJONG 14053.00	5.496	5.496	1.344	1.344	0.307	0.307

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 10yr 2hr**	**Water Level 10yr 6hr**	**Discharge 10yr 2hr**	**Discharge 10yr 6hr**	**Velocity 10yr 2hr**	**Velocity 10yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
OF_CURRAJONG 14803.50	4.694	4.653	0.679	0.635	0.614	0.733
OF_CURRA2 9118.00	7.603	7.603	0	0	0	0
OF_CURRA2 9639.14	6.735	6.694	0.018	0.009	0.005	0.002
OF_CURRA2 9937.22	6.072	6.072	0.064	0.065	0.086	0.086
OF_CURRA2 10304.30	5.58	5.552	0.835	0.508	0.34	0.27
OF_CURRA2 10975.00	4.526	4.5	2.286	1.018	0.453	0.277
OF_FULHAM 10000.00	10.962	10.941	0	0	0	-0.001
OF_FULHAM 10211.00	11.389	11.335	0.017	0.016	0.05	0.047
OF_FULHAM 10553.20	10.353	10.329	1.315	1.178	0.156	0.091
OF_FULHAM 10852.00	9.538	9.535	0.435	0.368	0.69	0.622
OF_GREGORY 10000.00	10.333	10.333	0.24	0.243	0.248	0.251
OF_GREGORY 10417.30	7.668	7.682	0.207	0.191	0.124	0.119
OF_GREGORY 10783.00	6.459	6.459	0	0	0	0
OF_GREGORY 10880.00	5.62	5.62	0	0	0	0
OF_GULLIVER 9576.00	8.443	8.443	0	0	0	0
OF_GULLIVER 10000.00	7.539	7.539	0	0	0	0
OF_GULLIVER 10289.00	7.305	7.222	0.157	0.001	0.287	0.001
OF_GULLIVER 10706.40	6.887	6.85	0.002	0	0.002	0
OF_GULLIVER 11300.20	6.029	5.996	2.691	1.832	1.543	1.447
OF_GULLIVER 11728.00	5.468	5.447	1.433	1.061	0.371	0.274
OF_GULLIVER 12119.00	3.754	3.714	2.453	1.84	0.484	0.485
OF_HOWITT 9338.00	6.613	6.556	0.299	0.243	0.308	0.227
OF_HOWITT 9961.80	3.765	3.701	0.042	0.04	0.118	0.114
OF_HOWITT 10388.00	2.923	2.886	1.879	1.307	0.067	0.054
OF_HUGH ST 10000.00	5.405	5.385	0.873	0.536	0.209	0.181
OF_HUGH ST 10479.10	5.035	5.006	0.636	0.508	0.127	0.126
OF_HUTCHINS 10000.00	9.171	9.138	0.813	0.371	0	0.855
OF_HUTCHINS 10406.00	8.586	8.599	0.567	0.462	0	0.065
OF_HUTCHINS 10716.00	7.865	7.858	1.585	1.594	0.7	2.487
OF_LAKES1 10191.70	2.532	2.543	0	0	0	0.001
OF_LAKES1 10309.50	2.607	2.607	0	0	0	0
OF_LAKES1 10568.00	2.536	2.518	0.502	0.486	0.043	0.044
OF_LANDSBOROUGH 10000.00	24.573	24.573	0	0	0	0
OF_LANDSBOROUGH 10470.00	9.593	9.57	0.799	0.065	0.166	0.015
OF_LANDSBOROUGH 10781.10	6.355	6.284	0.909	0.361	0.666	0.552
OF_LANDSBOROUGH 11162.00	2.999	2.959	0.854	0.318	0.276	0.158
OF_MUNDINGBURRA 10848.40	7.25	7.345	0.115	0.118	0.173	0.178
OF_MUNDINGBURRA 11416.30	6.76	6.76	0	0	0	0
OF_MUNDINGBURRA 11907.00	6.117	6.117	0.002	0.002	0.001	0.001
OF_MUND2 10000.00	6.302	6.302	0	0	0	0
OF_MUND2 10345.00	6.117	6.117	0	0	0	0
OF_NOONGAH ST 10000.00	6.819	6.772	0.492	0.26	0.486	0.499
OF_NOONGAH ST 10363.00	6.079	5.832	1.595	0.279	0.786	0.137
OF_PIMLICO 9560.00	8.732	8.717	0.159	0.119	0.244	0.229
OF_PIMLICO 9867.58	8.243	8.231	0.139	0.094	0.024	0.039
OF_PIMLICO 11676.80	6.196	6.197	0.001	0.001	0	0
OF_PRIMROSEST 10000.00	2.763	2.75	0.353	0.25	0.128	0.077
OF_PRIMROSEST 10628.00	3.045	3.045	0	0	0	0
OF_QUEENS 10000.00	3.251	3.219	1.06	0.553	0.149	0.174
OF_QUEENS 10533.10	3.204	3.26	0.008	0	0.022	0
OF_QUEENS 10836.00	3.364	3.437	0	0	0	0
OF_ROSSL2 10261.60	4.071	4.018	0.103	0.002	0.122	0.003
OF_ROSSL2 10670.00	3.051	3.1	0.1	1.056	0.12	0.192
OF_STOCKLAND 10697.00	12.469	12.418	2.371	1.434	0.387	0.292
OF_STOCKLAND 11080.20	11.667	11.573	2.163	1.41	0.579	0.484
OF_STOCKLAND 11400.40	11.373	11.341	1.314	0.835	0.62	0.441
OF_STOCKLAND 12000.00	10.858	10.852	0.183	0.474	0.028	0.073
OF_STOCKLAND 12519.00	10.35	10.318	0.003	0	0.002	0
OF_STOCKLAND 13123.00	8.57	8.57	0	2.253	0	2.8
OF_SWEET ST 10000.00	5.355	5.319	4.625	3.21	0.774	0.323
OF_SWEET ST 10340.00	4.935	4.91	3.441	2.745	0.753	0.711
OF_VINCENT 10183.30	9.031	8.964	1.181	0.584	0.502	0.371
OF_VINCENT 10839.00	7.473	7.417	0.357	0.137	0.172	0.13
OF_WARBUTONST 10000.00	9.968	9.911	-0.01	-0.01	-0.021	-0.021
OF_WARBUTONST 10410.00	7.668	7.682	0.013	0.01	0.007	0.005

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 10yr 2hr**	**Water Level 10yr 6hr**	**Discharge 10yr 2hr**	**Discharge 10yr 6hr**	**Velocity 10yr 2hr**	**Velocity 10yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
OON BREAKOUT 10910.00	1.871	2.148	2.042	2.856	0.059	0.059
PALMETUM CREEK 10033.30	9.527	9.372	4.099	3.087	1.091	0.938
PALMETUM CREEK 9944.00	9.545	9.44	4.71	3.109	0.478	0.431
PEEWEE CK 10151.90	5.269	5.227	5.61	4.63	0.402	0.641
PEEWEE CK 10413.00	4.816	4.798	8.029	7.641	0.178	0.162
PEEWEE CK 10509.70	4.73	4.678	13.024	11.897	0.473	0.422
PEEWEE CK 10844.30	3.76	3.715	15.807	14.017	0.491	0.473
PEEWEE CK 10989.40	3.593	3.559	15.563	13.947	0.368	0.34
PEEWEE CK 11532.00	3.077	3.242	2.97	2.515	0.18	1.23
PERCY ST - INGHAM RD DRAIN 10091.3(	2.914	2.915	0.62	0.785	0.617	0.636
PERCY ST - INGHAM RD DRAIN 10581.4(	2.672	2.768	6.501	6.787	0.562	0.554
PERCY ST - INGHAM RD DRAIN 10660.9(	2.33	2.568	6.511	6.786	1.784	1.793
RACECOURSE 1 DRAIN 10000.00	4.769	4.722	2.911	2.355	0.298	0.264
RACECOURSE 1 DRAIN 10042.00	3.993	3.957	4.854	4.013	0.422	0.384
RAIL YARDS CREEK 10000.00	38.527	38.46	14	12	2.19	2.059
RAIL YARDS CREEK 10265.70	26.554	26.439	13.998	11.999	1.372	1.345
RAIL YARDS CREEK 10310.40	25.382	25.328	13.998	12.007	1.654	1.591
RAIL YARDS CREEK 10837.30	16.697	16.511	20.102	17.672	0.878	0.871
RAIL YARDS CREEK 10894.70	16.21	16.055	24.439	21.462	1.115	1.161
RAIL YARDS CREEK 11286.50	12.463	12.303	30.732	27.752	1.031	1.046
RAIL YARDS CREEK 11344.80	11.383	11.305	31.188	27.964	1.764	1.75
RAIL YARDS CREEK 12585.20	5.103	5.058	29.082	24.605	0.636	0.605
RIVERSIDE CREEK 10144.90	11.628	11.587	6.089	5.317	1.145	1.102
RIVERSIDE CREEK 10512.30	7.496	7.62	7.938	6.981	0.844	0.794
RIVERSIDE CREEK 10588.80	7.493	7.614	9.136	8.395	0.845	0.831
ROSS CREEK 10000.00	1.633	1.7	3.854	2.9	0.078	0.054
ROSS CREEK 10146.70	1.627	1.696	2.355	2.483	0.03	0.029
ROSS CREEK 10277.30	1.537	1.638	2.019	1.783	0.012	0.011
ROSS CREEK 11010.00	1.536	1.638	4.212	4.21	0.033	0.031
ROSS CREEK 11087.20	1.335	1.401	5.116	5.303	0.039	0.038
ROSS CREEK 11427.80	1.314	1.325	54.355	74.485	0.6	0.807
ROSS CREEK 11913.60	1.292	1.282	55.3	76.076	0.332	0.45
ROSS CREEK 12528.80	1.278	1.265	60.091	78.431	0.234	0.306
ROSS CREEK 12713.00	1.27	1.257	70.481	82.188	0.205	0.239
ROSS CREEK 13131.30	1.251	1.238	82.831	86.441	0.366	0.383
ROSS CREEK 13264.20	1.246	1.233	85.45	87.036	0.323	0.33
ROSS CREEK 13890.10	1.238	1.229	96.322	93.51	0.124	0.12
ROSS RIVER 21732.00	9.632	9.674	190.621	204.011	0.383	0.405
ROSS RIVER 22660.00	7.516	7.632	191.774	207.352	0.424	0.444
ROSS RIVER 23317.00	7.486	7.597	190.818	213.618	0.354	0.384
ROSS RIVER 23736.00	7.468	7.575	189.253	213.853	0.358	0.392
ROSS RIVER 24334.00	7.451	7.555	199.255	231.14	0.309	0.349
ROSS RIVER 24374.00	7.441	7.543	199.177	231.031	0.287	0.325
ROSS RIVER 25058.00	7.423	7.521	200.063	231.797	0.319	0.361
ROSS RIVER 26593.00	7.382	7.471	268.925	303.142	0.418	0.46
ROSS RIVER 26690.00	3.076	3.377	268.622	303.049	0.531	0.561
ROSS RIVER 27504.00	2.972	3.285	257.576	296.425	0.667	0.668
ROSS RIVER 28123.00	2.89	3.218	241.034	285.711	0.528	0.532
ROSS RIVER 29070.00	2.79	3.131	280.585	346.501	0.537	0.577
ROSS RIVER 29142.00	2.782	3.122	279.495	345.57	0.558	0.601
ROSS RIVER 30115.00	2.592	2.926	267.81	338.395	0.89	0.899
ROSS RIVER 30752.00	2.423	2.744	262.109	334.351	0.778	0.824
ROSS RIVER 31457.00	2.198	2.518	262.247	339.45	0.852	0.875
ROSS RIVER 32211.00	1.965	2.255	259.811	338.6	1.01	1.094
ROSS RIVER 33120.00	1.738	1.976	260.035	340.268	0.923	1.102
ROSS RIVER 33210.00	1.7	1.925	260.498	341.349	0.661	0.799
ROSS RIVER 34636.00	1.387	1.506	259.881	341.409	0.649	0.79
ROSS RIVER 35506.00	1.285	1.342	265.795	358.112	0.658	0.87
ROSS RIVER 36466.00	1.231	1.247	269.638	364.472	0.387	0.52
ROSS RIVER 37339.00	1.22	1.228	277.544	375.97	0.324	0.438
ROWES BAY CANAL 10000.00	3.086	3.137	2.993	2.752	0.905	0.772
ROWES BAY CANAL 10256.00	2.973	3.027	3.388	3.243	0.4	0.378
ROWES BAY CANAL 10315.10	2.935	3.002	2.924	3.087	0.225	0.207
ROWES BAY CANAL 10959.10	2.854	2.956	10.618	9.633	0.5	0.311
ROWES BAY CANAL 11383.10	2.784	2.945	11.847	11.607	0.162	0.155

