



Coonamble Levee - Flood Gradient Sensitivity Modelling Study



- Final
- September 2009



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1 Introduction

1.1 Background

A seven kilometres long ring levee was constructed in 1975 to protect the town of Coonamble from flooding in the Castlereagh River and in Warrena Creek. An audit of the levee was undertaken by the then NSW Department of Public Works and Services (currently the Department of Commerce) in 1992. The audit identified a number of structural defects and recommended that the levee be upgraded to an acceptable standard.

The Department of Environment and Climate Change and Water (formally DECC and Department of Natural Resources, DNR) is undertaking an investigation to determine the safety and structural integrity of the town levee at Coonamble. The study is funded through the NSW State Emergency Management Committee from Emergency Management Australia. The overall investigation comprises a flood gradient sensitivity assessment as well as a crest level survey and a levee structural audit. This study is commissioned by DECCW to undertake a flood gradient sensitivity modelling study for Coonamble Levee. Results from this study will be used by the State Emergency Service (SES) and Coonamble Shire Council. Officers from DECCW, Coonamble Shire and SES have provided valuable information to the study team for completion of this study.

1.2 Study Area

The study area of interest to this study is shown in **Figure 1-1**. The study area includes the most significant outbreaks from the Castlereagh River that influence flooding in Coonamble, particularly those that break out into the Warrena Creek system. Although much of the Warrena Creek catchment is used to estimate rainfall-runoff generated within the catchment, it does not form part of the formal study area and hence was not specifically included in the hydraulic model.

1.3 Objectives

The primary objectives of this study are to:

- Define flood behaviour at Coonamble for the full range of flood events in sufficient detail to determine design flood profiles for the Coonamble levee,
- Assess the sensitivity of the design flood profiles, particularly adjacent to the Coonamble Levee, to the factors affecting the generation of flood hydrographs including the local variability of the rainfall patterns particularly over the Warrena Creek catchment, variation in floodplain vegetation from those typically assumed in design, and cross flows between the Castlereagh River and Warrena Creek upstream of Coonamble,



- Ensure Council and community confidence in the study results through the development of robust models that can be used to model flood behaviour, particularly in the immediate vicinity of Coonamble.

1.4 Scope of Study

- Undertake a flood frequency analysis for peak flows for Castlereagh River at Coonamble.
- Estimate flows in Warrena Creek that are to be added to the relevant right bank breakout flows from the Castlereagh River. Warrena Creek flows are to be obtained from an appropriate hydrologic model of the Warrena Creek catchment, calibrated and validated within the limits of the available historic data and the limitations of the study scope.
- Acquire an appropriate amount of topographic survey in order to be able to develop a computer model. This will supplement the available topographic data.
- Establish a quasi-2 dimensional hydraulic model of the study area that is sufficiently detailed to determine flood levels for the selected flood magnitudes in the immediate vicinity of the town of Coonamble and, in particular, adjacent to the Coonamble Levee. The hydraulic model shall also be capable of determining the flows that breakout of the Castlereagh River at the following breaks:
 - ‘Strathavon/Bundabulla’ Breakout;
 - ‘Nine Mile’ Breakout;
 - ‘Geamoney’ Breakout;
 - ‘Six Mile’ Breakout; and
 - Eurimie Creek.

This study does not require flood levels in the rural areas to be determined and provided as a study output.

- Investigate the coincidence of flows from the Castlereagh River and Warrena Creek through the consideration of various flow scenarios:
 - 100 year Average Recurrence Interval (ARI) peak flow in the Castlereagh River with 50 year ARI flows in Warrena Creek (due to local rainfall over the Warrena Creek catchment)
 - 50 year ARI peak flow in the Castlereagh River with 100 year ARI flows in Warrena Creek (due to local rainfall over the Warrena Creek catchment)
 - 100 year ARI peak flow in the Castlereagh River with 100 year ARI flows in Warrena Creek (due to local rainfall over the Warrena Creek catchment).
 - An extreme event consisting of peak flow in the Castlereagh River of 3 times the 100 year ARI flow with the PMF in Warrena Creek (due to local rainfall over the Warrena Creek catchment).



- The PMF in Warrena Creek based on the PMP estimated using the Generalised Short Duration Method (BoM 2003) even though the Warrena Creek catchment area exceeds 1000 km².

For each of the above scenarios, sensitivity runs relating to the amount of flow that breaks out of the Castlereagh River, particularly flows that move overland to Warrena Creek, are to be undertaken. The sensitivity runs will be based on different vegetation conditions on the floodplain.

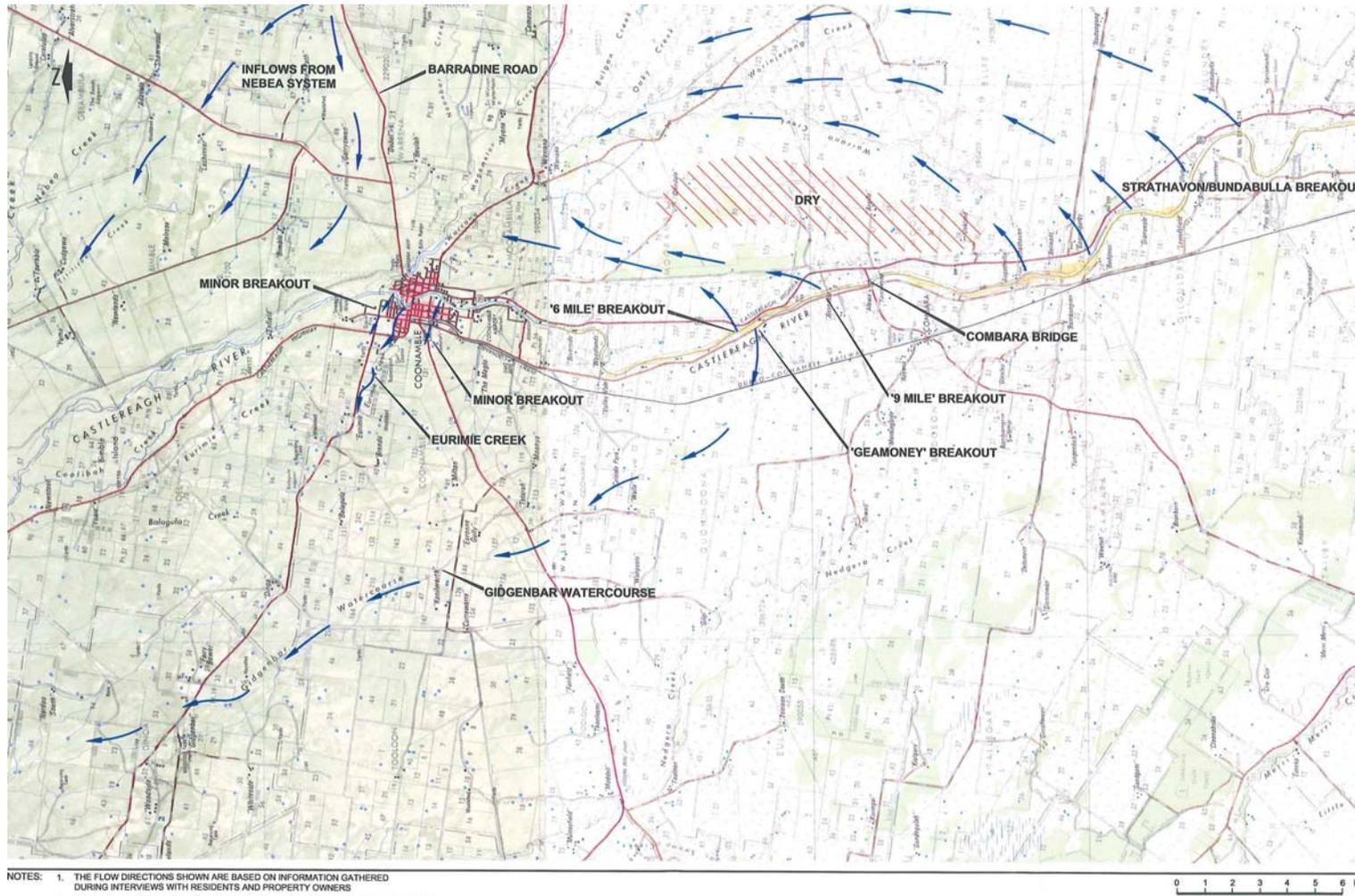
- Provide a final report (this report) outlining the findings of the study.

1.5 Structure of the Report

This report is structured as follows:

- **Section 1 – Introduction**
- **Section 2 – Nature of Flooding:** Overview of flood history in Coonamble and flood behaviour in the Castlereagh River and Warrena Creek
- **Section 3 – Available Data:** Details on the of relevant previous study reports, topographic data, rainfall and streamflow data, photographs taken during floods, satellite imagery, flood levels and Coonamble Levee
- **Section 4 – Hydraulic Modelling:** Background to the development, calibration and validation of a quasi two-dimensional hydraulic model for use in this study
- **Section 5 – Hydrology for Design Events:** Estimation of inflow hydrographs for the Castlereagh River and Warrena Creek for the selected design flood events
- **Section 6 – Flood Gradient Sensitivity Analysis :** Estimation of flood levels along Coonamble levee for the selected flood events and an assessment of the sensitivity of the design flood level profiles due to changes in selected model input
- **Section 7 – Conclusions:** Key conclusions from the study regarding levee gradient sensitivity analyses results.

■ Figure 1-1 Study Area of Interest





2 Nature of Flooding

2.1 Physical Setting

The town of Coonamble is located at the confluence of the Castlereagh River and Warrena Creek, approximately 165 km north of Dubbo in north-central NSW. Coonamble is one of the major urban centres in the Castlereagh Valley and had a population of 2659 at the 2001 Census. The administrative centre of Coonamble Shire is located at Coonamble. The economic activity in the town is mainly concerned with the provision of services to the surrounding rural areas. Agriculture in the rural areas is based on extensive grazing and dry land farming.

The Central Business District (CBD) of Coonamble lies between the Castlereagh River and Warrena Creek and is protected from flooding by a ring levee approximately 7 km long. This includes a 1.7 km long concrete retaining wall section which extends upstream and downstream of Aberford Street bridge.

2.2 Flood History

The main town of Coonamble has suffered severe inundation on several occasions, notably 1920, 1921, 1950 and 1955. The “flood of record” is generally thought to be the 1950 flood though opinion on this is divided. Some residents are adamant that the 1921 flood inundated a greater area of the Coonamble township. DECCW records state that the 1950 flood was higher than the 1955 but acknowledge that the 1920 flood may have been higher. SES records show the 1920 and 1921 floods to be of equal peak stage (Rankine & Hill, 1983).

Ranked by stage, the ten largest floods to have occurred in Coonamble, for which reliable records are available, are presented in **Table 2-1** (sourced from SKM Scoping Study 2002).

■ Table 2-1 Ten Largest Flood Since 1950

Rank	Year	Elevation (m AHD)
1	1950	180.82
2	1955	180.76
3	1971	180.70
4	1969	180.65
5	1974	180.61
6	1973	180.48
7	2000	180.47
8	1998	180.46
9	1990	180.27
10	1976	180.12



A levee was constructed around the eastern portion of the township between 1975 and 1976. The levee was constructed to a design level defined by a combination of levels produced by the 1974 flood along Warrena Creek and the 1955 flood along the Castlereagh River. While the levee has done much to protect the eastern area of the town, the western portions of Coonamble remain unprotected.

2.3 Flood Behaviour

The nature of flooding in the vicinity of Coonamble is complex. Both the Castlereagh and Warrena systems have significant catchment areas. The Castlereagh system represents 87% of the catchment at the Castlereagh/Warrena confluence and the Warrena system the remaining 13%.

The flattening of the terrain upstream of Coonamble results in decreased flow velocity and thus a greater flow area is required. This is evidenced through known and identified overbank breakouts from the Castlereagh to both the east and west. The breakouts flood large areas of farmland and often result in the cross connection of water courses. The breakouts to the north generally join the Warrena system which flows back to the Castlereagh. Breakouts to the south join the Nedgera system. Both the Warrena and Nedgera systems rejoin the Castlereagh River downstream. The Warrena rejoins at Coonamble and the Nedgera over 10km downstream.

The most significant breakouts identified in the course of this study and corroborated by residents and stakeholders of Coonamble are listed below:

- The Strathavon-Bundabulla Breakout – right bank breakout with flow initially to the northeast then north. Water exits the Castlereagh approximately 22km south of Coonamble and flows Northeast along a 10km front between the Strathavon and Bundabulla properties and joins the Warrena system;
- Nine Mile Breakout – right bank breakout located approximately 15 kilometres south of Coonamble. Flows north generally parallel to the Castlereagh joining with water from the “6 Mile Break” (see below) and then flowing into Warrena Creek;
- Geamoney Breakout – left bank breakout approximately 11km south of Coonamble. Water exits the Castlereagh to the west before flowing north west generally overland and parallel to the Castlereagh before rejoining the Castlereagh River via Eurimie Creek downstream of Coonamble;
- Six Mile Breakout – right bank breakout located approximately 10 km south of Coonamble. Floodwaters flow north east generally to meet waters from the Nine Mile Breakout and flow into the Warrena Creek,
- The Eurimie Creek breakout – left bank breakout where Eurimie Creek flows due west forming an anabranch of the Castlereagh River. Eurimie Creek initially flows west before turning north and eventually rejoins the Castlereagh 8-10km downstream.



3 Available Data

3.1 Relevant Previous Studies

- **Coonamble Flood Scoping Study (SKM, 2002):** The study was commissioned by the then Department of Land & Water Conservation (DLWC). The aim of the study was to identify the nature of flooding in and around Coonamble and to advise on and scope issues that need to be addressed in developing a flood model for Coonamble. Investigations involved review of calculation folders available in DECCW, interviews with Statutory Authorities, Emergency Services, Coonamble Shire Council Staff and local residents.
- **Flood Study Report Gilgandra (DWR, 1994):** The Castlereagh River at Gilgandra has a catchment area of 6,350 km². The February 1955 flood is the highest observed (10.06 m) at Gilgandra since European settlement. The peak flow corresponding to the February 1955 flood adopted in this study was 4,000 m³/s. The 1950 flood is the fifth largest flood (gauge height 7.92m and peak flow 2,200 m³/s) on record at Gilgandra. The SES classified the 1971 flood (gauge height 6.86 m and peak flow 1,560 m³/s) as a moderate flood and the 1974 flood (gauge height 5.64 m and peak flow 1,040 m³/s) as a minor flood. A flood frequency analysis was undertaken using historic flood data at the Gilgandra gauging station (No. 420001). A one dimensional steady state hydraulic model (HEC2), as constructed for the 1984 Gilgandra Flood Map, was reviewed and updated using peak flows from the Gilgandra gauging station as input. The model was calibrated for February 1955 flood. Results from the flood frequency analysis were used to estimate peak flood level profiles for a range flood events. Peak flows in the Castlereagh River at Gilgandra corresponding to the 2% AEP and 1% AEP events were estimated at 3,000 m³/s and 4,050 m³/s, respectively.
- **NSW Inland River Flood Plain Management Studies – Castlereagh Valley (Rankine & Hill, 1983):** The scope of the study included mapping of flood affected land throughout the whole valley; development of floodplain management plan for both urban centres and rural areas; identification of environmental factors and the preparation of a programme of works. The study report provides information on land use; availability of streamflow records; flood behaviour along the Castlereagh River around urban centres; nature of historic flooding; flood frequency curves; flood hydrographs for major flood events including the flood event of 1955; flood inundation mapping for urban centres including Coonamble.



3.2 Topographic Data

3.2.1 Topographic Survey Undertaken in 2005

No topographic data was available to undertake hydraulic modelling to satisfy the objectives of the study. A preliminary scope for the topographic survey was identified by SKM in their proposal submitted to DECCW. A joint site inspection was undertaken by staff from DECCW and SKM to refine the scope of the topographic survey. Following the site inspection a Brief was prepared and surveyors from Langford & Rowe (a survey firm based in Dubbo) were engaged to undertake the topographic survey. Coonamble Shire Council organised surveyor's access to the properties. Langford & Rowe provided the following as an outcome of the survey:

- Long section plots of high points and natural surface shots. In the case of cross sections along roads, natural surface shots were generally undertaken.
- Size, shape and inverts of culverts, bridges (excluding the bridge over Castlereagh River at Coonamble) and weirs were undertaken.
- Excel Spreadsheets were provided for all cross sections surveyed. The spreadsheets included the following columns of data.

ID	Easting	Northing	Height	Chainage	Description
----	---------	----------	--------	----------	-------------

- A geo-referenced plan in DXF of all surveyed points.
- The description column was used to enhance the detail of any points eg. edge of vegetation, canal, concrete, top bank, etc., location of photographs.

The survey was based on MGA coordinates and vertical datum was the Australian Height Datum. It was mentioned in the survey Brief that the vertical accuracy of the survey would be within 100mm and the horizontal accuracy would be within 200mm. A hard copy and an electronic copy of all topographic data provided by Langford & Rowe were handed over to DECCW. All data points surveyed by Langford & Rowe are shown in **Appendix A, Figure A1-1**.

3.2.2 Data Collected from the RTA

Details on the following bridges located within the study area were collected from the RTA:

- Bridge over Castlereagh River at Coonamble; and
- Bridge over Eurimie Creek at Coonamble.

3.2.3 Data Provided by Coonamble Shire in 2008

Coonamble Shire Council provided an electronic drawing file in AutoCAD format to SKM containing spot levels around Coonamble. The drawing file included spot levels on the following:

- Coonamble Levee, roads inside the levee and natural surface
- Coonamble-Tooraweenah Road in the vicinity of Bibleroi Creek and Warrena Creek crossings.



The accuracy of these spot levels was unknown. Coonamble Shire Council could not confirm whether the spot heights included in the drawing file were connected to the Australian Height Datum (AHD).

Also, Coonamble Shire Council provided drawings for the following:

- Bridge over Bibleroi Creek along Coonamble-Tooraweenah Road
- Bridge over Warrena Creek along Coonamble-Tooraweenah Road.

Timber bridges at the above two locations were replaced with concrete bridges during the period 2005-2006. Drawing files for both bridges did not specify whether levels shown on the drawings were connected to AHD.

3.2.4 Additional Topographic Survey

In consultation with DECCW, Langford & Rowe Surveyors were engaged in 2008 to undertake the following:

- Survey of three cross sections in the vicinity of Bibleroi Creek Bridge
- Survey of the existing Bibleroi Creek Bridge arrangement
- Preparation of a report to verify consistency between topographic survey data provided by Coonamble Shire and topographic survey data provided by Langford & Rowe Surveyors in 2005.

Details on the new Bibleroi Creek Bridge provided by Langford & Rowe indicated that the topographic data shown on Bibleroi Creek Bridge drawings provided by Coonamble Shire were not connected to the Australian Height Datum.

The consistency report prepared by Langford & Rowe Surveyors indicated that the topographic data provided by Coonamble Shire were consistent with the Langford & Rowe survey of 2005.

3.3 Rainfall Data and District Rainfall

Rainfall recording stations located within the Castlereagh Valley and its surrounding areas are shown in **Figure 3-1**. The availability of data at these stations is shown in **Table 3-1**.

Recorded daily rainfall at the stations shown in **Table 3-1** is available in house. Hence, it was necessary to collect pluviograph data only. Pluviograph data for the Station 064046 (Coonabarabran Echo) was collected from the Bureau of Meteorology for the selected rainfall events required for the calibration of the hydrologic model for Warrena Creek.

Pluviograph data for the period 21-23 December 2007 were also collected from the Bureau of Meteorology for Coonabarabran Airport AWS (064017) and Coonamble Airport AWS (051161). The depth of rainfall recorded at Coonamble Airport AWS pluviometer between 9 AM on 21 December



2007 and 9 AM on 22 December 2007 was only 60.2mm. However, the rainfall depth recorded at the daily read rain gauge at Coonamble for the same period was 171mm. Hence, there were errors in the pluviograph data for Coonamble Airport AWS.

■ **Table 3-1 Rainfall Stations**

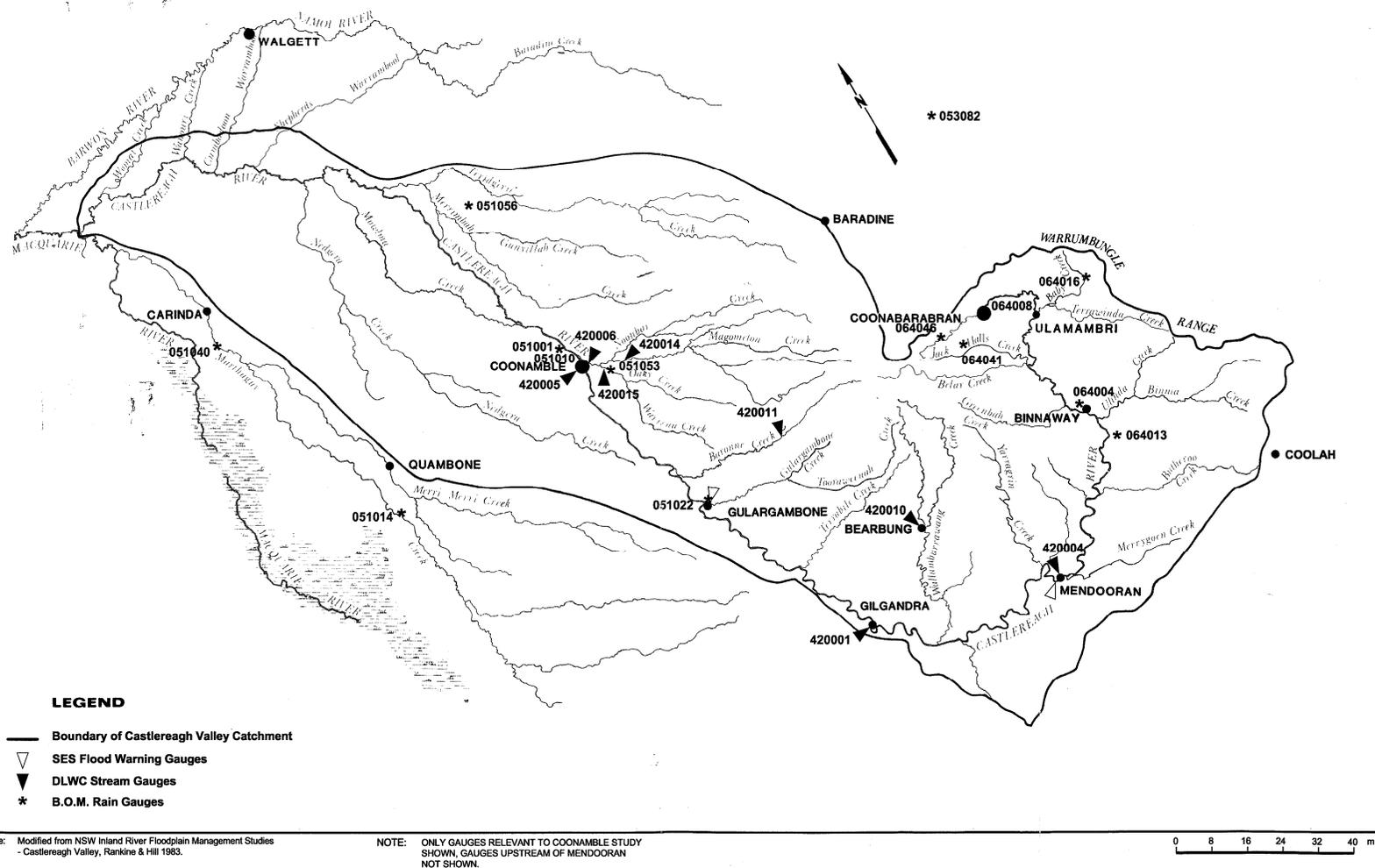
Station No.	Description	Period of Record	Comment/Data Type*
051010	Coonamble Comparision	1897 - present	WS, continuous record
051001	Coonamble Nardoo	1884 - present	Rainfall only, continuous record
051053	Coonamble Warrena	1882 – 1997	Rainfall only, continuous record
051040	Coonamble Pier	1883 - 1966	Rainfall only, continuous record
051056	Coonamble Wingadee	1879 - 1977	Rainfall only, continuous record
064041	Coonabarrabran Barina	1969 - present	Rainfall only, continuous record
064046	Coonabarrabran Echo	1965 – present	Pluviograph, continuous record
064016	Coonabarrabran Mia Mia	1919 – 1977	Rainfall only, continuous record
064008	Coonabarrabran Namoi Street	1897 - present	WS, continuous record
053082	Coonabarrabran Yamborah	1996 - present	Rainfall only, continuous record
064013	Binnaway Hawthorne	1886 - present	Rainfall only, continuous record
064004	Binnaway Ulinda St.	1901 - present	Rainfall only, continuous record
051014	Gulargumbone Emby	1908 - present	Rainfall only – ceases in 1993
051002	Gulargumbone Post Office	1886 - present	Rainfall only, continuous record

*WS-Weather Station, Continuous Record – meaning that there is a continuous record of unbroken data entries for the period of record

The headwaters of the Castlereagh rise on the eastern side of the Warrumbungle Ranges and generally flow in an easterly and southerly direction in relatively steep terrain before flowing onto much flatter relief north of Gilgandra. The orographic effect of the Warrumbungle Ranges in relation to rainfall generation is generally recognised.

The Scoping Study investigated the relationship between peak rainfall across the Valley upstream of Coonamble (SKM 2002). The study report demonstrated that in a large percentage of years, heavy rainfall in the eastern ranges of the Warrumbungles corresponds with heavy rainfall on the western plains. This means that following heavy rainfall, flooding will result in both the Castlereagh and Warrena Creeks.

■ **Figure 3-1 Castlereagh River Catchment Area and Gauge Locations**





3.4 Streamflow Data

Streamflow gauging stations of relevance to this study are shown in **Figure 3-1** and details on the stations are given in **Table 3-2**. Details on the streamflow gauging stations were sourced from PINNEENA (a surface water database released by the Department of Water and Energy, DWE) version 9.

■ **Table 3-2 Streamflow Gauging Stations**

Gauge No.	Description	Catchment Area (km ²)	Date Commenced and Ceased	Comment/Data Type
420005	Castlereagh River. @ Coonamble	8400	24/10/1958-30/4/2002	Discontinued
420001	Castlereagh River. @ Gilgandra	6350	01/09/1909-11/04/2000	Discontinued
420901	Castlereagh River. @ Lucas Bridge U/S of Gilgandra	NA	01/08/1999 - current	
420004	Castlereagh River. @ Mendooran	3600	18/11/1952-current	
420006	Warrena Creek @ Coonamble	1240	21/09/1960-11/12/1980	Discontinued No data available in PINNEENA
420015	Warrena Creek @ Warrana	583	06/12/1969-30/04/2002	Discontinued
420014	Magometon Creek (Site 3) @ Near Coonamble	540	06/12/1969-30/04/2002	Discontinued
420011	Baronne Creek @ Near Gulargumbone	398	07/05/1965-01/06/1973	Discontinued
420010	Wallumburrawang Creek. @ Bearbung	452	08/05/1965-03/05/2002	Discontinued

Gauging stations of particular interest to this study are the following:

- **Castlereagh River @ Gilgandra (GS 420001)** Data available in PINNEENA for this station is limited to monthly maximum and monthly minimum flow data for the period 1950 to 1982. Flood hydrographs for this station are available for the flood events of 1955 (peak approximately 3150 m³/s), 1969, 1974 1976 in the 1983 study undertaken by Rankine & Hill. The 1955 flood is the highest observed at Gilgandra. The recorded gauge height was 10.05m and the peak flow adopted in the Flood Study Report Gilgandra (DWR 1994) was 4000 m³/s. Further details on the gauging station are available in Section 4.2 of the “Flood Study Report Gilgandra” (DWR,1994).
- **Castlereagh River @ Coonamble (GS 420005)** - Continuous water level data for the period June 1986 to April 2002 is available in PINNEENA with some gaps in the data. Monthly maximum and minimum flow data for the period 1960 to 2003 are also available in



PINNEENA with some missing data. The gauge zero for this gauge identified in PINNEENA is **175.169** mAHD. It should be noted that the gauge zero of 175.169 mAHD relates to the staff gauge and NOT the automatic recorder. Records held by DWE indicate that when the automatic recorder was installed on 2 June, 1986 its gauge zero was set 1.0m lower than that of the station staff gauge. Since that time, due to an unstable orifice for the automatic recorder, the relationship between the gauge zeroes of staff gauge and the automatic recorder has varied constantly. More recently the difference has been often in the order of 0.6m but could vary between 0.5m and 0.9m.

DWE has advised that from 1979 to 2000 all gaugings/data and discharge rating tables were adjusted to the gauge zero of the recorder. However, due to the unstable nature of the recorder gauge zero, since 2000, all data, gaugings and ratings have been adjusted to the zero of the staff gauge. Accordingly, the most reliable way of obtaining a water surface elevation or flood height (to AHD) at the gauge site is to add the observed gauge height at the staff gauge to the gauge zero of 175.169 mAHD.

This gauging station (and others along the Castlereagh River), is affected by the movement of large amounts of sand in the channel that causes constantly varying stage-discharge relationships, especially at the low flow ranges of the rating tables.

The DWE Hydrographer responsible for managing the Castlereagh River @ Coonamble advised that the stage - discharge rating curves used in PINNEENA for this gauge do not include flows that break out the Castlereagh River upstream of Coonamble. The Hydrographer also advised that given the sandy bed of the river, the accuracy of the low flow gauging is likely to be poor whilst the accuracy of high flow gauging would be better.

Coonamble Shire Council provided gauge heights for the Castlereagh River at Coonamble gauge for the December 2007 flood event. A peak gauge height of 4.75m was reached at 11:00 PM on 24 December 2007 in the Castreagh River at Coonamble.

- **Warrena Creek @ Warrana (GS 420015)** - Continuous water level data for the period June 1987 to April 2002 is available in PINNEENA with some gaps in the data. Monthly maximum and minimum flow data for the period 1970 to 2003 are also available in PINNEENA with a lot of missing data. The gauge zero is connected to an assumed datum and efforts were made by officers from Coonamble Shire Council to connect the gauge zero to mAHD. However, the bolt that was used by DWE to define the gauge zero was missing. This gauge recorded the flow generated from rainfall runoff from the upstream catchment area and any flow that may have escaped the Castlereagh River at the Strathavon-Bundabulla Breakout.



- **Magometon Creek (Site 3) @ Near Coonamble (GS 420014)** - Magometon Creek is a major tributary of Warrena Creek. Continuous water level data for the period June 1987 to April 2002 is available in PINNEENA with some gaps in the data. Monthly maximum and minimum flow data for the period 1970 to 2003 are also available in PINNEENA with some missing data. The gauge zero was connected to an assumed datum. A comparison of flow hydrographs extracted from PINNEENA for November 2000, April 1999 and July 1998 for gauging stations Warrena Creek @ Warrana and Magometon Creek @ Near Coonamble indicated some inconsistency in the high flow rating for the later gauge. The concerned DWE Hydrographer provided updated half-hourly flow data for November 2000, April 1999 and July 1998 events for this gauging station.
- **Warrena Creek @ Coonamble (GS 420006)** - No data is available for this gauge in PINNEENA. Minute 39 dated 27/9/1995 pps 0086173 concludes that the gauge zero for this station is subject to BM error and the correct Gauge Zero should be 174.287mAHD. The 1955 peak flood level should be 179.24 mAHD. Flows in Warrena Creek at Warrena would be influenced by backwater from the Castlereagh River.

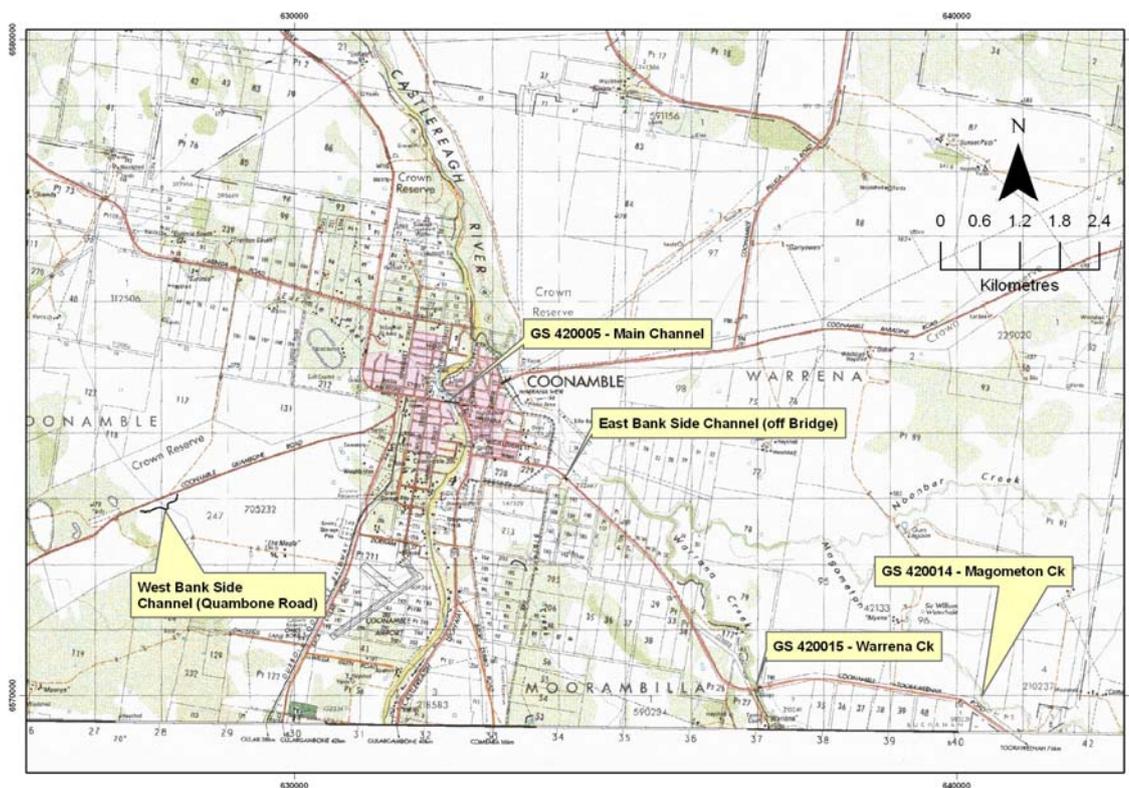
During the flood events of July 1998 and November 2000, Hydrographers from DWE measured flows at a number of locations of interest to this study. Information provided by the DWE Hydrographer is shown in **Table 3-3** and **Figure 3-2**.



■ **Table 3-3 Flow Measurements undertaken by DWE during 1998 and 2000 Flood Events**

Location	Date and Time	Gauge Height (m)	Measured Discharge (m ³ /s)
Flow Measured during July 1998 Flood Event			
GS 420005 (Main Channel)	29 Jul 1998 15:00 to 16:35 Hrs	Staff Gauge 5.29	696
East Bank Side Channel (Bibleroi Creek)	30 Jul 1998 10:45 to 12:00 Hrs		69
West Bank Side Channel (Quambone Road)	30 Jul 1990 Approx. 12:30 to 14:00 Hrs		30
Flow Measured during November 2000 Flood Event			
GS 420005 (Main Channel)	21 Nov 2000 11:30 Hrs	Staff Gauge 5.27	530
GS 420015 (Warrena Creek)	21 Nov 2000 11:50 Hrs	Staff Gauge 3.16	54
GS 420014 (Magometon Creek)	22 Nov 2000 12:30 Hrs	Staff Gauge 1.74	13
East Bank Side Channel (Bibleroi Creek)	22 Nov 2000 (time unknown)		106
West Bank Side Channel (Quambone Road)	22 Nov 2000 (time unknown)		31

■ **Figure 3-2 Location of Streamflow Gaugings**





3.5 Satellite Imagery and Aerial Photographs

3.5.1 Satellite Imagery

Geoimage Pty Ltd was contacted to make an inventory on the availability of satellite images captured during recent flood events including flood events of July 1998, April 1999 and November 2000. Geoimage searched both the Landsat and the SPOT archives and identified the availability of Landsat imagery on or near the occurrence of recent flood events. Following approval by DECCW the Landsat satellite images captured during July 1998 and November 2000 flood events were obtained from Geoimage.

The Landsat image for July 1998 flood event was captured at 9:33 AM on 29 July 1998 (local time). The time when the image was captured in relation to the water level in the Castlereagh River @ Coonamble is shown in **Figure 3-3**.

■ **Figure 3-3 Time of Capture of Landsat Image during 1998 Flood**

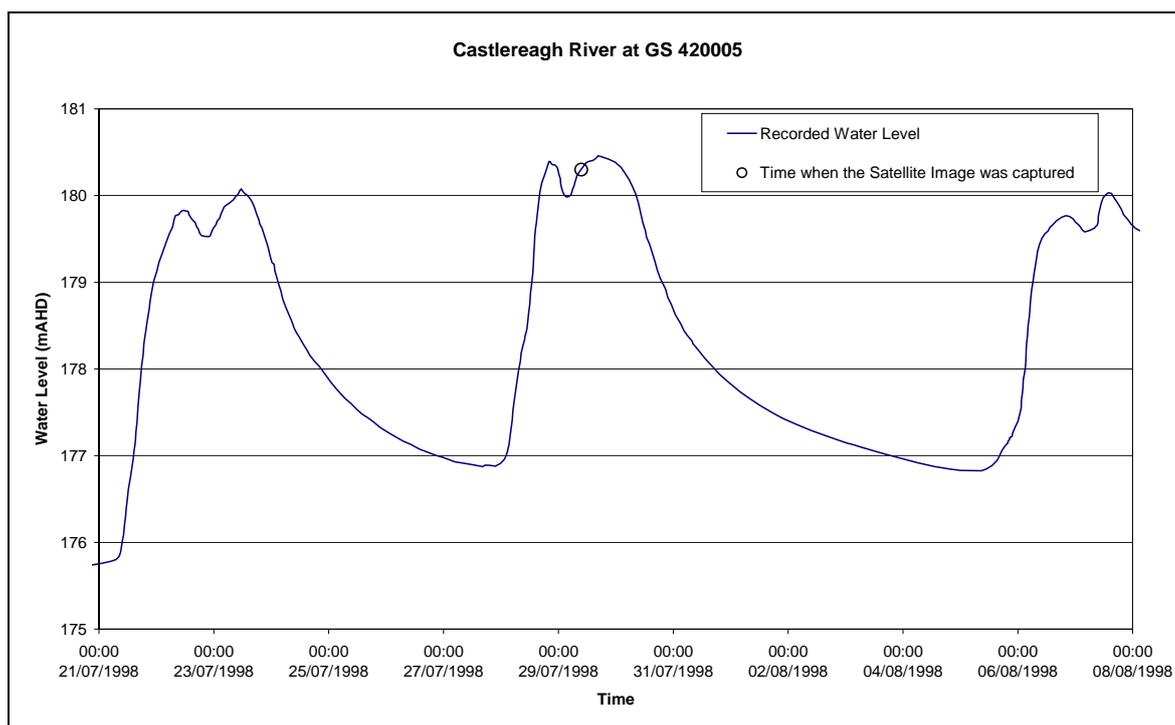


Figure 3-3 shows that the image was captured in the vicinity of the peak flood level. The image is shown in **Appendix A**. The following observations can be made from the satellite image:

- Flooding confined in the Castlereagh River between The Strathavon-Bundabulla Break and Combara Bridge.
- Widespread flooding along tributaries of Warrena Creek east of Castlereagh Highway possibly due to local rainfall and runoff.

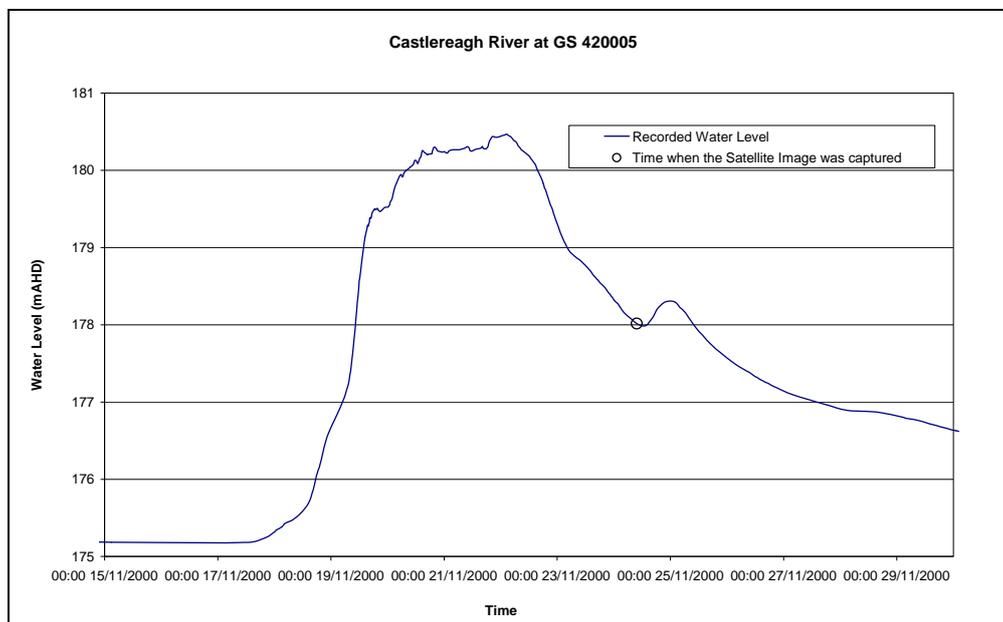


- Indication of breakout in the vicinity of Combara Bridge along the right bank (looking downstream) of Castlereagh River.
- Downstream of Combara Bridge, noticeable flooding along the left bank of Castlereagh River crossing the railway line confirming Geamoney Break in operation.
- Extensive flooding on Castlereagh Highway at the Nine Mile Break. The right bank breakout downstream of Combara Bridge appears to join the flow breaking out at the Nine Mile Break.
- No flooding at the Six Mile Break.
- Evidence of flooding in Eurimie Creek.
- Floodwaters that escaped Castlereagh River at the Nine Mile Break and downstream of Combara Bridge (on the right bank) joined Warrena Creek downstream of Torraweenah Road Bridge.
- Indication of widespread flooding on the floodplain located east of Rifle Range and south of Baradine Road. It could not be confirmed whether a bank in Rifle Range protected Rifle Range from the widespread flooding or the widespread flooding resulted from local rainfall runoff.
- Downstream of Baradine Road, flooding along Warrena Creek is more than one kilometre wide and the width of flooding downstream of the confluence of Warrena Creek and Castlereagh River is more than two kilometres.

The Landsat imagery during the November 2000 flood event was captured at 9:42 AM on 24 November 2000. The time when the image was captured in relation to the water level in the Castlereagh River @ Coonamble is shown in **Figure 3-4**. **Figure 3-4** shows that the Landsat image was captured at the receding stage of the flood. The image is shown in **Appendix A**. The image shows that areas around Combara Bridge and the Nine Mile Break are covered with clouds. However, a comparison of this image with the Landsat image for the 1998 flood indicates a close agreement in general flood behaviour within the study area. The image does not indicate any breakout at the Strathavon-Bundabulla Break.



■ **Figure 3-4 Time of Capture of Landsat Image during November 2000 Flood**



Geoimage Pty Ltd was contacted to make an inventory on the availability of satellite images captured during the December 2007 flood. Information provided by Geoimage indicated that a SPOT5 image was captured on 23 December 2007 at 12:23 PM UTC (almost midnight local time). Considering the timing of the peak flood level in Warrena Creek and the cloud cover, the SPOT5 image was not purchased. It is to be noted that Warrena Creek reached its peak flood height around 10:00 PM on 22 December 2007.

3.5.2 Aerial Photographs

Officers from DECCW took photographs from an aircraft on 29 July 1998 and 30 July 1998 in the Castlereagh Valley including the study area. Photographs for the study area were captured between 2:30 PM to 2:45 PM on 29 July 1998. The peak flood level in Castlereagh River at GS 420005 was recorded at 4:35 PM on 29 July 1998. Hence the photographs were captured close to the peak flood level in Castlereagh River at Coonamble. A review of the photographs and observations made by the officers from DECCW indicate the following:

- The Strathavon-Bundabulla Break did not operate;
- Downstream of Combara Bridge, the breakout on the left bank of Castlereagh River was prominent;
- Floodwaters overtopped the Castlereagh Highway at the Nine Mile Break; and
- The Six Mile Break did not operate.



Coonamble Shire Council provided some vital information on the flood behaviour at the Nine Mile Break during the November 2000 event as shown in **Figure 3-6** and **Figure 3-7**. These photographs were captured around mid-morning on 21 November 2000. A comparison of flood extent at the Nine Mile Break shown in **Figure 3-5** captured on 29 July 1998 and that shown in **Figure 3-6** and **Figure 3-7** for the November 2000 flood event indicates that the 2000 flood was more severe than 1998 at the Nine Mile Break. Photographs (supplied by Coonamble Shire Council) presented in **Figure 3-8** show flooding at Combara Bridge during the November 2000 flood. These photographs were captured around mid-morning on 21 November 2000.

Coonamble Shire Council also captured aerial photographs in the afternoon of 23 December 2007 but are not presented in this report.

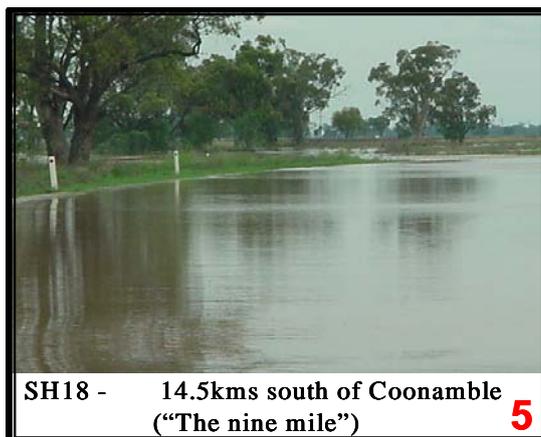
- **Figure 3-5 Flooding at the Nine Mile Break on 29 July 1998 Showing Location of Photographs taken during November 2000 Flood**



Note: The photograph was taken by Officers from DECCW on 29 November 1998. "X" indicates approximate location where a photograph was taken by officers from Coonamble Shire during November 2000 flood.



■ **Figure 3-6 Flooding on the Castlereagh Highway at the Nine Mile Break 2000 Flood**



Note: Photographs were provided by Coonamble Shire. The number in red shown on the photograph indicates approximate location shown in **Figure 3-5**



■ **Figure 3-7 Flooding on the Castlereagh Highway at the Nine Mile Break 2000 Flood**



Note: Photographs were provided by Coonamble Shire. The number in red shown on the photograph indicates approximate location shown in **Figure 3-5**.



■ **Figure 3-8 Flooding at Combara Bridge during the 2000 Flood**





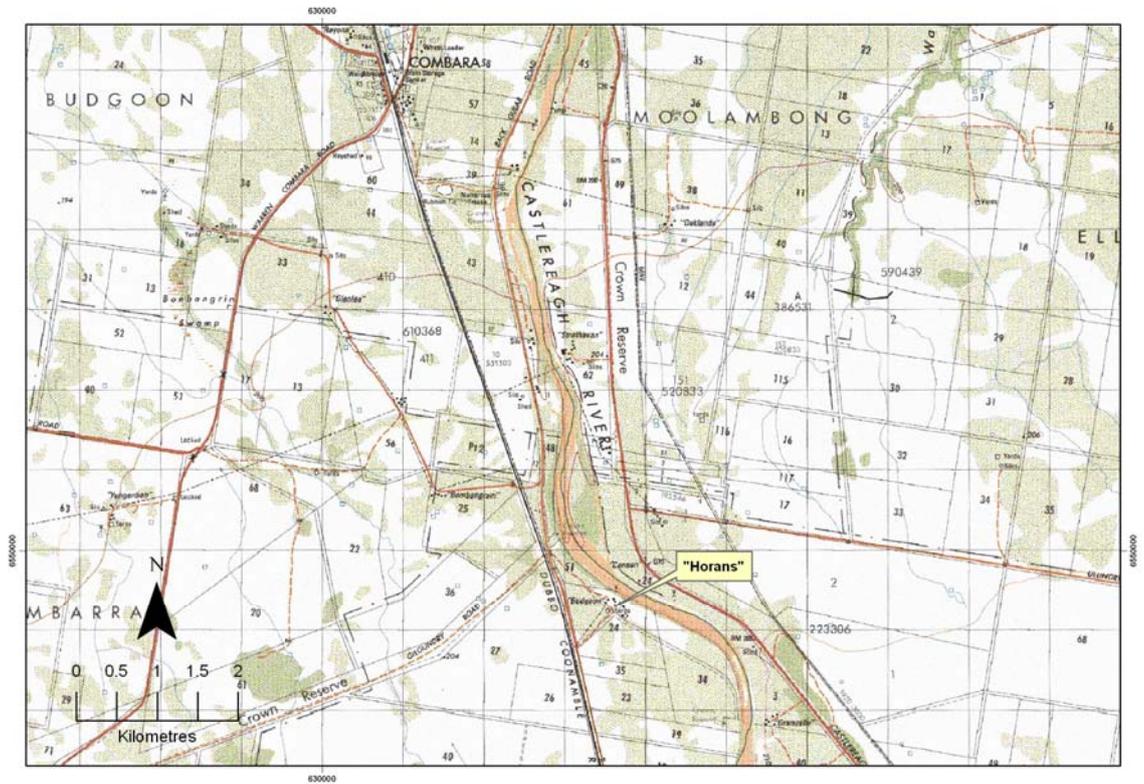
3.6 Flood Levels and Flood Extents

Recorded flood levels within the study area are available from the following sources:

- **Flood Levels in the Castlereagh River @ Coonamble Gauge** - Flood levels were compiled by DECCW and are presented in Appendix C of Scoping Study Report (SKM 2002).
- **1998 Flood Level in Coonamble from Local Flood Plan (SES 2000)** - The Local Flood Plan does not identify whether the levels are to AHD. A sanity check was undertaken in this study by the Officers from Coonamble Shire to check whether the flood levels are to AHD. Information provided by the concerned Officers indicates that the 1998 flood levels are to AHD. The officers from the Shire assisted to locate the 1998 flood marks. The flood marks are shown in **Figure 3-10**.
- **Flood Marks** were identified at the property "Horans" (refer to Figure 3-9) after completion of the topographic survey by Langford & Rowe. Coonamble Shire Council offered assistance in connecting the flood marks to AHD. Flood marks for the 1955, 1998 and 2000 were identified within the property and the flood levels corresponding to the flood events were estimated at 206.14 mAHD, 204.0 mAHD and 204.22 mAHD respectively.
- **Bridge Drawing** - The General Arrangement Plan (entitled Bridge Over Castlereagh River at Coonamble) prepared by the Department of Main Roads in 1980 shows RL 180.9m as the HFL for the 1950 flood. The RL was connected to the Standard Datum. The scoping study report (SKM 2002) adopted a flood level of 180.82 mAHD at Coonamble for the 1950 flood.
- **Coonamble Levee - Flood Levels (WRCS 1994)** - This study estimated flood levels in the Castlereagh River @ Coonamble gauge for the 1955 and 1974 flood events. The study identified an error in the bench mark used to estimate gauge zero for the gauging station and recommended further investigations.
- **HFL shown on Coonamble Street map** - Coonamble Shire Council provided Highest Flood Levels (HFL) for 1950, 1955 and 1974 shown on a street map for Coonamble. The origin of the map and the reliability of the flood levels are unknown.
- **December 2007 Flood Levels** - Coonamble Shire Council provided flood levels in Warrena Creek along Coonamble Levee. Debris marks were used to obtain flood levels along the levee. Flood levels for the December 2007 event provided by Coonamble Shire are shown in **Figure 3-10**. Two flood levels recorded along Warrena Creek between Tooraweenah Road and Baradine Road are lower than the downstream flood levels. Hence, the two recorded flood levels (179.183 mAHD and 178.92 mAHD, chainages 1604m and 1762m, respectively on **Figure 3-13**) are considered to be incorrect.
- **Flood Extent** - The approximate flood extent in Coonamble for the 1955 flood is included in the report prepared by Rankine & Hill (1983).

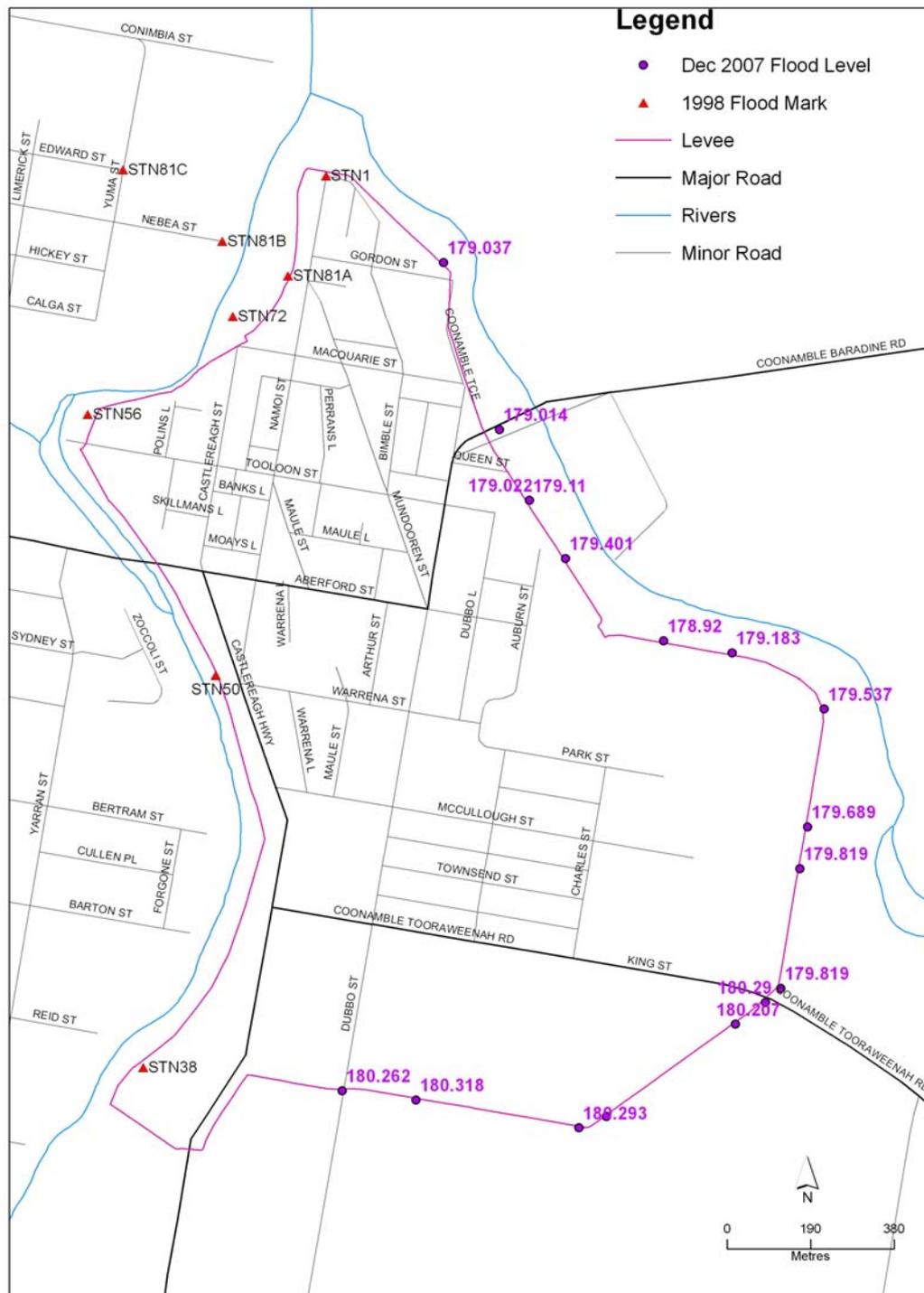


Figure 3-9 Location Map of “Horans”





■ **Figure 3-10 Location of Flood Marks for the 1998 Flood Event and December 2007 Flood Levels (mAHD)**





3.7 Coonamble Levee

The topographic data provided by Coonamble Shire in 2008 was used to extract crest levels along Coonamble Levee. The resulting crest levels were compared against crest levels of the Levee as presented in the report Coonamble Levee - Flood Levels prepared by WRCS in 1994 (refer to **Figure 3-11**). The two sets of data closely agree at a majority of locations as shown in **Figure 3-12**. Twelve cross sections surveyed in 2004/2005 included top of bank levels along the levee. Top of bank levels from the 2004/2005 survey are also shown in **Figure 3-12**.

