

## **Report on the Flooding of Coastal Streams in South East Queensland in December 1991**

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**Hydrology Section  
Queensland Regional Office  
Commonwealth Bureau of Meteorology**

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# TABLE OF CONTENTS

1.0	Introduction	1
1.1	Aim	1
1.2	Authorization	1
1.3	Sources of Information	1
2.0	Meteorological Situation	2
3.0	Rainfall Situation	2
4.0	Flooding	5
4.1	Logan and Albert Rivers	5
4.2	Oxley Creek	5
4.3	Bremer River and Warrill Creek	5
4.4	Mary River	7
5.0	Flood Warning Services	7
5.1	Logan and Albert Rivers	8
5.2	Oxley Creek	8
5.3	Bremer River and Warrill Creek	8
5.4	Mary River	9

## LIST OF TABLES

Table 3.0	Highest Recorded Rainfalls	3
Table 3.1	Intensity Duration Frequency Analysis for Ripley	4
Table 3.2	Intensity Duration Frequency Analysis for Maleny	4
Table 3.3	Intensity Duration Frequency Analysis for Mt Glorious	4
Table 4.1	Comparison of Flood Levels	6
Table 5.1	Distribution of Warnings	7

## LIST OF FIGURES

(Contained at the end of the Report)

Figure 3.1	Rainfall Isohyets for Brisbane, Bremer and Stanley Rivers
Figure 3.2	Rainfall Isohyets for Mary River and Sunshine Coast Streams
Figure 3.3	Rainfall Isohyets for Logan, Albert, Nerang Rivers and Warrill Creek
Figure 3.4	Intensity Frequency Duration Diagrams for Ripley
Figure 3.5	Intensity Frequency Duration Diagrams for Maleny
Figure 3.6	Intensity Frequency Duration Diagrams for Mt Glorious
Figure 3.7	Rainfall Mass Curve for Oxley Creek
Figure 3.8	Rainfall Mass Curve for Mary River
Figure 3.9	Rainfall Mass Curve for Logan River
Figure 3.10	Rainfall Mass Curves for Ripley, Maleny, and Mt Glorious
Figure 4.1	Rainfall and River Heights for Oxley Creek
Figure 4.2	Rainfall and River Heights for Bundamba Creek
Figure 4.3	River Levels for Bremer River and Warrill Creek

# Report on the Flooding of Coastal Streams in South East Queensland in December 1991

## **1.0 INTRODUCTION**

Severe flooding of some coastal streams occurred in South East Queensland from Thursday 12/12/91 to Saturday 14/12/91. Areas of major flooding along the Bremer River, Bundamba Creek, and Warrill Creek caused significant property loss and damage. In the Bundamba Creek area forty two people were rescued from their homes by the State Emergency Service. Several bridges and road crossings in the Ipswich, Oxley and Logan City areas were flooded.

Minor to moderate flooding occurred in the Logan and Mary Rivers but no significant damage was reported.

No lives were lost as a result of flooding.

### **1.1 Aim**

The purpose of this report is to document the meteorological and hydrological aspects of the flooding of coastal streams in South East Queensland in December 1991.

### **1.2 Authorization**

This document has been compiled by the Queensland Hydrology Section for the internal use of the Bureau of Meteorology.

### **1.3 Sources of Information**

The data used in this report has been gathered from the ALERT database, AROS database and from the logs of rainfall and river height stations which reported to the Bureau during the event.

The IFD analysis was obtained from Hydrometeorology Section in the Melbourne Head Office of the Bureau of Meteorology.

## 2.0 METEOROLOGICAL SITUATION

Over the 24 hours up to 1000 (Eastern Summer Time) 12/12/91 marked changes occurred in the tropospheric circulation over the eastern Australian region. A middle to upper cold low developed over Southwest Queensland. Warm low density north to northeasterly airflow over Southeast Queensland at middle levels was being lifted as it circulated around the low towards colder air. A large scale rain area was produced by this ascent.

At mean sea level (MSL) during this period a high pressure system moved from the Bight into the Tasman Sea. The high had an elongated ridge extending over towards Norfolk Island which directed a tropical oceanic northeasterly airflow from New Caledonia onto the South Queensland coast. This air stream was a source of moisture for the developing rain band. Coincidentally a MSL low formed near the Carnarvon Ranges in response to the development aloft. The low attracted a moist northwesterly monsoon airflow down into the Coral Sea which converged with the flow from New Caledonia over Southeast Queensland. The convergence zone lay in a line on the northern boundary of the large scale rain area and it generated areas of exceptional rainfall.

The convergence line moved southwards down the coast clearing the widespread rain from Brisbane City during the morning of Thursday 12/12/91. However in the wake of the rain band the atmosphere was left humid and unstable and conducive to shower and thunderstorm development. The ensuing convective rainfall was enhanced on the ranges near Brisbane where orographic lifting aided growth. Another complication occurred following the clearance of the rain band in that a small scale low developed between Brisbane and the border ranges turning the winds at Amberley southerly and opposing the general low level northerly airflow. This convergence produced areas of sustained convective rain between Brisbane and Ipswich well into Thursday night.

## 3.0 RAINFALL SITUATION

Figures 3.1, 3.2, and 3.3 illustrate the extent of the rain that fell during the 48 hour period ending 0900 on Friday 13/12/91.

Rainfall varied from 50 mm in 48 hours at the ranges near Toowoomba to above 400 mm in 48 hours in the upper reaches of the Mary River and in the Mount Glorious and Mount Nebo areas. Isolated areas of greater than 300 mm in 48 hrs occurred at Mount Crosby and in the upper reaches of the Nerang and Coomera Rivers.

The catchments of Oxley, Bundamba and Warrill Creeks and the Bremer River received greater than 200 mm in 48 hours. The majority of the rain fell between 2100 Wednesday 11/12/91 and 2100 Thursday 12/12/91.

The highest rainfalls recorded in South East Queensland for the 24 hours to 0900 on Thursday 12/12/91 and the 24 hours to 0900 on Friday 13/12/91 are listed below.

Rainfall Station	Stn. Type	Stn. CBM No.	Thursday 24 hrs to 0900 (mm)	Friday 24 hrs to 0900 (mm)	48hrs Totals (mm)
Mt Glorious	OBS	040308	319	269	588
Maleny	TM	040803	363	125	488
Peachester	OBS	040805	357	114	471
Mt Nebo	OBS	040147	245	185	430
Mapleton	TM	040804	285	68	353
Mt Tamborine	OBS	040197	168	184	352
Numinbah	TM	040747	153	193	346
Kenilworth	TM	040802	166	161	327
Woodford	TM	040969	202	88	290
Thompson Road	ALERT	040794	105	173	278
Ripley	ALERT	040792	125	143	268

Note: OBS - manual observing station.  
 TM - telephone telemetry station.  
 ALERT - event reporting radio telemetry station.

**Table 3.0 Highest Recorded Rainfalls**

The observed rainfall intensities during the event have been compared with the design rainfall intensities given by the Intensity Frequency Duration analysis at Ripley (ALERT), Maleny (TM), and Mt Glorious (OBS). The results of these analyses are contained in Tables 3.1 to 3.3 and are illustrated in Figures 3.4 to 3.6.

It should be noted that the data for the Maleny telemeter has not been adjusted to the data from the daily reporting observer station at Maleny. Also, the three stations were reporting at different intervals ie. Ripley was reporting every 1 millimetre of rain; Maleny was every three hours, and Mt Glorious was reporting approximately every 50 millimetres of rain and daily at 0900 hours. The IFD analysis that has been used, has not taken into account these factors. It is therefore not a stringent analysis but for the purposes of this report is deemed to be sufficient.

The analysis showed that the maximum 24 hour rainfall intensities at Mt Glorious and Ripley were slightly above the 1 in 100 ARI but the 24 hour levels for Maleny only reached the 20 to 50 year ARI intensity.

Rainfall Mass Curves have been plotted for stations in the catchments of Oxley Creek (Figure 3.7), Mary River (Figure 3.8), Logan River (Figure 3.9) and for the Ripley, Maleny, and Mt Glorious rainfall stations (Figure 3.10). The curves illustrate that the significant rainfall began at around 2400 Wednesday 11/12/91 and finished at around 2100 Thursday 12/12/91.

