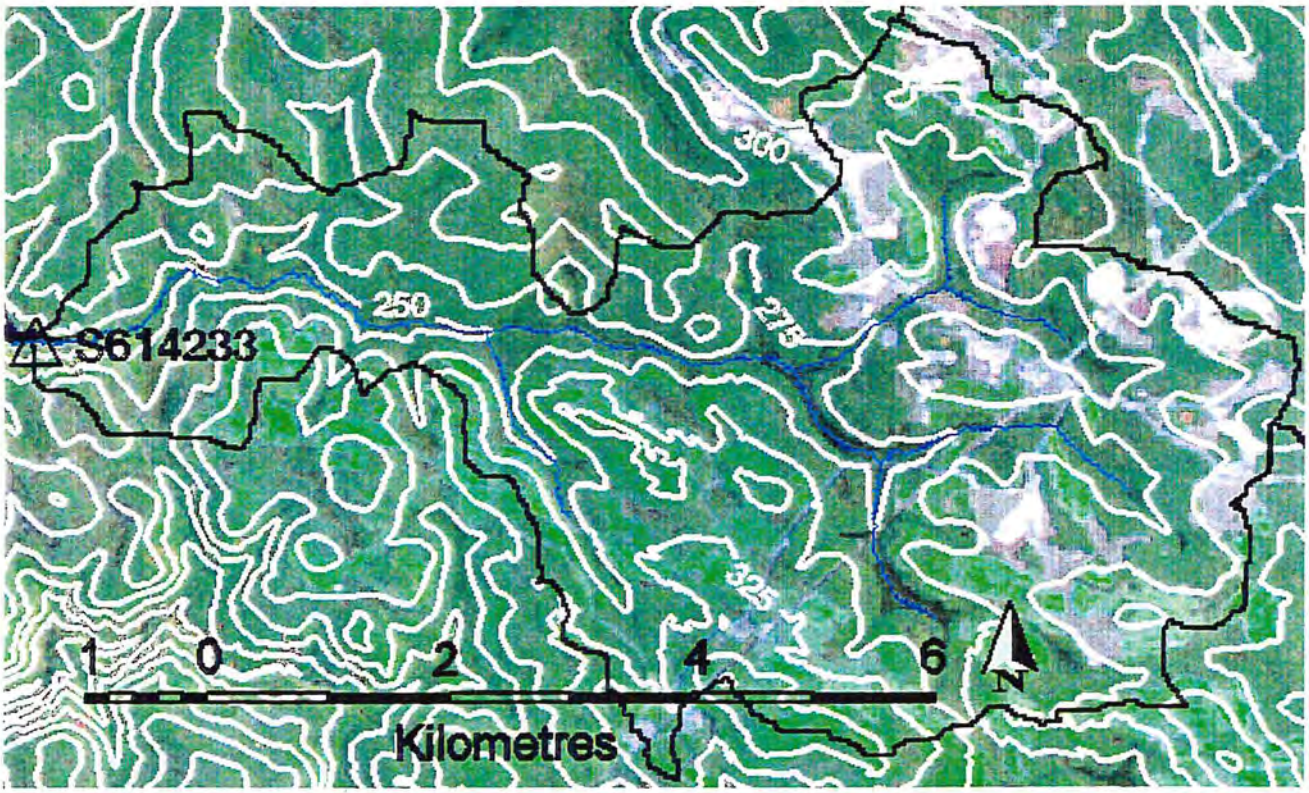
GOVERNMENT OF WESTERN AUSTRALIA

REVIEW OF THE EXPERIMENTAL CATCHMENTS IN THE JOINT INTERMEDIATE RAINFALL ZONE RESEARCH PROGRAMME



WATER RESOURCE TECHNICAL SERIES

WATER AND RIVERS COMMISSION REPORT WRT 13

1999

WATER AND RIVERS COMMISSION

WATER AND RIVERS COMMISSION
HYATT CENTRE
3 PLAIN STREET
EAST PERTH
WESTERN AUSTRALIA 6004

TELEPHONE (08) 9278 0300
FACSIMILE (08) 9278 0301
WEBSITE: http://www.wrc.wa.gov.au

Cover Photograph: Map of Conjurunup Catchment.

REVIEW
OF THE EXPERIMENTAL CATCHMENTS IN THE JOINT INTERMEDIATE RAINFALL ZONE RESEARCH PROGRAMME

Water and Rivers Commission
Resource Investigation Division
Catchment and Salinity Investigation Section

WATER AND RIVERS COMMISSION
WATER RESOURCE TECHNICAL SERIES
REPORT NO WRT 13
1999

Acknowledgments

This report was prepared by Lidia Boniecka, Resource Investigation Division, Catchment and Salinity Investigations Section.

Technical advice was supplied by:
James Croton (Water and Environmental Consultants)
Ian Freeman (CALM)
Joe Kinal (CALM)
Geoff Mauger (WRC)
Ken McIntosh (Alcoa of Australia Ltd.)

Catchment boundary maps on Landsat Scene January 1996 (with computer generated streamlines and catchment boundaries defined by M.A.G.I.C. modelling process) were prepared by: Paraat Punyindu.

For more information contact:

Lidia Boniecka
Resource Investigations Division
Salinity Investigations Section
Hyatt Centre
3 Plain Street
East Perth WA 6004
Telephone (08) 9278 0467
Facsimile (08) 9278 0586

Reference Details

The recommended reference for this publication is: Water and Rivers Commission 1999, *Review of the Experimental Catchments in the Joint Intermediate Rainfall Zone Research Programme,* Water and Rivers Commission, Water Resource Technical Series No WRT 13.

ISBN 0-7309-7331-X
ISSN 1327-8436

Printed on recycled stock
May, 1999

Contents

Summary

A number of experimental catchments have been operated in the Northern Jarrah Forest since 1972. Many were set up as part of the research into the impacts of bauxite mining on water resources. Others were to assess the effects of forest management.

Some of these catchments have been used as controls while others have been subject to treatment techniques such as logging, thinning or bauxite mining. The rainfall, streamflow and conductivity data from 36 of these catchments has been summarised in this report to assist the current research programme, the Joint Intermediate Rainfall Zone Research Programme, conducted jointly by Alcoa and Water and Rivers Commission.

A bibliography of previous reports reviewing data from those catchments has also been collected.

The data is presented in two sections: individual catchments and comparison. The individual catchment section presents information for each catchment separately. The comparison section shows comparison between selected catchments.

Data about individual catchments is organised in three sets: general information, annual data analysis and graphs with daily data.

Comparisons between selected catchments include general information and graphs with annual data analysis.

Data provided by the Water and Rivers Commission and used in this report was recorded on CD-ROM. A separate directory was created for each catchment. Each directory contains Access database, Excel spreadsheet, GIS information and data in ASCII form.

1. Introduction

1.1 Background

Bauxite mining has been a major land use within the northern jarrah forest of south-west Western Australia since 1963. The main bauxite area covers 50-60% of the northern jarrah forest and it includes most of the developed metropolitan water supply catchments for Perth, the irrigation supply catchments in the Harvey River Basin, and the northern part of the Collie River Basin (Jim Davis & Associates Pty Ltd, 1995). Currently the majority of mining operations take place within the High Rainfall Zone (HRZ) with annual rainfall greater than 1100 mm. However, approximately 30-40% of bauxite deposits is located in Intermediate Rainfall Zone (IRZ) areas with annual rainfall of 900 to 1100 mm.

Protection of drinking water source areas has high importance. To quantify the possible impact of bauxite mining and rehabilitation on streamflow and salinity, a Joint Intermediate Rainfall Zone Research programme (JIRZRP) was established (Mauger *et al.*, 1998). As a part of this research programme a number of experimental catchments was set up to investigate and monitor the possible impacts of mining and rehabilitation on water resources.

Some of these catchments have been used as controls while others have been subject to treatment techniques such as logging, thinning or bauxite mining.

The data from 36 experimental catchments is supplied in this report. Data includes daily records of rainfall, streamflow and stream salinity (TSS) and their annual analysis.

1.2 Study objectives

The objective of the report is to provide information on collected data of rainfall, streamflow and stream salinity (TSS) for 36 selected experimental catchments located in Darling Range of Western Australia. Presented data collection will enable researches to understand the characteristics of each catchment and to compare catchments on the basis of their characteristics.

2. Description of the study area

Experimental catchments selected for the study are in the western region of the central Darling Range (see **Figure 1**).

2.1 Site description

The climate of the Darling Range is Mediterranean characterised by dry hot summers and wet cool winters. Annual rainfall in the northern jarrah forest ranges from 1400 mm along the western edge to 700 mm at the eastern edge.

The bedrock geology of the area is generally granitic with a number of intruding dykes. The surface soils are typically gravelly sands, overlying a lateritic duricrust layer (caprock). The caprock, 2 m thick, is extensive and perforated by large holes infilled with coarse gravels and sands. Sandy or silty materials underlay the caprock. The bauxite deposits occur as pods within hillslope units, typically on the mid to upper slopes.

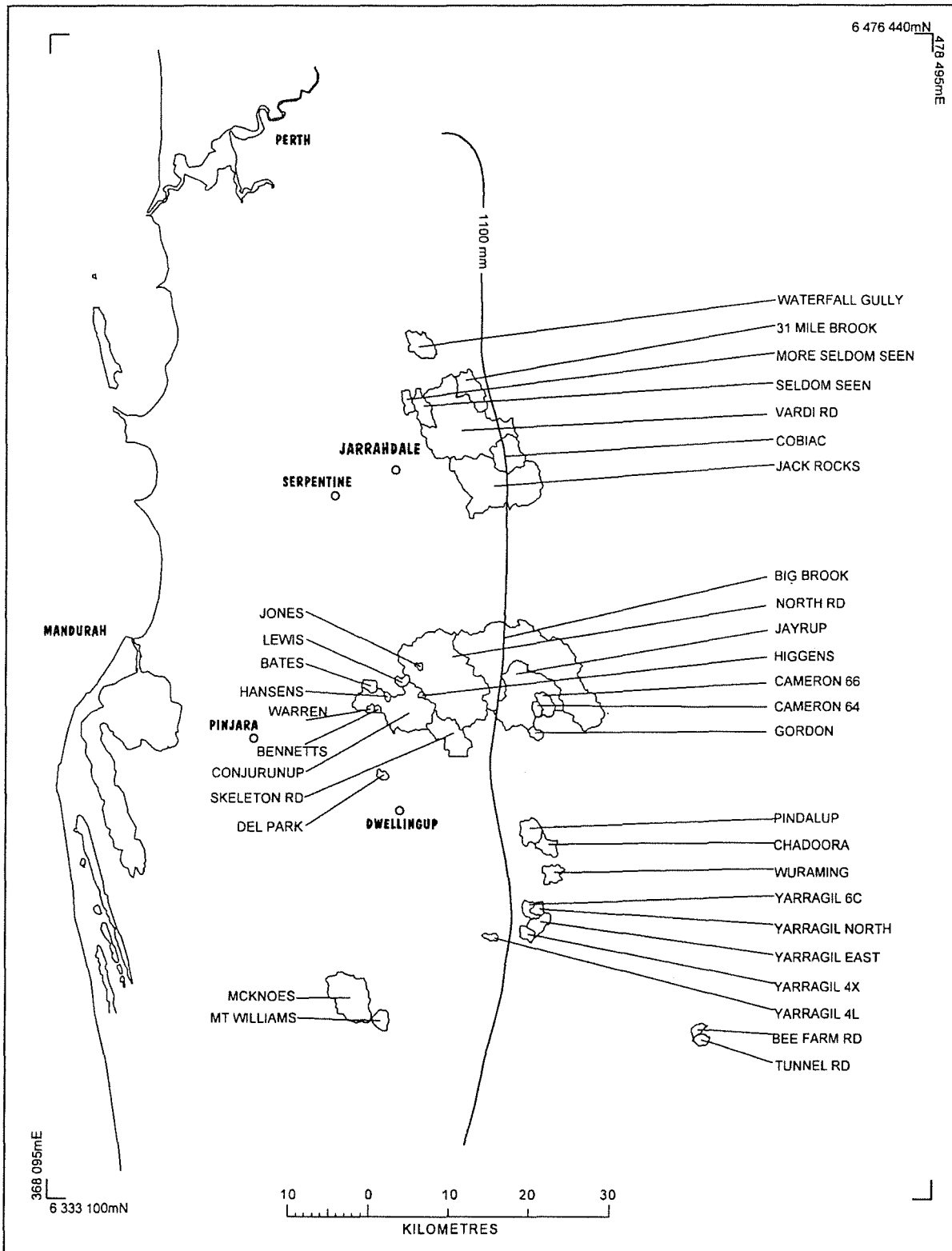
Jarrah (*E. marginata*) and marri (*E.calophylla*) dominate the forest of the Darling Range (Mauger *et al.*, 1998). The understorey vegetation of this forest includes sub-dominant trees and shrubs (*Banksia, Allocasuarina* and *Persoonia* species). The area has been affected by dieback (*Phytophthora cinnamomi*) causing the deaths of trees and shrubs (Jim Davis & Associates Pty Ltd, 1995).

2.2 Land use

Bauxite mining is a major land use within the study area (Mauger *et al.*, 1998). Mining operations are predominantly located within the high rainfall zone (HRZ) with annual rainfall greater than 1100 mm. Approximately 30-40% of bauxite deposits is located in the eastern part of jarrah forest in the intermediate rainfall zone (IRZ) which receives 1100-900 mm of rainfall annually (Mauger *et al.*, 1998).

The area is also used for silviculture, water and timber production and, conservation and recreation.

The northern jarrah forest of the Darling Range has been logged for approximately 100 years with different intensity depending on the location and forest quality. The area has also been subject to controlled burning to minimise the risk of wide-spread bush fire (Mauger *et al.*, 1998).



WATER AND RIVERS COMMISSION

Figure 1: Experimental Catchment Location.

3. Methods

3.1 General information

The report presents existing data on rainfall, streamflow and stream salinity for 36 experimental catchments located in Darling Range of Western Australia in relation to land use practices. Following is the list of these catchments:

High Rainfall Zone (HRZ) – Annual rainfall greater than 1100 mm:

1. McKnoes S 613018
2. Mt William S 613020
3. Del Park S 614007
4. Warren S 614017
5. Bennetts S 614018
6. Hannsens S 614019
7. Higgens S 614020
8. Lewis S 614021
9. Jones S 614024
10. Jack Rocks S 614031
11. North Road S 614036
12. O'neil Road S 614037
13. Yarragil 4L S 614057
14. Skeleton Road S 614059
15. Bates S 614062
16. Conjurunup S 614233
17. Seldom Seen S 616021
18. More Seldom Seen S 616022
19. Waterfall Gully S 616023
20. 31 Mile Road S 616026
21. Vardi Road S 616041
22. Cobiac S 616058

Intermediate Rainfall Zone (IRZ) – Annual rainfall between 900 – 1100 mm:

23. Wuraming S 614041
24. Pindalup S 614043
25. Chadoora S 614045
26. Yarragil North S 614046
27. Yarragil 4X S 614048
28. Yarragil 6C S614049
29. Yarragil East S 614050
30. Wuraming S 614056
31. Gordon S 614060
32. Cameron West S 614064
33. Cameron Central S 614066
34. Jayrup S 614093

Low Rainfall Zone (LRZ) – Annual rainfall less than 900 mm:

34. Tunnel Road S 614011
35. Bee Farm Road S 614012

Table 1 contains classification of the analysed catchments according to Water and Rivers Commission *Catalogue of Water Resources Information 1996.* All catchments are listed in gauging station numerical order.

Available historical information related to these experimental catchments was gathered and included in data analysis.

Copy of relevant digital data available from the Water and Rivers Commission database was obtained. This data included rainfall, streamflow and stream salinity (TSS).

3.1.1 Rainfall

For majority of catchments rainfall data was collected at existing rainfall gauges. The Water and Rivers Commission database provided daily total rainfall recorded in millimetres at 09.00 hrs.

A number of catchments do not have rainfall stations. In these cases, rainfall data from adjacent rainfall stations was used.

Following is the list of catchments for which rainfall data was adopted from adjacent catchments:

Catchment without rainfall gauge	Adjacent catchment
North Road S 614036	Jones M 509350
Wuraming S 614041	Yarragil North M 509433
Pindalup S 614043	Chadoora M 509235
Yarragil 6C S 614049	Yarragil North M 509433
Yarragil East S 614050	Yarragil North M 509433
Wuraming S 614056	Yarragil North M 509433
31 Mile Brook S 616026	Cobiac M 509576
Vardi Road S 616041	Cobiac M 509576
Skeleton Road S 614059	Hansens M 509347

3.1.2 Streamflow

The Water and Rivers Commission provided data on daily total flow recorded in cubic metres at 09.00 hrs for each catchment.

3.1.3 Stream salinity

Data of daily total soluble salts (TSS) measured in mg/L from Water and Rivers Commission's database was used to present the stream salinity trends. There are listed below catchments for which this data is available:

1. Tunnel Road S 614011
2. Lewis S 614021
3. Wuraming S 614041
4. Pindalup S 614043
5. Chadoora S 614045
6. Yarragil 4X S 614048
7. Gordon S 614060
8. Cameron West S 614064
9. Cameron Central S 614066
10. Jayrup S 6140093
11. Cobiac S 616058

3.1.4 Quality of data

Water and Rivers Commission classifies the quality of data stored in its database, according to the following quality codes:

Quality Code	Description
0	Quality not recorded
1	Good quality
2	Faulty, very confident in corrected record
3	Faulty, some doubt in corrected record
4	Estimated record
5	Derived from incomplete record
8	Record not available
156	Below inlet, stage below lowest recordable level
157	Not recorded
255	Not available

3.2 Structure of the report

The report is divided into two parts. Part 1 presents information about individual catchments. Part 2 shows comparison between selected catchments.

3.2.1 Individual catchments

Data about individual catchments is organised in three sets: general information, annual data analysis and graphs with daily data.

3.2.1.1 General information about catchments

Each page providing general information about catchment includes:

- Location map based on 5m Contours overlaid on January 1996 Landsat Scene. A catchment boundary and a computer-generated streamline depicted on the map were determined using the Water and Rivers Commission's MAGIC system (Mauger, 1996b).
- Gauging station number and rainfall gauge number.
- Catchment area, gauging station coordinates (northing and easting), and basic information about treatment practices within catchment.
- Information about records, eg: number of days and years recorded, number of years with complete records, date of the first and the last sample and number of days with each quality code, the number of flow days defined as the number of days with streamflow greater than zero.

- Annual Basic Statistics: average, minimum and maximum rainfall, streamflow and TSS.

3.2.1.2 Annual data analysis

Annual Data Analysis set contains a series of charts:

- Annual Rainfall and Flow versus time;
- Annual Flow Weighted TSS and Flow (where applicable) versus time;
- Annual Cumulative versus Residual Rainfall;
- Annual Cumulative versus Residual Flow;
- Annual Cumulative Flow versus Cumulative Rainfall;
- Annual Residual Flow versus Residual Rainfall;
- Flow Ratio of Summer to Winter;
- Flow Weighted TSS Ratio of Summer to Winter (where applicable);
- Annual Cumulative Salt Load (where applicable).

A residual rainfall (flow) curve represents a plot of the cumulative deviation from the mean. A positive slope of the curve indicates periods of data greater than the mean; a negative slope shows periods of data less than the mean.

To calculate the flow ratio of summer to winter sums of flow occurring in summer months and winter months for each year were prepared. Months of each year of existing records were divided into two groups: summer months (November, December, January, February, March, and April), and winter months (May, June, July, August, September, October). For example summer 1995 includes November and December 1994 and January, February, March and April 1995.

Flow weighted TSS ratio of summer to winter was calculated as a proportion of flow weighted TSS for summer months and flow weighted TSS for winter months for each year of existing records.

3.2.1.3 Daily data

Daily data of rainfall, streamflow and salinity is presented on charts for each year separately: daily rainfall and flow, and daily flow and TSS.

3.2.2 Comparison between catchments

A number of catchments were selected for comparison. These catchments are listed below:

1. a) Yarragil 4X versus Yarragil 4L
   b) Yarragil 4X versus Yarragil North
2. a) Gordon versus Cameron West
   b) Gordon versus Cameron Central
   c) Cameron Central versus Cameron West
3. a) Lewis versus Bates
   b) Lewis versus Warren
   c) Lewis versus Bennetts
4. a) Waterfall Gully versus Seldom Seen
   b) Waterfall Gully versus More Seldom Seen
5. North Road versus Vardi Road.

Comparisons between selected catchments include a page with general information, and graphs with annual data analysis.

3.2.2.1 General information

A page with general information in the comparison section of the report includes:

- Gauging station and rainfall gauge numbers of compared catchments
- Catchment areas and basic treatment data
- Annual basic statistics including annual average rainfall, flow and flow weighted TSS.
- Annual data of rainfall flow and flow weighted TSS for each year of records.

3.2.2.2 Annual data analysis

Annual data analysis set includes

- Annual Rainfall
- Annual Flow
- Flow Ratio of Summer to Winter
- Annual Cumulative Rainfall
- Annual Cumulative Flow
- Annual Cumulative Residual Rainfall
- Annual Cumulative Residual Flow

3.2.3 CD-ROM

Data provided by the Water and Rivers Commission and used in this report was recorded on CD-ROM.

A separate directory was created for each catchment and it contains Access database, Excel spreadsheet, GIS information and data in ASCII form (CSV data). The explanation of the CD structure is included in **Table 2**.

Table 1. List of Catchments (Water and Rivers Commission *Catalogue of Water Resources Information 1995, Volume 1: The South West Drainage Division*). Site names used in this report are in bold.

Basin 613: Harvey River Basin		
Location Name	**Site Name**	**Gauging Station Number**
McKnoes Brook	Urquharts	S 613018
Samson Brook	**Mt William**	S 613020

Basin 614: Murray River Basin		
Location Name	**Site Name**	**Gauging Station Number**
South Dandalup Tributary	**Del Park**	S 614007
Mooradung Brook Tributary	**Tunnel Road**	S 614011
Mooradung Brook Tributary	**Bee Farm Road**	S 614012
Little Dandalup	**Warren Catchment**	S 614017
Little Dandalup	**Bennetts Catchment**	S 614018
Little Dandalup	**Hansens Catchment**	S 614019
Little Dandalup	**Higgens Catchment**	S 614020
North Dandalup Tributary	**Lewis Catchment**	S 614021
North Dandalup Tributary	**Jones Catchment**	S 614024
Thirty Nine Mile Brook	**Jack Rocks**	S 614031
North Dandalup River	**North Road**	S 614036
Big Brook	**O'neil Road (Big Brook)**	S 614037
Wuraming	Yarragil Tributary	S 614041
South Dandalup River Tributary	**Pindalup**	S 614043
Swamp Oak Brook Tributary	**Chadoora**	S 614045
Yarragil Brook Tributary	**Yarragil North**	S 614046
Yarragil Brook Tributary	**Yarragil 4X**	S 614048
Yarragil Brook Tributary	**Yarragil 6C**	S 614049
Yarragil Brook Tributary	**Yarragil East**	S 614050
Yarragil Brook Tributary	9a Sub Catchment (**Wuraming 9A**)	S 614056
Yarragil Brook Tributary	4L Sub Catchment (**Yarragil 4L**)	S 614057
South Dandalup	**Skeleton Road**	S 614059
South Dandalup River Tributary	**Gordon Catchment**	S 614060
Little Dandalup	**Bates Catchment**	S 614062
Big Brook Tributary	**Cameron West**	S 614064
Big Brook Tributary	**Cameron Central**	S 614066
	Jayrup	S 614093
Conjurunup Creek	Lower Dandalup-Scarp Road	S 614233

Basin 616: Swan Coastal Basin		
Location Name	**Site Name**	**Gauging Station Number**
Seldom Seen Creek	Travellers Arms	S 616021
More Seldom Seen Creek	Ceriani Farm	S 616022
Waterfall Gully	Mount Curtis	S 616023
31 Mile Brook	**31 Mile Road**	S 616026
Wungong Brook	**Vardi Road**	S 616041
Wungong Brook	**Cobiac**	S 616058

Table 2. CD-ROM Contents

ACCESS DATABASE			
Data	**File Contents**	**Example: Query Name**	**Example: Table Name**
Daily Data			
Rainfall	Daily rainfall data with quality codes	*Data imported from .cvs file*	Cameron64_509569M
	Count of daily rainfall records with certain quality codes	Cameron64_509569M_Sum_Query	Cameron64_Rainfall_SumQual
Flow	Daily flow data with quality codes	*Data imported from .cvs file*	Cameron64_614064F
	Count of daily flow records with certain quality codes	Cameron64_614064F_Sum_Query	Cameron64_Flow_SumQual
	Daily records with flow greater than 0	Cameron64_Flow>0_Query	Cam64_Flow>0
TSS	Daily TSS data with quality codes	*Data imported from .cvs file*	Cameron64_614064T
	Count of daily TSS records with certain quality codes	Cameron64_614064T_Sum_Query	Cameron64_TSS_SumQual
Flow and Rainfall	Daily flow and rainfall data includes only those records where dates are the same	Cameron64_Flow&Rainfall_Query	Cameron64_Flow&Rainfall
Flow and TSS	Daily flow and TSS data includes only those records where dates are the same	Cameron64_Flow&TSS_Query	Cameron64_Flow&TSS
Salt Load	Daily salt load records	Cameron64_Load_Query	Cam64_Load
Monthly Data			
Flow	Sum of monthly flow	Cameron64_Flow_Monthly_Query	Cameron64_Flow_Monthly
Salt Load	Sum of monthly salt load	Cameron64_Load_Monthly_Query	Cameron64_Load_Monthly
Flow and Rainfall	Sum of monthly flow and rainfall	Cameron64_Flow&Rainfall_Monthly _Query	Cameron64_Flow&Rainfall_Monthly
Annual Data			
Rainfall	Sum of annual rainfall with count of records, and minimum and maximum of quality codes	Cameron64_Rainfall_Yearly_Query	Cameron64_Rainfall_Yearly
	Annual basic statistics: average, minimum and maximum of rainfall for the existing records	Cameron64_AnStat_Rain_Query	Cameron64_AnStat_Rain
Flow	Sum of annual flow with count of records, and minimum and maximum of quality codes	Cameron64_Flow_Yearly_Query	Cameron64_Flow_Yearly
	Count of flow greater than 0 for each year	Cameron64_Count_Flow>0_Query	Cameron64_Count_Flow>0
	Annual basic statistics: average, minimum and maximum of flow for the existing records	Cameron64_AnStat_Flow_Query	Cameron64_AnStat_Flow
TSS	Sum of annual salt load	Cameron64_Load_Yearly_Query	Cameron64_Load_Yearly
	Annual Flow Weighted TSS	Cameron64_AnWTSS_Query	Cam64_AnWTSS
	Annual basic statistics: minimum and maximum of flow weighted TSS for the existing records, total flow and total salt load	Cameron64_AnStatTSS_Query	Cameron64_AnStat_TSS

Table 2. CD-ROM Contents (Contd)

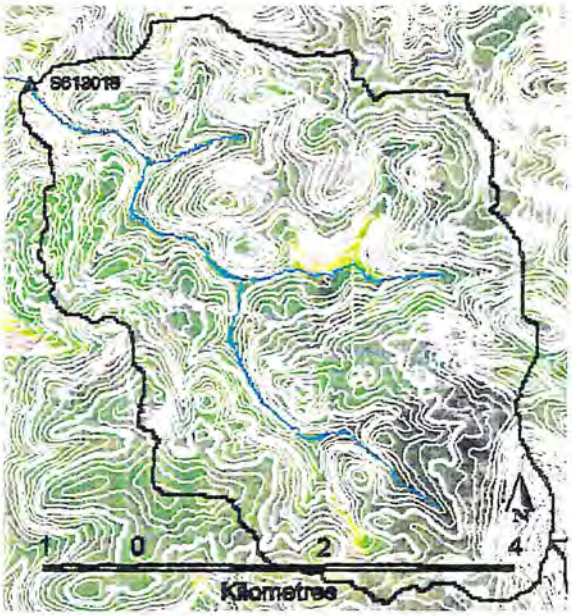
EXCEL		
Excel File Name	**Worksheet Name**	**Worksheet Contents**
Cameron64_gen.xls - Excel workbook containing general information about catchment, and charts with daily and annual data.	Final	General information about catchment and data records, and charts with daily and annual data.
	Simple	Annual data of rainfall, flow and flow weighted TSS.
	CumYear	Annual data and calculations of cumulative and residual rainfall, and cumulative and residual flow.
	FlowRatio	Data and calculations of flow ratio of summer to winter.
	TSSRatio	Data and calculations of flow weighted TSS ratio of summer to winter.
	Load	Data and calculations of annual flow weighted TSS and annual cumulative salt load.
	Flow&Rain	Daily data of rainfall and flow grouped annually.
	Flow&TSS	Daily data of flow and TSS grouped annually.
Cameron64&Cameron66.xls – comparison between Cameron West catchment and Cameron Central catchment.	Final	General information about catchments, annual basic statistics, and comparison charts with annual data.
	Simple	Annual data of rainfall, flow, flow weighted TSS, flow ratio of summer to winter, and flow weighted TSS ratio of summer to winter.
	Cumulative	Annual data of cumulative and residual rainfall, and cumulative and residual flow for Cameron West catchment and Cameron Central catchment.

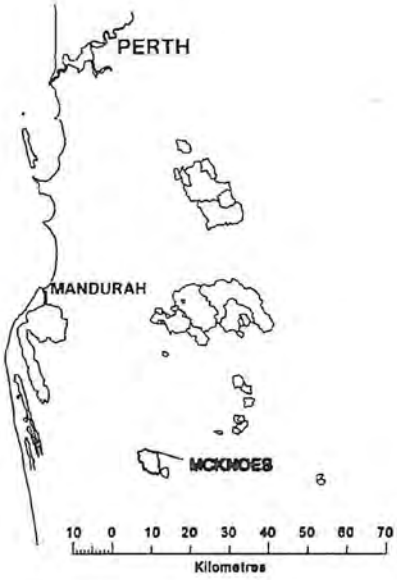
GIS INFORMATION	
File Contents	**File Name**
Landsat Scene January 1996; bands: 3 (blue), 4 (green), 5 (red)	Came64.bmp
Catchment location coordinates and size of bit map	Came64.bas
Catchment location map	locc64.bmp
Catchment boundary map on Landsat Scene January 1996	Rptc64.bmp
AMG coordinates of catchment boundary	Cat.asc

CSV DATA	
File Contents	**File Name**
Daily rainfall data with quality codes	509569.csv
Daily flow data with quality codes	614064.csv
Daily TSS data with quality codes	614064t.csv

4. Individual Catchments

McKnoes Catchment





Legend

Catchment Boundary △ Gauging Station

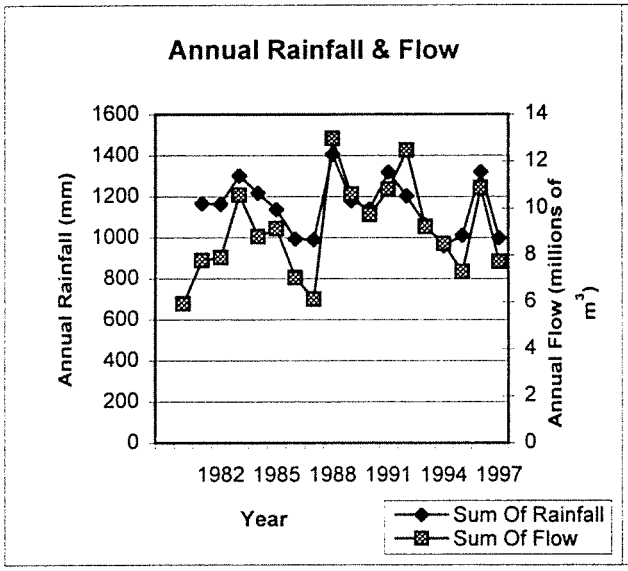
5 m Contours on Landsat Scene Jan 96

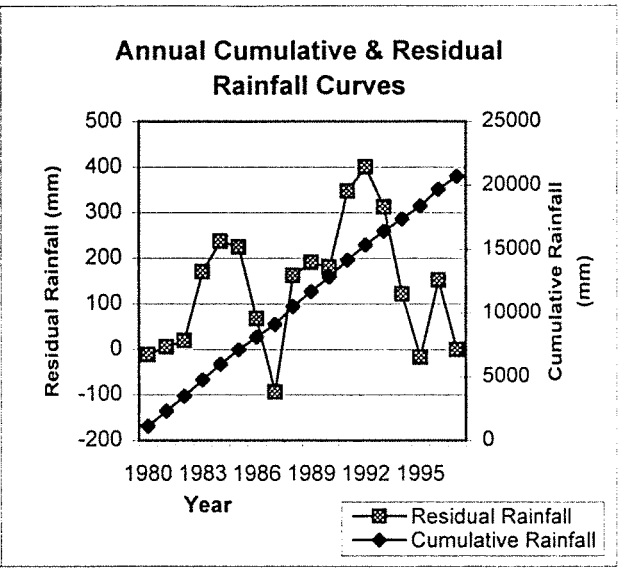
Computer Generated Stream Line

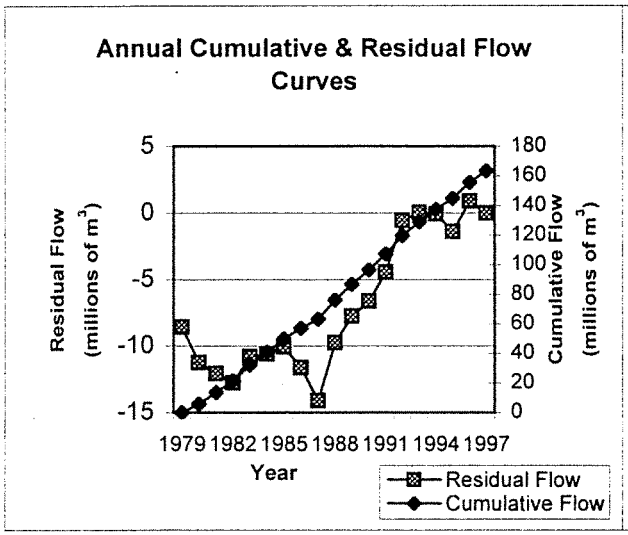
Gauging Station Number	S613018		
Rainfall Gauge Number	M509368		
Information about catchment			
Catchment area	24.1 km^2		
Gauging Station Coordinates (AMG)	N 6359833	E 403068	
Treatment data	Bauxite mining since 1982.		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	6613	6693	0
Number of years recorded	19	20	
Number of years with complete records	17	18	
Start date	17/03/80	28/12/79	
Finish date	24/04/98	24/04/98	
Number of days with quality code 1	6437	6378	
Number of days with quality code 2	4	62	
Number of days with quality code 3	119	190	
Number of days with quality code 4	42	41	
Number of days with quality code 157	2	11	
Number of days with quality code 255	9	11	
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	
Average	1150.5	9.079	
Min	959.5	5.934	
Max	1405.7	12.970	

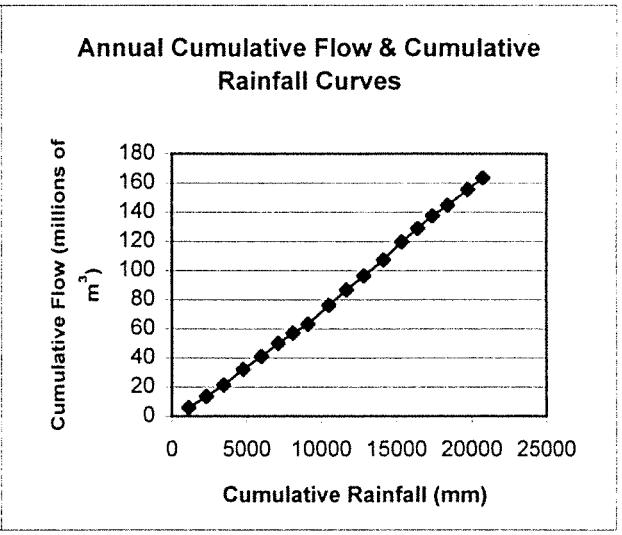
Year	Number of flow days
1980	366
1981	365
1982	354
1983	365
1984	366
1985	365
1986	365
1987	365
1988	366
1989	365
1990	365
1991	365
1992	364
1993	364
1994	362
1995	363
1996	365
1997	365
Total	**6555**

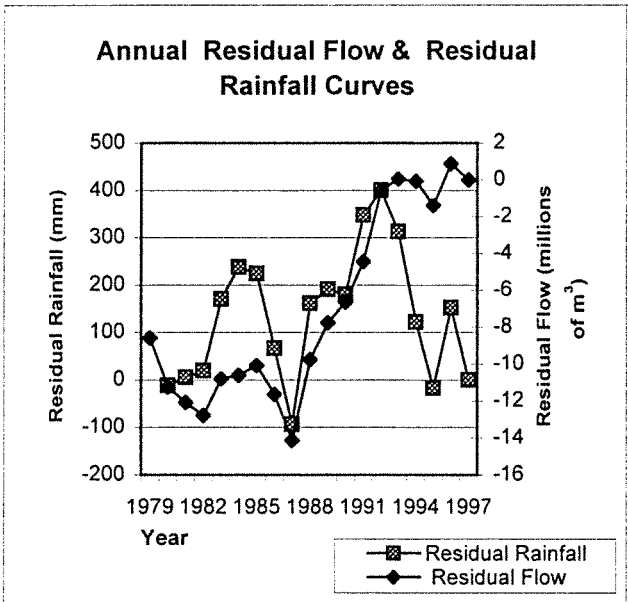
McKnoes Brook Catchment - S 613018

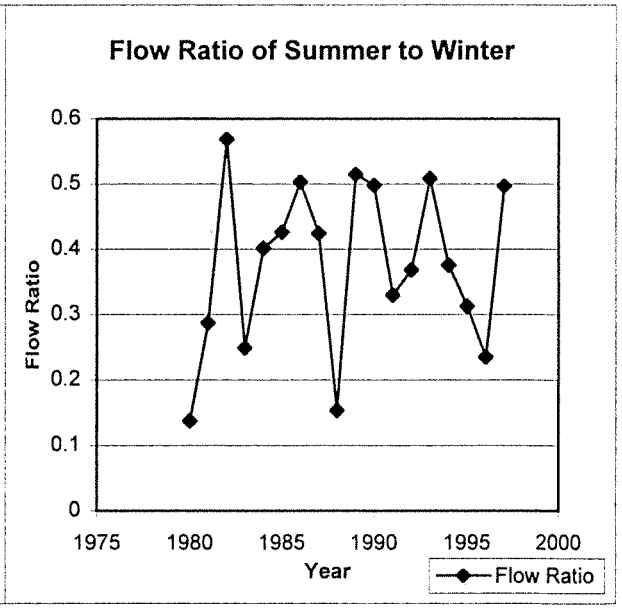




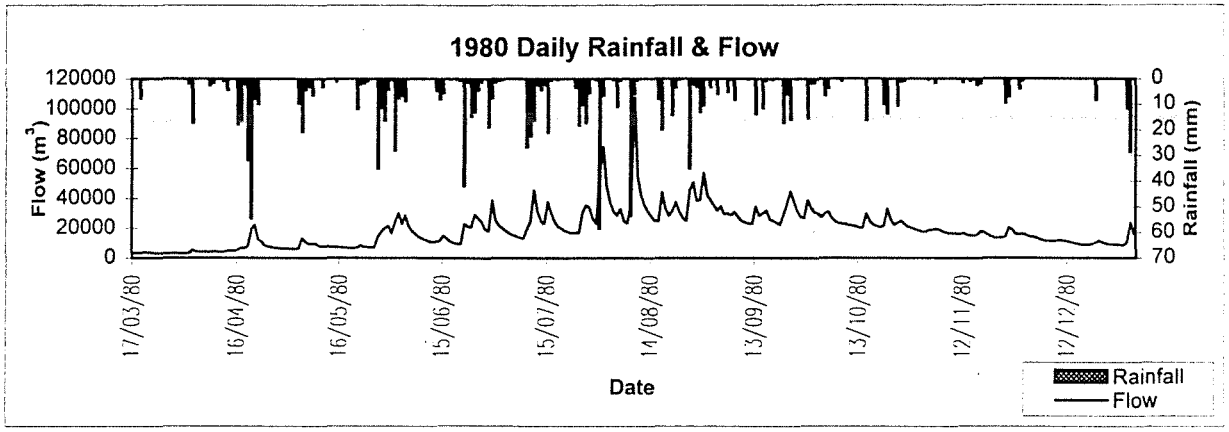


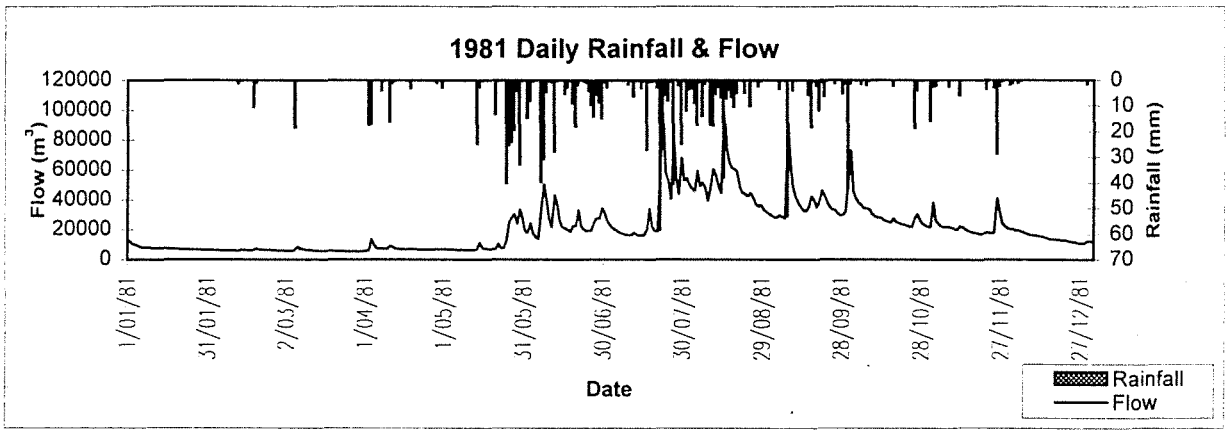


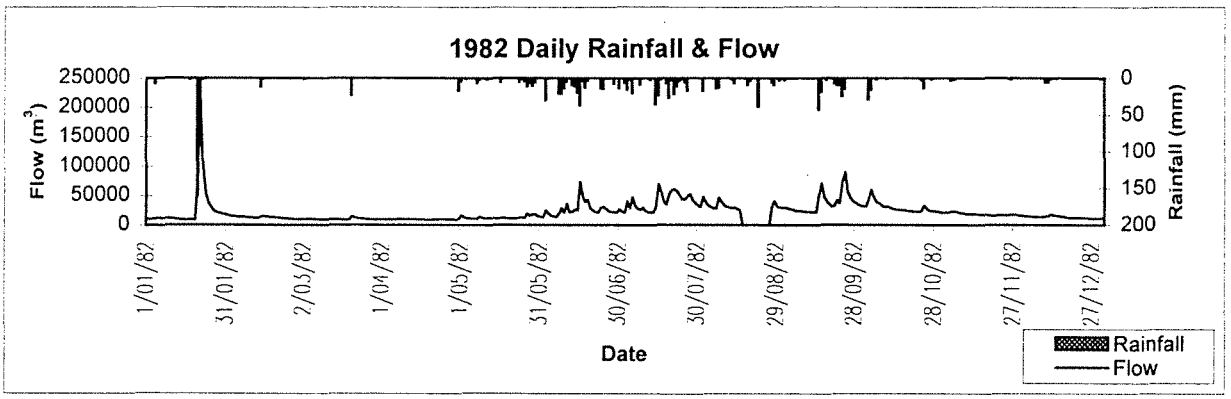


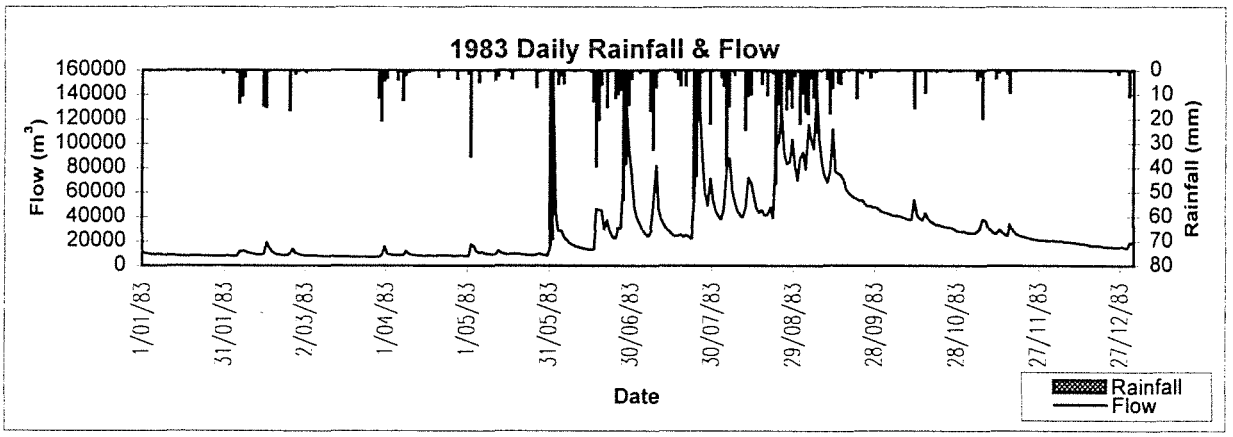


McKnoes Brook Catchment - S 613018

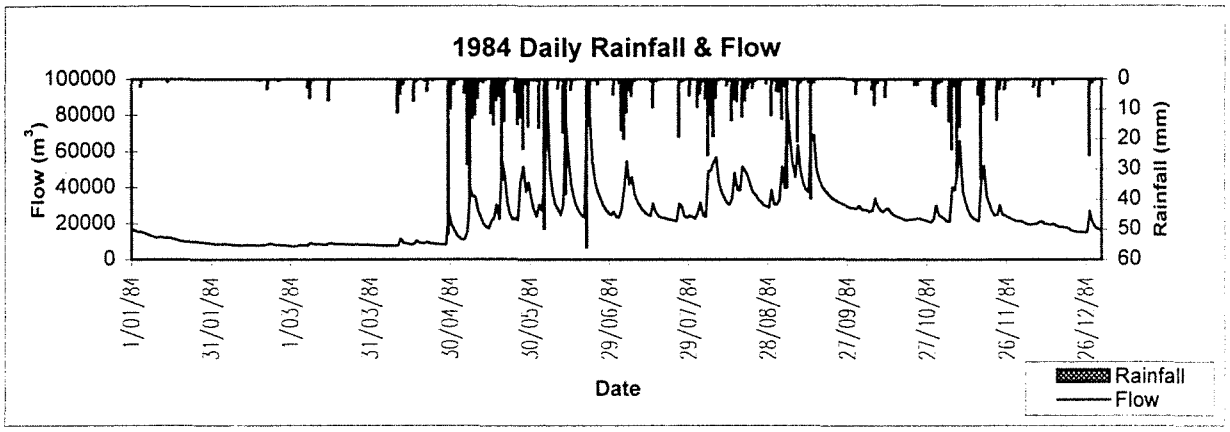


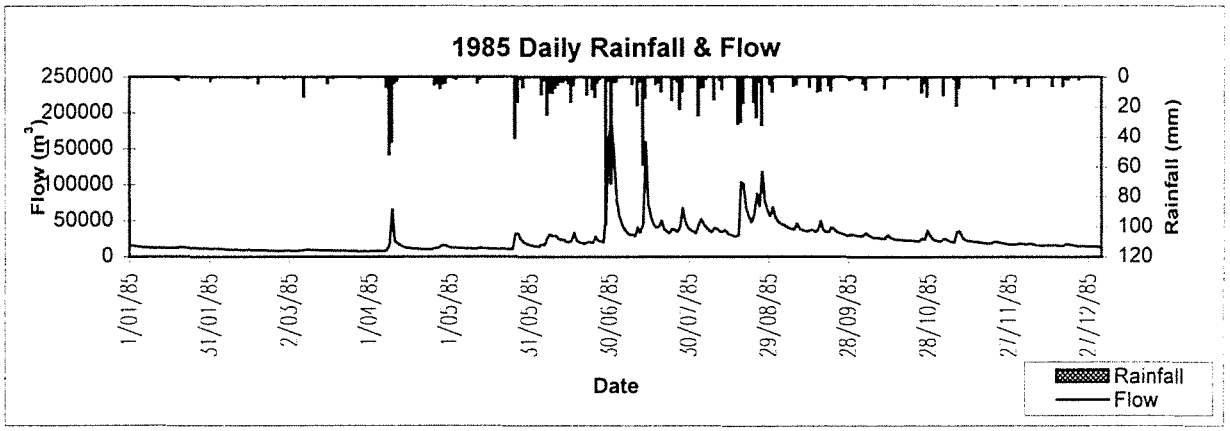


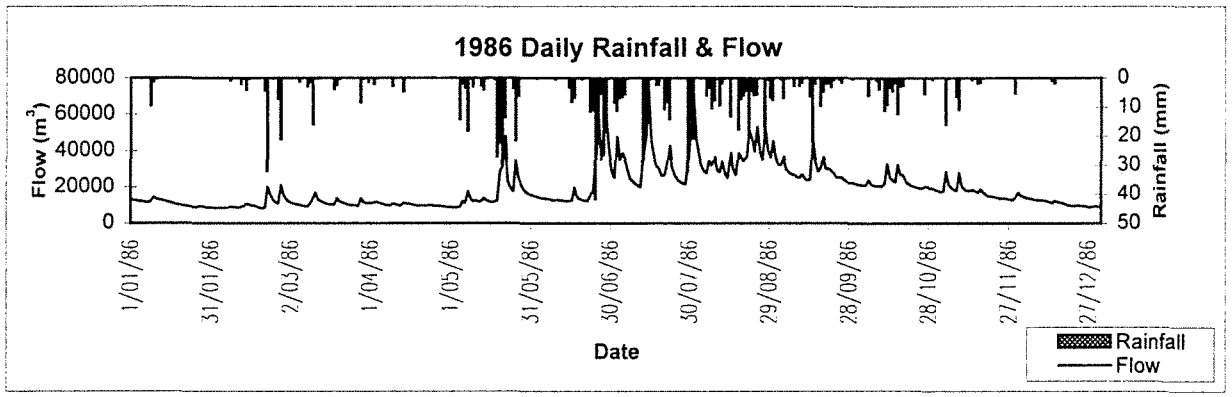


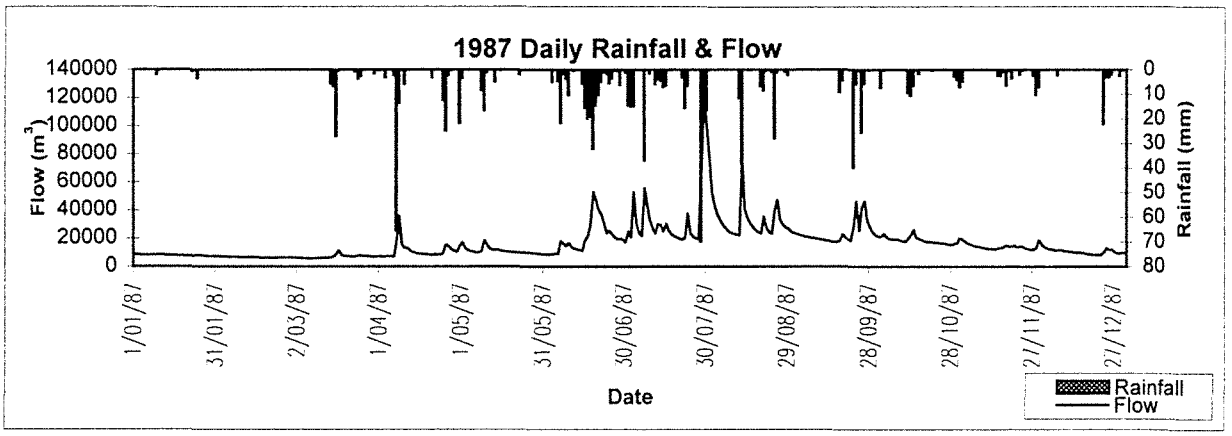


McKnoes Brook Catchment - S 613018

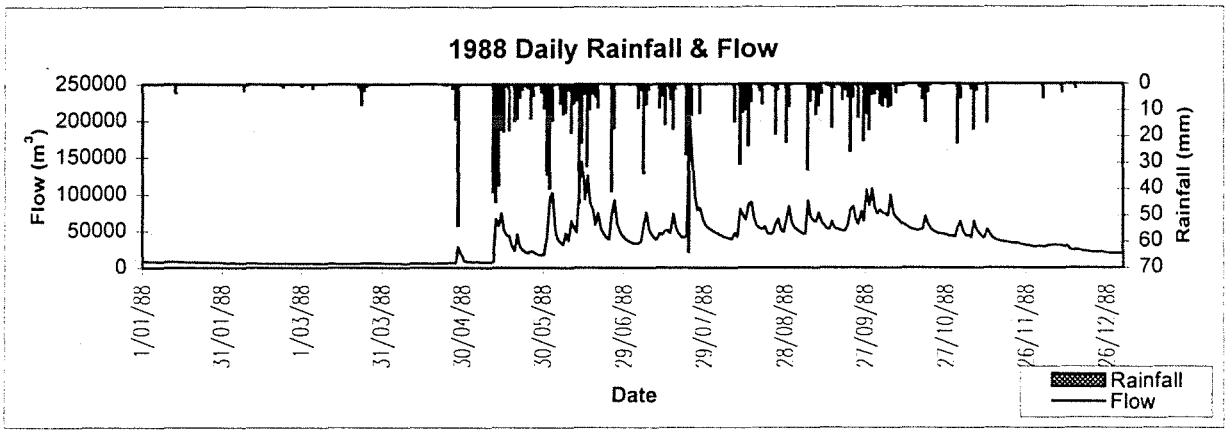


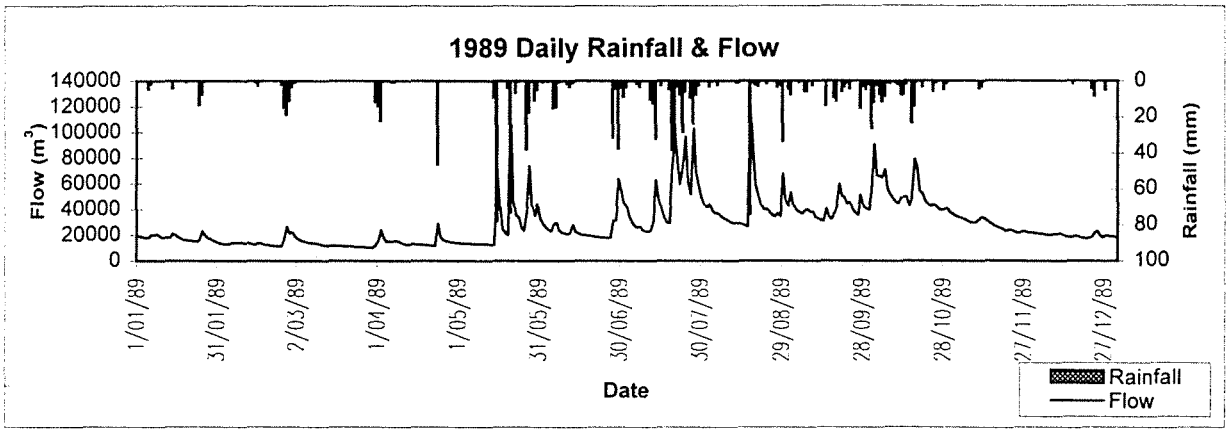


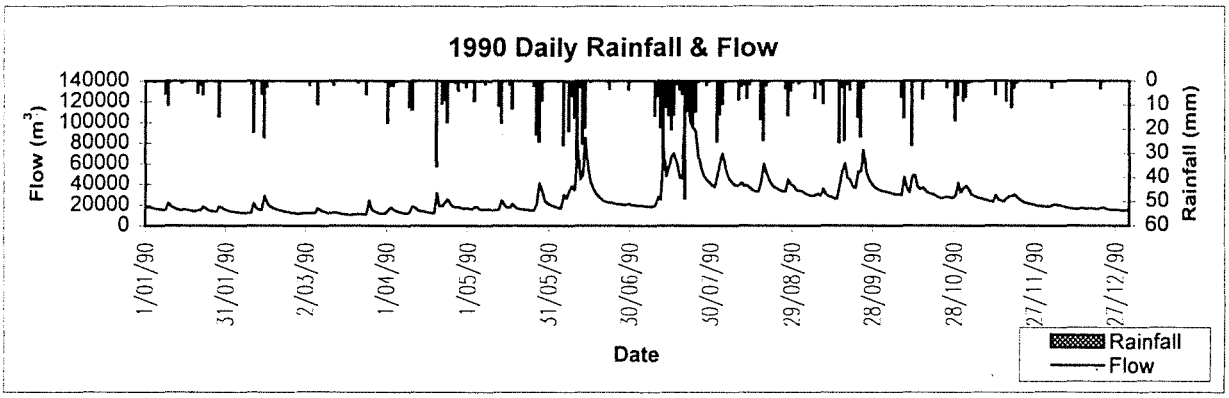


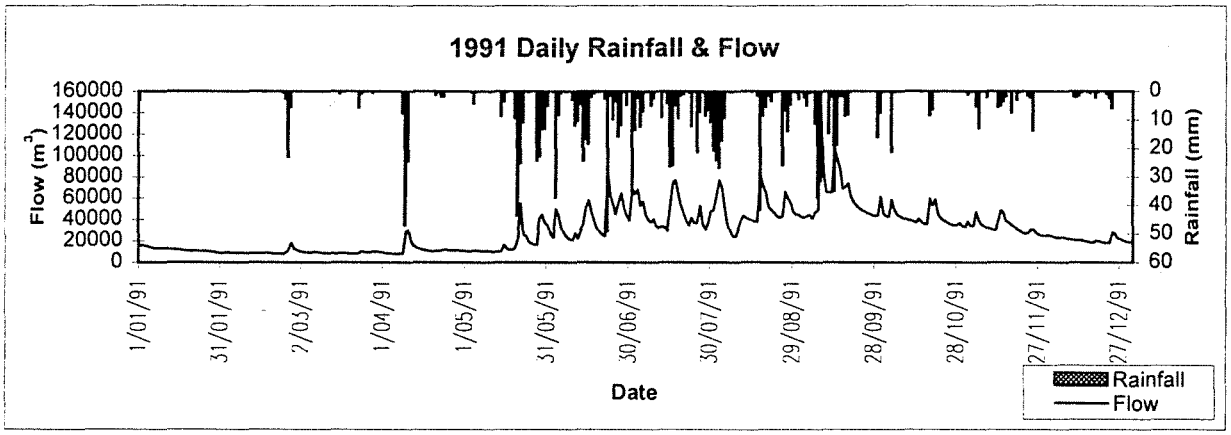


McKnoes Brook Catchment - S 613018

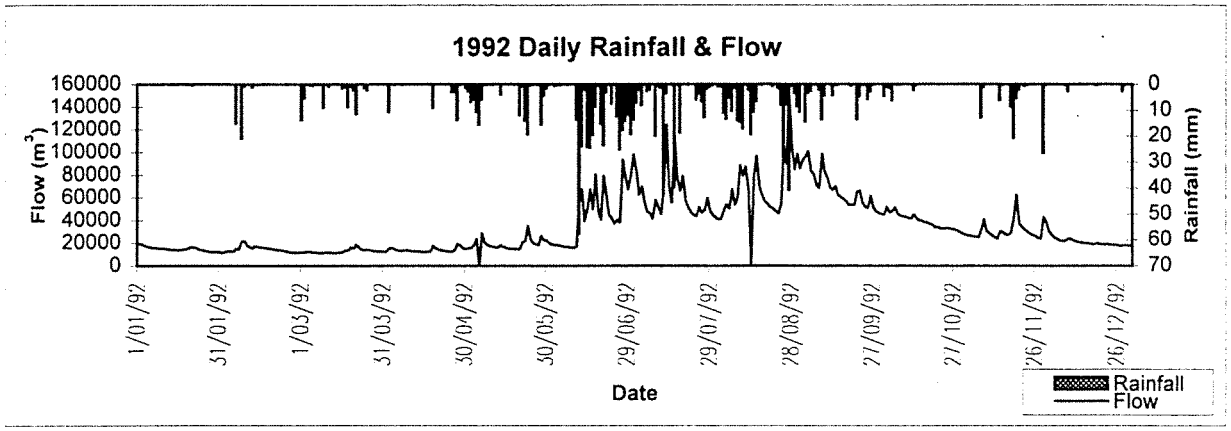


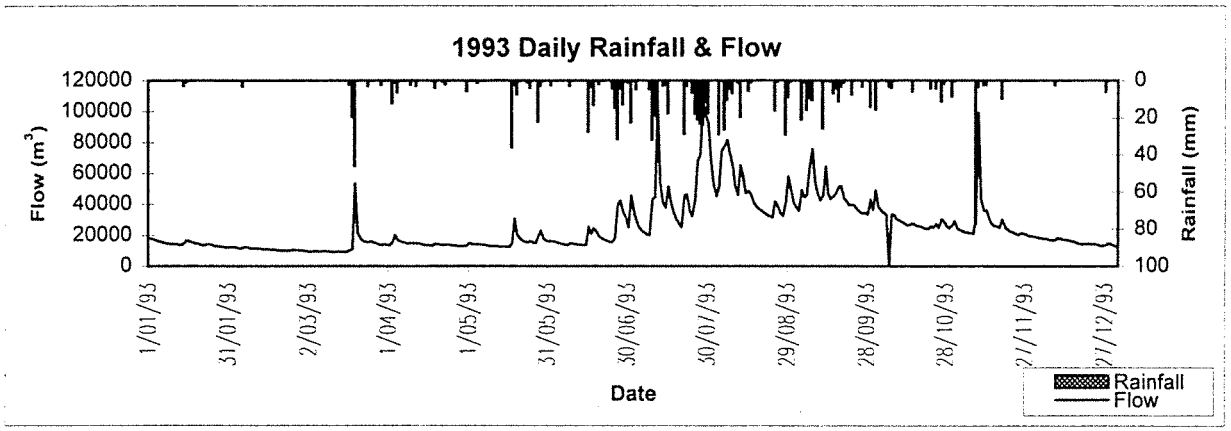


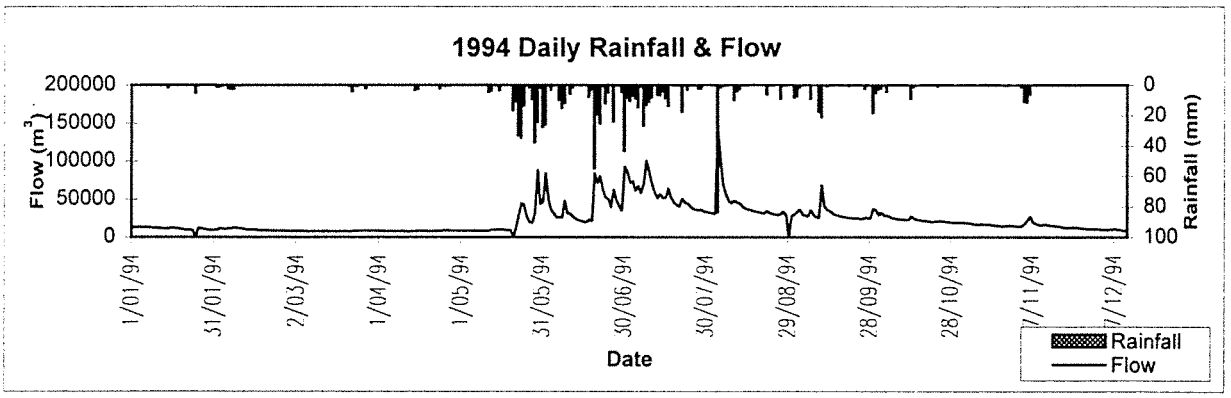


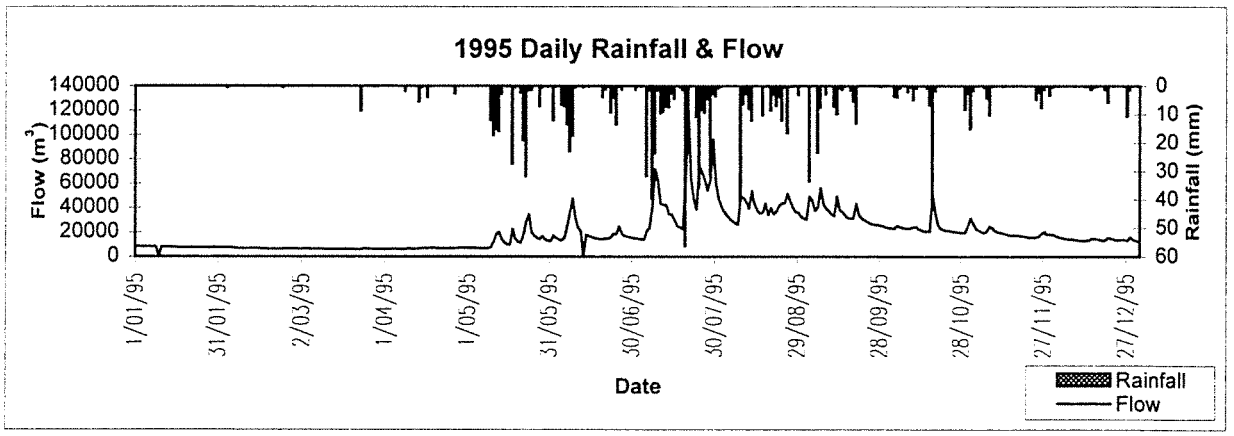


McKnoes Brook Catchment - S 613018

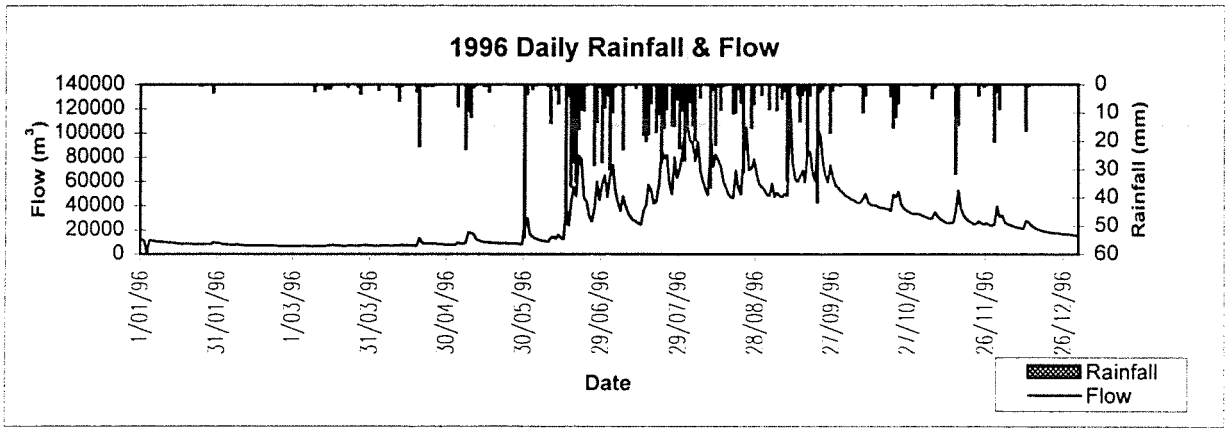


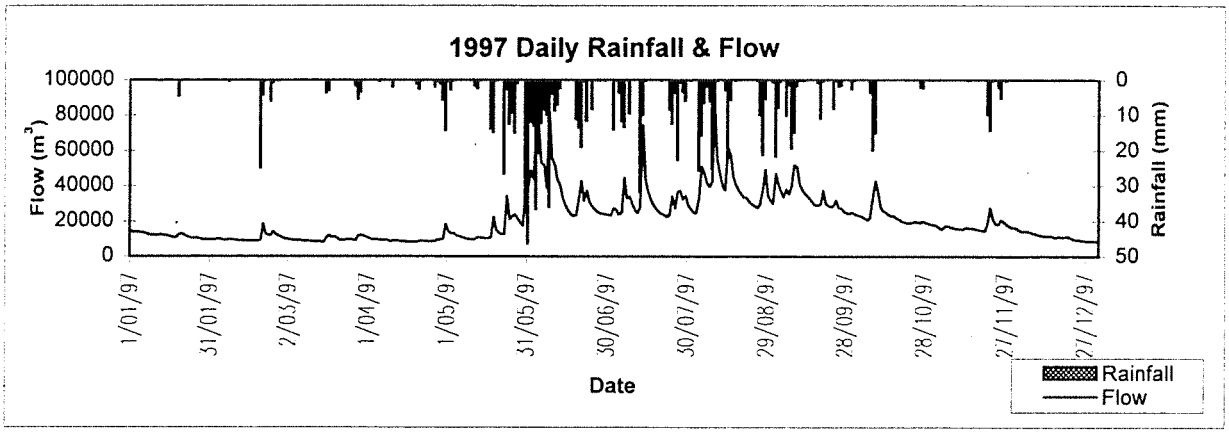




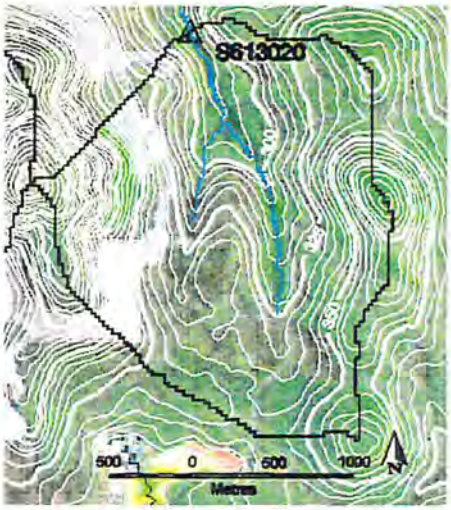


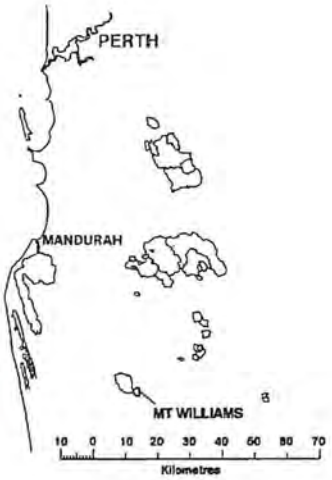
McKnoes Brook Catchment - S 613018





Mt William Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

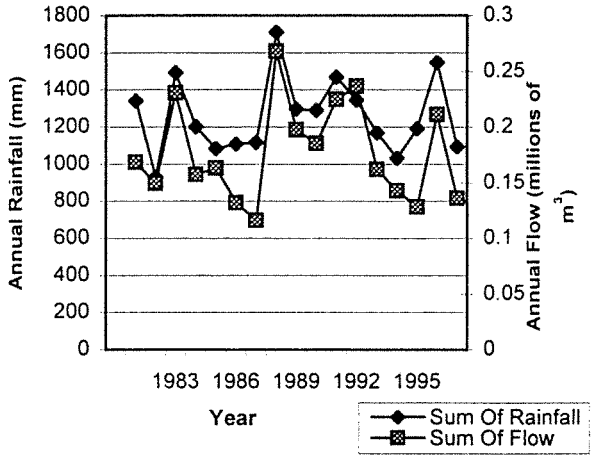
Computer Generated Stream Line

Gauging Station Number	S613020		
Rainfall Gauge Number	M509222		
Information about catchment			
Catchment area	3.95 km^2		
Gauging Station Coordinates (AMG)	N 6355891	E 409522	
Treatment data	Logging in 1970's.		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	6448	6515	0
Number of years recorded	19	19	
Number of years with complete records	17	17	
Start date	29/08/80	23/06/80	
Finish date	24/04/98	24/04/98	
Number of days with quality code 1	5909	5729	
Number of days with quality code 2	214	533	
Number of days with quality code 3	72	60	
Number of days with quality code 4	46	27	
Number of days with quality code 157	204	153	
Number of days with quality code 255	3	13	
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	
Average	1259.9	1.770	
Min	930.7	1.117	
Max	1710.2	2.680	

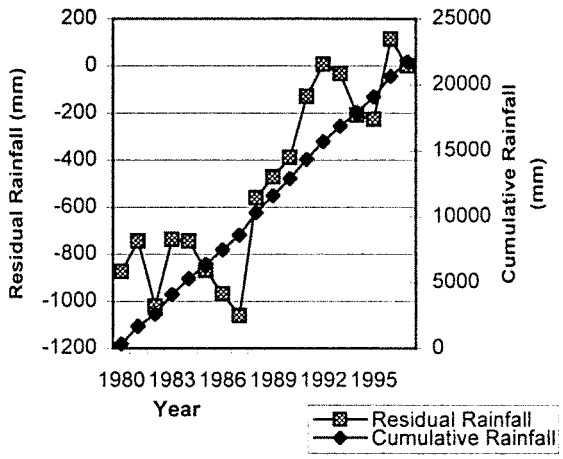
Year	Number of flow days
1981	346
1982	331
1983	362
1984	332
1985	305
1986	365
1987	365
1988	366
1989	365
1990	365
1991	364
1992	363
1993	363
1994	362
1995	363
1996	365
1997	365
Total	**6047**

Mt William Catchment - S 613020

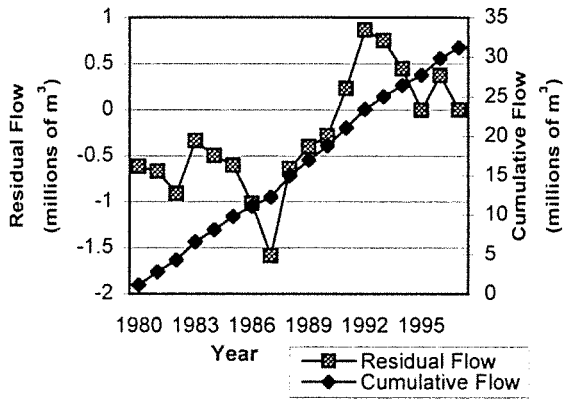
Annual Rainfall & Flow



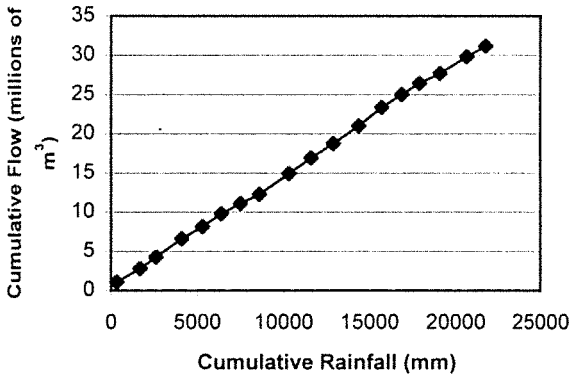
Annual Cumulative & Residual Rainfall Curves



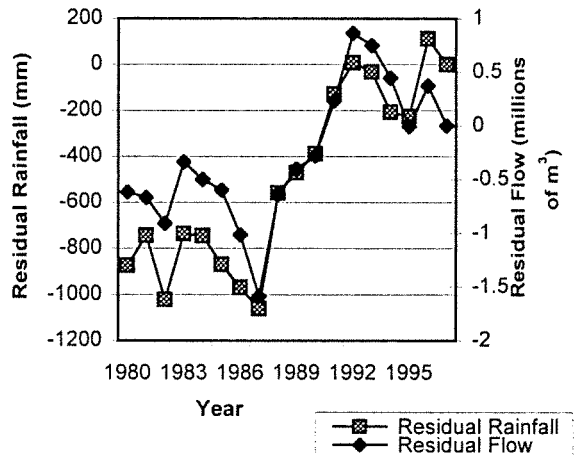
Annual Cumulative & Residual Flow Curves



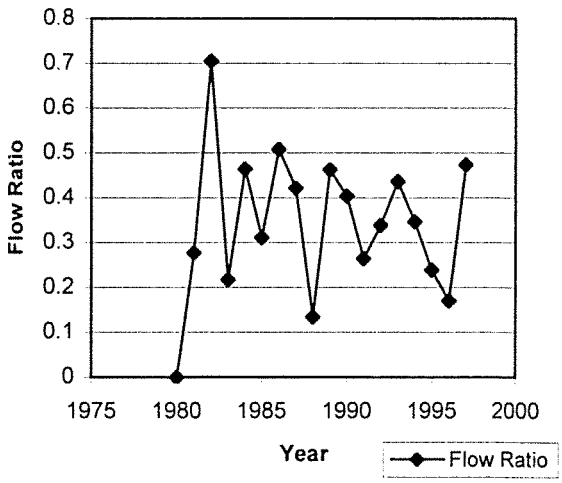
Annual Cumulative Flow & Cumulative Rainfall Curves



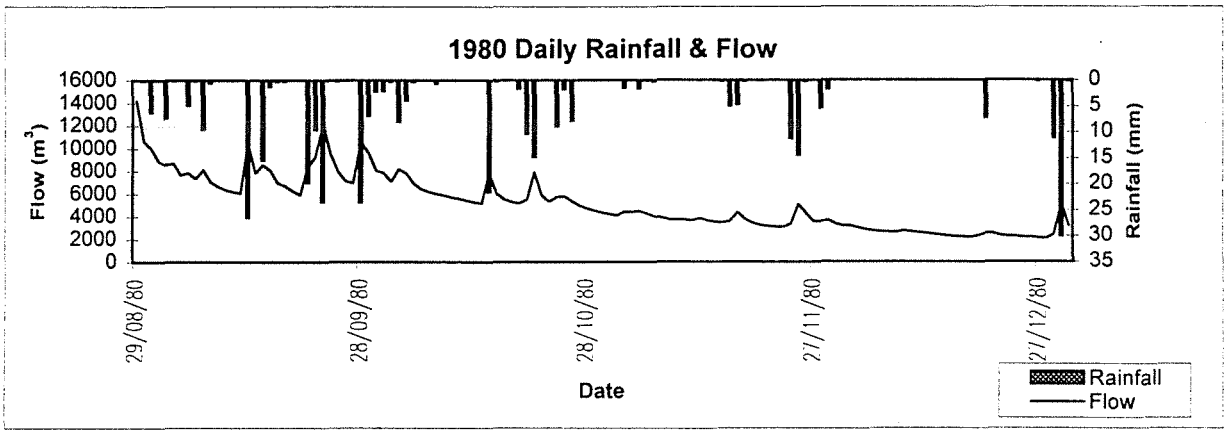
Annual Residual Flow & Residual Rainfall Curves

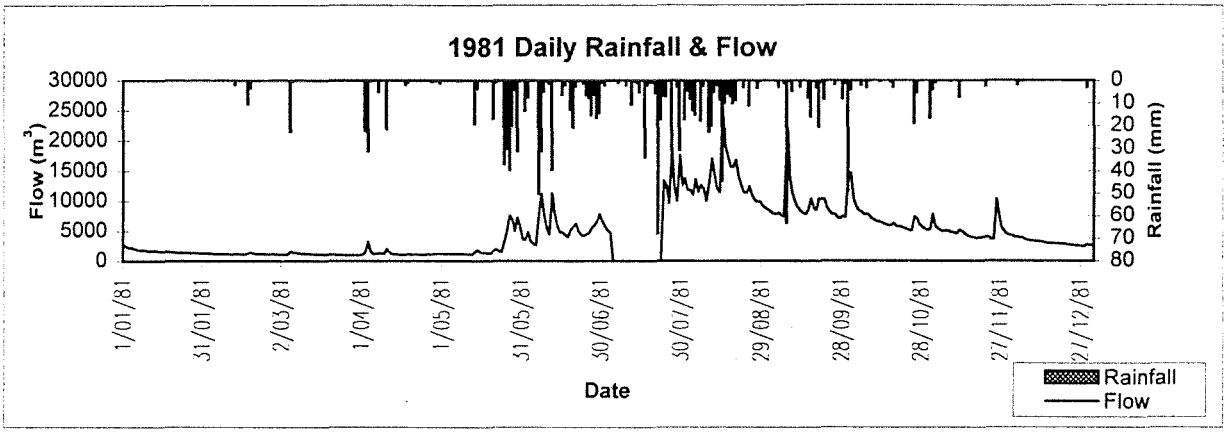


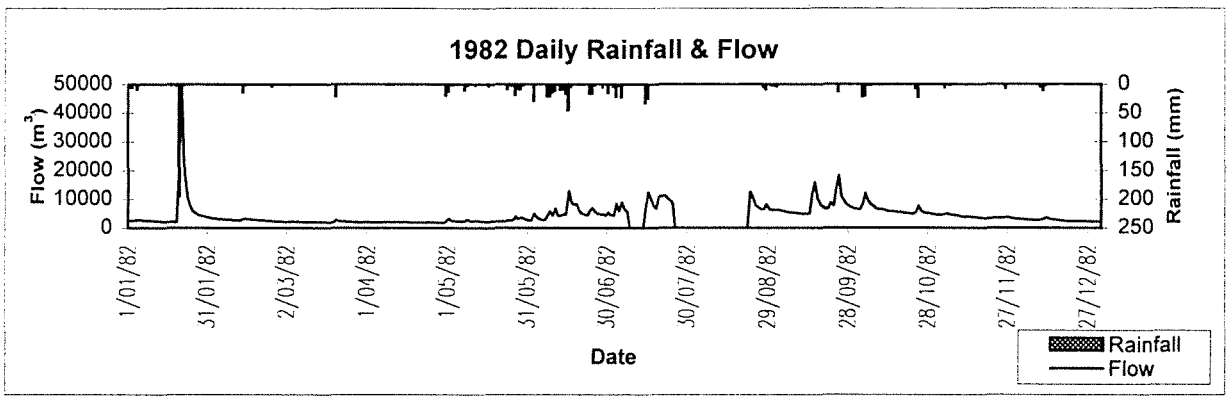
Flow Ratio of Summer to Winter

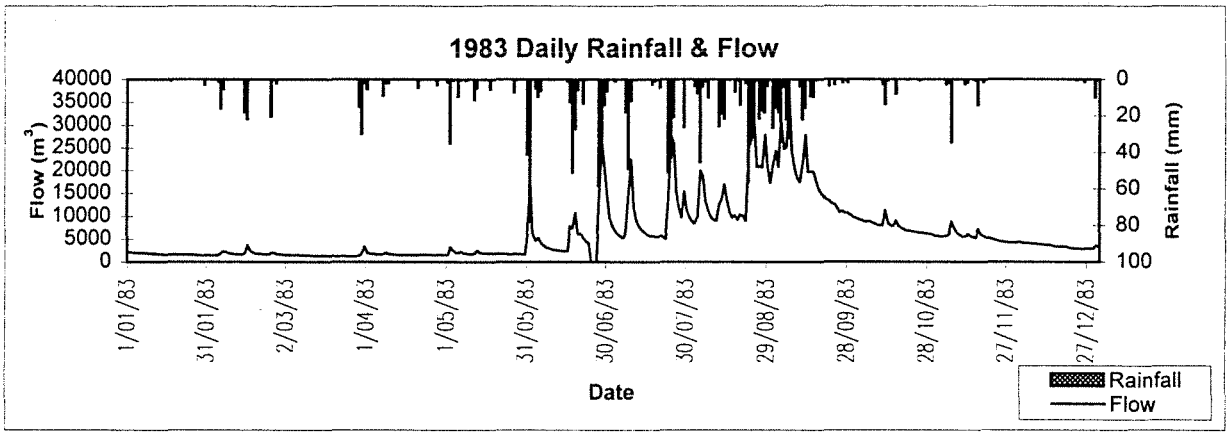


Mt William Catchment - S613020

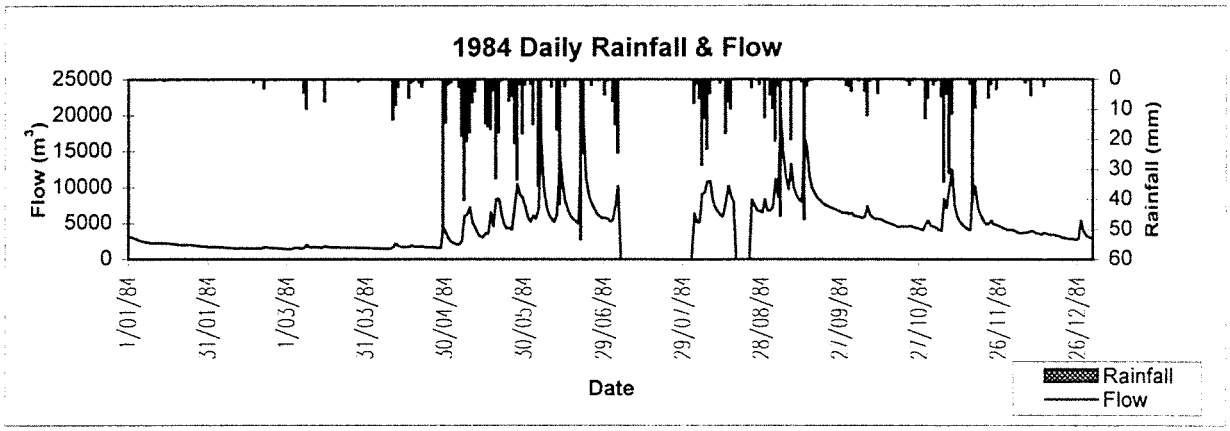


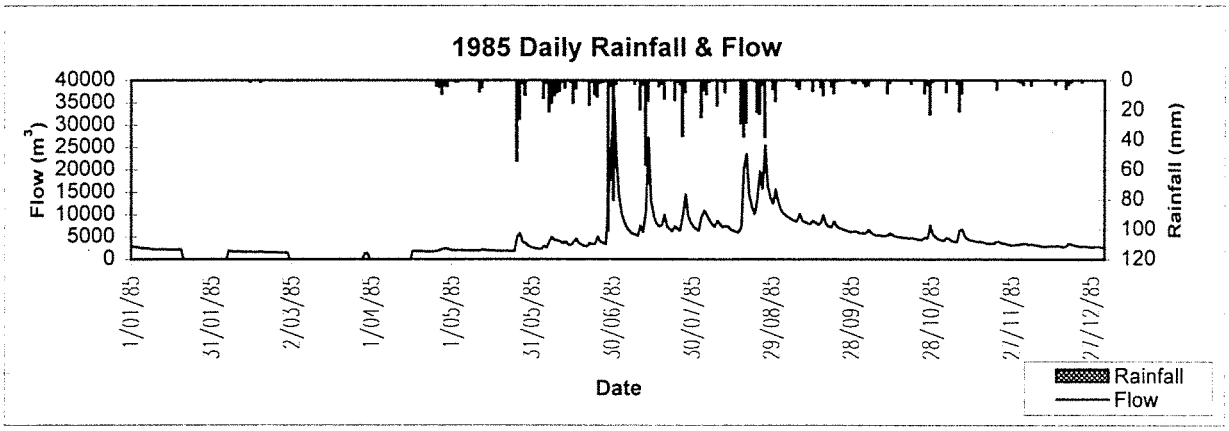


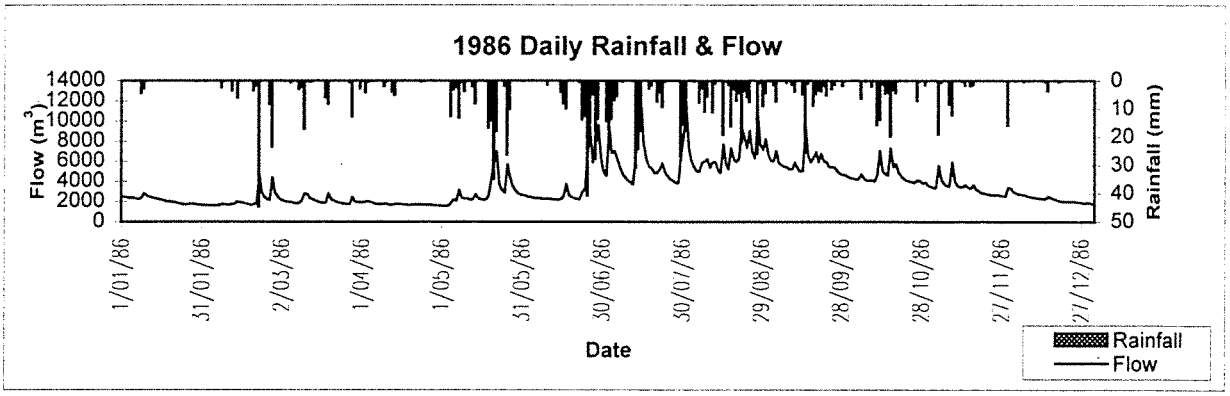


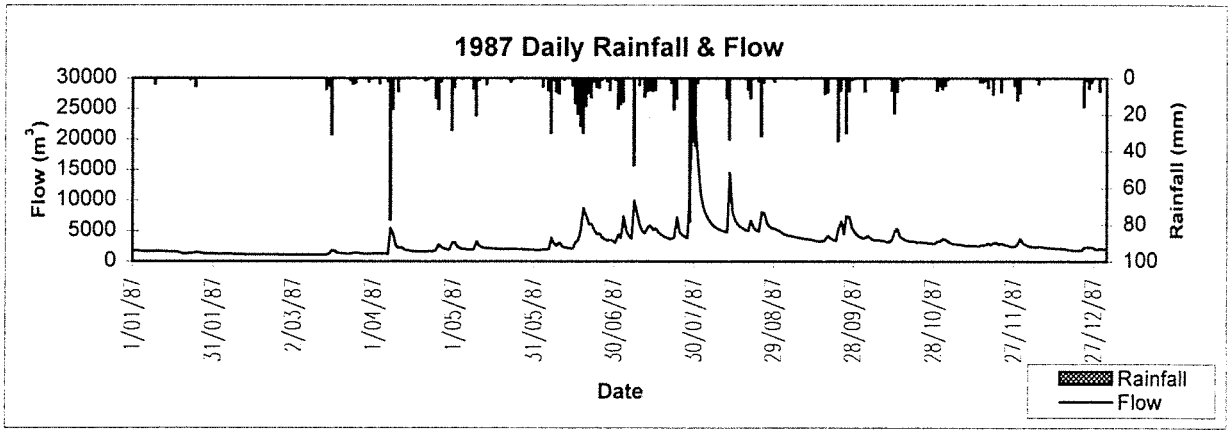


Mt William Catchment - S613020

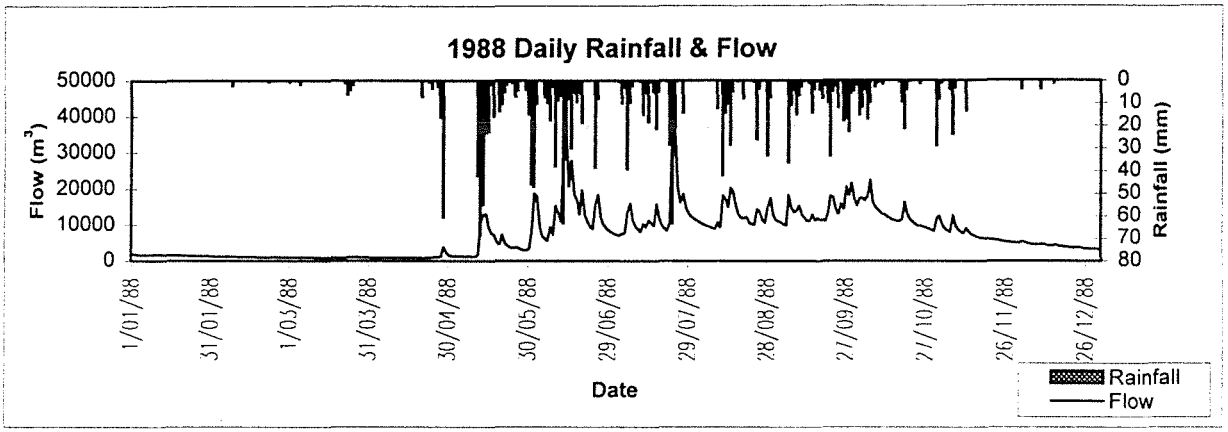


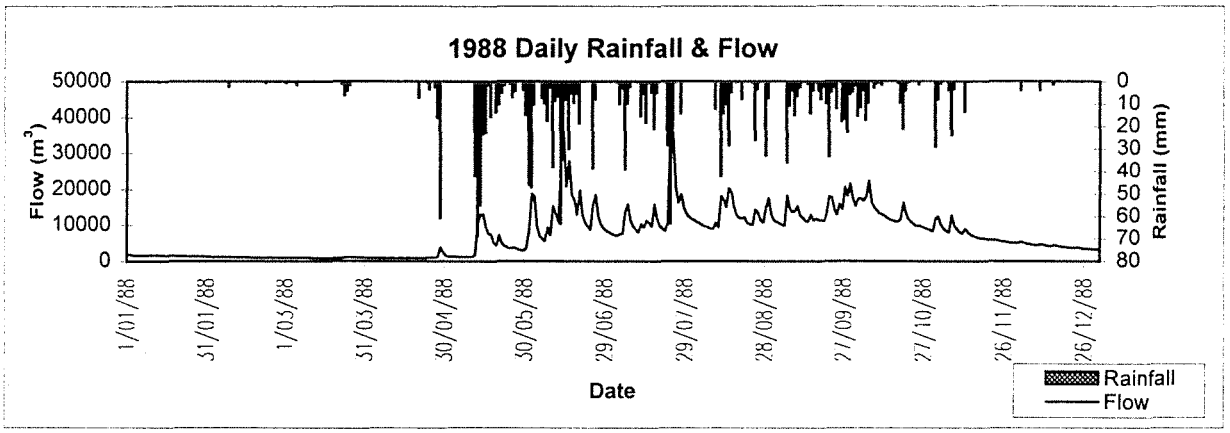


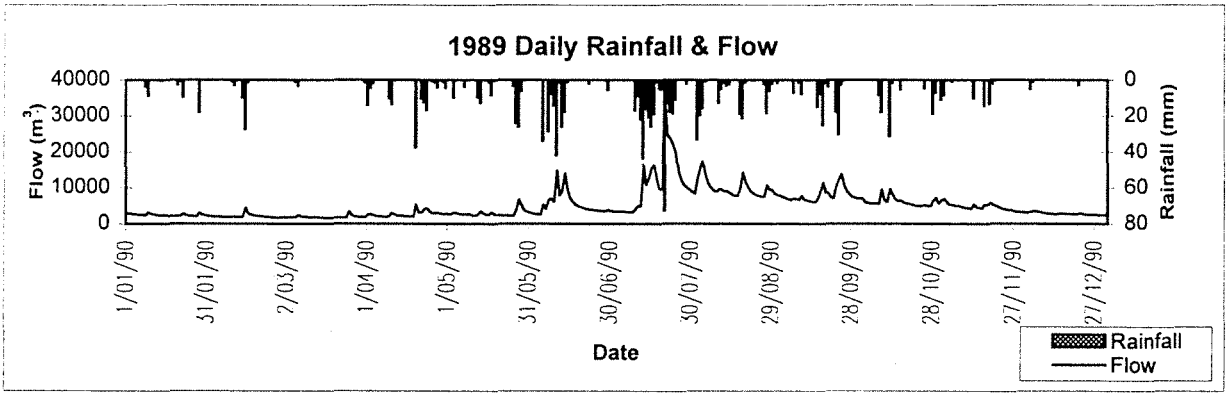


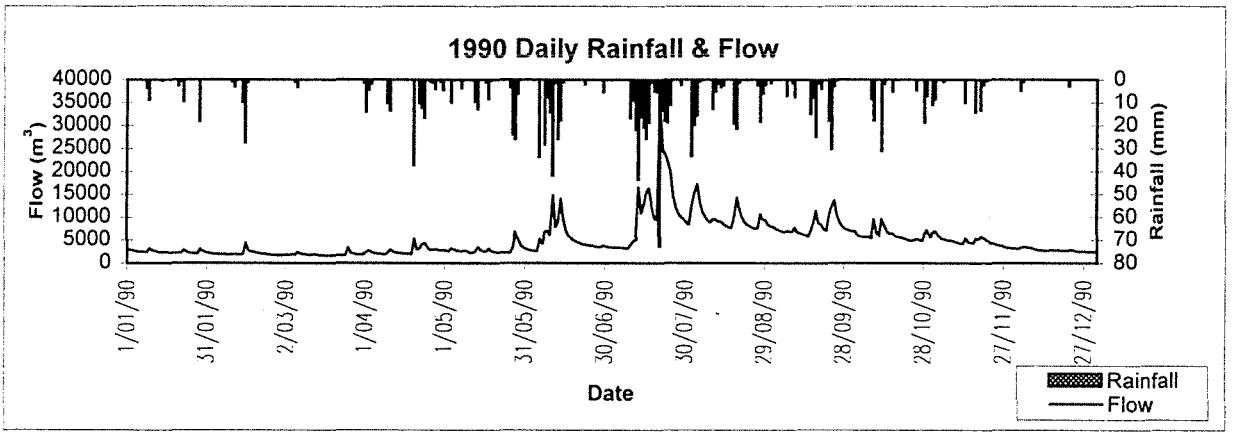


Mt William Catchment - S613020

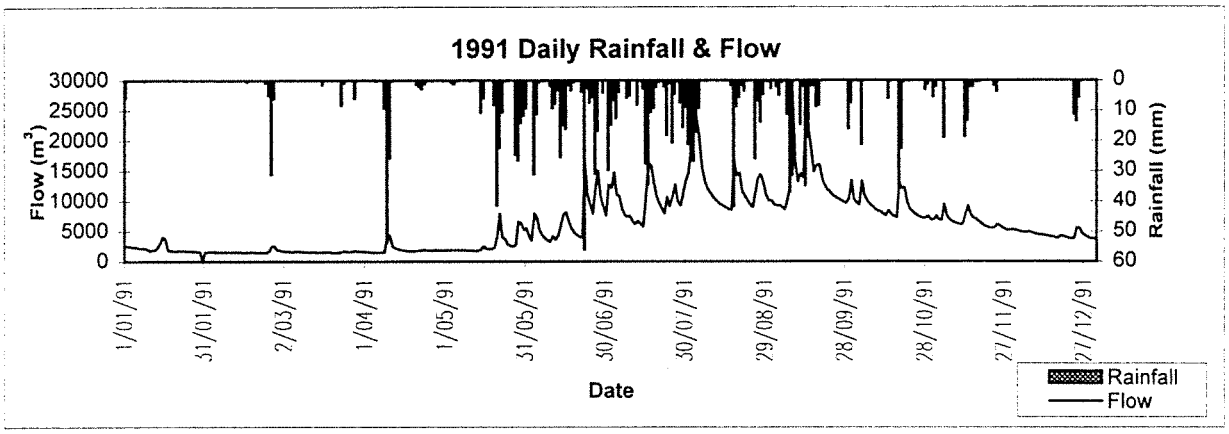


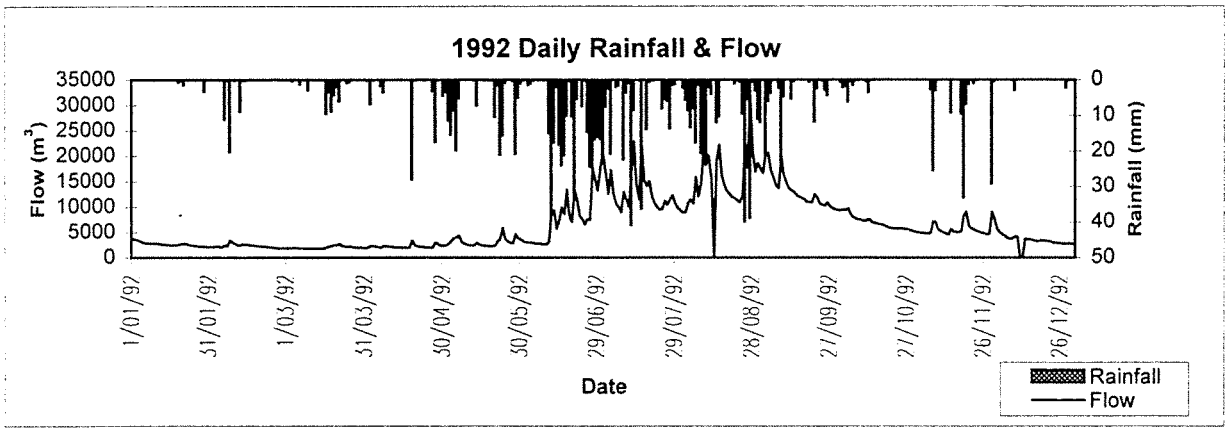


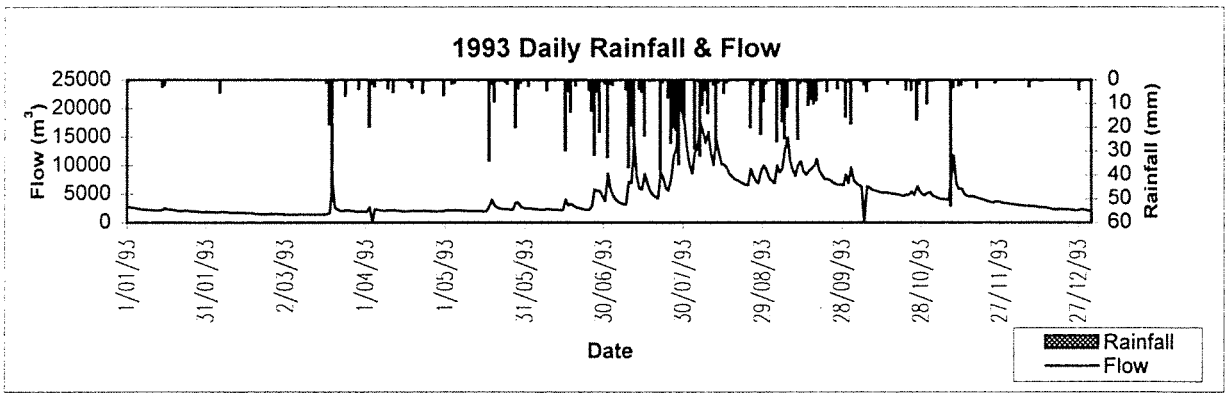


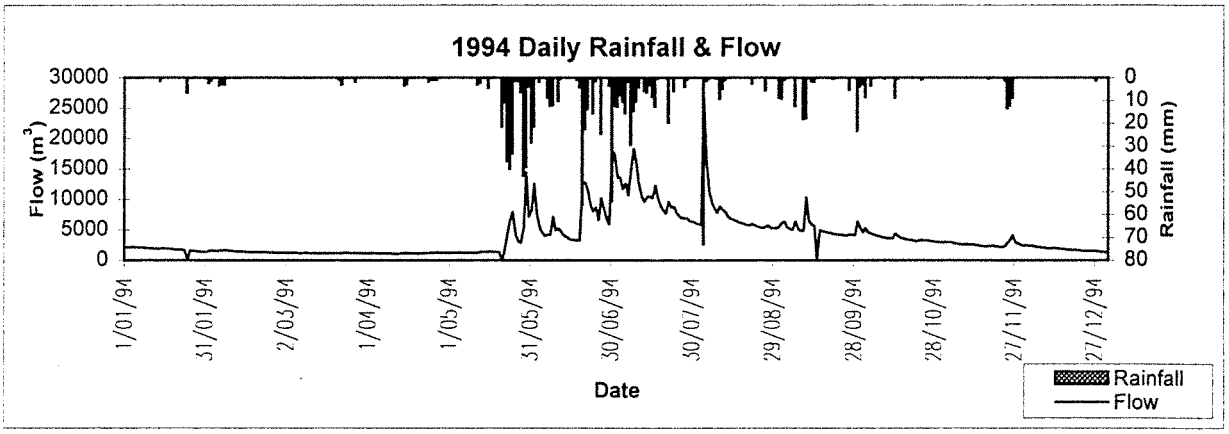


Mt William Catchment - S613020

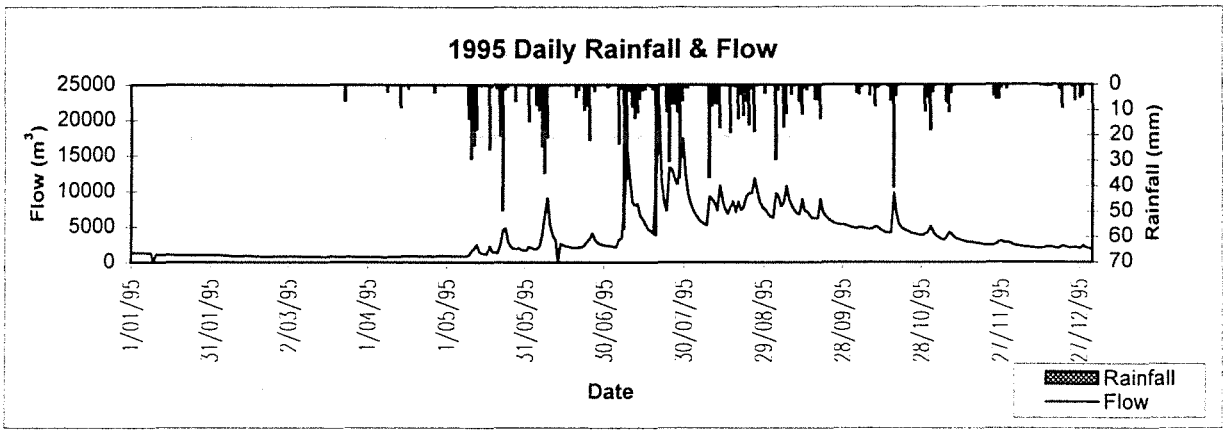


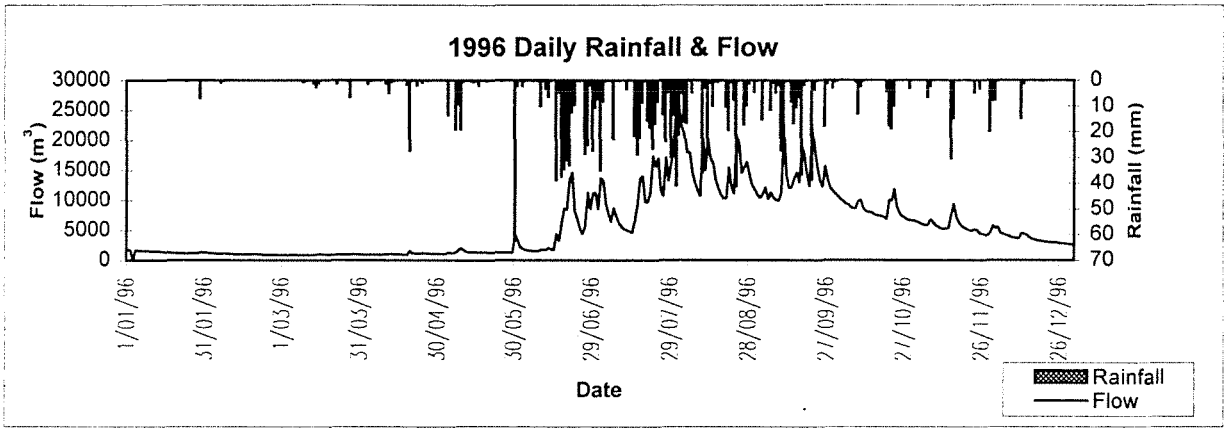


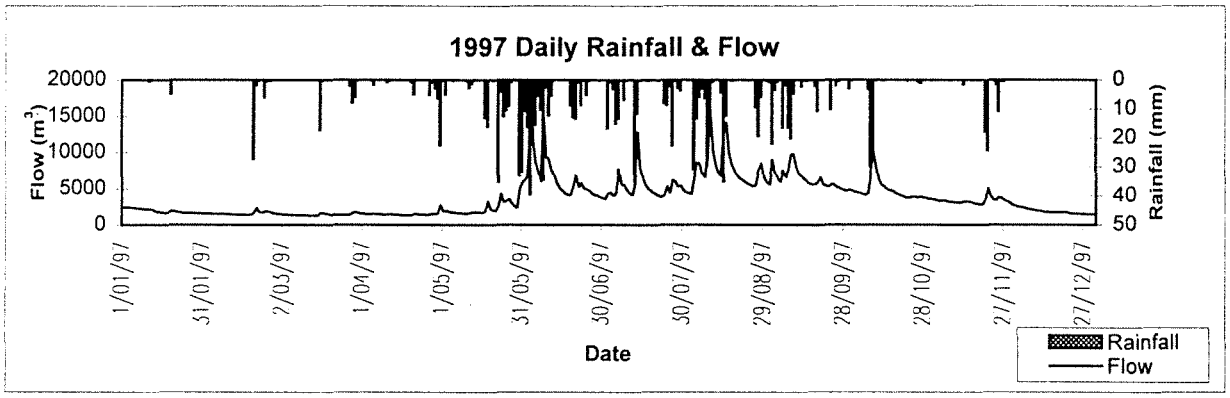




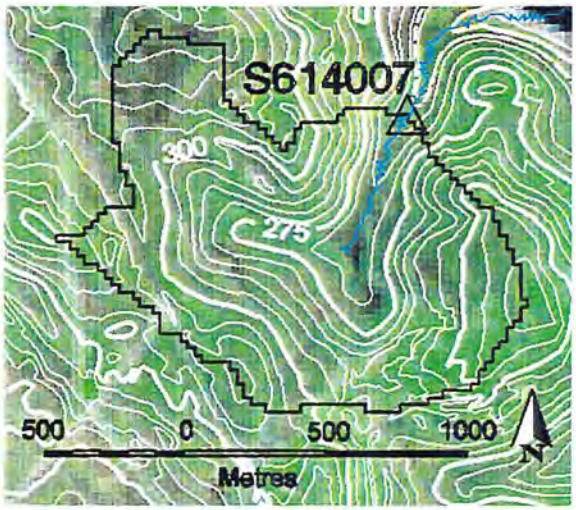
Mt William Catchment - S613020







Del Park Catchment



Legend

Catchment Boundary △ Gauging Station

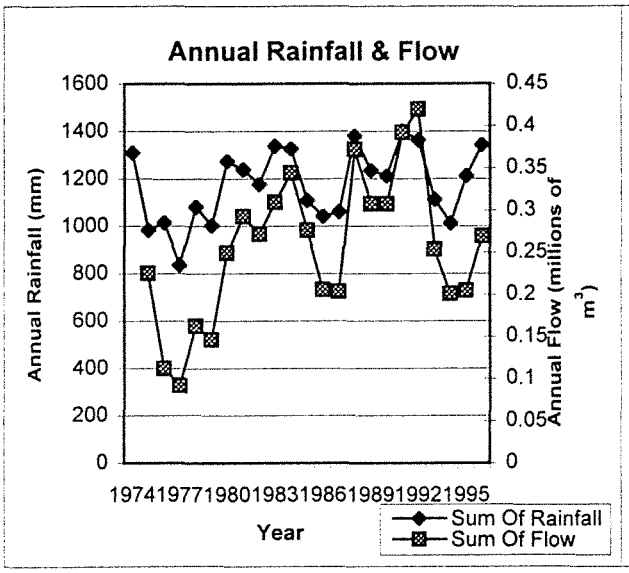
5 m Contours on Landsat Scene Jan 96

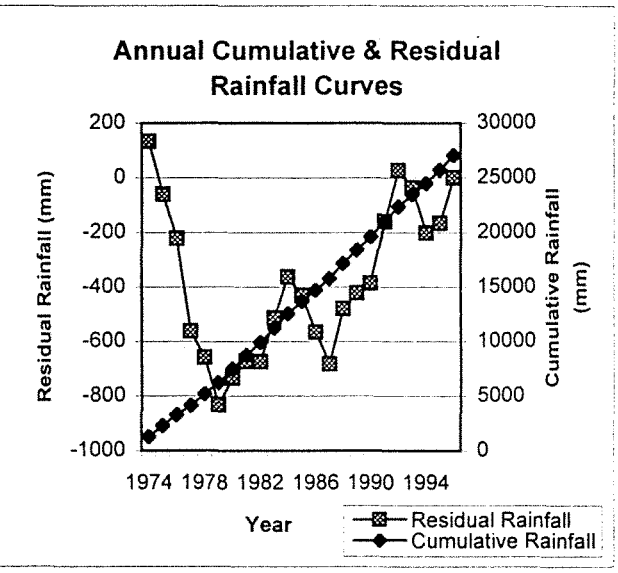
Computer Generated Stream Line

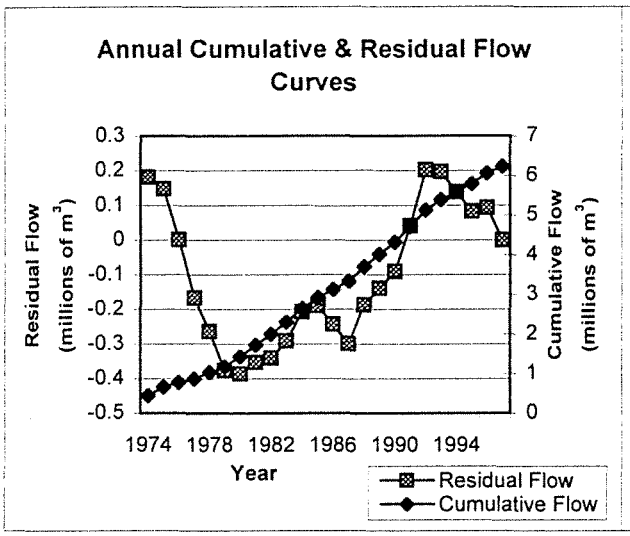
Gauging Station Number	S614007		
Rainfall Gauge Number	M509263		
Information about catchment			
Catchment area	1.33 km^2		
Gauging Station Coordinates (AMG)	N 6385050	E 410275	
Treatment data	Rehabilitated in 1970's		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	8404	8647	37
Number of years recorded	25	25	
Number of years with complete records	23	23	
Start date	1/01/74	22/05/74	18/09/84
Finish date	31/12/96	22/01/98	24/10/84
Number of days with quality code 1	7965	7934	31
Number of days with quality code 2	157	371	
Number of days with quality code 3	30	135	
Number of days with quality code 4	29	6	
Number of days with quality code 8	144	0	
Number of days with quality code 157	0	8	4
Number of days with quality code 255	193	193	2
Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	1176.6	0.252	
Min	836.0	0.093	
Max	1403.0	0.420	

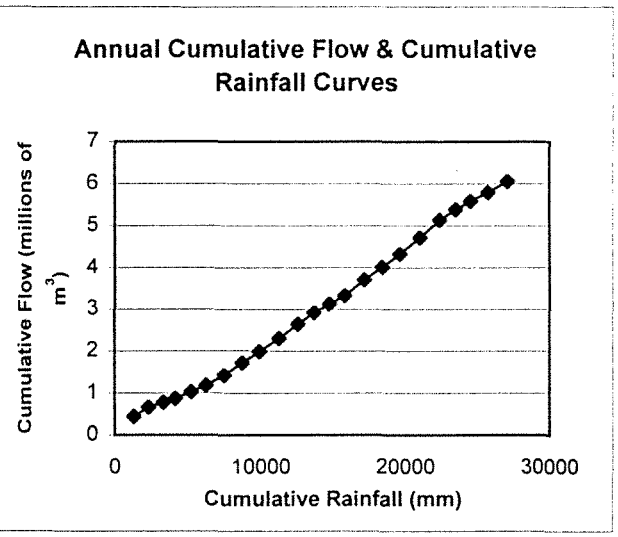
Year	Number of flow days
1975	365
1976	366
1977	291
1978	241
1979	365
1980	356
1981	365
1982	365
1983	365
1984	366
1985	365
1986	365
1987	365
1988	350
1989	365
1990	365
1991	365
1992	366
1993	305
1994	234
1995	365
1996	366
1997	365
Total	**7986**