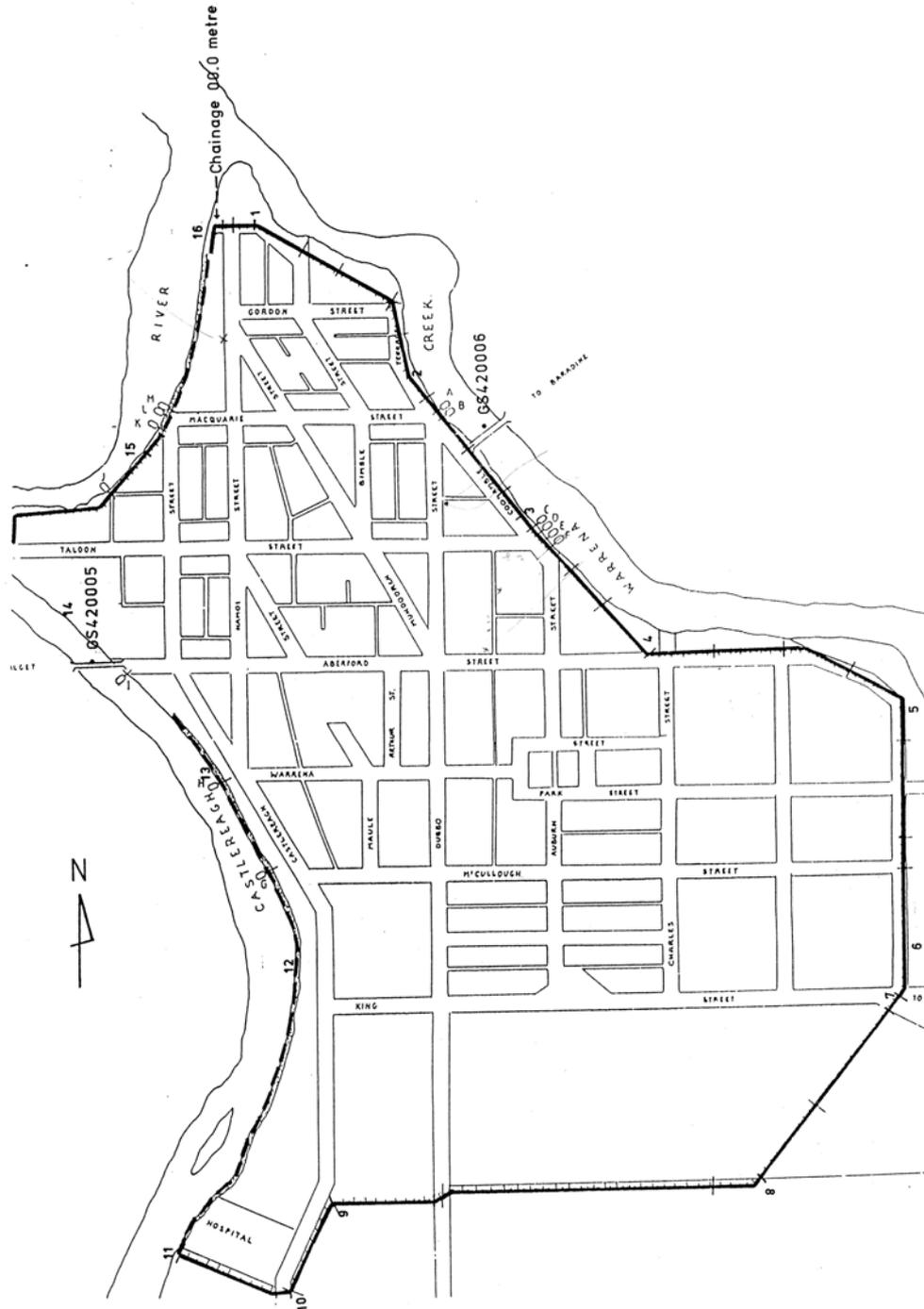
Three sets of data generally agree closely at majority of the locations as shown in **Figure 3-12**. However, at a few locations there are significant differences in levels amongst the three sets of data. The differences may be due to location of points for the three surveys were different. It is possible that the 2004/2005 survey did not survey the crest of the levee.

Topographic data along the Levee provided by Coonamble Shire in 2008 was the most recent and detailed, hence, this data was used to define crest levels along the Levee for use in this study.

Recorded flood level data provided by Coonamble Shire for the December 2007 event and 1974 and 1950/1955 flood levels extracted from DECCW's project folders along the Coonamble Levee are shown in **Figure 3-13**. **Figure 3-13** shows that the recorded flood levels in Warrena Creek for the December 2007 event were higher than those for the 1974 flood event. However, the recorded flood level in the Castlereagh River for the December 2007 event was significantly lower than that for the 1974 flood event.



■ Figure 3-11 Coonamble Flood Levee



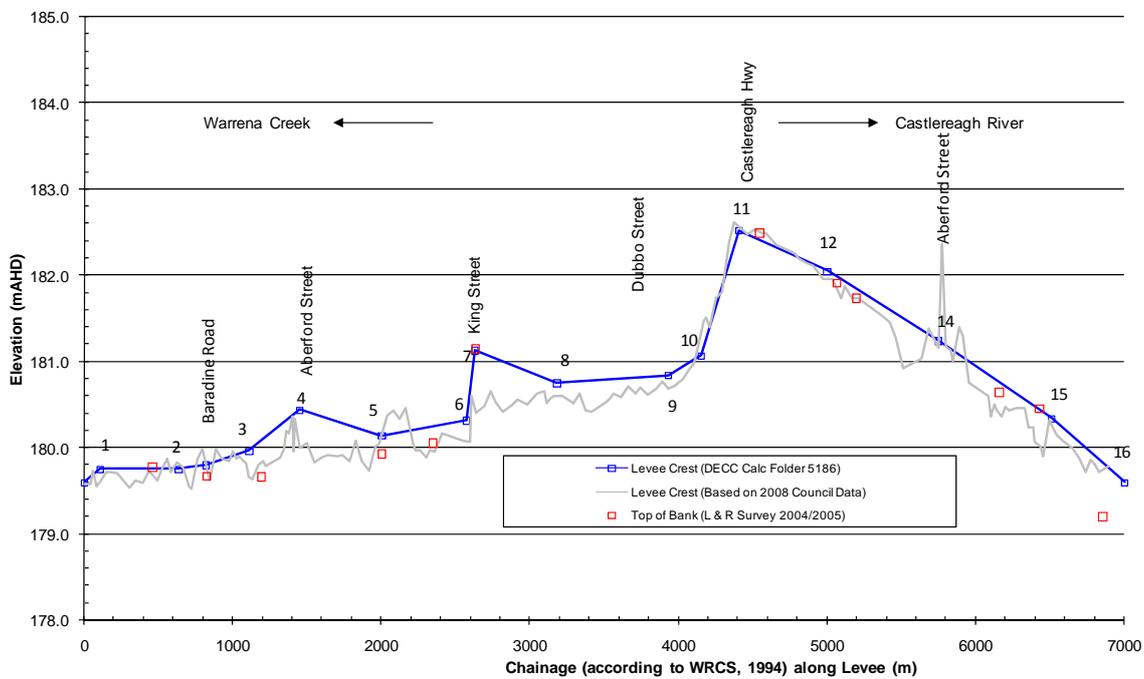
LEGEND:

- EARTHFILL LEVEE
- - - CONCRETE RETAINING WALL

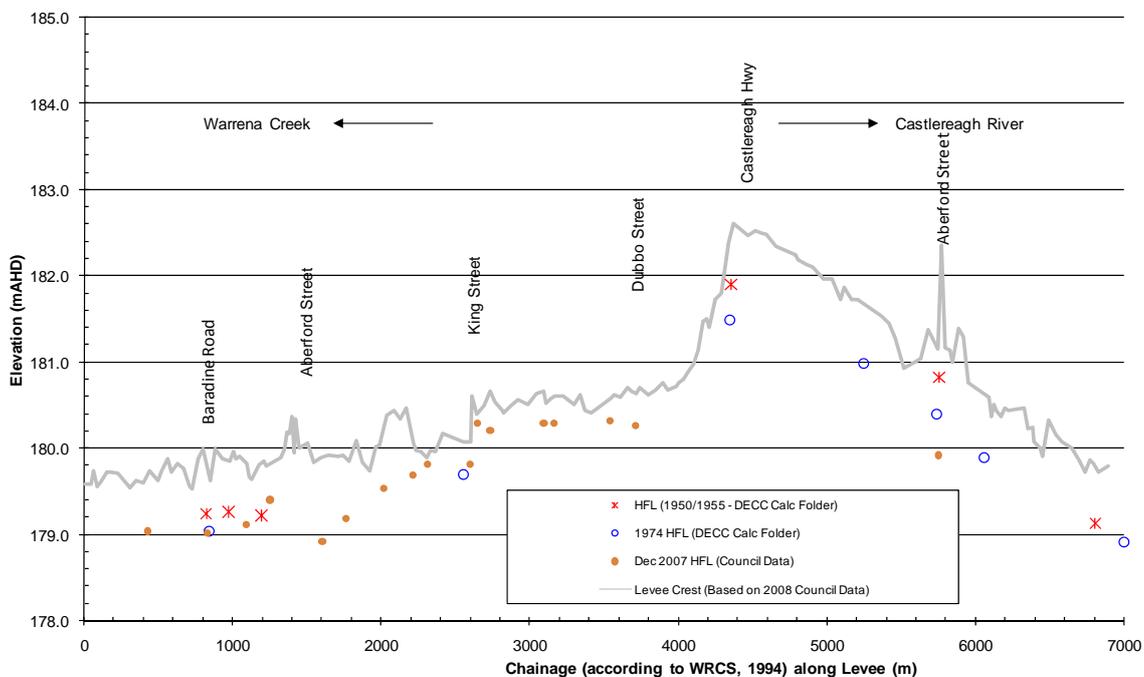
Source: WRCS (1994)



■ **Figure 3-12 Comparison of Crest Levels along Coonamble Levee**



■ **Figure 3-13 Recorded Flood Levels along Coonamble Levee for Major Flood Events**





4 Hydraulic Modelling

4.1 The Modelling System

The hydrodynamic model selected for use in this study is the Danish Hydraulic Institute's MIKE-11 modelling system (version 2004b). MIKE-11 is a one-dimensional, finite difference modelling system for rivers and floodplains using the full Saint Venant Equations of momentum and continuity for unsteady flow. The modelling system allows flow to occur in one-dimensional flowpaths (which must be identified by the modeller) which can be linked in a network to represent quasi two-dimensional flow behaviour experienced on floodplains. It has the ability to model hydraulic structures, weirs and floodplain storages. MIKE-11 has been extensively used in flood studies and floodplain management studies in Australia and overseas for the last 20 years.

MIKE-11 has the following data requirements:

- Topographic data: as channel and floodplain cross sections;
- Bed resistance for cross sections;
- Obstructions to flow: details of hydraulic structures such as levees, culverts, bridges and weirs;
- Inflows to the model at appropriate locations; and
- Downstream boundary conditions in the form of water levels or stage-discharge rating curves.

The first step in developing a MIKE-11 model involves schematising the floodplain into discrete topological elements. Important topological elements are stream channels, floodplains and hydraulic structures including bridges, culverts, weirs, levees, causeways, etc. These elements are usually represented by cross sections orthogonal to the direction of flow.

The second step in constructing a MIKE-11 model is to designate links between each of the topologic elements. The links indicate the direction of flow assigned in the model and show the inter-connected network of flowpaths.

The third step involves transforming the topologic data into hydraulic parameters for use in the solution of the momentum and continuity equations. This includes vertical integration of cross sectional area, hydraulic radius, width and bed resistance.

In the fourth step, hydrologic inputs such as inflows and outflows to the model are defined. Generally, inflows are defined by inflow hydrographs whereas, outflows are defined by water level hydrographs or stage-discharge rating curves (a curve that shows relationship between flood flows and flood levels at a specified location in a stream channel).

In the fifth step, the model is run to simulate selected historic flooding conditions and comparisons are made between recorded and simulated results to gain confidence in the model and its results. In



this process refinement is made to the model schematic and assigned bed resistance values until the model satisfactorily reproduced the recorded flood behaviour.

Once the model is calibrated, the performance of the model is validated against flood events not used in model calibration.

4.2 Model Formulation

4.2.1 Identification of Major Flowpaths

Major flowpaths within the study area were identified from the following sources:

- Information presented in the Scoping Study Report (SKM 2002);
- Cross sections surveyed as part of this study;
- Aerial photographs;
- Satellite images;
- Historic streamflow data;
- Correspondence with Officers from Coonamble Shire Council; and
- A site visit.

Availability of data on the above is given in **Section 3** of this report. Major flowpaths included the following watercourses within the study area:

- Castlereagh River;
- Warrena Creek;
- Overland flowpath representing the Strathavon-Bundabulla Breakout;
- Overland flowpaths representing the Nine Mile Breakout and the Six Mile Breakout;
- Overland flowpaths representing Geamoney Breakout; and
- Eurimie Creek.

4.2.2 Sources of Topographic Data

Topographic survey undertaken as part of this study was the main source of topographic data. Details on the Aberford Street Bridge over the Castlereagh River at Coonamble and the bridge over Eurimie Creek at Coonamble were provided by the RTA.

Dimensions of the Aberford Street Bridge were estimated from the drawing on the General Arrangement provided by the RTA. It is to be noted that RLs shown on the drawing are in Standard Datum (StD). According to WRCS (1994) a height of 0.136 m was subtracted from StD to obtain RLs in mAHD.



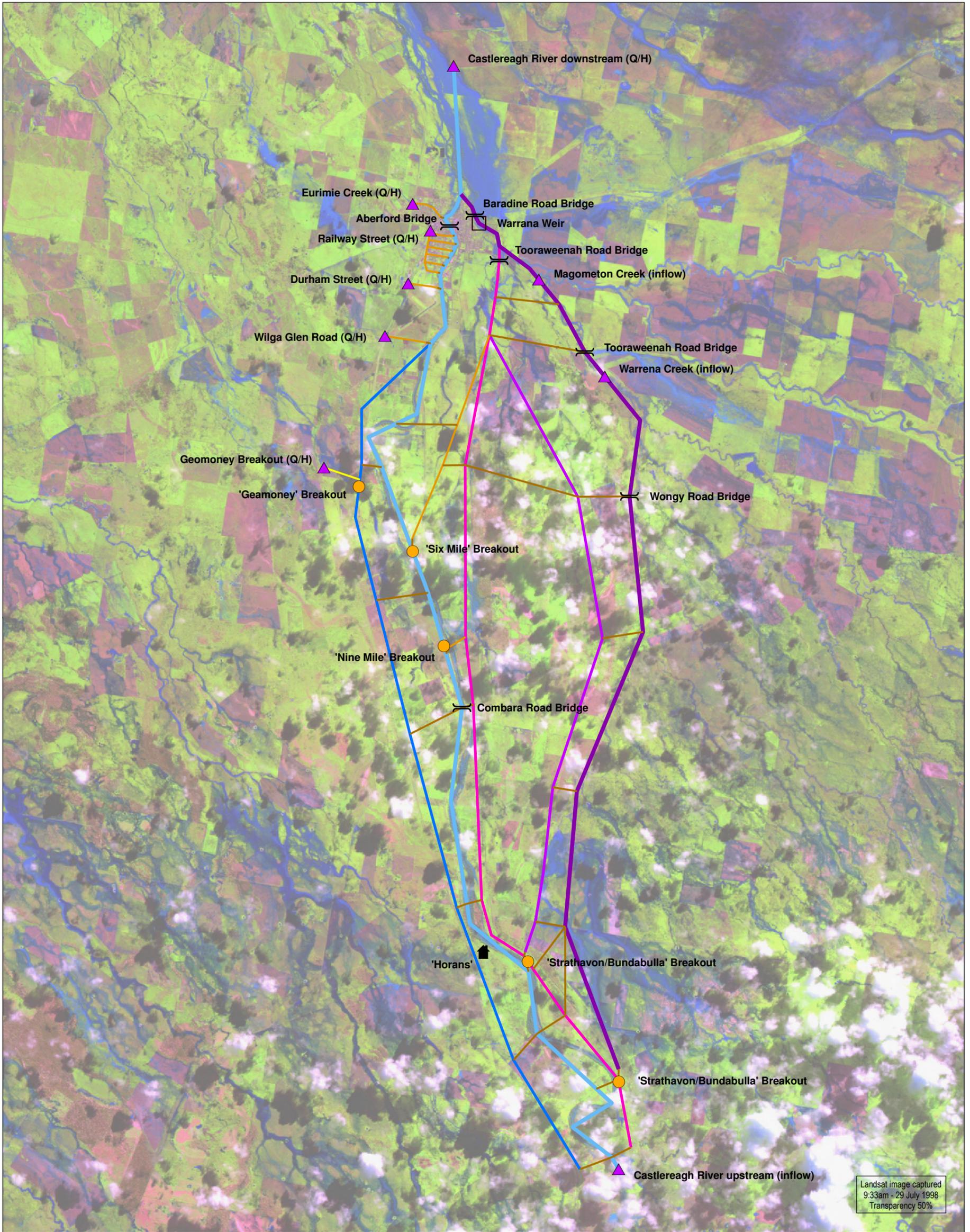
4.2.3 Schematisation

Major flowpaths and the surveyed cross section information were utilised to schematise the model. As the model would be used in flood assessment, the distances between the cross sections were generally measured along high overland flowpaths rather than the true river length.

A number of surveyed cross sections were very long and covered a number of major flowpaths. Hence, it was necessary to split cross sections to represent topographic conditions for each of the identified flowpaths. Splitting up a cross section into a number of segments was generally guided by the presence and continuity of ridges (natural or constructed). Details on the splitting of the cross sections are presented in **Appendix B**.

Overflow from one flowpath to another one was generally represented in the MIKE-11 model by a link channel connecting the two flowpaths. Usage of link channels was preferred in this study over regular channels to avoid duplication in floodplain storage. Geometry of a link channel was usually estimated from the available topographic information, aerial photographs and satellite images for historic flooding. Upstream and downstream invert levels of link channels were generally based on the surveyed data.

Given the spatial distribution of cross sections, in many cases it was necessary to estimate topographic conditions, especially in the vicinity of the junction of overland flowpaths. This was achieved by interpolating cross sections within MIKE-11. A schematic plan of the MIKE-11 model is shown in **Figure 4-1**. Further details on the MIKE-11 model schematic are provided in **Appendix B**.



Landsat image captured
9:33am - 29 July 1998
Transparency 50%

Legend

- Link Channels
- Minor Channels
- Castlereagh River
- Castlereagh River Left Bank Floodplain
- Castlereagh River Right Bank Floodplain
- Warrena Creek
- Warrena Creek Left Bank Floodplain
- Breakout
- Model boundary
- Weir
- Bridge
- Property

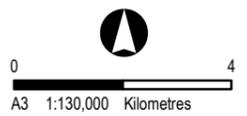


Fig 4-1 : MIKE-11 Model Schematic
Coonamble Levee - Flood Gradient Sensitivity Modelling Study Version 2



4.2.4 Obstruction to Flow

Waterway crossings, weirs, levees etc. within the study area obstruct flood flows to different degrees in the watercourses as well as on the floodplain. Considering the degree of impacts of these obstructions on the distribution of flood flows, the following structures were represented in the MIKE-11 model:

- Combara Bridge over the Castlereagh River;
- Aberford Street Bridge over the Castlereagh River;
- Wongy Road Bridge over Warrena Creek;
- Tooraweenah Road Bridge over Warrena Creek;
- Tooraweenah Road Bridge over Bibleroi Creek;
- Warrena Weir across Warrena Creek;
- Baradine Road Bridge over Warrena Creek; and
- Caswell Street Bridge over Eurimie Creek.

All bridges were represented in MIKE-11 as a combination of a culvert (representing flow under the bridge) and a broad crested weir representing the overflow. At the time of undertaking this study, this approach was considered more robust than using bridge routines available in MIKE-11 (version 2004b). Moreover, bridge routines available in MIKE-11 do not allow the user to vary the size of bridge piers vertically. Bridge routines in MIKE-11 generally provide satisfactory results when flood levels are below the underside of the bridge.

4.2.5 Boundary Conditions

■ Inflow Boundary

There were three inflow boundaries of the MIKE-11 model. These boundaries represent inflow at the following locations:

- Castlereagh River upstream of the Strathavon-Bundabulla Breakout;
- Warrena Creek @ Warrana (GS 420015); and
- Magometon Creek (Site 3) @ Near Coonamble (GS 420014).

■ Downstream Boundary

There were six (6) downstream boundaries defined for the MIKE-11 model. These boundary conditions are located at the following locations:

- Geamoney Breakout at Dubbo-Coonamble Railway;
- Western end of Wilga Glen Road;
- Western end of Durham Street;
- Northern end of Railway Street;
- Eurimie Creek downstream of Caswell Street; and
- Castlereagh River approximately 7.4 km downstream of its confluence with Warrena Creek.



All six downstream boundaries were defined as stage-discharge relationships. A stage discharge relationship was estimated for each location making use of the conveyance calculated within MIKE-11 for the last cross sections for a range of elevations and assuming a constant friction slope of 0.001. Stage-discharge tables used to define all downstream boundary conditions are presented in **Appendix B**.

4.3 Model Calibration

4.3.1 General

To have confidence in using the hydraulic model to investigate the sensitivity of flood gradient along Coonamble Levee, it is necessary for the model to satisfactorily reproduce observed flood events. The degree of confidence is very much dependent on the quantity and quality of information available to calibrate and validate the hydraulic model.

In most of the hydraulic modelling studies, Manning's n and energy losses at hydraulic structures are usually the parameters that are varied to obtain an acceptable calibration. However, in this study there were other factors that required special attention during the calibration process. These included the estimation of inflow in the Castlereagh River upstream of the Strathavon-Bundabulla Breakout, size and shape of breakouts and link channels for which limited topographic information was available. A number of cross sections were estimated by interpolation using upstream and downstream cross sections.

The Scoping Study Report (SKM 2002) identified issues regarding the geomorphological activity of the bed and banks of the Castlereagh River. It is to be noted that cross sections surveyed as part of this study were used to set up the MIKE-11 model. It was assumed in the MIKE-11 model that both the banks and the bed of the Castlereagh River were fixed (ie. no changes in bed forms or banks) before and after the flood event.

4.3.2 Selection of the Calibration Event

The availability of data for calibration of the MIKE-11 model was sparse. The July 1998 flood event was the flood event for which the maximum amount of data was available to calibrate the MIKE-11 model. Information available for this event included the following:

- Recorded streamflow data:
 - Castlereagh River @ Coonamble (GS 420005);
 - Warrena Creek @ Warrana (GS 420015); and
 - Magometon Creek (Site 3) @ Near Coonamble (GS 420014).
- Streamflow gaugings:
 - Castlereagh River @ Coonamble (GS 420005);
 - Bibleroi Creek @ Tooraweenah Road Bridge; and
 - West Bank Side Channel on Quambone Road.



- Landsat Image captured (at 9:33 AM on 29 July 1998, local time) in the vicinity of the recorded peak flood level;
- Aerial photographs captured by Officers from DECCW at the time of the peak flood level on 29 July 1998;
- 1998 Flood Levels in Coonamble from Local Flood Plan (SES 2000); and
- 1998 flood level at the property "Horans".

The Stage-Probability plot (compiled by the former Department of Land & Water Conservation, now DECCW) shown in the Scoping Study Report (SKM 2002) indicates that the 1998 flood would have an Average Recurrence Interval (ARI) of approximately seven (7) years.

4.3.3 Estimation of Upstream Inflow for the Castlereagh River

The streamflow in the Castlereagh River @ Coonamble gauge (GS 420005) does not include flows that escape the Castlereagh River upstream of Coonamble though the following major breakouts:

- Strathavon-Bundabulla Breakout;
- Left bank Breakout in the vicinity of Combara Bridge;
- Geamoney Breakout; and
- Nine Mile and Six Mile Breakouts.

Upstream of Coonamble, the gauging station in the Castlereagh River at Mendooran is the only station where streamflow records are available for the 1998 flood event. However, the catchment area of the Castlereagh River at Mendooran is only 3,600 km² and represents approximately 42% of the total catchment area of the Castlereagh River at Coonamble. Hence it was not feasible to extrapolate the recorded streamflow data at Mendooran to estimate streamflow in the Castlereagh River upstream of the Strathavon-Bundabulla Breakout.

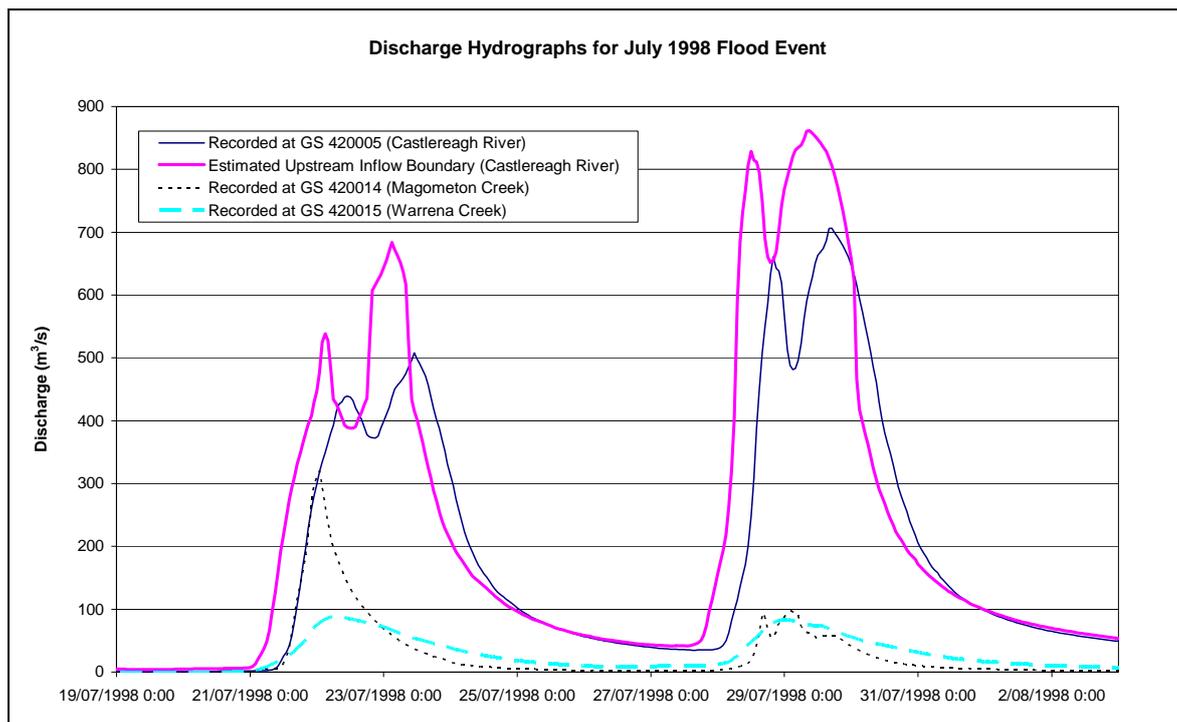
As a feasible alternative, the recorded hydrograph at the Castlereagh River gauge at Coonamble was modified to include assumed losses from the major breaks upstream of the gauge above bankfull capacity (on the basis of the information available for April 1999 flood event). This was input into the hydraulic model and the modelled hydrograph at the gauge compared to the recorded hydrograph. The model inflow hydrograph was further modified as appropriate and the procedure repeated until the modelled and the recorded hydrographs were in reasonable agreement. The adopted discharge hydrograph is shown in **Figure 4-2**.

Recorded discharge hydrographs for Castlereagh River @ Coonamble, Warrena Creek @ Warrana and Magometon Creek @ Near Coonamble are also shown in **Figure 4-2**. Discharge hydrographs for Warrena Creek and Magometon Creek shown in **Figure 4-2** were used to represent inflow hydrographs for Warrena Creek and Magometon Creek in the hydraulic model.



Discharge hydrographs for both Warrena Creek and Magometon Creek were provided by Hydrographers from DWE.

■ **Figure 4-2 Inflow Hydrographs for July 1998 Flood Event**



4.4 Calibration Results

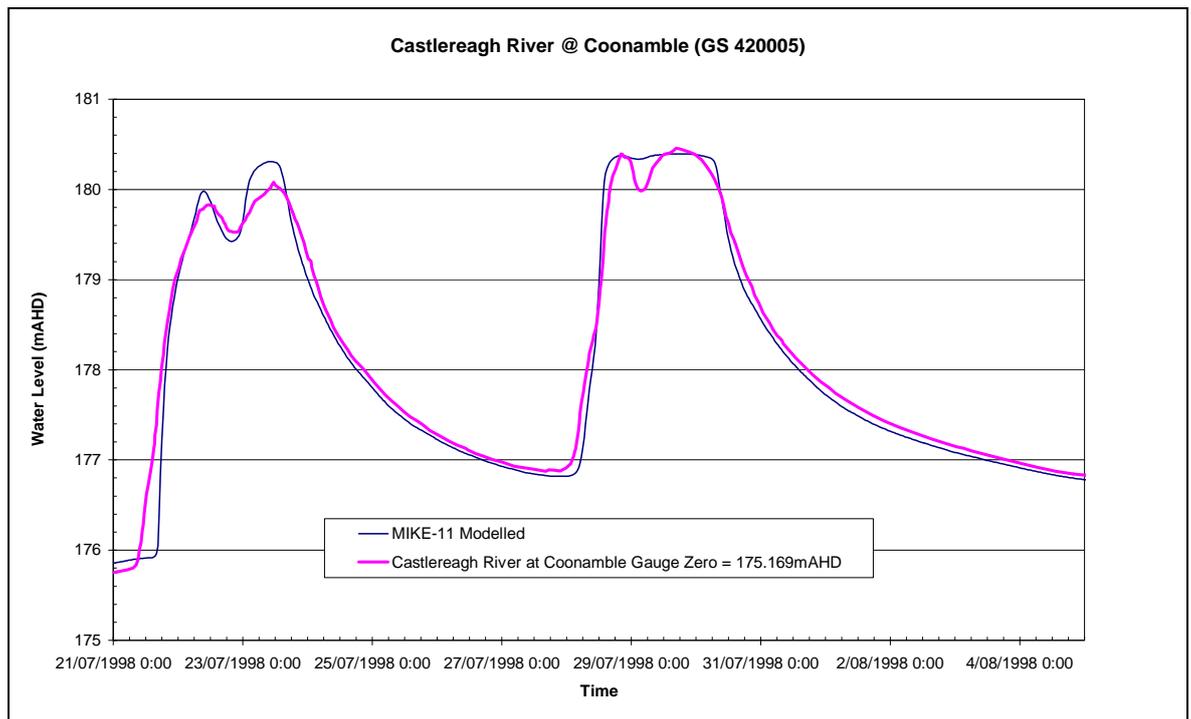
The MIKE-11 model was set up using topographic data surveyed during the period December 2004 to February 2005. Bed resistance in the MIKE-11 model was defined in terms of Manning's n using information collected from a range of sources including a site visit, photographs captured by the surveyors, available literature etc. Manning's n values used at model cross sections are given in **Appendix B**.

4.4.1 Comparison of Flood Levels

A comparison of modelled and recorded water level hydrograph in the Castlereagh River @ Coonamble for the 1998 flood is shown in **Figure 4-3**. This shows that the MIKE-11 model satisfactorily reproduced the second peak. The MIKE-11 model however overestimated the first peak. This is due to overestimation of discharge corresponding to the first peak. Overestimation of discharge for the first peak may result from the following sources:



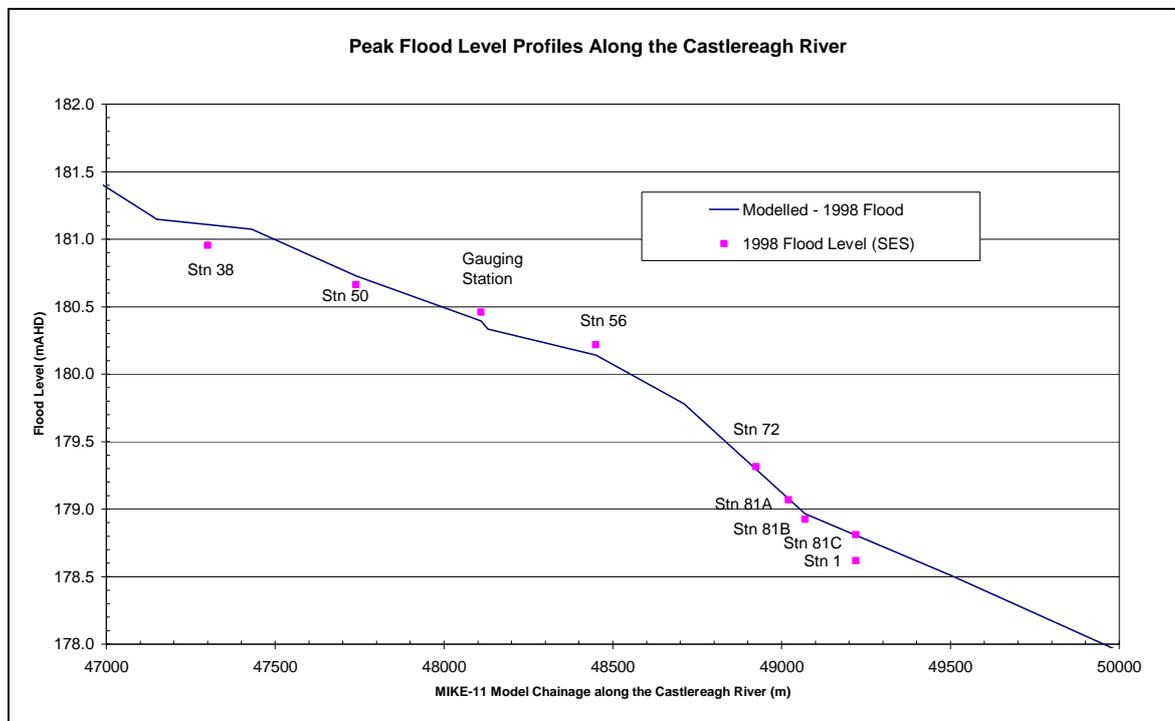
- Overestimation of the assumed losses from the major breaks upstream of the gauge for minor flood events; and
 - The channel may have scoured out more during the second peak and as the focus of the calibration was on the second peak hence the overestimation of the first peak.
- **Figure 4-3 Comparison of Water Level Hydrographs in the Castlereagh River @ Coonamble**



Modelled peak flood level profile along the Castlereagh River in the vicinity of Coonamble for the July 1998 flood event is shown in **Figure 4-4**. Flood levels for the 1998 flood event included in the Local Flood Plan (SES 2000) are also shown in **Figure 4-4**. **Figure 4-4** indicates a satisfactory reproduction of flood levels in the Castlereagh River by the MIKE-11 model. Except for Station 1 and Station 38, the maximum difference between modelled flood levels and the recorded flood levels was 76mm. The model underestimated the flood level at Coonamble gauge by 64mm. The model overestimated flood level at Station 38 by 153mm. The model also overestimated the flood level at Station 1 by 189mm however the model underestimated the flood level by 4mm at Station 81C. It is to be noted that both Station 1 and Station 81C are located on the same cross section. It would be difficult to get a reasonable calibration at both Station 1 and Station 81C using a one-dimensional hydraulic model.



■ **Figure 4-4 Comparison of Peak Flood Levels**



The MIKE-11 model simulated a peak flood level of 204.03 mAHD in the vicinity of the property “Horans” (MIKE-11 cross section CASTLEREAGH 20700m) for the 1998 flood event. The recorded flood level at “Horans” was estimated at 204.0 mAHD. The difference between the modelled and the recorded flood level at “Horans” is 29mm. This indicates that the MIKE-11 model satisfactorily reproduced the recorded flood level at “Horans”.

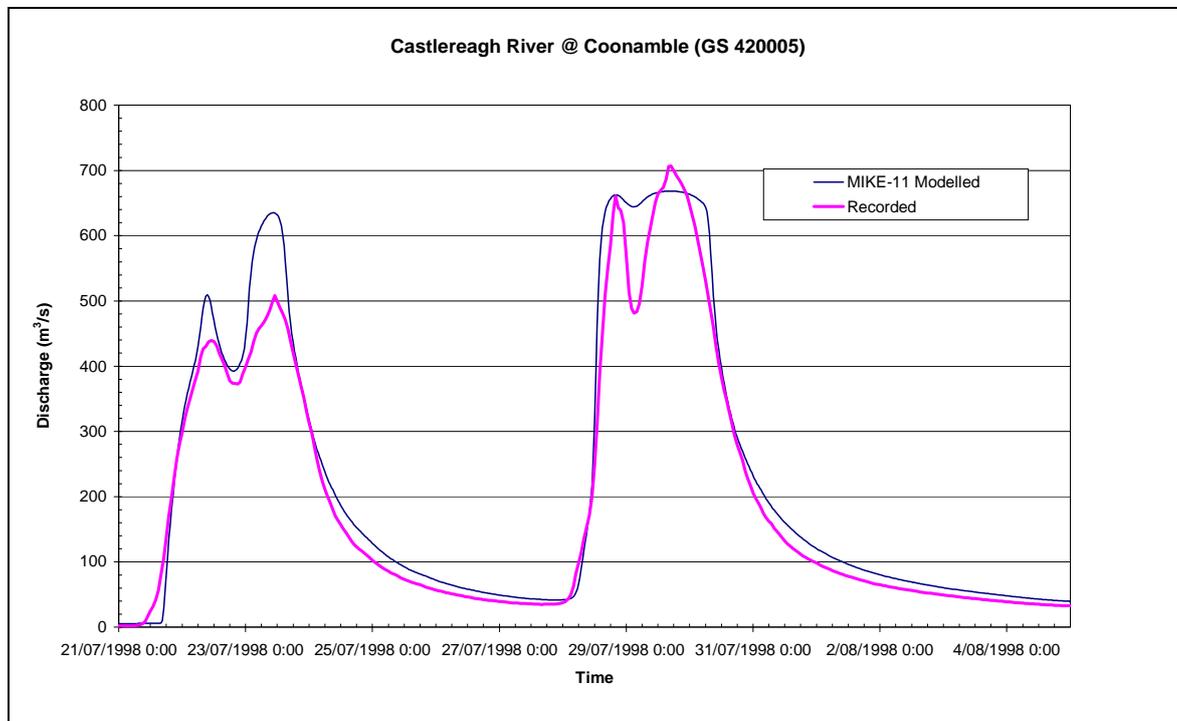
It is to be noted that water level hydrographs for gauging stations Warrena Creek @ Warrana and Magometon Creek (Site 3) @ Near Coonamble were not used, as flood levels to AHD were not available.

4.4.2 Comparison of Discharge

A comparison between modelled and recorded discharge hydrographs in the Castlereagh River @ Coonamble is shown in **Figure 4-5**. **Figure 4-5** shows that the MIKE-11 model reproduced the rise and fall of the hydrographs satisfactorily. However, the MIKE-11 model overestimated the peak discharge corresponding to the first peak and slightly under estimated the second peak (ie. the main peak). As the focus of the calibration was on the second peak and the overestimation of the first peak did not influence the second peak, reproduction of the second peak by the MIKE-11 model is considered satisfactory. The difference between the modelled and recorded flow for the second peak is 38 m³/s (being 5% of the recorded peak flow).



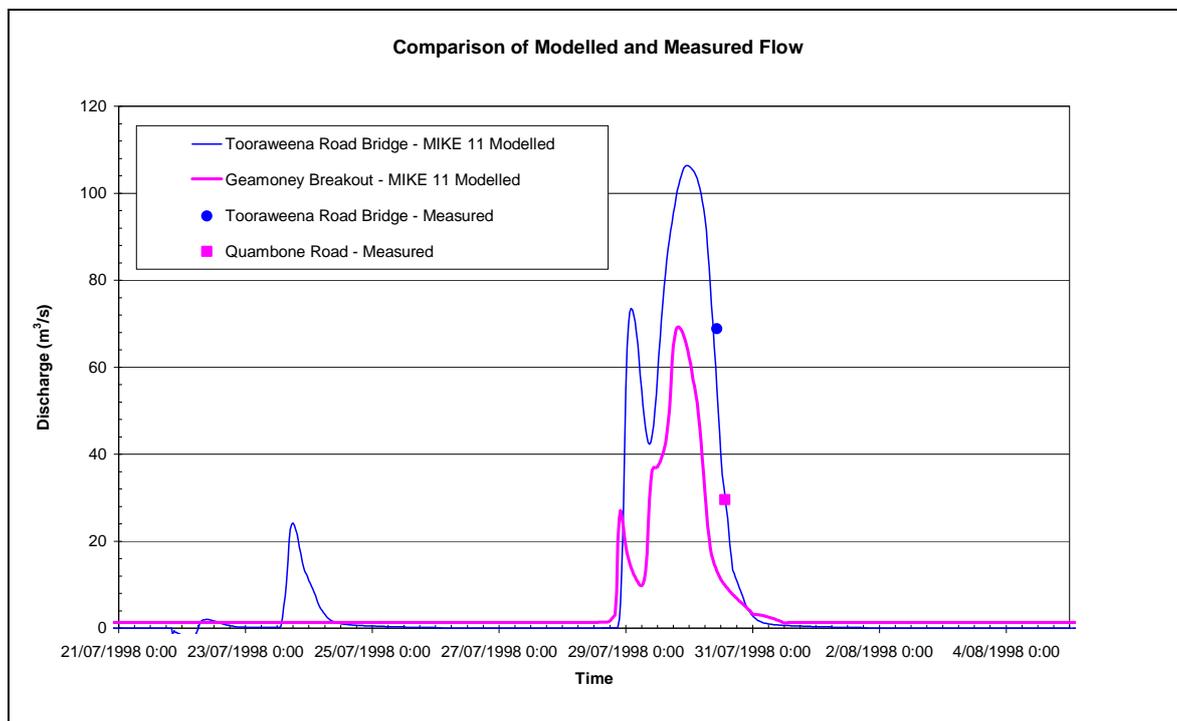
■ **Figure 4-5 Modelled and Recorded Discharge Hydrographs at GS 420005**



Modelled discharge hydrographs in Bibleroi Creek at Tooraweenah Road Bridge and Geamoney Breakout at Dubbo-Coonamble Railway are shown in **Figure 4-6**. Discharges measured in the vicinity of both locations by DWE Hydrographers during the 1998 flood event are also shown in **Figure 4-6**. A close agreement between the modelled and the measured data is shown in **Figure 4-6**.



■ **Figure 4-6 Modelled Discharge Hydrographs and Measured Discharges**



4.4.3 Comparison with Other Relevant Information

Adequate topographic data is not available to prepare a flood extent map. A spot check on the modelled width of flood inundation with the flood extent shown on the Landsat image was undertaken at a number of locations. Particular attention was given to flood extent along Warrena Creek downstream of the Rifle Range. The check indicated satisfactory agreement between the modelled flood width and the flood extent shown on the Landsat image.

Results of the MIKE-11 model for the 1998 flood event agree with the following observations made by staff from DECCW (as recorded by the photo obliques) and Coonamble Shire during the July 1998 flood:

- Strathavon-Bundabulla Breakout did not operate;
- Six Mile Break did not operate;
- The Nine Mile Break operated during the first two peaks and the Castlereagh Highway at the Nine Mile Break was flooded for approximately two days during the second peak; and
- The afflux (ie. increment in flood level) estimated by the MIKE-11 model at Aberford Street Bridge over the Castlereagh River was comparable to that obtained using Austroads Waterway Design (1994). An afflux of 43mm (the maximum difference in modelled flood levels with and



without Aberford Street Bridge) was estimated by the MIKE-11 model for this flood event. A conservative (assuming no scouring of the channel section on the basis of the cross section available on DMR Bridge drawing) estimate based on the procedures in Austroads (1994) provided an afflux of 90mm. However, the afflux was estimated at 50mm using the cross section surveyed in 20004/2005 and applying the same procedure. The channel cross section used in the MIKE-11 model is based on the topographic survey undertaken as part of this study in the year 2004/2005 and hence include the scoured channel section.

Peak flood levels and discharges for all modelled cross sections are given in **Appendix B**.

4.5 Validation of the Model against 1999 and 2000 Flood Events

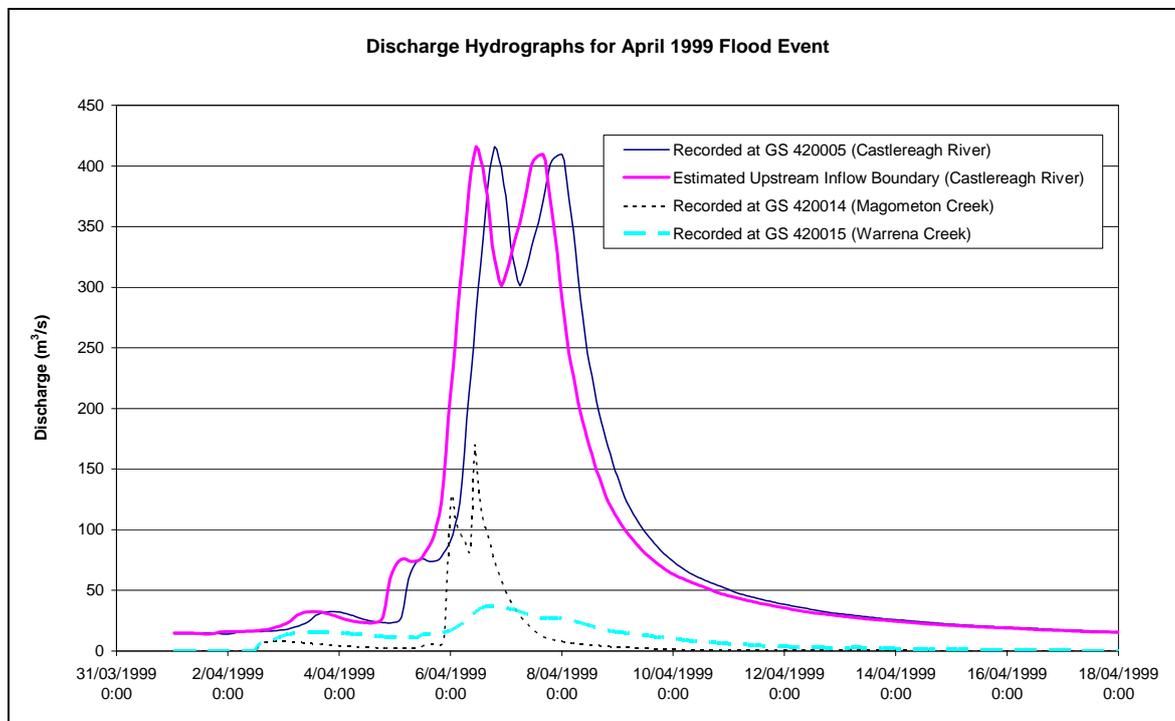
As identified earlier that data available to calibrate and validate the MIKE-11 model were sparse. On the basis of the availability of data the November 2000 and April 1999 flood events were initially selected for validation of the MIKE-11 model. The November 2000 flood event in Coonamble was similar in magnitude to the July 1998 flood event. The April 1999 flood event is however a minor flood event and neither the Nine Mile Breakout nor the Geamoney Breakout were operational during this flood event.

4.5.1 Estimation of Upstream Inflow for the Castlereagh River

The Castlereagh River did not break its banks upstream of Coonamble during the flood event of April 1999. Hence, it was fairly straight forward to estimate the upstream inflow for the Castlereagh River. Discharge data extracted from PINNEENA for the Castlereagh River @ Coonamble gauge was advanced by eight hours (in order to align the modelled hydrograph with the recorded hydrograph for the Castlereagh River @ Coonamble Gauge) to obtain the upstream inflow hydrograph for the Castlereagh River for the April 1999 flood event. The estimated inflow hydrograph as well as the recorded hydrographs for the Castlereagh River @ Coonamble, Warrena Creek and Magometon Creek are shown in **Figure 4-7**. Except the recorded discharge hydrograph for the Castlereagh River shown in **Figure 4-7**, the remaining three discharge hydrographs were used as input into the MIKE-11 model to simulate flooding conditions for the April 1999 flood event.



■ **Figure 4-7 Inflow Hydrographs for April 1999 Flood Event**



Estimation of the inflow hydrograph for the November 2000 event for the Castlereagh River was problematic. The calculation that was made to estimate the upstream inflow hydrograph for the Castlereagh River for the calibration event was repeated in the first instance to estimate the inflow hydrograph for the November 2000 event. However, a comparison of modelled and recorded water level and discharge hydrographs in the Castlereagh River @ Coonamble for this event indicated an overestimation of discharge leading to an overestimation of water level at the rising and falling stages of the hydrograph.

A comparison of July 1998 and November 2000 recorded water level hydrographs at Coonamble gauge is made in **Figure 4-8**. A similar comparison of July 1998 and November 2000 discharge hydrographs at the gauge is made in **Figure 4-8**. The following observations can be made from **Figure 4-8**:

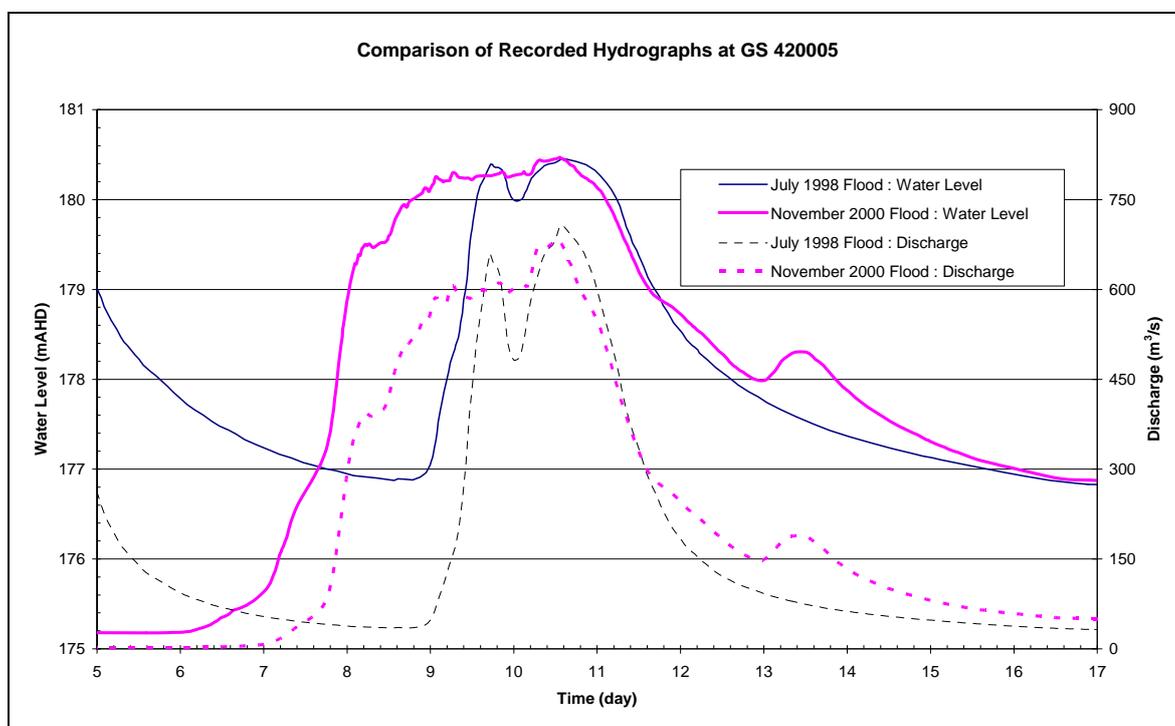
- The peak flood level for the November 2000 flood is slightly higher than the July 1998 flood event however the peak discharge corresponding to the July 1998 event is greater than the peak discharge for the November 2000 event. A discharge of 696 m³/s (refer to Table 3-3 for details) was measured by DWE Hydrographers in the Castlereagh River @ Coonamble corresponding to a gauge height of 5.29m during the 1998 flood event. However, a discharge of 530 m³/s was measured (refer to for details) in the Castlereagh River @ Coonamble by DWE Hydrographers corresponding to a gauge height of 5.27m during the 2000 flood event. An increment in discharge of 166 m³/s due to a difference in gauge height of only 20mm



appears to be questionable. However, it could not be confirmed whether the abrupt increment in discharge is due to uncertainty in the discharge measurement and/or due to a change in bed form that occurred between the 1998 flood and the 2000 flood.

- The November 2000 water level hydrograph is flatter than the July 1998 water level hydrograph;
- Above RL 180 mAHD, discharge for the November 2000 event changes more rapidly than that for the July 1998 event; and
- In the vicinity of the peak flood level, increment in discharge for the November 2000 is more pronounced than that for the July 1998 event.