Table 3.1 Intensity Frequency Duration Analysis for Ripley

Duration	Highest Rainfall (mm)	Time Period				Average Intensity (mm/hr)	Average Recurrence Interval
		From		To			
15 min	11	0830	(12/12/91)	0845	(12/12/91)	44.0	< 1
30 min	20	0830	(12/12/91)	0900	(12/12/91)	40.0	< 1
1 hr	37	0830	(12/12/91)	0930	(12/12/91)	37.0	1–2
2 hr	65	0830	(12/12/91)	1030	(12/12/91)	32.5	2–5
3 hr	82	0830	(12/12/91)	1130	(12/12/91)	27.3	5–10
6 hr	142	0700	(12/12/91)	1300	(12/12/91)	23.7	20–50
12 hr	187	0100	(12/12/91)	1300	(12/12/91)	15.6	50–100
24 hr	256	2300	(11/12/91)	2300	(12/12/91)	10.7	> 100
48 hr	268	0000	(11/12/91)	0000	(13/12/91)	5.6	20–50

Table 3.2 Intensity Frequency Duration Analysis for Maleny

Duration	Highest Rainfall (mm)	Time Period				Average Intensity (mm/hr)	Average Recurrence Interval
		From		To			
15 min	---	---		---		---	---
30 min	---	---		---		---	---
1 hr	---	---		---		---	---
2 hr	---	---		---		---	---
3 hr	113	0300	(12/12/91)	0600	(12/12/91)	37.7	5-10
6 hr	199	0300	(12/12/91)	0900	(12/12/91)	33.2	10-20
12 hr	322	2100	(11/12/91)	0900	(12/12/91)	26.8	20-50
24 hr	443	2100	(11/12/91)	2100	(12/12/91)	18.5	20-50
48 hr	481	0000	(11/12/91)	0000	(13/12/91)	10.0	10-20

Table 3.3 Intensity Frequency Duration Analysis for Mt Glorious

Duration	Highest Rainfall (mm)	Time Period				Average Intensity (mm/hr)	Average Recurrence Interval
		From		To			
15 min	---	---		---		---	---
30 min	---	---		---		---	---
1 hr	---	---		---		---	---
2 hr	80	1500	(12/12/91)	1700	(12/12/91)	40.0	5–10
3 hr	119	0600	(12/12/91)	0900	(12/12/91)	39.7	10–20
6 hr	179	0600	(12/12/91)	1200	(12/12/91)	29.8	20–50
12 hr	319	0600	(12/12/91)	1800	(12/12/91)	26.6	> 100
24 hr	454	0400	(11/12/91)	0400	(12/12/91)	18.9	> 100
48 hr	588	0900	(11/12/91)	0900	(13/12/91)	12.3	50–100

## **4.0 FLOODING**

### **4.1 Logan and Albert Rivers**

The rainfall in the upper reaches of the Logan River and Teviot Brook produced minor to moderate flooding downstream at Macleans Bridge and Waterford Bridge. Waterford Bridge was covered from 1100 hrs on Friday 13/12/91 to 1300 hrs on Saturday 14/12/91. Minor flooding also occurred downstream as flood waters backed up Scrubby and Slacks Creek.

The peak at Waterford Bridge of 6.00 metres was the highest since early 1991 and just reached minor flood levels. Macleans Bridge peaked at 13.63 metres just above the moderate flood level and this was also the highest since early 1991.

The Albert River at Bromfleet reached 9.00 metres, just on minor flood level.

Table 4.1 compares these flood levels with previous floods and minor, moderate and major classifications and shows that they were well below record levels.

### **4.2 Oxley Creek**

Minor to moderate flooding developed in Oxley Creek with the level at Beatty Road reaching 5.46 metres on Friday 13/12/91. Figure 4.1 illustrates the relationship between the mean catchment rainfall and the resultant river rises at Beatty Road, which is the reference gauge for floods in Oxley Creek. From this figure, it can be seen that there was approximately 20 hours between the centroid of the average catchment rainfall and the peak at Beatty Road.

The main consequence of this flood was the closure of sections of Ipswich Road, the major arterial between Brisbane and Ipswich, and other local suburban roads.

### **4.3 Bremer River and Warrill Creek**

Very heavy rainfalls on the morning of Thursday 12/12/91 caused major flooding in Warrill Creek at Amberley and Harrisville. As shown in Figure 4.1, flood levels were the highest since 1976 for both Amberley and Harrisville.

Major flooding occurred along the middle reaches of the Bremer River at Rosewood and Walloon. The peak at Rosewood of 6.06 metres was just over the major flood level and was the highest since 1988. Walloon peaked at 7.24 metres which was well above the major flood level and was also the highest since 1988.

The flood peaks at Three Mile Bridge and Ipswich on the Bremer River below the junction with Warrill Creek were the highest since 1976 and caused major flooding. The Bremer river at Ipswich peaked at 13.10 metres at 2400 on Thursday 12/12/91 which was within 24 hours of the beginning of the rainfall. The river at Ipswich rose about 1.5 metres per hour during the afternoon of Thursday 12/12/91. Local area inflow was a significant component of the flood waters at Ipswich.

**Table 4.1 Comparison of Flood Levels**

River/Stream	Station	December 1991 Flooding		Minor Flood Level (m)	Moderate Flood Level (m)	Major Flood Level (m)	Bridge Level (m)	Highest on Record (m)	Highest Since (m)	
		Peak (m)	Time							Date
Logan and Albert Rivers	Round Mt	9.54	2100	12/12/91	9.00	13.00	14.00	---	16.85 (1991)	16.85 (1991)
	Broomfleet	9.00	0130	13/12/91	9.00	12.00	16.00	14.20	---	---
	The Overflow	10.04	0300	13/12/91	8.00	9.00	12.00	7.60	13.42 (1991)	13.42 (1991)
	Macleans Bridge	13.63	1530	13/12/91	10.00	13.50	16.00	17.00	21.67 (1974)	18.55 (1991)
	Waterford	6.00	2400	13/12/91	6.00	7.50	9.00	5.00	12.95 (1974)	9.06 (1991)
Warrill Creek	Amberley	7.74	1800	12/12/91	3.50	4.50	5.50	---	10.18 (1974)	8.6 (1976)
	Harrisville	5.81	2030	12/12/91	3.00	4.00	5.00	5.50	8.33 (1893)	5.95 (1976)
Bremer River	Stokes Crossing	4.40	1500	12/12/91	4.00	5.00	6.00	1.10	8.00 (1893)	4.55 (1991)
	Rosewood	6.06	1630	12/12/91	4.00	5.00	6.00	5.20	6.46 (1988)	6.46 (1988)
	Walloon	7.24	1800	12/12/91	3.50	5.00	6.00	---	7.58 (1988)	7.58 (1988)
	Three Mile Bridge	21.20	2130	12/12/91	---	---	---	19.35	21.41 (1976)	21.41 (1976)
	Ipswich	13.10	2400	12/12/91	7.00	9.00	11.70	---	24.50 (1893)	13.65 (1976)
Oxley Creek	Beatty Road	5.46	0600	13/12/91	4.00	5.00	6.00	---	---	---
Mary River	Bellbird Creek	5.35	2230	12/12/91	---	---	---	---	8.40 (1968)	7.49 (1983)
	Kenilworth Bridge	7.60	2400	12/12/91	5.00	8.00	11.00	5.80	16.84 (1898)	14.00 (1989)
	Kenilworth HS	6.23	2400	12/12/91	---	---	---	---	---	---
	Moy Pocket	11.52	0300	13/12/91	---	---	---	---	---	---
	Dagun Pocket	11.10	1500	13/12/91	---	---	---	---	---	---
	Gympie	10.00	2330	13/12/91	9.90	12.00	17.00	9.90	25.45 (1893)	19.65 (1989)



Severe flash flooding developed in Bundamba Creek causing inundation of residential and commercial districts in the lower reaches. Flood levels in these areas are monitored by the Ipswich City Council via ALERT stations at Bundamba School and Blackstone Bridge. Figure 4.2 illustrates the relationship between rainfalls at the Oxley Gap rainfall station and rises in Bundamba Creek at Blackstone Bridge and Bundamba School.

As can be seen from Figure 4.2, the heaviest rainfall in the Bundamba Creek area were between 0900 and 1100 on Thursday 12/12/91 and the river peaked at Bundamba School at 17.58 metres AHD at around 1500 hours. The rain to flood response time for Bundamba Creek was very short, within about 5.0 hours of the centroid of the rainfall. The river level at Bundamba School rose 6.40 metres in a 7 hour period.

The hydrographs of the flooding in Warrill Creek and the Bremer River, seen in Figure 4.3, illustrate that there was approximately 12 hours between the first reported rise at Ipswich (reports start at 5 metres) and the peak. Recorded flood levels are compared with defined classifications and record heights in Table 4.1.

#### 4.4 Mary River

Minor flooding occurred in the Mary River with Gympie peaking at 10.00 metres at 2330 hours on Friday 13/12/91. As indicated in Table 4.1, the peak was the highest since 1989 but just reached minor flood level and lapped the Kidd Bridge at Gympie.

### 5.0 FLOOD WARNING SERVICES

A total of twenty nine warnings were issued by the Bureau of Meteorology Queensland Regional Office between Thursday 12/12/91 and Saturday 14/12/91. Table 5.1 illustrates the distribution of warnings issued for this event on a catchment by catchment basis.