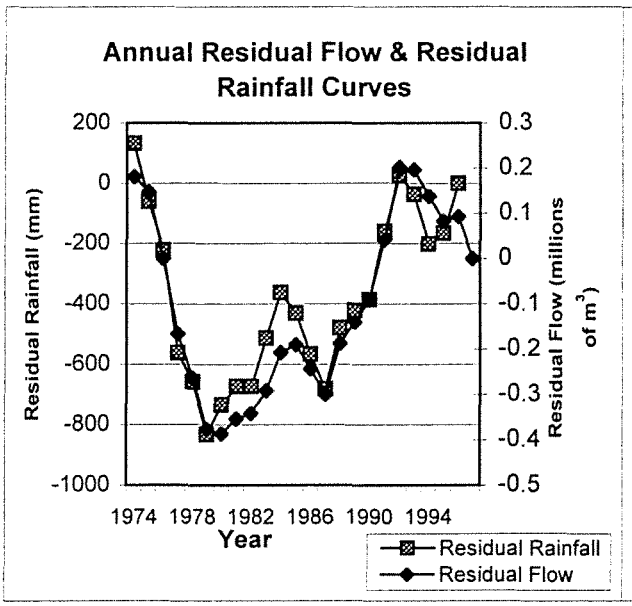
Del Park Catchment - S614007

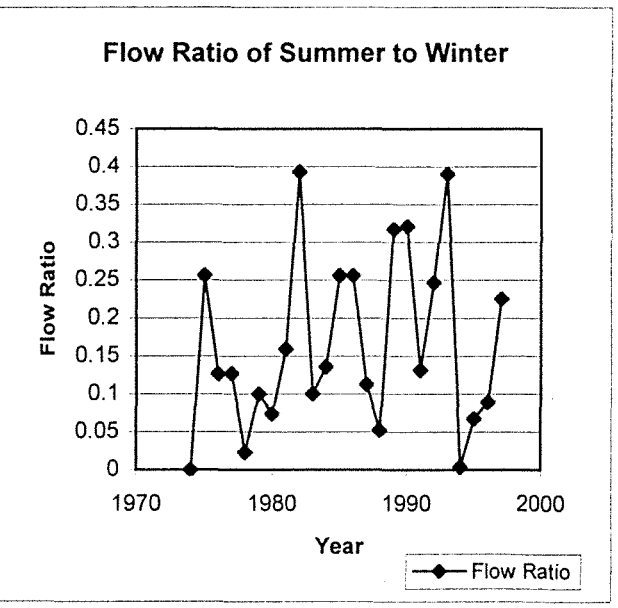




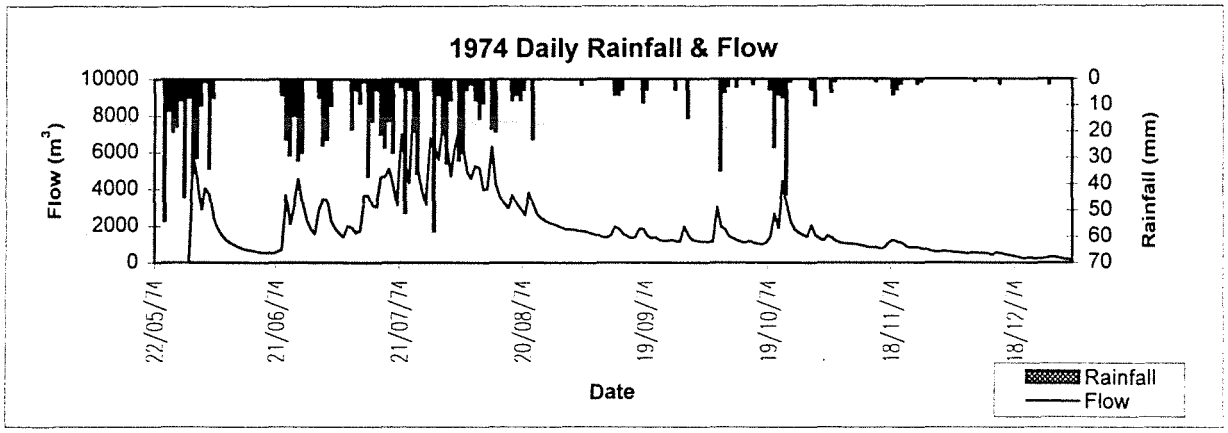


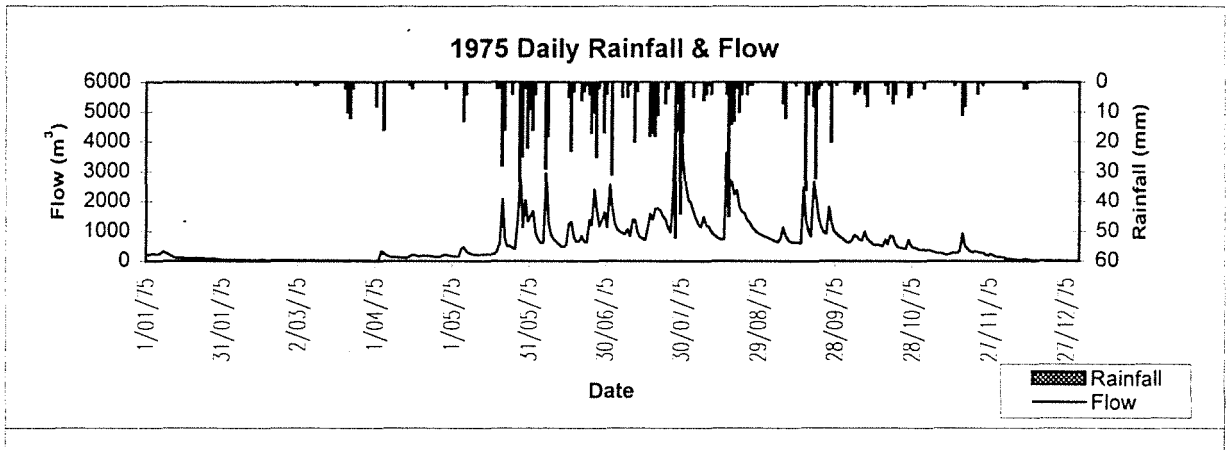


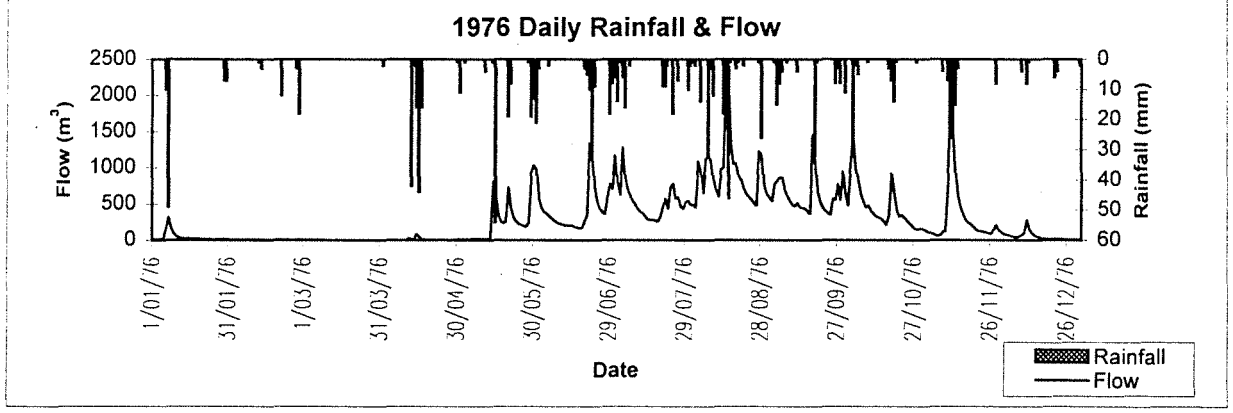


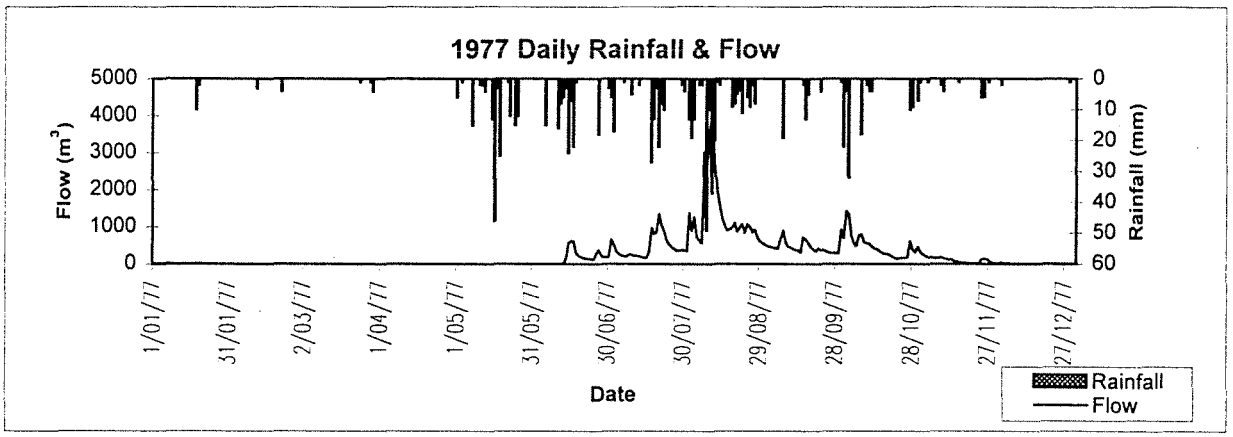


Del Park Catchment - S614007

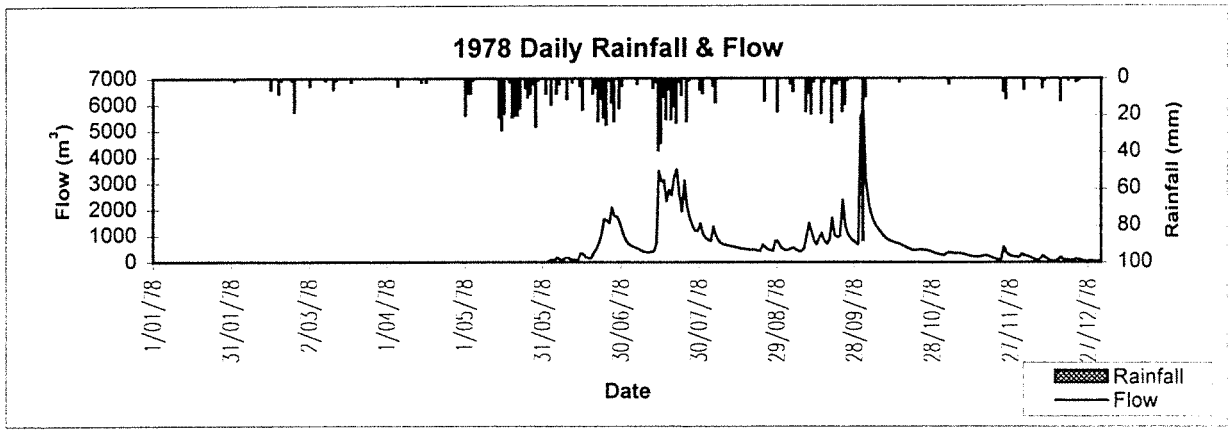


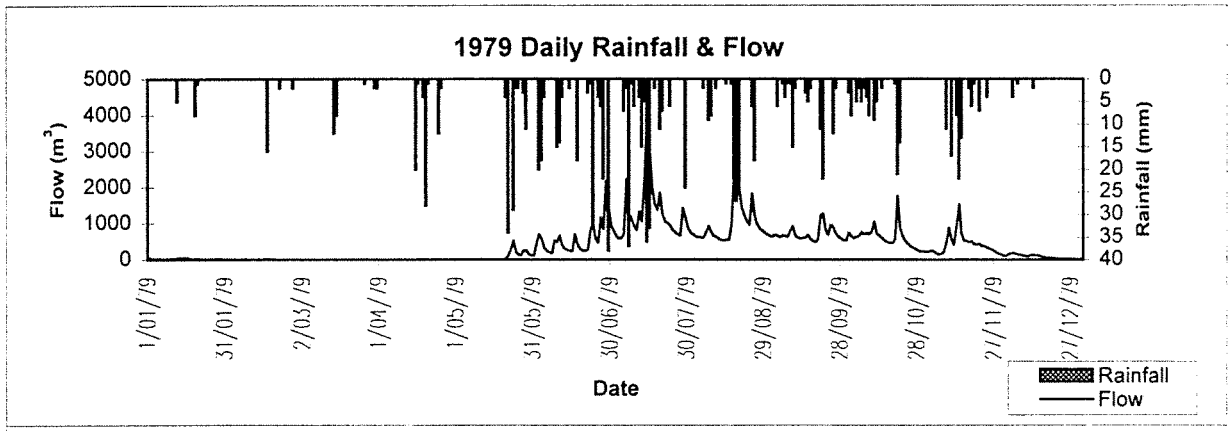


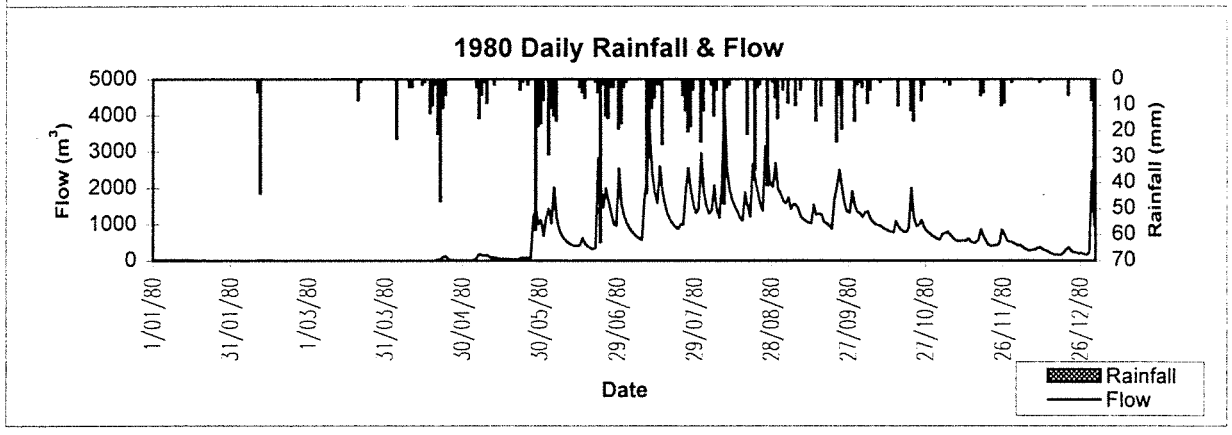


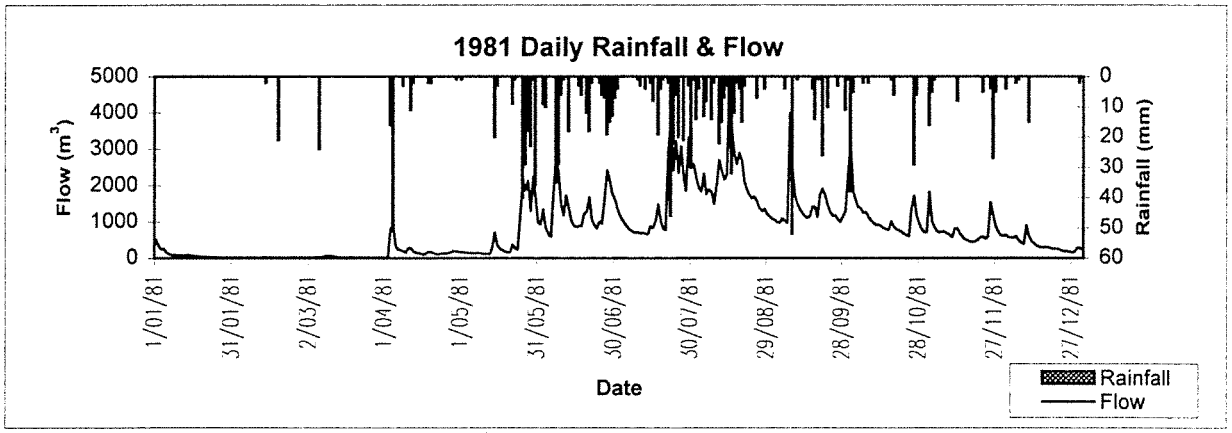


Del Park Catchment - S614007

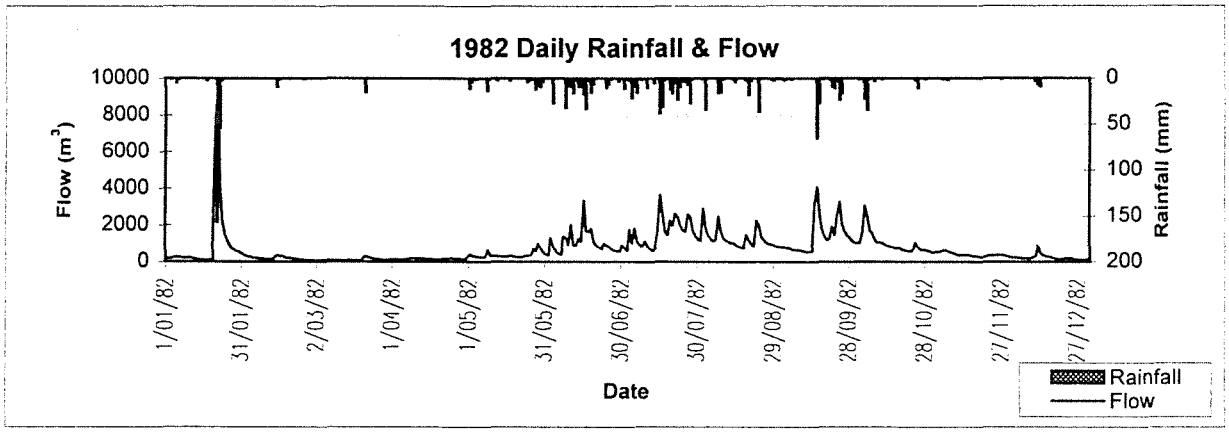


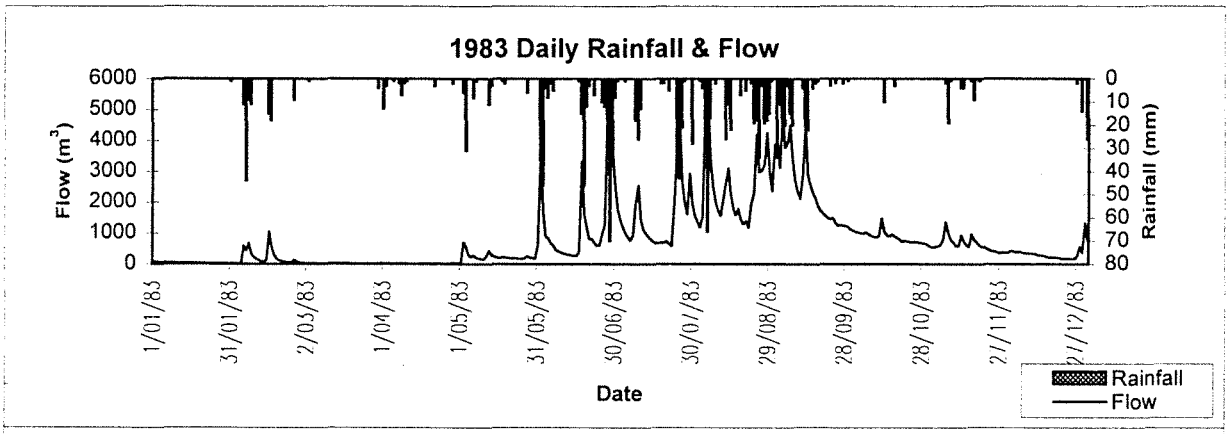


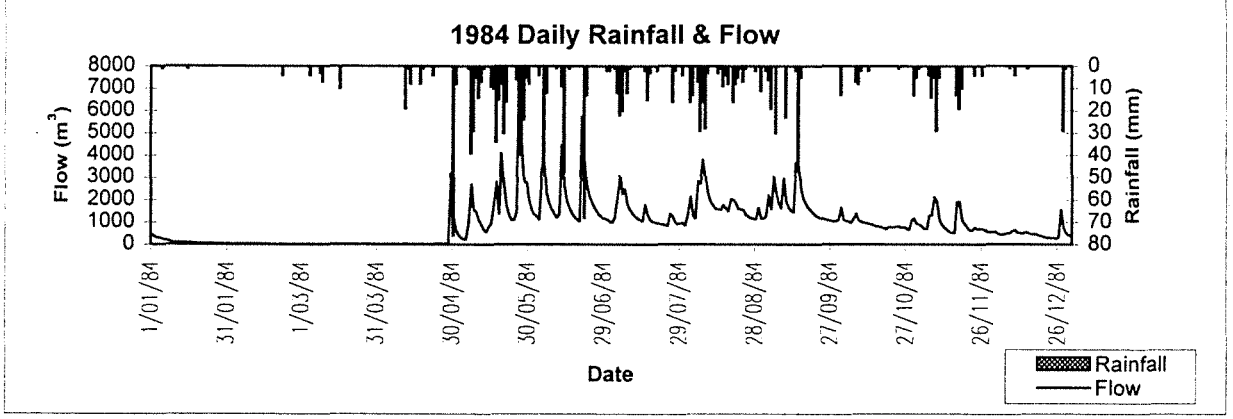


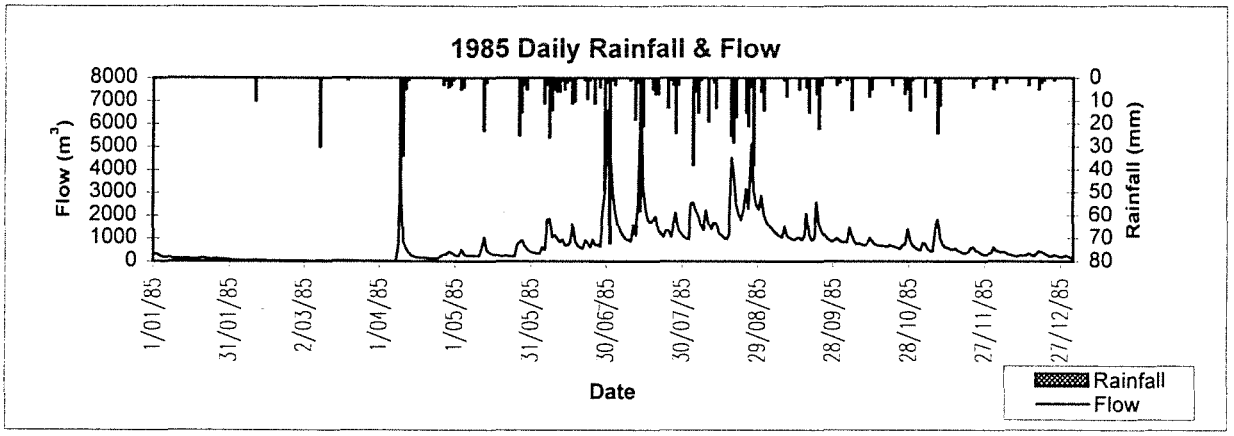


Del Park Catchment - S614007

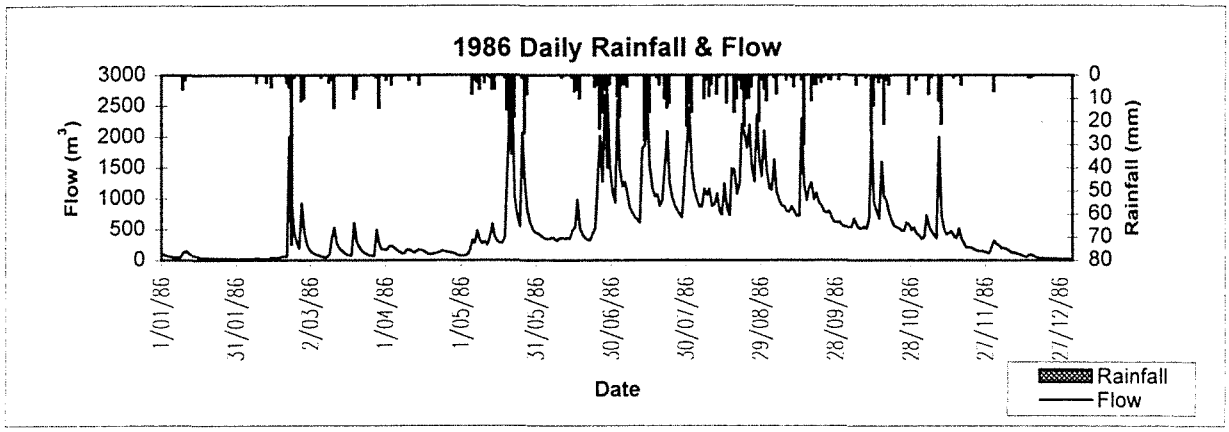


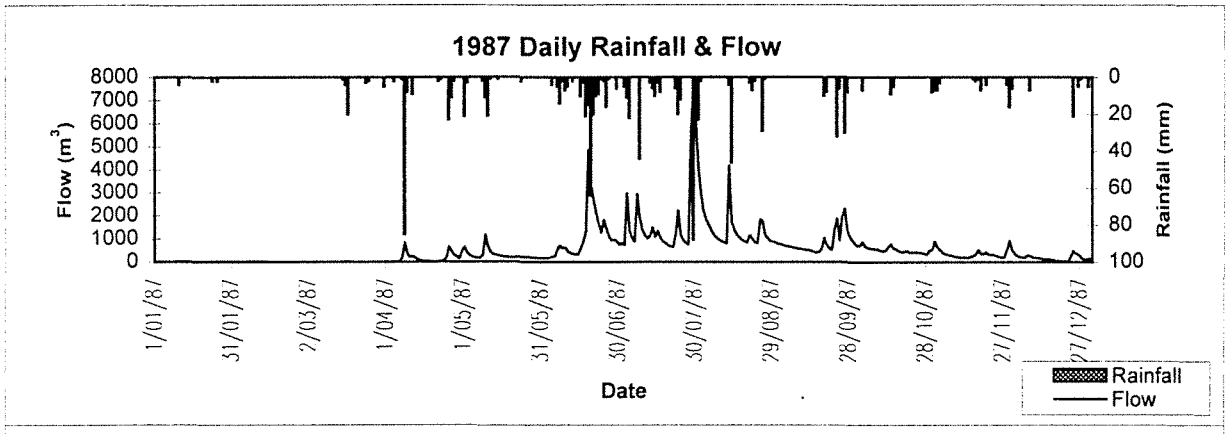


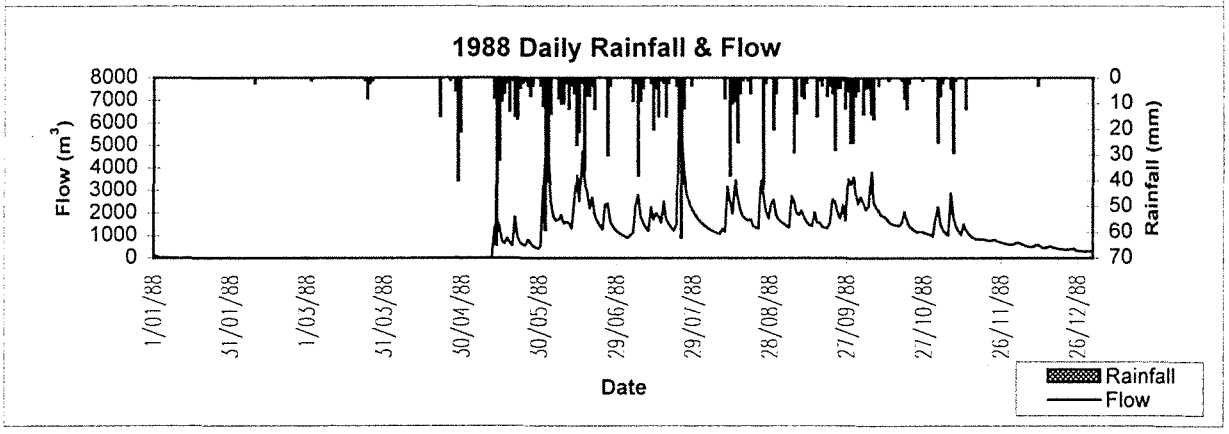


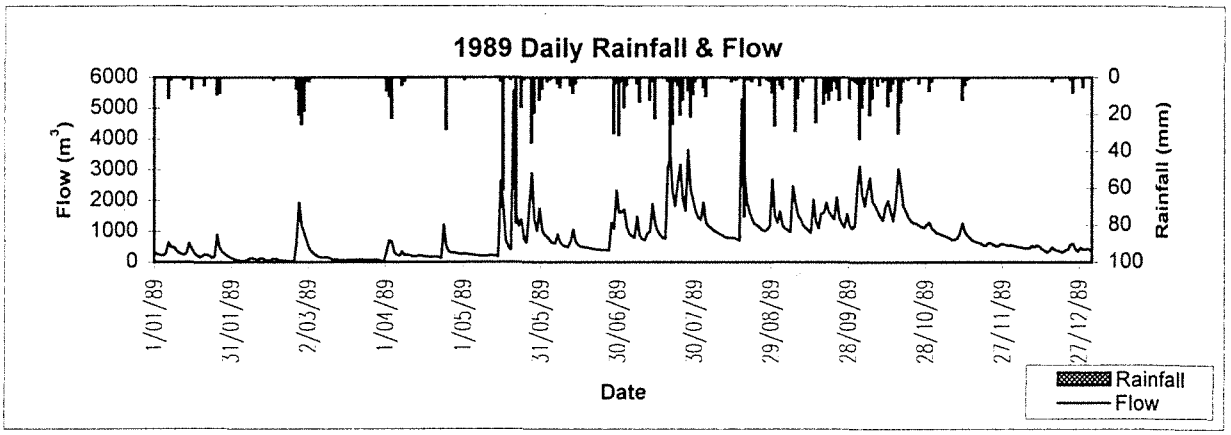


Del Park Catchment - S614007

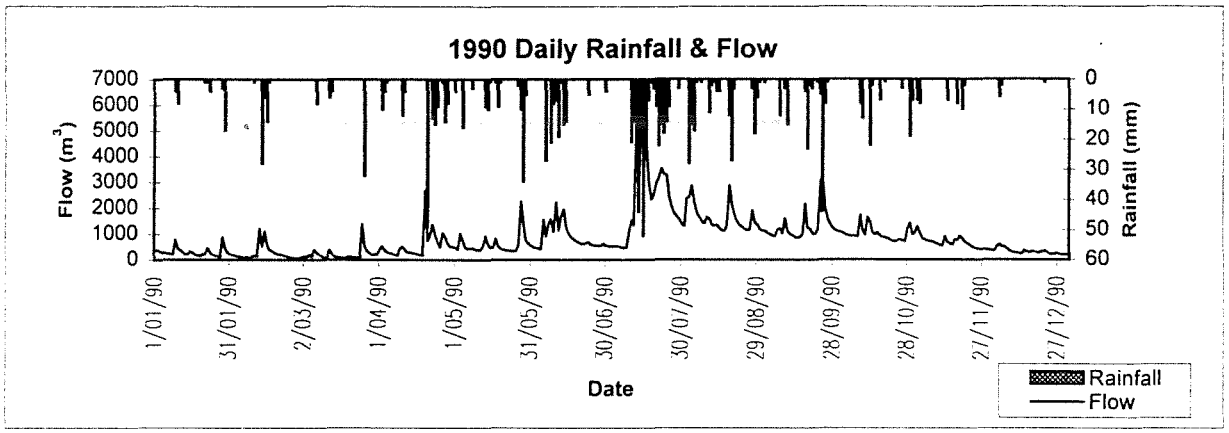


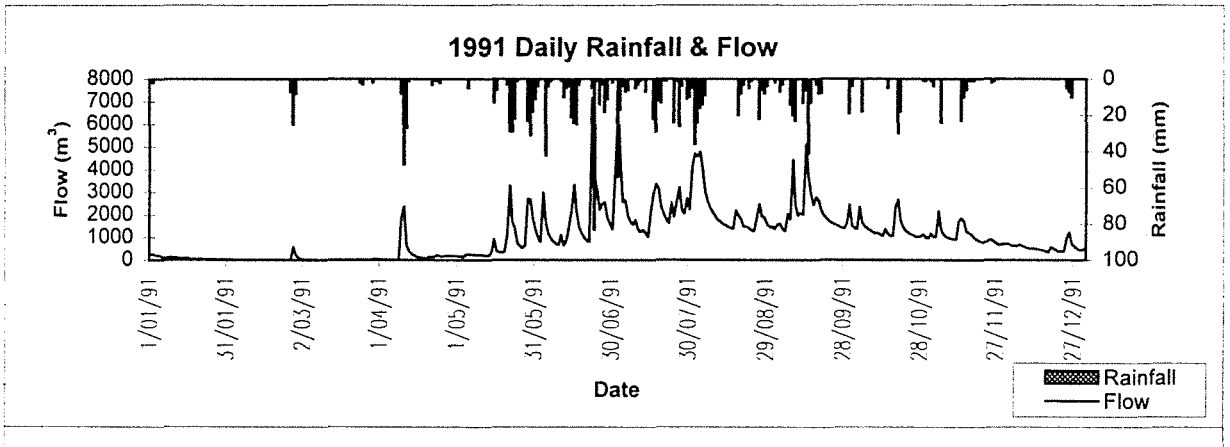


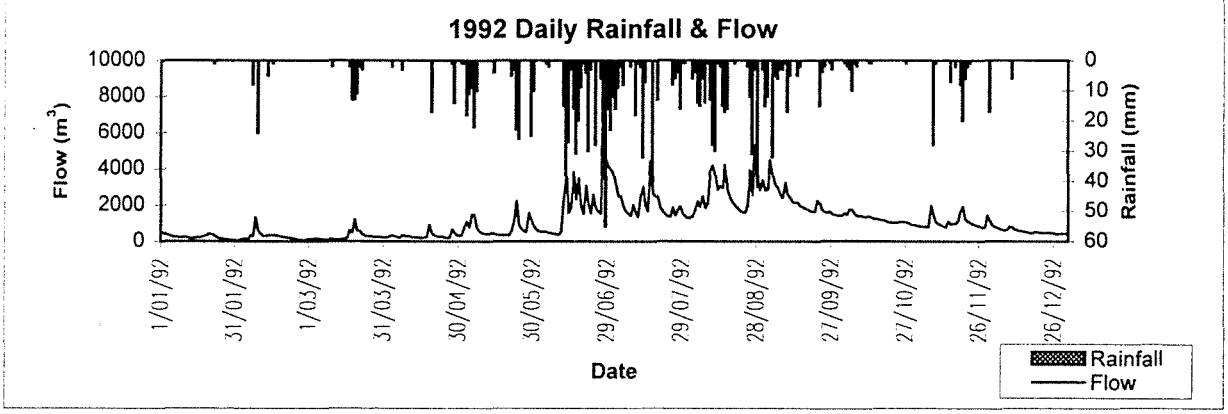


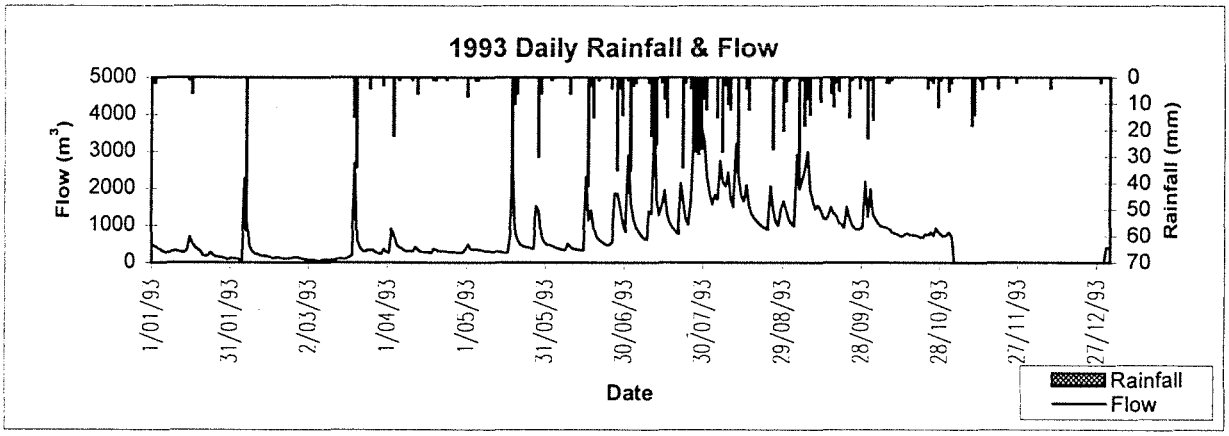


Del Park Catchment - S614007

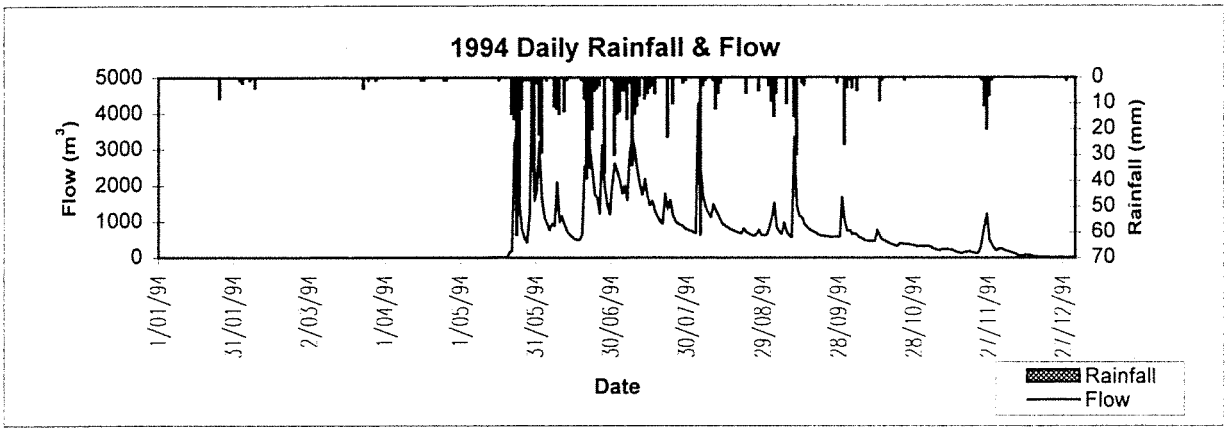


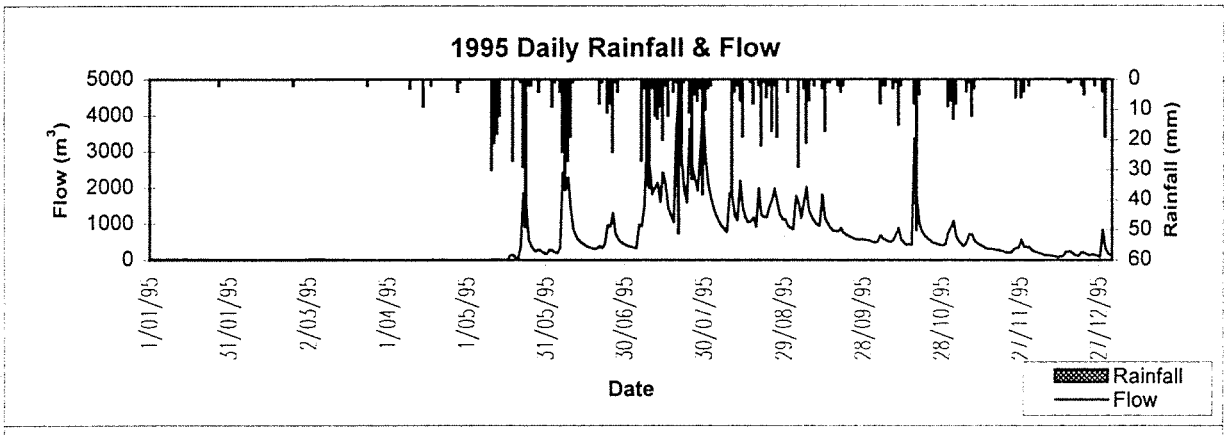


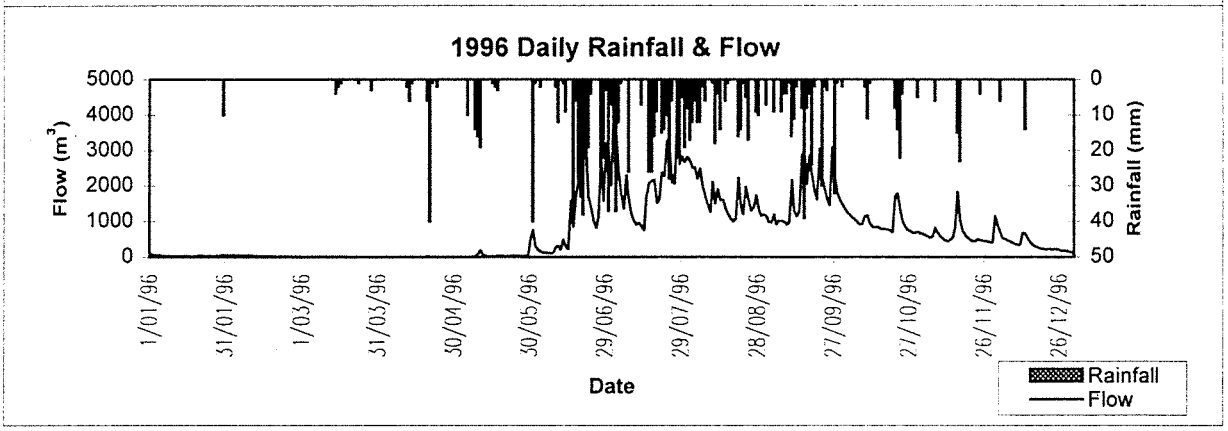




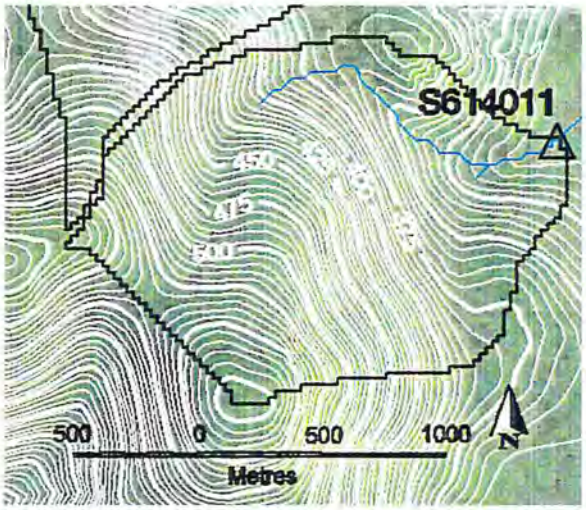
Del Park Catchment - S614007

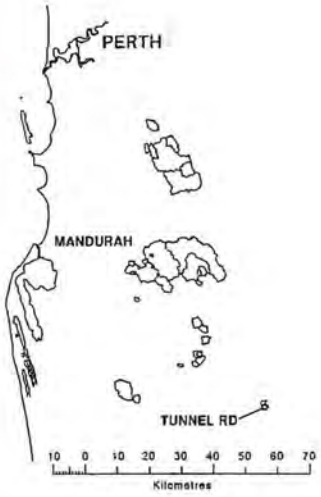






Tunnel Road Catchment





Legend

Catchment Boundary △ Gauging Station

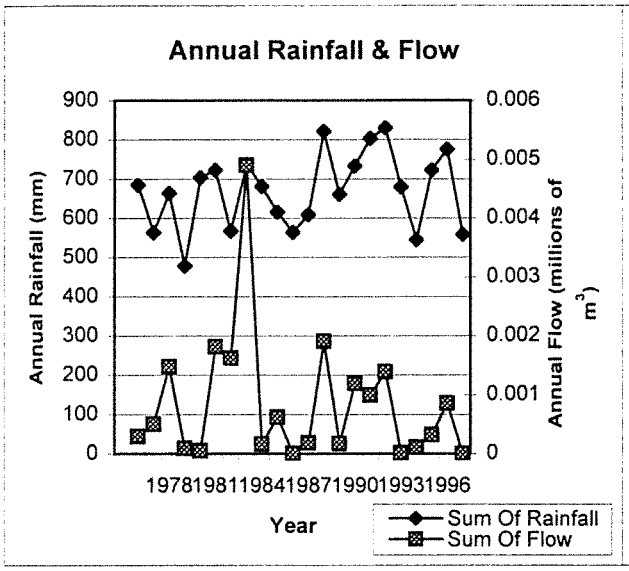
5 m Contours on Landsat Scene Jan 96

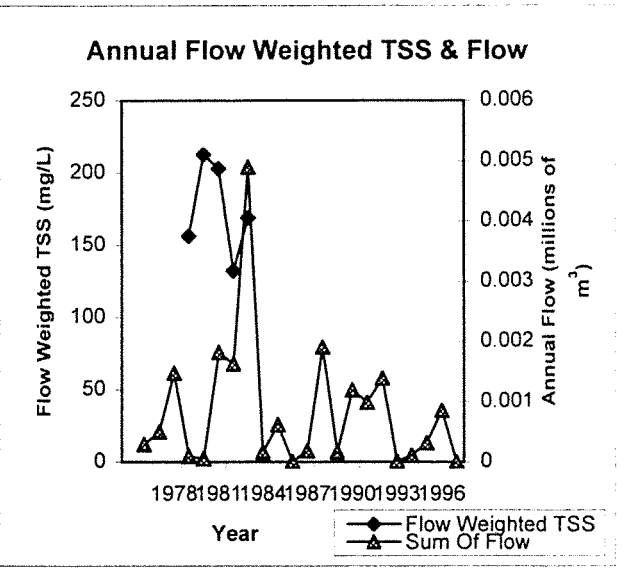
Computer Generated Stream Line

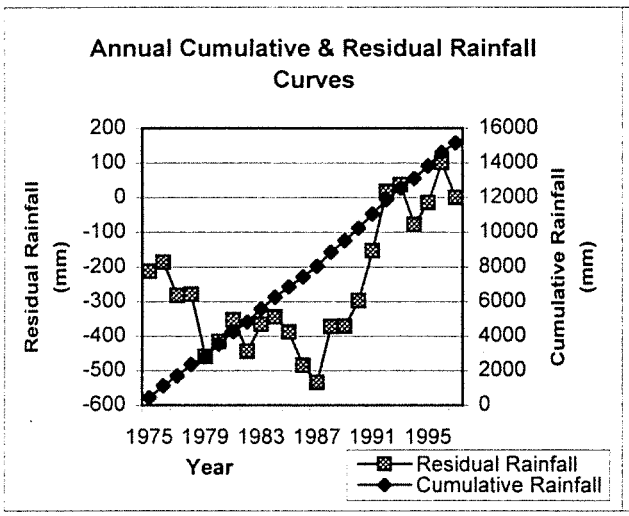
Gauging Station Number	S614011		
Rainfall Gauge Number	M509311		
Information about catchment			
Catchment area	2.07 km^2		
Gauging Station Coordinates (AMG)	N 6354050	E 451120	
Treatment data	Undisturbed Catchment		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	8339	8352	1774
Number of years recorded	24	24	6
Number of years with complete records	22	22	4
Start date	3/06/75	21/05/75	13/06/79
Finish date	1/04/98	1/04/98	10/04/84
Number of days with quality code 1	7794	8205	1222
Number of days with quality code 2	141	86	32
Number of days with quality code 3	209	0	254
Number of days with quality code 4	19	22	264
Number of days with quality code 157	150	26	0
Number of days with quality code 255	26	13	2
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	669.1	0.008	179.18
Min	478.4	0.000	132.15
Max	830.2	0.005	212.67

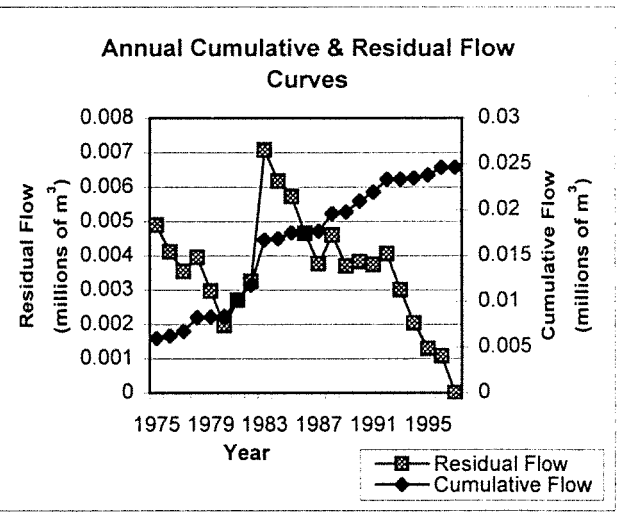
Year	Number of flow days
1976	18
1977	7
1978	27
1979	3
1980	7
1981	20
1982	6
1983	43
1984	6
1985	13
1986	1
1987	7
1988	31
1989	5
1990	10
1991	9
1992	25
1993	3
1994	6
1995	9
1996	23
Total	**279**

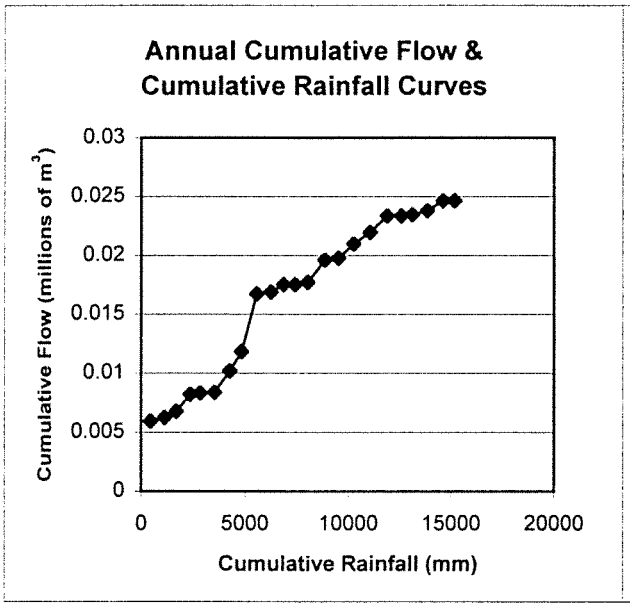
Tunnel Road Catchment - S 614011

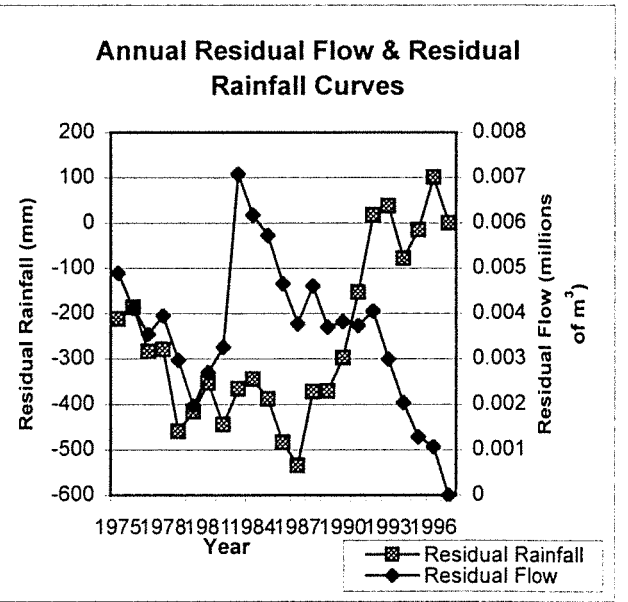




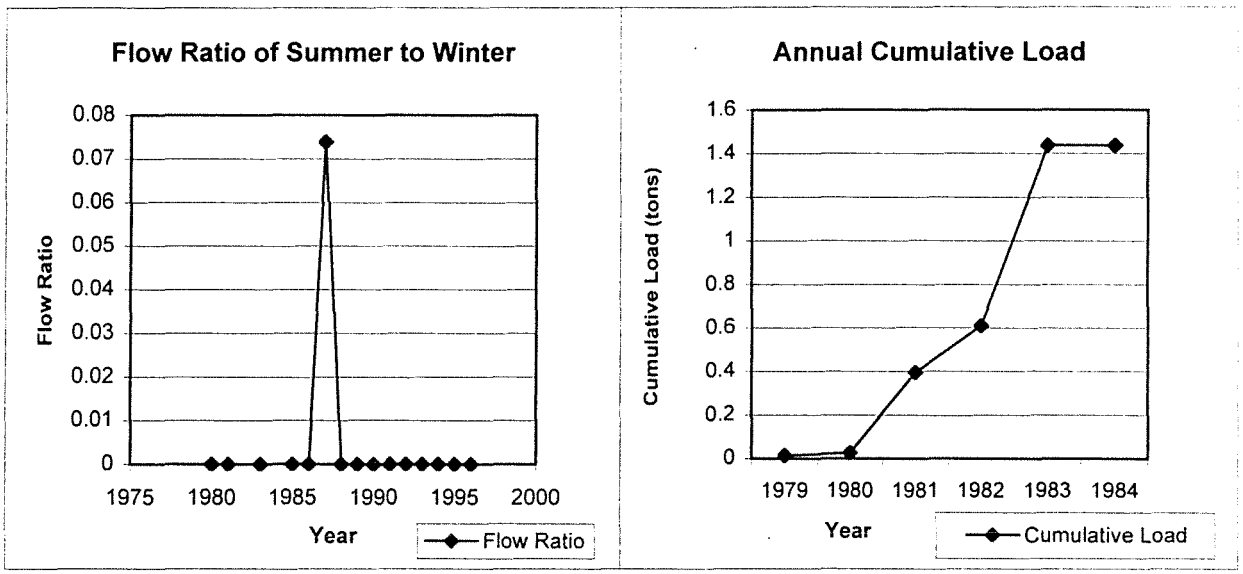




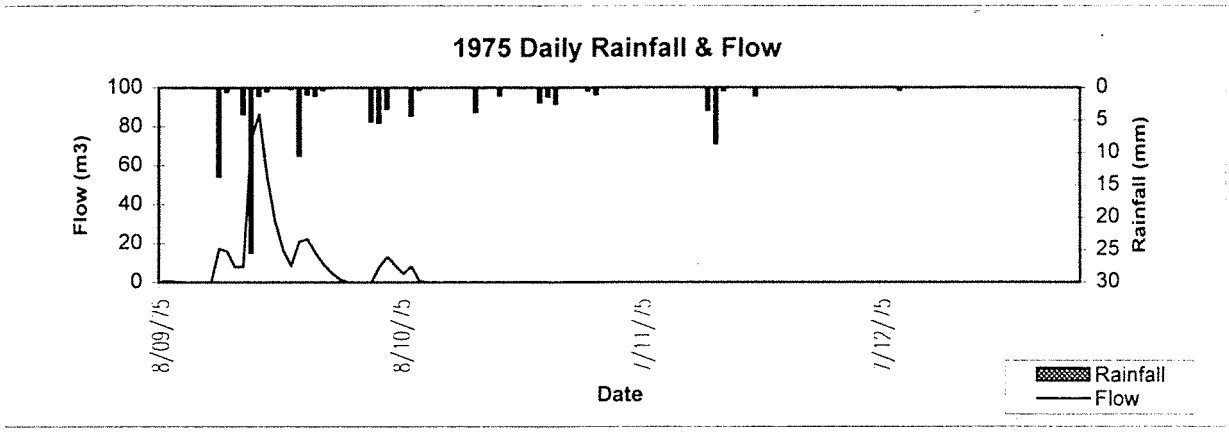




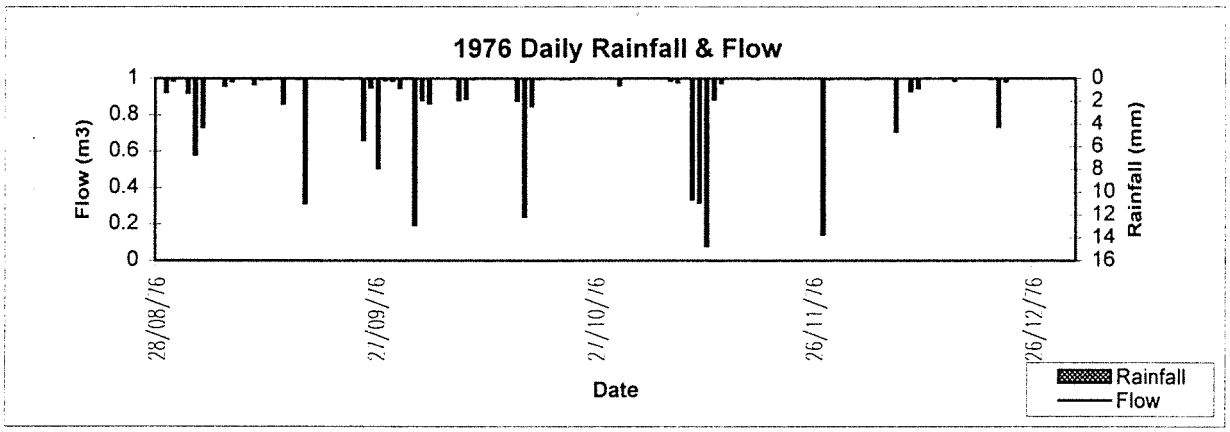
Tunnel Road Catchment - S 614011



Tunnel Road Catchment - S 614011

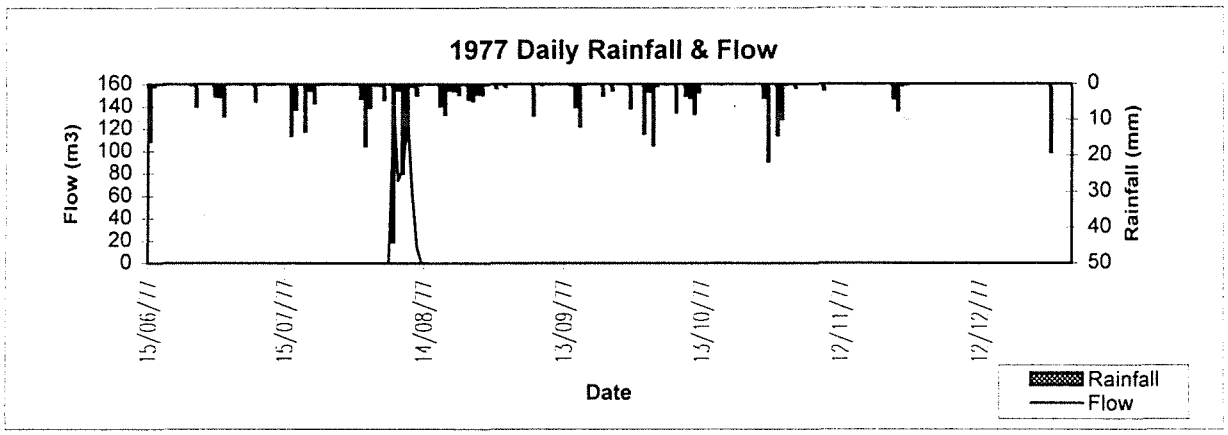


Salinity data not avalilable for 1975

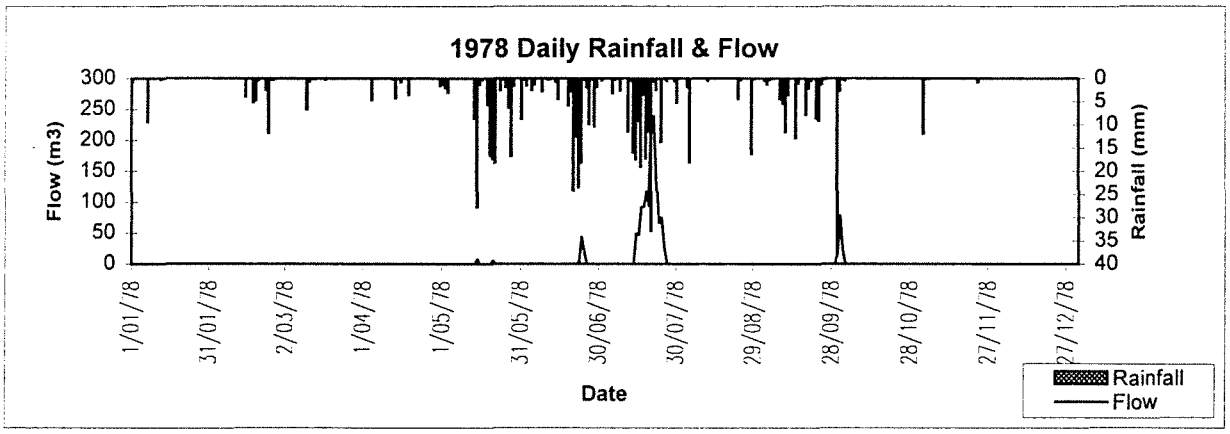


Salinity data not avalilable for 1976

Tunnel Road Catchment - S 614011

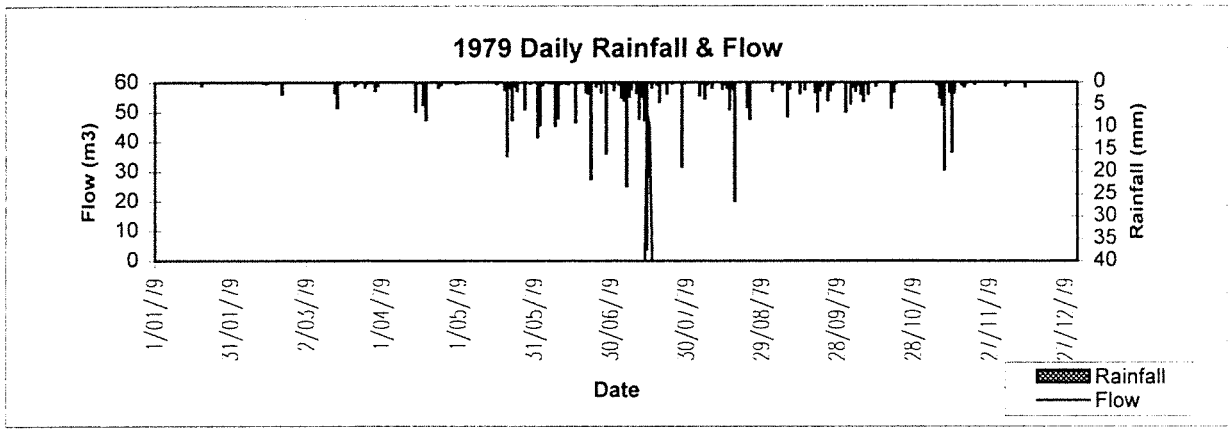


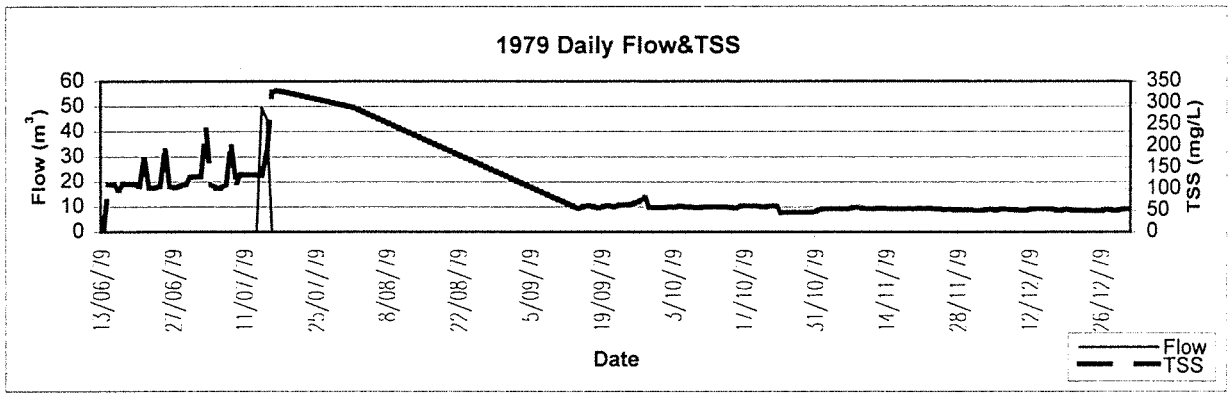
Salinity data not avalilable for 1977

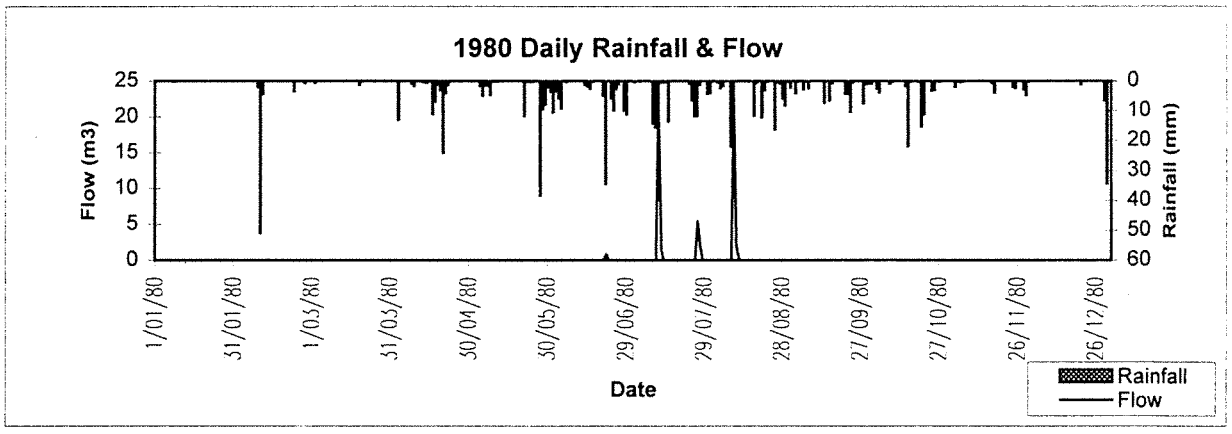


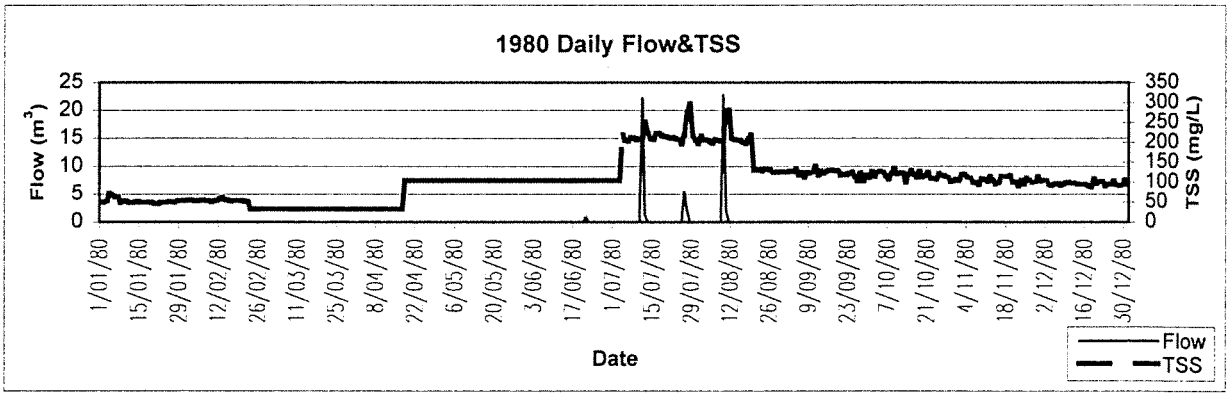
Salinity data not avalilable for 1978

Tunnel Road Catchment - S 614011

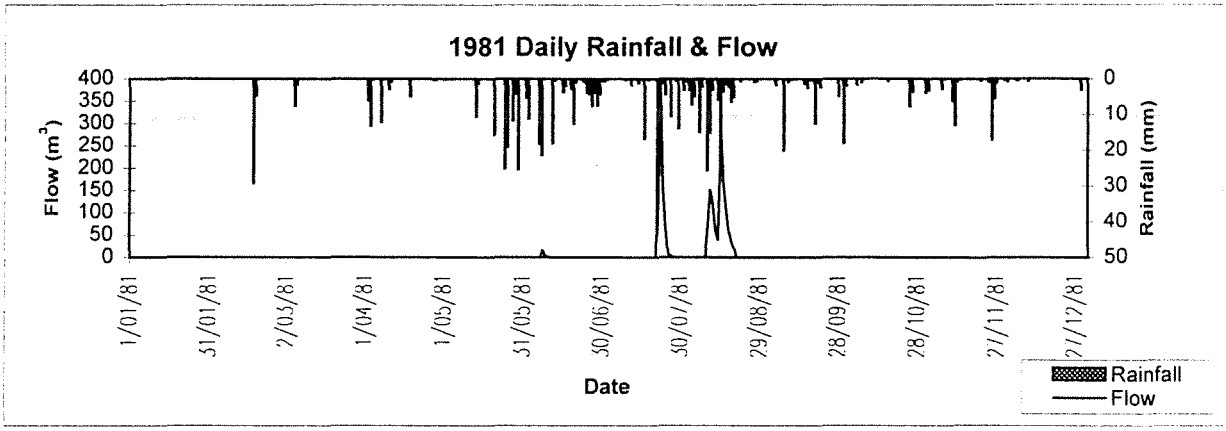


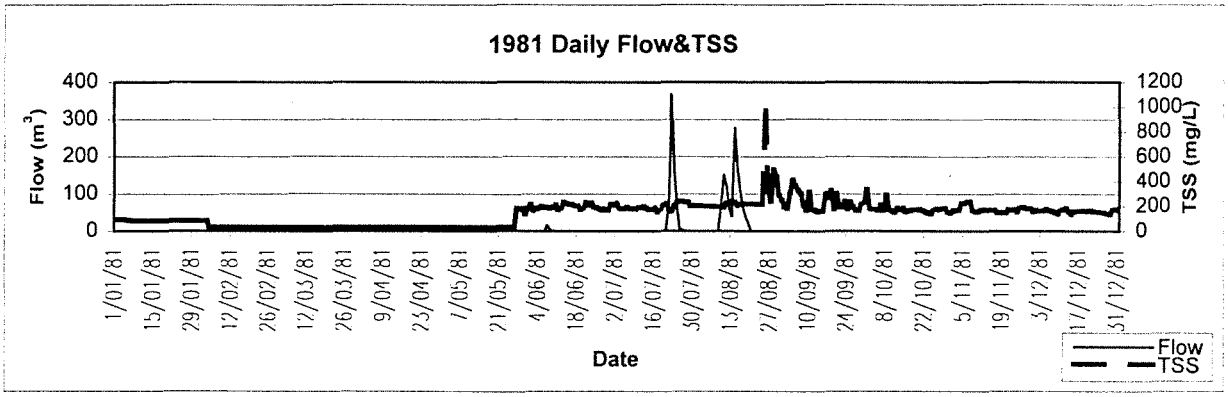


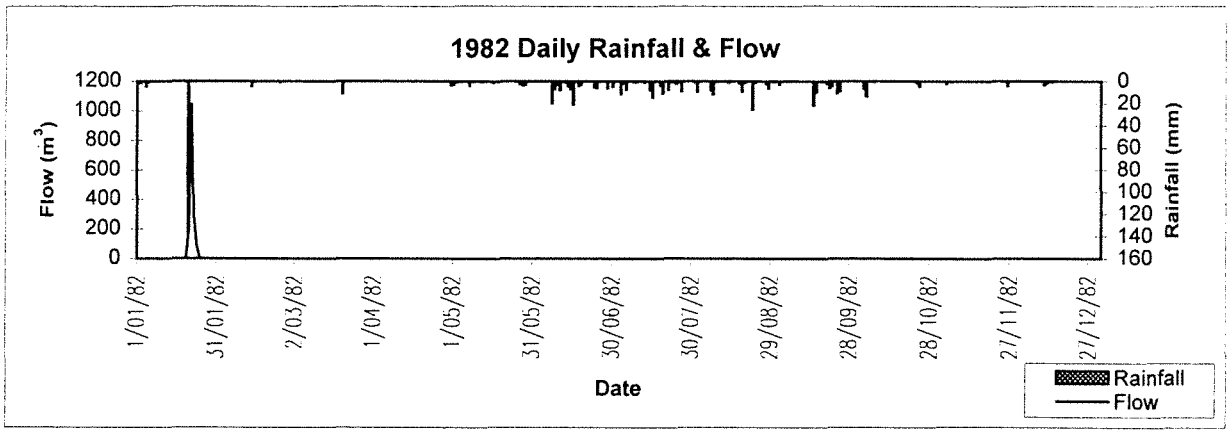


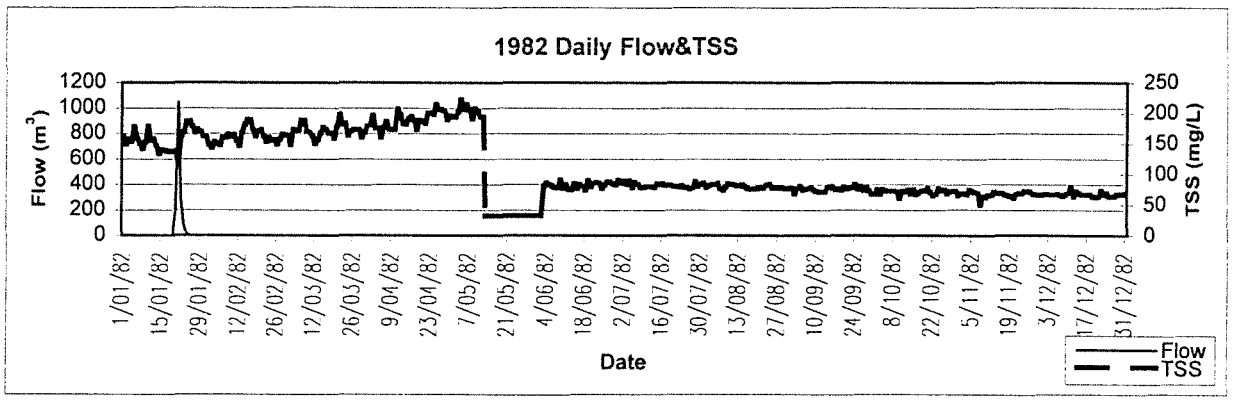


Tunnel Road Catchment - S 614011

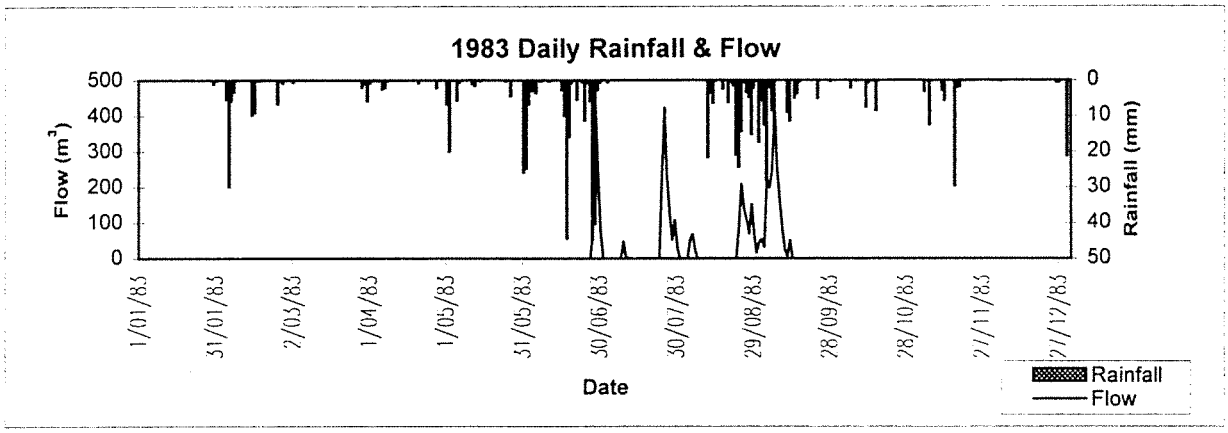


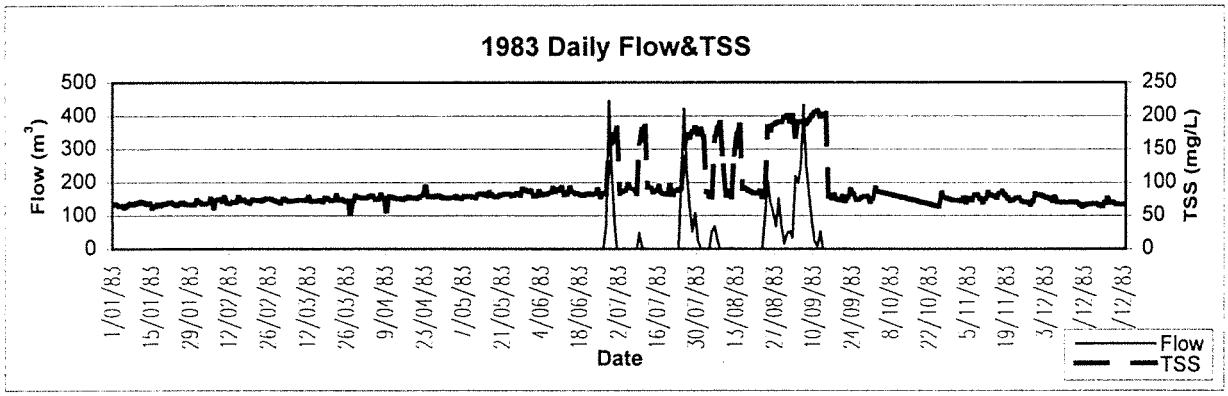


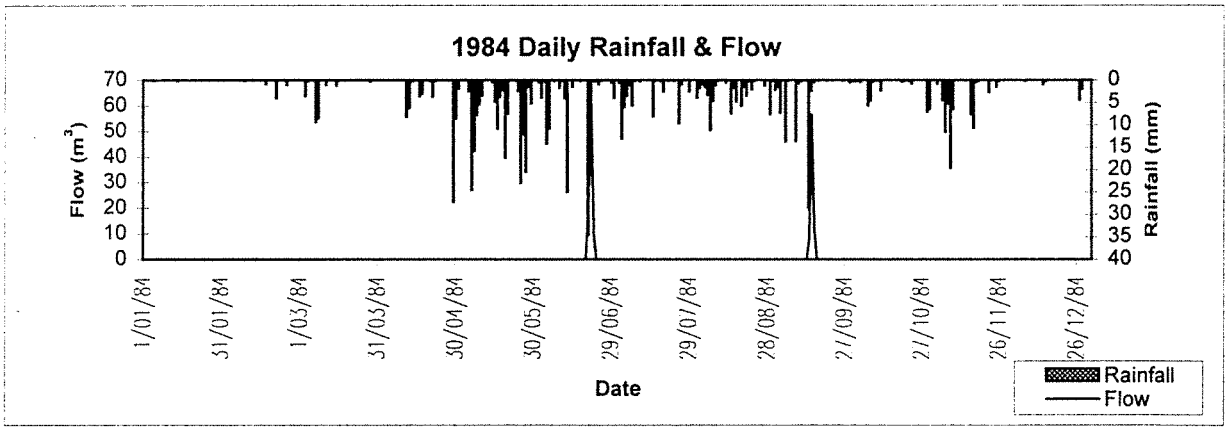


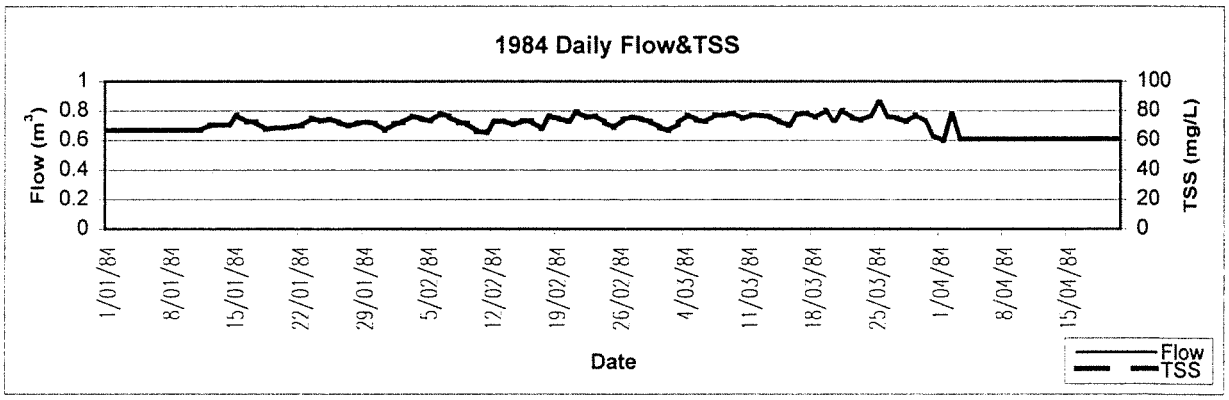


Tunnel Road Catchment - S 614011

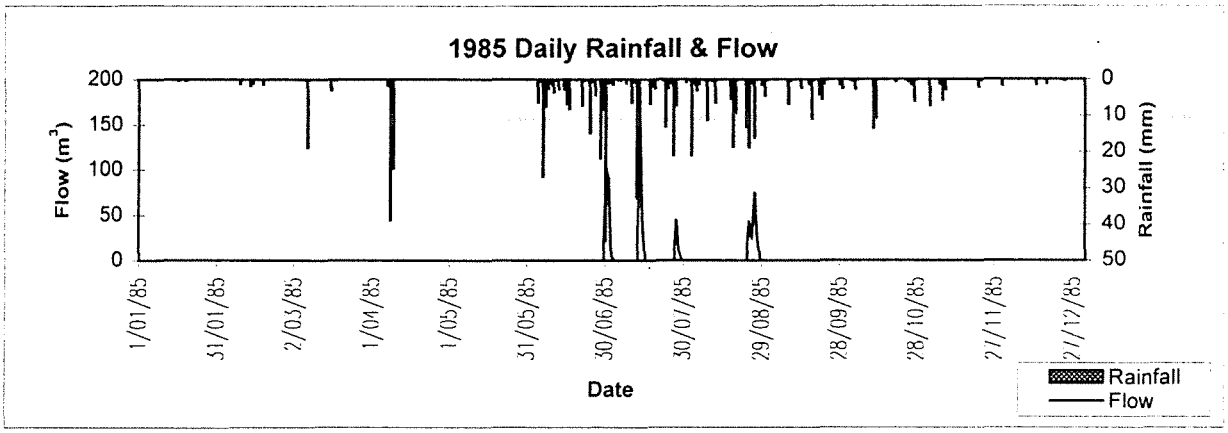


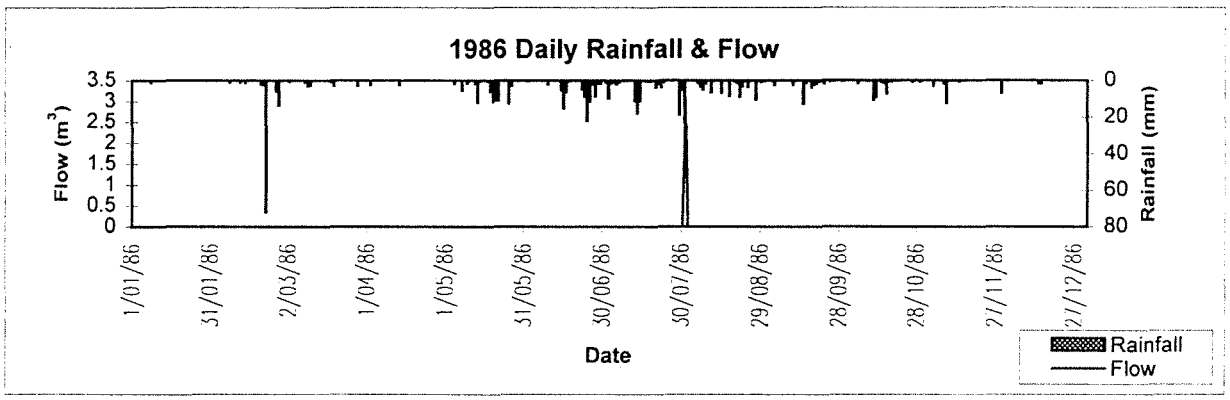


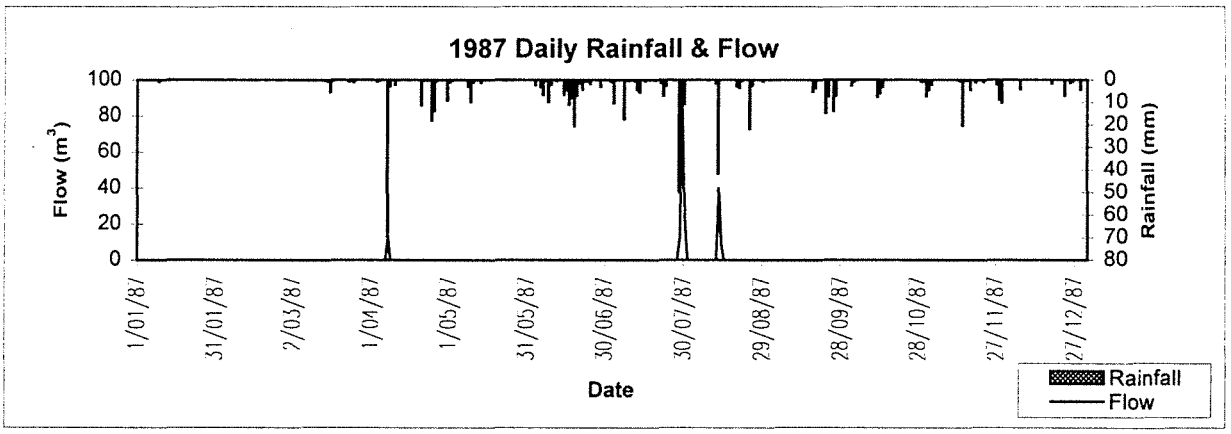


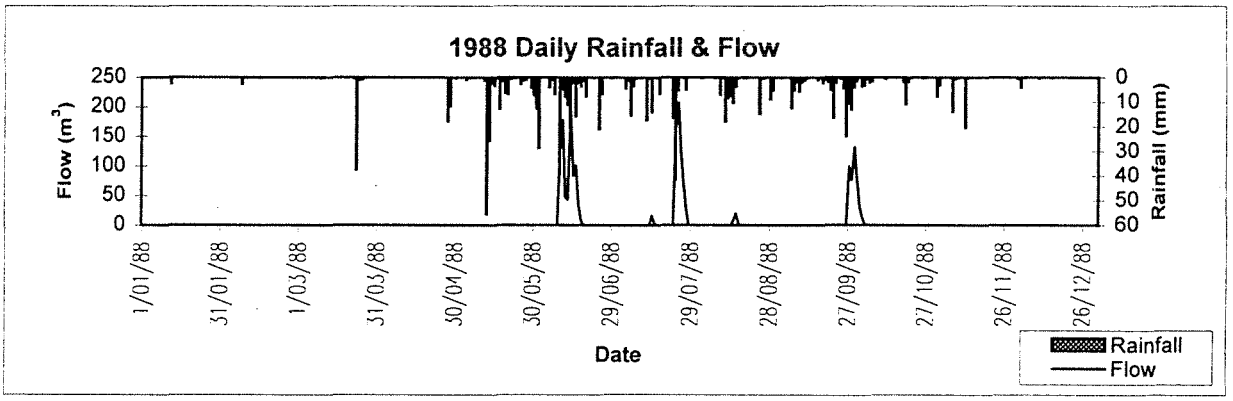


Tunnel Road Catchment - S 614011

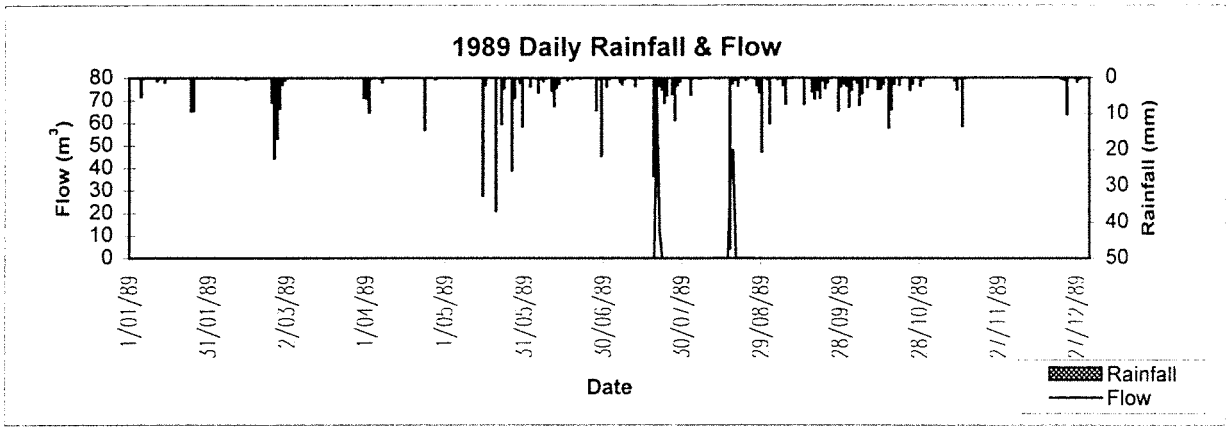


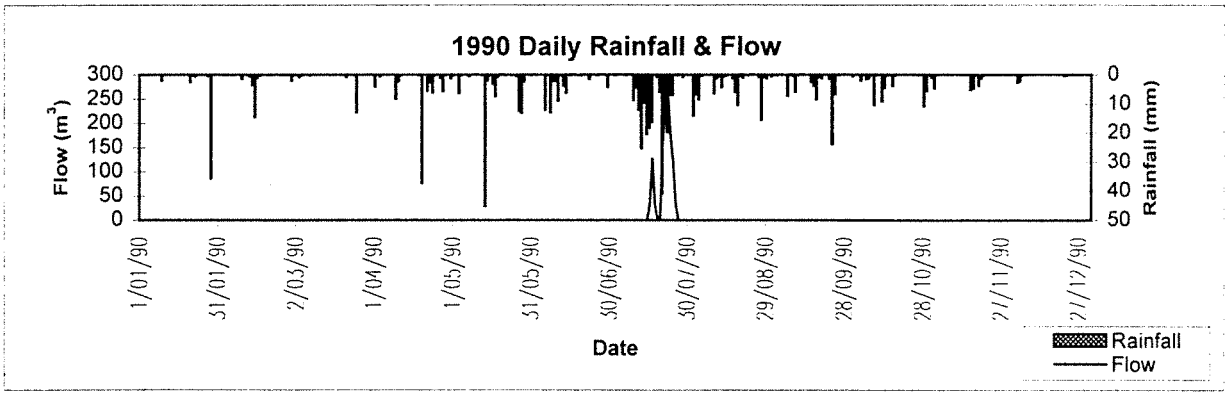


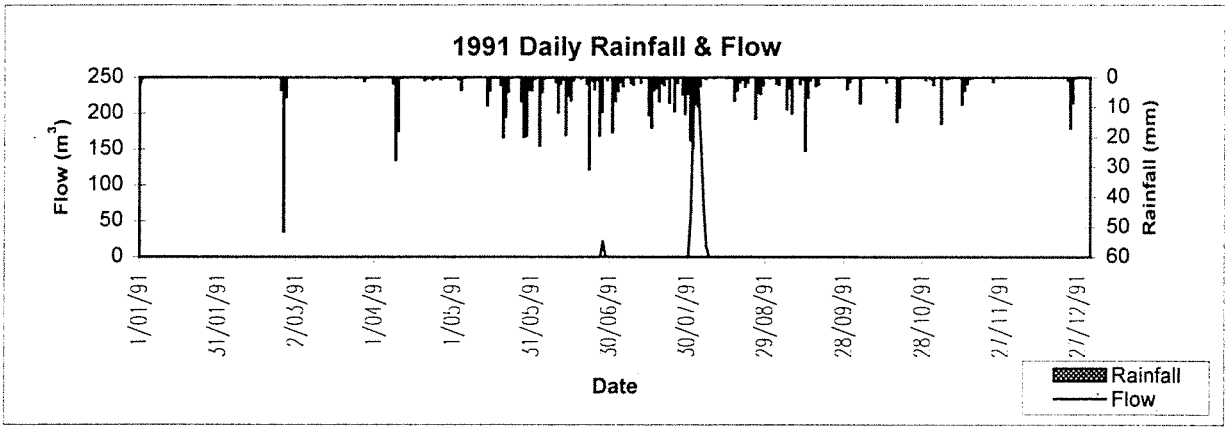


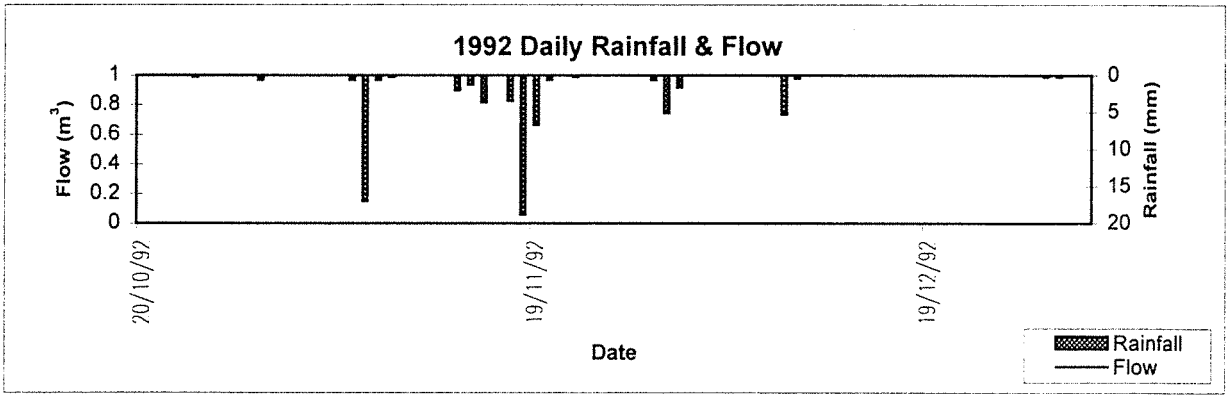


Tunnel Road Catchment - S 614011

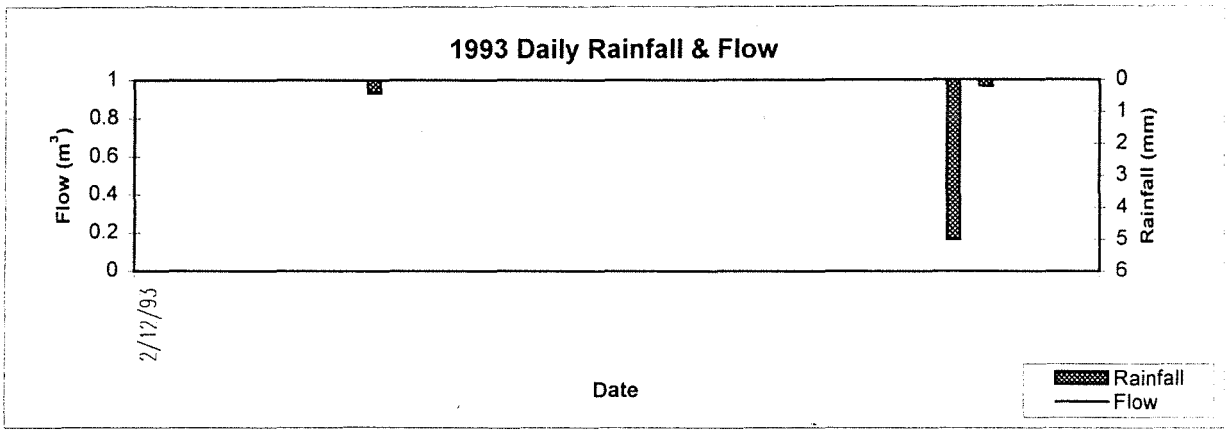


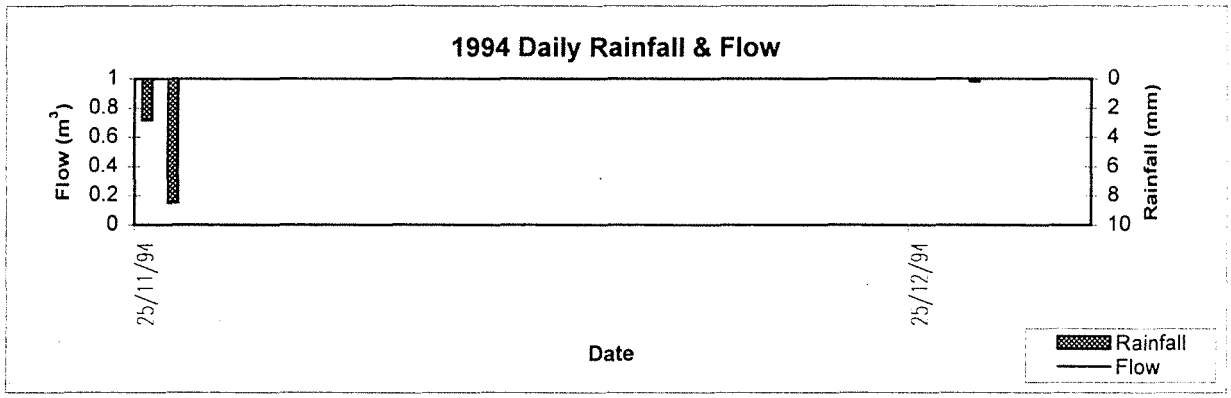


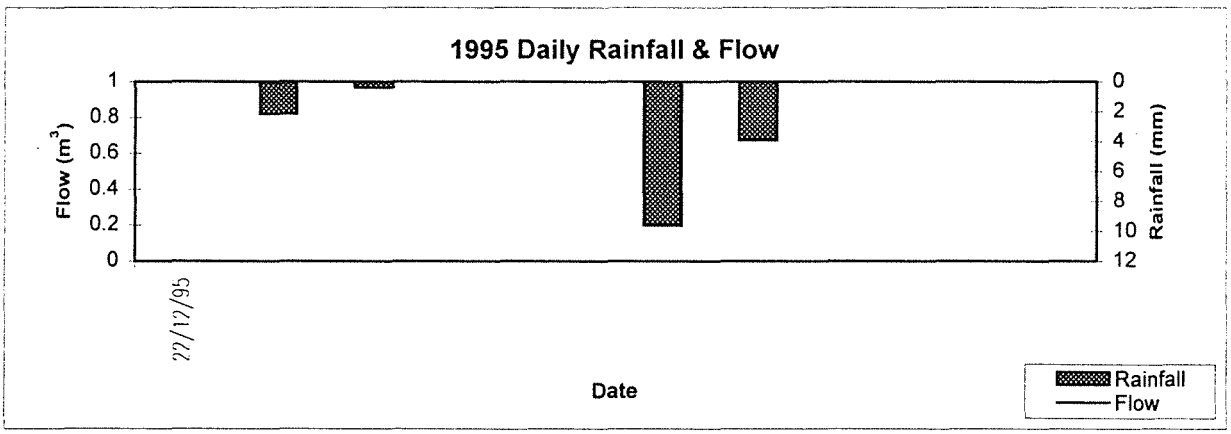


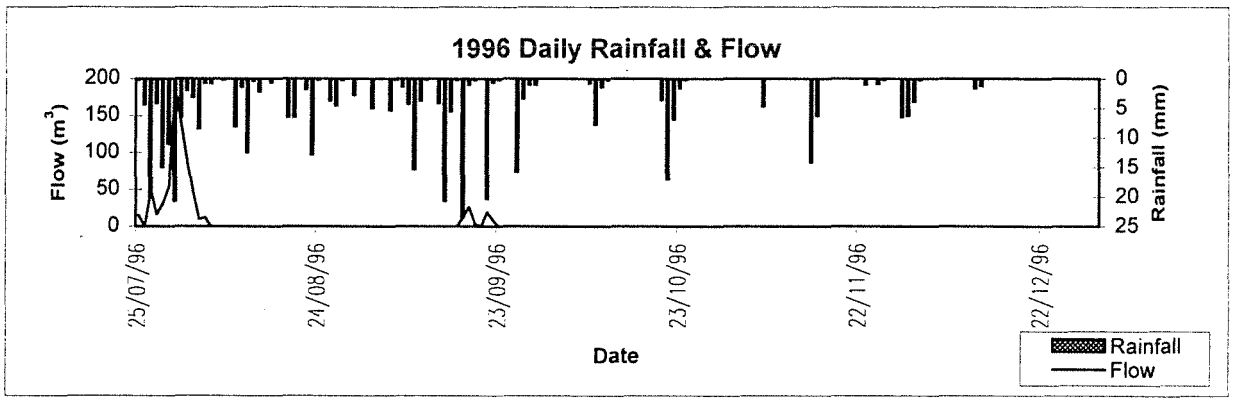


Tunnel Road Catchment - S 614011

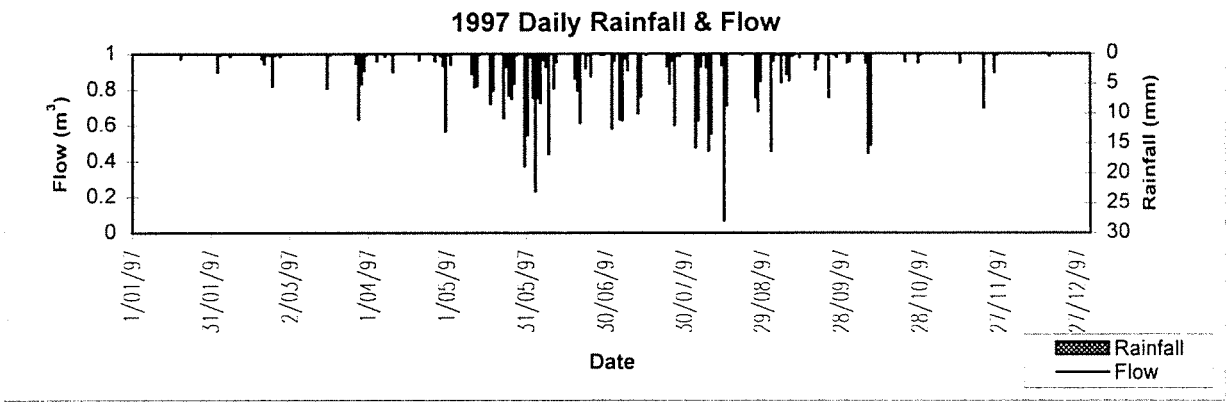




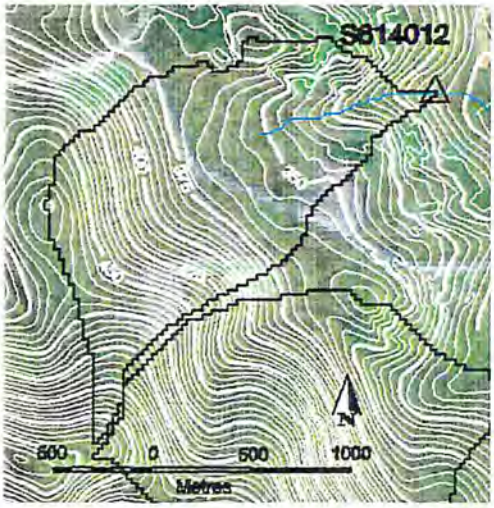


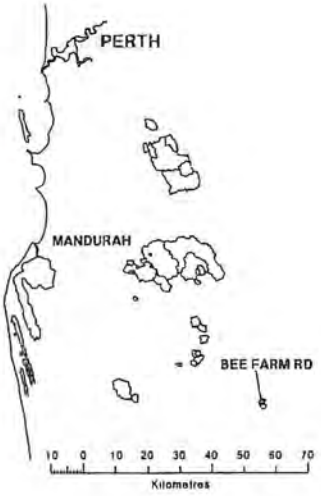


Tunnel Road Catchment - S 614011



Bee Farm Road Catchment





Legend

Catchment Boundary Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

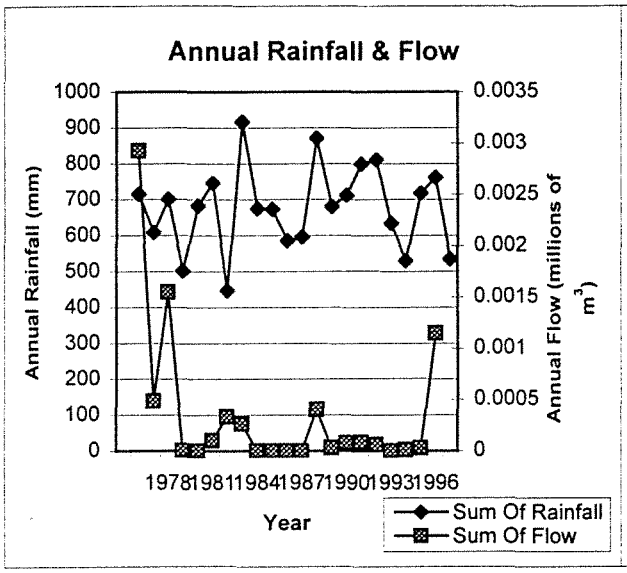
Gauging Station Number	S614012	
Rainfall Gauge Number	M509312	
Information about catchment		
Catchment area	1.81 km^2	
Gauging Station Coordinates (AMG)	N 6354000	E 450500
Treatment data	Bauxite mining in 1986.	

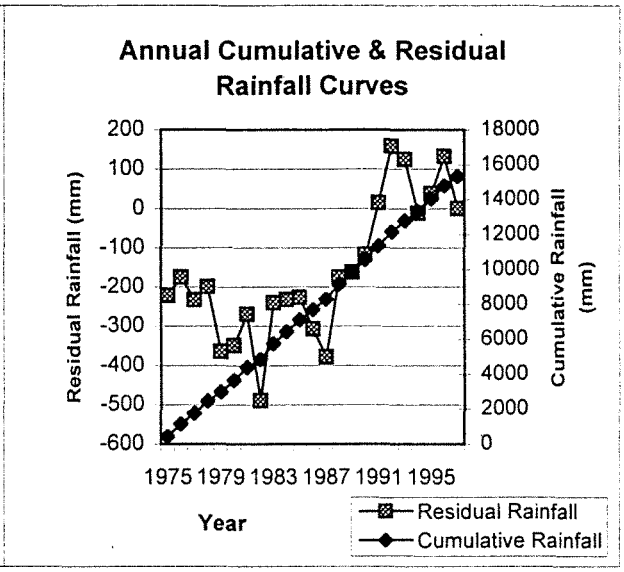
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	8372	8378	0
Number of years recorded	24	24	0
Number of years with complete records	22	22	0
Start date	5/06/75	6/05/98	
Finish date	30/05/75	6/05/98	
Number of days with quality code 1	7988	8191	
Number of days with quality code 2	232	83	
Number of days with quality code 3	34	49	
Number of days with quality code 4	59	34	
Number of days with quality code 157	34	10	
Number of days with quality code 255	25	11	

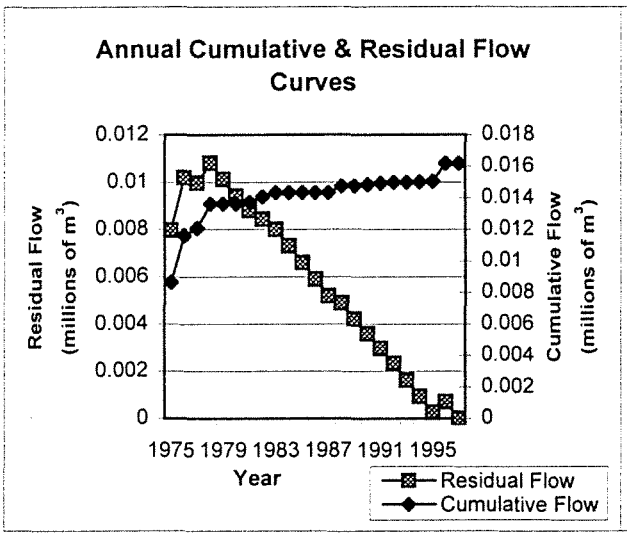
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	677.6	0.00044289
Min	447.2	0.000000036
Max	916.9	0.002926094

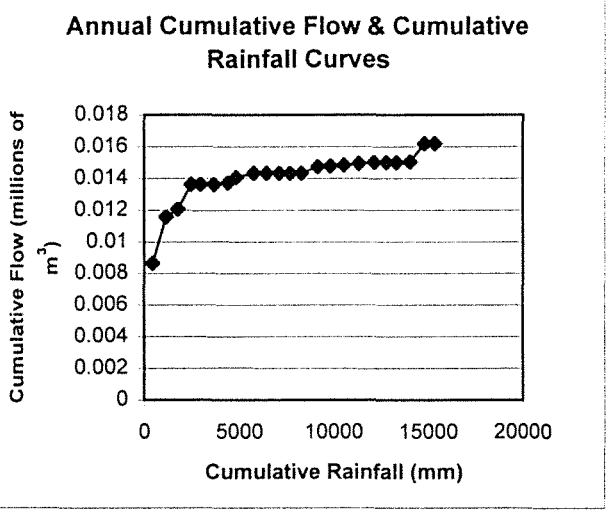
Year	**Number of flow days**
1976	329
1977	77
1978	25
1979	4
1980	1
1981	9
1982	3
1983	15
1985	1
1988	19
1989	4
1990	7
1991	4
1992	5
1994	1
1995	6
1996	89
Total	**599**

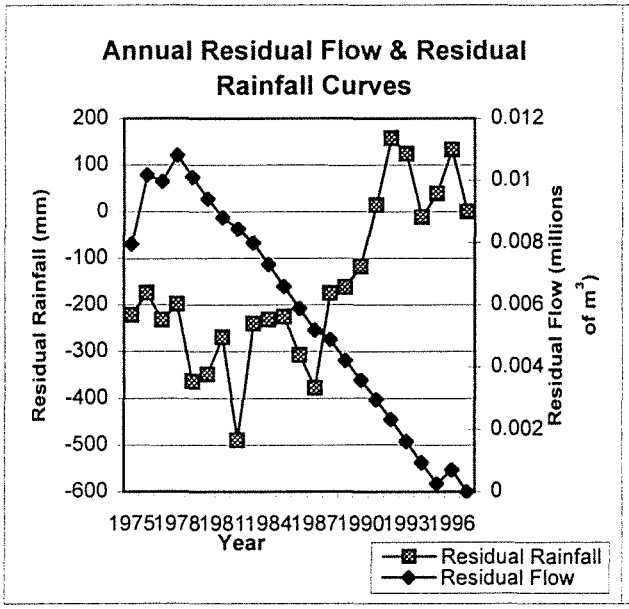
Bee Farm Road Catchment - S 614012

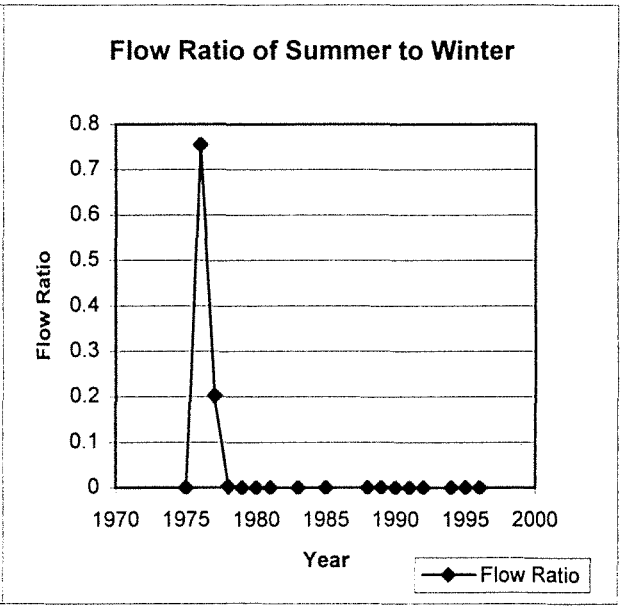




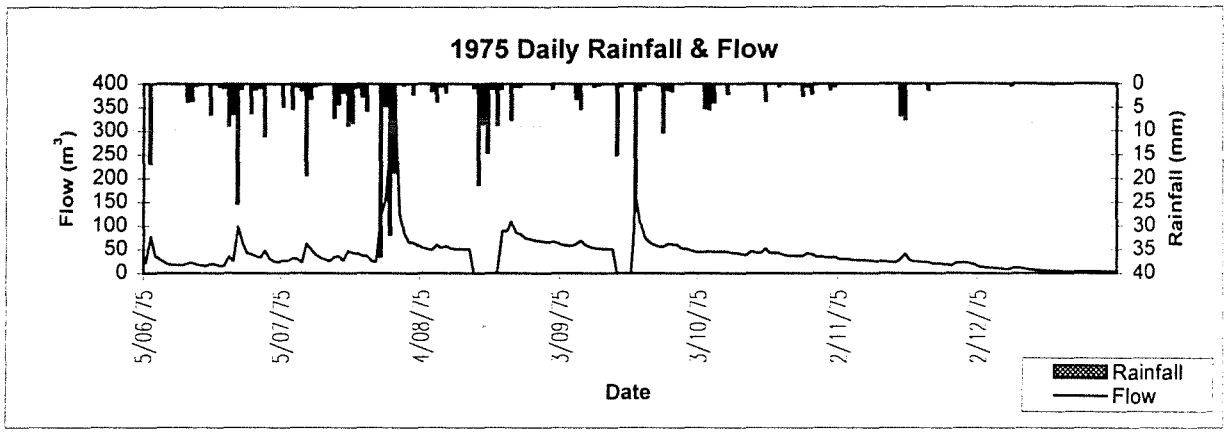


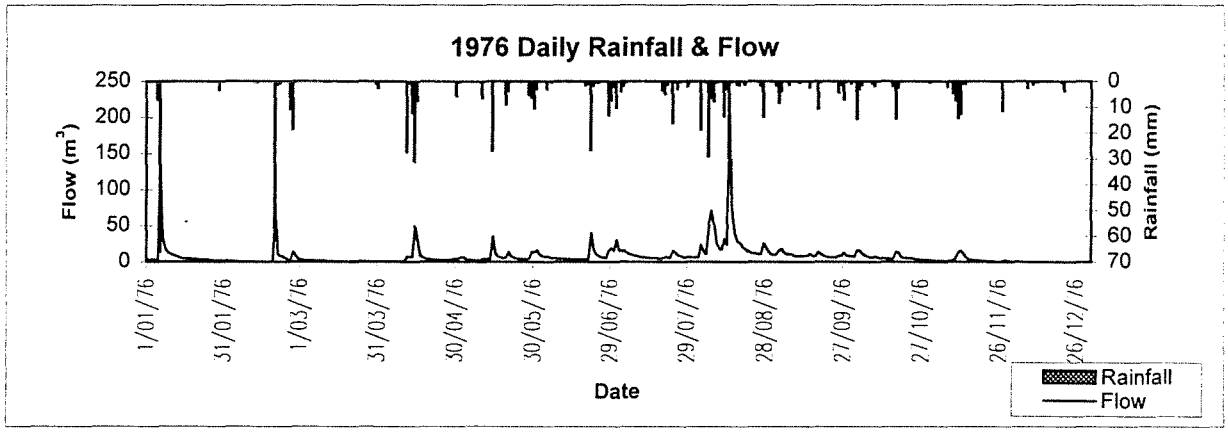


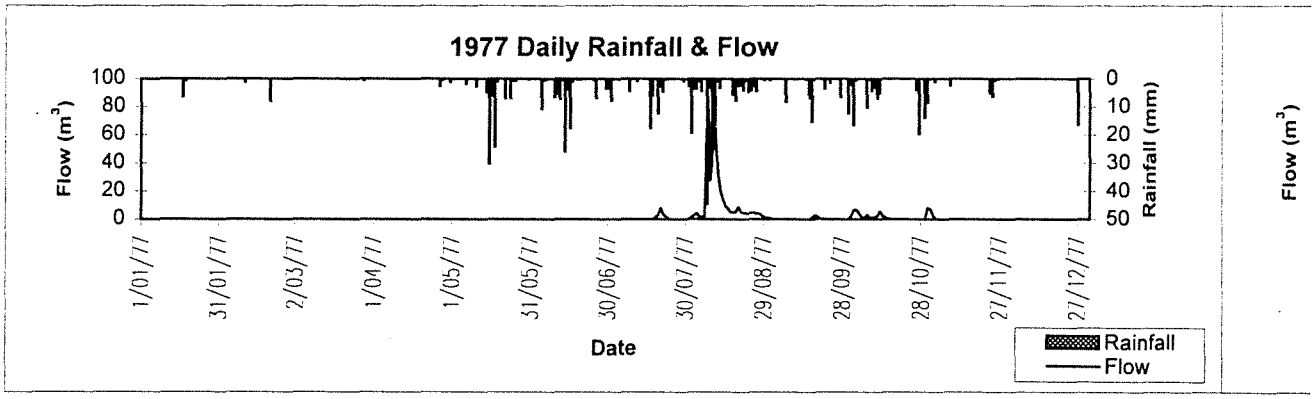


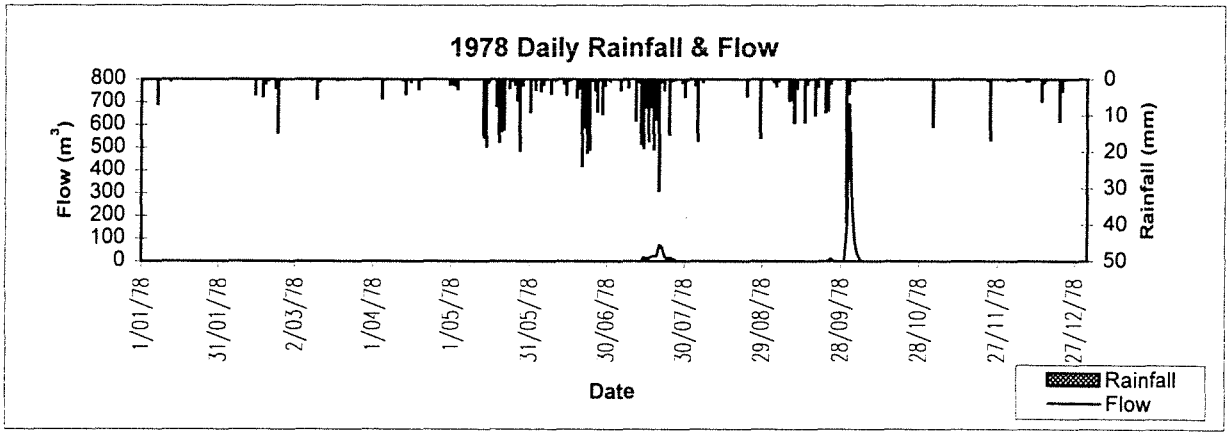


Bee Farm Road Catchment - S614012

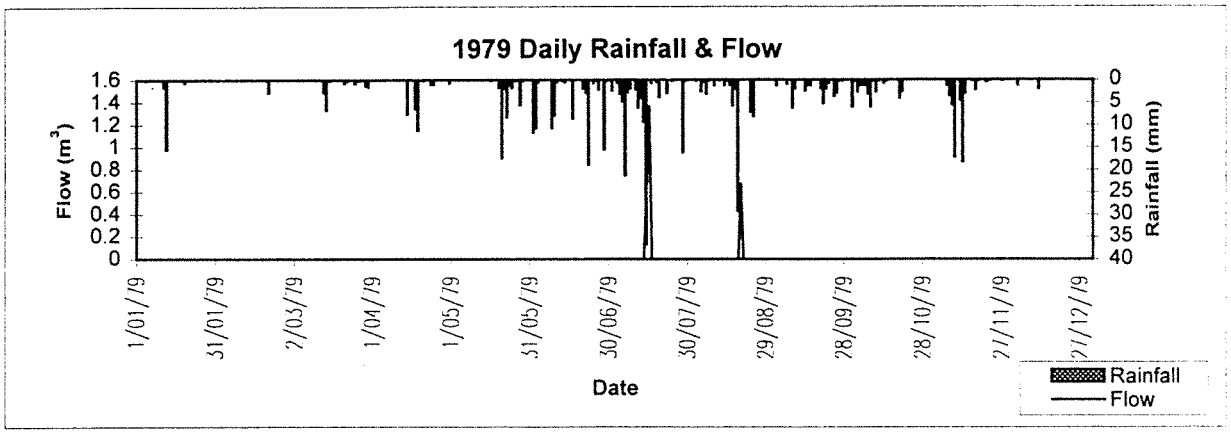


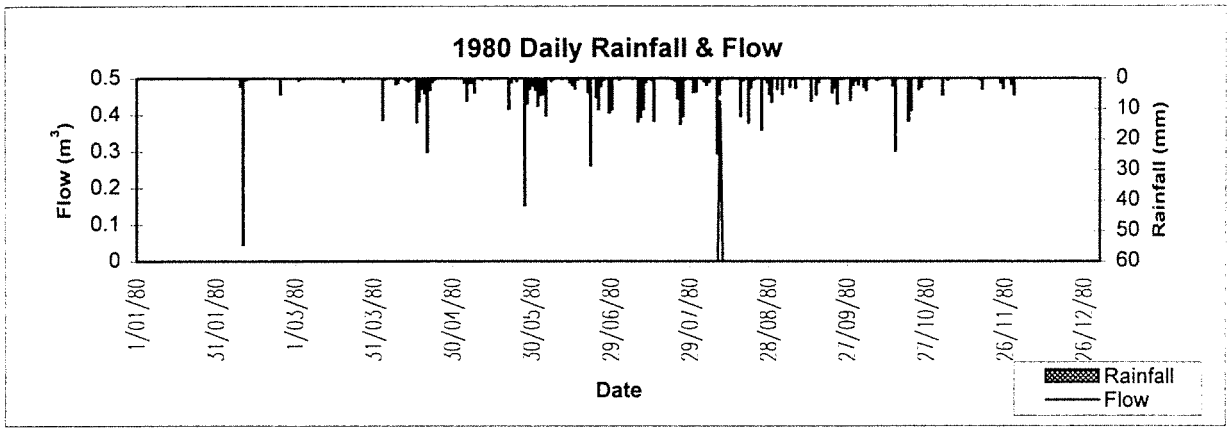


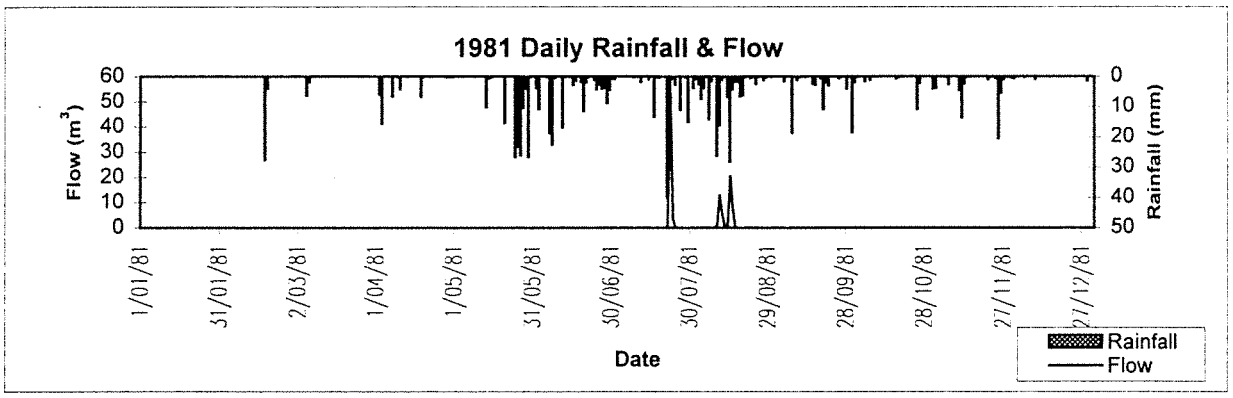


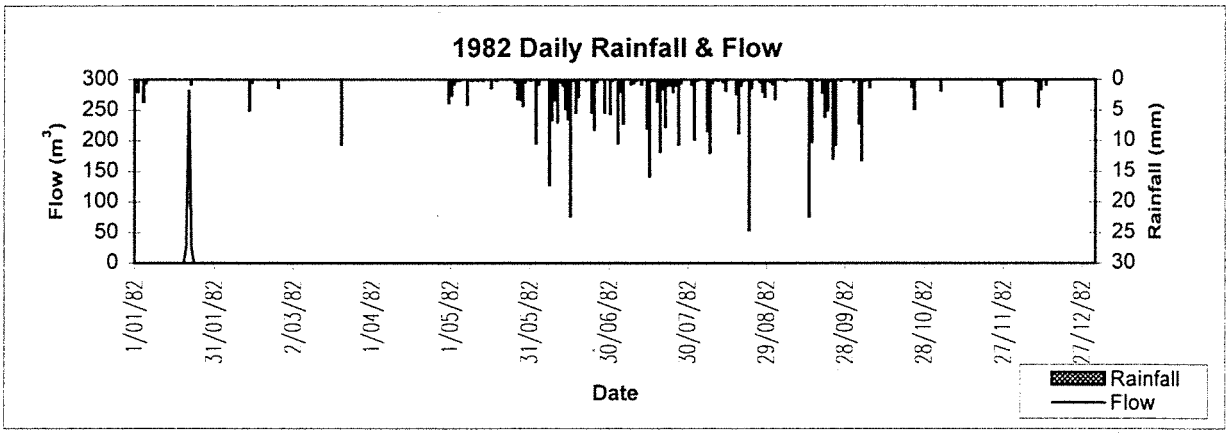


Bee Farm Road Catchment - S614012

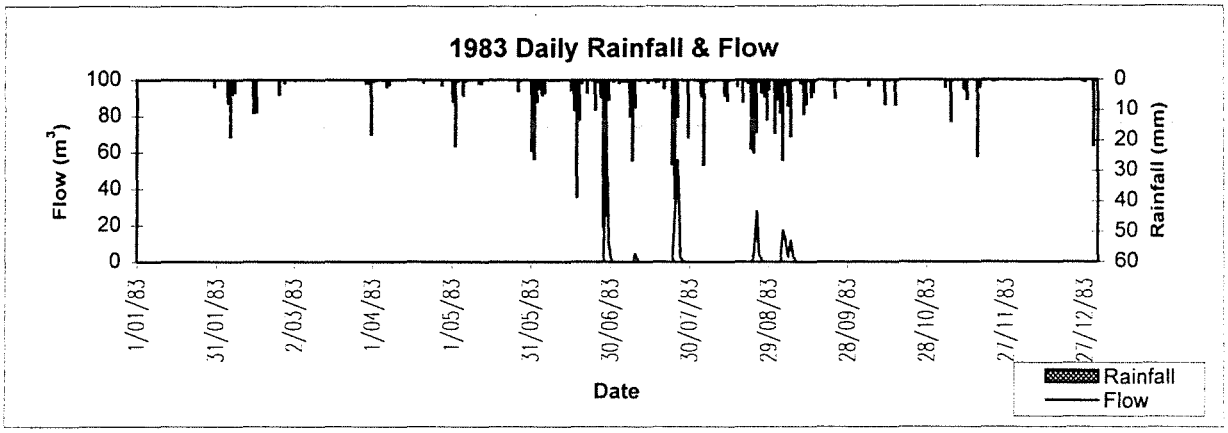


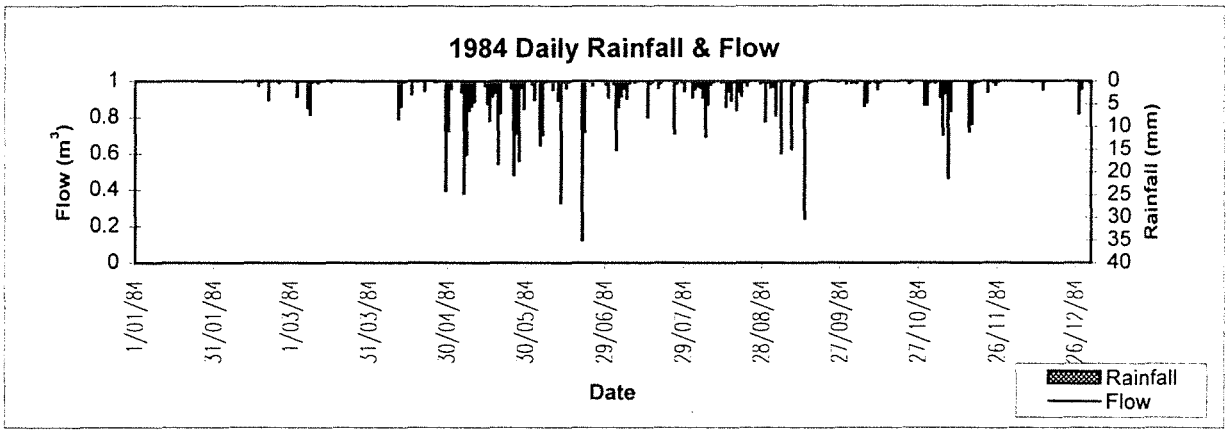


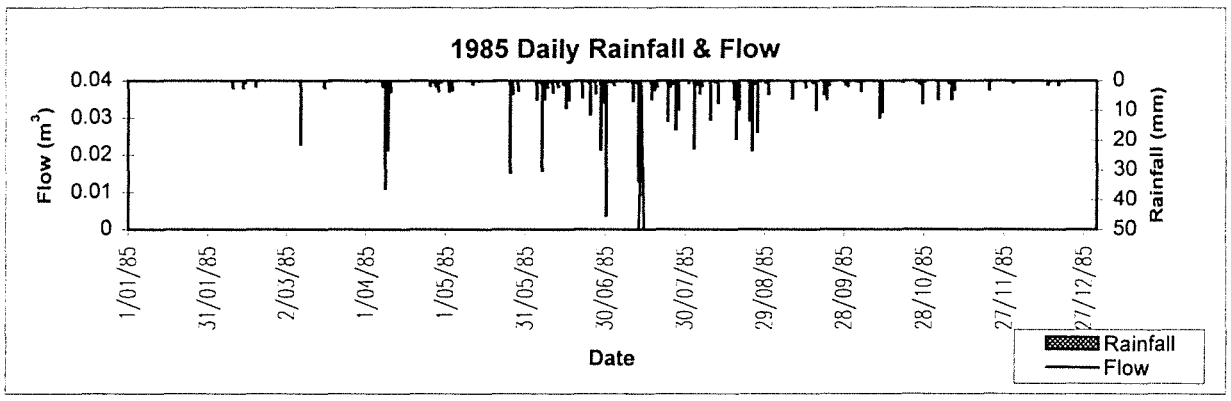


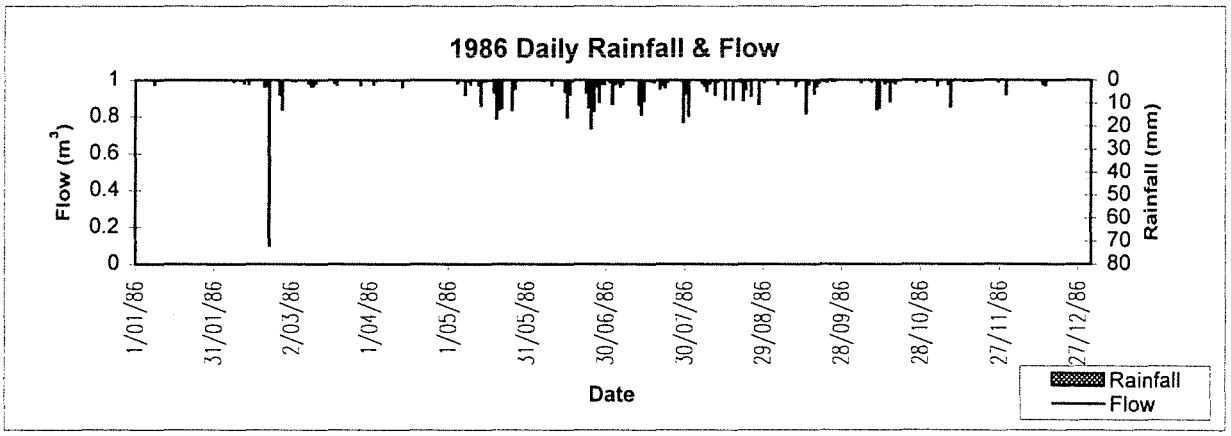


Bee Farm Road Catchment - S614012

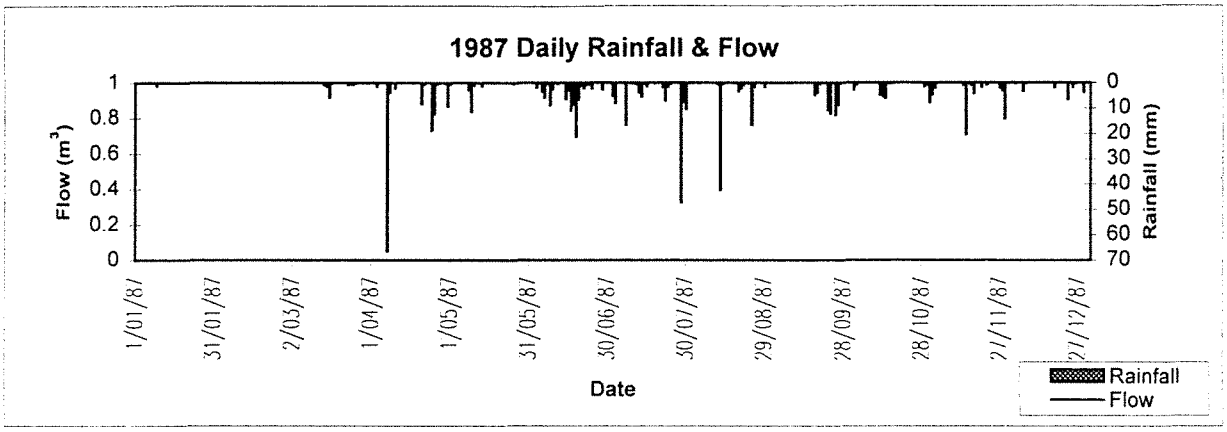


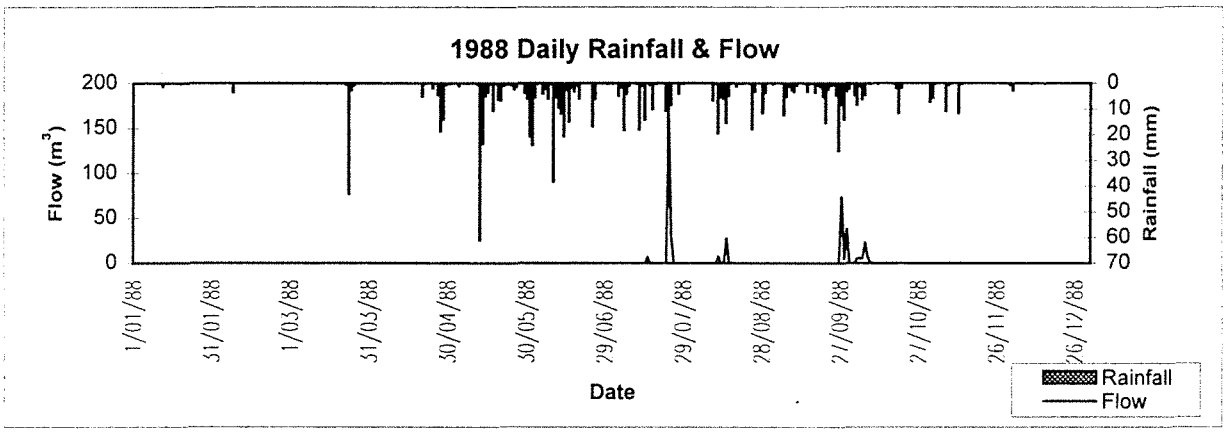


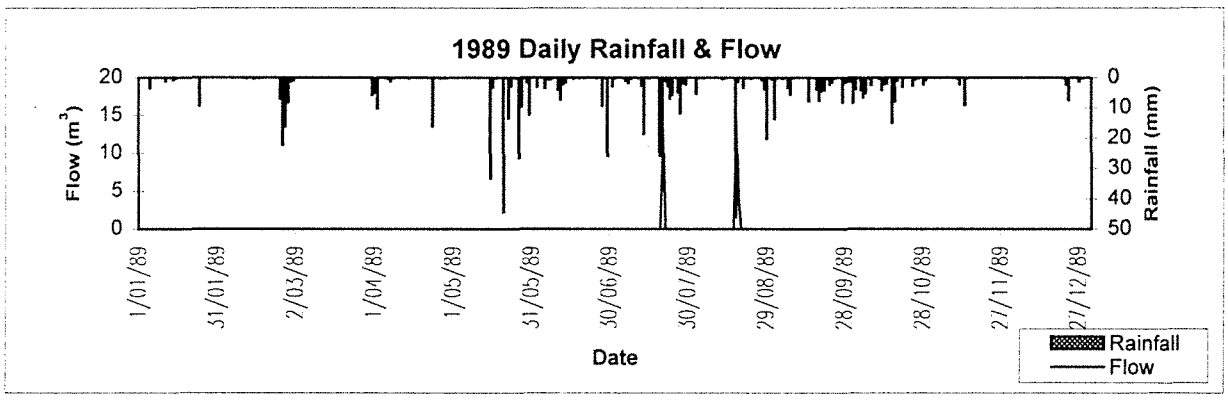


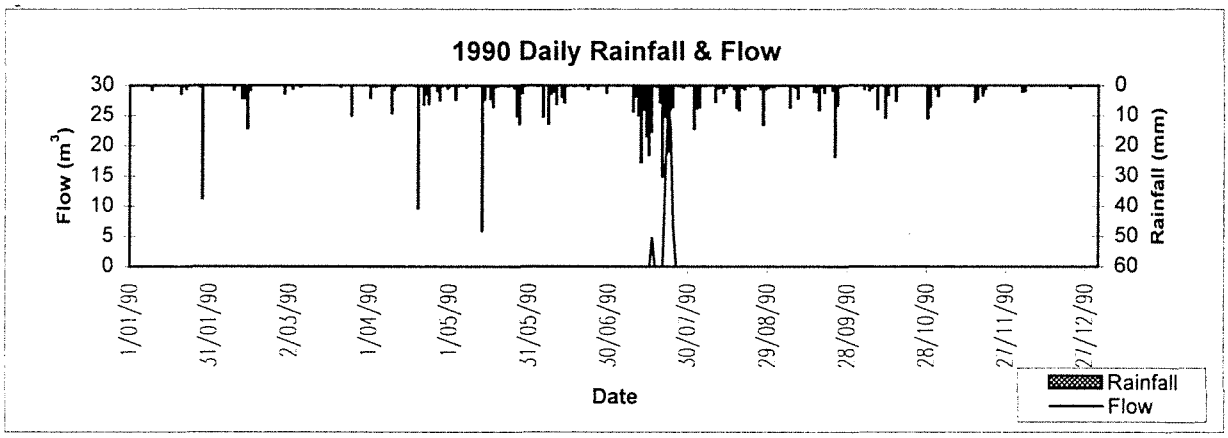


Bee Farm Road Catchment - S614012

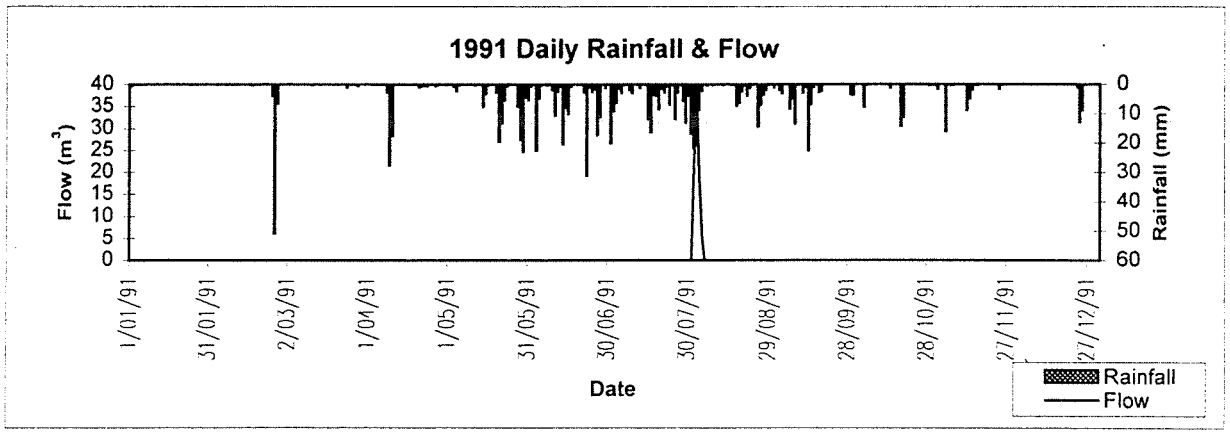


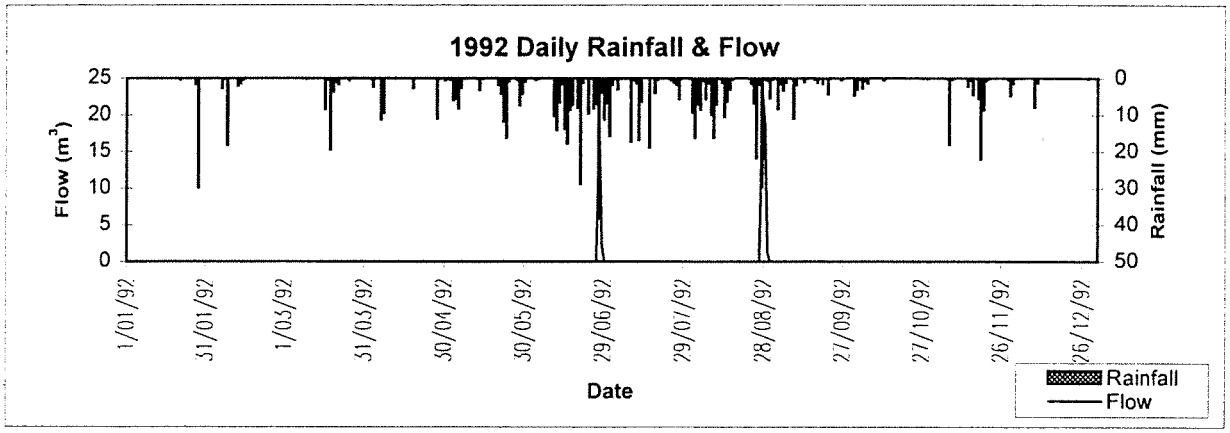


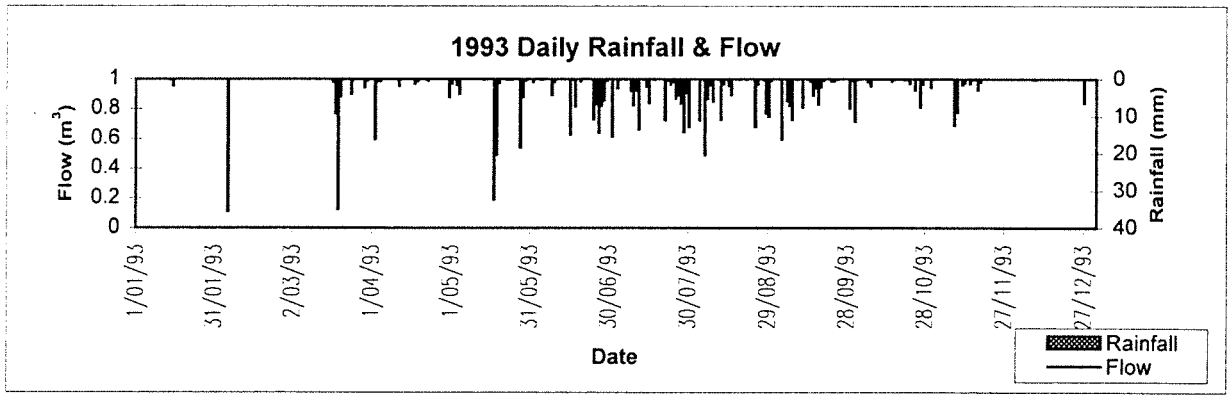


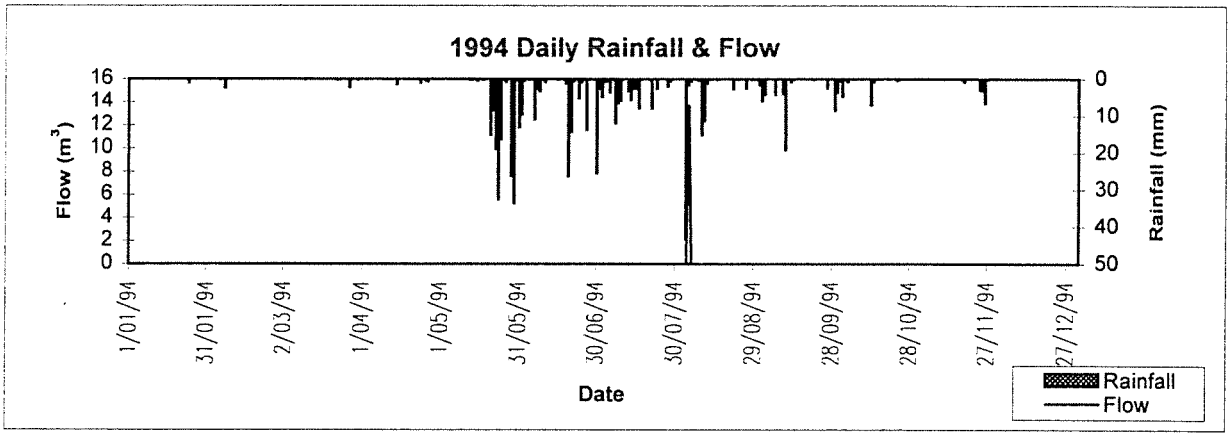


Bee Farm Road Catchment - S614012

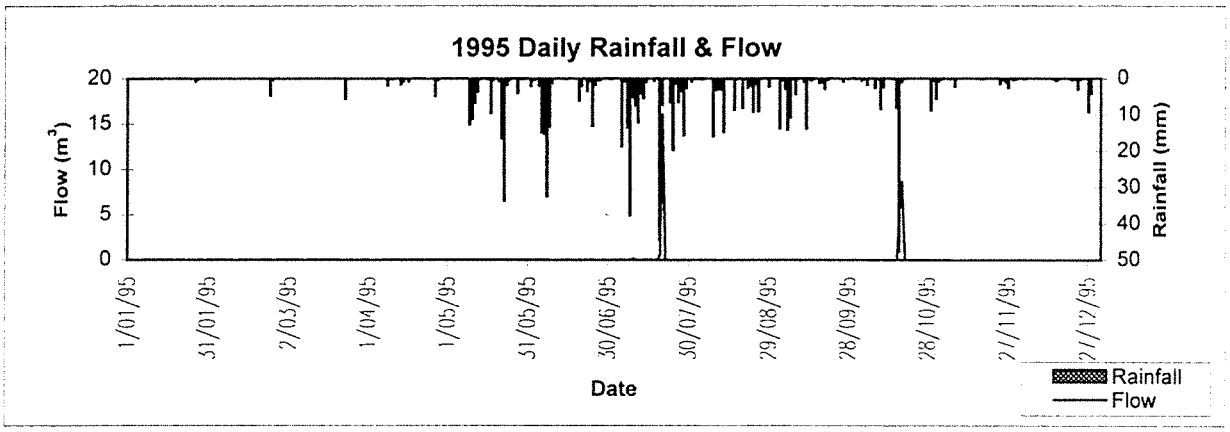


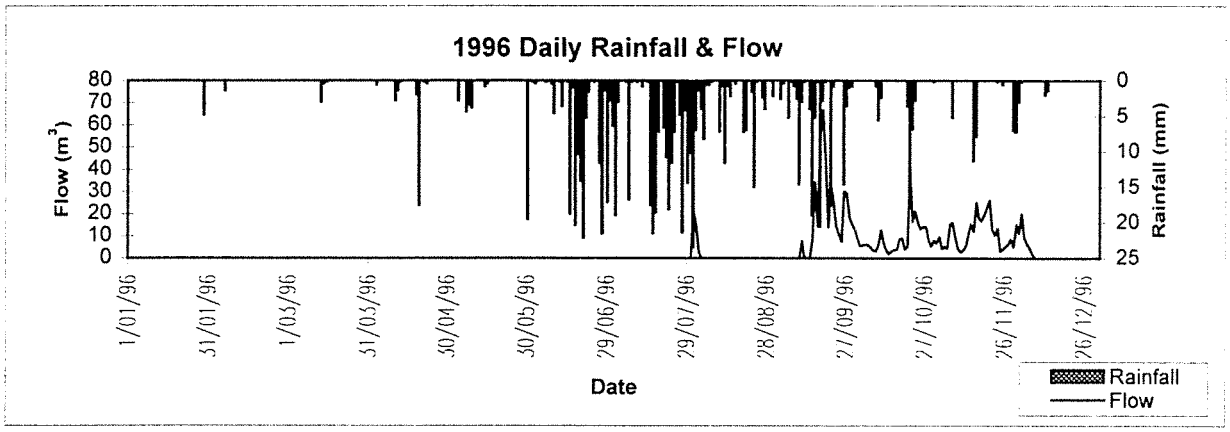


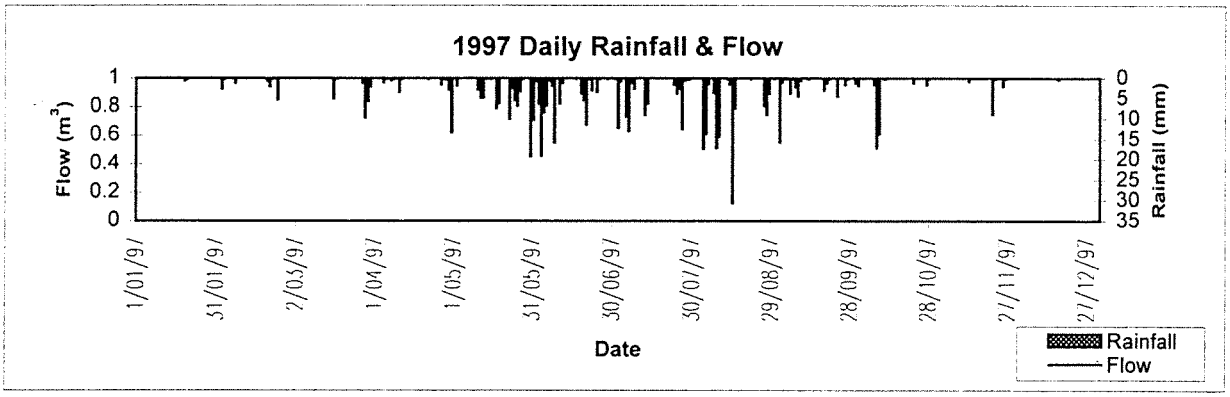




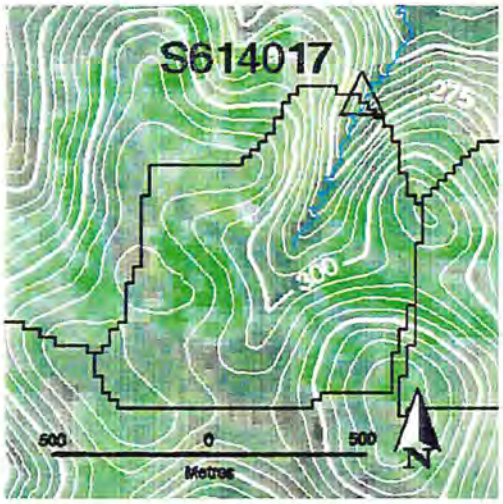
Bee Farm Road Catchment - S614012







Warren Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 86

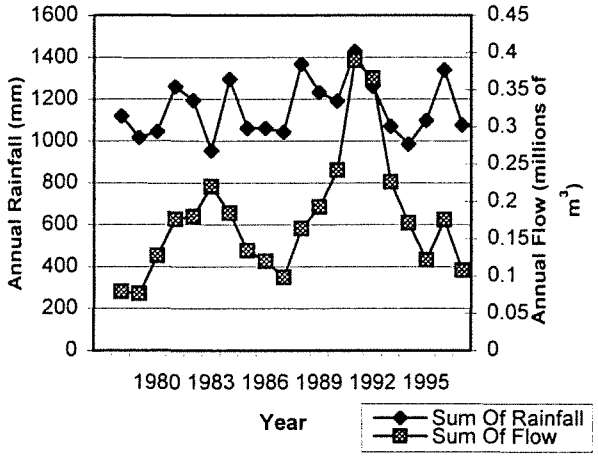
Computer Generated Stream Line

Gauging Station Number	S614017		
Rainfall Gauge Number	M509345		
Information about catchment			
Catchment area	0.87 km^2		
Gauging Station Coordinates (AMG)	N 6393090		
	E 408710		
Treatment data	1. Severe dieback.	2. Mined in '89-'92.	3. Rehabilitated in'92.
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	7657	7657	0
Number of years recorded	22	22	
Number of years with complete records	20	20	
Start date	24/03/77	24/03/77	
Finish date	10/03/98	10/03/98	
Number of days with quality code 1	7058	6978	
Number of days with quality code 2	253	197	
Number of days with quality code 3	200	450	
Number of days with quality code 4	61	15	
Number of days with quality code 157	75	157	
Number of days with quality code 255	10	7	
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	
Average	1154.8	0.177	
Min	954.0	0.076	
Max	1428.0	0.390	