■ **Figure 4-8 Comparison of Recorded Hydrographs - Castlereagh River @ Coonamble**



The broad approach used to estimate inflow in the Castlereagh River at the upstream boundary of the MIKE-11 model for the 1998 flood event was also used to estimate inflow for the 2000 flood event. However, the calculation that was used to estimate inflow for the 1998 event was different from that used to estimate inflow for the 2000 event. In the case of the 2000 flood event, the discharge hydrograph for the Castlereagh River @ Coonamble gauge was used. Discharges below the bankfull capacity were not adjusted, however, discharges above the bankfull capacity were multiplied by a range of multipliers between 1 (for flows up to 500 m³/s) and 1.45 (for flows up to 900 m³/s). Multipliers were also assumed for intermediate flows between 500 m³/s and 900 m³/s. The estimated hydrograph was advanced in time and input into the hydraulic model and the

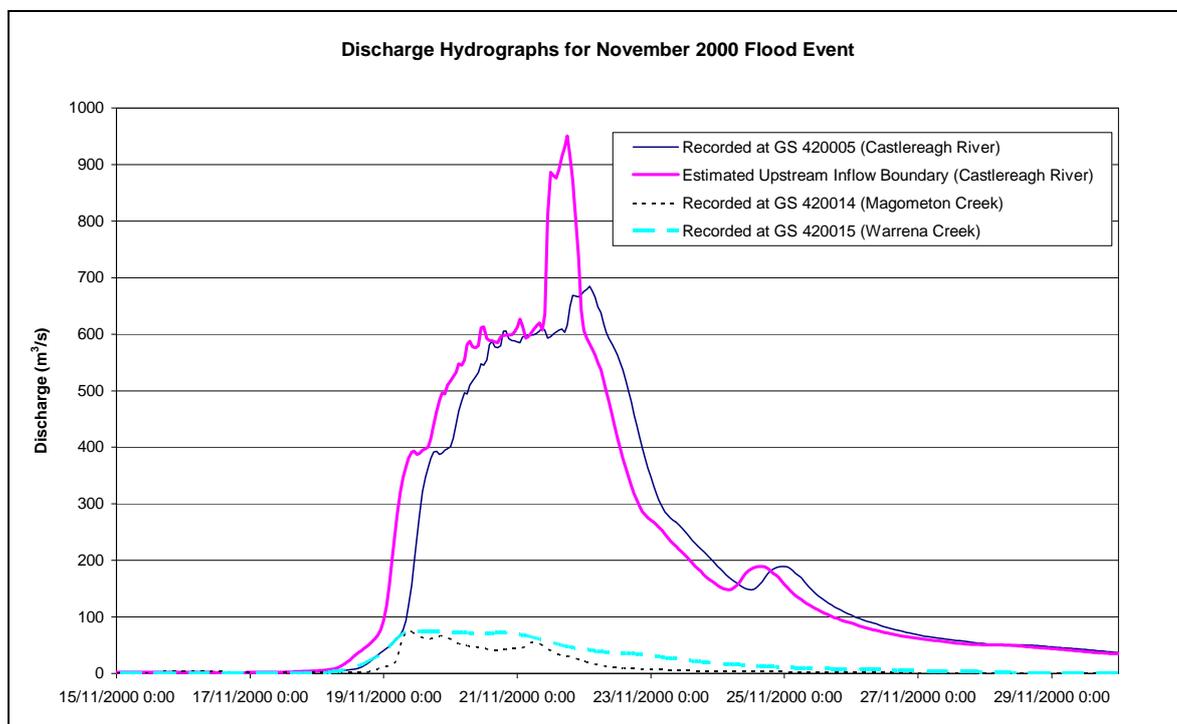


modelled hydrograph at the gauge compared to the recorded hydrograph. Multipliers were further modified as appropriate and the procedure repeated until the modelled and the recorded hydrographs were in reasonable agreement.

As the stage-discharge rating curve for the Castlereagh River gauging station at Coonamble is generally modified after each flood, it is not surprising that two different sets of calculations were required to estimate inflow in the Castlereagh River at the upstream boundary of the MIKE-11 model.

The estimated inflow hydrograph in the Castlereagh River providing a reasonable agreement between the modelled and the recorded data in the Castlereagh River @ Coonamble is shown in **Figure 4-9**. Recorded discharge hydrographs in the Castlereagh River, Warrena Creek and Magometon Creek are also shown in **Figure 4-9**. Except for the recorded discharge hydrograph for the Castlereagh River @ Coonamble shown in **Figure 4-9**, the remaining three discharge hydrographs were used as input into the MIKE-11 model to simulate flooding conditions for the November 2000 flood event.

■ **Figure 4-9 Inflow Hydrographs for November 2000 Flood Event**



4.5.2 Bed Resistance and Other Input Data Used in Model Validation

Apart from the inflow hydrographs, the input data used in the calibration of the MIKE-11 model for the July 1998 event were used for the validation of the MIKE-11 model for the 1999 and 2000

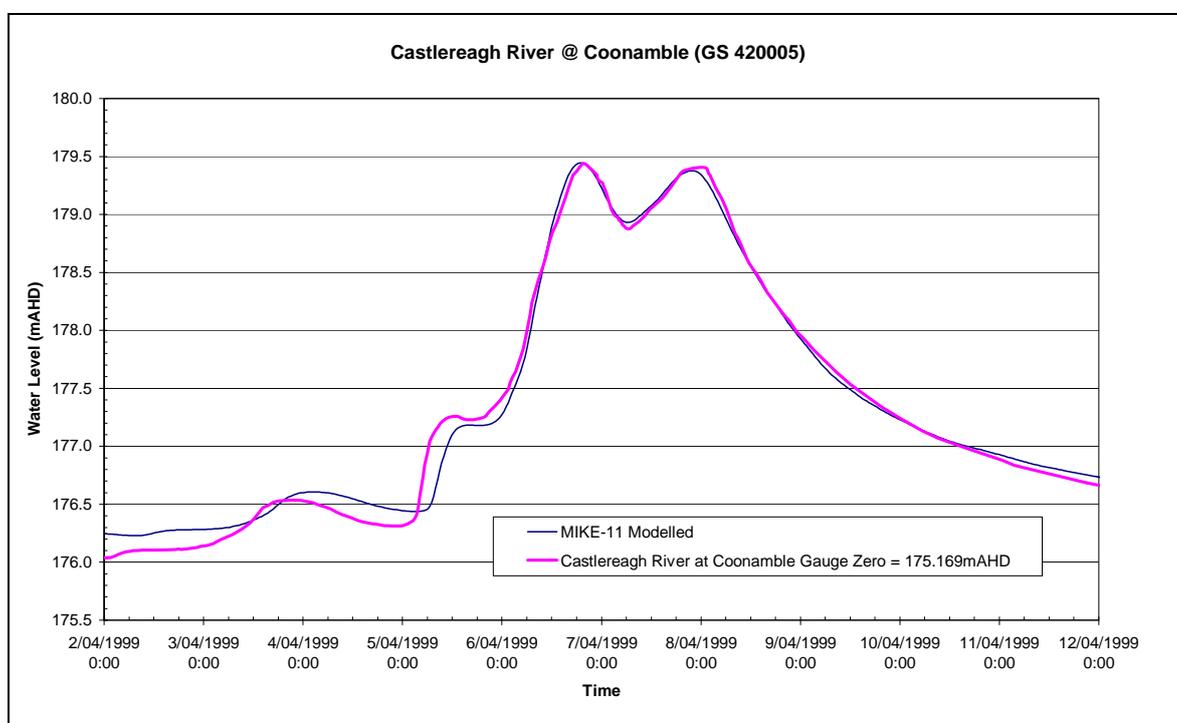


flood events. This means that the river set up, cross section data base, Manning's n values, friction losses at hydraulic structures etc. were the same for the calibration and validation flood events.

4.5.3 Results April 1999 Flood Event

Modelled and recorded water level hydrographs in the Castlereagh River @ Coonamble are shown in **Figure 4-10**. This shows that the MIKE-11 model satisfactorily reproduced the recorded water level hydrograph. The MIKE-11 model overestimated the peak flood level by 19mm.

■ Figure 4-10 Comparison of Modelled and Recorded Water Level for 1999 Event



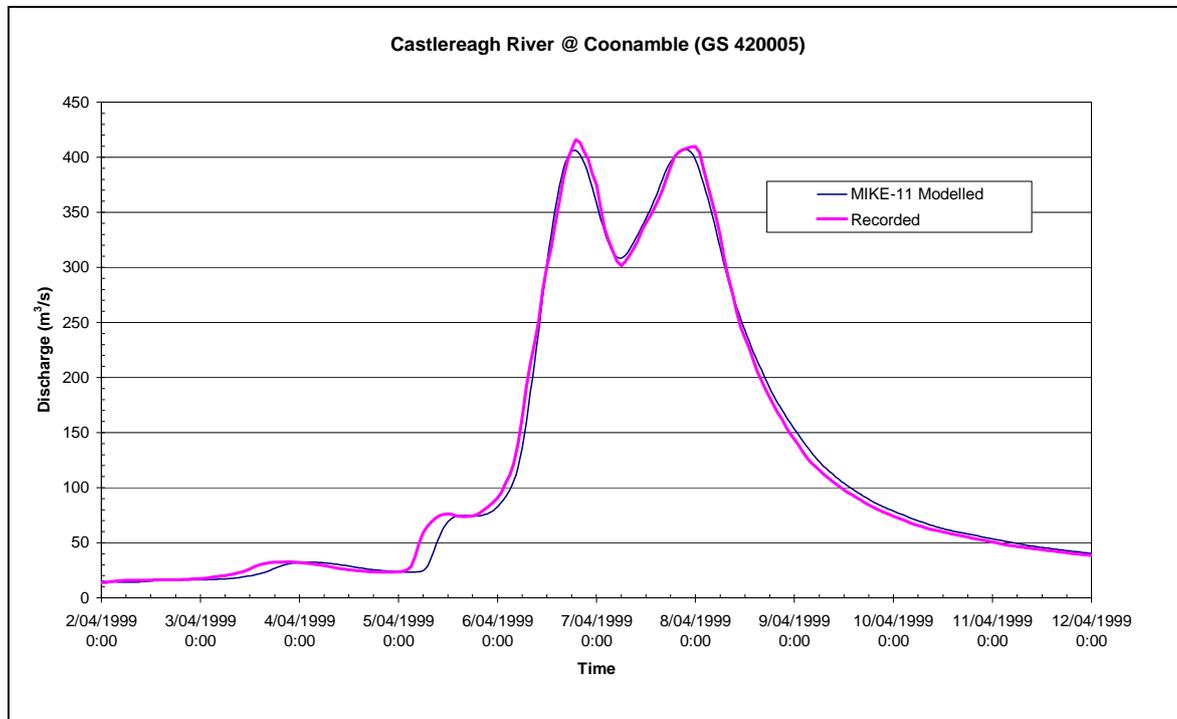
Modelled and recorded discharge hydrographs in the Castlereagh River @ Coonamble for the 1999 flood event are shown in **Figure 4-11**. **Figure 4-11** shows that the MIKE-11 model satisfactorily reproduced the recorded discharge hydrograph in the Castlereagh River at Coonamble. The MIKE-11 model, however, underestimated the peak discharge by 2% for this event.

No other relevant recorded information was available to this study on the April 1999 flood event that could be used to validate the MIKE-11 model further.

Peak flood levels and discharges for all modelled cross sections are given in **Appendix B**.



■ **Figure 4-11 Comparison of Modelled and Recorded Discharge 1999 Flood Event**



4.5.4 Results November 2000 Flood Event

Information available to validate the MIKE-11 model for this event included the following:

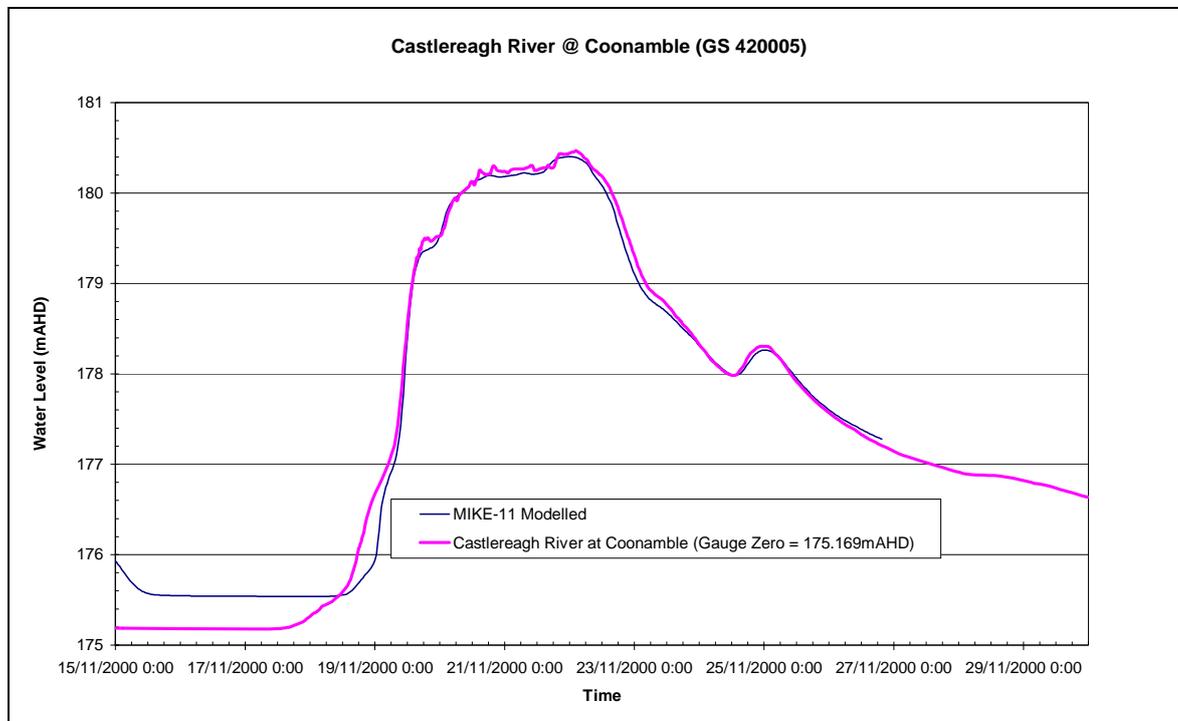
- Water level and discharge hydrographs in the Castlereagh River at Coonamble;
- Streamflow gaugings undertaken by DWE Hydrographers in Bibleroi Creek at Tooraweenah Road Bridge and West Bank Side Channel on Quambone Road; and
- Flood level at the property “Horans”.

Modelled and recorded water level and discharge hydrographs in the Castlereagh River @ Coonamble are shown in **Figure 4-12** and **Figure 4-13**, respectively. Both figures indicate a close agreement between the modelled and recorded data. The MIKE-11 model underestimated peak flood level in the Castlereagh River @ Coonamble by 66mm. The model also underestimated peak discharge for this event by 2%.

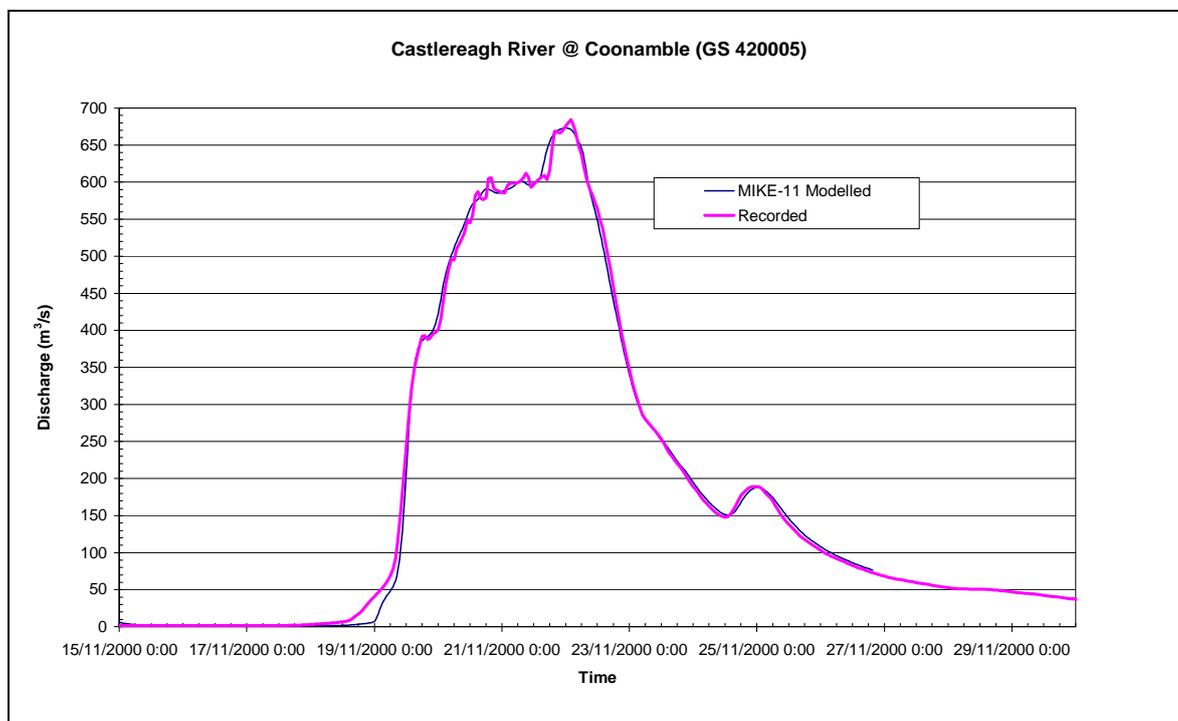
Modelled discharge hydrographs in Bibleroi Creek at Tooraweenah Road Bridge and Geamoney Breakout at Dubbo-Coonamble Railway are shown in **Figure 4-14**. Discharges measured in the vicinity of both locations by DWE Hydrographers during the 2000 flood event are also shown in **Figure 4-14**. This indicates a satisfactory agreement between the modelled and the measured discharge at both locations.



■ **Figure 4-12 Comparison of Water Level Hydrographs for 2000 Event**

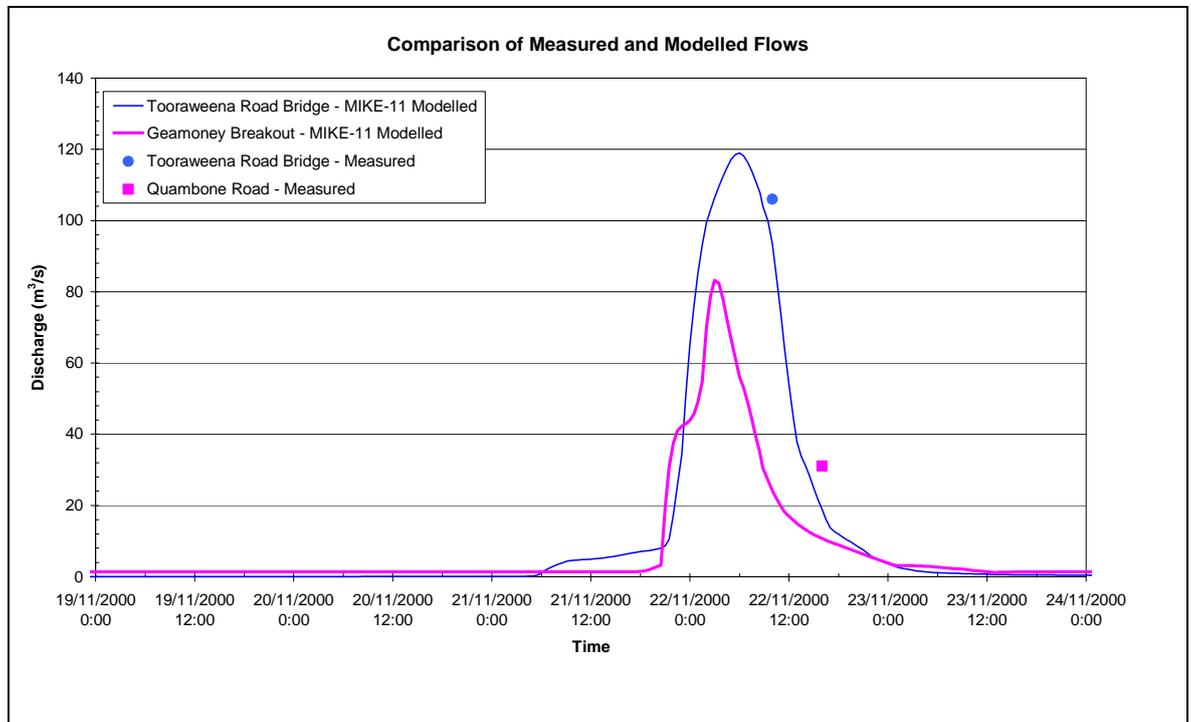


■ **Figure 4-13 Comparison of Discharge Hydrographs for 2000 Event**





■ **Figure 4-14 Modelled Discharge Hydrographs and Measured Discharges 2000 Event**



The MIKE-11 model simulated a peak flood level of 204.32 mAHD is at the property “Horans” (cross section CASTLEREAGH 20700m). The recorded peak flood level during the November 2000 flood at “Horans” was estimated at 204.22 mAHD. A difference of 103 mm between the modelled and the recorded flood level indicates a reasonable agreement between the modelled and the recorded peak flood levels at “Horans”.

The modelled flood behaviour for the November 2000 event is generally consistent with the modelled flood behaviour for the July 1998 flood event in the context of the following aspects:

- Strathavon-Bundabulla Breakout did not operate;
- Six Mile Break did not operate;
- The Nine Mile Break operated for a period of two days; and
- An afflux (ie. increment in flood level) of 44mm estimated by the MIKE-11 model at Aberford Street Bridge.

Modelled peak flood levels and discharges for all modelled cross sections are given in **Appendix B**.



4.6 Validation of Model against 2007 Flood

During the course of this study a major storm event occurred on Warrena Creek catchment at Coonamble during 22-23 December 2007. A 24 hour rainfall of 171 mm was recorded in Coonamble during this storm event. This is the highest 24 hour recording on record since 1886 at the Coonamble Comparison Rain Gauge. The storm caused widespread flooding in Warrena Creek along the Coonamble Levee and flood levels in Warrena Creek were 150mm below the levee crest in places. This flood event was much larger than the floods from the Warrena Creek catchment that were used to calibrate the computer models. The flooding in the Castlereagh River for this event was a minor one and both Six Mile and Nine Mile Breakouts did not operate during this flood event. Given the magnitude of the 2007 flood in Warrena Creek the overall study was extended to verify the performance of the computer models against this flood event.

4.6.1 Available Data

4.6.1.1 Topographic Data Provided by Coonamble Shire Council

Coonamble Shire Council provided an electronic drawing file in AutoCAD format to SKM containing spot levels around Coonamble. The drawing file included spot levels on the following:

- Coonamble Levee, roads inside the levee and natural surface
- Coonamble-Tooraweenah Road in the vicinity of Bibleroi Creek and Warrena Creek crossings.

The accuracy of these spot levels was unknown. Coonamble Shire Council could not confirm whether the spot heights included in the drawing file were connected to the Australian Height Datum (AHD).

Also, Coonamble Shire Council provided drawings for the following:

- Bridge over Bibleroi Creek along Coonamble-Tooraweenah Road
- Bridge over Warrena Creek along Coonamble-Tooraweenah Road.

Timber bridges at the above two locations were replaced with concrete bridges during the period 2005-2006. Drawing files for both bridges did not specify whether levels shown on the drawings were connected to AHD.

4.6.1.2 Additional Topographic Survey

In consultation with DECC, Langford & Rowe Surveyors were engaged in 2008 to undertake the following:

- Survey of three cross sections in the vicinity of Bibleroi Creek Bridge
- Survey of the existing Bibleroi Creek Bridge arrangement
- Preparation of a report to verify consistency between topographic survey data provided by Coonamble Shire and topographic survey data provided by Langford & Rowe Surveyors in 2005.



Details on the new Bibleroi Creek Bridge provided by Langford & Rowe indicated that the topographic data shown on Bibleroi Creek Bridge drawings provided by Coonamble Shire were not connected to the Australian Height Datum.

The consistency report prepared by Langford & Rowe Surveyors indicated that the topographic data provided by Coonamble Shire were consistent with the Langford & Rowe survey of 2005.

4.6.1.3 Rainfall Data

Daily rainfall data for December 2007 for all available rain gauges located within, and around, Warrena Creek catchment were collected from the Bureau of Meteorology.

Pluviograph data for the period 21-23 December 2007 were also collected from the Bureau of Meteorology for Coonabarabran Airport AWS (064017) and Coonamble Airport AWS (051161). The depth of rainfall recorded at Coonamble Airport AWS pluviometer between 9 AM on 21 December 2007 and 9 AM on 22 December 2007 was only 60.2mm. However, the rainfall depth recorded at the daily read rain gauge at Coonamble for the same period was 171mm. Hence there were errors in the pluviograph data for Coonamble Airport AWS.

4.6.1.4 Streamflow Data

Coonamble Shire Council provided gauge heights for the Castlereagh River at Coonamble gauge for the December 2007 flood event. A peak gauge height of 4.75m was reached at 11:00 PM on 24 December 2007 in the Castlereagh River at Coonamble. No streamflow data was available for Warrena Creek. Warrena Creek reached its peak flood height in Coonamble around 10:00 PM on 22 December 2007, almost 49 hours before the Castlereagh River reached its peak at the Coonamble gauge.

4.6.1.5 Satellite Imagery and Aerial Photographs

Geoimage Pty Ltd was contacted to make an inventory on the availability of satellite images captured during the December 2007 flood. Information provided by Geoimage indicated that a SPOT5 image was captured on 23 December 2007 at 12:23 PM UTC (almost midnight local time). Considering the timing of the peak flood level in Warrena Creek and the cloud cover, the SPOT5 image was not purchased. It is to be noted that Warrena Creek reached its peak flood height around 10:00 PM on 22 December 2007.

Coonamble Shire Council captured aerial photographs in the afternoon of 23 December 2007.

4.6.1.6 Flood Levels

Coonamble Shire Council provided flood levels in Warrena Creek along Coonamble Levee. Debris marks were used to obtain flood levels along the levee. Flood levels for the December 2007 event



provided by Coonamble Shire are shown in **Figure 3-10**. Two flood levels recorded along Warrena Creek between Tooraweenah Road and Baradine Road are lower than the downstream flood levels. Hence, the two recorded flood levels (179.183 mAHD and 178.92 mAHD) are considered to be incorrect.

Recorded flood level data provided by Coonamble Shire for the December 2007 event and 1974 and 1955 flood levels extracted from DECC's project folders along the Coonamble Levee are shown in **Figure 3-13**.

4.6.1.7 Coonamble Levee

The topographic data provided by Coonamble Shire was used to extract crest levels along Coonamble Levee. The resulting crest levels were compared against crest levels of the Levee as presented in the report Coonamble Levee - Flood Levels prepared by WRCS in 1994. The two sets of data closely agree at a majority of locations as shown in **Figure 3-12**. Topographic data along the Levee provided by Coonamble Shire was the most recent and detailed, hence, this data was used to define crest levels along the Levee for use in this study

4.6.2 Estimation of Inflow Hydrographs

A hydrologic analysis was undertaken to estimate inflow hydrographs for the Castlereagh River and Warrena Creek for the December 2007 flood event. Details on the methodology used to estimate inflow hydrographs for the December 2007 flood event are discussed in the following sections.

4.6.2.1 Castlereagh River

Neither the Six Mile Break nor the Nine Mile Break was operational during the December 2007 flood. Hence, a preliminary estimate on the inflow hydrograph for the Castlereagh River was made using a similar approach to that described in **Section 4.3.3**:

- The recorded water level data for the Castlereagh River @ Coonamble gauge provided by Coonamble Shire was converted to discharge using the latest stage discharge rating curve (No. 130) for the gauging station
- The resulting inflow hydrograph was advanced by 8 hours to align the modelled hydrograph and the recorded hydrograph for the Castlereagh River @ Coonamble gauge.

On the basis of a comparison of results from hydraulic modelling, the latest stage discharge rating curve for the Castlereagh River @ Coonamble gauge was lowered. The modified stage discharge rating curve was applied to obtain the final inflow hydrograph for the Castlereagh River.

4.6.2.2 Warrena Creek

Two inflow boundaries of the MIKE-11 model were defined at the following locations:



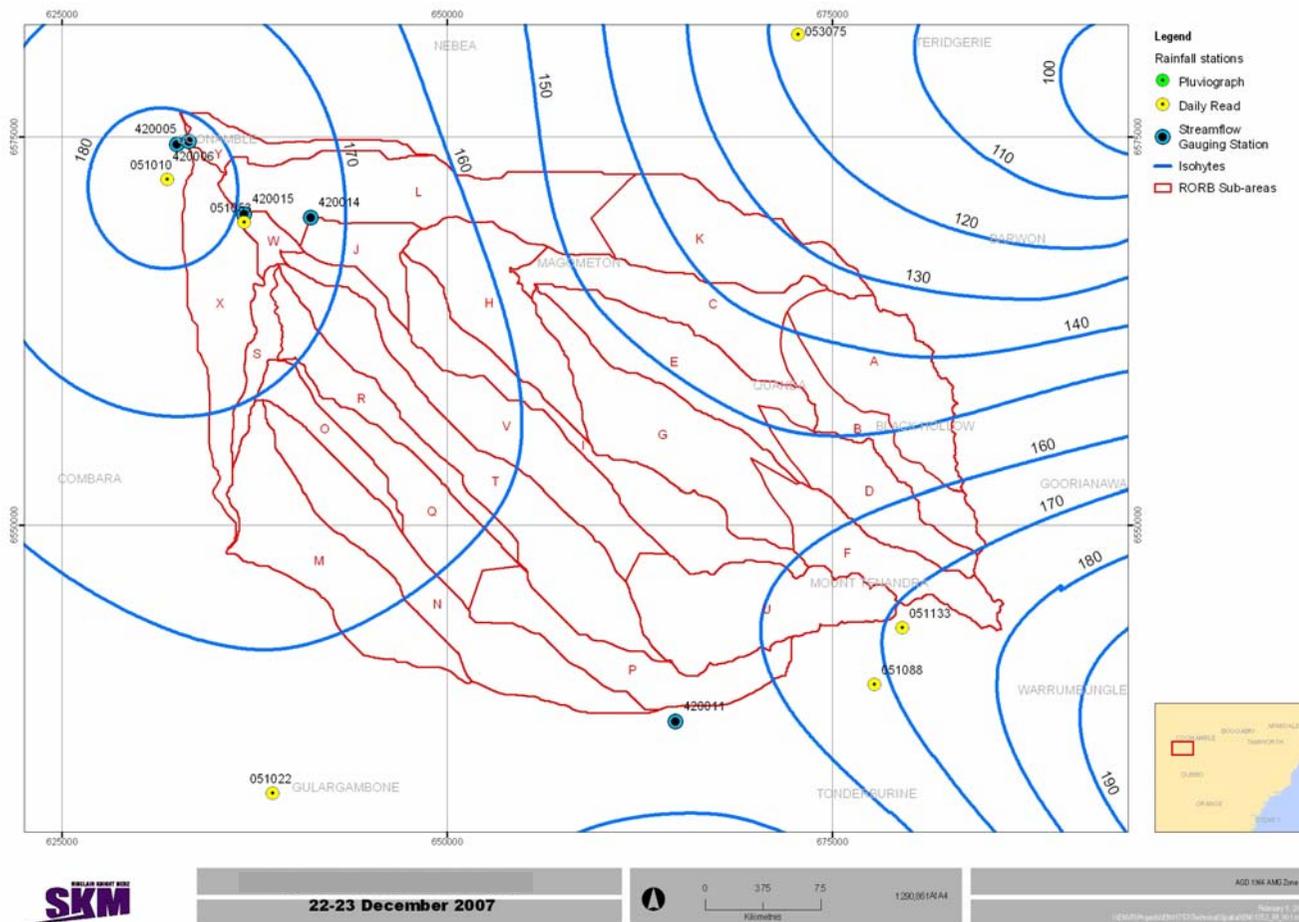
- Warrena Creek @ Warrana; and
- Magometon Creek (Site 3) @ Near Coonamble.

The gauging stations at the above two locations were discontinued a few years ago. Hence, it was necessary to estimate inflow hydrographs for the two locations using the recorded rainfall data for the December 2007 event. A calibrated RORB (refer to **Section 5.2**) model was used to estimate inflow hydrographs for the two locations.

4.6.2.2.1 Spatial Distribution of Rainfall

The available daily rainfall data for the period 22-23 December 2007 were used to derive isohyets over the catchment area of Warrena Creek shown in **Figure 4-15**. Rainfall depths recorded at the rain gauges during the period 22-23 (two days) December 2007 are provided in **Table 4-1**. A rainfall depth of 171mm was recorded at daily read rain gauge Nos. 051161 and 051010 on 22 December 2007 located at Coonamble.

■ **Figure 4-15 Rainfall Isohytes – 22-23 December 2007**





■ **Table 4-1 Recoderd Rainfall Depths During 22-23 December 2007**

Station No	Station Name	Rainfall (mm)
064020	PURLEWAUGH (BYFIELD)	137.4
065034	WELLINGTON (AGROWFLOW)	71.6
051042	QUAMBONE STATION	131.0
052038	COME BY CHANCE STORE	112.0
051161	COONAMBLE AIRPORT AWS	186.4
055268	BOGGABRI (BE-BARA)	62.4
051049	TRANGIE RESEARCH STATION AWS	92.4
051010	COONAMBLE COMPARISON	186.4
051022	GULARGAMBONE (YALCOGRIN ST)	157.0
064046	COONABARABRAN (WESTMOUNT)	203.6
064041	COONABARABRAN (BARINA)	220.0
064008	COONABARABRAN (NAMOI STREET)	190.6
064004	BINNAWAY (WATTLE ST)	150.4
064013	BINNAWAY (HAWTHORNE)	121.0
051133	WARRUMBUNGL (MIAGUNYAH)	172.2
053001	BARADINE POST OFFICE	108.4
053002	BARADINE FORESTRY	91.0
053075	BARADINE (WOODVILLE)	116.0
064022	TOORAWEEAH (DENHAM ST)	142.0

4.6.2.2.2 Rainfall Runoff Modelling using RORB

The RORB model used to simulate design inflow hydrographs for Warrena Creek and Magometon Creek (refer to **Section 5.2**) was used to estimate inflow hydrographs for the December 2007 flood event. Rainfall depths used in the RORB model for the December 2007 event was based on **Figure 4-15**. The pluviograph data for Coonabarabran Airport AWS (064017) was used to define the temporal distribution of rainfall over Warrena Creek Catchment. RORB model parameter values used in the estimation of design floods were also used for the December 2007 flood event. As a result, an initial rainfall loss of 15mm and a continuing rainfall loss of 2.5mm/hour were used. A k_c value of 28 was used for the gauging station on Magometon Creek and a k_c value of 94 was used for the gauging station Warrena Creek @ Warrana.

4.6.2.2.3 Results

A summary of results simulated by the RORB model for the December 2007 flood event is presented in **Table 4-2** and the hydrographs are shown in **Figure 4-16**.



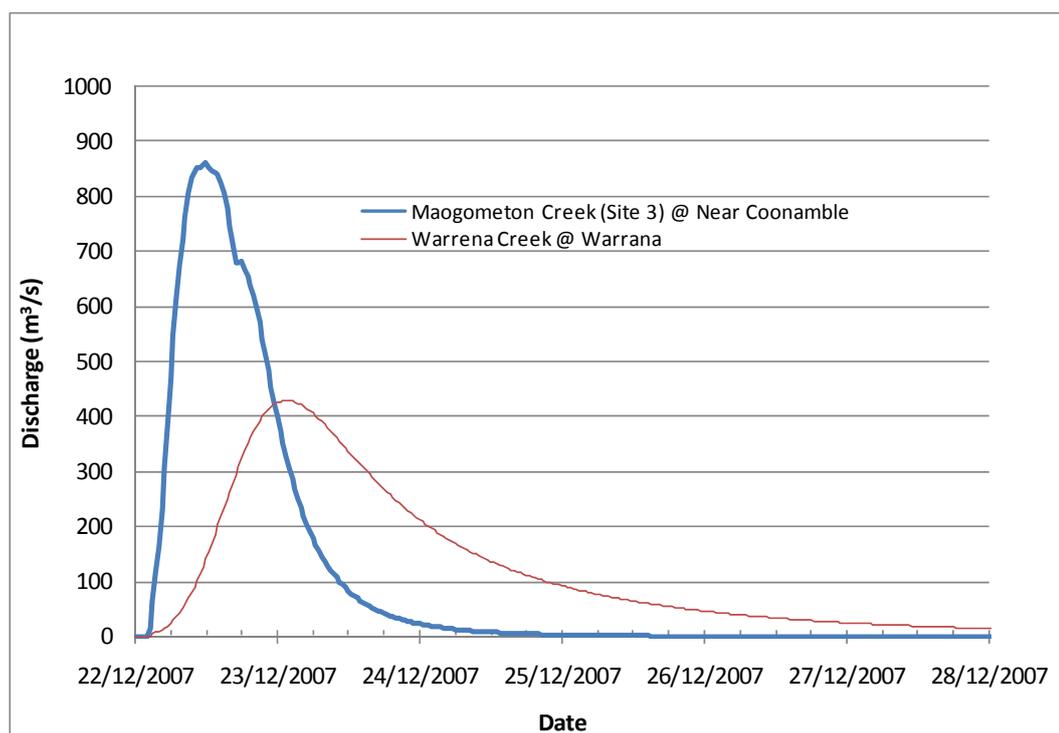
■ **Table 4-2 RORB Model Results – December 2007 Flood**

Gauging Station	Modelled Peak Flow (m ³ /s)	Modelled Total Volume (m ³)
Warrena Creek @ Warrana	429 (300)	6.81E+07
Magometon Creek (Site 3) @ Near Coonamble	861 (905)	5.97E+07

(300) Peak flow for the 100 year ARI event

A comparison of RORB model results with peak flow estimates for the design flood events indicates that the peak flow in Warrena Creek for the December 2007 was higher than a 100 year ARI event. Consequently, the simulated peak flow for the December 2007 event in Magometon Creek was slightly less than the 100 year ARI event.

■ **Figure 4-16 Inflow Hydrographs for the December 2007 Flood Event**





4.6.3 Hydraulic Modelling

4.6.3.1 Updating of the MIKE-11 Model

The following issues were considered before using the MIKE-11 model for validation against larger flood events:

- Flood events used to calibrate (ie. 1998 flood event) and validate the MIKE-11 model for 1999 and 2000 flood events were smaller than a 10 year ARI event at Coonamble. The Strathavon-Bundabulla Breakout did not operate during all calibration and validation flood events.
- The calibration of the MIKE-11 model involved adjustment of the size of breakouts and link channels on the basis of satellite images or other relevant information.
- A section (approximately 50m) of Dubbo-Coonamble Railway was washed out in the vicinity of Geamoney Breakout during the November 2000 flood event. A newspaper article dated 30 November 1950 states that over 1 mile (approximately 1,600 m) of railway line between Coonamble and Combara was washed out. The newspaper article dated 3 March 1955 does not mention any problems with the railway line due to the 1955 flood.

In order to use the MIKE-11 model to validate against larger flood events the following updates were made to the MIKE-11 model:

- Four Additional Breakouts along Dubbo-Coonamble Railway line between Combara and Geamoney Breakout were defined in the MIKE-11 model. These breakouts are defined at cross sections CASTLEREAGH_LB 20100 (Rail_Breakout4), CASTLEREAGH_LB 26300(Rail_Breakout3), CASTLEREAGH_LB 34400 (Rail_Breakout2) and CASTLEREAGH_LB 31800 (Rail_Breakout1). Each breakout was assumed to be 500m long so that the total length of the breakouts was similar to the washed out section of the railway during the 1950 flood. A stage-discharge relationship at each breakout was calculated using the Broad Crested Weir Formula. It was assumed that the weir crest was located half-way between top of rail level and the natural surface level. The difference between the top of rail level and the natural surface is typically around 1m.
- The stage-discharge relationship for the Geamoney Breakout was lowered by 0.5m to represent a washed out section of the railway.
- Representation of the Strathavon-Bundabulla Breakout was refined further and one additional link channel (LINK_CASTLEREAGH_RB_15300) was included in the MIKE-11 model set up.
- Another link channel (LINK_WARRENA_26500) was also included in the MIKE-11 model set up.

Details on the updated MIKE-11 model schematic are presented in **Appendix B.1**.



Cross sections surveyed by Langford & Rowe in 2008 both upstream and downstream of Bibleroi Creek Bridge, were included in the MIKE-11 model. The existing Bibleroi Creek Bridge was represented in the model based on survey data provided by Langford & Rowe. Topographic data provided by Coonamble Shire was used to represent the natural topography in the vicinity of the bridge over Warrena Creek. The existing Warrena Creek Bridge was represented in the MIKE-11 model on the basis of the bridge construction drawings (Nos. 9158-S03 – General Arrangement and 9158-S04 – Long Sections, dated 17 February 2006) prepared by Barnson for Bridging Australia.

The same Manning's n values used for validation of the model for the 1999 and 2000 flood events were used for the December 2007 flood event.

4.6.3.2 Verification of Model Performance

The performance of the updated MIKE-11 model was verified using the following inflow hydrographs:

- Estimated inflow hydrograph for the Castlereagh River
- Estimated inflow hydrographs for Warrena Creek and Magometon Creek shown in **Figure 4-16**.

4.6.3.2.1 Castlereagh River

A comparison between modelled and recorded water level hydrograph for the Castlereagh River @ Coonamble gauge is shown in **Figure 4-17**. The MIKE-11 model satisfactorily reproduced the recorded flood behaviour in the Castlereagh River after the Rating Table No. 130 for the gauge was lowered by 0.178m. The lowering of the rating table by 0.178m was required to get a closer agreement between the recorded and the modelled water levels. It is to be noted that the stage-discharge rating curve for the Castlereagh River @ Coonamble gauge was modified after each major flood event due to changes in bed form of the Castlereagh River. However, the gauge was discontinued in the year 2002 and hence no information was available on the nature of the change in the rating curve for the December 2007 flood event.

The inflow hydrograph used in the Castlereagh River at the upstream boundary of the MIKE-11 model is shown in **Figure 4-18**.

4.6.3.2.2 Coonamble Levee

A comparison of recorded and modelled peak flood levels along Coonamble Levee is shown in **Figure 4-19**. There is generally a good agreement between the modelled and the recorded flood levels along Coonamble Levee.

Flood levels shown in **Figure 4-19** along Coonamble Levee between Dubbo Street and Tooraweenah Road result from flooding in Bibleroi Creek. Flooding in Bibleroi Creek for this

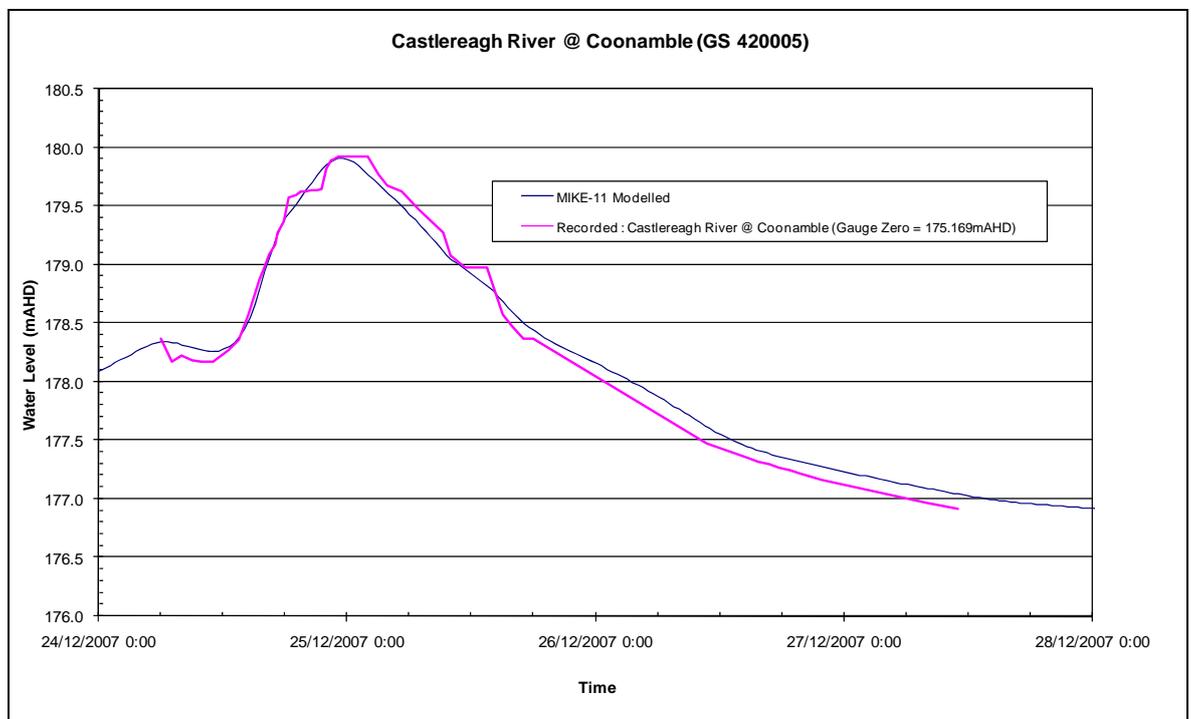


event resulted mainly from breakouts in Warrena Creek upstream of the bridge on Tooraweenah Road. Rainfall runoff generated from the catchment upstream of Bibleroi Creek Bridge was a minor contributor to flooding. Upstream of Bibleroi Creek Bridge, flooding along the levee was due to backwater flooding. However, recorded data indicate some oscillation in flood level upstream of Bibleroi Creek Bridge. The oscillation in recorded flood levels could be due to waves generated by wind.

The MIKE-11 model satisfactorily reproduced the flood behaviour in the vicinity of Bibleroi Creek Bridge. Information on flooding at Bibleroi Creek Bridge for the December 2007 flood event provided by Coonamble Shire indicated that the depth of flooding on the Bridge was approximately 0.5m (ie. 180.0 mAHD). The MIKE-11 model simulated a peak flood level of 180.15 mAHD just upstream of the bridge.

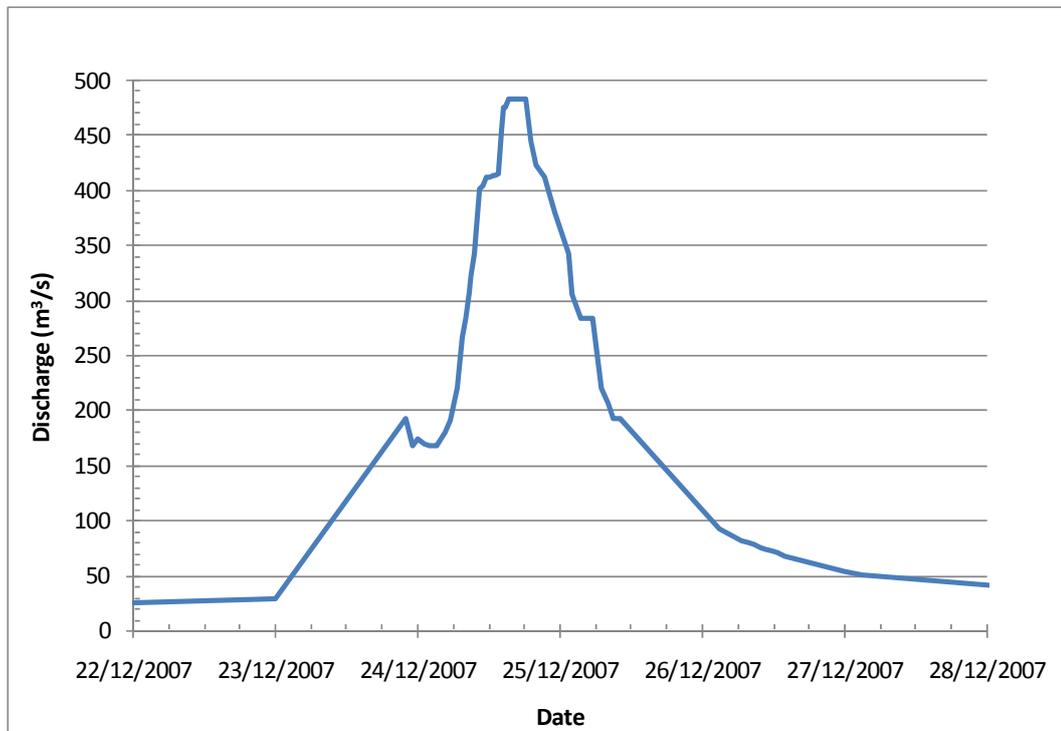
Except for the two recorded flood levels along Warrena Creek (between Tooraweenah Road and Baradine Road), all other flood levels were generally reproduced well by the MIKE-11 model. The two recorded flood levels in question are lower than the downstream flood levels.

■ **Figure 4-17 Comparison of Water Level Hydrographs for December 2007 Event**

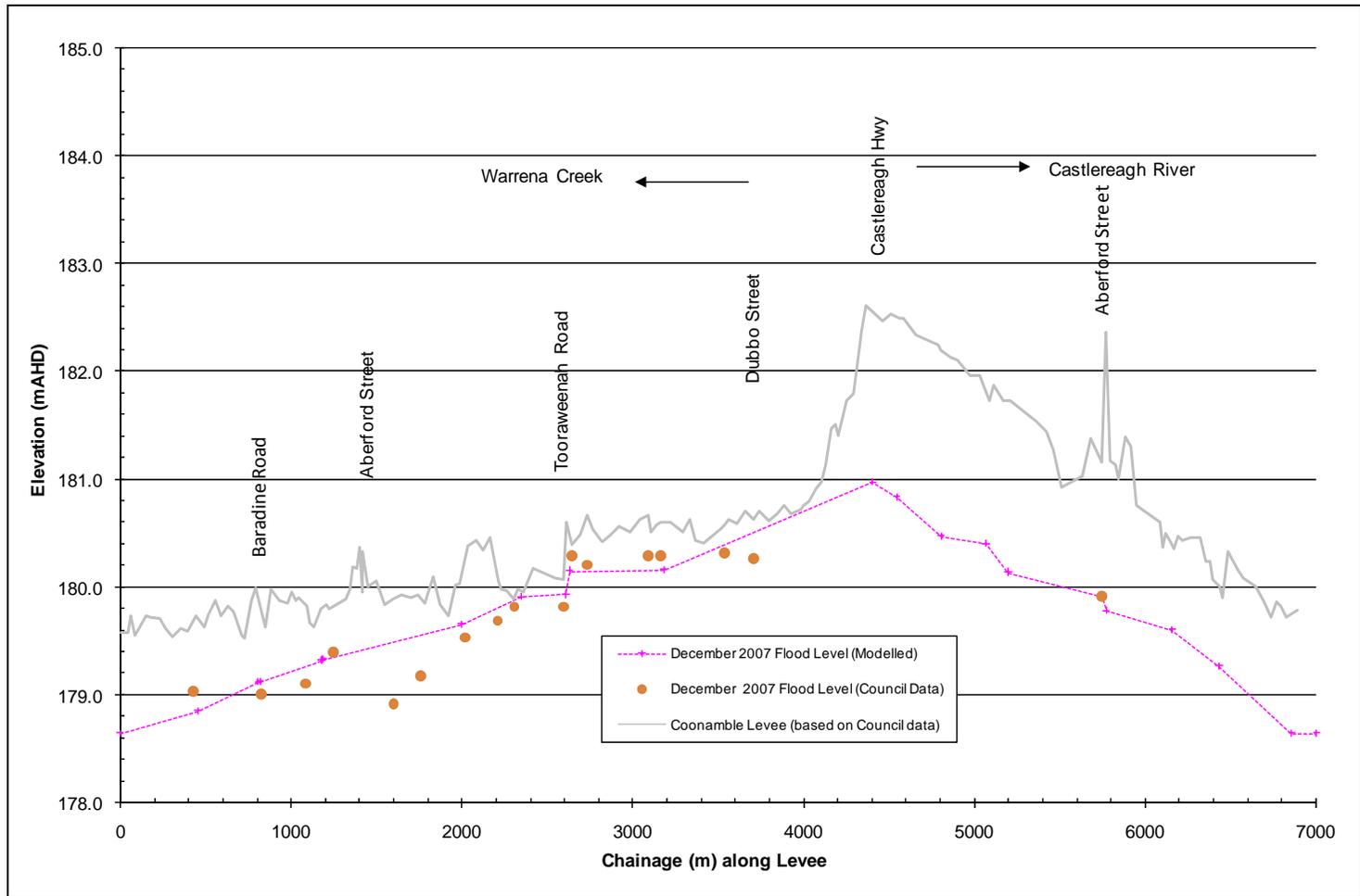




■ **Figure 4-18 Inflow Hydrograph for the Castlereagh River used in the MIKE-11 Model**



■ **Figure 4-19 Comparison of Modelled and Recorded Flood Levels along Coonamble Levee**





4.6.3.2.3 Tooraweenah Road at Warrena Creek Bridge

The Tooraweenah Road Bridge on Warrena Creek is located approximately 5 km upstream of the Coonamble Levee. Information provided by Coonamble Shire was used to estimate December 2007 flood levels in the vicinity of the Tooraweenah Road Bridge. The depth of flooding above the concrete weir located approximately 15m downstream of the Bridge was estimated at 5.015m by Coonamble Shire. The crest of the concrete weir, according to topographic survey data provided by Coonamble Shire, is at RL 178.23 mAHD. Hence, the December 2007 flood level at the concrete weir was located at about RL 183.24mAHD. It is expected that officers from Coonamble Shire used debris mark at the Bridge to estimate flood depth on the concrete weir and hence the flood level at the upstream face of the Bridge was RL 183.24 mAHD. The MIKE-11 model simulated a peak flood level of 182.706 mAHD upstream of Tooraweenah Road Bridge. The flood level simulated by the MIKE-11 model was approximately 0.5m lower than the flood level estimated by Coonamble Shire.

There is a paucity of topographic data upstream of the Bridge. The upstream cross section is located approximately 6 km upstream of the Bridge. The inflow hydrograph for Warrena Creek used in the MIKE-11 model for the December 2007 flood event was estimated using the available data for this storm. The temporal distribution of rainfall used in the estimation of the inflow hydrograph was based on a pluviograph data that was located outside the catchment area of Warrena Creek. Considering all these uncertainties and the relatively low importance of estimated flood levels at this location on the outcome of this study, no attempt was made to improve the performance of the MIKE-11 model at Warrena Creek Bridge.

Results from a sensitivity analysis indicated that a 30% increase in discharge for Warrena Creek @ Warrana resulted in a peak flood level upstream of the bridge that closely agreed with the flood level provided by Coonamble Shire. A 30% increase in discharge for Warrena Creek @Warrana resulted in a maximum increment in peak flood level of 0.06m in Warrena Creek along Coonamble Levee for the December 2007 flood event.

4.6.4 Conclusions

The additional topographic survey undertaken by Langford & Rowe in 2008 confirmed that the topographic data provided by Coonamble Shire was consistent with the topographic data surveyed by Langford & Rowe in 2005. Topographic survey data provided by Coonamble Shire along the Levee provided more detailed information on the levee than those extracted from DECC's database.

Recorded flood levels in Warrena Creek for the December 2007 event were higher than those for the 1974 flood event. However, the recorded flood level in the Castlereagh River for the December 2007 event was significantly lower than that for the 1974 flood event.



In the absence of recorded streamflow data in Warrena Creek, the calibrated RORB model was used to estimate inflow hydrographs in Warrena Creek and Magometon Creek using the recorded rainfall data. Recorded water levels in the Castlereagh River were used to estimate the inflow hydrograph in the Castlereagh River.

The existing Bibleroi Creek Bridge and Tooraweenah Road Bridge on Warrena Creek were included in the MIKE-11 model. The estimated inflow hydrographs were used in the updated MIKE-11 model to obtain water levels and discharges at all model cross sections.

A comparison of modelled and recorded peak flood levels along Coonamble Levee indicated a satisfactory performance of the MIKE-11 model. Modelled flood levels along the levee were within 0.2m of the recorded flood levels.

4.7 Validation of Model against 1955 Flood

The three calibration floods (1998, 1999 and 2000) and the the December 2007 flood were all relatively small events in the Castlereagh River (smaller than a 10 year ARI event at Coonamble). The Strathavon-Bundabulla Breakout did not operate during all calibration and validation flood events. It was considered necessary to verify the performance of the MIKE-11 model against 1955 flood event to have reasonable confidence in its performance against major flooding in the Castlereagh River.