All warnings contained details of the rain that had fallen and the latest river levels, along with river height predictions at critical locations in some of the catchments.

River/Creek System	No of Warnings
Logan and Albert Rivers	7
Bremer River and Warrill Creek	6
Oxley Creek	7
Mary River and Adjacent Coastal Streams	9

**Table 5.1                      Distribution of Warnings**

## **5.1 Logan and Albert Rivers**

The first warning for the Logan and Albert rivers was issued at 1130 hours on Thursday 12/12/91.

The initial prediction for Waterford Bridge, which indicated that the river level would rise to near bridge deck level during Friday morning, was included in the warning issued at 1000 hours Thursday 12/12/91.

On Friday morning the prediction in the updated warning indicated that the bridge would be under water for most of that day and into the night. At 1045 hours on Friday it was predicted that the flood level at Waterford would reach 6.00 metres by that night. Later that afternoon the timing of the forecast was refined to indicate that the flood would peak at 6.00 metres between midnight and 0300 hours Saturday morning.

The flood peaked at 6.00 metres at 2400 on Friday 13/12/91 and the final warning was issued at 0945 hours on Saturday 14/12/91.

## **5.2 Oxley Creek**

The initial warning for Oxley Creek was issued at 1200 hours on Thursday 12/12/91. Minor flood levels were predicted for Beatty Road by Thursday evening with further rises the following day.

On Friday morning the warning stated that minor flooding was continuing with Beatty road peaking overnight. Further warnings indicated that roads would be affected by flood waters until Saturday afternoon.

## **5.3 Bremer River and Warrill Creek**

The first warning for the Bremer River and Warrill Creek was issued at 1100 hours on Thursday 12/12/91 and contained predictions of moderate flooding at Ipswich by Thursday evening.

The warning was renewed at 1615 hours and contained a quantitative forecast for Ipswich. A peak of 12.0 metres between 2100 and 2400 on Thursday 12/12/91 was predicted for Ipswich, causing major flooding. At 2115 hours that night the prediction was updated to 13 metres at midnight Thursday 12/12/91.

During Thursday 12/12/91, Ipswich City Council monitored the flash flooding in Bundamba Creek and the Bremer River flood levels, and provided advice to the Police for counter disaster operations.

The flood peaked at Ipswich at 13.10 metres at 2400 on Thursday 12/12/91 and the final warning was issued at 1630 hours on Friday 13/12/91.

#### 5.4 Mary River

The initial warning for the Mary River was issued at 0715 hours on Thursday 12/12/91. Minor to moderate flooding was predicted for the upper reaches of the Mary River.

Subsequent warnings predicted rises at Gympie during Thursday night and minor to moderate flooding was predicted for the area between Kenilworth to Gympie during Thursday night.

The warning issued at 1645 Thursday afternoon predicted minor flooding at Gympie by Friday afternoon. At 1245 hours Friday 13/12/91 the warning stated that the Mary River at Gympie would reach 11.5 to 12.5 metres by early Saturday morning causing only minor flooding.

The flood waters peaked at Gympie at 10.00 metres at 2330 hours on Friday 13/12/91 and the final warning was issued at 0945 hours Saturday 14/12/91.

## Figures

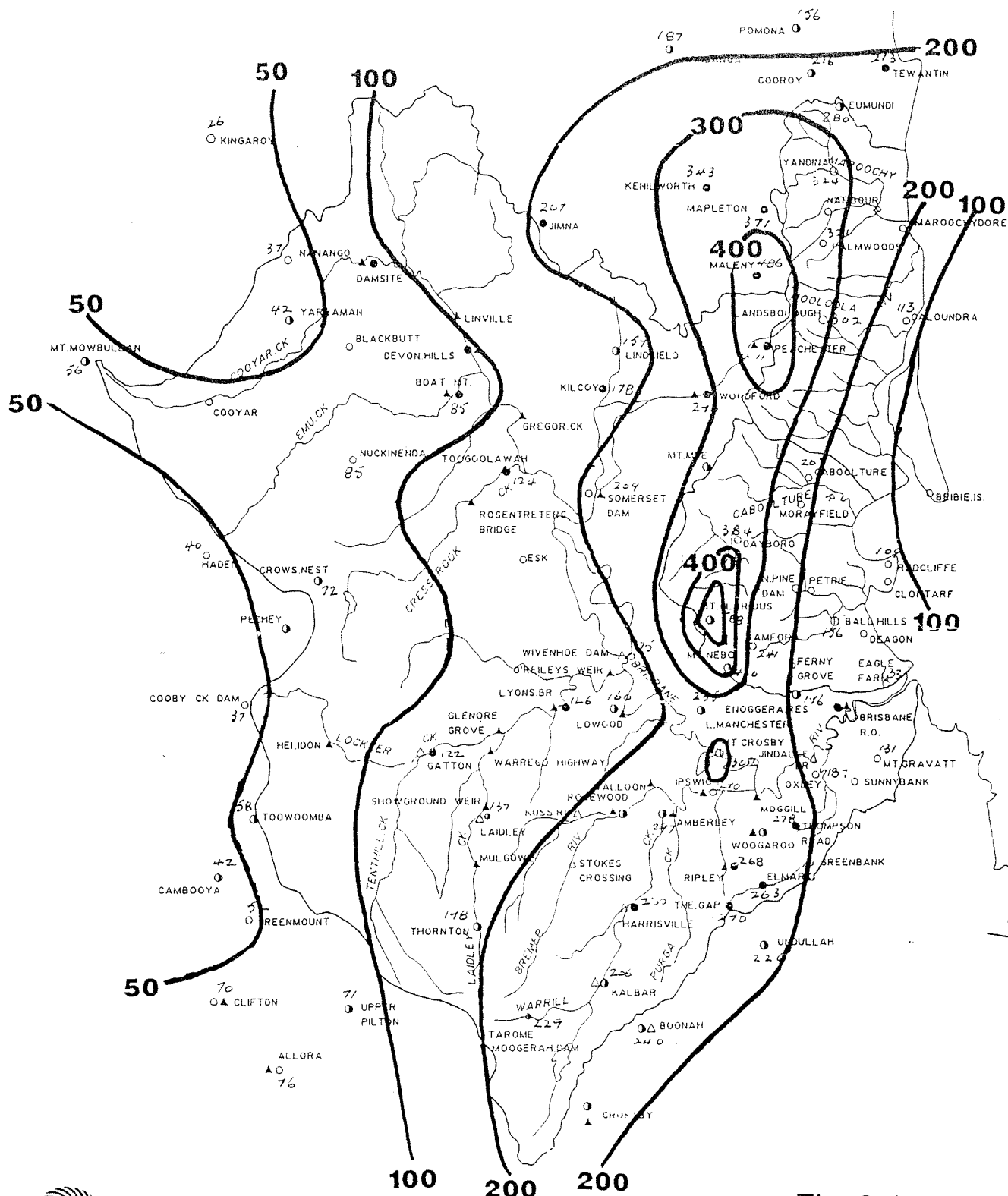
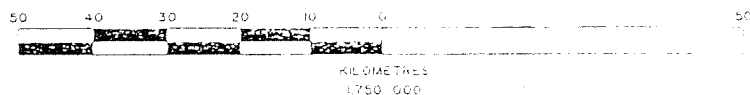