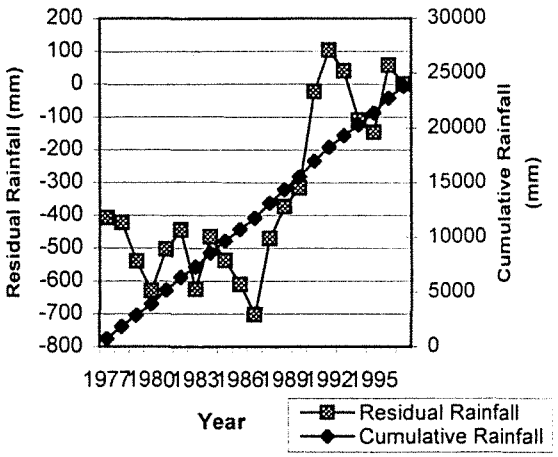
Year	Number of flow days
1978	355
1979	365
1980	366
1981	365
1982	365
1983	365
1984	366
1985	365
1986	365
1987	365
1988	366
1989	365
1990	365
1991	365
1992	366
1993	364
1994	362
1995	364
1996	366
1997	365
1998	68
Total	**7358**

Warren Catchment - S 614017

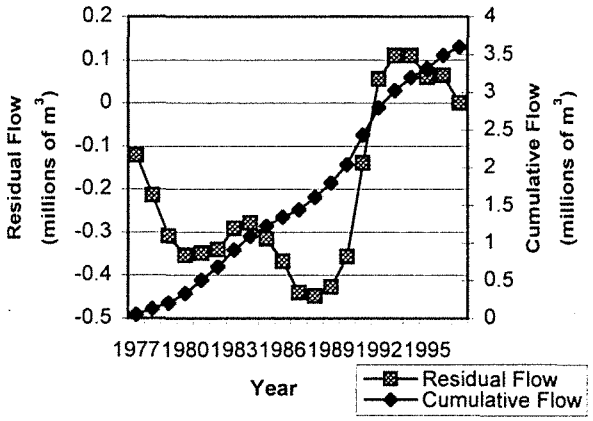
Annual Rainfall & Flow



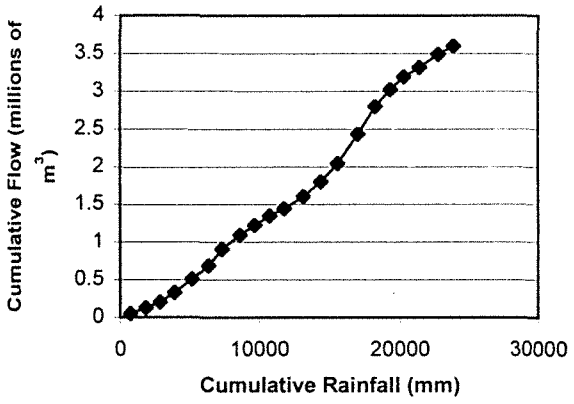
Annual Cumulative & Residual Rainfall Curves



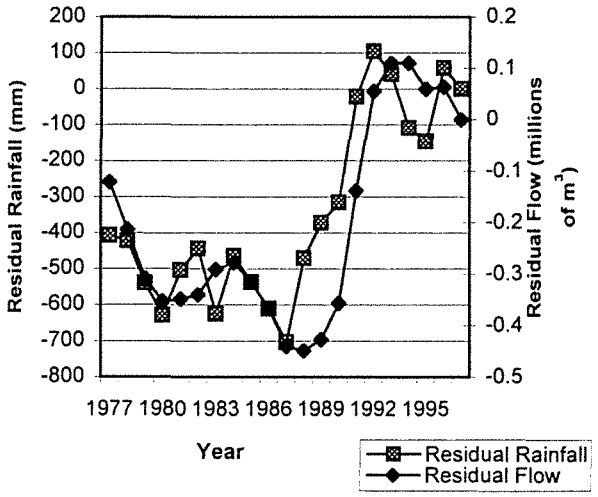
Annual Cumulative & Residual Flow Curves



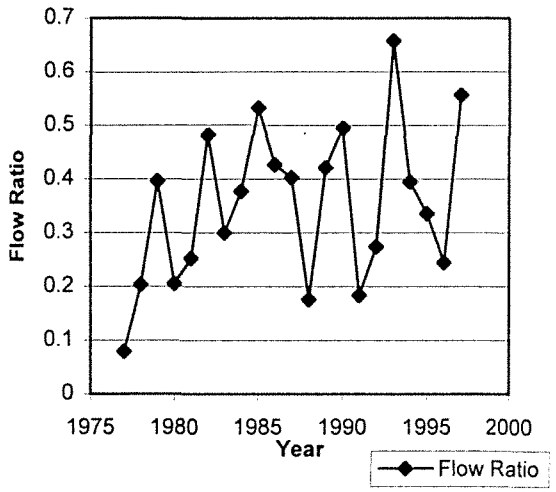
Annual Cumulative Flow & Cumulative Rainfall Curves



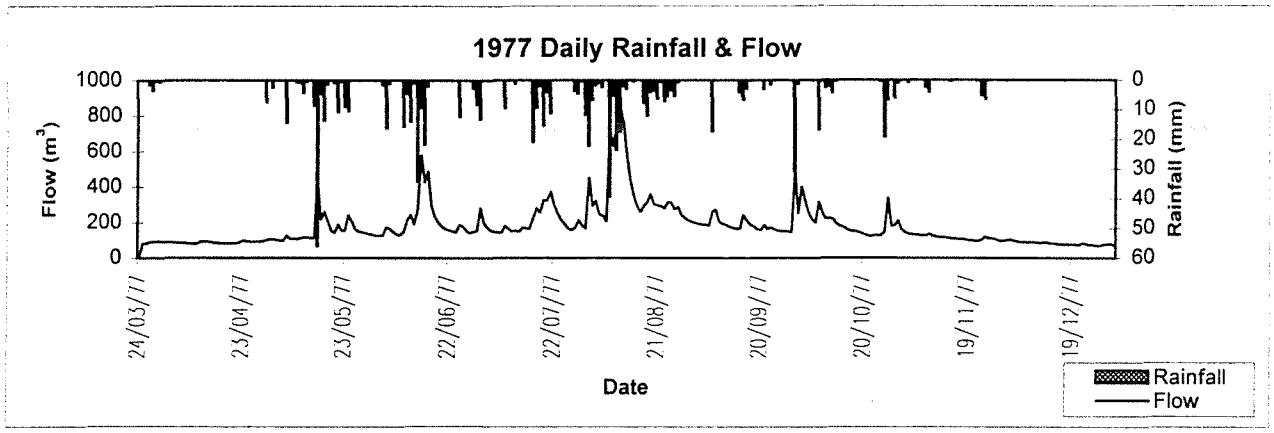
Annual Residual Flow & Residual Rainfall Curves

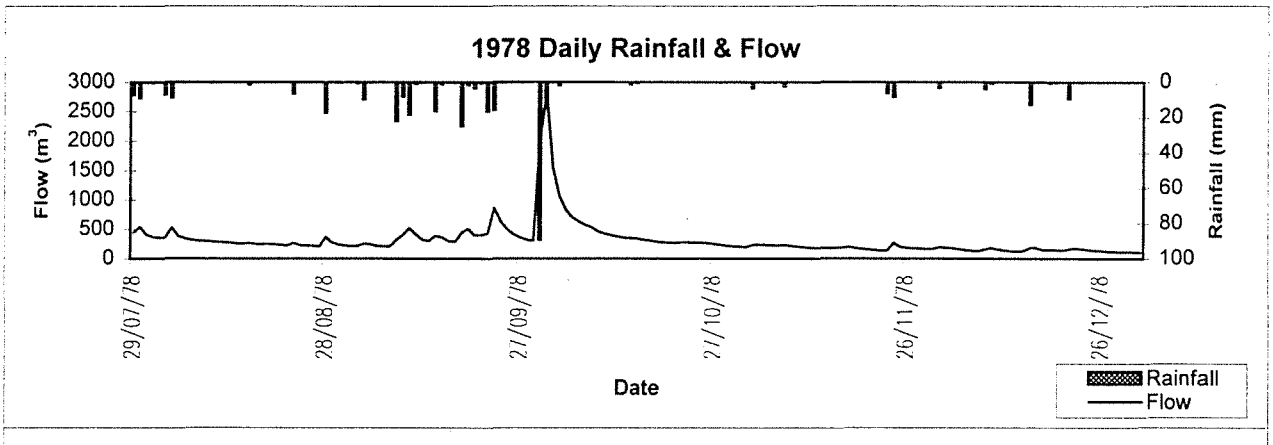


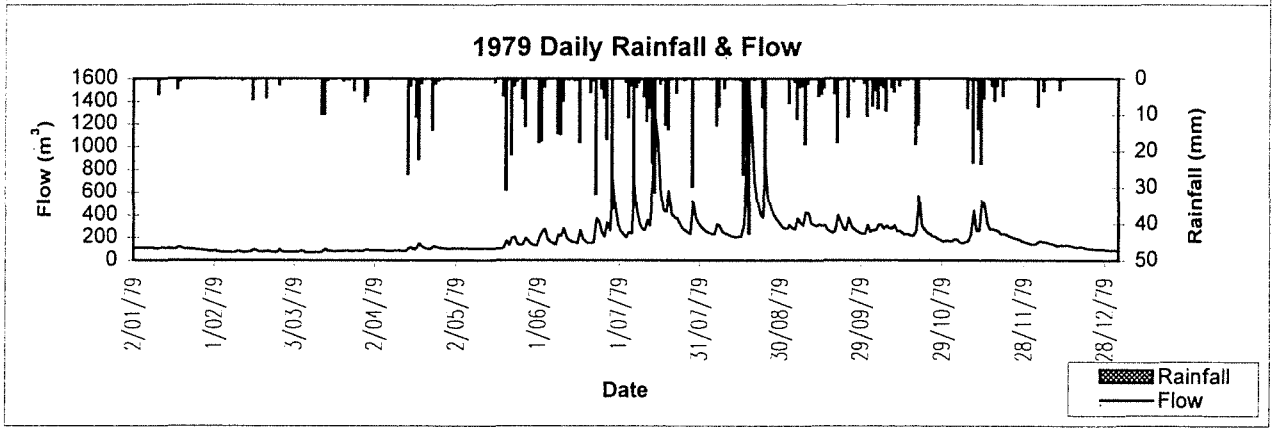
Flow Ratio of Summer to Winter

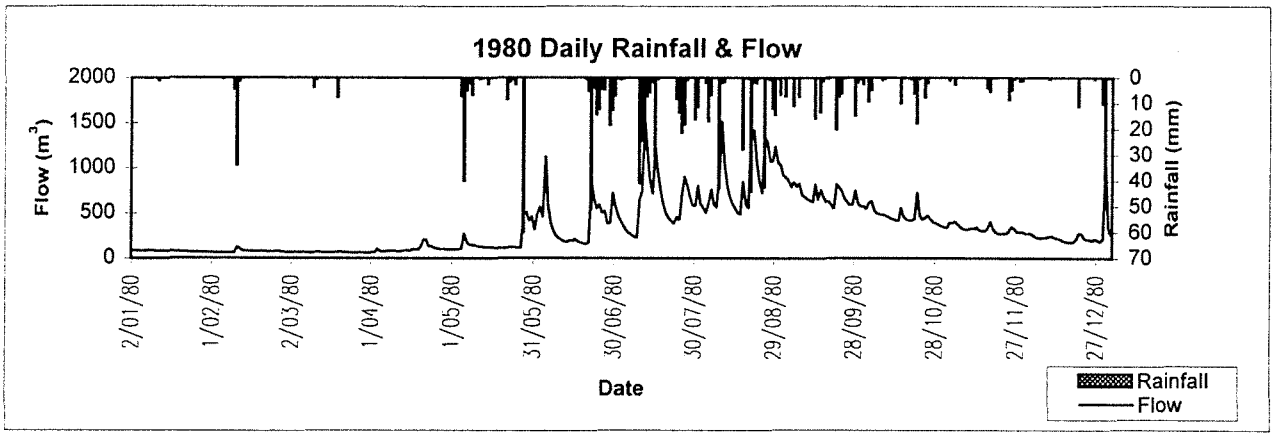


Warren Catchment - S 614017

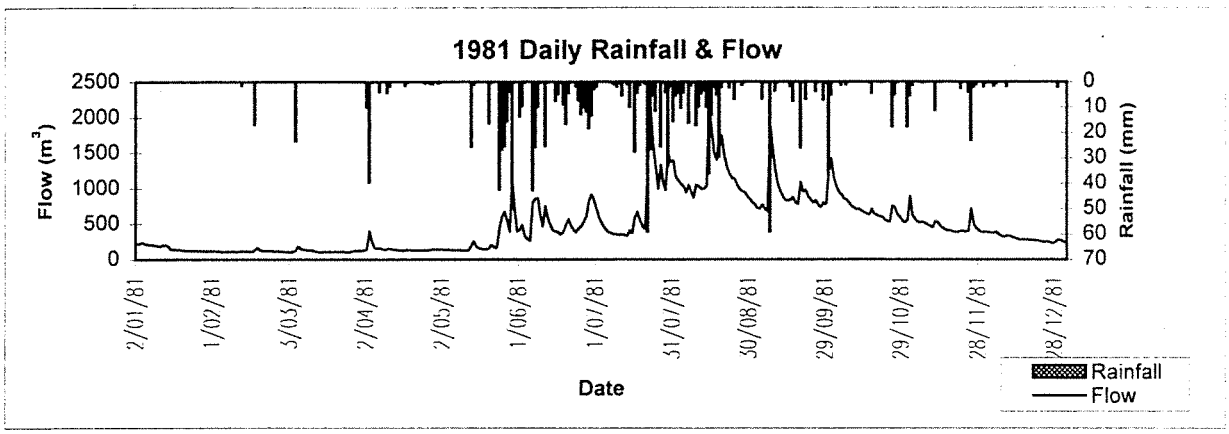


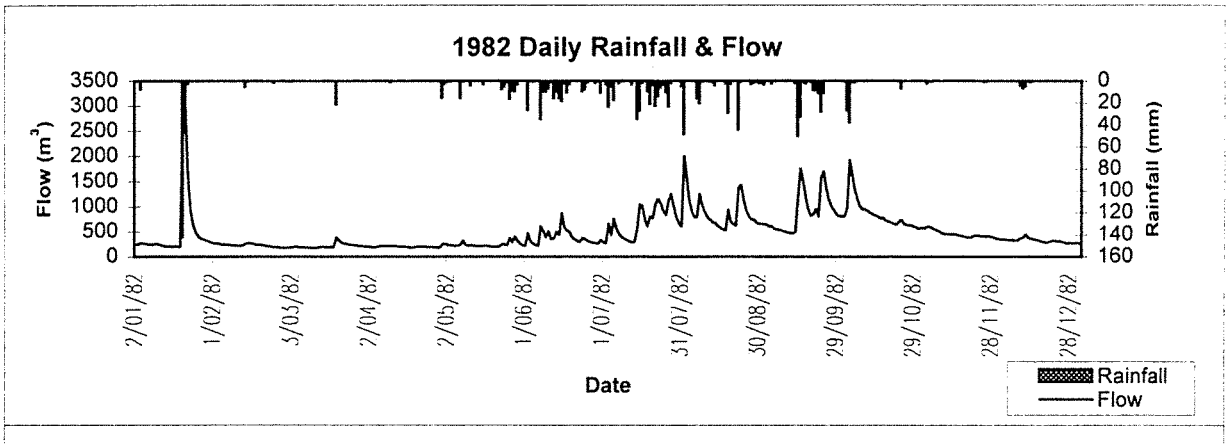


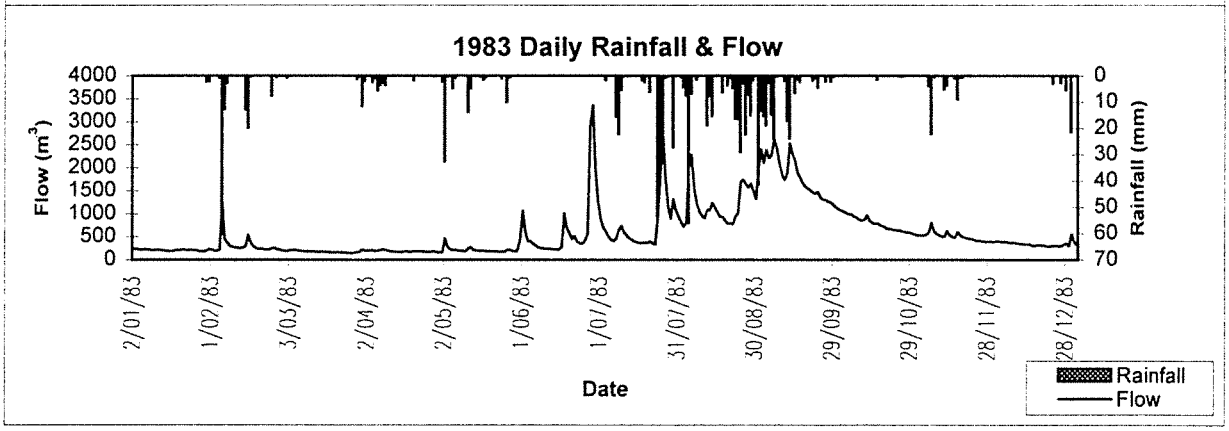


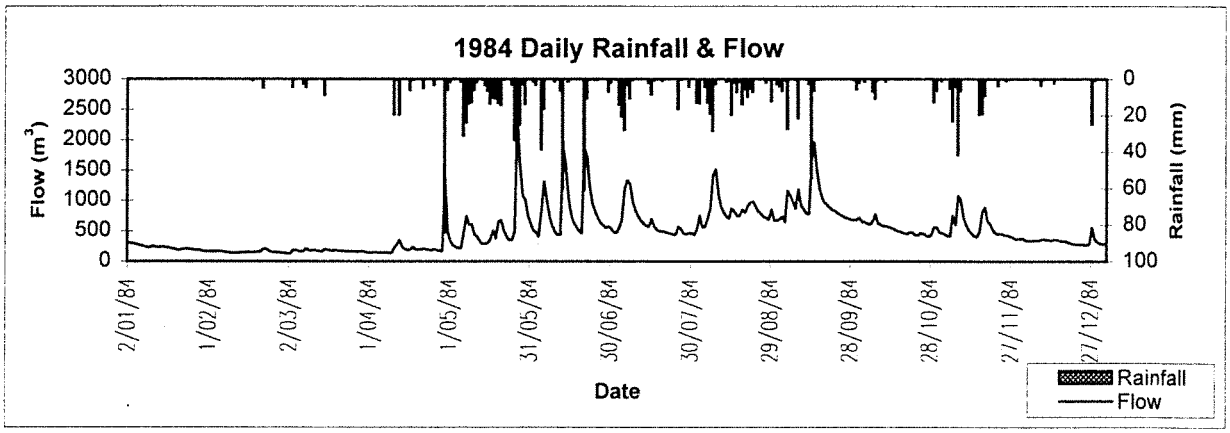


Warren Catchment - S 614017

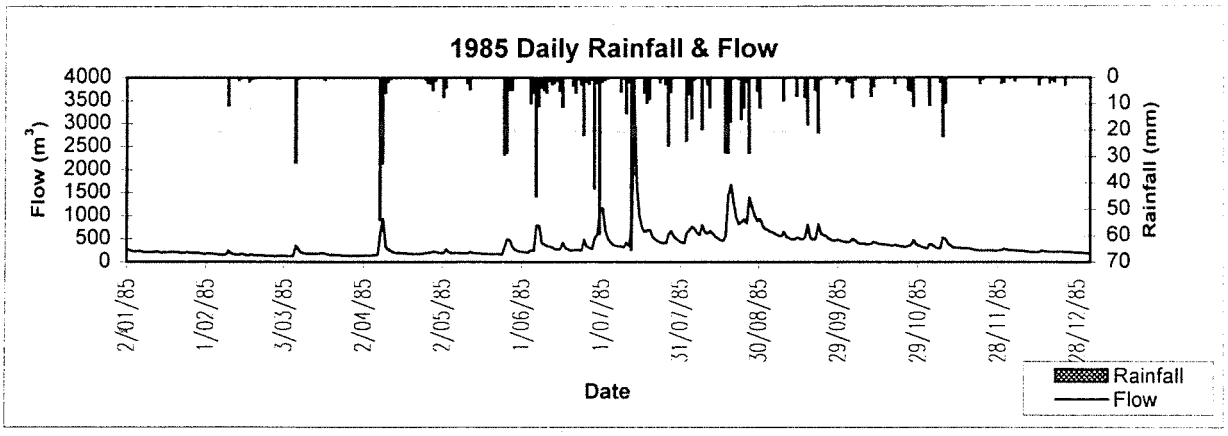


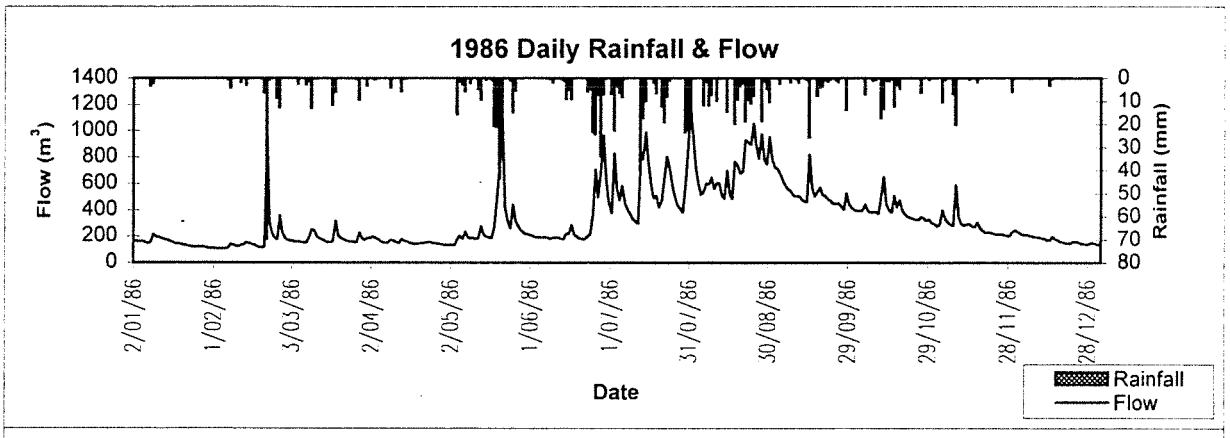


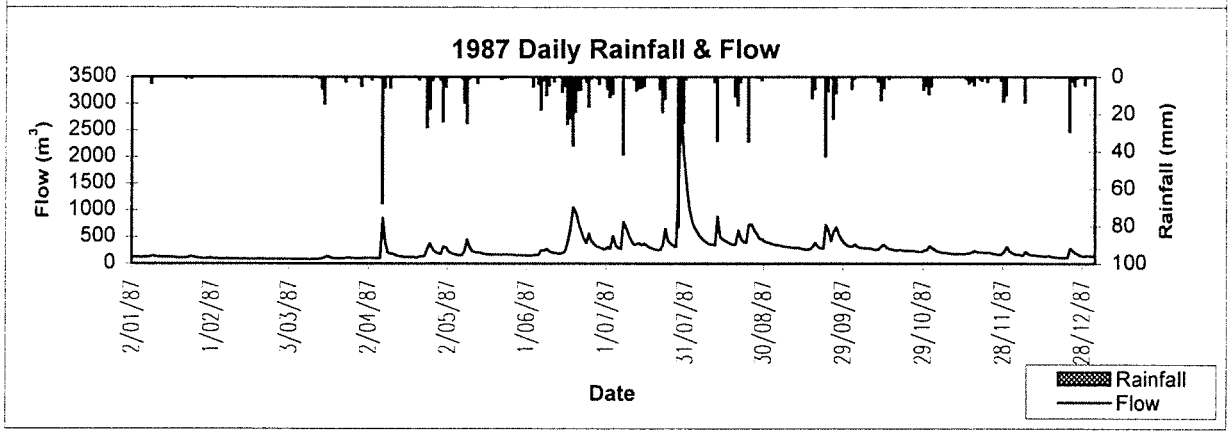


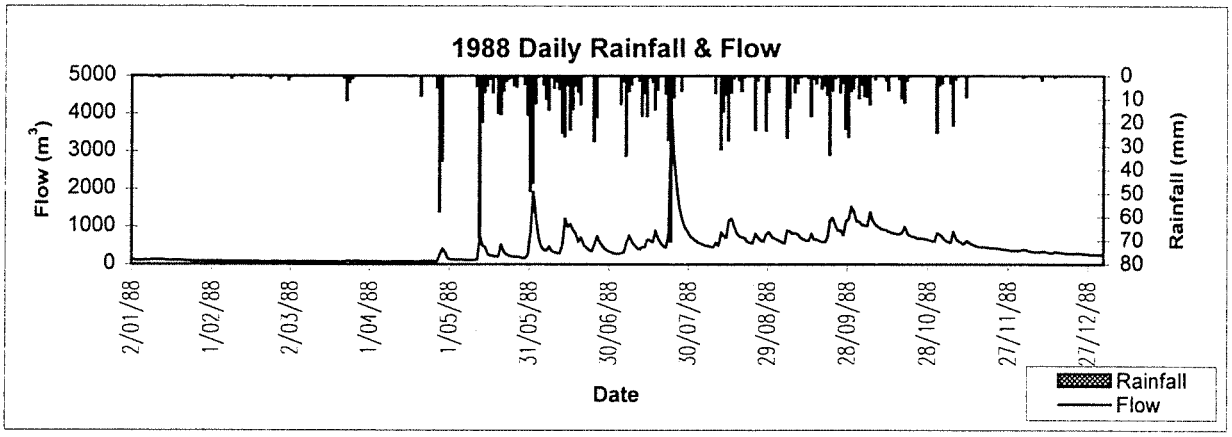


Warren Catchment - S 614017

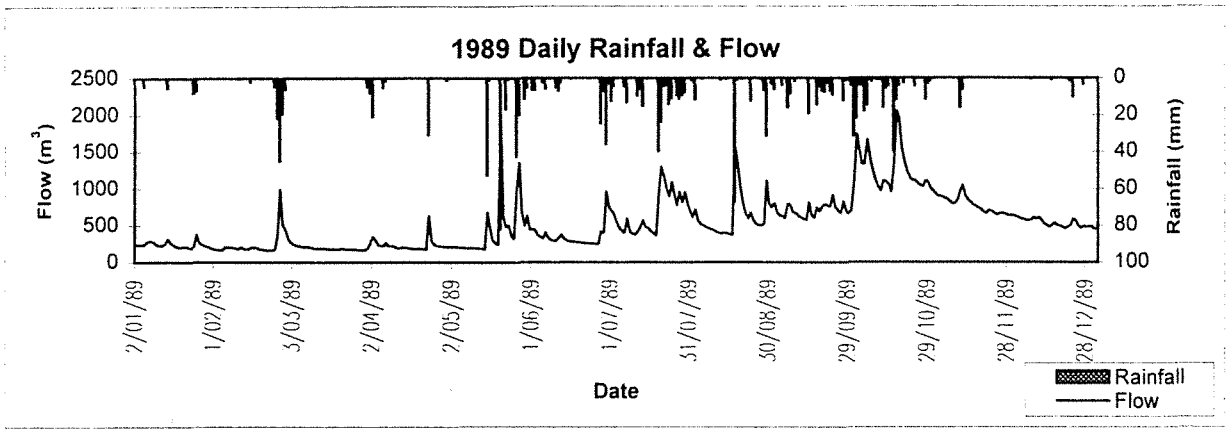


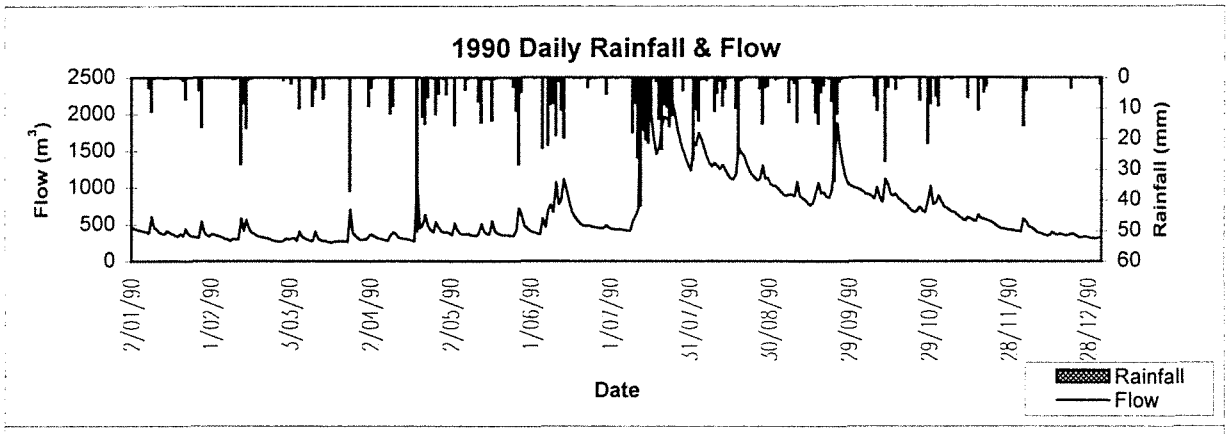


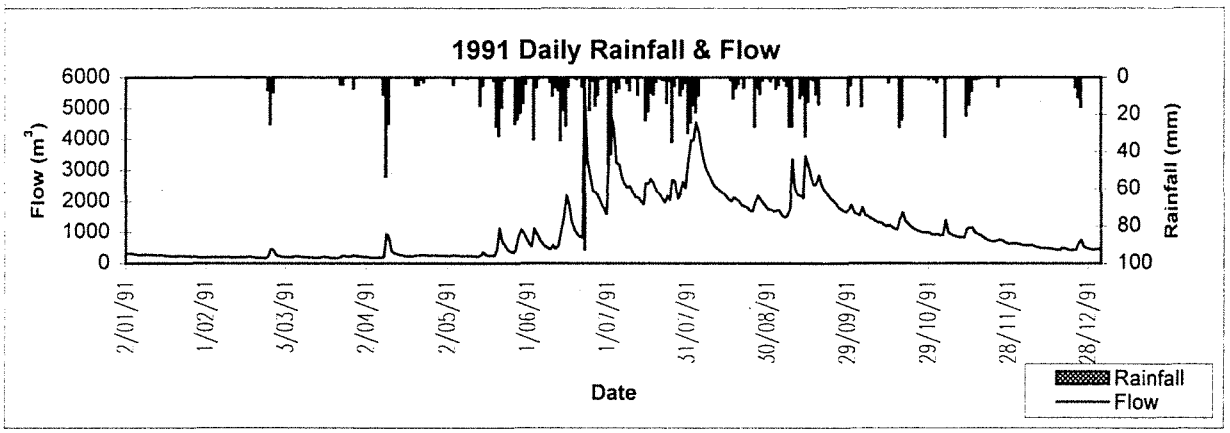


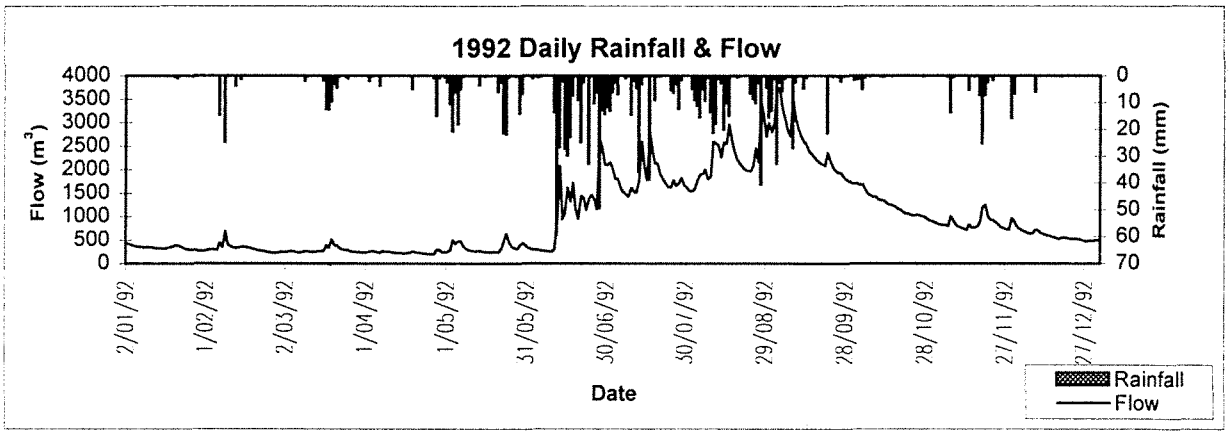


Warren Catchment - S 614017

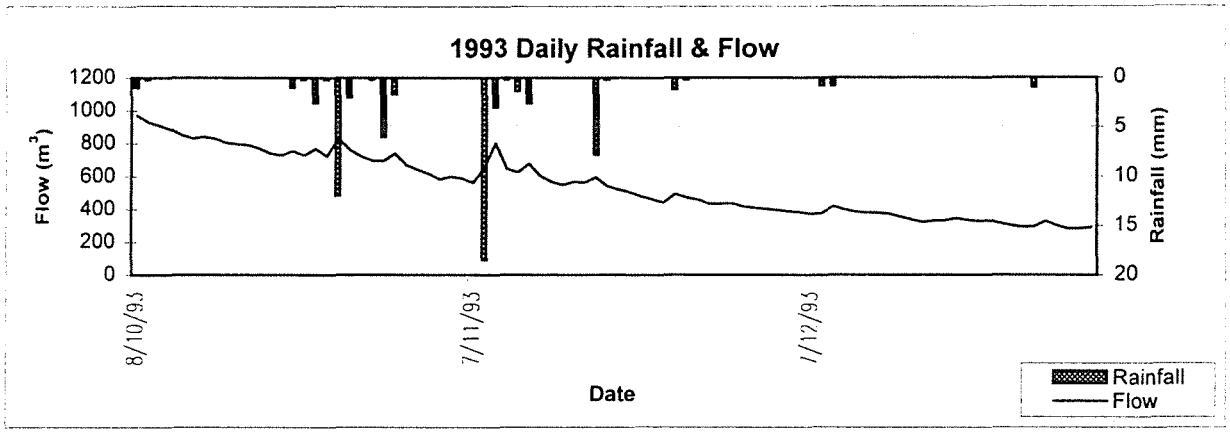


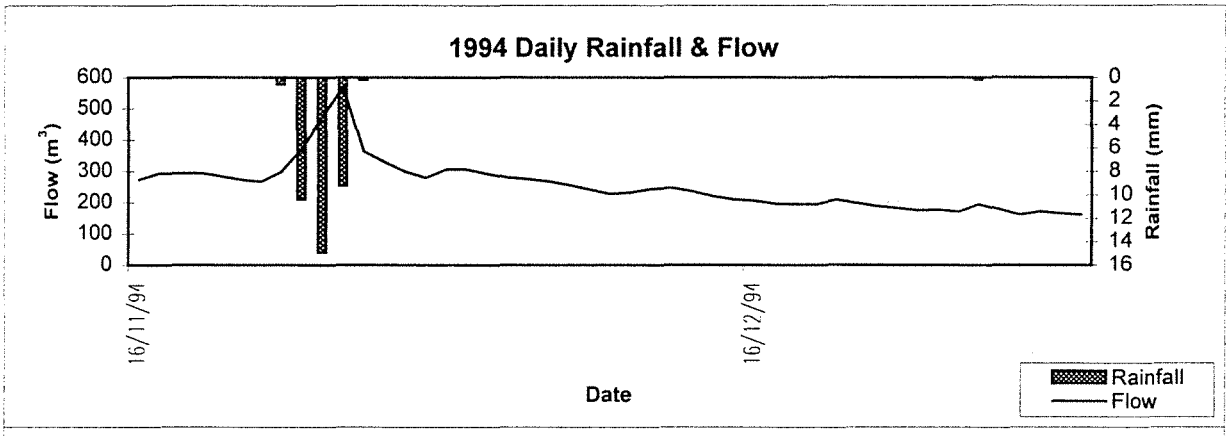


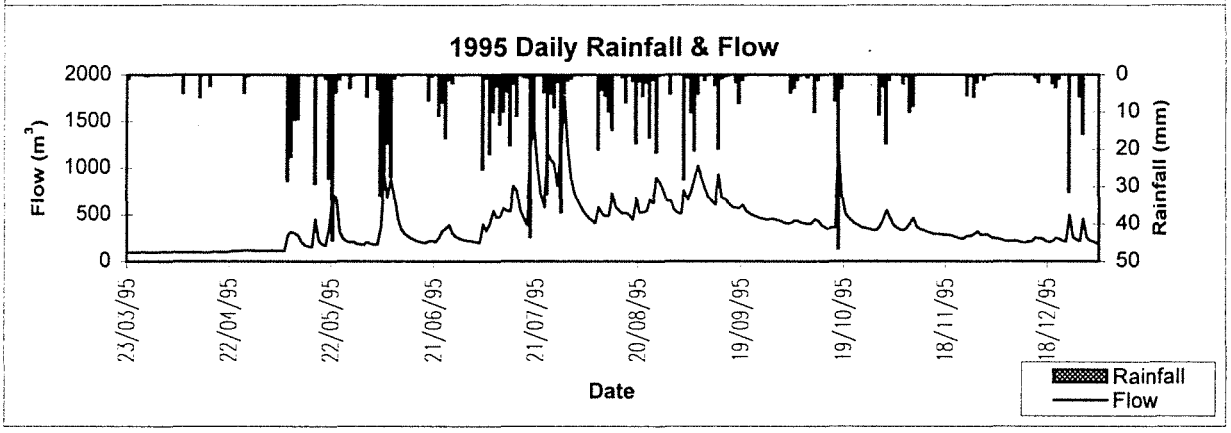


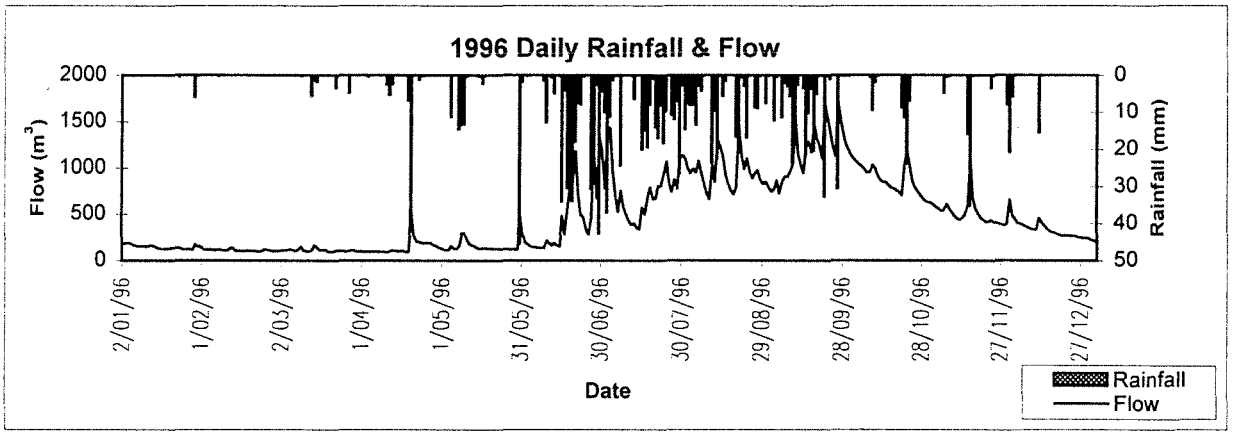


Warren Catchment - S 614017

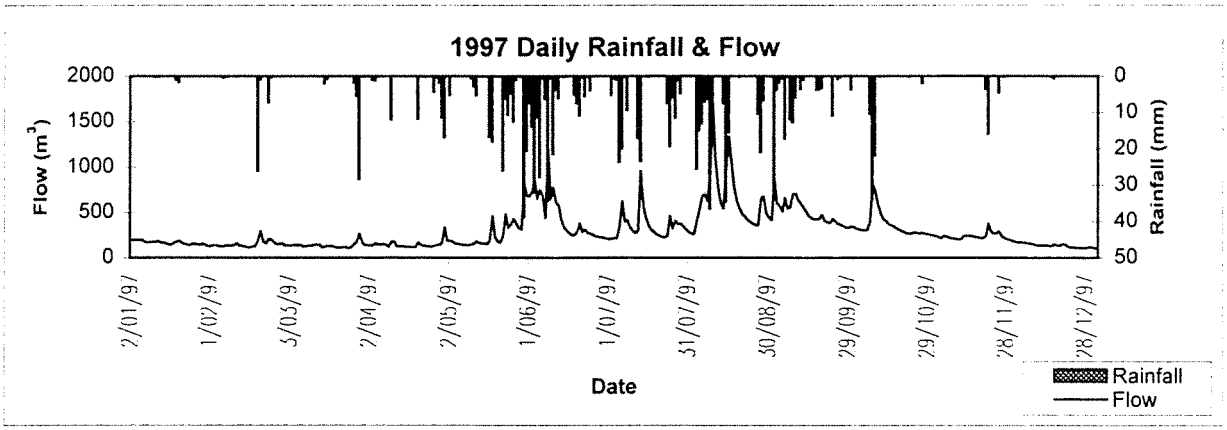




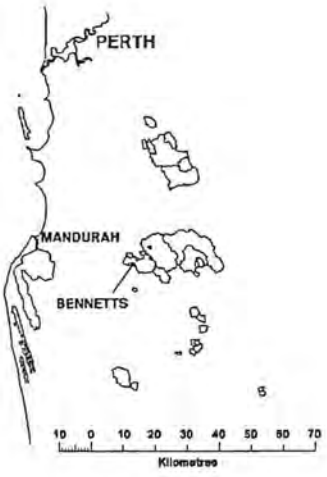




Warren Catchment - S 614017



Bennetts Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

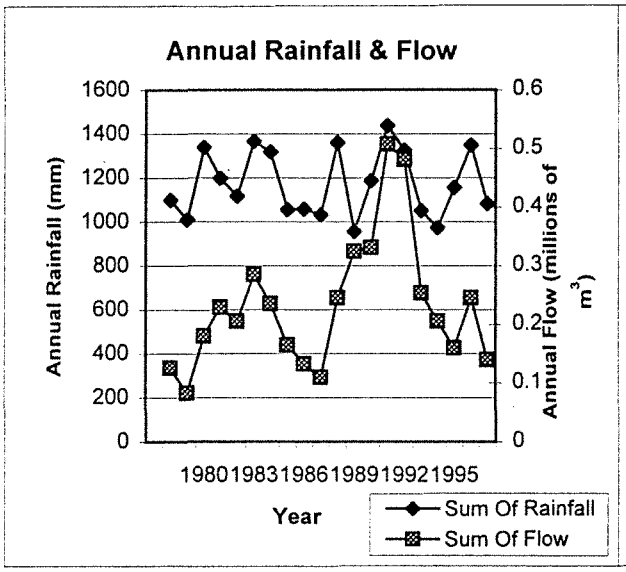
Computer Generated Stream Line

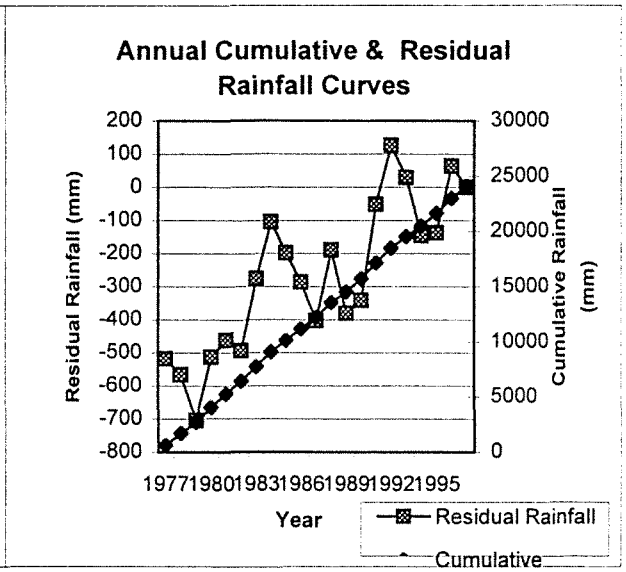
Gauging Station Number	S614018		
Rainfall Gauge Number	M509346		
Information about catchment			
Catchment area	0.88 km^2		
Gauging Station Coordinates (AMG)	N 6393040	E 409240	
Treatment data	1. Severe dieback.	2. Mined in '89-'92	3. Rehabilitated in'92
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	7603	7604	0
Number of years recorded	22	22	
Number of years with complete records	20	20	
Start date	17/05/77	16/05/77	
Finish date	10/03/98	10/03/98	
Number of days with quality code 1	7126	7283	
Number of days with quality code 2	298	130	
Number of days with quality code 3	45	47	
Number of days with quality code 4	14	114	
Number of days with quality code 157	52	28	
Number of days with quality code 255	25	2	

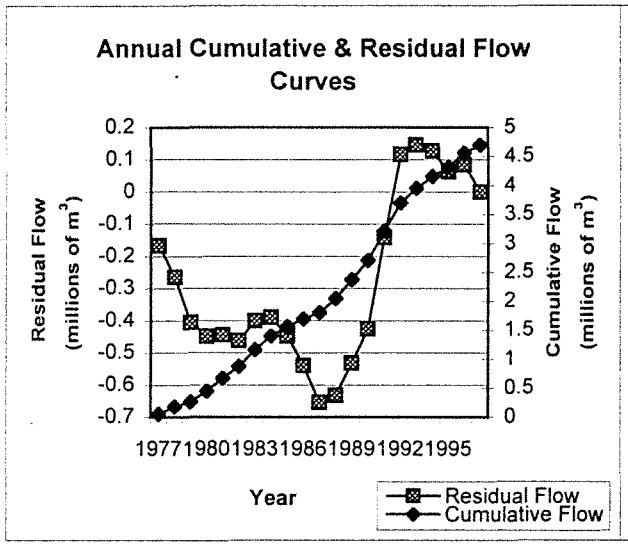
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	1173.8	0.232
Min	956.4	0.083
Max	1437.7	0.508

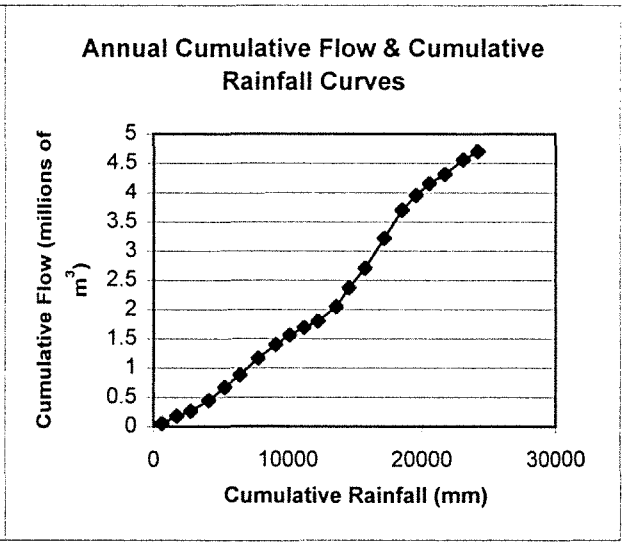
Year	Number of flow days
1978	227
1979	223
1980	233
1981	299
1982	341
1983	365
1984	355
1985	354
1986	344
1987	292
1988	271
1989	365
1990	365
1991	365
1992	366
1993	365
1994	365
1995	257
1996	275
1997	313
Total	**6340**

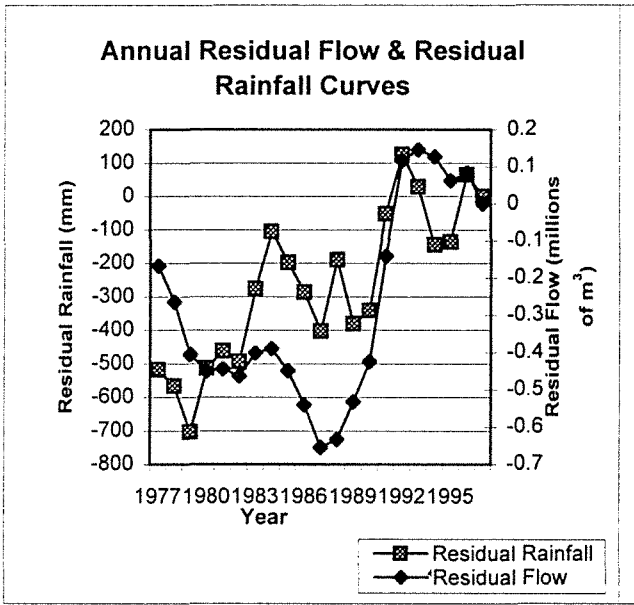
Bennetts Catchment - S 614018

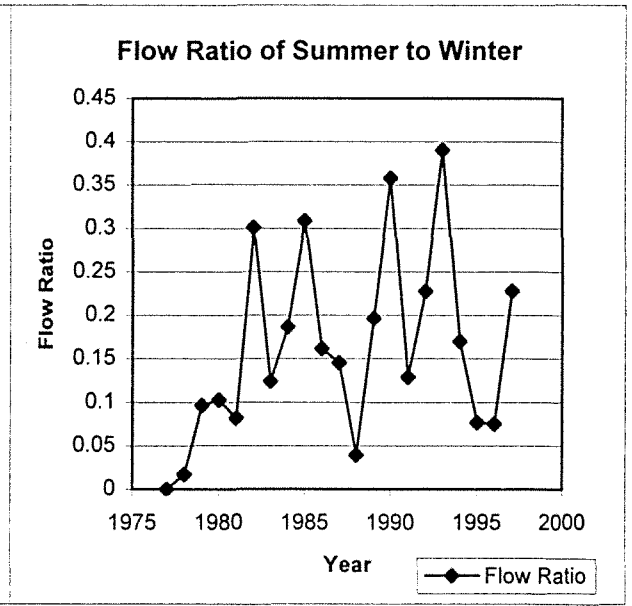




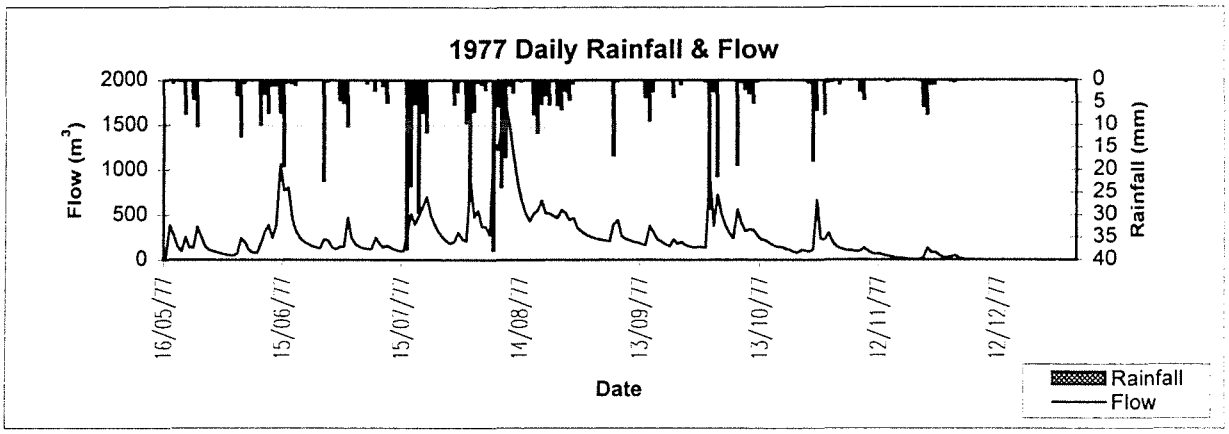


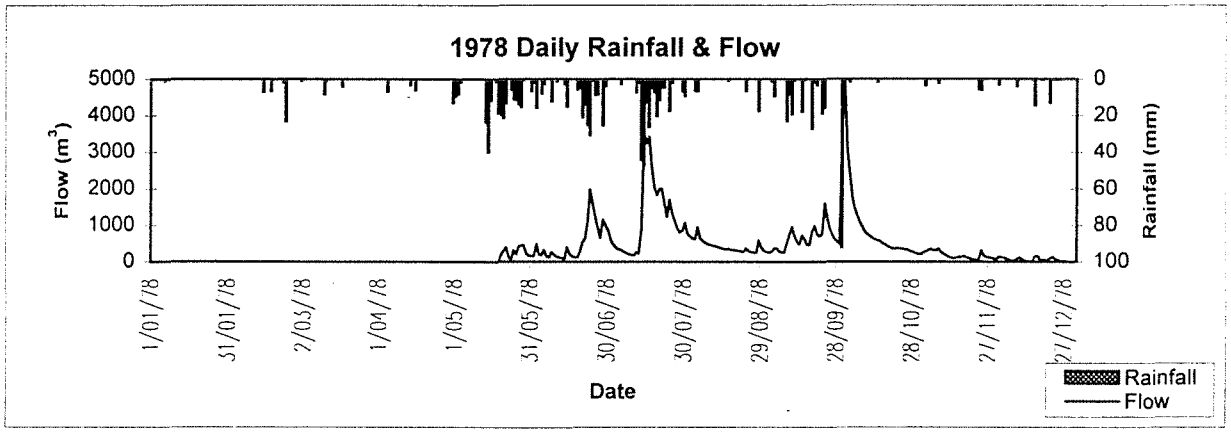


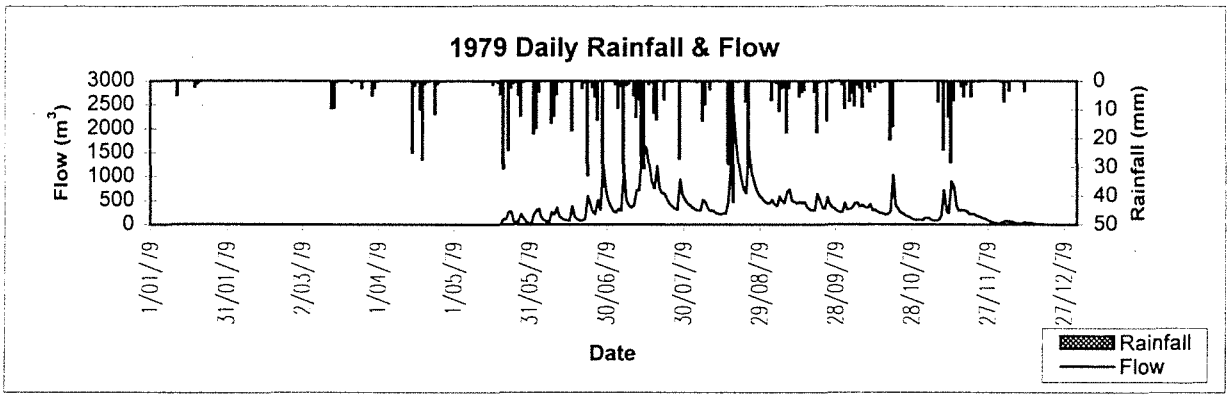


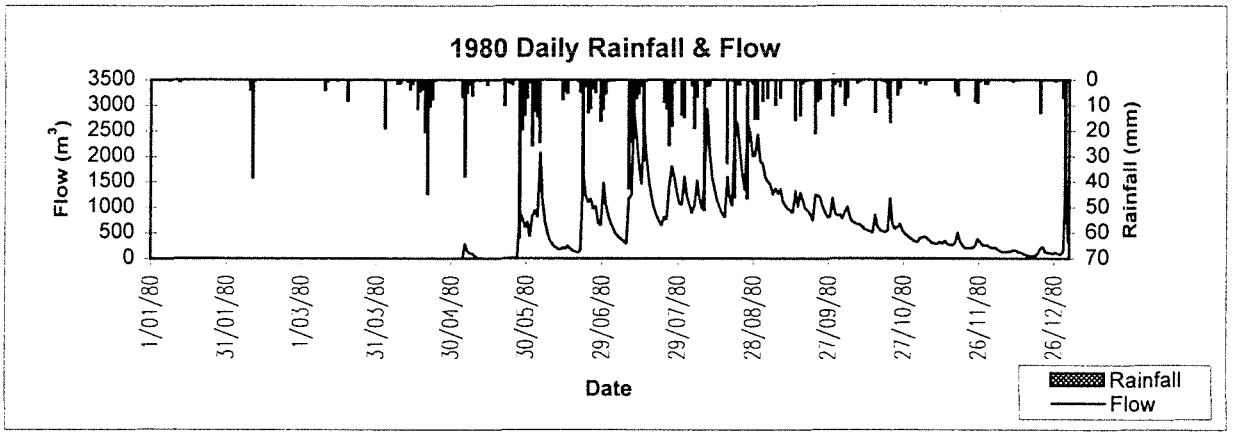


Bennetts Catchment - S 614018

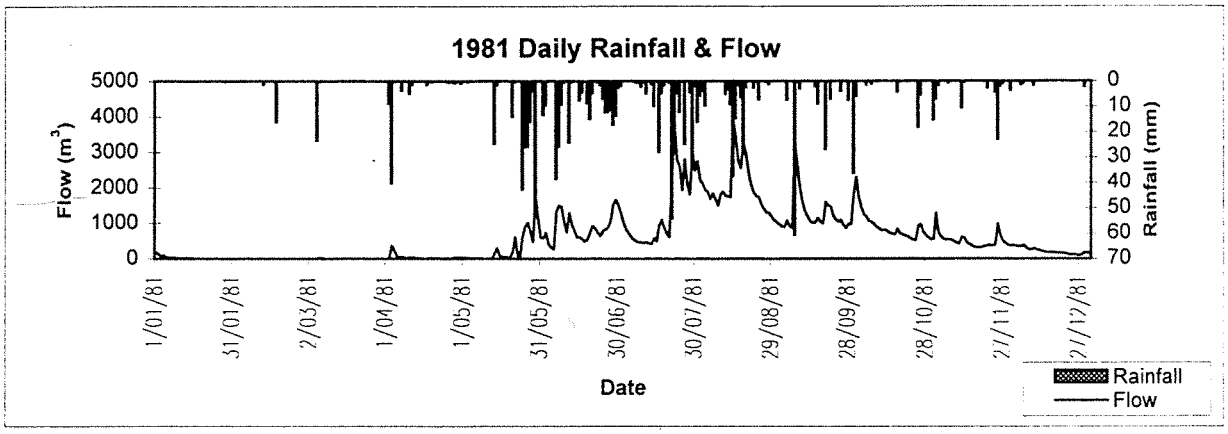


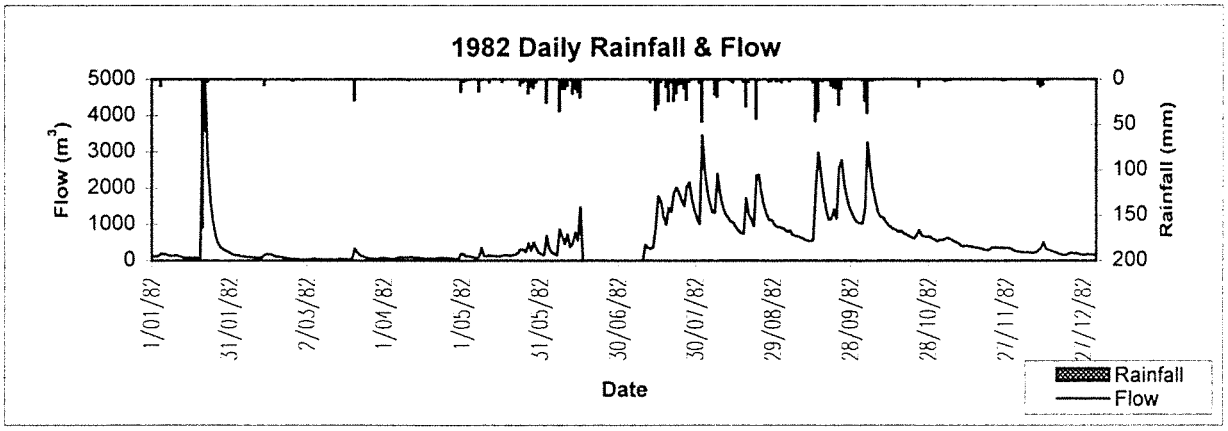


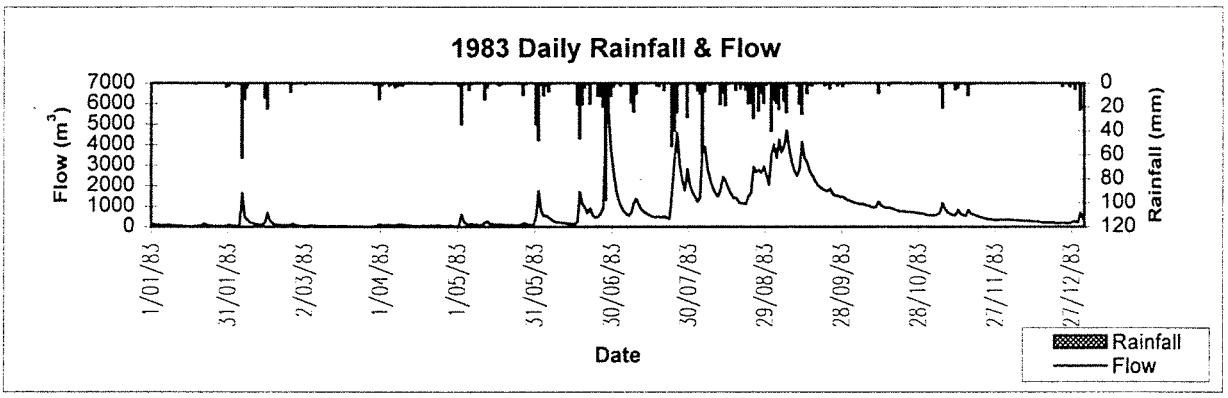


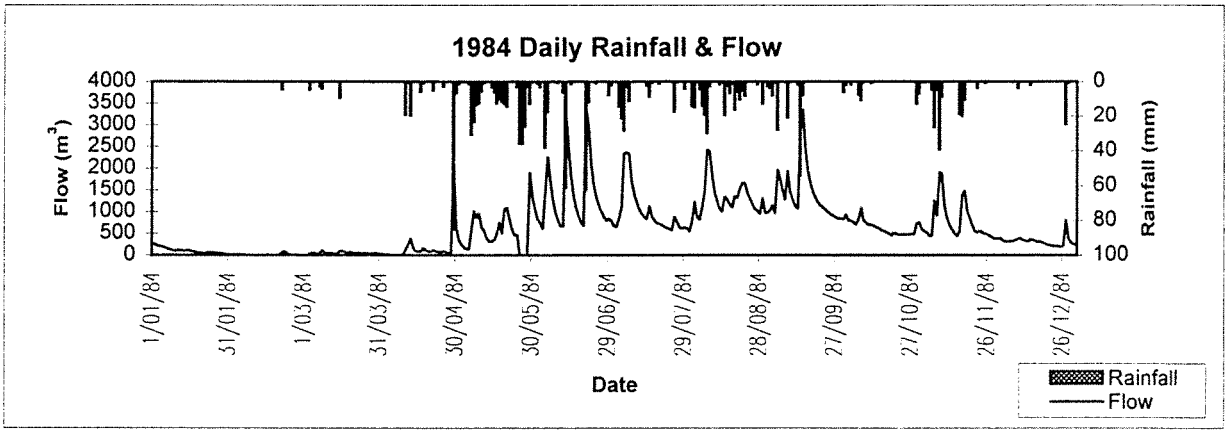


Bennetts Catchment - S 614018

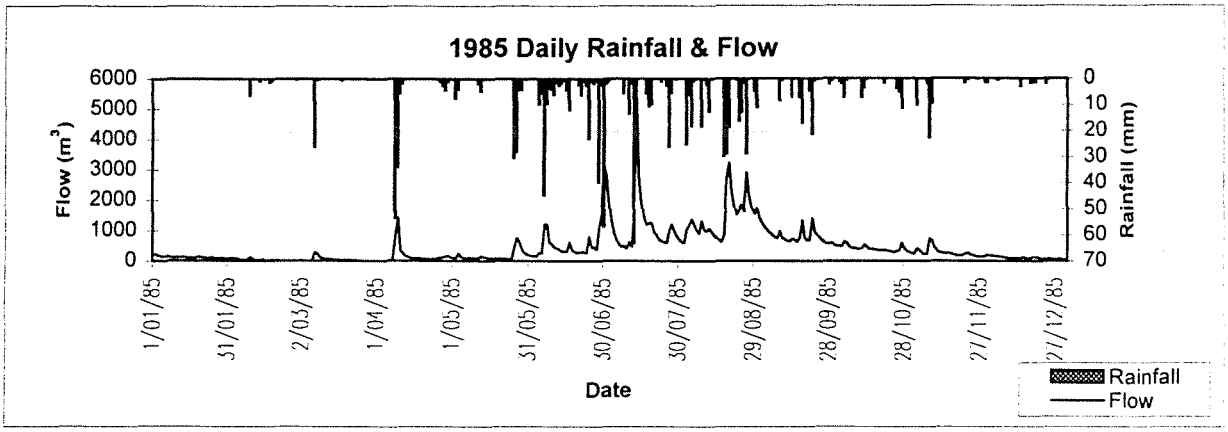


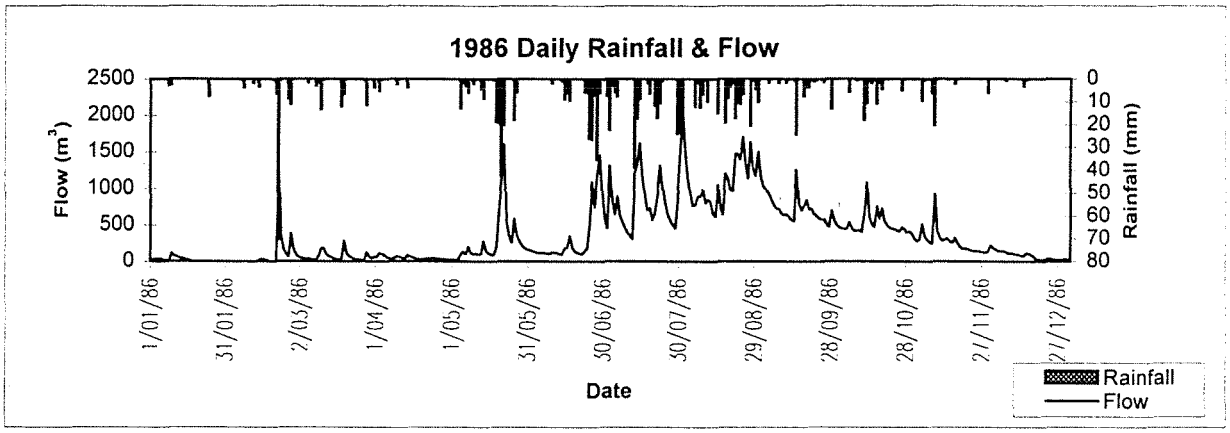


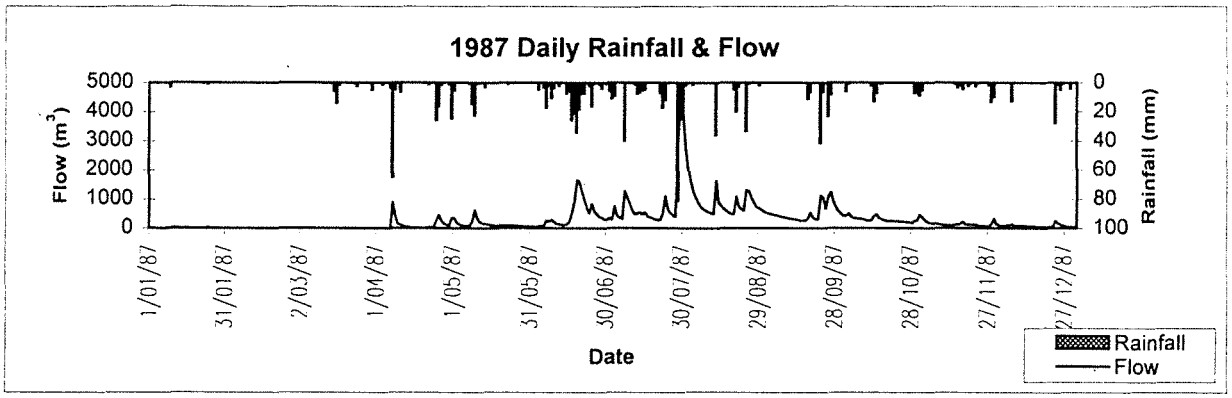


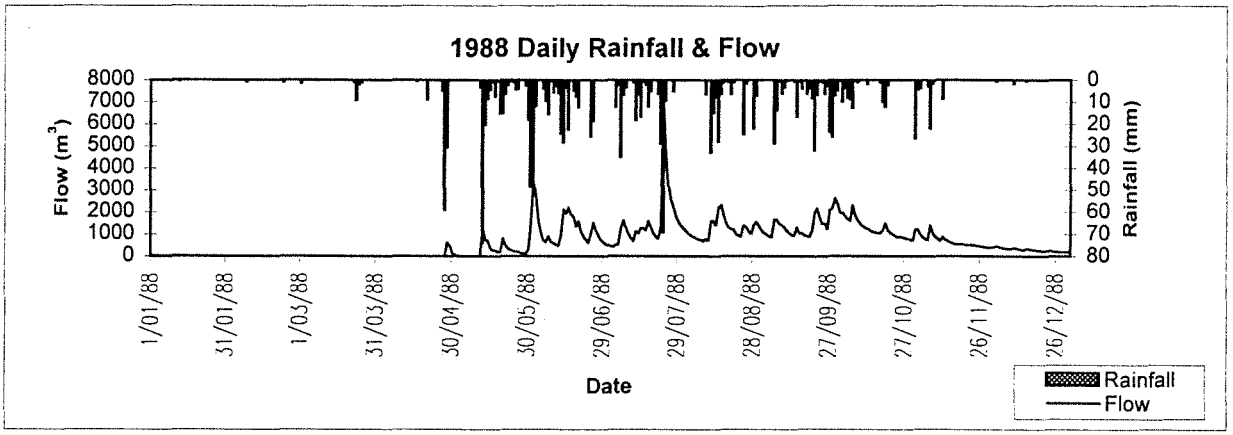


Bennetts Catchment - S 614018

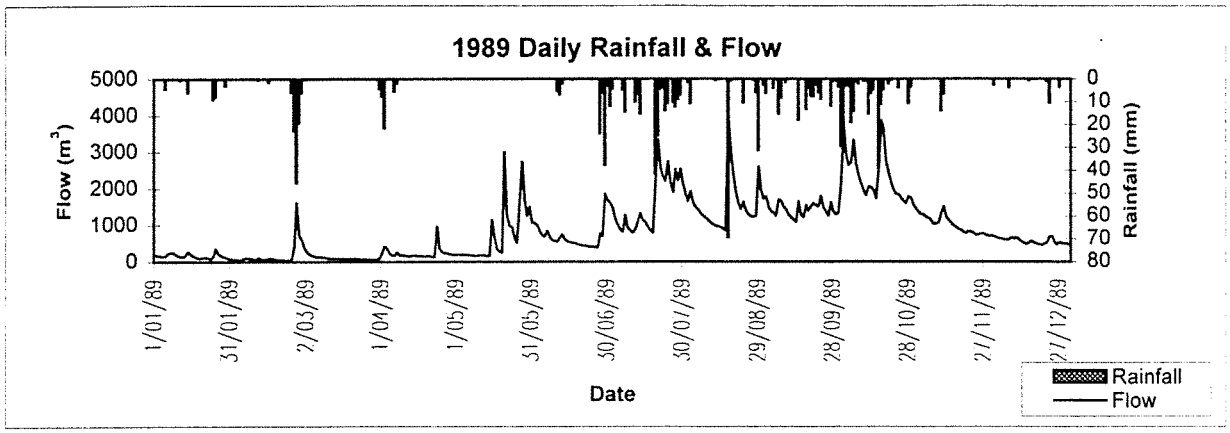


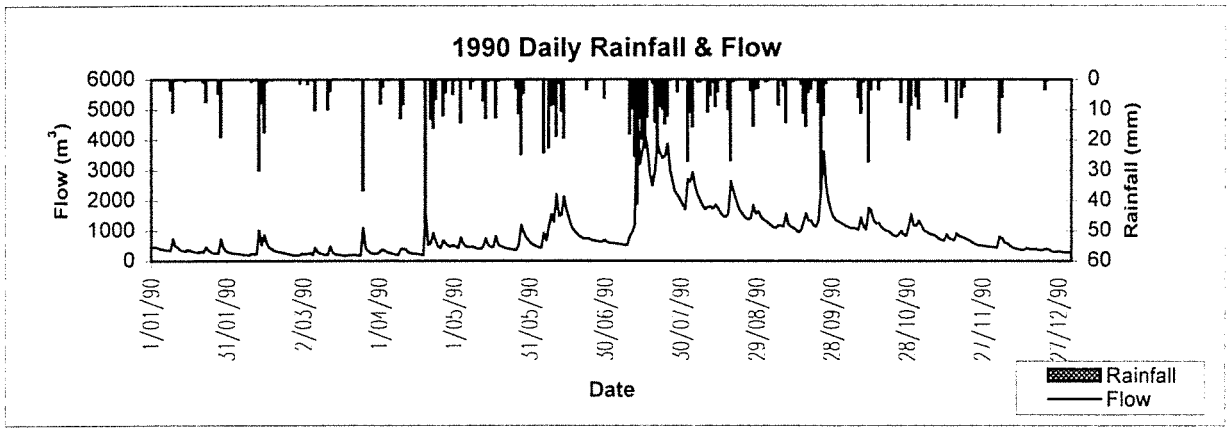


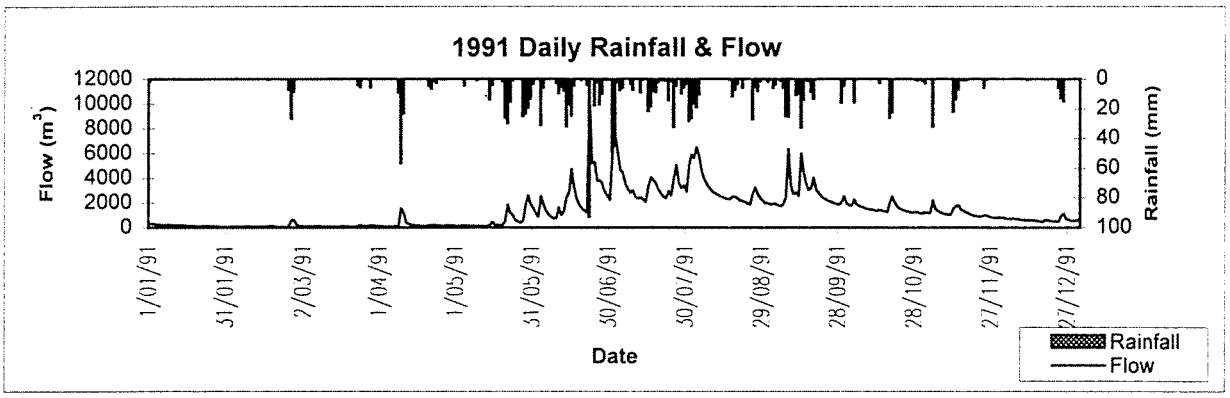


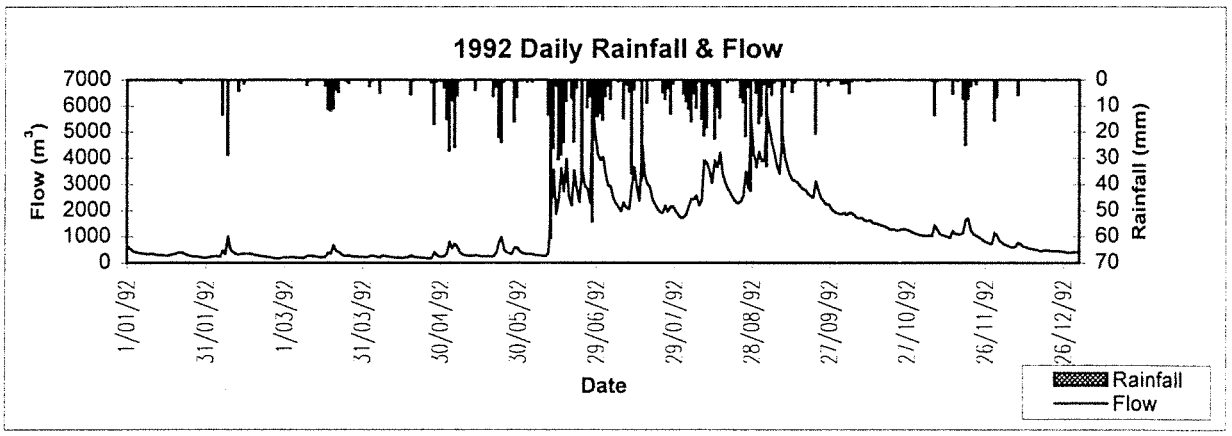


Bennetts Catchment - S 614018

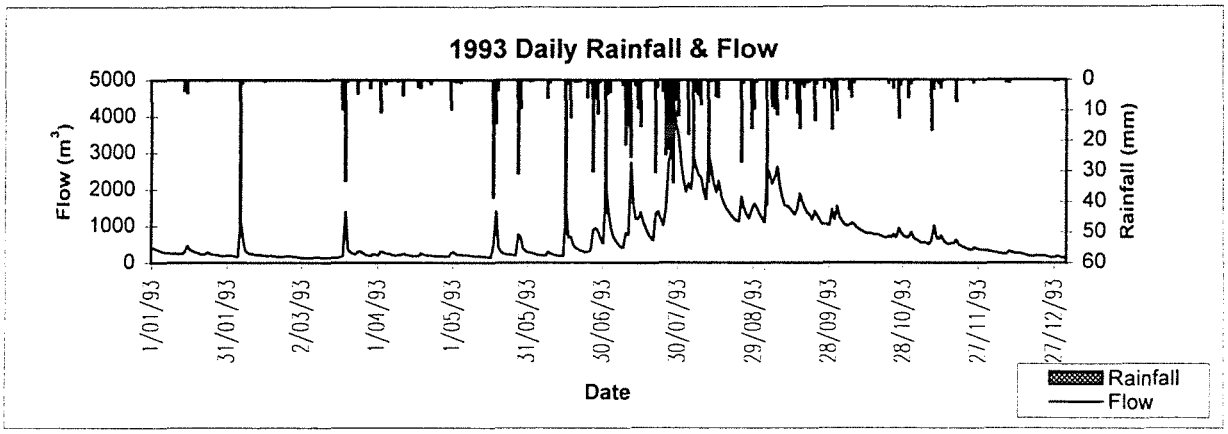


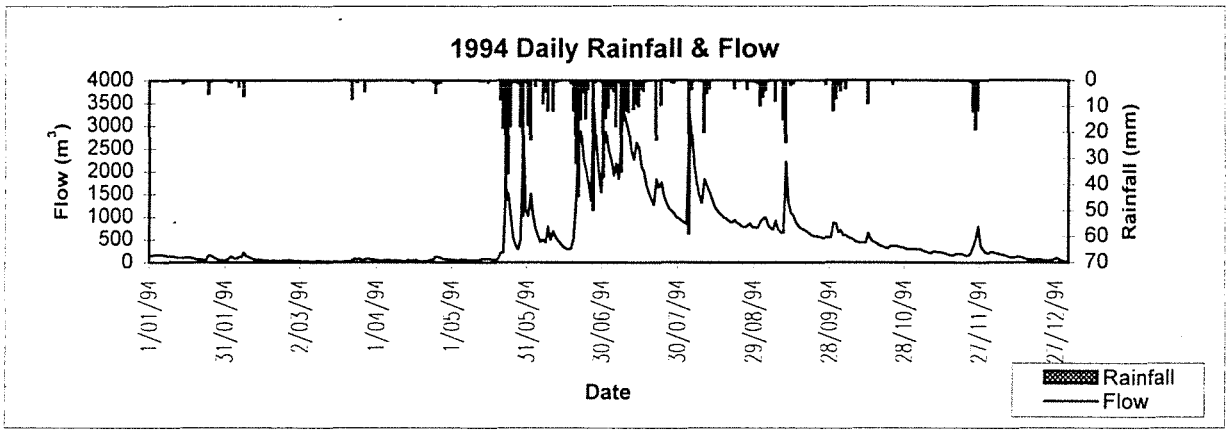


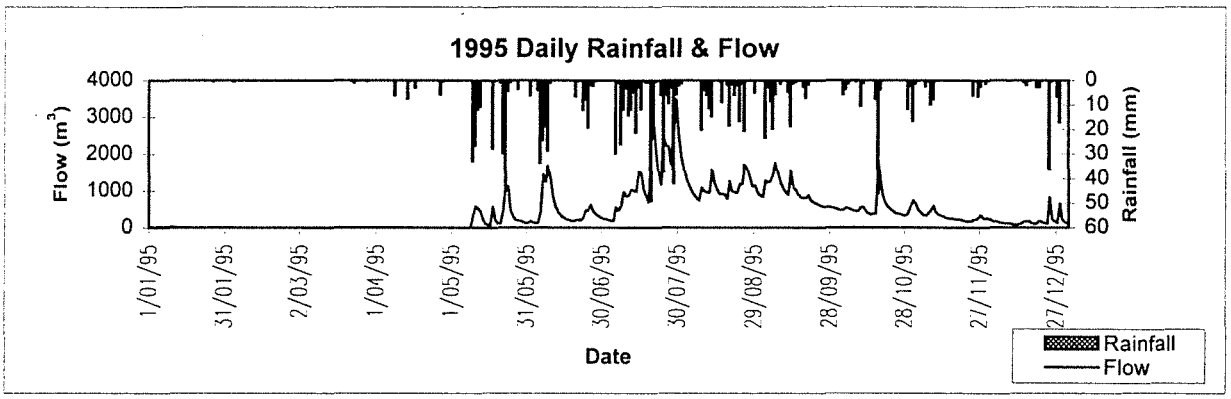


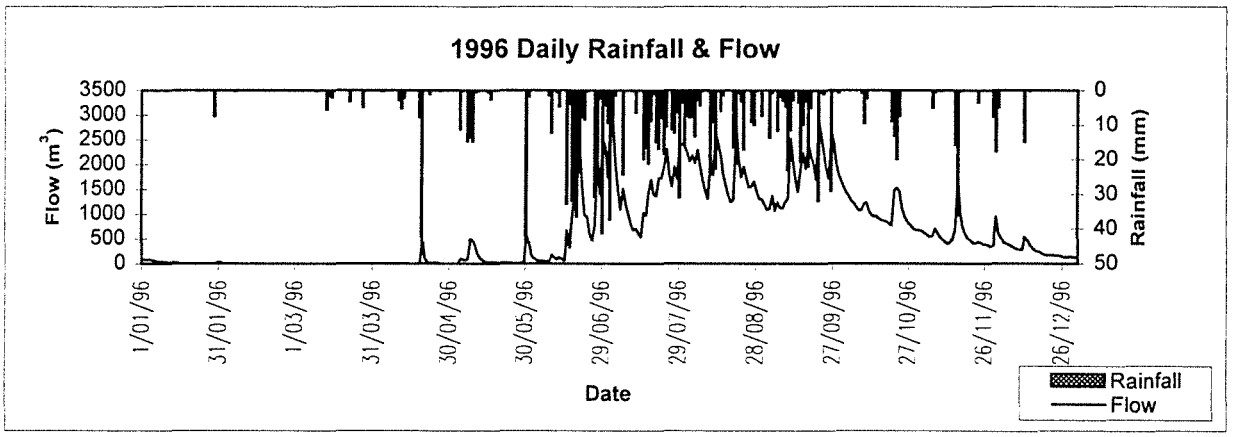


Bennetts Catchment - S 614018

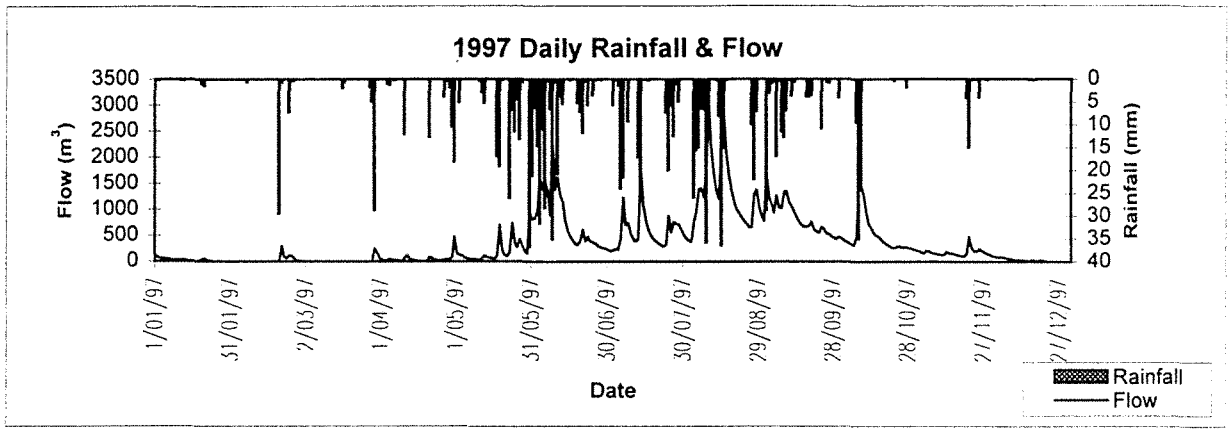




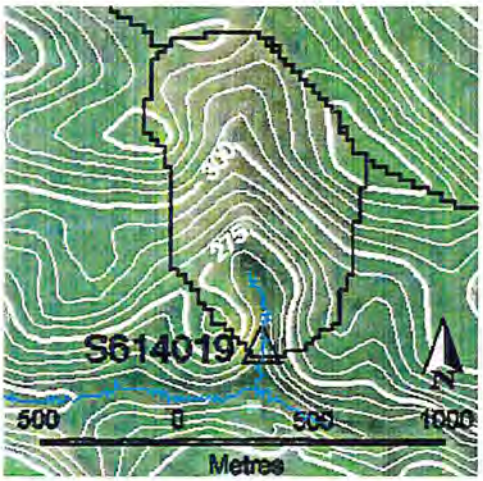


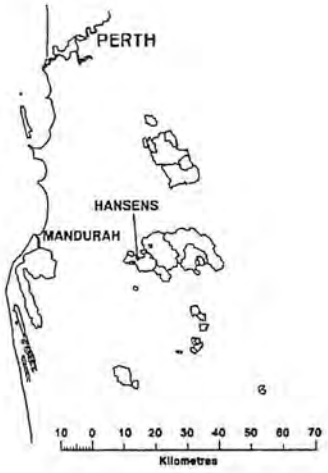


Bennetts Catchment - S 614018



Hansens Catchment





Legend

Catchment Boundary △ Gauging Station

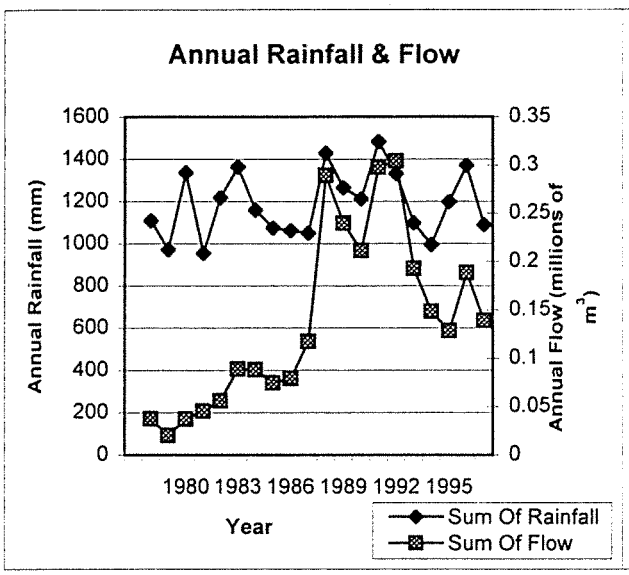
5 m Contours on Landsat Scene Jan 96

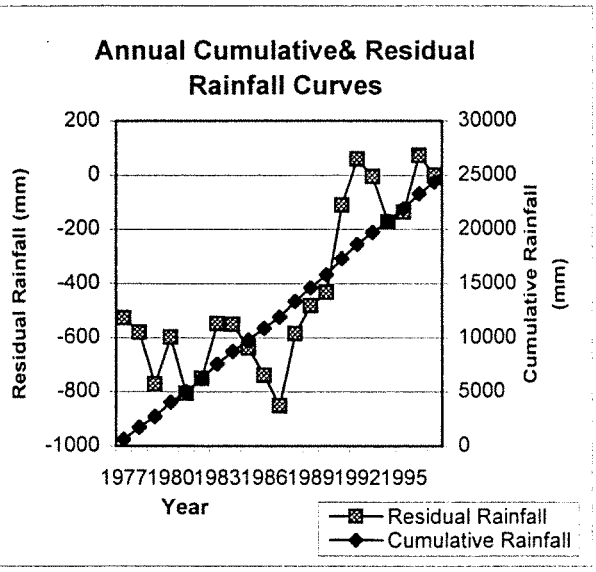
Computer Generated Stream Line

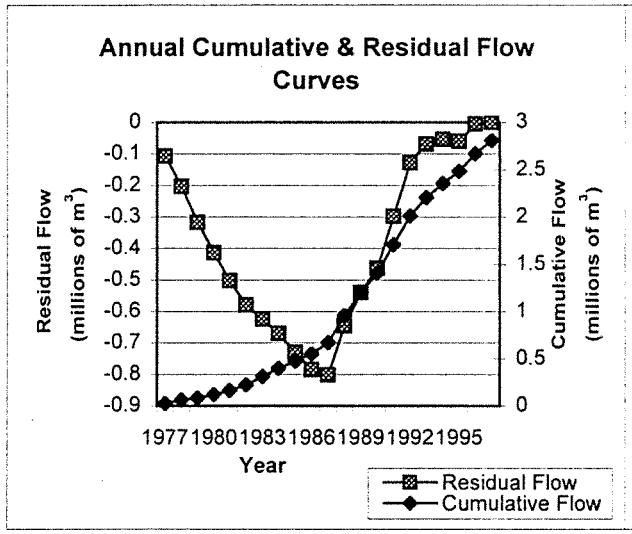
Gauging Station Number	S614019		
Rainfall Gauge Number	M509347		
Information about catchment			
Catchment area	0.73 km^2		
Gauging Station Coordinates (AMG)	N 6393210	E 411340	
Treatment data	1. Selective logging in '40&'50.		
	2. Uniform thinning in 1985-1986.		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	7595	7603	0
Number of years recorded	22	22	
Number of years with complete records	20	20	
Start date	25/05/77	17/05/77	
Finish date	10/03/98	10/03/98	
Number of days with quality code 1	7370	6876	
Number of days with quality code 2	96	210	
Number of days with quality code 3	10	354	
Number of days with quality code 4	4	79	
Number of days with quality code 157	107	78	
Number of days with quality code 255	8	6	
Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	
Average	1188.3	0.139	
Min	953.8	0.020	
Max	1483.7	0.304	

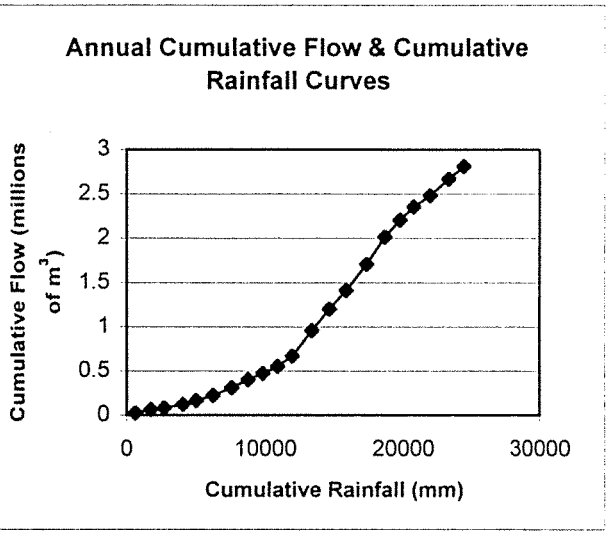
Year	Number of flow days
1978	252
1979	239
1980	234
1981	213
1982	365
1983	346
1984	342
1985	365
1986	365
1987	365
1988	366
1989	365
1990	365
1991	365
1992	366
1993	363
1994	363
1995	365
1996	366
1997	365
1998	68
Total	**6803**

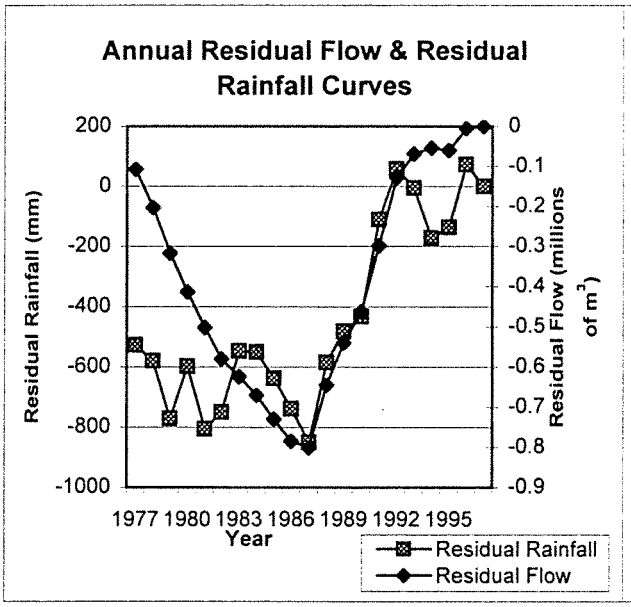
Hansens Catchment - S 614019

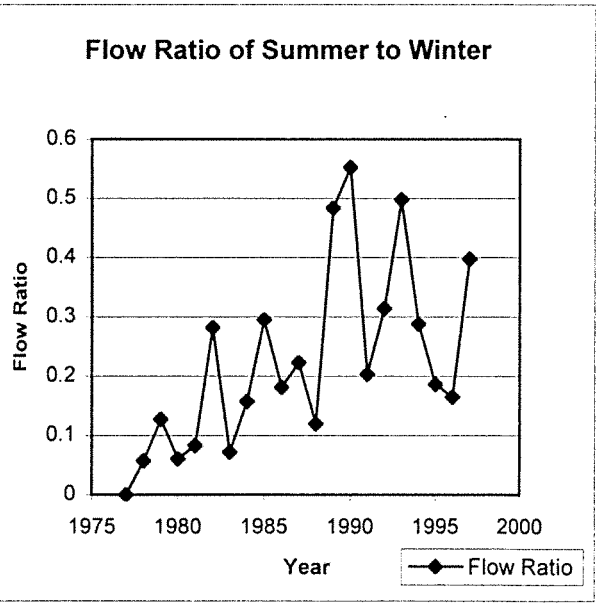




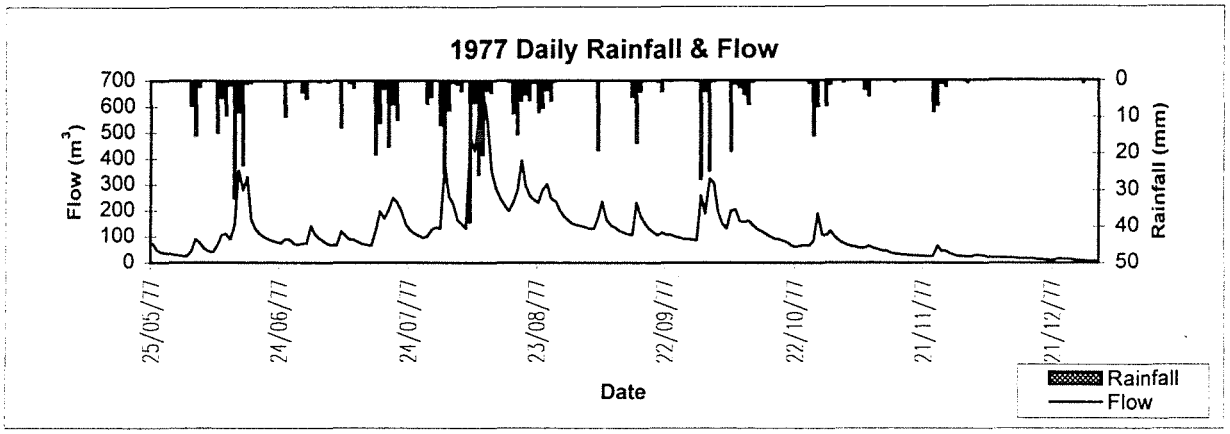


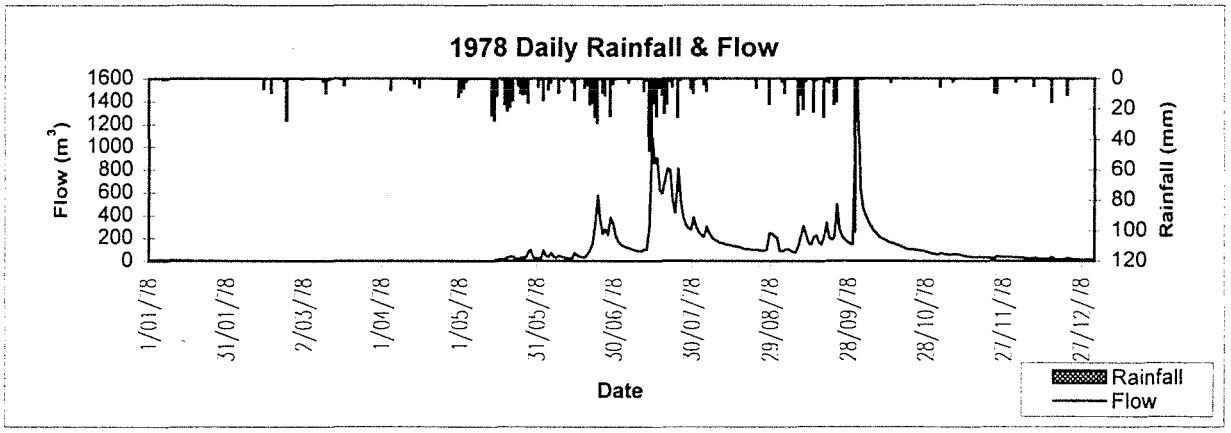


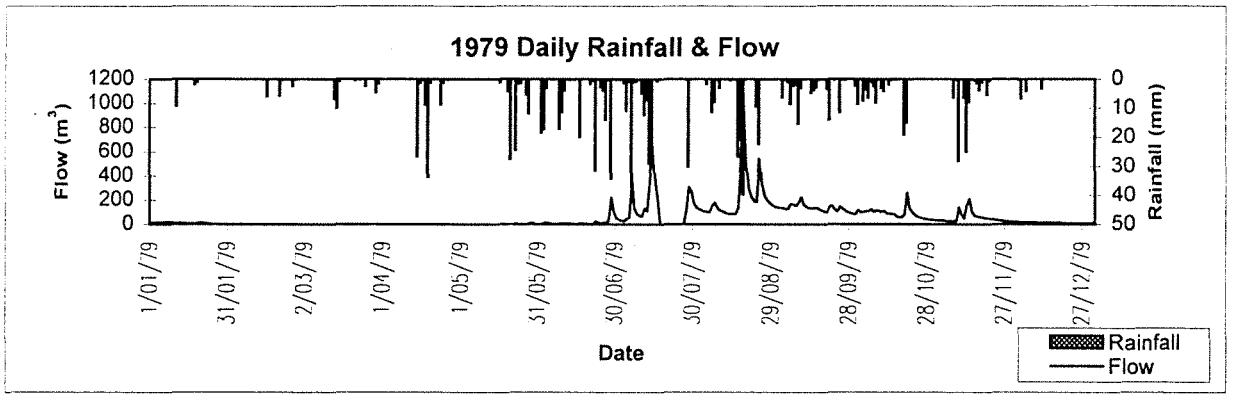


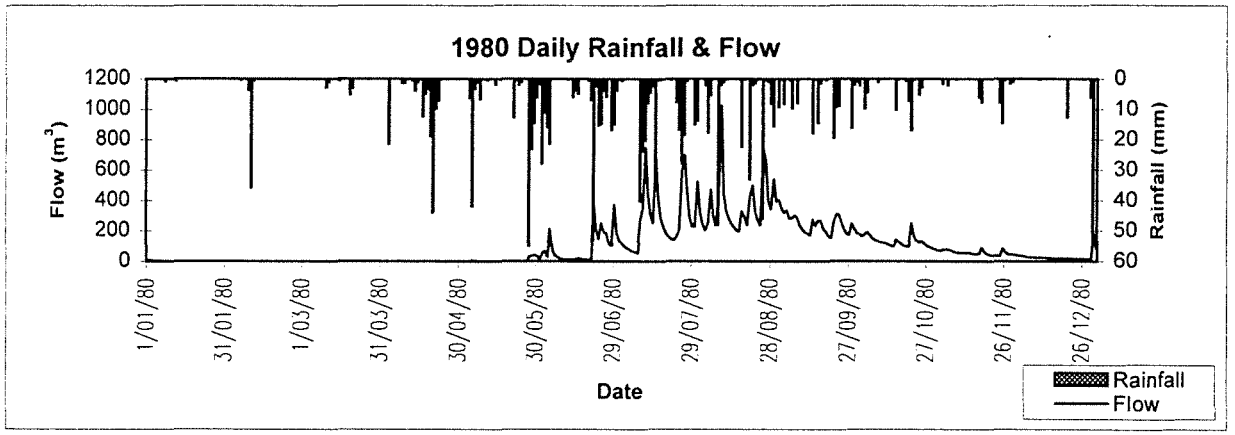


Hansens Catchment - S 614019

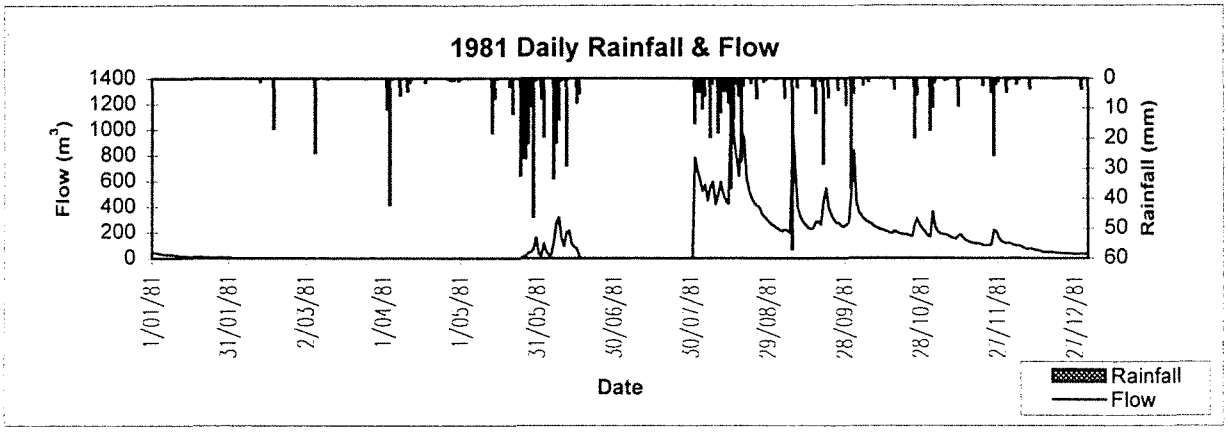


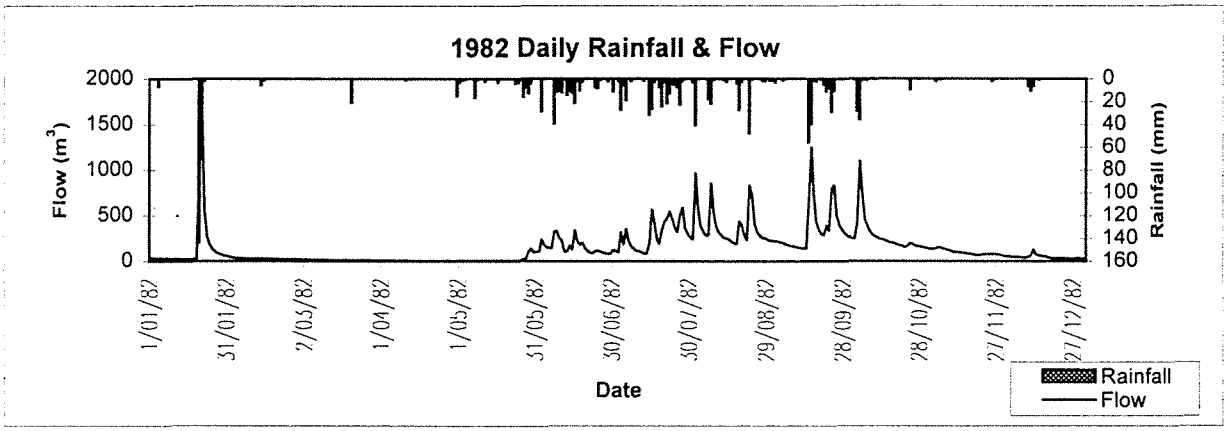


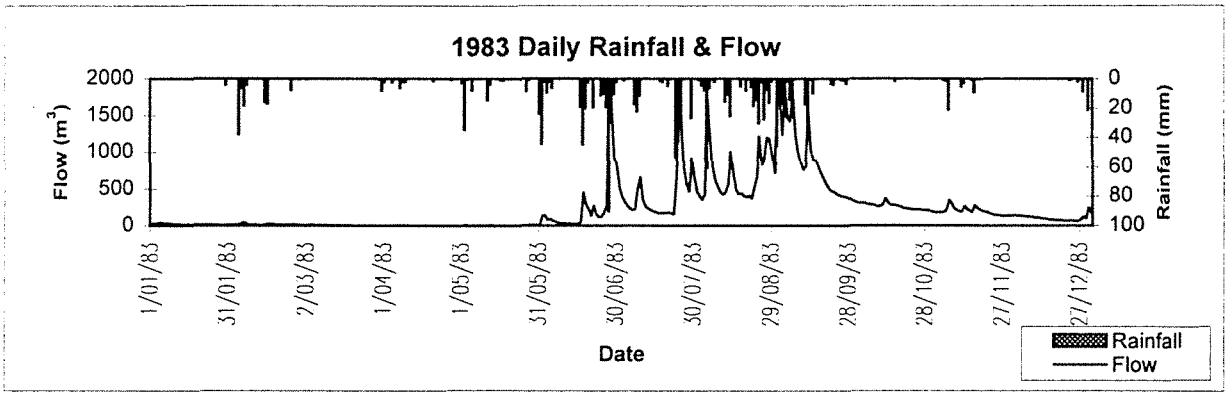


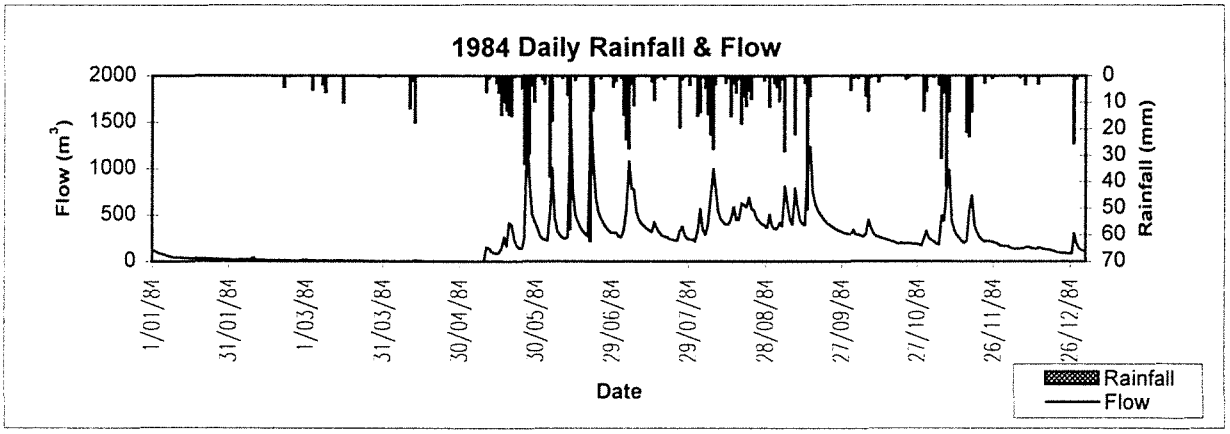


Hansens Catchment - S 614019

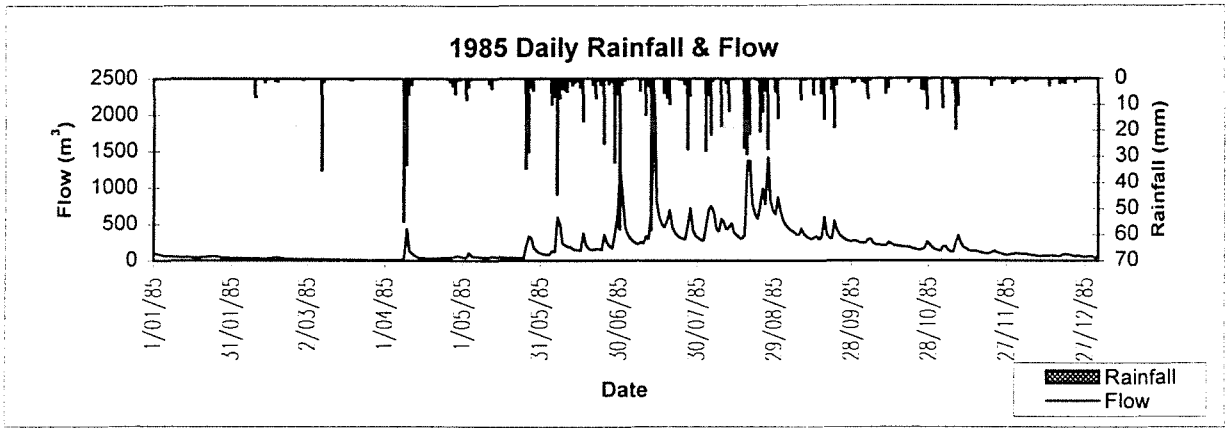


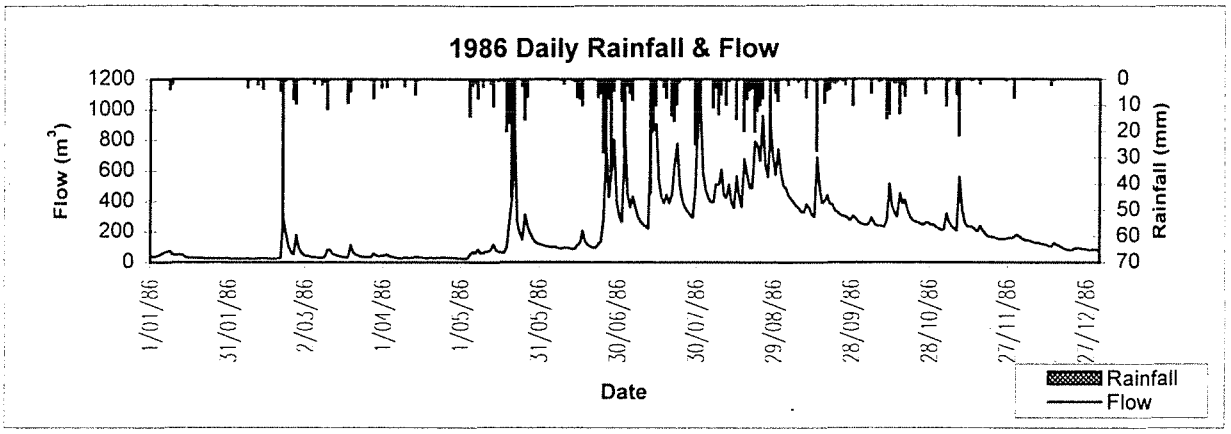


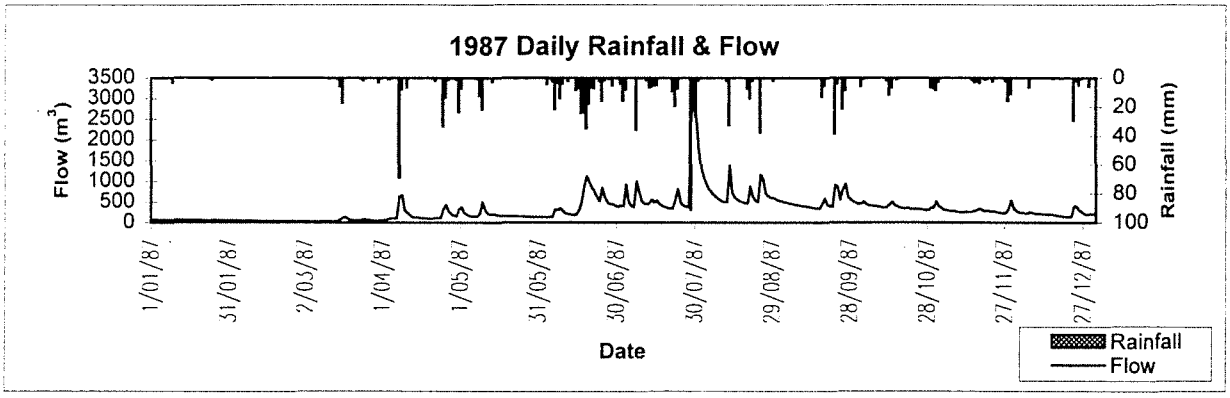


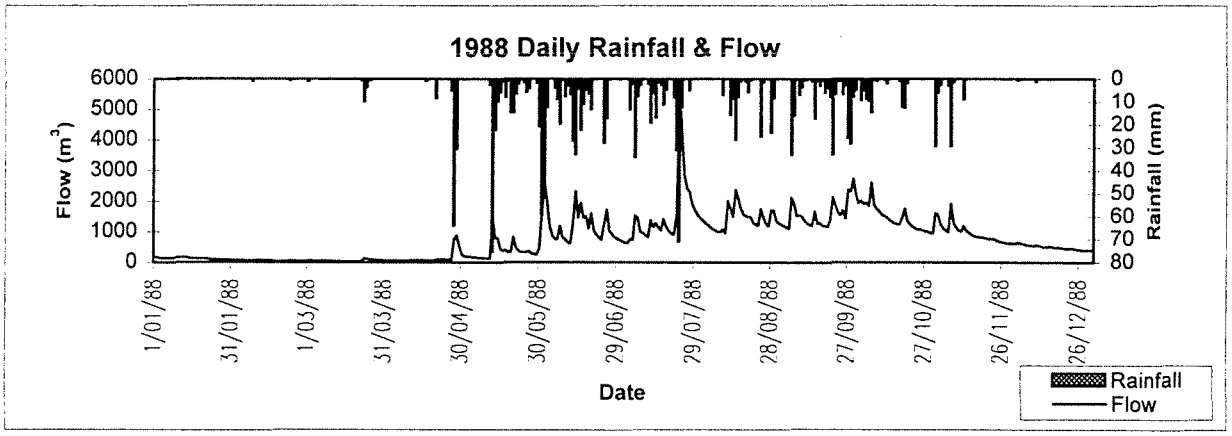


Hansens Catchment - S 614019

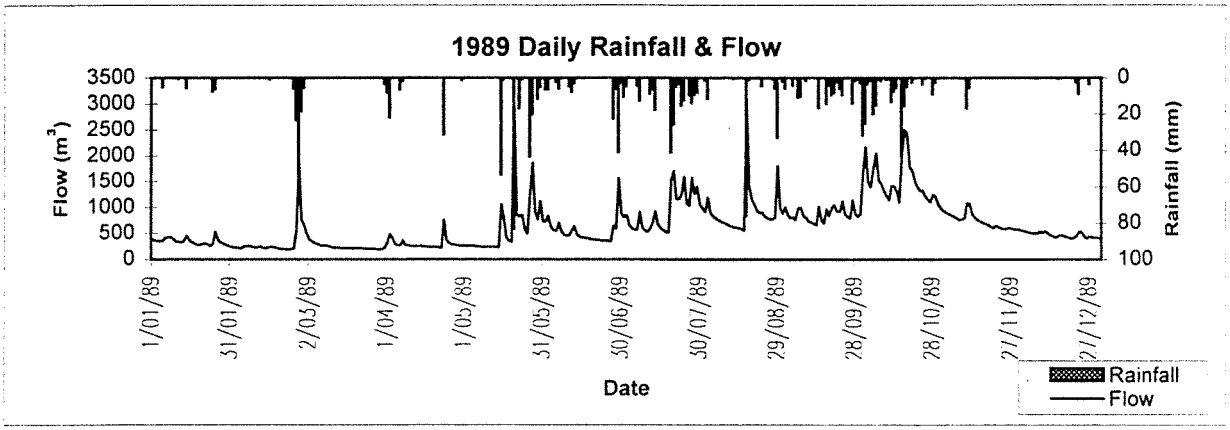


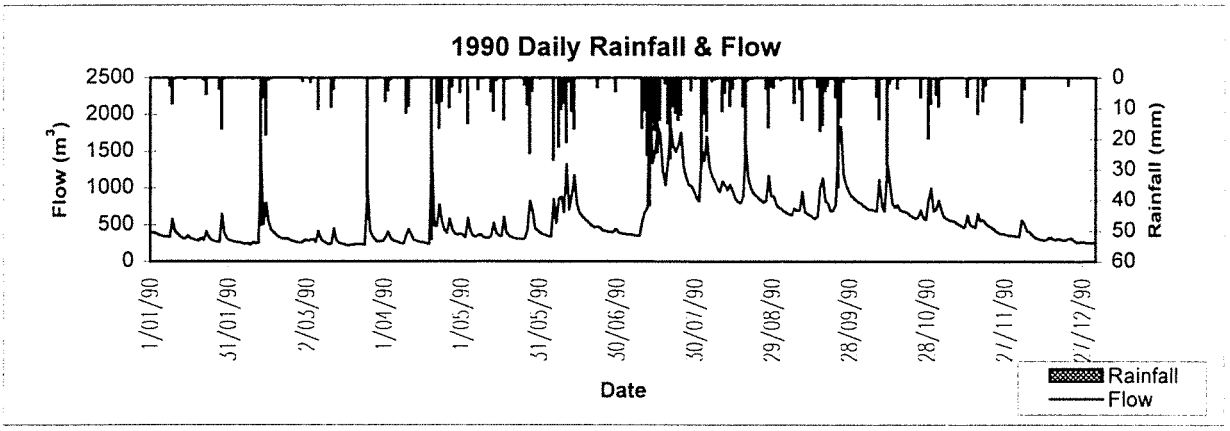


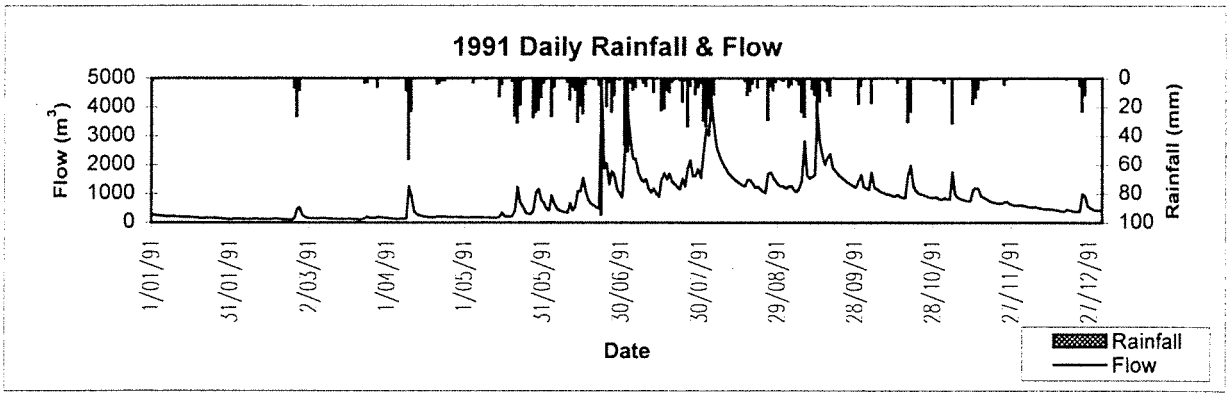


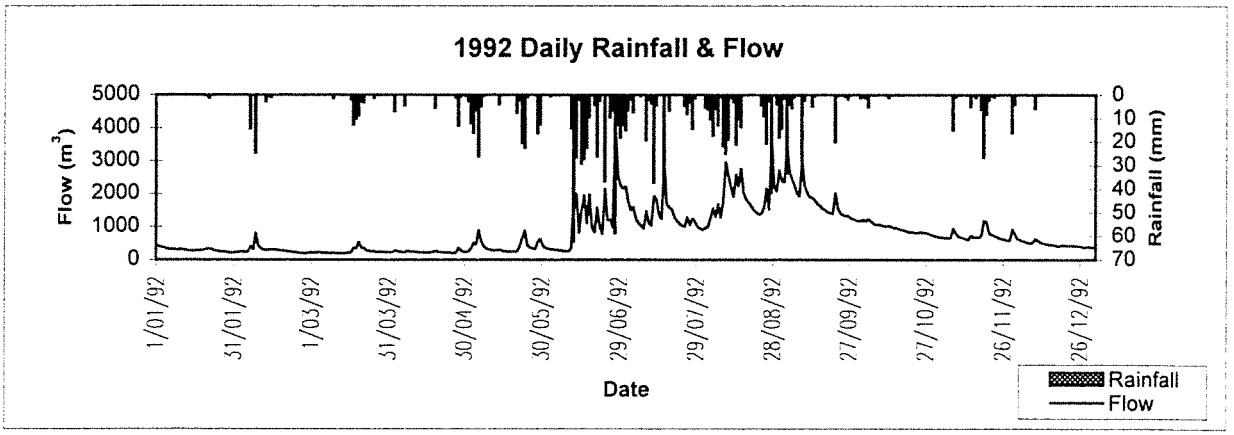


Hansens Catchment - S 614019

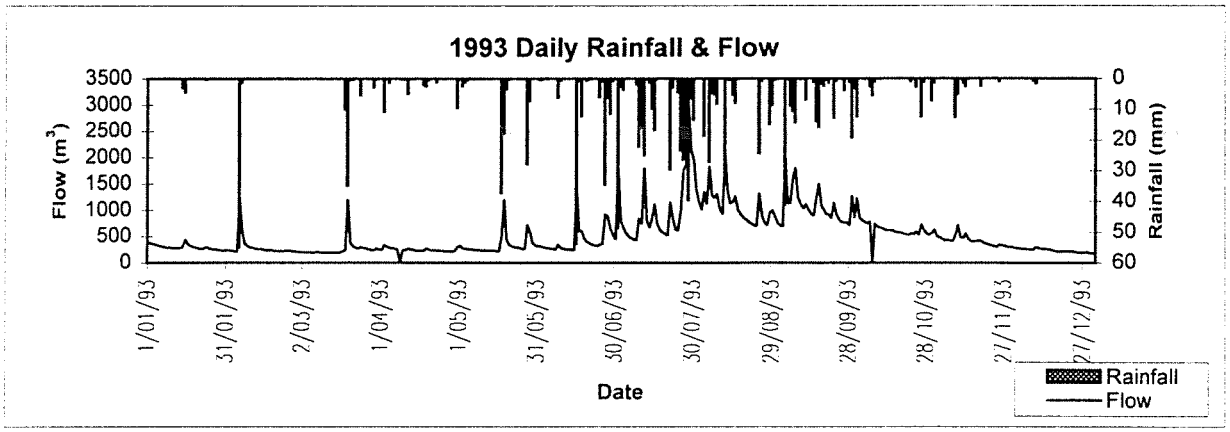


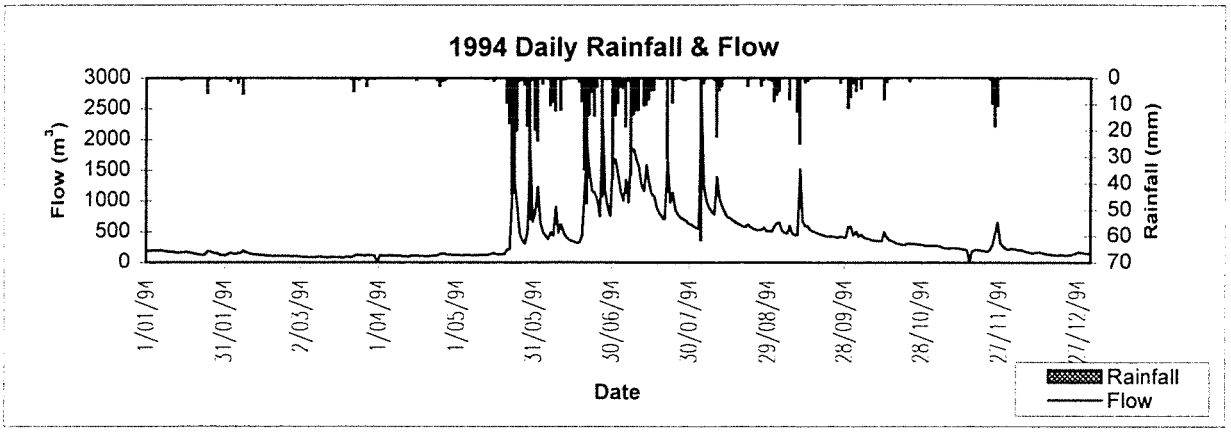


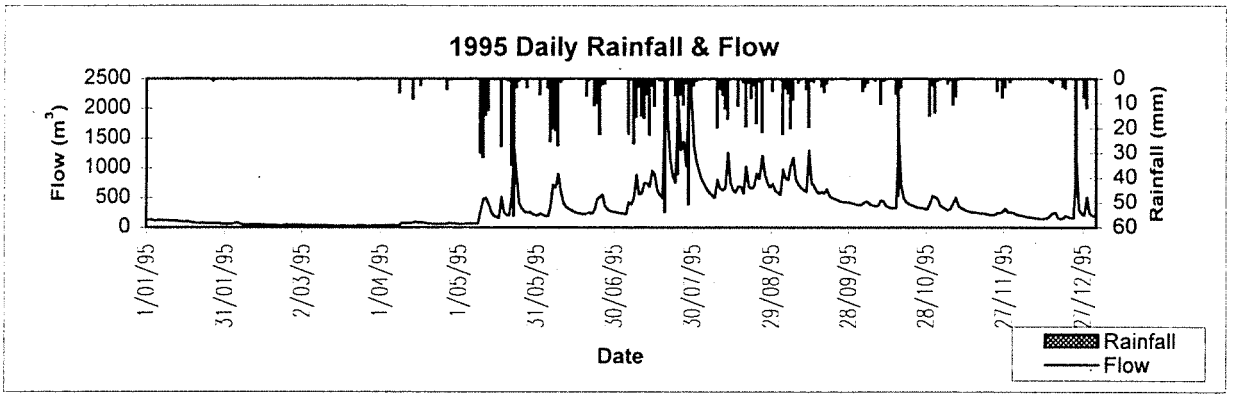


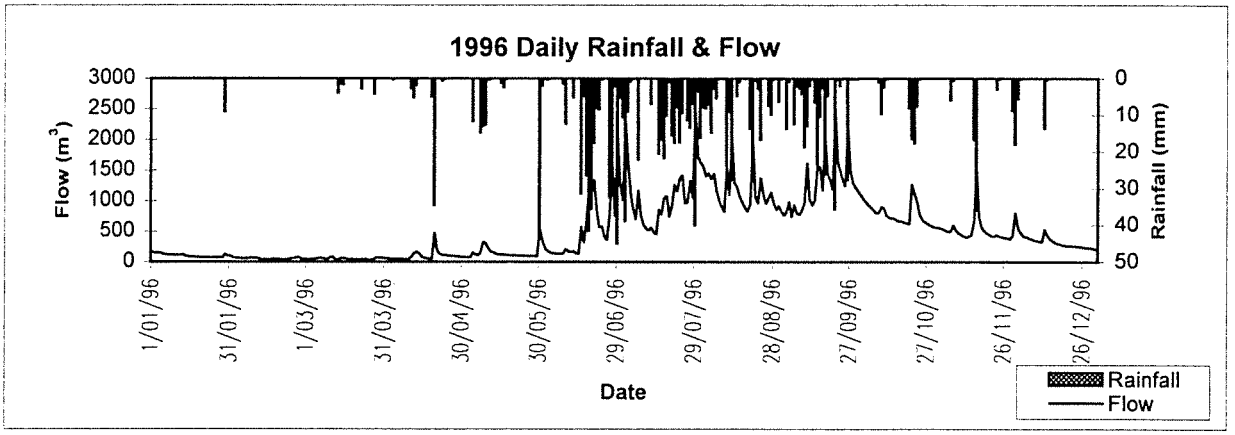


Hansens Catchment - S 614019

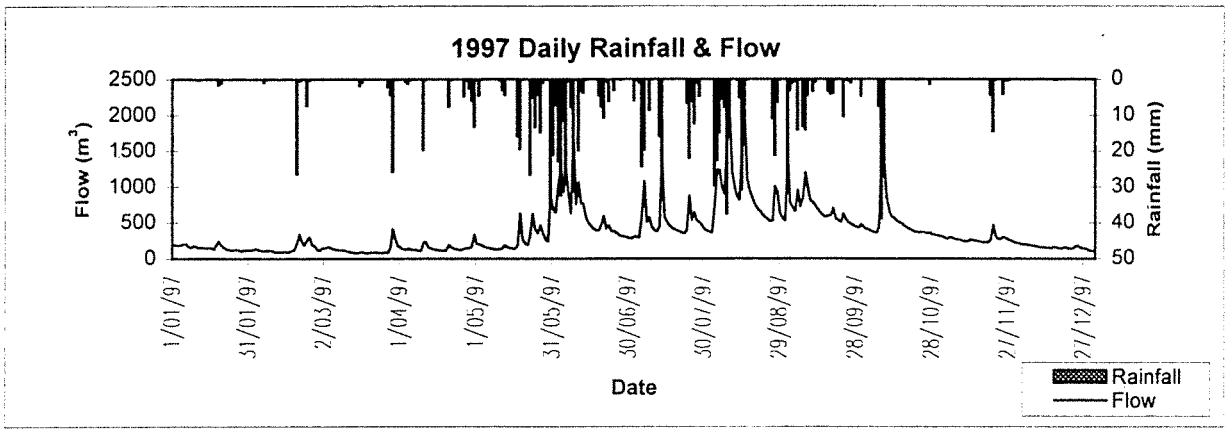




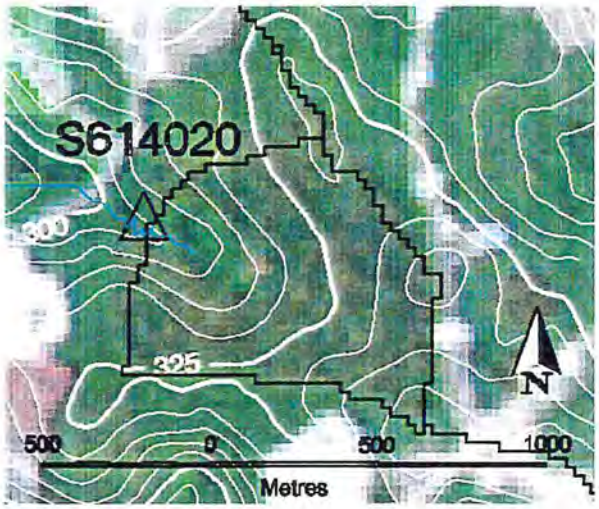


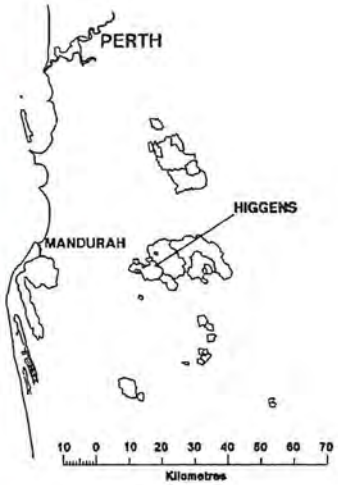


Hansens Catchment - S 614019



Higgens Catchment





Legend

Catchment Boundary △ Gauging Station

300 5 m Contours on Landsat Scene Jan 96

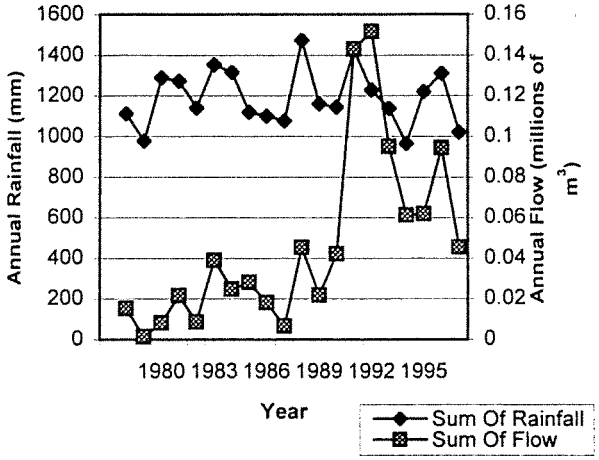
Computer Generated Stream Line

Gauging Station Number	S614020		
Rainfall Gauge Number	M509348		
Information about catchment			
Catchment area	0.60 km^2		
Gauging Station Coordinates (AMG)	N 6394450	E 414475	
Treatment data	Uniform thinning in 1988/89.		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	7624	7624	0
Number of years recorded	22	22	
Number of years with complete records	20	20	
Start date	16/06/77	16/06/77	
Finish date	30/04/98	30/04/98	
Number of days with quality code 1	7152	7494	
Number of days with quality code 2	372	65	
Number of days with quality code 3	68	37	
Number of days with quality code 157	22	21	
Number of days with quality code 255	10	7	
Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	
Average	1192.7	0.047	
Min	964.9	0.001	
Max	1473.1	0.152	