4.7.1 Model Amendments to Reflect 1955 Floodplain Conditions

In the case of the validation of the model for the 1955 flood events the following changes were made to the model to represent the conditions that existed at the time:

- The existing bridge on the Castlereagh River at Coonamble was replaced with the Old Timber Bridge.
- Existing Bridges on Warrena Creek and Bibleroi Creek were replaced with old timber bridges and road embankments removed.
- Warrena Weir removed.
- Warrena Creek cross sections extended to include the floodplain located inside Coonamble Levee.
- Surveyed floodplain cross sections for Warrena Creek were extended using the available 10m contour data to represent the entire floodplain located along the eastern floodplain of the Creek.

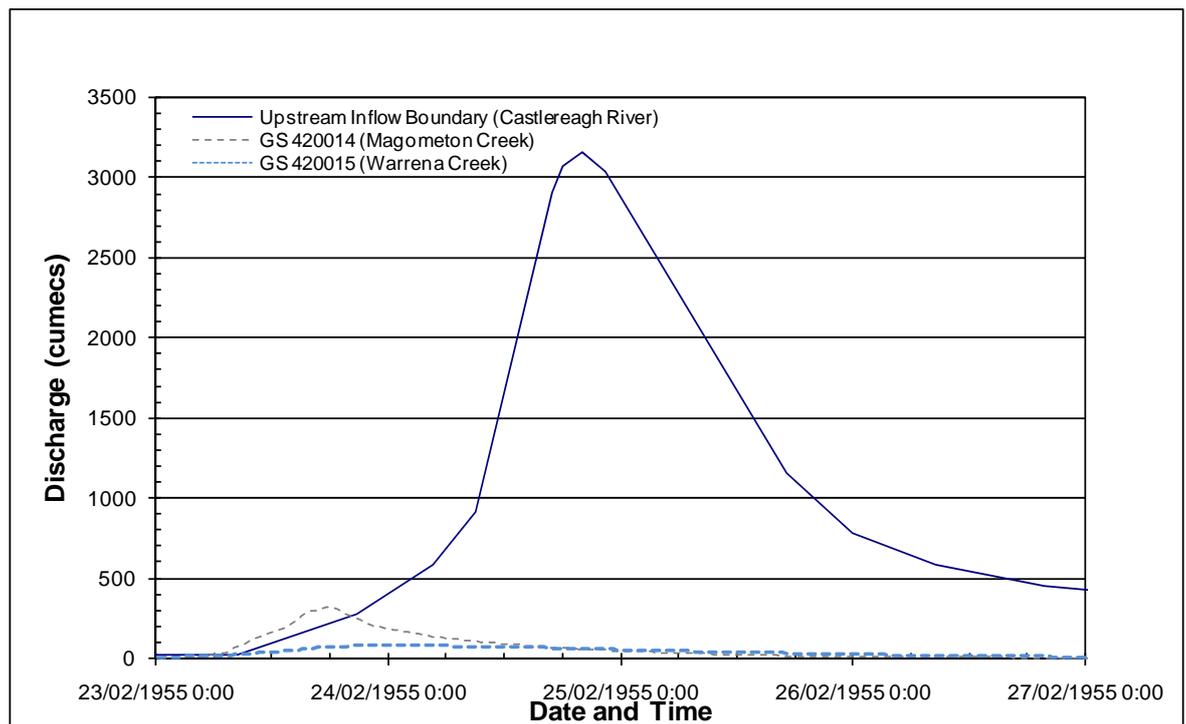
The same Manning's n values used for validation of the model for the 1999, 2000 and 2007 flood events were used for the 1955 flood event



4.7.2 Estimation of Inflow Hydrographs

Inflow hydrographs (refer to **Figure 4-20**) used in the MIKE-11 model for the 1955 flood event was sourced from the following:

- Upstream boundary of the Castlereagh River – 1955 inflow hydrograph presented in Rankine & Hill (1993) report for the Castlereagh River @ Gilgandra Gauge.
- Warrena Creek Catchment – Hydrographs for the 1955 flood event are not available as gauging stations were not established until 1969. Hence, recorded largest inflow hydrographs in Warrena Creek Catchment were used. Recorded discharge hydrographs for the July 1998 flood event had the highest peak discharge both in Warrena Creek and in Magometon Creek. Recorded inflow hydrographs for the July 1998 for Warrena Creek @ Warrana gauge and Magometon Creek (Site 3) @ Near Coonamble shifted in time to maintain the same lag time between the peak flows in the Castlereagh River and in Warrena Creek for the July 1998 flood event.
- **Figure 4-20 Inflow Hydrographs used for the 1955 Flood Event**



4.7.3 Results for 1955 Flood

The recorded 1955 peak flood level in the Castlereagh River @ Coonamble gauge was 180.76 mAHD. The MIKE-11 model simulated a peak flood level of 180.65 mAHD at the Castlereagh River @ Coonamble gauge which is 0.11m lower than the recorded flood level. The MIKE-11

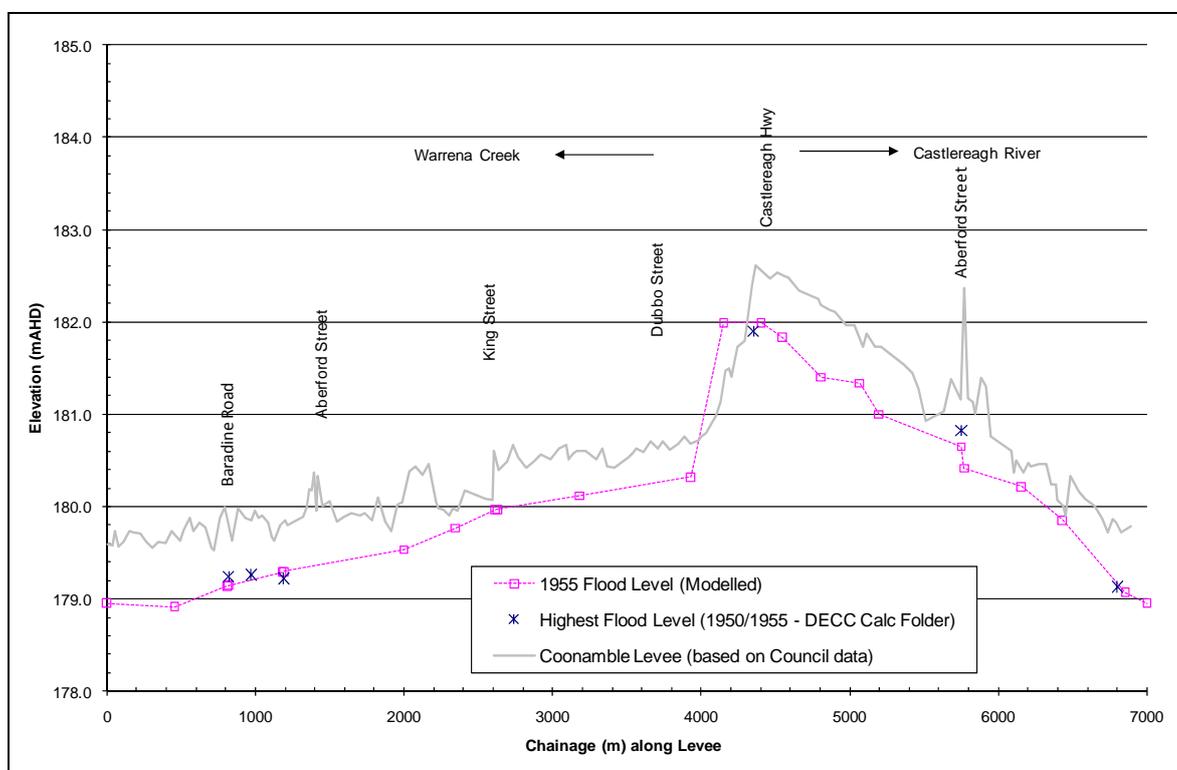


model simulated a peak flood level of 206.08 mAHD at “Horans”. The recorded 1955 peak flood level at “Horans” was 206.14 mAHD.

A comparison between modelled and recorded Highest Flood Levels (HFLs) for 1950/1955 flood events is shown in **Figure 4-21**. Modelled flood levels along the levee were within 0.17m of the recorded HFLs for the 1950/1955 flood events. Modelled peak flood levels and discharges for this event are given in **Appendix B.6**.

Upstream of Aberford Street along Warrena Creek, levee chainages and flood profile chainages do not correspond and hence it was necessary to estimate peak flood levels (shown in **Figure 4-21**) at levee Chainages 3930m and 4150m. The velocity head (ie. $v^2/2g$) at Bibleroi Creek Bridge was added to the modelled peak flood levels upstream of Bibleroi Creek (ie. Levee Chainage 3180m) to estimate the peak flood level at Levee Chainage 3930m. The peak flood level at Levee Chainage 4403m was used to estimate the peak flood level at Levee Chainage 4150m.

■ **Figure 4-21 Comparison of Modelled and Recorded HFLs (1950/1955) along Coonamble Levee**





4.8 Conclusions on Model Calibration and Verification

The events used in the model calibration and validation process cover a range of broad flood scenarios:

- Relatively recent small events in both the Castlereagh River and Warrena Creek catchment (1998, 1999 and 2000)
- A recent large flood in Warrena Creek catchment with minor flooding in the Castlereagh River (2007) and
- A large historic flood in the Castlereagh River with minor flooding in Warrena Creek catchment.

The ability of the MIKE-11 model to satisfactorily reproduce the flood behaviour for a variety of different flood scenarios for which information is available involving both the Castlereagh River and Warrena Creek is indicative of a robust model that can be used with reasonable confidence to model flood behaviour, particularly in the immediate vicinity of Coonamble. Beyond the immediate vicinity of Coonamble confidence in the ability of the model to simulate flood behaviour is reduced due to the lack of observed historical flood data to calibrate and validate the model.

Streamflow monitoring at all three gauging sites used as input into the MIKE-11 model were ceased a few years ago. It is recommended that DECCW, SES and Coonamble Shire develop a strategy to monitor future flooding within the study area.



5 Hydrology for Design Events

Hydrologic analysis involving estimation of inflows for the Castlereagh River and in Warrena Creek was included in the scope of the study for the selected design flood events identified in **Section 1.4** of this report. Details on the methodology used to estimate inflow hydrographs for the selected design flood events in the Castlereagh River and Warrena Creek are discussed in the following sections.

5.1 Castlereagh River

An inflow boundary is defined in the MIKE-11 model upstream of the Strathavon-Bundabulla Breakout and hence inflows for the selected design events need to be estimated. The following factors were considered in the estimation of inflow hydrographs for the selected design events:

- The catchment area of the Castlereagh River at the Strathavon-Bundabulla Breakout is approximately 8,000 km². Considerable effort is required to develop a hydrologic model to estimate design inflow hydrographs for such a large catchment and consequently, undertaking a rainfall-runoff modelling for the Castlereagh River is outside the scope of this study;
- The rating curve for the gauging station on the Castlereagh River at Coonamble is based on flow measurements in the Castlereagh River and does not include flows that escape the river upstream of Coonamble. Hence a flow frequency analysis cannot be undertaken to estimate the total flow in the Castlereagh River upstream of the Strathavon-Bundabulla Breakout ; and
- The rating curve for the gauging station on the Castlereagh River at Coonamble is generally modified after each flood. This is likely to be due to changes in bed forms of the Castlereagh River after each flood.

Considering the above issues it was found that the gauging station on the Castlereagh River at Gilgandra was the only nearest gauging site upstream of Coonamble that could be used to estimate design inflows in the Castlereagh River at the Strathavon-Bundabulla Breakout. However, it should be noted that this gauge was discontinued in 1982. Details on the gauging site are presented in **Section 3.4** of the report.

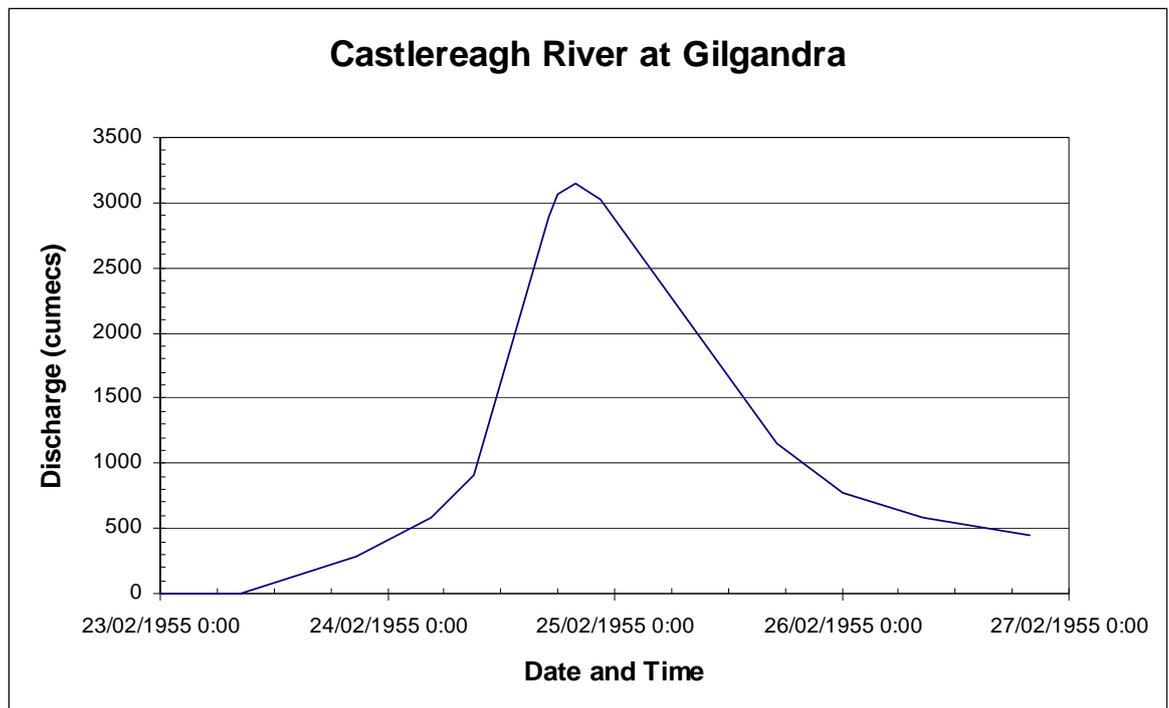
The 1955 flood is the highest observed at Gilgandra and the discharge hydrograph is presented in the study report prepared by Rankine & Hill in 1983 and is shown in **Figure 5-1**. It should be noted that later studies (DWR 1994 and Lyall & Macoun 1996) adopted a peak discharge of 4,000 m³/s for the 1955 flood in the Castlereagh River at Gilgandra considering the following limitations on the accuracy of the magnitude of the peak discharge estimate:

- The highest gauged flow level in the Castlereagh River @ Gilgandra gauge is only 3.8m (405 m³/s). This gauging was undertaken in 1976. The maximum recorded gauge level in the Castlereagh River at Gilgandra gauge occurred in February 1955. The gauge recorded a level



of 10.06m for this event. Hence, estimation of the peak discharge for the 1955 flood event involved huge extrapolation of the rating curve. The 1955 flow in the Castlereagh River at Mendooran, an upstream gauging station with a good (as noted by Gauging Engineer) high water rating curve, was estimated to be 492,000 ML/day whereas the Gilgandra rating curve estimation was 358,000 ML/day, with no significant outflow between the stations.

■ **Figure 5-1 1955 Discharge Hydrograph - Castlereagh River at Gilgandra**



Source: Rankine & Hill (1983), New South Wales Inland Rivers Floodplain Management Studies, Castlereagh Valley

A pragmatic approach is used in this study to estimate the inflow hydrograph upstream of the Strathavon-Bundabulla Breakout for the 50 year and 100 year ARI events. The approach involves the following:

- Adoption of the peak discharges for the 50 year and 100 year ARI events from the Gilgandra Floodplain Management Study (Lyall & Macoun 1996) and scaling up peak discharges to cater for the increased catchment area of the Castlereagh River between Gilgandra and the Strathavon-Bundabulla Breakout.
- Utilisation of the shape of the discharge hydrograph for the 1955 event (shown in **Figure 5-1**) to estimate the resulting inflow hydrographs for a preliminary estimate on 50 year and 100 year ARI events.

Outcomes from the above are provided in **Section 6.1.2**.



5.2 Warrena Creek

Two inflow boundaries of the MIKE-11 model were defined at the following locations:

- Warrena Creek @ Warrana; and
- Magometon Creek (Site 3) @ Near Coonamble.

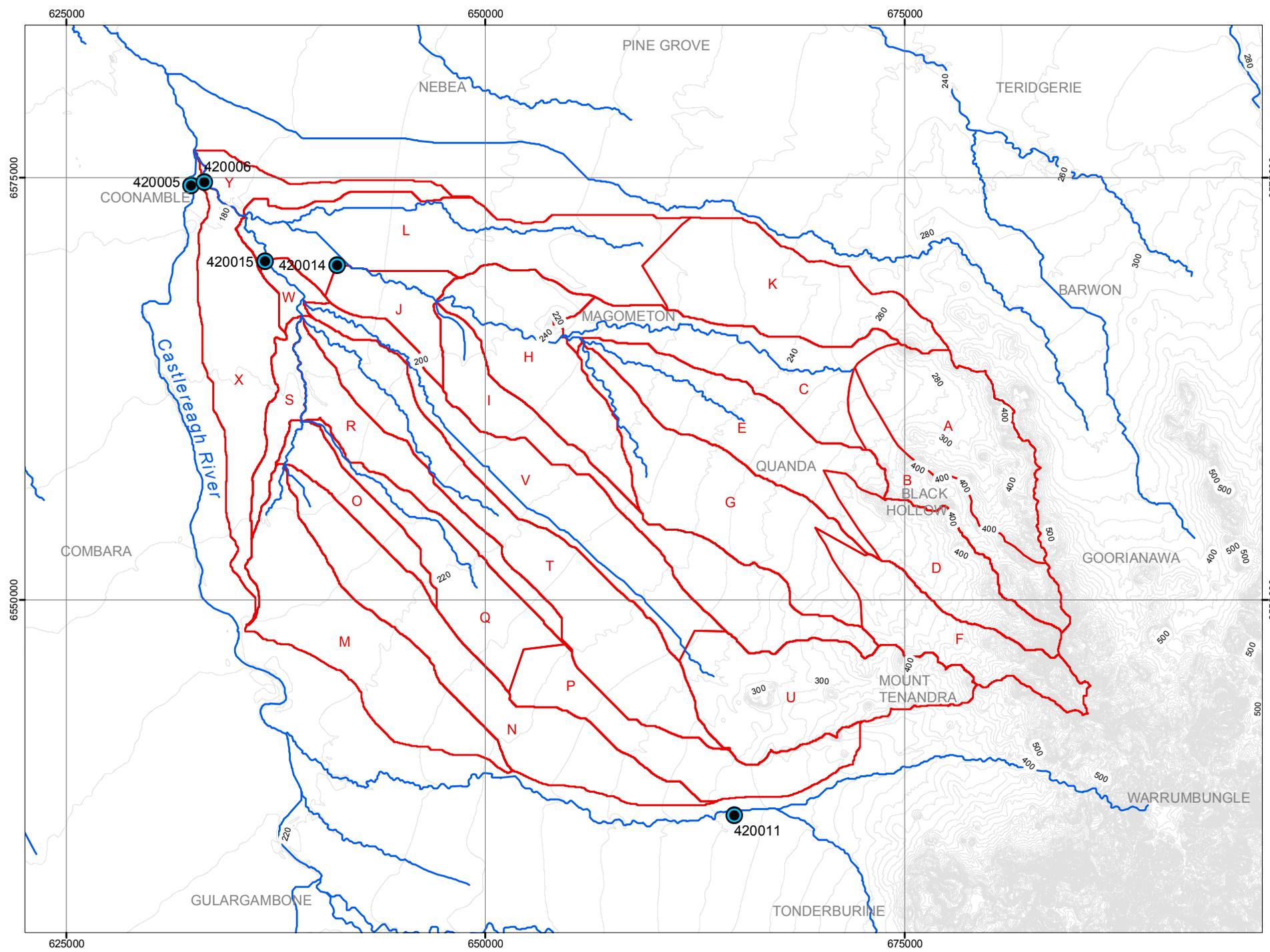
Magometon Creek is a tributary of Warrena Creek. Warrena Creek rises on the western slopes of the Warrumbungle Range. Catchment areas of Warrena Creek and Magometon Creek are shown in **Figure 5-2**. Warrena Creek has a catchment area of approximately 580 km² at the gauging station Warrena Creek @ Warrana (GS 420015). Magometon Creek drains a catchment of approximately 540 km² at the gauging station located at “Near Coonamble” (GS 420014).

The upper catchment area representing approximately 30% of the total catchment of Magometon Creek at the gauging station located “Near Coonamble” is situated on relatively steep slopes with ground levels located between 300m to a maximum of 900m above sea level. The upper catchment area of Warrena Creek above the gauging station located at Warrana is relatively flat with the exception of a few isolated hills with the maximum peak being about 500m above sea level.

Estimation of discharge hydrographs for the two locations involved rainfall runoff modelling. Details on the estimation of the design inflow hydrographs for the two locations are discussed in the following sections.

5.2.1 Selection of the Rainfall Runoff Model

The runoff routing model that was selected for this study is the **RORB model version 5.32**. This model is one of the most widely used models of its type in Australia, and consequently there is substantial information available on the value of the model parameters for a wide range of catchments. The model has the capability to simulate both linear and non-linear catchment behaviour, and exhibits many desirable modelling features such as areally distributed inputs, flexible reservoir-routing options, and the ability to model flows at a number of points throughout the catchment.



- Legend**
- Streamflow Gauging Station
 - Stream Network
 - 10m Contours
 - RORB Sub-areas



Figure 5.2: Warrena Creek Catchment





5.2.2 Model Calibration

5.2.2.1 Selection of Events

On the basis of the available streamflow and rainfall data the following events were selected for calibration of the RORB model:

- 18-25 July 1998;
- 1 - 11 April 1999; and
- 17-23 November 2000.

All above events have in excess of 20mm of runoff. Availability of pluviograph data for the calibration events was checked with the Bureau of Meteorology (BoM). Information provided by BoM confirmed that no pluviographs were located within the Warrena Creek catchment. Information provided by BoM further revealed that the nearest (from the Warrena Creek catchment) pluviograph was located at Coonabarabran Echo (Station No. 064046).

It is to be noted that the selected events are smaller than a 10 year ARI event in the Castlereagh River. Hence, it is expected that these events would also be relatively frequent in the Warrena Creek catchment.

5.2.2.2 Spatial Distribution of Rainfall

For each selected storm event the available pluviograph and daily rainfall station data were used to derive isohyets over the catchment area of Warrena Creek. Rainfall isohyetal patterns for the three calibration events are presented in **Appendix C**. Rainfall for the period 18-25 July 1998, 1-11 April 1999 and 17-23 November 2000 were used to derive the isohyetal patterns for the three events.

5.2.2.3 Configuration of the RORB Model

The 25m x 25m digital elevation data for whole NSW is available in SKM. SKM sourced the data from NSW Department of Lands. The 25mx25m digital elevation data was used to delineate sub-areas for the RORB model in GIS. The sub-areas within the RORB model were defined to coincide with watershed boundaries and stream junctions, and the location of streamflow gauging stations. Ten sub-areas were defined upstream of the Magometon Creek gauge at Near Coonamble and thirteen sub-areas were defined upstream of the Warrena Creek gauge at Warrana. Sub-areas used in the RORB model are shown in **Figure 5-2**. Rainfall depths for the sub-areas for each calibration event were estimated using GIS.

5.2.2.4 Calibration Procedure

Calibration of model parameters was undertaken by trial and error so as to obtain the best possible agreement between observed and estimated hydrographs. The approach to the fitting procedure



was to determine loss parameter values which gave acceptable reproduction of the initial rise and volume of the observed hydrograph, and then to determine the optimum combination of routing parameters that yielded the best fit to the observed hydrograph.

5.2.2.5 Calibration Results

The initial / continuing loss model in RORB was used for model calibration. A summary of the calibration results is presented in **Table 5-1**. Hydrographs of these calibrations are given in **Appendix C**.

■ **Table 5-1 RORB Model Calibration Results**

Event	Peak Flow (m ³ /s)		Total Volume (m ³)		k _c	m	IL (m m)	CL (mm/h r)
	Observed	Modelled	Observed	Modelled				
Warrena Creek at Warrana (GS 420015)								
Jul-98	89	89	1.82E+07	1.77E+07	78	0.8	30	1.32
Apr-99	37	37	1.34E+07	1.32E+07	110	0.8	40	2.57
Nov-00	76	74	2.60E+07	2.49E+07	95	0.8	16	0.86
Magometon Creek (Site 3) at Near Coonamble (GS 420014)								
Jul-98	320	314	2.46E+07	2.46E+07	22	0.8	35	0.95
Apr-99	159	156	1.30E+07	1.31E+07	34	0.8	52	2.71
Nov-00	75	74	1.45E+07	1.46E+07	34	0.8	23	1.06

Calibration results presented in **Table 5-1** show a wide range of variation in RORB model parameter k_c for all three events at the Warrena Creek gauge. The range of variation of k_c value is however, less pronounced at the Magometon Creek gauge. It is to be noted that the contributing catchment area at both gauging stations is almost the same however there is a wide variation in k_c values between the two gauging sites. This could be due to the flat terrain of the upper catchment area of the Warrena Creek gauge at Warrana. **Table 5-1** show a wide range of variation in initial loss (IL) and continuing loss for all three events.

Calibration results presented in **Appendix C.2** show that the RORB model was able to reproduce peak discharges satisfactorily for all events at both gauging sites. The RORB model reproduced the shape of the hydrograph for the gauging site Warrena Creek at Warrana satisfactorily for July 1998 and April 1999 events. Reproduction of the shape of the recorded hydrographs for the same events at Magometon Creek gauging site was generally acceptable. However, the RORB model was unable to reproduce the shape of the hydrographs for the November 2000 event at both gauging sites properly. This could be due to the fact that the pluviograph data used to define the temporal distribution of rainfall for the calibration event was located outside the study catchment and was not representative of the temporal distribution of rainfall for the November 2000 event.



5.2.3 Model Validation

Due to paucity of historic rainfall and streamflow data and the wide range of variation in RORB model parameter values amongst calibration events, validation of the RORB model against other recorded events was not undertaken.

5.2.4 Input Data for Design Flood Estimation

5.2.4.1 Rainfall Depths

The rainfall design data necessary for this study was generated by extracting the required rainfall parameters from Australian Rainfall and Runoff Volume 2 (ARR87). This rainfall data were inserted into the selected runoff routing model to generate the required storm files. Therefore the catchment was represented by one rainfall zone that had the following characteristics as shown in **Table 5-2**. The derivation of the rainfall intensity, frequency and duration (IFD) relationship was based on data presented in **Table 5-2**.

■ **Table 5-2: Data Used to Estimate Rainfall IFD**

Zone	2
1 hour 2 year ARI mm/hr	29.0
12 hour 2 year ARI mm/hr	4.75
72 hour 2 year ARI mm/hr	1.3
1 hour 50 year ARI mm/hr	59.0
12 hour 50 year ARI mm/hr	9.75
72 hour 50 year ARI mm/hr	2.6
Skewness G	0.275
Geographical factor 2 year ARI F2	4.32
Geographical factor 50 year ARI F50	15.75

5.2.4.2 Areal Reduction Factors

Areal reduction factors based on Siriwardena and Weinmann formulation within RORB (Laurenson et al 2006) were used.

5.2.4.3 Temporal Patterns

The temporal patterns for durations for 50 and 100 year ARI events were obtained from ARR87 for Zone 2.

5.2.4.4 RORB Model Parameters

■ Initial Loss and Continuing Loss

The initial loss values used for the 50 and 100 year ARI events were estimated based on Walsh et al. (1991) who undertook an extensive study on the initial loss for a broad catchment area of NSW. An initial loss of 15mm was used for the 100 year ARI event and an initial loss of



20mm was used for the 50 year ARI event. A continuing rainfall loss rate value of 2.5 mm/hr was adopted for both the 50 and 100 year ARI events based on Book II of AR&R 2003.

- **k_c and m Parameters**

A fixed value of 0.8 was adopted for m. The average k_c value obtained from calibration results for July 1998 and April 1999 events was adopted. As a result a k_c value of 28 was adopted for the gauging site in Magometon Creek and a k_c value of 94 was adopted for the gauging station Warrena Creek at Warrana.

The difference of storage routing effects between Warrena Creek catchment and Magometon Creek catchment for the calibration events suggests that comparisons of k_c values with regional k_c relationships may not be appropriate for the Warrena Creek catchment.

In the case of the Magometon Creek catchment, regional k_c relationships result in k_c values between 22 (Kleemola, 1987) and 63.5 (Lipp, 1983). The Kleemola relationship is recommended in AR&R (2003) for use in Eastern NSW including catchments on the Tablelands and Upper Western Slopes. The Lipp relationship is recommended in AR&R (2003) for use on the Western Region of NSW. Calibration results indicate that Magometon Creek catchment is more representative of catchments on the Tablelands and upper Western Slopes. Given the range of variability of k_c values resulting from the two regional relationships, a k_c value of 28 obtained from calibration results was adopted for Magometon Creek catchment.

5.3 Validation of Design Flood Estimates

The RORB model for Warrena Creek was run for a range of design storm durations between 1 hour and 72 hours for the 50 year and 100 year ARI events. Estimated peak flows at the two gauging sites using the RORB model are given in **Table 5-3** and hydrographs are shown in **Figure 5-3**. At the two locations design peak flows for both the 50 year and 100 year ARI events resulted from the 18 hour storm.

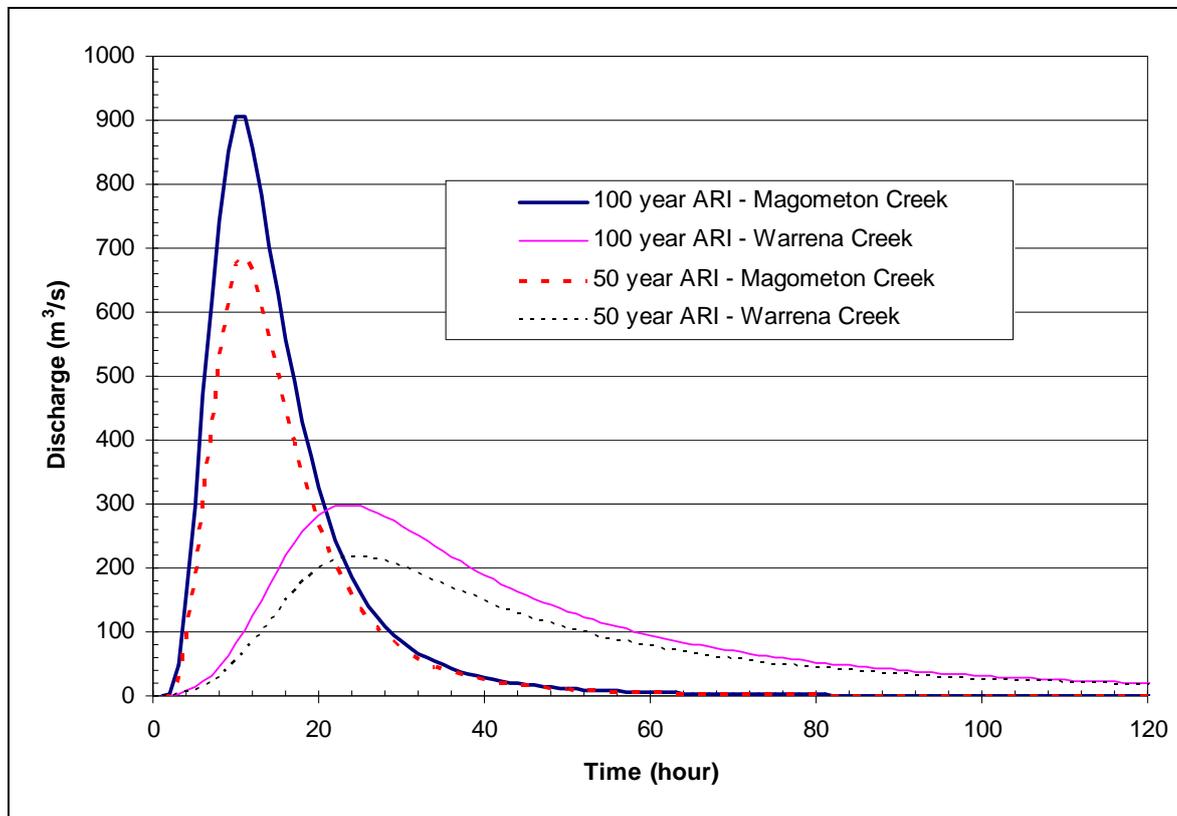
- **Table 5-3: Estimated Peak Flows for Design Floods**

Location	Catchment Area (km ²)	Peak Flow (m ³ /s) - 50 year ARI	Peak Flow (m ³ /s) - 100 year ARI
Warrena Creek @ Warrana	583	210	300
Magometon Creek (Site 3) @ Near Coonamble	540	690	905

Adequate data to undertake at-site flood frequency analysis is not available at both gauging sites. The catchment area contributing to both gauging sites is greater than 250 km² and hence the Probabilistic Rational Method (AR&R 2003) may not provide a reasonable estimate on the design peak flows for the catchments. Moreover, both catchments are located west of the published C_{10} values in AR&R and hence a C_{10} value of 0.1 is to be adopted.



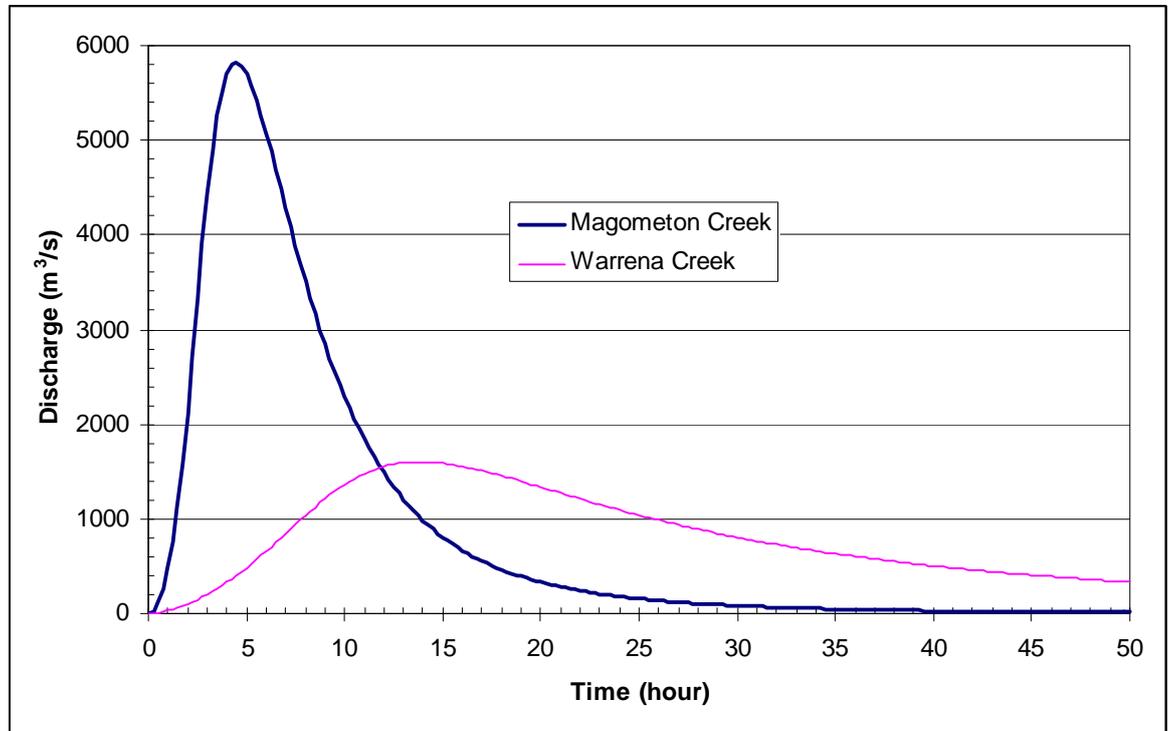
■ Figure 5-3 Design Inflow Hydrographs for 50 and 100 year ARI events



The Generalised Short Duration Method (BoM, 2003) was used to estimate rainfall runoff for the two catchments. Both catchments are located within the zone where the Generalised Short Duration Method is valid for storm duration up to 3 hours and a maximum catchment size of 1000 km². An initial rainfall loss of 0mm and a continuing rainfall loss of 1mm/hr were used to estimate rainfall runoff resulting from PMP events of 15 minutes to 3 hours. The three hour PMP event resulted in peak flows for both catchments. The three hour PMP is considered as the PMF for Warrena Creek. Hydrographs for the PMF event are shown in **Figure 5-4**.



■ **Figure 5-4 Discharge Hydrographs for the PMF Event**





6 Flood Gradient Sensitivity Analysis

6.1 MIKE-11 Model Used for Simulation of Design Flood Events

6.1.1 Model Schematic

The MIKE-11 model that was used in model validation was used in design flood simulations. Cross sections for Warrena Creek floodplain were extended to represent the entire eastern floodplain of the creek in the model.

Floodwaters were not allowed to enter inside Coonamble Levee although flood levels outside the levee may be above the crest of the levee for some events. Manning's n values used in the calibration and validation were used for simulation of design flood events.

6.1.2 Design Inflows

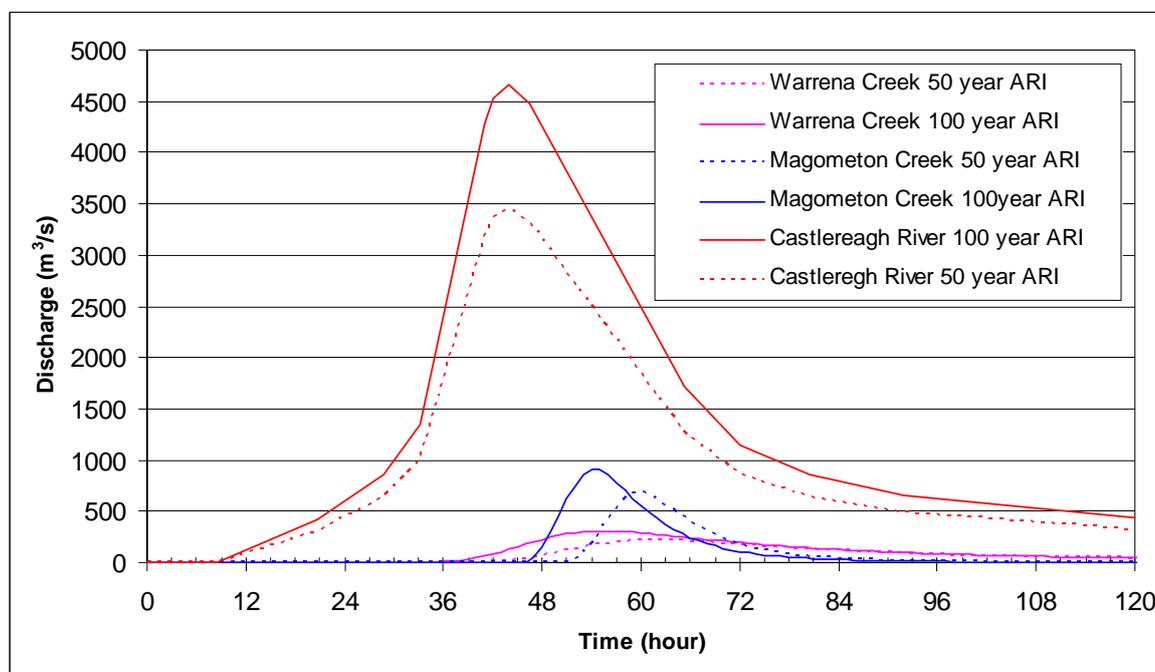
The discharge hydrograph for the 1955 flood event at Gilgandra (shown in **Figure 5-1**) in conjunction with the design discharges for Gilgandra adopted in the DWR 1994 and Lyall & Macoun 1996 studies were used to estimate 50 year and 100 year ARI inflow hydrographs in the Castlereagh River upstream of the Strathavon-Bundabulla Breakout. The ordinates of the hydrograph (shown in **Figure 5-1**) were multiplied by 1.1 to obtain the inflow hydrograph (peak flow 3450 m³/s) for the 50 year ARI event in the Castlereagh River upstream of the Strathavon-Bundabulla Breakout. The ordinates of the hydrograph (shown in **Figure 5-1**) were multiplied by 1.48 to obtain the inflow hydrograph (peak flow 4660 m³/s) for the 100 year ARI event flood in the Castlereagh River upstream of the Strathavon-Bundabulla Breakout. The multipliers adopted to obtain the design inflow hydrographs were based on judgement so that the resulting design flood levels were in reasonable agreement with the stage-probability plot for Coonamble gauge presented in the Coonamble Flood Scoping Study Report (SKM 2002).

The adopted peak discharges for the 50 and 100 year ARI events in the Castlereagh River upstream of the Strathavon-Bundabulla Breakout are 15% greater than the corresponding peak discharges adopted in the DWR 1994 and Lyall & Macoun 1996 studies for Gilgandra. The catchment area of the Castlereagh River @ Coonamble gauge is almost 32% larger than that at the Castlereagh River @ Gilgandra gauge (refer to **Table 3-2**). A 15% increment in design discharge for a 32% larger catchment is considered a reasonable estimate.

Inflow hydrographs for Warrena Creek and Magometon Creek were timed to coincide with breakouts from the Castlereagh River into Warrena Creek. The time of arrival of the peak breakout flow into Warrena Creek was estimated by running the model with the Castlereagh River inflow hydrograph only. The breakout flow for the 50 year ARI event was found to arrive approximately 5 hours later than the peak breakout flow for the 100 year ARI event. Adopted design flows for 50 year and 100 year ARI are shown in **Figure 6-1**.



■ **Figure 6-1 Adopted Discharge Hydrographs for 50 year and 100 year ARI Events**



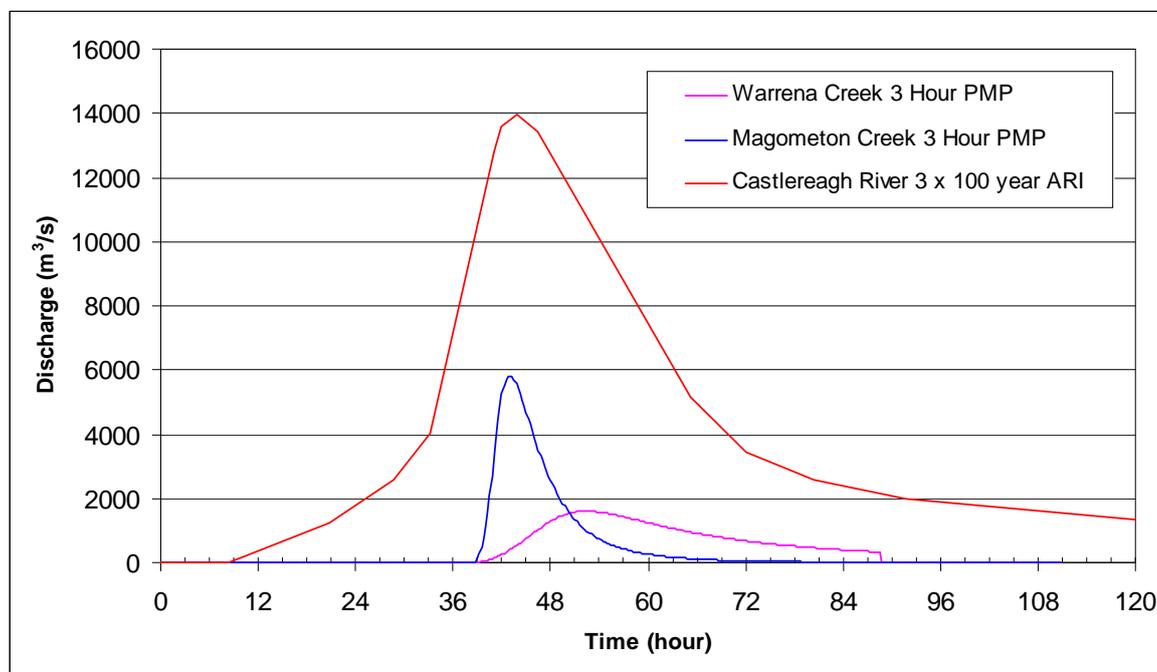
The adopted design flows shown in **Figure 6-1** resulted in 50 year and 100 year ARI flood levels of 206.12 mAHD and 206.33 mAHD respectively at “Horans”. The recorded 1955 flood level was estimated at 206.14 mAHD. Modelled flood levels in Castlereagh River @ Coonamble Gauge were estimated at 180.49 mAHD and 180.56 mAHD for the 50 year and 100 year ARI events respectively. The adopted HFL at the gauge since 1950 flood is 180.82 mAHD. The difference between the design flood levels for the 50 and 100 year ARI flood levels and the recorded HFL in Castlereagh River @ Coonamble Gauge can be attributed to the old timber bridge. It is to be noted that the old timber bridge on the Castlereagh River at Aberford Street had 10 trestle piers (current bridge has 4 concrete piers) had a less favourable skew than the current bridge thus increasing the projected obstruction to flow. The total length of the old bridge was about 10m less than the current bridge and the trestle piers of the old bridge were better at collecting debris than the new bridge.

Modelled results for the 50 year and 100 year ARI events at “Horans” and the Castlereagh @ Coonamble Gauge agree closely with the stage-probability plot presented in the Coonamble Flood Scoping Study Report (SKM 2002). The 1950 and 1955 floods have 200 year and 75 year ARIs respectively according to the stage-probability plot.

Discharge hydrographs used in the MIKE-11 model for the extreme flood event are shown in **Figure 6-2**.



■ **Figure 6-2 Adopted Discharge Hydrographs for Extreme Events**



6.2 Estimated Flood Profiles along Coonamble Levee

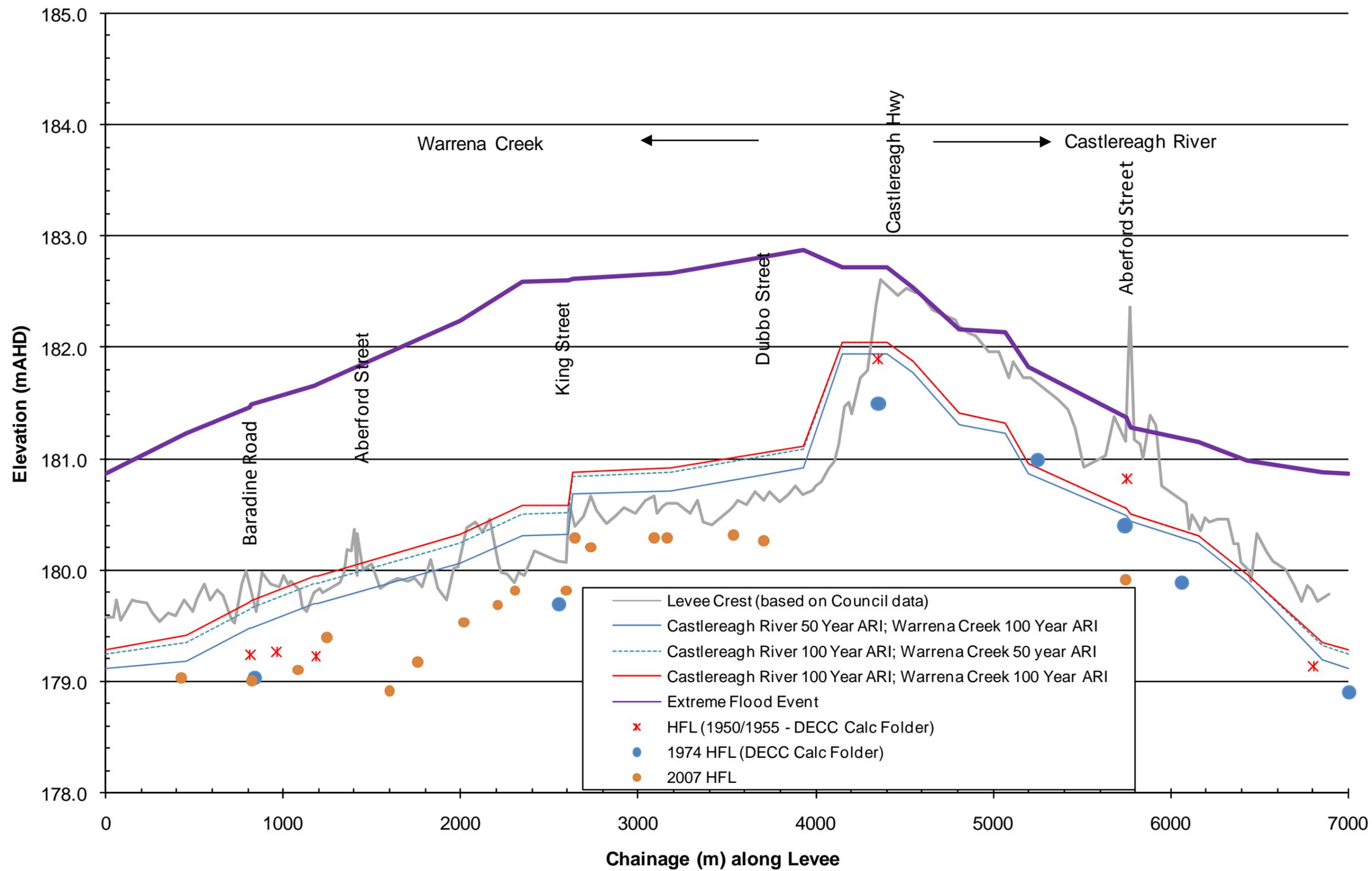
The MIKE-11 model was used to simulate flooding conditions within the study area for the following flow scenarios:

- 100 year ARI inflow in the Castlereagh River with 50 year ARI inflow in both Warrena Creek and Magometon Creek
- 50 year ARI inflow in the Castlereagh River with 100 year ARI inflow in both Warrena Creek and Magometon Creek
- 100 year ARI inflow in the Castlereagh River with 100 year ARI inflow in both Warrena Creek and Magometon Creek
- An extreme event consisting of 3 times 100 year ARI inflow in the Castlereagh River with 3 hour PMP event on Warrena Creek catchment (including Magometon Creek).

Detailed modelling results for the above four scenarios are given in **Appendix D**. Flood level profiles along the levee are shown in **Figure 6-3**. Highest Flood Levels (HFL) for 1950/1955, 1974 and 2007 flood events are also shown in **Figure 6-3**. Design flood levels used to draw flood level profiles are shown in **Table 6-1**.



■ Figure 6-3 Flood Level Profiles along the Levee



■ **Table 6-1: Design Flood Levels along Coonamble Levee**

Levee Chainage (m)	Design Flood Level (mAHD)				MIKE-11 Cross Section	Remarks
	C50:W100 ¹	C100:W50 ²	C100:W100 ³	Extreme		
0	179.11	179.24	179.28	180.87		Same Flood Level as Chainage 7000m
455	179.19	179.35	179.41	181.23	WARRENA 33090.00	
810	179.48	179.65	179.71	181.46	WARRENA 32760.00	Downstream of Baradine Road
820	179.48	179.66	179.72	181.49	WARRENA 32750.00	Upstream of Baradine Road
1180	179.69	179.88	179.94	181.66	WARRENA 32460.00	Downstream of Warrana Weir
1190	179.70	179.89	179.95	181.67	WARRENA 32450.00	Upstream of Warrana Weir
2000	180.06	180.25	180.32	182.24	WARRENA 31750.00	
2345	180.31	180.51	180.58	182.59	WARRENA 31310.00	
2610	180.32	180.51	180.59	182.60	CASTLEREAGH_RB 42720.00	Downstream of Bibleroi Creek Bridge
2630	180.68	180.84	180.87	182.61	CASTLEREAGH_RB 42700.00	Upstream of Bibleroi Creek Bridge
3180	180.71	180.88	180.91	182.68		Interpolated between "CASTLEREAGH 42700 and 42100"
3930	180.92	181.08	181.12	182.88		Estimated
4150	181.94	182.05	182.05	182.72		Same flood level as Chainage 4403m
4403	181.94	182.05	182.05	182.72		Interpolated between "CASTLEREAGH 46570 and 46870"
4545	181.78	181.88	181.88	182.55	CASTLEREAGH 46870.00	
4805	181.31	181.41	181.41	182.17	CASTLEREAGH 47150.00	
5065	181.23	181.33	181.33	182.14	CASTLEREAGH 47430.00	
5195	180.87	180.96	180.96	181.83	CASTLEREAGH 47740.00	
5750	180.49	180.55	180.56	181.38	CASTLEREAGH 48110.00	Upstream of Aberford Street Bridge
5770	180.44	180.50	180.51	181.29	CASTLEREAGH 48130.00	Downstream of Aberford Street Bridge
6155	180.24	180.31	180.31	181.15	CASTLEREAGH 48450.00	
6430	179.89	179.95	179.96	180.98	CASTLEREAGH 48710.00	
6855	179.20	179.32	179.35	180.88	CASTLEREAGH 49070.00	
7000	179.11	179.24	179.28	180.87		Interpolated between "CASTLEREAGH 49070 and 49500"

¹ Castlereagh River 50 year ARI; Warrena Creek 100 year ARI

² Castlereagh River 100 year ARI; Warrena Creek 50 year ARI

³ Castlereagh River 100 year ARI; Warrena Creek 100 year ARI



Upstream of Aberford Street along Warrena Creek, levee chainages and flood profile chainages do not correspond and hence it was necessary to estimate peak flood levels at levee Chainages 3930m and 4150m. The velocity head (ie. $v^2/2g$) at Bibleroi Creek Bridge was added to the modelled peak flood levels upstream of Bibleroi Creek (ie. Levee Chainage 3180m) to estimate the peak flood levels at Levee Chainage 3930m. The peak flood level at Levee Chainage 4403m was used to estimate the peak flood level at Levee Chainage 4150m.

The following observations can be made from **Figure 6-3**:

- Flood events resulting from 50 year and 100 year ARI inflows in the Castlereagh River results in flood levels in the Castlereagh River @ Coonamble Gauge (levee chainage 5750m) that are lower than the adopted HFL of 180.82 mAHD at the gauge. HFLs elsewhere along the levee are generally lower than the 50 year ARI event.
- Sections of the levee along Warrena Creek between King Street and Baradine Road have levee crest below the estimated flood profile for the scenario using a 50 year ARI inflow in Castlereagh River and a 100 year ARI inflow in Warrena Creek.
- The maximum difference in flood level between the 100 year ARI event (100 year ARI inflows both in the Castlereagh River and in Warrena Creek) and the 50 year ARI event (50 year ARI inflow in the Castlereagh River and 100 year ARI inflow in Warrena Creek) is approximately 300mm along Warrena Creek. The maximum difference in levels for the same events along the Castlereagh River is approximately 100mm.
- The maximum difference in flood level along Warrena Creek is less than 100mm whether a 50 year ARI inflow or a 100 year ARI inflow is used in combination with a 100 year ARI inflow in the Castlereagh River.
- In the case of an extreme flood event, the entire levee is overtopped. The depth of overtopping of the levee is as high as 3m due to an extreme flood event. It is to be noted that no provision was made in the model for floodwaters to enter inside the levee.