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 10yr 2hr (m)**	**Water Level 10yr 6hr (m)**	**Discharge 10yr 2hr (m^3/s)**	**Discharge 10yr 6hr (m^3/s)**	**Velocity 10yr 2hr (m/s)**	**Velocity 10yr 6hr (m/s)**
ROWES BAY CANAL 11438.80	2.777	2.94	15.381	14.218	0.21	0.191
ROWES BAY CANAL 11726.00	2.745	2.936	14.559	14.412	0.166	0.122
ROWES BAY CANAL 12201.00	2.6	2.74	11.257	16.592	0.387	0.438
ROWES BAY CANAL 12751.80	2.031	2.104	16.117	19.676	0.515	0.588
ROWES BAY CANAL 12811.40	2.001	2.067	16.112	19.702	0.84	0.931
RYAN ST CANAL 10085.60	2.05	1.981	8.446	7.445	0.869	0.873
RYAN ST CANAL 10348.00	1.666	1.609	8.375	7.576	1.678	1.633
RYAN ST CANAL 10380.40	1.281	1.27	9.337	8.448	0.596	0.55
S DALRYMPLE DRAIN 1 10000.00	7.863	7.85	0.249	0.229	0.387	0.384
S DALRYMPLE DRAIN 1 10646.90	6.855	6.965	0.24	0.209	0.166	0.096
S DALRYMPLE DRAIN 1 11010.40	6.38	6.387	0.975	1.033	0.061	0.059
S DALRYMPLE DRAIN 2 10000.00	5.692	5.752	0	0.1	0.097	0.099
S DALRYMPLE DRAIN 2 10571.00	4.092	4.182	0.43	0.295	0.217	0.211
STUART CREEK 10369.30	10.732	10.936	267.327	309.975	1.234	1.316
STUART CREEK 11823.80	8.719	8.8	193.344	222.233	1.111	1.091
STUART CREEK 13185.20	6.494	6.638	133.623	137.323	0.974	1.014
STUART CREEK 13250.10	6.397	6.492	196.316	230.585	1.012	0.989
TOMKINS ST DRAIN 10350.00	2.93	3.27	3.257	3.557	0.452	0.413
UNIVERSITY CREEK 11532.00	14.247	14.04	79.192	68.069	1.542	1.528
UNIVERSITY CREEK 11599.80	13.508	13.425	79.638	68.675	1.796	1.689
UNIVERSITY CREEK 12009.10	11.871	11.665	79.852	68.577	1.521	1.516
UNIVERSITY CREEK 12107.10	10.694	10.598	80.218	68.917	1.307	1.24
UNIVERSITY CREEK 12752.50	9.537	9.378	75.32	62.984	0.88	0.858
VENNARD ST DRAIN 10236.20	6.445	6.411	1.4	1.149	0.352	0.27
WOOLCOCK CANAL 10115.20	2.855	2.806	4.527	3.797	1.131	1.06
WOOLCOCK CANAL 10461.60	2.43	2.614	5.862	5.206	0.276	0.32
WOOLCOCK CANAL 10530.90	2.421	2.606	7.027	6.324	0.499	0.444
WOOLCOCK CANAL 10860.00	2.421	2.606	4.604	5.025	0.008	0.009
WOOLCOCK CANAL 11230.70	2.417	2.604	19.682	22.396	0.552	0.661
WOOLCOCK CANAL 11304.90	2.331	2.57	18.71	21.31	0.108	0.116
WOOLCOCK CANAL 11657.50	2.323	2.562	18.878	24.355	0.481	0.511
WOOLCOCK CANAL 11716.90	2.179	2.444	19.58	24.834	1.465	1.641
WOOLCOCK CANAL 12256.60	1.852	1.782	20.352	25.408	1.297	1.652
WOOLCOCK CANAL 12773.00	1.553	1.568	48.744	44.208	1.806	1.667
WOOLCOCK CANAL 12839.00	1.525	1.55	48.747	44.169	1.706	1.63
WOOLCOCK CANAL 12987.00	1.364	1.423	48.804	45.271	1.958	1.761
WOOLCOCK CANAL 13050.00	1.338	1.407	48.81	45.268	0.412	0.366
WOOLCOCK ST DRAIN 10000.00	5.873	5.796	0.013	0.008	0.011	0.01
WOOLCOCK ST DRAIN 10284.90	5.235	5.173	4.071	3.202	1.265	1.17
WOOLCOCK ST DRAIN 10748.00	4.919	4.876	5.398	4.288	0.45	0.34
WOOLCOCK ST DRAIN 11083.00	4.816	4.798	5.848	4.637	0.373	0.301
WULGURU DRAIN 10000.00	21.588	21.55	15	14	2.234	2.186
WULGURU DRAIN 10185.60	20.36	20.251	14.994	13.879	0.873	0.867
WULGURU DRAIN 10241.10	18.94	18.916	14.988	13.874	1.473	1.431
WULGURU DRAIN 10893.90	12.663	12.607	20.109	17.938	0.955	0.972
WULGURU DRAIN 10948.00	11.02	10.963	23.333	21.209	2.963	2.861
WULGURU DRAIN 11679.00	4.182	4.041	25.287	22.676	1.333	1.34
WULGURU DRAIN 11734.10	4.151	4.009	25.661	22.93	0.862	0.864
WYNBERG DR DRAIN 10000.00	7.724	7.715	6.712	6.6	0.973	0.972
WYNBERG DR DRAIN 10121.00	7.374	7.372	6.73	6.597	1.232	1.213
WYNBERG DR DRAIN 10435.60	5.277	5.285	6.377	6.56	1.406	1.365
WYNBERG DR DRAIN 10644.30	4.514	4.551	8.889	8.786	1.217	1.122

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 20yr 2hr**	**Water Level 20yr 6hr**	**Discharge 20yr 2hr**	**Discharge 20yr 6hr**	**Velocity 20yr 2hr**	**Velocity 20yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
AIRPORT DRAIN 10053.00	4.854	4.747	0.007	0.005	0.001	0.001
AIRPORT DRAIN 10789.90	3.52	3.404	6.582	5.087	0.693	0.606
AIRPORT DRAIN 11383.00	2.836	3.091	16.841	13.488	0.685	0.585
AIRPORT DRAIN 11435.50	2.831	3.083	18.301	15.268	0.425	0.307
AIRPORT DRAIN 11741.60	2.83	3.082	15.269	13.236	0.444	0.442
AIRPORT DRAIN 12216.50	2.83	3.082	2.862	4.601	0.023	0.331
AIRPORT DRAIN 12465.40	2.826	3.079	6.677	10.588	0.075	0.049
AIRPORT DRAIN 12999.00	2.801	3.055	7.335	11.625	0.244	0.298
ANGUS AV DRAIN 10091.00	9.48	9.534	7.363	5.18	0.698	0.568
ANGUS AV DRAIN 10455.40	9.457	9.51	11.674	9.368	1.494	1.324
ANNANDALE DRAIN 10005.00	11.908	11.825	9.477	8.807	0.693	0.667
ANNANDALE DRAIN 10072.00	10.74	10.706	8.991	8.214	1.246	1.222
ANNANDALE DRAIN 10434.80	8.013	7.899	10.814	9.509	0.77	0.74
ANNANDALE DRAIN 10505.30	7.904	7.826	11.886	10.337	0.658	0.634
ANNANDALE DRAIN 11020.00	6.654	6.529	12.78	10.854	0.544	0.552
ANNANDALE DRAIN 11539.10	6.037	5.837	30.528	25.124	0.705	0.681
ANNANDALE DRAIN 11604.20	5.818	5.672	31.946	26.063	1.015	0.946
ANNANDALE DRAIN 12439.30	4.7	4.72	33.19	26.889	0.887	0.898
ANNANDALE DRAIN 12704.00	4.519	4.532	122.156	126.24	1.245	1.277
ANNANDALE DRAIN 12792.20	4.473	4.437	122.102	126.061	1.209	1.225
ANNANDALE DRAIN 13249.20	3.97	3.853	127.291	132.084	1.463	1.887
ANNANDALE GDNS DRAIN 10095.50	6.174	6.127	64.873	56.861	1.193	1.141
ANNANDALE GDNS DRAIN 9295.00	11.677	11.632	63.838	58.094	0.918	0.876
ANNANDALE GDNS DRAIN 9995.08	6.928	6.854	63.115	55.583	1.142	1.167
BAIN ST DRAIN 10000.00	4.503	4.442	12.367	10.854	0.9	0.899
BAIN ST DRAIN 10233.20	3.512	3.39	17.399	15.215	1.012	0.984
BAIN ST DRAIN 10301.20	2.903	2.95	17.373	15.151	1.32	1.309
BALLS LA DRAIN 10000.00	4.088	4.137	0.149	0.18	0.02	0.02
BALLS LA DRAIN 10071.10	3.889	3.977	0.192	0.242	0.283	0.331
BELGIAN GDNS DRAIN 10005.00	9.077	8.985	8.055	7.385	0.897	0.877
BELGIAN GDNS DRAIN 10085.20	8.426	8.384	8.02	7.3	1.295	1.232
BELGIAN GDNS DRAIN 10455.50	3.892	3.858	8.965	7.792	2.326	2.458
BOWEN RD DRAIN 10084.50	3.814	3.707	4.318	3.592	0.616	0.569
BOWEN RD DRAIN 10153.80	3.618	3.599	4.287	3.604	0.649	0.593
BOWEN RD DRAIN 10740.00	3.167	3.197	6.202	5.582	0.832	0.818
BROOKS ST DRAIN 10000.00	2.389	2.338	1.036	0.898	0.13	0.101
BROOKS ST DRAIN 9870.00	2.623	2.588	0	0	0	0
CENTRE FAIRFIELD DRAIN 10000.00	3.259	3.477	20.482	28.362	0.132	0.158
CLUDEN CREEK 10010.00	3.839	3.895	61.096	71.978	0.241	0.273
CLUDEN CREEK 10098.30	3.815	3.868	61.091	72.126	0.542	0.531
CLUDEN CREEK 9100.40	4.939	4.975	64.085	71.749	0.454	0.448
CLUDEN DRAIN 10007.50	11.44	10.954	43.984	34.939	1.263	1.253
CLUDEN DRAIN 10100.80	10.601	10.201	47.859	38.268	1.23	1.158
CLUDEN DRAIN 10907.20	5.929	5.512	48.063	39.091	1.502	1.498
CLUDEN DRAIN 10982.20	5.161	4.997	48.07	39.068	1.153	1.084
CLUDEN DRAIN 11533.30	4.243	4.179	101.77	84.282	0.73	0.665
CLUDEN DRAIN 11574.30	3.874	3.955	101.602	84.038	1.076	1.034
CLUDEN DRAIN 12142.10	3.773	3.874	52.642	45.899	0.366	0.336
CLUDEN DRAIN 12399.30	3.766	3.866	36.512	43.664	0.142	0.153
CLUDEN DRAIN 13184.20	3.128	3.431	13.146	21.84	0.246	0.243
CLUDEN DRAIN 13382.50	3.092	3.42	32.706	51.982	0.093	0.101
CLUDEN DRAIN 9331.00	16.989	16.798	40.999	32	1.641	1.518
CRANBROOK CREEK 10145.20	10.663	10.588	7.439	6.411	0.755	0.779
CRANBROOK CREEK 10577.90	7.89	7.974	9.472	8.21	0.998	0.924
CREEKWOOD E 10010.00	13.168	13.065	6.1	5.499	1.01	1.01
CREEKWOOD E 10104.00	12.342	12.175	28.476	5.286	0.739	1.181
CREEKWOOD E 10495.00	7.739	7.87	8.667	8.059	1.117	1.02
CREEKWOOD W 10010.00	12.505	12.403	6.095	5.471	0.739	0.734
CREEKWOOD W 10144.50	10.318	10.297	6.069	5.286	1.064	1.007
DOUGLAS CREEK 10081.90	14.013	13.848	8.122	7.566	0.595	0.592
DOUGLAS CREEK 10161.80	12.334	12.307	8.086	7.522	1.015	0.981
DOUGLAS CREEK 10642.10	8.685	8.657	9.267	8.703	1.224	1.197
FAIRFIELD DRAIN 10235.60	3.34	3.235	0.515	0.645	0.165	0.059
FAIRFIELD DRAIN 10802.00	3.34	3.235	0.453	0.323	0.096	0.168
FAIRFIELD DRAIN 10875.90	3.137	3.433	0.405	0.339	0.084	0.067