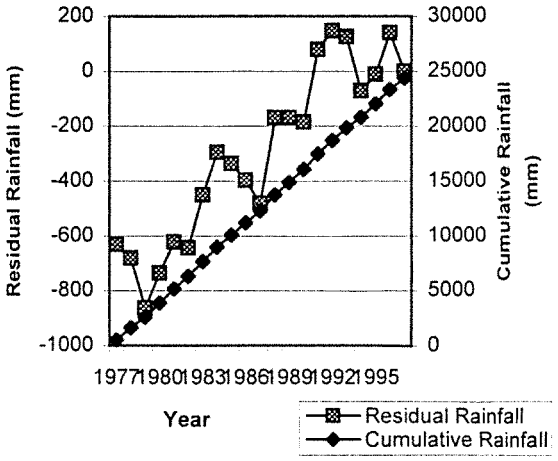
Year	Number of flow days
1978	121
1979	47
1980	107
1981	110
1982	109
1983	130
1984	178
1985	149
1986	144
1987	67
1988	177
1989	136
1990	165
1991	218
1992	340
1993	343
1994	225
1995	213
1996	204
1997	207
Total	**3390**

Higgens Catchment - S 614020

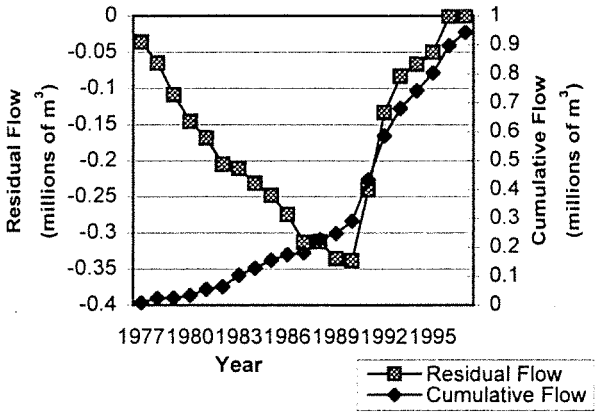
Annual Rainfall & Flow



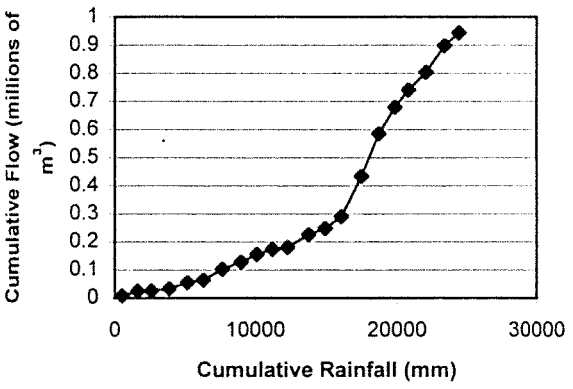
Annual Cumulative & Residual Rainfall Curves



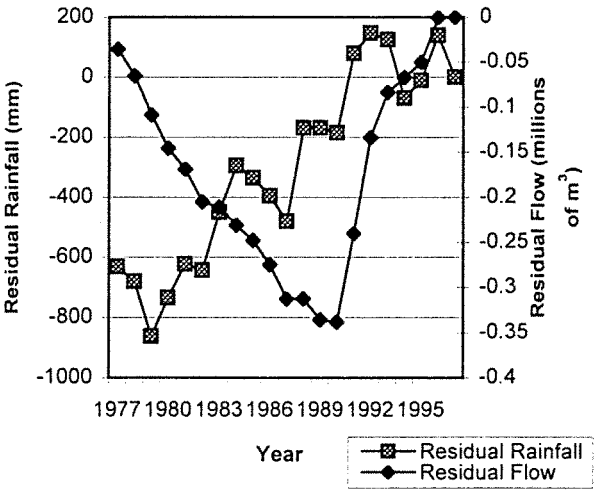
Annual Cumulative & Residual Flow Curves



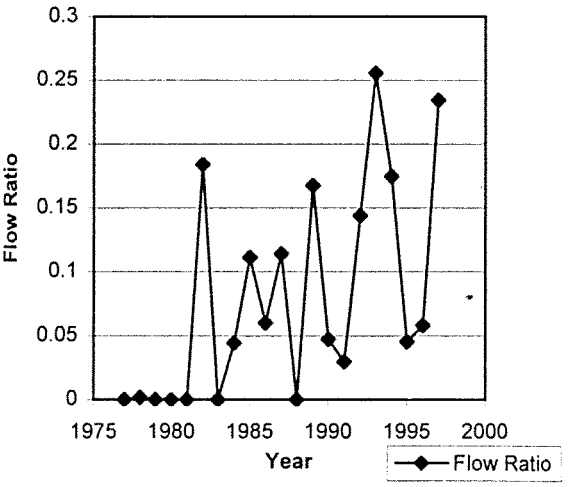
Annual Cumulative Flow & Cumulative Rainfall Curves



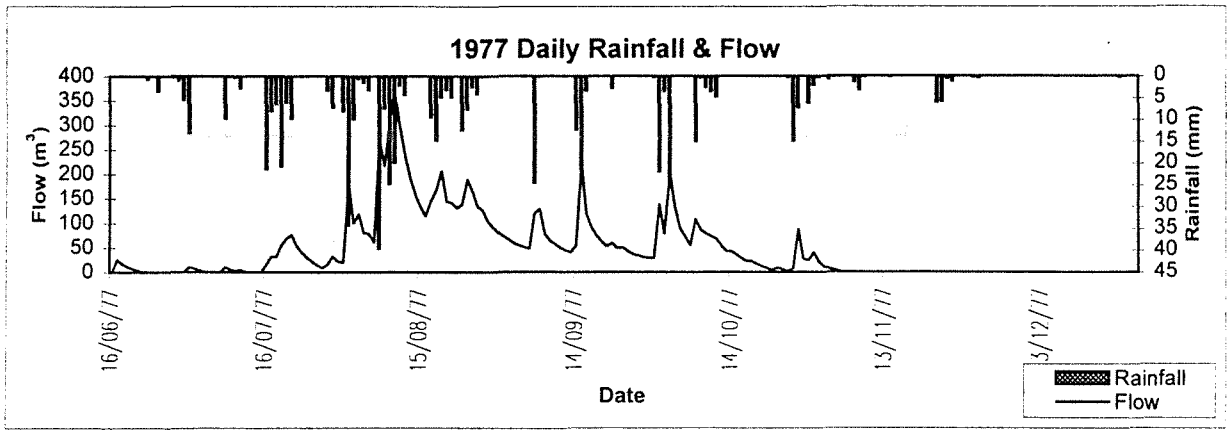
Annual Residual Flow & Residual Rainfall Curves

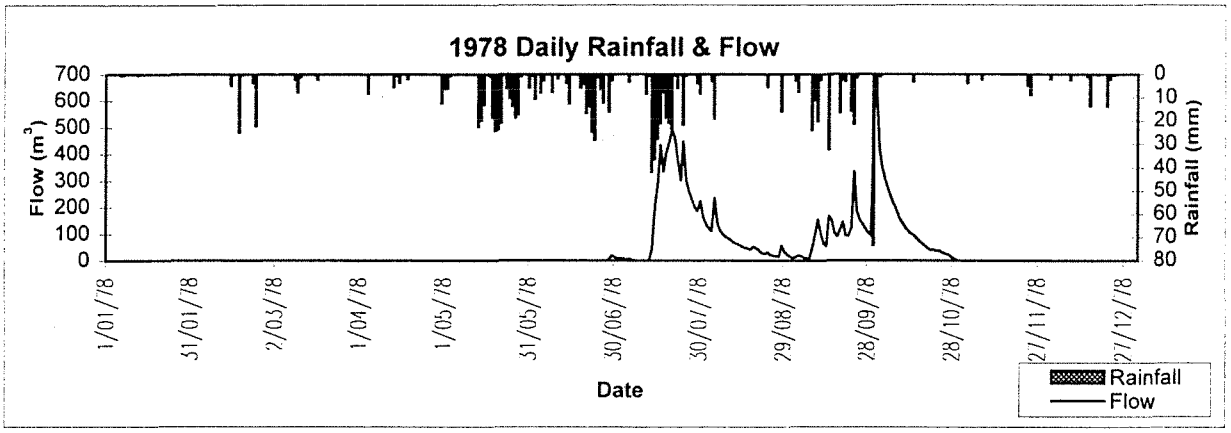


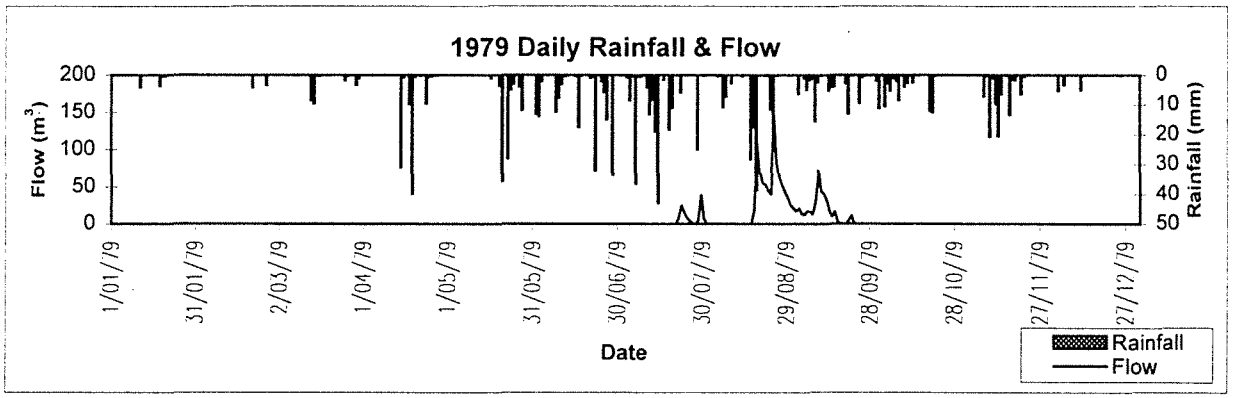
Flow Ratio of Summer to Winter

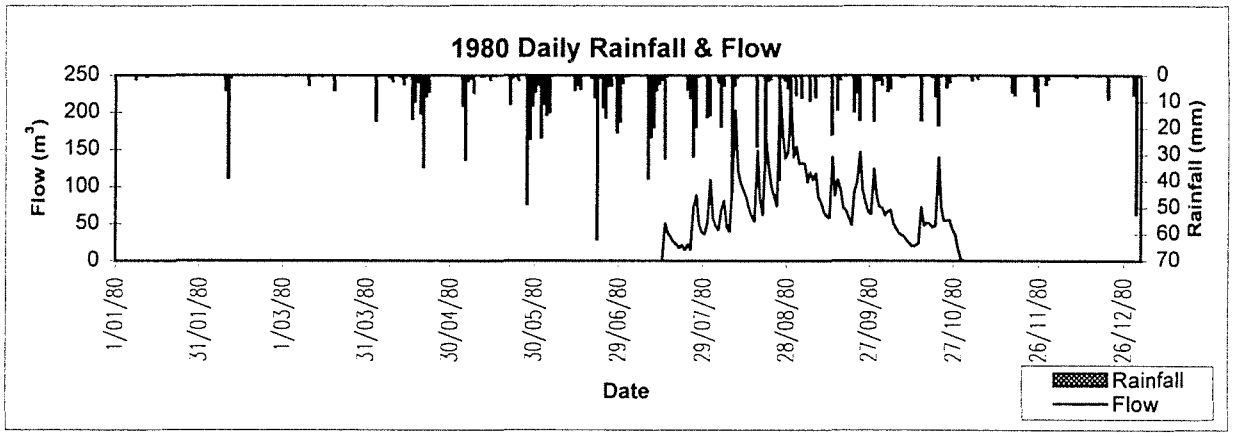


Higgens Catchment - S 614020

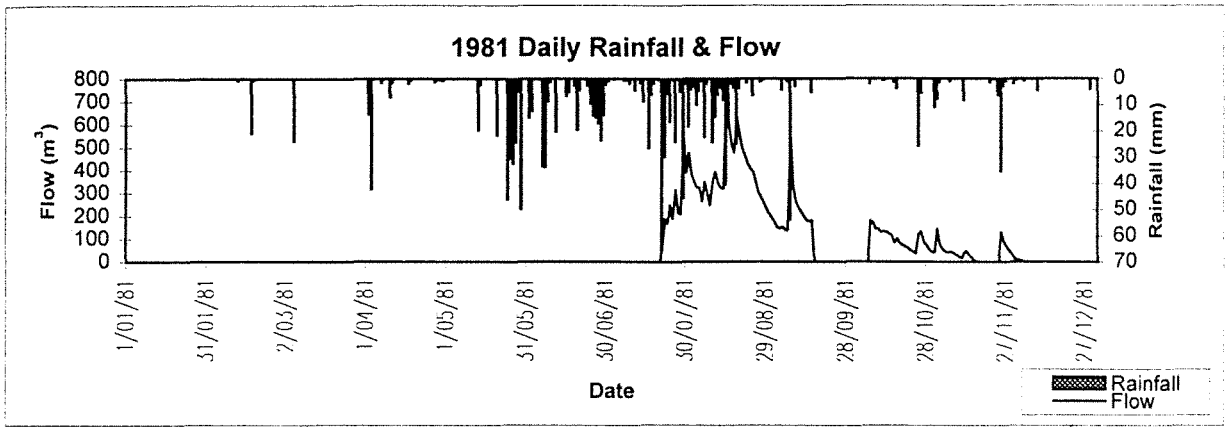


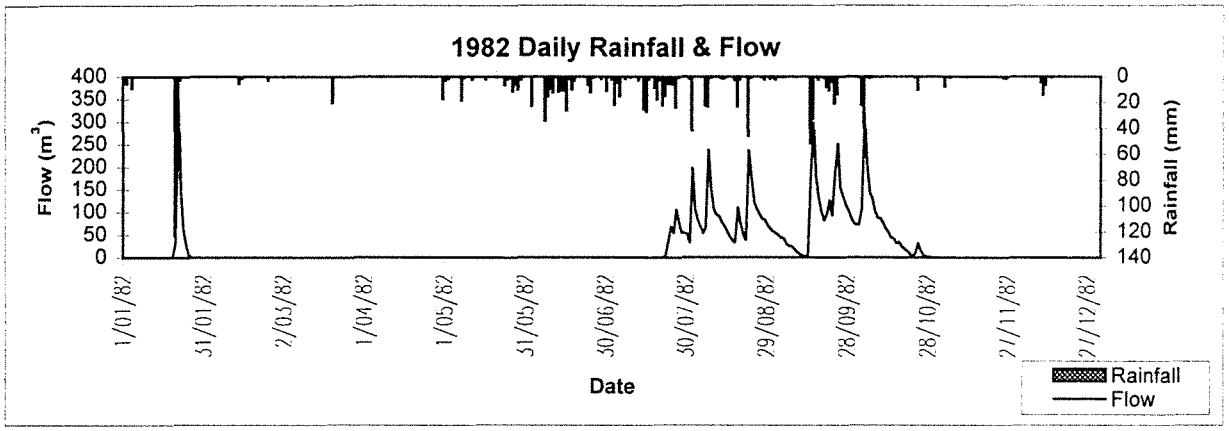


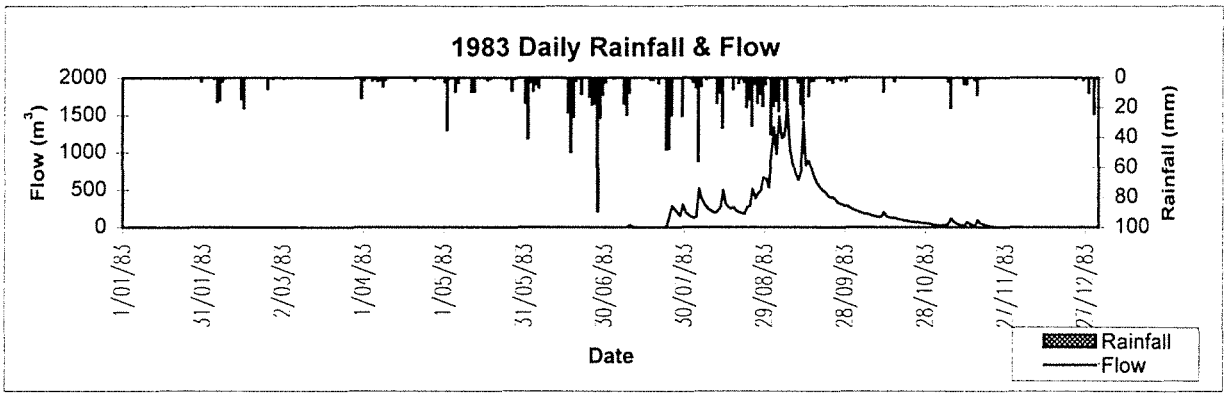


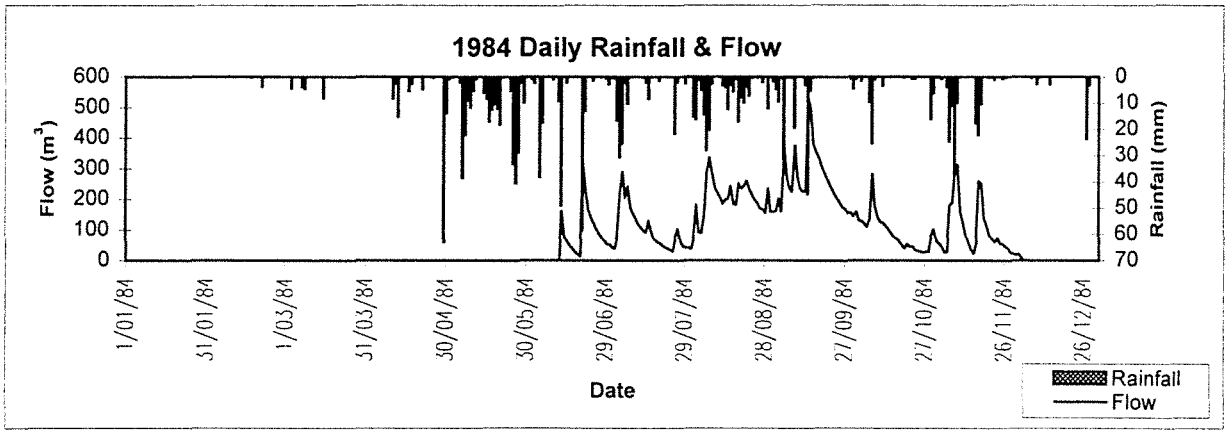


Higgens Catchment - S 614020

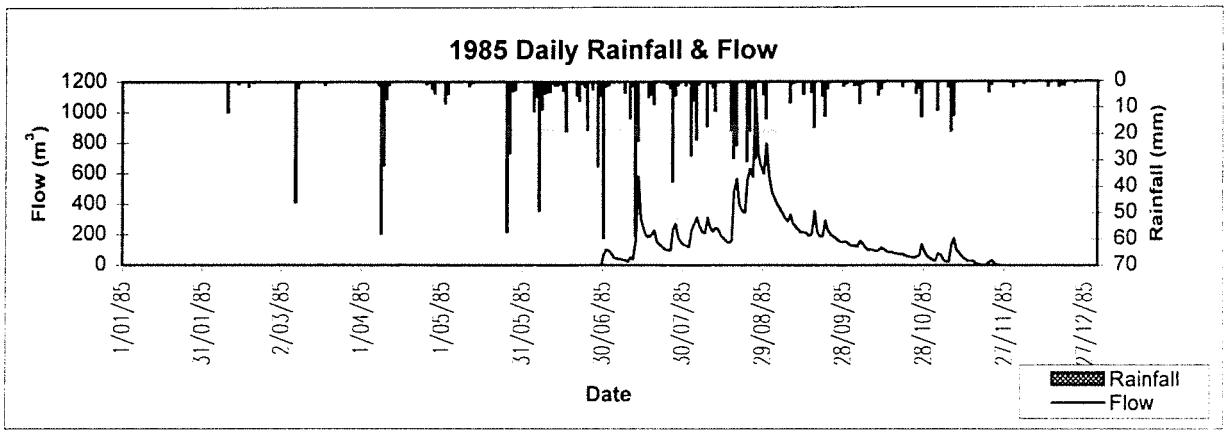


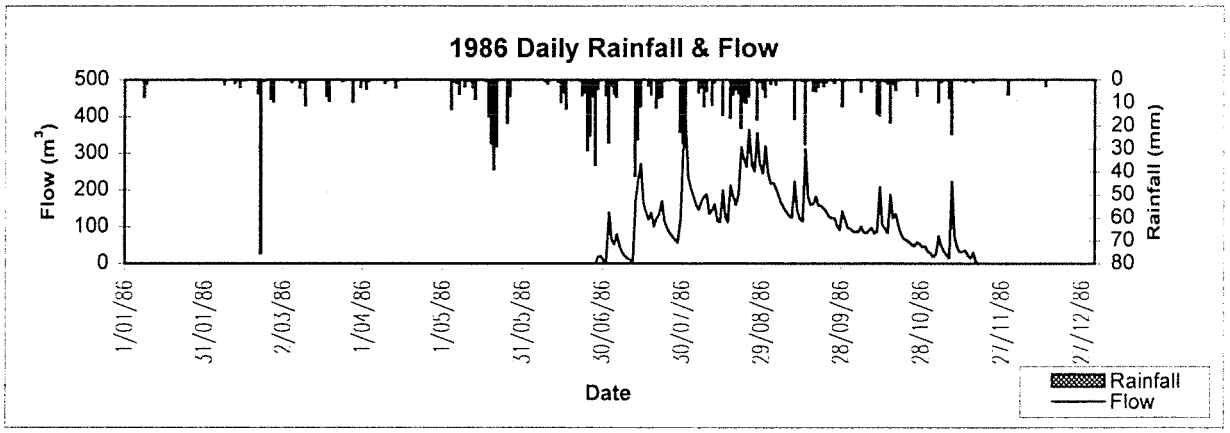


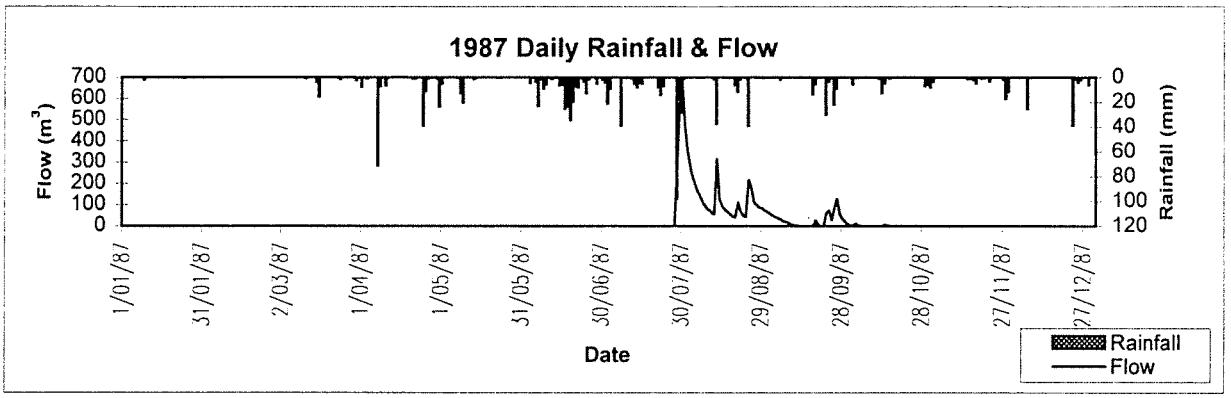


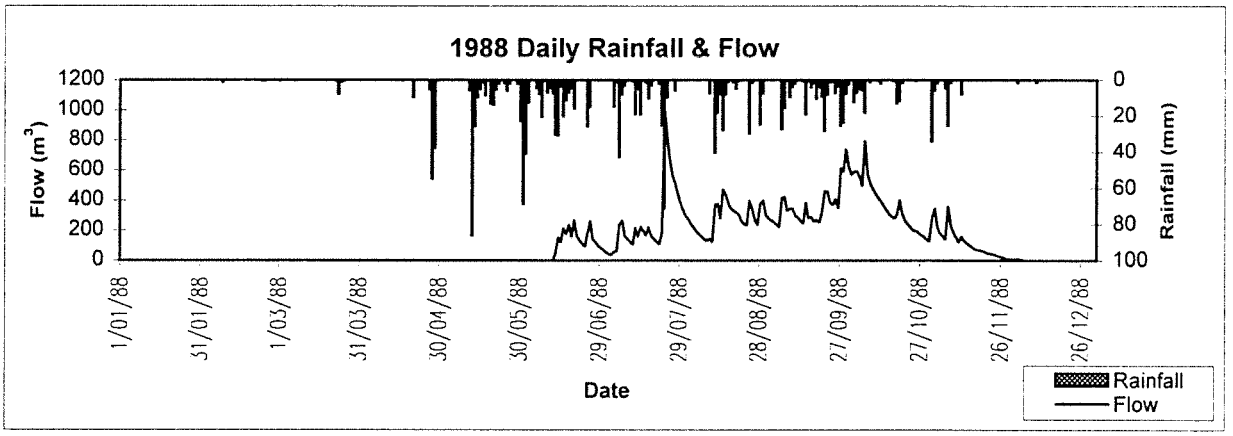


Higgens Catchment - S 614020

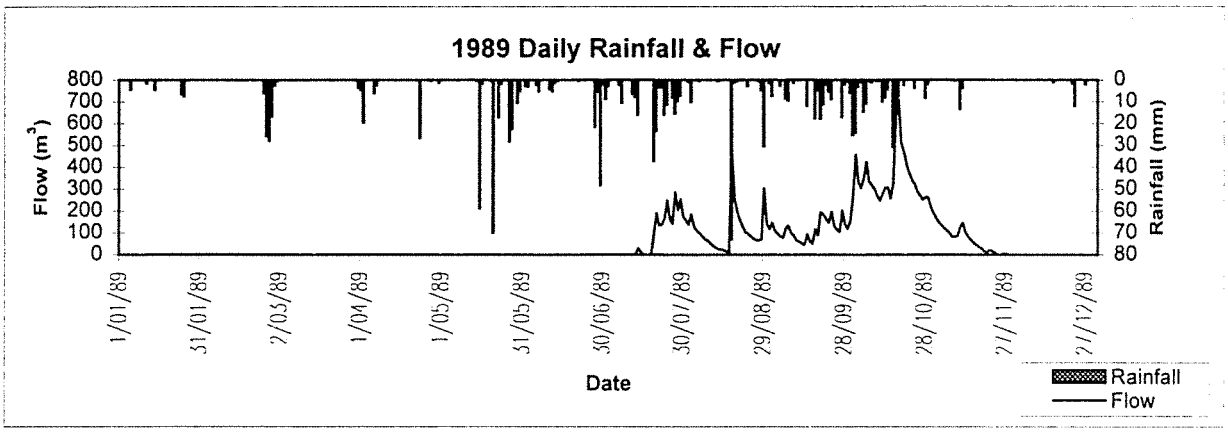


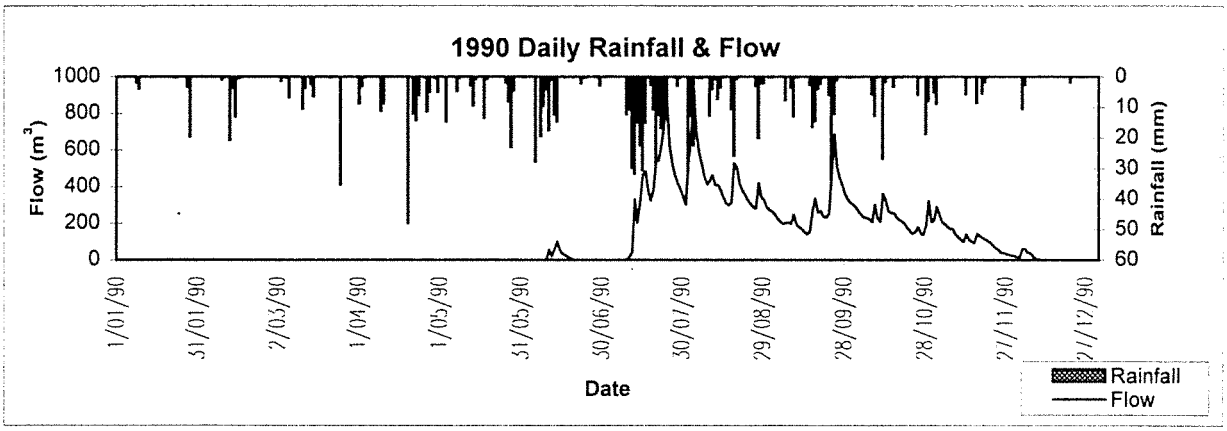


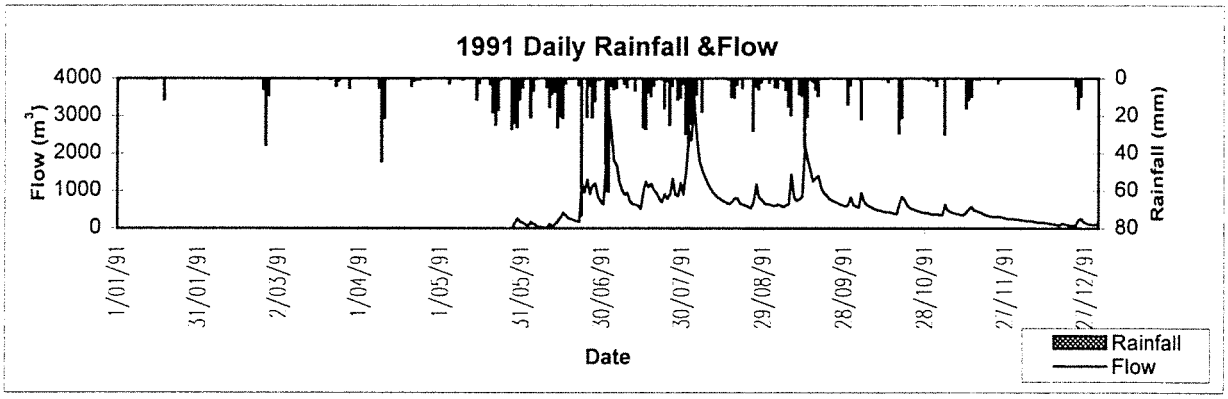


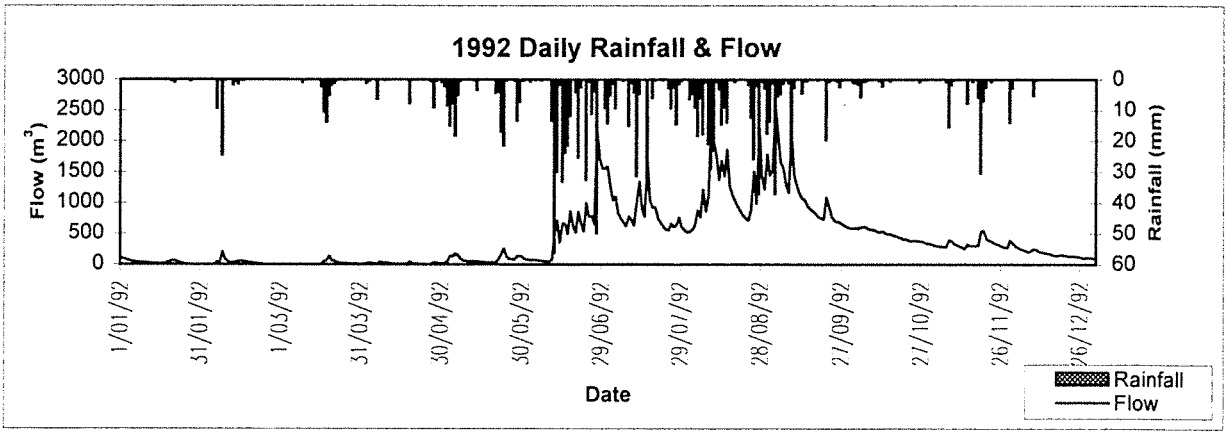


Higgens Catchment - S 614020

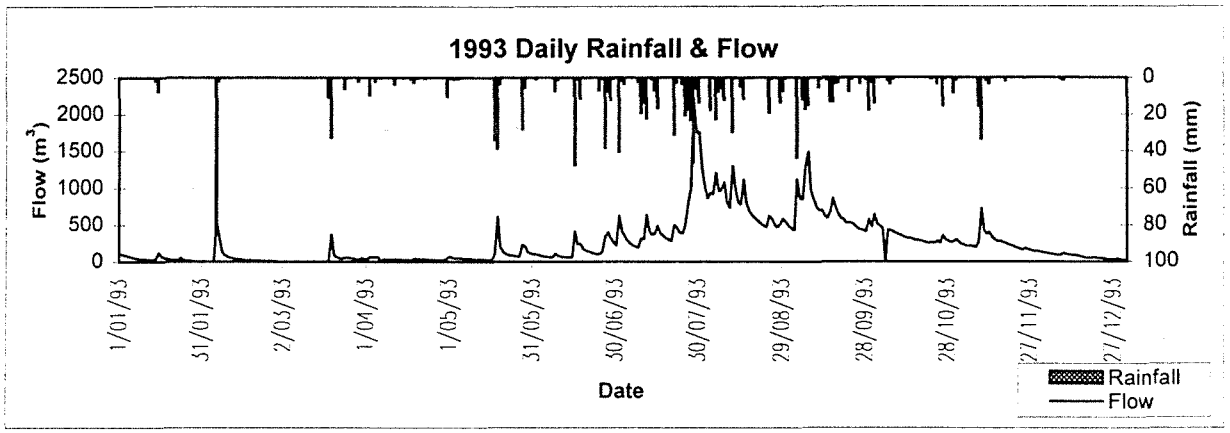


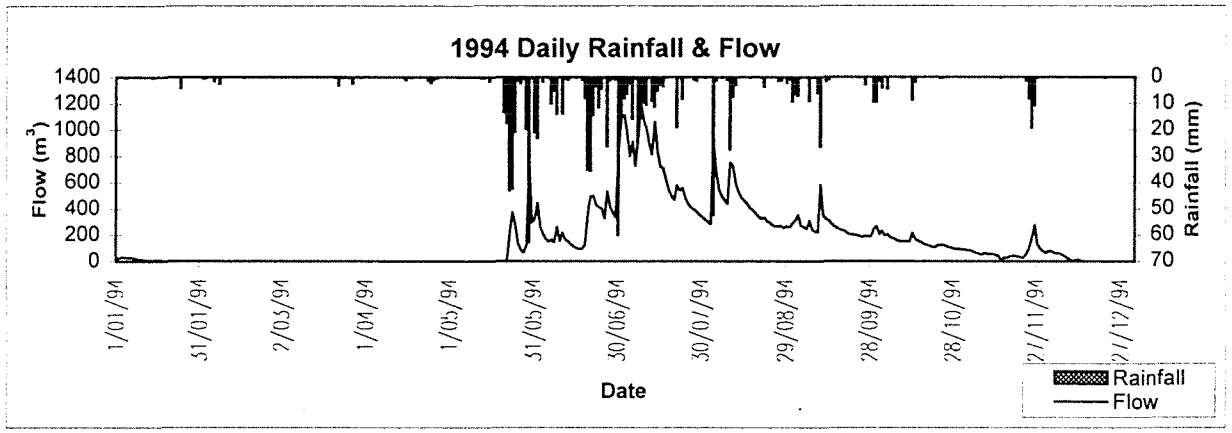


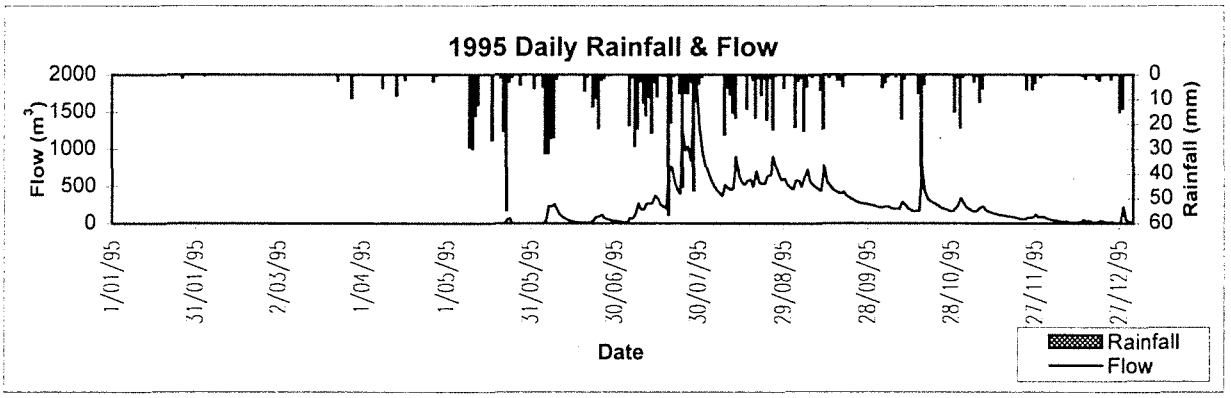


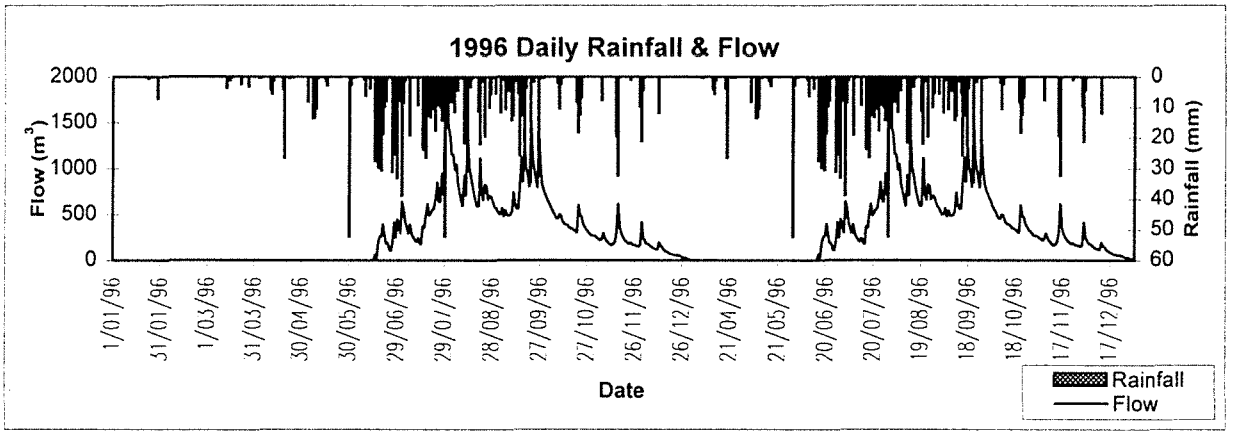


Higgens Catchment - S 614020

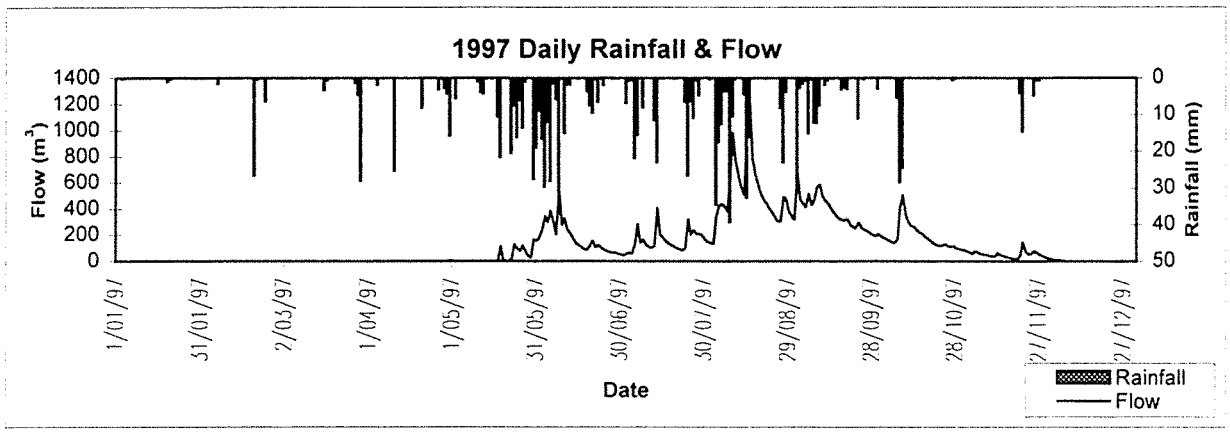




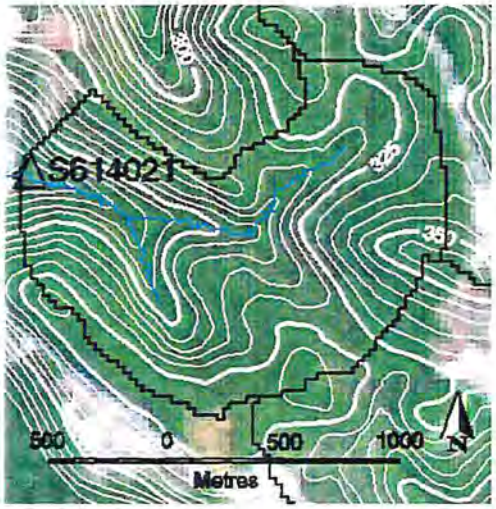


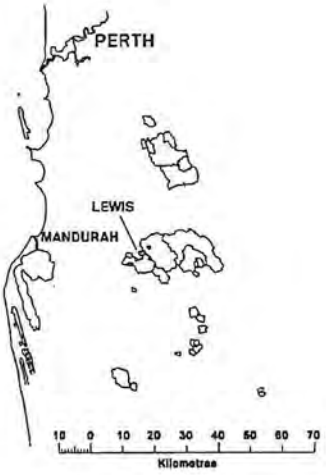


Higgens Catchment - S 614020



Lewis Catchment





Legend

Catchment Boundary △ Gauging Station

300 5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S614021
Rainfall Gauge Number	M509349

Information about catchment

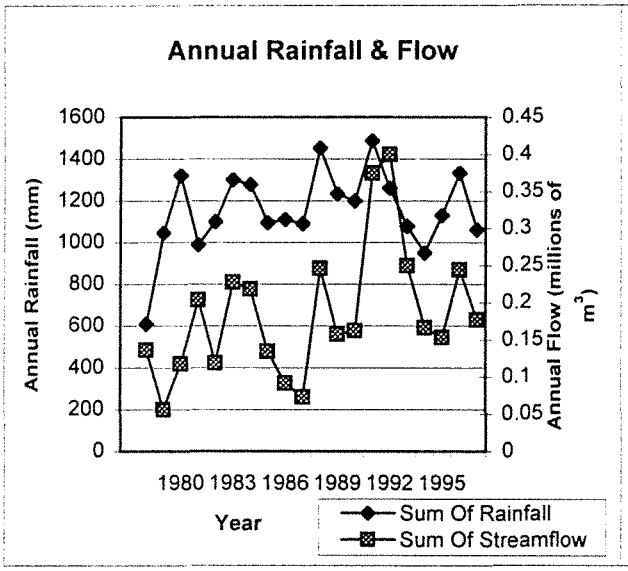
Catchment area	2.01 km^2		
Gauging Station Coordinates (AMG)	N 6396320		
	E 411400		
Treatment data	1. Severe dieback.	2. Untreated.	3. Bauxite mining since 1996.

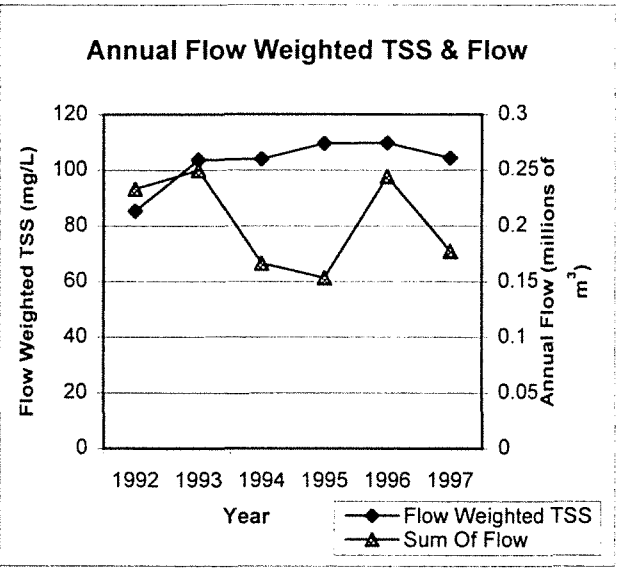
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	7645	7645	2090
Number of years recorded	22	22	6
Number of years with complete records	5	5	7
Start date	26/05/77	26/05/77	11/08/92
Finish date	30/04/98	30/04/98	1/05/98
Number of days with quality code 1	7296	7041	1858
Number of days with quality code 2	135	356	29
Number of days with quality code 3	75	199	88
Number of days with quality code 4	90	46	113
Number of days with quality code 157	90	0	0
Number of days with quality code 172	1	0	0
Number of days with quality code 255	10	3	2

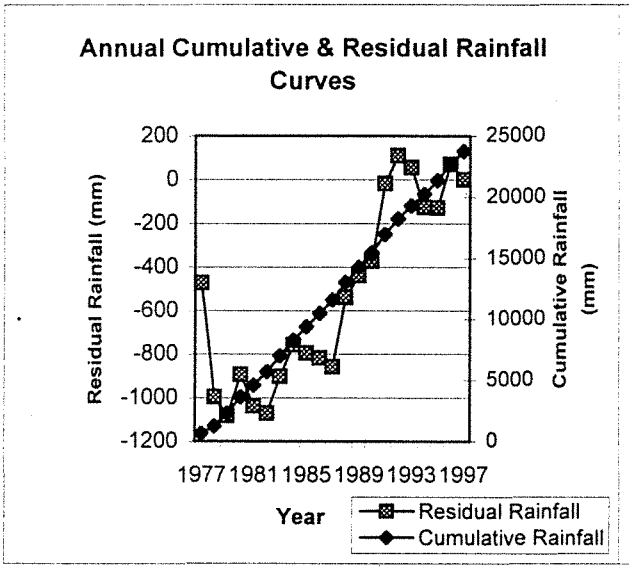
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	1156.1	0.186	102.31
Min	609.2	0.056	85.33
Max	1487.6	0.400	109.85

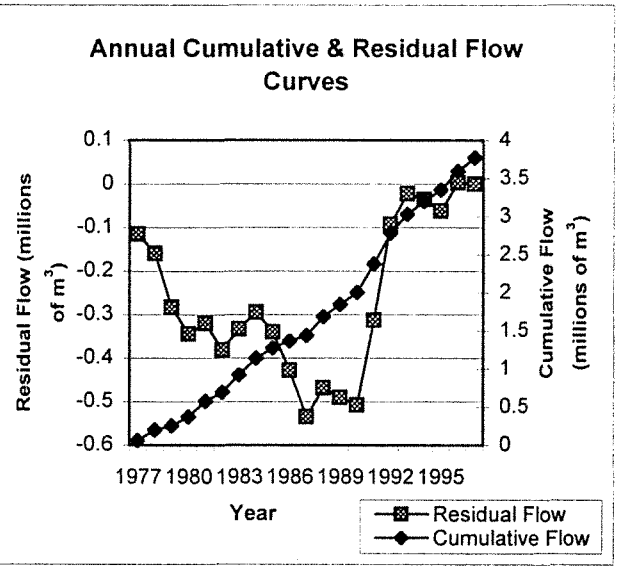
Year	Number of flow days
1978	365
1979	357
1980	287
1981	353
1982	365
1983	365
1984	366
1985	365
1986	365
1987	316
1988	275
1989	365
1990	365
1991	365
1992	366
1993	365
1994	365
1995	364
1996	366
1997	365
Total	7065

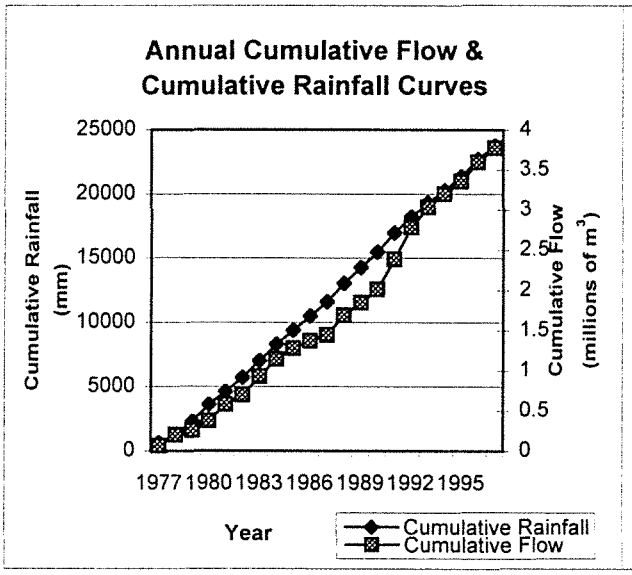
Lewis Catchment - S 614021

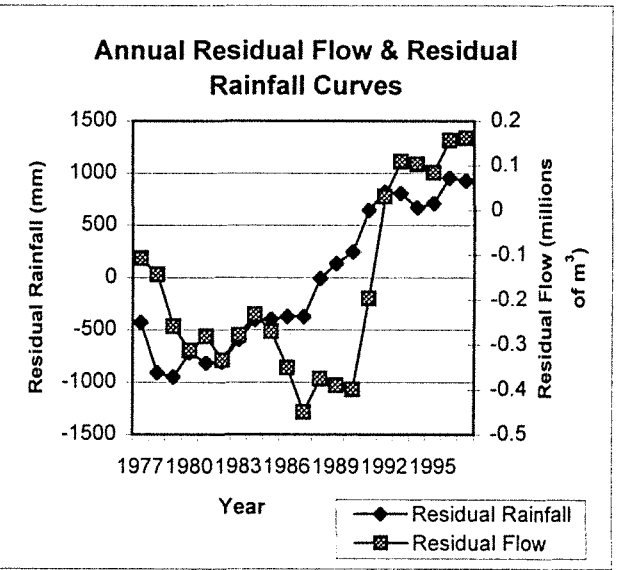




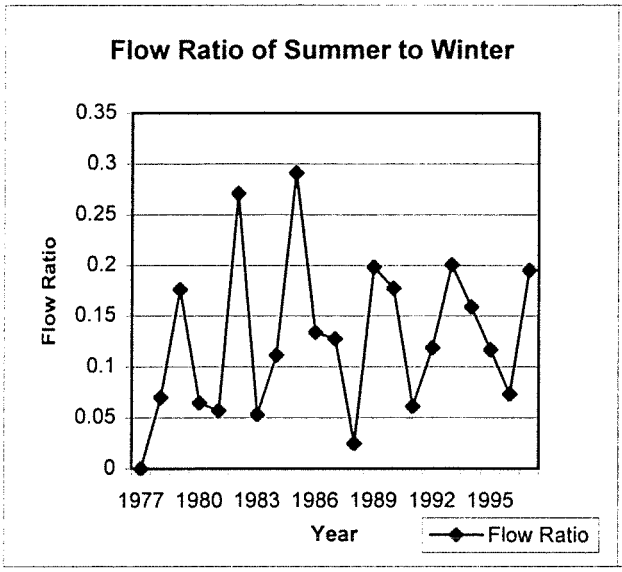


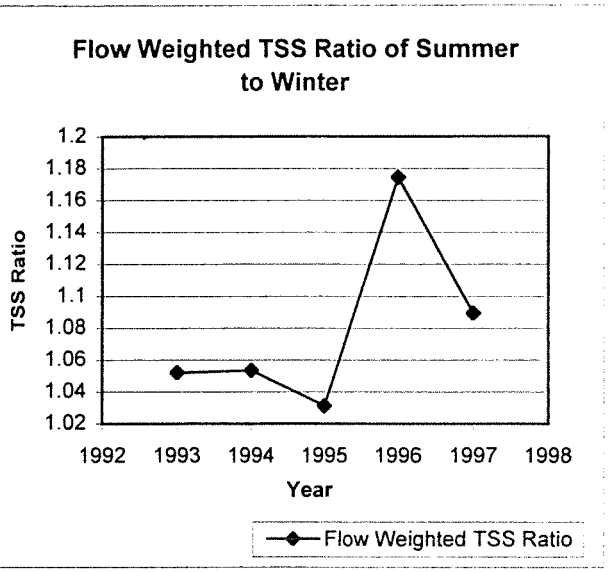


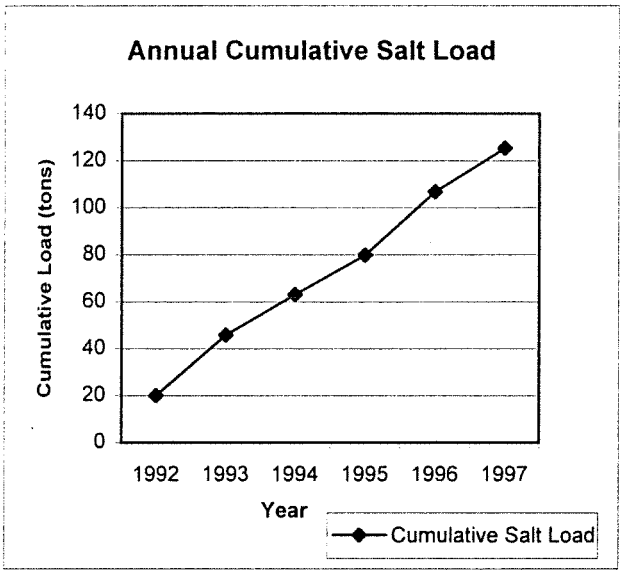




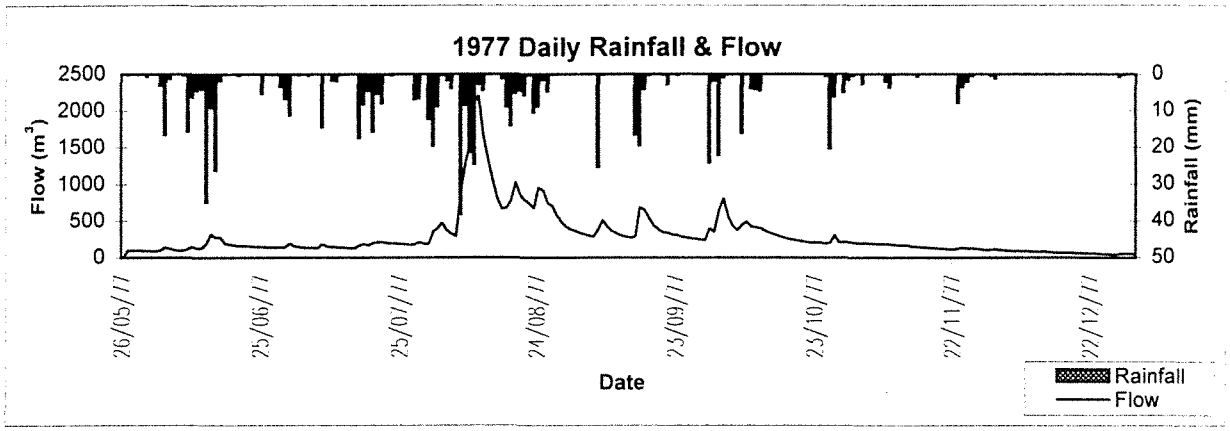
Lewis Catchment - S 614021

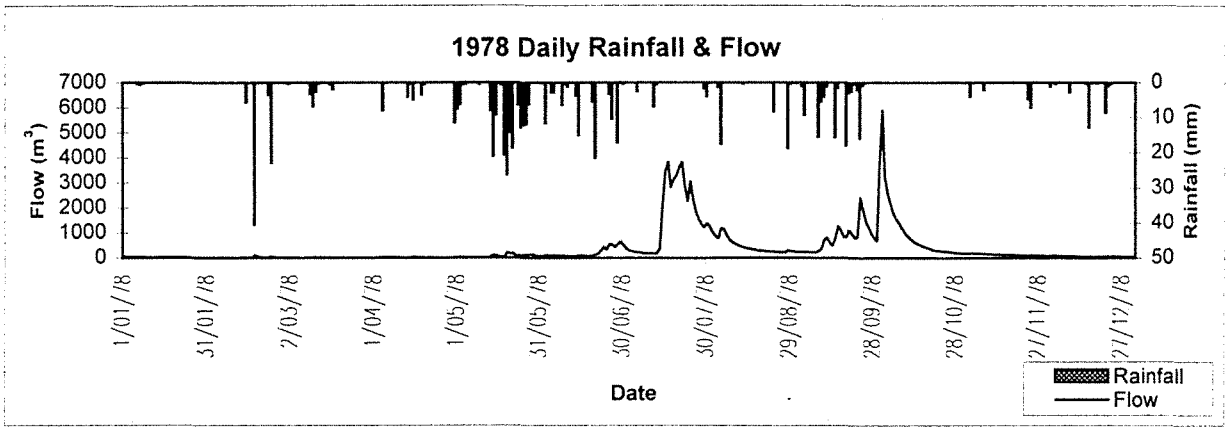


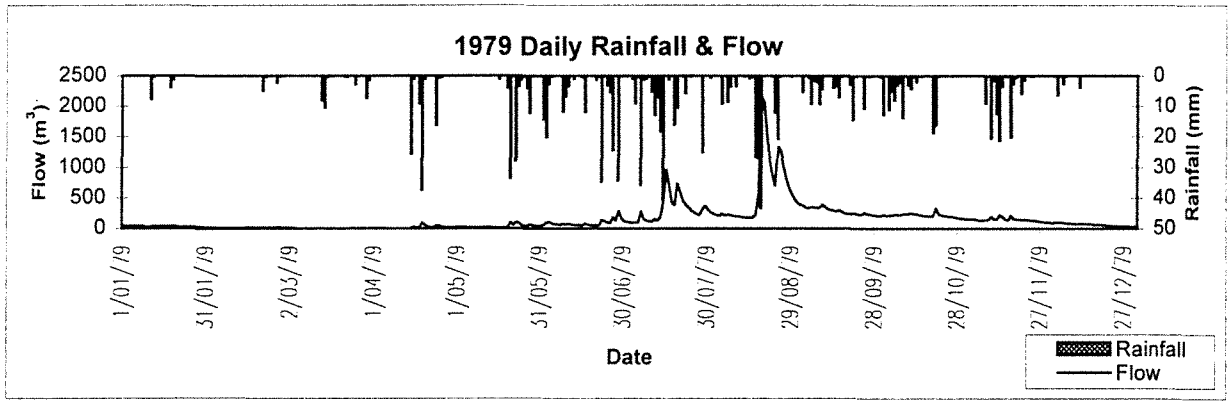


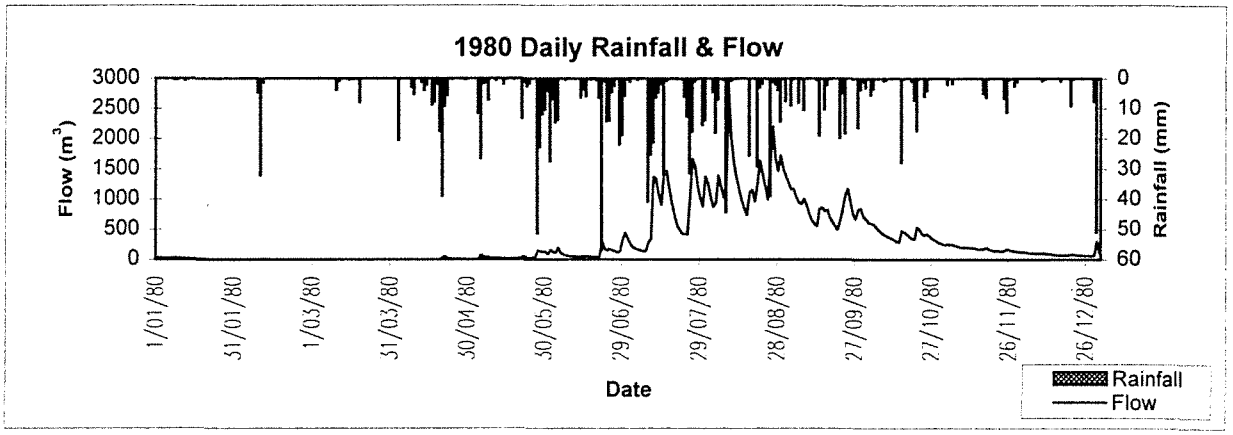


Lewis Catchment - S 614021

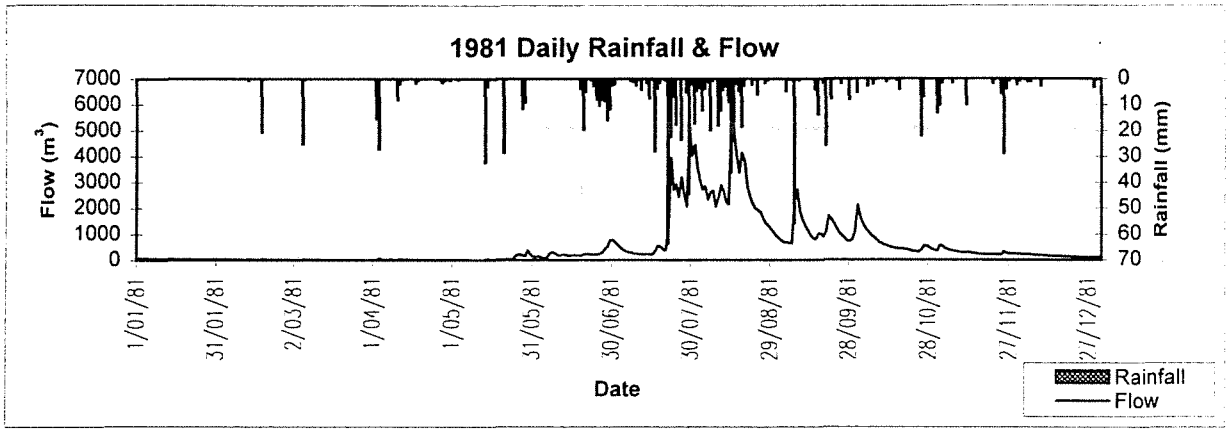


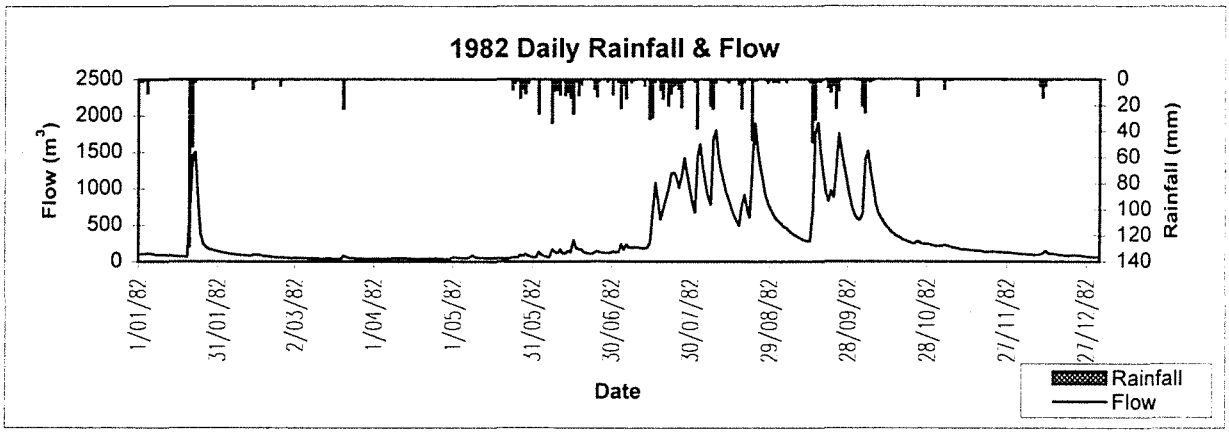


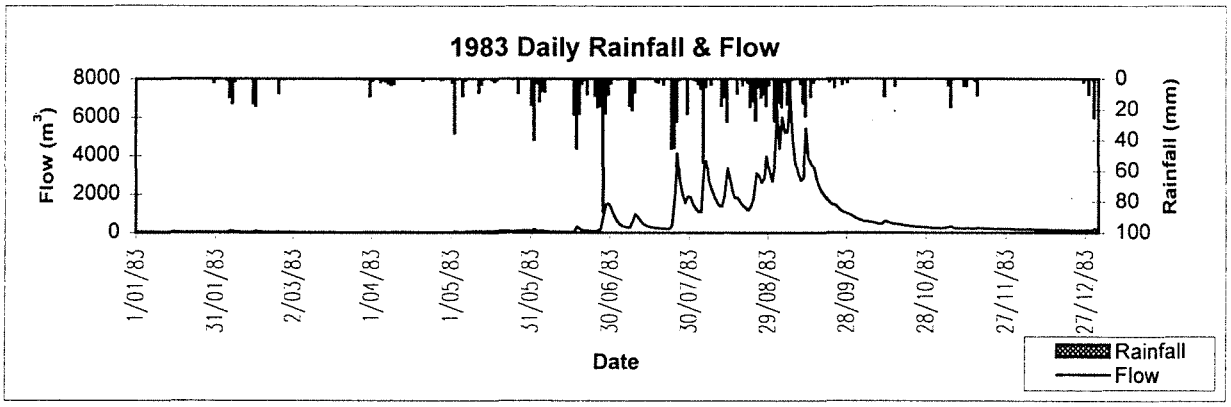


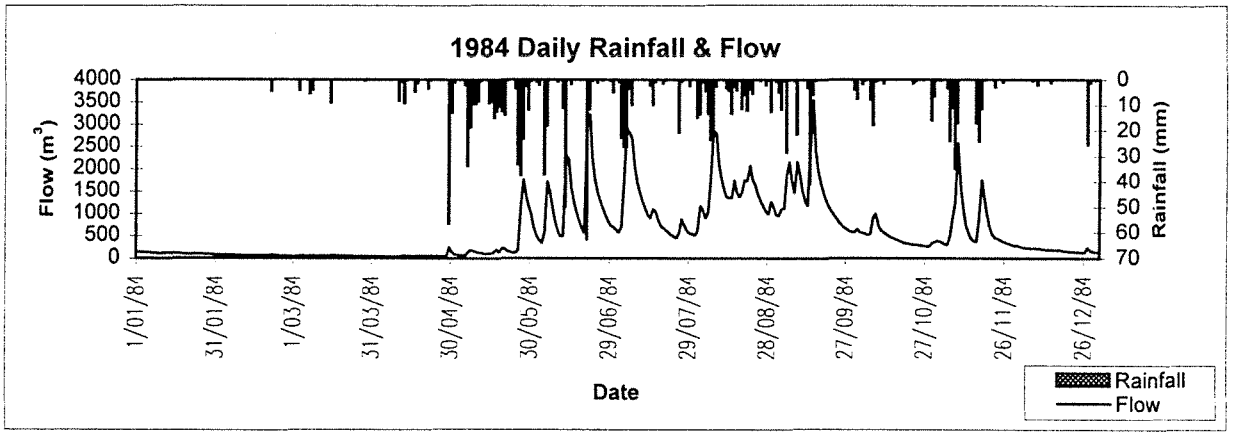


Lewis Catchment - S 614021

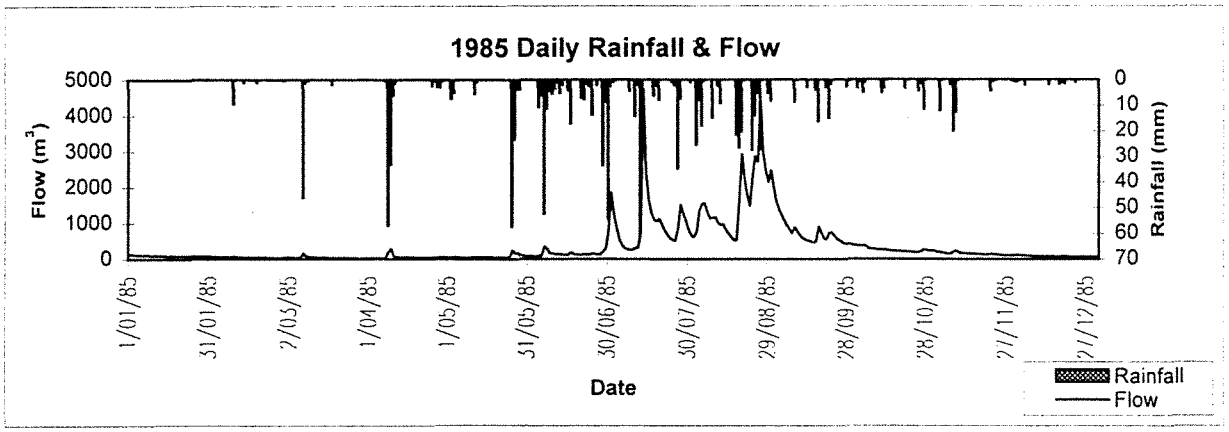


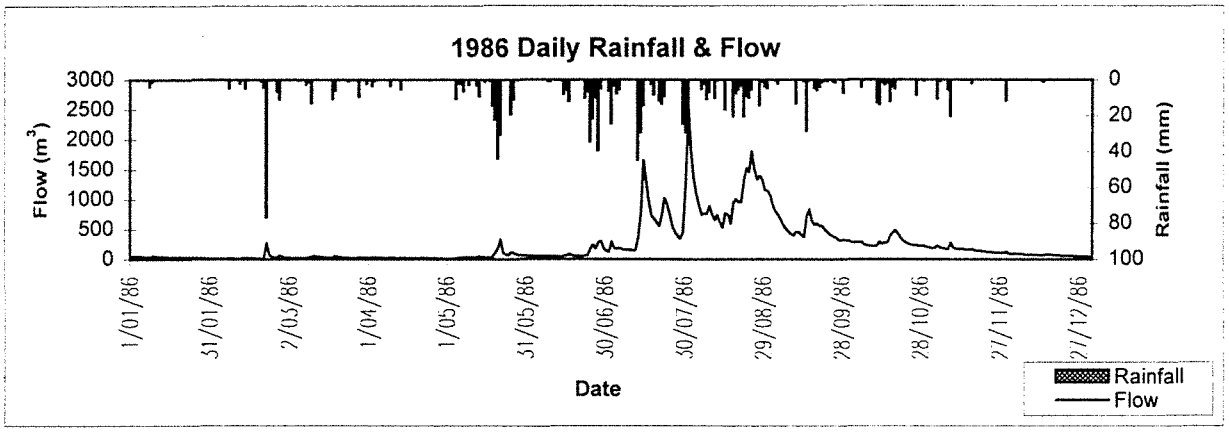


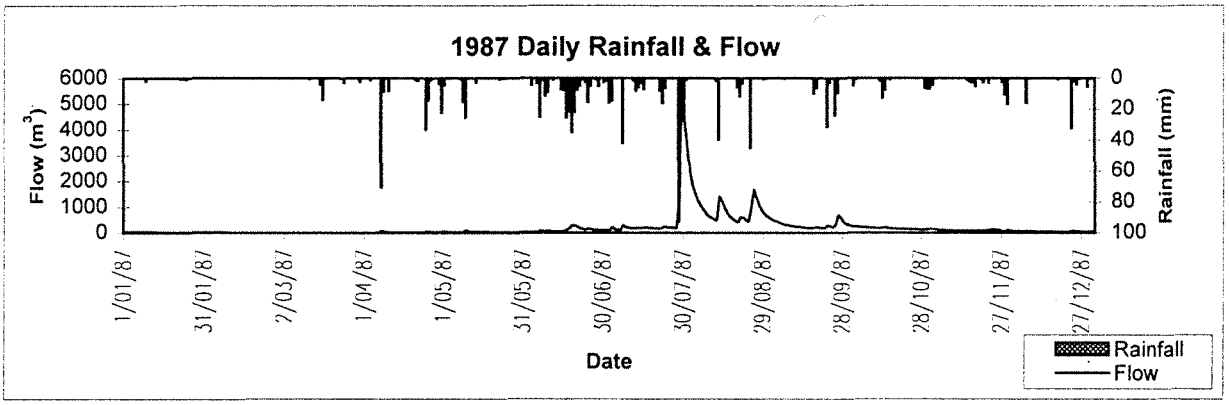


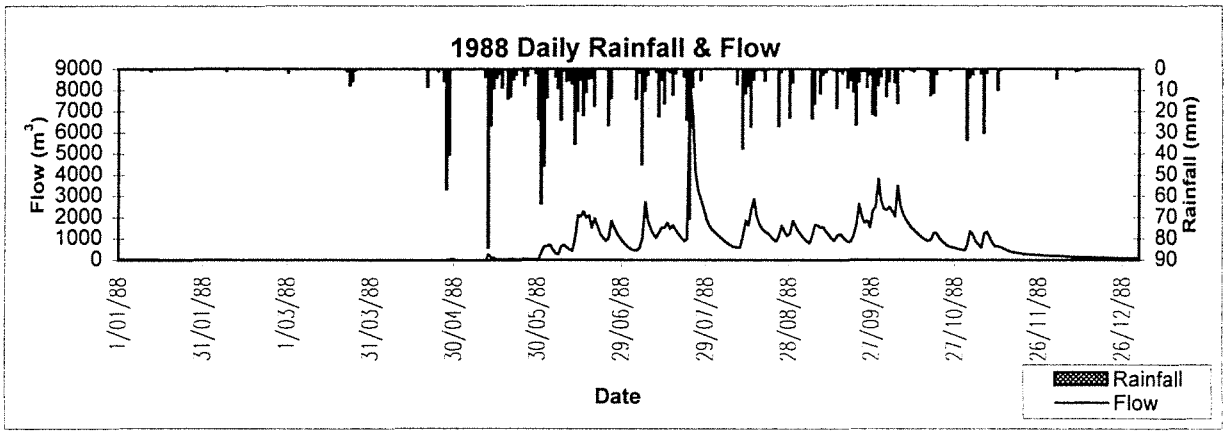


Lewis Catchment - S 614021

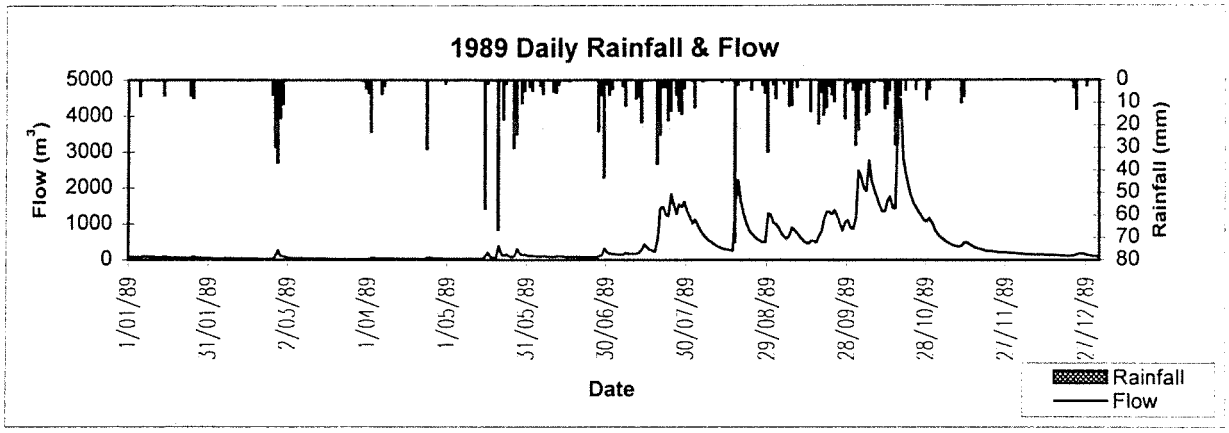


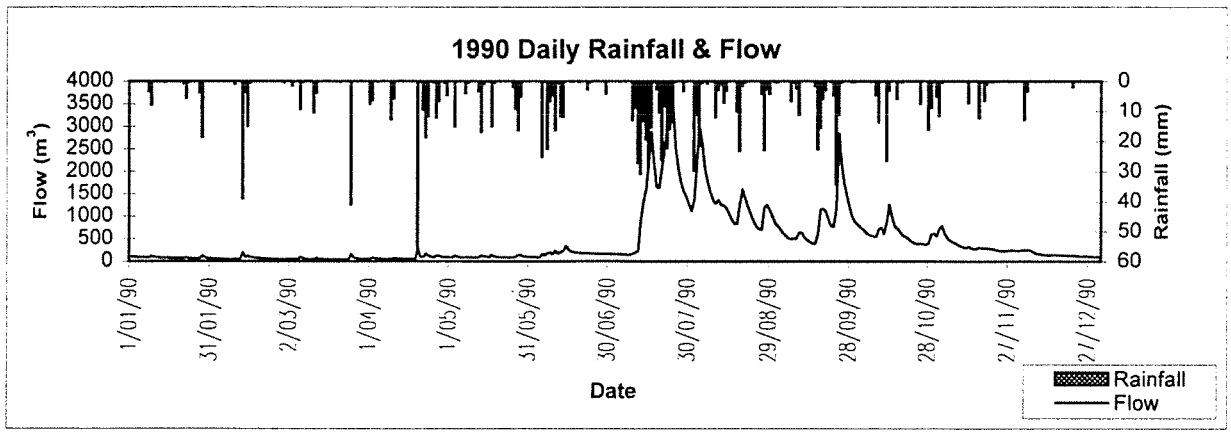


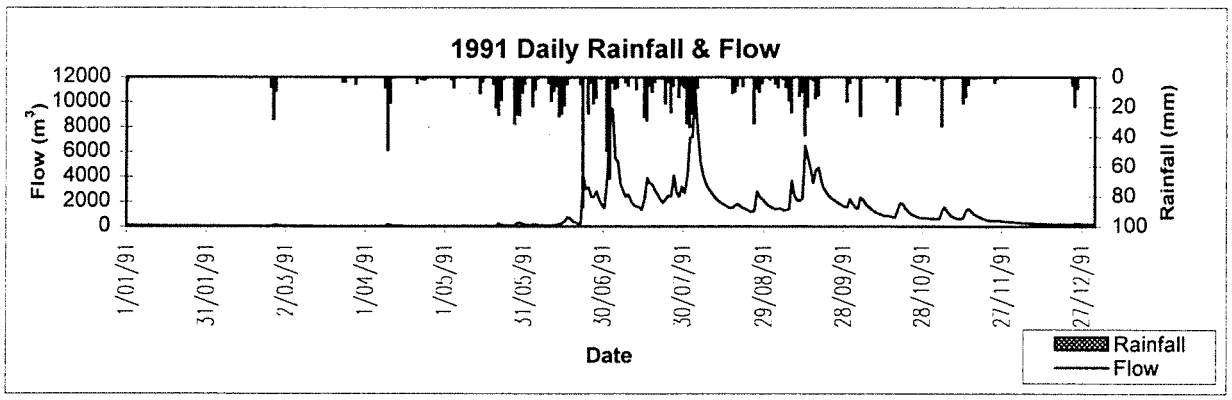


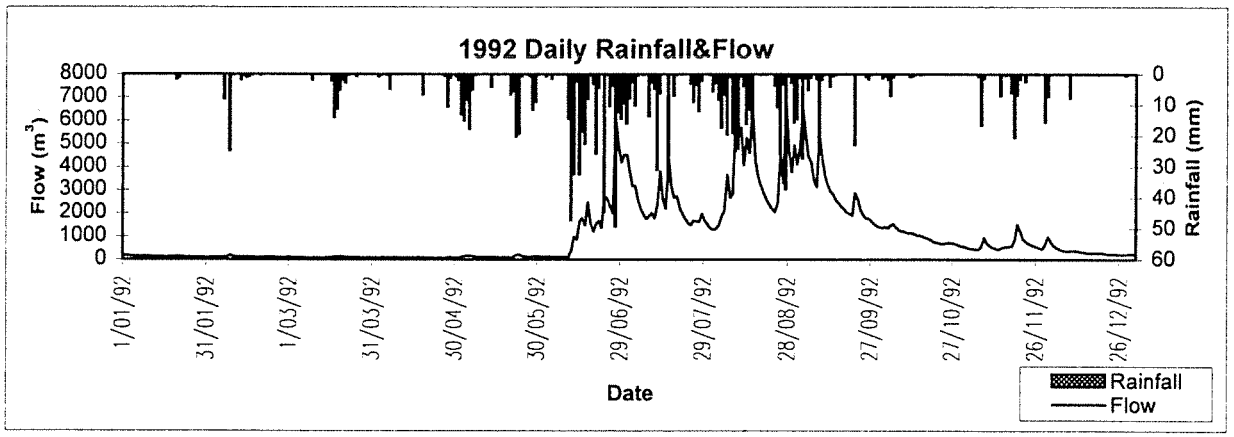


Lewis Catchment - S 614021

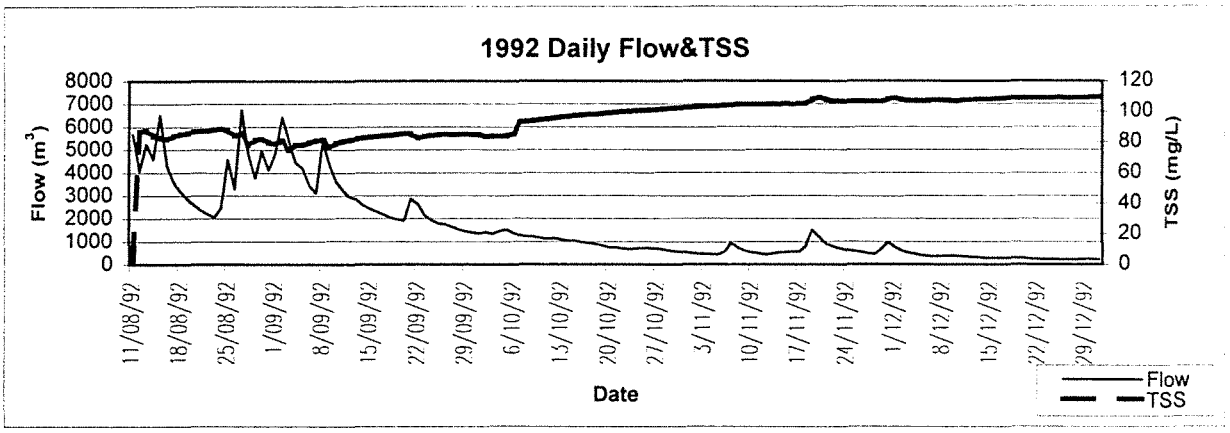


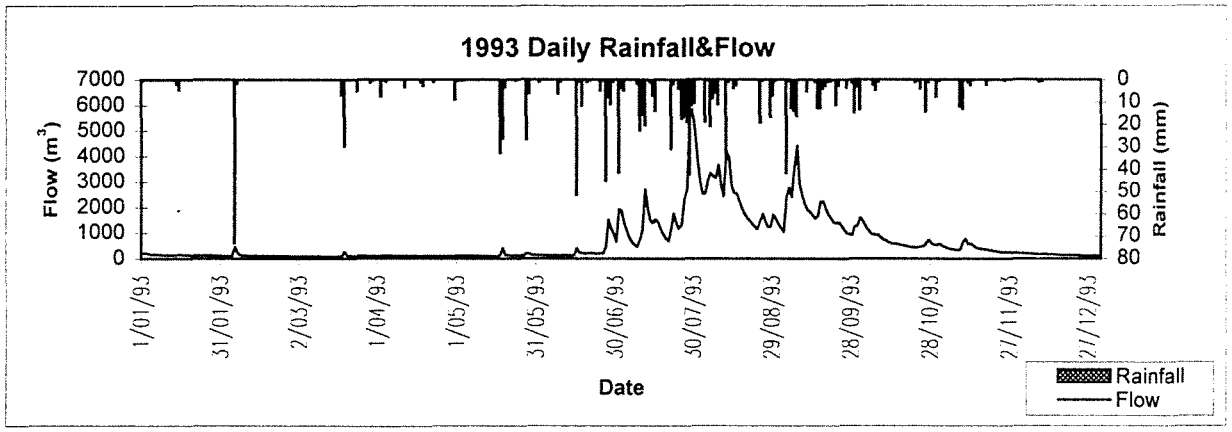


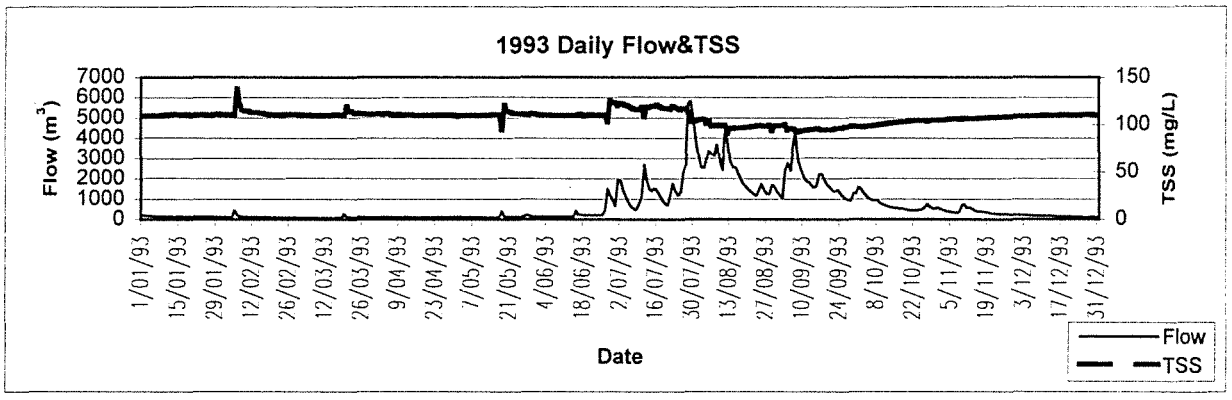


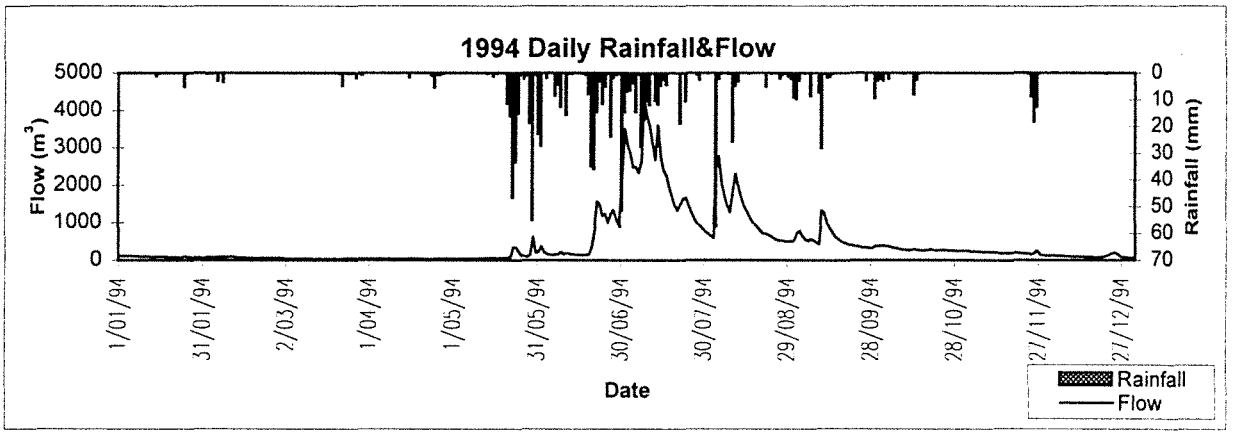


Lewis Catchment - S 614021

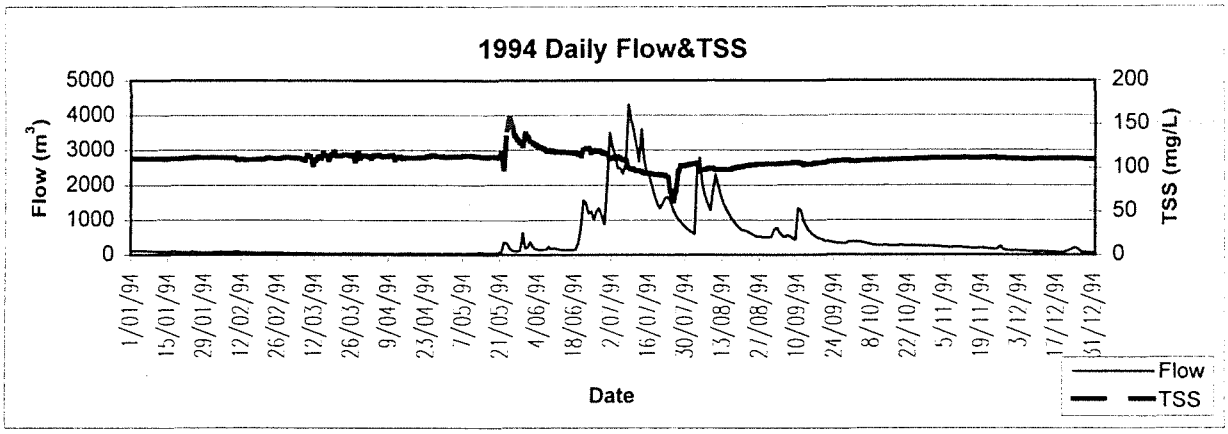


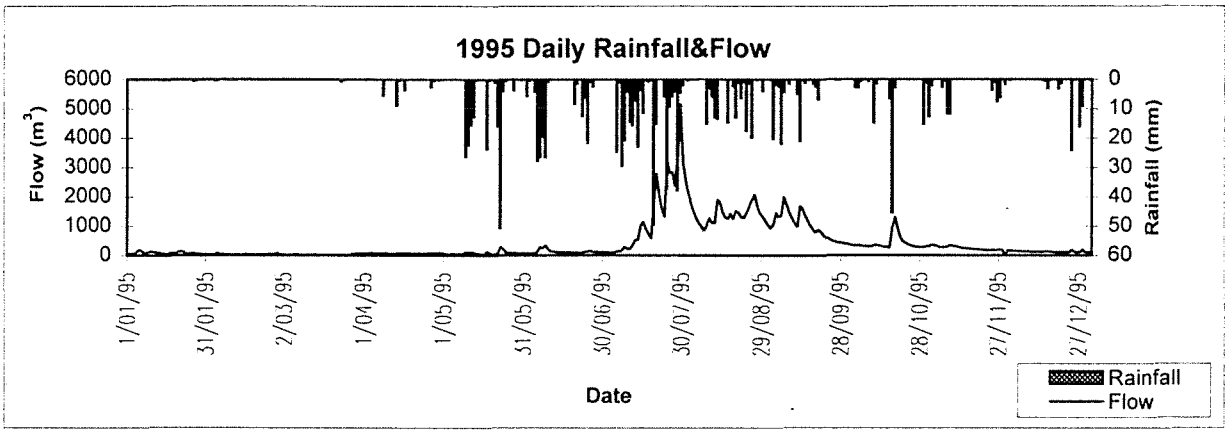


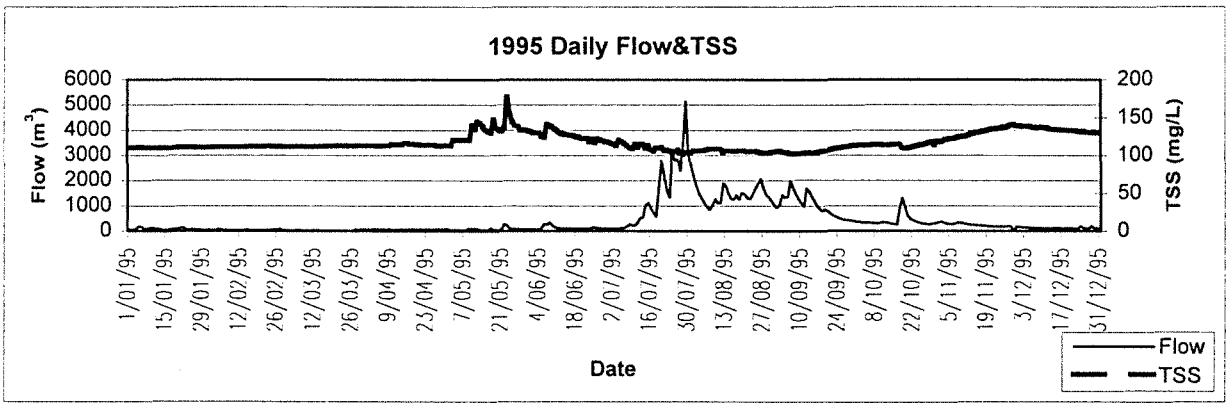


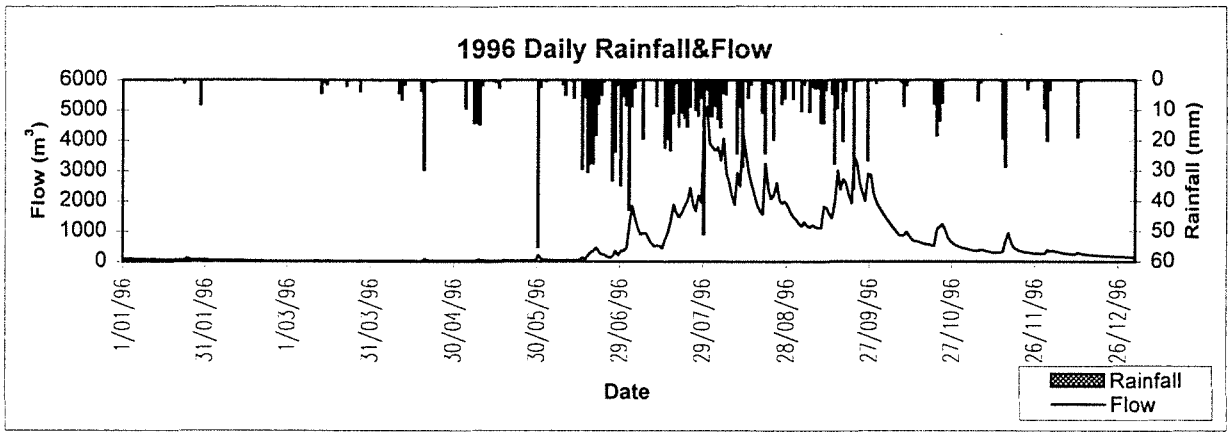


Lewis Catchment - S 614021

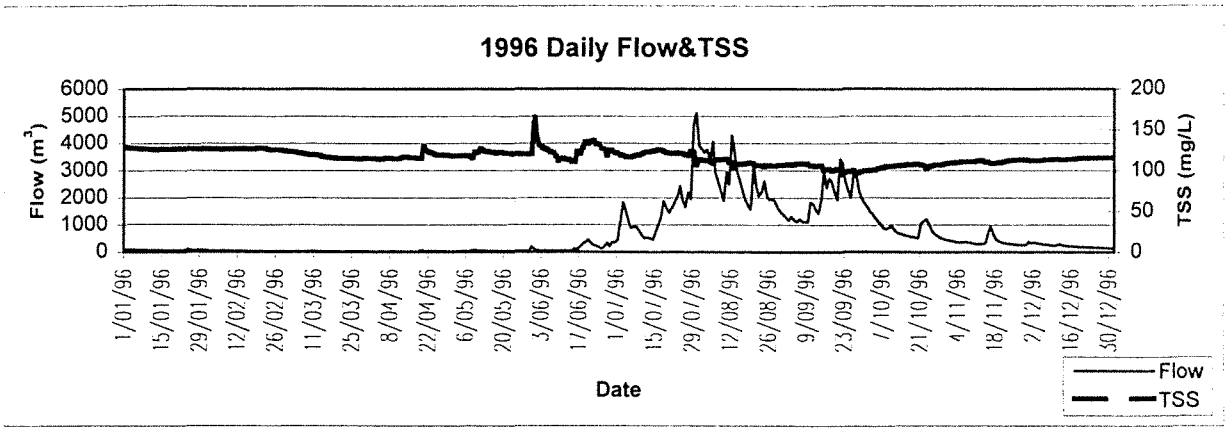


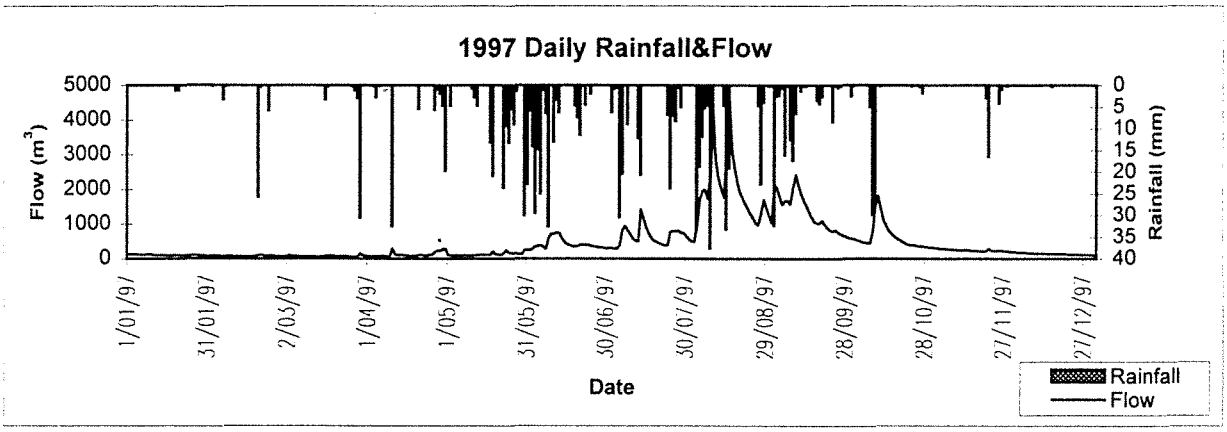


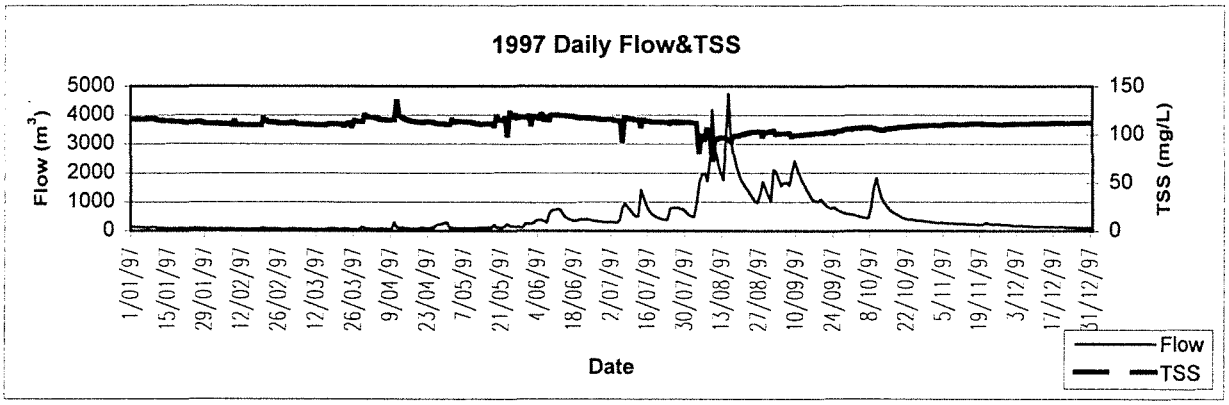




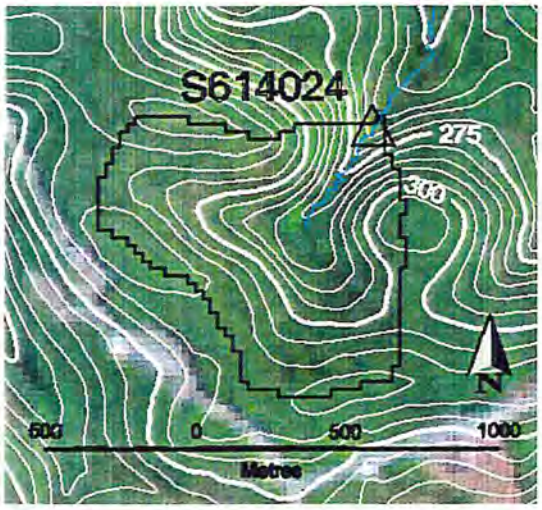
Lewis Catchment - S 614021

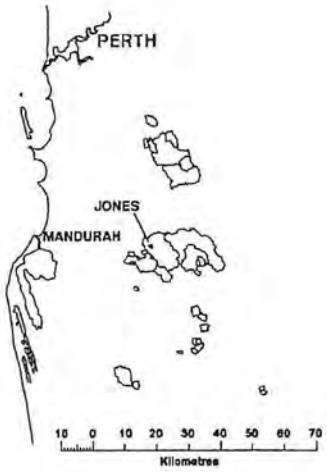






Jones Catchment





Legend

Catchment Boundary △ Gauging Station

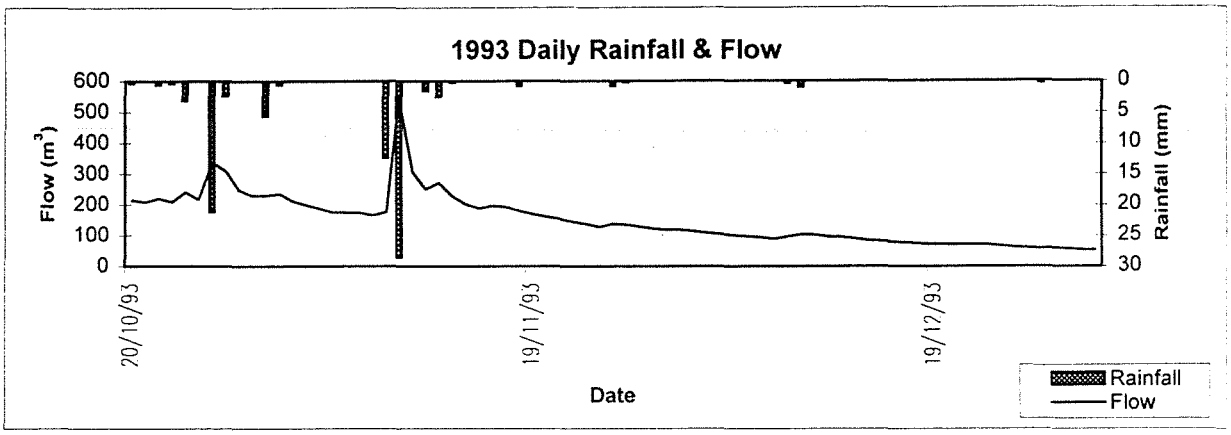
300 5 m Contours on Landsat Scene Jan 96

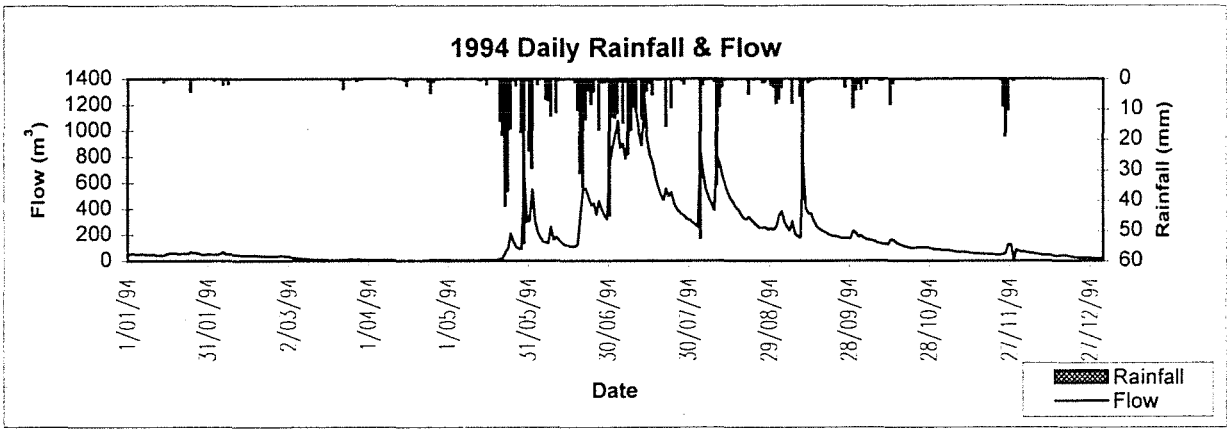
Computer Generated Stream Line

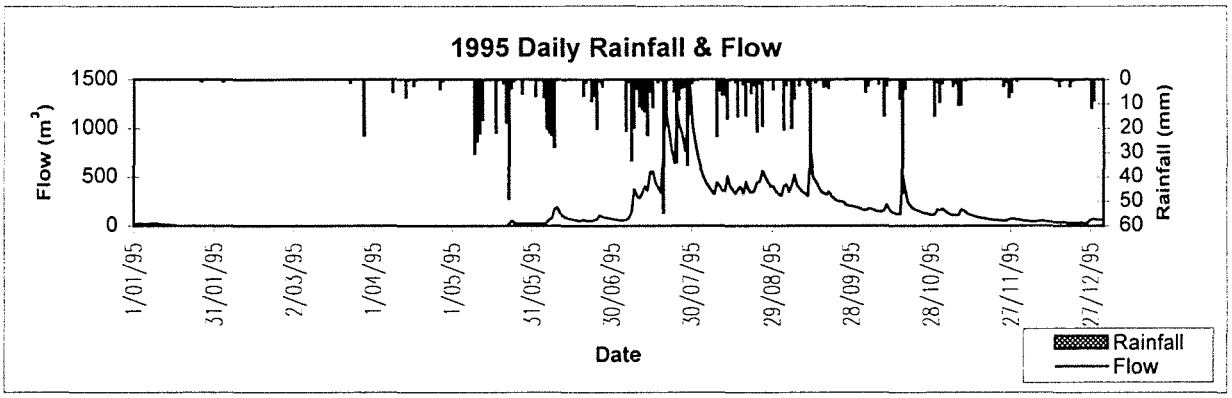
Gauging Station Number	S614024		
Rainfall Gauge Number	M509350		
Information about catchment			
Catchment area	0.69 km^2		
Gauging Station Coordinates (AMG)	N 6398300	E 414850	
Treatment data	Uniform thinning in 1988/89		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	7549	7549	0
Number of years recorded	22	22	
Number of years with complete records	20	20	
Start date	1/08/77	6/07/77	
Finish date	1/04/98	1/04/98	
Number of days with quality code 1	7293	7248	
Number of days with quality code 2	25	212	
Number of days with quality code 3	204	99	
Number of days with quality code 4	9	10	
Number of days with quality code 157	8	0	
Number of days with quality code 255	10	6	
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	
Average	1161.5	0.036	
Min	922.4	0.000	
Max	1471.3	0.115	

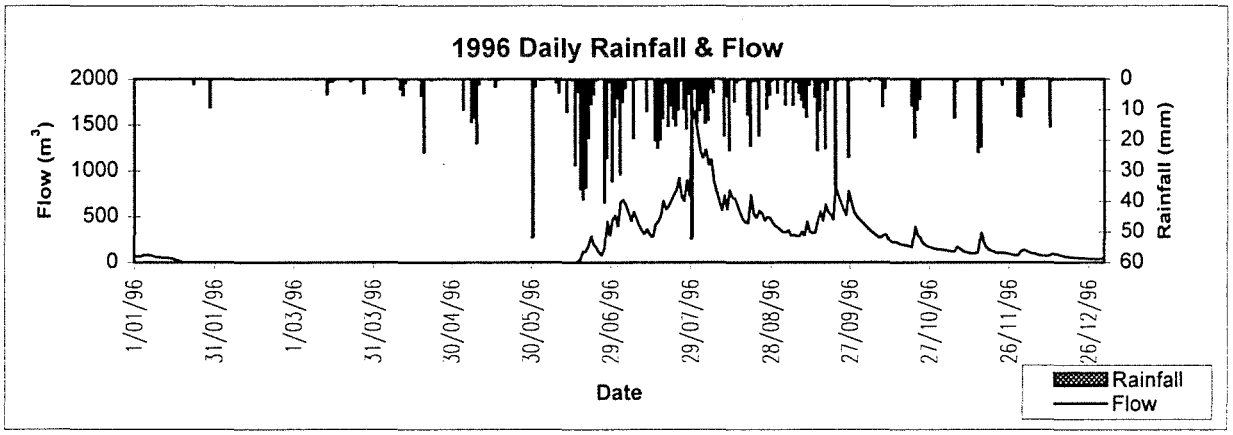
Year	Number of flow days
1978	115
1980	94
1981	116
1982	81
1983	120
1984	161
1985	79
1986	65
1987	29
1988	172
1989	140
1990	162
1991	210
1992	366
1993	363
1994	363
1995	243
1996	221
1997	271
Total	**3371**

Jones Catchment - S 614024

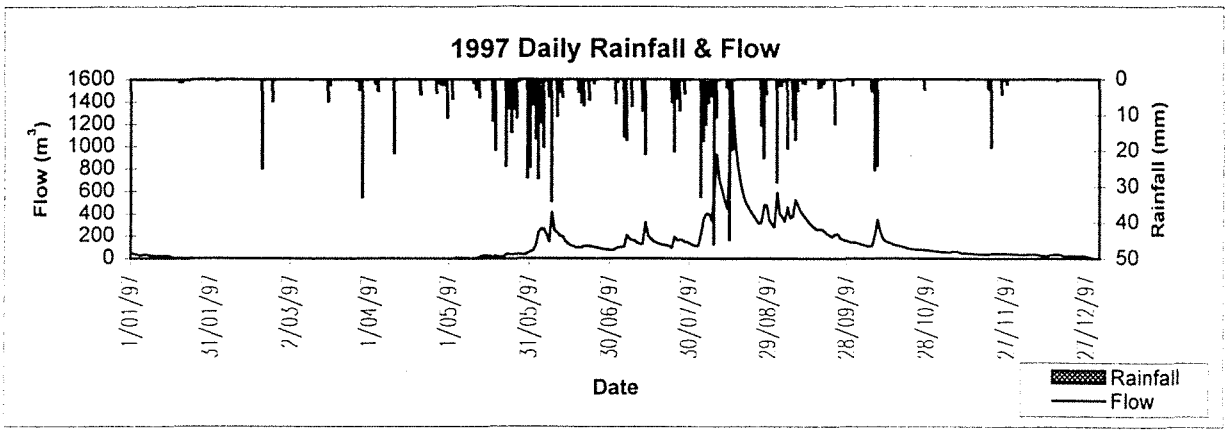




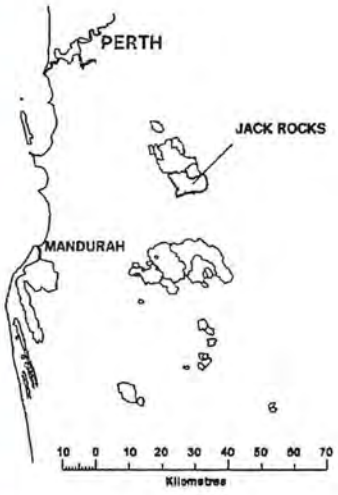




Jones Catchment - S 614024



Jack Rocks Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

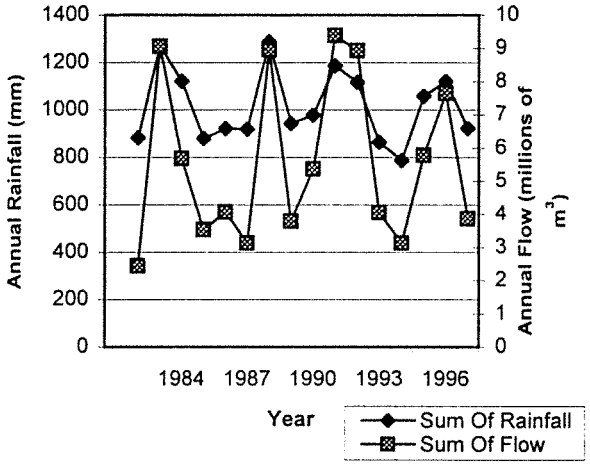
Computer Generated Stream Line

Gauging Station Number	S614031		
Rainfall Gauge Number	M509232		
Information about catchment			
Catchment area	58.1 km^2		
Gauging Station Coordinates (AMG)	N 6417500	E 420550	
Treatment data	Bauxite mining in 1990's.		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	6231	6231	0
Number of years recorded	18	18	
Number of years with complete records	16	16	
Start date	14/04/81	14/04/81	
Finish date	5/05/98	5/05/98	
Number of days with quality code 1	6135	5902	
Number of days with quality code 2	1	143	
Number of days with quality code 3	31	164	
Number of days with quality code 4	58	14	
Number of days with quality code 255	6	8	
Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	
Average	1016.6	5.553	
Min	788.3	2.451	
Max	1288.0	9.379	

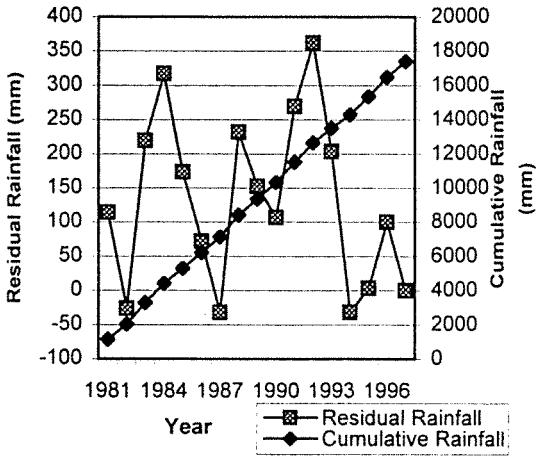
Year	Number of flow days
1982	360
1983	245
1984	267
1985	309
1986	330
1987	289
1988	270
1989	274
1990	352
1991	295
1992	366
1993	357
1994	236
1995	235
1996	207
1997	332
Total	**4724**

Jack Rocks Catchment - S 614031

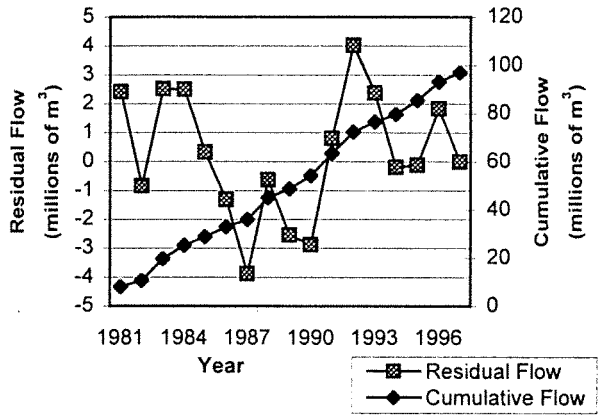
Annual Rainfall & Flow



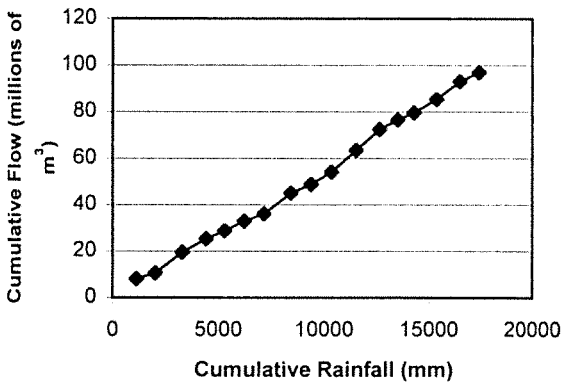
Annual Cumulative & Residual Rainfall Curves



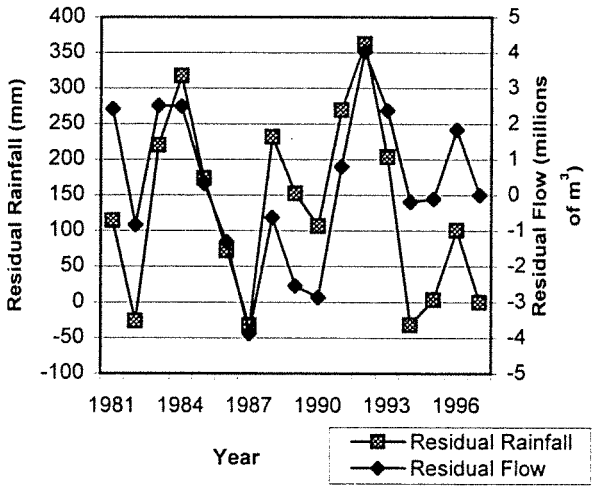
Annual Cumulative & Residual Flow Curves



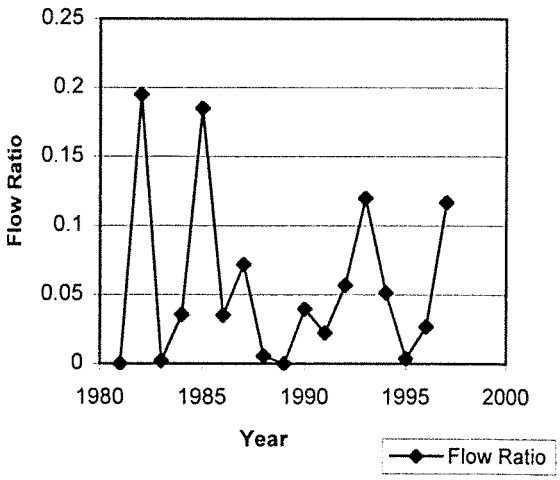
Annual Cumulative Flow & Cumulative Rainfall Curves



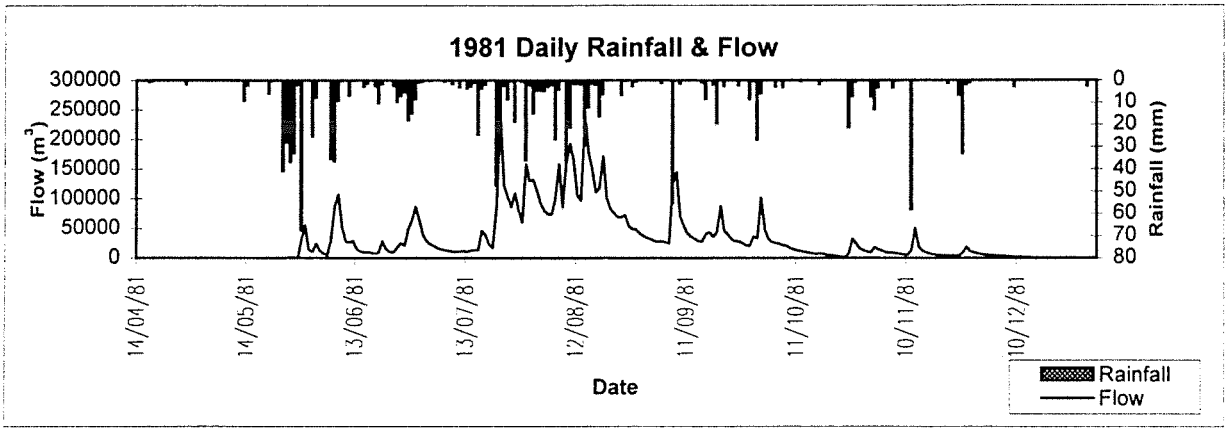
Annual Residual Flow & Residual Rainfall Curves