6.3 Sensitivity Analysis

The following sensitivity analyses were undertaken for 50 year and 100 year ARI inflows in the Castlereagh River:

- 20% reduction in floodplain resistance
- 20% increase in floodplain resistance
- Steady peak inflows both in the Castlereagh River and in Warrena Creek
- No breach of the railway embankment.

Results from the sensitivity analyses are presented in the following sections.



6.3.1 50 year ARI Flood Event in the Castlereagh River

Flood level profiles along the levee for the modelled scenarios are shown in **Figure 6-4**. The following observations can be made from **Figure 6-4**:

- Flood levels along Warrena Creek are more sensitive than flood levels along the Castlereagh River for the modelled scenarios.
- A 20% rougher floodplain will result in a maximum increment in flood level of 0.11m in Warrena Creek.
- A 20% smoother floodplain will result in up to a maximum 0.13m lower peak flood level in Warrena Creek.
- Flood levels estimated using a steady state inflows in the Castlereagh River and in Warrena Creek are up to 0.42m higher than that for the base case (ie. 50 year ARI inflow in the Castlereagh River and 100 year ARI inflow in Warrena Creek).
- No breach in the railway embankment will increase peak flood levels in the Castlereagh River up to a maximum of 0.3m and almost negligible increment in flood levels in Warrena Creek.

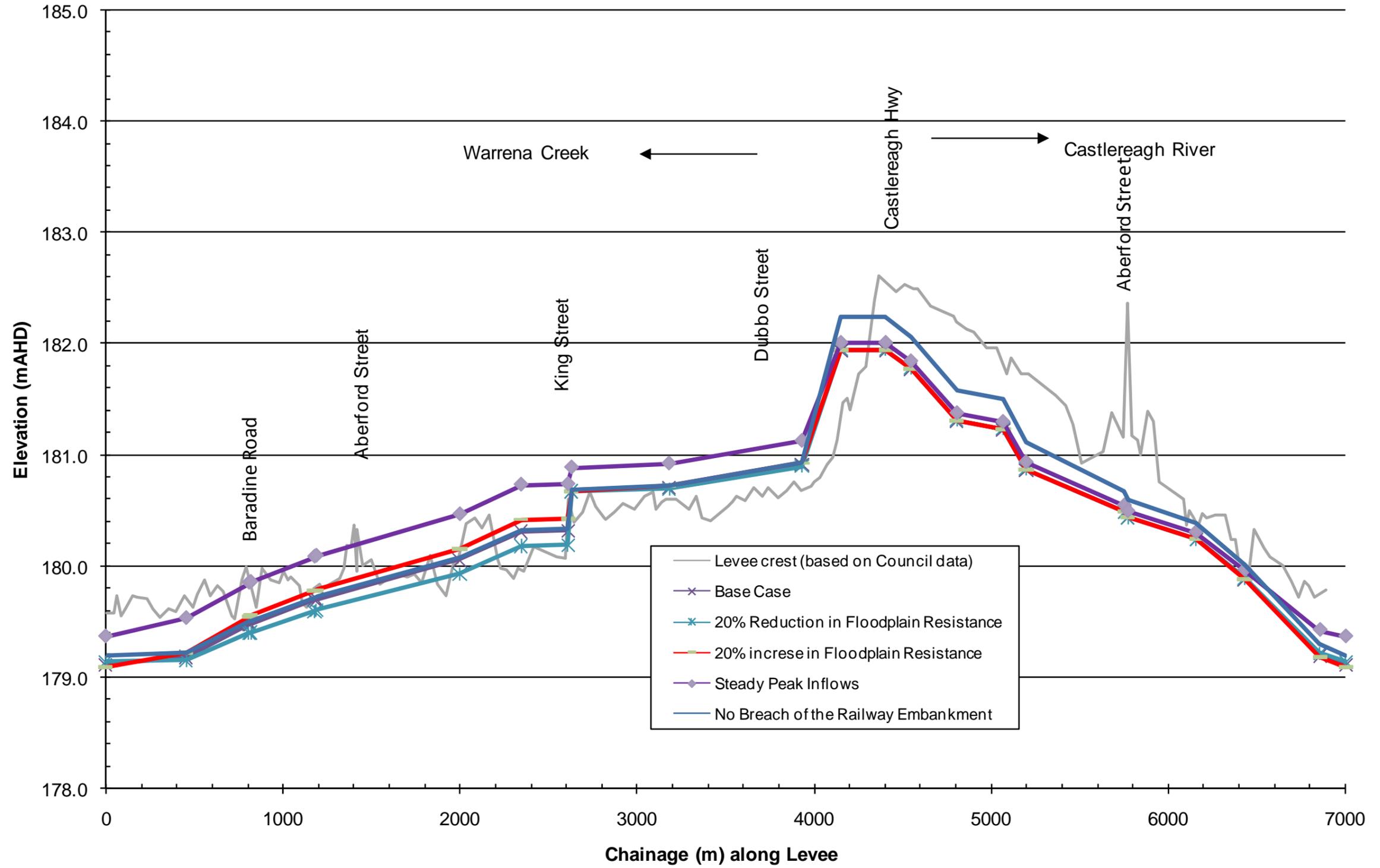
6.3.2 100 year ARI Event in the Castlereagh River and 50 year ARI Event in Warrena Creek

Flood level profiles along the levee for the modelled scenarios are shown in **Figure 6-5**. The following observations can be made from **Figure 6-5**:

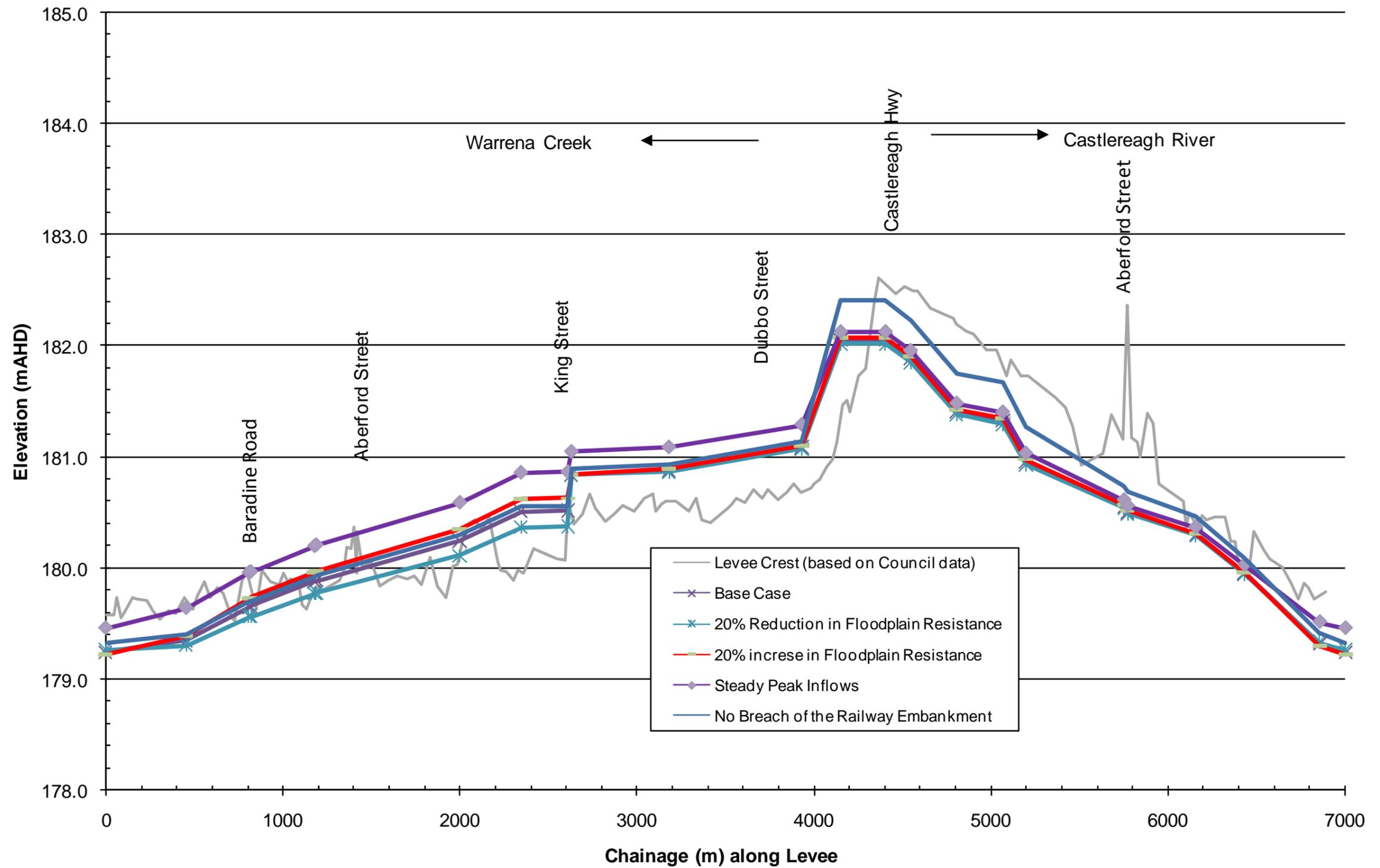
- Flood levels along Warrena Creek are more sensitive than flood levels along the Castlereagh River for the modelled scenarios.
- A 20% rougher floodplain will result in a maximum increment in flood level of 0.12m in Warrena Creek.
- A 20% smoother floodplain will result in up to a maximum 0.15m lower peak flood level in Warrena Creek.
- Flood levels estimated using a steady state inflows in the Castlereagh River and in Warrena Creek are up to 0.35m higher than that for the base case (ie. 100 year ARI inflow in the Castlereagh River and 50 year ARI inflow in Warrena Creek).
- No breach in the railway embankment will increase peak flood levels in the Castlereagh River up to a maximum of 0.35m and 0.05m in Warrena Creek.



■ Figure 6-4 Flood Level Profiles for 50 year ARI Events



■ Figure 6-5 Flood Level Profiles for 100 year ARI Events with 50 year ARI Warrena Creek Inflow



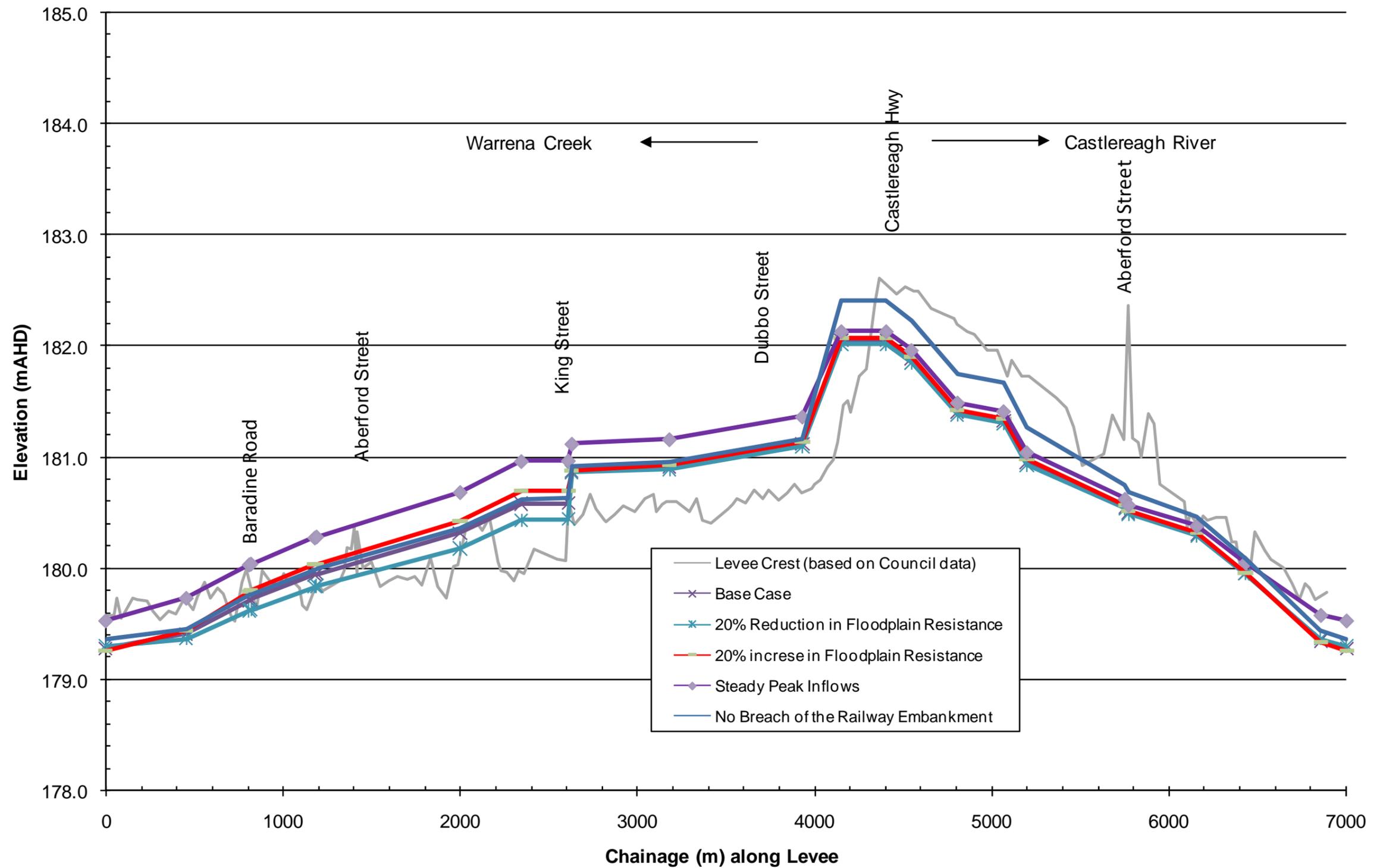


6.3.3 100 year ARI Event in the Castlereagh River and 100 year ARI Event in Warrena Creek

Flood level profiles along the levee for the modelled scenarios are shown in **Figure 6-6**. The following observations can be made from **Figure 6-6**:

- Flood levels along Warrena Creek are more sensitive than flood levels along the Castlereagh River for the modelled scenarios.
- A 20% rougher floodplain will result in a maximum increment in flood level of 0.12m in Warrena Creek.
- A 20% smoother floodplain will result in up to a maximum 0.15m lower peak flood level in Warrena Creek.
- Flood levels estimated using a steady state inflows in the Castlereagh River and in Warrena Creek are up to 0.39m higher than that for the base case (ie. 100 year ARI inflow in the Castlereagh River and 100 year ARI inflow in Warrena Creek).
- No breach in the railway embankment will increase peak flood levels in the Castlereagh River up to a maximum of 0.36m and 0.05m in Warrena Creek.

■ Figure 6-6 Flood Level Profiles for 100 year ARI Events with 100 year ARI Warrena Creek Inflow





7 Conclusions

The Coonamble levee was constructed in 1975 to protect the town of Coonamble from flooding in the Castlereagh River and in Warrena Creek. The levee was constructed to a design level defined by a combination of levels produced by the 1974 flood along Warrena Creek and the 1955 flood along the Castlereagh River.

The nature of flooding in the vicinity of Coonamble is complex. Both the Castlereagh and Warrena systems have significant catchment areas. The Castlereagh system represents 87% of the catchment at the Castlereagh/Warrena confluence and the Warrena system the remaining 13%.

Sparse streamflow and flood level data are available for Coonamble. The main streamflow gauge is the Castlereagh River @ Coonamble Gauge. The stage-discharge rating curve for this gauge is modified after each flood event due to changes in bed form of the Castlereagh River.

Sensitivity of flood gradients along Coonamble levee for 50 year ARI, 100 year ARI and an extreme flood event were estimated using a hydrologic model (RORB) and a quasi two-dimensional hydraulic computer model (MIKE-11).

The RORB model was used to simulate catchment runoff from Warrena Creek. The model was calibrated against flood events of 1998, 1999 and 2000. The calibrated model was used to simulate rainfall runoff from Warrena Creek catchment for the 50 year ARI, 100 year ARI and PMP events. The RORB model was used to simulate rainfall runoff from the catchment for the December 2007 storm event.

The MIKE-11 model was used to define the flood behaviour for the study area. A topographic survey was undertaken as part of this study to develop the MIKE-11 model. The MIKE-11 model was calibrated against 1998 flood event and was validated against flood events of 1998, 1999, 2007 and 1955. Recorded streamflow data for Warrena Creek were used in the MIKE-11 model for flood events of 1998, 1999 and 2000. The inflow in the Castlereagh River upstream of Coonamble was estimated for 1998, 1999, 2000 and 2007 flood events using streamflow data for the Castlereagh River @ Coonamble Gauge. The inflow hydrograph used in the Castlereagh River for the 1955 flood event was based on the discharge hydrograph for the Castlereagh River @ Gilgandra gauge.

The 1955 flood is considered (SKM 2002) the second largest flood in the Castlereagh River at Coonamble since 1950. The 2007 flood event is the highest flood on record in Warrena Creek with only minor flooding in the Castlereagh River. Modelled peak flood levels are within 0.2m of the recorded HFLs for both events.

The modelled flood levels agreed closely with the limited flood level data available for Coonamble.



In the absence of recorded hydrographs for large flood events, streamflow data from the Castlereagh River @ Gilgandra Gauge was used to estimate the 50 year and 100 year ARI inflow hydrographs in the Castlereagh River upstream of Coonamble. The inflow hydrographs for Warrena Creek were timed to coincide with the breakout flows from the Castlereagh River.

The recorded 1955 flood level at “Horans” is located between the estimated 50 year ARI and the 100 year ARI event. The estimated flood levels at the Castlereagh River @ Coonamble Gauge for the 50 year and 100 year ARI event are consistent with the stage-probability plot for the gauge compiled by DECCW.

Sensitivity of flood gradients along Coonamble Levee for the 50 year and 100 year ARI events were assessed for scenarios involving 20% reduction in floodplain resistance; 20% increment in floodplain resistance; steady peak inflows both in the Castlereagh River and in Warrena Creek; and no breach in the railway embankment. Results from the sensitivity analyses indicate that flood levels in Warrena Creek resulting from 50 year ARI inflow in the Castlereagh River and 100 year ARI inflow in Warrena Creek are higher than crest of the levee located between King Street and Baradine Road.

Results from the sensitivity analyses indicate that flood levels in Warrena Creek are most sensitive to the assumption made about steady inflows both in the Castlereagh River and in Warrena Creek. Steady peak inflows can increase flood levels in Warrena Creek along the levee up to a maximum of 0.42m. However, it is to be noted that the steady state assumption is the worst case scenario for a long duration flood event.

Results from the sensitivity analyses also indicate that flood levels in the Castlereagh River are most sensitive to the assumption made about the breach of the railway embankment. If the railway embankment is not breached, peak flood levels in the Castlereagh River along the levee can increase up to a maximum of 0.36m.

Streamflow monitoring at all three gauging sites used in the calibration of the computer models in this study were ceased a few years ago. It is recommended that DECCW, SES and Coonamble Shire develop a strategy to monitor future flooding at Coonamble.

A number of assumptions have been made in this study to estimate design flood profiles along the Coonamble levee. Hence, outcomes from this study need to be re-assessed soon after the occurrence of future major flood events in Coonamble.



8 References

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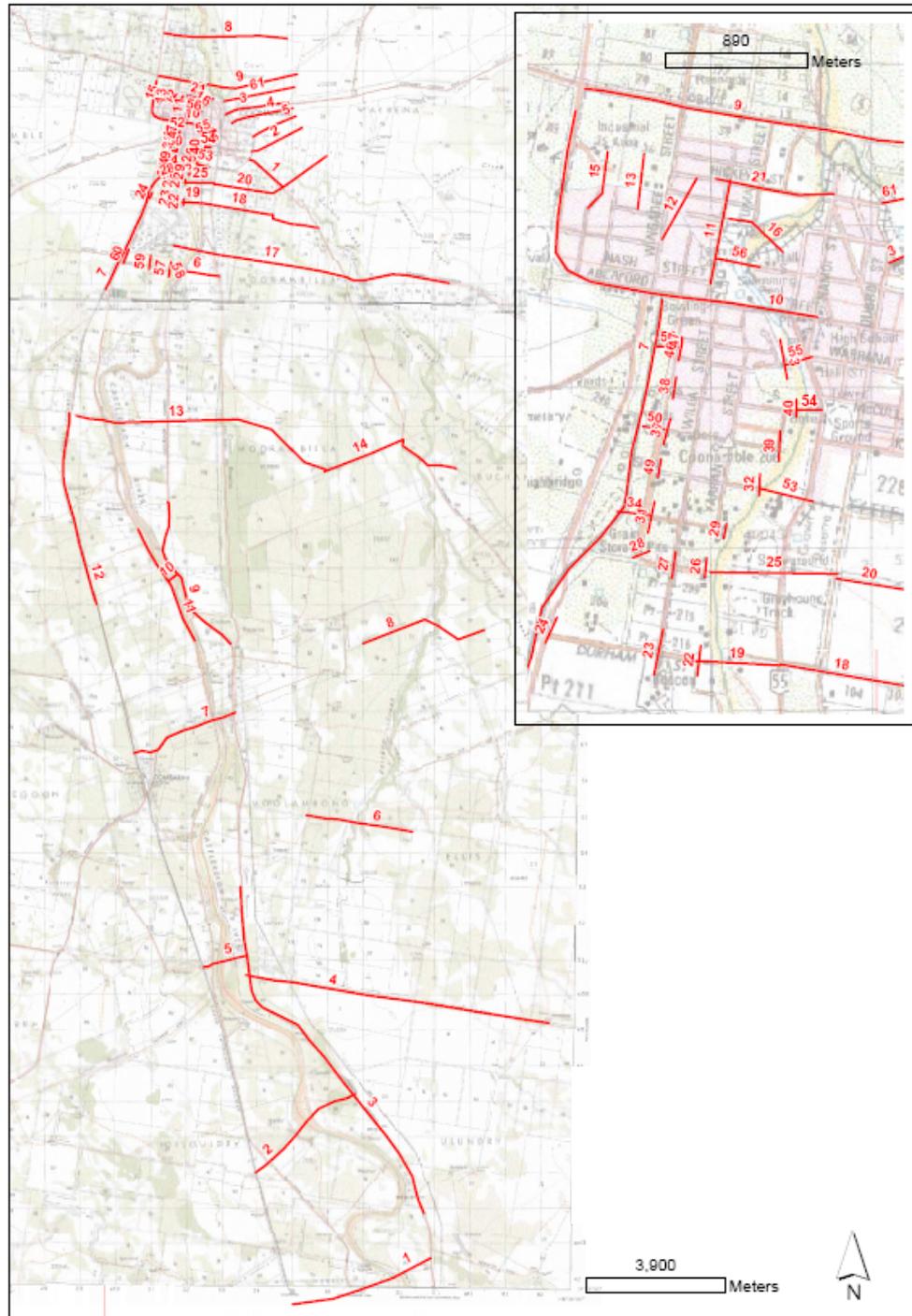
Water Resources Consulting Service (1994) Coonamble Levee – Flood Levels, Volume 1 and Volume 2



Appendix A Available Data

A.1 Survey Data Points

- Figure A1-1 Survey by Langford and Rowe





A.2 Satellite Images

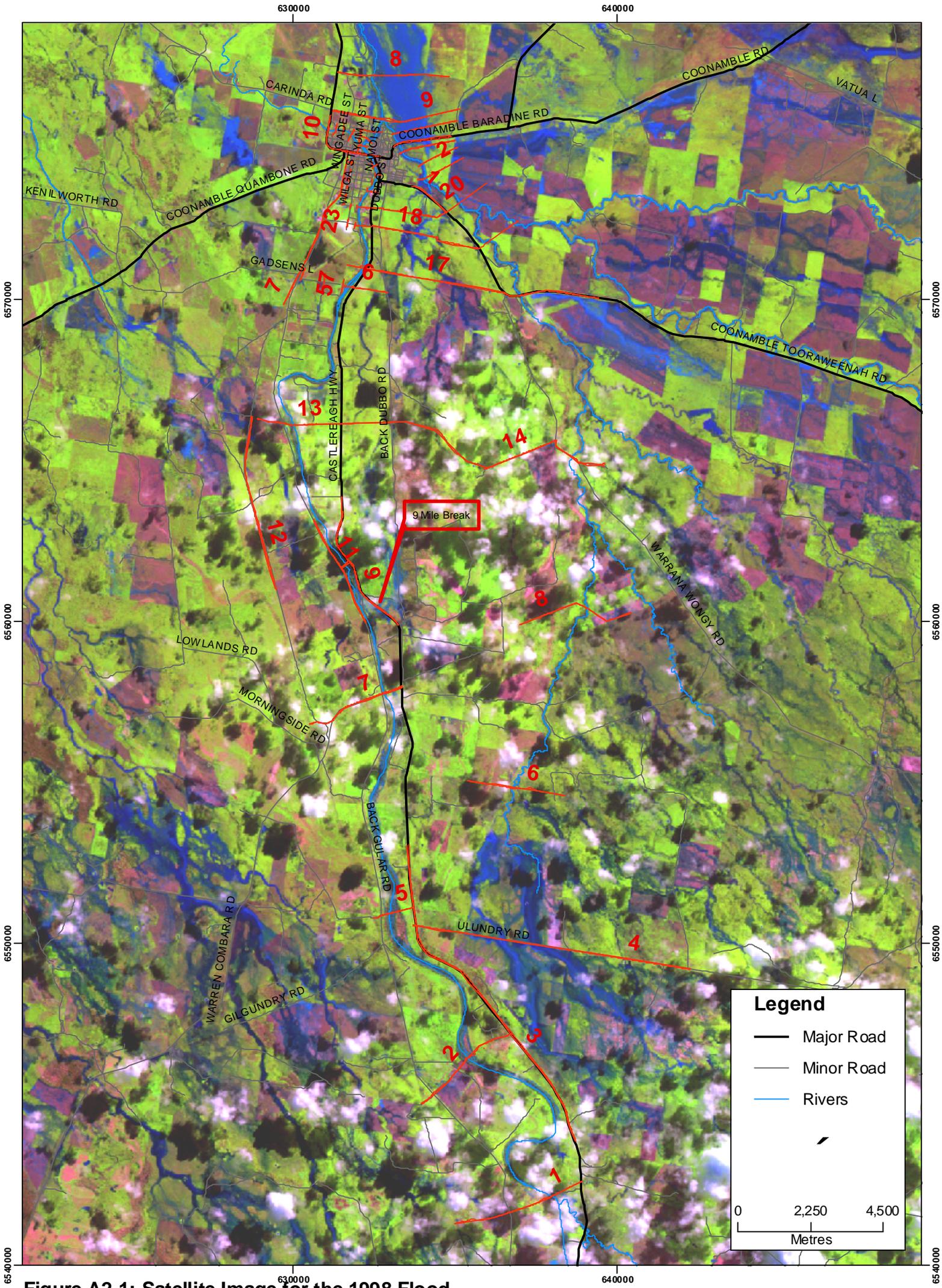


Figure A2-1: Satellite Image for the 1998 Flood

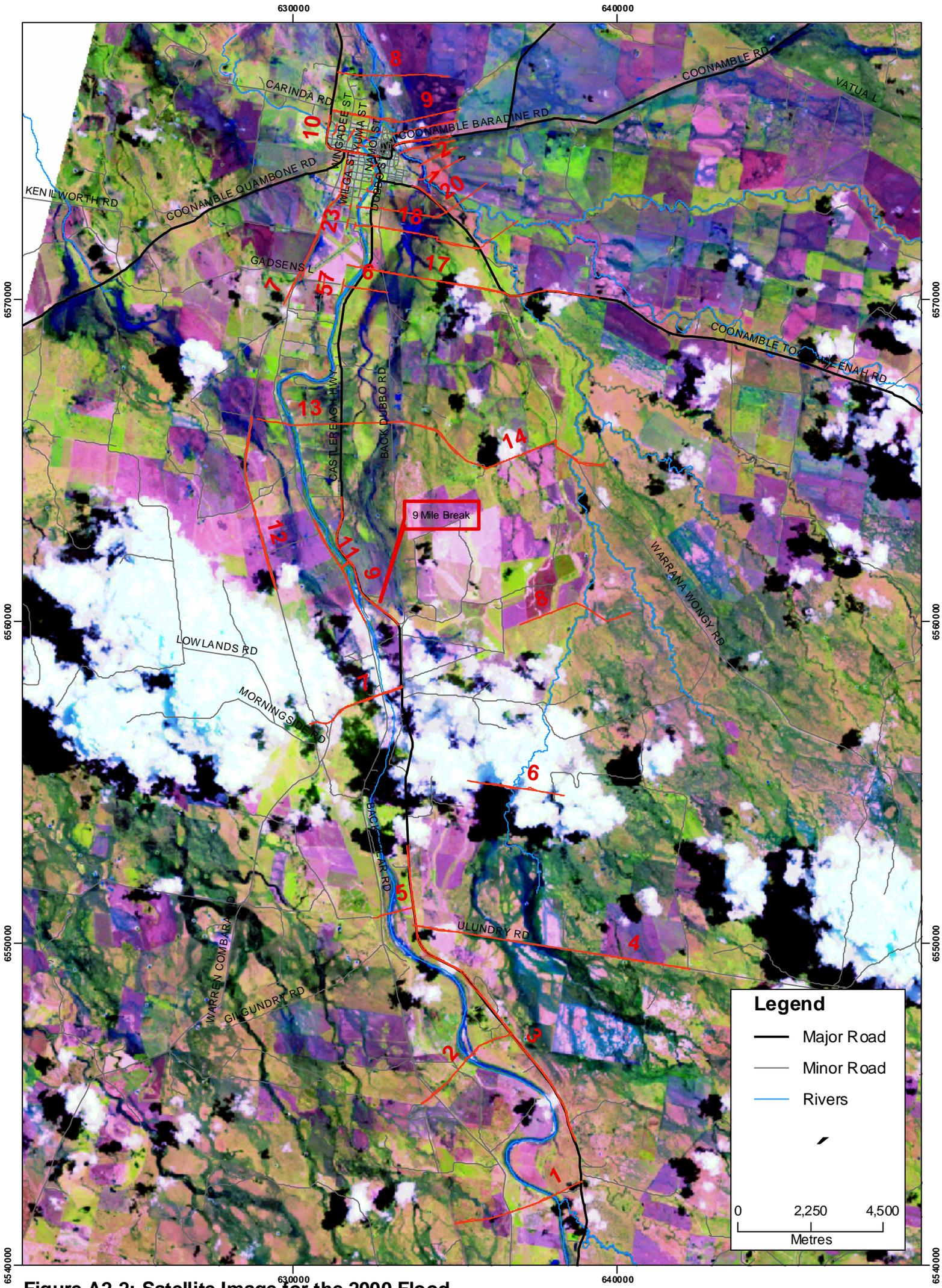


Figure A2-2: Satellite Image for the 2000 Flood



Appendix B Hydraulic Modelling

B.1 MIKE-11 Model Set up



B.1.1 Model Schematic

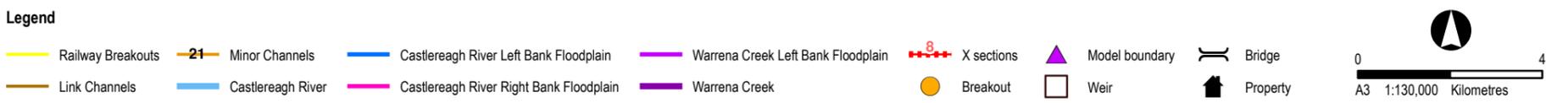
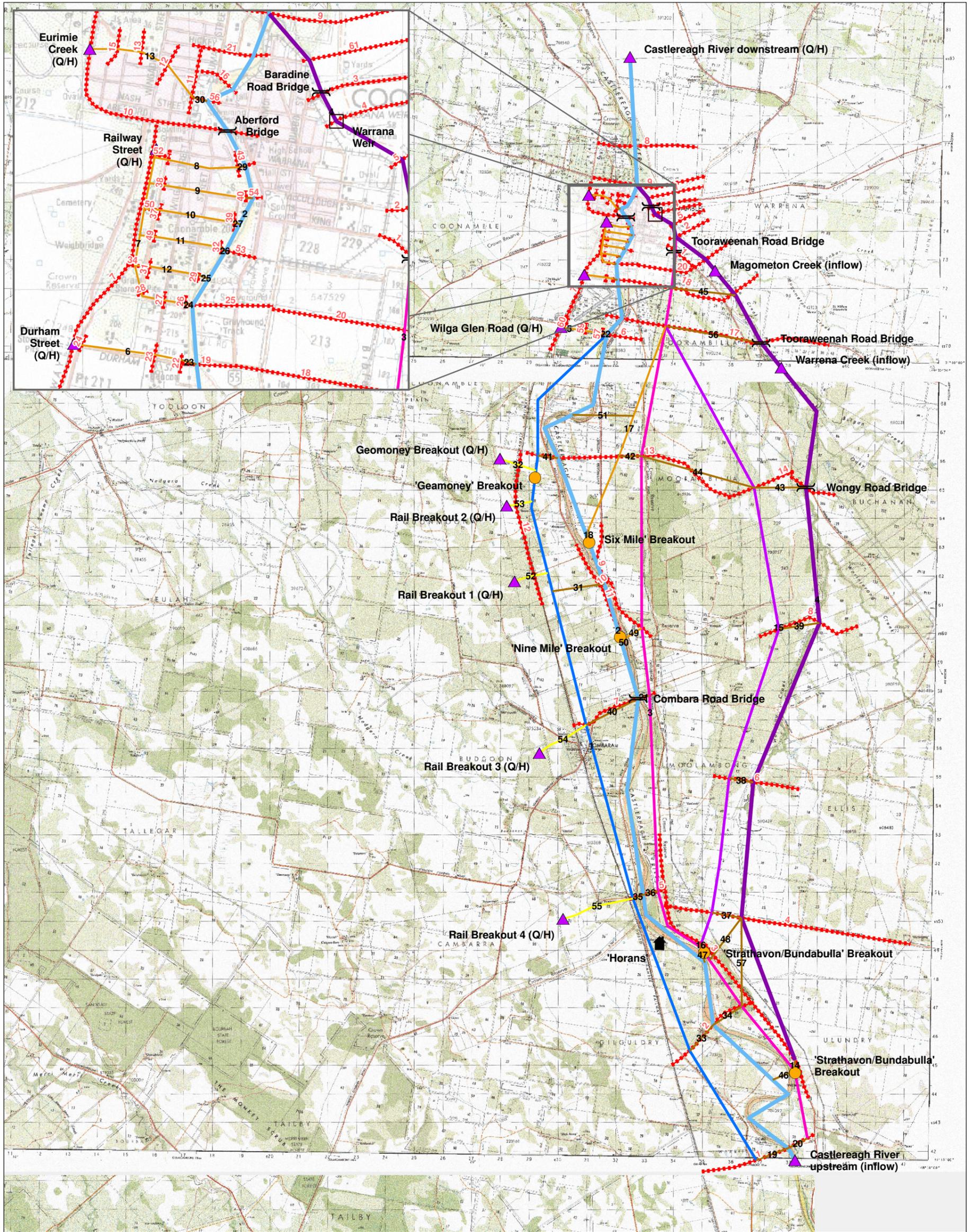


Fig B.1.1 : MIKE-11 Model Schematic

Coonamble Levee - Flood Gradient Sensitivity Modelling Study Version 1

B.1.2 Details on MIKE-11 Branches

ID ¹	MIKE-11 Branch	Chainage (m)		Branch Type	Upstream Connection		Downstream Connection	
		Start	Finish		Branch Name	Chainage (m)	Branch Name	Chainage (m)
1	Castlereagh_LB	10000	41100	Regular			Castlereagh	43700
2	Castlereagh	9500	56900	Regular				
3	Castlereagh_RB	10000	43200	Regular			Warrena	31310
4	Warrena	0	33500	Regular			Castlereagh	49500
5	Wilga_Glen_Rd	0	1450	Regular				
6	Durham_St	0	1020	Regular				
7	Railway_St	0	1850	Regular				
8	McMahon_St	0	780	Regular			Railway_St	1750
9	Bertram_St	0	900	Regular			Railway_St	1500
10	Barton_St	0	840	Regular			Railway_St	1240
11	Reid_St	0	760	Regular			Railway_St	990
12	Quanmoona_St	0	600	Regular			Railway_St	700
13	Eurimie_Ck	0	1140	Regular				
14	Link_Castlereagh_RB_12400_Warrena	0	20	Link Channel	Castlereagh_RB	12400	Warrena	0
15	Warrena_LB	0	22600	Regular			Castlereagh_RB	40100
16	Link_Castlereagh_RB_17800_Warrena_LB	0	20	Link Channel	Castlereagh_RB	17800	Warrena_LB	0
17	6mile_Breakout	1500	9100	Regular			Castlereagh_RB	40100
18	Link_Castlereagh_6mile	0	20	Link Channel	Castlereagh	35000	6mile_Breakout	1500
19	Link_Castlereagh_10000_Castlereagh_LB	0	20	Link Channel	Castlereagh	10000	Castlereagh_LB	10000
20	Link_Castlereagh_10000_Castlereagh_RB	0	20	Link Channel	Castlereagh	10000	Castlereagh_RB	10000
21	Link_Castlereagh_29300_Castlereagh_RB	0	20	Link Channel	Castlereagh	29300	Castlereagh_RB	27200
22	Link_Castlereagh_Wilga_Glen	0	20	Link Channel	Castlereagh	43700	Wilga_Glen_Rd	0
23	Link_Castlereagh_Durham_St	0	20	Link Channel	Castlereagh	45720	Durham_St	0
24	Link_Castlereagh_Railway_St	0	20	Link Channel	Castlereagh	46270	Railway_St	0
25	Link_Castlereagh_Quanmoona_St	0	20	Link Channel	Castlereagh	46570	Quanmoona_St	0

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ID ¹	MIKE-11 Branch	Chainage (m)		Branch Type	Upstream Connection		Downstream Connection	
		Start	Finish		Branch Name	Chainage (m)	Branch Name	Chainage (m)
26	Link_Castlereagh_Reid_St	0	20	Link Channel	Castlereagh	46870	Reid_St	0
27	Link_Castlereagh_Barton_St	0	20	Link Channel	Castlereagh	47150	Barton_St	0
28	Link_Castlereagh_Bertram_St	0	20	Link Channel	Castlereagh	47430	Bertram_St	0
29	Link_Castlereagh_McMahon_St	0	20	Link Channel	Castlereagh	47740	McMahon_St	0
30	Link_Castlereagh_Eurimie	0	20	Link Channel	Castlereagh	48450	Eurimie_Ck	0
31	Link_Castlereagh_33500_Castlereagh_LB	0	20	Link Channel	Castlereagh	33500	Castlereagh_LB	31100
32	Geamoney_Breakout	0	200	Regular	Castlereagh_LB	35400		
33	Link_Castlereagh_6900_Castlereagh_LB	0	20	Link Channel	Castlereagh	16900	Castlereagh_LB	14400
34	Link_Castlereagh_6900_Castlereagh_RB	0	20	Link Channel	Castlereagh	16900	Castlereagh_RB	15300
35	Link_Castlereagh_22400_Castlereagh_LB	0	20	Link Channel	Castlereagh	22400	Castlereagh_LB	20100
36	Link_Castlereagh_22400_Castlereagh_RB	0	20	Link Channel	Castlereagh	22400	Castlereagh_RB	20400
37	Link_Warrena_5300_Warrena_LB	0	20	Link Channel	Warrena	5300	Warrena_LB	1100
38	Link_Warrena_10000_Warrena_LB	0	20	Link Channel	Warrena	10000	Warrena_LB	5800
39	Link_Warrena_16000_Warrena_LB	0	20	Link Channel	Warrena	16000	Warrena_LB	11300
40	Link_Castlereagh_29300_Castlereagh_LB	0	20	Link Channel	Castlereagh	29300	Castlereagh_LB	26300
41	Link_Castlereagh_38100_Castlereagh_LB	0	20	Link Channel	Castlereagh	38100	Castlereagh_LB	35900
42	Link_6mile_Castlereagh_RB	0	20	Link Channel	6mile_Breakout	4300	Castlereagh_RB	35500
43	Link_Warrena_20700_Warrena_LB	0	20	Link Channel	Warrena	20700	Warrena_LB	16300
44	Link_Castlereagh_RB_35500_Warrena_LB	0	20	Link Channel	Castlereagh_RB	35500	Warrena_LB	16300
45	Link_Castlereagh_RB_41500_Warrena	0	20	Link Channel	Castlereagh_RB	41500	Warrena	28400
46	Link_Castlereagh_14000	0	20	Link Channel	Castlereagh	14000	Castlereagh_RB	12400
47	Link_Castlereagh_19000	0	20	Link Channel	Castlereagh	19000	Castlereagh_RB	17800
48	Link_Castlereagh_19000_Warrena	0	20	Link Channel	Castlereagh	19000	Warrena	5300
49	9Mile_Breakout	0	2000	Regular			Castlereagh_RB	31200
50	Link_9Mile	0	20	Link Channel	Castlereagh	31550	9Mile_Breakout	0
51	Link_6Mile	0	500	Link Channel	Castlereagh	40600	6mile_breakout	5900

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ID ¹	MIKE-11 Branch	Chainage (m)		Branch Type	Upstream Connection		Downstream Connection	
		Start	Finish		Branch Name	Chainage (m)	Branch Name	Chainage (m)
52	Rail_Breakout1	0	200	Regular	Castlereagh_LB	31800		
53	Rail_breakout2	0	200	Regular	Castlereagh_LB	34400		
54	Rail_Breakout3	0	200	Regular	Castlereagh_LB	26300		
55	Rail_breakout4	0	200	Regular	Castlereagh_LB	20100		
56	Link_Warrena_26500	0	1000	Link Channel	Warrena	26500	Castlereagh_RB	40100
57	Link_Castlereagh_RB_15300	0	2800	Link Channel	Castlereagh_RB	15300	Warrena	5300

¹ Refer to Figure B.1.1



B.2 Details on Splitting of Surveyed Cross Sections and Flowpath Chainages

Surveyed Cross Section	Chainage (m)		MIKE-11 Branch	MIKE-11 Chainage (m)
	Start	Finish		
Cross Section 1 (North)	145	1390	CASTLEREAGH_RB	42700
Cross Section 2 (North)	21	1599	WARRENA	31310
Cross Section 3 (North)	104	1859	WARRENA	32750
Cross Section 4 (North)	26	1836	WARRENA	32450
Cross Section 5 (North)	35	1380	WARRENA	31750
Cross Section 6 (North)	0	43	CASTLEREAGH_LB	41100
Cross Section 6 (North)	0	242	CASTLEREAGH	43700
Cross Section 7 (North)	0	2456	WILGA_GLEN_RD	1450
Cross Section 7 (North)	2456	4246	DURHAM_ST	1020
Cross Section 7 (North)	4709	5218	RAILWAY_ST	1850
Cross Section 8 (North)	0	3532	CASTLEREAGH	50900
Cross Section 9 (North)	0	1664	CASTLEREAGH	49500
Cross Section 9 (North)	1743	4060	WARRENA	33500
Cross Section 10 (North)	2255	2382	CASTLEREAGH	48110
Cross Section 10 (North)	2143	2592	EURIMIE_CK	1140
Cross Section 11 (North)	0	299	EURIMIE_CK	0
Cross Section 12 (North)	0	410	EURIMIE_CK	380
Cross Section 13 (North)	0	361	EURIMIE_CK	650
Cross Section 15 (North)	0	403	EURIMIE_CK	880
Cross Section 16 (North)	-300	368	CASTLEREAGH	48710
Cross Section 17 (North)	542	721	CASTLEREAGH	44400
Cross Section 17 (North)	720	5540	CASTLEREAGH_RB	40100
Cross Section 17 (North)	5539	8008	WARRENA	26500
Cross Section 17 (North)	720	5539	WARRENA_LB	22600
Cross Section 18 (North)	0	3547	CASTLEREAGH_RB	41500
Cross Section 19 (North)	110	366	CASTLEREAGH	45720
Cross Section 20 (North)	0	2076	CASTLEREAGH_RB	42100
Cross Section 18 (North)	3546	5067	WARRENA	28400
Cross Section 21 (North)	0	696	CASTLEREAGH	49070
Cross Section 22 (North)	0	204	DURHAM_ST	0
Cross Section 23 (North)	0	305	DURHAM_ST	255
Cross Section 24 (North)	0	189	DURHAM_ST	941
Cross Section 25 (North)	0	136	CASTLEREAGH	46270
Cross Section 26 (North)	0	76	RAILWAY_ST	0
Cross Section 27 (North)	0	175	RAILWAY_ST	190
Cross Section 28 (North)	0	120	RAILWAY_ST	410
Cross Section 29 (North)	0	97	QUANMOONA_ST	0
Cross Section 31 (North)	0	199	QUANMOONA_ST	470
Cross Section 32 (North)	0	142	REID_ST	0
Cross Section 37 (North)	0	170	BARTON_ST	720
Cross Section 38 (North)	0	166	BERTRAM_ST	780
Cross Section 39 (North)	0	217	BARTON_ST	0
Cross Section 40 (North)	0	118	BERTRAM_ST	0
Cross Section 43 (North)	0	240	MCPAHON_ST	0
Cross Section 46 (North)	0	124	MCPAHON_ST	660
Cross Section 49 (North)	0	127	REID_ST	640
Cross Section 50 (North)	0	134	RAILWAY_ST	990
Cross Section 52 (North)	0	129	RAILWAY_ST	1500
Cross Section 52 (North)	0	129	MCPAHON_ST	780
Cross Section 53 (North)	0	75	CASTLEREAGH	46870
Cross Section 54 (North)	0	182	CASTLEREAGH	47430
Cross Section 55 (North)	0	105	CASTLEREAGH	47740
Cross Section 56 (North)	0	224	CASTLEREAGH	48450
Cross Section 57 (North)	0	448	WILGA_GLEN_RD	0
Cross Section 59 (North)	0	411	WILGA_GLEN_RD	577
Cross Section 60 (North)	0	444	WILGA_GLEN_RD	1305
Cross Section 61 (North)	15	2080	WARRENA	33090
Cross Section 1 (South)	1713	3058	CASTLEREAGH_LB	10000
Cross Section 1 (South)	3059	3403	CASTLEREAGH	10000
Cross Section 1 (South)	3416	4165	CASTLEREAGH_RB	10000
Cross Section 2 (South)	0	1935	CASTLEREAGH_LB	14400

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Surveyed Cross Section	Chainage (m)		MIKE-11 Branch	MIKE-11 Chainage (m)
	Start	Finish		
Cross Section 2 (South)	1935	3123	CASTLEREAGH	16900
Cross Section 2 (South)	3123	3852	CASTLEREAGH_RB	15300
Cross Section 3 (South)	6020	10974	WARRENA	0
Cross Section 3 (South)	2941	6020	WARRENA_LB	0
Cross Section 4 (South)	1327	8686	WARRENA	5300
Cross Section 4 (South)	124	1327	WARRENA_LB	1100
Cross Section 5 (South)	0	435	CASTLEREAGH_LB	20100
Cross Section 5 (South)	435	968	CASTLEREAGH	22400
Cross Section 5 (South)	968	1348	CASTLEREAGH_RB	20400
Cross Section 6 (South)	841	3054	WARRENA	10000
Cross Section 6 (South)	0	841	WARRENA_LB	5800
Cross Section 7 (South)	1445	2556	CASTLEREAGH_LB	26300
Cross Section 7 (South)	2556	2707	CASTLEREAGH	29320
Cross Section 7 (South)	2707	3199	CASTLEREAGH_RB	27200
Cross Section 8 (South)	1325	3794	WARRENA	16000
Cross Section 8 (South)	0	1325	WARRENA_LB	11300
Cross Section 9 (South)	372	3203	6MILE_BREAKOUT	1500
Cross Section 9 (South)	3203	4751	9MILE_BREAKOUT	500
Cross Section 10 (South)	0	339	CASTLEREAGH	33500
Cross Section 12 (South)	0	5554	GEAMONEY_BREAKOUT	200
Cross Section 13 (South)	0	1020	CASTLEREAGH_LB	35900
Cross Section 13 (South)	1019	1228	CASTLEREAGH	38100
Cross Section 13 (South)	3965	7622	CASTLEREAGH_RB	35500
Cross Section 13 (South)	1228	3965	6MILE_BREAKOUT	4300
Cross Section 14 (South)	1858	4329	WARRENA	20700
Cross Section 14 (South)	0	1858	WARRENA_LB	16300
Cross Section 9 (South)	372	3203	6MILE_BREAKOUT	1500
Cross Section 13 (South)	1228	3965	6MILE_BREAKOUT	4300
Cross Section 9 (South)	3203	4751	9MILE_BREAKOUT	500
Cross Section 39 (North)	0	217	BARTON_ST	0
Cross Section 37 (North)	0	170	BARTON_ST	720
Cross Section 40 (North)	0	118	BERTRAM_ST	0
Cross Section 38 (North)	0	166	BERTRAM_ST	780
Cross Section 1 (South)	3059	3403	CASTLEREAGH	10000
Cross Section 2 (South)	1935	3123	CASTLEREAGH	16900
Cross Section 5 (South)	435	968	CASTLEREAGH	22400
Cross Section 7 (South)	2556	2707	CASTLEREAGH	29320
Cross Section 10 (South)	0	339	CASTLEREAGH	33500
Cross Section 13 (South)	1019	1228	CASTLEREAGH	38100
Cross Section 6 (North)	0	242	CASTLEREAGH	43700
Cross Section 17 (North)	542	721	CASTLEREAGH	44400
Cross Section 19 (North)	110	366	CASTLEREAGH	45720
Cross Section 25 (North)	0	136	CASTLEREAGH	46270
Cross Section 53 (North)	0	75	CASTLEREAGH	46870
Cross Section 54 (North)	0	182	CASTLEREAGH	47430
Cross Section 55 (North)	0	105	CASTLEREAGH	47740
Cross Section 10 (North)	2255	2382	CASTLEREAGH	48110
Cross Section 56 (North)	0	224	CASTLEREAGH	48450
Cross Section 16 (North)	-300	368	CASTLEREAGH	48710
Cross Section 21 (North)	0	696	CASTLEREAGH	49070
Cross Section 9 (North)	0	1664	CASTLEREAGH	49500
Cross Section 8 (North)	0	3532	CASTLEREAGH	50900
Cross Section 1 (South)	1713	3058	CASTLEREAGH_LB	10000
Cross Section 2 (South)	0	1935	CASTLEREAGH_LB	14400
Cross Section 5 (South)	0	435	CASTLEREAGH_LB	20100
Cross Section 7 (South)	1445	2556	CASTLEREAGH_LB	26300
Cross Section 13 (South)	0	1020	CASTLEREAGH_LB	35900
Cross Section 6 (North)	0	43	CASTLEREAGH_LB	41100
Cross Section 1 (South)	3416	4165	CASTLEREAGH_RB	10000
Cross Section 2 (South)	3123	3852	CASTLEREAGH_RB	15300
Cross Section 5 (South)	968	1348	CASTLEREAGH_RB	20400
Cross Section 7 (South)	2707	3199	CASTLEREAGH_RB	27200
Cross Section 13 (South)	3965	7622	CASTLEREAGH_RB	35500
Cross Section 17 (North)	720	5540	CASTLEREAGH_RB	40100

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Surveyed Cross Section	Chainage (m)		MIKE-11 Branch	MIKE-11 Chainage (m)
	Start	Finish		
Cross Section 18 (North)	0	3547	CASTLEREAGH_RB	41500
Cross Section 20 (North)	0	2076	CASTLEREAGH_RB	42100
Cross Section 1 (North)	145	1390	CASTLEREAGH_RB	42700
Cross Section 22 (North)	0	204	DURHAM_ST	0
Cross Section 23 (North)	0	305	DURHAM_ST	255
Cross Section 24 (North)	0	189	DURHAM_ST	941
Cross Section 7 (North)	2456	4246	DURHAM_ST	1020
Cross Section 11 (North)	0	299	EURIMIE_CK	0
Cross Section 12 (North)	0	410	EURIMIE_CK	380
Cross Section 13 (North)	0	361	EURIMIE_CK	650
Cross Section 15 (North)	0	403	EURIMIE_CK	880
Cross Section 10 (North)	2143	2592	EURIMIE_CK	1140
Cross Section 12 (South)	0	5554	GEAMONEY_BREAKOUT	200
Cross Section 43 (North)	0	240	MCPMAHON_ST	0
Cross Section 46 (North)	0	124	MCPMAHON_ST	660
Cross Section 52 (North)	0	129	MCPMAHON_ST	780
Cross Section 29 (North)	0	97	QUANMOONA_ST	0
Cross Section 31 (North)	0	199	QUANMOONA_ST	470
Cross Section 26 (North)	0	76	RAILWAY_ST	0
Cross Section 27 (North)	0	175	RAILWAY_ST	190
Cross Section 28 (North)	0	120	RAILWAY_ST	410
Cross Section 50 (North)	0	134	RAILWAY_ST	990
Cross Section 52 (North)	0	129	RAILWAY_ST	1500
Cross Section 7 (North)	4709	5218	RAILWAY_ST	1850
Cross Section 32 (North)	0	142	REID_ST	0
Cross Section 49 (North)	0	127	REID_ST	640
Cross Section 3 (South)	6020	10974	WARRENA	0
Cross Section 4 (South)	1327	8686	WARRENA	5300
Cross Section 6 (South)	841	3054	WARRENA	10000
Cross Section 8 (South)	1325	3794	WARRENA	16000
Cross Section 14 (South)	1858	4329	WARRENA	20700
Cross Section 17 (North)	5539	8008	WARRENA	26500
Cross Section 20 (North)	3546	5067	WARRENA	28400
Cross Section 2 (North)	21	1599	WARRENA	31310
Cross Section 5 (North)	35	1380	WARRENA	31750
Cross Section 4 (North)	26	1836	WARRENA	32450
Cross Section 3 (North)	104	1859	WARRENA	32750
Cross Section 61 (North)	15	2080	WARRENA	33090
Cross Section 9 (North)	1743	4060	WARRENA	33500
Cross Section 3 (South)	2941	6020	WARRENA_LB	0
Cross Section 4 (South)	124	1327	WARRENA_LB	1100
Cross Section 6 (South)	0	841	WARRENA_LB	5800
Cross Section 8 (South)	0	1325	WARRENA_LB	11300
Cross Section 14 (South)	0	1858	WARRENA_LB	16300
Cross Section 17 (North)	720	5539	WARRENA_LB	22600
Cross Section 57 (North)	0	448	WILGA_GLEN_RD	0
Cross Section 59 (North)	0	411	WILGA_GLEN_RD	577
Cross Section 60 (North)	0	444	WILGA_GLEN_RD	1305
Cross Section 7 (North)	0	2456	WILGA_GLEN_RD	1450

Cross section 9 (South) - chainage increases from north



B.3 Adopted Downstream Boundary Conditions

B.3.1 Geamoney_Breakout at Ch 990m

Elevation mAHD	Discharge m ³ /s
184.868	0.00
185.235	0.02
185.603	1.95
185.971	8.44
186.338	20.45
186.657	54.91
186.894	394.27
187.131	1003.40
187.368	1825.25
187.606	2846.37
187.843	4062.53
188.080	5577.55
188.317	7458.68
188.554	9749.34
188.791	12420.50
189.028	15426.20
189.265	18751.10
189.502	22387.40