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 20yr 2hr**	**Water Level 20yr 6hr**	**Discharge 20yr 2hr**	**Discharge 20yr 6hr**	**Velocity 20yr 2hr**	**Velocity 20yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
FAIRFIELD DRAIN 11402.40	3.134	3.433	1.101	1.596	0.013	0.014
FAIRFIELD DRAIN 12207.00	3.133	3.433	4.998	8.175	0.032	0.03
FAIRFIELD DRAIN 12296.10	3.079	3.416	8.454	29.513	0.047	0.069
GLENDALE DR DRAIN 10000.00	6.994	6.943	2.408	1.831	0.871	0.778
GLENDALE DR DRAIN 10158.10	6.507	6.476	2.138	1.792	0.995	0.896
GLENDALE DR DRAIN 10403.10	5.006	4.958	3.743	3.126	0.897	0.813
GLENDALE DR DRAIN 10442.50	4.979	4.942	4.265	3.566	0.572	0.51
GOONDI CREEK 10000.00	1.6	1.624	6.738	4.531	0.691	0.377
GOONDI CREEK 10865.20	1.531	1.598	4.085	5.023	0.063	0.064
GORDON CREEK 10000.00	3.075	3.4	34.525	67.832	0.5	0.537
GORDON CREEK 10883.20	2.181	2.48	35.206	70.82	0.221	0.32
GORDON CREEK 11594.00	1.969	2.211	51.232	89.829	0.237	0.306
GORDON CREEK 11820.40	1.925	2.154	51.571	91.172	0.244	0.331
GORDON CREEK 14080.00	1.468	1.628	50.281	96.102	0.168	0.254
GRAMMAR DRAIN 10000.00	16.539	16.521	11.542	10	2.049	2.066
GRAMMAR DRAIN 10290.00	11.649	11.601	13.328	11.704	0.828	0.794
HAROLD ST DRAIN 10000.00	6.712	6.694	18.958	18.306	3.401	3.175
HAROLD ST DRAIN 10372.70	3.024	3.08	18.043	17.014	1.198	1.143
HERMIT DRAIN 10000.00	2.423	2.438	1.946	1.3	0.652	0.553
HERMIT DRAIN 10505.00	2.266	2.422	5.13	4.377	0.58	0.506
HERMIT DRAIN 10578.50	2.253	2.416	4.199	3.615	0.394	0.353
HERMIT DRAIN 10921.00	2.243	2.415	5.302	4.977	0.21	0.209
HERMIT DRAIN 10992.30	2.186	2.374	6.604	6.035	0.355	0.323
HONEYSUCKLE DR DRAIN 10005.00	12.082	11.867	13	11	1.061	1.04
HONEYSUCKLE DR DRAIN 10102.00	10.862	10.761	13	11	1.846	1.738
HONEYSUCKLE DR DRAIN 10583.70	7.199	7.116	14.748	12.699	1.858	1.767
JUREKEY ST DRAIN 10000.00	6.323	6.226	7.633	5.392	1.006	0.908
JUREKEY ST DRAIN 10506.00	4.262	4.226	5.042	4.275	0.433	0.404
JUREKEY ST DRAIN 10563.40	4.14	4.06	34.186	28.788	0.67	0.664
KINGS RD DRAIN 10094.60	4.421	4.263	3.544	2.867	0.457	0.373
KINGS RD DRAIN 10455.00	4.023	4.049	5.406	4.935	0.46	0.449
KINGS RD DRAIN 10514.00	3.764	3.938	5.294	4.9	0.483	0.435
KINGS RD DRAIN 10582.60	3.76	3.937	5.286	4.899	0.327	0.313
KINGS RD DRAIN 10632.60	3.66	3.891	5.372	4.929	0.943	0.823
KINGS RD DRAIN 10880.00	3.641	3.888	5.563	4.916	0.387	0.385
KINGS RD DRAIN 10990.00	3.44	3.718	5.066	4.672	0.241	0.308
LAKES TWO 10138.90	2.516	2.734	0.643	0.814	0.003	0.003
LAKES TWO 10793.10	2.516	2.734	9.464	10.48	0.025	0.027
LOUISA-CK 10083.60	2.662	2.873	24.218	47.025	0.218	0.256
LOUISA-CK 3007.82	9.468	9.517	5.7	6.05	0.423	0.357
LOUISA-CK 3979.59	9.13	9.066	17.159	14.931	0.33	0.31
LOUISA-CK 4055.00	9.084	9.033	20.641	17.939	0.502	0.489
LOUISA-CK 4926.69	7.618	7.636	42.098	40.968	0.657	0.629
LOUISA-CK 5388.98	6.612	6.68	42.59	43.219	0.776	0.748
LOUISA-CK 5823.04	5.922	6.001	42.118	43.548	0.349	0.352
LOUISA-CK 5915.00	5.807	5.875	42.539	44.232	0.452	0.448
LOUISA-CK 6590.00	4.019	4.097	50.401	52.676	1.296	1.263
LOUISA-CK 6671.00	4.001	4.081	49.994	52.667	0.233	0.229
LOUISA-CK 6999.00	3.817	3.922	53.699	59.746	0.207	0.2
LOUISA-CK 7046.00	3.737	3.809	53.535	59.667	0.325	0.307
LOUISA-CK 7410.00	3.145	3.352	54.123	59.628	0.232	0.247
LOUISA-CK 7459.85	3.134	3.345	54.444	59.714	0.226	0.214
L_RAIL EST 0.00	2.372	2.482	0.31	2.451	0.11	0.662
L_RAIL EST 636.00	2.113	2.129	0.032	0.202	0.023	0.156
MACARTHUR PARK DRAIN 10805.50	12.021	11.977	88.355	86.14	0.516	0.484
MACARTHUR PARK DRAIN 10912.30	11.174	11.156	88.296	85.892	1.683	1.695
MACARTHUR PARK DRAIN 11757.10	8.327	8.301	88.205	86.132	0.92	1.307
MACARTHUR PARK DRAIN 11836.80	7.149	7.139	88.845	87.288	1.666	1.653
MACARTHUR PARK DRAIN 12400.20	5.414	5.414	89.196	87.972	1.338	1.321
MACARTHUR PARK DRAIN 9954.04	13.953	13.863	73.767	72.865	1.187	1.535
MARABOU DRAIN 10005.00	13.754	13.557	25	20.999	1.063	1.033
MARABOU DRAIN 10115.20	13.457	13.349	25	20.967	0.746	0.699
MARABOU DRAIN 10658.20	10.02	9.78	26.544	22.002	0.665	0.654
MARABOU DRAIN 10721.30	9.202	9.127	27.416	22.719	0.889	0.857
MARABOU DRAIN 11349.20	7.795	7.736	28.496	24.021	0.674	0.604

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

	TOWNSVILLE FLOODPLAIN					
Branch, Chainage	**Water Level 20yr 2hr**	**Water Level 20yr 6hr**	**Discharge 20yr 2hr**	**Discharge 20yr 6hr**	**Velocity 20yr 2hr**	**Velocity 20yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
MINDHAM DRAIN 10082.00	7.744	7.485	3.552	3.326	0.459	0.474
MINDHAM DRAIN 10367.00	7.684	7.384	9.634	8.121	0.863	0.802
MINDHAM DRAIN 10697.50	6.663	6.613	18.251	16.858	1.5	1.439
MINDHAM DRAIN 11267.50	6.376	6.271	16.742	16.248	1.021	1.021
MINDHAM DRAIN 11805.60	6.341	6.216	24.741	26.098	0.746	0.682
MINDHAM DRAIN 11850.00	5.881	5.74	25.189	26.557	1.061	1.194
MINDHAM DRAIN 12236.00	5.68	5.248	26.925	28.409	0.588	0.809
MINDHAM DRAIN 12307.00	5.174	5.216	26.647	28.177	0.828	0.832
MINDHAM DRAIN 13050.30	4.886	4.948	30.965	33.477	0.364	0.365
MINDHAM DRAIN 13238.40	4.854	4.917	34.024	36.66	0.921	0.639
MINDHAM DRAIN 13324.40	4.182	4.225	33.783	36.512	2.753	1.555
MINDHAM DRAIN 13746.00	3.885	3.974	33.079	36.529	0.786	0.655
MINDHAM DRAIN 14214.00	3.819	3.919	32.187	36.691	0.271	0.283
MINDHAM DRAIN 14268.10	3.654	3.851	32.443	37.195	0.894	0.897
MINDHAM DRAIN 14900.00	3.44	3.718	31.339	35.915	0.21	0.211
MINDHAM DRAIN 14952.80	3.423	3.709	35.87	42.148	0.388	0.401
MINDHAM DRAIN 15376.00	3.395	3.682	31.782	42.281	0.338	0.392
MINDHAM DRAIN 15448.10	2.294	2.492	31.803	42.55	0.519	0.592
MINDHAM DRAIN 15976.20	2.185	2.373	31.576	42.859	0.262	0.323
MINDHAM DRAIN 16181.20	2.177	2.364	32.281	45.665	0.256	0.347
MT LOUISA DRAIN 10000.00	12.509	12.506	3	2.861	0.76	0.759
MT LOUISA DRAIN 10336.10	7.09	7.001	3.149	2.805	0.857	0.583
MT LOUISA DRAIN 10596.50	6.226	6.184	4.357	3.727	0.252	0.238
MT LOUISA DRAIN 10902.70	4.291	4.189	5.941	4.936	0.68	0.683
MT LOUISA DRAIN 11081.00	4.14	4.126	12.803	10.949	0.964	0.937
MT LOUISA DRAIN 11192.40	4.002	4.082	12.369	10.535	0.612	0.572
MT ST JOHN 10000.00	2.356	2.456	2.808	2.5	0.317	0.23
MT ST JOHN 11694.50	2.175	2.266	7.042	11.791	0.168	0.191
N DALRYMPLE DRAIN 10000.00	7.687	7.576	2.546	1.831	0.653	0.493
N DALRYMPLE DRAIN 10806.00	6.204	6.18	1.97	1.838	0.45	0.419
N DALRYMPLE DRAIN 10903.20	6.131	6.119	2.216	2.035	0.489	0.412
N DALRYMPLE DRAIN 11570.00	4.486	4.555	3	2.727	0.596	0.548
N DALRYMPLE DRAIN 11659.90	4.468	4.538	3.944	3.786	0.158	0.15
N DALRYMPLE DRAIN 11885.90	4.433	4.514	5.854	5.61	0.24	0.325
N DALRYMPLE DRAIN 12361.60	4.216	4.328	10.813	10.078	1.234	1.207
OF_AITKENVALE 10000.00	11.579	11.579	0	0.002	0	0.001
OF_AITKENVALE 10305.80	10.841	10.841	0	0.378	0	0.206
OF_AITKENVALE 10678.20	10.357	10.357	0	1.292	0	0.19
OF_AITKENVALE 11027.90	9.742	9.671	0.108	0.091	0.044	0.04
OF_AITKENVALE 11238.00	9.179	9.173	0.505	0.21	0.227	0.095
OF_AITKENVALE 11491.00	7.744	7.485	0.569	0.213	0.65	4.681
OF_ANDERS2 9612.00	7.844	7.844	0	0.01	0.002	0.002
OF_ANDERS2 9982.00	7.133	7.131	0	0.02	0.023	0.012
OF_ANDERSON1 9606.00	7.444	7.444	0	0	0	0
OF_A-VALE2 10000.00	9.433	9.433	0	0.006	0.042	0.022
OF_A-VALE2 10445.00	8.843	8.848	0.07	0.046	0.035	0.035
OF_BUCHANAN 10000.00	7.096	7.104	0.851	0.927	0.573	0.427
OF_BUCHANAN 10432.00	6.233	6.194	0.649	0.357	0.072	0.036
OF_BUCHANAN 10754.30	4.697	4.776	2.54	1.634	0.24	0.239
OF_CASTLETOWN 10000.00	3.498	3.351	1.396	0.31	0.565	0.434
OF_CASTLETOWN 10413.60	2.64	2.648	0.266	0.111	0.059	0.013
OF_CASTLETOWN 10473.30	2.64	2.648	0.11	0.047	0.108	0.025
OF_CAUSEWAY 10000.00	2.552	2.365	1.163	0	5.29	0
OF_CAUSEWAY 10346.20	2.46	2.46	0.178	0.179	0.149	0.149
OF_CRANBROOK 10000.00	14.292	14.266	2.716	1.794	0.369	1.656
OF_CRANBROOK 10736.10	12.43	12.425	1.585	1.506	0.869	0.761
OF_CURRAJONG 10000.00	11.717	11.661	2.577	1.563	1.533	0.631
OF_CURRAJONG 10155.60	11.486	11.455	2.925	1.292	0.402	0.361
OF_CURRAJONG 10583.10	10.595	10.553	1.274	0.766	0.575	0.425
OF_CURRAJONG 10914.60	10.23	10.206	1.139	0.775	0.738	0.468
OF_CURRAJONG 11244.50	9.584	9.586	1.018	0.743	0.274	0.284
OF_CURRAJONG 11760.90	9.132	9.143	0.821	0.958	0.223	0.139
OF_CURRAJONG 12545.50	8.527	8.493	1.05	0.708	0.254	0.238
OF_CURRAJONG 13148.60	7.5	7.492	0.915	0.645	0.233	0.257
OF_CURRAJONG 14053.00	5.496	5.504	1.344	1.375	0.307	0.307