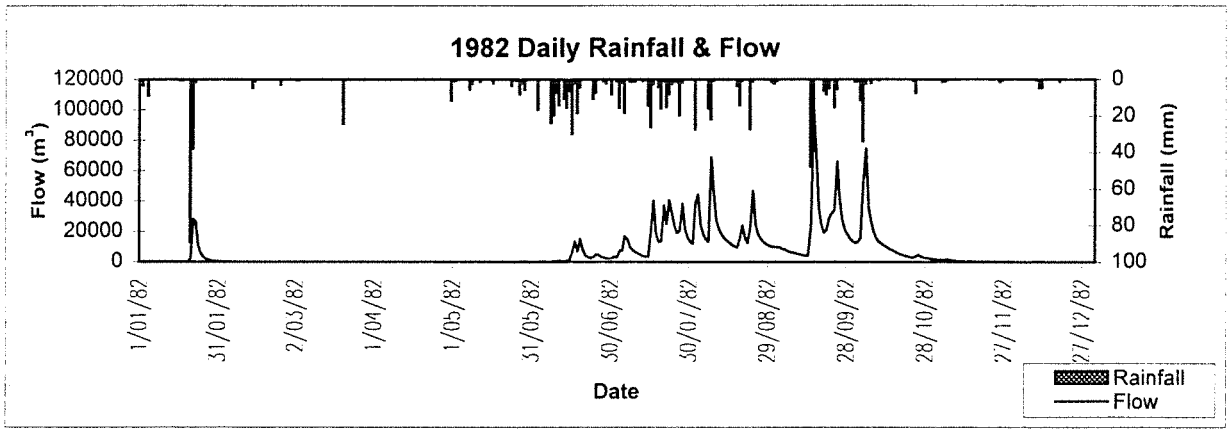


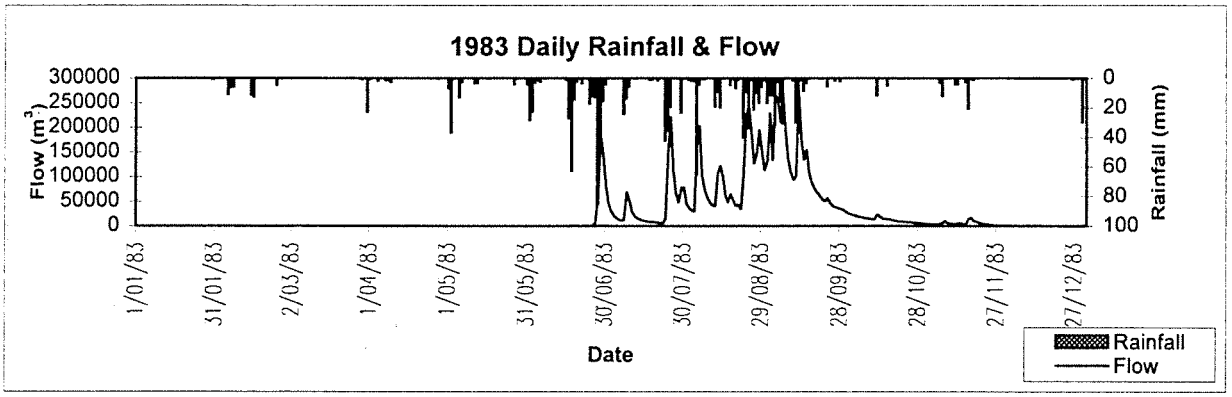
Flow Ratio of Summer to Winter

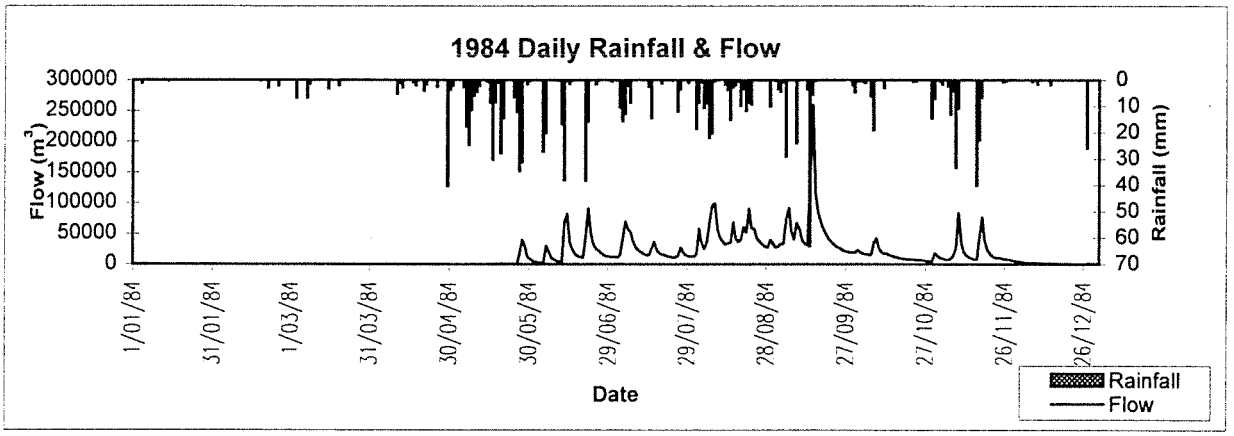


Jack Rocks Catchment - S 614031

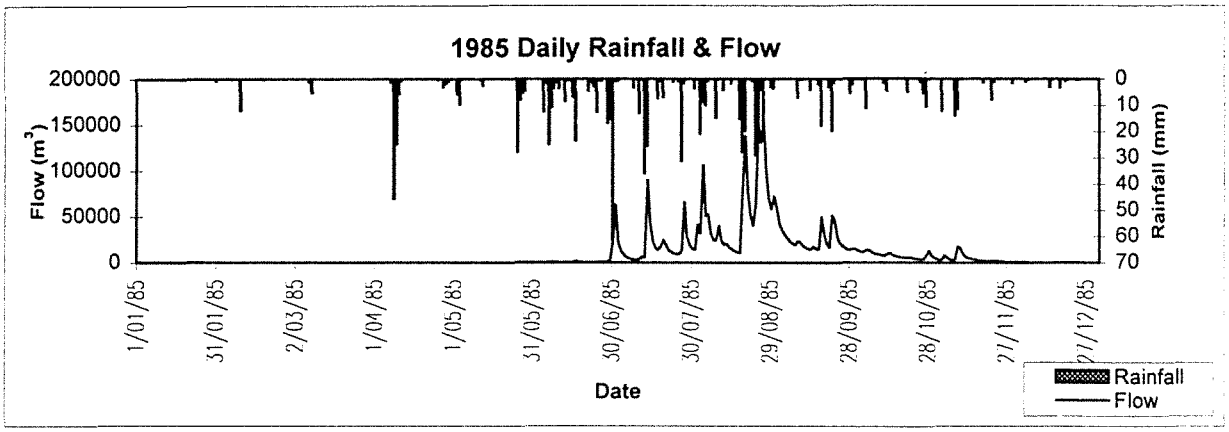


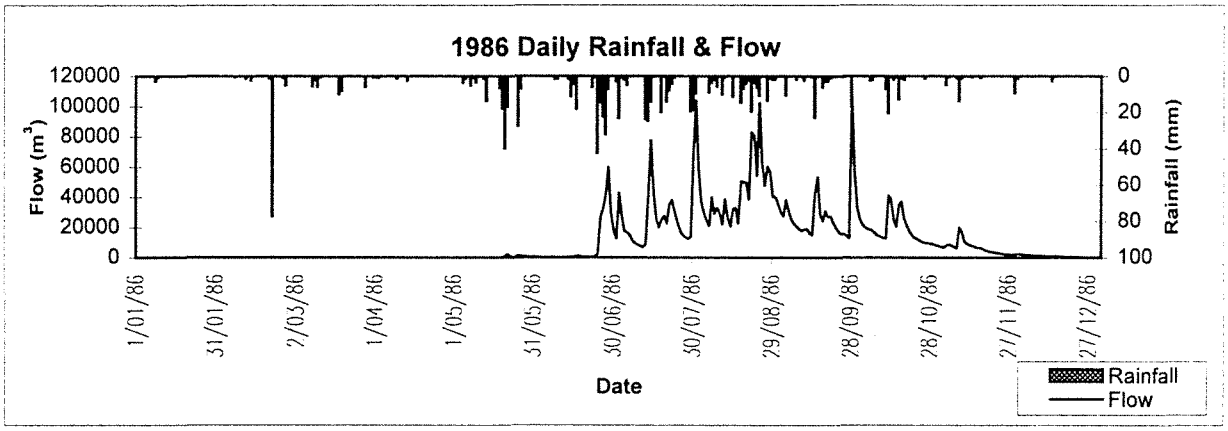


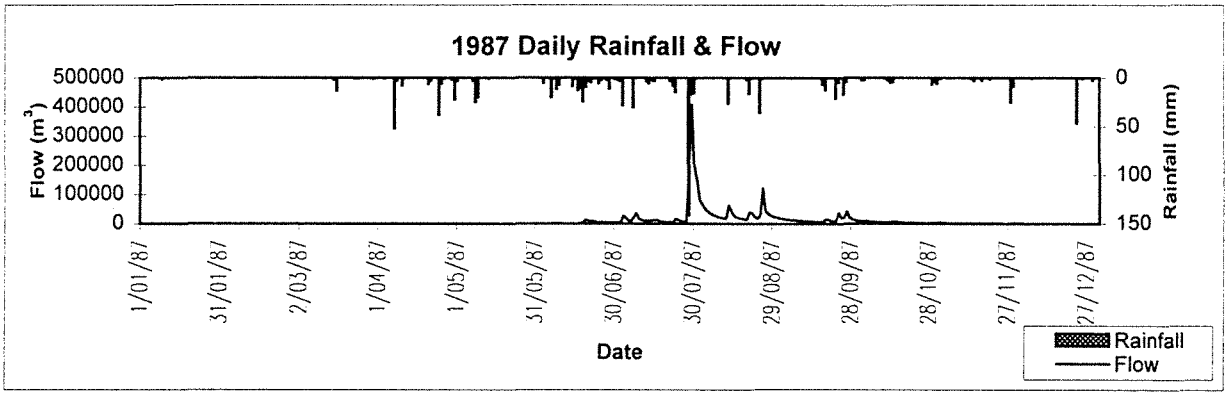


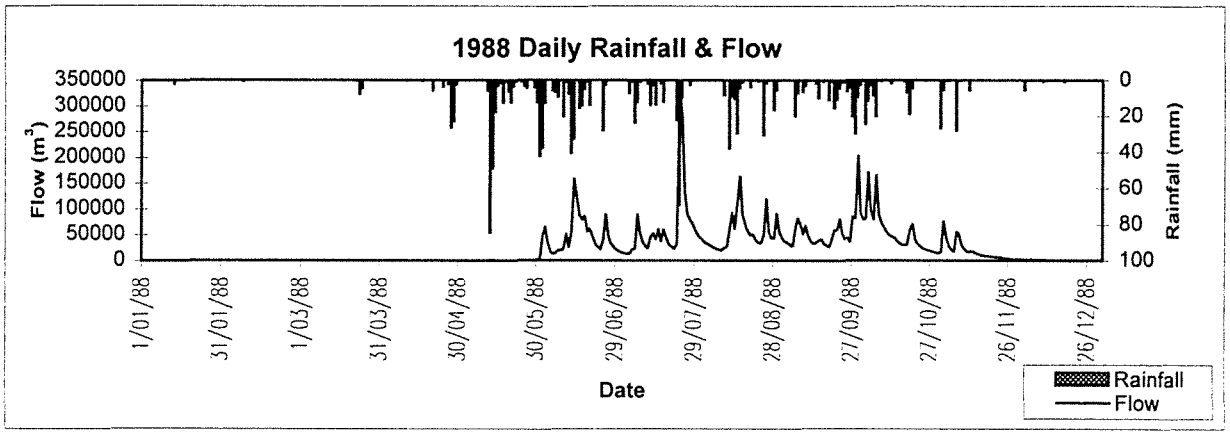


Jack Rocks Catchment - S 614031

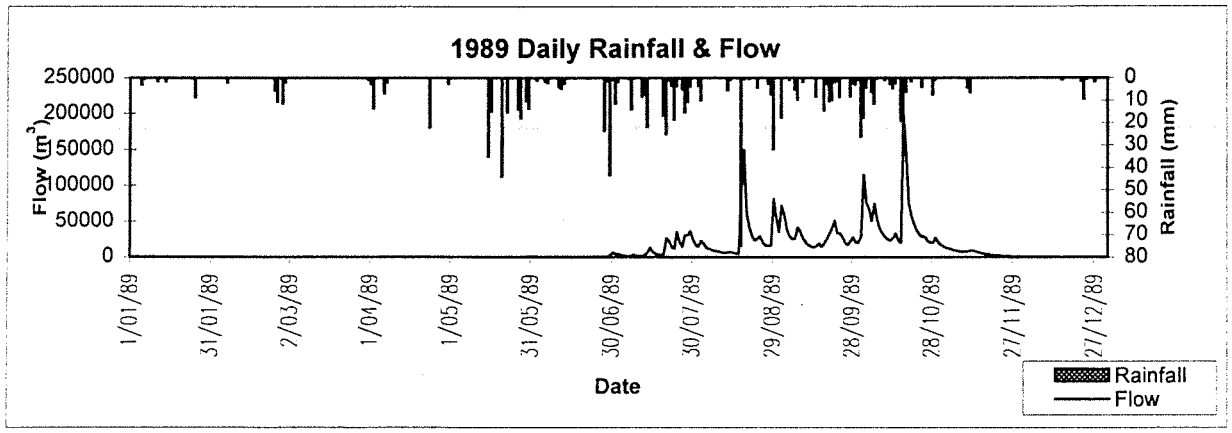


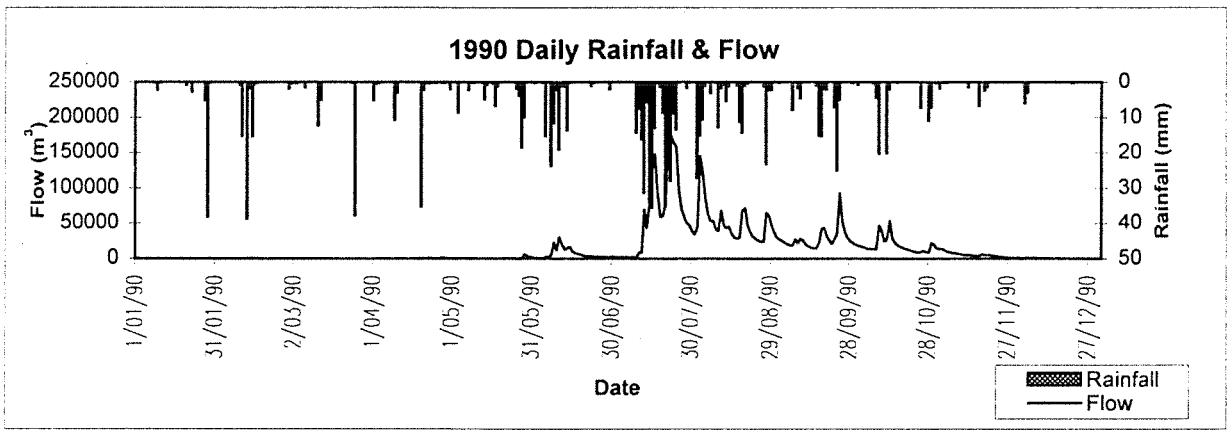


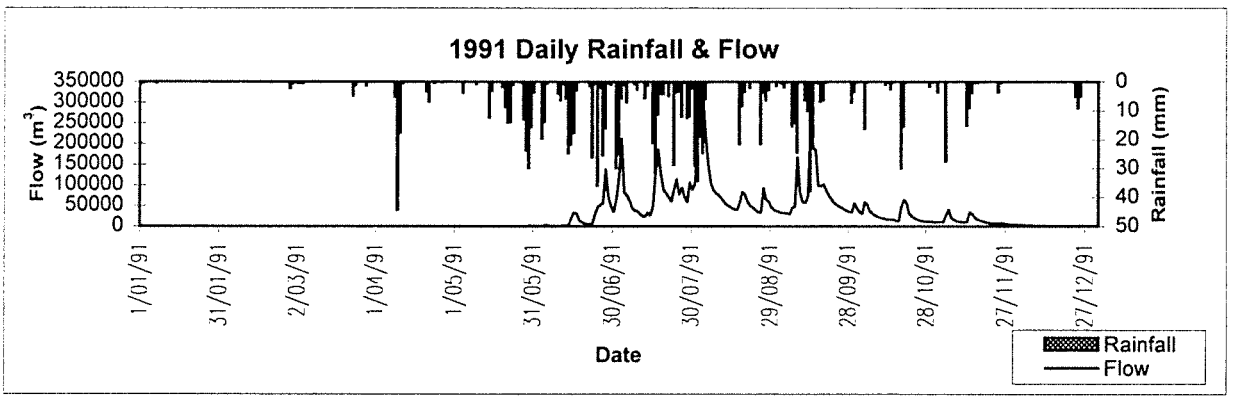


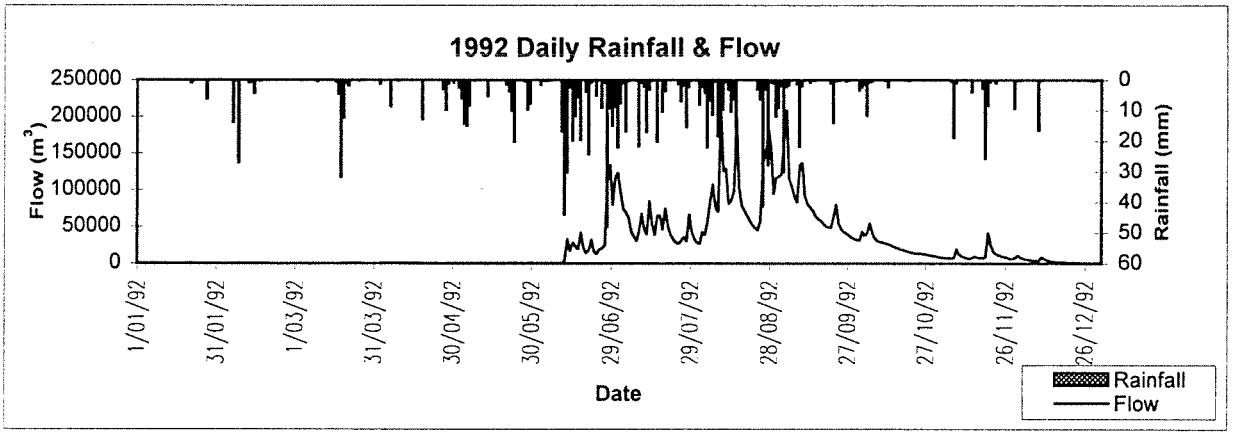


Jack Rocks Catchment - S 614031

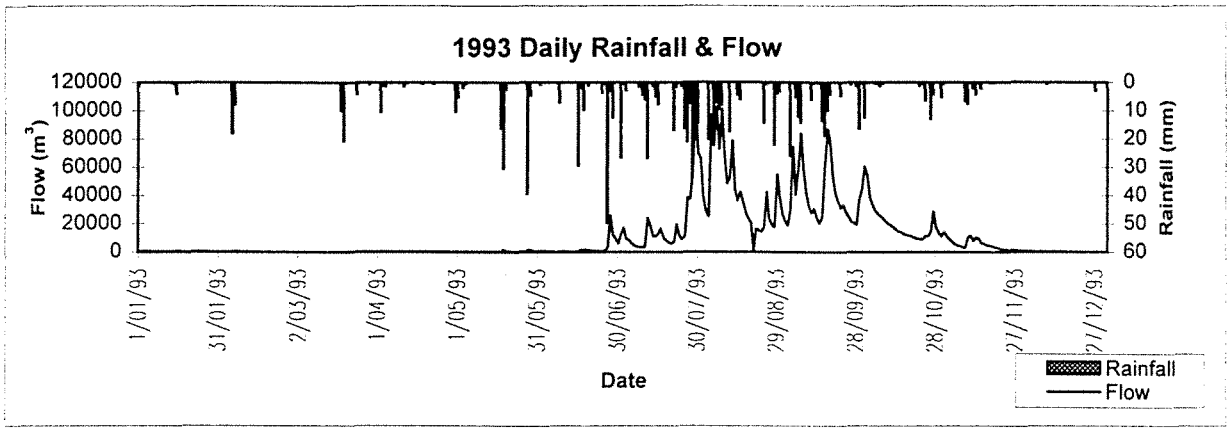


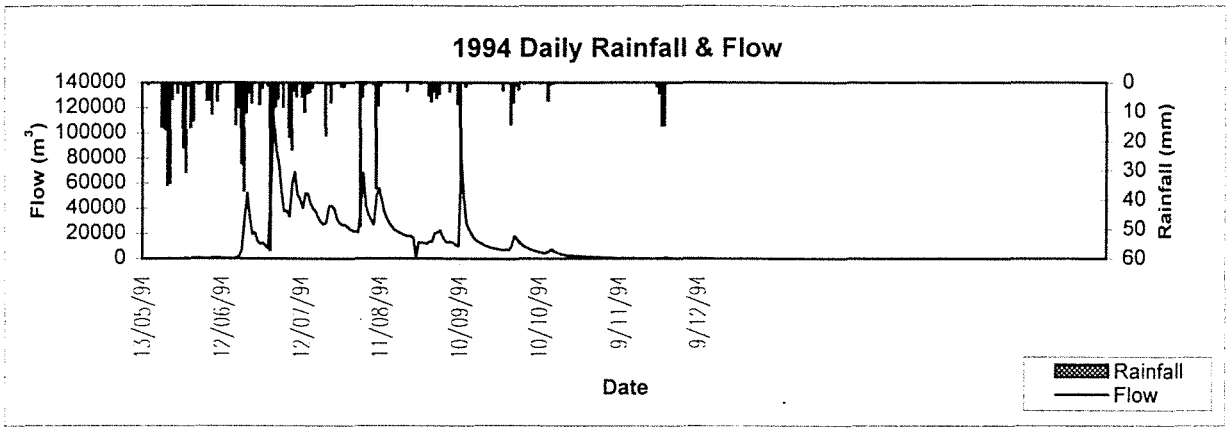


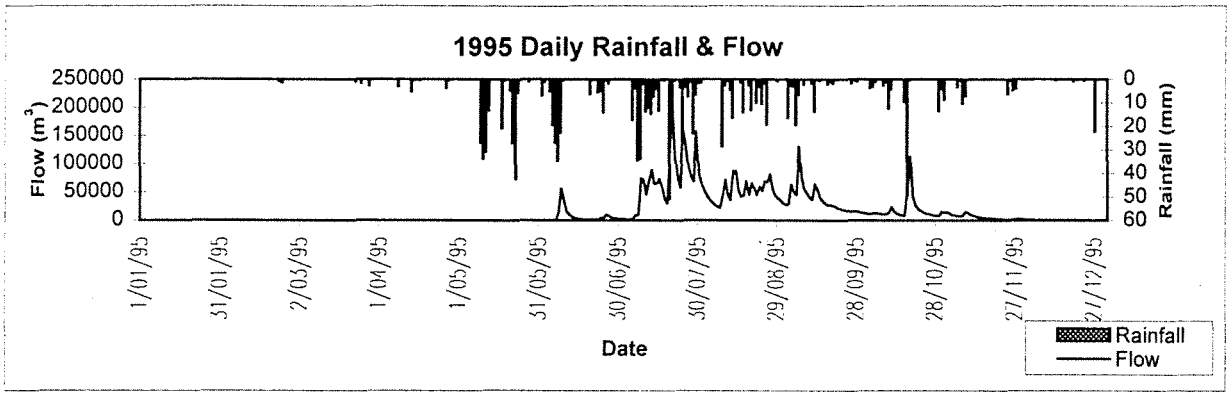


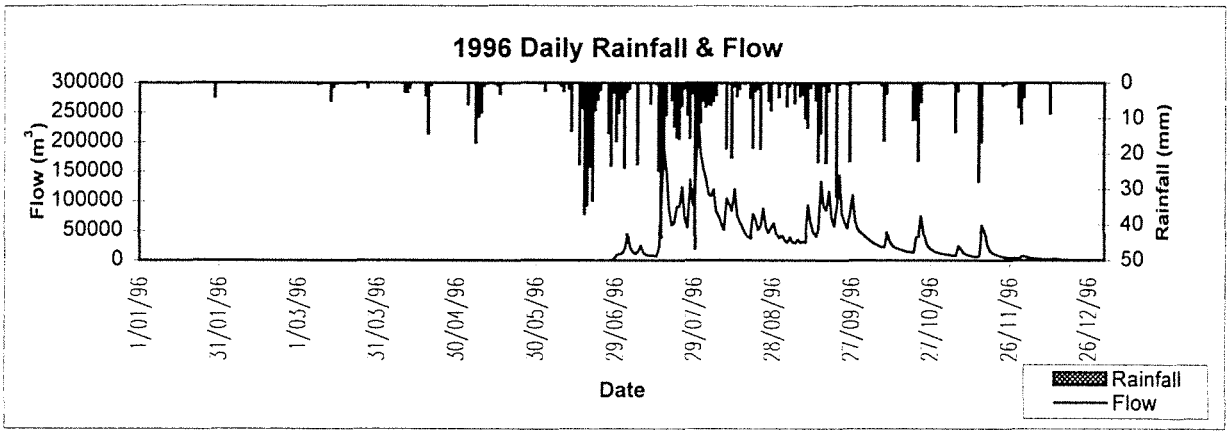


Jack Rocks Catchment - S 614031

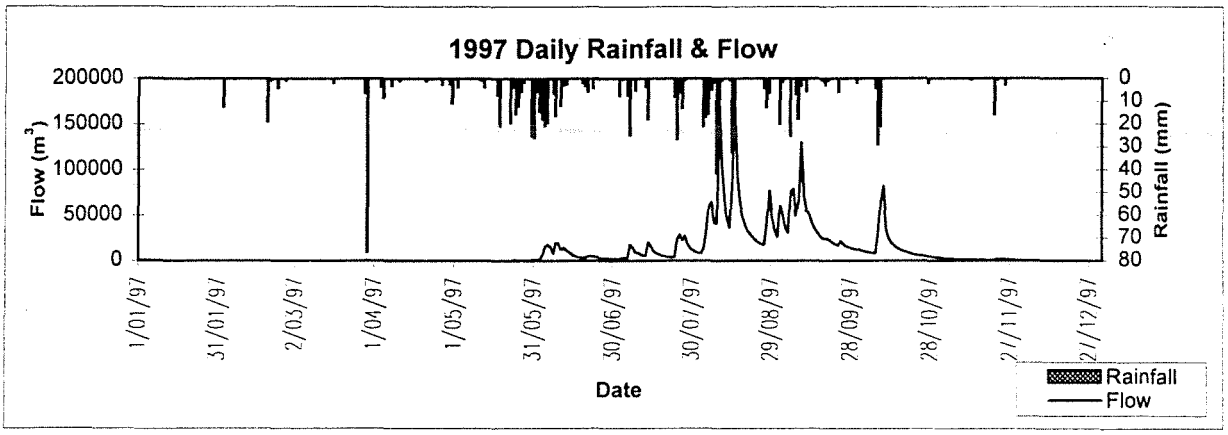




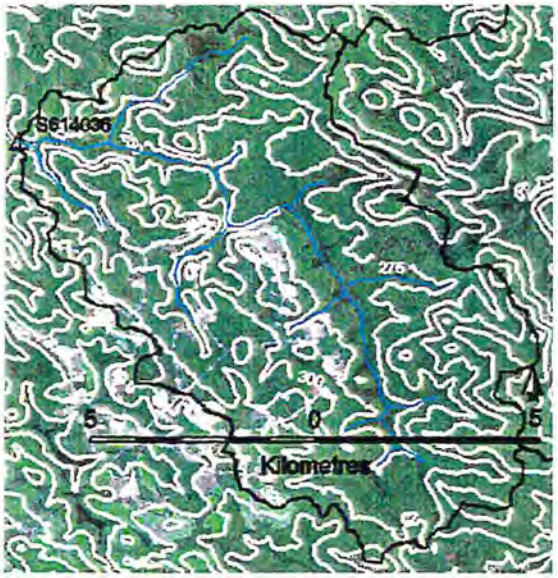


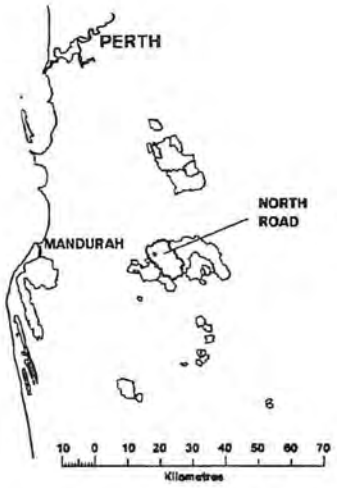


Jack Rocks Catchment - S 614031



North Road Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

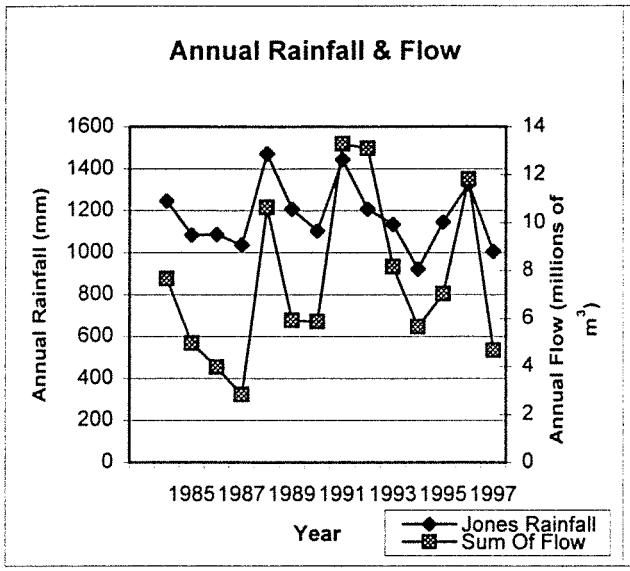
Computer Generated Stream Line

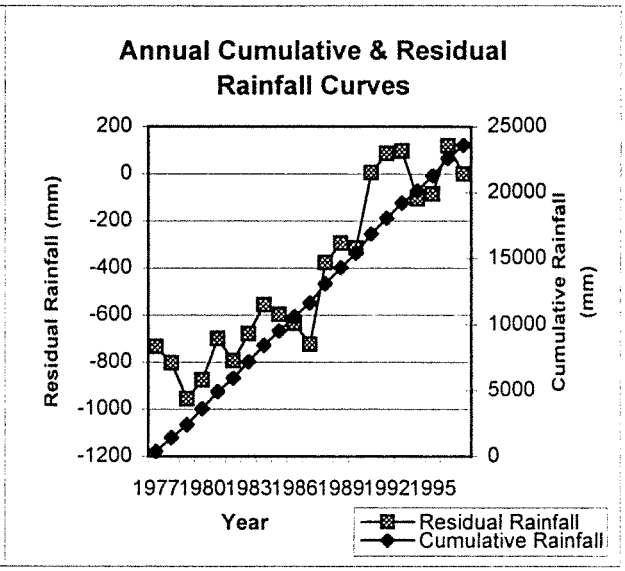
Gauging Station Number	S614036
	Jones Catchment (M 509350) rainfall data
Information about catchment	
Catchment area	81.6 km^2
Gauging Station Coordinates (AMG)	N 6399400 E 411867
Treatment data	Bauxite mining since 1980's.

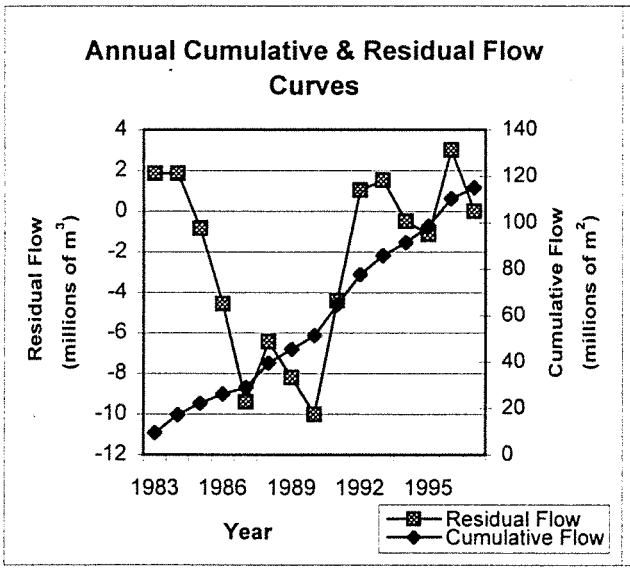
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	0	5315	0
Number of years recorded		16	
Number of years with complete records		13	
Start date		3/03/83	
Finish date		19/09/97	
Number of days with quality code 1		4866	
Number of days with quality code 2		183	
Number of days with quality code 3		248	
Number of days with quality code 4		11	
Number of days with quality code 255		7	
Annual Basic Statistics		Flow (millions of m^3)	
Average		7.541	
Min		2.827	
Max		13.285	

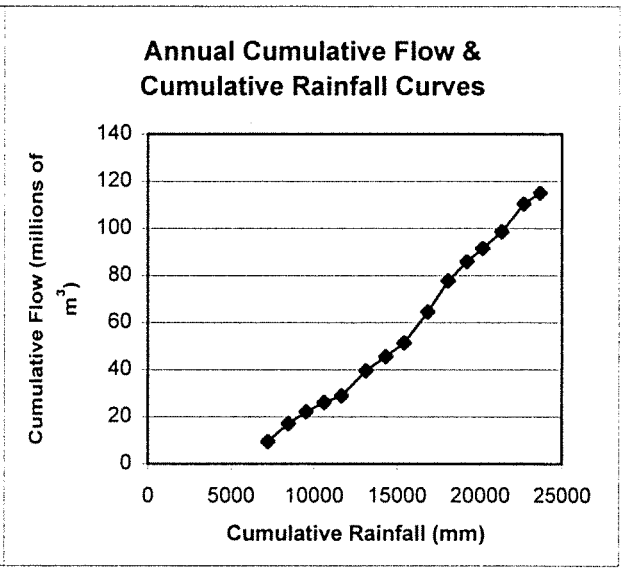
Year	**Number of flow days**
1984	337
1985	343
1986	339
1987	303
1988	259
1989	365
1990	365
1991	365
1992	366
1993	363
1994	363
1995	270
1996	285
1997	258
Total	**4581**

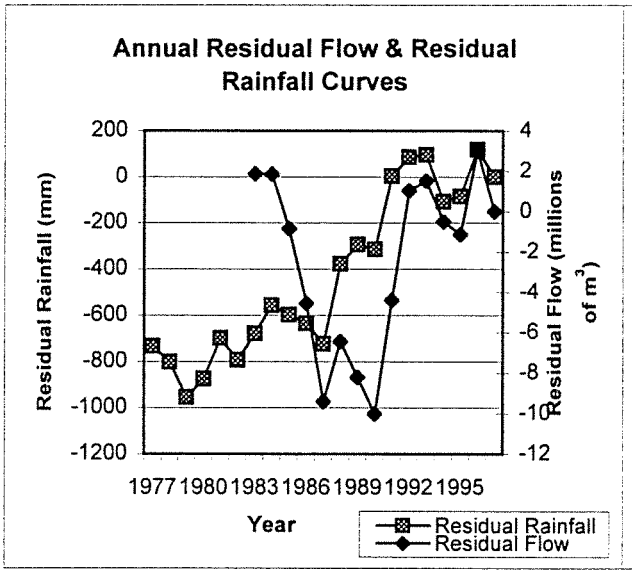
North Road Catchment - S 614036

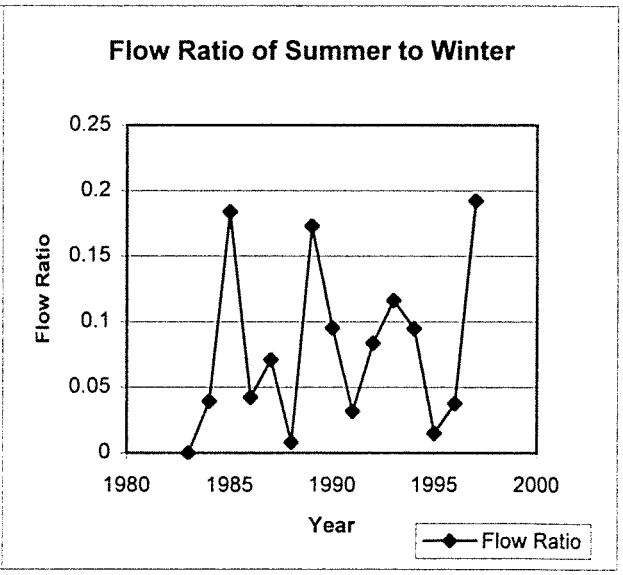




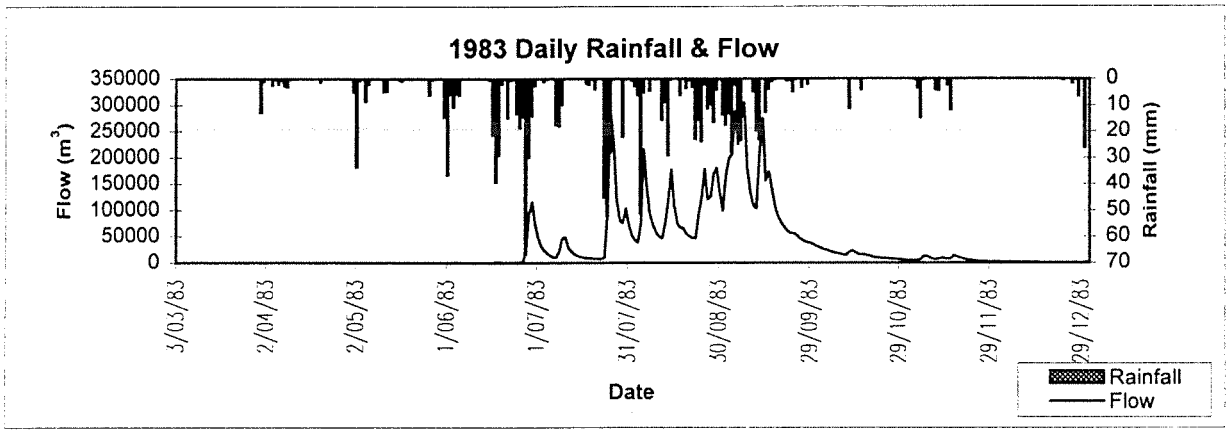


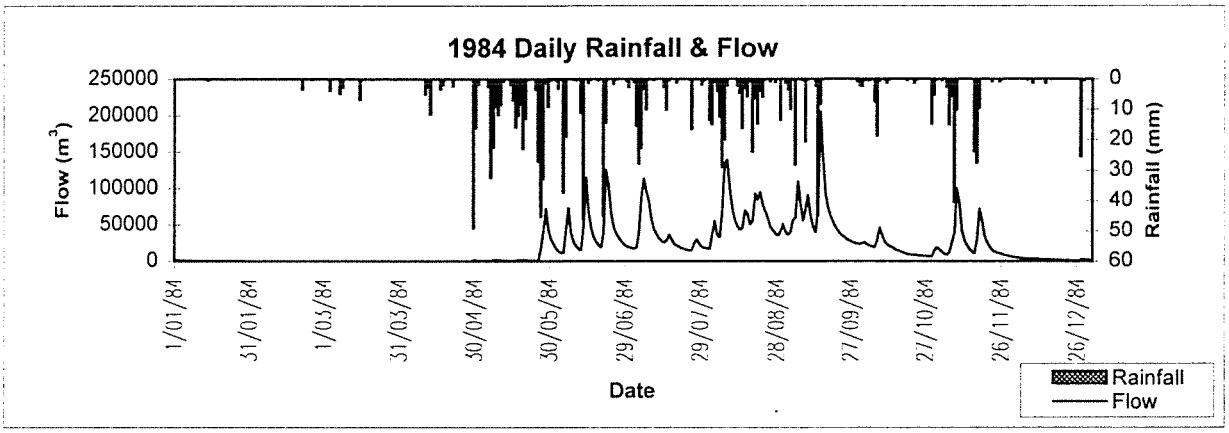


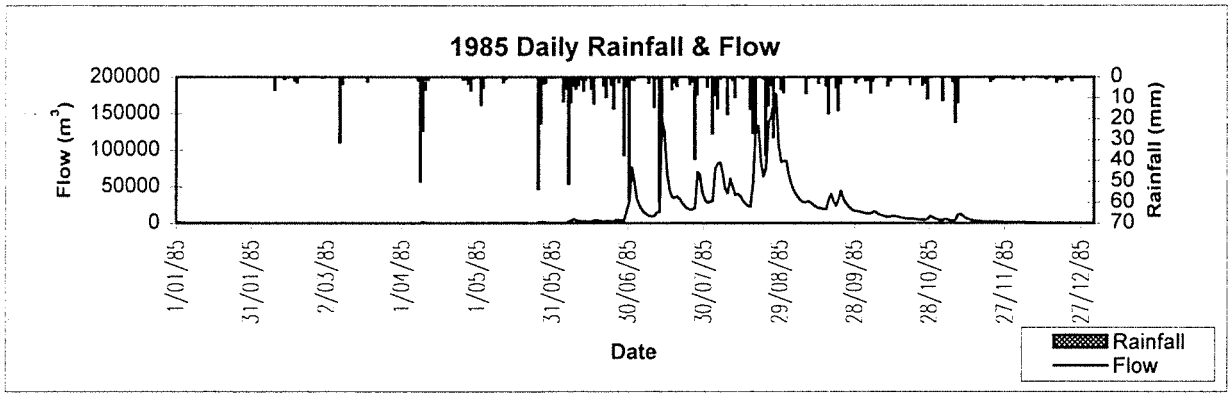


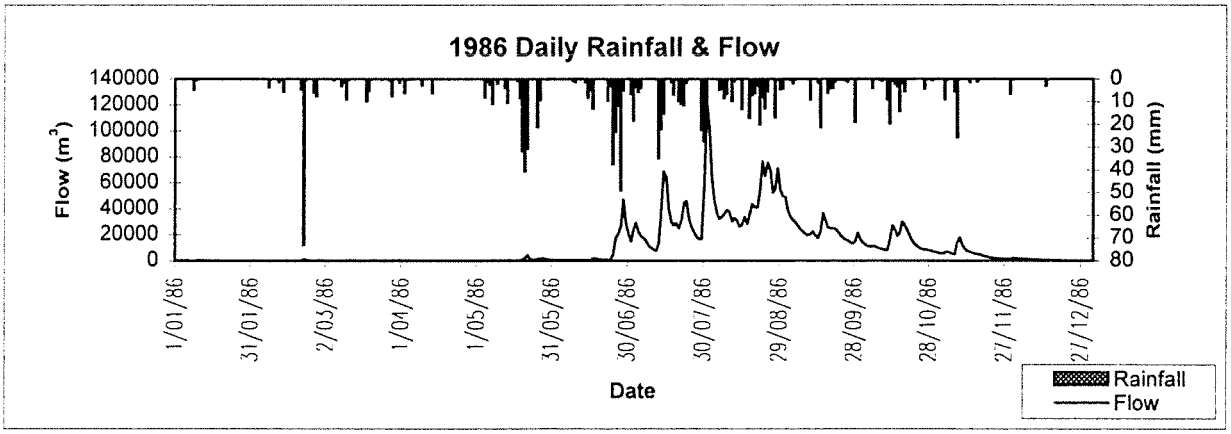


North Rd Catchment - S 614036

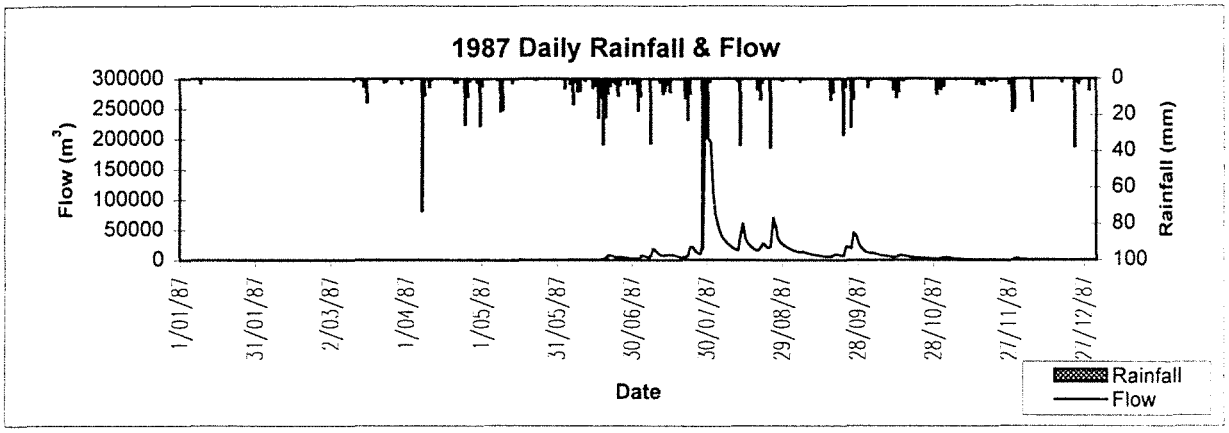


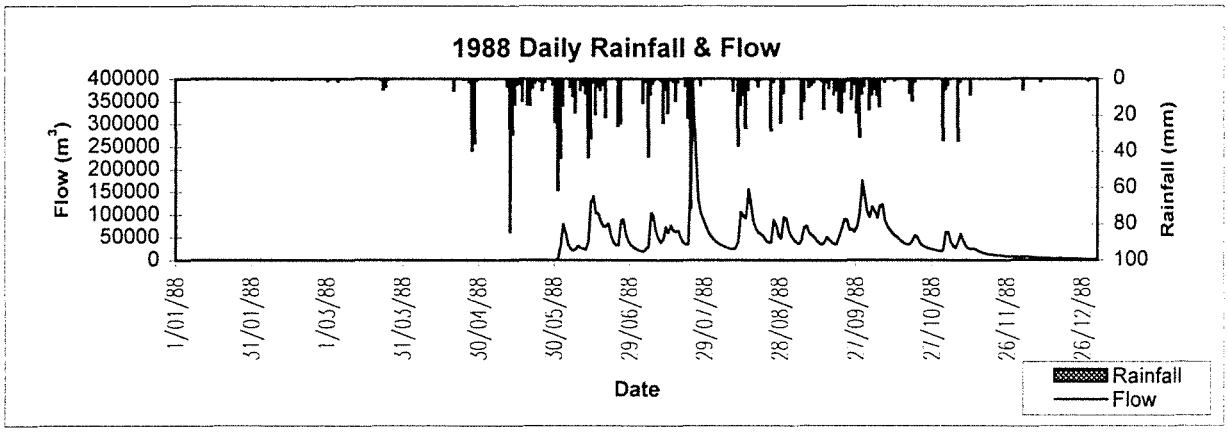


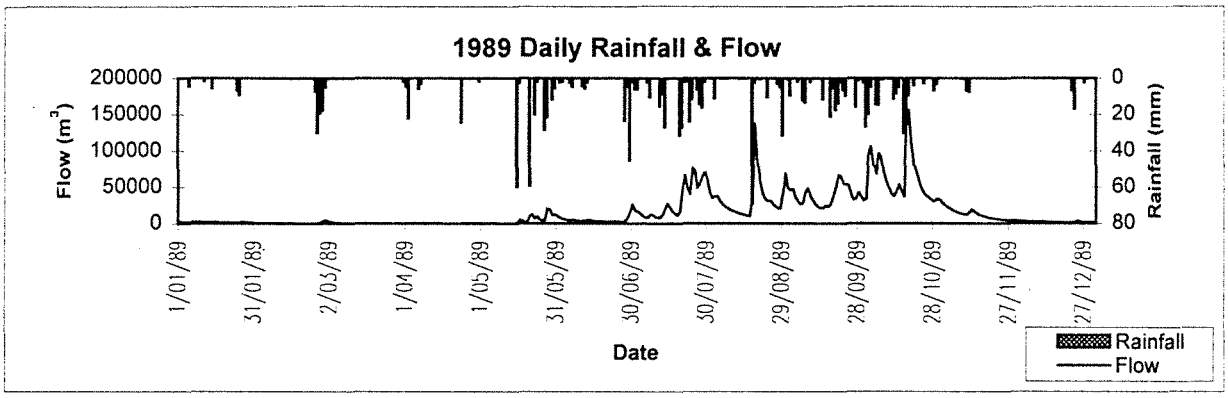


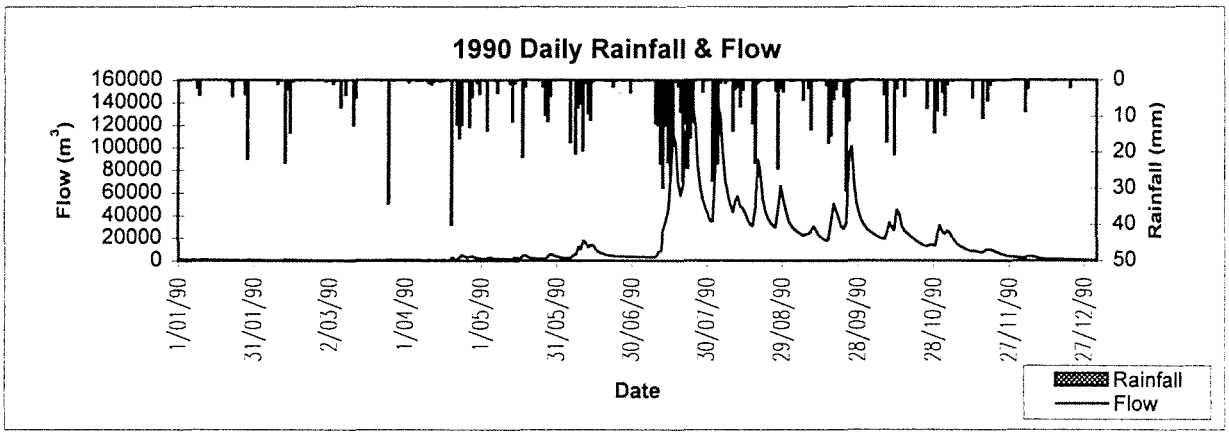


North Rd Catchment - S 614036

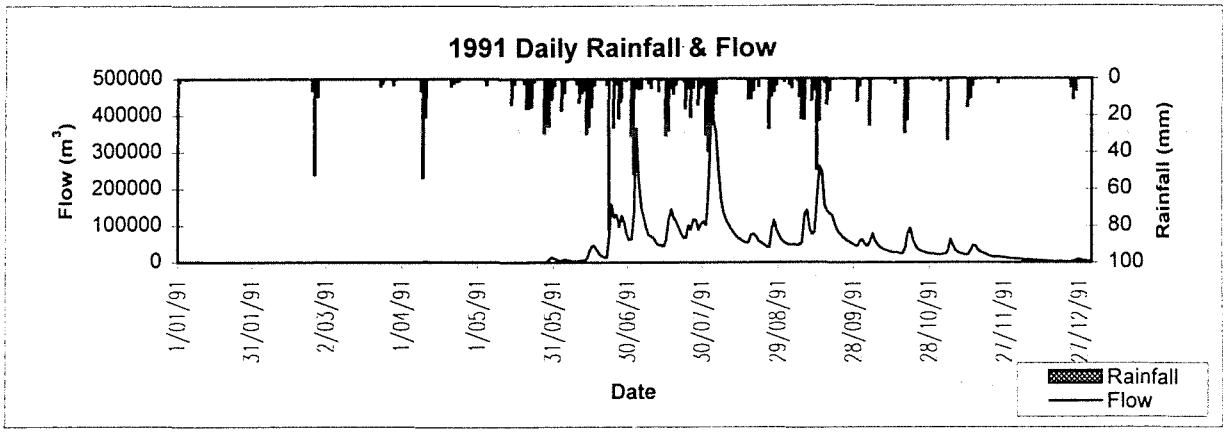


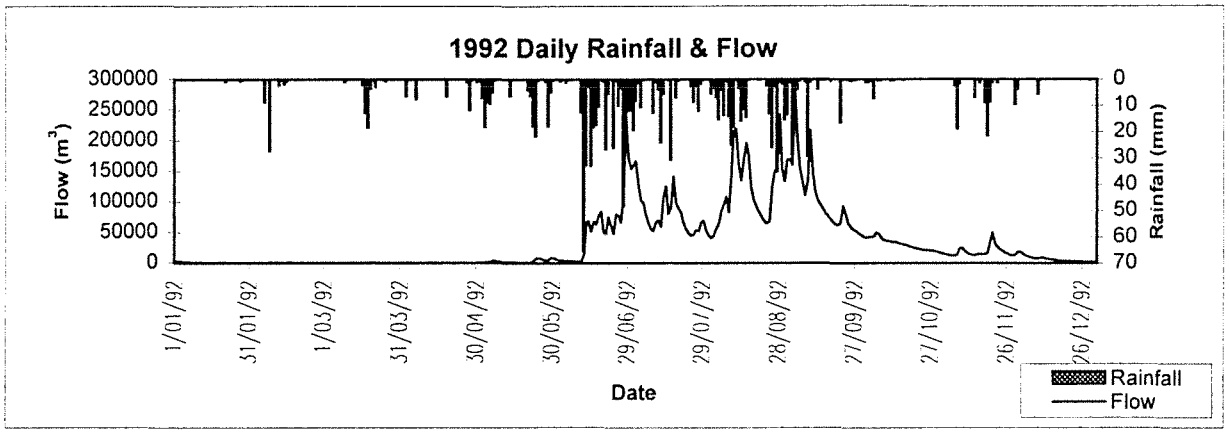


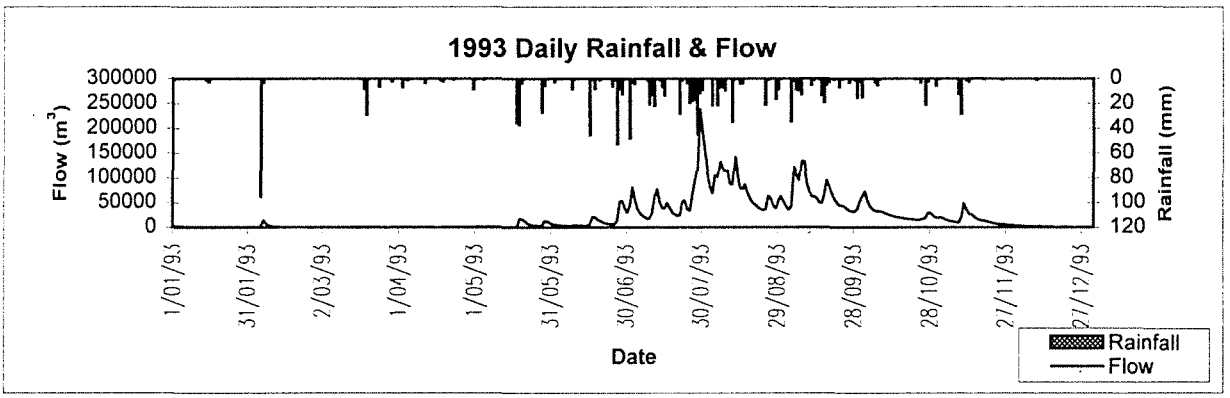


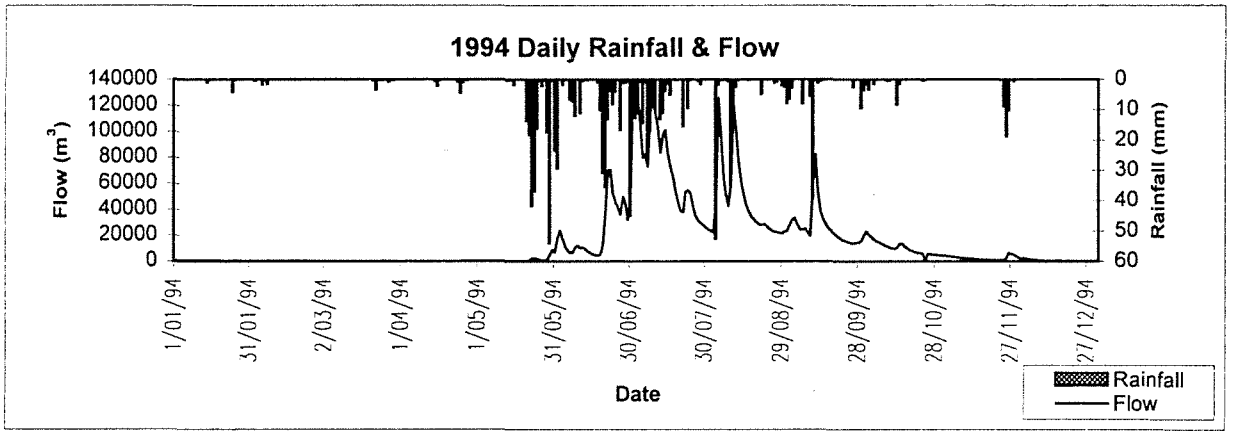


North Rd Catchment - S 614036

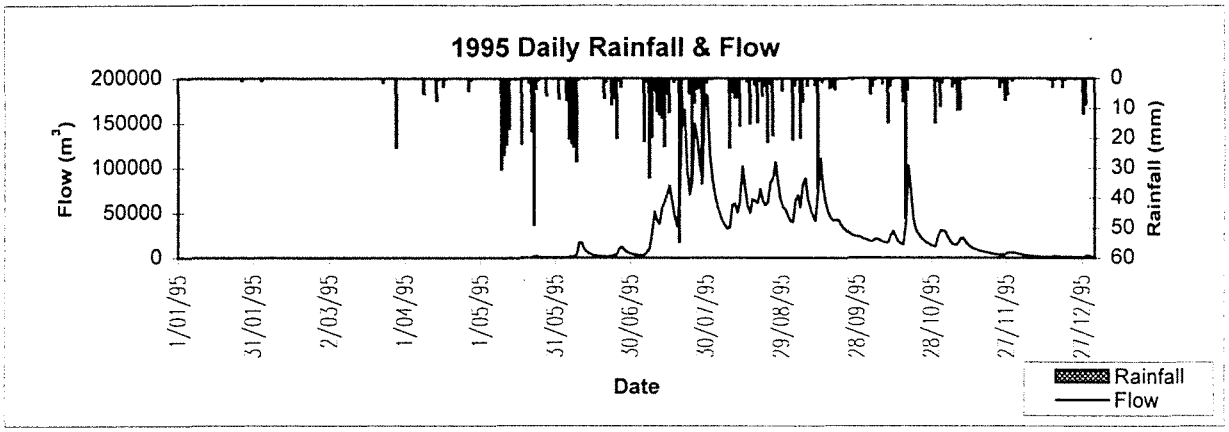


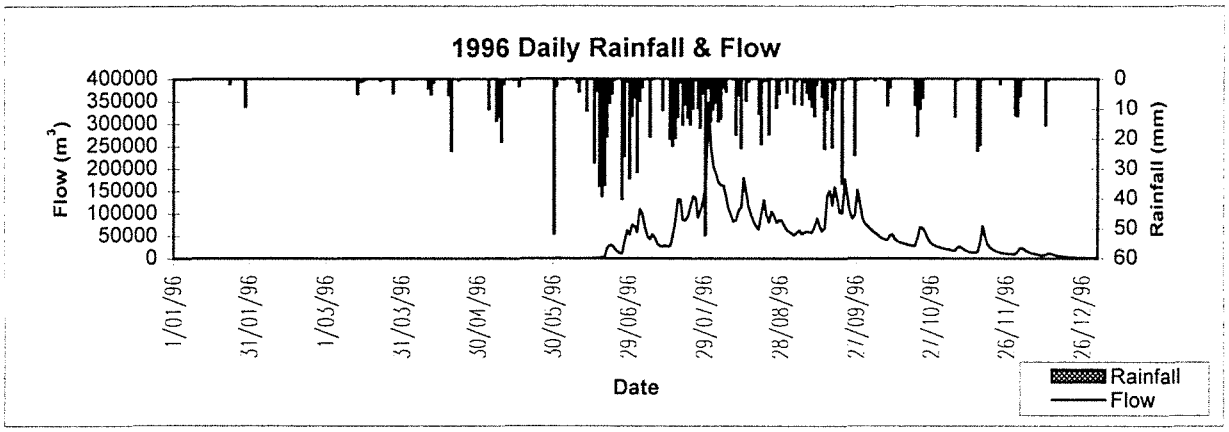


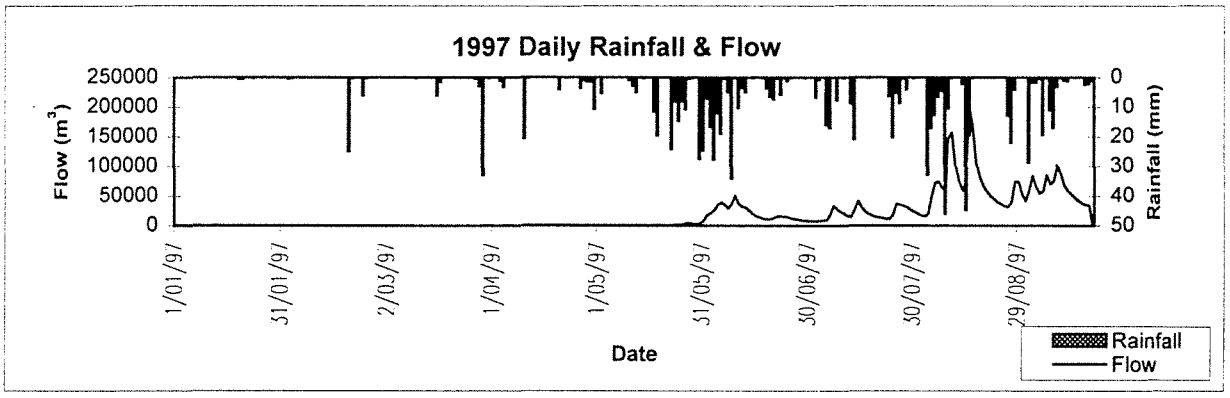




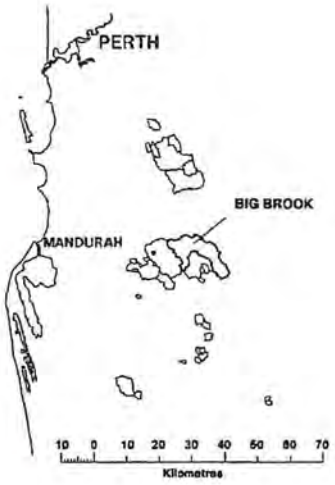
North Rd Catchment - S 614036







Big Brook Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S614037
Rainfall Gauge Number	M509221

Information about catchment

Catchment area	149 km^2	
Gauging Station Coordinates (AMG)	N 6402450	E 423800
Treatment data	Normal Forest Management	

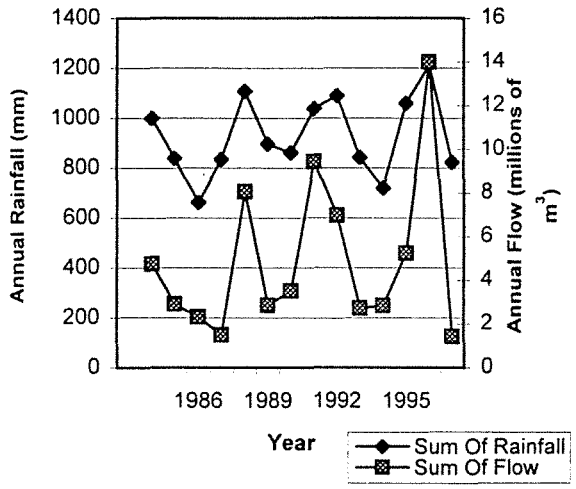
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	5357	5502	0
Number of years recorded	16	16	
Number of years with complete records	14	14	
Start date	31/08/83	8/04/83	
Finish date	30/04/98	30/04/98	
Number of days with quality code 1	4889	5474	
Number of days with quality code 2	137	14	
Number of days with quality code 3	89	9	
Number of days with quality code 4	40	0	
Number of days with quality code 157	195	0	
Number of days with quality code 255	7	5	

Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	927.8	4.895
Min	662.8	1.422
Max	1213.2	13.996

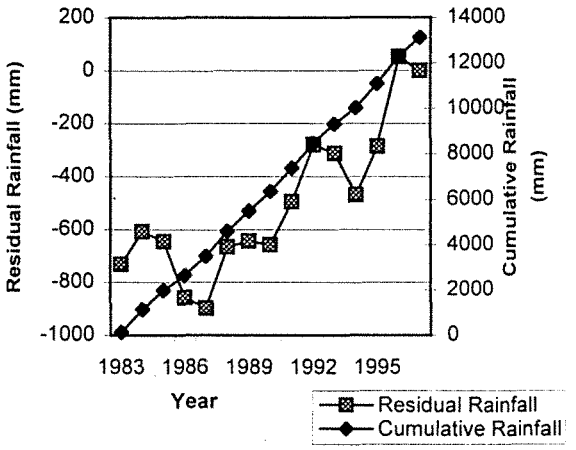
Year	**Number of flow days**
1984	234
1985	159
1986	161
1987	126
1988	197
1989	146
1990	166
1991	192
1992	192
1993	156
1994	139
1995	162
1996	180
1997	97
Total	**2307**

Big Brook (O'Neil Road) Catchment - S 614037

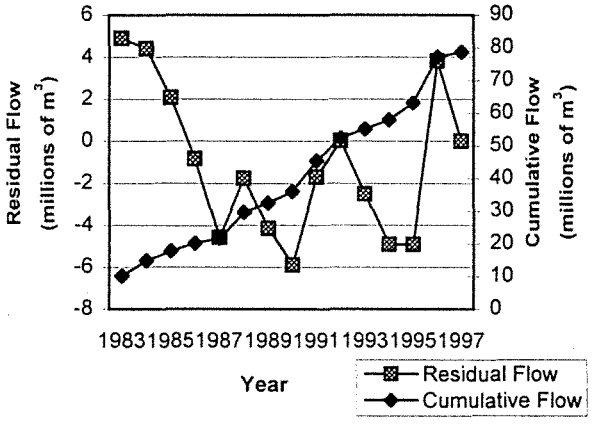
Annual Rainfall & Flow



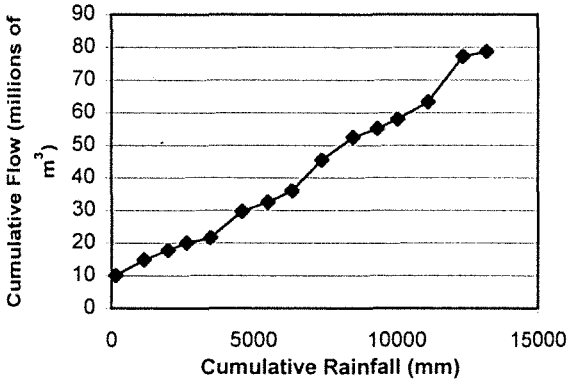
Annual Cumulative & Residual Rainfall Curves



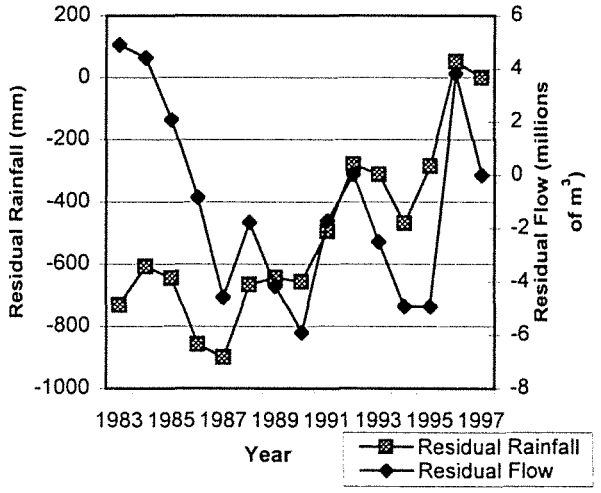
Annual Cumulative & Residual Flow Curves



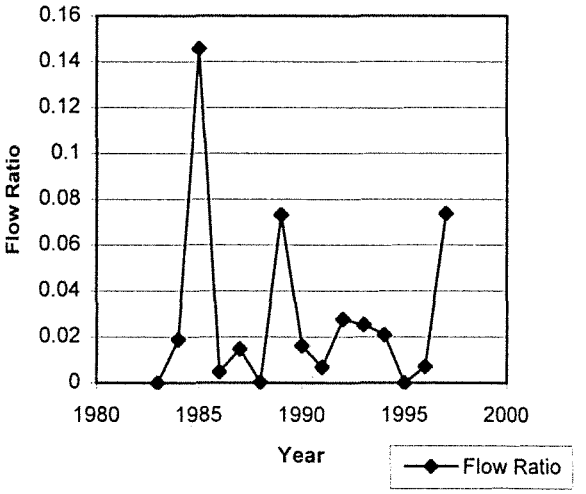
Annual Cumulative Flow & Cumulative Rainfall Curves



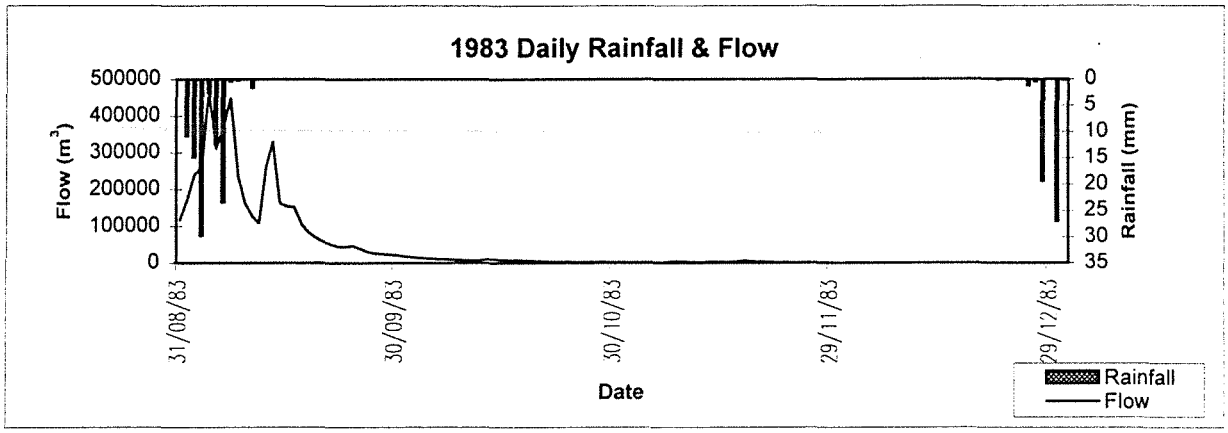
Annual Residual Flow & Residual Rainfall Curves

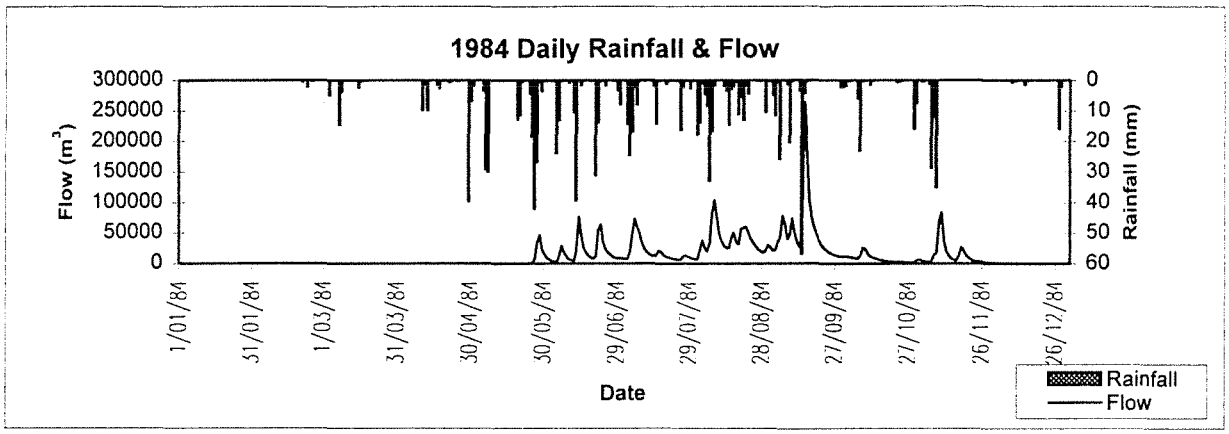


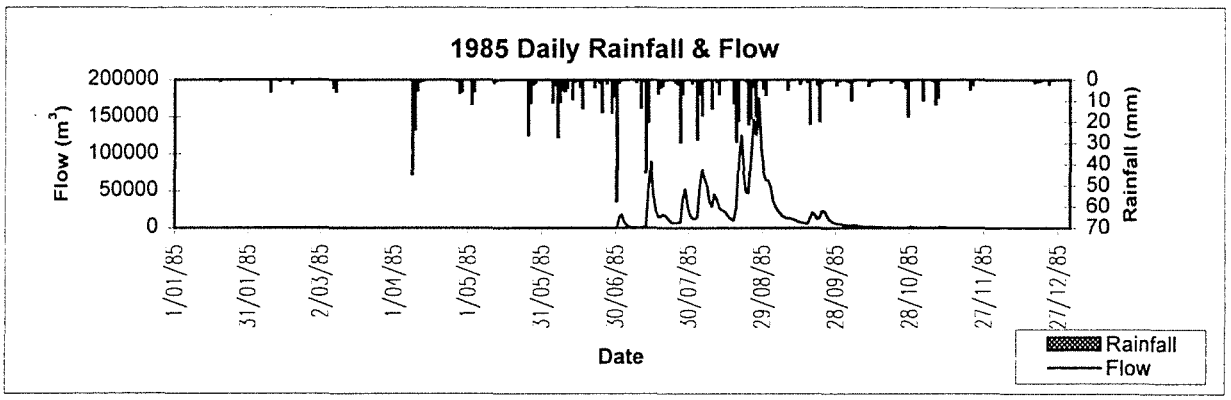
Flow Ratio of Summer to Winter

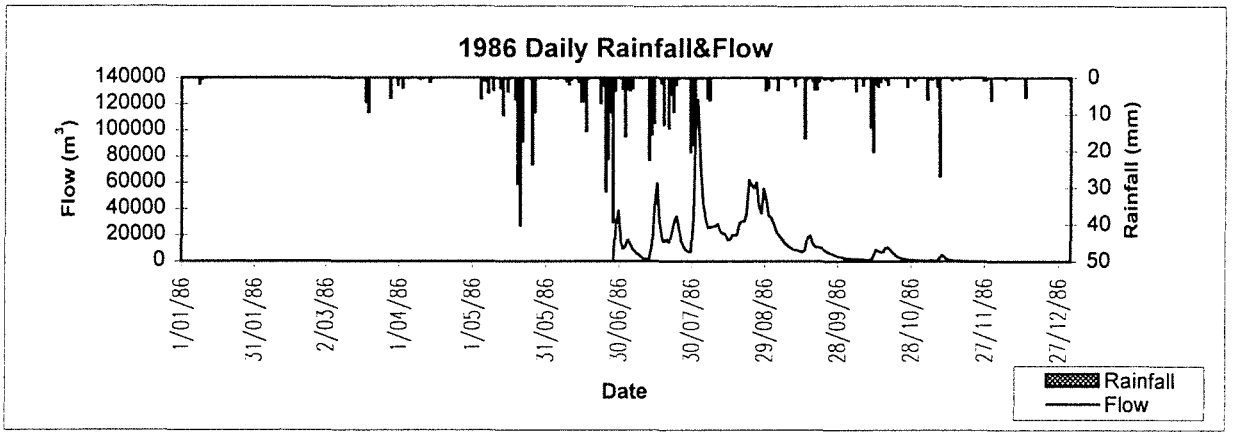


Big Brook (O'Neil Road) Catchment - S 614037

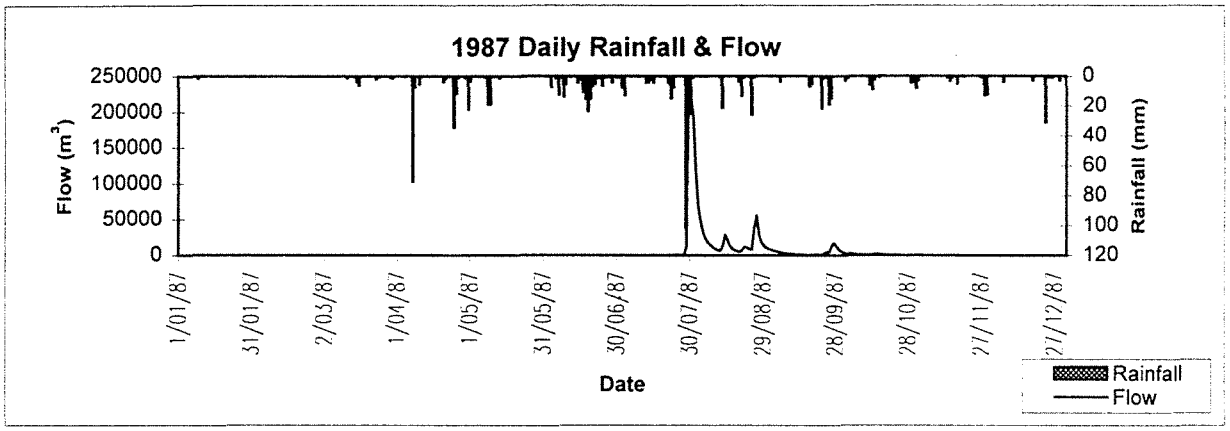


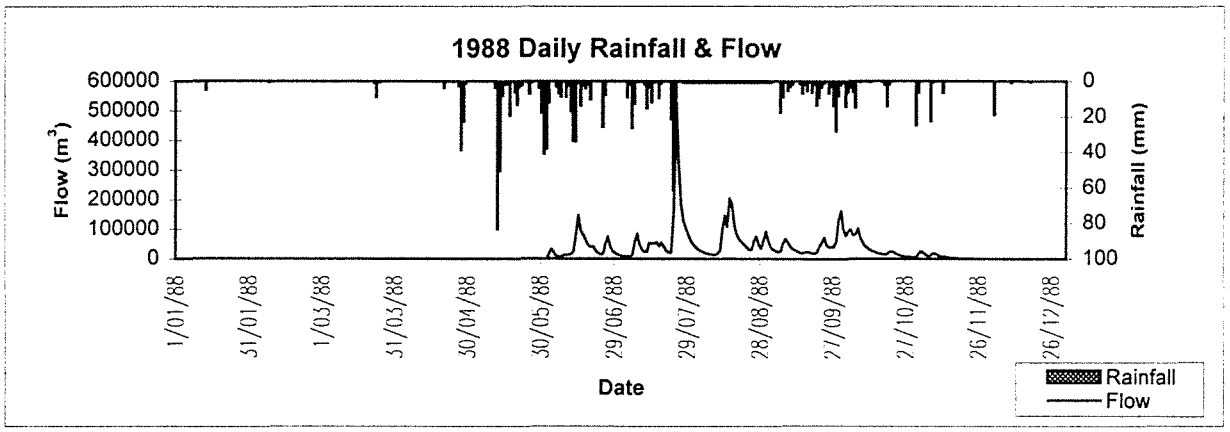


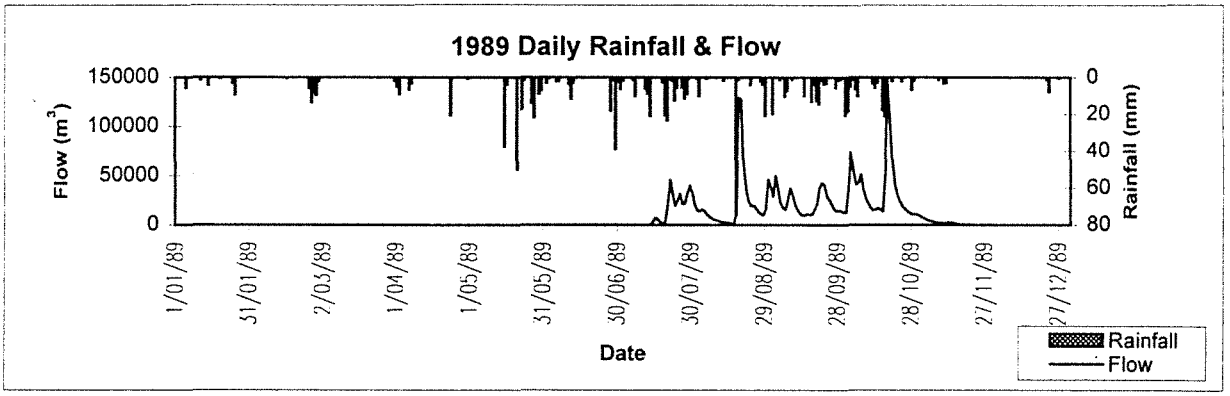


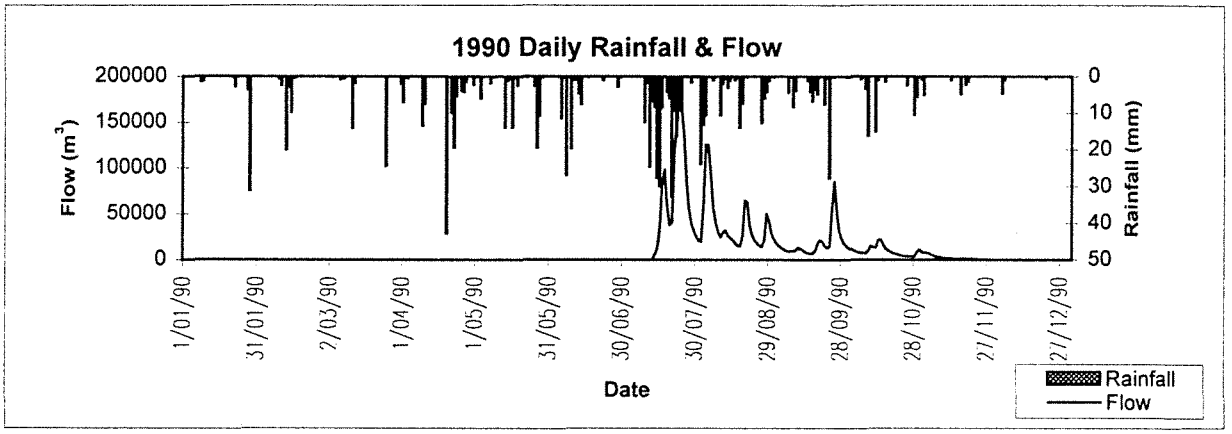


Big Brook (O'Neil Road) Catchment - S 614037

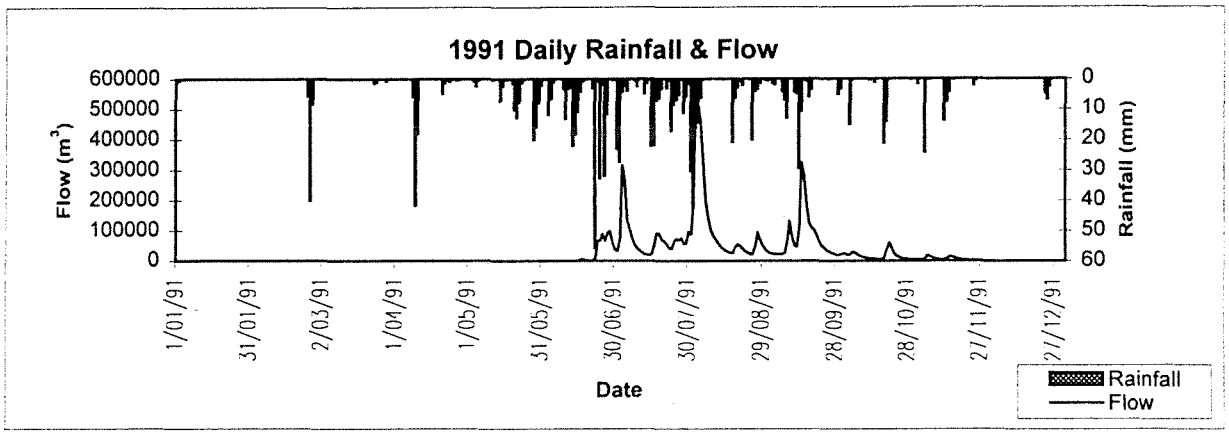


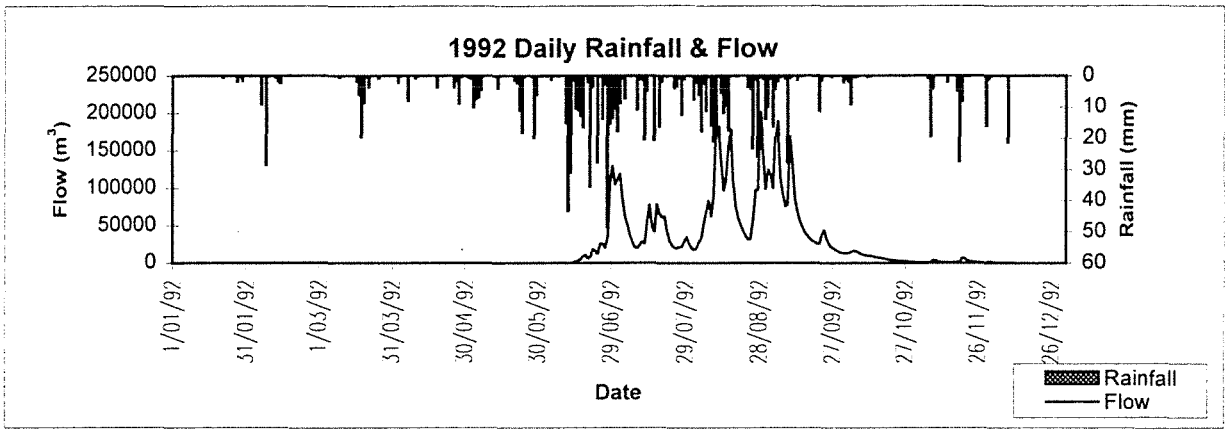


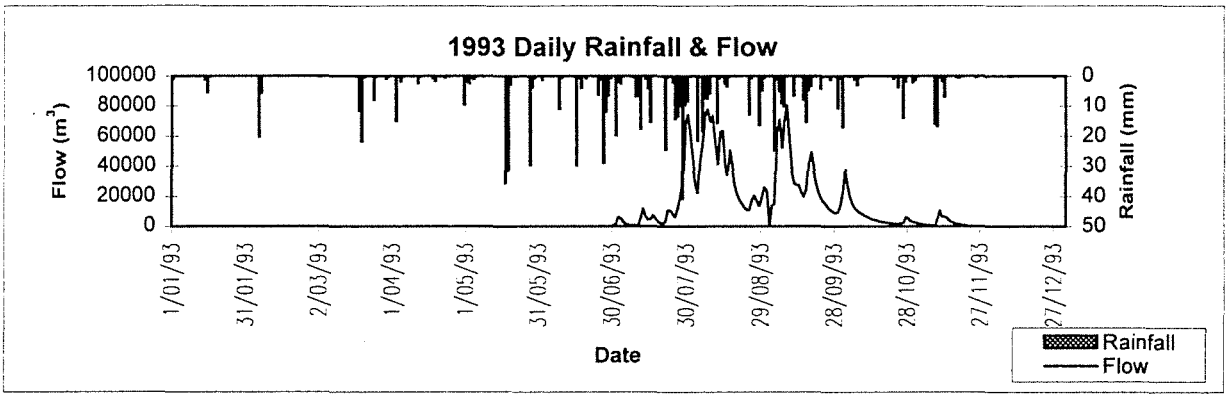


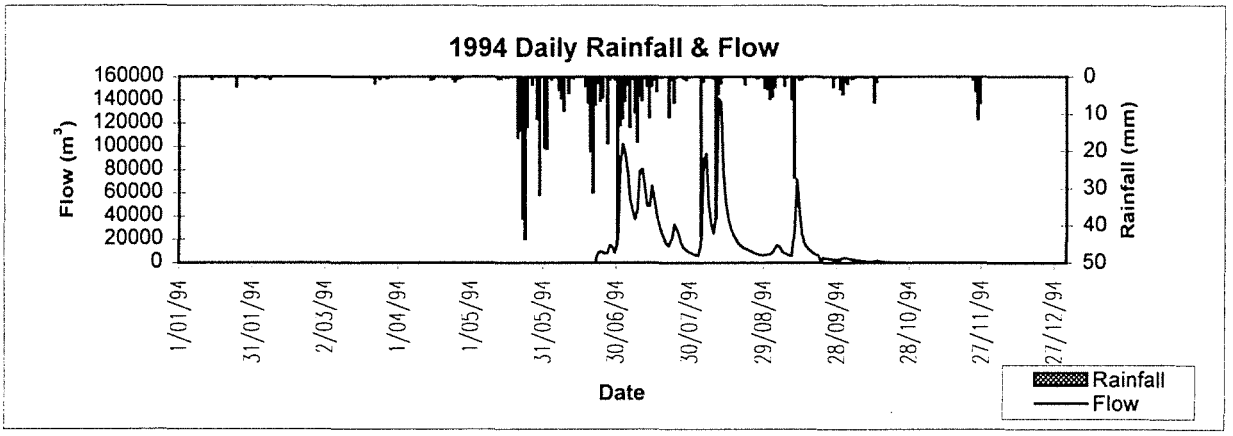


Big Brook (O'Neil Road) Catchment - S 614037

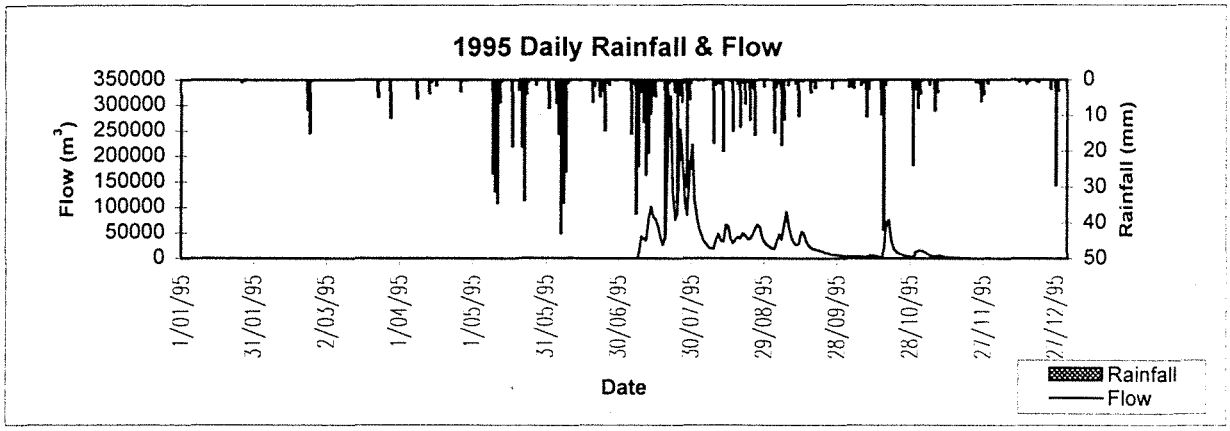


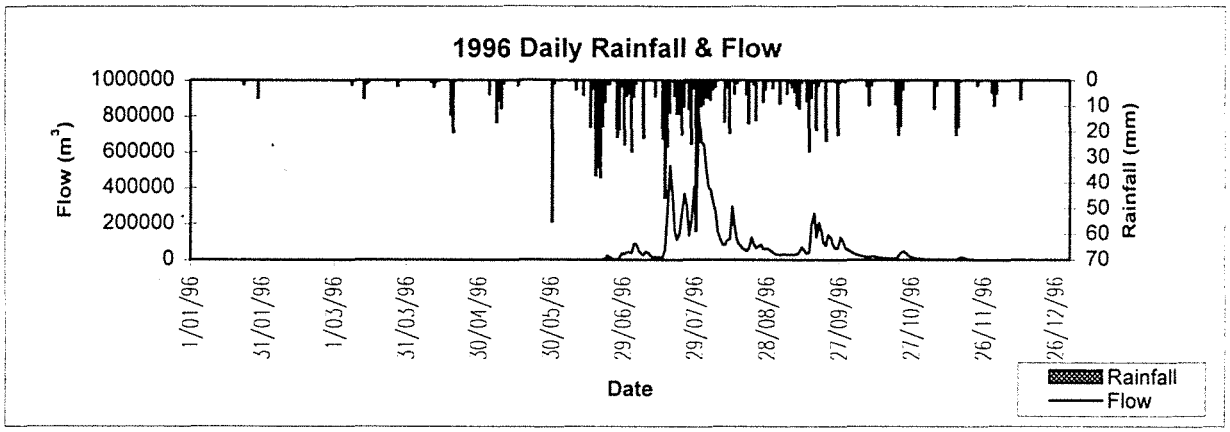


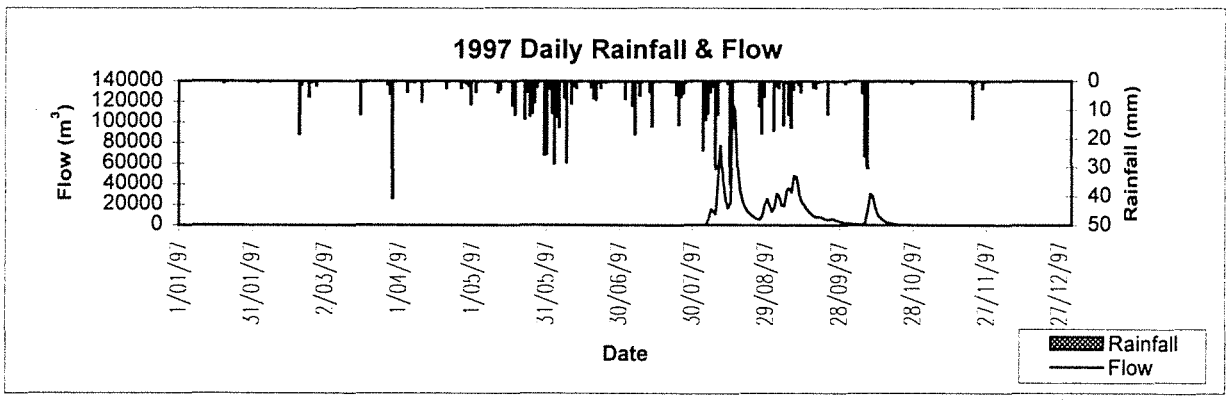




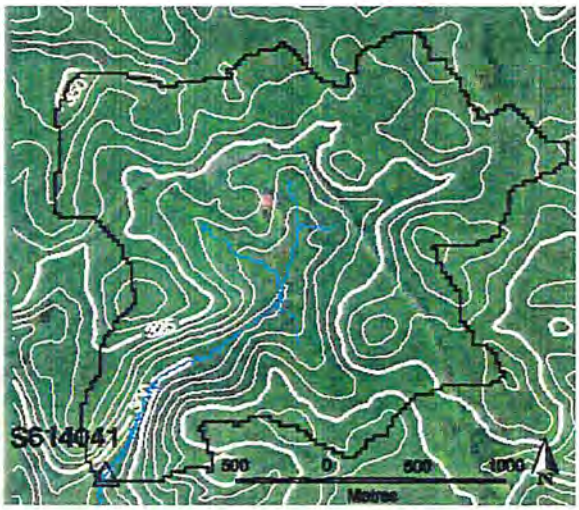
Big Brook (O'Neil Road) Catchment - S 614037







Wuraming Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

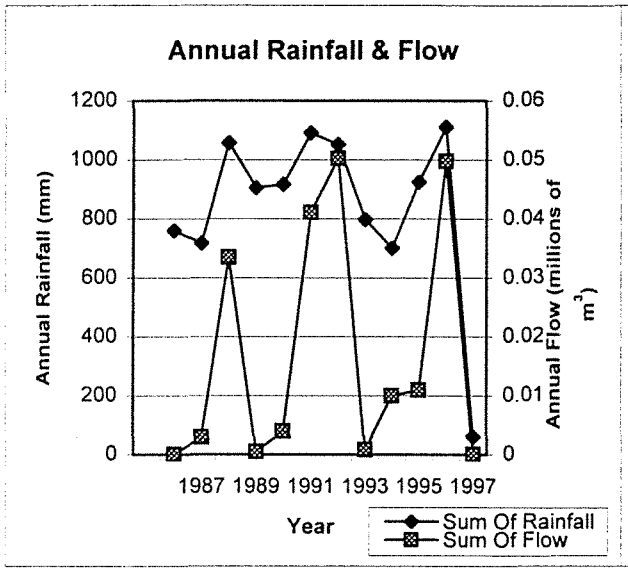
Computer Generated Stream Line

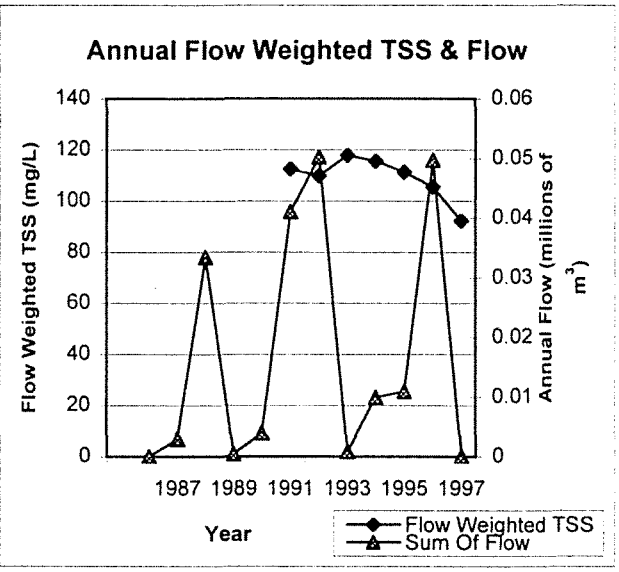
Gauging Station Number	S614041
Rainfall Gauge Number	Yarragil North (M509433) rainfall data
Information about catchment	
Catchment area	4.4 km^2
Gauging Station Coordinates (AMG)	N 6371180 E 430250
Treatment data	Undisturbed Catchment.

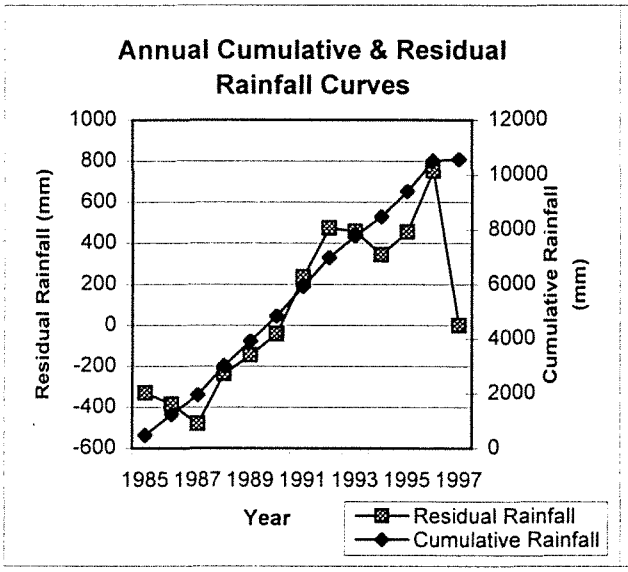
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	0	4775	4775
Number of years recorded		14	14
Number of years with complete records		12	12
Start date		21/05/85	21/05/85
Finish date		16/06/98	16/06/98
Number of days with quality code 1		4736	2421
Number of days with quality code 2		26	137
Number of days with quality code 3		0	2
Number of days with quality code 4		3	56
Number of days with quality code 255		10	2159
Annual Basic Statistics		Flow (millions of m^3)	Salinity (mg/L)
Average		0.0170	82.29
Min		0.0001	92.38
Max		0.0503	117.85

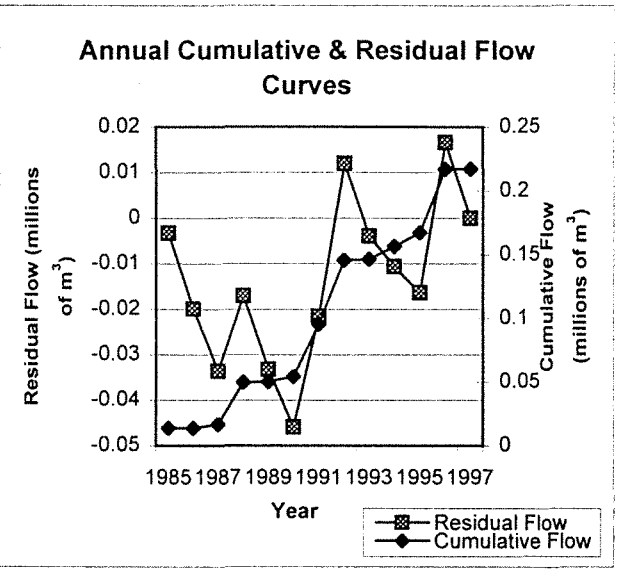
Year	**Number of flow days**
1986	14
1987	34
1988	126
1989	37
1990	41
1991	100
1992	109
1993	37
1994	60
1995	71
1996	93
1997	6
Total	**728**

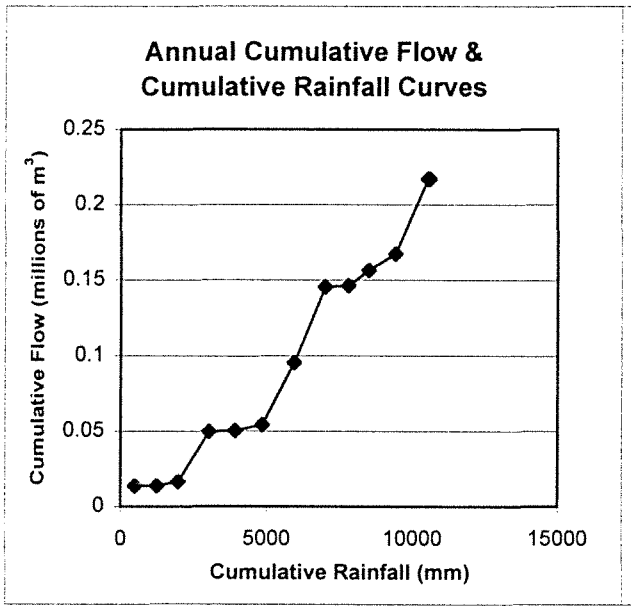
Wuraming Catchment - S 614041

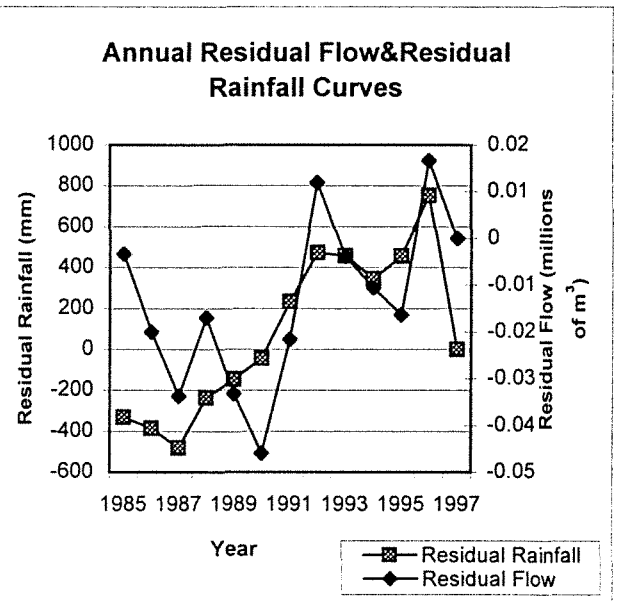




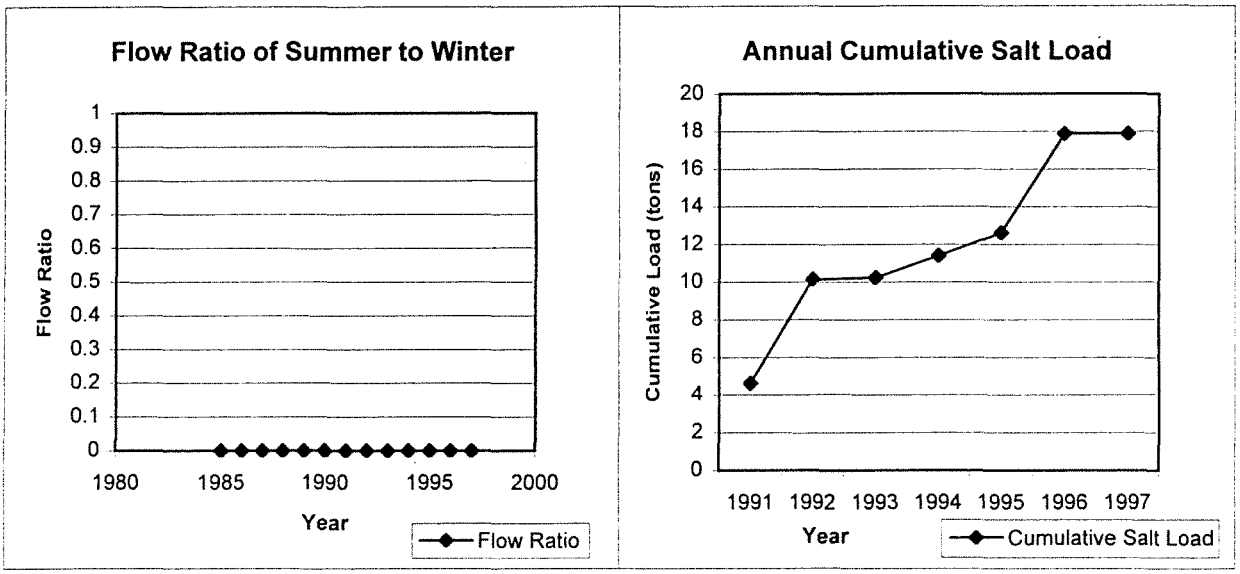




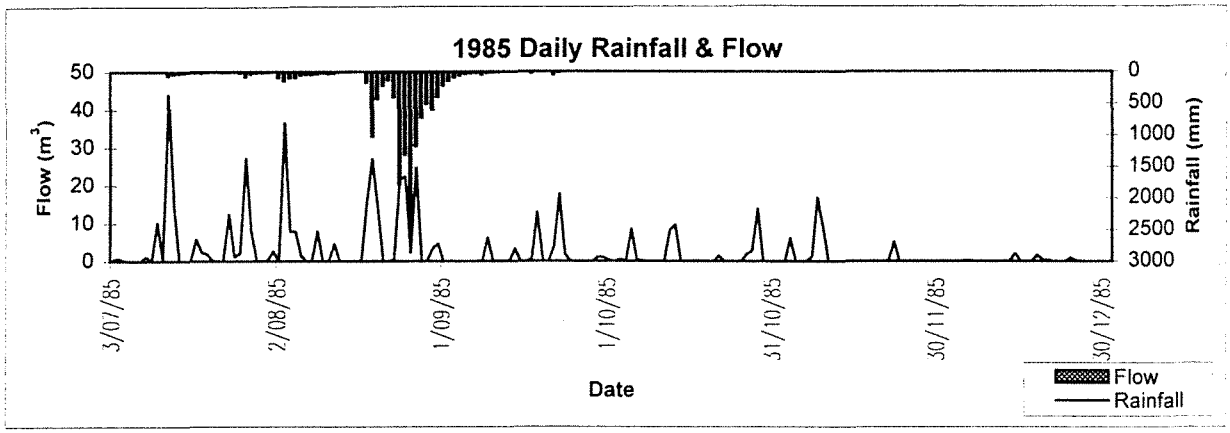


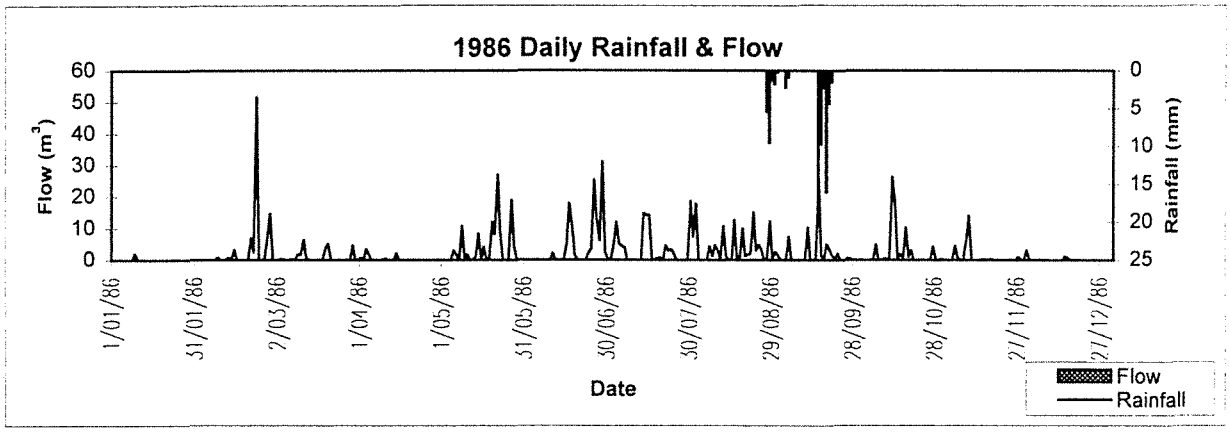


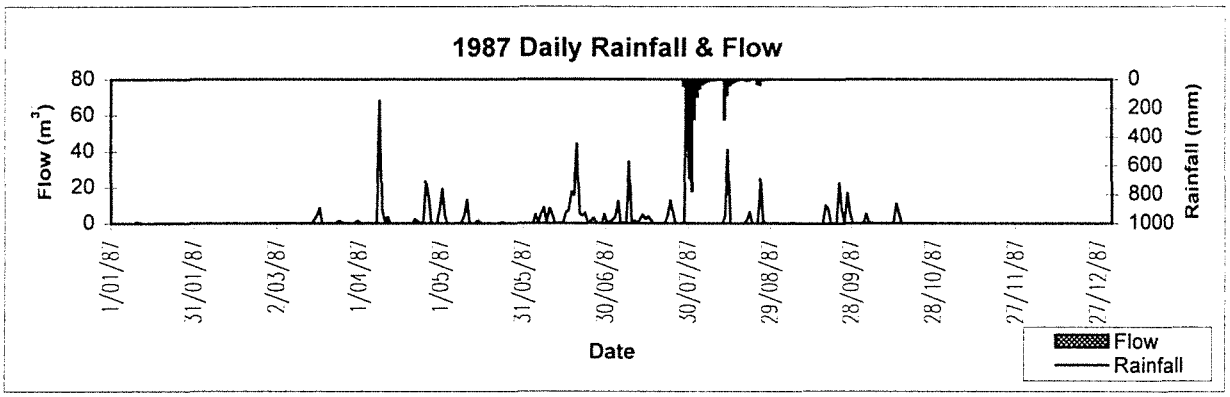
Wuraming Catchment - S 614041

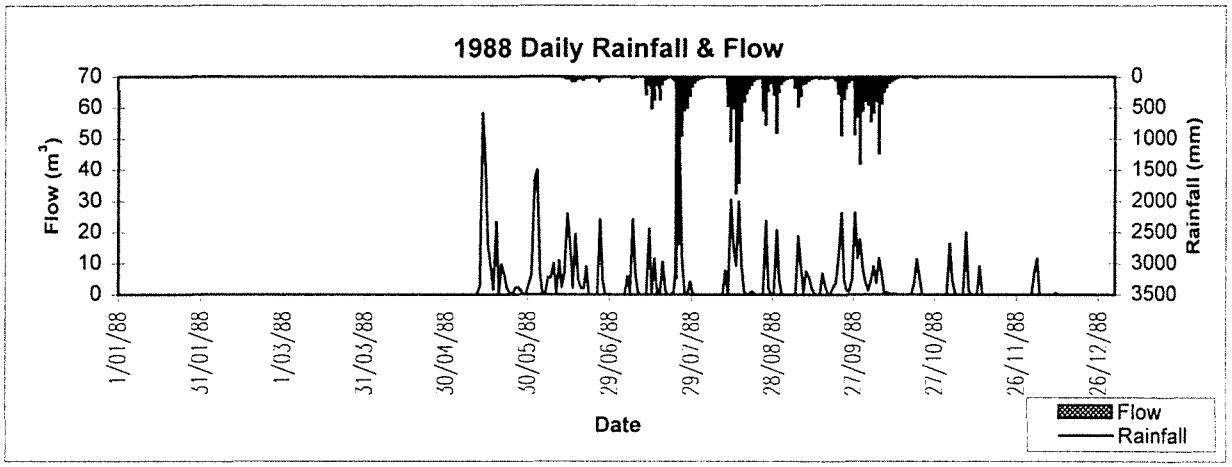


Wuraming Catchment - S 614041

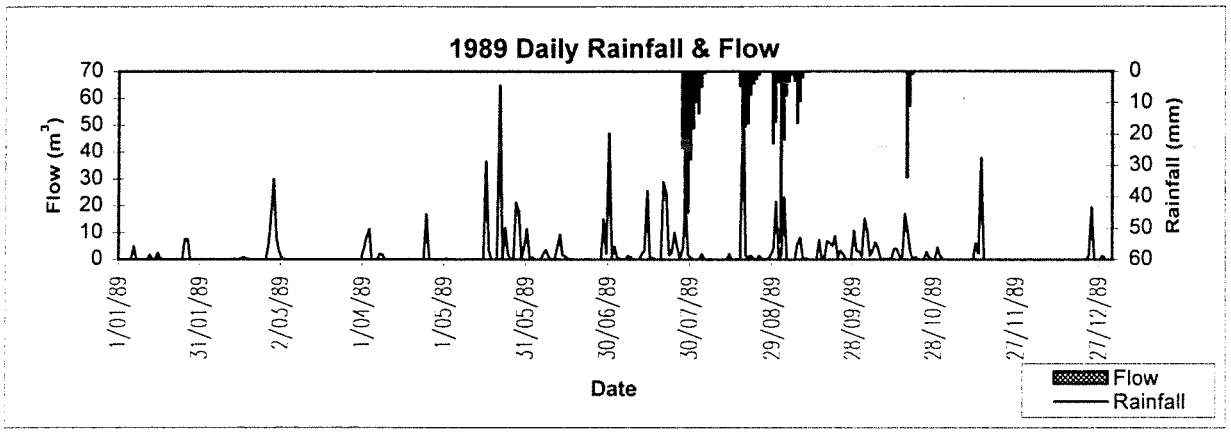


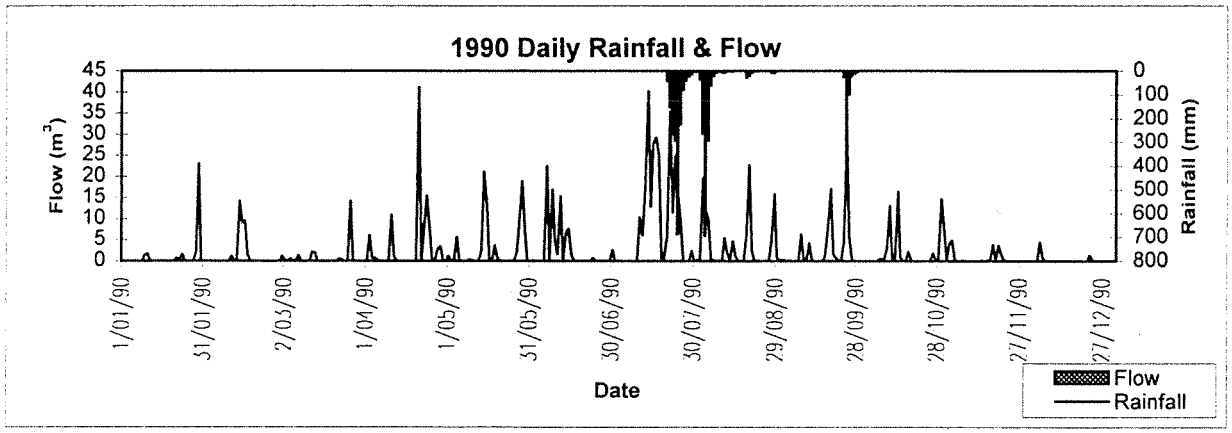


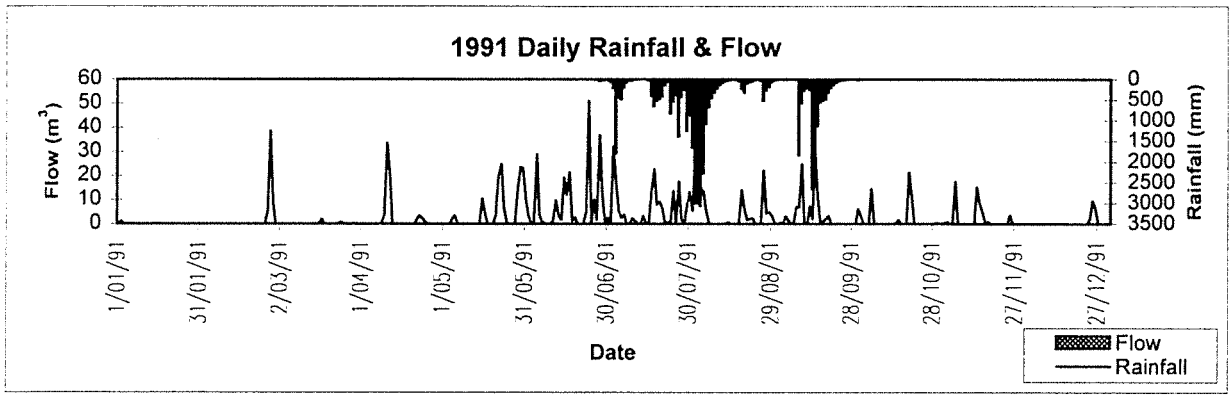


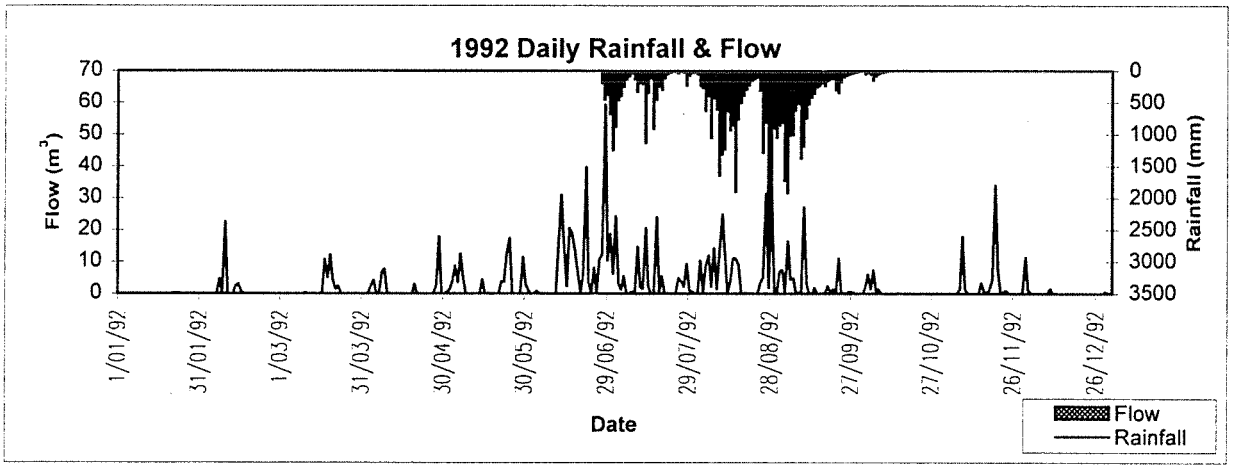


Wuraming Catchment - S 614041

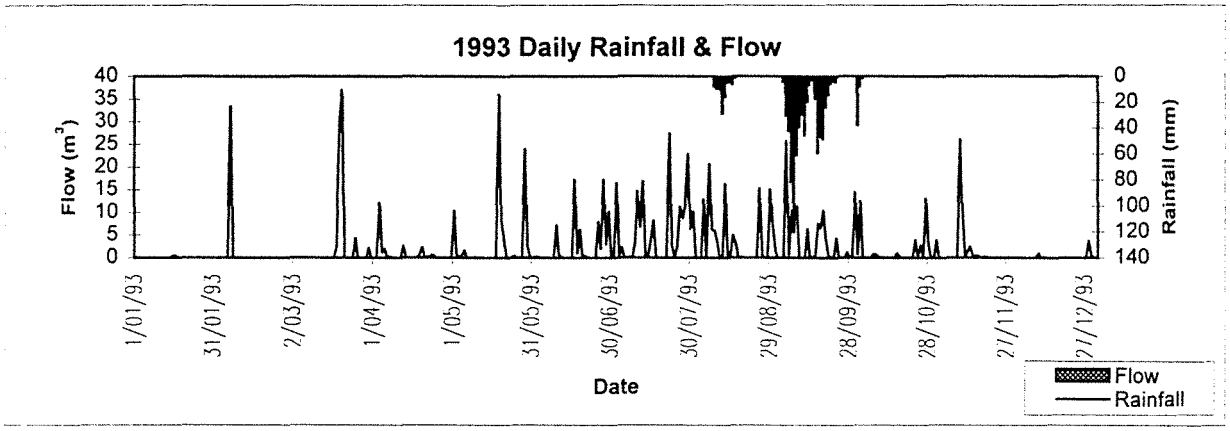


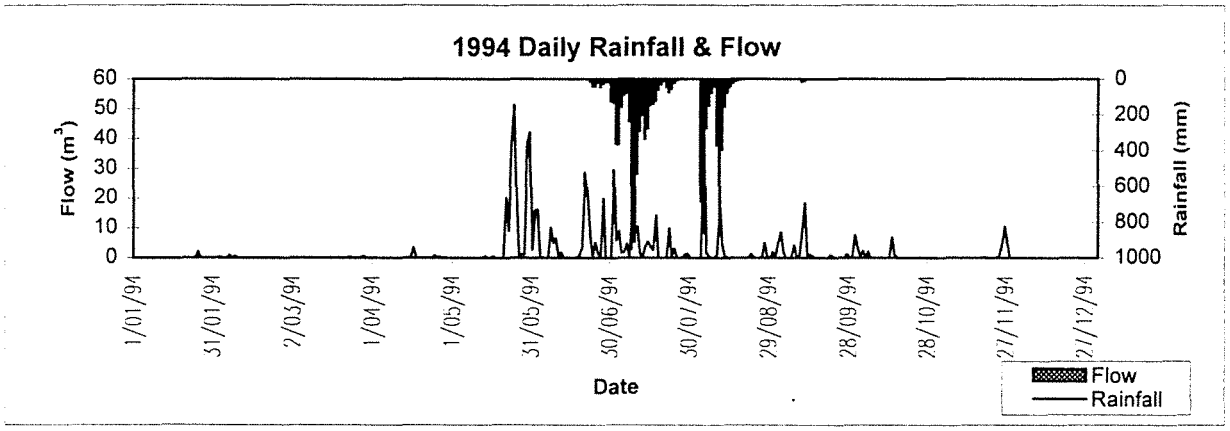


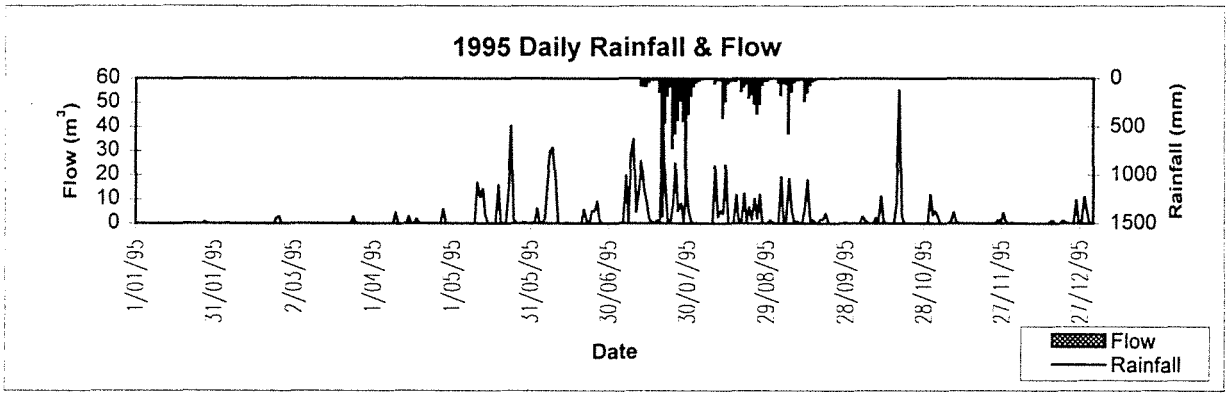


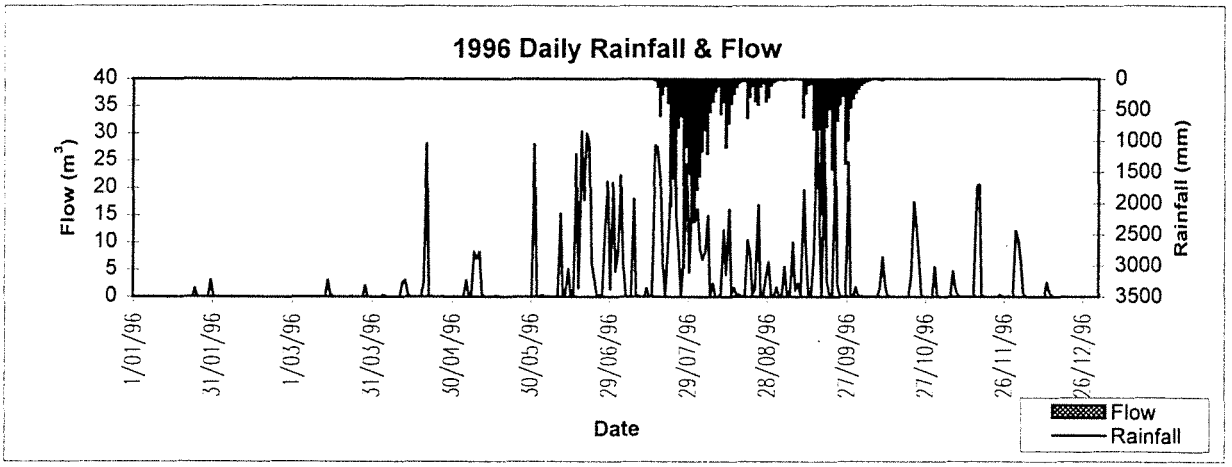


Wuraming Catchment - S 614041

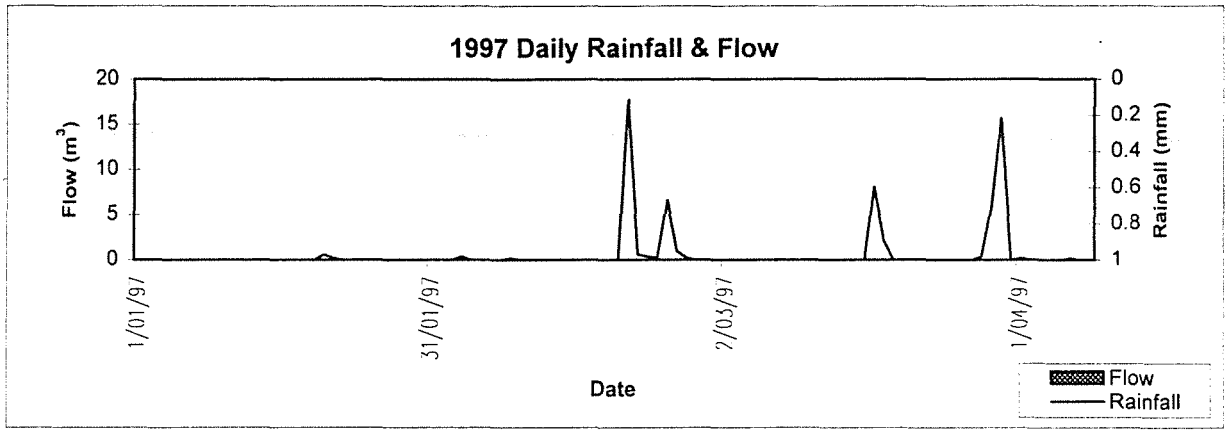




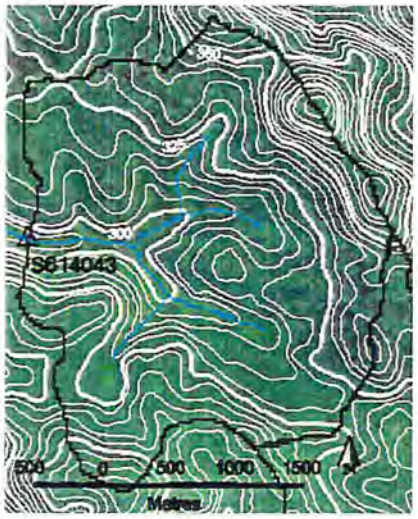




Wuraming Catchment - S 614041



Pindalup Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

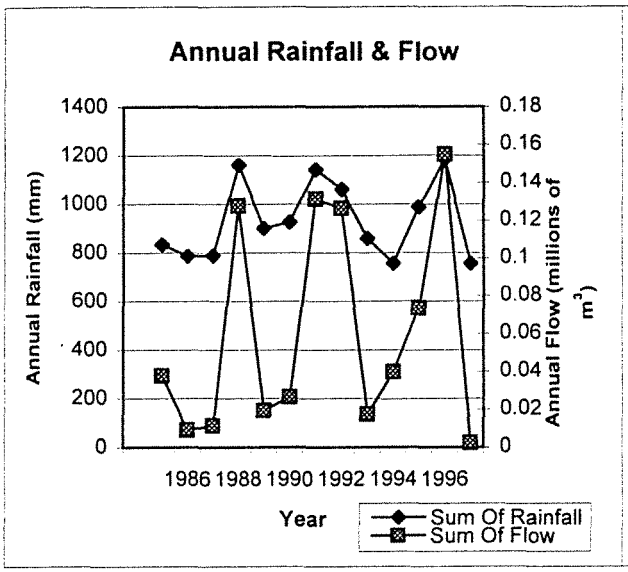
Computer Generated Stream Line

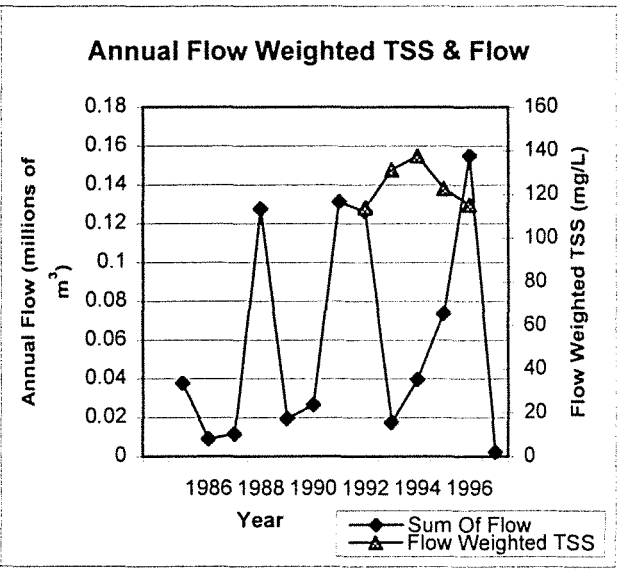
Gauging Station Number	S614043
	Chadoora (M 509235) rainfall data
Information about catchment	
Catchment area	6.88 km^2
Gauging Station Coordinates (AMG)	N 6377770 E 427275
Treatment data	Control Catchment

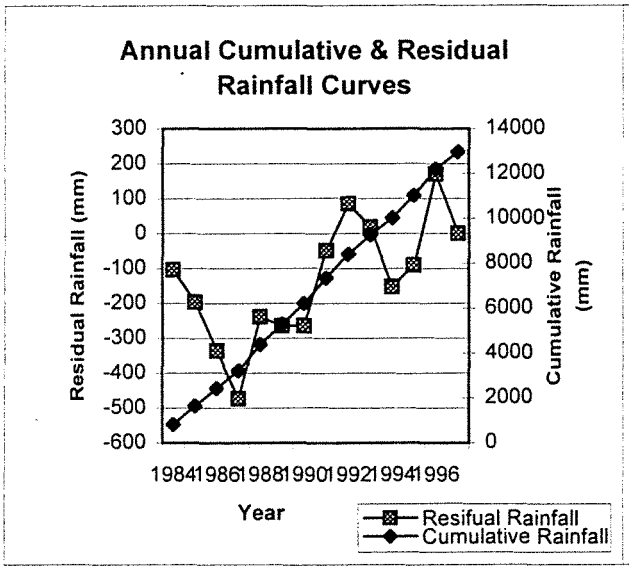
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	0	5077	3389
Number of years recorded		15	11
Number of years with complete records		13	9
Start date		1/05/84	8/10/87
Finish date		25/03/98	16/01/97
Number of days with quality code 1		4793	1716
Number of days with quality code 2		132	1
Number of days with quality code 3		42	31
Number of days with quality code 4		96	165
Number of days with quality code 255		14	1476
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average		0.060	103.55
Min		0.002	0.00
Max		0.155	137.76

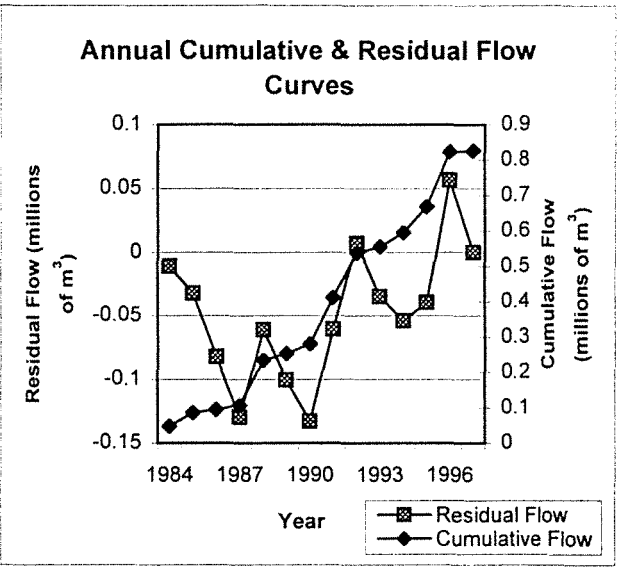
Year	**Number of flow days**
1985	136
1986	141
1987	103
1988	182
1989	125
1990	127
1991	164
1992	159
1993	109
1994	122
1995	142
1996	150
1997	87
Total	**1747**