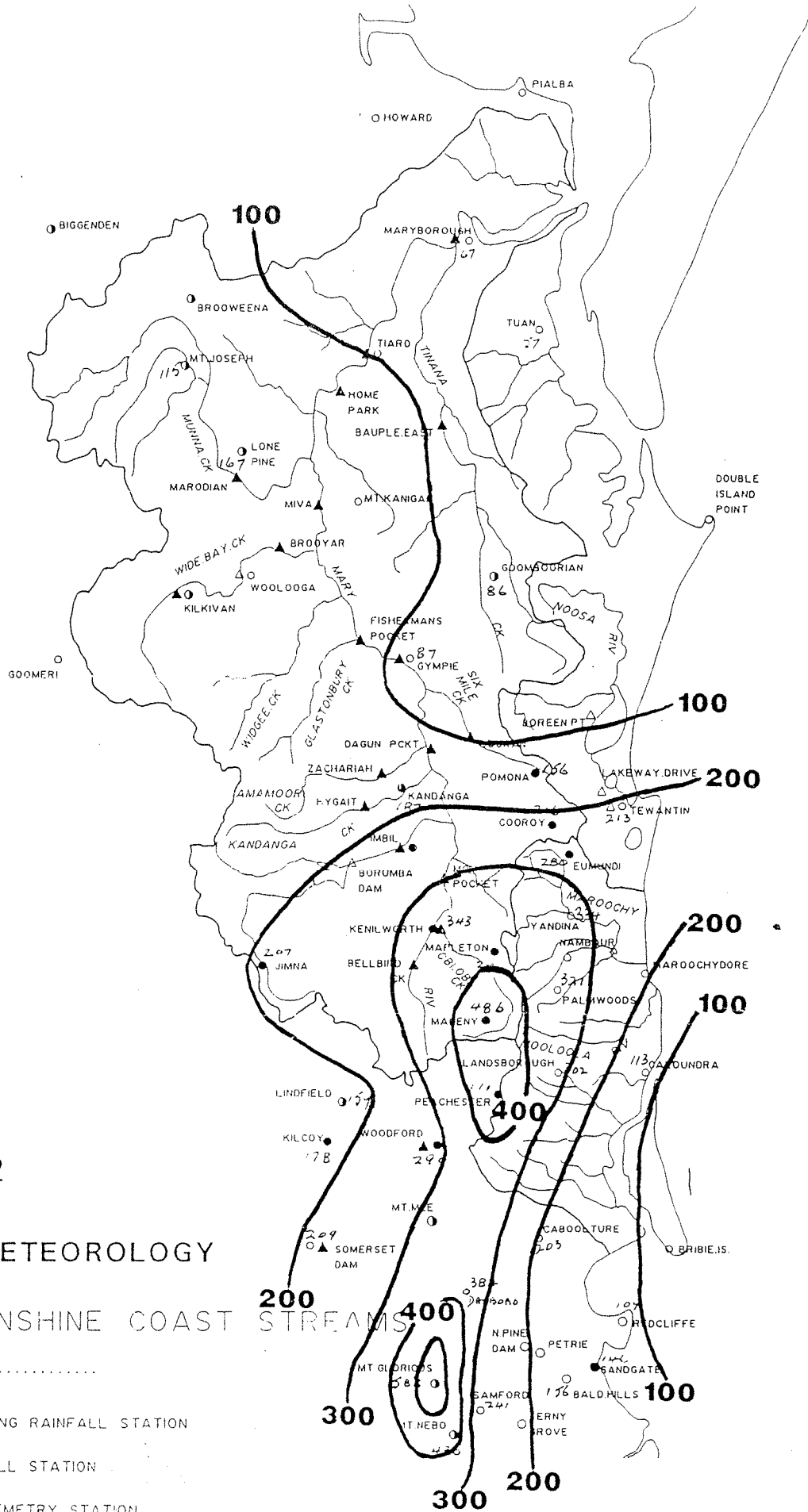
Fig 3.1

BRISBANE, BREMER & STANLEY RIVERS  
SITUATION AS AT .....

- DAILY REPORTING RAINFALL STATION
- HEAVY RAINFALL STATION
- ⊙ RAINFALL TELEMETRY STATION
- △ FLOODWARNING RIVER HEIGHT STATION
- ▲ RIVER HEIGHT TELEMETRY STATION
- UNOFFICIAL RIVER HEIGHT STATION



**RAINFALL ISOHYETS for 48 HOUR PERIOD ENDING 0900 13/12/91**





# DESIGN RAINFALL INTENSITY DIAGRAM

LOCATION 27.725 S 152.800 E \* NEAR.. RIPLEY

\* ENSURE THE COORDINATES ARE THOSE REQUIRED.  
SINCE DATA IS BASED ON THESE AND NOT THE LOCATION NAME.

ISSUED 18<sup>TH</sup> DECEMBER 1991 REF. -FN3593

GRAPH DATA 45.02, 6.99, 1.84, 87.44, 13.88, 3.96, 0.200, 3HF)

PREPARED BY -- HYDROMETEOROLOGICAL ADVISORY SERVICE -- MELBOURNE

(C) COMMONWEALTH OF AUSTRALIA, BUREAU OF METEOROLOGY 1987

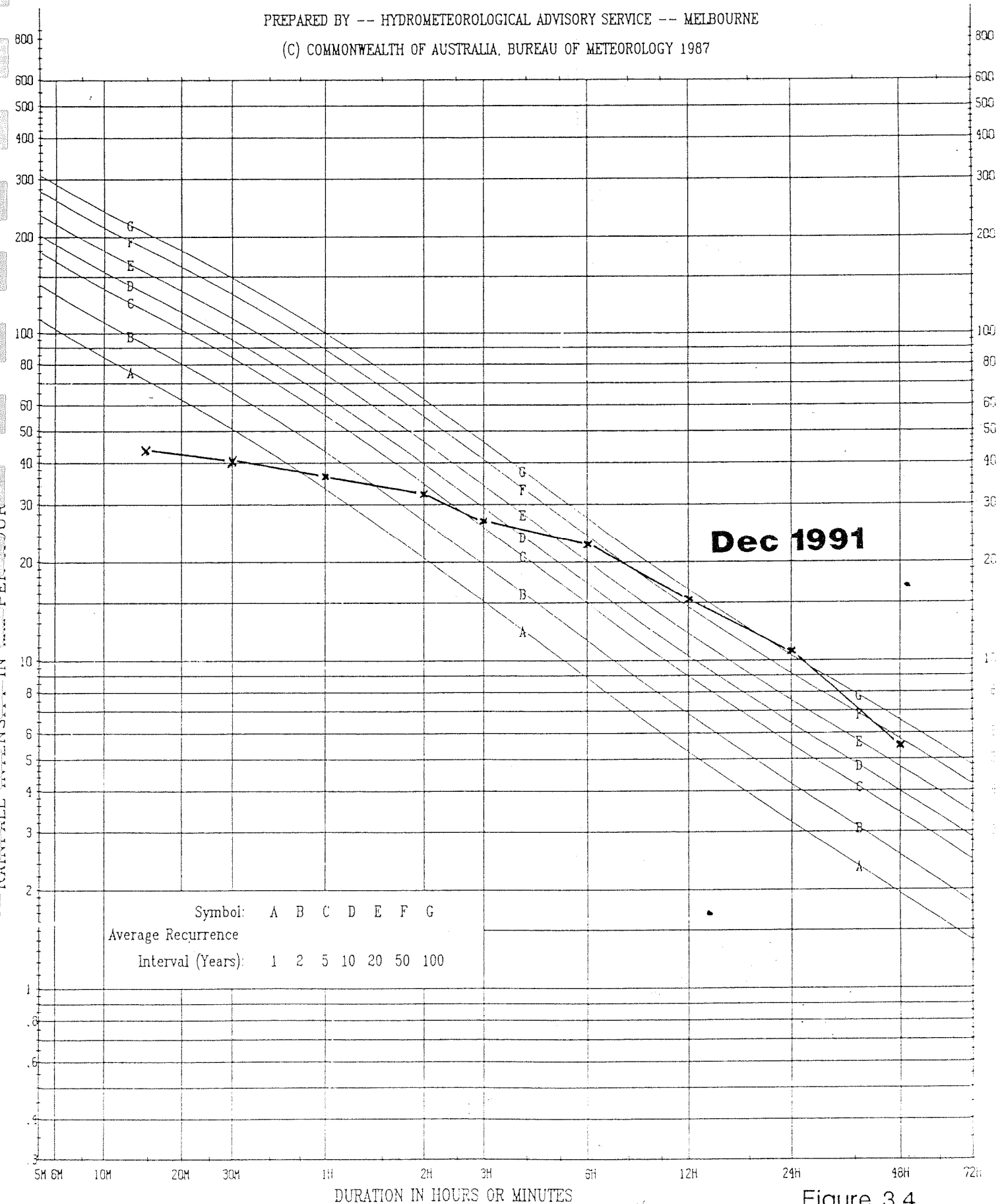


Figure 3.4



# DESIGN RAINFALL INTENSITY DIAGRAM

LOCATION 26.750 S 152.850 E \* NEAR.. MALENY

\* ENSURE THE COORDINATES ARE THOSE REQUIRED.  
SINCE DATA IS BASED ON THESE AND NOT THE LOCATION NAME.