B.3.2 Wilga_Glen_Rd at Ch 1450m

Elevation mAHD	Discharge m ³ /s
179.800	0.00
181.203	31.69
181.420	36.91
182.303	122.02
182.450	129.97
188.000	1945.47



B.3.3 Durham_St at Ch 1020m

Elevation mAHD	Discharge m ³ /s
178.867	0.00
179.010	0.19
179.293	3.63
179.363	5.26
179.661	15.02
179.702	16.07
179.770	19.20
179.893	26.08
180.087	38.73
180.324	56.96
180.545	77.43
186.000	1332.28

B.3.4 Railway_St at Ch 1850m

Elevation mAHD	Discharge m ³ /s
170.000	0.00
179.112	0.00
179.264	10.45
179.417	76.68
179.569	202.15
179.721	432.20
179.874	796.07
180.026	1337.91
180.179	2007.27
180.331	2875.24
180.483	3876.04

B.3.5 Eurimie_Ck at Ch 1140m

Elevation mAHD	Discharge m ³ /s
178.281	0.00
179.367	0.30
179.829	2.22
185.000	245.54



B.3.6 Castlereagh at Ch 56900m

Elevation mAHD	Discharge m ³ /s
163.689	0.00
167.465	18.53
167.681	21.17
167.973	27.90
168.075	29.88
168.092	30.62
168.160	33.37
168.513	69.44
168.856	115.87
169.106	160.78
169.132	164.20
173.153	1746.61
173.187	1756.58
174.000	2229.57
179.000	20000.00



B.4 Adopted Manning's n Values for Model Calibration

Branch	Chainage (m)	Manning's n	Branch	Chainage (m)	Manning's n	Branch	Chainage (m)	Manning's n
CASTLEREAGH_LB	10000	0.05	CASTLEREAGH	56900	0.035	RAILWAY_ST	0	0.02
CASTLEREAGH_LB	14400	0.05	CASTLEREAGH_RB	10000	0.05	RAILWAY_ST	190	0.02
CASTLEREAGH_LB	17250	0.05	CASTLEREAGH_RB	12400	0.05	RAILWAY_ST	410	0.02
CASTLEREAGH_LB	20100	0.05	CASTLEREAGH_RB	15300	0.05	RAILWAY_ST	700	0.02
CASTLEREAGH_LB	23200	0.05	CASTLEREAGH_RB	17800	0.05	RAILWAY_ST	990	0.02
CASTLEREAGH_LB	26300	0.05	CASTLEREAGH_RB	20400	0.05	RAILWAY_ST	1240	0.02
CASTLEREAGH_LB	31100	0.05	CASTLEREAGH_RB	23800	0.05	RAILWAY_ST	1500	0.02
CASTLEREAGH_LB	35400	0.05	CASTLEREAGH_RB	27200	0.05	RAILWAY_ST	1750	0.02
CASTLEREAGH_LB	35900	0.05	CASTLEREAGH_RB	29600	0.05	RAILWAY_ST	2070	0.02
CASTLEREAGH_LB	38500	0.05	CASTLEREAGH_RB	32550	0.05	RAILWAY_ST	2600	0.02
CASTLEREAGH_LB	41100	0.05	CASTLEREAGH_RB	35500	0.05	MCPAHON_ST	0	0.02
CASTLEREAGH	9500	0.045	CASTLEREAGH_RB	40100	0.05	MCPAHON_ST	660	0.02
CASTLEREAGH	10000	0.045	CASTLEREAGH_RB	41500	0.05	MCPAHON_ST	780	0.02
CASTLEREAGH	14000	0.045	CASTLEREAGH_RB	42100	0.05	BERTRAM_ST	0	0.02
CASTLEREAGH	16900	0.045	CASTLEREAGH_RB	42700	0.05	BERTRAM_ST	780	0.02
CASTLEREAGH	19000	0.048	CASTLEREAGH_RB	42720	0.05	BERTRAM_ST	900	0.02
CASTLEREAGH	22400	0.048	CASTLEREAGH_RB	43200	0.05	BARTON_ST	0	0.02
CASTLEREAGH	25850	0.045	WARRENA	0	0.035	BARTON_ST	720	0.02
CASTLEREAGH	29300	0.045	WARRENA	2650	0.035	BARTON_ST	840	0.02
CASTLEREAGH	29320	0.045	WARRENA	5300	0.035	REID_ST	0	0.02
CASTLEREAGH	33500	0.04	WARRENA	10000	0.04	REID_ST	640	0.02
CASTLEREAGH	38100	0.045	WARRENA	13000	0.04	REID_ST	760	0.02
CASTLEREAGH	40900	0.045	WARRENA	16000	0.04	QUANMOONA_ST	0	0.02
CASTLEREAGH	43700	0.045	WARRENA	20700	0.04	QUANMOONA_ST	470	0.02
CASTLEREAGH	44400	0.045	WARRENA	20710	0.04	QUANMOONA_ST	600	0.02
CASTLEREAGH	45720	0.04	WARRENA	23605	0.04	EURIMIE_CK	0	0.045
CASTLEREAGH	46270	0.035	WARRENA	26500	0.05	EURIMIE_CK	378	0.045
CASTLEREAGH	46570	0.035	WARRENA	26510	0.05	EURIMIE_CK	380	0.045
CASTLEREAGH	46870	0.035	WARRENA	28400	0.05	EURIMIE_CK	650	0.045
CASTLEREAGH	47150	0.035	WARRENA	31310	0.05	EURIMIE_CK	880	0.045
CASTLEREAGH	47430	0.035	WARRENA	31750	0.05	EURIMIE_CK	1140	0.045
CASTLEREAGH	47740	0.035	WARRENA	32450	0.05	WARRENA_LB	0	0.04
CASTLEREAGH	48110	0.04	WARRENA	32460	0.05	WARRENA_LB	1100	0.04
CASTLEREAGH	48130	0.045	WARRENA	32750	0.05	WARRENA_LB	5800	0.04
CASTLEREAGH	48450	0.05	WARRENA	32760	0.05	WARRENA_LB	8550	0.04
CASTLEREAGH	48710	0.05	WARRENA	33090	0.05	WARRENA_LB	11300	0.04
CASTLEREAGH	49070	0.05	WARRENA	33500	0.05	WARRENA_LB	16300	0.04
CASTLEREAGH	49500	0.035	WILGA_GLEN_RD	0	0.02	WARRENA_LB	19450	0.04
CASTLEREAGH	50200	0.035	WILGA_GLEN_RD	577	0.02	WARRENA_LB	22600	0.04
CASTLEREAGH	50900	0.035	WILGA_GLEN_RD	1305	0.02	6MILE_BREAKOUT	0	0.04
CASTLEREAGH	51900	0.035	WILGA_GLEN_RD	1450	0.02	6MILE_BREAKOUT	4300	0.04
CASTLEREAGH	52900	0.035	DURHAM_ST	0	0.02	6MILE_BREAKOUT	9100	0.04
CASTLEREAGH	53900	0.035	DURHAM_ST	255	0.02	Geamoney_Breakout	0	0.07
CASTLEREAGH	54900	0.035	DURHAM_ST	941	0.02	Geamoney_Breakout	200	0.07
CASTLEREAGH	55900	0.035	DURHAM_ST	1020	0.02			



B.5 Modelling Results for 2000, 1999 and 1998 Flood Events

B.5.1 Modelled Peak Flood Levels((PFL) in mAHD)

MIKE-11 Branch	Chainage (m)	PFL 2000 Flood	PFL 1999 Flood	PFL 1998 Flood	Remarks
6MILE_BREAKOUT	1500	189.819	189.819	189.819	
6MILE_BREAKOUT	2433.33	188.036	188.036	188.036	
6MILE_BREAKOUT	3366.67	186.252	186.252	186.252	
6MILE_BREAKOUT	4300	184.469	184.469	184.469	
6MILE_BREAKOUT	5100	183.675	183.675	183.675	
6MILE_BREAKOUT	5900	183.107	182.882	183.1	
6MILE_BREAKOUT	6700	182.355	182.088	182.341	
6MILE_BREAKOUT	7500	181.593	181.294	181.587	
6MILE_BREAKOUT	8300	180.865	180.501	180.823	
6MILE_BREAKOUT	9100	180.859	179.707	180.812	
9MILE_BREAKOUT	0	195.153	194.284	195.106	
9MILE_BREAKOUT	500	194.534	193.784	194.502	
9MILE_BREAKOUT	1250	192.575	192.081	192.546	
9MILE_BREAKOUT	2000	191.148	190.379	191.116	
BARTON_ST	0	180.683	180.683	180.683	
BARTON_ST	720	180.338	180.338	180.338	
BARTON_ST	840	180.428	180.428	180.428	
BERTRAM_ST	0	175.819	175.819	175.819	
BERTRAM_ST	780	180.197	180.197	180.197	
BERTRAM_ST	900	179.422	179.422	179.422	
CASTLEREAGH	9500	212.86	211.208	212.634	
CASTLEREAGH	10000	212.513	210.852	212.289	
CASTLEREAGH	11000	211.858	210.232	211.645	
CASTLEREAGH	12000	211.185	209.615	210.984	
CASTLEREAGH	13000	210.479	209.003	210.29	
CASTLEREAGH	14000	209.691	208.402	209.526	
CASTLEREAGH	14966.67	208.903	207.816	208.763	
CASTLEREAGH	15933.33	208.101	207.181	207.983	
CASTLEREAGH	16900	207.162	206.338	207.052	
CASTLEREAGH	17600	206.388	205.51	206.257	
CASTLEREAGH	18300	205.724	204.705	205.554	
CASTLEREAGH	19000	205.261	204.063	205.042	
CASTLEREAGH	19850	204.807	203.424	204.535	
CASTLEREAGH	20700	204.323	202.789	204.029	"Horans"
CASTLEREAGH	21550	203.765	202.139	203.486	
CASTLEREAGH	22400	203.075	201.401	202.838	
CASTLEREAGH	23385.71	202.193	200.466	202.025	
CASTLEREAGH	24371.43	201.415	199.561	201.259	
CASTLEREAGH	25357.14	200.783	198.715	200.604	
CASTLEREAGH	26342.86	200.244	197.958	200.084	
CASTLEREAGH	27328.57	199.67	197.308	199.551	
CASTLEREAGH	28314.29	198.994	196.754	198.878	
CASTLEREAGH	29300	198.06	196.262	197.97	
CASTLEREAGH	29320	198.028	196.249	197.939	
CASTLEREAGH	30063.33	197.308	195.83	197.226	
CASTLEREAGH	30806.67	196.534	195.271	196.469	
CASTLEREAGH	31550	195.492	194.526	195.455	
CASTLEREAGH	32525	194.621	193.453	194.585	
CASTLEREAGH	33500	193.652	192.45	193.626	
CASTLEREAGH	34250	192.817	191.912	192.802	
CASTLEREAGH	35000	192.136	191.206	192.12	
CASTLEREAGH	35775	191.388	190.398	191.37	
CASTLEREAGH	36550	190.778	189.838	190.762	
CASTLEREAGH	37325	190.25	189.349	190.235	
CASTLEREAGH	38100	189.633	188.746	189.618	
CASTLEREAGH	38933.33	188.847	187.989	188.832	
CASTLEREAGH	39766.67	188.097	187.202	188.083	
CASTLEREAGH	40600	187.304	186.368	187.289	
CASTLEREAGH	41375	186.528	185.563	186.511	
CASTLEREAGH	42150	185.813	184.758	185.794	
CASTLEREAGH	42925	185.121	183.963	185.095	
CASTLEREAGH	43700	184.472	183.201	184.443	
CASTLEREAGH	44400	183.82	182.502	183.793	
CASTLEREAGH	45060	183.133	181.85	183.111	

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MIKE-11 Branch	Chainage (m)	PFL 2000 Flood	PFL 1999 Flood	PFL 1998 Flood	Remarks
CASTLEREAGH	45720	182.393	181.145	182.372	
CASTLEREAGH	46270	182.036	180.828	182.017	
CASTLEREAGH	46570	181.938	180.735	181.919	
CASTLEREAGH	46870	181.611	180.456	181.593	
CASTLEREAGH	47150	181.163	180.063	181.147	
CASTLEREAGH	47430	181.089	179.967	181.075	
CASTLEREAGH	47740	180.74	179.696	180.728	
CASTLEREAGH	48110	180.403	179.458	180.395	U/S Aberford St Br
CASTLEREAGH	48130	180.341	179.437	180.334	D/S Aberford St Br
CASTLEREAGH	48450	180.146	179.293	180.141	
CASTLEREAGH	48710	179.783	179.032	179.783	
CASTLEREAGH	49070	178.941	178.278	178.966	
CASTLEREAGH	49500	178.395	177.763	178.51	
CASTLEREAGH	50200	177.642	177	177.722	
CASTLEREAGH	50900	176.936	176.296	176.99	
CASTLEREAGH	51900	175.935	175.295	175.99	
CASTLEREAGH	52900	174.934	174.295	174.99	
CASTLEREAGH	53900	173.933	173.295	173.99	
CASTLEREAGH	54900	172.932	172.294	172.988	
CASTLEREAGH	55900	171.93	171.288	172	
CASTLEREAGH	56900	170.761	170.096	170.942	
CASTLEREAGH_LB	10000	206.501	206.501	206.501	
CASTLEREAGH_LB	10880	206.2	206.2	206.2	
CASTLEREAGH_LB	11760	205.4	205.4	205.4	
CASTLEREAGH_LB	12640	204.6	204.6	204.6	
CASTLEREAGH_LB	13520	203.8	203.8	203.8	
CASTLEREAGH_LB	14400	202.501	202.501	202.501	
CASTLEREAGH_LB	15350	202.865	202.865	202.865	
CASTLEREAGH_LB	16300	202.729	202.729	202.729	
CASTLEREAGH_LB	17250	202.594	202.594	202.594	
CASTLEREAGH_LB	18200	202.458	202.458	202.458	
CASTLEREAGH_LB	19150	202.322	202.322	202.322	
CASTLEREAGH_LB	20100	202.187	202.187	202.187	
CASTLEREAGH_LB	20985.71	201.223	201.223	201.223	
CASTLEREAGH_LB	21871.43	200.258	200.258	200.258	
CASTLEREAGH_LB	22757.14	199.294	199.294	199.294	
CASTLEREAGH_LB	23642.86	198.33	198.33	198.33	
CASTLEREAGH_LB	24528.57	197.366	197.366	197.366	
CASTLEREAGH_LB	25414.29	196.401	196.401	196.401	
CASTLEREAGH_LB	26300	196.164	195.437	196.094	
CASTLEREAGH_LB	27260	195.595	194.86	195.519	
CASTLEREAGH_LB	28220	195.031	194.282	194.926	
CASTLEREAGH_LB	29180	194.471	193.705	194.378	
CASTLEREAGH_LB	30140	193.848	193.127	193.762	
CASTLEREAGH_LB	31100	193.278	192.55	193.24	
CASTLEREAGH_LB	31960	192.024	191.272	191.98	
CASTLEREAGH_LB	32820	190.799	189.993	190.75	
CASTLEREAGH_LB	33680	189.526	188.715	189.469	
CASTLEREAGH_LB	34540	188.358	187.436	188.301	
CASTLEREAGH_LB	35400	186.792	185.625	186.777	
CASTLEREAGH_LB	35900	186.792	185.664	186.777	
CASTLEREAGH_LB	36766.67	185.889	184.637	185.877	
CASTLEREAGH_LB	37633.33	185.066	183.609	185.045	
CASTLEREAGH_LB	38500	184.009	182.857	184.269	
CASTLEREAGH_LB	39366.67	183.986	182.857	184.266	
CASTLEREAGH_LB	40233.33	183.985	182.857	184.266	
CASTLEREAGH_LB	41100	184.472	183.201	184.443	
CASTLEREAGH_RB	10000	213.467	213.467	213.467	
CASTLEREAGH_RB	10800	212.639	212.639	212.639	
CASTLEREAGH_RB	11600	211.811	211.811	211.811	
CASTLEREAGH_RB	12400	210.983	210.983	210.983	
CASTLEREAGH_RB	13366.67	209.798	209.798	209.798	
CASTLEREAGH_RB	14333.33	208.614	208.614	208.614	
CASTLEREAGH_RB	15300	207.429	207.429	207.429	
CASTLEREAGH_RB	16133.33	206.585	206.585	206.585	
CASTLEREAGH_RB	16966.67	205.741	205.741	205.741	
CASTLEREAGH_RB	17800	204.896	204.896	204.896	
CASTLEREAGH_RB	18666.67	204.015	204.015	204.015	
CASTLEREAGH_RB	19533.33	203.133	203.133	203.133	

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MIKE-11 Branch	Chainage (m)	PFL 2000 Flood	PFL 1999 Flood	PFL 1998 Flood	Remarks
CASTLEREAGH_RB	20400	202.251	202.251	202.251	
CASTLEREAGH_RB	21371.43	201.329	201.329	201.329	
CASTLEREAGH_RB	22342.86	200.406	200.406	200.406	
CASTLEREAGH_RB	23314.29	199.484	199.484	199.484	
CASTLEREAGH_RB	24285.71	198.562	198.562	198.562	
CASTLEREAGH_RB	25257.14	197.64	197.64	197.64	
CASTLEREAGH_RB	26228.57	196.717	196.717	196.717	
CASTLEREAGH_RB	27200	196.456	195.795	196.393	
CASTLEREAGH_RB	28200	194.955	194.441	194.903	
CASTLEREAGH_RB	29200	193.574	193.087	193.52	
CASTLEREAGH_RB	30200	191.963	191.733	191.934	
CASTLEREAGH_RB	31200	191.148	190.379	191.116	
CASTLEREAGH_RB	32060	189.709	189.214	189.681	
CASTLEREAGH_RB	32920	188.768	188.05	188.741	
CASTLEREAGH_RB	33780	187.819	186.885	187.788	
CASTLEREAGH_RB	34640	186.799	185.721	186.737	
CASTLEREAGH_RB	35500	185.782	184.556	185.702	
CASTLEREAGH_RB	36420	184.769	183.586	184.7	
CASTLEREAGH_RB	37340	183.765	182.616	183.706	
CASTLEREAGH_RB	38260	182.791	181.647	182.737	
CASTLEREAGH_RB	39180	181.786	180.677	181.738	
CASTLEREAGH_RB	40100	180.859	179.707	180.812	
CASTLEREAGH_RB	40800	180.248	179.361	180.2	
CASTLEREAGH_RB	41500	179.944	179.014	179.908	
CASTLEREAGH_RB	42100	179.828	178.785	179.796	
CASTLEREAGH_RB	42700	179.55	178.785	179.517	
CASTLEREAGH_RB	42720	179.259	178.785	179.314	
CASTLEREAGH_RB	43200	178.908	178.785	179.314	
DURHAM_ST	0	180.987	180.987	180.987	
DURHAM_ST	255	180.346	180.346	180.346	
DURHAM_ST	941	177.617	177.617	177.617	
DURHAM_ST	1020	178.822	178.822	178.822	
EURIMIE_CK	0	180.06	179.494	180.057	
EURIMIE_CK	380	180.017	178.765	180.014	
EURIMIE_CK	650	180.009	178.459	180.007	
EURIMIE_CK	880	180.006	178.439	180.004	
EURIMIE_CK	1140	180.004	177.781	180.001	
GEAMONEY_BREAKOUT	0	186.792	185.625	186.777	
GEAMONEY_BREAKOUT	100	186.789	185.625	186.775	
GEAMONEY_BREAKOUT	120	186.679	185.492	186.669	
GEAMONEY_BREAKOUT	200	186.677	185.491	186.667	
LINK_6MILE	0	187.304	186.368	187.289	
LINK_6MILE	500	183.107	182.882	183.1	
LINK_6MILE_CASTLEREAGH_RB	0	184.469	184.469	184.469	
LINK_6MILE_CASTLEREAGH_RB	20	185.782	184.556	185.702	
LINK_9MILE	0	195.492	194.526	195.455	
LINK_9MILE	20	195.153	194.284	195.106	
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB	0	212.513	210.852	212.289	
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB	20	206.501	206.501	206.501	
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB	0	212.513	210.852	212.289	
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB	20	213.467	213.467	213.467	
LINK_CASTLEREAGH_14000	0	209.691	208.402	209.526	
LINK_CASTLEREAGH_14000	20	210.983	210.983	210.983	
LINK_CASTLEREAGH_19000	0	205.261	204.063	205.042	
LINK_CASTLEREAGH_19000	20	204.896	204.896	204.896	
LINK_CASTLEREAGH_19000_WARRENA	0	205.261	204.063	205.042	
LINK_CASTLEREAGH_19000_WARRENA	20	204.676	204.676	204.676	
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB	0	203.075	201.401	202.838	
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB	20	202.187	202.187	202.187	
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB	0	203.075	201.401	202.838	
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB	20	202.251	202.251	202.251	
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB	0	198.06	196.262	197.97	
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB	20	196.164	195.437	196.094	
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB	0	198.06	196.262	197.97	
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB	20	196.456	195.795	196.393	
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB	0	193.652	192.45	193.626	
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB	20	193.278	192.55	193.24	
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB	0	189.633	188.746	189.618	
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB	20	186.792	185.664	186.777	

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LINK_CASTLEREAGH_6900_CASTLEREAGH_LB	0	207.162	206.338	207.052	
LINK_CASTLEREAGH_6900_CASTLEREAGH_LB	20	202.501	202.501	202.501	
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB	0	207.162	206.338	207.052	
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB	20	207.429	207.429	207.429	
LINK_CASTLEREAGH_6MILE	0	192.136	191.206	192.12	
LINK_CASTLEREAGH_6MILE	20	189.819	189.819	189.819	
LINK_CASTLEREAGH_BARTON_ST	0	181.163	180.063	181.147	
LINK_CASTLEREAGH_BARTON_ST	20	180.683	180.683	180.683	
LINK_CASTLEREAGH_BERTRAM_ST	0	181.089	179.967	181.075	
LINK_CASTLEREAGH_BERTRAM_ST	20	175.819	175.819	175.819	
LINK_CASTLEREAGH_DURHAM_ST	0	182.393	181.145	182.372	
LINK_CASTLEREAGH_DURHAM_ST	20	180.987	180.987	180.987	
LINK_CASTLEREAGH_EURIMIE	0	180.146	179.293	180.141	
LINK_CASTLEREAGH_EURIMIE	20	180.06	179.494	180.057	
LINK_CASTLEREAGH_MCMAHON_ST	0	180.74	179.696	180.728	
LINK_CASTLEREAGH_MCMAHON_ST	20	180.692	180.692	180.692	
LINK_CASTLEREAGH_QUANMOONA_ST	0	181.938	180.735	181.919	
LINK_CASTLEREAGH_QUANMOONA_ST	20	176.958	176.958	176.958	
LINK_CASTLEREAGH_RAILWAY_ST	0	182.036	180.828	182.017	
LINK_CASTLEREAGH_RAILWAY_ST	20	181.897	181.897	181.897	
LINK_CASTLEREAGH_RB_12400_WARRENA	0	210.983	210.983	210.983	
LINK_CASTLEREAGH_RB_12400_WARRENA	20	207.529	207.529	207.529	
LINK_CASTLEREAGH_RB_17800_WARRENA_LB	0	204.896	204.896	204.896	
LINK_CASTLEREAGH_RB_17800_WARRENA_LB	20	205.245	205.245	205.245	
LINK_CASTLEREAGH_RB_35500_WARRENA_LB	0	185.782	184.556	185.702	
LINK_CASTLEREAGH_RB_35500_WARRENA_LB	20	187.536	187.536	187.536	
LINK_CASTLEREAGH_RB_41500_WARRENA	0	179.944	179.014	179.908	
LINK_CASTLEREAGH_RB_41500_WARRENA	20	179.886	180.083	180.92	
LINK_CASTLEREAGH_REID_ST	0	181.611	180.456	181.593	
LINK_CASTLEREAGH_REID_ST	20	179.929	179.929	179.929	
LINK_CASTLEREAGH_WILGA_GLEN	0	184.472	183.201	184.443	
LINK_CASTLEREAGH_WILGA_GLEN	20	183.684	183.684	183.684	
LINK_WARRENA_10000_WARRENA_LB	0	197.042	197.042	197.042	
LINK_WARRENA_10000_WARRENA_LB	20	199.789	199.789	199.789	
LINK_WARRENA_16000_WARRENA_LB	0	189.162	189.162	189.162	
LINK_WARRENA_16000_WARRENA_LB	20	194.009	194.009	194.009	
LINK_WARRENA_20700_WARRENA_LB	0	183.086	183.086	183.086	
LINK_WARRENA_20700_WARRENA_LB	20	187.536	187.536	187.536	
LINK_WARRENA_5300_WARRENA_LB	0	204.676	204.676	204.676	
LINK_WARRENA_5300_WARRENA_LB	20	204.871	204.871	204.871	
MCMAHON_ST	0	180.692	180.692	180.692	
MCMAHON_ST	660	179.682	179.682	179.682	
MCMAHON_ST	780	179.419	179.419	179.419	
QUANMOONA_ST	0	176.958	176.958	176.958	
QUANMOONA_ST	470	178.983	178.983	178.983	
QUANMOONA_ST	600	178.845	178.845	178.845	
RAILWAY_ST	0	181.897	181.897	181.897	
RAILWAY_ST	190	180.197	180.197	180.197	
RAILWAY_ST	410	178.859	178.859	178.859	
RAILWAY_ST	700	178.845	178.845	178.845	
RAILWAY_ST	990	179.929	179.929	179.929	
RAILWAY_ST	1240	180.428	180.428	180.428	
RAILWAY_ST	1500	179.422	179.422	179.422	
RAILWAY_ST	1750	179.419	179.419	179.419	
RAILWAY_ST	1850	179.112	179.112	179.112	
REID_ST	0	179.929	179.929	179.929	
REID_ST	640	179.929	179.929	179.929	
REID_ST	760	179.929	179.929	179.929	
WARRENA	0	207.529	207.529	207.529	
WARRENA	883.33	207.053	207.053	207.053	
WARRENA	1766.67	206.578	206.578	206.578	
WARRENA	2650	206.103	206.103	206.103	
WARRENA	3533.33	205.627	205.627	205.627	
WARRENA	4416.67	205.151	205.151	205.151	
WARRENA	5300	204.676	204.676	204.676	
WARRENA	6240	203.15	203.15	203.15	
WARRENA	7180	201.623	201.623	201.623	
WARRENA	8120	200.097	200.097	200.097	
WARRENA	9060	198.57	198.57	198.57	

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WARRENA	10000	197.042	197.042	197.042	
WARRENA	11000	195.73	195.73	195.73	
WARRENA	12000	194.417	194.417	194.417	
WARRENA	13000	193.103	193.103	193.103	
WARRENA	14000	191.789	191.789	191.789	
WARRENA	15000	190.476	190.476	190.476	
WARRENA	16000	189.162	189.162	189.162	
WARRENA	16940	187.947	187.947	187.947	
WARRENA	17880	186.732	186.732	186.732	
WARRENA	18820	185.516	185.516	185.516	
WARRENA	19760	184.301	184.301	184.301	
WARRENA	20700	183.086	183.086	183.086	
WARRENA	20710	183.086	183.086	183.086	
WARRENA	21675	182.442	182.442	182.656	
WARRENA	22640	182.254	181.797	182.655	
WARRENA	23605	182.254	181.602	182.655	
WARRENA	24570	182.254	181.602	182.655	
WARRENA	25535	182.231	181.589	182.636	
WARRENA	26500	181.435	181.236	182.275	
WARRENA	26510	181.392	181.227	182.266	
WARRENA	27455	180.822	181.088	182.126	
WARRENA	28400	179.886	180.083	180.92	
WARRENA	29370	179.242	179.397	180.364	
WARRENA	30340	178.934	179.008	179.84	
WARRENA	31310	178.908	178.785	179.314	
WARRENA	31750	178.775	178.663	179.071	
WARRENA	32450	178.591	178.294	178.79	
WARRENA	32460	178.584	178.285	178.78	
WARRENA	32750	178.49	178.097	178.622	
WARRENA	32760	178.483	178.087	178.615	
WARRENA	33090	178.414	177.938	178.532	
WARRENA	33500	178.395	177.763	178.51	
WARRENA_LB	0	205.245	205.245	205.245	
WARRENA_LB	550	205.058	205.058	205.058	
WARRENA_LB	1100	204.871	204.871	204.871	
WARRENA_LB	2040	203.855	203.855	203.855	
WARRENA_LB	2980	202.838	202.838	202.838	
WARRENA_LB	3920	201.822	201.822	201.822	
WARRENA_LB	4860	200.805	200.805	200.805	
WARRENA_LB	5800	199.789	199.789	199.789	
WARRENA_LB	6716.67	198.826	198.826	198.826	
WARRENA_LB	7633.33	197.862	197.862	197.862	
WARRENA_LB	8550	196.899	196.899	196.899	
WARRENA_LB	9466.67	195.936	195.936	195.936	
WARRENA_LB	10383.33	194.972	194.972	194.972	
WARRENA_LB	11300	194.009	194.009	194.009	
WARRENA_LB	12300	192.714	192.714	192.714	
WARRENA_LB	13300	191.42	191.42	191.42	
WARRENA_LB	14300	190.125	190.125	190.125	
WARRENA_LB	15300	188.831	188.831	188.831	
WARRENA_LB	16300	187.536	187.536	187.536	
WARRENA_LB	17200	186.418	186.418	186.418	
WARRENA_LB	18100	185.299	185.299	185.299	
WARRENA_LB	19000	184.181	184.181	184.181	
WARRENA_LB	19900	183.062	183.062	183.062	
WARRENA_LB	20800	181.944	181.944	181.944	
WARRENA_LB	21700	180.859	180.825	180.825	
WARRENA_LB	22600	180.859	179.707	180.812	
WILGA_GLEN_RD	0	183.684	183.684	183.684	
WILGA_GLEN_RD	577	182.268	182.268	182.268	
WILGA_GLEN_RD	1305	179.99	179.99	179.99	
WILGA_GLEN_RD	1450	179.787	179.787	179.787	

Numbers within () indicate recoded data



B.5.2 Modelled Peak Discharges (m³/s)

MIKE-11 Branch	Chainage (m)	2000 Flood	1999 Flood	1998 Flood	Remarks
6MILE_BREAKOUT	1966.67	0	0	0	
6MILE_BREAKOUT	2900	0	0	0	
6MILE_BREAKOUT	3833.33	0	0	0	
6MILE_BREAKOUT	4700	0	0	0	
6MILE_BREAKOUT	5500	0	0	0	
6MILE_BREAKOUT	6300	1	0	1	
6MILE_BREAKOUT	7100	1	0	1	
6MILE_BREAKOUT	7900	2	0	1	
6MILE_BREAKOUT	8700	2	0	1	
9MILE_BREAKOUT	250	125	0	104	
9MILE_BREAKOUT	875	125	0	104	
9MILE_BREAKOUT	1625	125	0	104	
BARTON_ST	360	0	0	0	
BARTON_ST	780	0	0	0	
BERTRAM_ST	390	0	0	0	
BERTRAM_ST	840	0	0	0	
CASTLEREAGH	9750	950	416	861	
CASTLEREAGH	10500	948	415	861	
CASTLEREAGH	11500	945	415	861	
CASTLEREAGH	12500	943	414	861	
CASTLEREAGH	13500	942	414	861	
CASTLEREAGH	14483.33	943	414	861	
CASTLEREAGH	15450	943	414	861	
CASTLEREAGH	16416.67	942	413	861	
CASTLEREAGH	17250	940	413	860	
CASTLEREAGH	17950	939	413	860	
CASTLEREAGH	18650	937	413	860	
CASTLEREAGH	19425	932	413	859	
CASTLEREAGH	20275	926	412	858	
CASTLEREAGH	21125	920	412	857	
CASTLEREAGH	21975	918	412	855	
CASTLEREAGH	22892.86	915	412	855	
CASTLEREAGH	23878.57	914	411	855	
CASTLEREAGH	24864.29	912	411	854	
CASTLEREAGH	25850	911	411	854	
CASTLEREAGH	26835.71	910	410	854	
CASTLEREAGH	27821.43	910	409	854	
CASTLEREAGH	28807.14	910	409	854	
CASTLEREAGH	29310	846	409	812	Combara Bridge
CASTLEREAGH	29691.67	846	409	812	
CASTLEREAGH	30435	846	408	812	
CASTLEREAGH	31178.33	846	408	812	
CASTLEREAGH	32037.5	721	408	708	
CASTLEREAGH	33012.5	721	408	708	
CASTLEREAGH	33875	679	408	673	
CASTLEREAGH	34625	679	408	673	
CASTLEREAGH	35387.5	679	408	673	
CASTLEREAGH	36162.5	679	408	673	
CASTLEREAGH	36937.5	679	408	673	
CASTLEREAGH	37712.5	679	407	673	
CASTLEREAGH	38516.67	679	407	673	
CASTLEREAGH	39350	679	407	673	
CASTLEREAGH	40183.33	679	407	673	
CASTLEREAGH	40987.5	677	407	672	
CASTLEREAGH	41762.5	677	407	672	
CASTLEREAGH	42537.5	677	407	672	
CASTLEREAGH	43312.5	677	407	672	
CASTLEREAGH	44050	673	407	668	
CASTLEREAGH	44730	673	407	668	
CASTLEREAGH	45390	673	407	668	
CASTLEREAGH	45995	673	407	668	
CASTLEREAGH	46420	673	407	668	
CASTLEREAGH	46720	673	407	668	
CASTLEREAGH	47010	673	407	668	
CASTLEREAGH	47290	673	407	668	
CASTLEREAGH	47585	673	407	668	
CASTLEREAGH	47925	673	407	668	
CASTLEREAGH	48120	673	407	668	Aberford Street Bridge



MIKE-11 Branch	Chainage (m)	2000 Flood	1999 Flood	1998 Flood	Remarks
CASTLEREAGH	48290	673	407	668	
CASTLEREAGH	48580	663	407	658	
CASTLEREAGH	48890	663	407	658	
CASTLEREAGH	49285	663	407	658	
CASTLEREAGH	49850	809	545	877	
CASTLEREAGH	50550	809	545	877	
CASTLEREAGH	51400	809	545	877	
CASTLEREAGH	52400	808	544	877	
CASTLEREAGH	53400	807	544	877	
CASTLEREAGH	54400	806	544	877	
CASTLEREAGH	55400	806	544	877	
CASTLEREAGH	56400	805	543	877	
CASTLEREAGH_LB	10440	0	0	0	
CASTLEREAGH_LB	11320	0	0	0	
CASTLEREAGH_LB	12200	0	0	0	
CASTLEREAGH_LB	13080	0	0	0	
CASTLEREAGH_LB	13960	0	0	0	
CASTLEREAGH_LB	14875	0	0	0	
CASTLEREAGH_LB	15825	0	0	0	
CASTLEREAGH_LB	16775	0	0	0	
CASTLEREAGH_LB	17725	0	0	0	
CASTLEREAGH_LB	18675	0	0	0	
CASTLEREAGH_LB	19625	0	0	0	
CASTLEREAGH_LB	20542.86	0	0	0	
CASTLEREAGH_LB	21428.57	0	0	0	
CASTLEREAGH_LB	22314.29	0	0	0	
CASTLEREAGH_LB	23200	0	0	0	
CASTLEREAGH_LB	24085.71	0	0	0	
CASTLEREAGH_LB	24971.43	0	0	0	
CASTLEREAGH_LB	25857.14	0	0	0	
CASTLEREAGH_LB	26780	57	0	37	
CASTLEREAGH_LB	27740	59	0	37	
CASTLEREAGH_LB	28700	62	0	36	
CASTLEREAGH_LB	29660	60	0	37	
CASTLEREAGH_LB	30620	55	0	36	
CASTLEREAGH_LB	31530	86	0	69	
CASTLEREAGH_LB	32390	86	0	69	
CASTLEREAGH_LB	33250	86	0	69	
CASTLEREAGH_LB	34110	86	0	69	
CASTLEREAGH_LB	34970	84	0	69	
CASTLEREAGH_LB	35650	0	0	0	
CASTLEREAGH_LB	36333.33	0	0	0	
CASTLEREAGH_LB	37200	0	0	0	
CASTLEREAGH_LB	38066.67	0	0	0	
CASTLEREAGH_LB	38933.33	0	0	0	
CASTLEREAGH_LB	39800	1	0	5	
CASTLEREAGH_LB	40666.67	-4	0	12	
CASTLEREAGH_RB	10400	0	0	0	
CASTLEREAGH_RB	11200	0	0	0	
CASTLEREAGH_RB	12000	0	0	0	
CASTLEREAGH_RB	12883.33	0	0	0	
CASTLEREAGH_RB	13850	0	0	0	
CASTLEREAGH_RB	14816.67	0	0	0	
CASTLEREAGH_RB	15716.67	0	0	0	
CASTLEREAGH_RB	16550	0	0	0	
CASTLEREAGH_RB	17383.33	0	0	0	
CASTLEREAGH_RB	18233.33	0	0	0	
CASTLEREAGH_RB	19100	0	0	0	
CASTLEREAGH_RB	19966.67	0	0	0	
CASTLEREAGH_RB	20885.71	0	0	0	
CASTLEREAGH_RB	21857.14	0	0	0	
CASTLEREAGH_RB	22828.57	0	0	0	
CASTLEREAGH_RB	23800	0	0	0	
CASTLEREAGH_RB	24771.43	0	0	0	
CASTLEREAGH_RB	25742.86	0	0	0	
CASTLEREAGH_RB	26714.29	0	0	0	
CASTLEREAGH_RB	27700	6	0	4	
CASTLEREAGH_RB	28700	6	0	4	
CASTLEREAGH_RB	29700	6	0	4	
CASTLEREAGH_RB	30700	6	0	4	

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MIKE-11 Branch	Chainage (m)	2000 Flood	1999 Flood	1998 Flood	Remarks
CASTLEREAGH_RB	31630	130	0	108	
CASTLEREAGH_RB	32490	130	0	108	
CASTLEREAGH_RB	33350	130	0	108	
CASTLEREAGH_RB	34210	130	0	108	
CASTLEREAGH_RB	35070	129	0	108	
CASTLEREAGH_RB	35960	129	0	108	
CASTLEREAGH_RB	36880	128	0	108	
CASTLEREAGH_RB	37800	128	0	108	
CASTLEREAGH_RB	38720	127	0	108	
CASTLEREAGH_RB	39640	127	0	108	
CASTLEREAGH_RB	40450	128	0	109	
CASTLEREAGH_RB	41150	127	0	109	
CASTLEREAGH_RB	41800	124	0	107	
CASTLEREAGH_RB	42400	119	0	106	
CASTLEREAGH_RB	42710	119	0	106	Tooraweenah Rd
CASTLEREAGH_RB	42960	119	-1	106	
DURHAM_ST	127.5	0	0	0	
DURHAM_ST	598	0	0	0	
DURHAM_ST	980.5	0	0	0	
EURIMIE_CK	190	11	0	10	
EURIMIE_CK	515	11	0	10	
EURIMIE_CK	765	10	0	10	
EURIMIE_CK	1010	10	0	10	
GEAMONEY_BREAKOUT	50	83	2	69	
GEAMONEY_BREAKOUT	110	83	1	69	
GEAMONEY_BREAKOUT	160	83	1	69	
LINK_6MILE	250	1	0	1	
LINK_6MILE_CASTLEREAGH_RB	10	0	0	0	
LINK_9MILE	10	125	0	104	
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB	10	0	0	0	
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB	10	0	0	0	
LINK_CASTLEREAGH_14000	10	0	0	0	
LINK_CASTLEREAGH_19000	10	0	0	0	
LINK_CASTLEREAGH_19000_WARRENA	10	0	0	0	
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB	10	0	0	0	
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB	10	0	0	0	
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB	10	58	0	38	
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB	10	6	0	4	
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB	10	42	0	35	
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB	10	0	0	0	
LINK_CASTLEREAGH_6900_CASTLEREAGH_LB	10	0	0	0	
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB	10	0	0	0	
LINK_CASTLEREAGH_6MILE	10	0	0	0	
LINK_CASTLEREAGH_BARTON_ST	10	0	0	0	
LINK_CASTLEREAGH_BERTRAM_ST	10	0	0	0	
LINK_CASTLEREAGH_DURHAM_ST	10	0	0	0	
LINK_CASTLEREAGH_EURIMIE	10	11	0	10	
LINK_CASTLEREAGH_MCMAHON_ST	10	0	0	0	
LINK_CASTLEREAGH_QUANMOONA_ST	10	0	0	0	
LINK_CASTLEREAGH_RAILWAY_ST	10	0	0	0	
LINK_CASTLEREAGH_RB_12400_WARRENA	10	0	0	0	
LINK_CASTLEREAGH_RB_17800_WARRENA_LB	10	0	0	0	
LINK_CASTLEREAGH_RB_35500_WARRENA_LB	10	0	0	0	
LINK_CASTLEREAGH_RB_41500_WARRENA	10	0	0	0	
LINK_CASTLEREAGH_REID_ST	10	0	0	0	
LINK_CASTLEREAGH_WILGA_GLEN	10	0	0	0	
LINK_WARRENA_10000_WARRENA_LB	10	0	0	0	
LINK_WARRENA_16000_WARRENA_LB	10	0	0	0	
LINK_WARRENA_20700_WARRENA_LB	10	0	0	0	
LINK_WARRENA_5300_WARRENA_LB	10	0	0	0	
MCMAHON_ST	330	0	0	0	
MCMAHON_ST	720	0	0	0	
QUANMOONA_ST	235	0	0	0	
QUANMOONA_ST	535	0	0	0	
RAILWAY_ST	95	0	0	0	
RAILWAY_ST	300	0	0	0	
RAILWAY_ST	555	0	0	0	
RAILWAY_ST	845	0	0	0	
RAILWAY_ST	1115	0	0	0	
RAILWAY_ST	1370	0	0	0	

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RAILWAY_ST	1625	0	0	0	
RAILWAY_ST	1800	0	0	0	
REID_ST	320	0	0	0	
REID_ST	700	0	0	0	
WARRENA	441.67	0	0	0	
WARRENA	1325	0	0	0	
WARRENA	2208.33	0	0	0	
WARRENA	3091.67	0	0	0	
WARRENA	3975	0	0	0	
WARRENA	4858.33	0	0	0	
WARRENA	5770	0	0	0	
WARRENA	6710	0	0	0	
WARRENA	7650	0	0	0	
WARRENA	8590	0	0	0	
WARRENA	9530	0	0	0	
WARRENA	10500	0	0	0	
WARRENA	11500	0	0	0	
WARRENA	12500	0	0	0	
WARRENA	13500	0	0	0	
WARRENA	14500	0	0	0	
WARRENA	15500	0	0	0	
WARRENA	16470	0	0	0	
WARRENA	17410	0	0	0	
WARRENA	18350	0	0	0	
WARRENA	19290	0	0	0	
WARRENA	20230	0	0	0	
WARRENA	20705	0	0	0	
WARRENA	21192.5	0	0	0	Wongy Rd
WARRENA	22157.5	0	0	0	
WARRENA	23122.5	0	0	-1	
WARRENA	24087.5	-1	0	-2	
WARRENA	25052.5	-2	-2	-5	
WARRENA	26017.5	76	37	91	
WARRENA	26505	76	37	92	Tooraweenah Rd
WARRENA	26982.5	76	37	93	
WARRENA	27927.5	148	193	391	
WARRENA	28885	148	186	378	
WARRENA	29855	147	178	363	
WARRENA	30825	146	168	358	
WARRENA	31530	172	156	352	
WARRENA	32100	172	156	351	
WARRENA	32455	172	148	349	Warrena Weir
WARRENA	32605	172	147	348	
WARRENA	32755	173	147	347	Baradine Road
WARRENA	32925	173	147	346	
WARRENA	33295	177	145	342	
WARRENA_LB	275	0	0	0	
WARRENA_LB	825	0	0	0	
WARRENA_LB	1570	0	0	0	
WARRENA_LB	2510	0	0	0	
WARRENA_LB	3450	0	0	0	
WARRENA_LB	4390	0	0	0	
WARRENA_LB	5330	0	0	0	
WARRENA_LB	6258.33	0	0	0	
WARRENA_LB	7175	0	0	0	
WARRENA_LB	8091.67	0	0	0	
WARRENA_LB	9008.33	0	0	0	
WARRENA_LB	9925	0	0	0	
WARRENA_LB	10841.67	0	0	0	
WARRENA_LB	11800	0	0	0	
WARRENA_LB	12800	0	0	0	
WARRENA_LB	13800	0	0	0	
WARRENA_LB	14800	0	0	0	
WARRENA_LB	15800	0	0	0	
WARRENA_LB	16750	0	0	0	
WARRENA_LB	17650	0	0	0	
WARRENA_LB	18550	0	0	0	
WARRENA_LB	19450	0	0	0	
WARRENA_LB	20350	0	0	0	
WARRENA_LB	21250	0	0	0	



MIKE-11 Branch	Chainage (m)	2000 Flood	1999 Flood	1998 Flood	Remarks
WARRENA_LB	22150	0	0	0	
WILGA_GLEN_RD	288.5	0	0	0	
WILGA_GLEN_RD	941	0	0	0	
WILGA_GLEN_RD	1377.5	0	0	0	

B.6 Verification Results for 2007 and 1955 Events

B.6.1 Peak Flood Levels (PFL) in mAHD

MIKE-11 Cross Section	2007 ^a	2007 ^b	1955 ^a	1955 ^b	Remarks
CASTLEREAGH_LB 10000.00	213.498		214.627		
CASTLEREAGH_LB 10880.00	211.398		212.847		
CASTLEREAGH_LB 11760.00	209.299		211.162		
CASTLEREAGH_LB 12640.00	207.199		209.759		
CASTLEREAGH_LB 13520.00	205.1		209.262		
CASTLEREAGH_LB 14400.00	202.501		208.852		
CASTLEREAGH_LB 14400.00	202.501		208.852		
CASTLEREAGH_LB 15350.00	202.865		208.165		
CASTLEREAGH_LB 16300.00	202.729		207.444		
CASTLEREAGH_LB 17250.00	202.594		206.693		
CASTLEREAGH_LB 18200.00	202.458		205.964		
CASTLEREAGH_LB 19150.00	202.322		205.32		
CASTLEREAGH_LB 20100.00	202.187		204.585		
CASTLEREAGH_LB 20100.00	202.187		204.585		
CASTLEREAGH_LB 20985.71	201.223		202.943		
CASTLEREAGH_LB 21871.43	200.258		201.676		
CASTLEREAGH_LB 22757.14	199.294		200.551		
CASTLEREAGH_LB 23642.86	198.33		199.476		
CASTLEREAGH_LB 24528.57	197.366		198.461		
CASTLEREAGH_LB 25414.29	196.401		197.405		
CASTLEREAGH_LB 26300.00	195.437		196.97		
CASTLEREAGH_LB 26300.00	195.437		196.97		
CASTLEREAGH_LB 27260.00	194.86		196.391		
CASTLEREAGH_LB 28220.00	194.282		195.813		
CASTLEREAGH_LB 29180.00	193.705		195.235		
CASTLEREAGH_LB 30140.00	193.127		194.665		
CASTLEREAGH_LB 31100.00	192.55		193.735		
CASTLEREAGH_LB 31100.00	192.55		193.735		
CASTLEREAGH_LB 31800.00	190.359		191.274		
CASTLEREAGH_LB 31800.00	190.359		191.274		
CASTLEREAGH_LB 32666.67	189.448		189.728		
CASTLEREAGH_LB 33533.33	188.532		188.537		
CASTLEREAGH_LB 34400.00	187.179		187.268		
CASTLEREAGH_LB 34400.00	187.179		187.268		
CASTLEREAGH_LB 35400.00	185.643		185.901		
CASTLEREAGH_LB 35400.00	185.643		185.901		
CASTLEREAGH_LB 35900.00	185.658		186.053		
CASTLEREAGH_LB 35900.00	185.658		186.053		
CASTLEREAGH_LB 36766.67	184.632		185.112		
CASTLEREAGH_LB 37633.33	183.605		184.679		
CASTLEREAGH_LB 38500.00	182.579		184.676		
CASTLEREAGH_LB 39366.67	181.553		184.675		
CASTLEREAGH_LB 40233.33	181.197		184.674		
CASTLEREAGH_LB 41100.00	183.505		184.67		
CASTLEREAGH 9500.00	211.46		216.351		
CASTLEREAGH 10000.00	211.108		216.017		
CASTLEREAGH 10000.00	211.108		216.017		
CASTLEREAGH 11000.00	210.487		215.31		
CASTLEREAGH 12000.00	209.865		214.532		
CASTLEREAGH 13000.00	209.242		213.615		
CASTLEREAGH 14000.00	208.616		212.465		
CASTLEREAGH 14000.00	208.616		212.465		
CASTLEREAGH 14966.67	207.999		211.236		
CASTLEREAGH 15933.33	207.338		210.226		
CASTLEREAGH 16900.00	206.479		209.218		
CASTLEREAGH 16900.00	206.479		209.218		
CASTLEREAGH 17600.00	205.654		208.44		
CASTLEREAGH 18300.00	204.851		207.717		
CASTLEREAGH 19000.00	204.217		207.136		

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MIKE-11 Cross Section	2007 ^a	2007 ^b	1955 ^a	1955 ^b	Remarks
CASTLEREAGH 19000.00	204.217		207.136		
CASTLEREAGH 19850.00	203.601		206.603		
CASTLEREAGH 20700.00	202.989		206.076	206.14	"Horans"
CASTLEREAGH 21550.00	202.354		205.514		
CASTLEREAGH 22400.00	201.63		204.823		
CASTLEREAGH 22400.00	201.63		204.823		
CASTLEREAGH 23385.71	200.715		204.143		
CASTLEREAGH 24371.43	199.839		203.507		
CASTLEREAGH 25357.14	199.03		202.903		
CASTLEREAGH 26342.86	198.312		202.291		
CASTLEREAGH 27328.57	197.696		201.594		
CASTLEREAGH 28314.29	197.16		200.625		
CASTLEREAGH 29300.00	196.657		198.722		
CASTLEREAGH 29300.00	196.657		198.722		U/S Combara Br
CASTLEREAGH 29320.00	196.643		198.651		D/S Combara Br
CASTLEREAGH 30063.33	196.179		197.866		
CASTLEREAGH 30806.67	195.531		196.96		
CASTLEREAGH 31550.00	194.735		195.719		
CASTLEREAGH 31550.00	194.735		195.719		
CASTLEREAGH 32525.00	193.694		194.848		
CASTLEREAGH 33500.00	192.735		193.803		
CASTLEREAGH 33500.00	192.735		193.803		
CASTLEREAGH 34250.00	192.178		192.94		
CASTLEREAGH 35000.00	191.486		192.276		
CASTLEREAGH 35000.00	191.486		192.276		
CASTLEREAGH 35775.00	190.683		191.541		
CASTLEREAGH 36550.00	190.125		190.911		
CASTLEREAGH 37325.00	189.625		190.367		
CASTLEREAGH 38100.00	188.999		189.731		
CASTLEREAGH 38100.00	188.999		189.731		
CASTLEREAGH 38933.33	188.226		188.943		
CASTLEREAGH 39766.67	187.429		188.196		
CASTLEREAGH 40600.00	186.594		187.413		
CASTLEREAGH 40600.00	186.594		187.413		
CASTLEREAGH 41375.00	185.794		186.644		
CASTLEREAGH 42150.00	184.995		185.933		
CASTLEREAGH 42925.00	184.219		185.265		
CASTLEREAGH 43700.00	183.505		184.67		
CASTLEREAGH 43700.00	183.505		184.67		
CASTLEREAGH 44400.00	182.843		184.027		
CASTLEREAGH 45060.00	182.205		183.317		
CASTLEREAGH 45720.00	181.514		182.602		
CASTLEREAGH 45720.00	181.514		182.602		
CASTLEREAGH 46270.00	181.208		182.244		
CASTLEREAGH 46270.00	181.208		182.244		
CASTLEREAGH 46570.00	181.118		182.15		
CASTLEREAGH 46570.00	181.118		182.15		
CASTLEREAGH 46870.00	180.837		181.832	181.9	Hospital
CASTLEREAGH 46870.00	180.837		181.832		
CASTLEREAGH 47150.00	180.473		181.399		
CASTLEREAGH 47150.00	180.473		181.399		
CASTLEREAGH 47430.00	180.405		181.333		
CASTLEREAGH 47430.00	180.405		181.333		
CASTLEREAGH 47740.00	180.14		180.999		
CASTLEREAGH 47740.00	180.14		180.999		
CASTLEREAGH 48110.00	179.912	179.919	180.648	180.76	U/S Aberford St Bridge
CASTLEREAGH 48130.00	179.78		180.414		D/S Aberford St Bridge
CASTLEREAGH 48450.00	179.605		180.215		
CASTLEREAGH 48450.00	179.605		180.215		
CASTLEREAGH 48710.00	179.266		179.853		
CASTLEREAGH 49070.00	178.642		179.07	179.13	
CASTLEREAGH 49500.00	178.641		178.726		
CASTLEREAGH 49500.00	178.641		178.726		
CASTLEREAGH 50200.00	177.839		177.82		
CASTLEREAGH 50900.00	177.107		177.431		
CASTLEREAGH 51900.00	176.105		176.431		
CASTLEREAGH 52900.00	175.104		175.429		
CASTLEREAGH 53900.00	174.102		174.437		
CASTLEREAGH 54900.00	173.102		173.431		
CASTLEREAGH 55900.00	172.106		172.969		
CASTLEREAGH 56900.00	171.272		172.892		