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

TOWNSVILLE FLOODPLAIN						
Branch, Chainage	**Water Level 20yr 2hr**	**Water Level 20yr 6hr**	**Discharge 20yr 2hr**	**Discharge 20yr 6hr**	**Velocity 20yr 2hr**	**Velocity 20yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
OF_CURRAJONG 14803.50	4.714	4.682	0.878	0.805	0.607	0.725
OF_CURRA2 9118.00	7.603	7.603	0	0	0	0
OF_CURRA2 9639.14	6.751	6.752	0.128	0.165	0.035	0.045
OF_CURRA2 9937.22	6.163	6.189	0.125	0.237	0.166	0.257
OF_CURRA2 10304.30	5.615	5.642	1.366	1.893	0.289	0.323
OF_CURRA2 10975.00	4.542	4.544	3.167	1.964	0.489	0.34
OF_FULHAM 10000.00	11.028	11.055	0	0	-0.001	-0.001
OF_FULHAM 10211.00	11.41	11.412	0.003	0.031	0.01	0.094
OF_FULHAM 10553.20	10.404	10.4	1.517	1.492	0.126	0.092
OF_FULHAM 10852.00	9.589	9.61	0.695	0.673	0.741	0.647
OF_GREGORY 10000.00	10.342	10.339	0.294	0.29	0.298	0.299
OF_GREGORY 10417.30	7.694	7.701	0.238	0.222	0.142	0.134
OF_GREGORY 10783.00	6.464	6.495	0.001	0.003	0.001	0.005
OF_GREGORY 10880.00	5.62	5.635	0	0.003	0	0.002
OF_GULLIVER 9576.00	8.443	8.443	0	0	0	0
OF_GULLIVER 10000.00	7.887	7.749	0.046	0.009	0.04	0.039
OF_GULLIVER 10289.00	7.357	7.251	0.497	0.012	0.564	0.022
OF_GULLIVER 10706.40	6.937	6.85	0.115	0	0.105	0
OF_GULLIVER 11300.20	6.047	6.025	3.219	2.544	1.842	1.519
OF_GULLIVER 11728.00	5.489	5.486	2.028	1.839	0.524	0.476
OF_GULLIVER 12119.00	3.793	3.734	3.205	2.14	0.485	0.486
OF_HOWITT 9338.00	6.677	6.665	0.503	0.482	0.383	0.371
OF_HOWITT 9961.80	3.872	3.842	0.304	0.132	0.284	0.268
OF_HOWITT 10388.00	2.989	2.956	3.526	2.569	0.102	0.082
OF_HUGH ST 10000.00	5.443	5.465	1.343	1.254	0.206	0.209
OF_HUGH ST 10479.10	5.049	5.079	0.956	1.137	0.131	0.132
OF_HUTCHINS 10000.00	9.192	9.165	1.054	0.636	0	0.899
OF_HUTCHINS 10406.00	8.632	8.652	0.764	0.683	0	0.072
OF_HUTCHINS 10716.00	8.006	8.011	2.391	2.559	0.8	2.433
OF_LAKES1 10191.70	2.6	2.789	0.025	0.447	0.046	0.127
OF_LAKES1 10309.50	2.607	2.789	0	0.199	0	0.059
OF_LAKES1 10568.00	2.64	2.648	0.509	0.268	0.044	0.012
OF_LANDSBOROUGH 10000.00	24.573	24.585	0.002	0.089	0.001	0.053
OF_LANDSBOROUGH 10470.00	9.682	9.652	1.557	0.53	0.28	0.109
OF_LANDSBOROUGH 10781.10	6.475	6.424	3.407	2.074	0.765	0.728
OF_LANDSBOROUGH 11162.00	3.073	3.047	3.136	1.823	0.607	0.399
OF_MUNDINGBURRA 10848.40	7.355	7.43	0.192	0.65	0.29	0.297
OF_MUNDINGBURRA 11416.30	6.826	7.006	0.064	0.472	0.057	0.419
OF_MUNDINGBURRA 11907.00	6.117	6.125	0.002	0.018	0.001	0.011
OF_MUND2 10000.00	6.302	6.302	0	0	0	0
OF_MUND2 10345.00	6.117	6.125	0	-0.001	0	-0.001
OF_NOONGAH ST 10000.00	6.856	6.857	0.805	0.816	0.553	0.938
OF_NOONGAH ST 10363.00	6.205	5.909	1.595	0.841	0.786	0.414
OF_PIMLICO 9560.00	8.822	8.835	0.545	0.625	0.347	0.24
OF_PIMLICO 9867.58	8.338	8.353	0.526	0.613	0.055	0.057
OF_PIMLICO 11676.80	6.234	6.241	0.008	0.013	0.001	0.001
OF_PRIMROSEST 10000.00	2.787	2.776	0.475	0.303	0.136	0.088
OF_PRIMROSEST 10628.00	3.045	3.045	0	0	0	0
OF_QUEENS 10000.00	3.288	3.451	1.412	1.687	0.414	0.232
OF_QUEENS 10533.10	3.244	3.451	0.012	0.05	0.032	0.108
OF_QUEENS 10836.00	3.405	3.451	0	0	0	0
OF_ROSSL2 10261.60	4.129	4.058	0.436	0.024	0.34	0.029
OF_ROSSL2 10670.00	3.208	3.242	0.42	1.425	0.212	0.194
OF_STOCKLAND 10697.00	12.507	12.477	5.777	2.98	0.432	0.381
OF_STOCKLAND 11080.20	11.766	11.666	4.137	2.86	0.645	0.626
OF_STOCKLAND 11400.40	11.426	11.403	2.17	1.602	0.643	0.534
OF_STOCKLAND 12000.00	10.861	10.86	0.784	1.103	0.121	0.17
OF_STOCKLAND 12519.00	10.367	10.342	0.046	0.003	0.022	0.001
OF_STOCKLAND 13123.00	8.57	8.575	0	2.253	0	2.8
OF_SWEET ST 10000.00	5.377	5.343	5.401	3.918	0.847	0.366
OF_SWEET ST 10340.00	4.962	4.935	4.216	3.458	0.788	0.754
OF_VINCENT 10183.30	9.077	9.018	1.715	1.008	0.753	0.422
OF_VINCENT 10839.00	7.5	7.492	0.669	0.432	0.209	0.148
OF_WARBUTONST 10000.00	10.106	10.06	0.385	0.111	0.364	0.16
OF_WARBUTONST 10410.00	7.694	7.7	0.102	0.009	0.048	0.005