ISSUED 18<sup>TH</sup> DECEMBER 1991 REF. - FN3593

RAW DATA 48.91, 12.42, 4.36, 87.13, 27.95, 10.28, 0.170, 2161

PREPARED BY -- HYDROMETEOROLOGICAL ADVISORY SERVICE -- MELBOURNE

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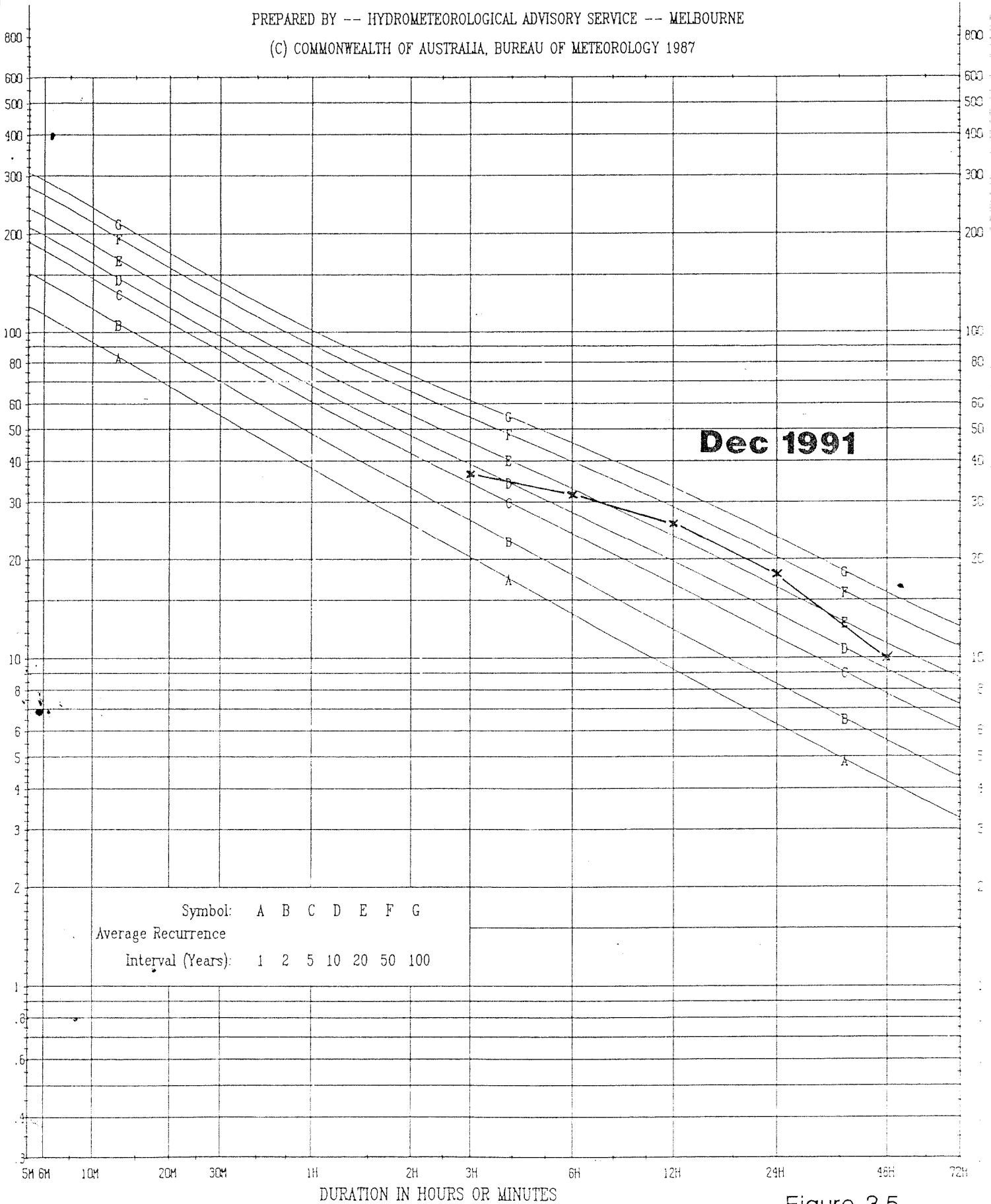


Figure 3.5

# DESIGN RAINFALL INTENSITY DIAGRAM

LOCATION 27.325 S 152.775 E \* NEAR.. MT GLORIOUS

\* ENSURE THE COORDINATES ARE THOSE REQUIRED.  
SINCE DATA IS BASED ON THESE AND NOT THE LOCATION NAME.

ISSUED 18<sup>TH</sup> DECEMBER 1991 REF.-FN3593

(RPM DATA 46.84, 10.43, 3.48, 88.62, 20.07, 8.00, 0.200, 2HGI)

PREPARED BY -- HYDROMETEOROLOGICAL ADVISORY SERVICE -- MELBOURNE

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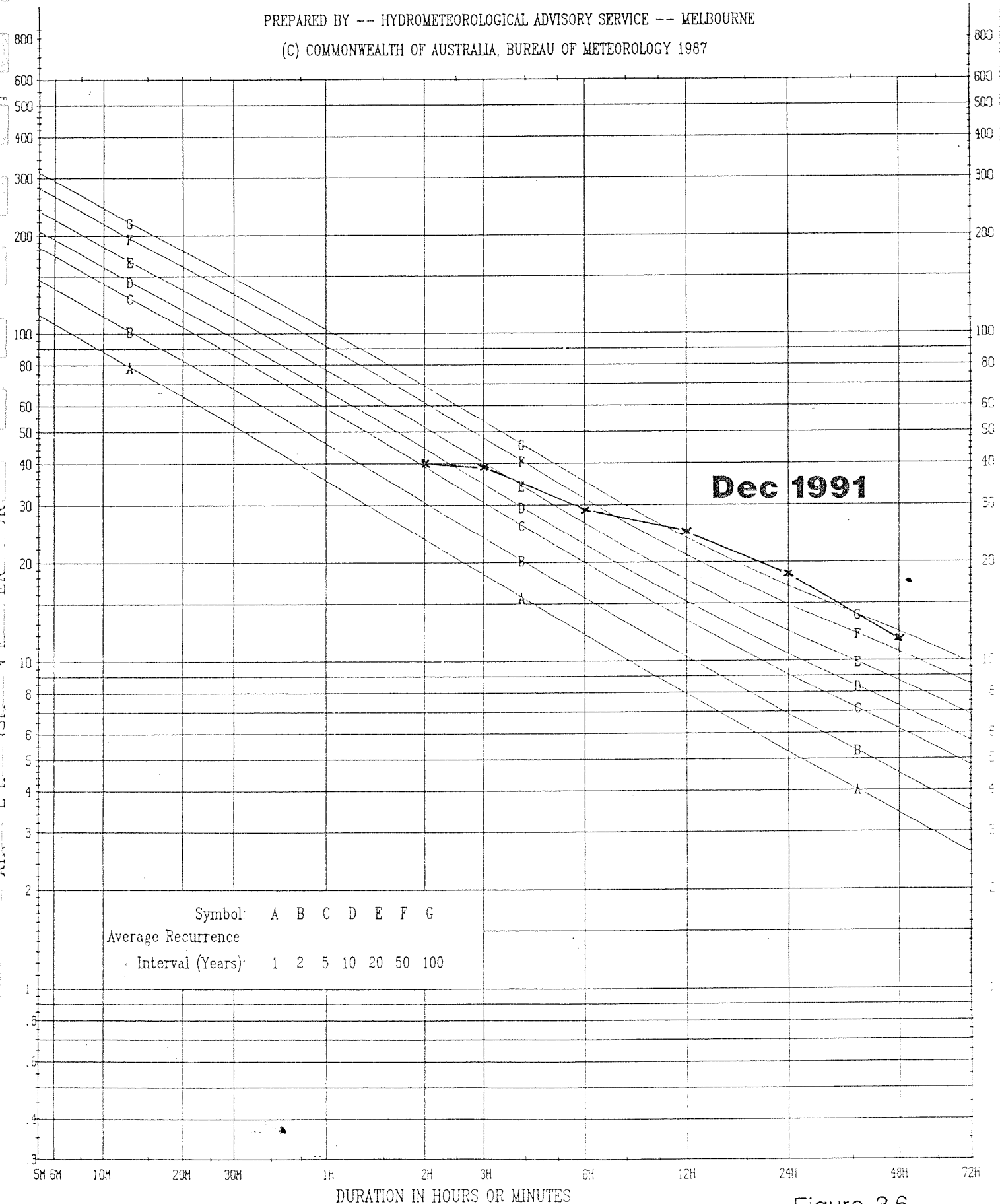
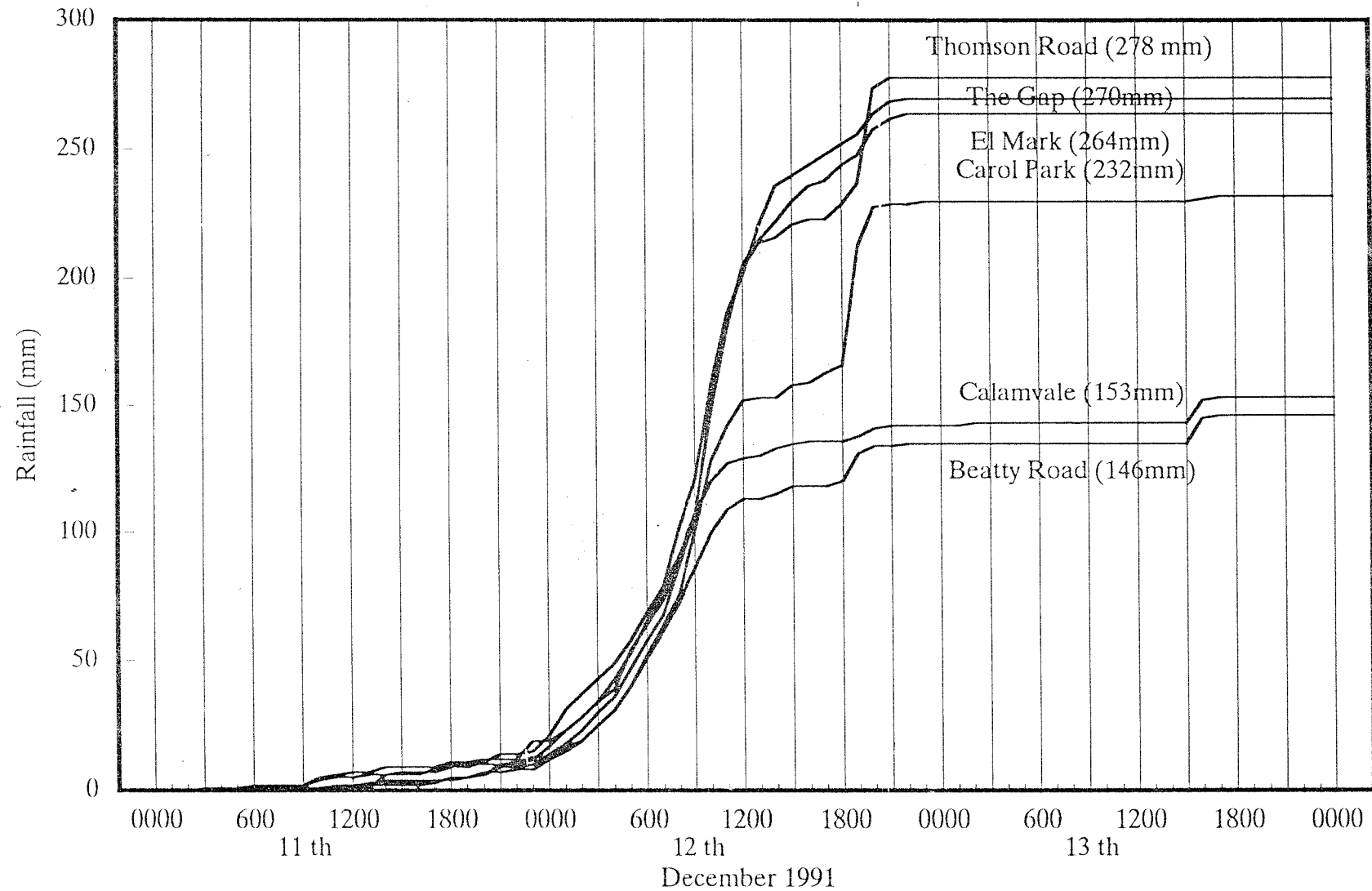