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CASTLEREAGH_RB 10000.00	213.467		215.31		
CASTLEREAGH_RB 10800.00	212.639		214.514		
CASTLEREAGH_RB 11600.00	211.811		213.753		
CASTLEREAGH_RB 12400.00	210.983		212.482		
CASTLEREAGH_RB 12400.00	210.983		212.482		
CASTLEREAGH_RB 13366.67	209.798		211.344		
CASTLEREAGH_RB 14333.33	208.614		210.323		
CASTLEREAGH_RB 15300.00	207.385		208.879		
CASTLEREAGH_RB 15300.00	207.385		208.879		
CASTLEREAGH_RB 16133.33	206.585		208.073		
CASTLEREAGH_RB 16966.67	205.741		207.188		
CASTLEREAGH_RB 17800.00	204.896		206.63		
CASTLEREAGH_RB 17800.00	204.896		206.63		
CASTLEREAGH_RB 18666.67	204.015		205.831		
CASTLEREAGH_RB 19533.33	203.133		205.128		
CASTLEREAGH_RB 20400.00	202.251		204.633		
CASTLEREAGH_RB 20400.00	202.251		204.633		
CASTLEREAGH_RB 21371.43	201.329		203.37		
CASTLEREAGH_RB 22342.86	200.406		202.246		
CASTLEREAGH_RB 23314.29	199.484		201.175		
CASTLEREAGH_RB 24285.71	198.562		200.12		
CASTLEREAGH_RB 25257.14	197.64		199.118		
CASTLEREAGH_RB 26228.57	196.717		198.068		
CASTLEREAGH_RB 27200.00	195.795		197.2		
CASTLEREAGH_RB 27200.00	195.795		197.2		
CASTLEREAGH_RB 28200.00	194.441		195.64		
CASTLEREAGH_RB 29200.00	193.087		194.154		
CASTLEREAGH_RB 30200.00	191.733		192.907		
CASTLEREAGH_RB 31200.00	190.379		191.874		
CASTLEREAGH_RB 31200.00	190.379		191.874		
CASTLEREAGH_RB 32060.00	189.214		190.422		
CASTLEREAGH_RB 32920.00	188.05		189.342		
CASTLEREAGH_RB 33780.00	186.885		188.396		
CASTLEREAGH_RB 34640.00	185.721		187.496		
CASTLEREAGH_RB 35500.00	184.556		186.38		
CASTLEREAGH_RB 35500.00	184.556		186.38		
CASTLEREAGH_RB 36420.00	183.586		185.372		
CASTLEREAGH_RB 37340.00	182.616		184.355		
CASTLEREAGH_RB 38260.00	181.647		183.382		
CASTLEREAGH_RB 39180.00	180.677		182.328		
CASTLEREAGH_RB 40100.00	180.222		181.547		
CASTLEREAGH_RB 40100.00	180.222		181.547		
CASTLEREAGH_RB 40800.00	180.222		180.999		
CASTLEREAGH_RB 41500.00	180.222		180.608		
CASTLEREAGH_RB 41500.00	180.222		180.608		
CASTLEREAGH_RB 42100.00	180.174		180.263		
CASTLEREAGH_RB 42700.00	180.153	180.29	179.971		U/S Tooraweenah Rd
CASTLEREAGH_RB 42720.00	179.933	179.819	179.964		D/S Tooraweenah Rd
CASTLEREAGH_RB 43200.00	179.911		179.765		
WARRENA 0.00	212.61		212.61		
WARRENA 883.33	211.288		211.288		
WARRENA 1766.67	209.965		209.965		
WARRENA 2650.00	208.643		208.643		
WARRENA 3533.33	207.321		207.321		
WARRENA 4416.67	205.998		205.998		
WARRENA 5300.00	204.675		205.158		
WARRENA 5300.00	204.675		205.158		
WARRENA 6240.00	203.15		203.69		
WARRENA 7180.00	201.623		202.25		
WARRENA 8120.00	200.097		200.867		
WARRENA 9060.00	198.57		199.965		
WARRENA 10000.00	197.042		199.463		
WARRENA 10000.00	197.042		199.463		
WARRENA 11000.00	195.73		198.215		
WARRENA 12000.00	194.417		196.924		
WARRENA 13000.00	193.103		195.606		
WARRENA 14000.00	191.789		194.283		
WARRENA 15000.00	190.476		193.185		
WARRENA 16000.00	189.162		192.193		
WARRENA 16000.00	189.162		192.193		
WARRENA 16940.00	187.947		191.008		

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WARRENA 17880.00	186.732		189.776		
WARRENA 18820.00	185.516		188.613		
WARRENA 19760.00	184.301		188.253		
WARRENA 20700.00	183.495		188.048		
WARRENA 20700.00	183.495		188.048		U/S Wongy Rd
WARRENA 20710.00	183.496		188.042		D/S Wongy Rd
WARRENA 21675.00	183.495		186.478		
WARRENA 22640.00	183.495		185.02		
WARRENA 23605.00	183.495		184.12		
WARRENA 24570.00	183.495		183.371		
WARRENA 25535.00	183.481		182.814		
WARRENA 26500.00	182.706		181.962		
WARRENA 26500.00	182.706	183.24	181.962		U/S Tooraweenah Rd
WARRENA 26510.00	182.469		181.443		D/S Tooraweenah Rd
WARRENA 27455.00	182.147		181.18		
WARRENA 28400.00	181.394		180.863		
WARRENA 28400.00	181.394		180.863		
WARRENA 29370.00	180.842		180.253		
WARRENA 30340.00	180.321		179.835		
WARRENA 31310.00	179.911	179.819	179.765		
WARRENA 31310.00	179.911		179.765		
WARRENA 31750.00	179.655	179.537	179.532		
WARRENA 32450.00	179.329	179.401	179.293	179.22	Warrena Weir
WARRENA 32460.00	179.321		179.29		
WARRENA 32750.00	179.125	179.014	179.148	179.24	U/S Baradine Rd
WARRENA 32760.00	179.117		179.139		D/S Baradine Rd
WARRENA 33090.00	178.851	179.037	178.913		
WARRENA 33500.00	178.641		178.726		
WILGA_GLEN_RD 0.00	183.684		183.684		
WILGA_GLEN_RD 577.00	182.268		182.268		
WILGA_GLEN_RD 1305.00	179.99		179.99		
WILGA_GLEN_RD 1450.00	179.789		179.789		
DURHAM_ST 0.00	180.987		180.987		
DURHAM_ST 255.00	180.346		180.346		
DURHAM_ST 941.00	177.617		177.617		
DURHAM_ST 1020.00	178.828		178.828		
RAILWAY_ST 0.00	181.897		181.897		
RAILWAY_ST 190.00	180.197		180.197		
RAILWAY_ST 410.00	178.859		178.859		
RAILWAY_ST 700.00	178.845		178.845		
RAILWAY_ST 700.00	178.845		178.845		
RAILWAY_ST 990.00	179.929		179.929		
RAILWAY_ST 990.00	179.929		179.929		
RAILWAY_ST 1240.00	180.428		180.428		
RAILWAY_ST 1240.00	180.428		180.428		
RAILWAY_ST 1500.00	179.423		179.423		
RAILWAY_ST 1500.00	179.423		179.423		
RAILWAY_ST 1750.00	179.419		179.419		
RAILWAY_ST 1750.00	179.419		179.419		
RAILWAY_ST 1850.00	179.112		179.112		
MCMAHON_ST 0.00	180.692		180.692		
MCMAHON_ST 660.00	179.682		179.682		
MCMAHON_ST 780.00	179.419		179.419		
BERTRAM_ST 0.00	175.819		175.819		
BERTRAM_ST 780.00	180.197		180.197		
BERTRAM_ST 900.00	179.423		179.423		
BARTON_ST 0.00	180.683		180.683		
BARTON_ST 720.00	180.338		180.338		
BARTON_ST 840.00	180.428		180.428		
REID_ST 0.00	179.929		179.929		
REID_ST 640.00	179.929		179.929		
REID_ST 760.00	179.929		179.929		
QUANMOONA_ST 0.00	176.958		176.958		
QUANMOONA_ST 470.00	178.983		178.983		
QUANMOONA_ST 600.00	178.845		178.845		
EURIMIE_CK 0.00	179.494		180.133		
EURIMIE_CK 380.00	178.765		180.093		
EURIMIE_CK 650.00	178.459		180.085		
EURIMIE_CK 880.00	178.439		180.081		
EURIMIE_CK 1140.00	177.782		180.078		
LINK_CASTLEREAGH_RB_12400_WARRENA 0.00	210.983		212.482		

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LINK_CASTLEREAGH_RB_12400_WARRENA 20.00	212.61		212.61		
WARRENA_LB 0.00	205.245		205.496		
WARRENA_LB 550.00	205.058		205.311		
WARRENA_LB 1100.00	204.871		205.084		
WARRENA_LB 1100.00	204.871		205.084		
WARRENA_LB 2040.00	203.855		204.058		
WARRENA_LB 2980.00	202.838		203.034		
WARRENA_LB 3920.00	201.822		202.012		
WARRENA_LB 4860.00	200.805		200.99		
WARRENA_LB 5800.00	199.789		199.974		
WARRENA_LB 5800.00	199.789		199.974		
WARRENA_LB 6716.67	198.826		199.021		
WARRENA_LB 7633.33	197.862		198.067		
WARRENA_LB 8550.00	196.899		197.112		
WARRENA_LB 9466.67	195.936		196.156		
WARRENA_LB 10383.33	194.972		195.212		
WARRENA_LB 11300.00	194.009		194.249		
WARRENA_LB 11300.00	194.009		194.249		
WARRENA_LB 12300.00	192.714		192.927		
WARRENA_LB 13300.00	191.42		191.588		
WARRENA_LB 14300.00	190.125		190.228		
WARRENA_LB 15300.00	188.831		188.842		
WARRENA_LB 16300.00	187.536		187.552		
WARRENA_LB 16300.00	187.536		187.552		
WARRENA_LB 17200.00	186.418		186.492		
WARRENA_LB 18100.00	185.299		185.412		
WARRENA_LB 19000.00	184.181		184.322		
WARRENA_LB 19900.00	183.062		183.203		
WARRENA_LB 20800.00	181.944		182.159		
WARRENA_LB 21700.00	180.825		181.547		
WARRENA_LB 22600.00	180.222		181.547		
LINK_CASTLEREAGH_RB_17800_WARRENA_LB 0.00	204.896		206.63		
LINK_CASTLEREAGH_RB_17800_WARRENA_LB 20.00	205.245		205.496		
6MILE_BREAKOUT 1500.00	189.819		189.819		
6MILE_BREAKOUT 2433.33	188.036		188.036		
6MILE_BREAKOUT 3366.67	186.252		186.252		
6MILE_BREAKOUT 4300.00	184.469		186.017		
6MILE_BREAKOUT 4300.00	184.469		186.017		
6MILE_BREAKOUT 5100.00	183.675		185.22		
6MILE_BREAKOUT 5900.00	182.883		184.394		
6MILE_BREAKOUT 5900.00	182.883		184.394		
6MILE_BREAKOUT 6700.00	182.089		183.488		
6MILE_BREAKOUT 7500.00	181.295		182.648		
6MILE_BREAKOUT 8300.00	180.502		181.77		
6MILE_BREAKOUT 9100.00	180.222		181.547		
LINK_CASTLEREAGH_6MILE 0.00	191.486		192.276		
LINK_CASTLEREAGH_6MILE 20.00	189.819		189.819		
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB 0.00	211.108		216.017		
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB 20.00	213.498		214.627		
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB 0.00	211.108		216.017		
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB 20.00	213.467		215.31		
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB 0.00	196.657		198.722		
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB 20.00	195.795		197.2		
LINK_CASTLEREAGH_WILGA_GLEN 0.00	183.505		184.67		
LINK_CASTLEREAGH_WILGA_GLEN 20.00	183.684		183.684		
LINK_CASTLEREAGH_DURHAM_ST 0.00	181.514		182.602		
LINK_CASTLEREAGH_DURHAM_ST 20.00	180.987		180.987		
LINK_CASTLEREAGH_RAILWAY_ST 0.00	181.208		182.244		
LINK_CASTLEREAGH_RAILWAY_ST 20.00	181.897		181.897		
LINK_CASTLEREAGH_QUANMOONA_ST 0.00	181.118		182.15		
LINK_CASTLEREAGH_QUANMOONA_ST 20.00	176.958		176.958		
LINK_CASTLEREAGH_REID_ST 0.00	180.837		181.832		
LINK_CASTLEREAGH_REID_ST 20.00	179.929		179.929		
LINK_CASTLEREAGH_BARTON_ST 0.00	180.473		181.399		
LINK_CASTLEREAGH_BARTON_ST 20.00	180.683		180.683		
LINK_CASTLEREAGH_BERTRAM_ST 0.00	180.405		181.333		
LINK_CASTLEREAGH_BERTRAM_ST 20.00	175.819		175.819		
LINK_CASTLEREAGH_MCMAHON_ST 0.00	180.14		180.999		
LINK_CASTLEREAGH_MCMAHON_ST 20.00	180.692		180.692		
LINK_CASTLEREAGH_EURIMIE 0.00	179.605		180.215		
LINK_CASTLEREAGH_EURIMIE 20.00	179.494		180.133		

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MIKE-11 Cross Section	2007 ^a	2007 ^b	1955 ^a	1955 ^b	Remarks
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB 0.00	192.735		193.803		
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB 20.00	192.55		193.735		
GEAMONEY_BREAKOUT 0.00	185.643		185.901		
GEAMONEY_BREAKOUT 100.00	185.643		185.901		
GEAMONEY_BREAKOUT 120.00	185.5		185.71		
GEAMONEY_BREAKOUT 200.00	185.499		185.709		
LINK_CASTLEREAGH_6900_CASTLEREAGH_LB 0.00	206.479		209.218		
LINK_CASTLEREAGH_6900_CASTLEREAGH_LB 20.00	202.501		208.852		
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB 0.00	206.479		209.218		
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB 20.00	207.385		208.879		
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB 0.00	201.63		204.823		
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB 20.00	202.187		204.585		
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB 0.00	201.63		204.823		
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB 20.00	202.251		204.633		
LINK_WARRENA_5300_WARRENA_LB 0.00	204.675		205.158		
LINK_WARRENA_5300_WARRENA_LB 20.00	204.871		205.084		
LINK_WARRENA_10000_WARRENA_LB 0.00	197.042		199.463		
LINK_WARRENA_10000_WARRENA_LB 20.00	199.789		199.974		
LINK_WARRENA_16000_WARRENA_LB 0.00	189.162		192.193		
LINK_WARRENA_16000_WARRENA_LB 20.00	194.009		194.249		
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB 0.00	196.657		198.722		
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB 20.00	195.437		196.97		
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB 0.00	188.999		189.731		
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB 20.00	185.658		186.053		
LINK_6MILE_CASTLEREAGH_RB 0.00	184.469		186.017		
LINK_6MILE_CASTLEREAGH_RB 20.00	184.556		186.38		
LINK_WARRENA_20700_WARRENA_LB 0.00	183.495		188.048		
LINK_WARRENA_20700_WARRENA_LB 20.00	187.536		187.552		
LINK_CASTLEREAGH_RB_35500_WARRENA_LB 0.00	184.556		186.38		
LINK_CASTLEREAGH_RB_35500_WARRENA_LB 20.00	187.536		187.552		
LINK_CASTLEREAGH_RB_41500_WARRENA 0.00	180.222		180.608		
LINK_CASTLEREAGH_RB_41500_WARRENA 20.00	181.394		180.863		
LINK_CASTLEREAGH_14000 0.00	208.616		212.465		
LINK_CASTLEREAGH_14000 20.00	210.983		212.482		
LINK_CASTLEREAGH_19000 0.00	204.217		207.136		
LINK_CASTLEREAGH_19000 20.00	204.896		206.63		
LINK_CASTLEREAGH_19000_WARRENA 0.00	204.217		207.136		
LINK_CASTLEREAGH_19000_WARRENA 20.00	204.675		205.158		
9MILE_BREAKOUT 0.00	194.284		195.389		
9MILE_BREAKOUT 500.00	193.784		194.72		
9MILE_BREAKOUT 1250.00	192.081		192.764		
9MILE_BREAKOUT 2000.00	190.379		191.874		
LINK_9MILE 0.00	194.735		195.719		
LINK_9MILE 20.00	194.284		195.389		
LINK_6MILE 0.00	186.594		187.413		
LINK_6MILE 500.00	182.883		184.394		
RAIL_BREAKOUT1 0.00	190.359		191.274		
RAIL_BREAKOUT1 100.00	190.239		191.13		
RAIL_BREAKOUT1 120.00	190.239		191.1		
RAIL_BREAKOUT1 200.00	189.66		190.93		
RAIL_BREAKOUT2 0.00	187.179		187.268		
RAIL_BREAKOUT2 100.00	187.059		187.267		
RAIL_BREAKOUT2 120.00	187.059		187.193		
RAIL_BREAKOUT2 200.00	186.478		187.193		
RAIL_BREAKOUT3 0.00	195.437		196.97		
RAIL_BREAKOUT3 100.00	195.35		196.877		
RAIL_BREAKOUT3 120.00	195.37		196.803		
RAIL_BREAKOUT3 200.00	194.941		196.675		
RAIL_BREAKOUT4 0.00	202.187		204.585		
RAIL_BREAKOUT4 100.00	202.137		204.569		
RAIL_BREAKOUT4 120.00	202.107		204.514		
RAIL_BREAKOUT4 200.00	134.137		204.501		
LINK_WARRENA_26500 0.00	182.706		181.962		
LINK_WARRENA_26500 1000.00	180.222		181.547		
LINK_CASTLEREAGH_RB_15300 0.00	207.385		208.879		
LINK_CASTLEREAGH_RB_15300 2800.00	204.675		205.158		

^a Modelled; ^b Recorded



B.6.2 Modelled Peak Discharges (m³/s)

MIKE-11 Cross Section	2007 Flood	1955 Flood	Remarks
CASTLEREAGH_LB 10440.00	0	203	
CASTLEREAGH_LB 11320.00	0	211	
CASTLEREAGH_LB 12200.00	0	212	
CASTLEREAGH_LB 13080.00	0	186	
CASTLEREAGH_LB 13960.00	0	177	
CASTLEREAGH_LB 14875.00	0	169	
CASTLEREAGH_LB 15825.00	0	164	
CASTLEREAGH_LB 16775.00	0	160	
CASTLEREAGH_LB 17725.00	0	158	
CASTLEREAGH_LB 18675.00	0	156	
CASTLEREAGH_LB 19625.00	0	154	
CASTLEREAGH_LB 20542.86	0	219	
CASTLEREAGH_LB 21428.57	0	219	
CASTLEREAGH_LB 22314.29	0	219	
CASTLEREAGH_LB 23200.00	0	219	
CASTLEREAGH_LB 24085.71	0	218	
CASTLEREAGH_LB 24971.43	0	219	
CASTLEREAGH_LB 25857.14	0	218	
CASTLEREAGH_LB 26780.00	0	496	
CASTLEREAGH_LB 27740.00	0	495	
CASTLEREAGH_LB 28700.00	0	494	
CASTLEREAGH_LB 29660.00	0	493	
CASTLEREAGH_LB 30620.00	0	492	
CASTLEREAGH_LB 31450.00	0	573	
CASTLEREAGH_LB 32233.33	0	0	
CASTLEREAGH_LB 33100.00	0	0	
CASTLEREAGH_LB 33966.67	0	0	
CASTLEREAGH_LB 34900.00	0	0	
CASTLEREAGH_LB 35650.00	0	-4	
CASTLEREAGH_LB 36333.33	0	11	
CASTLEREAGH_LB 37200.00	0	11	
CASTLEREAGH_LB 38066.67	0	11	
CASTLEREAGH_LB 38933.33	0	8	
CASTLEREAGH_LB 39800.00	0	13	
CASTLEREAGH_LB 40666.67	0	16	
CASTLEREAGH 9750.00	482	3146	
CASTLEREAGH 10500.00	482	2415	
CASTLEREAGH 11500.00	482	2414	
CASTLEREAGH 12500.00	482	2412	
CASTLEREAGH 13500.00	482	2410	
CASTLEREAGH 14483.33	482	2676	
CASTLEREAGH 15450.00	482	2675	
CASTLEREAGH 16416.67	482	2674	
CASTLEREAGH 17250.00	482	2674	
CASTLEREAGH 17950.00	482	2673	
CASTLEREAGH 18650.00	482	2672	
CASTLEREAGH 19425.00	482	2520	
CASTLEREAGH 20275.00	481	2519	
CASTLEREAGH 21125.00	481	2519	
CASTLEREAGH 21975.00	481	2518	
CASTLEREAGH 22892.86	481	2215	
CASTLEREAGH 23878.57	480	2215	
CASTLEREAGH 24864.29	480	2214	
CASTLEREAGH 25850.00	479	2214	
CASTLEREAGH 26835.71	479	2214	
CASTLEREAGH 27821.43	478	2214	
CASTLEREAGH 28807.14	478	2214	
CASTLEREAGH 29310.00	478	1109	Combara Bridge
CASTLEREAGH 29691.67	478	1109	
CASTLEREAGH 30435.00	478	1109	
CASTLEREAGH 31178.33	477	1109	
CASTLEREAGH 32037.50	477	813	
CASTLEREAGH 33012.50	477	813	
CASTLEREAGH 33875.00	477	730	
CASTLEREAGH 34625.00	476	730	
CASTLEREAGH 35387.50	476	730	
CASTLEREAGH 36162.50	476	730	
CASTLEREAGH 36937.50	476	730	

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MIKE-11 Cross Section	2007 Flood	1955 Flood	Remarks
CASTLEREAGH 37712.50	475	730	
CASTLEREAGH 38516.67	475	715	
CASTLEREAGH 39350.00	475	715	
CASTLEREAGH 40183.33	475	715	
CASTLEREAGH 40987.50	475	713	
CASTLEREAGH 41762.50	474	713	
CASTLEREAGH 42537.50	474	713	
CASTLEREAGH 43312.50	474	713	
CASTLEREAGH 44050.00	473	705	
CASTLEREAGH 44730.00	473	705	
CASTLEREAGH 45390.00	473	705	
CASTLEREAGH 45995.00	473	705	
CASTLEREAGH 46420.00	473	705	
CASTLEREAGH 46720.00	473	705	
CASTLEREAGH 47010.00	473	705	
CASTLEREAGH 47290.00	473	705	
CASTLEREAGH 47585.00	472	705	
CASTLEREAGH 47925.00	472	705	
CASTLEREAGH 48120.00	472	705	
CASTLEREAGH 48290.00	472	705	
CASTLEREAGH 48580.00	472	691	
CASTLEREAGH 48890.00	472	691	
CASTLEREAGH 49285.00	472	691	
CASTLEREAGH 49850.00	1013	1720	
CASTLEREAGH 50550.00	1013	1720	
CASTLEREAGH 51400.00	1011	1720	
CASTLEREAGH 52400.00	1009	1720	
CASTLEREAGH 53400.00	1007	1719	
CASTLEREAGH 54400.00	1006	1721	
CASTLEREAGH 55400.00	1005	1712	
CASTLEREAGH 56400.00	1010	1656	
CASTLEREAGH_RB 10400.00	0	524	
CASTLEREAGH_RB 11200.00	0	523	
CASTLEREAGH_RB 12000.00	0	523	
CASTLEREAGH_RB 12883.33	0	256	
CASTLEREAGH_RB 13850.00	0	256	
CASTLEREAGH_RB 14816.67	0	255	
CASTLEREAGH_RB 15716.67	0	126	
CASTLEREAGH_RB 16550.00	0	127	
CASTLEREAGH_RB 17383.33	0	126	
CASTLEREAGH_RB 18233.33	0	217	
CASTLEREAGH_RB 19100.00	0	216	
CASTLEREAGH_RB 19966.67	0	215	
CASTLEREAGH_RB 20885.71	0	383	
CASTLEREAGH_RB 21857.14	0	383	
CASTLEREAGH_RB 22828.57	0	383	
CASTLEREAGH_RB 23800.00	0	383	
CASTLEREAGH_RB 24771.43	0	382	
CASTLEREAGH_RB 25742.86	0	383	
CASTLEREAGH_RB 26714.29	0	381	
CASTLEREAGH_RB 27700.00	0	562	
CASTLEREAGH_RB 28700.00	0	561	
CASTLEREAGH_RB 29700.00	0	561	
CASTLEREAGH_RB 30700.00	0	561	
CASTLEREAGH_RB 31630.00	0	853	
CASTLEREAGH_RB 32490.00	0	853	
CASTLEREAGH_RB 33350.00	0	853	
CASTLEREAGH_RB 34210.00	0	853	
CASTLEREAGH_RB 35070.00	0	852	
CASTLEREAGH_RB 35960.00	0	651	
CASTLEREAGH_RB 36880.00	0	651	
CASTLEREAGH_RB 37800.00	0	651	
CASTLEREAGH_RB 38720.00	0	651	
CASTLEREAGH_RB 39640.00	0	650	
CASTLEREAGH_RB 40450.00	-2	844	
CASTLEREAGH_RB 41150.00	-14	843	
CASTLEREAGH_RB 41800.00	181	840	
CASTLEREAGH_RB 42400.00	180	837	
CASTLEREAGH_RB 42710.00	180	834	
CASTLEREAGH_RB 42960.00	181	832	

Aberford Street Bridge

Tooraweenah Road



MIKE-11 Cross Section	2007 Flood	1955 Flood	Remarks
WARRENA 441.67	0	0	
WARRENA 1325.00	0	0	
WARRENA 2208.33	0	0	
WARRENA 3091.67	0	0	
WARRENA 3975.00	0	0	
WARRENA 4858.33	0	0	
WARRENA 5770.00	0	184	
WARRENA 6710.00	0	192	
WARRENA 7650.00	0	192	
WARRENA 8590.00	0	193	
WARRENA 9530.00	0	175	
WARRENA 10500.00	0	173	
WARRENA 11500.00	0	171	
WARRENA 12500.00	0	171	
WARRENA 13500.00	0	170	
WARRENA 14500.00	0	171	
WARRENA 15500.00	0	170	
WARRENA 16470.00	0	169	
WARRENA 17410.00	0	169	
WARRENA 18350.00	0	169	
WARRENA 19290.00	0	168	
WARRENA 20230.00	0	162	
WARRENA 20705.00	0	157	Wongy Road
WARRENA 21192.50	0	156	
WARRENA 22157.50	0	155	
WARRENA 23122.50	-1	155	
WARRENA 24087.50	-3	154	
WARRENA 25052.50	-6	153	
WARRENA 26017.50	429	203	Tooraweenah Road
WARRENA 26505.00	430	203	
WARRENA 26982.50	430	203	
WARRENA 27927.50	1020	383	
WARRENA 28885.00	824	371	
WARRENA 29855.00	823	358	
WARRENA 30825.00	821	349	
WARRENA 31530.00	990	1036	
WARRENA 32100.00	990	1036	
WARRENA 32455.00	989	1034	Warrena Weir
WARRENA 32605.00	989	1034	
WARRENA 32755.00	988	1126	Baradine Rd
WARRENA 32925.00	988	1034	
WARRENA 33295.00	988	1033	
WILGA_GLEN_RD 288.50	0	0	
WILGA_GLEN_RD 941.00	0	0	
WILGA_GLEN_RD 1377.50	0	0	
DURHAM_ST 127.50	0	0	
DURHAM_ST 598.00	0	0	
DURHAM_ST 980.50	0	0	
RAILWAY_ST 95.00	0	0	
RAILWAY_ST 300.00	0	0	
RAILWAY_ST 555.00	0	0	
RAILWAY_ST 845.00	0	0	
RAILWAY_ST 1115.00	0	0	
RAILWAY_ST 1370.00	0	0	
RAILWAY_ST 1625.00	0	0	
RAILWAY_ST 1800.00	0	0	
MCMAHON_ST 330.00	0	0	
MCMAHON_ST 720.00	0	0	
BERTRAM_ST 390.00	0	0	
BERTRAM_ST 840.00	0	0	
BARTON_ST 360.00	0	0	
BARTON_ST 780.00	0	0	
REID_ST 320.00	0	0	
REID_ST 700.00	0	0	
QUANMOONA_ST 235.00	0	0	
QUANMOONA_ST 535.00	0	0	
EURIMIE_CK 190.00	0	14	
EURIMIE_CK 515.00	0	14	
EURIMIE_CK 765.00	0	14	
EURIMIE_CK 1010.00	0	14	

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MIKE-11 Cross Section	2007 Flood	1955 Flood	Remarks
LINK_CASTLEREAGH_RB_12400_WARRENA 10.00	0	0	
WARRENA_LB 275.00	0	7	
WARRENA_LB 825.00	0	6	
WARRENA_LB 1570.00	0	5	
WARRENA_LB 2510.00	0	5	
WARRENA_LB 3450.00	0	4	
WARRENA_LB 4390.00	0	4	
WARRENA_LB 5330.00	0	3	
WARRENA_LB 6258.33	0	3	
WARRENA_LB 7175.00	0	3	
WARRENA_LB 8091.67	0	3	
WARRENA_LB 9008.33	0	3	
WARRENA_LB 9925.00	0	3	
WARRENA_LB 10841.67	0	3	
WARRENA_LB 11800.00	0	3	
WARRENA_LB 12800.00	0	2	
WARRENA_LB 13800.00	0	1	
WARRENA_LB 14800.00	0	1	
WARRENA_LB 15800.00	0	1	
WARRENA_LB 16750.00	0	1	
WARRENA_LB 17650.00	0	1	
WARRENA_LB 18550.00	0	1	
WARRENA_LB 19450.00	0	1	
WARRENA_LB 20350.00	0	1	
WARRENA_LB 21250.00	0	1	
WARRENA_LB 22150.00	0	-3	
LINK_CASTLEREAGH_RB_17800_WARRENA_LB 10.00	0	7	
6MILE_BREAKOUT 1966.67	0	0	
6MILE_BREAKOUT 2900.00	0	0	
6MILE_BREAKOUT 3833.33	0	0	
6MILE_BREAKOUT 4700.00	0	200	
6MILE_BREAKOUT 5500.00	0	199	
6MILE_BREAKOUT 6300.00	0	199	
6MILE_BREAKOUT 7100.00	0	198	
6MILE_BREAKOUT 7900.00	0	198	
6MILE_BREAKOUT 8700.00	0	198	
LINK_CASTLEREAGH_6MILE 10.00	0	0	
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB 10.00	0	204	
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB 10.00	0	526	
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB 10.00	0	187	
LINK_CASTLEREAGH_WILGA_GLEN 10.00	0	0	
LINK_CASTLEREAGH_DURHAM_ST 10.00	0	0	
LINK_CASTLEREAGH_RAILWAY_ST 10.00	0	0	
LINK_CASTLEREAGH_QUANMOONA_ST 10.00	0	0	
LINK_CASTLEREAGH_REID_ST 10.00	0	0	
LINK_CASTLEREAGH_BARTON_ST 10.00	0	0	
LINK_CASTLEREAGH_BERTRAM_ST 10.00	0	0	
LINK_CASTLEREAGH_MCMAHON_ST 10.00	0	0	
LINK_CASTLEREAGH_EURIMIE 10.00	0	14	
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB 10.00	0	83	
GEAMONEY_BREAKOUT 50.00	2	4	
GEAMONEY_BREAKOUT 110.00	2	4	
GEAMONEY_BREAKOUT 160.00	2	4	
LINK_CASTLEREAGH_6900_CASTLEREAGH_LB 10.00	0	0	
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB 10.00	0	0	
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB 10.00	0	133	
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB 10.00	0	170	
LINK_WARRENA_5300_WARRENA_LB 10.00	0	0	
LINK_WARRENA_10000_WARRENA_LB 10.00	0	0	
LINK_WARRENA_16000_WARRENA_LB 10.00	0	0	
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB 10.00	0	919	
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB 10.00	0	15	
LINK_6MILE_CASTLEREAGH_RB 10.00	0	-201	
LINK_WARRENA_20700_WARRENA_LB 10.00	0	0	
LINK_CASTLEREAGH_RB_35500_WARRENA_LB 10.00	0	0	
LINK_CASTLEREAGH_RB_41500_WARRENA 10.00	-195	-1	
LINK_CASTLEREAGH_14000 10.00	0	-266	
LINK_CASTLEREAGH_19000 10.00	0	99	
LINK_CASTLEREAGH_19000_WARRENA 10.00	0	53	
9MILE_BREAKOUT 250.00	0	296	



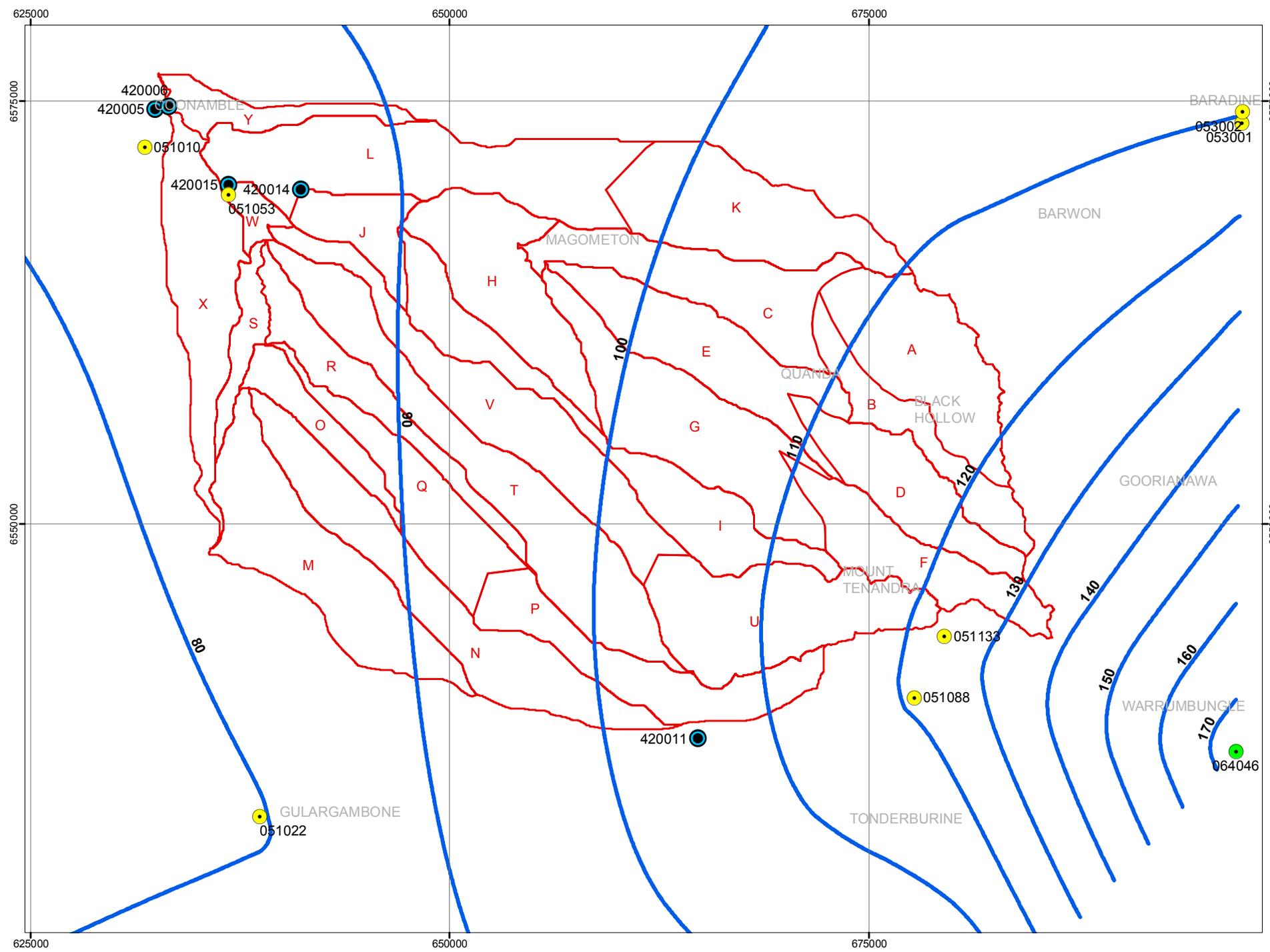
MIKE-11 Cross Section	2007 Flood	1955 Flood	Remarks
9MILE_BREAKOUT 875.00	0	295	
9MILE_BREAKOUT 1625.00	0	297	
LINK_9MILE 10.00	0	296	
LINK_6MILE 250.00	0	2	
RAIL_BREAKOUT1 50.00	0	573	
RAIL_BREAKOUT1 110.00	0	573	
RAIL_BREAKOUT1 160.00	0	573	
RAIL_BREAKOUT2 50.00	0	0	
RAIL_BREAKOUT2 110.00	0	0	
RAIL_BREAKOUT2 160.00	0	0	
RAIL_BREAKOUT3 50.00	0	598	
RAIL_BREAKOUT3 110.00	0	598	
RAIL_BREAKOUT3 160.00	0	598	
RAIL_BREAKOUT4 50.00	0	44	
RAIL_BREAKOUT4 110.00	0	44	
RAIL_BREAKOUT4 160.00	0	44	
LINK_WARRENA_26500 500.00	0	0	
LINK_CASTLEREAGH_RB_15300 1400.00	0	128	



Appendix C Rainfall Runoff Modelling



C.1 Isohyetal Patterns

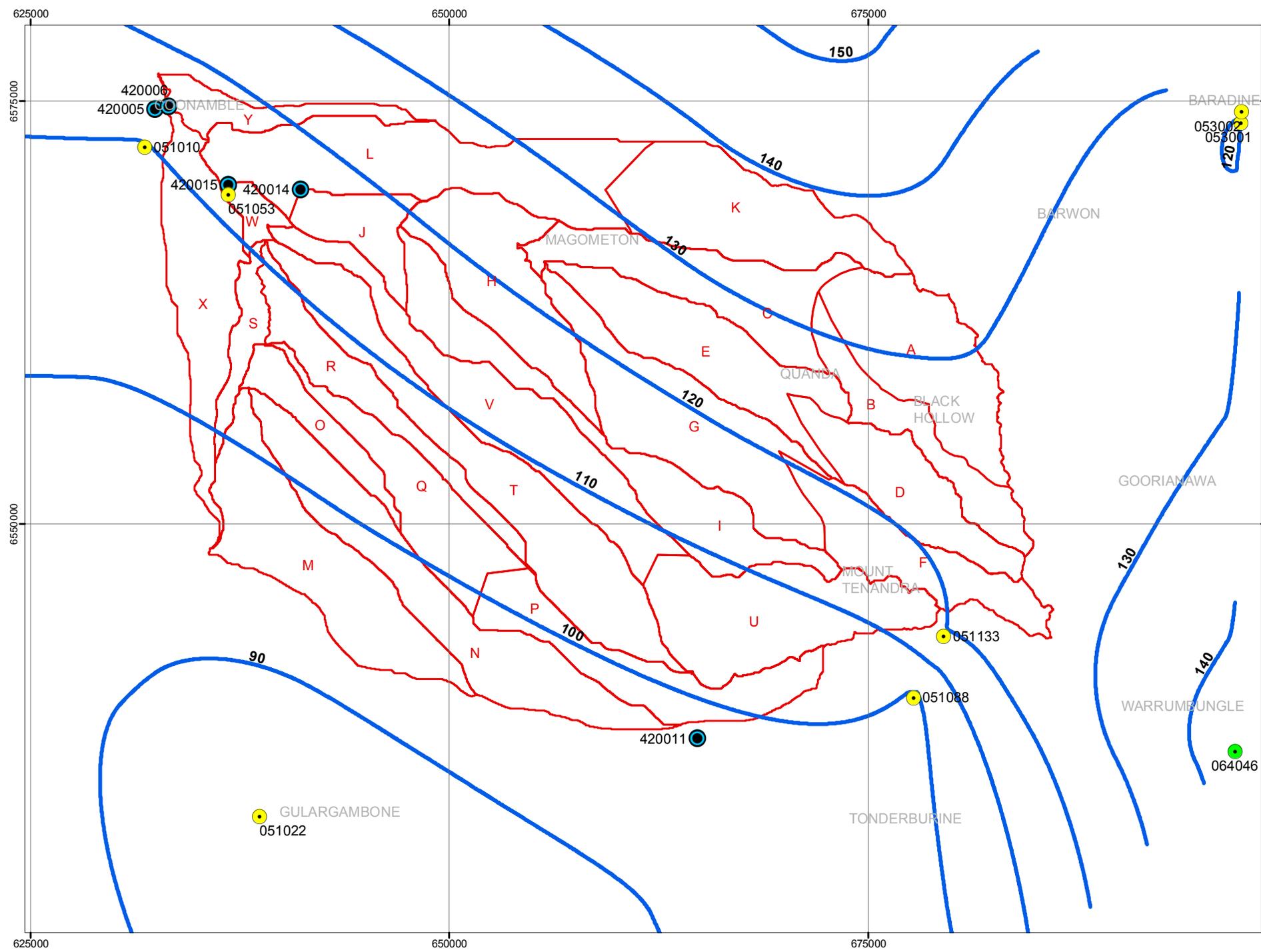


- Legend**
- Isohytes
 - RORB Sub-areas
 - Rainfall stations**
 - Pluviograph
 - Daily Read
 - Streamflow Gauging Station



Figure C1-1: Rainfall Isohytes - July 1998 event

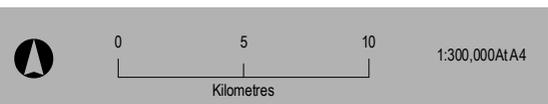


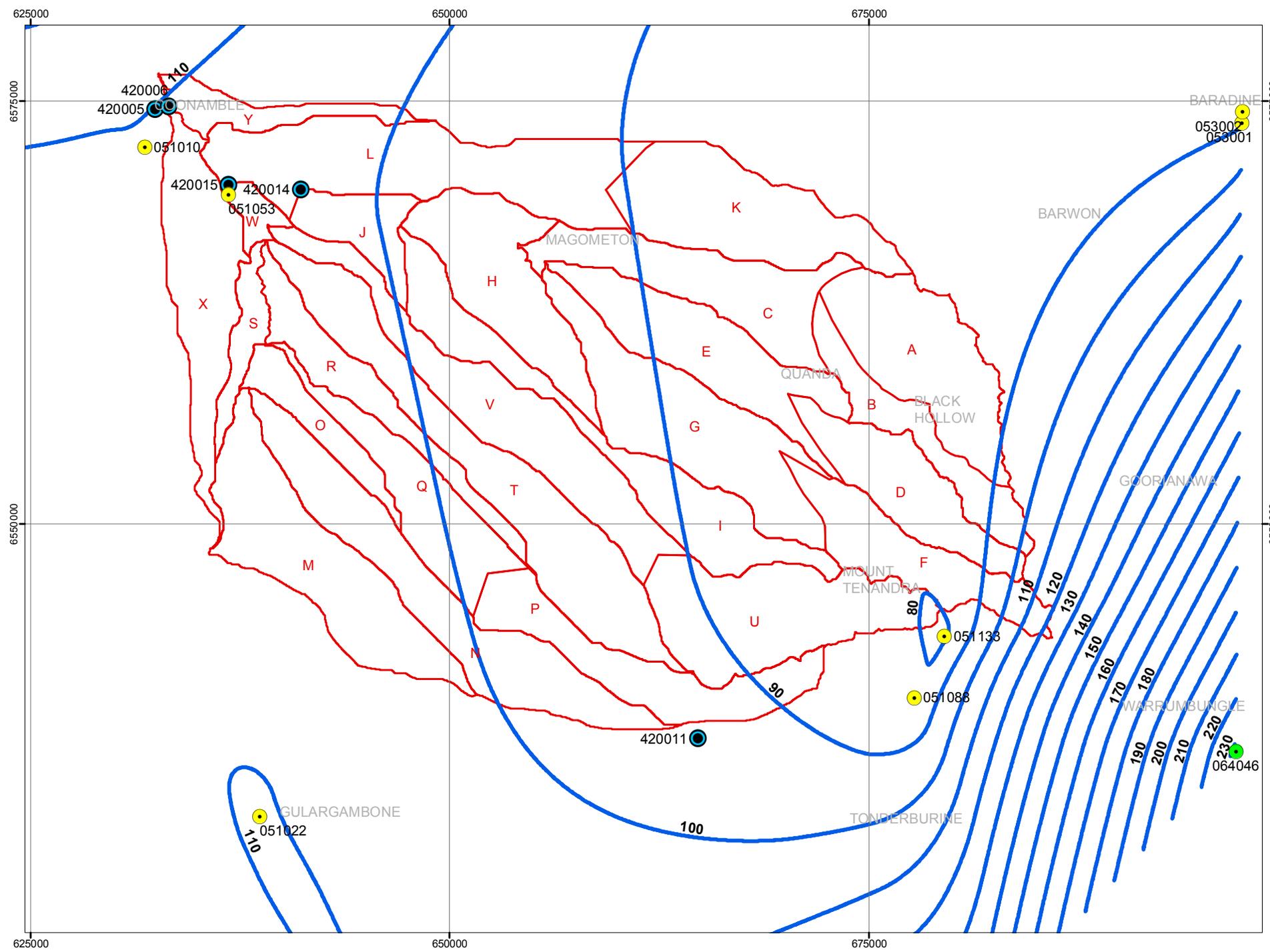


- Legend**
- Isohytes
 - RORB Sub-areas
 - Rainfall stations**
 - Pluviograph
 - Daily Read
 - Streamflow Gauging Station



Figure C1-2: Rainfall Isohytes - April 1999 event





- Legend**
- Isohytes
 - RORB Sub-areas
 - Rainfall stations**
 - Pluviograph
 - Daily Read
 - Streamflow Gauging Station



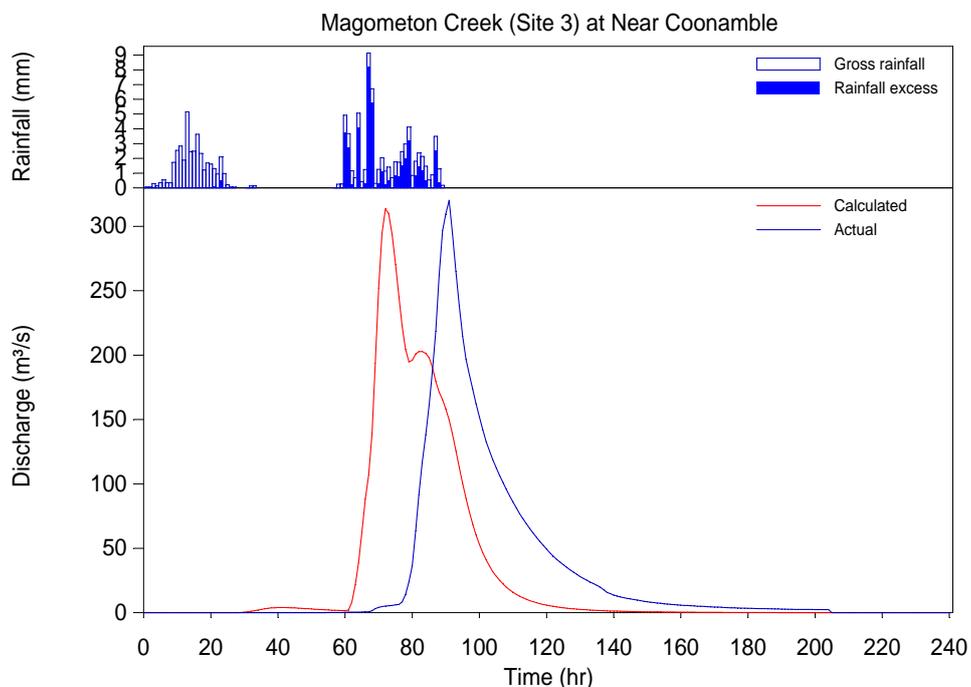
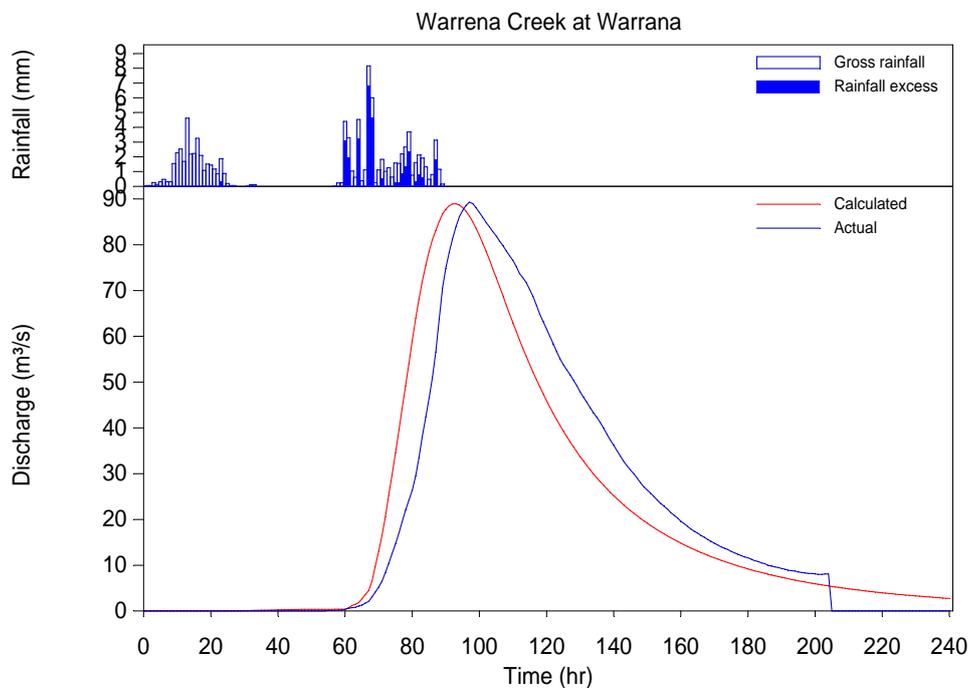
Figure C1-3: Rainfall Isohytes - November 2000 event





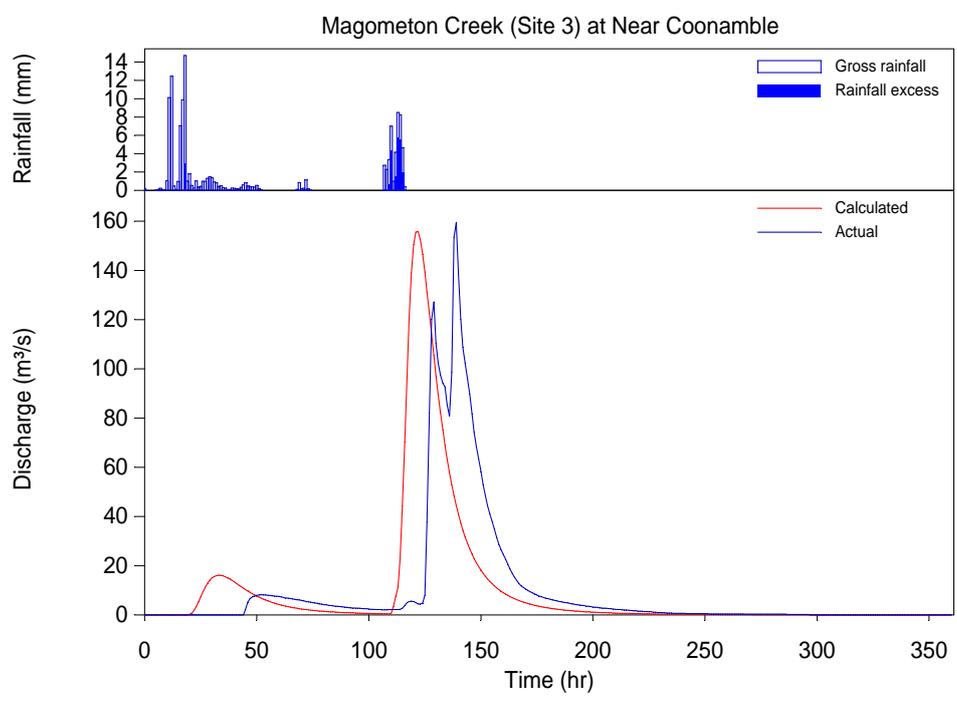
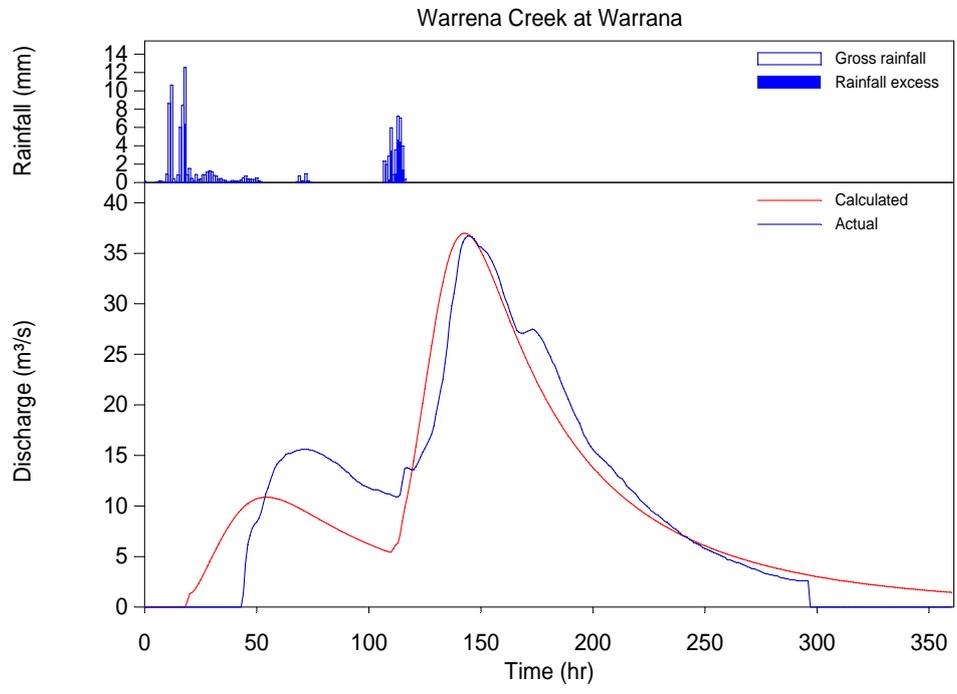
C.2 Calibration Results

C.2.1 July 1998 Event



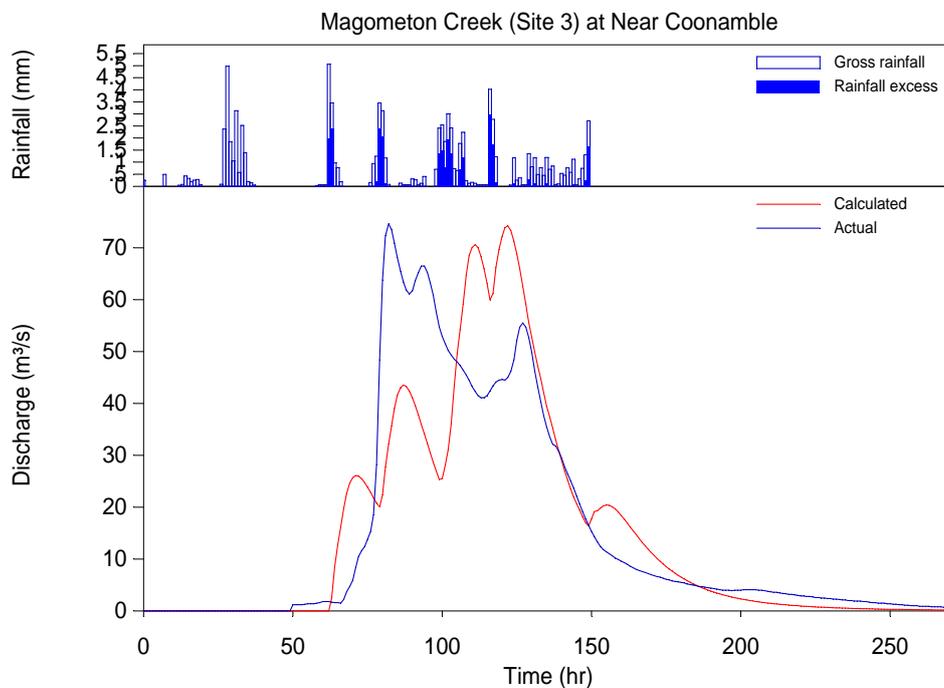
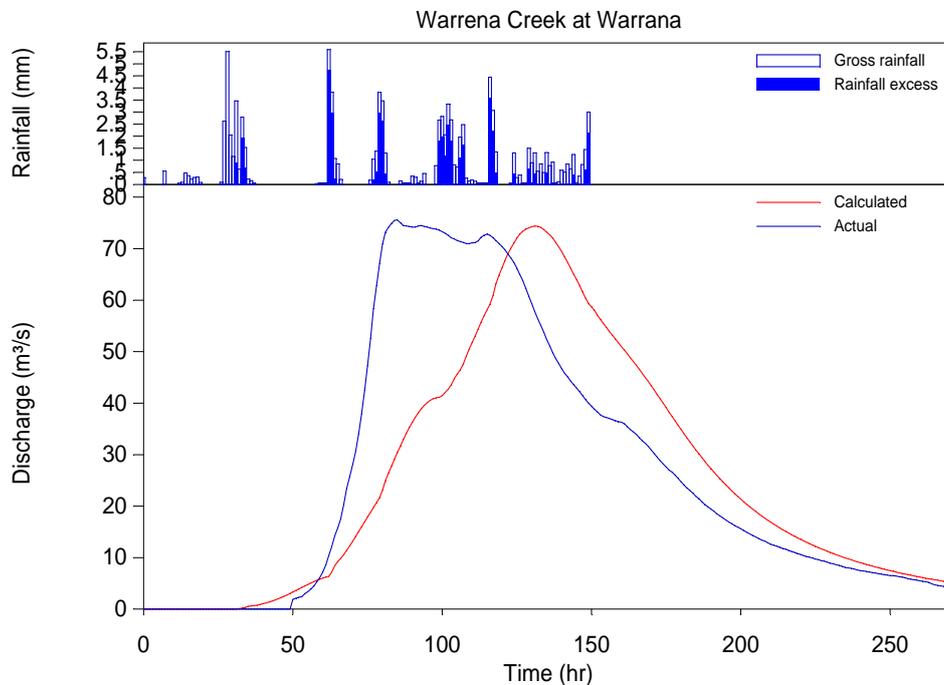