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

Branch, Chainage	TOWNSVILLE FLOODPLAIN					
	Water Level 20yr 2hr	Water Level 20yr 6hr	Discharge 20yr 2hr	Discharge 20yr 6hr	Velocity 20yr 2hr	Velocity 20yr 6hr
	(m)	(m)	(m^3/s)	(m^3/s)	(m/s)	(m/s)
OON BREAKOUT 10910.00	2.088	2.388	3.015	3.735	0.067	0.065
PALMETUM CREEK 10033.30	9.774	9.639	4.931	3.811	1.089	0.952
PALMETUM CREEK 9944.00	9.785	9.681	5.52	3.898	0.486	0.436
PEEWEE CK 10151.90	5.351	5.296	6.171	5.139	0.41	1.01
PEEWEE CK 10413.00	4.856	4.841	9.641	8.865	0.204	0.185
PEEWEE CK 10509.70	4.812	4.768	15.523	14.535	0.484	0.432
PEEWEE CK 10844.30	3.865	3.814	19.386	17.495	0.536	0.527
PEEWEE CK 10989.40	3.671	3.635	19.229	17.434	0.418	0.374
PEEWEE CK 11532.00	3.145	3.352	3.783	3.248	0.184	1.62
PERCY ST - INGHAM RD DRAIN 10091.3	2.992	2.993	0.887	1.129	0.642	0.655
PERCY ST - INGHAM RD DRAIN 10581.4	2.768	2.848	6.555	6.787	0.565	0.555
PERCY ST - INGHAM RD DRAIN 10660.9	2.516	2.734	6.786	6.786	1.784	1.793
RACECOURSE 1 DRAIN 10000.00	4.895	4.887	5.114	5.01	0.393	0.394
RACECOURSE 1 DRAIN 10042.00	4.092	4.053	7.46	7.326	0.559	0.587
RAIL YARDS CREEK 10000.00	38.649	38.534	18	14.306	2.42	2.216
RAIL YARDS CREEK 10265.70	26.737	26.586	17.66	14.514	1.342	1.35
RAIL YARDS CREEK 10310.40	25.448	25.394	17.5	14.598	1.67	1.656
RAIL YARDS CREEK 10837.30	16.869	16.775	25.605	21.788	0.882	0.871
RAIL YARDS CREEK 10894.70	16.295	16.247	31.223	26.876	1.115	1.113
RAIL YARDS CREEK 11286.50	12.733	12.565	37.021	33.283	1.048	1.037
RAIL YARDS CREEK 11344.80	11.477	11.419	37.289	33.456	1.782	1.763
RAIL YARDS CREEK 12585.20	5.155	5.118	36.314	31.039	0.668	0.643
RIVERSIDE CREEK 10144.90	11.708	11.673	7.771	7.024	1.231	1.207
RIVERSIDE CREEK 10512.30	7.706	7.823	10.115	9.243	0.89	0.876
RIVERSIDE CREEK 10588.80	7.703	7.816	11.644	10.944	0.942	0.928
ROSS CREEK 10000.00	1.754	1.839	4.654	3.561	0.087	0.065
ROSS CREEK 10146.70	1.75	1.837	2.712	2.714	0.038	0.035
ROSS CREEK 10277.30	1.63	1.766	2.306	1.991	0.013	0.012
ROSS CREEK 11010.00	1.629	1.765	4.832	4.67	0.035	0.031
ROSS CREEK 11087.20	1.364	1.458	5.906	6.042	0.044	0.043
ROSS CREEK 11427.80	1.336	1.353	59.715	87.996	0.657	0.94
ROSS CREEK 11913.60	1.309	1.297	61.601	89.081	0.368	0.522
ROSS CREEK 12528.80	1.294	1.274	70.615	90.59	0.274	0.352
ROSS CREEK 12713.00	1.285	1.265	83.73	94.573	0.243	0.275
ROSS CREEK 13131.30	1.261	1.244	99.073	98.344	0.438	0.435
ROSS CREEK 13264.20	1.256	1.239	102.1	99.084	0.386	0.374
ROSS CREEK 13890.10	1.246	1.233	114.84	110.278	0.148	0.142
ROSS RIVER 21732.00	9.776	9.805	237.811	248.013	0.46	0.476
ROSS RIVER 22660.00	7.734	7.843	238.917	251.999	0.503	0.513
ROSS RIVER 23317.00	7.694	7.799	237.823	260.172	0.419	0.445
ROSS RIVER 23736.00	7.671	7.772	235.749	260.726	0.42	0.451
ROSS RIVER 24334.00	7.648	7.746	248.323	282.244	0.364	0.404
ROSS RIVER 24374.00	7.635	7.73	248.233	282.12	0.341	0.378
ROSS RIVER 25058.00	7.61	7.701	250.032	283.104	0.382	0.424
ROSS RIVER 26593.00	7.553	7.635	335.782	369.447	0.499	0.538
ROSS RIVER 26690.00	3.372	3.676	335.369	369.344	0.619	0.639
ROSS RIVER 27504.00	3.266	3.584	321.783	360.822	0.705	0.703
ROSS RIVER 28123.00	3.189	3.52	302.404	349.714	0.551	0.548
ROSS RIVER 29070.00	3.091	3.434	354.767	425.511	0.605	0.641
ROSS RIVER 29142.00	3.083	3.425	353.497	424.612	0.63	0.669
ROSS RIVER 30115.00	2.879	3.217	338.718	416.692	0.936	0.937
ROSS RIVER 30752.00	2.692	3.02	331.234	411.929	0.848	0.888
ROSS RIVER 31457.00	2.459	2.79	330.659	416.695	0.897	0.912
ROSS RIVER 32211.00	2.195	2.506	326.246	414.695	1.097	1.165
ROSS RIVER 33120.00	1.921	2.186	325.53	416.404	1.076	1.253
ROSS RIVER 33210.00	1.871	2.121	326.081	417.717	0.778	0.916
ROSS RIVER 34636.00	1.468	1.628	322.967	415.472	0.768	0.897
ROSS RIVER 35506.00	1.323	1.405	329.902	444.086	0.806	1.046
ROSS RIVER 36466.00	1.242	1.266	333.403	451.331	0.477	0.64
ROSS RIVER 37339.00	1.225	1.236	342.9	464.892	0.4	0.54
ROWES BAY CANAL 10000.00	3.14	3.188	3.081	2.86	0.884	0.76
ROWES BAY CANAL 10256.00	3.041	3.104	3.429	3.27	0.399	0.376
ROWES BAY CANAL 10315.10	3.012	3.097	3.126	3.2	0.221	0.209
ROWES BAY CANAL 10959.10	2.932	3.077	12.486	11.726	0.519	0.314
ROWES BAY CANAL 11383.10	2.879	3.07	14.145	13.788	0.181	0.173

MIKE11 MODELLING RESULTS: TOWNSVILLE FLOODPLAIN

Branch, Chainage	TOWNSVILLE FLOODPLAIN					
	Water Level 20yr 2hr	Water Level 20yr 6hr	Discharge 20yr 2hr	Discharge 20yr 6hr	Velocity 20yr 2hr	Velocity 20yr 6hr
	(m)	(m)	(m^3/s)	(m^3/s)	(m/s)	(m/s)
ROWES BAY CANAL 11438.80	2.87	3.065	18.003	16.913	0.228	0.214
ROWES BAY CANAL 11726.00	2.836	3.062	17.597	16.951	0.175	0.126
ROWES BAY CANAL 12201.00	2.691	2.852	14.227	20.582	0.428	0.484
ROWES BAY CANAL 12751.80	2.096	2.18	19.388	23.807	0.583	0.667
ROWES BAY CANAL 12811.40	2.062	2.135	19.425	23.847	0.925	1.026
RYAN ST CANAL 10085.60	2.182	2.05	10.027	8.109	0.87	0.853
RYAN ST CANAL 10348.00	1.766	1.67	9.895	8.268	1.759	1.657
RYAN ST CANAL 10380.40	1.309	1.284	11.09	9.367	0.678	0.596
S DALRYMPLE DRAIN 1 10000.00	7.924	8.008	0.306	0.572	0.393	0.581
S DALRYMPLE DRAIN 1 10646.90	6.975	7.021	0.399	0.374	0.232	0.161
S DALRYMPLE DRAIN 1 11010.40	6.391	6.4	1.116	1.298	0.173	0.072
S DALRYMPLE DRAIN 2 10000.00	5.692	5.692	0	0.01	0.018	0.018
S DALRYMPLE DRAIN 2 10571.00	4.447	4.526	0.498	0.563	0.259	0.219
STUART CREEK 10369.30	11.049	11.222	338.811	379.961	1.345	1.369
STUART CREEK 11823.80	8.836	8.904	235.777	262.567	1.096	1.075
STUART CREEK 13185.20	6.641	6.762	133.795	139.801	1.041	1.047
STUART CREEK 13250.10	6.493	6.565	232.2	259.669	1.002	0.981
TOMKINS ST DRAIN 10350.00	3.092	3.42	3.979	4.289	0.468	0.432
UNIVERSITY CREEK 11532.00	14.631	14.408	100.782	87.668	1.536	1.545
UNIVERSITY CREEK 11599.80	13.675	13.571	101.158	88.079	1.963	1.875
UNIVERSITY CREEK 12009.10	12.238	12.018	100.981	87.615	1.532	1.527
UNIVERSITY CREEK 12107.10	10.851	10.76	101.689	88.376	1.414	1.349
UNIVERSITY CREEK 12752.50	9.782	9.644	93.14	80.785	0.921	0.886
VENNARD ST DRAIN 10236.20	6.471	6.441	1.647	1.363	0.322	0.389
WOOLCOCK CANAL 10115.20	2.911	2.86	5.43	4.141	1.187	1.062
WOOLCOCK CANAL 10461.60	2.654	2.808	6.904	5.956	0.26	0.312
WOOLCOCK CANAL 10530.90	2.647	2.8	8.343	7.331	0.533	0.461
WOOLCOCK CANAL 10860.00	2.647	2.8	5.16	5.578	0.009	0.009
WOOLCOCK CANAL 11230.70	2.645	2.797	21.939	26.242	0.556	0.658
WOOLCOCK CANAL 11304.90	2.518	2.737	20.846	25.649	0.109	0.117
WOOLCOCK CANAL 11657.50	2.512	2.729	20.039	29.663	0.49	0.513
WOOLCOCK CANAL 11716.90	2.381	2.65	20.619	29.32	1.53	1.669
WOOLCOCK CANAL 12256.60	1.979	2	20.864	31.266	1.405	1.671
WOOLCOCK CANAL 12773.00	1.637	1.732	53.006	51.098	1.884	1.745
WOOLCOCK CANAL 12839.00	1.602	1.716	53.008	51.11	1.773	1.662
WOOLCOCK CANAL 12987.00	1.409	1.585	53.062	52.076	2.088	1.808
WOOLCOCK CANAL 13050.00	1.366	1.465	53.063	52.088	0.443	0.407
WOOLCOCK ST DRAIN 10000.00	5.953	5.867	0.014	0.009	0.011	0.01
WOOLCOCK ST DRAIN 10284.90	5.314	5.237	5.111	4.01	1.337	1.246
WOOLCOCK ST DRAIN 10748.00	5.017	4.943	6.753	5.51	0.419	0.363
WOOLCOCK ST DRAIN 11083.00	4.856	4.841	7.279	5.99	0.456	0.382
WULGURU DRAIN 10000.00	21.743	21.697	19	18	2.322	2.285
WULGURU DRAIN 10185.60	20.764	20.625	18.877	17.688	0.888	0.885
WULGURU DRAIN 10241.10	19.021	18.992	18.846	17.492	1.584	1.432
WULGURU DRAIN 10893.90	12.792	12.749	25.227	22.445	0.951	0.95
WULGURU DRAIN 10948.00	11.184	11.11	29.321	26.539	3.183	3.087
WULGURU DRAIN 11679.00	4.634	4.366	31.531	28.243	1.347	1.328
WULGURU DRAIN 11734.10	4.521	4.306	31.402	28.572	0.876	0.871
WYNBERG DR DRAIN 10000.00	7.799	7.796	8.217	8.2	1.052	1.053
WYNBERG DR DRAIN 10121.00	7.436	7.437	8.271	8.199	1.304	1.291
WYNBERG DR DRAIN 10435.60	5.359	5.359	8.189	8.185	1.5	1.457
WYNBERG DR DRAIN 10644.30	4.704	4.727	10.958	11.031	1.234	1.141