Figure 3.6

# Oxley Creek

Rainfall Mass Curves

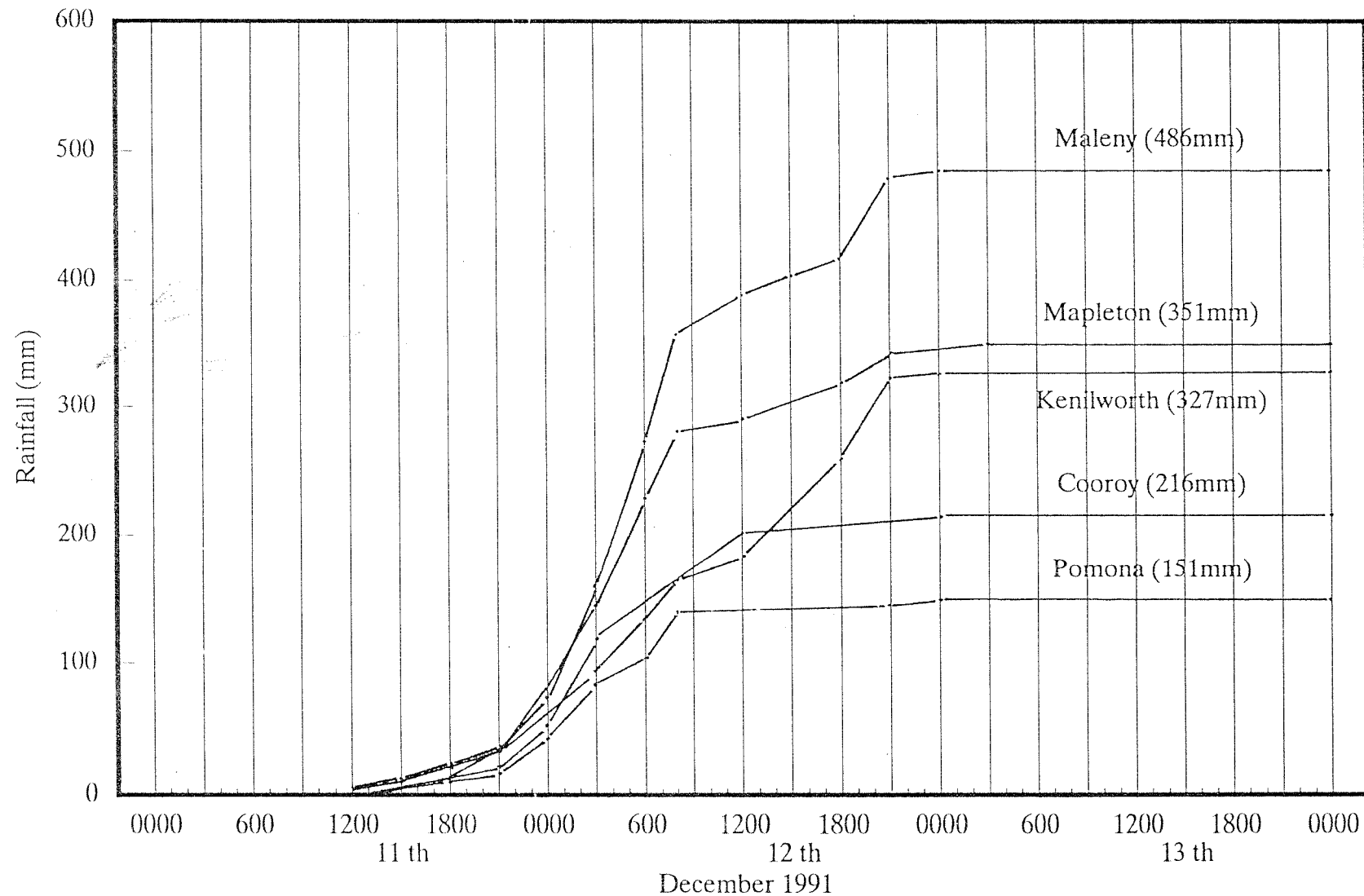


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Figure 3.7

# Mary River

## Rainfall Mass Curves

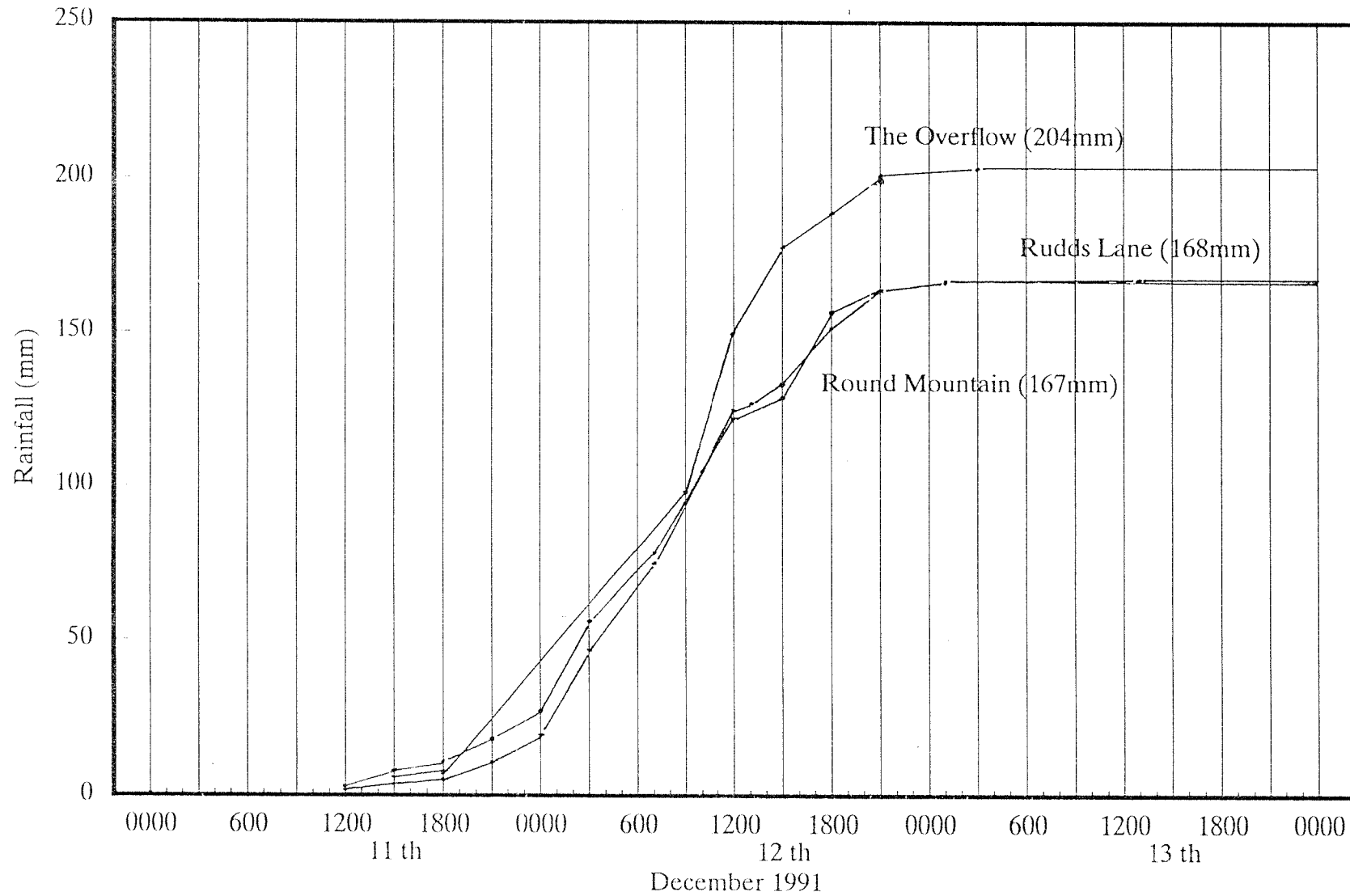