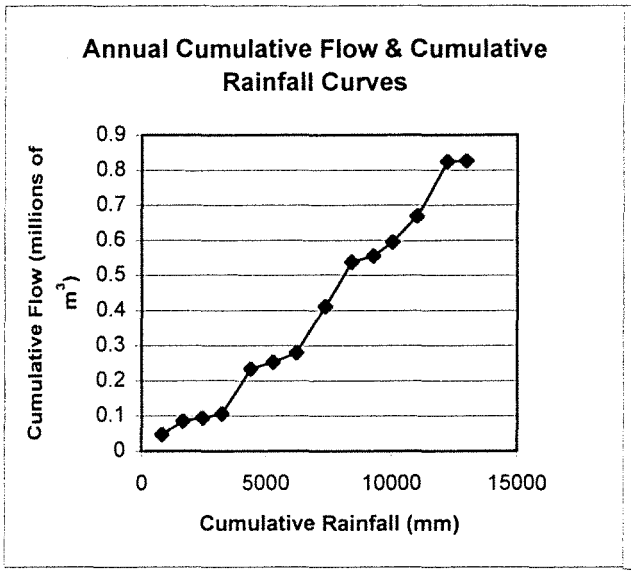
Pindalup Catchment - S 614043

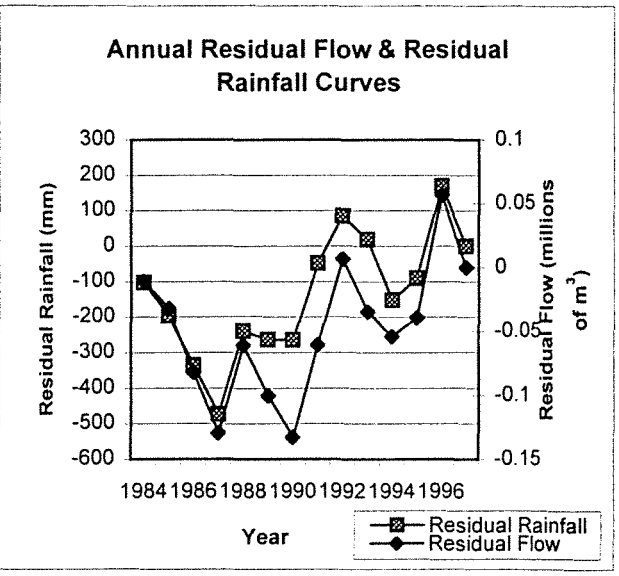




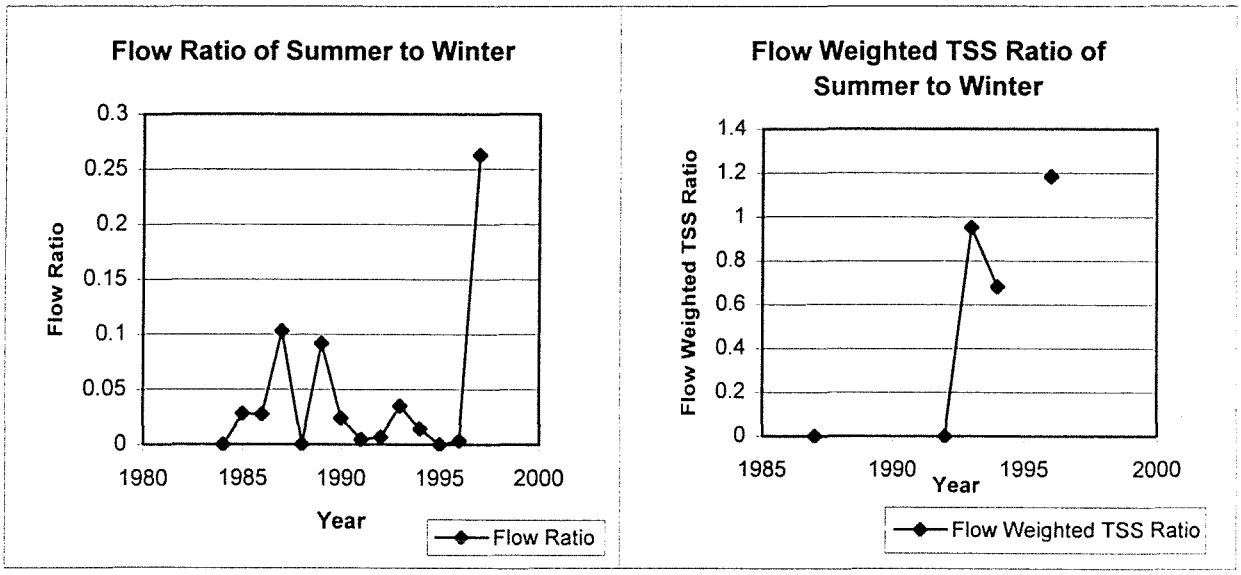


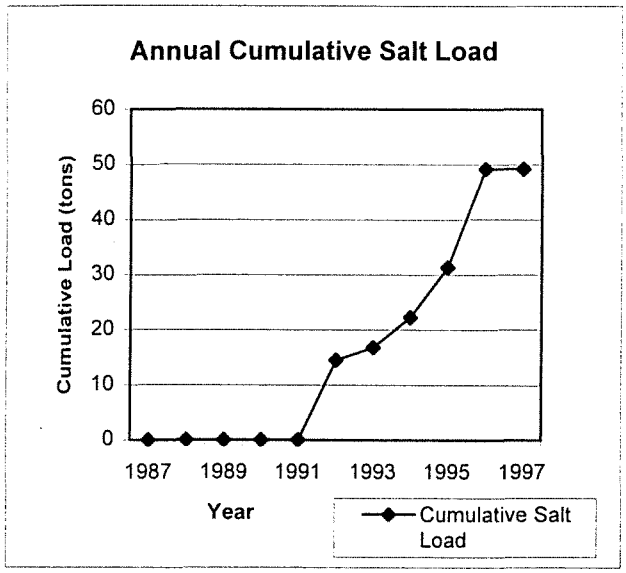




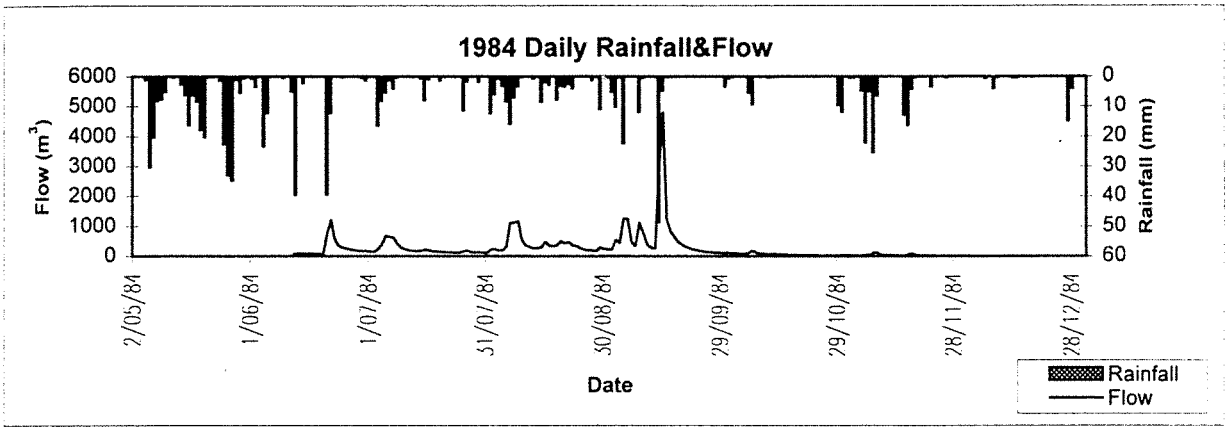


Pindalup Catchment - S 614043

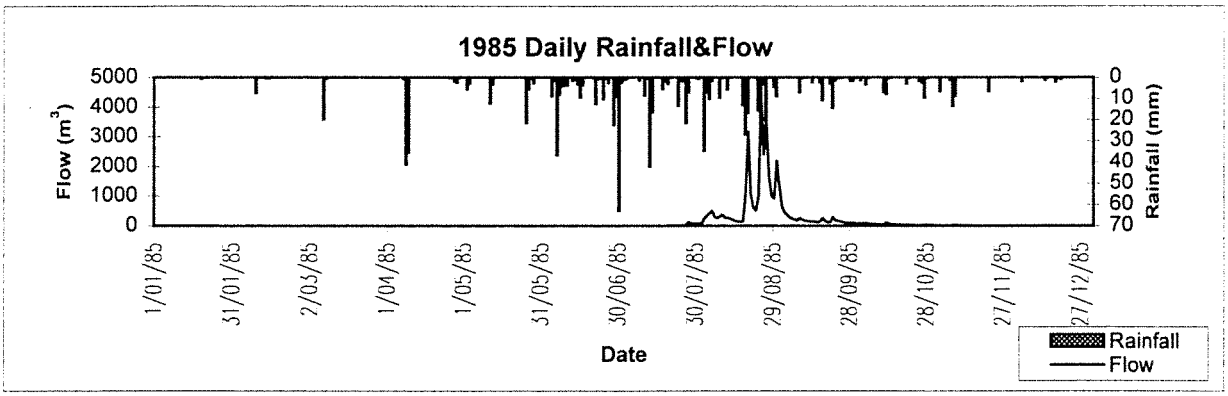




Pindalup Catchment - S 614043

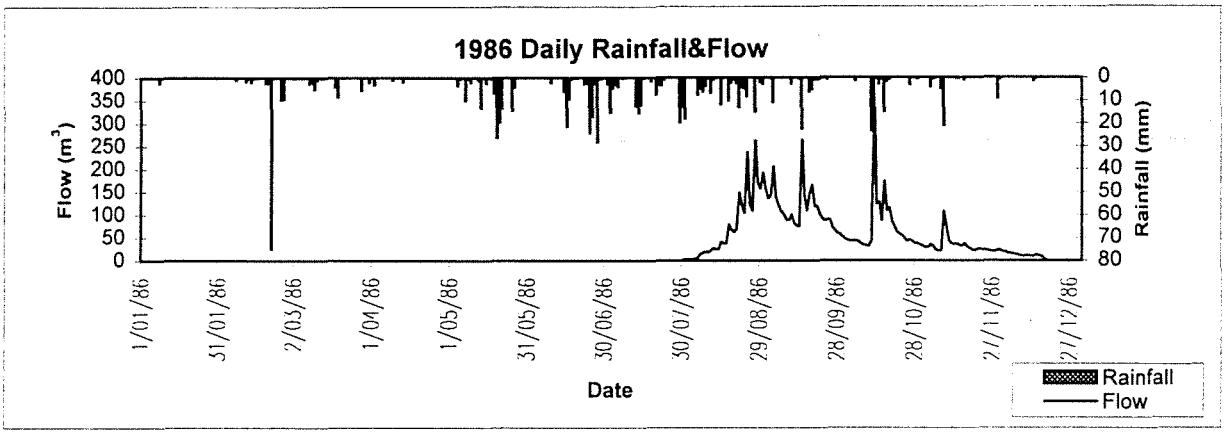


Salinity data not available for 1984

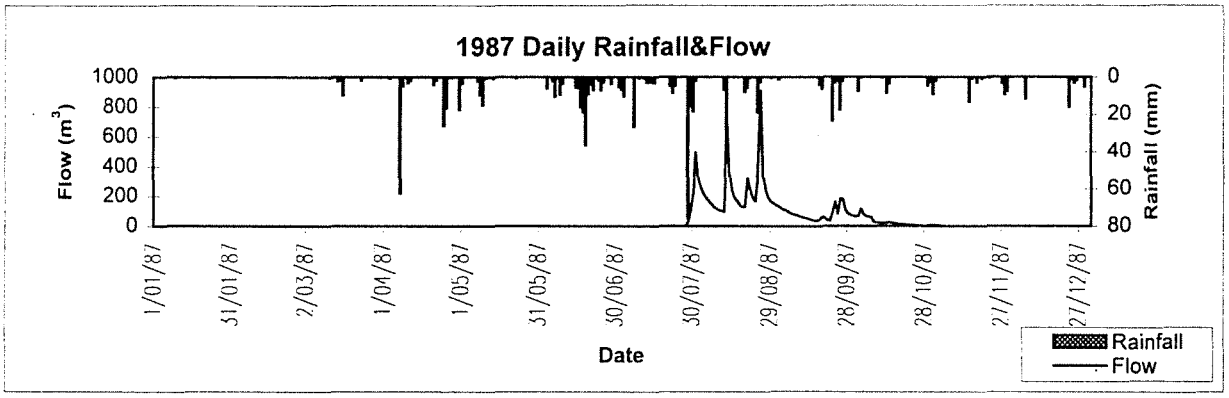


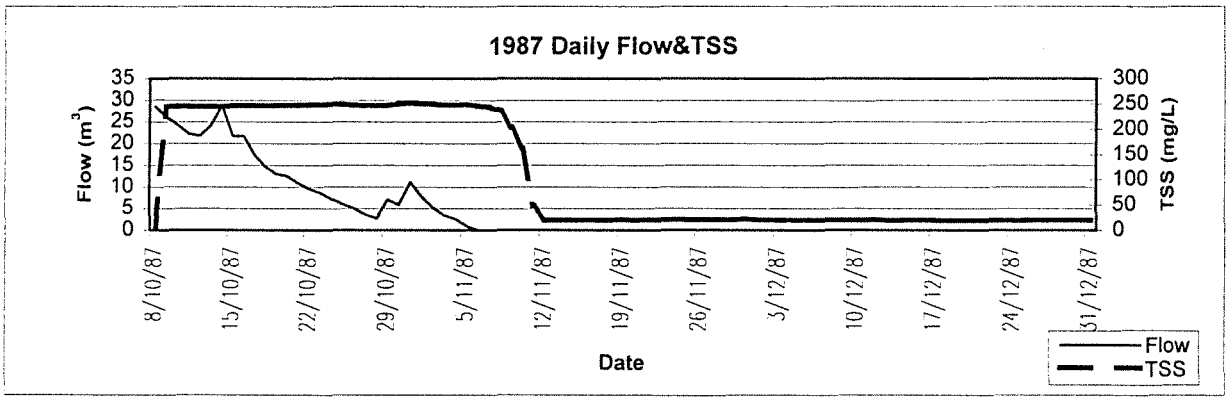
Salinity data not available for 1985

Pindalup Catchment - S 614043

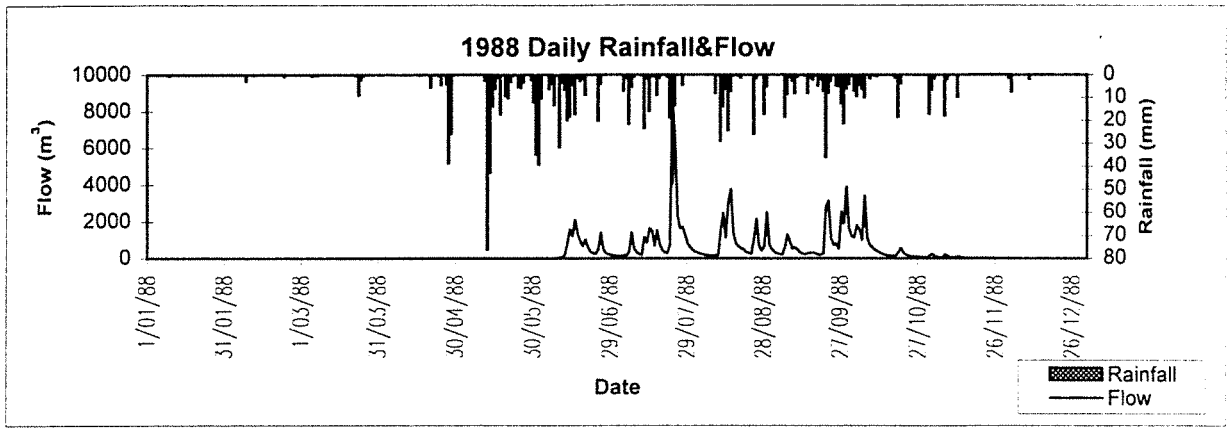


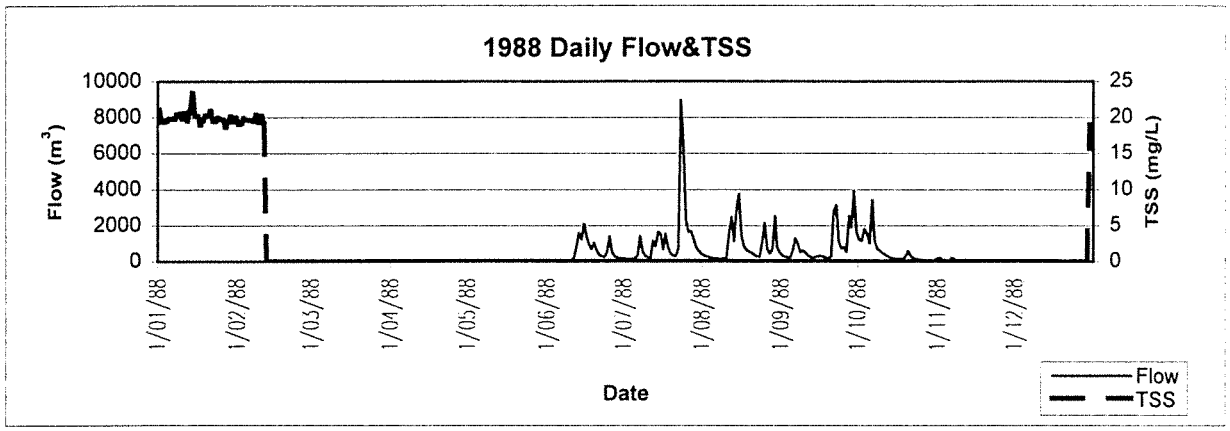
Salinity data not available for 1986

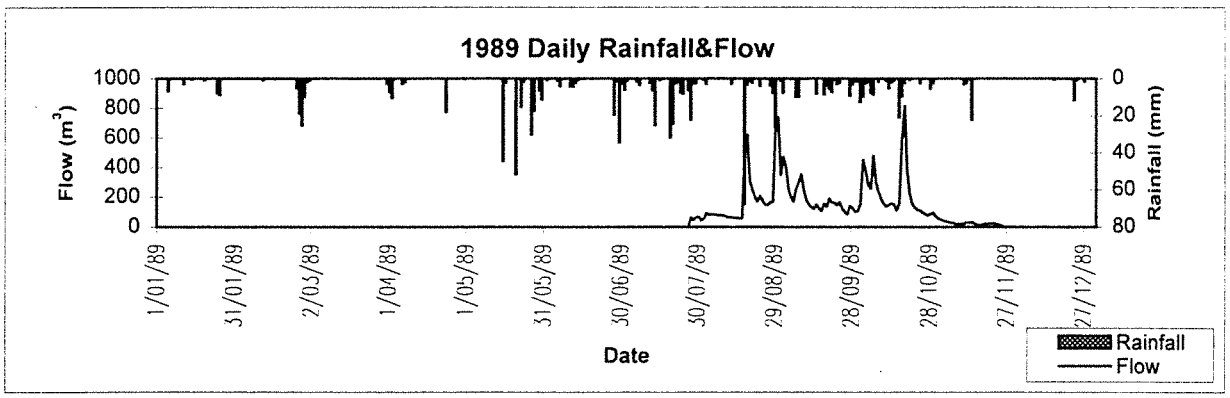




Pindalup Catchment - S 614043

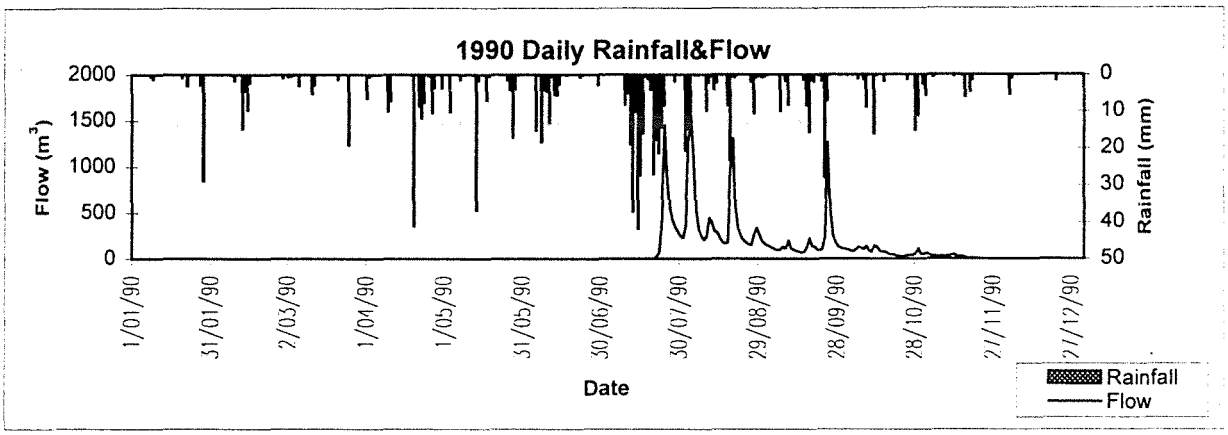




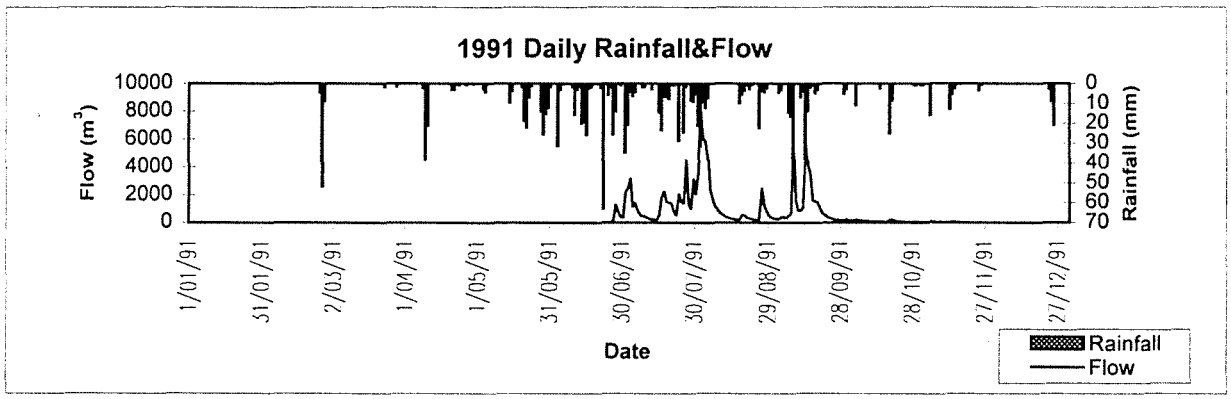


Salinity data not available for 1989

Pindalup Catchment - S 614043

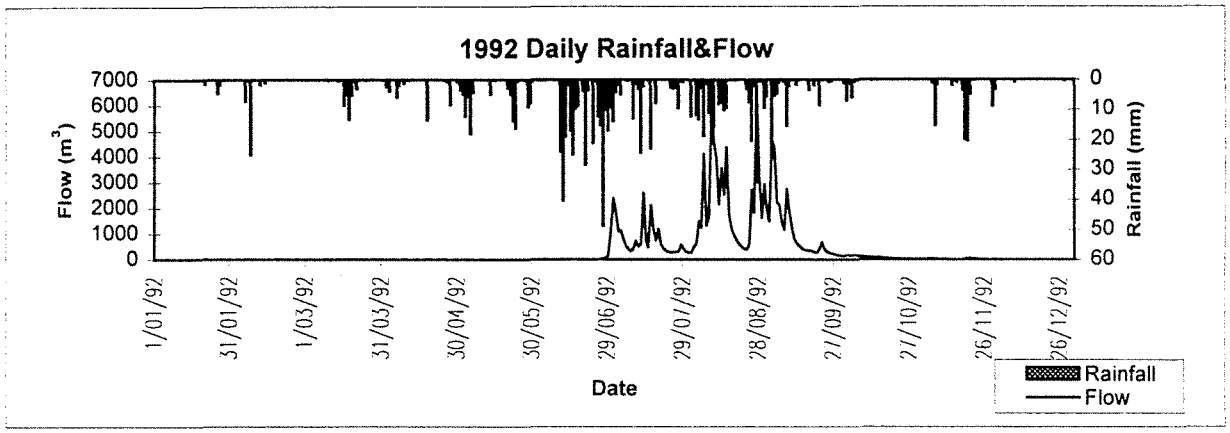


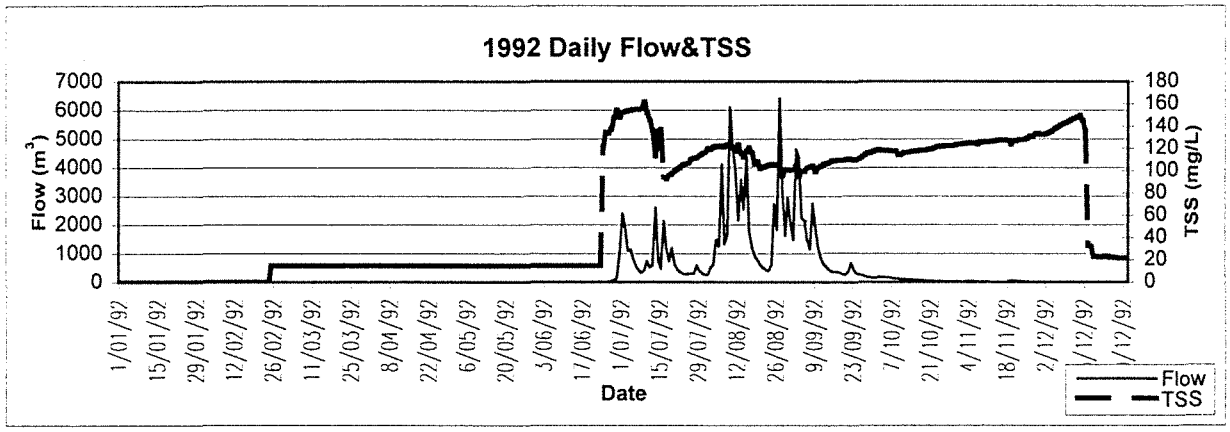
Salinity data not available for 1990

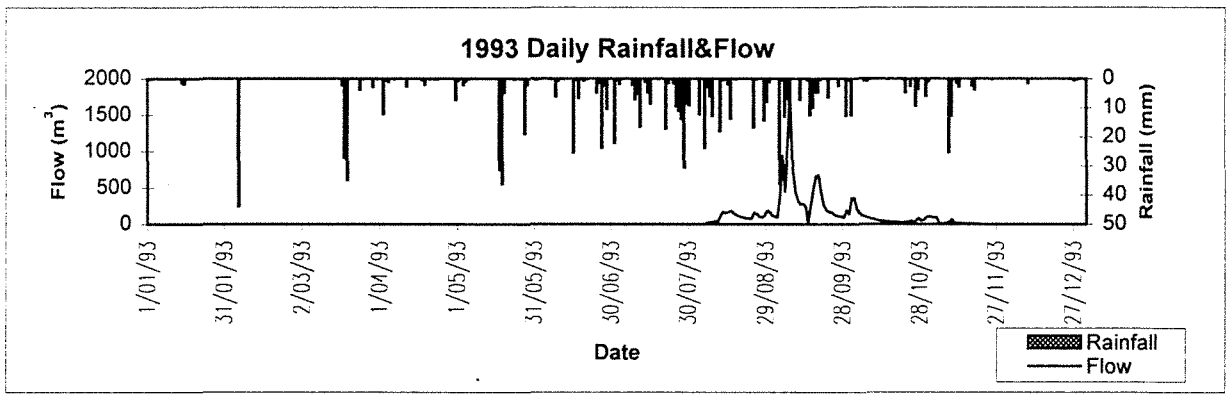


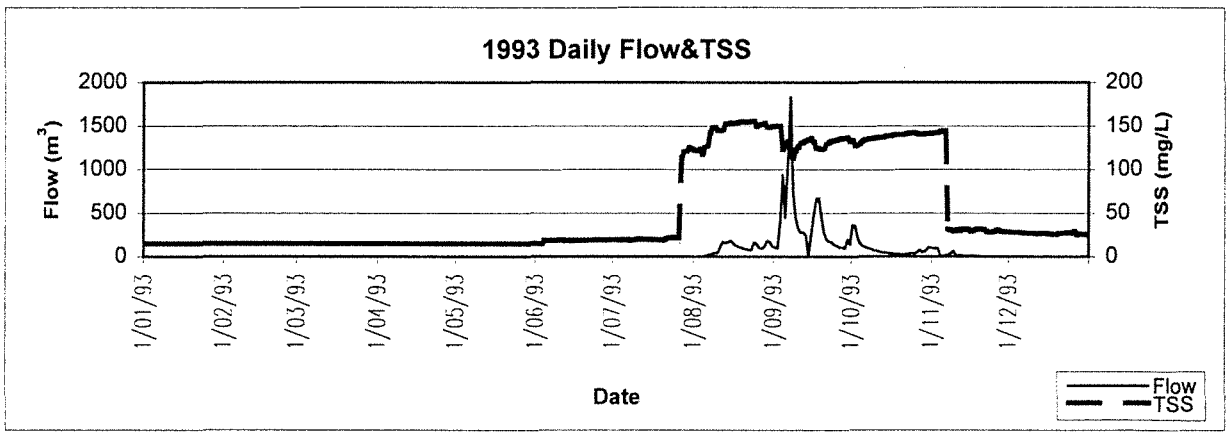
Salinity data not available for 1991

Pindalup Catchment - S 614043

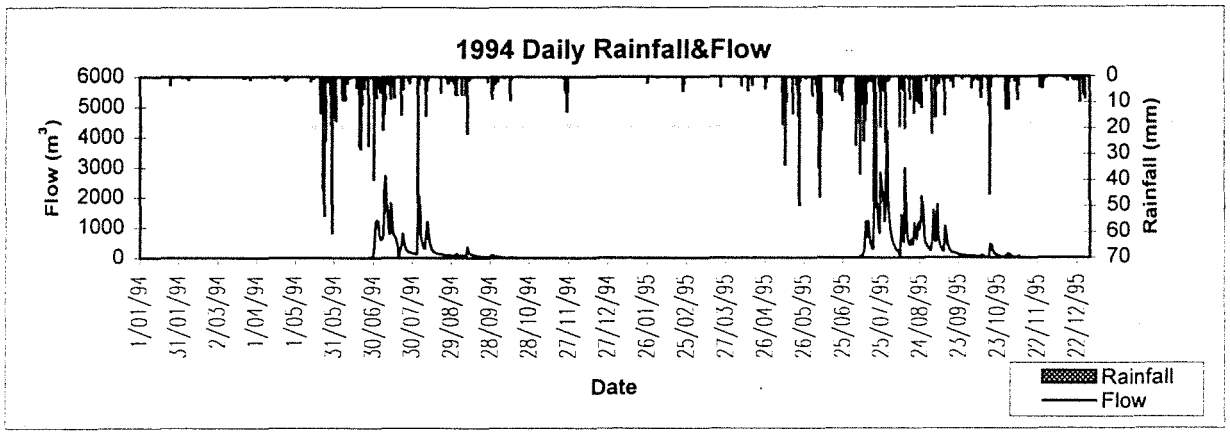


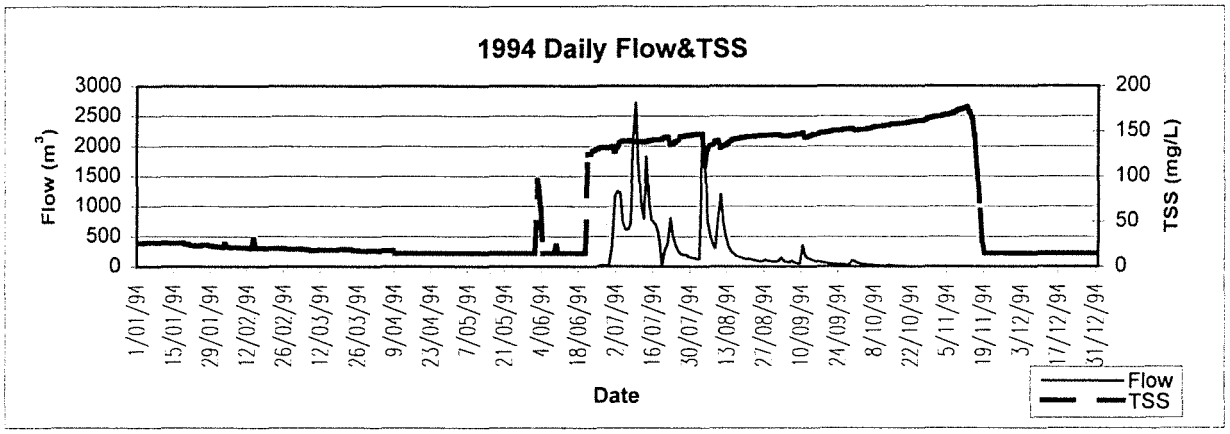


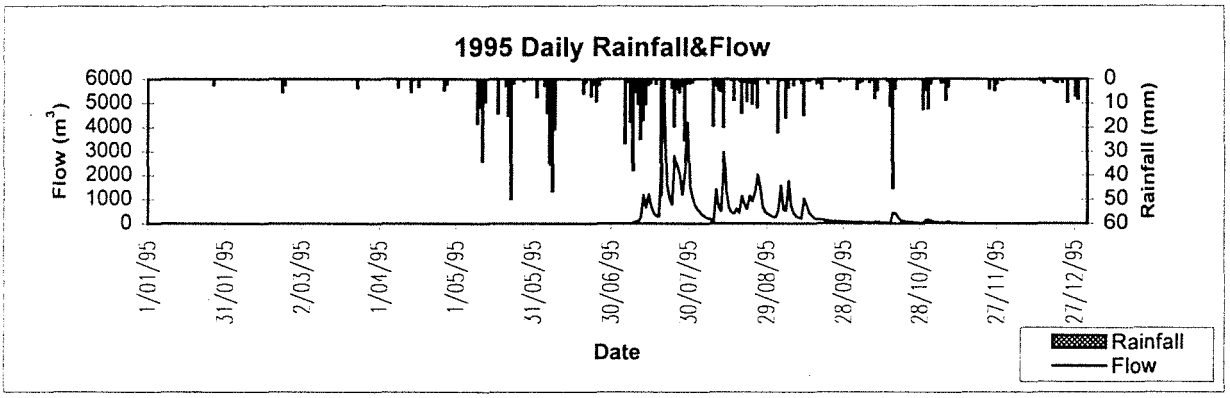


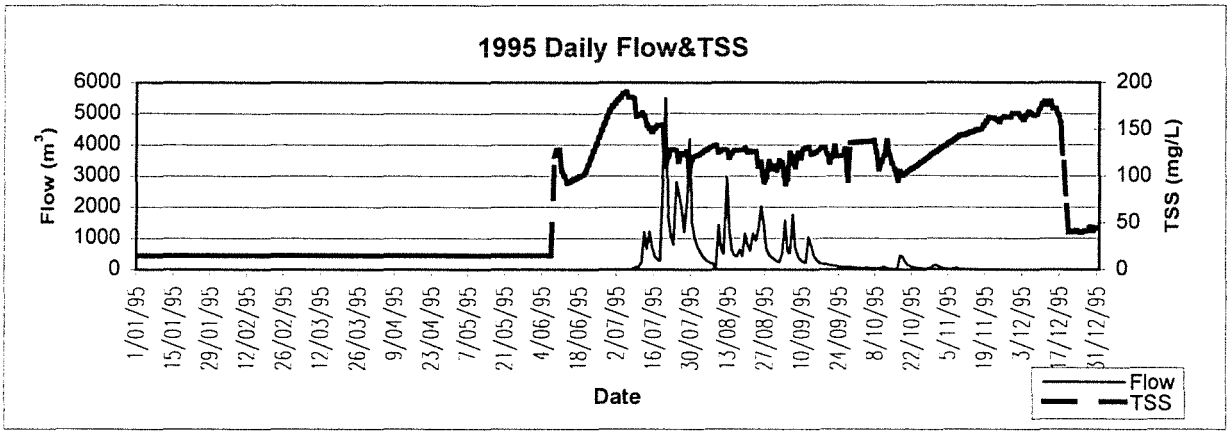


Pindalup Catchment - S 614043

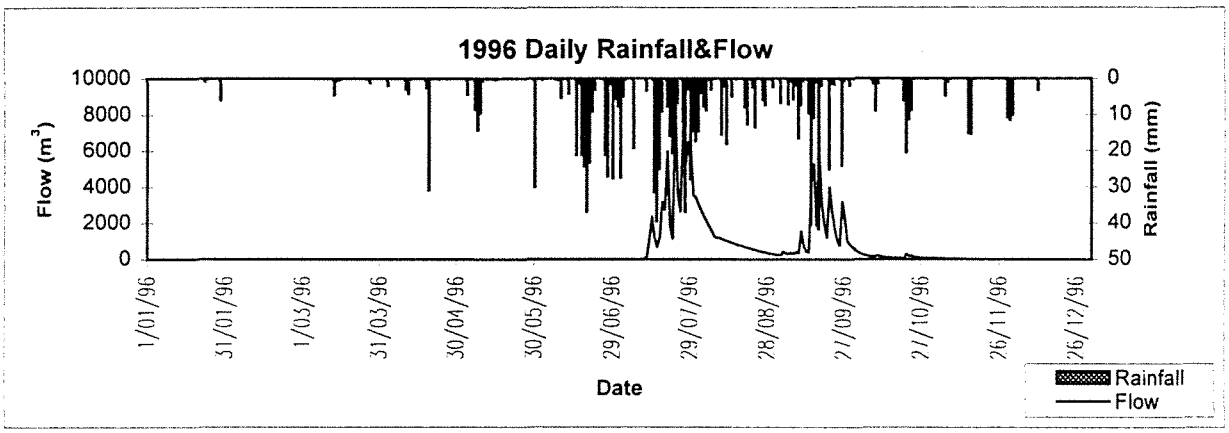


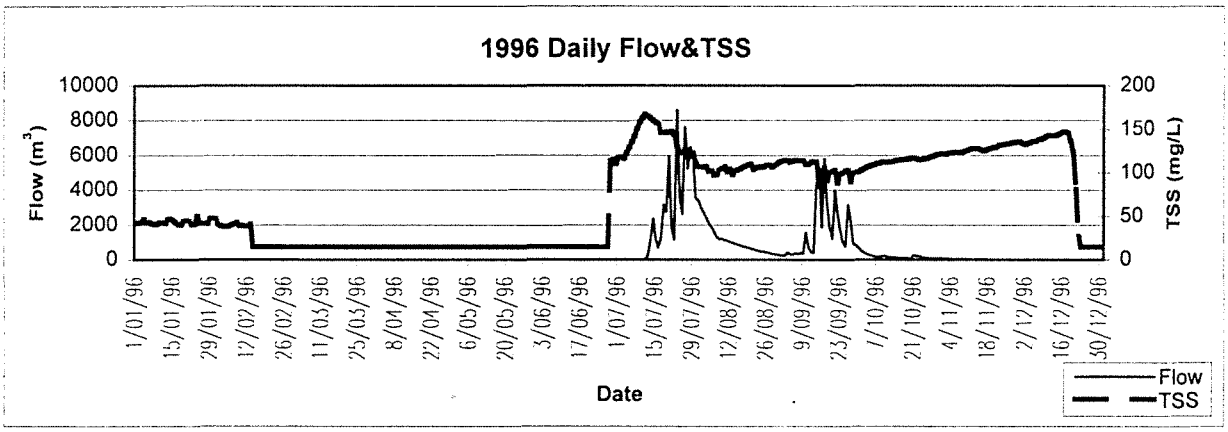


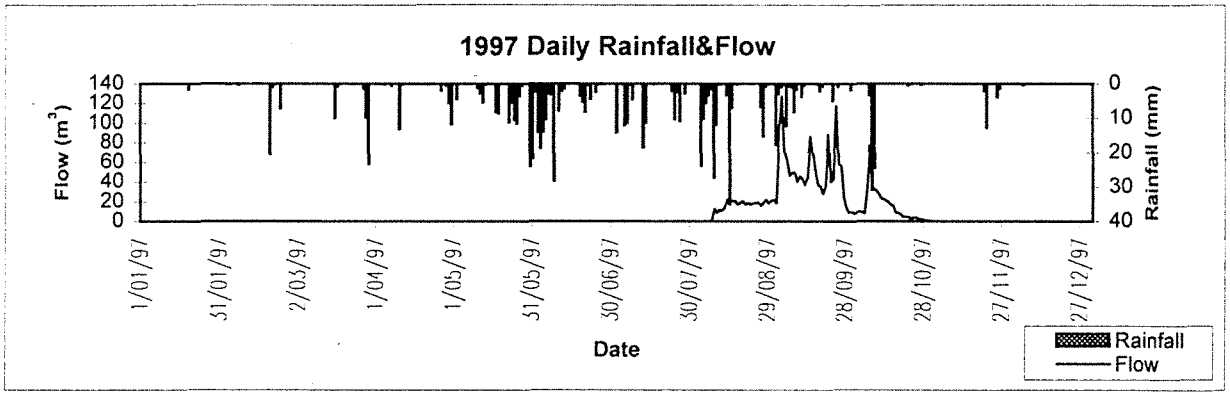




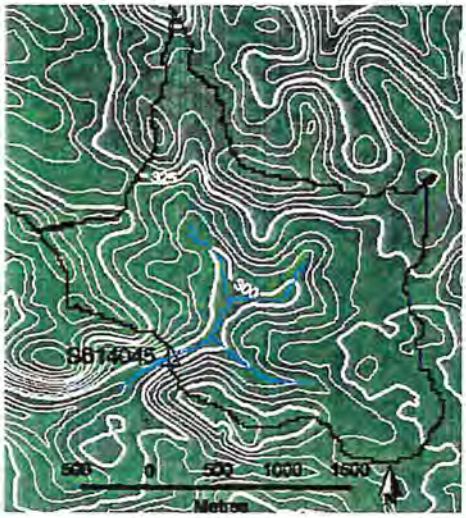
Pindalup Catchment - S 614043







Chadoora Catchment



Legend

Catchment Boundary △ Gauging Station

300 5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S614045
Rainfall Gauge Number	M509235

Information about catchment

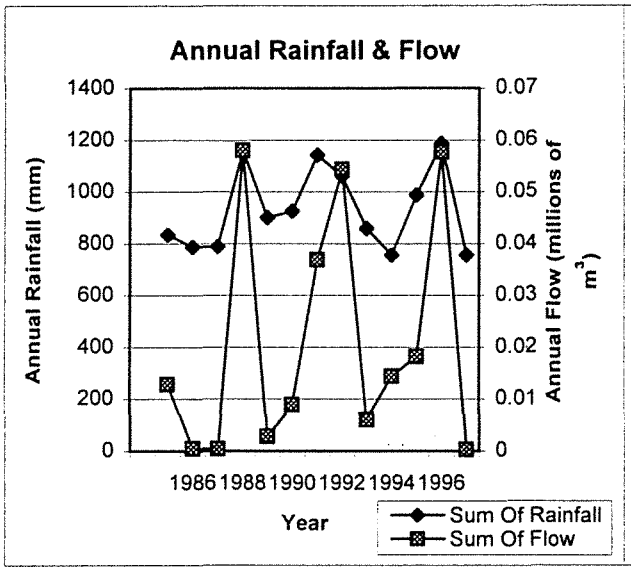
Catchment area	4.63 km^2	
Gauging Station Coordinates (AMG)	N 6375250	E 429980
Treatment data	Control Catchment	

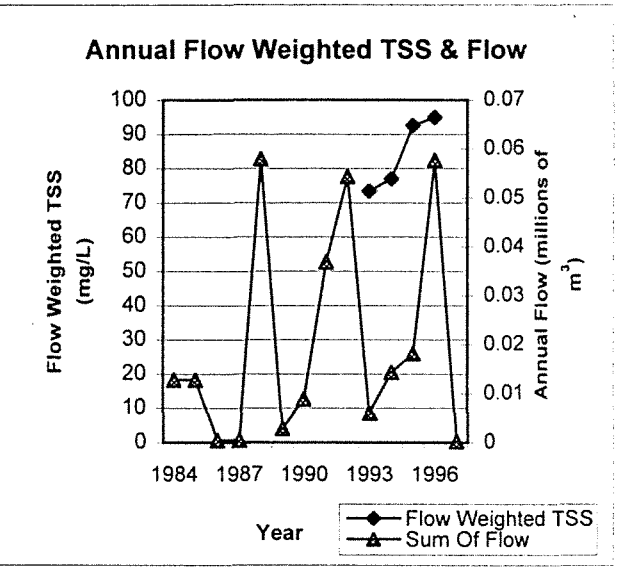
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	5104	5076	1794
Number of years recorded	15	15	6
Number of years with complete records	13	13	4
Start date	2/05/84	2/05/84	19/02/92
Finish date	22/04/98	25/03/98	16/01/97
Number of days with quality code 1	4470	5000	1704
Number of days with quality code 2	2	1	29
Number of days with quality code 3	398	1	21
Number of days with quality code 4	228	63	38
Number of days with quality code 157	1	0	0
Number of days with quality code 255	5	11	2

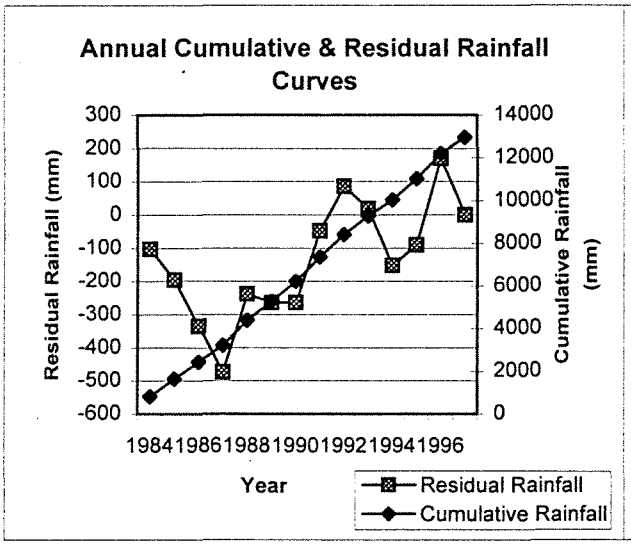
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	934.3	0.0209	84.49
Min	756.0	0.0003	73.45
Max	1186.7	0.0580	94.93

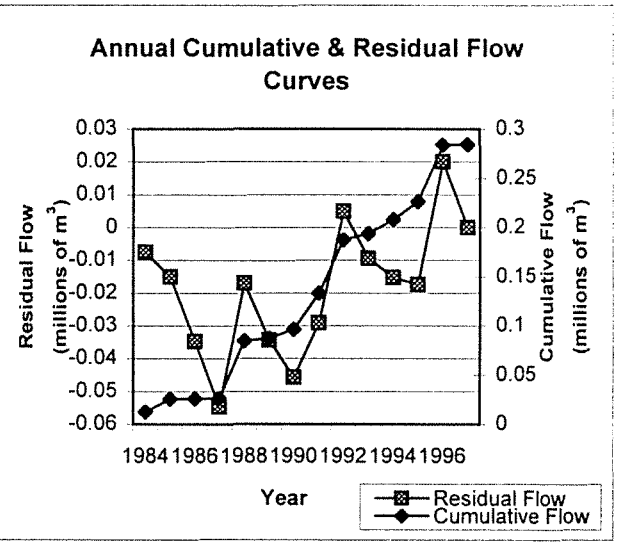
Year	**Number of flow days**
1985	28
1986	6
1987	3
1988	107
1989	22
1990	27
1991	76
1992	83
1993	32
1994	40
1995	54
1996	70
1997	3
Total	**551**

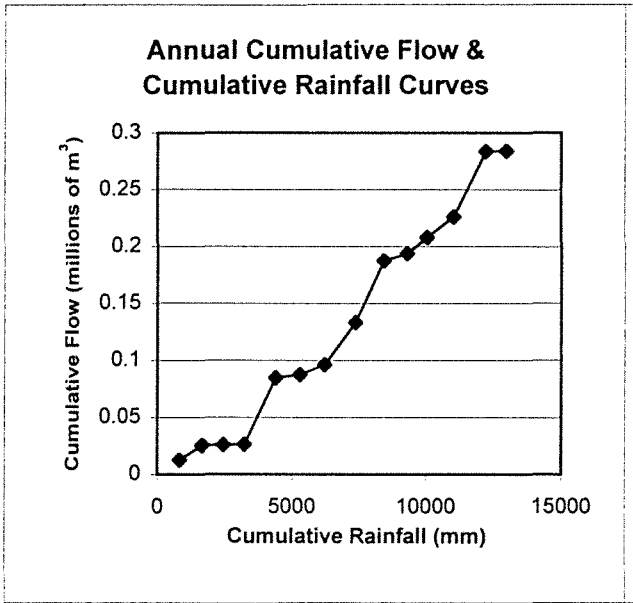
Chadoora Catchment - S 614045

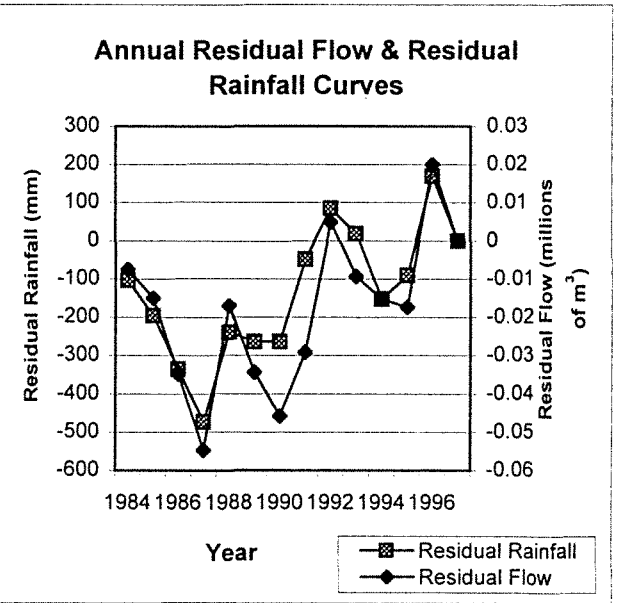




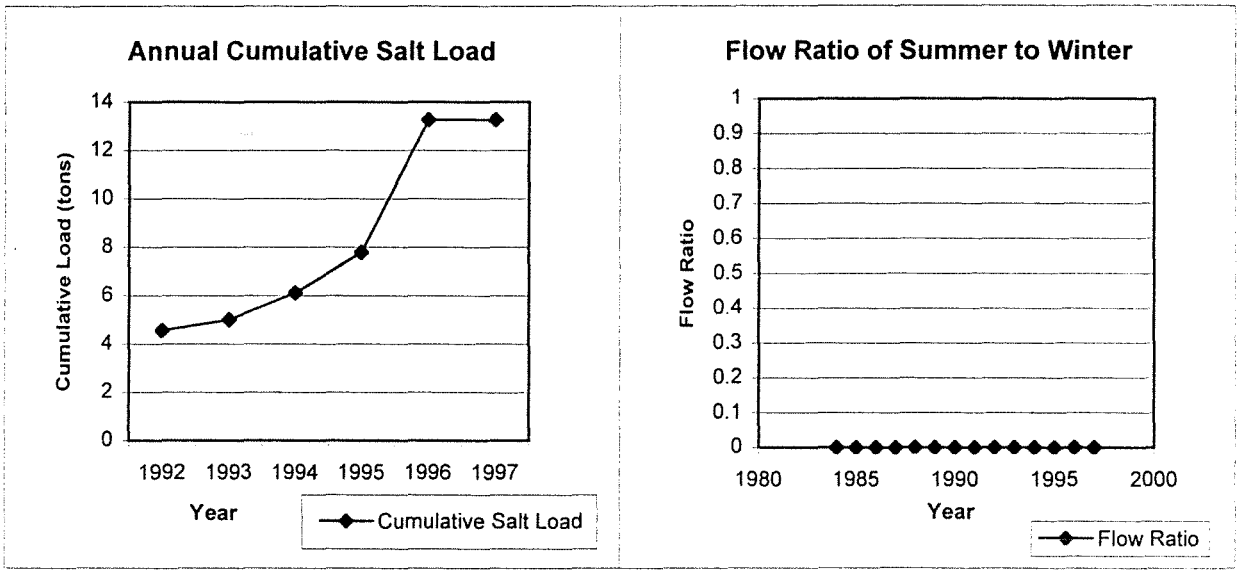




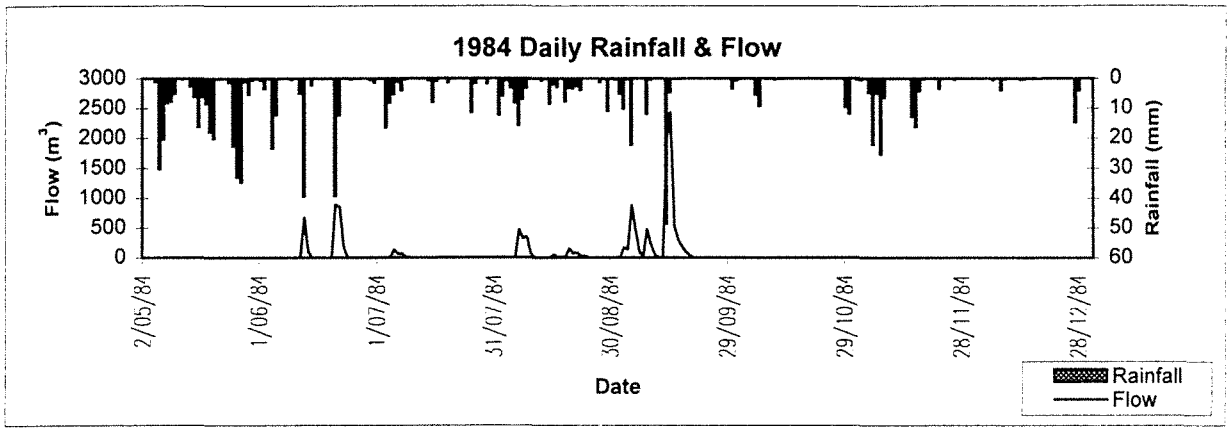


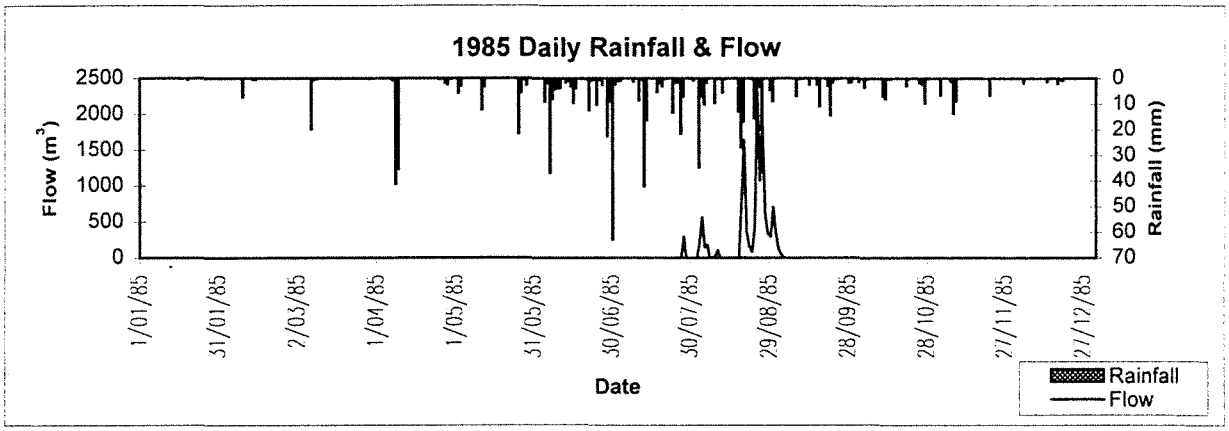


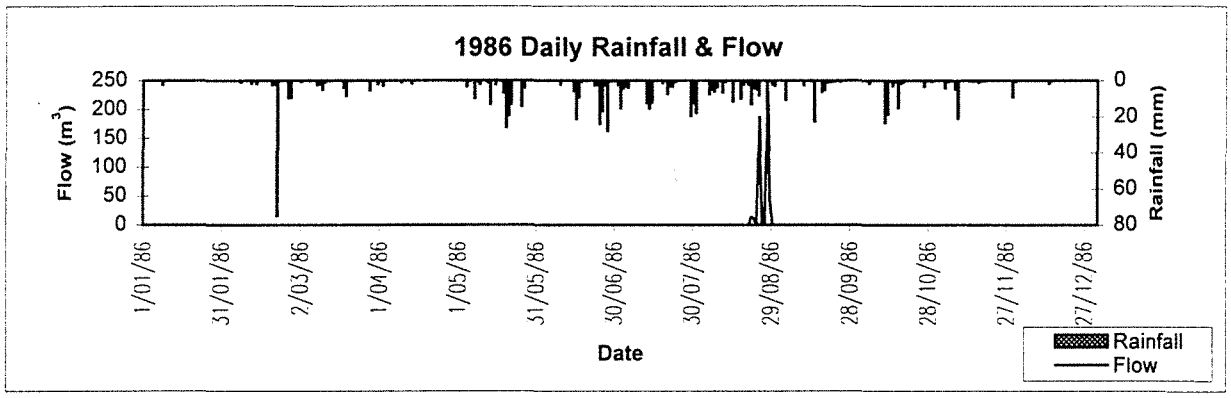
Chadoora Catchment - S 614045

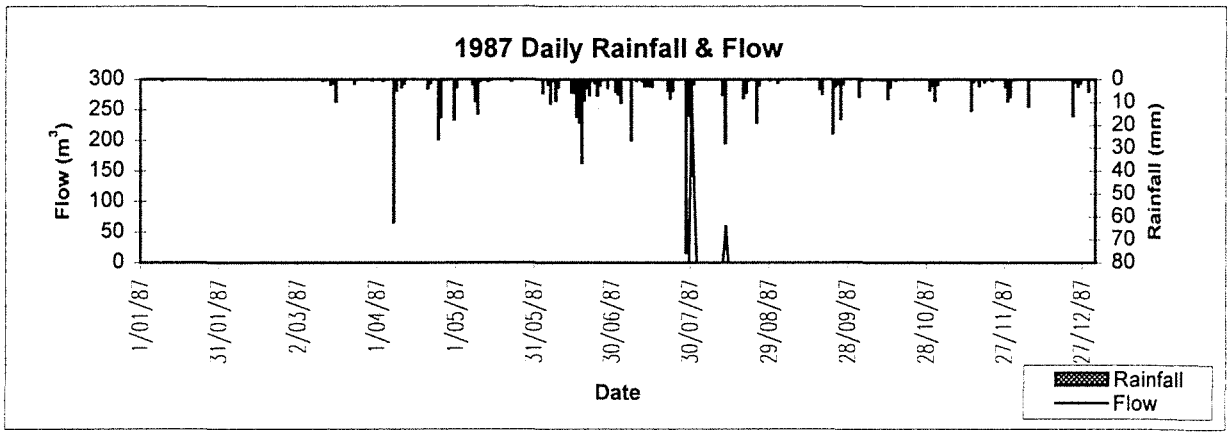


Chadoora Catchment - S 614045

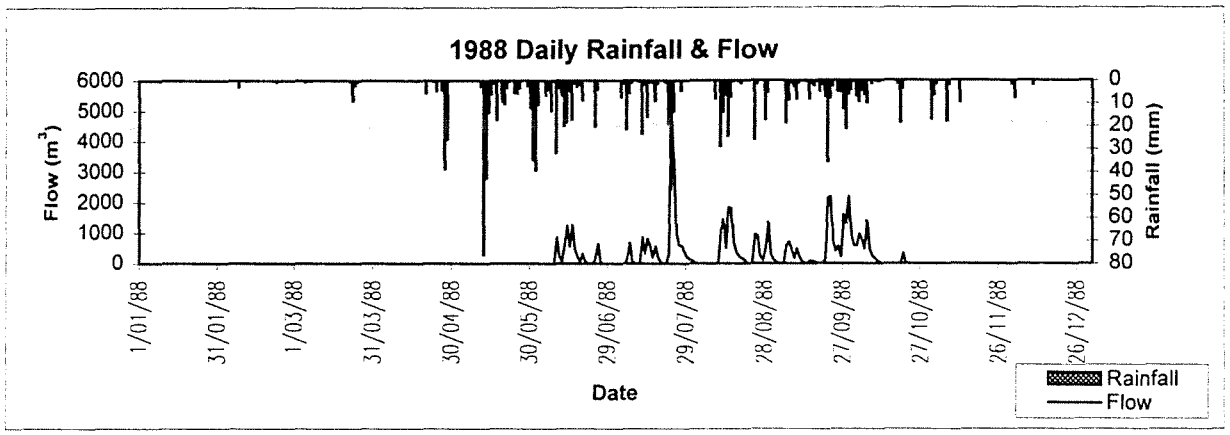


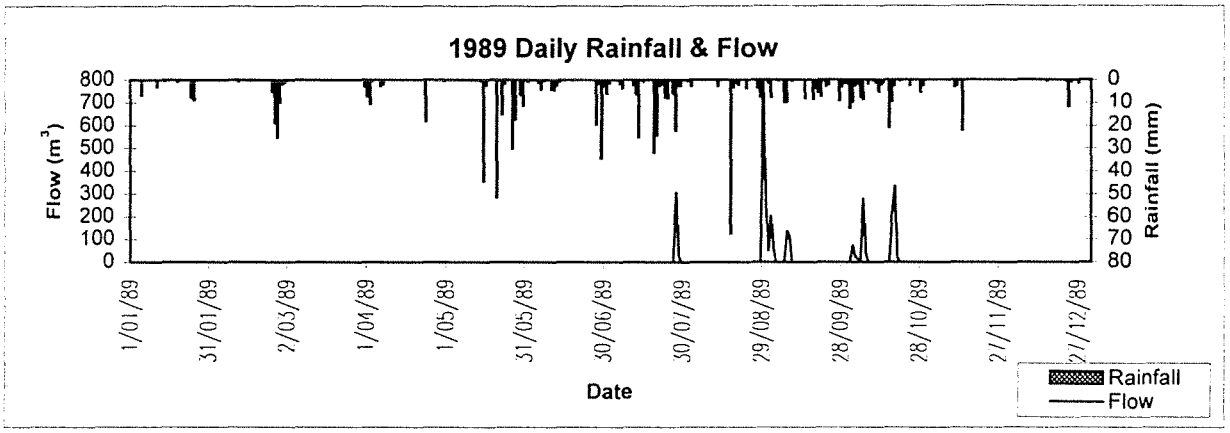


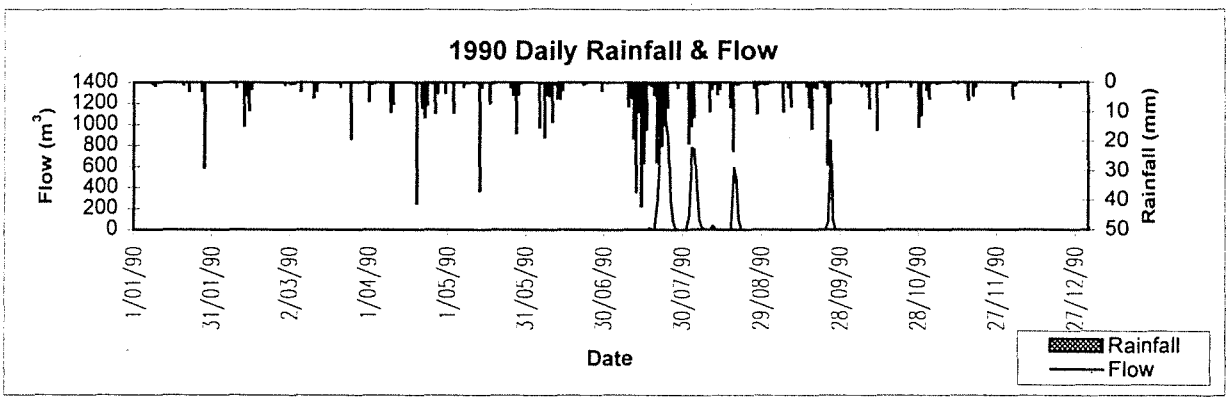


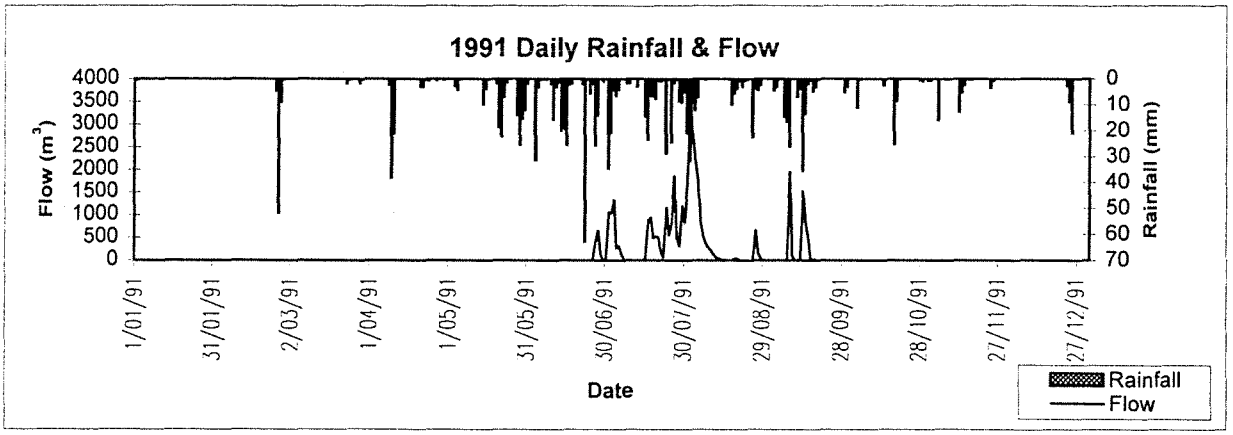


Chadoora Catchment - S 614045

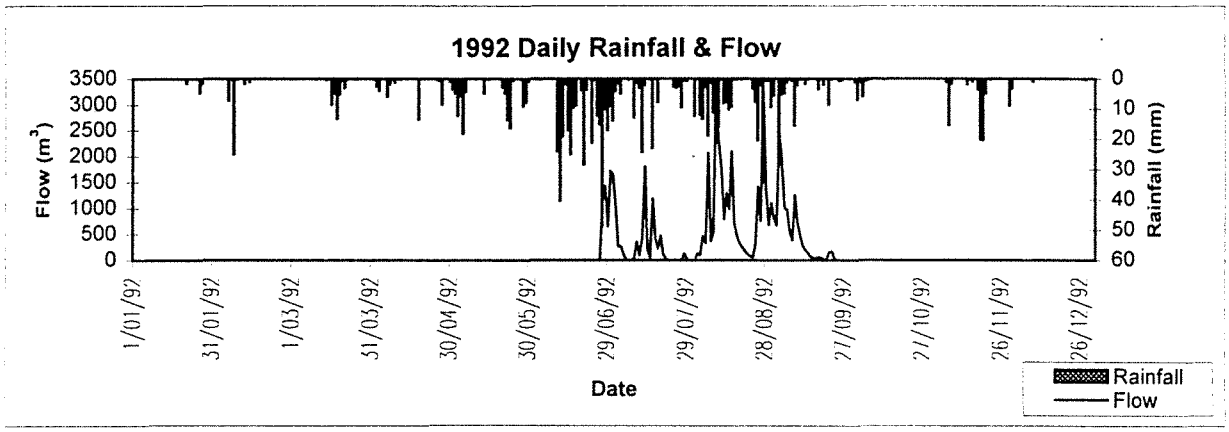


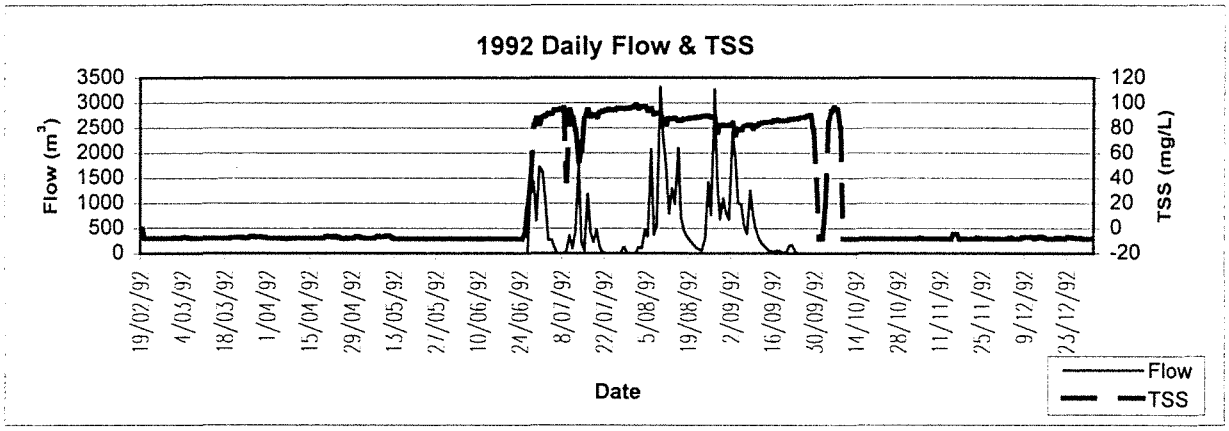


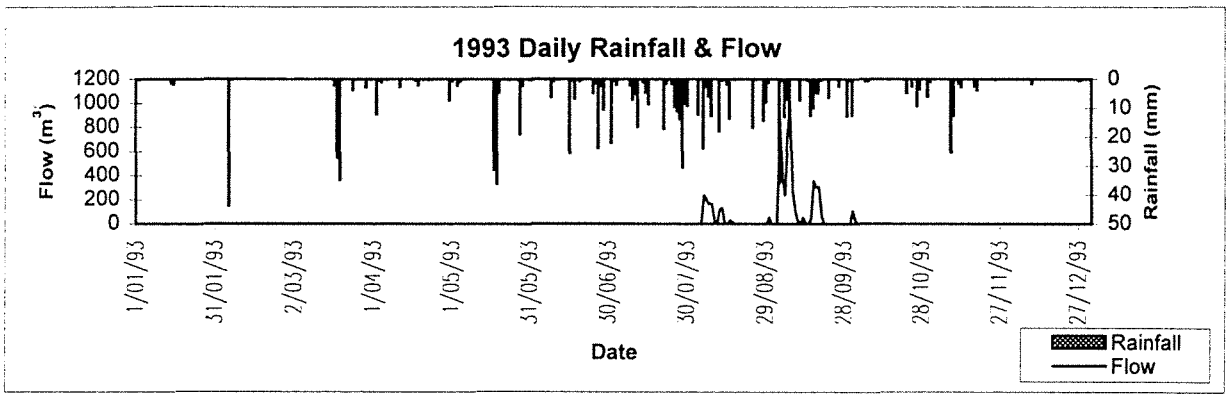


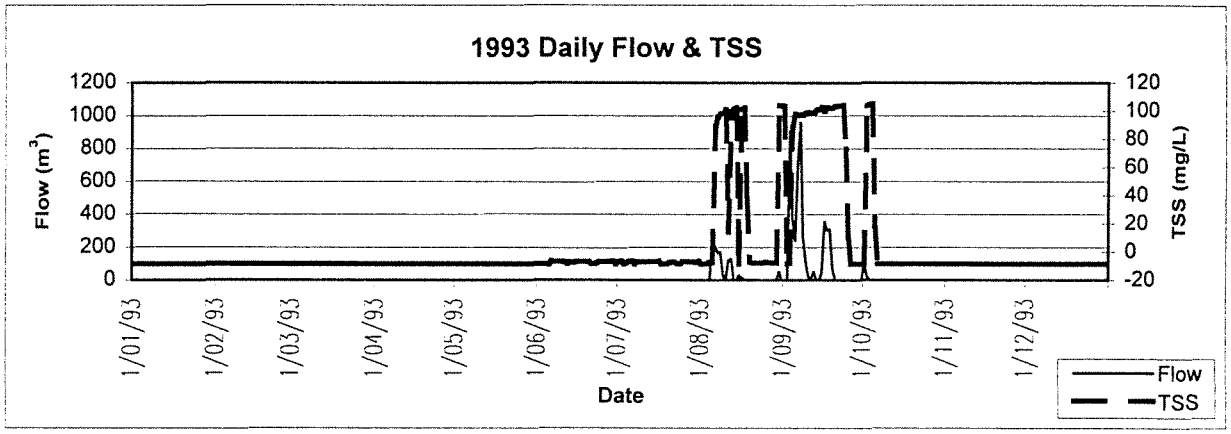


Chadoora Catchment - S 614045

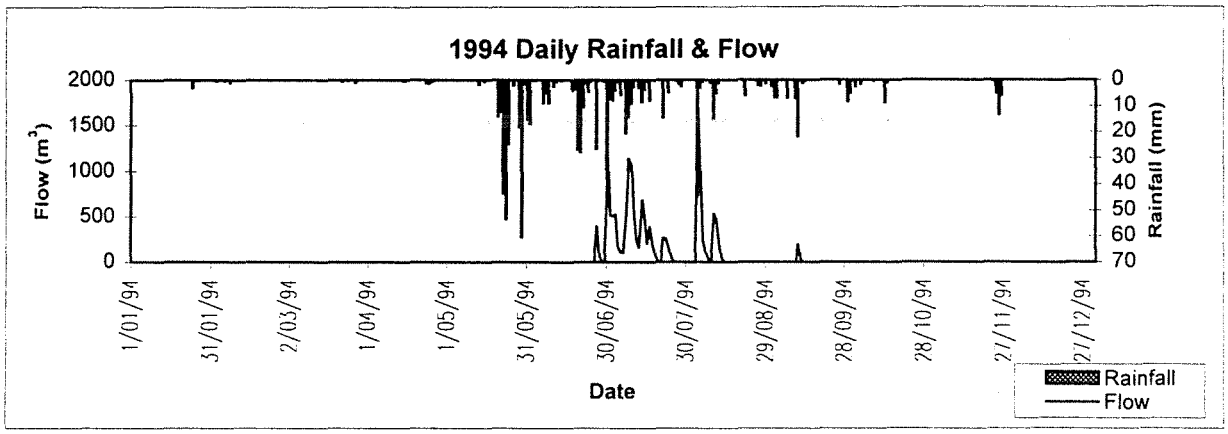


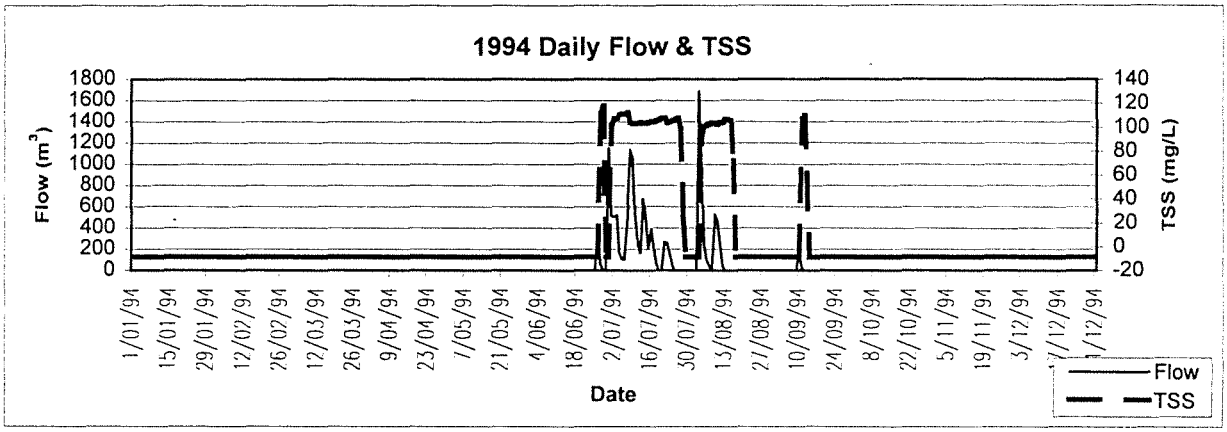


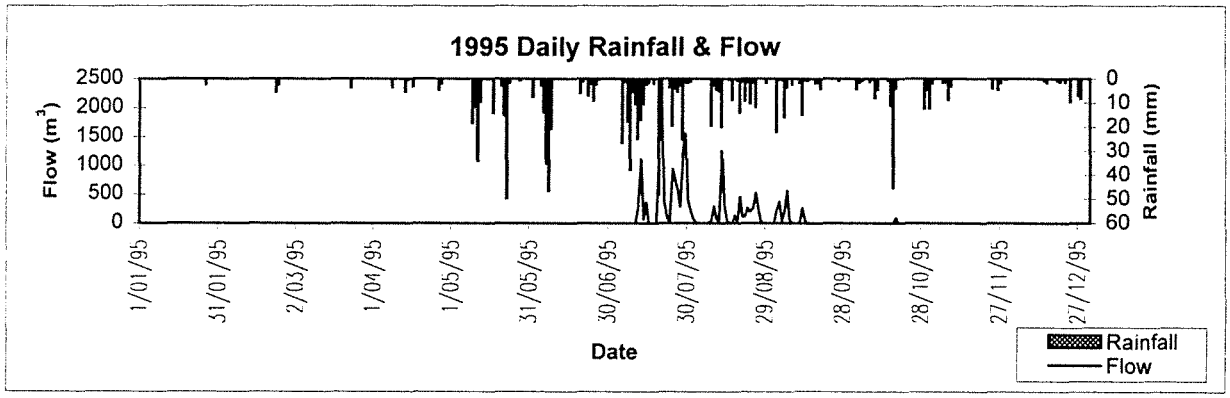


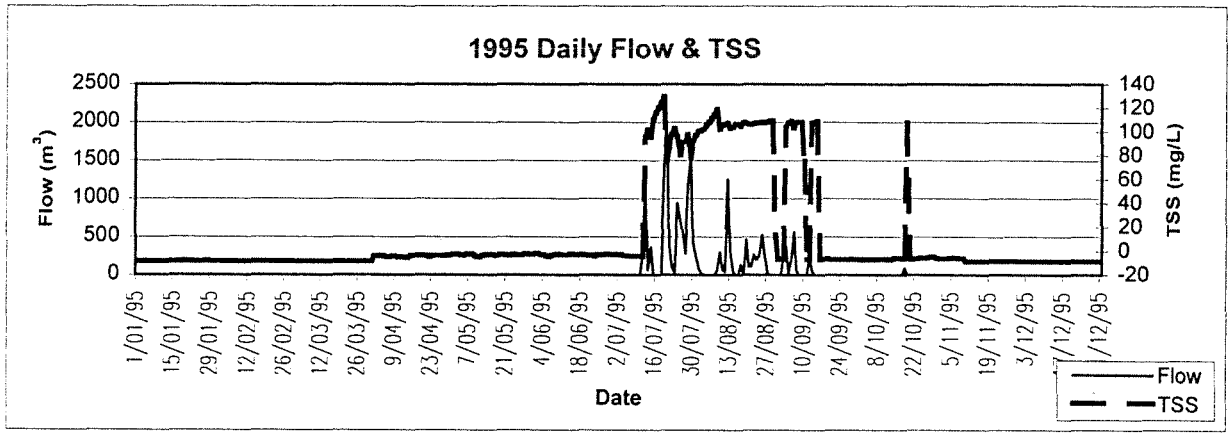


Chadoora Catchment - S 614045

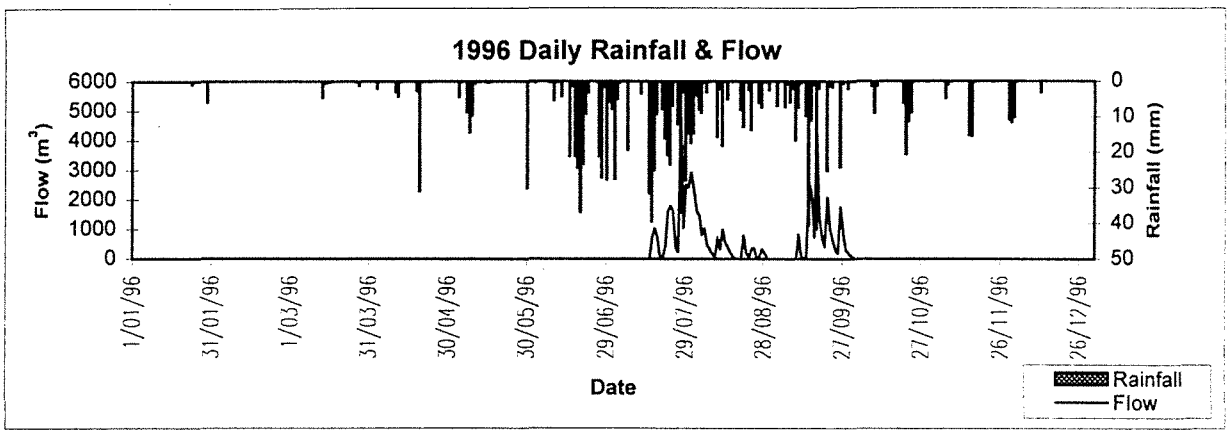


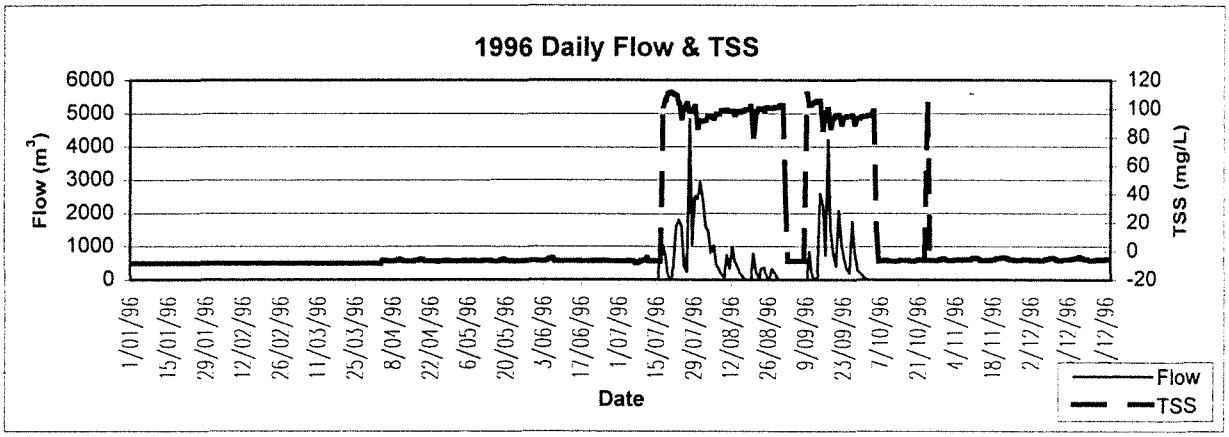


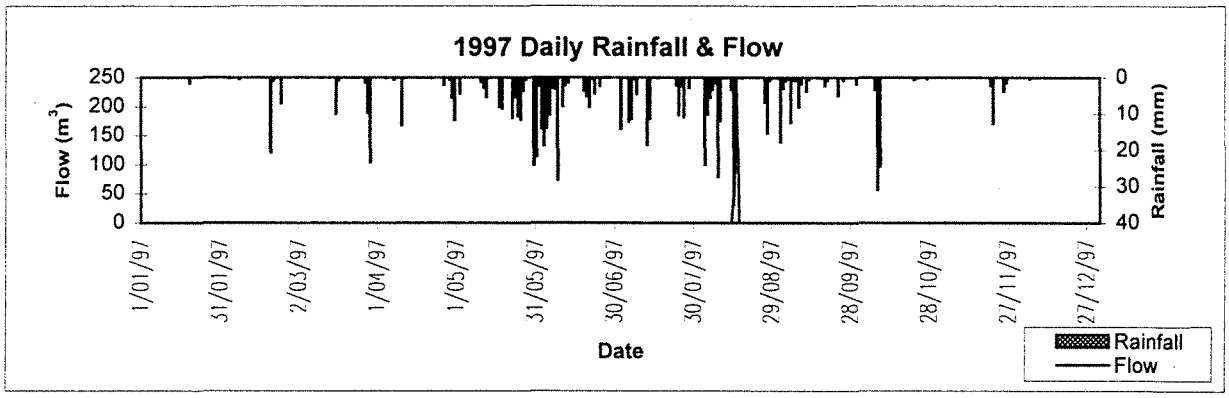




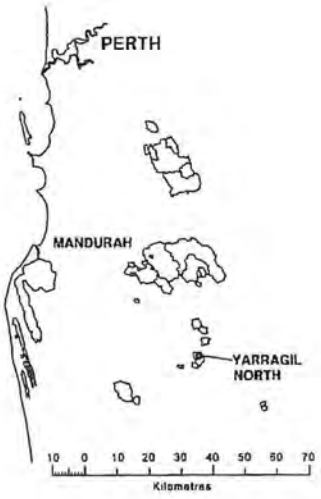
Chadoora Catchment - S 614045







Yarragil North Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S614046	
Rainfall Gauge Number	M509433	
Information about catchment		
Catchment area	2.24 km^2	
Gauging Station Coordinates (AMG)	N 6367835	E 428585
Treatment data	Undisturbed Catchment.	

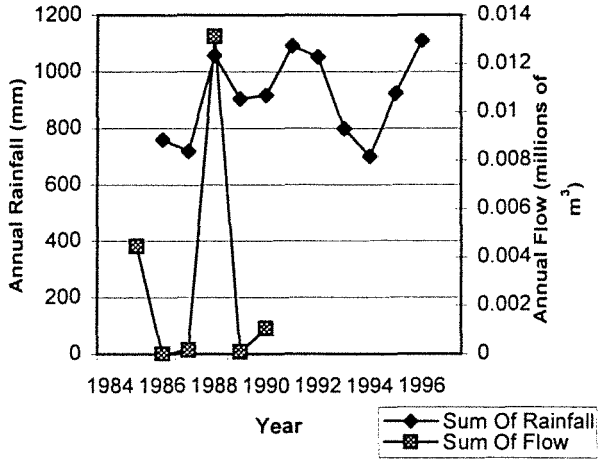
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	4298	2564	0
Number of years recorded	13	8	
Number of years with complete records	11	6	
Start date	3/07/85	29/03/84	
Finish date	8/04/97	5/04/91	
Number of days with quality code 0	1	0	
Number of days with quality code 1	4040	2532	
Number of days with quality code 2	4	20	
Number of days with quality code 3	0	1	
Number of days with quality code 4	46	9	
Number of days with quality code 5	6	0	
Number of days with quality code 7	1	0	
Number of days with quality code 8	200	0	
Number of days with quality code 255	0	2	

Year	**Number of flow days**
1985	44
1987	9
1988	92
1989	9
1990	27
Total	**181**

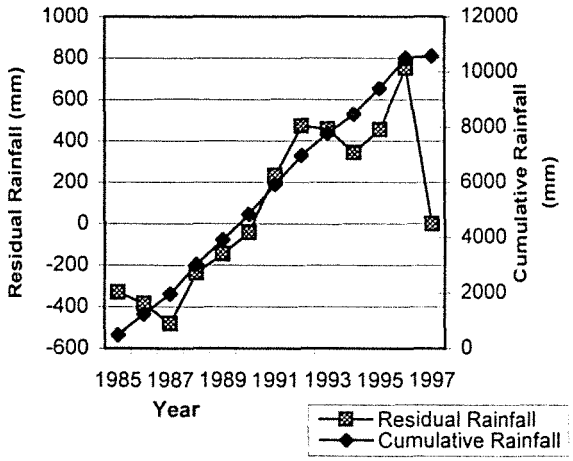
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	912.0	0.003
Min	700.7	0.000
Max	1110.7	0.013

Yarrgil North Catchment - S 614046

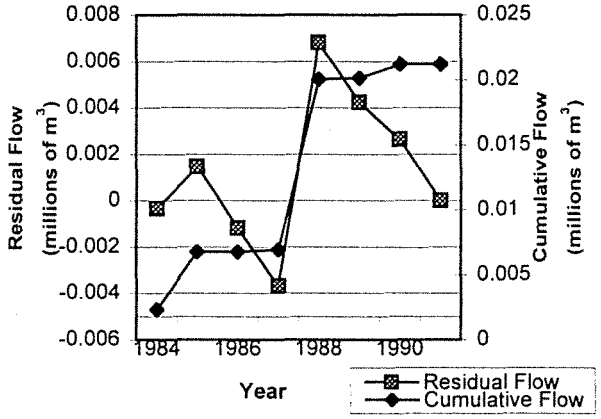
Annual Rainfall & Flow



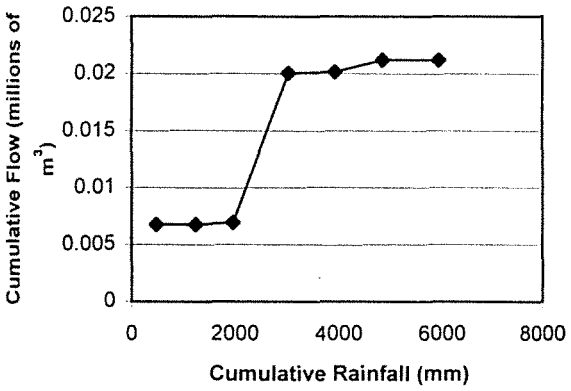
Annual Cumulative & Residual Rainfall Curves



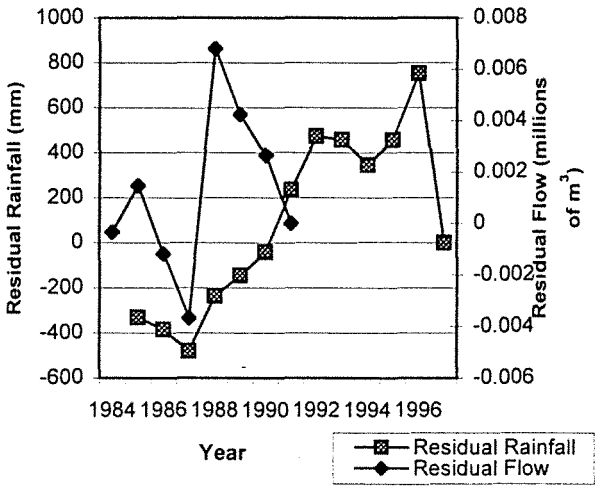
Annual Cumulative & Residual Flow Curves



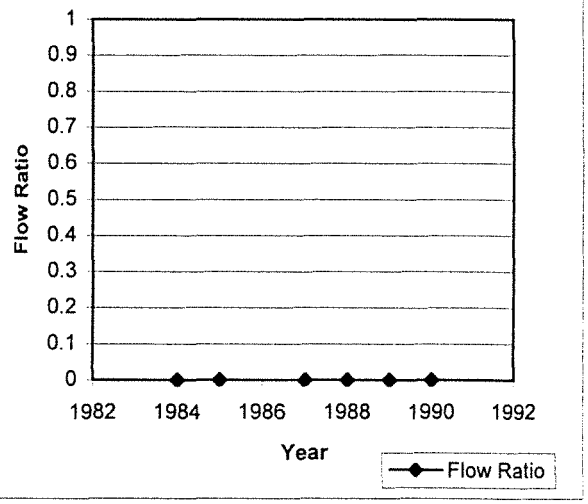
Annual Cumulative Flow & Cumulative Rainfall Curves



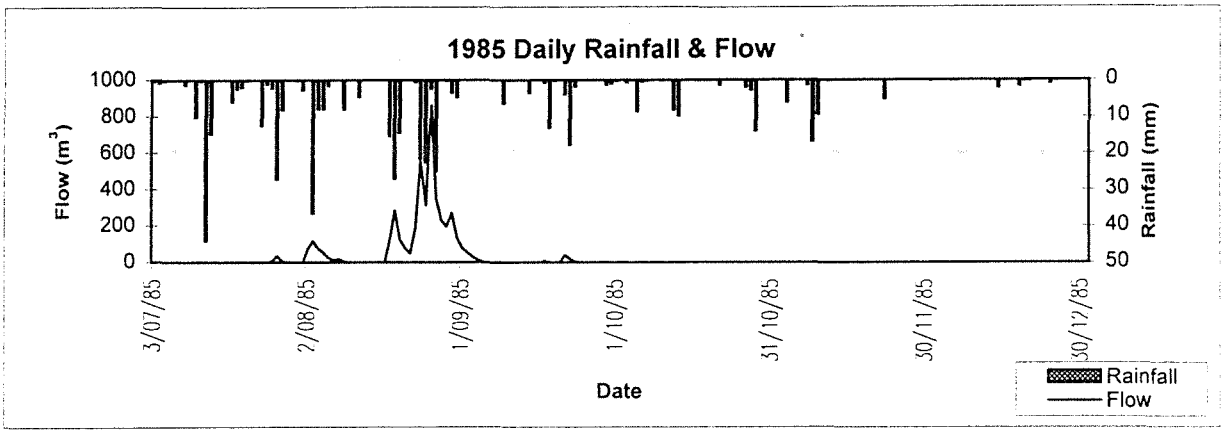
Annual Residual Flow & Residual Rainfall Curves

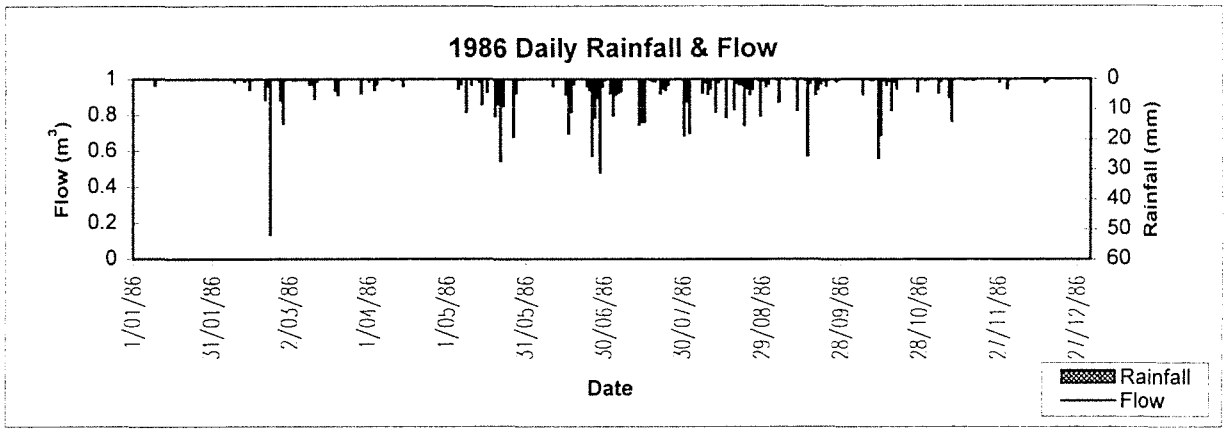


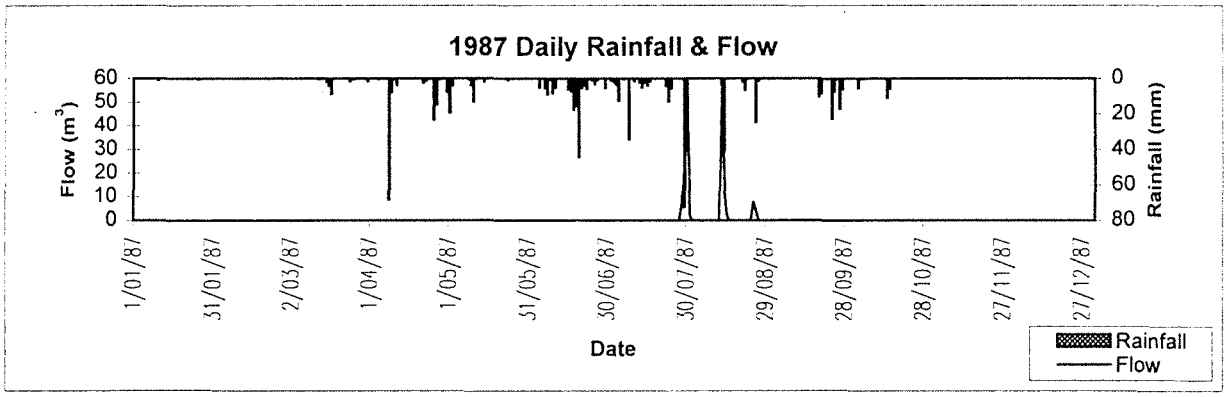
Flow Ratio of Summer to Winter

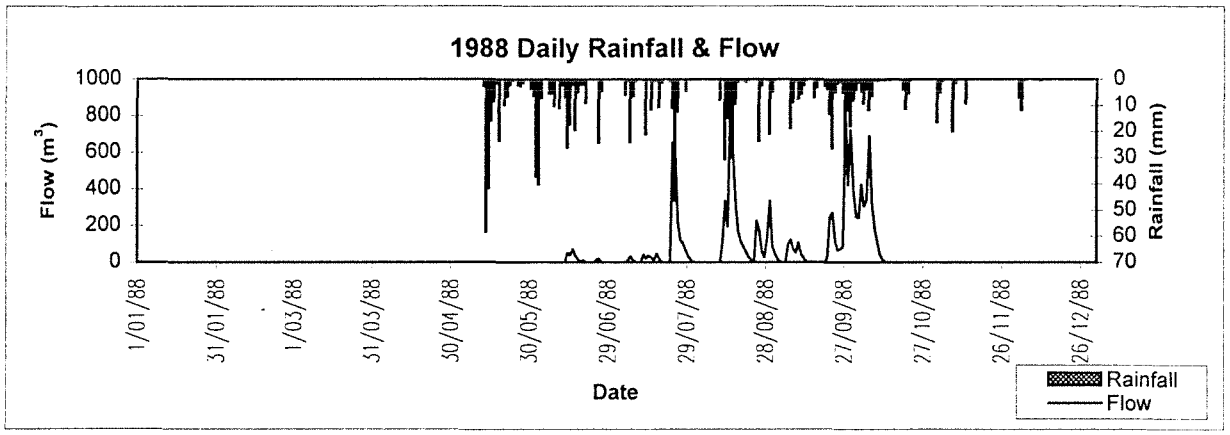


Yarragil North Catchment - S 614046

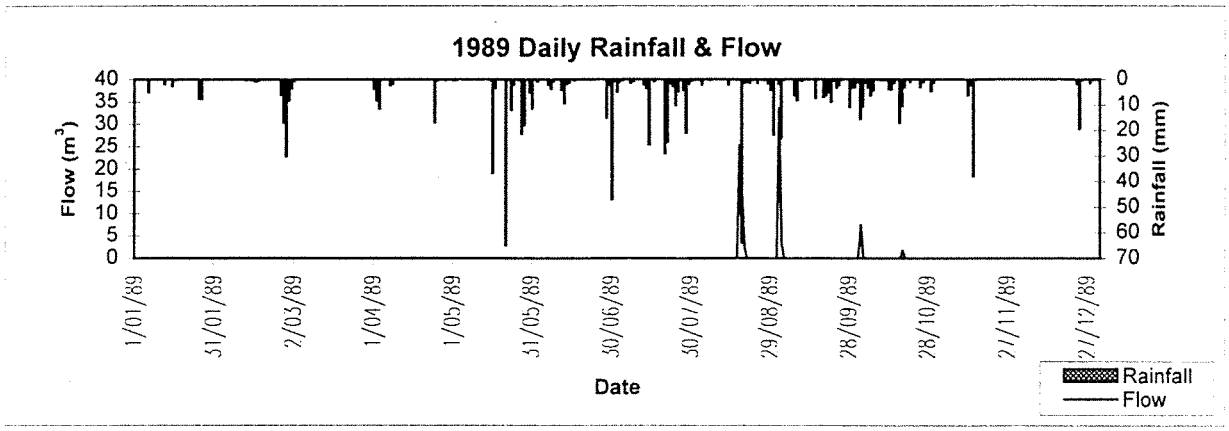


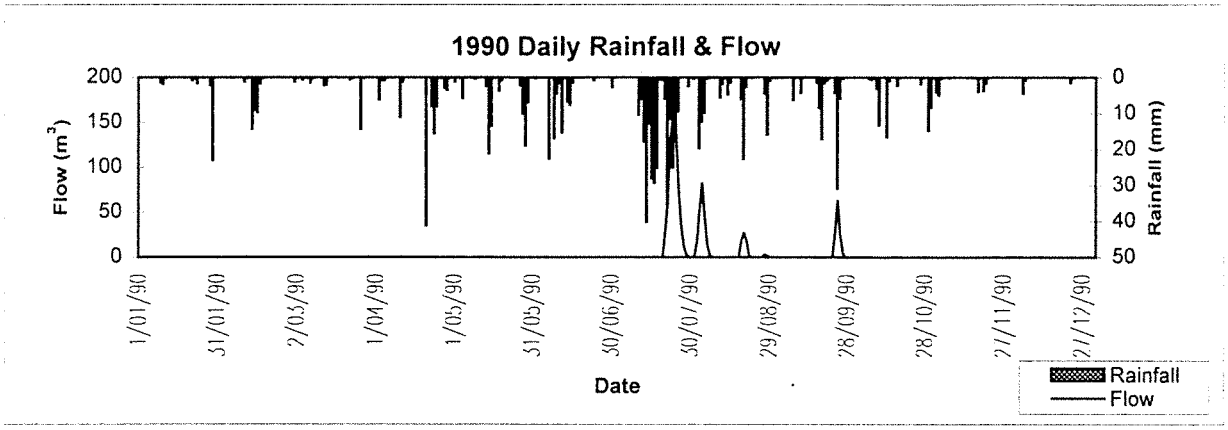


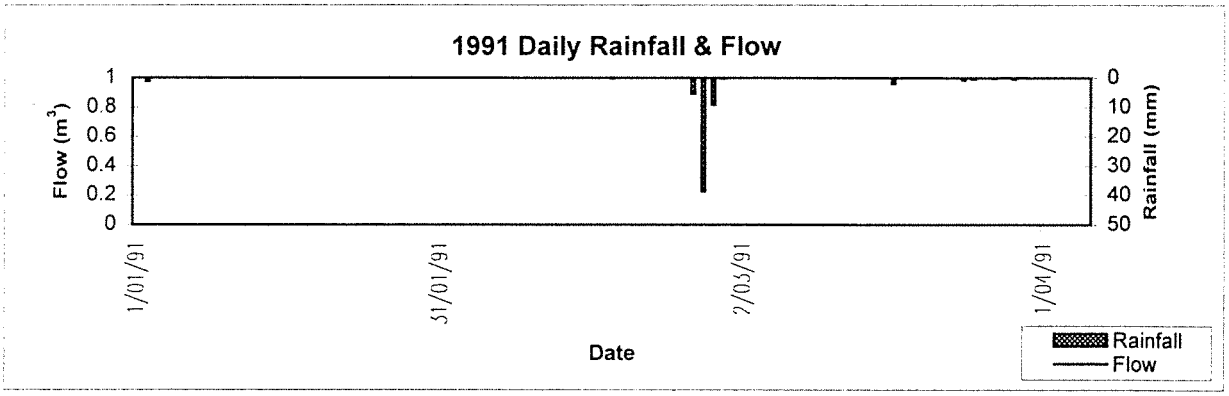




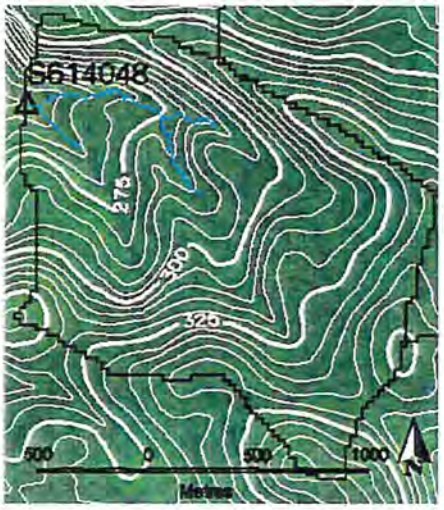
Yarragil North Catchment - S 614046

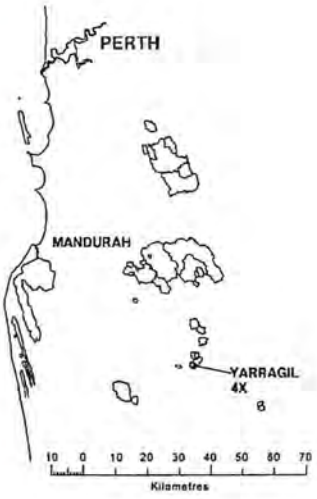






Yarragil 4X Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S614048
Rainfall Gauge Number	M509236
Information about catchment	
Catchment area	2.73 km^2
Gauging Station Coordinates (AMG)	N 6365860 E 427235
Treatment data	Logging in 1940's.

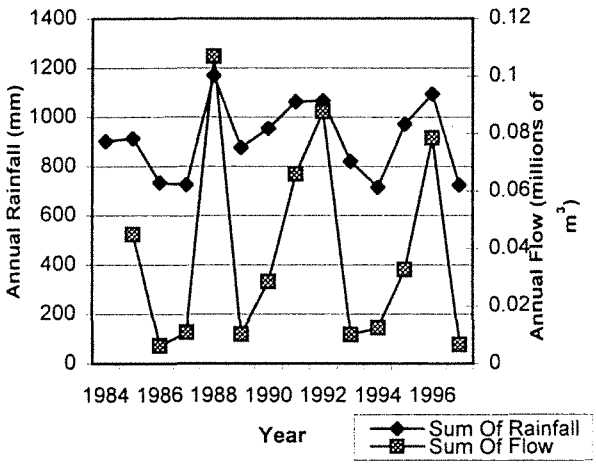
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	5116	5182	5182
Number of years recorded	16	15	15
Number of years with complete records	14	13	13
Start date	31/12/83	10/04/84	10/04/84
Finish date	1/01/98	17/06/98	17/06/98
Number of days with quality code 0	41	0	0
Number of days with quality code 1	4810	4938	2148
Number of days with quality code 2	23	87	83
Number of days with quality code 3	80	10	121
Number of days with quality code 4	0	85	389
Number of days with quality code 5	5	0	0
Number of days with quality code 7	21	0	0
Number of days with quality code 8	136	0	0
Number of days with quality code 255	0	62	2441

Year	**Number of flow days**
1985	120
1986	98
1987	89
1988	172
1989	102
1990	107
1991	120
1992	125
1993	77
1994	94
1995	103
1996	119
1997	56
Total	**1382**

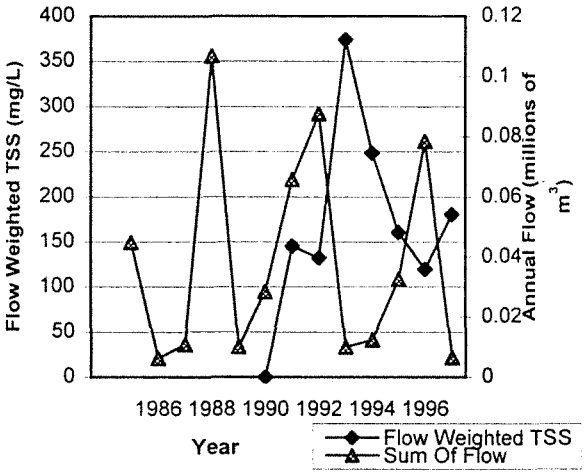
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	909.4	0.039	82.27
Min	715.0	0.006	0.00
Max	1169.0	0.107	374.00

Yarragil 4X Catchment - S 614048

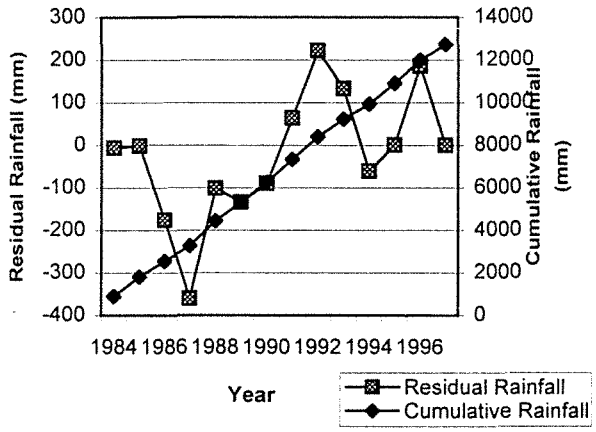
Annual Rainfall & Flow



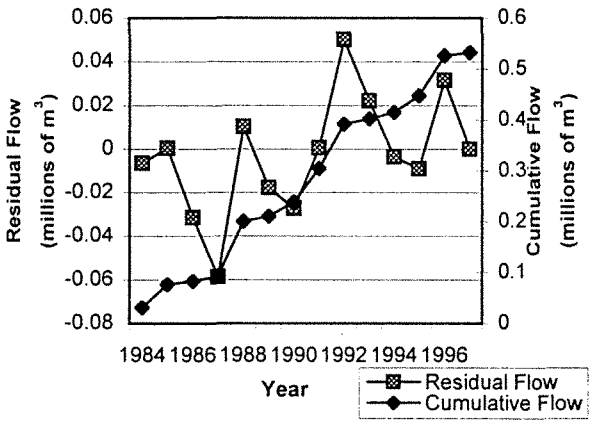
Annual Flow Weighted TSS & Flow



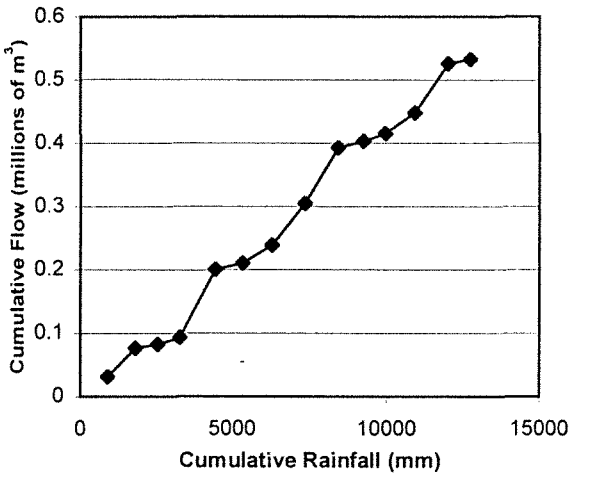
Annual Cumulative & Residual Rainfall Curves



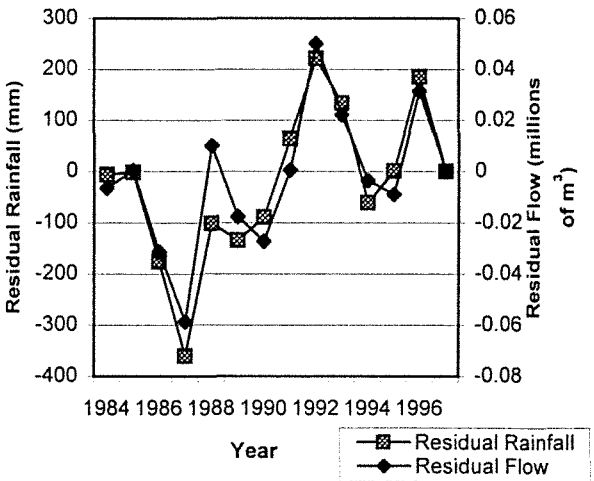
Annual Cumulative & Residual Flow Curves



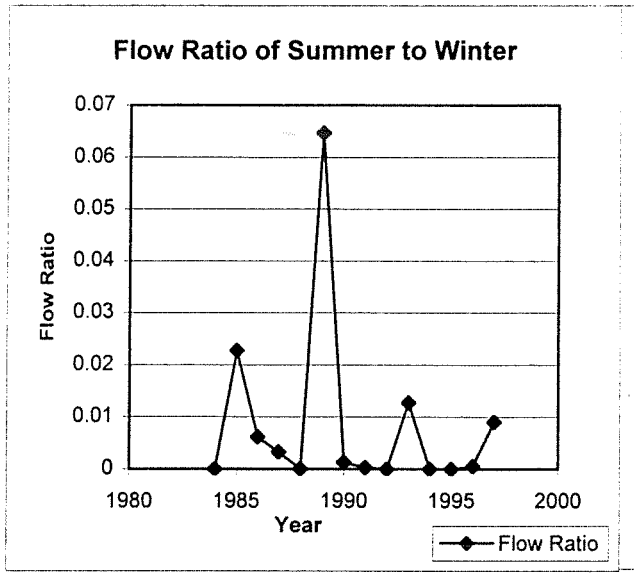
Annual Cumulative Flow & Cumulative Rainfall Curves

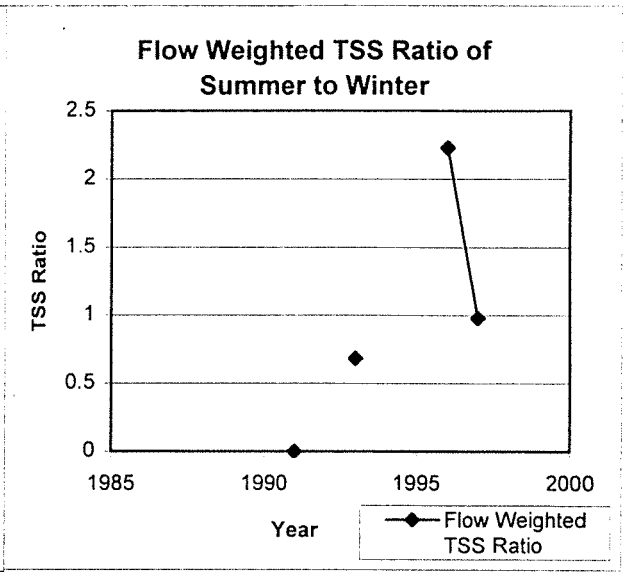


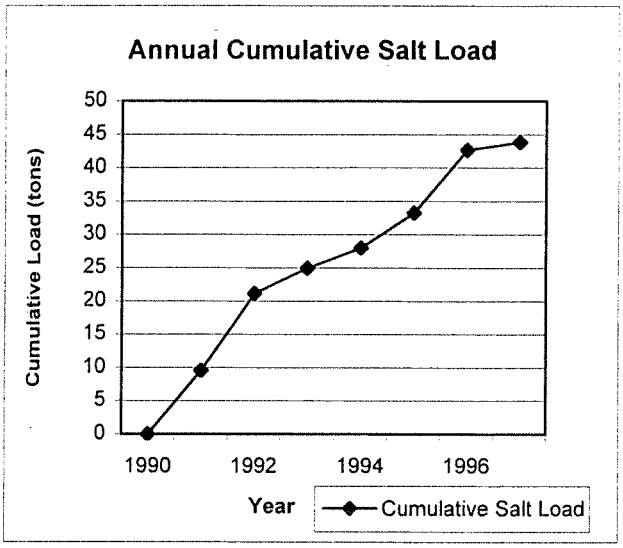
Annual Residual Flow & Residual Rainfall Curves