MIKE11 MODELLING RESULTS: BOHLE INDUSTRIAL ESTATE

Branch, Chainage	Water Level 2yr 2hr (m)	Water Level 2yr 6hr (m)	Discharge 2yr 2hr (m^3/s)	Discharge 2yr 6hr (m^3/s)	Velocity 2yr 2hr (m/s)	Velocity 2yr 6hr (m/s)
	BOHLE INDUSTRIAL ESTATE					
BOHLE IND DRAIN 10255.60	7.172	7.175	6.314	6.374	0.752	0.753
BOHLE IND DRAIN 10489.70	5.889	5.896	6.751	6.933	0.671	0.679
BOHLE IND DRAIN 10950.00	4.201	4.211	7.78	8.307	0.466	0.487
BOHLE IND DRAIN 11484.00	3.017	3.044	12.727	13.533	0.804	0.726
BOHLE IND DRAIN 12099.00	2.15	2.268	10.992	13.13	0.472	0.368
CALVARY COLL DRAIN 10000.00	18.587	18.439	3.6	2.9	0.513	0.482
CALVARY COLL DRAIN 10453.50	13.052	12.957	4.095	3.188	1.307	1.217
CALVARY COLL DRAIN 10973.00	7.013	6.961	4.636	3.353	0.095	0.092
CALVARY COLL DRAIN 11194.00	5.596	5.544	4.957	3.574	0.578	0.477
CALVARY COLL DRAIN 11252.50	5.568	5.535	4.986	3.577	0.454	0.351
CALVARY COLL DRAIN 11480.00	5.227	5.17	5.465	4.517	0.212	0.179
CALVARY COLL DRAIN 11550.10	5.207	5.154	5.586	4.734	0.159	0.148
CALVARY COLL DRAIN 11757.00	4.108	4.069	5.928	5.218	1.04	0.987
CALVARY COLL DRAIN 11813.60	3.682	3.652	6.084	5.442	0.451	0.433
CALVARY COLL DRAIN 12460.80	2.408	2.424	5.707	5.814	0.279	0.271
CORBETT ST DRAIN 10005.00	12.432	12.341	3.957	3	0.609	0.506
CORBETT ST DRAIN 10041.80	11.104	11.009	3.966	3	1.297	1.018
CORBETT ST DRAIN 10503.00	6.166	6.121	4.266	3.18	0.89	0.788
CORBETT ST DRAIN 10622.90	6.013	5.957	4.627	3.638	0.654	0.636
CORBETT ST DRAIN 11034.00	3.491	3.453	13.685	11.604	0.866	0.787
CORBETT ST DRAIN 11110.90	3.349	3.292	13.956	11.979	0.486	0.479
CORBETT ST DRAIN 12223.10	2.125	2.249	4.059	6.987	0.057	0.05
CORBETT ST DRAIN 13125.70	1.949	2.103	9.376	16.256	0.114	0.115
DUNDEE ST DRAIN 10005.00	4.43	4.428	0.757	0.712	0.22	0.209
DUNDEE ST DRAIN 10060.00	3.502	3.515	0.665	0.711	0.467	0.402
E CORBETT ST DRAIN 10020.00	12.905	12.853	3	2.599	0.409	0.375
E CORBETT ST DRAIN 10058.30	11.711	11.653	3	2.592	0.9	0.852
E CORBETT ST DRAIN 10601.00	6.195	6.133	3.247	2.532	0.753	0.676
E CORBETT ST DRAIN 10663.80	5.955	5.889	3.412	2.626	0.837	0.772
REWARD CT DRAIN 10125.00	8.256	8.161	3.3	2.7	0.698	0.688
REWARD CT DRAIN 10197.80	7.684	7.632	3.299	2.7	0.887	0.671
REWARD CT DRAIN 10487.80	5.805	5.752	3.406	2.851	0.539	0.517
REWARD CT DRAIN 10641.50	5.495	5.461	3.458	2.91	0.867	0.817
W CORBETT ST DRAIN 10050.90	16.756	16.726	4	2.9	0.68	0.622
W CORBETT ST DRAIN 10709.10	8.376	8.252	4.919	4.003	0.552	0.556
W CORBETT ST DRAIN 10793.80	7.698	7.616	4.813	3.982	1.223	1.152
WESTON ST DRAIN 10005.00	5.012	5.021	0.54	0.58	0.255	0.266
WESTON ST DRAIN 10050.00	4.706	4.722	0.538	0.578	0.546	0.529
WESTON ST DRAIN 10492.00	3.017	3.044	0.532	0.572	0.533	0.521

MIKE11 MODELLING RESULTS: BOHLE INDUSTRIAL ESTATE

	BOHLE INDUSTRIAL ESTATE					
Branch, Chainage	**Water Level 5yr 2hr**	**Water Level 5yr 6hr**	**Discharge 5yr 2hr**	**Discharge 5yr 6hr**	**Velocity 5yr 2hr**	**Velocity 5yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
BOHLE IND DRAIN 10255.60	7.312	7.312	9.804	9.804	0.837	0.837
BOHLE IND DRAIN 10489.70	6.001	6.001	10.597	10.597	0.851	0.851
BOHLE IND DRAIN 10950.00	4.428	4.428	12.69	12.69	0.543	0.543
BOHLE IND DRAIN 11484.00	3.273	3.273	20.742	20.742	0.824	0.824
BOHLE IND DRAIN 12099.00	2.407	2.407	20.247	20.247	0.464	0.464
CALVARY COLL DRAIN 10000.00	18.91	18.91	5.594	5.594	0.668	0.668
CALVARY COLL DRAIN 10453.50	13.192	13.192	5.876	5.876	1.483	1.483
CALVARY COLL DRAIN 10973.00	7.075	7.075	6.47	6.47	0.099	0.099
CALVARY COLL DRAIN 11194.00	5.699	5.699	6.917	6.917	0.615	0.615
CALVARY COLL DRAIN 11252.50	5.631	5.631	6.956	6.956	0.556	0.556
CALVARY COLL DRAIN 11480.00	5.338	5.338	7.222	7.222	0.233	0.233
CALVARY COLL DRAIN 11550.10	5.299	5.299	7.477	7.477	0.182	0.182
CALVARY COLL DRAIN 11757.00	4.251	4.251	8.256	8.256	1.126	1.126
CALVARY COLL DRAIN 11813.60	3.786	3.786	8.611	8.611	0.503	0.503
CALVARY COLL DRAIN 12460.80	2.494	2.494	8.861	8.861	0.325	0.325
CORBETT ST DRAIN 10005.00	12.536	12.536	5.785	5.785	0.731	0.731
CORBETT ST DRAIN 10041.80	11.233	11.233	5.74	5.74	1.214	1.214
CORBETT ST DRAIN 10503.00	6.241	6.241	5.973	5.973	1.023	1.023
CORBETT ST DRAIN 10622.90	6.095	6.095	6.409	6.409	0.718	0.718
CORBETT ST DRAIN 11034.00	3.568	3.568	17.971	17.971	1.002	1.002
CORBETT ST DRAIN 11110.90	3.463	3.463	18.18	18.18	0.509	0.509
CORBETT ST DRAIN 12223.10	2.391	2.391	11.4	11.4	0.064	0.064
CORBETT ST DRAIN 13125.70	2.248	2.248	26.501	26.501	0.139	0.139
DUNDEE ST DRAIN 10005.00	4.534	4.534	1.1	1.1	0.218	0.218
DUNDEE ST DRAIN 10060.00	3.568	3.568	1.1	1.1	0.41	0.41
E CORBETT ST DRAIN 10020.00	13.048	13.048	4.718	4.718	0.486	0.486
E CORBETT ST DRAIN 10058.30	11.988	11.988	4.696	4.696	0.991	0.991
E CORBETT ST DRAIN 10601.00	6.292	6.292	4.616	4.616	0.877	0.877
E CORBETT ST DRAIN 10663.80	6.058	6.058	4.794	4.794	0.929	0.929
REWARD CT DRAIN 10125.00	8.405	8.405	4.289	4.289	0.713	0.713
REWARD CT DRAIN 10197.80	7.801	7.801	4.218	4.218	0.803	0.803
REWARD CT DRAIN 10487.80	5.887	5.887	4.278	4.278	0.559	0.559
REWARD CT DRAIN 10641.50	5.565	5.565	4.344	4.344	0.921	0.921
W CORBETT ST DRAIN 10050.90	16.794	16.794	5.644	5.644	0.766	0.766
W CORBETT ST DRAIN 10709.10	8.556	8.556	6.488	6.488	0.575	0.575
W CORBETT ST DRAIN 10793.80	7.82	7.82	6.147	6.147	1.317	1.317
WESTON ST DRAIN 10005.00	5.077	5.077	0.873	0.873	0.332	0.332
WESTON ST DRAIN 10050.00	4.782	4.782	0.87	0.87	0.57	0.57
WESTON ST DRAIN 10492.00	3.273	3.273	0.861	0.862	0.568	0.568

MIKE11 MODELLING RESULTS: BOHLE INDUSTRIAL ESTATE

Branch, Chainage	BOHLE INDUSTRIAL ESTATE					
	Water Level 10yr 2hr	Water Level 10yr 6hr	Discharge 10yr 2hr	Discharge 10yr 6hr	Velocity 10yr 2hr	Velocity 10yr 6hr
	(m)	(m)	(m^3/s)	(m^3/s)	(m/s)	(m/s)
BOHLE IND DRAIN 10255.60	7.423	7.374	13.459	11.595	0.952	0.878
BOHLE IND DRAIN 10489.70	6.093	6.053	14.311	12.632	0.991	0.929
BOHLE IND DRAIN 10950.00	4.598	4.539	16.242	15.259	0.571	0.57
BOHLE IND DRAIN 11484.00	3.431	3.386	26.598	25.04	0.947	0.877
BOHLE IND DRAIN 12099.00	2.36	2.478	25.173	24.31	0.74	0.512
CALVARY COLL DRAIN 10000.00	19.207	19.1	7.4	6.897	0.768	0.736
CALVARY COLL DRAIN 10453.50	13.367	13.288	8.385	7.255	1.638	1.585
CALVARY COLL DRAIN 10973.00	7.147	7.123	10.036	8.491	0.124	0.125
CALVARY COLL DRAIN 11194.00	5.908	5.817	10.209	8.84	0.636	0.611
CALVARY COLL DRAIN 11252.50	5.736	5.695	10.195	8.808	0.661	0.621
CALVARY COLL DRAIN 11480.00	5.534	5.447	10.904	9.045	0.278	0.26
CALVARY COLL DRAIN 11550.10	5.429	5.379	11.507	9.341	0.237	0.202
CALVARY COLL DRAIN 11757.00	4.668	4.438	11.789	10.091	1.141	1.147
CALVARY COLL DRAIN 11813.60	3.902	3.852	12.073	10.508	0.578	0.545
CALVARY COLL DRAIN 12460.80	2.553	2.531	12.181	10.953	0.336	0.336
CORBETT ST DRAIN 10005.00	12.674	12.627	8.192	7.384	0.793	0.776
CORBETT ST DRAIN 10041.80	11.371	11.322	8.168	7.335	1.298	1.277
CORBETT ST DRAIN 10503.00	6.36	6.312	8.814	7.694	1.155	1.11
CORBETT ST DRAIN 10622.90	6.225	6.175	9.5	8.171	0.746	0.741
CORBETT ST DRAIN 11034.00	3.712	3.643	26.748	22.388	1.218	1.12
CORBETT ST DRAIN 11110.90	3.654	3.572	27.422	22.716	0.549	0.531
CORBETT ST DRAIN 12223.10	2.334	2.464	10.238	13.86	0.083	0.069
CORBETT ST DRAIN 13125.70	2.157	2.317	21.598	33.058	0.151	0.152
DUNDEE ST DRAIN 10005.00	4.583	4.6	1.3	1.392	0.214	0.216
DUNDEE ST DRAIN 10060.00	3.586	3.589	1.299	1.354	0.679	0.417
E CORBETT ST DRAIN 10020.00	13.148	13.126	6.178	5.742	0.506	0.496
E CORBETT ST DRAIN 10058.30	12.095	12.06	6.162	5.746	1.011	1.005
E CORBETT ST DRAIN 10601.00	6.43	6.371	6.682	5.792	1.008	0.959
E CORBETT ST DRAIN 10663.80	6.208	6.146	6.995	6.017	1.038	1.001
REWARD CT DRAIN 10125.00	8.83	8.622	6.65	5.534	0.725	0.715
REWARD CT DRAIN 10197.80	7.952	7.92	6.326	5.382	0.829	0.89
REWARD CT DRAIN 10487.80	6.179	6.039	6.402	5.425	0.567	0.568
REWARD CT DRAIN 10641.50	5.691	5.626	6.505	5.482	0.985	0.963
W CORBETT ST DRAIN 10050.90	16.847	16.825	8.267	7.208	0.857	0.832
W CORBETT ST DRAIN 10709.10	8.914	8.733	9.61	8.014	0.608	0.585
W CORBETT ST DRAIN 10793.80	8.05	7.936	9.091	7.575	1.482	1.403
WESTON ST DRAIN 10005.00	5.118	5.118	1.1	1.1	0.37	0.37
WESTON ST DRAIN 10050.00	4.824	4.823	1.099	1.098	0.651	0.621
WESTON ST DRAIN 10492.00	3.431	3.386	1.081	1.08	0.621	0.616