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Figure 3.8

# Logan River

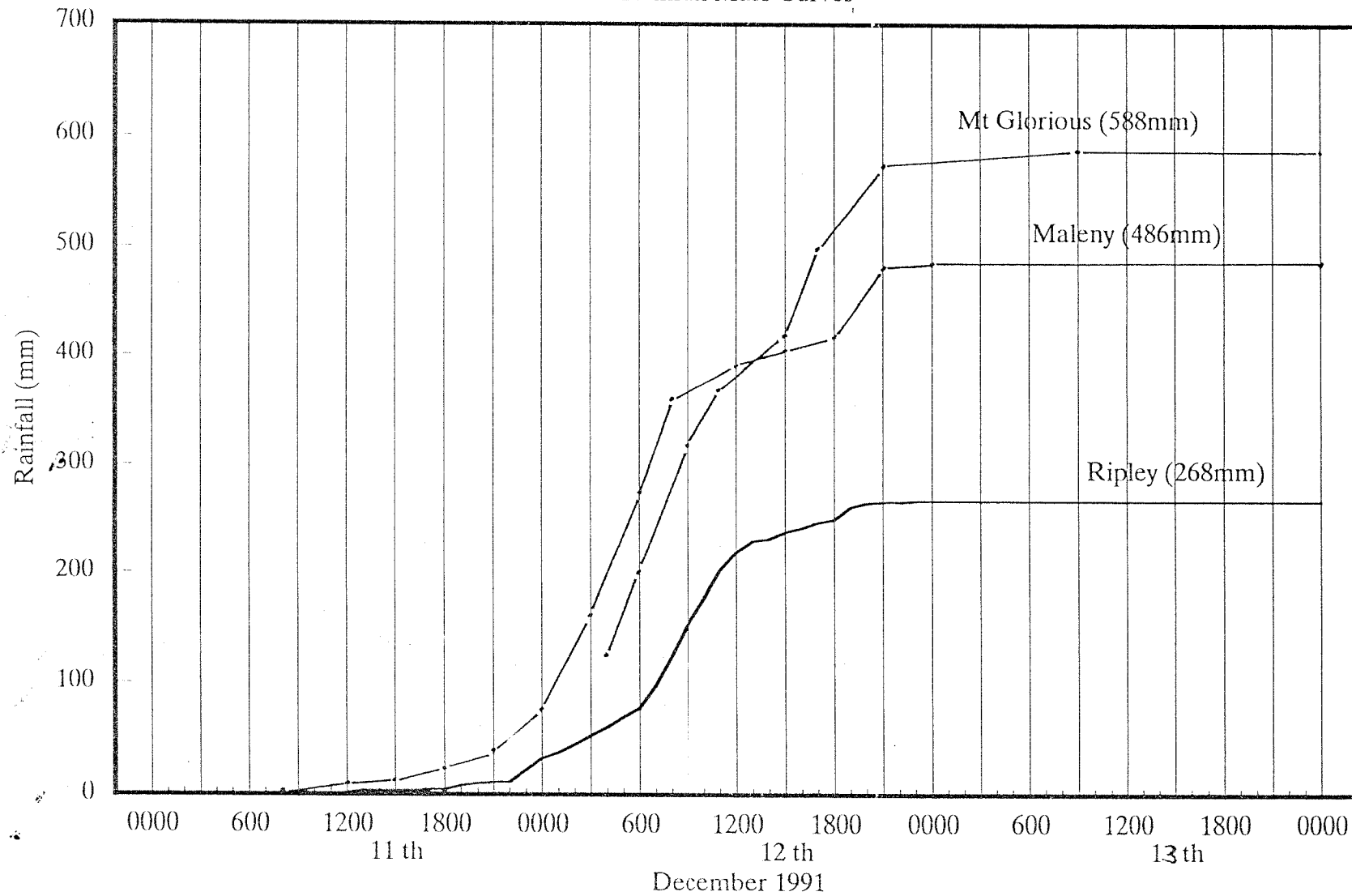
## Rainfall Mass Curves



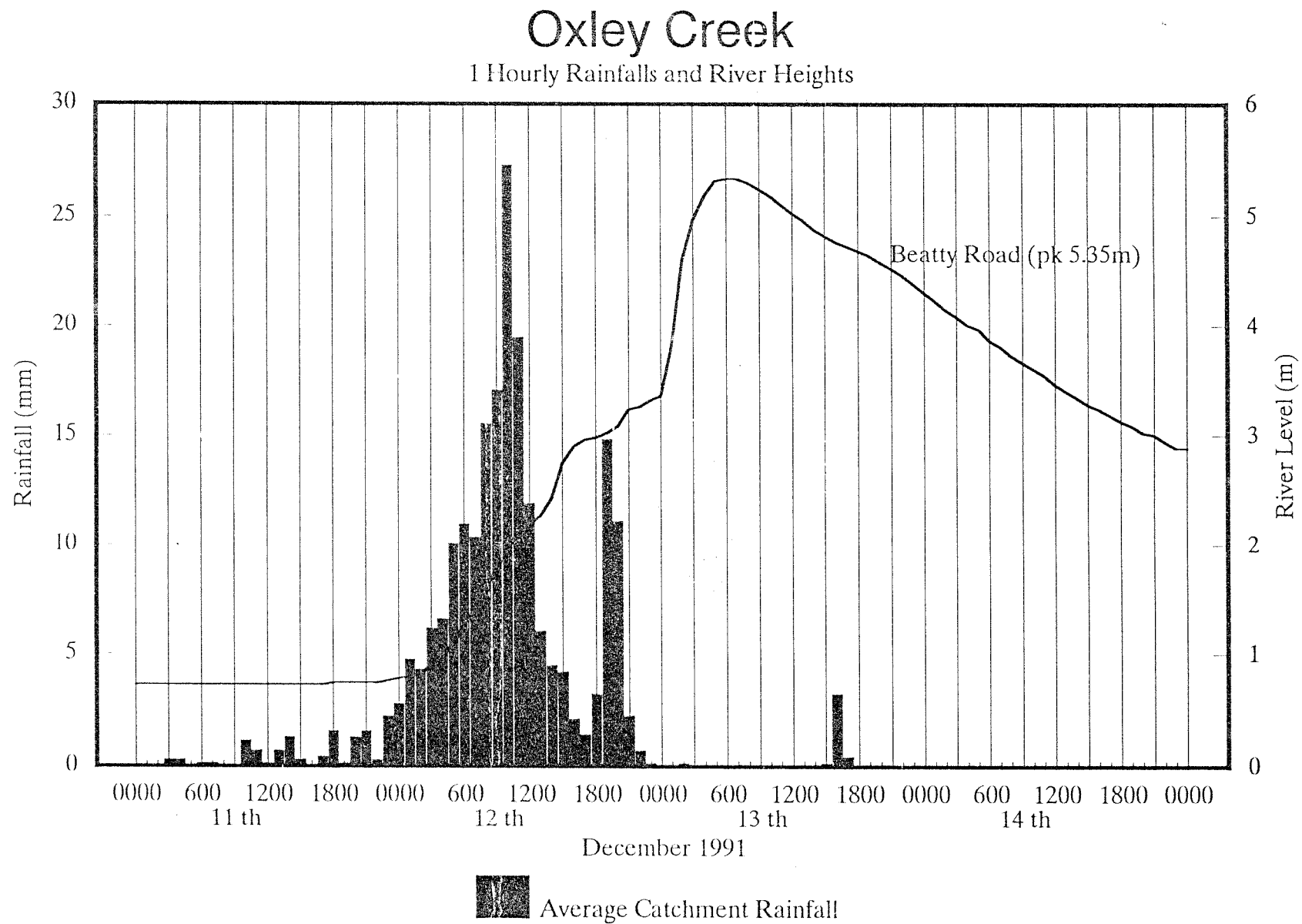
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# Ripley, Maleny, and Mt Glorious