C.2.2 April 1999 Event





C.2.3 November 2000 Event





Appendix D Results for Design Flood Events

D.1 Peak Flood Levels (mAHD) for Design Flood Events

MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
CASTLEREAGH_LB 10000	214.75	215.08	215.08	216.37	
CASTLEREAGH_LB 10880	212.98	213.45	213.45	215.21	
CASTLEREAGH_LB 11760	211.36	212.12	212.12	214.11	
CASTLEREAGH_LB 12640	210.18	211.21	211.21	213.06	
CASTLEREAGH_LB 13520	209.59	210.37	210.37	212.08	
CASTLEREAGH_LB 14400	209.06	209.52	209.52	211.24	
CASTLEREAGH_LB 14400	209.06	209.52	209.52	211.24	
CASTLEREAGH_LB 15350	208.40	208.90	208.90	210.76	
CASTLEREAGH_LB 16300	207.76	208.30	208.30	210.29	
CASTLEREAGH_LB 17250	207.09	207.71	207.71	209.82	
CASTLEREAGH_LB 18200	206.40	207.14	207.14	209.28	
CASTLEREAGH_LB 19150	205.72	206.49	206.49	208.43	
CASTLEREAGH_LB 20100	204.80	205.15	205.15	206.52	
CASTLEREAGH_LB 20100	204.80	205.15	205.15	206.52	
CASTLEREAGH_LB 20985.71	203.34	203.83	203.83	205.05	
CASTLEREAGH_LB 21871.43	201.82	202.47	202.47	203.71	
CASTLEREAGH_LB 22757.14	200.67	201.10	201.10	202.44	
CASTLEREAGH_LB 23642.86	199.58	199.96	199.96	201.21	
CASTLEREAGH_LB 24528.57	198.55	198.89	198.89	200.03	
CASTLEREAGH_LB 25414.29	197.49	197.81	197.81	198.88	
CASTLEREAGH_LB 26300	196.99	197.20	197.20	197.95	
CASTLEREAGH_LB 26300	196.99	197.20	197.20	197.95	
CASTLEREAGH_LB 27260	196.41	196.62	196.62	197.37	
CASTLEREAGH_LB 28220	195.84	196.04	196.04	196.78	
CASTLEREAGH_LB 29180	195.26	195.46	195.46	196.18	
CASTLEREAGH_LB 30140	194.69	194.87	194.87	195.52	
CASTLEREAGH_LB 31100	193.75	193.86	193.86	194.27	
CASTLEREAGH_LB 31100	193.75	193.86	193.86	194.27	
CASTLEREAGH_LB 31800	191.29	191.38	191.38	191.75	
CASTLEREAGH_LB 31800	191.29	191.38	191.38	191.75	
CASTLEREAGH_LB 32666.67	189.74	189.78	189.78	190.50	
CASTLEREAGH_LB 33533.33	188.54	188.54	188.54	189.21	
CASTLEREAGH_LB 34400	187.27	187.30	187.30	187.76	
CASTLEREAGH_LB 34400	187.27	187.30	187.30	187.76	
CASTLEREAGH_LB 35400	185.93	186.02	186.02	186.22	
CASTLEREAGH_LB 35400	185.93	186.02	186.02	186.22	
CASTLEREAGH_LB 35900	186.08	186.23	186.23	186.67	
CASTLEREAGH_LB 35900	186.08	186.23	186.23	186.67	
CASTLEREAGH_LB 36766.67	185.14	185.26	185.26	185.85	
CASTLEREAGH_LB 37633.33	184.71	184.86	184.86	185.54	
CASTLEREAGH_LB 38500	184.71	184.84	184.84	185.46	
CASTLEREAGH_LB 39366.67	184.71	184.84	184.84	185.42	
CASTLEREAGH_LB 40233.33	184.70	184.83	184.83	185.36	
CASTLEREAGH_LB 41100	184.70	184.81	184.81	185.22	
CASTLEREAGH 9500	216.45	216.78	216.78	218.66	
CASTLEREAGH 10000	216.10	216.37	216.37	218.19	
CASTLEREAGH 10000	216.10	216.37	216.37	218.19	
CASTLEREAGH 11000	215.40	215.68	215.68	217.43	
CASTLEREAGH 12000	214.64	214.93	214.93	216.60	
CASTLEREAGH 13000	213.74	214.07	214.07	215.63	
CASTLEREAGH 14000	212.60	212.96	212.96	214.30	
CASTLEREAGH 14000	212.60	212.96	212.96	214.30	
CASTLEREAGH 14966.67	211.34	211.61	211.61	212.76	
CASTLEREAGH 15933.33	210.30	210.53	210.53	211.55	
CASTLEREAGH 16900	209.28	209.49	209.49	210.68	
CASTLEREAGH 16900	209.28	209.49	209.49	210.68	
CASTLEREAGH 17600	208.50	208.69	208.69	209.88	
CASTLEREAGH 18300	207.77	207.94	207.94	209.09	
CASTLEREAGH 19000	207.18	207.34	207.34	208.33	
CASTLEREAGH 19000	207.18	207.34	207.34	208.33	
CASTLEREAGH 19850	206.65	206.83	206.83	207.92	
CASTLEREAGH 20700	206.12	206.33	206.33	207.51	"Horans"



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
CASTLEREAGH 21550	205.56	205.80	205.80	207.06	
CASTLEREAGH 22400	204.86	205.16	205.16	206.50	
CASTLEREAGH 22400	204.86	205.16	205.16	206.50	
CASTLEREAGH 23385.71	204.19	204.50	204.50	205.93	
CASTLEREAGH 24371.43	203.55	203.89	203.89	205.36	
CASTLEREAGH 25357.14	202.95	203.29	203.29	204.78	
CASTLEREAGH 26342.86	202.34	202.68	202.68	204.14	
CASTLEREAGH 27328.57	201.64	201.96	201.96	203.32	
CASTLEREAGH 28314.29	200.66	200.93	200.93	202.01	
CASTLEREAGH 29300	198.73	198.87	198.87	199.51	
CASTLEREAGH 29300	198.73	198.87	198.87	199.51	U/S Combara Br
CASTLEREAGH 29320	198.70	198.83	198.83	199.48	D/S Combara Br
CASTLEREAGH 30063.33	197.91	198.03	198.03	198.61	
CASTLEREAGH 30806.67	196.99	197.08	197.08	197.54	
CASTLEREAGH 31550	195.73	195.78	195.78	195.97	
CASTLEREAGH 31550	195.73	195.78	195.78	195.97	
CASTLEREAGH 32525	194.86	194.90	194.90	195.11	
CASTLEREAGH 33500	193.81	193.87	193.87	194.26	
CASTLEREAGH 33500	193.81	193.87	193.87	194.26	
CASTLEREAGH 34250	192.95	193.03	193.03	193.47	
CASTLEREAGH 35000	192.29	192.38	192.38	192.84	
CASTLEREAGH 35000	192.29	192.38	192.38	192.84	
CASTLEREAGH 35775	191.55	191.66	191.66	192.15	
CASTLEREAGH 36550	190.92	191.01	191.01	191.44	
CASTLEREAGH 37325	190.38	190.45	190.45	190.79	
CASTLEREAGH 38100	189.74	189.78	189.78	189.96	
CASTLEREAGH 38100	189.74	189.78	189.78	189.96	
CASTLEREAGH 38933.33	188.95	188.99	188.99	189.18	
CASTLEREAGH 39766.67	188.20	188.25	188.25	188.43	
CASTLEREAGH 40600	187.42	187.47	187.47	187.65	
CASTLEREAGH 40600	187.42	187.47	187.47	187.65	
CASTLEREAGH 41375	186.65	186.70	186.70	186.92	
CASTLEREAGH 42150	185.94	185.99	185.99	186.25	
CASTLEREAGH 42925	185.29	185.36	185.36	185.67	
CASTLEREAGH 43700	184.70	184.81	184.81	185.22	
CASTLEREAGH 43700	184.70	184.81	184.81	185.22	
CASTLEREAGH 44400	184.05	184.16	184.16	184.62	
CASTLEREAGH 45060	183.32	183.42	183.42	183.95	
CASTLEREAGH 45720	182.58	182.70	182.70	183.36	
CASTLEREAGH 45720	182.58	182.70	182.70	183.36	
CASTLEREAGH 46270	182.21	182.32	182.32	183.00	
CASTLEREAGH 46270	182.21	182.32	182.32	183.00	
CASTLEREAGH 46570	182.11	182.22	182.22	182.89	
CASTLEREAGH 46570	182.11	182.22	182.22	182.89	
CASTLEREAGH 46870	181.78	181.88	181.88	182.55	
CASTLEREAGH 46870	181.78	181.88	181.88	182.55	
CASTLEREAGH 47150	181.31	181.41	181.41	182.17	
CASTLEREAGH 47150	181.31	181.41	181.41	182.17	
CASTLEREAGH 47430	181.23	181.33	181.33	182.14	
CASTLEREAGH 47430	181.23	181.33	181.33	182.14	
CASTLEREAGH 47740	180.87	180.96	180.96	181.83	
CASTLEREAGH 47740	180.87	180.96	180.96	181.83	
CASTLEREAGH 48110	180.49	180.55	180.56	181.38	U/S Aberford St Bridge
CASTLEREAGH 48130	180.44	180.50	180.51	181.29	D/S Aberford St Bridge
CASTLEREAGH 48450	180.24	180.31	180.31	181.15	
CASTLEREAGH 48450	180.24	180.31	180.31	181.15	
CASTLEREAGH 48710	179.89	179.95	179.96	180.98	
CASTLEREAGH 49070	179.20	179.32	179.35	180.88	
CASTLEREAGH 49500	178.95	179.09	179.15	180.85	
CASTLEREAGH 49500	178.95	179.09	179.15	180.85	
CASTLEREAGH 50200	178.00	178.13	178.17	179.75	
CASTLEREAGH 50900	177.58	177.69	177.73	179.10	
CASTLEREAGH 51900	176.58	176.69	176.73	178.13	
CASTLEREAGH 52900	175.59	175.68	175.72	177.30	
CASTLEREAGH 53900	174.57	174.74	174.79	176.77	
CASTLEREAGH 54900	174.00	174.25	174.30	176.55	
CASTLEREAGH 55900	173.87	174.13	174.18	176.46	
CASTLEREAGH 56900	173.85	174.11	174.16	176.42	
CASTLEREAGH_RB 10000	215.44	215.82	215.82	217.57	



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
CASTLEREAGH_RB 10800	214.65	215.04	215.04	216.78	
CASTLEREAGH_RB 11600	213.88	214.25	214.25	215.84	
CASTLEREAGH_RB 12400	212.61	212.98	212.98	214.31	
CASTLEREAGH_RB 12400	212.61	212.98	212.98	214.31	
CASTLEREAGH_RB 13366.67	211.48	211.85	211.85	213.16	
CASTLEREAGH_RB 14333.33	210.47	210.82	210.82	211.98	
CASTLEREAGH_RB 15300	208.98	209.21	209.21	210.02	
CASTLEREAGH_RB 15300	208.98	209.21	209.21	210.02	
CASTLEREAGH_RB 16133.33	208.17	208.38	208.38	209.20	
CASTLEREAGH_RB 16966.67	207.30	207.54	207.54	208.41	
CASTLEREAGH_RB 17800	206.71	206.94	206.94	207.80	
CASTLEREAGH_RB 17800	206.71	206.94	206.94	207.80	
CASTLEREAGH_RB 18666.67	205.93	206.24	206.24	207.30	
CASTLEREAGH_RB 19533.33	205.28	205.64	205.64	206.86	
CASTLEREAGH_RB 20400	204.79	205.14	205.14	206.46	
CASTLEREAGH_RB 20400	204.79	205.14	205.14	206.46	
CASTLEREAGH_RB 21371.43	203.47	203.77	203.77	205.04	
CASTLEREAGH_RB 22342.86	202.33	202.53	202.53	203.73	
CASTLEREAGH_RB 23314.29	201.25	201.43	201.43	202.50	
CASTLEREAGH_RB 24285.71	200.20	200.36	200.36	201.32	
CASTLEREAGH_RB 25257.14	199.18	199.33	199.33	200.18	
CASTLEREAGH_RB 26228.57	198.13	198.27	198.27	199.05	
CASTLEREAGH_RB 27200	197.25	197.41	197.41	198.15	
CASTLEREAGH_RB 27200	197.25	197.41	197.41	198.15	
CASTLEREAGH_RB 28200	195.68	195.83	195.83	196.69	
CASTLEREAGH_RB 29200	194.20	194.36	194.36	195.37	
CASTLEREAGH_RB 30200	192.96	193.16	193.16	194.05	
CASTLEREAGH_RB 31200	191.91	192.04	192.04	192.63	
CASTLEREAGH_RB 31200	191.91	192.04	192.04	192.63	
CASTLEREAGH_RB 32060	190.45	190.55	190.55	191.23	
CASTLEREAGH_RB 32920	189.39	189.52	189.52	190.26	
CASTLEREAGH_RB 33780	188.44	188.60	188.60	189.36	
CASTLEREAGH_RB 34640	187.54	187.70	187.70	188.44	
CASTLEREAGH_RB 35500	186.41	186.50	186.50	187.00	
CASTLEREAGH_RB 35500	186.41	186.50	186.50	187.00	
CASTLEREAGH_RB 36420	185.40	185.49	185.49	185.96	
CASTLEREAGH_RB 37340	184.38	184.47	184.47	184.93	
CASTLEREAGH_RB 38260	183.41	183.49	183.49	183.95	
CASTLEREAGH_RB 39180	182.35	182.43	182.43	183.50	
CASTLEREAGH_RB 40100	181.59	181.75	181.77	183.41	
CASTLEREAGH_RB 40100	181.59	181.75	181.77	183.41	
CASTLEREAGH_RB 40800	181.12	181.31	181.34	183.16	
CASTLEREAGH_RB 41500	180.90	181.09	181.13	182.99	
CASTLEREAGH_RB 41500	180.90	181.09	181.13	182.99	
CASTLEREAGH_RB 42100	180.75	180.92	180.96	182.74	
CASTLEREAGH_RB 42700	180.68	180.84	180.87	182.61	U/S Tooraweenah Rd
CASTLEREAGH_RB 42720	180.32	180.51	180.59	182.60	D/S Tooraweenah Rd
CASTLEREAGH_RB 43200	180.31	180.51	180.58	182.59	
WARRENA 0	212.61	212.96	212.96	214.14	
WARRENA 883.33	211.29	211.53	211.53	212.37	
WARRENA 1766.67	209.97	210.16	210.16	210.93	
WARRENA 2650	208.64	208.80	208.80	209.52	
WARRENA 3533.33	207.32	207.43	207.43	208.21	
WARRENA 4416.67	206.00	206.00	206.00	206.77	
WARRENA 5300	205.21	205.36	205.36	206.13	
WARRENA 5300	205.21	205.36	205.36	206.13	
WARRENA 6240	203.73	203.93	203.93	204.82	
WARRENA 7180	202.32	202.52	202.52	203.78	
WARRENA 8120	200.95	201.26	201.26	203.01	
WARRENA 9060	200.20	200.62	200.62	202.25	
WARRENA 10000	199.76	200.13	200.13	201.32	
WARRENA 10000	199.76	200.13	200.13	201.32	
WARRENA 11000	198.40	198.76	198.76	200.07	
WARRENA 12000	197.06	197.42	197.42	198.96	
WARRENA 13000	195.75	196.09	196.09	198.04	
WARRENA 14000	194.44	194.92	194.92	197.22	
WARRENA 15000	193.48	194.21	194.21	196.43	
WARRENA 16000	192.64	193.41	193.41	195.37	
WARRENA 16000	192.64	193.41	193.41	195.37	



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^p	Extreme Event	Remarks
WARRENA 16940	191.34	192.05	192.05	193.95	
WARRENA 17880	190.05	190.63	190.63	192.75	
WARRENA 18820	188.83	189.58	189.58	191.71	
WARRENA 19760	188.37	189.08	189.08	190.68	
WARRENA 20700	188.06	188.37	188.37	189.77	
WARRENA 20700	188.06	188.37	188.37	189.77	U/S Wongy Rd
WARRENA 20710	188.05	188.36	188.36	189.76	D/S Wongy Rd
WARRENA 21675	185.73	186.62	186.62	188.89	
WARRENA 22640	184.86	185.58	185.59	188.14	
WARRENA 23605	184.29	184.96	185.00	187.48	
WARRENA 24570	183.99	184.49	184.58	186.93	
WARRENA 25535	183.81	184.15	184.30	186.48	
WARRENA 26500	183.07	183.44	183.56	184.90	
WARRENA 26500	183.07	183.44	183.56	184.90	U/S Tooraweenah Rd
WARRENA 26510	182.65	182.83	182.93	184.67	U/S Tooraweenah Rd
WARRENA 27455	182.19	182.11	182.22	184.26	
WARRENA 28400	181.40	181.35	181.43	183.13	
WARRENA 28400	181.40	181.35	181.43	183.13	
WARRENA 29370	180.84	180.85	180.93	182.82	
WARRENA 30340	180.44	180.60	180.68	182.68	
WARRENA 31310	180.31	180.51	180.58	182.59	
WARRENA 31310	180.31	180.51	180.58	182.59	
WARRENA 31750	180.06	180.25	180.32	182.24	
WARRENA 32450	179.70	179.89	179.95	181.67	
WARRENA 32460	179.69	179.88	179.94	181.66	
WARRENA 32750	179.48	179.66	179.72	181.49	
WARRENA 32760	179.48	179.65	179.71	181.46	U/S Baradine Rd
WARRENA 33090	179.19	179.35	179.41	181.23	D/S Baradine Rd
WARRENA 33500	178.95	179.09	179.15	180.85	
WILGA_GLEN_RD 0	183.68	183.69	183.69	183.82	
WILGA_GLEN_RD 577	182.27	182.27	182.27	182.53	
WILGA_GLEN_RD 1305	179.99	179.99	179.99	180.21	
WILGA_GLEN_RD 1450	179.79	179.80	179.80	179.93	
DURHAM_ST 0	180.99	180.99	180.99	180.99	
DURHAM_ST 255	180.35	180.35	180.35	180.35	
DURHAM_ST 941	177.62	177.62	177.62	177.75	
DURHAM_ST 1020	178.83	178.83	178.83	178.83	
RAILWAY_ST 0	181.90	181.90	181.90	182.20	
RAILWAY_ST 190	180.20	180.20	180.20	180.61	
RAILWAY_ST 410	178.86	178.86	178.86	180.61	
RAILWAY_ST 700	178.85	178.85	178.85	180.61	
RAILWAY_ST 700	178.85	178.85	178.85	180.61	
RAILWAY_ST 990	179.93	179.93	179.93	180.69	
RAILWAY_ST 990	179.93	179.93	179.93	180.69	
RAILWAY_ST 1240	180.43	180.43	180.43	180.61	
RAILWAY_ST 1240	180.43	180.43	180.43	180.61	
RAILWAY_ST 1500	179.42	179.42	179.42	179.61	
RAILWAY_ST 1500	179.42	179.42	179.42	179.61	
RAILWAY_ST 1750	179.42	179.42	179.42	179.45	
RAILWAY_ST 1750	179.42	179.42	179.42	179.45	
RAILWAY_ST 1850	179.11	179.11	179.11	179.15	
MCMAHON_ST 0	180.69	180.69	180.69	180.70	
MCMAHON_ST 660	179.68	179.68	179.68	179.79	
MCMAHON_ST 780	179.42	179.42	179.42	179.45	
BERTRAM_ST 0	175.82	175.82	175.82	180.42	
BERTRAM_ST 780	180.20	180.20	180.20	180.42	
BERTRAM_ST 900	179.42	179.42	179.42	179.61	
BARTON_ST 0	180.68	180.68	180.68	180.82	
BARTON_ST 720	180.34	180.34	180.34	180.61	
BARTON_ST 840	180.43	180.43	180.43	180.61	
REID_ST 0	179.93	179.93	179.93	180.69	
REID_ST 640	179.93	179.93	179.93	180.69	
REID_ST 760	179.93	179.93	179.93	180.69	
QUANMOONA_ST 0	176.96	176.96	176.96	180.61	
QUANMOONA_ST 470	178.98	178.98	178.98	180.61	
QUANMOONA_ST 600	178.85	178.85	178.85	180.61	
EURIMIE_CK 0	180.16	180.23	180.23	181.14	
EURIMIE_CK 380	180.12	180.19	180.20	181.13	
EURIMIE_CK 650	180.12	180.18	180.19	181.13	



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
EURIMIE_CK 880	180.11	180.18	180.18	181.13	
EURIMIE_CK 1140	180.11	180.18	180.18	181.12	
LINK_CASTLEREAGH_RB_12400_WARRENA 0	212.61	212.98	212.98	214.31	
LINK_CASTLEREAGH_RB_12400_WARRENA 20	212.61	212.96	212.96	214.14	
WARRENA_LB 0	205.65	205.99	205.99	207.10	
WARRENA_LB 550	205.47	205.76	205.76	206.69	
WARRENA_LB 1100	205.20	205.43	205.43	206.21	
WARRENA_LB 1100	205.20	205.43	205.43	206.21	
WARRENA_LB 2040	204.20	204.43	204.43	205.27	
WARRENA_LB 2980	203.20	203.45	203.45	204.34	
WARRENA_LB 3920	202.20	202.48	202.48	203.41	
WARRENA_LB 4860	201.21	201.53	201.53	202.51	
WARRENA_LB 5800	200.23	200.58	200.58	201.47	
WARRENA_LB 5800	200.23	200.58	200.58	201.47	
WARRENA_LB 6716.67	199.26	199.59	199.59	200.43	
WARRENA_LB 7633.33	198.29	198.61	198.61	199.40	
WARRENA_LB 8550	197.33	197.62	197.62	198.38	
WARRENA_LB 9466.67	196.36	196.65	196.65	197.37	
WARRENA_LB 10383.33	195.39	195.67	195.67	196.35	
WARRENA_LB 11300	194.41	194.66	194.66	195.36	
WARRENA_LB 11300	194.41	194.66	194.66	195.36	
WARRENA_LB 12300	193.08	193.33	193.33	194.01	
WARRENA_LB 13300	191.76	192.02	192.02	192.65	
WARRENA_LB 14300	190.44	190.70	190.70	191.32	
WARRENA_LB 15300	189.13	189.37	189.37	189.97	
WARRENA_LB 16300	187.83	188.07	188.07	188.69	
WARRENA_LB 16300	187.83	188.07	188.07	188.69	
WARRENA_LB 17200	186.73	186.99	186.99	187.65	
WARRENA_LB 18100	185.64	185.92	185.92	186.61	
WARRENA_LB 19000	184.55	184.85	184.85	185.60	
WARRENA_LB 19900	183.46	183.81	183.81	184.52	
WARRENA_LB 20800	182.36	182.70	182.70	183.63	
WARRENA_LB 21700	181.59	181.76	181.77	183.43	
WARRENA_LB 22600	181.59	181.75	181.77	183.41	
LINK_CASTLEREAGH_RB_17800_WARRENA_LB 0	206.71	206.94	206.94	207.80	
LINK_CASTLEREAGH_RB_17800_WARRENA_LB 20	205.65	205.99	205.99	207.10	
6MILE_BREAKOUT 1500	189.82	189.82	189.82	190.24	
6MILE_BREAKOUT 2433.33	188.04	188.04	188.04	188.51	
6MILE_BREAKOUT 3366.67	186.25	186.25	186.25	186.90	
6MILE_BREAKOUT 4300	186.06	186.23	186.23	186.83	
6MILE_BREAKOUT 4300	186.06	186.23	186.23	186.83	
6MILE_BREAKOUT 5100	185.27	185.39	185.39	185.92	
6MILE_BREAKOUT 5900	184.45	184.55	184.55	185.05	
6MILE_BREAKOUT 5900	184.45	184.55	184.55	185.05	
6MILE_BREAKOUT 6700	183.55	183.70	183.70	184.15	
6MILE_BREAKOUT 7500	182.70	182.83	182.83	183.57	
6MILE_BREAKOUT 8300	181.82	181.98	181.99	183.43	
6MILE_BREAKOUT 9100	181.59	181.75	181.77	183.41	
LINK_CASTLEREAGH_6MILE 0	192.29	192.38	192.38	192.84	
LINK_CASTLEREAGH_6MILE 20	189.82	189.82	189.82	190.24	
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB 0	216.10	216.37	216.37	218.19	
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB 20	214.75	215.08	215.08	216.37	
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB 0	216.10	216.37	216.37	218.19	
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB 20	215.44	215.82	215.82	217.57	
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB 0	198.73	198.87	198.87	199.51	
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB 20	197.25	197.41	197.41	198.15	
LINK_CASTLEREAGH_WILGA_GLEN 0	184.70	184.81	184.81	185.22	
LINK_CASTLEREAGH_WILGA_GLEN 20	183.68	183.69	183.69	183.82	
LINK_CASTLEREAGH_DURHAM_ST 0	182.58	182.70	182.70	183.36	
LINK_CASTLEREAGH_DURHAM_ST 20	180.99	180.99	180.99	180.99	
LINK_CASTLEREAGH_RAILWAY_ST 0	182.21	182.32	182.32	183.00	
LINK_CASTLEREAGH_RAILWAY_ST 20	181.90	181.90	181.90	182.20	
LINK_CASTLEREAGH_QUANMOONA_ST 0	182.11	182.22	182.22	182.89	
LINK_CASTLEREAGH_QUANMOONA_ST 20	176.96	176.96	176.96	180.61	
LINK_CASTLEREAGH_REID_ST 0	181.78	181.88	181.88	182.55	
LINK_CASTLEREAGH_REID_ST 20	179.93	179.93	179.93	180.69	
LINK_CASTLEREAGH_BARTON_ST 0	181.31	181.41	181.41	182.17	
LINK_CASTLEREAGH_BARTON_ST 20	180.68	180.68	180.68	180.82	
LINK_CASTLEREAGH_BERTRAM_ST 0	181.23	181.33	181.33	182.14	



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^p	Extreme Event	Remarks
LINK_CASTLEREAGH_BERTRAM_ST 20	175.82	175.82	175.82	180.42	
LINK_CASTLEREAGH_MCMAHON_ST 0	180.87	180.96	180.96	181.83	
LINK_CASTLEREAGH_MCMAHON_ST 20	180.69	180.69	180.69	180.70	
LINK_CASTLEREAGH_EURIMIE 0	180.24	180.31	180.31	181.15	
LINK_CASTLEREAGH_EURIMIE 20	180.16	180.23	180.23	181.14	
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB 0	193.81	193.87	193.87	194.26	
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB 20	193.75	193.86	193.86	194.27	
GEAMONEY_BREAKOUT 0	185.93	186.02	186.02	186.22	
GEAMONEY_BREAKOUT 100	185.93	186.01	186.01	186.20	
GEAMONEY_BREAKOUT 120	185.75	185.98	185.98	186.11	
GEAMONEY_BREAKOUT 200	185.75	185.98	185.98	186.08	
LINK_CASTLEREAGH_6900_CASTLEREAGH_LB 0	209.28	209.49	209.49	210.68	
LINK_CASTLEREAGH_6900_CASTLEREAGH_LB 20	209.06	209.52	209.52	211.24	
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB 0	209.28	209.49	209.49	210.68	
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB 20	208.98	209.21	209.21	210.02	
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB 0	204.86	205.16	205.16	206.50	
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB 20	204.80	205.15	205.15	206.52	
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB 0	204.86	205.16	205.16	206.50	
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB 20	204.79	205.14	205.14	206.46	
LINK_WARRENA_5300_WARRENA_LB 0	205.21	205.36	205.36	206.13	
LINK_WARRENA_5300_WARRENA_LB 20	205.20	205.43	205.43	206.21	
LINK_WARRENA_10000_WARRENA_LB 0	199.76	200.13	200.13	201.32	
LINK_WARRENA_10000_WARRENA_LB 20	200.23	200.58	200.58	201.47	
LINK_WARRENA_16000_WARRENA_LB 0	192.64	193.41	193.41	195.37	
LINK_WARRENA_16000_WARRENA_LB 20	194.41	194.66	194.66	195.36	
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB 0	198.73	198.87	198.87	199.51	
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB 20	196.99	197.20	197.20	197.95	
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB 0	189.74	189.78	189.78	189.96	
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB 20	186.08	186.23	186.23	186.67	
LINK_6MILE_CASTLEREAGH_RB 0	186.06	186.23	186.23	186.83	
LINK_6MILE_CASTLEREAGH_RB 20	186.41	186.50	186.50	187.00	
LINK_WARRENA_20700_WARRENA_LB 0	188.06	188.37	188.37	189.77	
LINK_WARRENA_20700_WARRENA_LB 20	187.83	188.07	188.07	188.69	
LINK_CASTLEREAGH_RB_35500_WARRENA_LB 0	186.41	186.50	186.50	187.00	
LINK_CASTLEREAGH_RB_35500_WARRENA_LB 20	187.83	188.07	188.07	188.69	
LINK_CASTLEREAGH_RB_41500_WARRENA 0	180.90	181.09	181.13	182.99	
LINK_CASTLEREAGH_RB_41500_WARRENA 20	181.40	181.35	181.43	183.13	
LINK_CASTLEREAGH_14000 0	212.60	212.96	212.96	214.30	
LINK_CASTLEREAGH_14000 20	212.61	212.98	212.98	214.31	
LINK_CASTLEREAGH_19000 0	207.18	207.34	207.34	208.33	
LINK_CASTLEREAGH_19000 20	206.71	206.94	206.94	207.80	
LINK_CASTLEREAGH_19000_WARRENA 0	207.18	207.34	207.34	208.33	
LINK_CASTLEREAGH_19000_WARRENA 20	205.21	205.36	205.36	206.13	
9MILE_BREAKOUT 0	195.40	195.44	195.44	195.66	
9MILE_BREAKOUT 500	194.73	194.76	194.76	194.91	
9MILE_BREAKOUT 1250	192.78	192.79	192.79	193.04	
9MILE_BREAKOUT 2000	191.91	192.04	192.04	192.63	
LINK_9MILE 0	195.73	195.78	195.78	195.97	
LINK_9MILE 20	195.40	195.44	195.44	195.66	
LINK_6MILE 0	187.42	187.47	187.47	187.65	
LINK_6MILE 500	184.45	184.55	184.55	185.05	
RAIL_BREAKOUT1 0	191.29	191.38	191.38	191.75	
RAIL_BREAKOUT1 100	191.14	191.22	191.22	191.60	
RAIL_BREAKOUT1 120	191.11	191.19	191.19	191.45	
RAIL_BREAKOUT1 200	190.94	190.99	190.99	191.16	
RAIL_BREAKOUT2 0	187.27	187.30	187.30	187.76	
RAIL_BREAKOUT2 100	187.27	187.29	187.29	187.75	
RAIL_BREAKOUT2 120	187.20	187.21	187.21	187.62	
RAIL_BREAKOUT2 200	187.20	187.21	187.21	187.61	
RAIL_BREAKOUT3 0	196.99	197.20	197.20	197.95	
RAIL_BREAKOUT3 100	196.97	197.17	197.17	197.90	
RAIL_BREAKOUT3 120	196.78	196.98	196.98	197.76	
RAIL_BREAKOUT3 200	196.74	196.94	196.94	197.71	
RAIL_BREAKOUT4 0	204.80	205.15	205.15	206.52	
RAIL_BREAKOUT4 100	204.79	205.13	205.13	206.46	
RAIL_BREAKOUT4 120	204.69	205.00	205.00	206.42	
RAIL_BREAKOUT4 200	204.68	204.98	204.98	206.37	
LINK_WARRENA_26500 0	183.07	183.44	183.56	184.90	
LINK_WARRENA_26500 1000	181.59	181.75	181.77	183.41	



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
LINK_CASTLEREAGH_RB_15300 0	208.98	209.21	209.21	210.02	
LINK_CASTLEREAGH_RB_15300 2800	205.21	205.36	205.36	206.13	

^a 100 year ARI inflow in the Castlereagh River and 50 year ARI inflow in Warrena Creek

^b 100 year ARI inflow in the Castlereagh River and 100 year ARI inflow in Warrena Creek

D.2 Peak Discharges (m³/s) for Design Flood Events

MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
CASTLEREAGH_LB 10440	322	924	924	5,678	
CASTLEREAGH_LB 11320	323	923	923	5,665	
CASTLEREAGH_LB 12200	330	915	915	5,664	
CASTLEREAGH_LB 13080	304	911	911	5,664	
CASTLEREAGH_LB 13960	305	910	910	5,659	
CASTLEREAGH_LB 14875	302	842	842	4,433	
CASTLEREAGH_LB 15825	298	841	841	4,427	
CASTLEREAGH_LB 16775	295	840	840	4,424	
CASTLEREAGH_LB 17725	290	837	837	4,421	
CASTLEREAGH_LB 18675	287	837	837	4,417	
CASTLEREAGH_LB 19625	285	836	836	4,418	
CASTLEREAGH_LB 20542.86	277	518	518	1,840	
CASTLEREAGH_LB 21428.57	276	518	518	1,840	
CASTLEREAGH_LB 22314.29	276	518	518	1,840	
CASTLEREAGH_LB 23200	274	518	518	1,839	
CASTLEREAGH_LB 24085.71	275	518	518	1,839	
CASTLEREAGH_LB 24971.43	274	518	518	1,839	
CASTLEREAGH_LB 25857.14	273	517	517	1,838	
CASTLEREAGH_LB 26780	512	688	688	1,544	
CASTLEREAGH_LB 27740	511	686	686	1,543	
CASTLEREAGH_LB 28700	510	685	685	1,542	
CASTLEREAGH_LB 29660	510	683	683	1,541	
CASTLEREAGH_LB 30620	509	683	683	1,541	
CASTLEREAGH_LB 31450	592	745	745	1,428	
CASTLEREAGH_LB 32233.33	0	1	1	41	
CASTLEREAGH_LB 33100	0	0	0	43	
CASTLEREAGH_LB 33966.67	0	0	0	42	
CASTLEREAGH_LB 34900	0	0	0	2	
CASTLEREAGH_LB 35650	-5	-14	-14	-78	
CASTLEREAGH_LB 36333.33	12	24	24	97	
CASTLEREAGH_LB 37200	13	25	25	96	
CASTLEREAGH_LB 38066.67	12	18	18	94	
CASTLEREAGH_LB 38933.33	8	17	17	94	
CASTLEREAGH_LB 39800	10	18	18	94	
CASTLEREAGH_LB 40666.67	13	18	18	94	
CASTLEREAGH 9750	3,447	4,654	4,654	13,963	
CASTLEREAGH 10500	2,483	2,732	2,732	4,865	
CASTLEREAGH 11500	2,482	2,731	2,731	4,863	
CASTLEREAGH 12500	2,480	2,729	2,729	4,860	
CASTLEREAGH 13500	2,478	2,728	2,728	4,858	
CASTLEREAGH 14483.33	2,778	3,115	3,115	5,416	
CASTLEREAGH 15450	2,777	3,115	3,115	5,414	
CASTLEREAGH 16416.67	2,776	3,114	3,114	5,416	
CASTLEREAGH 17250	2,776	3,172	3,172	6,580	
CASTLEREAGH 17950	2,775	3,171	3,171	6,579	
CASTLEREAGH 18650	2,775	3,170	3,170	6,577	
CASTLEREAGH 19425	2,586	2,833	2,833	4,378	
CASTLEREAGH 20275	2,586	2,828	2,828	4,374	
CASTLEREAGH 21125	2,586	2,823	2,823	4,371	
CASTLEREAGH 21975	2,585	2,820	2,820	4,370	
CASTLEREAGH 22892.86	2,252	2,539	2,539	3,964	
CASTLEREAGH 23878.57	2,252	2,538	2,538	3,962	
CASTLEREAGH 24864.29	2,252	2,537	2,537	3,962	
CASTLEREAGH 25850	2,252	2,537	2,537	3,962	
CASTLEREAGH 26835.71	2,251	2,537	2,537	3,962	
CASTLEREAGH 27821.43	2,251	2,537	2,537	3,962	
CASTLEREAGH 28807.14	2,251	2,537	2,537	3,961	
CASTLEREAGH 29310	1,129	1,194	1,194	1,548	Combara Bridge



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
CASTLEREAGH 29691.67	1,129	1,194	1,194	1,548	
CASTLEREAGH 30435	1,129	1,194	1,194	1,548	
CASTLEREAGH 31178.33	1,129	1,194	1,194	1,548	
CASTLEREAGH 32037.5	819	838	838	915	
CASTLEREAGH 33012.5	819	838	838	914	
CASTLEREAGH 33875	734	773	773	1,026	
CASTLEREAGH 34625	734	773	773	1,026	
CASTLEREAGH 35387.5	734	773	773	979	
CASTLEREAGH 36162.5	734	773	773	979	
CASTLEREAGH 36937.5	734	773	773	979	
CASTLEREAGH 37712.5	734	773	773	979	
CASTLEREAGH 38516.67	717	735	735	805	
CASTLEREAGH 39350	717	735	735	805	
CASTLEREAGH 40183.33	717	735	735	805	
CASTLEREAGH 40987.5	715	732	732	801	
CASTLEREAGH 41762.5	715	732	732	800	
CASTLEREAGH 42537.5	715	732	732	800	
CASTLEREAGH 43312.5	715	732	732	799	
CASTLEREAGH 44050	714	741	741	888	
CASTLEREAGH 44730	714	741	741	888	
CASTLEREAGH 45390	714	741	741	888	
CASTLEREAGH 45995	714	741	741	888	
CASTLEREAGH 46420	714	741	741	885	
CASTLEREAGH 46720	714	741	741	884	
CASTLEREAGH 47010	714	741	741	880	
CASTLEREAGH 47290	714	741	741	879	
CASTLEREAGH 47585	714	741	741	874	
CASTLEREAGH 47925	714	741	741	874	
CASTLEREAGH 48120	714	741	741	874	
CASTLEREAGH 48290	716	741	741	874	
CASTLEREAGH 48580	699	722	721	814	
CASTLEREAGH 48890	699	722	722	815	
CASTLEREAGH 49285	700	722	722	818	
CASTLEREAGH 49850	2,244	2,649	2,806	11,109	
CASTLEREAGH 50550	2,244	2,649	2,806	11,107	
CASTLEREAGH 51400	2,244	2,649	2,806	11,106	
CASTLEREAGH 52400	2,243	2,647	2,804	11,090	
CASTLEREAGH 53400	2,244	2,650	2,805	11,045	
CASTLEREAGH 54400	2,239	2,638	2,799	10,963	
CASTLEREAGH 55400	2,196	2,621	2,789	10,885	
CASTLEREAGH 56400	2,150	2,614	2,782	10,840	
CASTLEREAGH_RB 10400	635	993	993	3,414	
CASTLEREAGH_RB 11200	633	990	990	3,411	
CASTLEREAGH_RB 12000	634	991	991	3,407	
CASTLEREAGH_RB 12883.33	333	591	591	2,056	
CASTLEREAGH_RB 13850	332	590	590	2,056	
CASTLEREAGH_RB 14816.67	331	590	590	2,057	
CASTLEREAGH_RB 15716.67	162	269	269	892	
CASTLEREAGH_RB 16550	162	269	269	891	
CASTLEREAGH_RB 17383.33	162	269	269	890	
CASTLEREAGH_RB 18233.33	251	352	352	913	
CASTLEREAGH_RB 19100	250	351	351	912	
CASTLEREAGH_RB 19966.67	250	350	350	911	
CASTLEREAGH_RB 20885.71	435	579	579	1,739	
CASTLEREAGH_RB 21857.14	434	579	579	1,739	
CASTLEREAGH_RB 22828.57	434	579	579	1,739	
CASTLEREAGH_RB 23800	434	579	579	1,738	
CASTLEREAGH_RB 24771.43	434	578	578	1,738	
CASTLEREAGH_RB 25742.86	434	578	578	1,737	
CASTLEREAGH_RB 26714.29	433	578	578	1,737	
CASTLEREAGH_RB 27700	622	861	861	2,468	
CASTLEREAGH_RB 28700	622	861	861	2,468	
CASTLEREAGH_RB 29700	622	861	861	2,467	
CASTLEREAGH_RB 30700	622	860	860	2,467	
CASTLEREAGH_RB 31630	929	1,215	1,215	3,098	
CASTLEREAGH_RB 32490	929	1,215	1,215	3,098	
CASTLEREAGH_RB 33350	929	1,214	1,214	3,097	
CASTLEREAGH_RB 34210	929	1,214	1,214	3,097	
CASTLEREAGH_RB 35070	929	1,214	1,214	3,095	
CASTLEREAGH_RB 35960	695	852	852	1,850	

Aberford Street Bridge



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
CASTLEREAGH_RB 36880	695	852	852	1,849	
CASTLEREAGH_RB 37800	695	852	852	1,851	
CASTLEREAGH_RB 38720	695	852	852	1,838	
CASTLEREAGH_RB 39640	695	851	851	1,828	
CASTLEREAGH_RB 40450	927	1,237	1,263	6,146	
CASTLEREAGH_RB 41150	922	1,233	1,260	6,152	
CASTLEREAGH_RB 41800	1,044	1,387	1,461	7,208	
CASTLEREAGH_RB 42400	1,040	1,385	1,459	7,196	
CASTLEREAGH_RB 42710	1,038	1,382	1,456	7,179	Tooraweenah Road
CASTLEREAGH_RB 42960	972	1,292	1,376	7,143	
WARRENA 441.67	0	12	12	787	
WARRENA 1325	0	13	13	789	
WARRENA 2208.33	0	13	13	789	
WARRENA 3091.67	0	11	11	786	
WARRENA 3975	0	8	8	787	
WARRENA 4858.33	0	8	8	785	
WARRENA 5770	242	478	478	3,203	
WARRENA 6710	241	477	477	3,198	
WARRENA 7650	245	478	478	3,197	
WARRENA 8590	248	476	476	3,194	
WARRENA 9530	236	474	474	3,192	
WARRENA 10500	236	474	474	3,273	
WARRENA 11500	236	474	474	3,269	
WARRENA 12500	236	473	473	3,267	
WARRENA 13500	235	474	474	3,260	
WARRENA 14500	235	472	472	3,257	
WARRENA 15500	231	469	469	3,252	
WARRENA 16470	230	468	468	3,130	
WARRENA 17410	230	467	467	3,129	
WARRENA 18350	230	467	467	3,126	
WARRENA 19290	229	467	467	3,127	
WARRENA 20230	226	466	466	3,126	
WARRENA 20705	238	463	463	3,108	Wongy Rd
WARRENA 21192.5	224	461	461	3,107	
WARRENA 22157.5	224	455	455	3,102	
WARRENA 23122.5	223	454	454	3,097	
WARRENA 24087.5	221	453	452	3,084	
WARRENA 25052.5	218	451	450	3,067	
WARRENA 26017.5	520	661	753	4,609	
WARRENA 26505	520	628	693	2,562	Tooraweenah Road
WARRENA 26982.5	520	628	693	2,567	
WARRENA 27927.5	995	907	1,046	6,181	
WARRENA 28885	796	738	826	4,590	
WARRENA 29855	792	727	813	4,497	
WARRENA 30825	787	692	785	4,269	
WARRENA 31530	1,555	1,931	2,088	10,307	
WARRENA 32100	1,555	1,930	2,087	10,308	
WARRENA 32455	1,554	1,929	2,086	10,307	Warrena Weir
WARRENA 32605	1,554	1,929	2,086	10,306	
WARRENA 32755	1,554	1,929	2,086	10,306	Baradine Rd
WARRENA 32925	1,554	1,929	2,086	10,305	
WARRENA 33295	1,554	1,928	2,086	10,303	
WILGA_GLEN_RD 288.5	0	0	0	3	
WILGA_GLEN_RD 941	0	0	0	3	
WILGA_GLEN_RD 1377.5	0	0	0	3	
DURHAM_ST 127.5	0	0	0	0	
DURHAM_ST 598	0	0	0	0	
DURHAM_ST 980.5	0	0	0	0	
RAILWAY_ST 95	0	0	0	3	
RAILWAY_ST 300	0	0	0	3	
RAILWAY_ST 555	0	0	0	2	
RAILWAY_ST 845	0	0	0	-3	
RAILWAY_ST 1115	0	0	0	0	
RAILWAY_ST 1370	0	0	0	1	
RAILWAY_ST 1625	0	0	0	2	
RAILWAY_ST 1800	0	0	0	2	
MCPAHON_ST 330	0	0	0	0	
MCPAHON_ST 720	0	0	0	0	
BERTRAM_ST 390	0	0	0	2	
BERTRAM_ST 840	0	0	0	2	

Coonamble Levee - Flood Gradient Sensitivity Modelling Study
Final Report



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
BARTON_ST 360	0	0	0	0	
BARTON_ST 780	0	0	0	0	
REID_ST 320	0	0	0	4	
REID_ST 700	0	0	0	4	
QUANMOONA_ST 235	0	0	0	-1	
QUANMOONA_ST 535	0	0	0	-3	
EURIMIE_CK 190	16	19	19	71	
EURIMIE_CK 515	15	19	19	65	
EURIMIE_CK 765	15	19	19	64	
EURIMIE_CK 1010	15	19	19	63	
LINK_CASTLEREAGH_RB_12400_WARRENA 10	0	12	12	788	
WARRENA_LB 275	23	100	100	976	
WARRENA_LB 825	22	100	100	975	
WARRENA_LB 1570	23	99	99	968	
WARRENA_LB 2510	23	99	99	968	
WARRENA_LB 3450	22	100	100	967	
WARRENA_LB 4390	22	102	102	967	
WARRENA_LB 5330	22	102	102	966	
WARRENA_LB 6258.33	22	104	104	884	
WARRENA_LB 7175	22	105	105	884	
WARRENA_LB 8091.67	22	107	107	884	
WARRENA_LB 9008.33	21	110	110	883	
WARRENA_LB 9925	21	110	110	883	
WARRENA_LB 10841.67	19	110	110	883	
WARRENA_LB 11800	18	108	108	1,007	
WARRENA_LB 12800	17	109	109	1,006	
WARRENA_LB 13800	17	109	109	1,006	
WARRENA_LB 14800	17	107	107	1,006	
WARRENA_LB 15800	18	107	107	1,005	
WARRENA_LB 16750	17	108	108	1,014	
WARRENA_LB 17650	16	106	106	1,013	
WARRENA_LB 18550	16	105	105	1,013	
WARRENA_LB 19450	15	107	107	1,013	
WARRENA_LB 20350	14	105	105	1,014	
WARRENA_LB 21250	12	101	101	1,011	
WARRENA_LB 22150	12	102	102	1,009	
LINK_CASTLEREAGH_RB_17800_WARRENA_LB 10	23	101	101	977	
6MILE_BREAKOUT 1966.67	0	0	0	46	
6MILE_BREAKOUT 2900	0	0	0	46	
6MILE_BREAKOUT 3833.33	0	0	0	46	
6MILE_BREAKOUT 4700	235	361	361	1,296	
6MILE_BREAKOUT 5500	238	361	361	1,295	
6MILE_BREAKOUT 6300	238	363	363	1,299	
6MILE_BREAKOUT 7100	236	363	363	1,298	
6MILE_BREAKOUT 7900	236	363	363	1,289	
6MILE_BREAKOUT 8700	236	362	362	1,285	
LINK_CASTLEREAGH_6MILE 10	0	0	0	46	
LINK_CASTLEREAGH_10000_CASTLEREAGH_LB 10	327	928	928	5,682	
LINK_CASTLEREAGH_10000_CASTLEREAGH_RB 10	636	994	994	3,416	
LINK_CASTLEREAGH_29300_CASTLEREAGH_RB 10	194	286	286	734	
LINK_CASTLEREAGH_WILGA_GLEN 10	0	0	0	3	
LINK_CASTLEREAGH_DURHAM_ST 10	0	0	0	0	
LINK_CASTLEREAGH_RAILWAY_ST 10	0	0	0	3	
LINK_CASTLEREAGH_QUANMOONA_ST 10	0	0	0	1	
LINK_CASTLEREAGH_REID_ST 10	0	0	0	4	
LINK_CASTLEREAGH_BARTON_ST 10	0	0	0	0	
LINK_CASTLEREAGH_BERTRAM_ST 10	0	0	0	6	
LINK_CASTLEREAGH_MCMAHON_ST 10	0	0	0	0	
LINK_CASTLEREAGH_EURIMIE 10	16	19	19	75	
LINK_CASTLEREAGH_33500_CASTLEREAGH_LB 10	85	91	91	-113	
GEAMONEY_BREAKOUT 50	5	14	14	80	
GEAMONEY_BREAKOUT 110	5	14	14	80	
GEAMONEY_BREAKOUT 160	5	14	14	80	
LINK_CASTLEREAGH_6900_CASTLEREAGH_LB 10	0	-65	-65	-1,217	
LINK_CASTLEREAGH_6900_CASTLEREAGH_RB 10	0	0	0	50	
LINK_CASTLEREAGH_22400_CASTLEREAGH_LB 10	146	209	209	-426	
LINK_CASTLEREAGH_22400_CASTLEREAGH_RB 10	186	229	229	828	
LINK_WARRENA_5300_WARRENA_LB 10	0	0	0	-8	
LINK_WARRENA_10000_WARRENA_LB 10	0	0	0	-82	
LINK_WARRENA_16000_WARRENA_LB 10	0	-5	-5	124	



MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
LINK_CASTLEREAGH_29300_CASTLEREAGH_LB 10	929	1,057	1,057	1,680	
LINK_CASTLEREAGH_38100_CASTLEREAGH_LB 10	17	38	38	175	
LINK_6MILE_CASTLEREAGH_RB 10	-233	-361	-361	-1,249	
LINK_WARRENA_20700_WARRENA_LB 10	0	0	0	13	
LINK_CASTLEREAGH_RB_35500_WARRENA_LB 10	0	0	0	-5	
LINK_CASTLEREAGH_RB_41500_WARRENA 10	-198	-166	-218	-1,571	
LINK_CASTLEREAGH_14000 10	-300	-389	-389	-602	
LINK_CASTLEREAGH_19000 10	114	184	184	999	
LINK_CASTLEREAGH_19000_WARRENA 10	74	154	154	1,201	
9MILE_BREAKOUT 250	310	356	356	633	
9MILE_BREAKOUT 875	309	356	356	634	
9MILE_BREAKOUT 1625	310	356	356	633	
LINK_9MILE 10	310	356	356	633	
LINK_6MILE 250	2	2	2	4	
RAIL_BREAKOUT1 50	591	744	744	1,387	
RAIL_BREAKOUT1 110	591	744	744	1,387	
RAIL_BREAKOUT1 160	591	744	744	1,387	
RAIL_BREAKOUT2 50	0	0	0	39	
RAIL_BREAKOUT2 110	0	0	0	39	
RAIL_BREAKOUT2 160	0	0	0	39	
RAIL_BREAKOUT3 50	664	882	882	1,973	
RAIL_BREAKOUT3 110	664	882	882	1,972	
RAIL_BREAKOUT3 160	664	882	882	1,972	
RAIL_BREAKOUT4 50	140	364	364	2,153	
RAIL_BREAKOUT4 110	140	364	364	2,153	
RAIL_BREAKOUT4 160	140	364	364	2,153	
LINK_WARRENA_26500 500	0	33	60	2,048	
LINK_CASTLEREAGH_RB_15300 1400	169	320	320	1,215	

^a 100 year ARI inflow in the Castlereagh River and 50 year ARI inflow in Warrena Creek

^b 100 year ARI inflow in the Castlereagh River and 100 year ARI inflow in Warrena Creek



D.3 Distribution of Peak Discharges (m³/s) for Design Flood Events

Discharge ID ^c	MIKE-11 Cross Section	50 year ARI	100 year ARI ^a	100 year ARI ^b	Extreme Event	Remarks
1	CASTLEREAGH 9750	3,447	4,654	4,654	13,963	
2	CASTLEREAGH_LB 12200	330	915	915	5,664	
3	CASTLEREAGH_RB 12000	634	991	991	3,407	
4	WARRENA 8590	248	476	476	3,194	
5	WARRENA_LB 3450	22	100	100	967	
6	RAIL_BREAKOUT4 110	140	364	364	2,153	
7	RAIL_BREAKOUT3 110	664	882	882	1,972	
8	RAIL_BREAKOUT1 110	591	744	744	1,387	
9	CASTLEREAGH_RB 32490	929	1,215	1,215	3,098	
10	6MILE_BREAKOUT 2900	0	0	0	46	
11	RAIL_BREAKOUT2 110	0	0	0	39	
12	GEAMONEY_BREAKOUT 110	5	14	14	80	
13	CASTLEREAGH 44730	714	741	741	888	
14	6MILE_BREAKOUT 7100	236	363	363	1,298	
15	CASTLEREAGH_RB 36880	695	852	852	1,849	
16	WARRENA_LB 19450	15	107	107	1,013	
17	WARRENA 23122.5	223	454	454	3,097	
18	CASTLEREAGH_RB 41150	922	1,233	1,260	6,152	
19	WARRENA 27927.5	995	907	1,046	6,181	
20	WARRENA 29855	792	727	813	4,497	
21	CASTLEREAGH_RB 42710	1,038	1,382	1,456	7,179	Tooraweena Road
22	WARRENA 32755	1,554	1,929	2,086	10,306	Baradine Rd
23	CASTLEREAGH 50550	2,244	2,649	2,806	11,107	
24	EURIMIE_CK 1010	15	19	19	63	
25	DURHAM_ST 980.5	0	0	0	0	
26	WILGA_GLEN_RD 1377.5	0	0	0	3	
27	9MILE_BREAKOUT 875	309	356	356	634	

a 100 year ARI inflow in the Castlereagh River and 50 year ARI inflow in Warrena Creek

b 100 year ARI inflow in the Castlereagh River and 100 year ARI inflow in Warrena Creek

c Refer to Discharge ID shown D.4



D.4 Discharge ID Shown in D.3