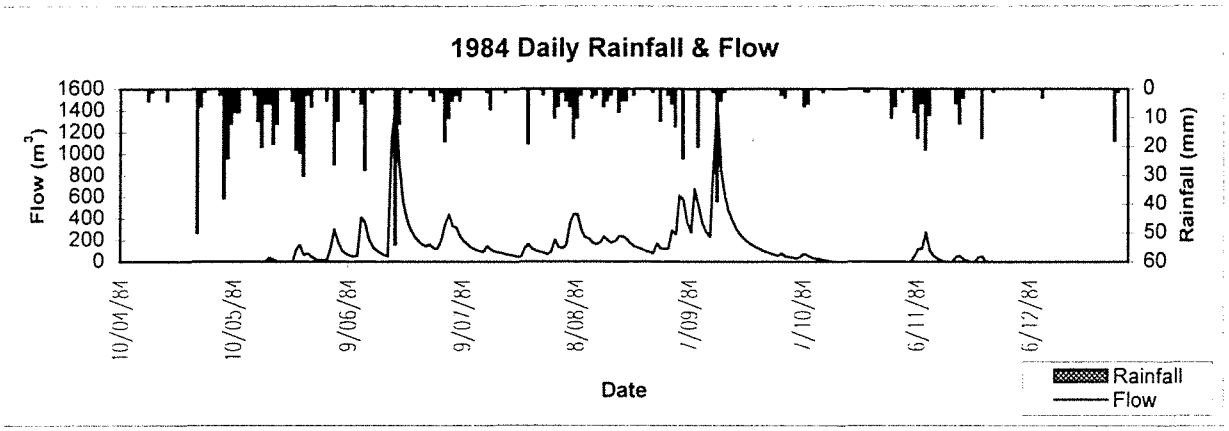
Yarragil 4X Catchment - S 614048



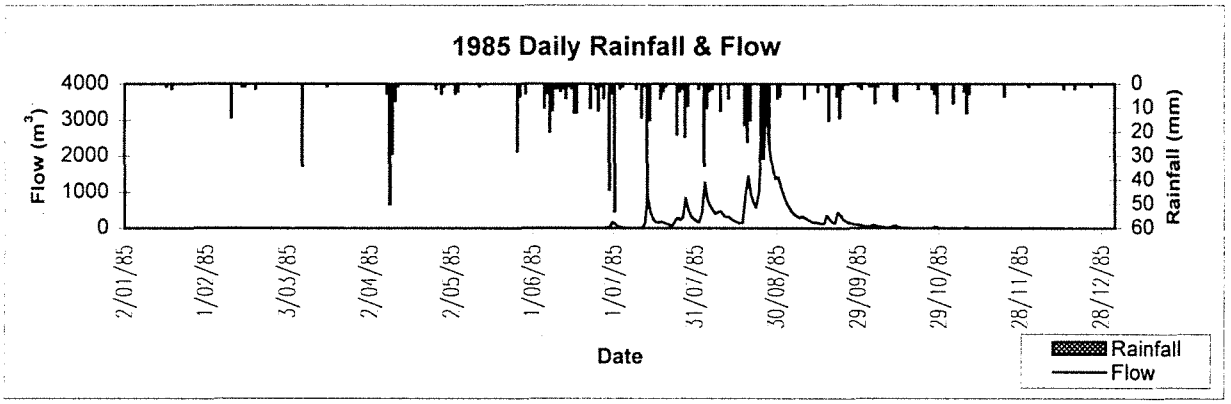




Yarragil 4X Catchment - S 614048

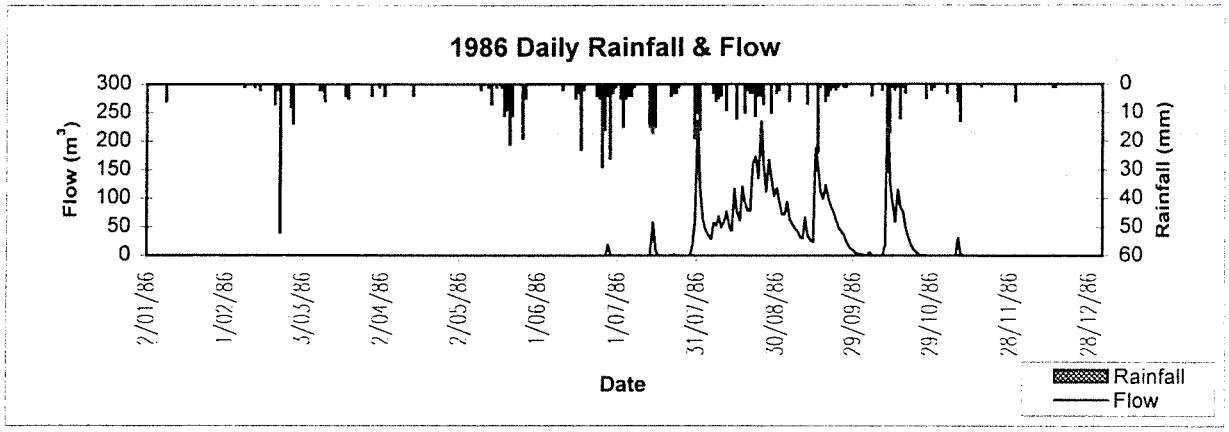


Salinity data not available for 1984

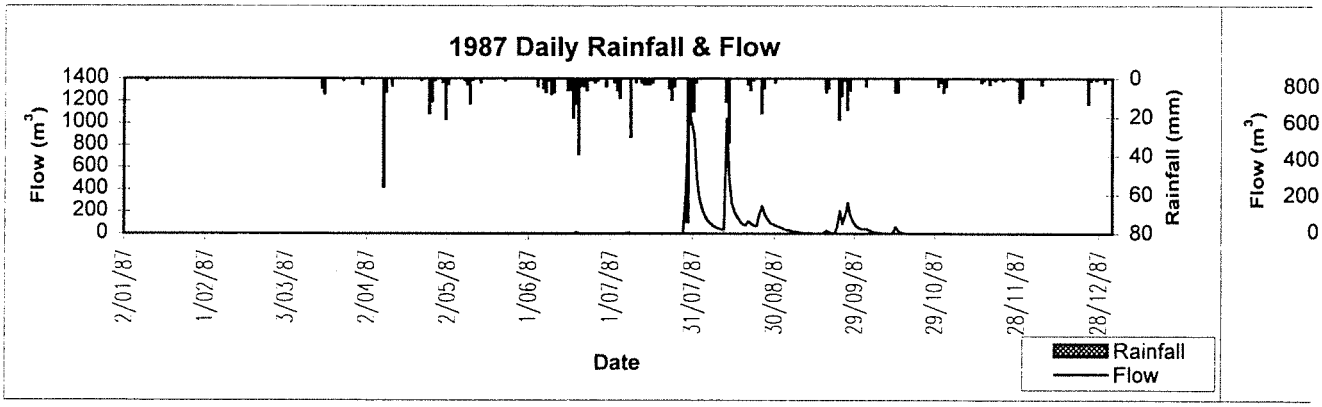


Salinity data not available for 1985

Yarragil 4X Catchment - S 614048

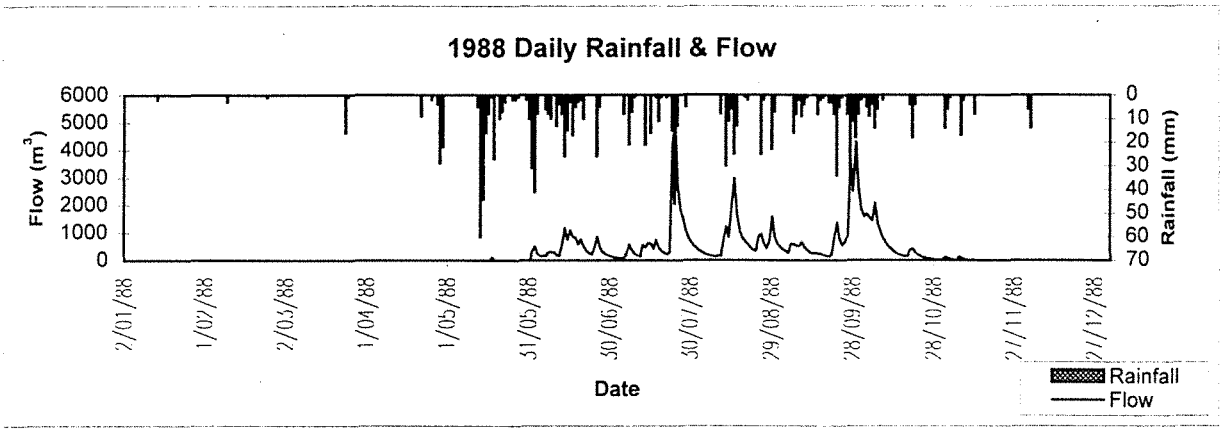


Salinity data not available for 1986

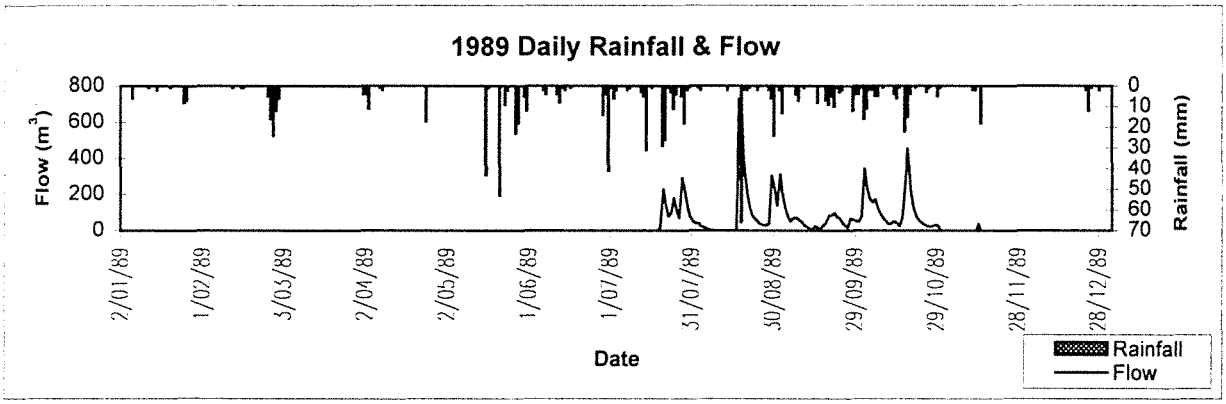


Salinity data not available for 1987

Yarragil 4X Catchment - S 614048

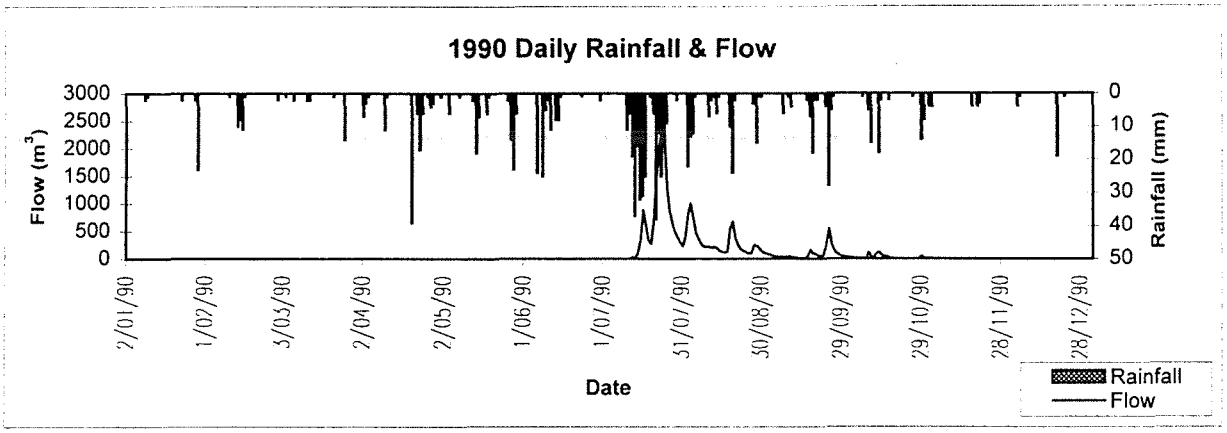


Salinity data not available for 1988

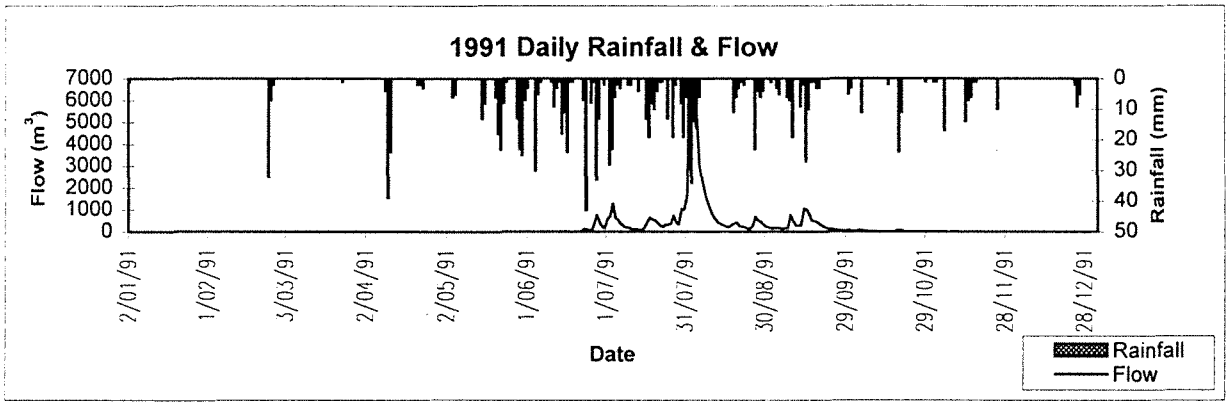


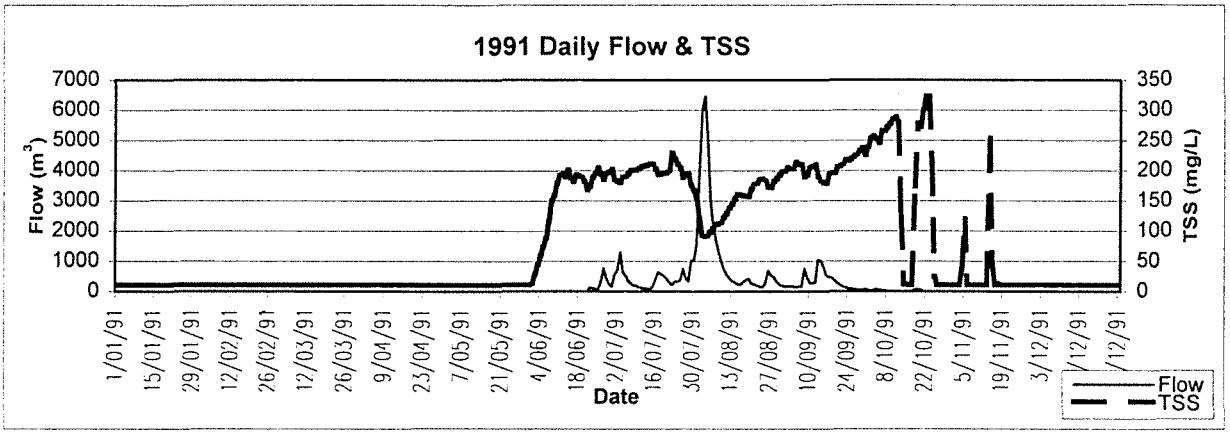
Salinity data not available for 1989

Yarragil 4X Catchment - S 614048

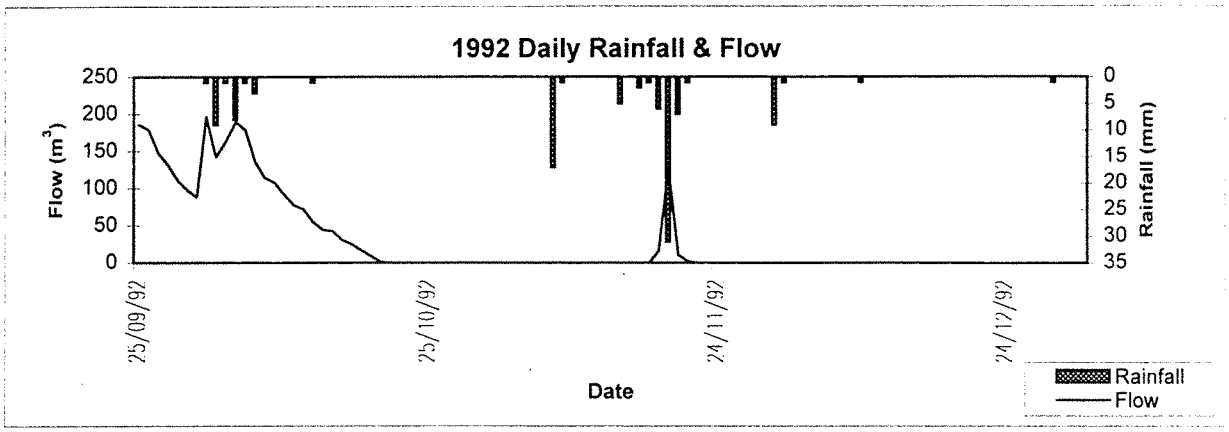


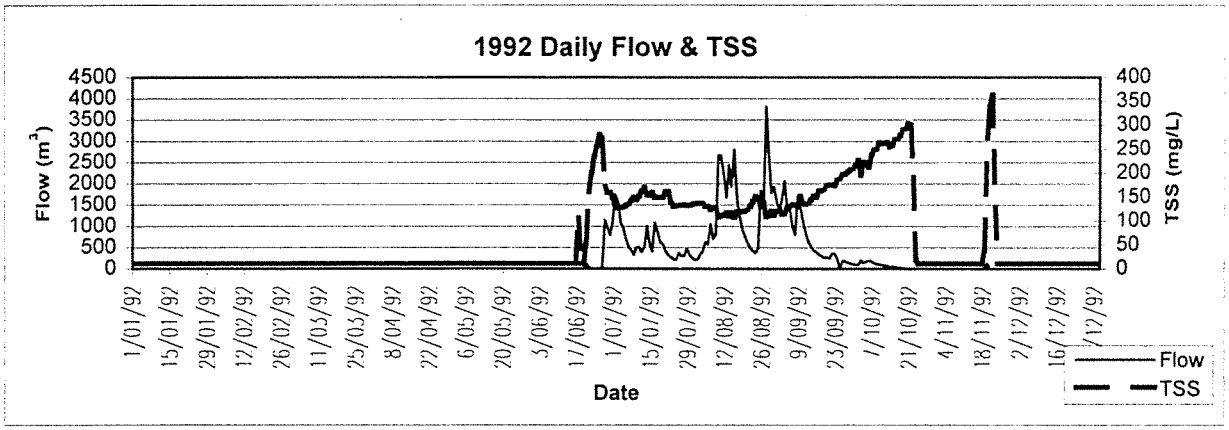
Salinity data not available for 1990

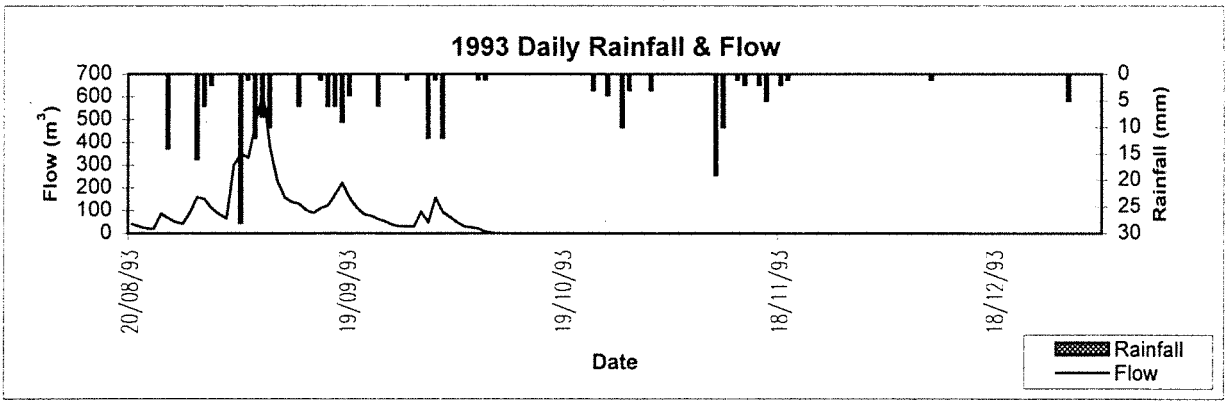


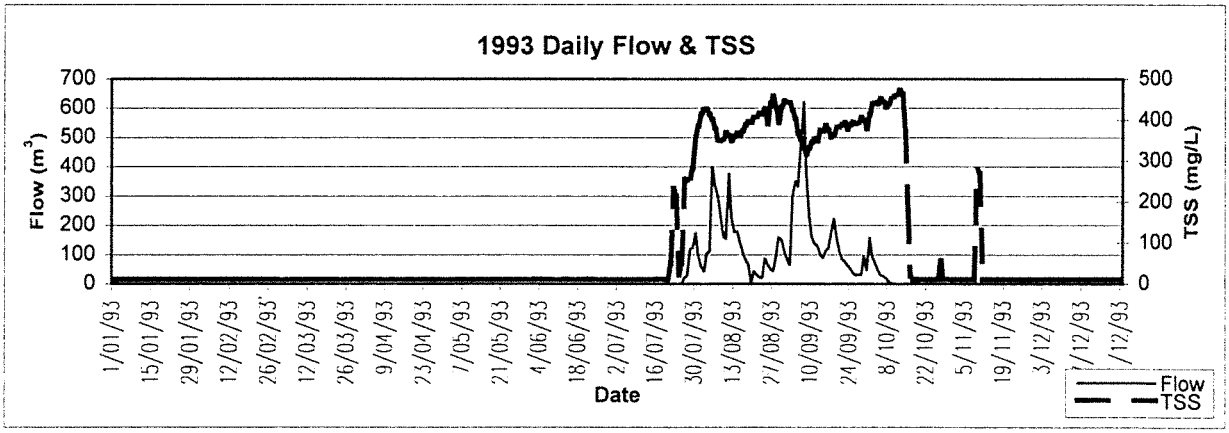


Yarragil 4X Catchment - S 614048

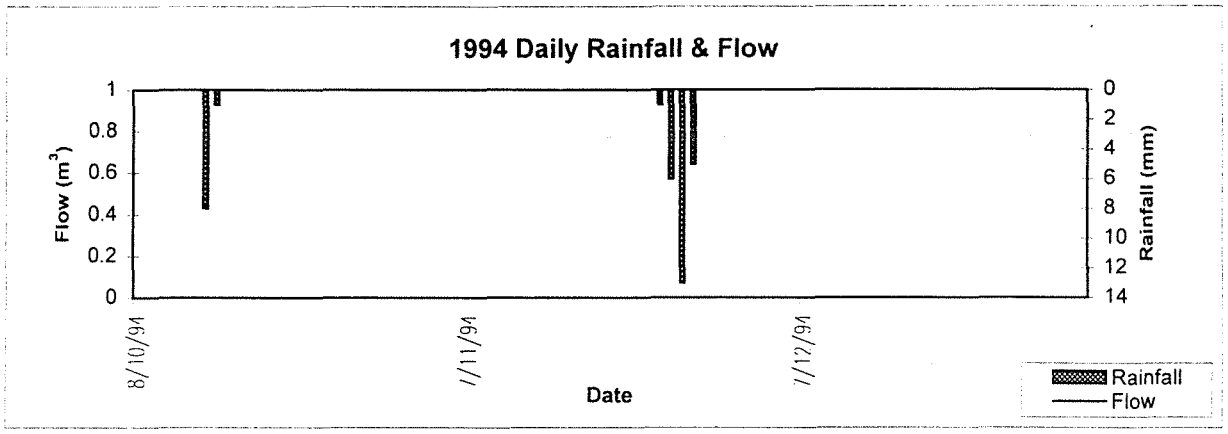


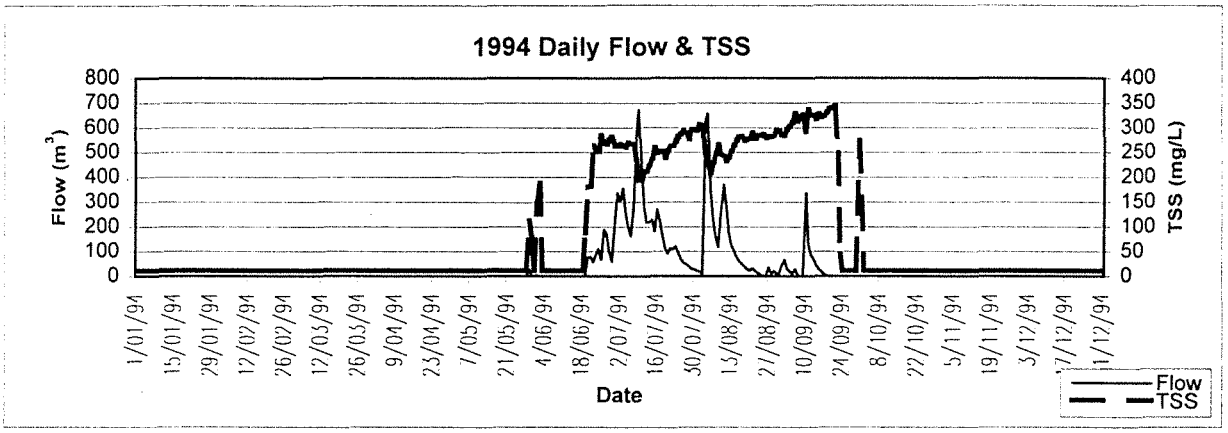


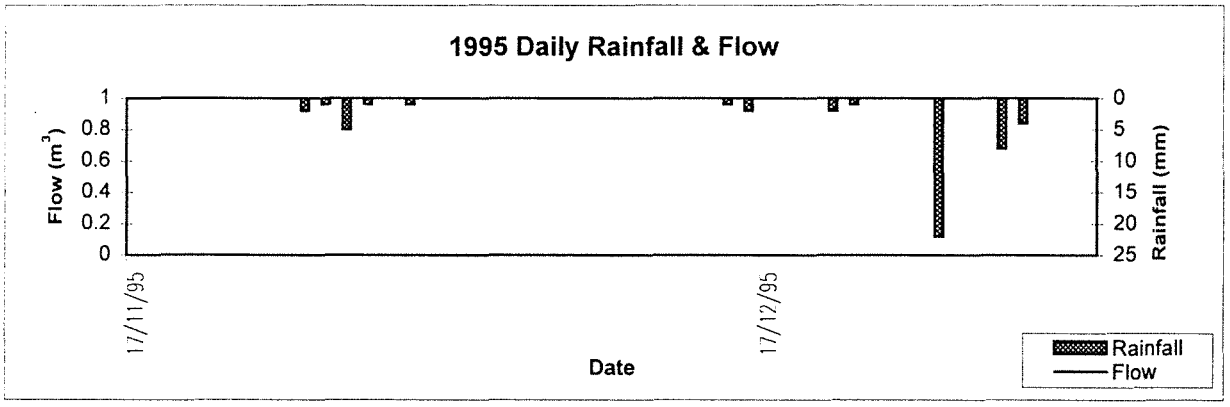


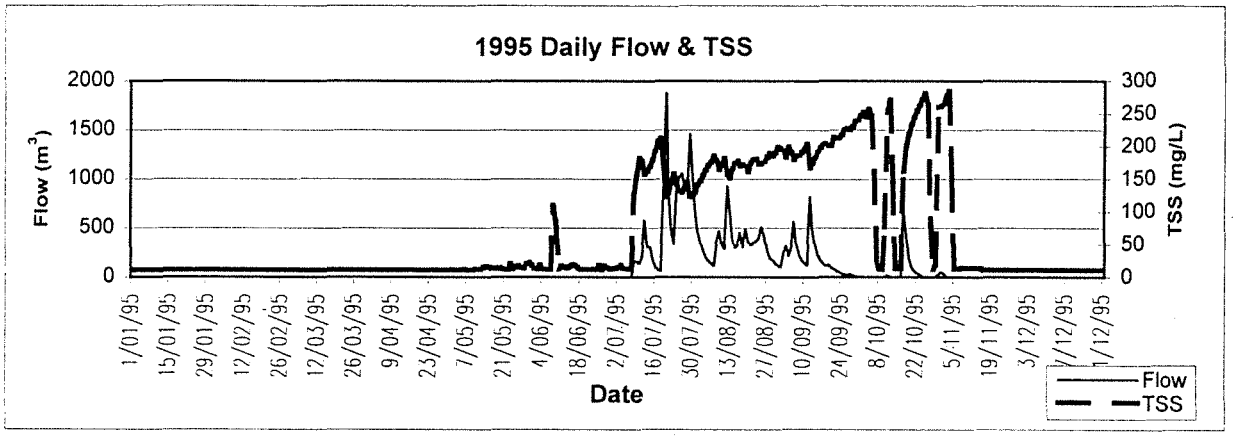


Yarragil 4X Catchment - S 614048

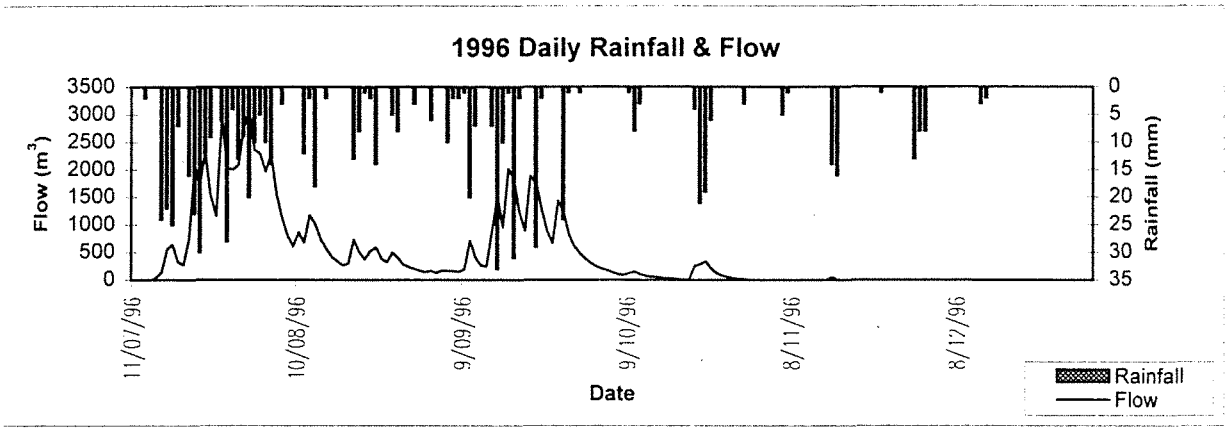


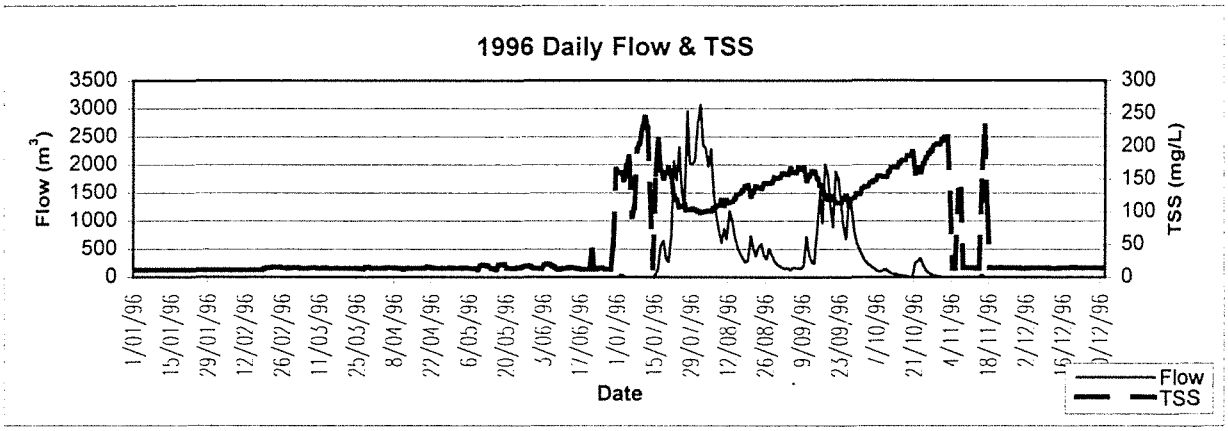


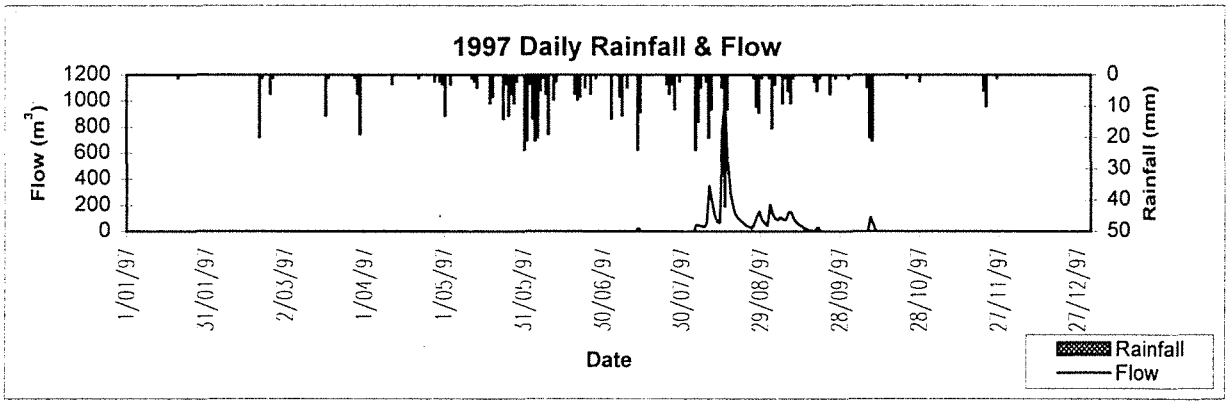


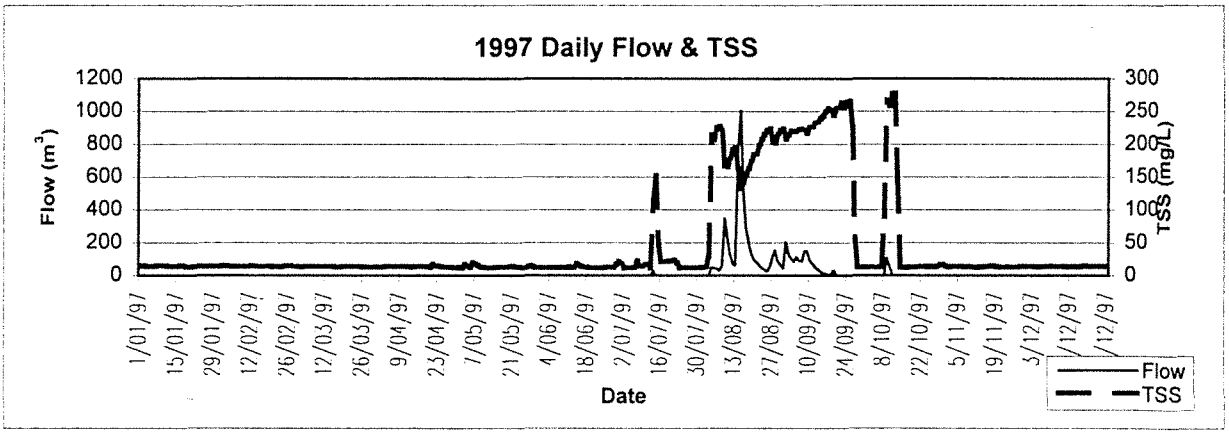


Yarragil 4X Catchment - S 614048

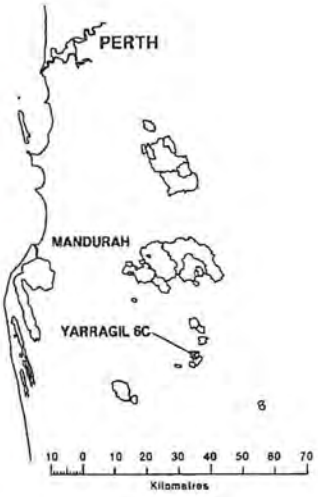








Yarragil 6C Catchment



Legend

Catchment Boundary △ Gauging Station

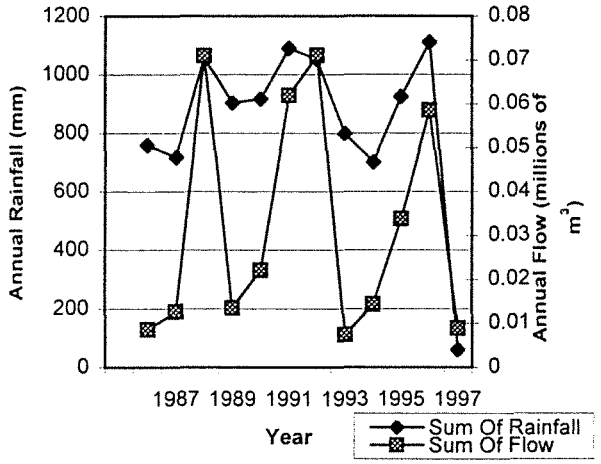
5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

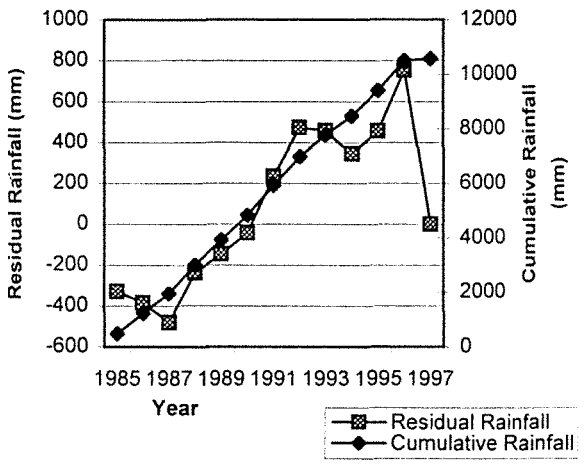
Gauging Station Number	S614049				
	Yarragil North (M 509433) rainfall data				
Information about catchment					
Catchment area	4.58 km^2				
Gauging Station Coordinates (AMG)	N 6367905	E 427600			
Treatment data	Undisturbed Catchment.				
Information about records	**Rainfall**	**Flow**	**Salinity**	**Year**	**Number of flow days**
Number of days recorded	0	4678	0	1986	98
Number of years recorded		14		1987	91
Number of years with complete records		12		1988	173
Start date		25/03/85		1989	123
Finish date		13/01/98		1990	106
Number of days with quality code 1		4512		1991	152
Number of days with quality code 2		58		1992	146
Number of days with quality code 3		36		1993	103
Number of days with quality code 4		68		1994	128
Number of days with quality code 255		4		1995	129
				1996	140
Annual Basic Statistics		Flow (millions of m^3)		1997	85
Average		0.032		**Total**	**1474**
Min		0.007			
Max		0.071			

Yarragil 6C Catchment - S 614049

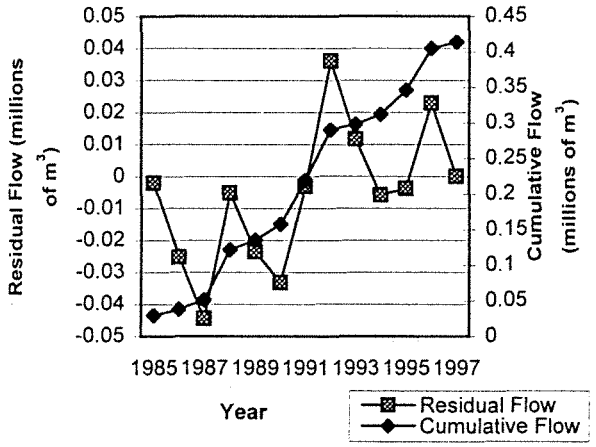
Annual Rainfall & Flow



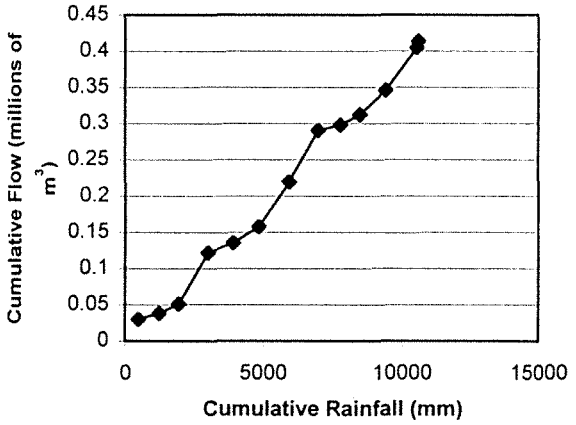
Annual Cumulative & Residual Rainfall Curves



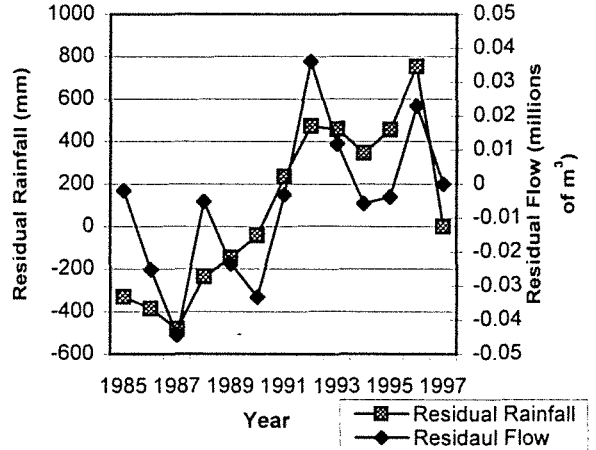
Annual Cumulative & Residual Flow Curves



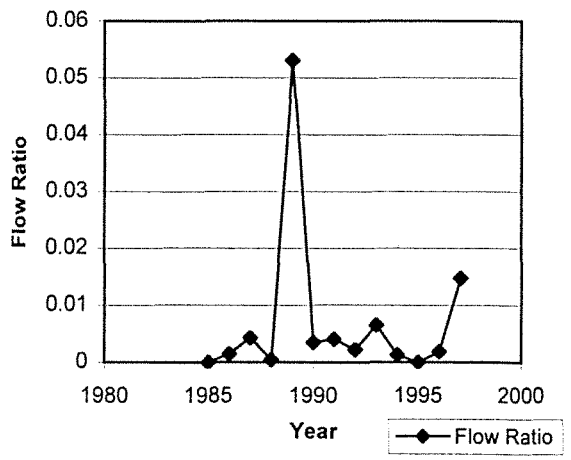
Annual Cumulative Flow & Cumulative Rainfall Curves



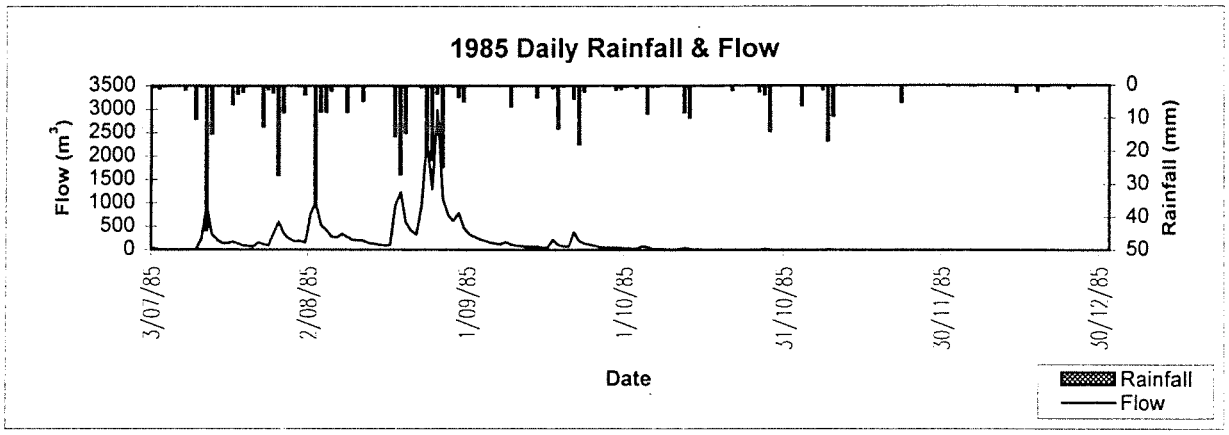
Annual Residual Flow & Residual Rainfall Curves

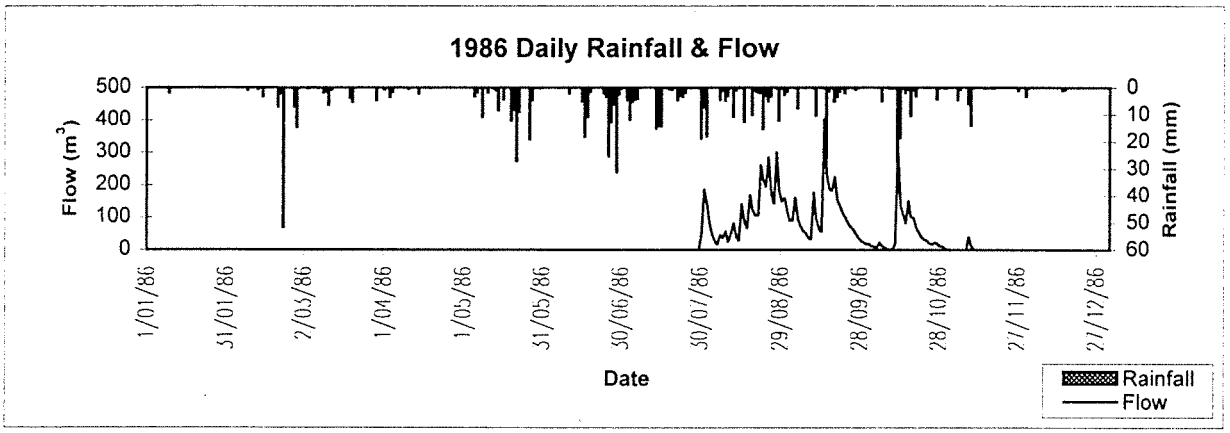


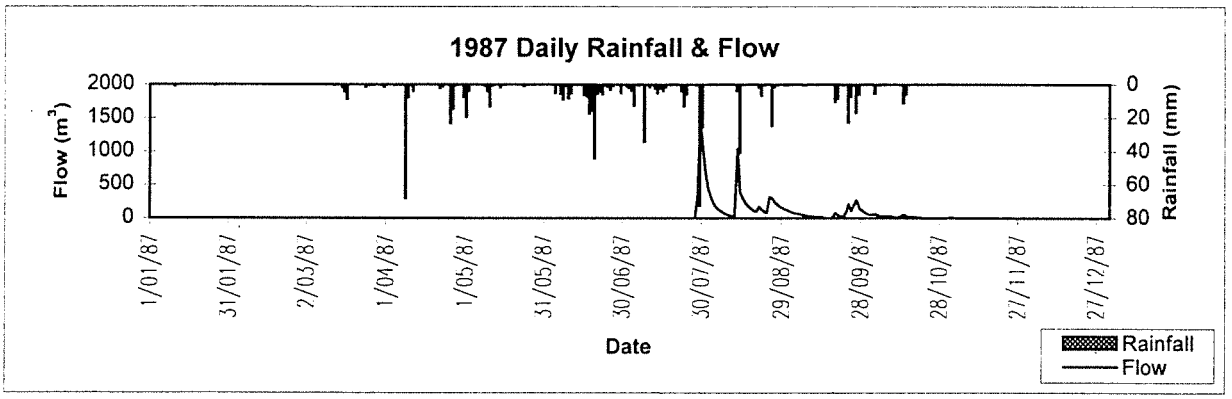
Flow Ratio of Summer to Winter

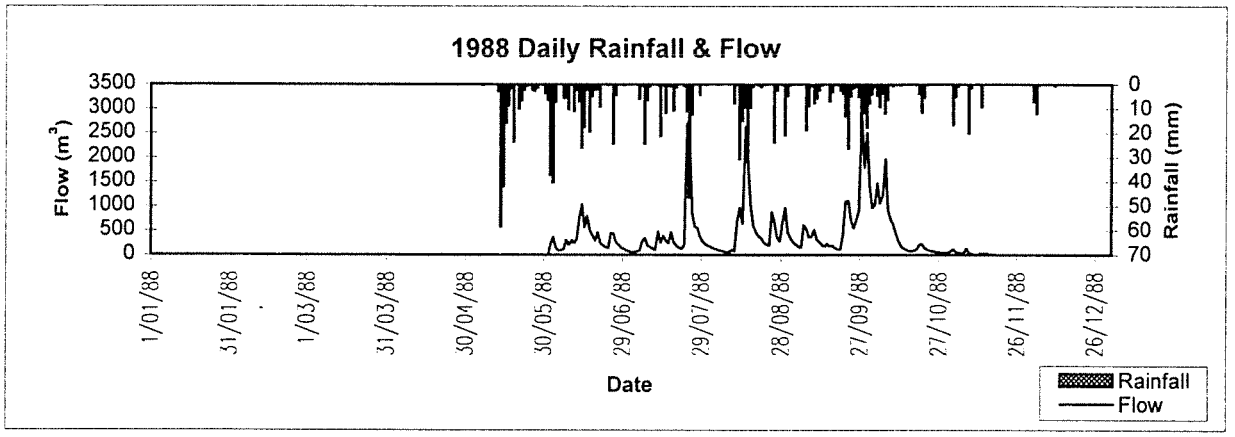


Yarragil 6C Catchment - S 614049

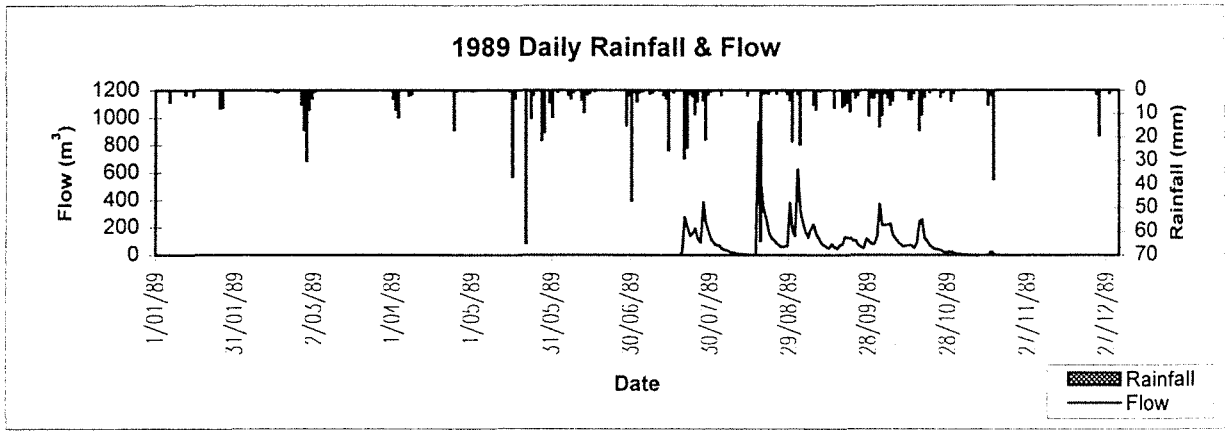


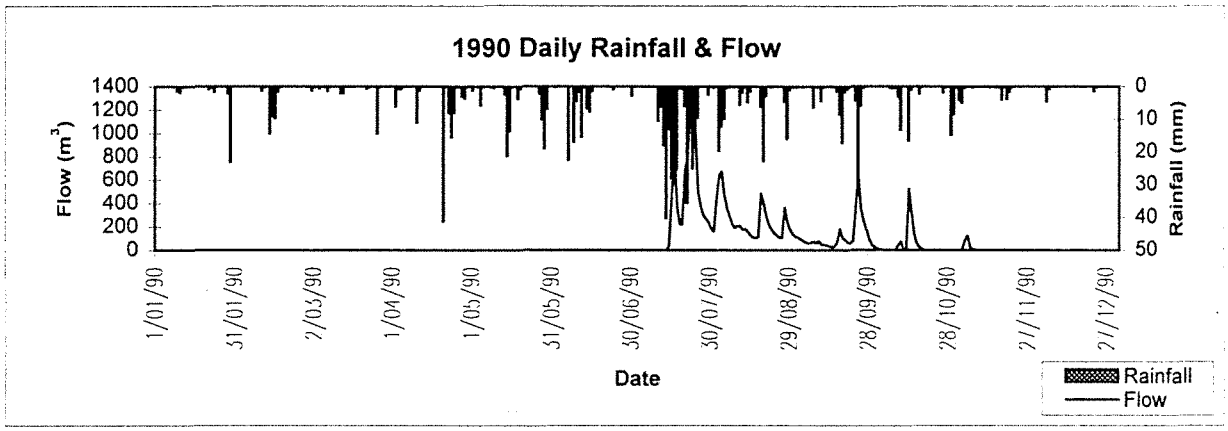


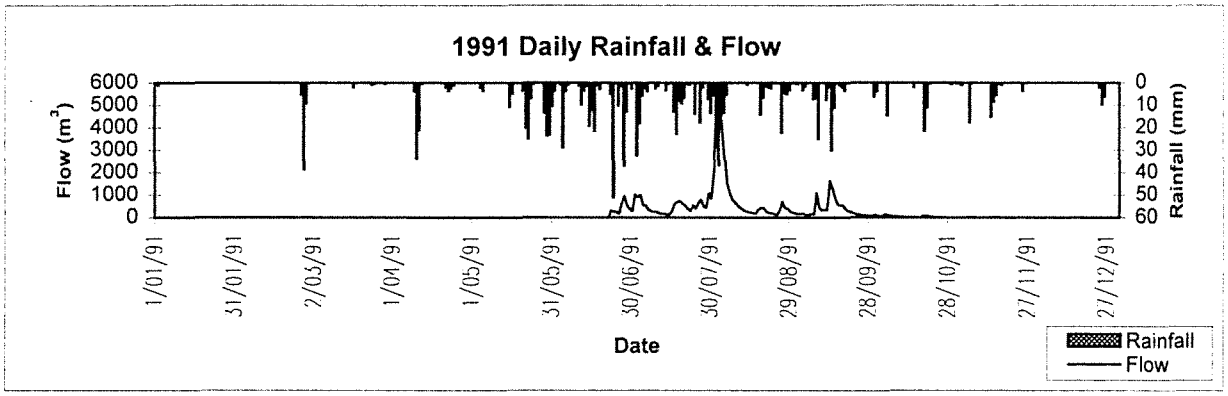


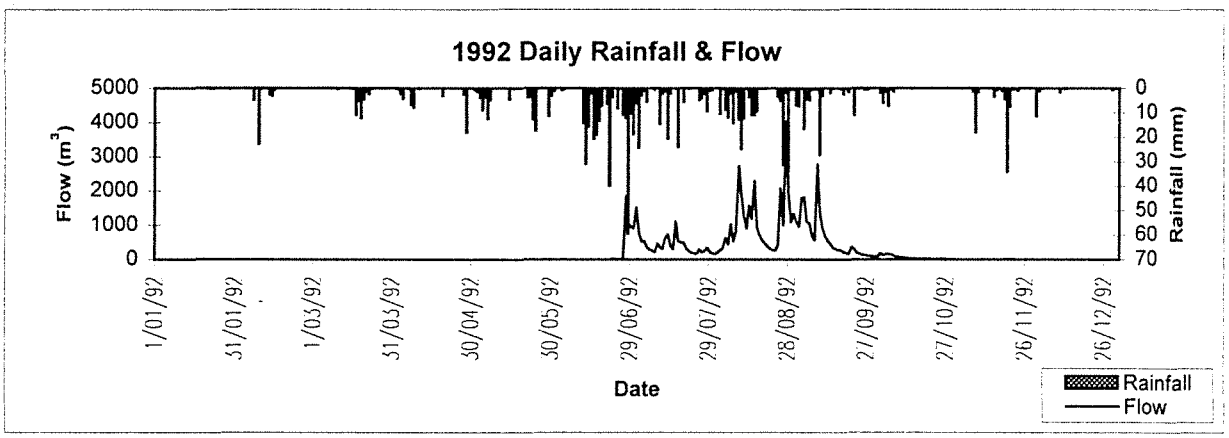


Yarragil 6C Catchment - S 614049

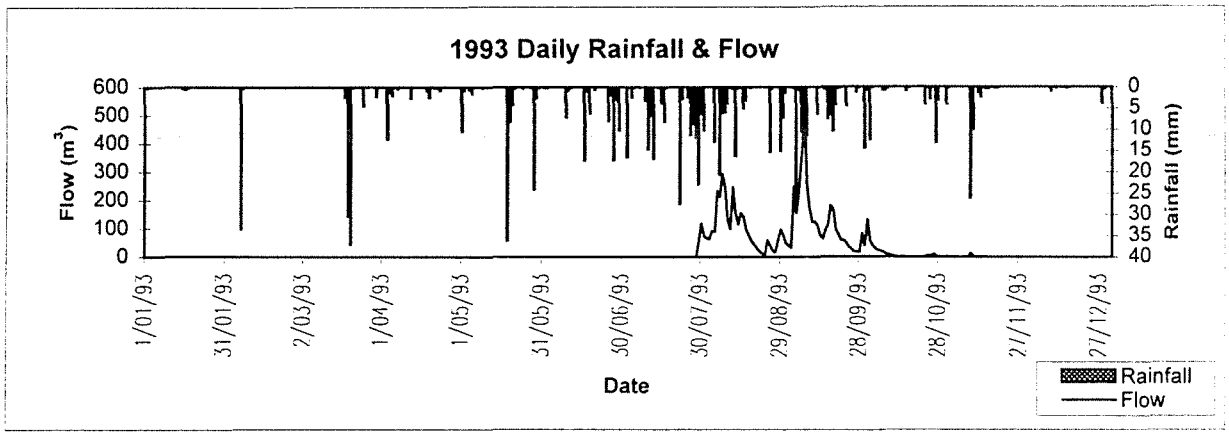


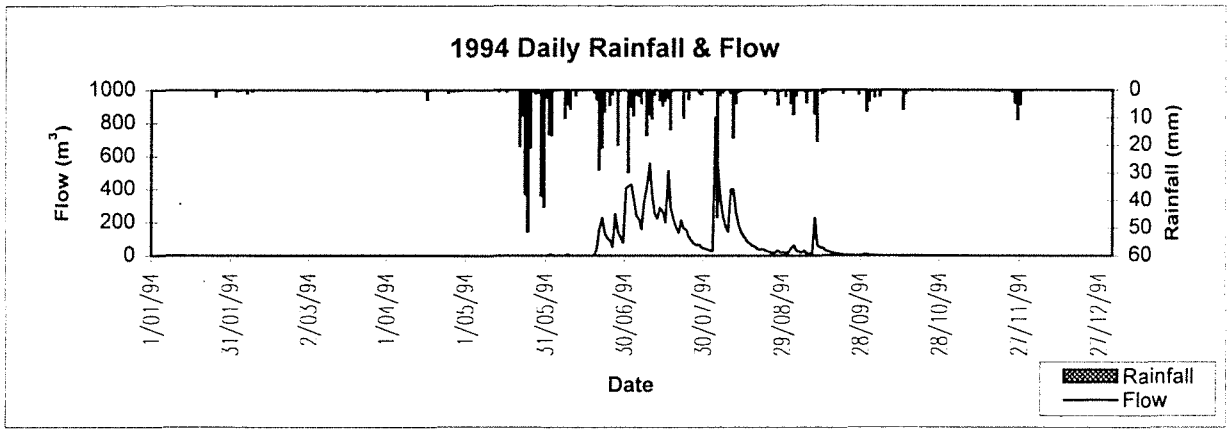


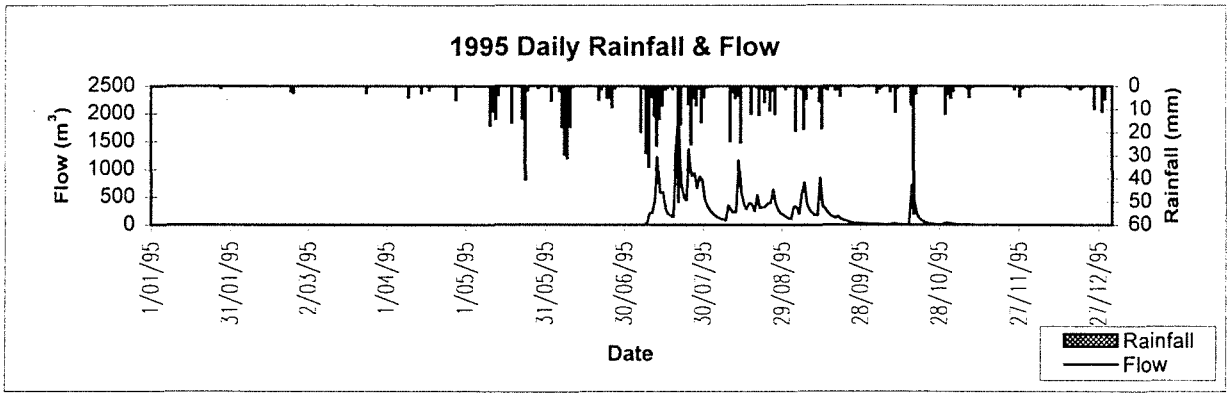


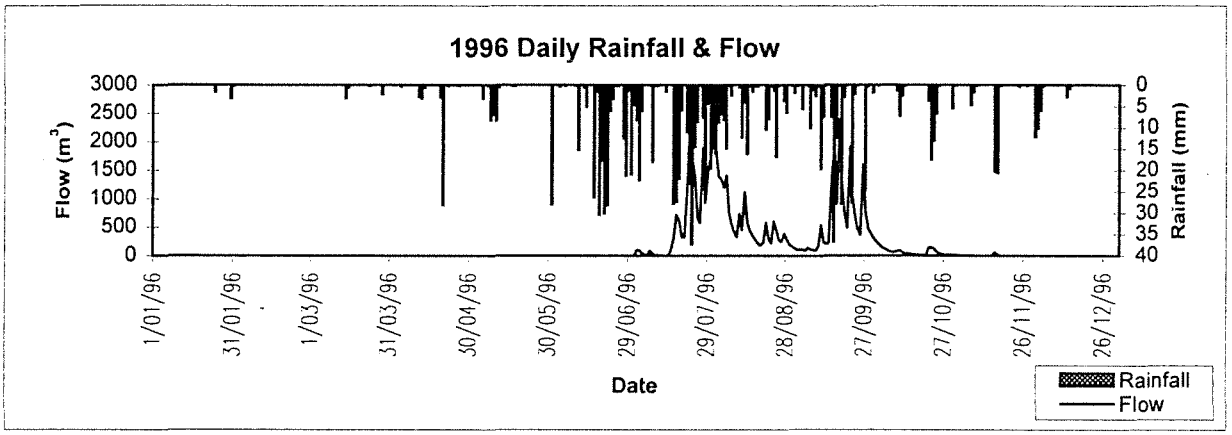


Yarragil 6C Catchment - S 614049

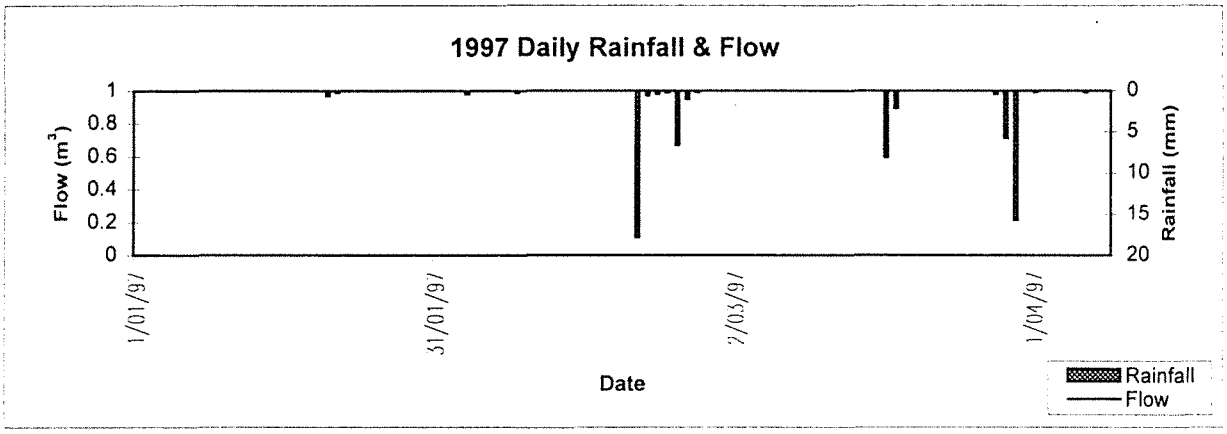




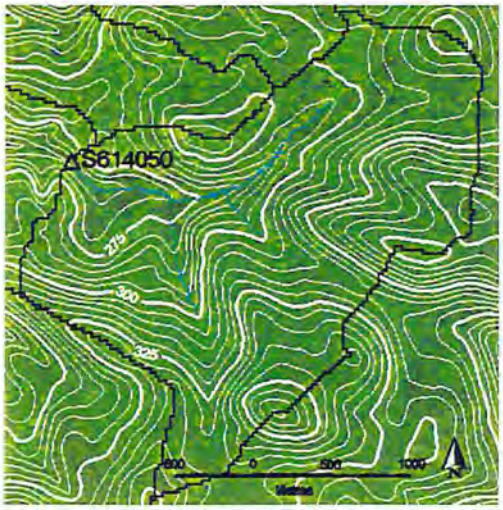


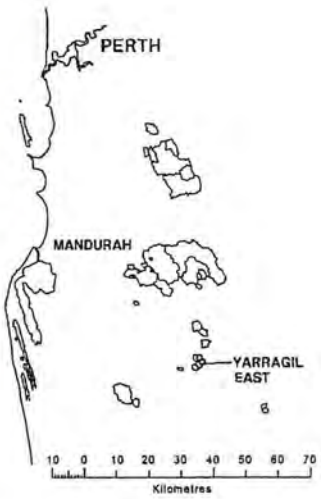


Yarragil 6C Catchment - S 614049



Yarragil East Catchment





Legend

Catchment Boundary △ Gauging Station

300 5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

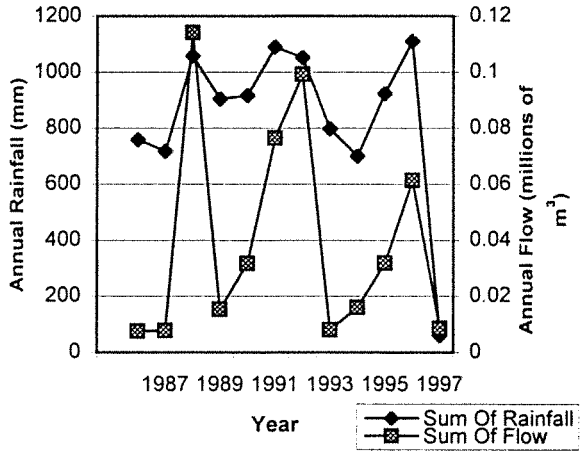
Gauging Station Number	S614050
	Yarragil North (M 509433) rainfall data
Information about catchment	
Catchment area	5.01 km^2
Gauging Station Coordinates (AMG)	N 6366840 E 428450
Treatment data	Undisturbed Catchment.

Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	0	4591	0
Number of years recorded		14	
Number of years with complete records		12	
Start date		19/06/85	
Finish date		12/01/98	
Number of days with quality code 1		4466	
Number of days with quality code 2		44	
Number of days with quality code 3		28	
Number of days with quality code 4		50	
Number of days with quality code 255		3	
Annual Basic Statistics		Flow (millions of m^3)	
Average		0.040	
Min		0.008	
Max		0.114	

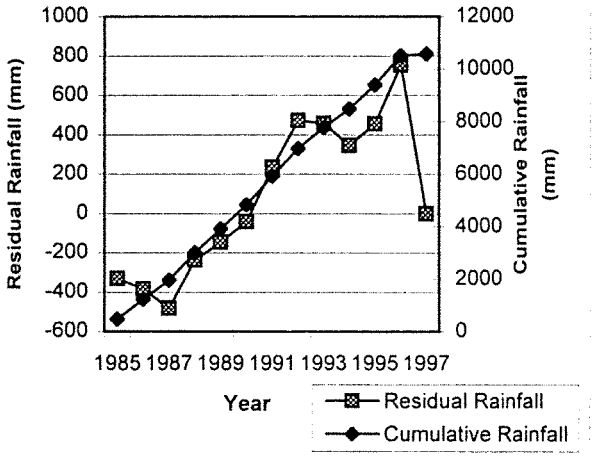
Year	**Number of flow days**
1985	131
1986	111
1987	90
1988	176
1989	117
1990	117
1991	142
1992	138
1993	81
1994	108
1995	128
1996	134
1997	75
Total	**1548**

Yarragil East Catchment - S 614050

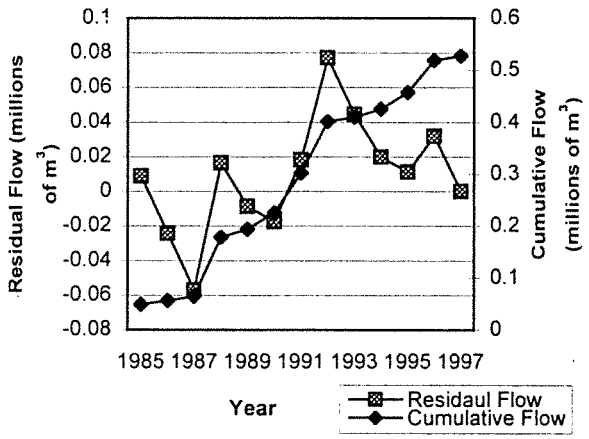
Annual Rainfall & Flow



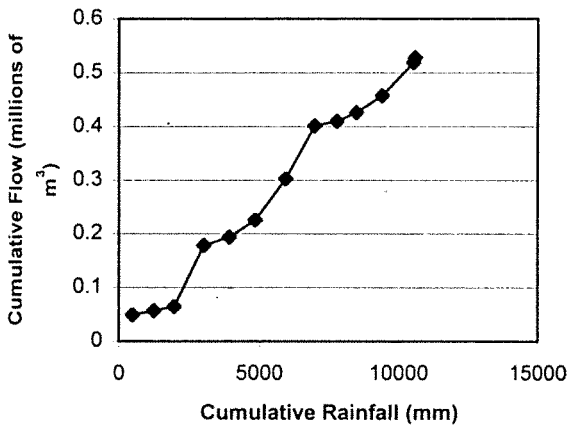
Annual Cumulative & Residual Rainfall Curves



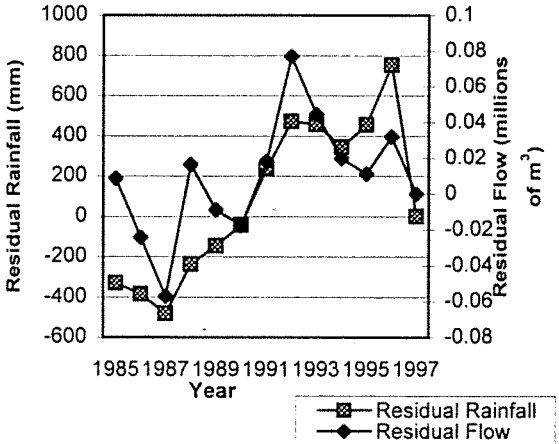
Annual Cumulative & Residual Flow Curves



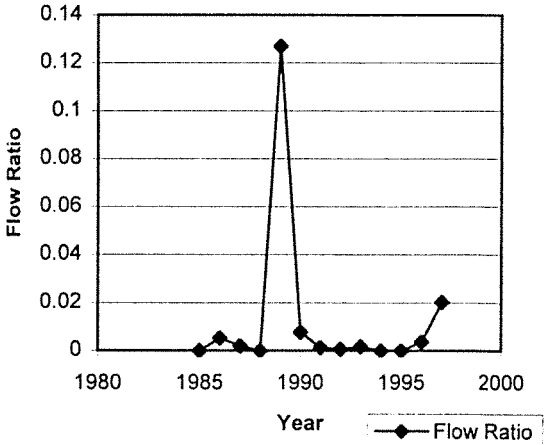
Annual Cumulative Flow & Cumulative Rainfall Curves



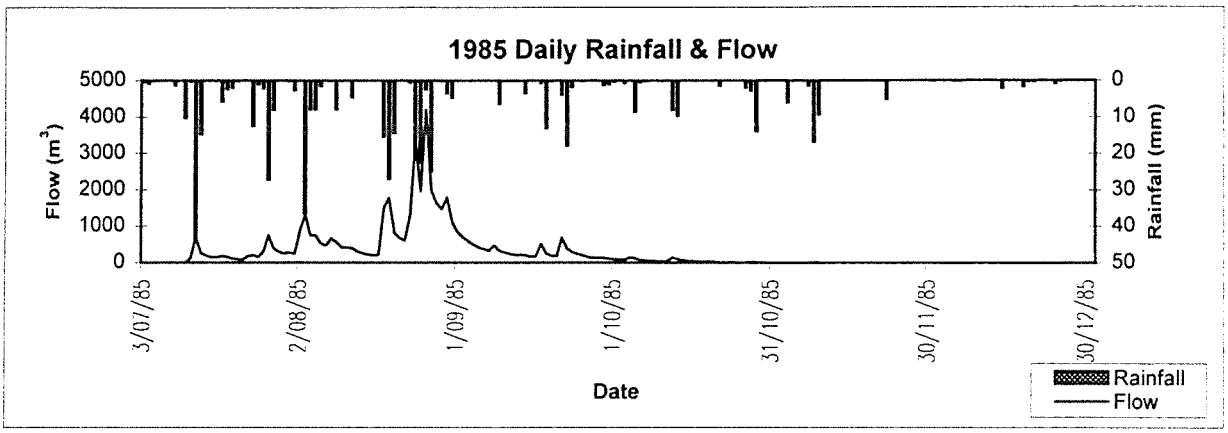
Annual Residual Flow & Residual Rainfall Curves

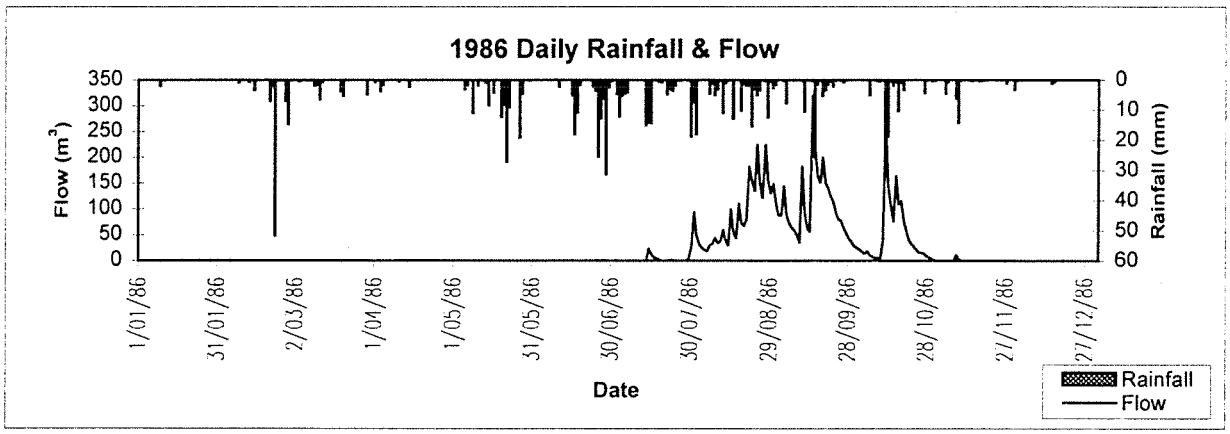


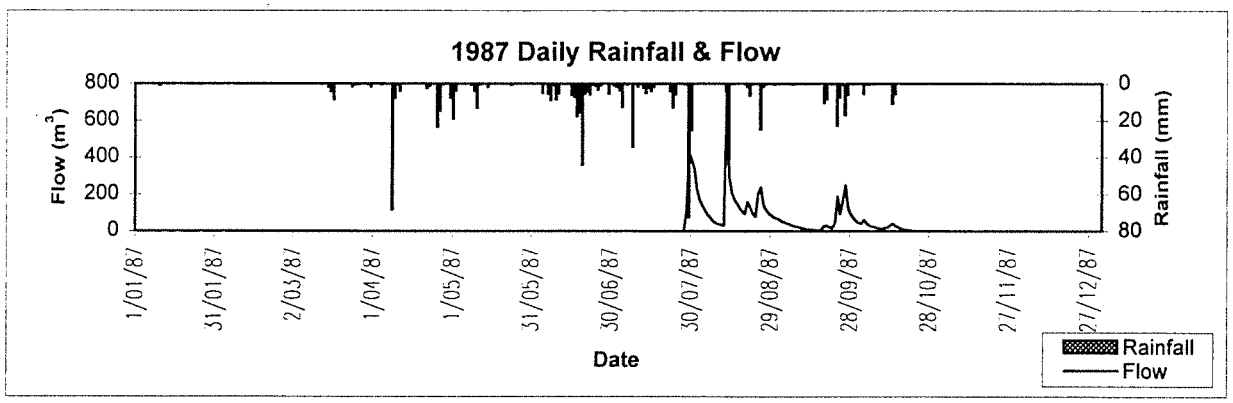
Flow Ratio of Summer to Winter

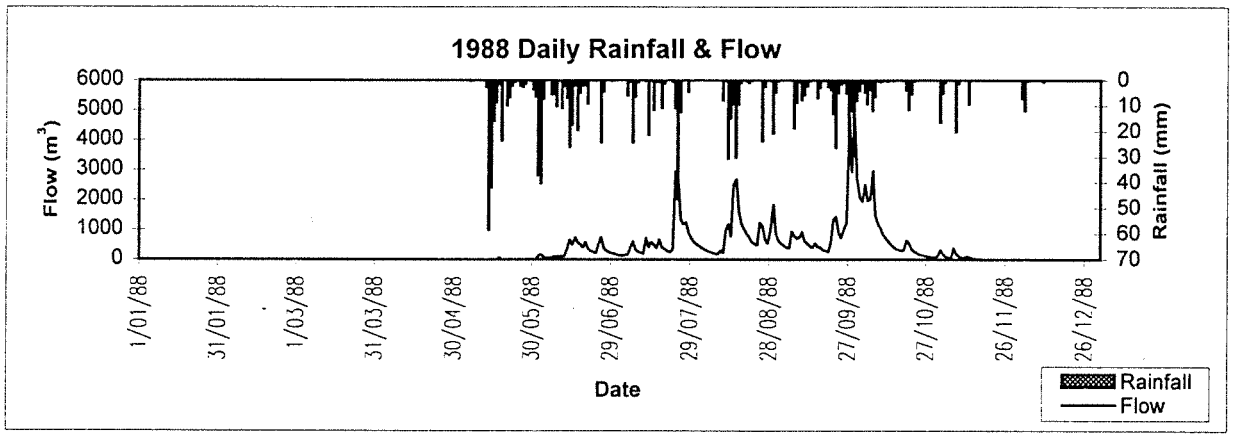


Yarragil East Catchment - S 614050

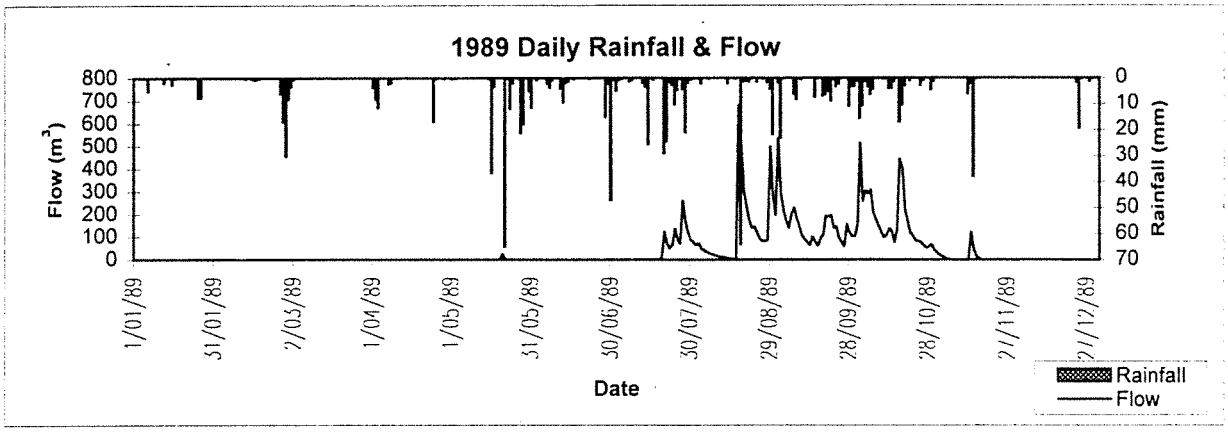


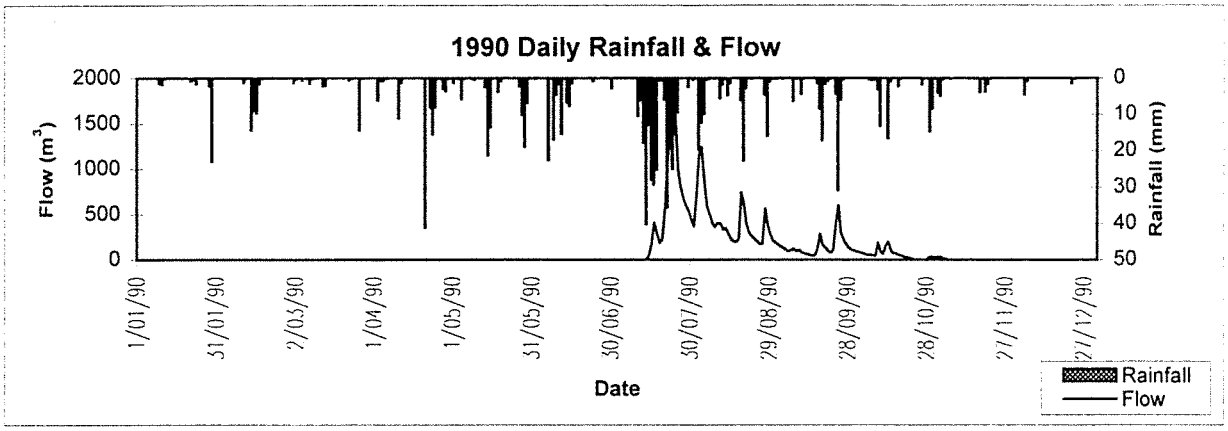


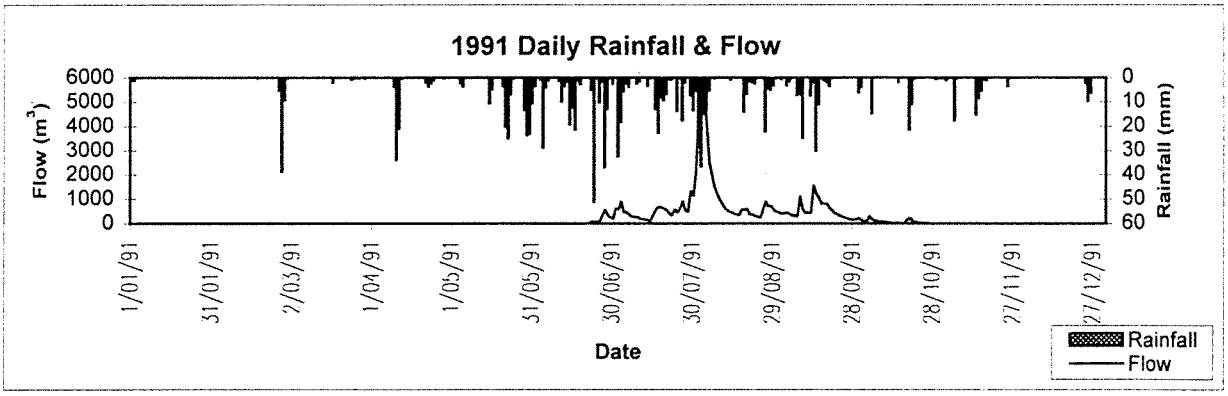


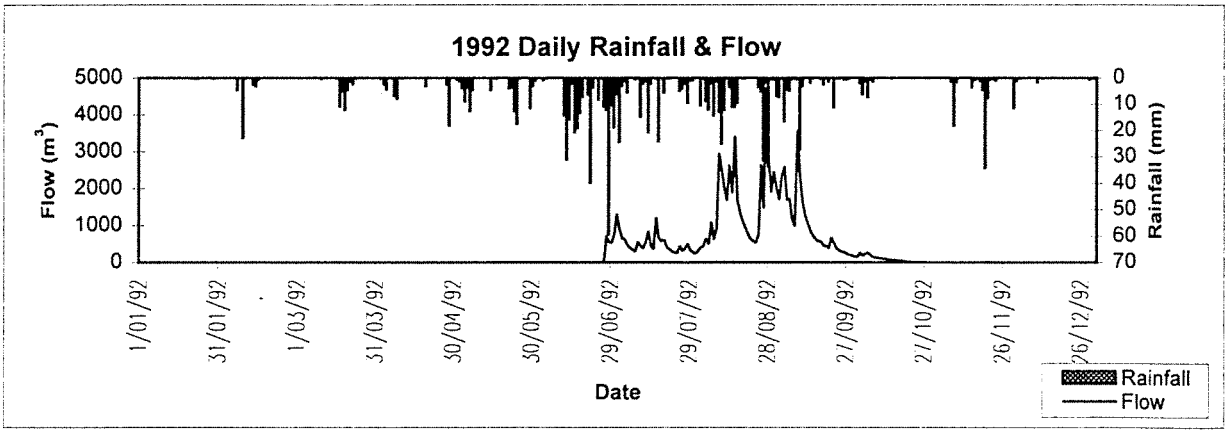


Yarragil East Catchment - S 614050

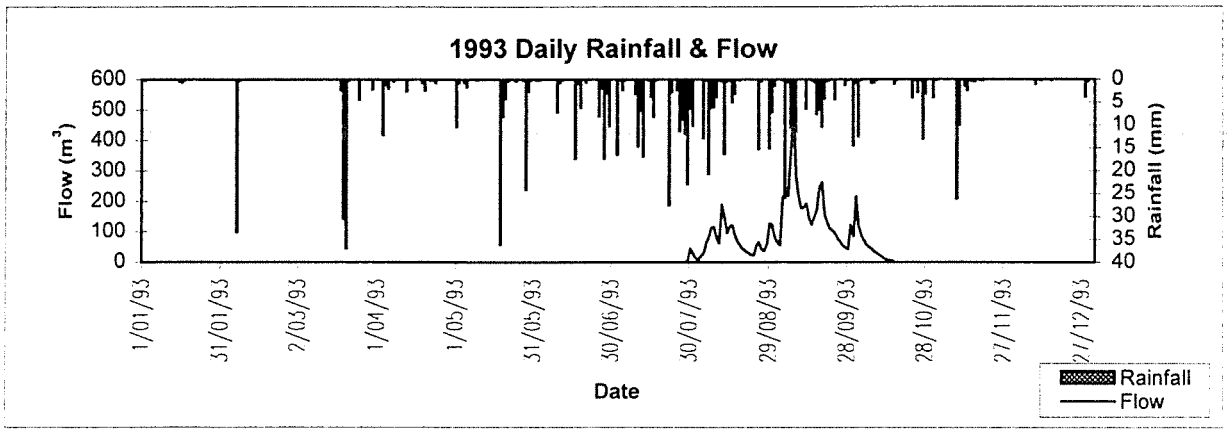


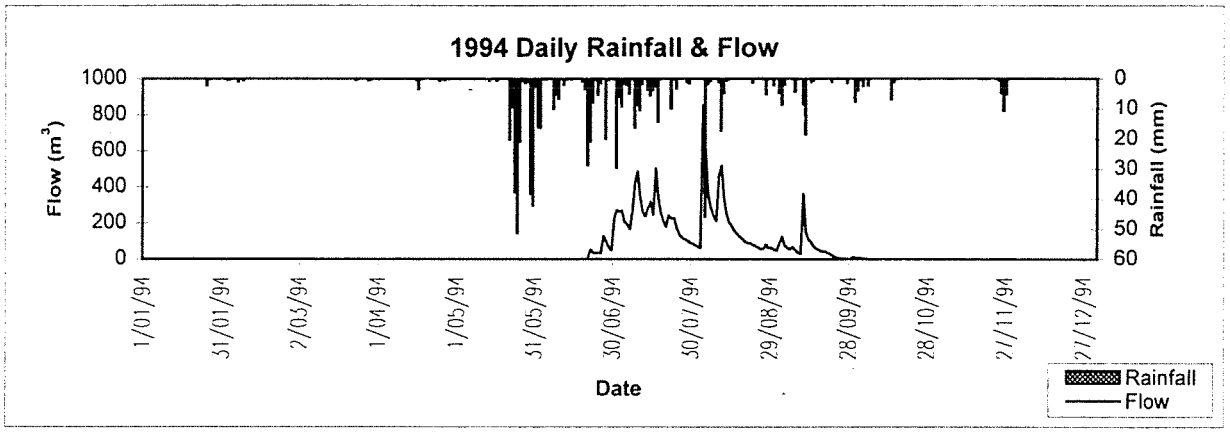


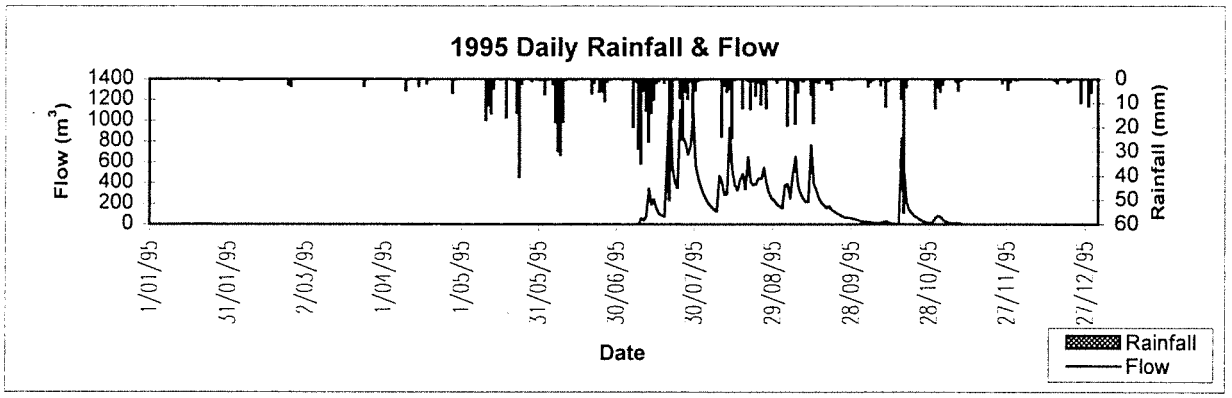


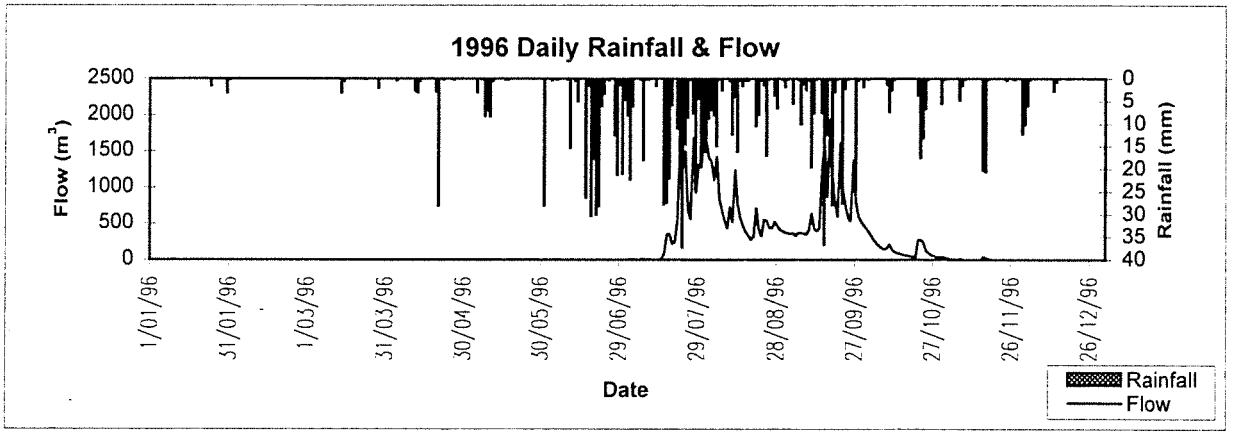


Yarragil East Catchment - S 614050

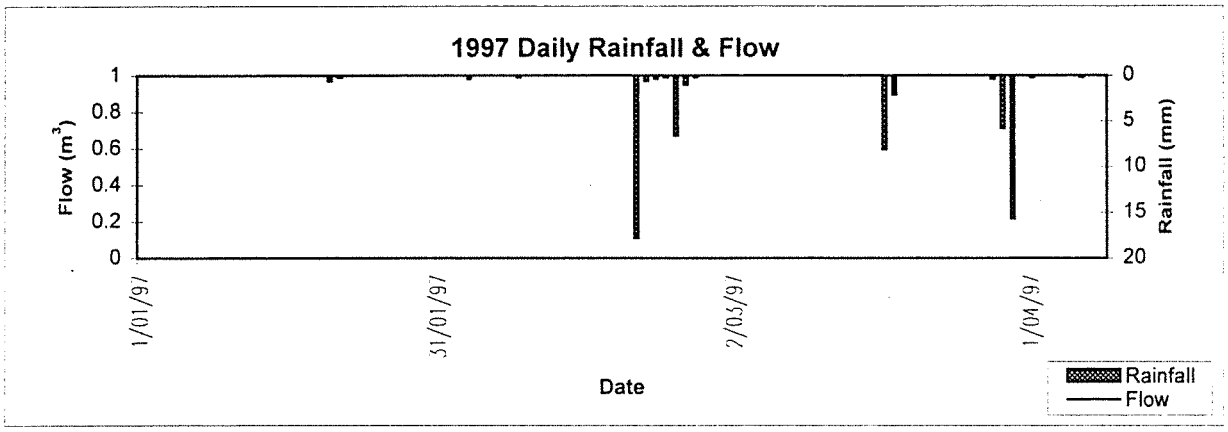




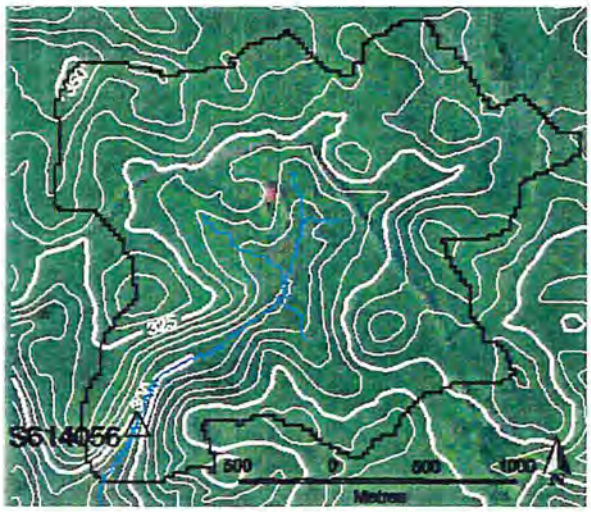




Yarragil East Catchment - S 614050



Wuraming Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

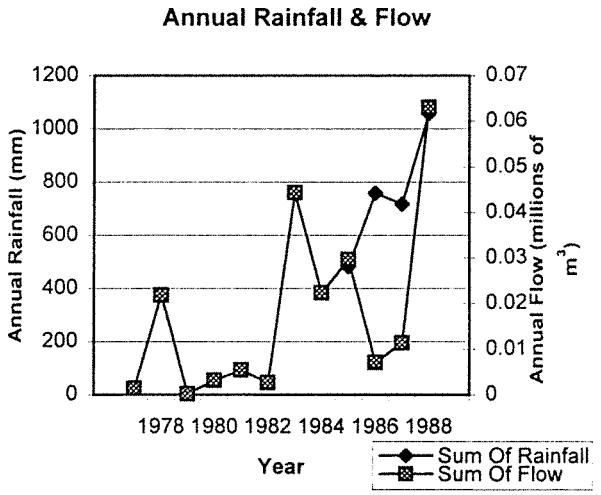
Gauging Station Number	S614056
	Yarragil North (M509433) rainfall data
Information about catchment	
Catchment area	4.78 km^2
Gauging Station Coordinates (AMG)	N 6371450 E 430500
Treatment data	Undisturbed Catchment.

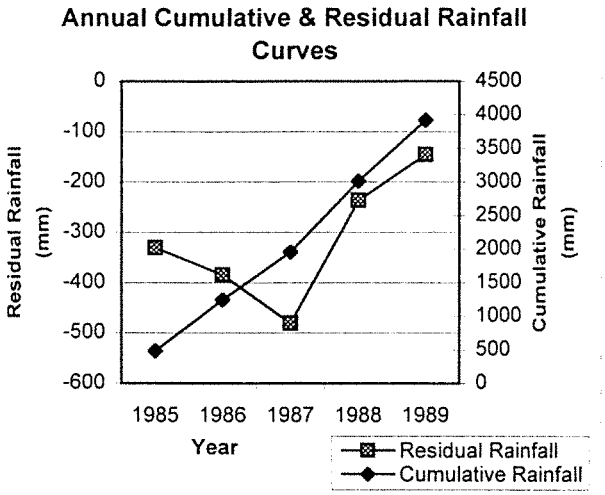
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	0	4790	0
Number of years recorded		14	
Number of years with complete records		12	
Start date		23/08/76	
Finish date		3/10/89	
Number of days with quality code 1		1558	
Number of days with quality code 2		85	
Number of days with quality code 3		43	
Number of days with quality code 4		27	
Number of days with quality code 157		3075	
Number of days with quality code 255		2	

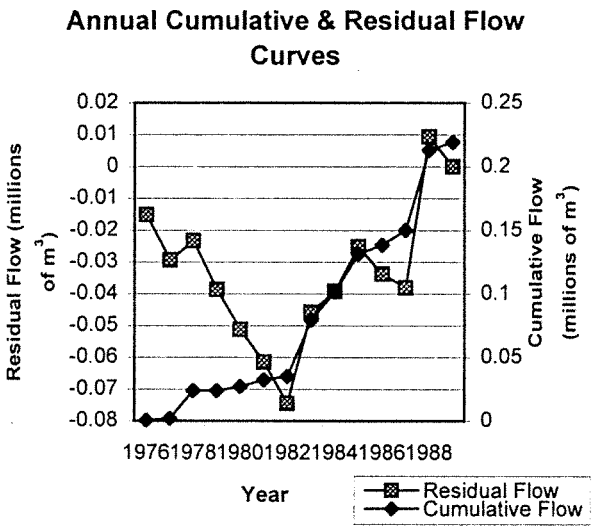
Annual Basic Statistics	Flow (millions of m^3)
Average	0.0177
Min	0.0002
Max	0.0631

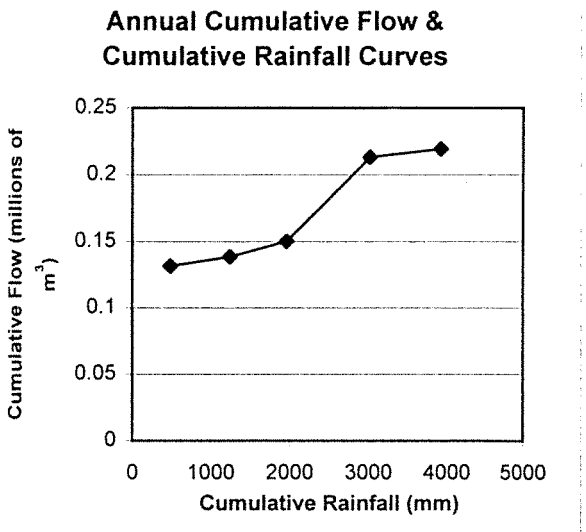
Year	**Number of flow days**
1977	6
1978	15
1979	5
1980	7
1981	9
1982	7
1983	27
1984	71
1985	97
1986	81
1987	59
1988	153
Total	**537**

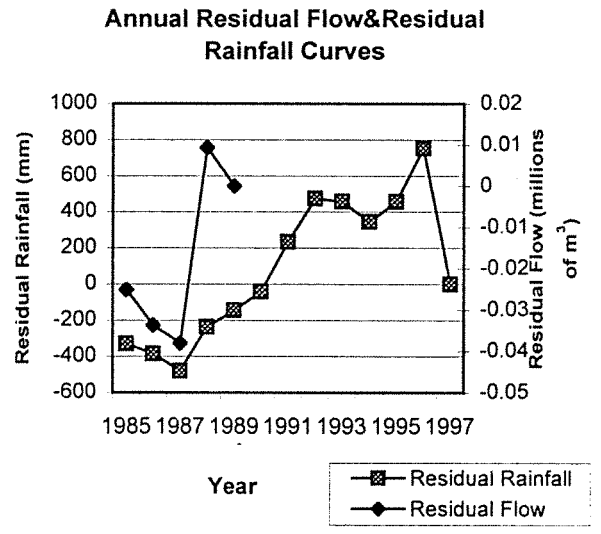
Wuraming 9A Catchment - S 614056

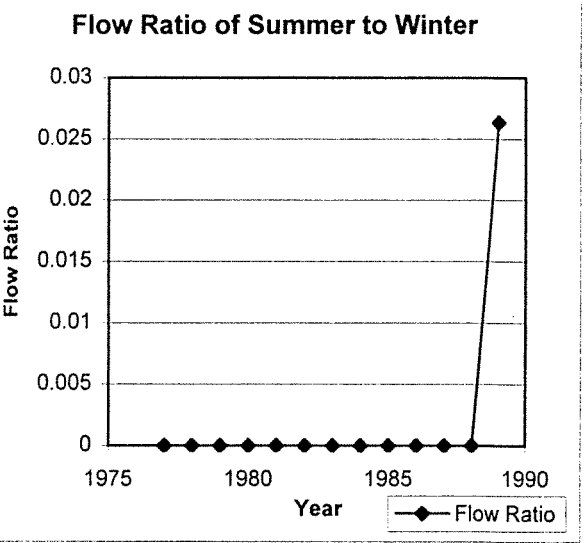




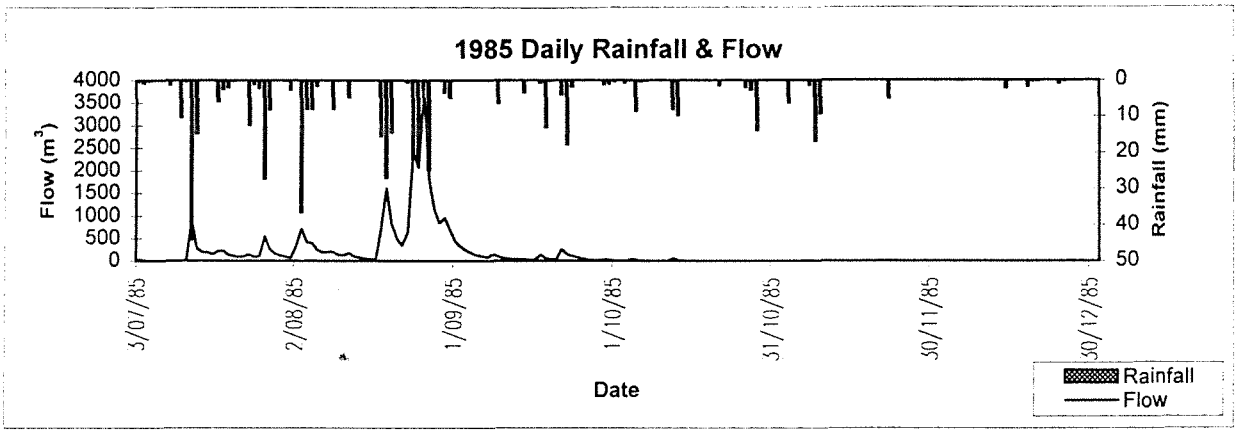


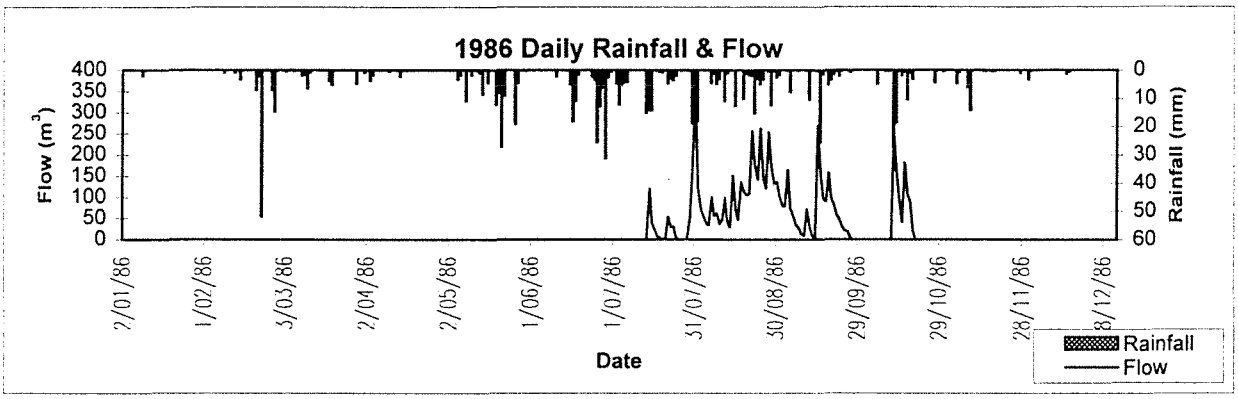


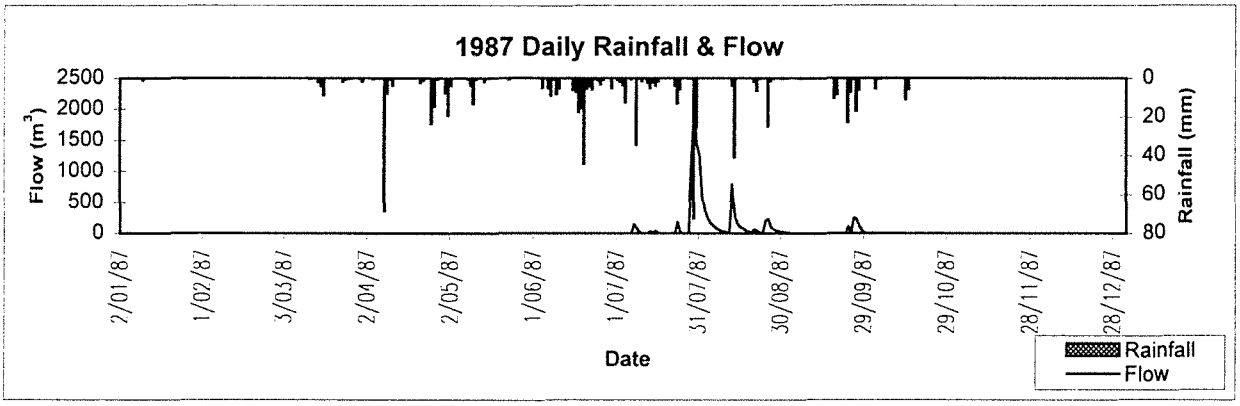


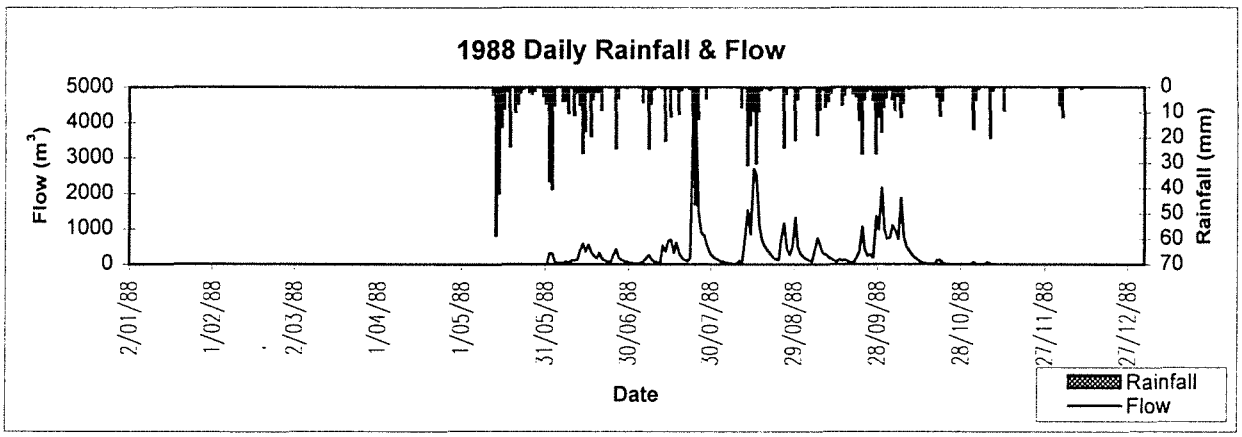


Wuraming 9A Catchment - S 614056

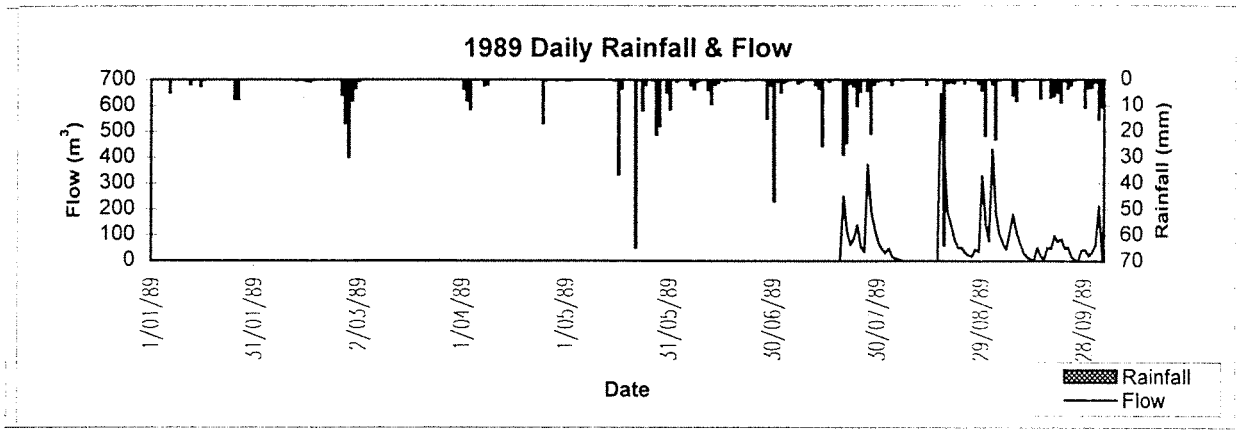




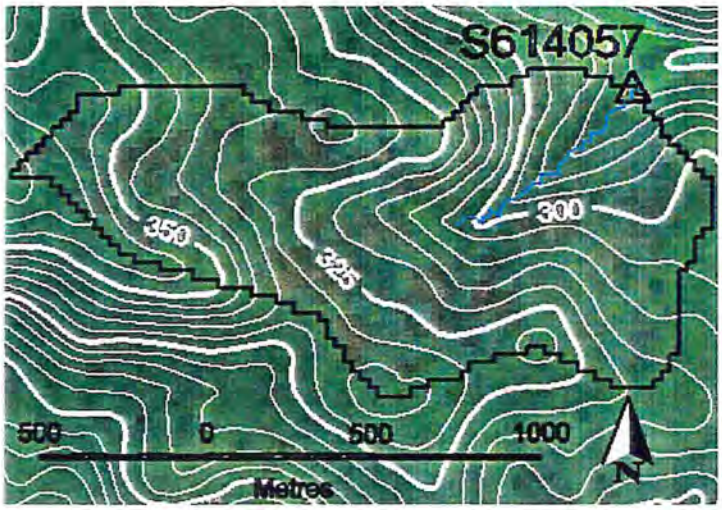


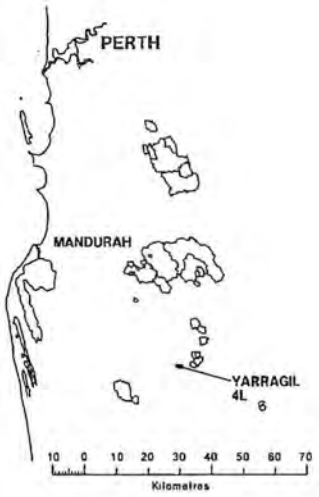


Wuraming 9A Catchment - S 614056



Yarragil 4L Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S614057	
Rainfall Gauge Number	M509225	
Information about catchment		
Catchment area	1.28 km^2	
Gauging Station Coordinates (AMG)	N 6365200	E 424260
Treatment data	Logging in 1983.	

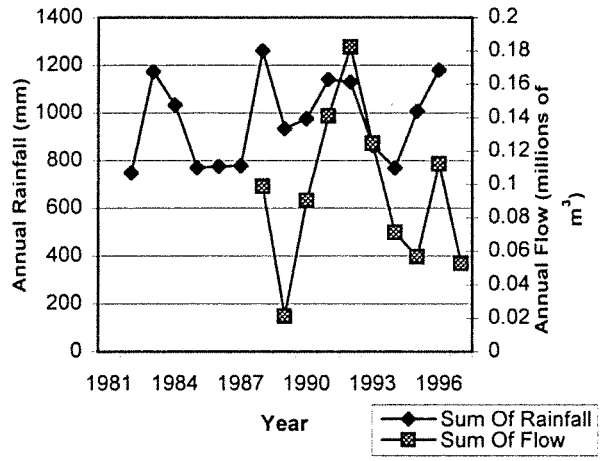
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	6015	4014	0
Number of years recorded	17	12	
Number of years with complete records	15	10	
Start date	9/04/81	4/05/87	
Finish date	26/09/97	29/04/98	
Number of days with quality code 0	34	0/01/00	
Number of days with quality code 1	5882	3774	
Number of days with quality code 2	0	139	
Number of days with quality code 3	2	18	
Number of days with quality code 5	16	0	
Number of days with quality code 7	80	0	
Number of days with quality code 8	1	0	
Number of days with quality code 157	0	77	
Number of days with quality code 255	0	6	

Year	**Number of flow days**
1988	195
1989	126
1990	213
1991	214
1992	264
1993	365
1994	224
1995	175
1996	197
1997	212
Total	**2185**

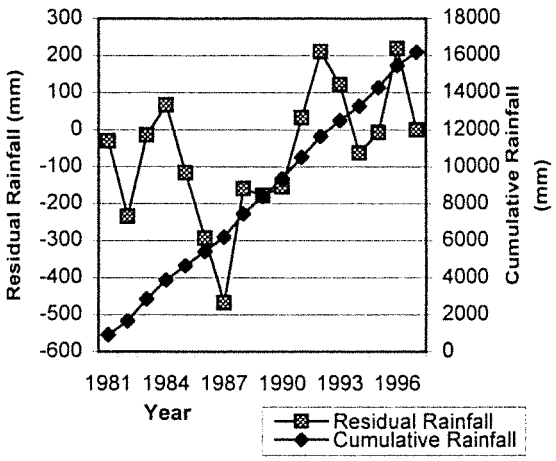
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	969.3	0.095
Min	748.4	0.021
Max	1261.7	0.182

Yarragil 4L Catchment - S 614057

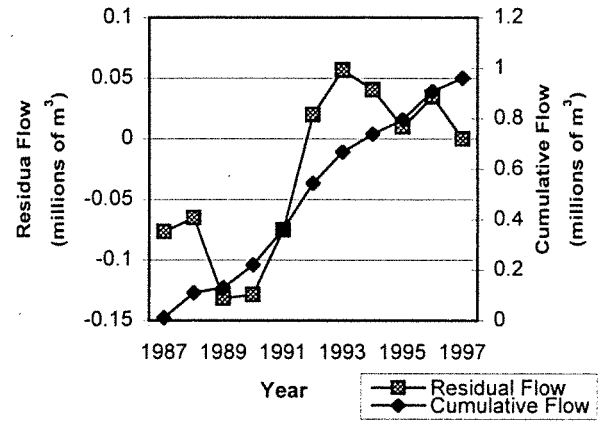
Annual Rainfall & Flow



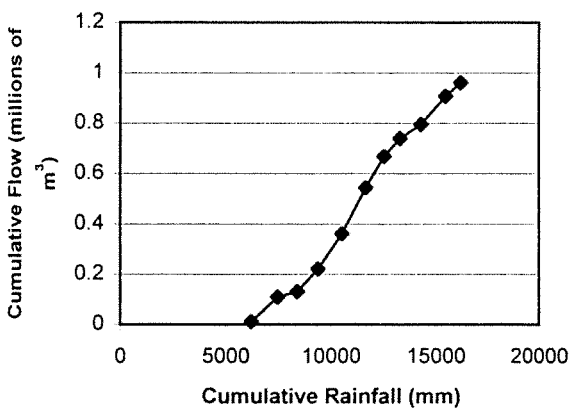
Annual Cumulative & Residual Rainfall Curves



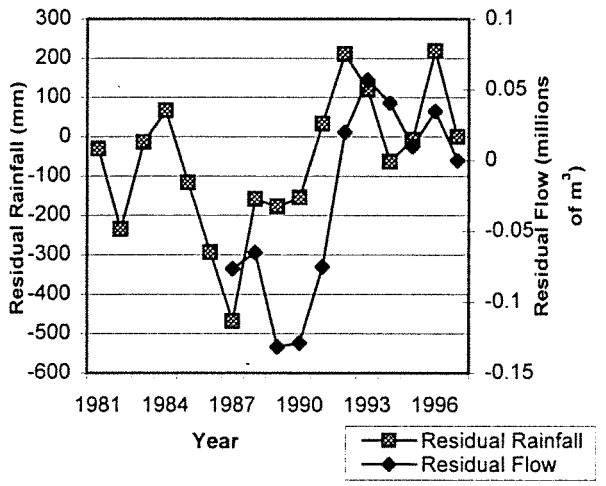
Annual Cumulative & Residual Flow Curves



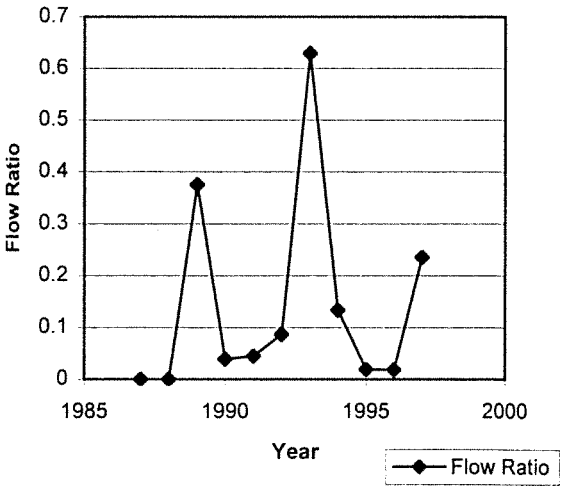
Annual Cumulative Flow & Cumulative Rainfall Curves



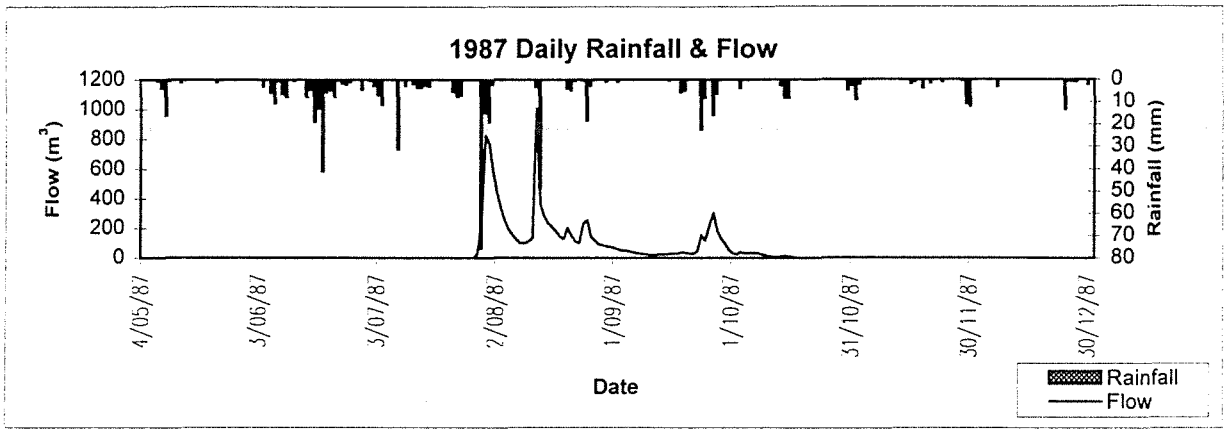
Annual Residual Flow & Residual Rainfall Curves

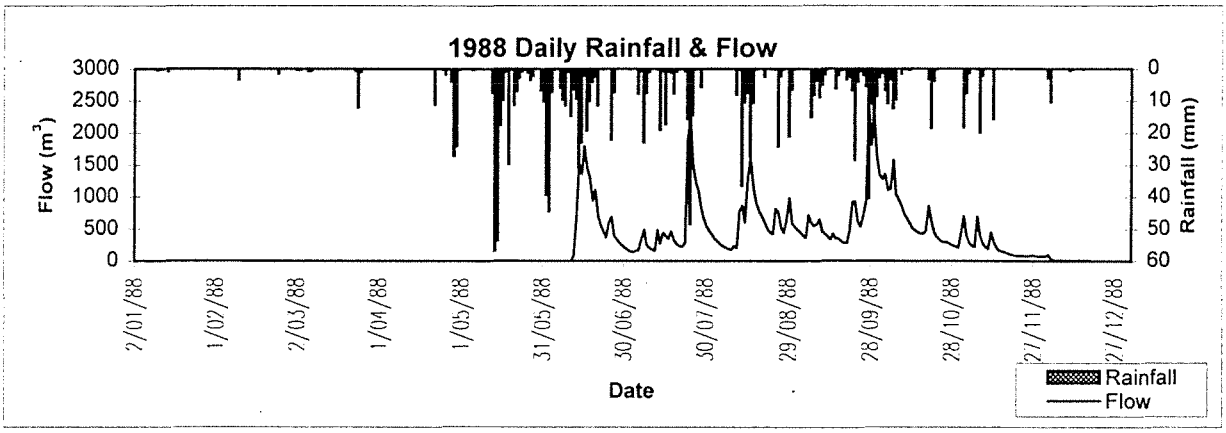


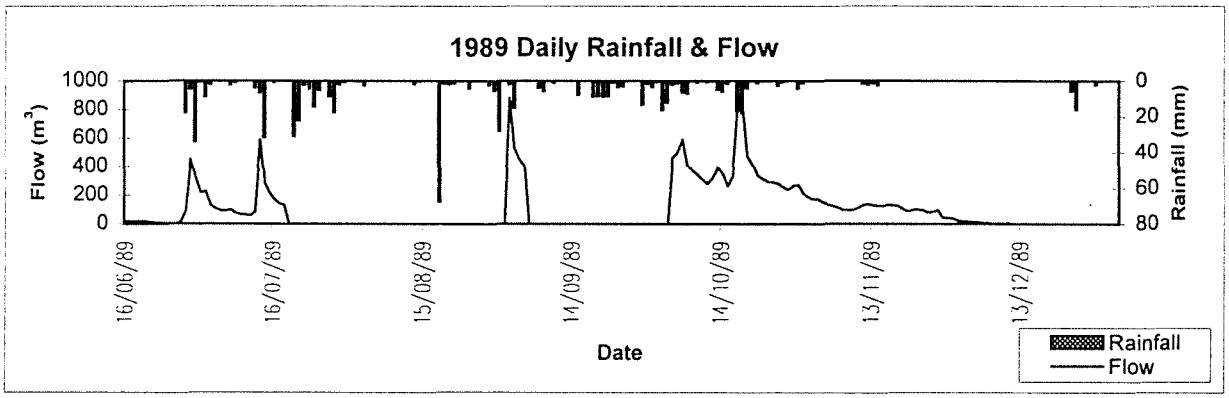
Flow Ratio of Summer to Winter

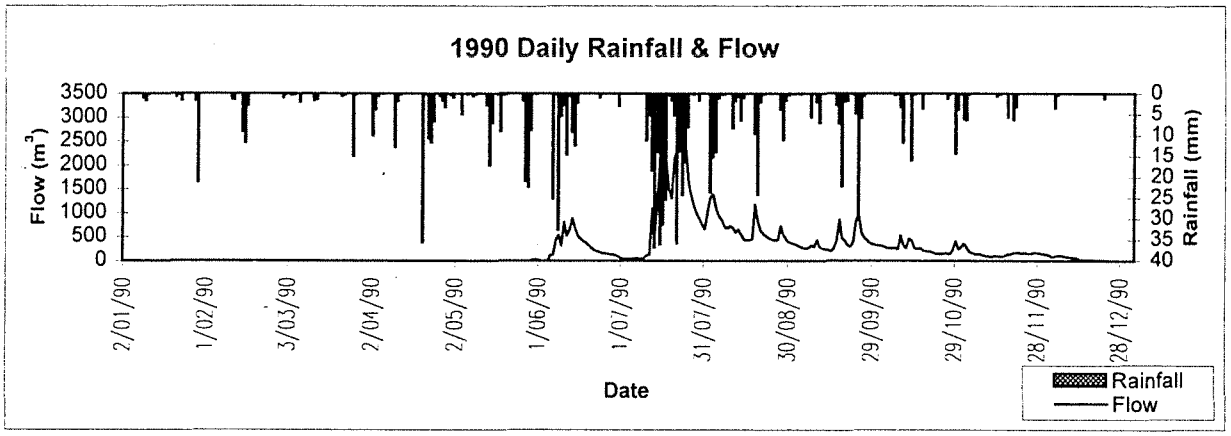


Yarragil 4L Catchment - S 614057

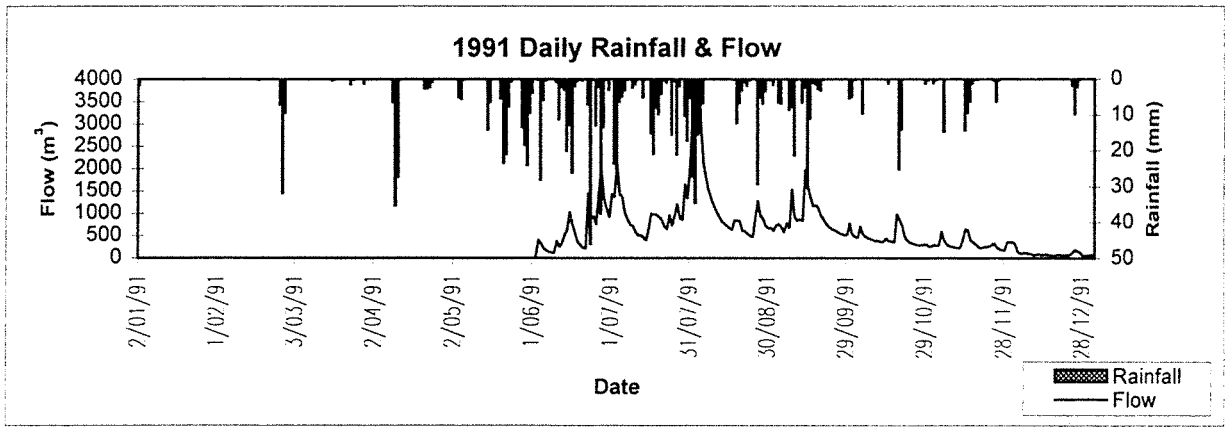


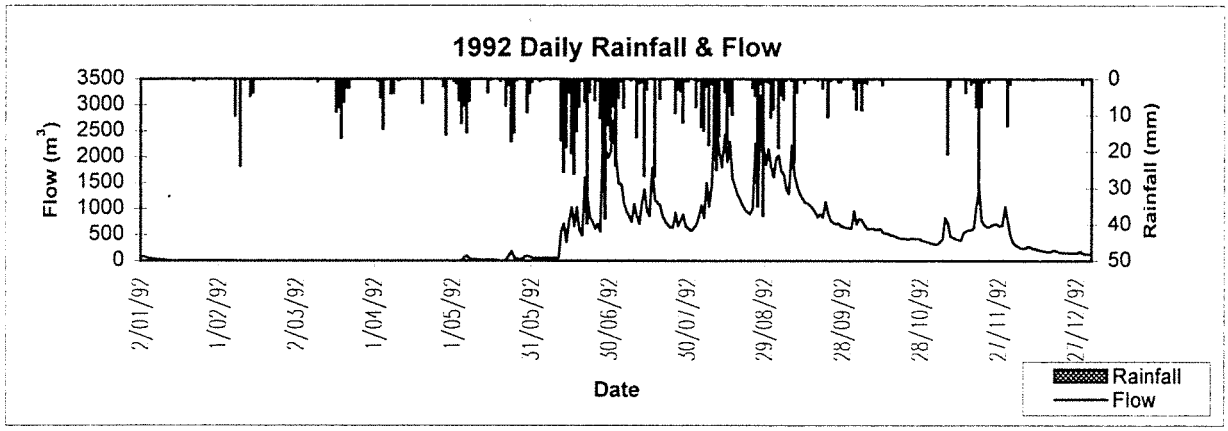


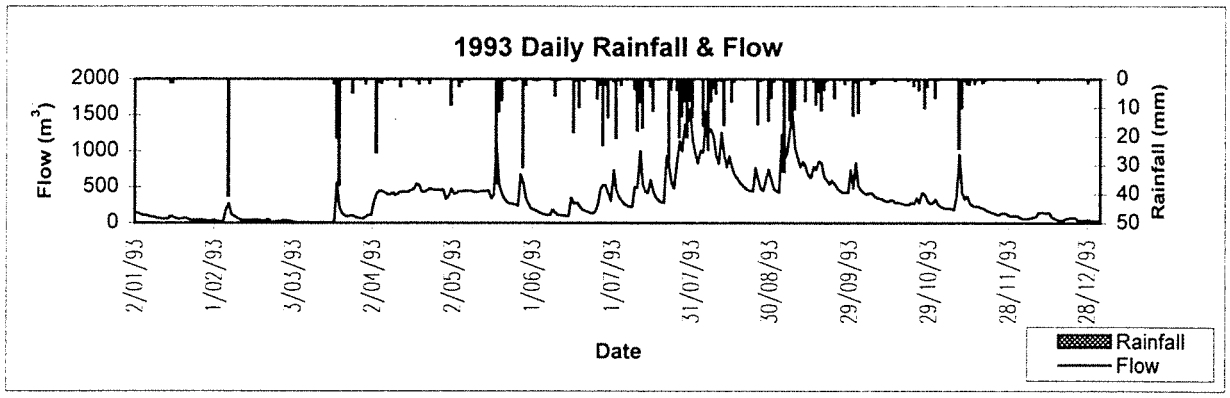


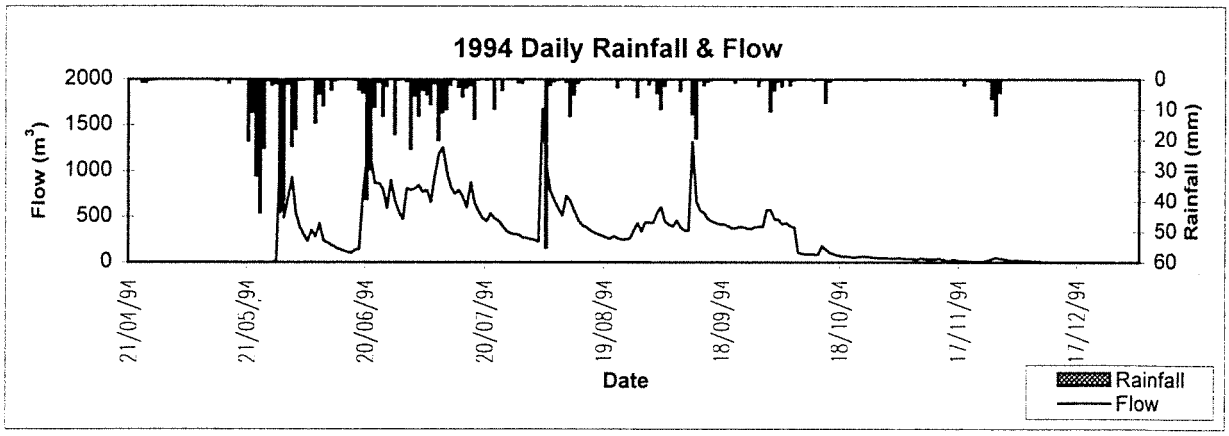


Yarragil 4L Catchment - S 614057

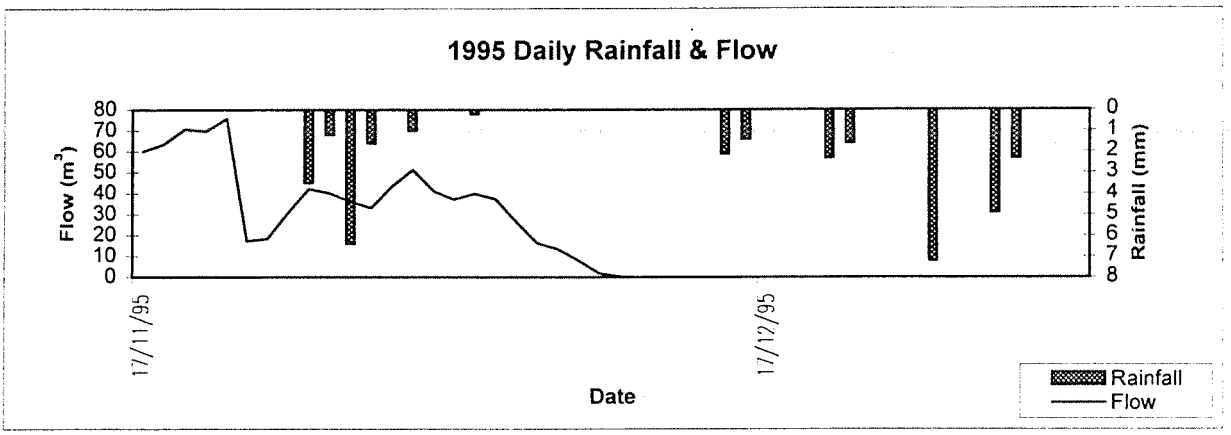


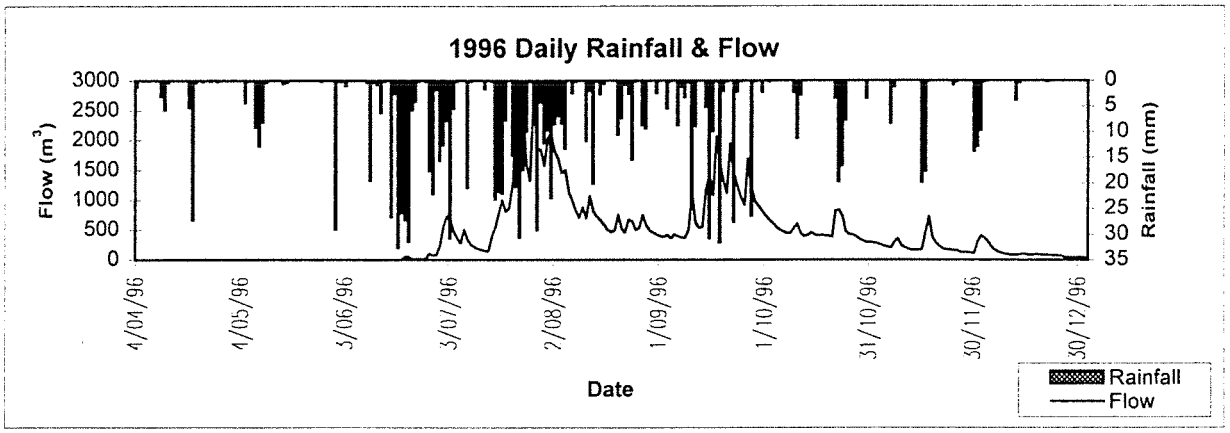


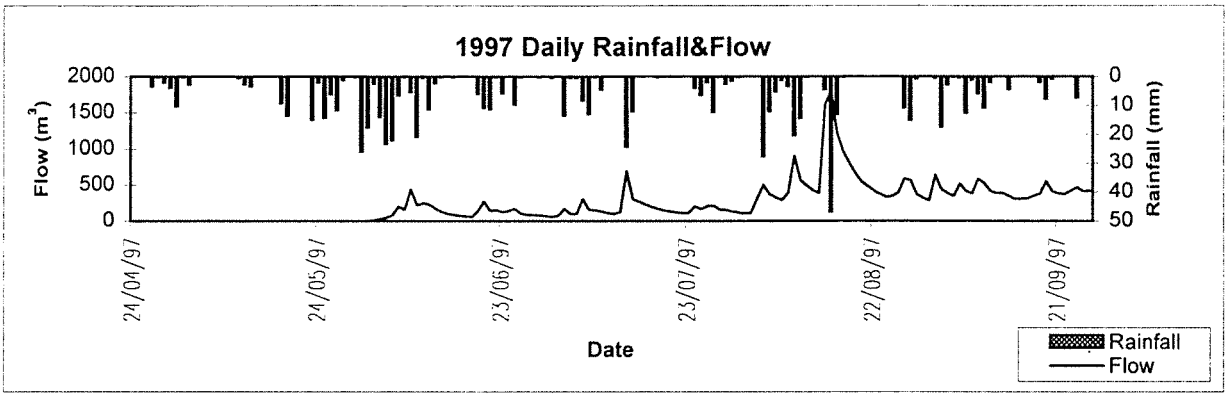




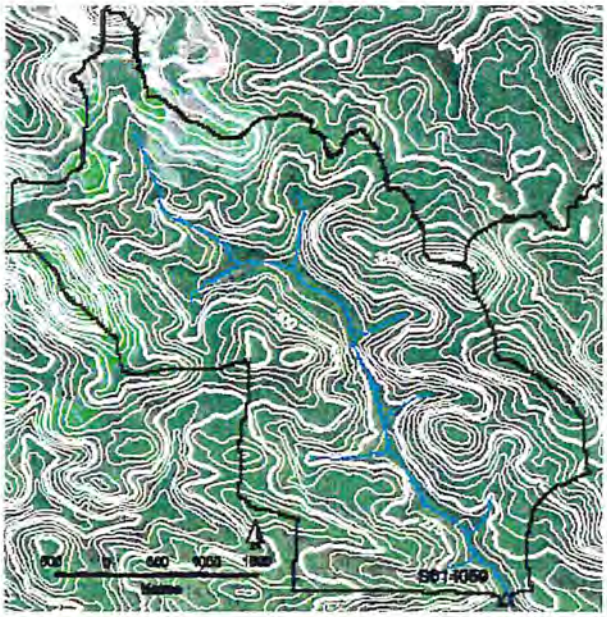
Yarragil 4L Catchment - S 614057

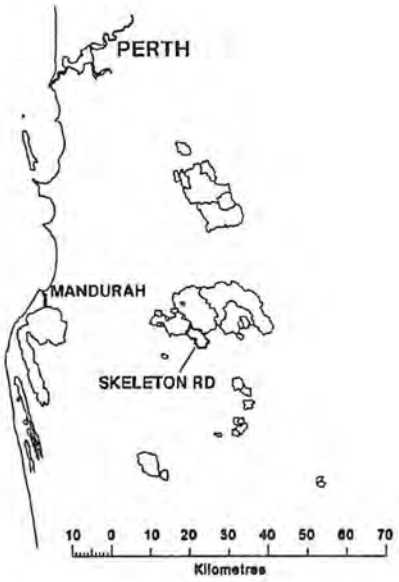






Skeleton Road Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

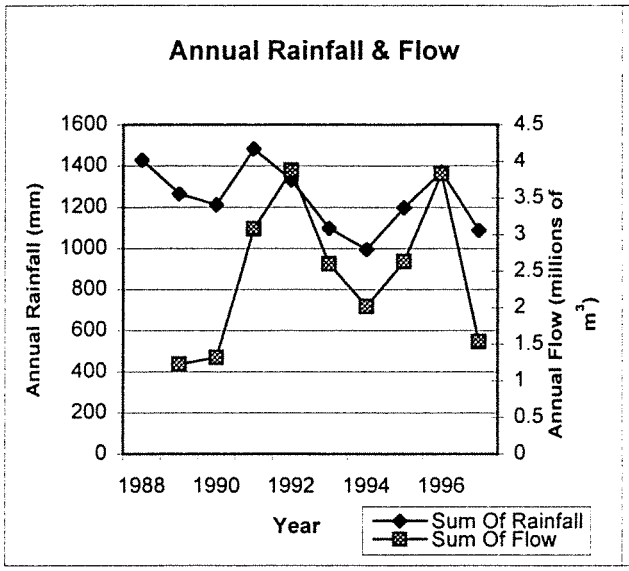
Gauging Station Number	S614059
	Hansens (M 509347) rainfall data
Information about catchment	
Catchment area	18.65 km^2
Gauging Station Coordinates (AMG)	N 6386600 E 420200
Treatment data	Normal Forest Management

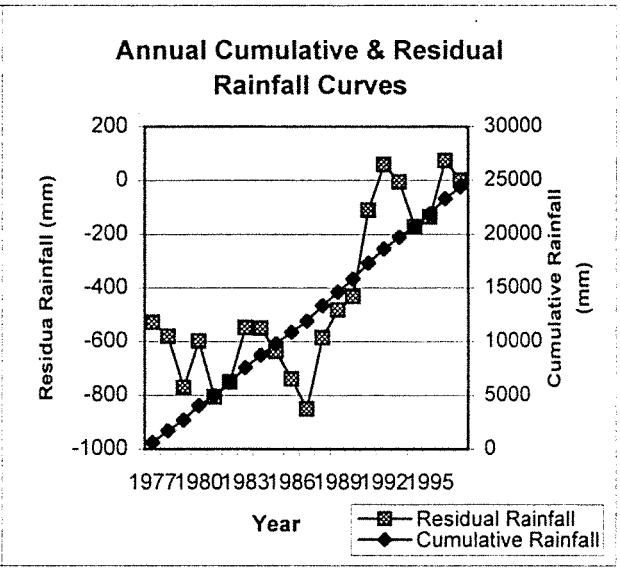
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	0	3524	0
Number of years recorded		11	
Number of years with complete records		9	
Start date		31/05/88	
Finish date		22/01/98	
Number of days with quality code 1		3315	
Number of days with quality code 2		13	
Number of days with quality code 3		7	
Number of days with quality code 255		189	

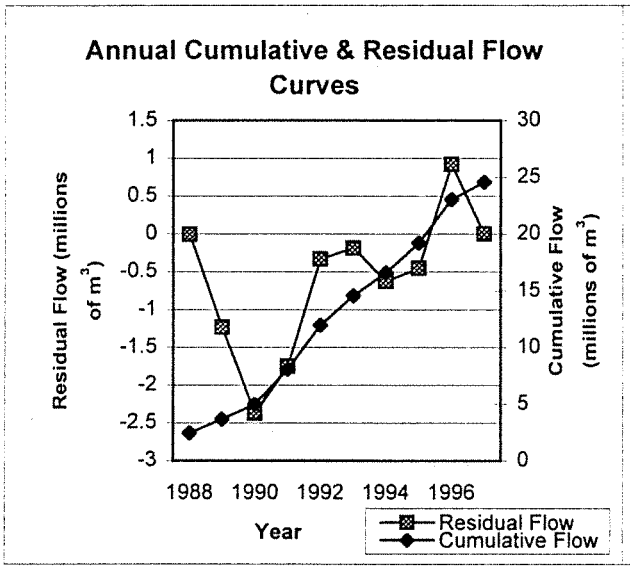
Year	**Number of flow days**
1989	200
1990	201
1991	214
1992	149
1993	267
1994	202
1995	209
1996	201
1997	188
Total	**1831**

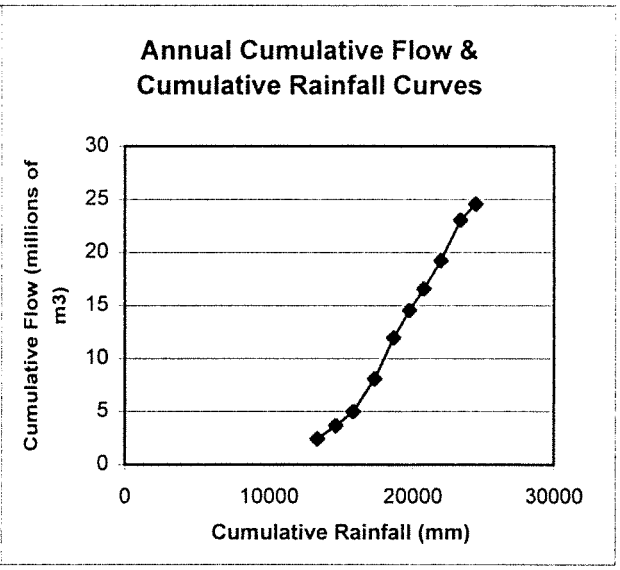
Annual Basic Statistics	Flow (millions of m^3)
Average	2.458
Min	1.228
Max	3.878