Rainfall Mass Curves



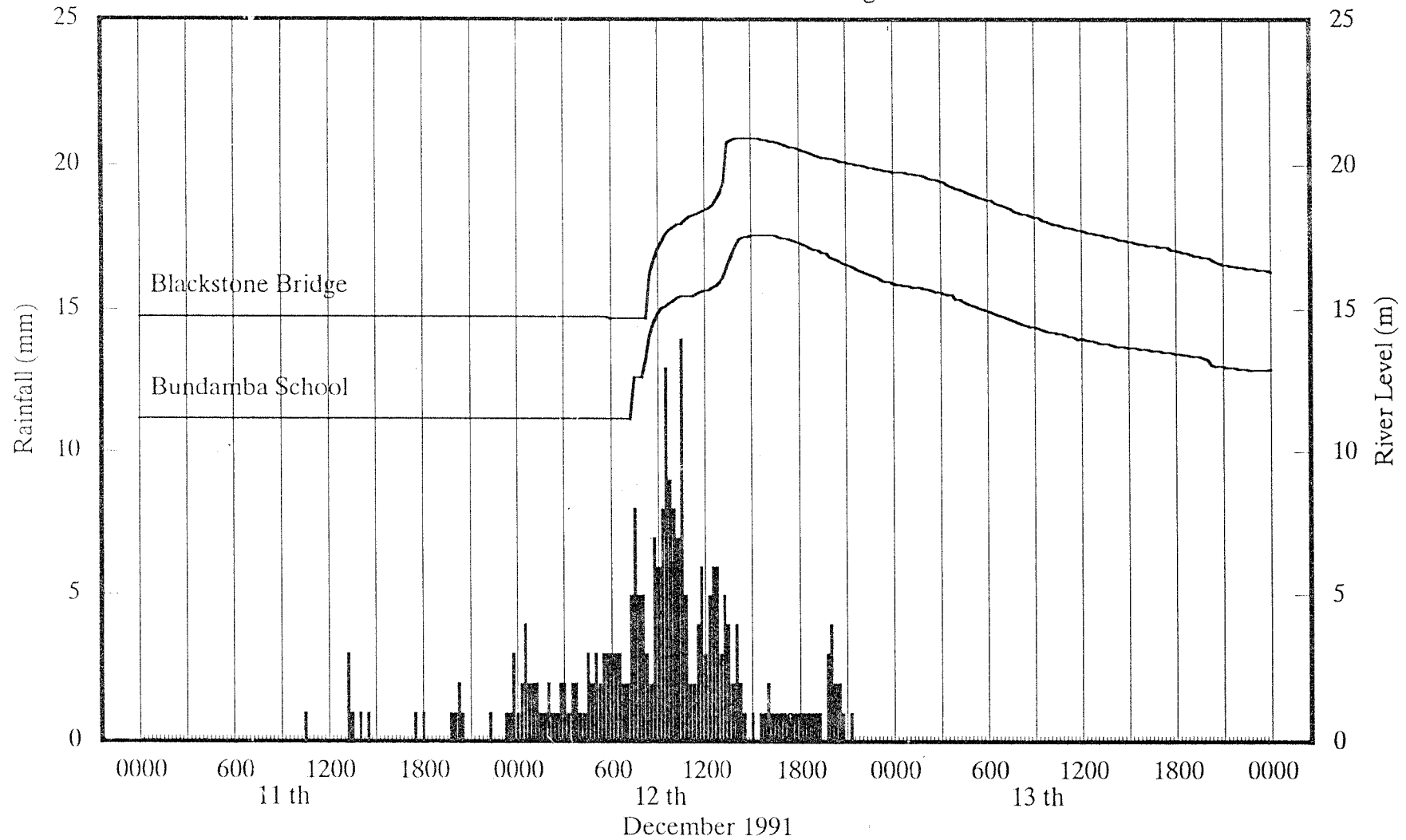
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# Bundamba Creek

15 Minute Rainfall and River Heights



 The Oxley Gap – Rainfall

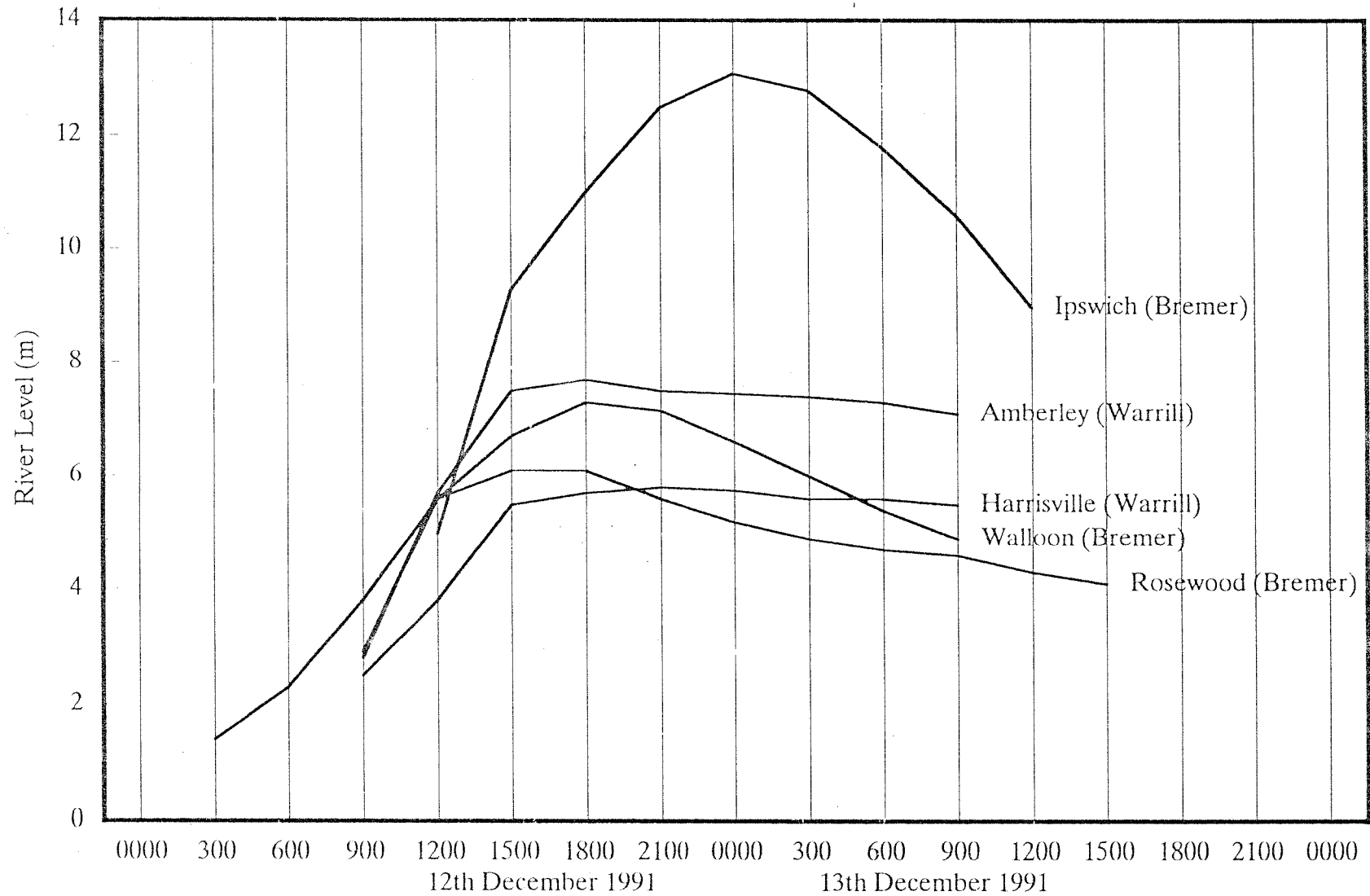
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Figure 4.2



# Bremer River and Warrill Creek

River Levels



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Figure 4.3