MIKE11 MODELLING RESULTS: BOHLE INDUSTRIAL ESTATE

	BOHLE INDUSTRIAL ESTATE					
Branch, Chainage	**Water Level 20yr 2hr**	**Water Level 20yr 6hr**	**Discharge 20yr 2hr**	**Discharge 20yr 6hr**	**Velocity 20yr 2hr**	**Velocity 20yr 6hr**
	(m)	**(m)**	**(m^3/s)**	**(m^3/s)**	**(m/s)**	**(m/s)**
BOHLE IND DRAIN 10255.60	7.508	7.458	16.685	14.685	0.995	0.95
BOHLE IND DRAIN 10489.70	6.174	6.133	17.896	15.972	1.102	1.041
BOHLE IND DRAIN 10950.00	4.77	4.692	20.72	19.172	0.611	0.608
BOHLE IND DRAIN 11484.00	3.701	3.574	33.352	31.075	0.961	0.934
BOHLE IND DRAIN 12099.00	2.448	2.572	31.606	30.23	0.785	0.552
CALVARY COLL DRAIN 10000.00	19.468	19.351	9.396	8.603	0.879	0.833
CALVARY COLL DRAIN 10453.50	13.495	13.416	10.713	9.339	1.771	1.711
CALVARY COLL DRAIN 10973.00	7.209	7.17	13.125	11.071	0.136	0.107
CALVARY COLL DRAIN 11194.00	6.068	5.954	12.905	11.164	0.639	0.643
CALVARY COLL DRAIN 11252.50	5.821	5.759	12.851	11.028	0.729	0.688
CALVARY COLL DRAIN 11480.00	5.635	5.556	13.663	11.567	0.311	0.288
CALVARY COLL DRAIN 11550.10	5.471	5.443	14.303	12.194	0.279	0.25
CALVARY COLL DRAIN 11757.00	4.931	4.783	14.022	12.634	1.132	1.14
CALVARY COLL DRAIN 11813.60	3.972	3.934	14.384	13.106	0.619	0.598
CALVARY COLL DRAIN 12460.80	2.602	2.585	14.949	13.898	0.345	0.337
CORBETT ST DRAIN 10005.00	12.767	12.757	10	9.686	0.835	0.822
CORBETT ST DRAIN 10041.80	11.467	11.442	9.999	9.641	1.384	1.363
CORBETT ST DRAIN 10503.00	6.445	6.405	10.955	9.986	1.229	1.205
CORBETT ST DRAIN 10622.90	6.309	6.258	11.906	10.773	0.777	0.754
CORBETT ST DRAIN 11034.00	3.804	3.738	33.046	28.613	1.346	1.262
CORBETT ST DRAIN 11110.90	3.749	3.68	33.846	29.086	0.582	0.559
CORBETT ST DRAIN 12223.10	2.424	2.558	13.889	17.214	0.089	0.079
CORBETT ST DRAIN 13125.70	2.239	2.405	28.69	42.609	0.16	0.166
DUNDEE ST DRAIN 10005.00	4.675	4.673	1.697	1.696	0.21	0.215
DUNDEE ST DRAIN 10060.00	3.619	3.617	1.684	1.665	0.659	0.439
E CORBETT ST DRAIN 10020.00	13.237	13.192	7.991	7.116	0.553	0.535
E CORBETT ST DRAIN 10058.30	12.224	12.195	7.847	6.897	1.052	1.013
E CORBETT ST DRAIN 10601.00	6.524	6.463	8.241	7.197	1.085	1.034
E CORBETT ST DRAIN 10663.80	6.315	6.247	8.65	7.535	1.101	1.045
REWARD CT DRAIN 10125.00	8.88	8.849	8.611	7.215	0.76	0.729
REWARD CT DRAIN 10197.80	8.018	7.97	8.56	6.977	0.937	0.904
REWARD CT DRAIN 10487.80	6.397	6.22	8.131	6.729	0.564	0.567
REWARD CT DRAIN 10641.50	5.783	5.704	8.181	6.81	1.021	1.005
W CORBETT ST DRAIN 10050.90	16.885	16.869	10.743	9.627	0.955	0.909
W CORBETT ST DRAIN 10709.10	9.134	8.972	11.626	10.372	0.609	0.586
W CORBETT ST DRAIN 10793.80	8.213	8.075	11.269	9.374	1.548	1.49
WESTON ST DRAIN 10005.00	5.172	5.151	1.44	1.3	0.416	0.4
WESTON ST DRAIN 10050.00	4.879	4.86	1.433	1.299	0.697	0.674
WESTON ST DRAIN 10492.00	3.701	3.574	1.421	4.327	0.691	0.67

Note: 6 Hour event was modelled with Bohle River flows with Equivalent ARI

MIKE11 MODELLING RESULTS: BOHLE INDUSTRIAL ESTATE

Branch, Chainage	Water Level 50yr 2hr (m)	Water Level 50yr 6hr (m)	Discharge 50yr 2hr (m^3/s)	Discharge 50yr 6hr (m^3/s)	Velocity 50yr 2hr (m/s)	Velocity 50yr 6hr (m/s)
	BOHLE INDUSTRIAL ESTATE					
BOHLE IND DRAIN 10255.60	7.652	7.515	21.77	16.869	1.035	0.995
BOHLE IND DRAIN 10489.70	6.29	6.19	23.431	18.482	1.246	1.115
BOHLE IND DRAIN 10950.00	5.02	4.82	26.645	22.469	0.666	0.632
BOHLE IND DRAIN 11484.00	3.93	3.819	41.374	36.2	0.989	0.941
BOHLE IND DRAIN 12099.00	2.562	2.676	38.794	35.749	0.9	0.553
CALVARY COLL DRAIN 10000.00	19.663	19.477	11	9.503	0.956	0.87
CALVARY COLL DRAIN 10453.50	13.578	13.487	12.255	10.619	1.831	1.775
CALVARY COLL DRAIN 10973.00	7.242	7.198	15.207	12.918	0.134	0.119
CALVARY COLL DRAIN 11194.00	6.183	6.056	15.177	12.69	0.673	0.659
CALVARY COLL DRAIN 11252.50	5.909	5.812	15.045	12.63	0.755	0.721
CALVARY COLL DRAIN 11480.00	5.747	5.621	16.45	13.4	0.341	0.309
CALVARY COLL DRAIN 11550.10	5.501	5.465	17.318	14.024	0.331	0.276
CALVARY COLL DRAIN 11757.00	5.261	4.96	16.573	14.032	1.068	1.136
CALVARY COLL DRAIN 11813.60	4.043	3.978	16.97	14.623	0.663	0.624
CALVARY COLL DRAIN 12460.80	2.649	2.622	17.864	15.942	0.357	0.345
CORBETT ST DRAIN 10005.00	12.847	12.8	12.426	11	0.932	0.876
CORBETT ST DRAIN 10041.80	11.564	11.511	12.305	10.989	1.436	1.401
CORBETT ST DRAIN 10503.00	6.532	6.46	13.378	11.459	1.295	1.243
CORBETT ST DRAIN 10622.90	6.423	6.311	14.347	12.242	0.803	0.758
CORBETT ST DRAIN 11034.00	3.902	3.796	40.179	32.594	1.47	1.341
CORBETT ST DRAIN 11110.90	3.848	3.739	41.311	33.29	0.623	0.58
CORBETT ST DRAIN 12223.10	2.535	2.662	17.377	21.023	0.098	0.086
CORBETT ST DRAIN 13125.70	2.339	2.504	38.874	54.332	0.185	0.178
DUNDEE ST DRAIN 10005.00	4.789	4.74	2.269	1.993	0.215	0.22
DUNDEE ST DRAIN 10060.00	3.661	3.643	2.172	1.957	0.613	0.438
E CORBETT ST DRAIN 10020.00	13.302	13.226	9.327	7.797	0.566	0.549
E CORBETT ST DRAIN 10058.30	12.25	12.223	9.322	7.692	1.03	1.02
E CORBETT ST DRAIN 10601.00	6.629	6.524	10.042	8.202	1.153	1.08
E CORBETT ST DRAIN 10663.80	6.425	6.316	10.545	8.612	1.158	1.085
REWARD CT DRAIN 10125.00	8.912	8.881	10.999	8.812	0.749	0.729
REWARD CT DRAIN 10197.80	8.084	8.016	10.873	8.587	0.83	0.813
REWARD CT DRAIN 10487.80	6.626	6.369	9.286	7.886	0.569	0.567
REWARD CT DRAIN 10641.50	5.86	5.77	9.254	8.044	1.019	1.021
W CORBETT ST DRAIN 10050.90	16.926	16.893	12.991	10.983	1	0.945
W CORBETT ST DRAIN 10709.10	9.271	9.118	14.602	11.569	0.628	0.59
W CORBETT ST DRAIN 10793.80	8.427	8.195	14.385	10.981	1.629	1.537
WESTON ST DRAIN 10005.00	5.243	5.198	1.9	1.6	0.444	0.428
WESTON ST DRAIN 10050.00	4.949	4.906	1.885	1.59	0.726	0.694
WESTON ST DRAIN 10492.00	3.93	3.819	1.884	5.085	0.722	0.701

Note: 6 Hour event was modelled with Bohle River flows with Equivalent ARI

MIKE11 MODELLING RESULTS: BOHLE INDUSTRIAL ESTATE

Branch, Chainage	BOHLE INDUSTRIAL ESTATE					
	Water Level 100yr 2hr	Water Level 100yr 6hr	Discharge 100yr 2hr	Discharge 100yr 6hr	Velocity 100yr 2hr	Velocity 100yr 6hr
	(m)	(m)	(m^3/s)	(m^3/s)	(m/s)	(m/s)
BOHLE IND DRAIN 10255.60	7.744	7.589	25.404	19.607	1.053	1.028
BOHLE IND DRAIN 10489.70	6.365	6.244	27.288	21.001	1.332	1.183
BOHLE IND DRAIN 10950.00	5.231	5.002	30.968	25.586	0.69	0.647
BOHLE IND DRAIN 11484.00	4.036	3.946	47.916	41.929	1.02	0.967
BOHLE IND DRAIN 12099.00	2.645	2.755	43.995	41.557	0.93	0.594
CALVARY COLL DRAIN 10000.00	19.877	19.656	13	11	1.067	0.948
CALVARY COLL DRAIN 10453.50	13.742	13.571	14.716	12.001	1.914	1.83
CALVARY COLL DRAIN 10973.00	7.279	7.229	18.132	14.878	0.151	0.131
CALVARY COLL DRAIN 11194.00	6.289	6.157	17.926	14.584	0.702	0.676
CALVARY COLL DRAIN 11252.50	5.985	5.882	17.675	14.497	0.776	0.752
CALVARY COLL DRAIN 11480.00	5.837	5.708	19.019	15.371	0.361	0.331
CALVARY COLL DRAIN 11550.10	5.52	5.488	19.926	16.233	0.37	0.313
CALVARY COLL DRAIN 11757.00	5.42	5.213	18.294	15.979	1.071	1.12
CALVARY COLL DRAIN 11813.60	4.091	4.033	18.909	16.608	0.693	0.657
CALVARY COLL DRAIN 12460.80	2.679	2.659	19.948	18.182	0.365	0.351
CORBETT ST DRAIN 10005.00	12.933	12.866	15	13	0.935	0.936
CORBETT ST DRAIN 10041.80	11.671	11.595	14.984	12.99	1.471	1.454
CORBETT ST DRAIN 10503.00	6.627	6.544	16.181	13.745	1.349	1.297
CORBETT ST DRAIN 10622.90	6.529	6.406	17.226	14.621	0.822	0.766
CORBETT ST DRAIN 11034.00	3.966	3.874	45.115	38.308	1.547	1.443
CORBETT ST DRAIN 11110.90	3.922	3.819	46.43	39.15	0.636	0.61
CORBETT ST DRAIN 12223.10	2.617	2.742	22.531	24.823	0.105	0.092
CORBETT ST DRAIN 13125.70	2.411	2.574	47.484	65.148	0.198	0.189
DUNDEE ST DRAIN 10005.00	4.864	4.802	2.576	2.287	0.226	0.214
DUNDEE ST DRAIN 10060.00	3.687	3.668	2.508	2.232	0.61	0.453
E CORBETT ST DRAIN 10020.00	13.346	13.284	11	8.998	0.561	0.553
E CORBETT ST DRAIN 10058.30	12.278	12.245	10.987	8.888	1.067	1.001
E CORBETT ST DRAIN 10601.00	6.719	6.617	11.679	9.804	1.208	1.142
E CORBETT ST DRAIN 10663.80	6.578	6.415	12.243	10.344	1.205	1.141
REWARD CT DRAIN 10125.00	8.933	8.908	12.996	10.873	0.742	0.725
REWARD CT DRAIN 10197.80	8.111	8.07	12.897	10.498	0.885	0.836
REWARD CT DRAIN 10487.80	6.768	6.539	10.397	8.907	0.566	0.566
REWARD CT DRAIN 10641.50	6.063	5.825	9.998	8.89	1.02	1.021
W CORBETT ST DRAIN 10050.90	16.957	16.925	14.998	12.984	1.053	1.001
W CORBETT ST DRAIN 10709.10	9.369	9.239	17.24	13.882	0.607	0.593
W CORBETT ST DRAIN 10793.80	8.721	8.371	16.83	13.505	1.688	1.605
WESTON ST DRAIN 10005.00	5.286	5.228	2.2	1.8	0.447	0.443
WESTON ST DRAIN 10050.00	4.99	4.953	2.194	1.798	0.761	0.703
WESTON ST DRAIN 10492.00	4.036	3.946	2.05	1.789	0.741	0.699

MIKE11 MODELLING RESULTS: BOHLE INDUSTRIAL ESTATE

Branch, Chainage	Water Level PMP 2hr	Water Level PMP 6hr	Discharge PMP 2hr	Discharge PMP 6hr	Velocity PMP 2hr	Velocity PMP 6hr
	BOHLE INDUSTRIAL ESTATE					
	(m)	(m)	(m^3/s)	(m^3/s)	(m/s)	(m/s)
BOHLE IND DRAIN 10255.60	8.792	8.537	116.756	81.555	1.373	1.226
BOHLE IND DRAIN 10489.70	7.79	7.578	127.212	89.62	1.662	1.684
BOHLE IND DRAIN 10950.00	6.413	6.241	154.072	111.492	0.867	0.771
BOHLE IND DRAIN 11484.00	5.363	5.215	245.683	193.003	2.736	1.338
BOHLE IND DRAIN 12099.00	3.783	3.981	244.058	198.557	1.81	1.027
CALVARY COLL DRAIN 10000.00	21.777	20.986	42.669	26	1.926	1.48
CALVARY COLL DRAIN 10453.50	14.436	14.278	51.76	32.599	1.824	1.855
CALVARY COLL DRAIN 10973.00	7.835	7.561	63.784	40.062	0.312	0.245
CALVARY COLL DRAIN 11194.00	7.576	7.226	66.935	41.769	0.775	0.743
CALVARY COLL DRAIN 11252.50	6.51	6.334	66.863	41.756	0.877	0.814
CALVARY COLL DRAIN 11480.00	6.185	6.076	83.889	53.775	1.232	0.85
CALVARY COLL DRAIN 11550.10	6.088	5.947	88.018	56.588	0.941	0.677
CALVARY COLL DRAIN 11757.00	5.912	5.84	97.28	63.967	1.009	1.076
CALVARY COLL DRAIN 11813.60	5.169	5	101.386	67.309	1.162	1.023
CALVARY COLL DRAIN 12460.80	3.289	3.692	108.029	74.118	0.678	0.556
CORBETT ST DRAIN 10005.00	13.617	13.35	52	32	0.933	0.937
CORBETT ST DRAIN 10041.80	12.455	12.167	51.997	31.999	1.622	1.529
CORBETT ST DRAIN 10503.00	8.427	8.181	59.998	38.812	1.45	1.421
CORBETT ST DRAIN 10622.90	7.327	7.113	68.642	45.988	0.947	0.851
CORBETT ST DRAIN 11034.00	5.503	5.193	216.374	149.925	1.703	1.681
CORBETT ST DRAIN 11110.90	5.097	4.786	223.238	155.15	1.143	0.668
CORBETT ST DRAIN 12223.10	3.748	3.963	145.7	150.656	0.27	0.184
CORBETT ST DRAIN 13125.70	3.508	3.81	365.213	385.042	0.384	0.395
DUNDEE ST DRAIN 10005.00	5.475	5.446	13	9.6	0.218	0.234
DUNDEE ST DRAIN 10060.00	3.973	4.021	12.959	9.499	0.904	0.807
E CORBETT ST DRAIN 10020.00	13.699	13.554	34	21	0.62	0.599
E CORBETT ST DRAIN 10058.30	12.546	12.416	33.989	20.996	1.176	1.051
E CORBETT ST DRAIN 10601.00	8.28	8.2	43.775	32.567	1.181	1.24
E CORBETT ST DRAIN 10663.80	7.337	7.201	48.471	36.739	1.294	1.276
REWARD CT DRAIN 10125.00	9.182	9.058	50.593	31	0.859	0.756
REWARD CT DRAIN 10197.80	8.428	8.311	50.736	31	0.986	0.879
REWARD CT DRAIN 10487.80	7.052	6.983	52.698	33.549	0.55	0.56
REWARD CT DRAIN 10641.50	6.553	6.434	51.997	34.395	0.942	0.976
W CORBETT ST DRAIN 10050.90	17.331	17.164	54.999	33.999	1.547	1.351
W CORBETT ST DRAIN 10709.10	10.03	9.828	74.593	48.026	0.625	0.647
W CORBETT ST DRAIN 10793.80	9.652	9.473	74.549	48.014	1.807	1.783
WESTON ST DRAIN 10005.00	6.39	6.033	11	7.367	0.467	0.456
WESTON ST DRAIN 10050.00	5.508	5.457	10.554	7.183	0.909	0.786
WESTON ST DRAIN 10492.00	5.363	5.215	9.608	5.769	0.906	0.883

Note: 6 Hour event was modelled with Bohle River flows with Equivalent ARI

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(MIKE Modelling Results – Bound Separately)

Plan No.		Description
80301202/DM1		Magnetic Island - Picnic Bay Drainage Paths
80301202/DM2		Magnetic Island - Nelly Bay Drainage Paths
80301202/DM3		Magnetic Island - Geoffery Bay and Alma Bay Drainage Paths
80301202/DM4		Magnetic Island - Horseshoe Bay Drainage Paths
80301202/DT1	A	MIKE II Modelled Drainage Paths Sh 1 of 15
80301202/DT2	A	MIKE II Modelled Drainage Paths Sh 2 of 15
80301202/DT3	A	MIKE II Modelled Drainage Paths Sh 3 of 15
80301202/DT4	A	MIKE II Modelled Drainage Paths Sh 4 of 15
80301202/DT5	A	MIKE II Modelled Drainage Paths Sh 5 of 15
80301202/DT6	A	MIKE II Modelled Drainage Paths Sh 6 of 15
80301202/DT7	A	MIKE II Modelled Drainage Paths Sh 7 of 15
80301202/DT8	A	MIKE II Modelled Drainage Paths Sh 8 of 15
80301202/DT9	A	MIKE II Modelled Drainage Paths Sh 9 of 15
80301202/DT10	A	MIKE II Modelled Drainage Paths Sh 10 of 15
80301202/DT11	A	MIKE II Modelled Drainage Paths Sh 11 of 15
80301202/DT12	A	MIKE II Modelled Drainage Paths Sh 12 of 15
80301202/DT13	A	MIKE II Modelled Drainage Paths Sh 13 of 15
80301202/DT14	A	MIKE II Modelled Drainage Paths Sh 14 of 15
80301202/DT15	A	MIKE II Modelled Drainage Paths Sh 15 of 15

Appendix E Inundation Maps – Volume 2

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(Inundation Maps – Bound Separately)

Plan	Description
62000	Magnetic Island – ARI 2/5 Year – Areas of Inundation
62001	Magnetic Island – ARI 10/20 Year – Areas of Inundation
62002	Magnetic Island – ARI 50/100 Year – Areas of Inundation
62003	Magnetic Island – PMF – Areas of Inundation
62004	Magnetic Island – ARI 5 Year – Depths of Inundation
62005	Magnetic Island – ARI 20 Year – Depths of Inundation
62006	Magnetic Island – ARI 50 Year – Depths of Inundation
62007	Townsville Floodplain ARI 2/5 Year – Areas of Inundation Sheet 1
62008	Townsville Floodplain ARI 2/5 Year – Areas of Inundation Sheet 2
62009	Townsville Floodplain ARI 2/5 Year – Areas of Inundation Sheet 3
62010	Townsville Floodplain ARI 2/5 Year – Areas of Inundation Sheet 4
62011	Townsville Flood plain ARI 2/5 Year – Areas of Inundation Sheet 5
62012	Townsville Floodplain ARI 10/20 Year – Areas of Inundation Sheet 1
62013	Townsville Floodplain ARI 10/20 Year – Areas of Inundation Sheet 2
62014	Townsville Floodplain ARI 10/20 Year – Areas of Inundation Sheet 3
62015	Townsville Floodplain ARI 10/20 Year – Areas of Inundation Sheet 4
62016	Townsville Floodplain ARI 10/20 Year – Areas of Inundation Sheet 5
62017	Townsville Floodplain ARI 50/100 Year – Areas of Inundation Sheet 1
62018	Townsville Floodplain ARI 50/100 Year – Areas of Inundation Sheet 2
62019	Townsville Floodplain ARI 50/100 Year – Areas of Inundation Sheet 3
62020	Townsville Floodplain ARI 50/100 Year – Areas of Inundation Sheet 4
62021	Townsville Floodplain ARI 50/100 Year – Areas of Inundation Sheet 5
62022	Townsville Floodplain ARI 5 Year – Depths of Inundation Sheet 1
62023	Townsville Floodplain ARI 5 Year – Depths of Inundation Sheet 2
62024	Townsville Floodplain ARI 5 Year – Depths of Inundation Sheet 3
62025	Townsville Floodplain ARI 5 Year – Depths of Inundation Sheet 4
62026	Townsville Floodplain ARI 5 Year – Depths of Inundation Sheet 5
62027	Townsville Floodplain ARI 20 Year – Depths of Inundation Sheet 1
62028	Townsville Floodplain ARI 20 Year – Depths of Inundation Sheet 2
62029	Townsville Floodplain ARI 20 Year – Depths of Inundation Sheet 3
62030	Townsville Floodplain ARI 20 Year – Depths of Inundation Sheet 4
62031	Townsville Floodplain ARI 20 Year – Depths of Inundation Sheet 5
62032	Townsville Floodplain ARI 50 Year – Depths of Inundation Sheet 1
62033	Townsville Floodplain ARI 50 Year – Depths of Inundation Sheet 2
62034	Townsville Floodplain ARI 50 Year – Depths of Inundation Sheet 3
62035	Townsville Floodplain ARI 50 Year – Depths of Inundation Sheet 4
62036	Townsville Floodplain ARI 50 Year – Depths of Inundation Sheet 5
62037	Townsville Floodplain – 1998 Event – Areas of Inundation Sheet 1
62038	Townsville Floodplain – 1998 Event – Areas of Inundation Sheet 2
62039	Townsville Floodplain – 1998 Event – Areas of Inundation Sheet 3

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