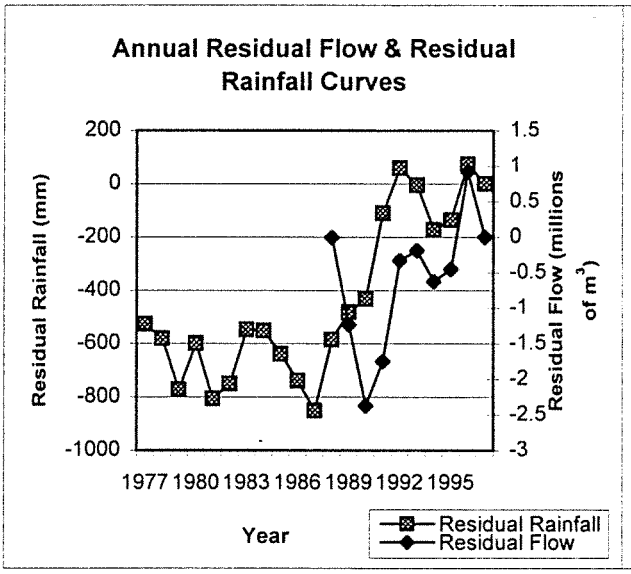
Skeleton Road Catchment - S 614059

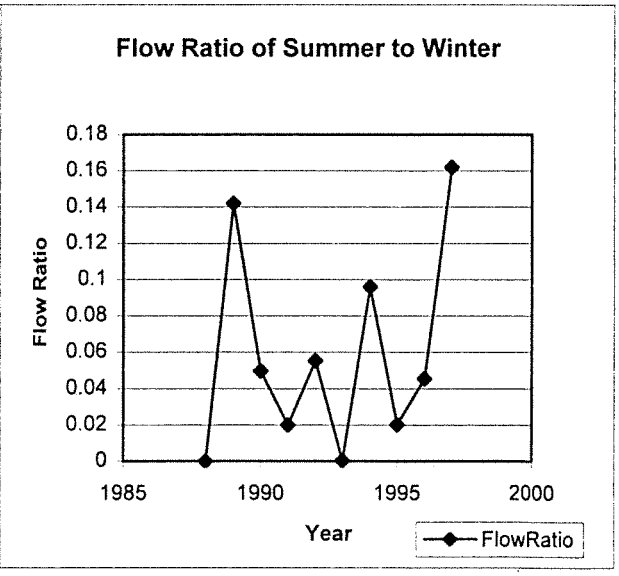




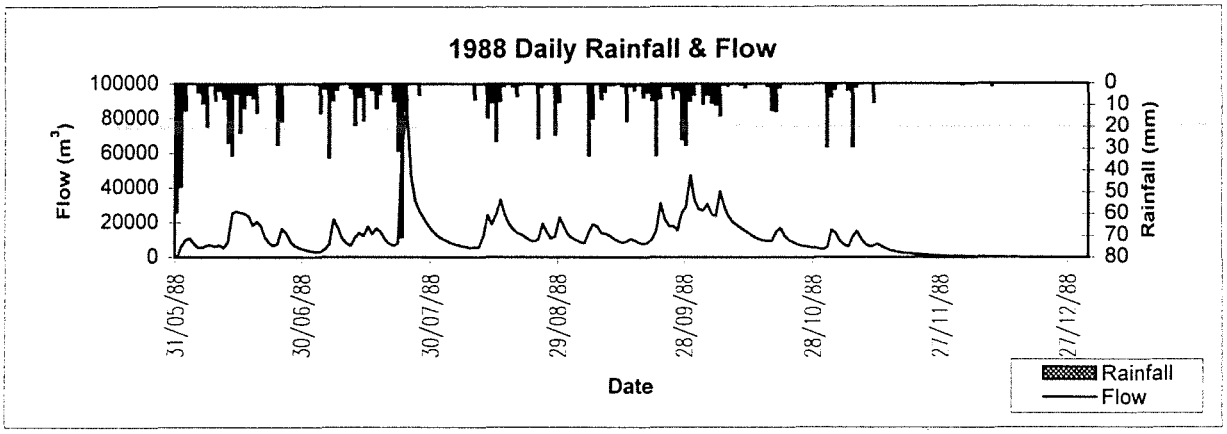


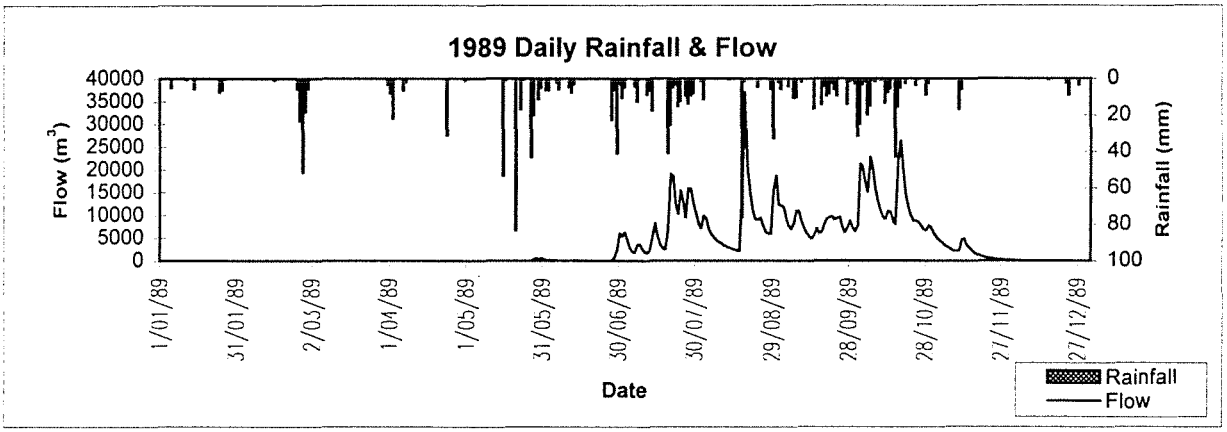


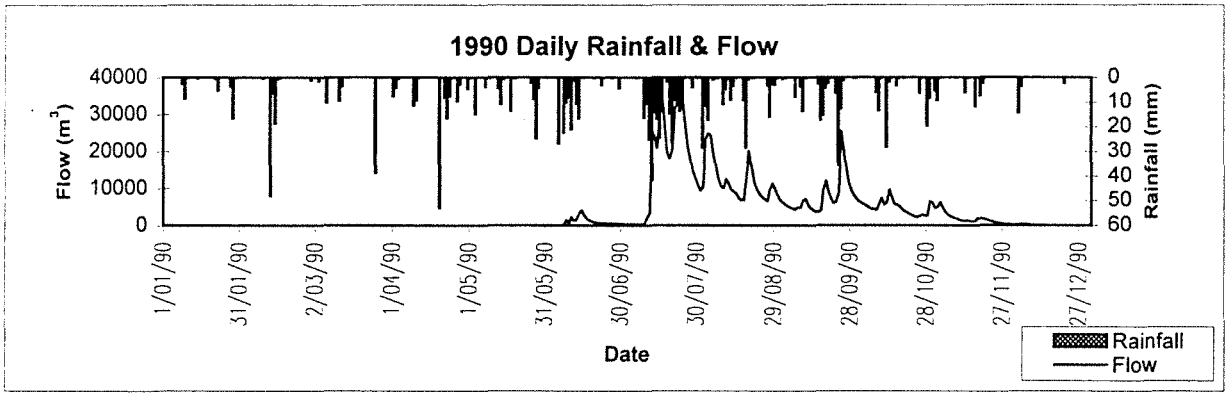


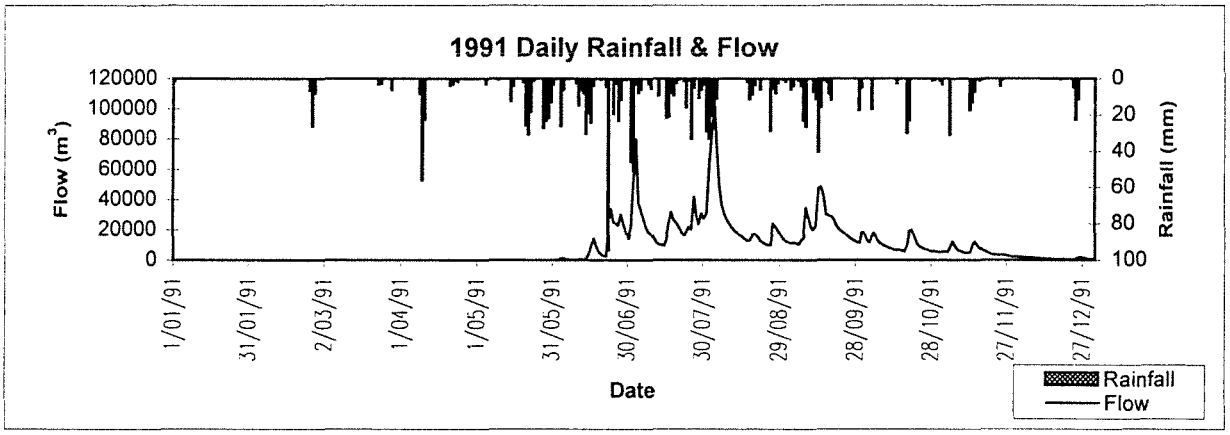


Skeleton Road Catchment - S 614059

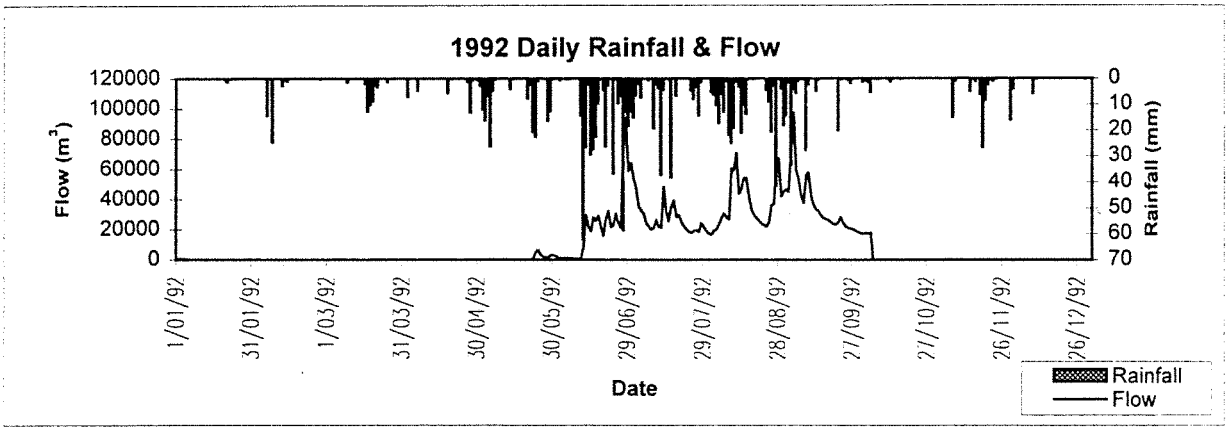


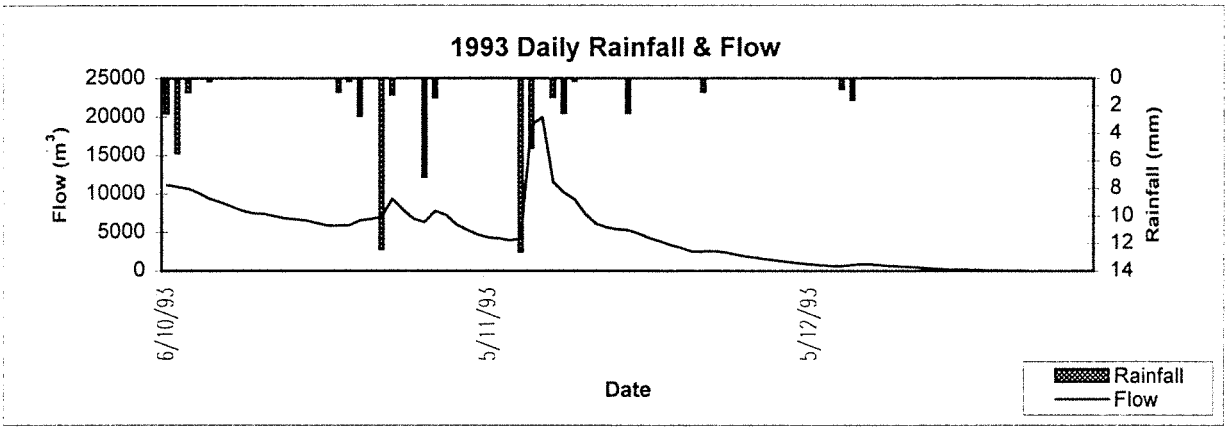


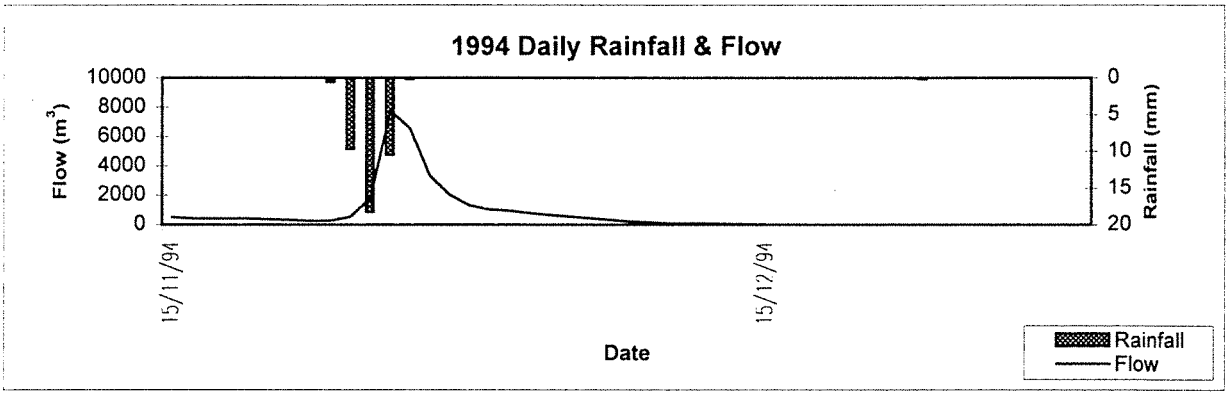


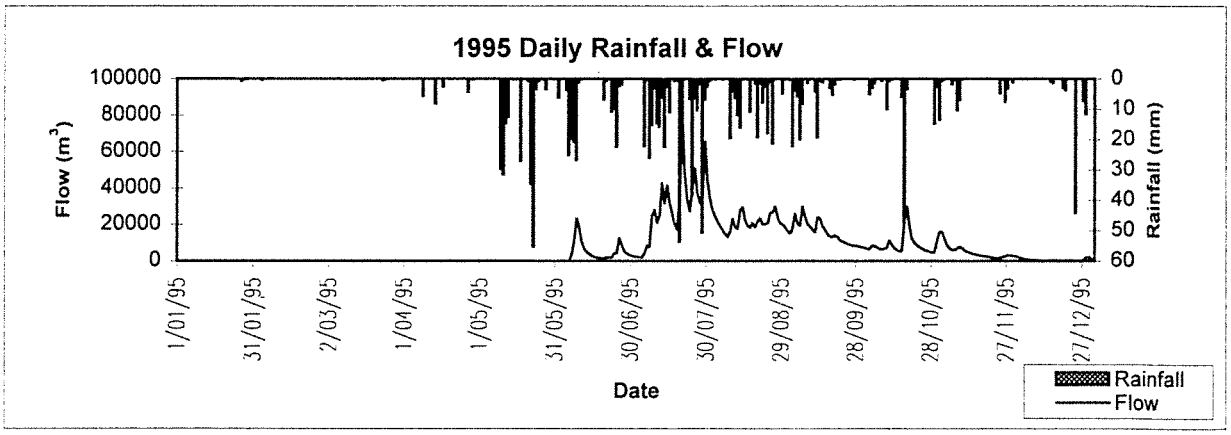


Skeleton Road Catchment - S 614059

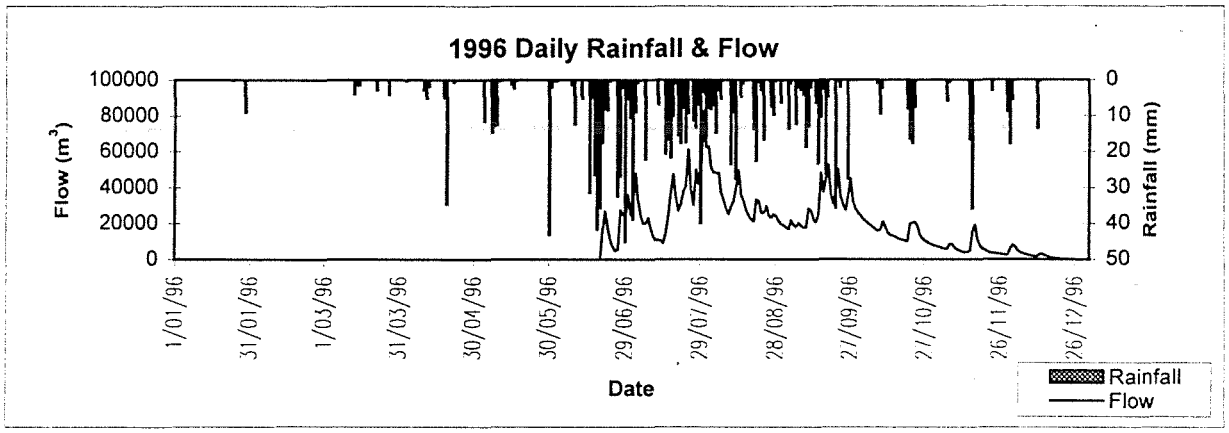


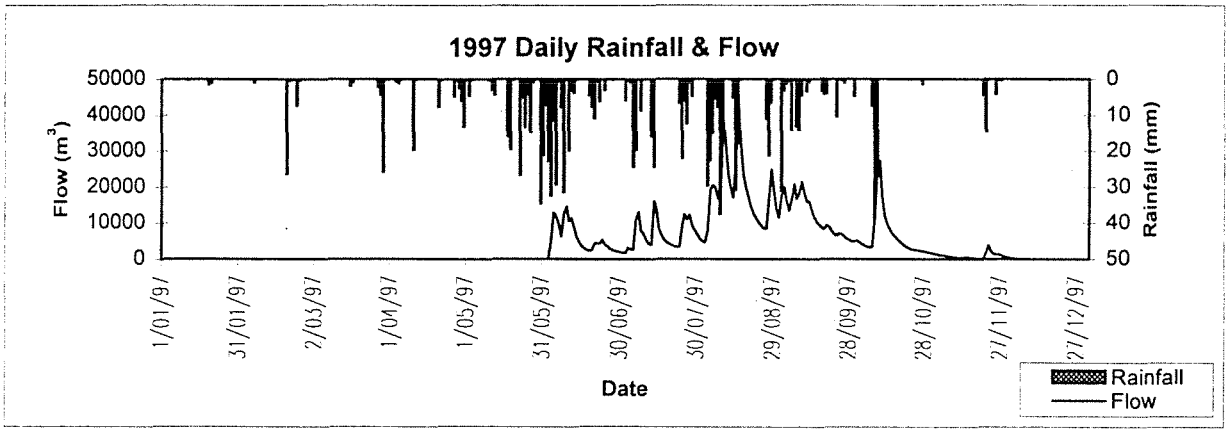




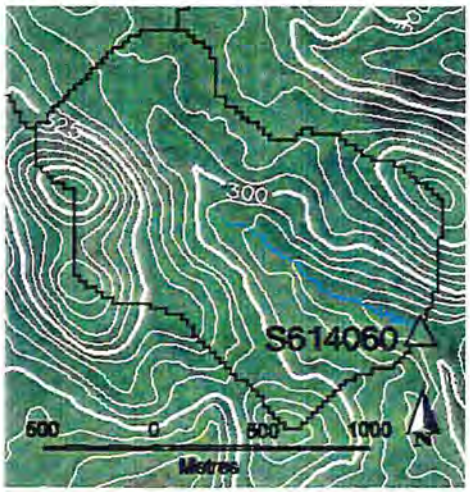


Skeleton Road Catchment - S 614059





Gordon Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

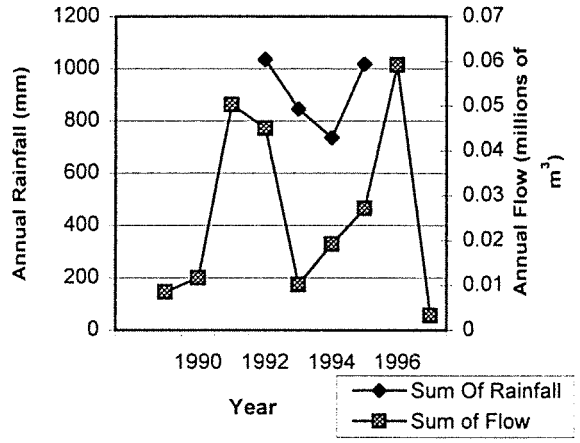
Gauging Station Number	S614060
Rainfall Gauge Number	M509568
Information about catchment	
Catchment area	2.1 km2
Gauging Station Coordinates (AMG)	N 6389100
	E 430000
Treatment data	Control Catchment

Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	1828	3535	2438
Number of years recorded	7	11	8
Number of years with complete records	5	9	6
Start date	31/12/90	10/05/88	13/05/91
Finish date	1/01/96	12/01/98	13/01/98
Number of days with quality code 0	8	0	0
Number of days with quality code 1	1319	3386	2261
Number of days with quality code 2	68	3	101
Number of days with quality code 3	36	74	58
Number of days with quality code 4	0	58	16
Number of days with quality code 5	1	0	0
Number of days with quality code 8	396	0	0
Number of days with quality code 157	0	9	0
Number of days with quality code 255	0	5	2
Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	908.5	0.026	84.58
Min	736.0	0.003	80.28
Max	1035.0	0.059	90.72

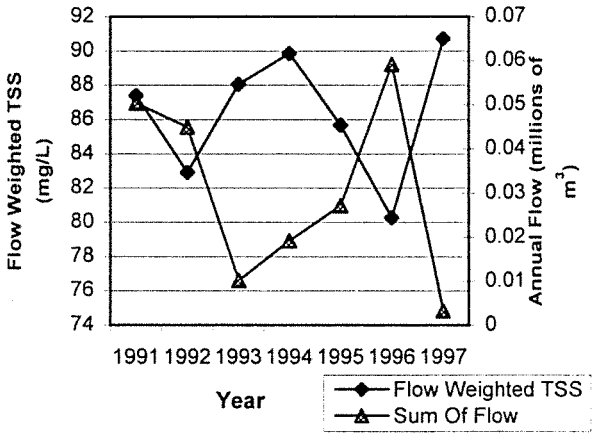
Year	**Number of flow days**
1989	106
1990	100
1991	137
1992	118
1993	77
1994	110
1995	126
1996	133
1997	65
Total	**972**

Gordon Catchment - S 614060

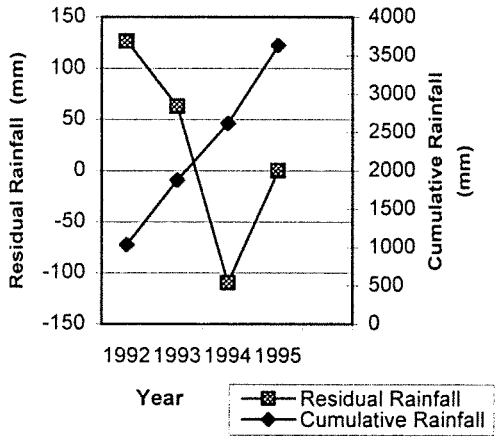
Annual Rainfall & Flow



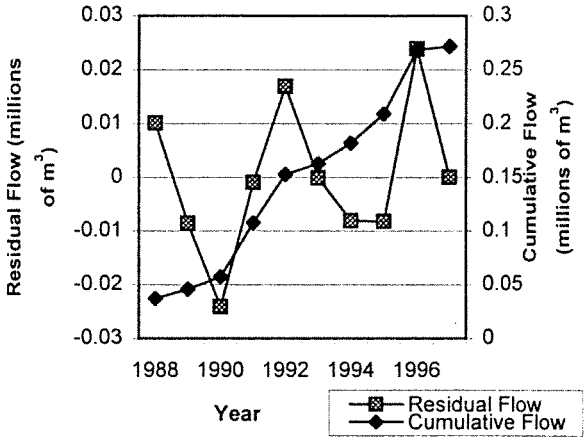
Annual Flow Weighted TSS & Flow



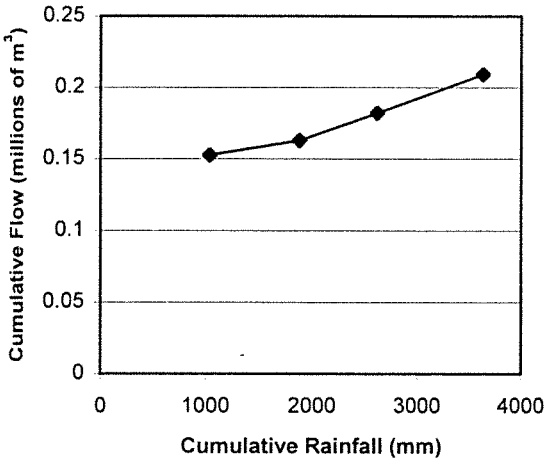
Annual Cumulative & Residual Rainfall Curves



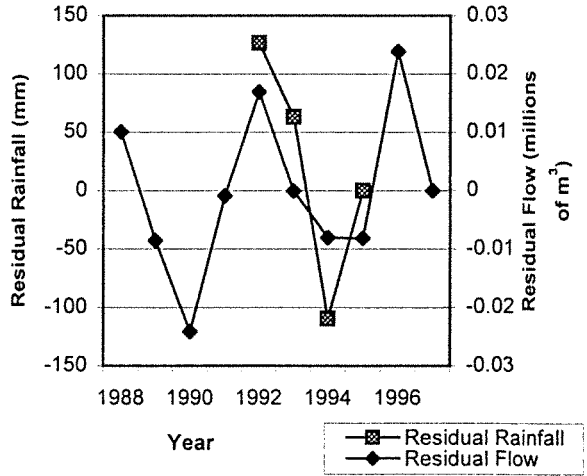
Annual Cumulative & Residual Flow Curves



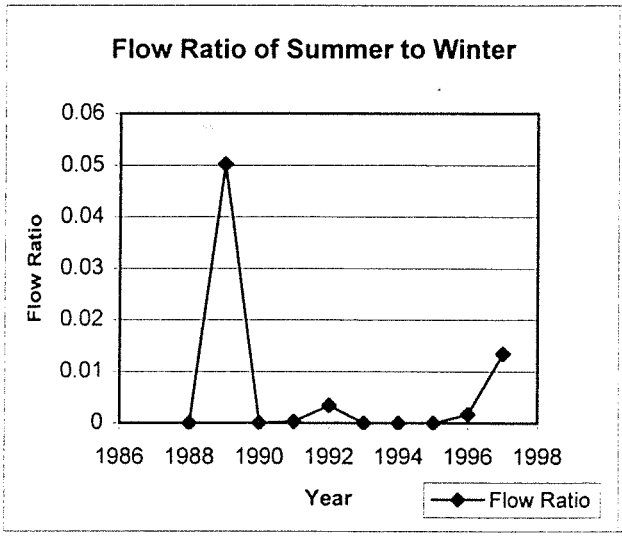
Annual Cumulative Flow & Cumulative Rainfall Curves

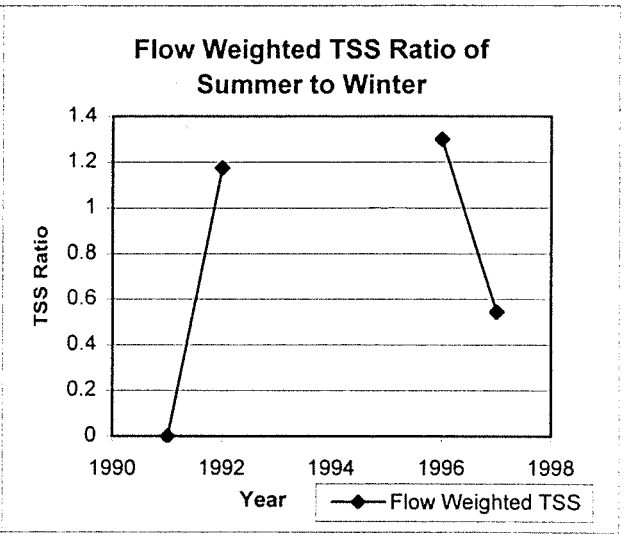


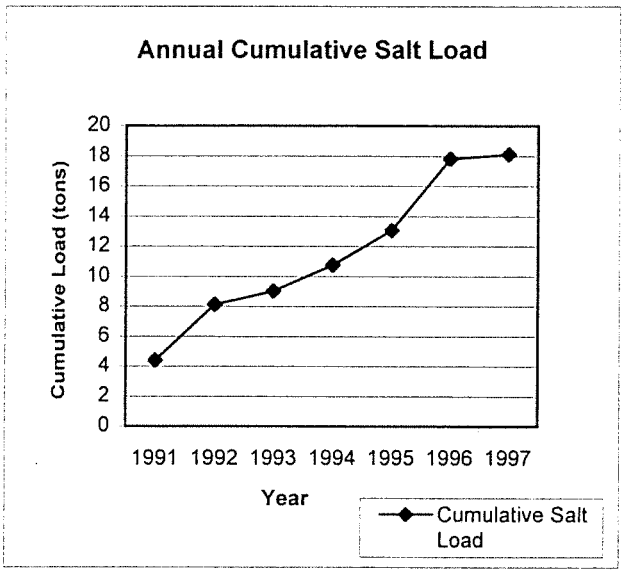
Annual Residual Flow & Residual Rainfall Curves



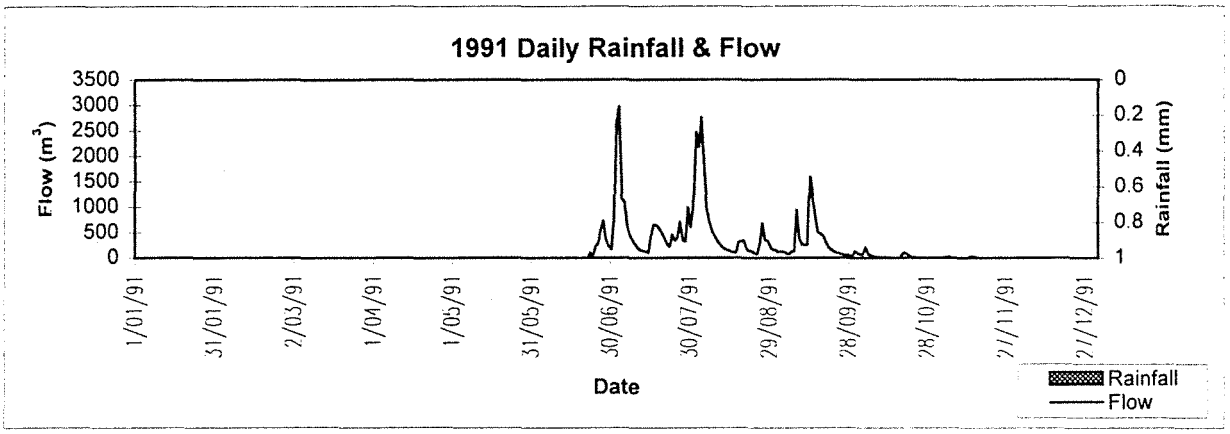
Gordon Catchment - S 614060

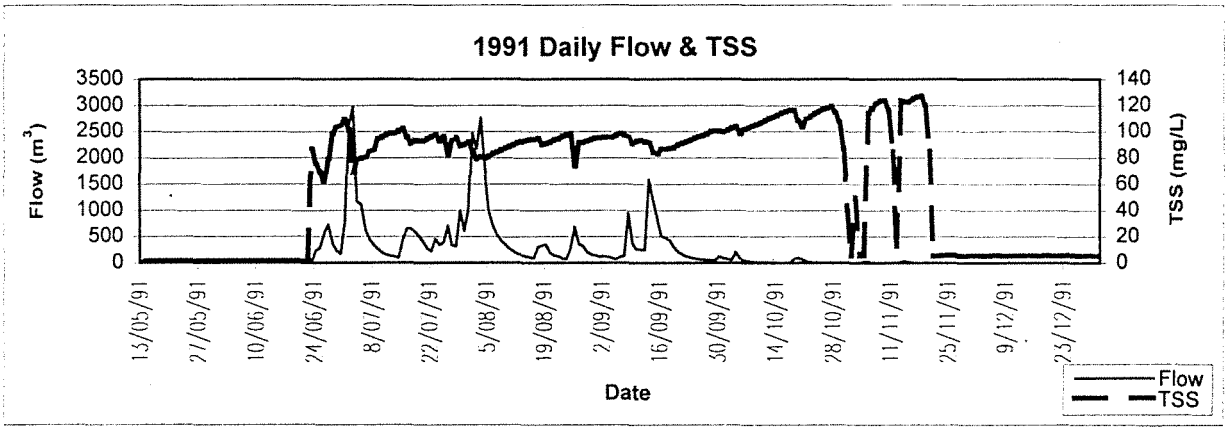


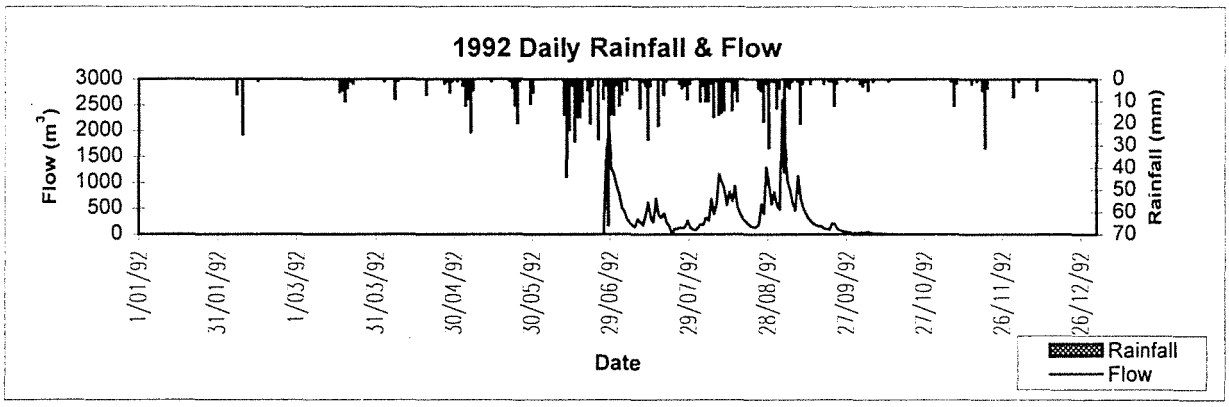


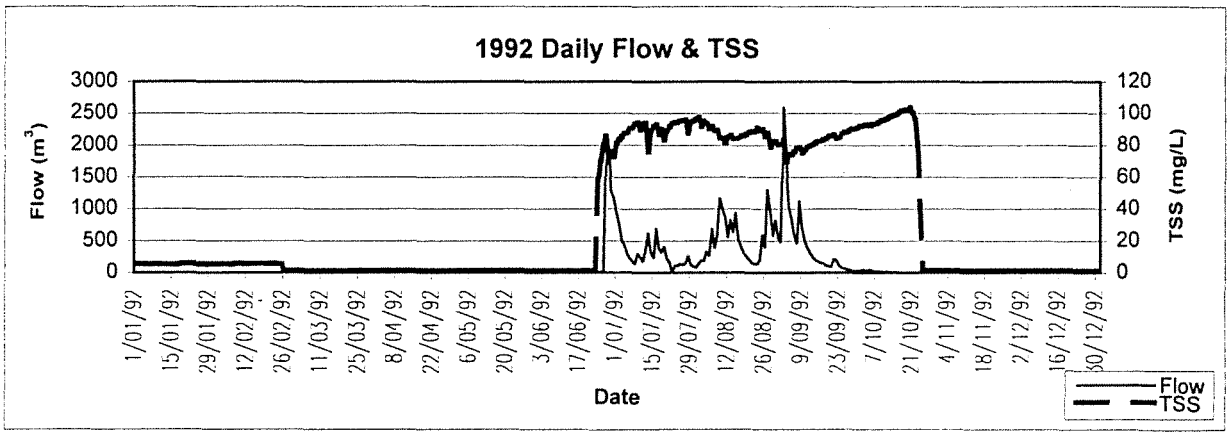


Gordon Catchment - S 614060

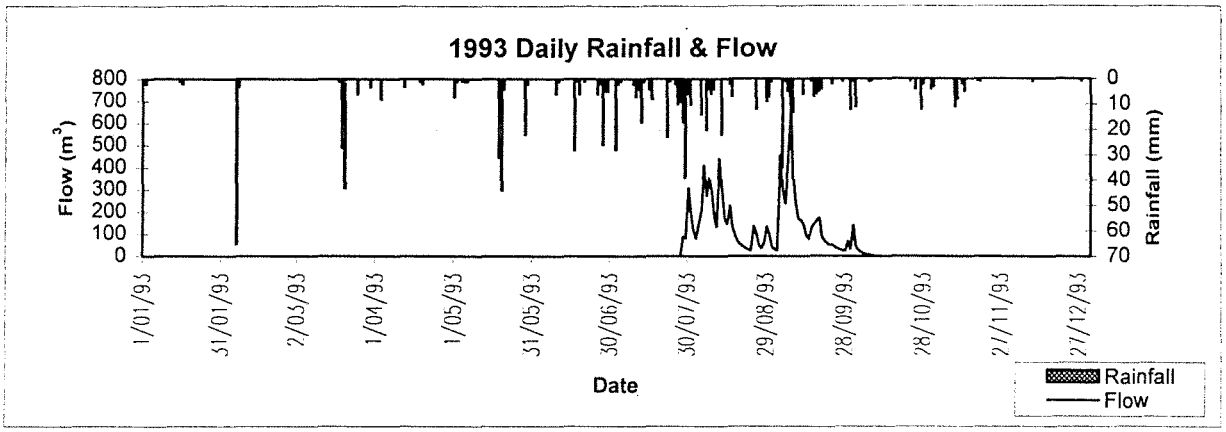


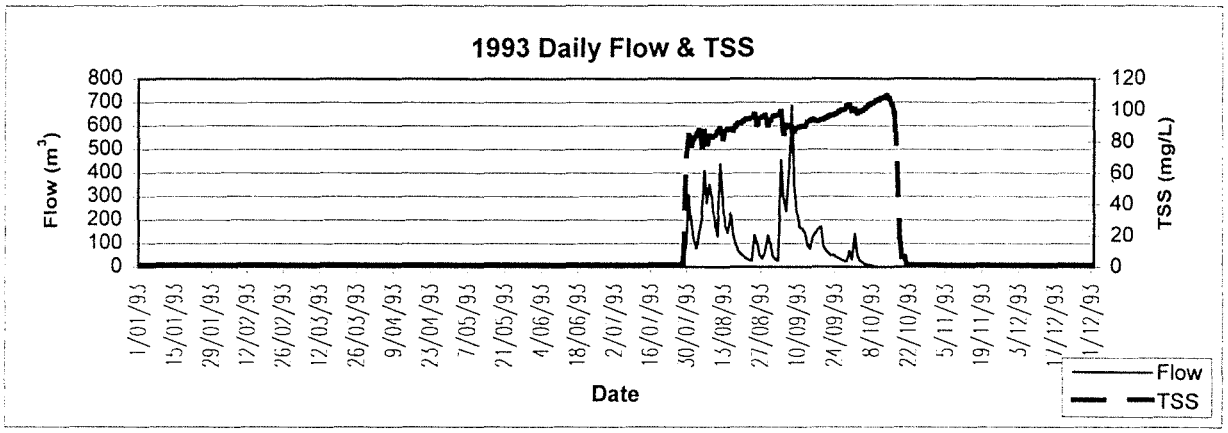


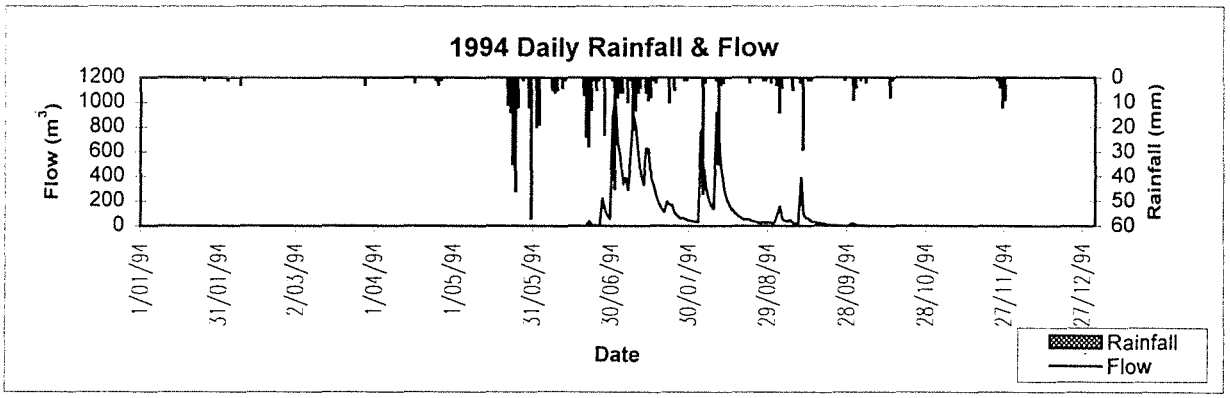


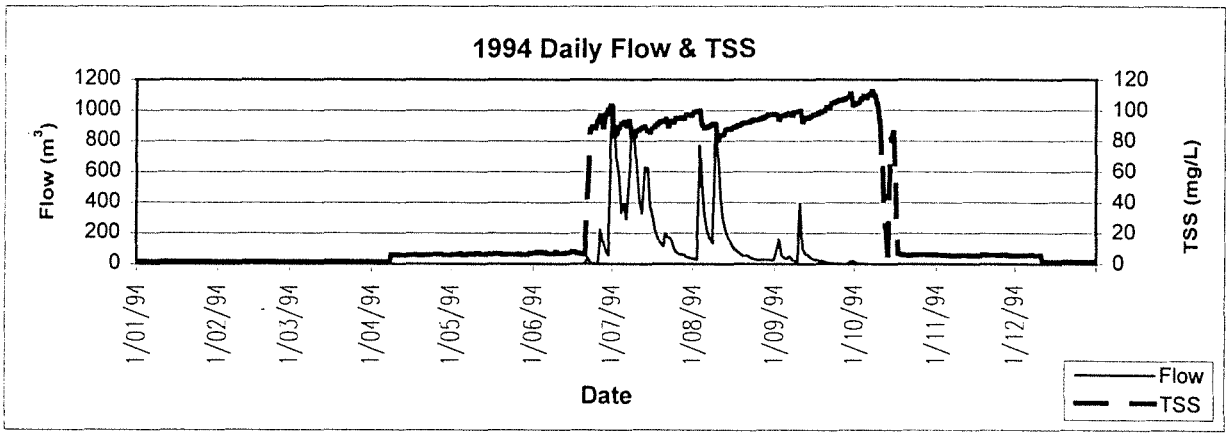


Gordon Catchment - S 614060

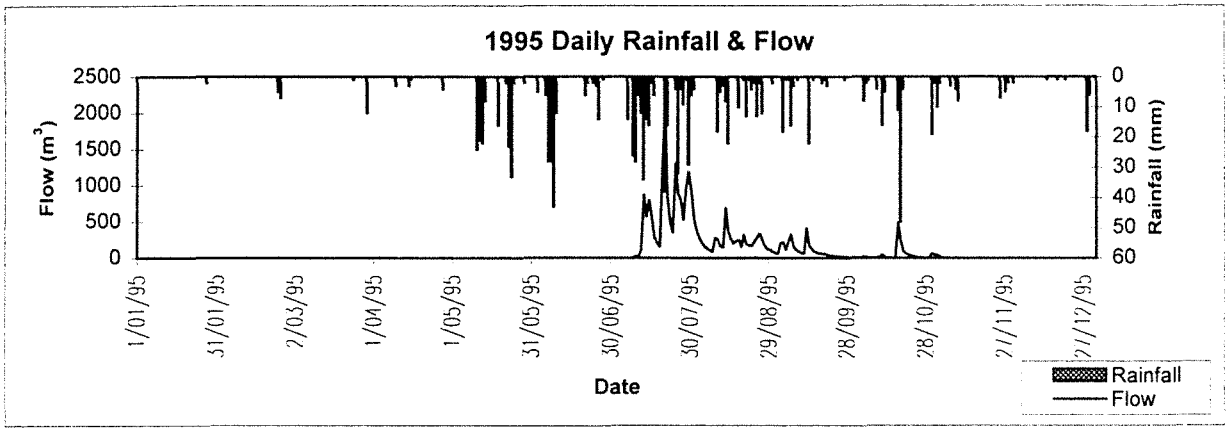


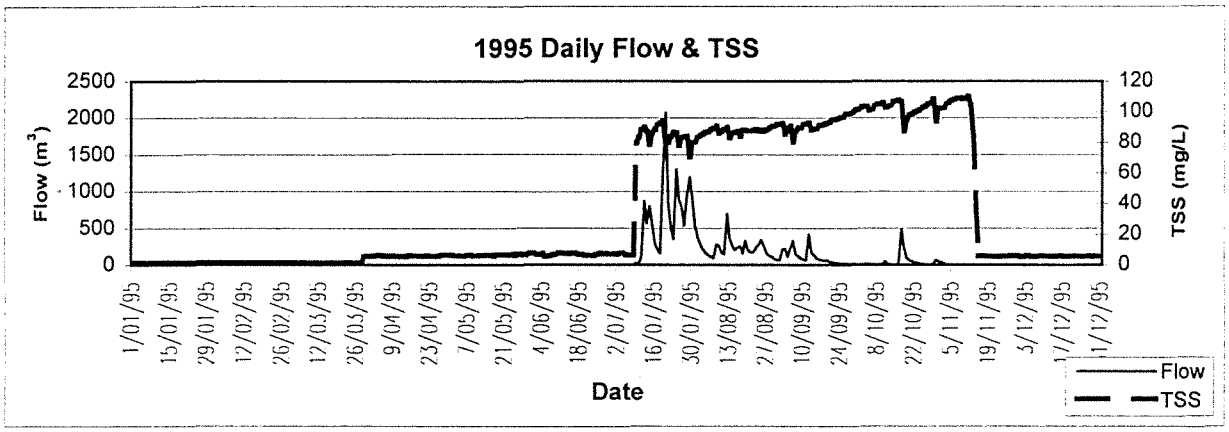




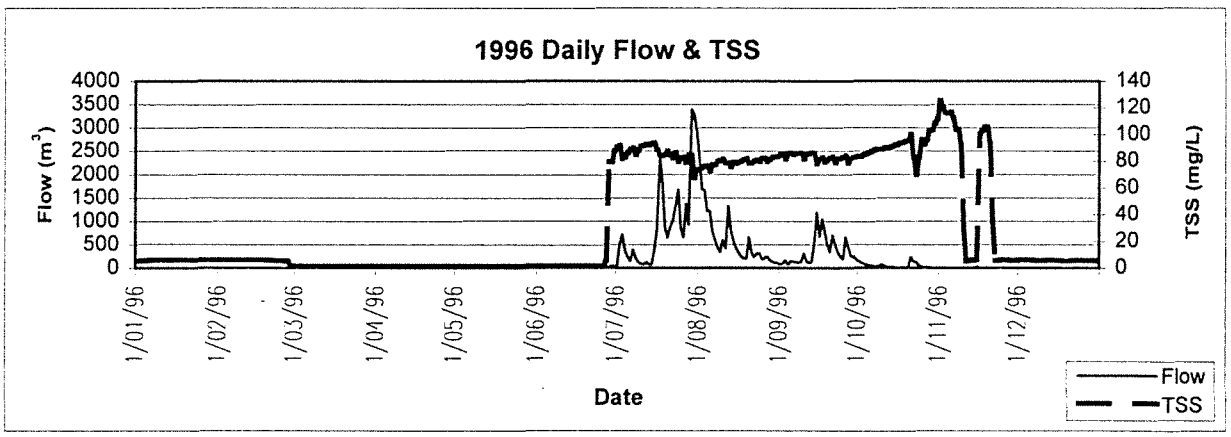


Gordon Catchment - S 614060



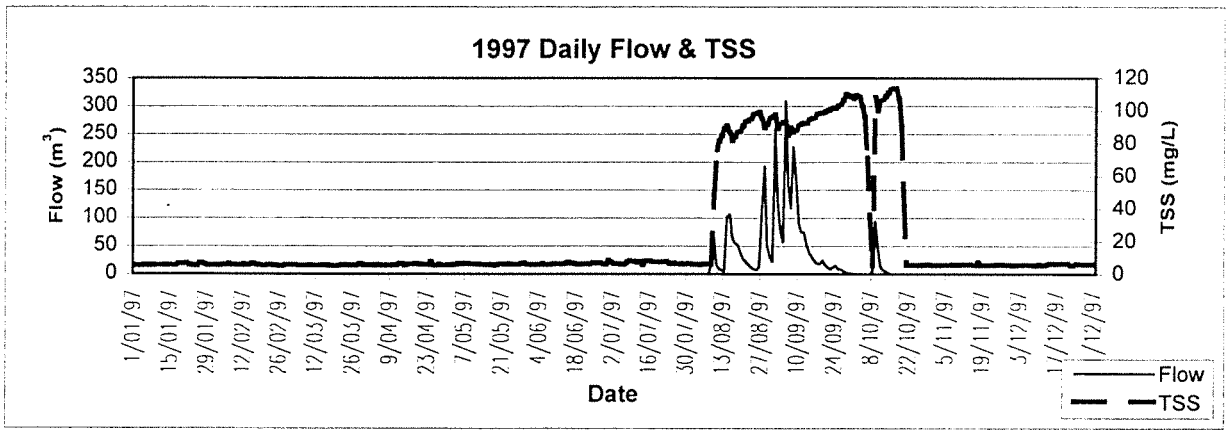


Rainfall data not available for 1996

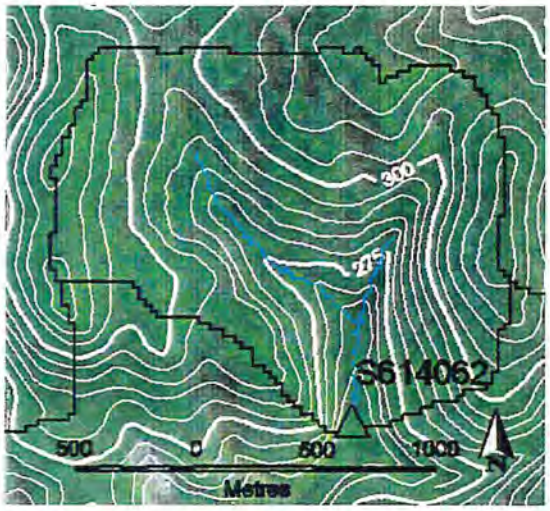


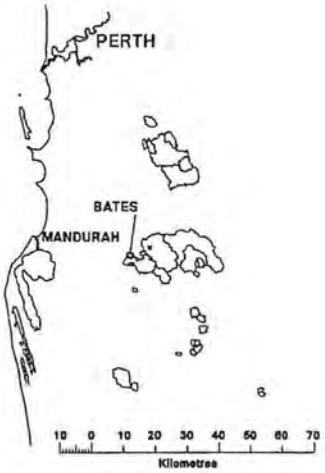
Gordon Catchment - S 614060

Rainfall data not available for 1997



Bates Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

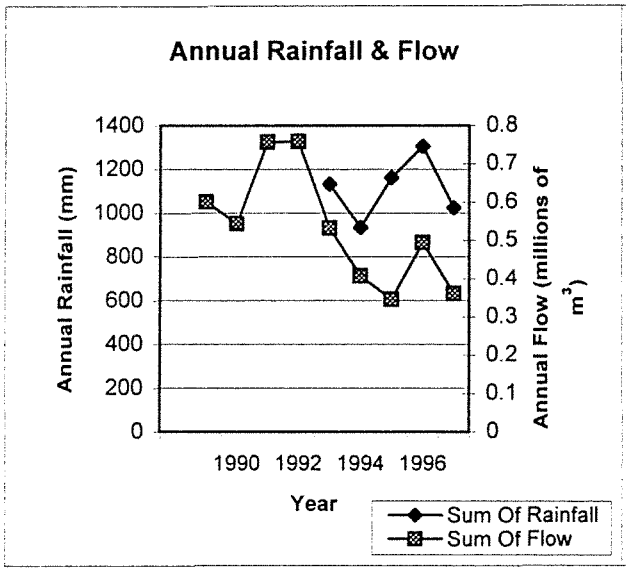
Gauging Station Number	S614062
Rainfall Gauge Number	M509579
Information about catchment	
Catchment area	2.23 km^2
Gauging Station Coordinates (AMG)	N 6394380
	E 408570
Treatment data	Control Catchment

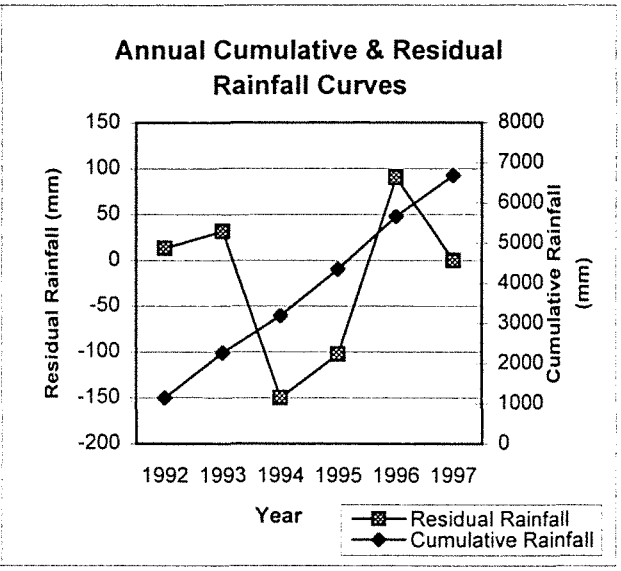
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	2193	3599	0
Number of years recorded	7	11	0
Number of years with complete records	5	9	0
Start date	30/492	1/05/98	
Finish date	23/06/88	30/04/98	
Number of days with quality code 1	2158	3306	0
Number of days with quality code 2	4	84	0
Number of days with quality code 3	28	162	0
Number of days with quality code 4	0	38	0
Number of days with quality code 255	3	255	0

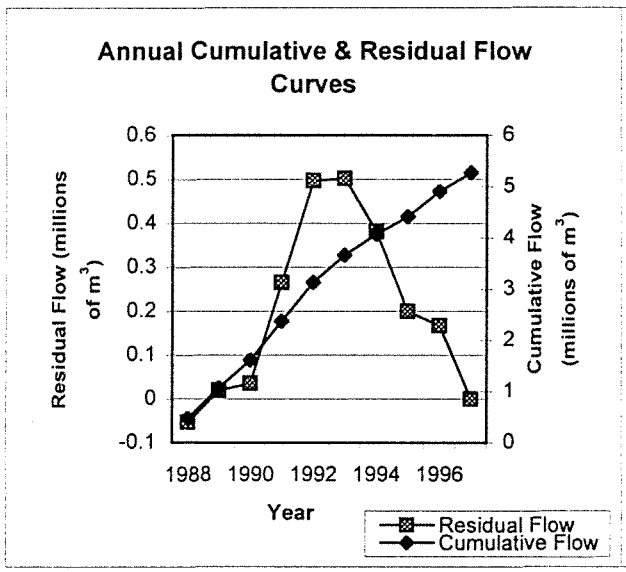
Year	**Number of flow days**
1989	365
1990	365
1991	365
1992	366
1993	363
1994	360
1995	365
1996	366
1997	365
Total	**3280**

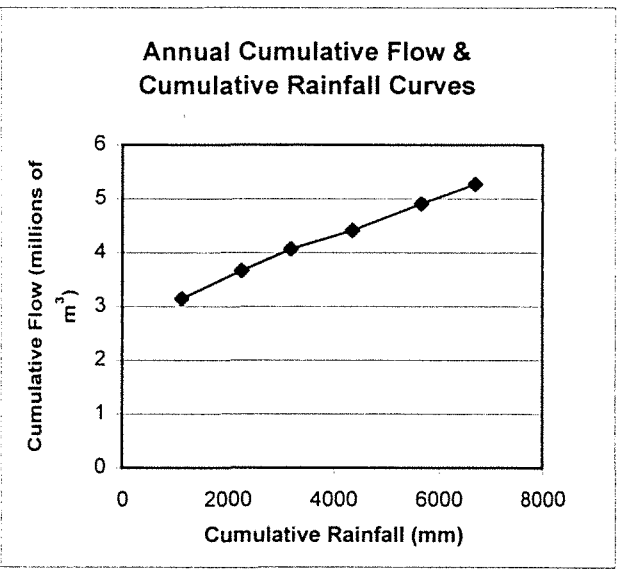
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	1111.9	0.533
Min	933.2	0.346
Max	1306.7	0.759

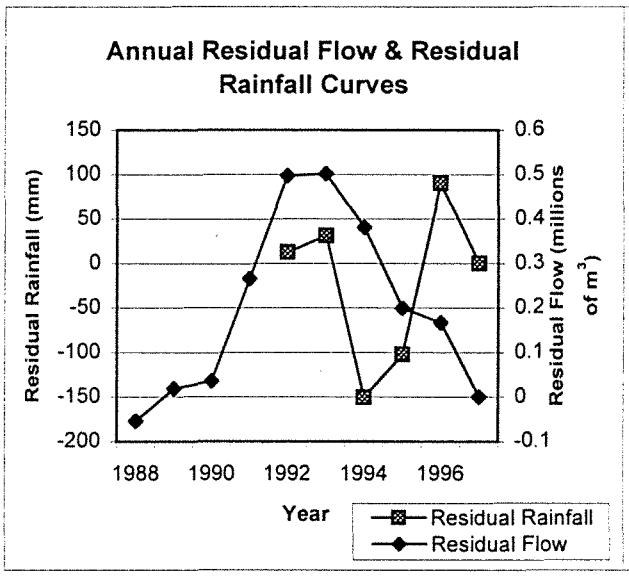
Bates Catchment - S 614062

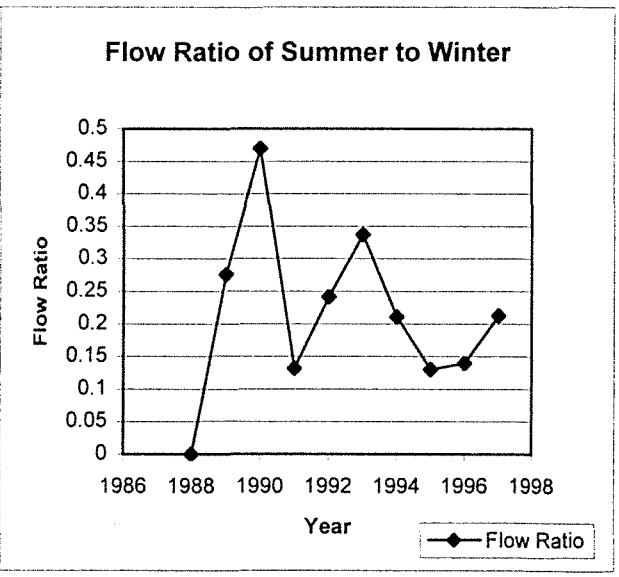




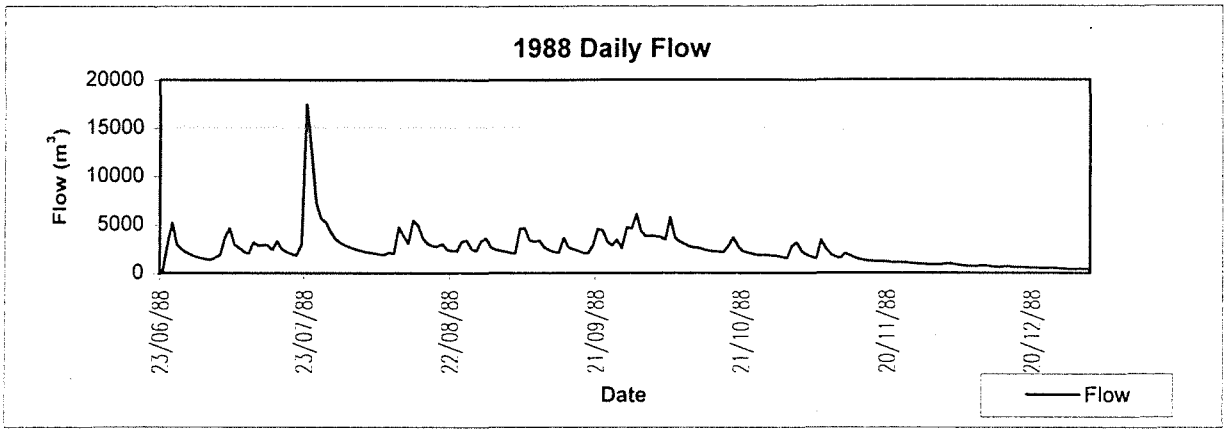


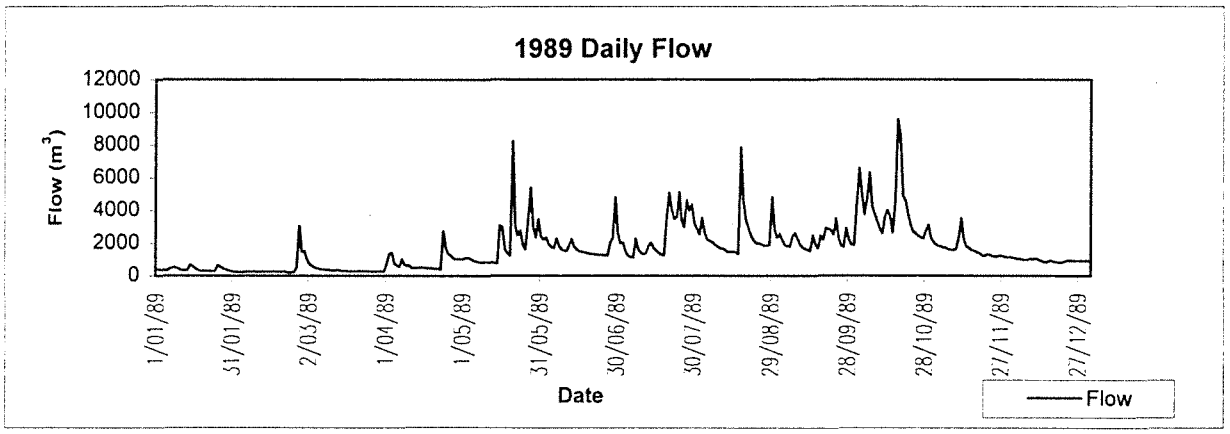


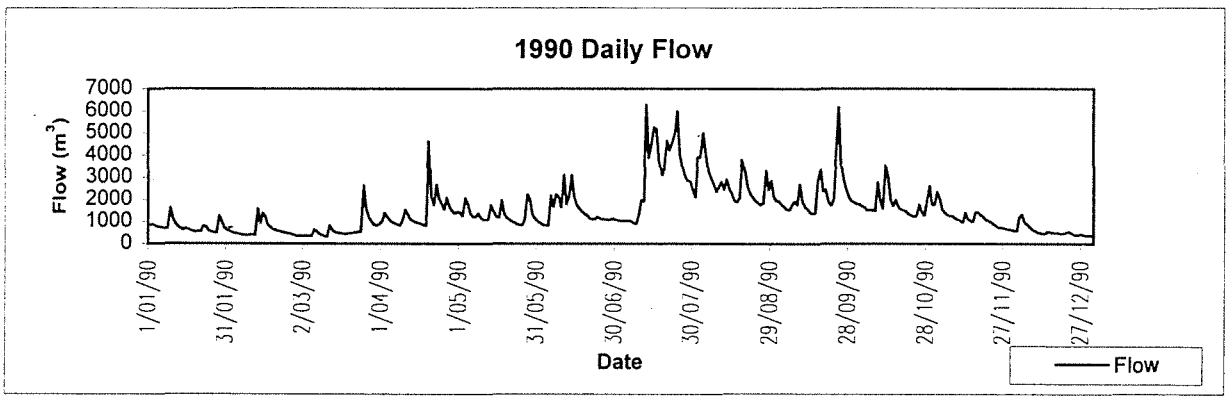


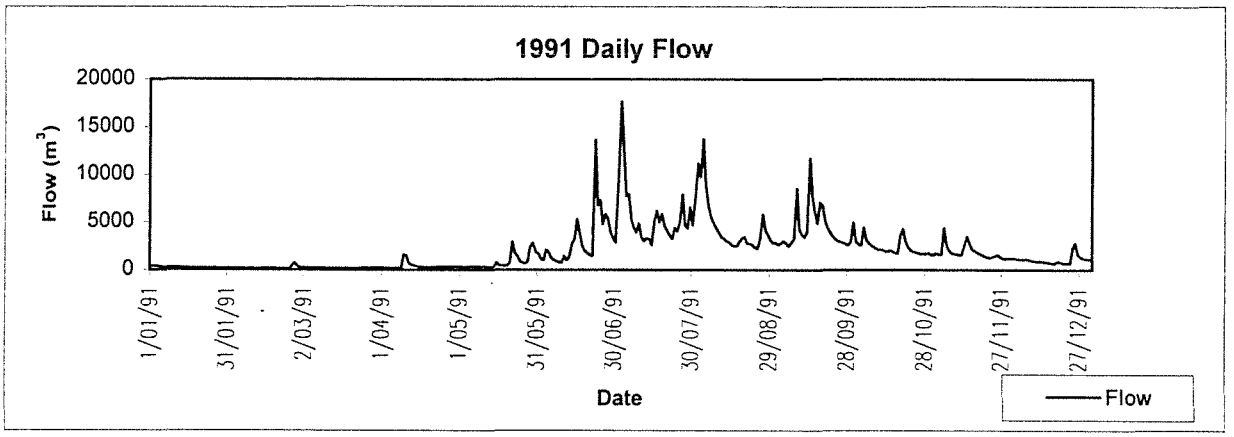


Bates Catchment - S 614062

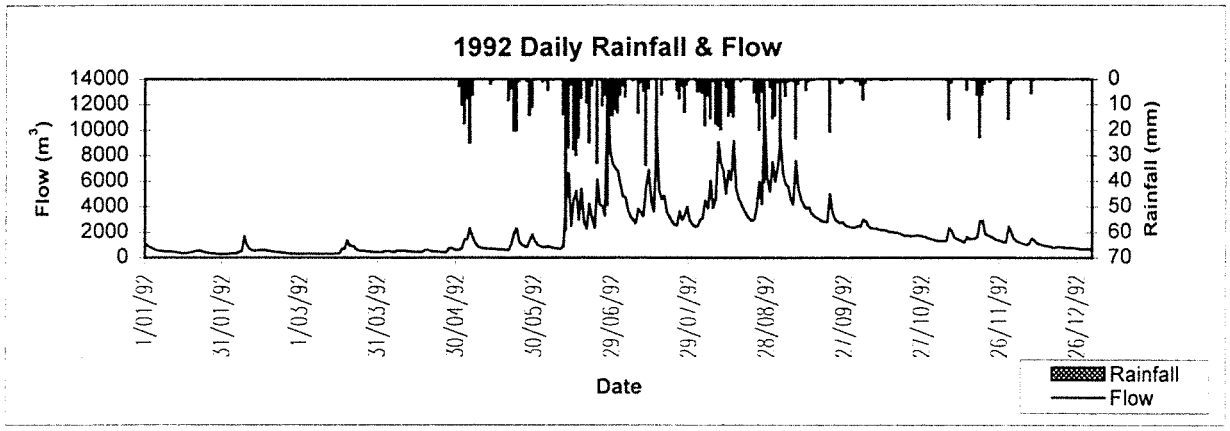


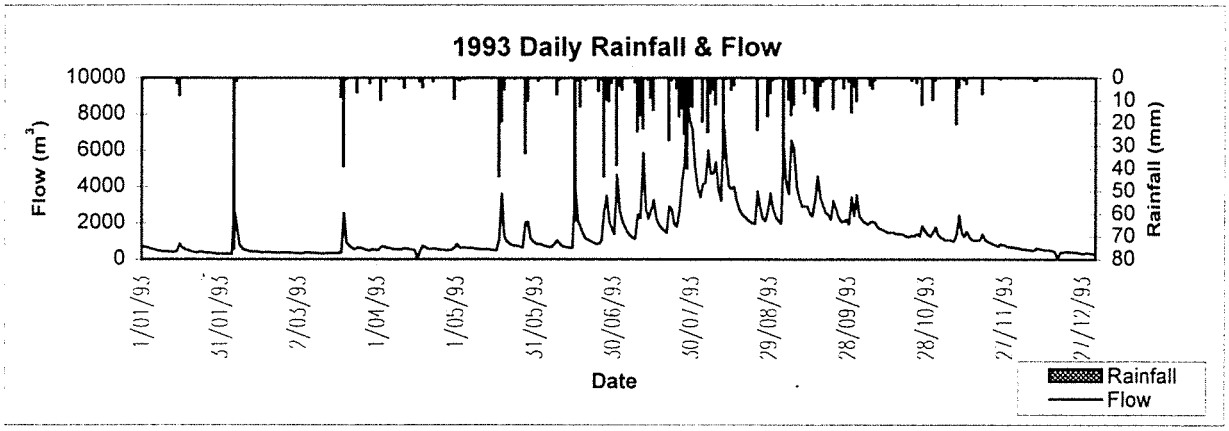


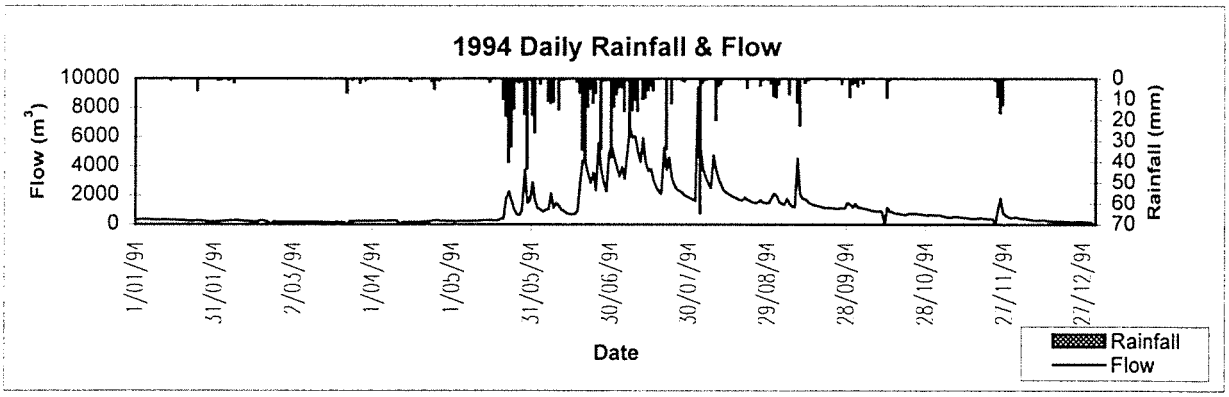


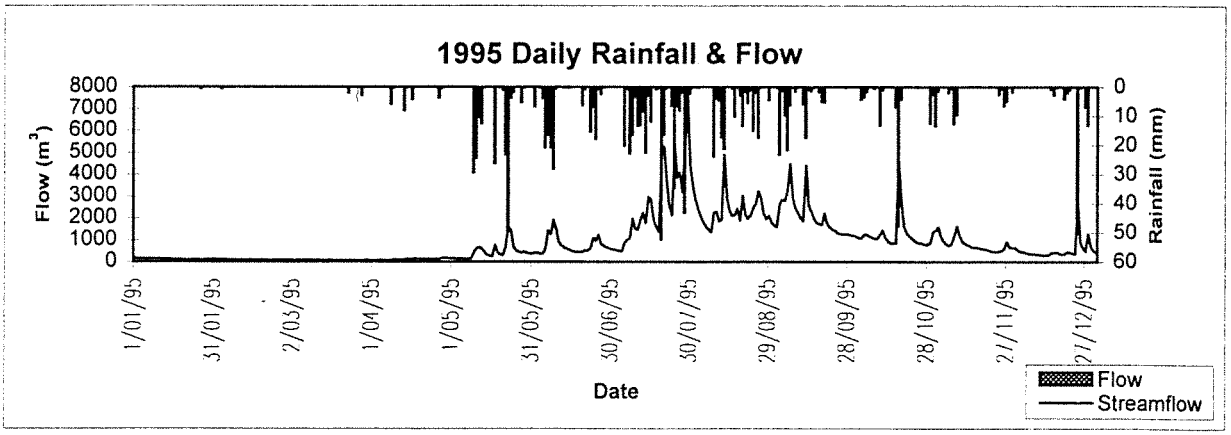


Bates Catchment - S 614062

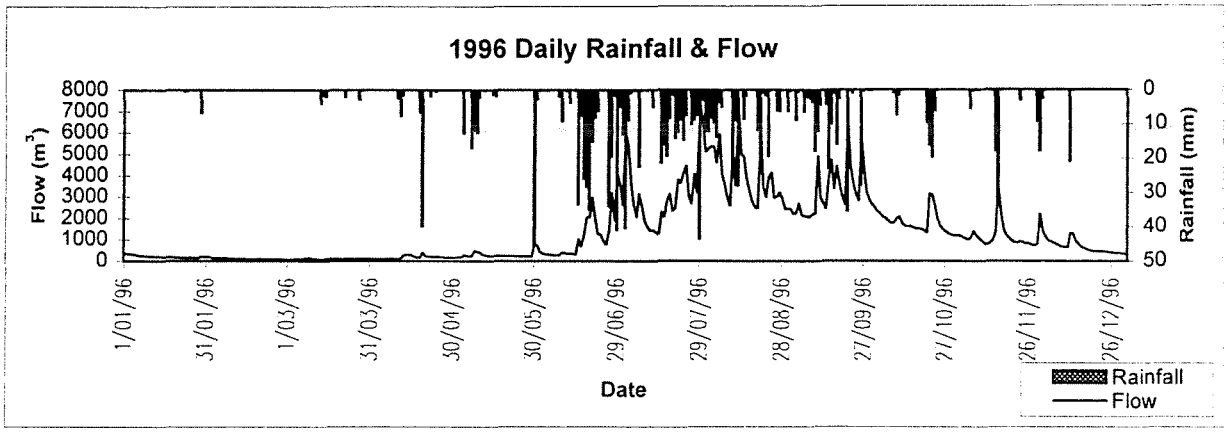


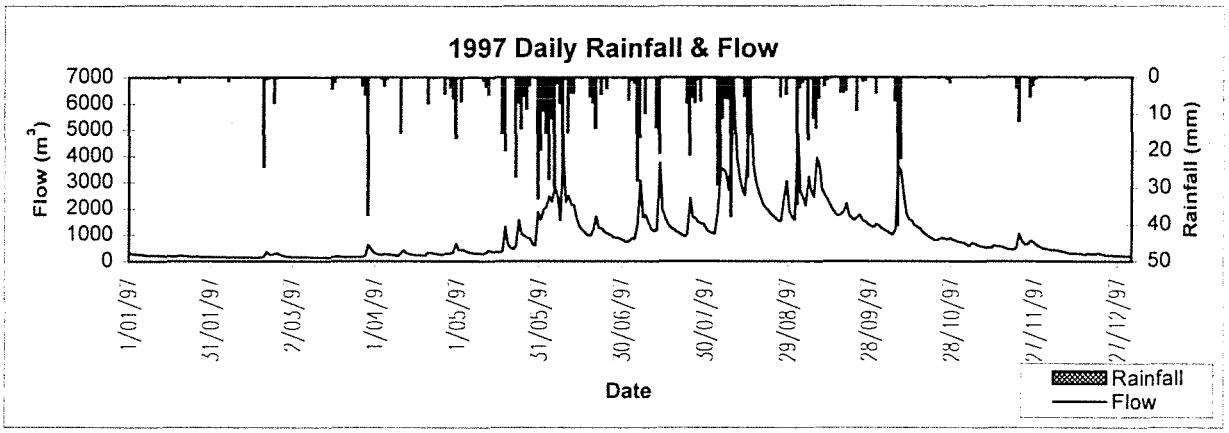




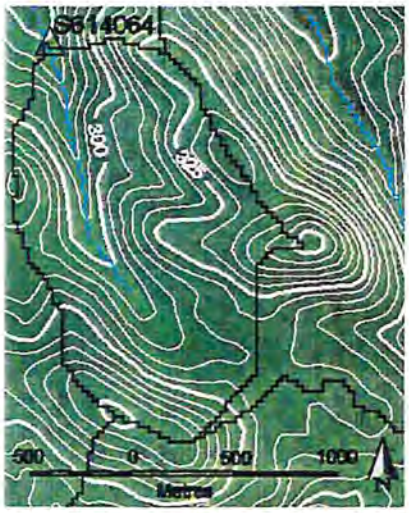


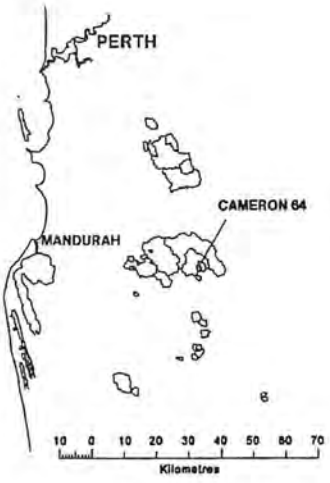
Bates Catchment - S 614062





Cameron West Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S614064
Rainfall Gauge Number	M509569

Information about catchment

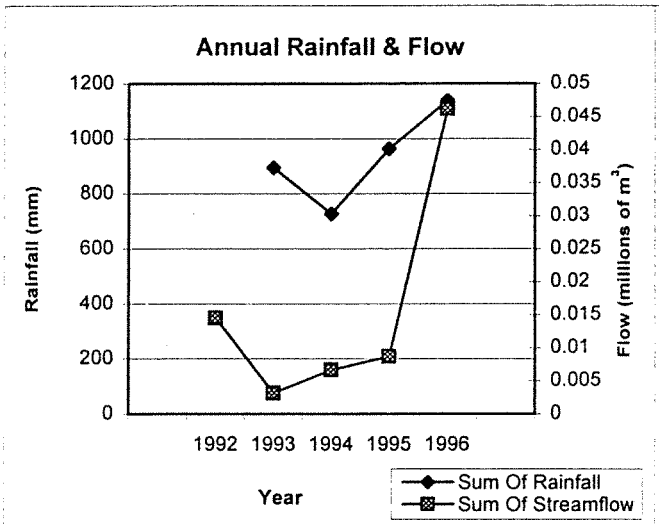
Catchment area	2.09 km^2
Gauging Station Coordinates (AMG)	N 6393500
	E 428870
Treatment data	Logging in 1995/96

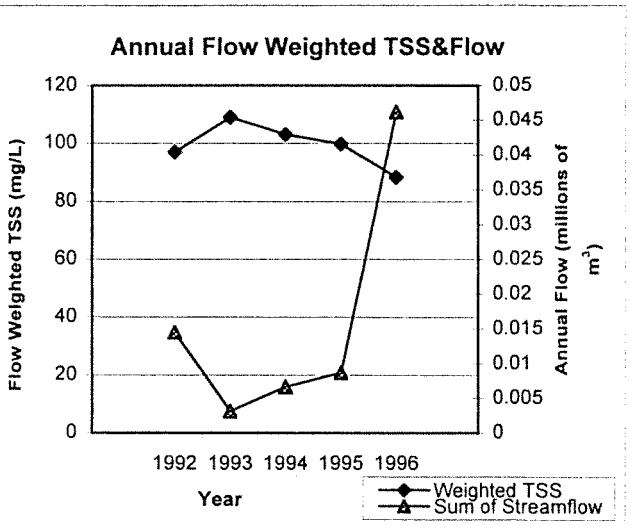
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	1837	2417	2475
Number of years recorded	6	7	8
Number of years with complete records	4	5	6
Start date	31/03/92	13/05/91	14/05/91
Finish date	10/04/97	23/12/97	20/02/98
Number of days with quality code 1	1830	2191	1476
Number of days with quality code 2	4	223	216
Number of days with quality code 4	0	0	781
Number of days with quality code 5	1	0	0
Number of days with quality code 255	3	3	2

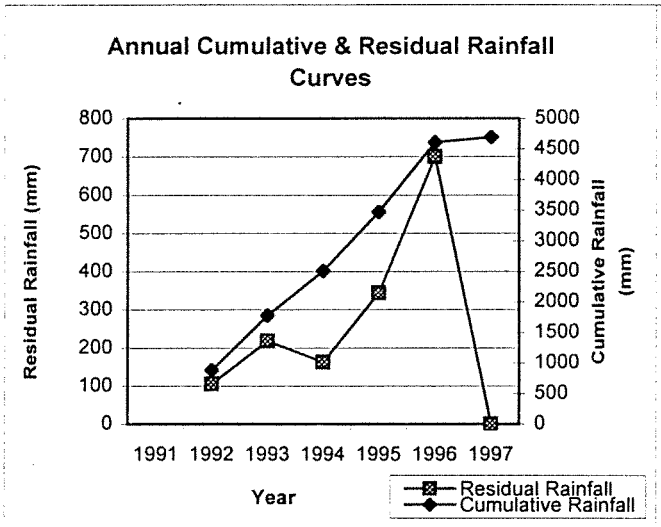
Year	**Number of flow days**
1991	143
1992	108
1993	105
1994	86
1995	100
1996	127
1997	62
Total	**731**

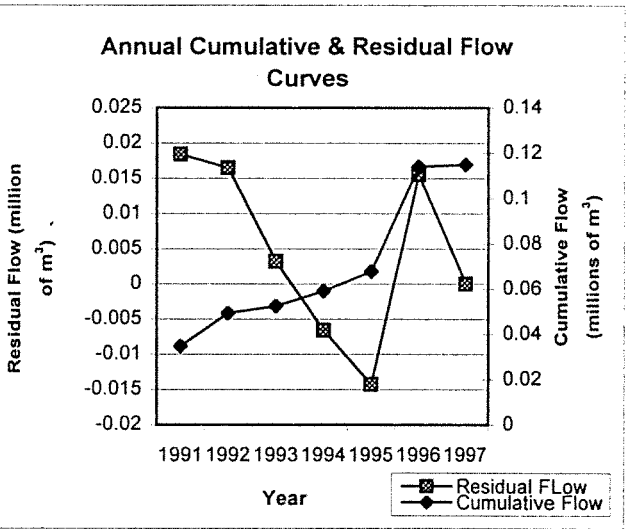
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	782.38	0.016	93.19
Min	82.06	0.001	88.42
Max	1139.16	0.046	115.62

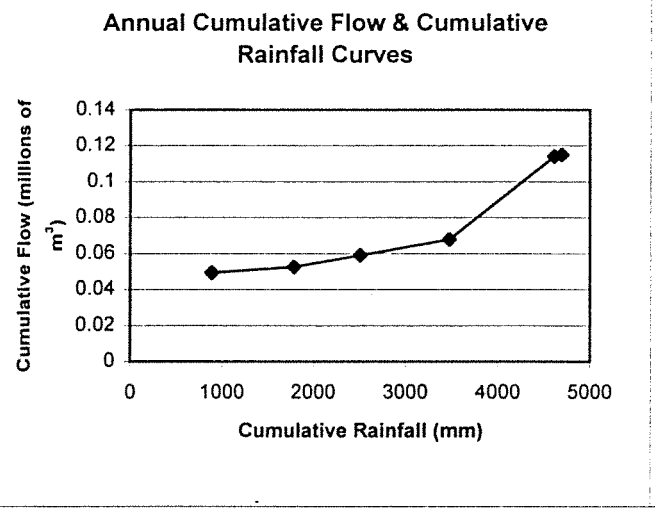
Cameron West Catchment - S 614064

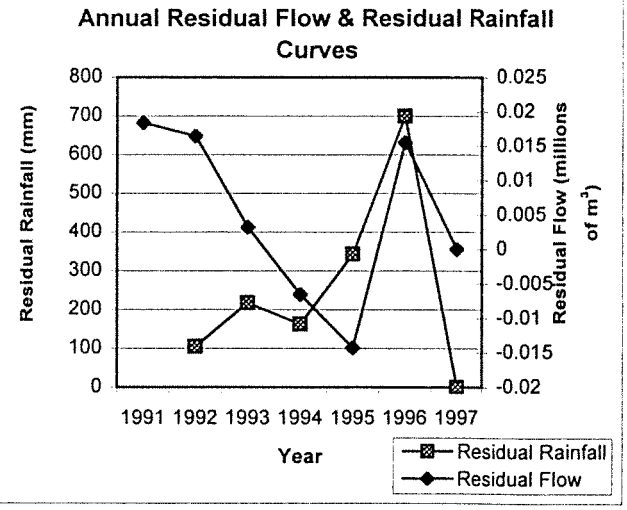




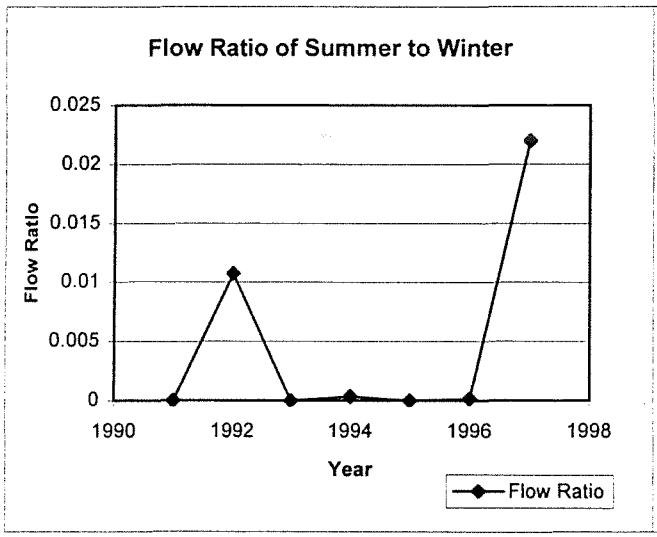


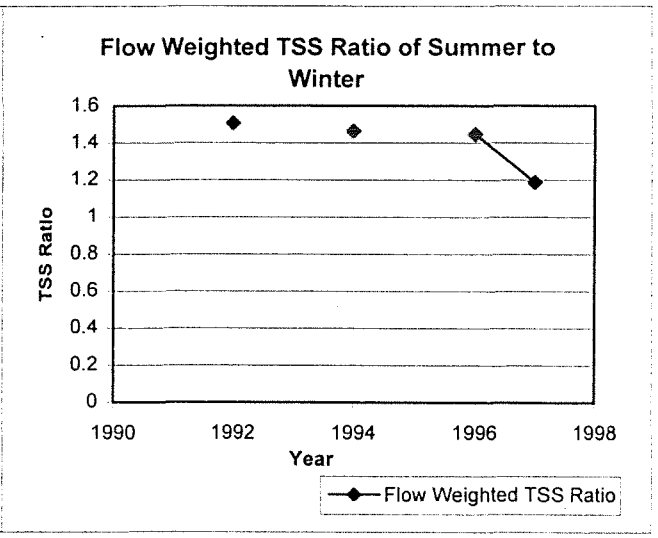


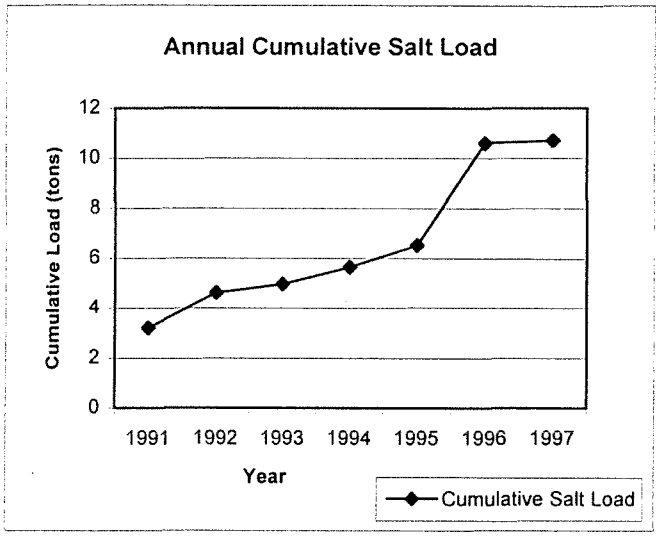




Cameron West Catchment - S 614064

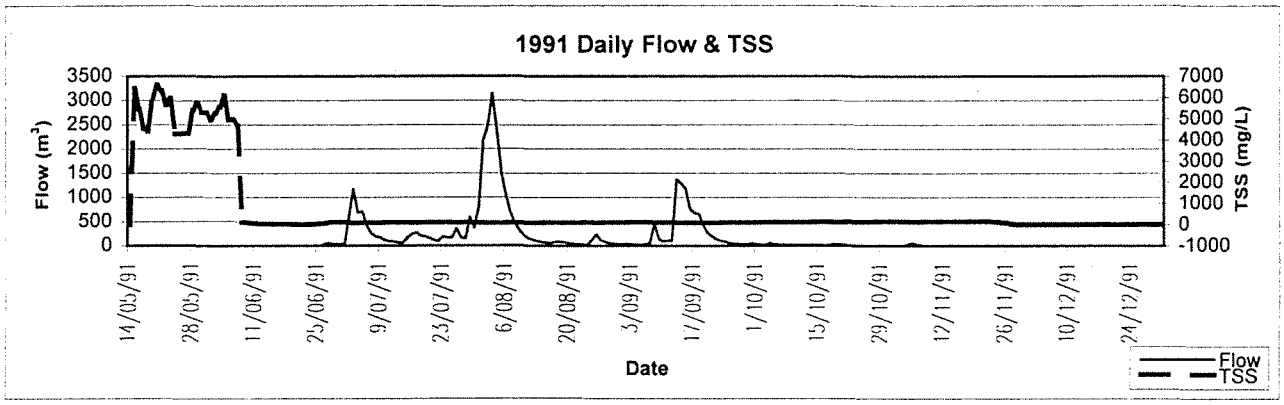


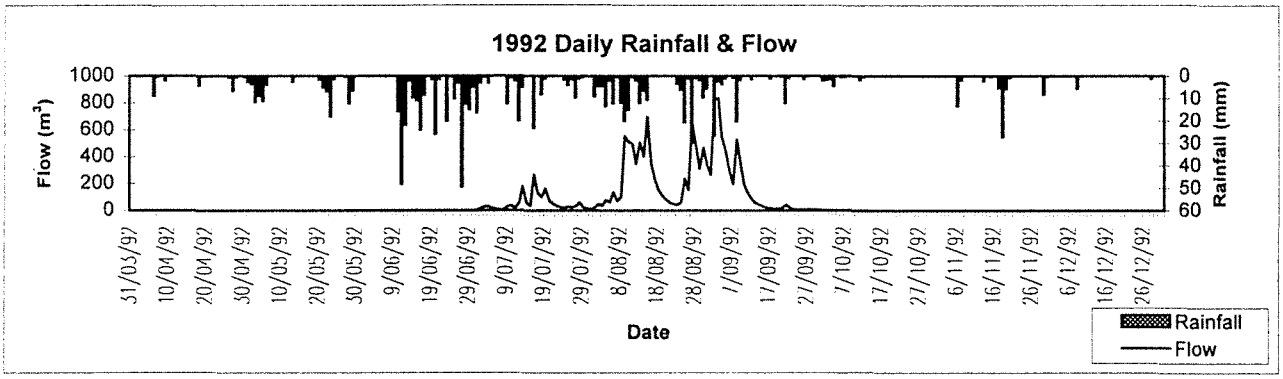


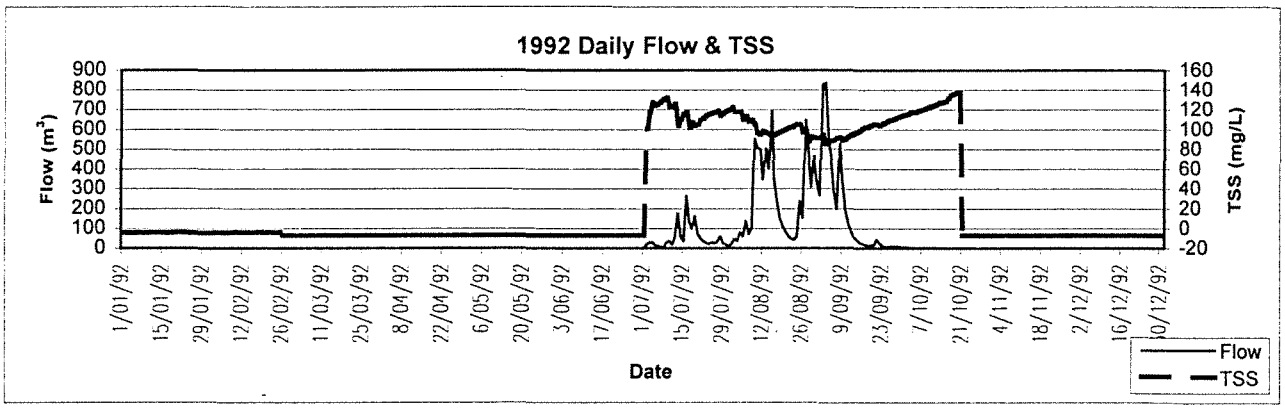


Cameron West Catchment - S 614064

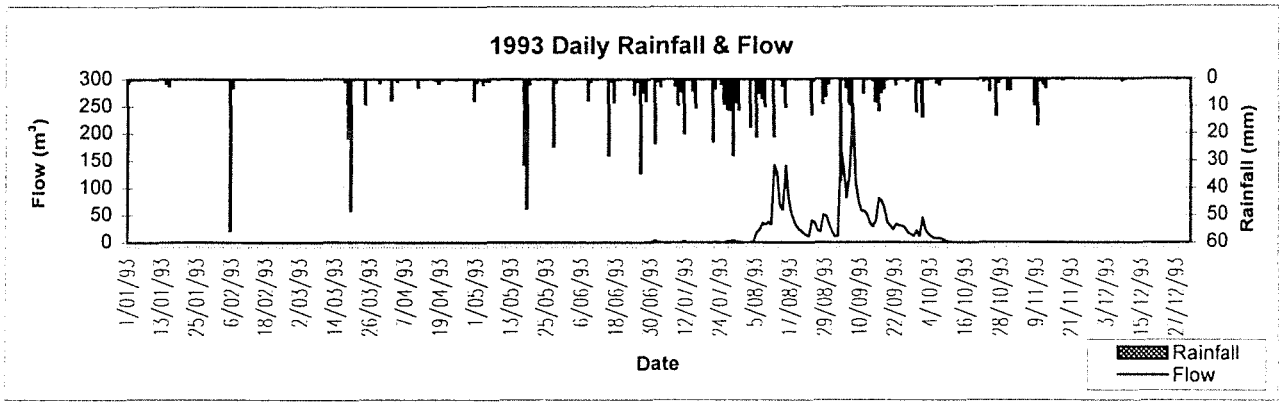
Rainfall data not available for 1991

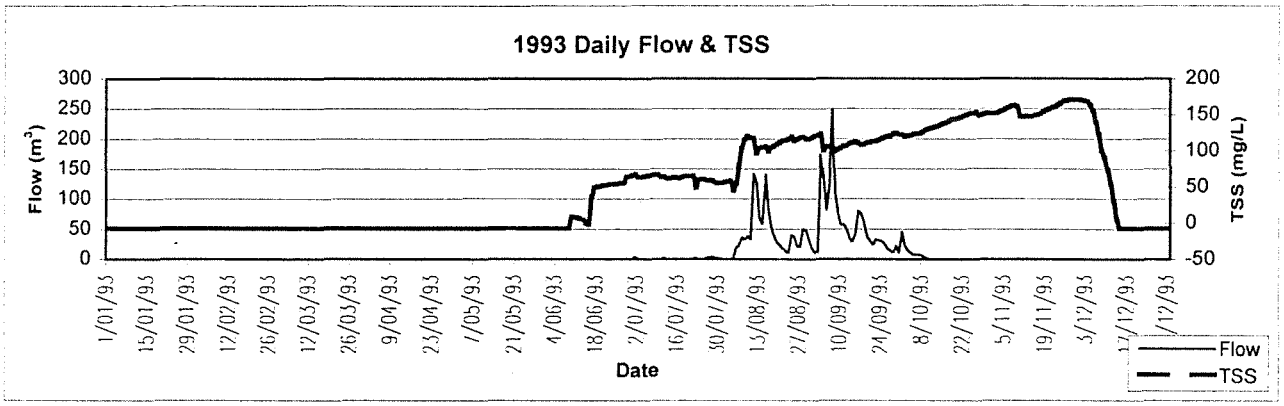


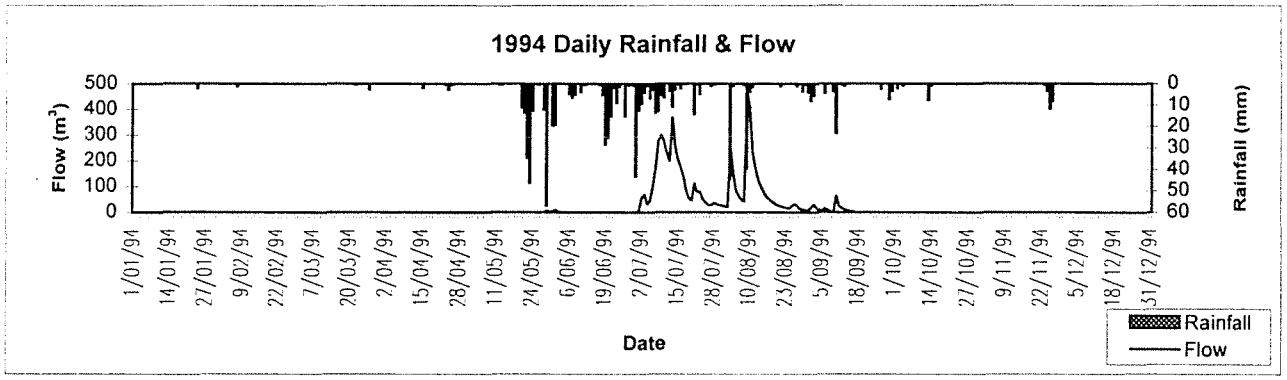


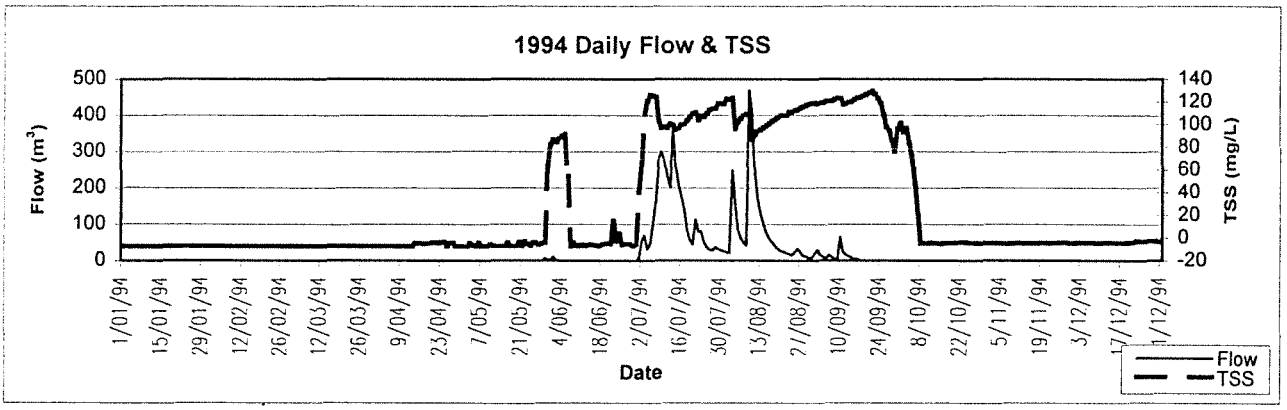


Cameron West Catchment - S 614064

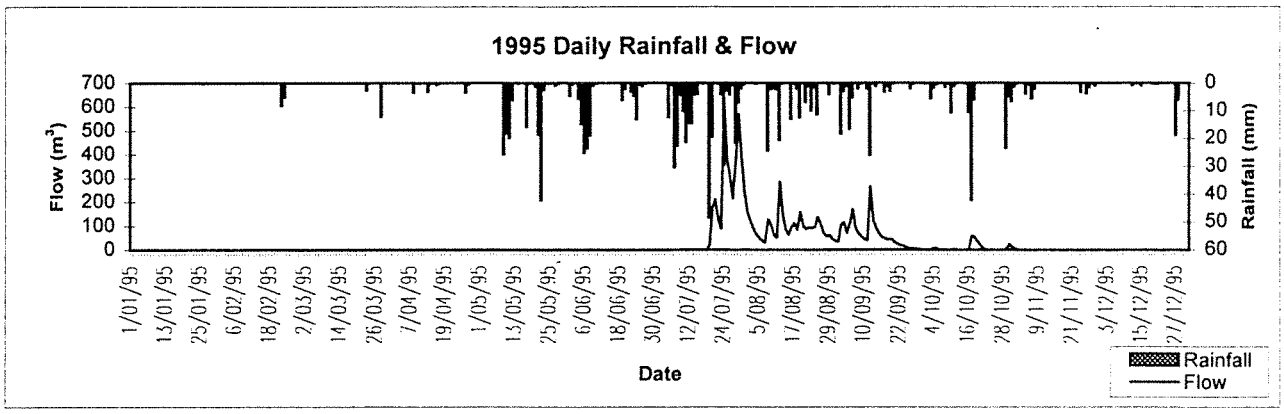


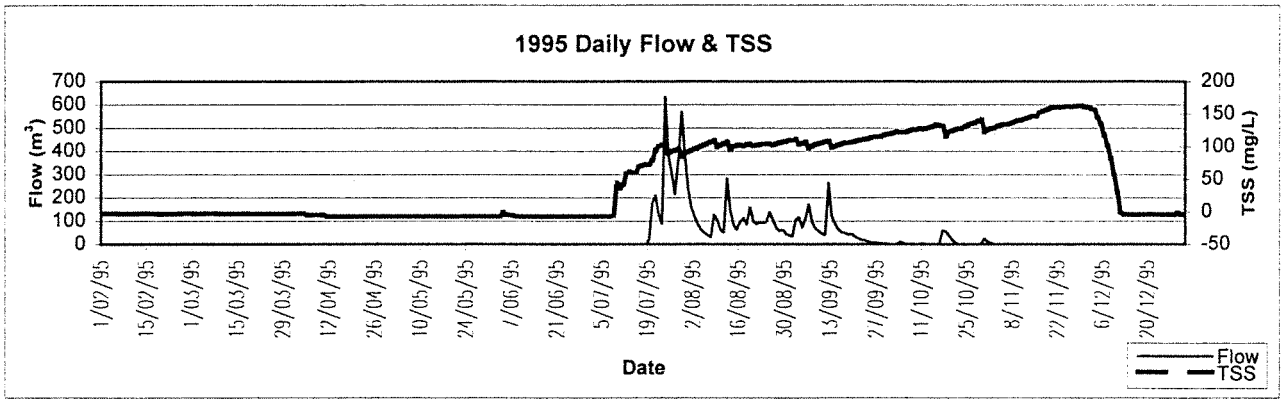


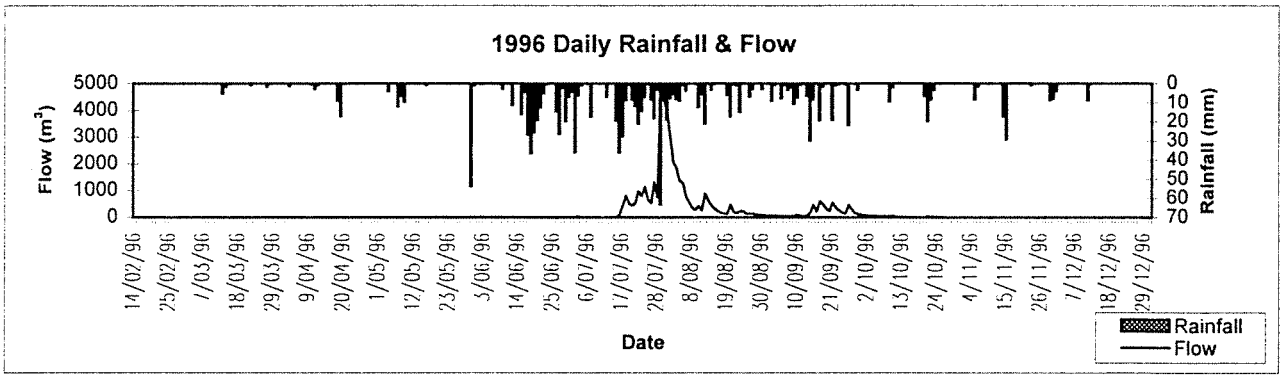


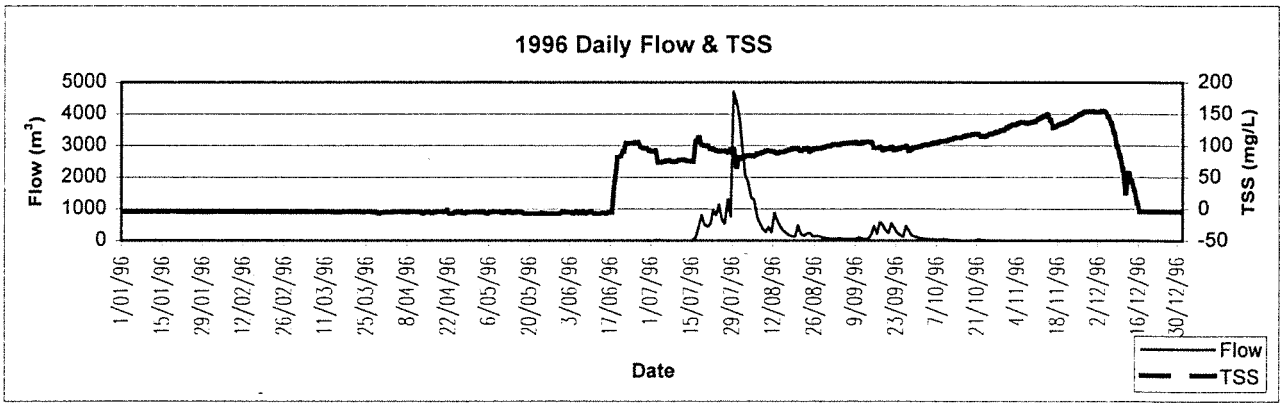


Cameron West Catchment - S 614064

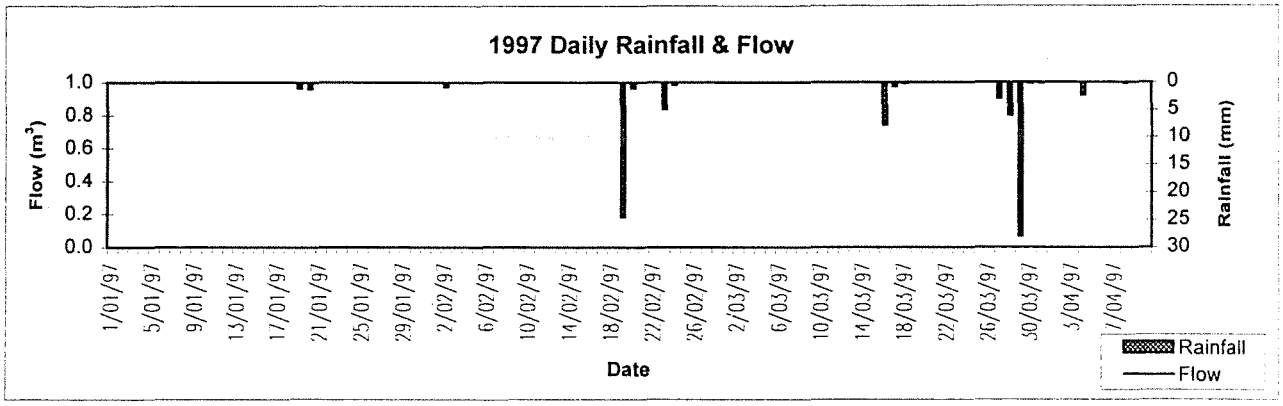


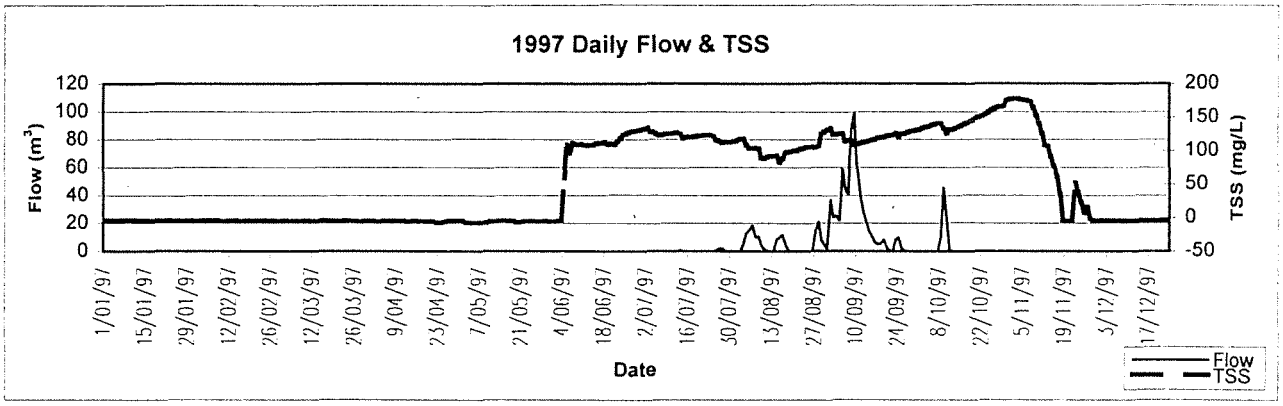




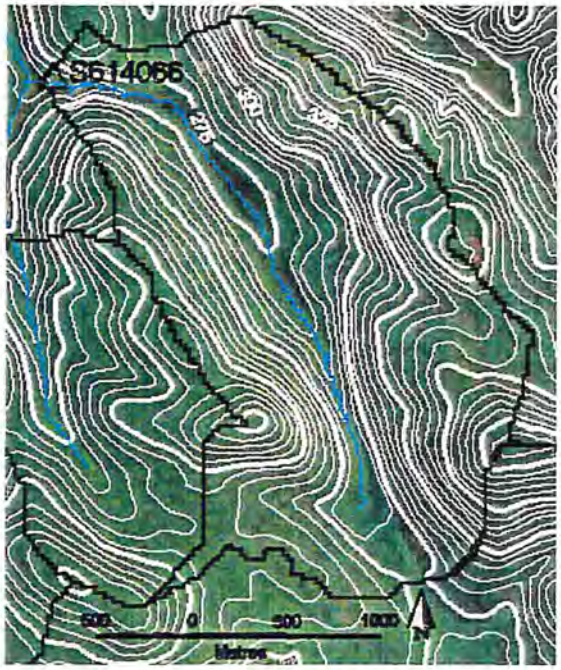


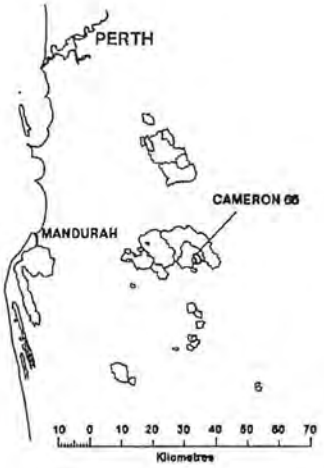
Cameron West Catchment - S 614064





Cameron Central Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

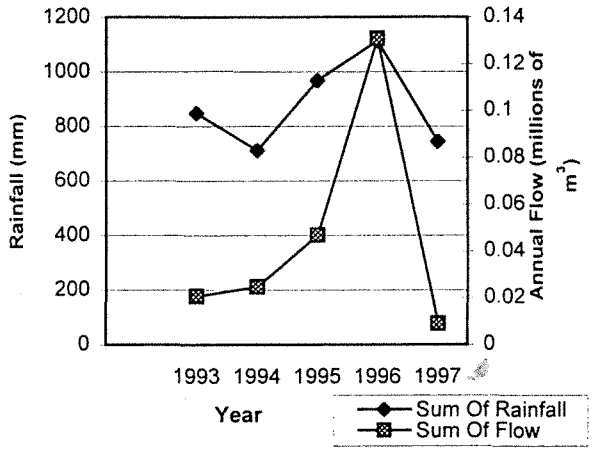
Gauging Station Number	S614066
Rainfall Gauge Number	M509577
Information about catchment	
Catchment area	4.94 km^2
Gauging Station Coordinates (AMG)	N 6394300
	E 429050
Treatment data	Logging in 1995/96

Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	2115	2137	2053
Number of years recorded	7	7	6
Number of years with complete records	5	5	4
Start date	9/04/92	15/04/92	12/05/92
Finish date	22/01/98	19/02/98	24/12/97
Number of days with quality code 1	1997	2135	1840
Number of days with quality code 2	26	0	157
Number of days with quality code 4	90	0	27
Number of days with quality code 255	2	2	29
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	877.7	0.046	110.10
Min	712.3	0.009	97.77
Max	1114.1	0.131	116.88

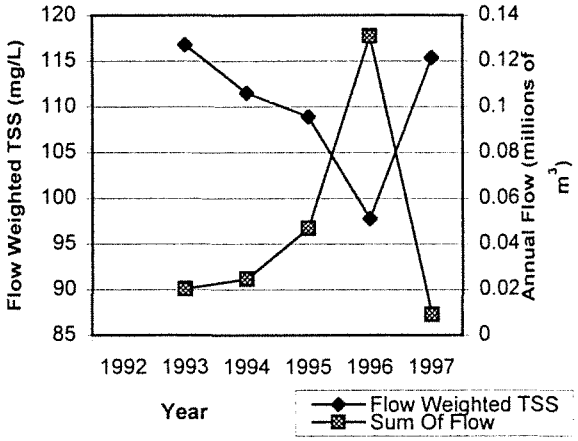
Year	**Number of flow days**
1993	88
1994	69
1995	88
1996	113
1997	43
Total	**401**

Cameron Central Catchment - S 614066

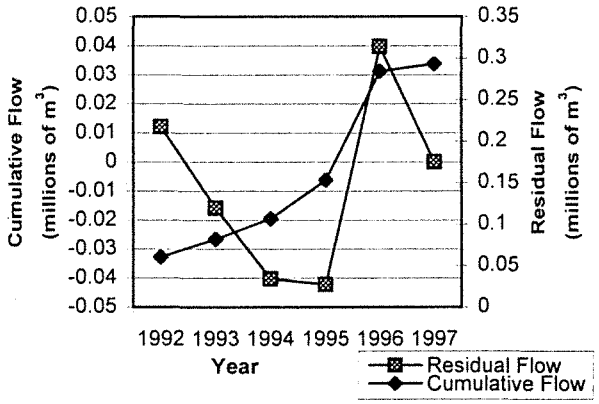
Annual Rainfall & Flow



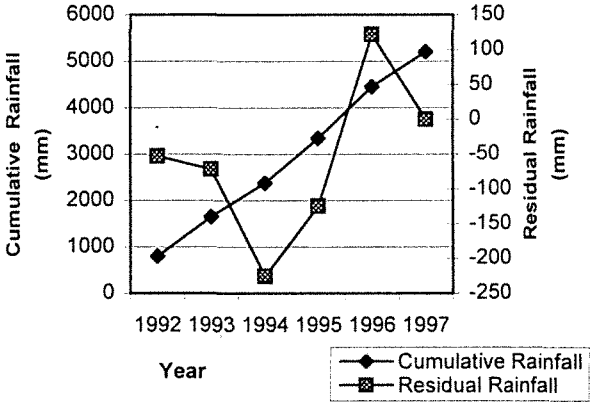
Annual Flow Weighted TSS & Flow



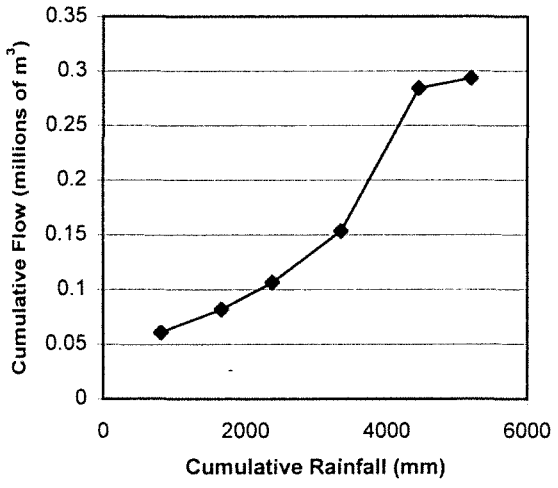
Annual Cumulative&Residual Flow Curves



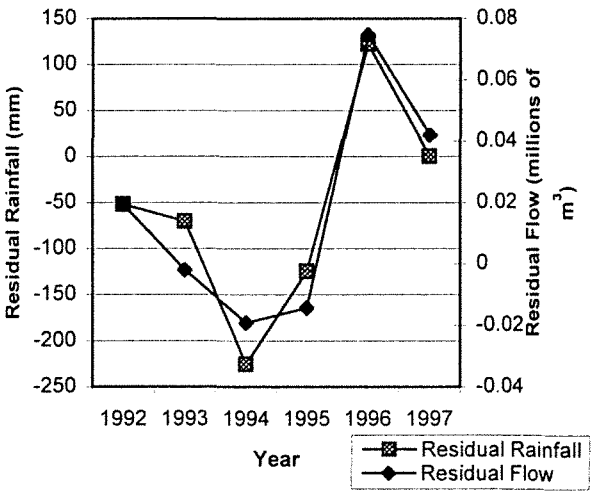
Annual Cumulative & Residual Rainfall Curves



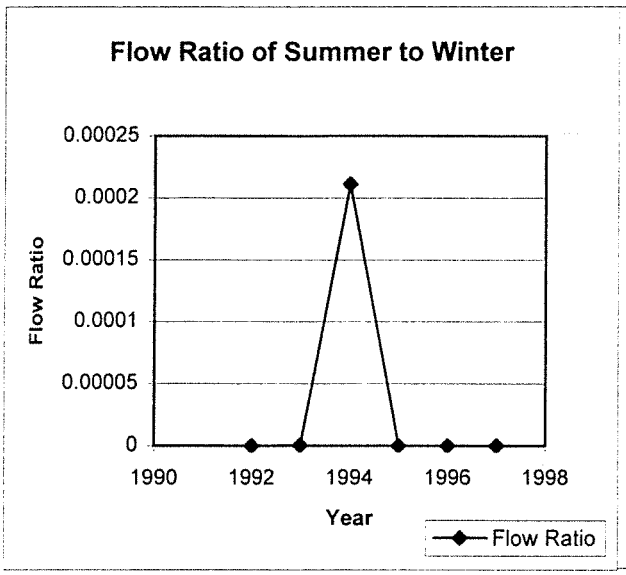
Annual Cumulative Flow & Cumulative Rainfall Curves

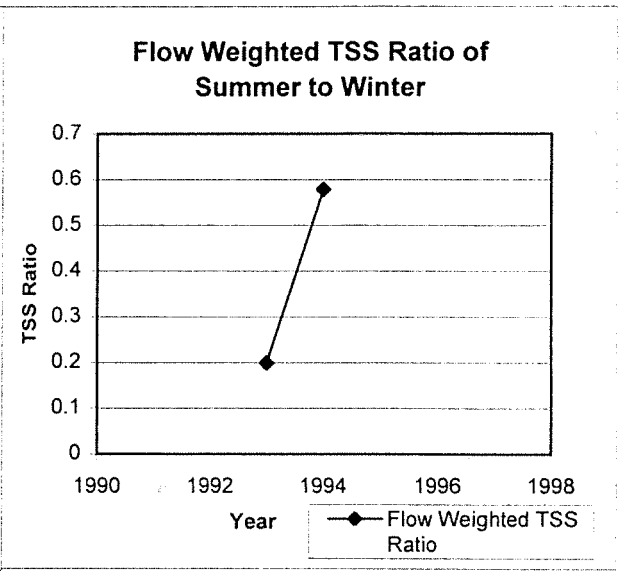


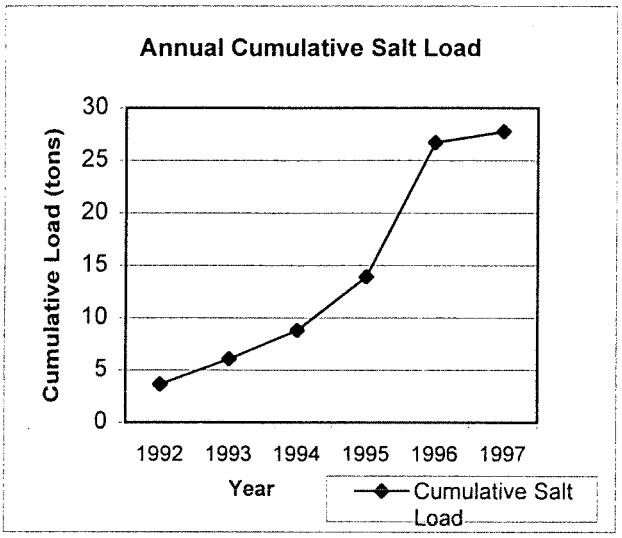
Annual Residual Flow & Residual Rainfall Curves



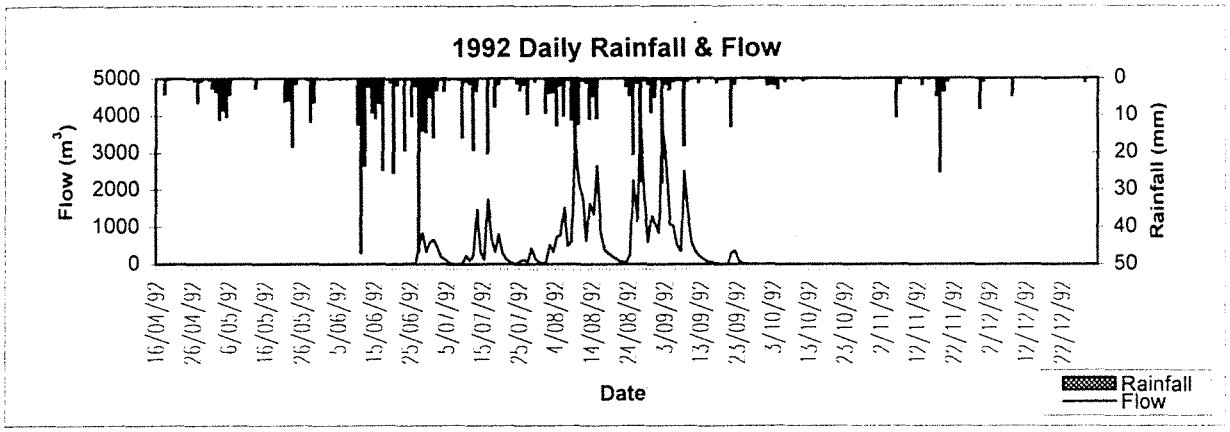
Cameron Central Catchment - S 614066

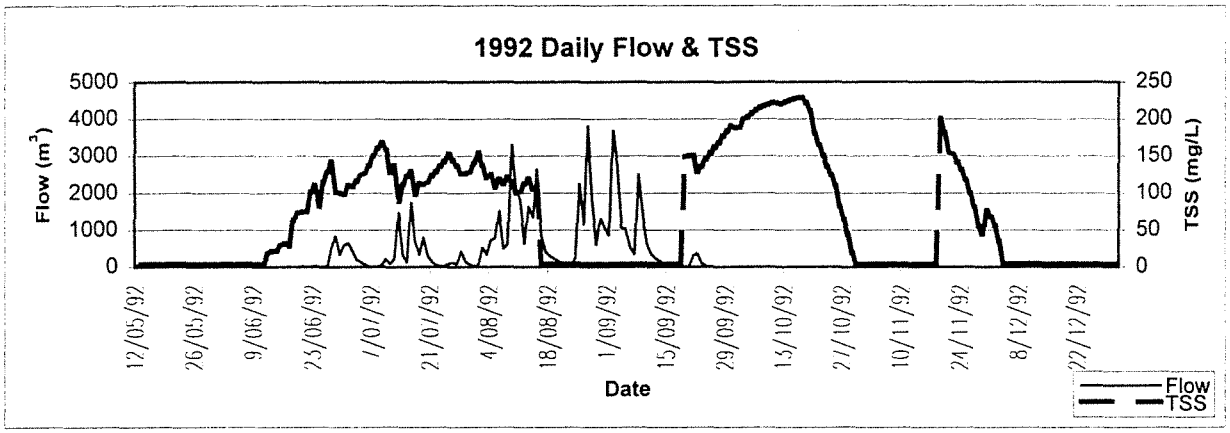


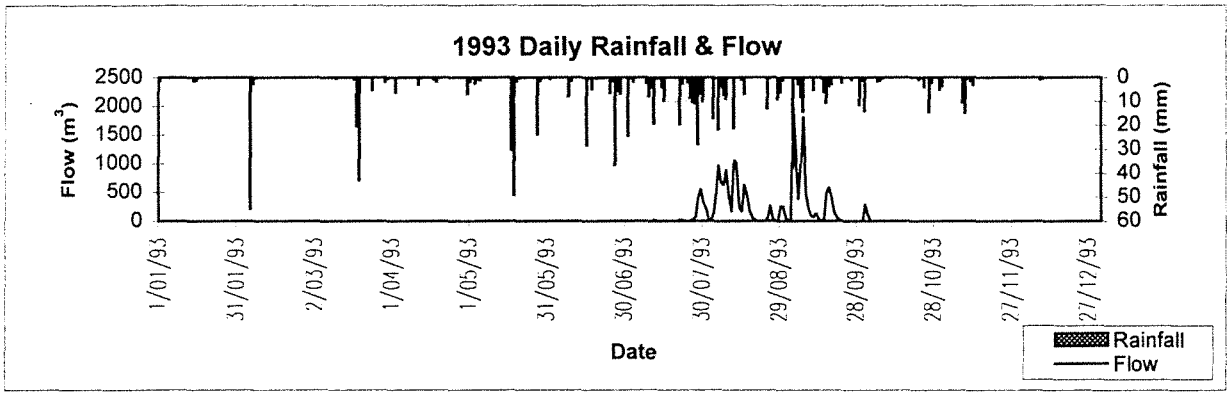


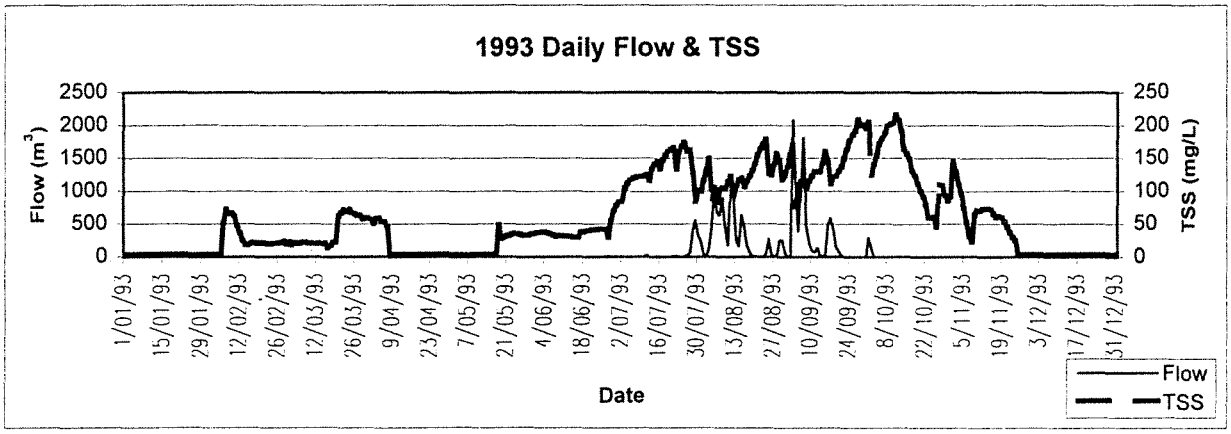


Cameron Central Catchment - S 614066

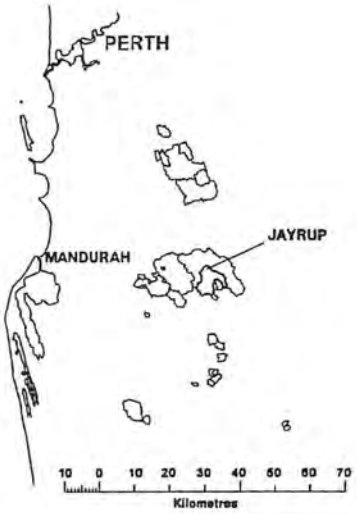








Jayrup Catchment



Legend

Catchment Boundary △ Gauging Station

300 5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

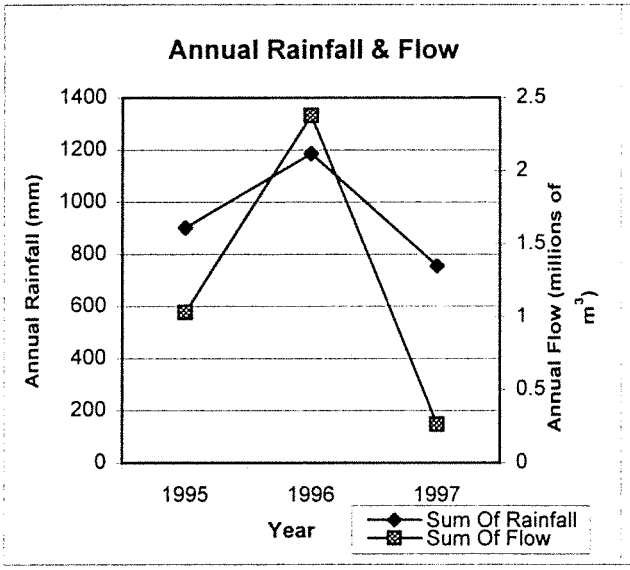
Gauging Station Number	S614093
Rainfall Gauge Number	M509589
Information about catchment	
Catchment area	45.2km^2
Gauging Station Coordinates (AMG)	N 6398366 E 426390
Treatment data	1. Control Catchment. 2. Selective logging.

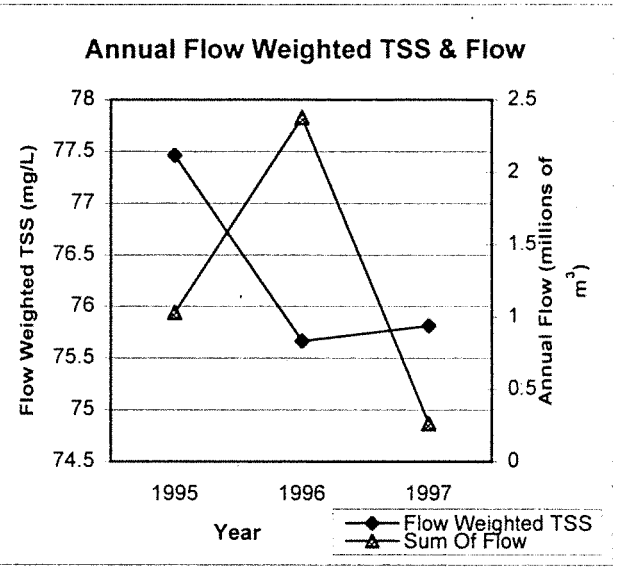
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	979	1108	965
Number of years recorded	4	4	4
Number of years with complete records	2	3	2
Start date	10/05/95	1/01/95	25/05/95
Finish date	12/01/98	12/01/98	13/01/98
Number of days with quality code 1	963	933	907
Number of days with quality code 2	6	11	52
Number of days with quality code 3	8	0	4
Number of days with quality code 4	0	32	0
Number of days with quality code 255	2	132	2

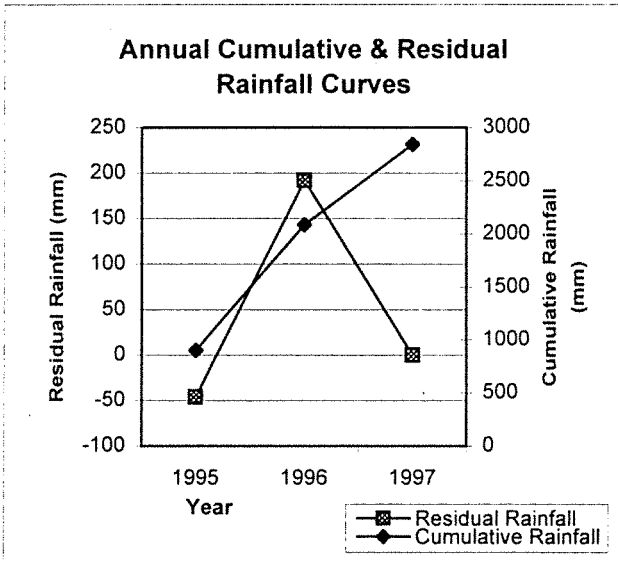
Year	**Number of flow days**
1995	159
1996	155
1997	107
Total	**421**

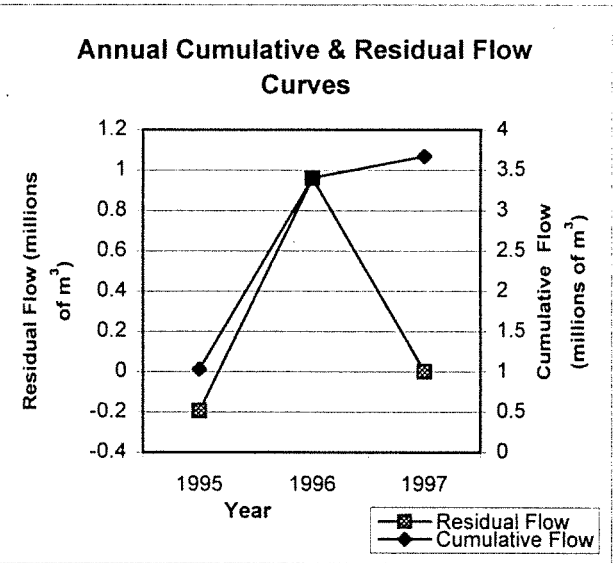
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	947.7	1.224	76.18
Min	755.8	0.264	75.66
Max	1185.8	2.378	77.46

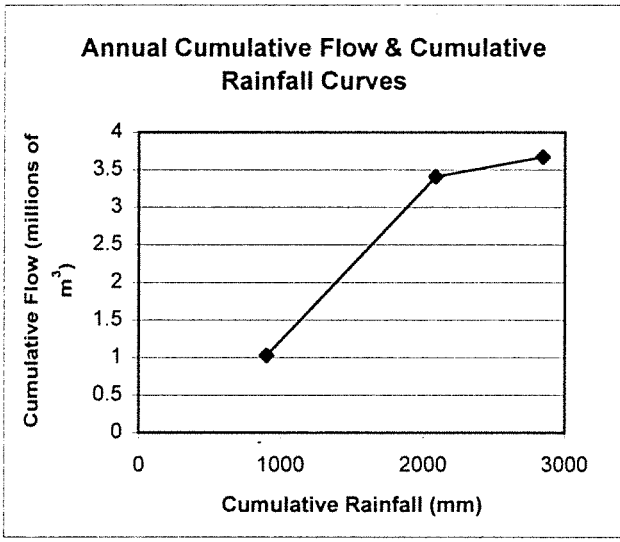
Jayrup Catchment - S 614093

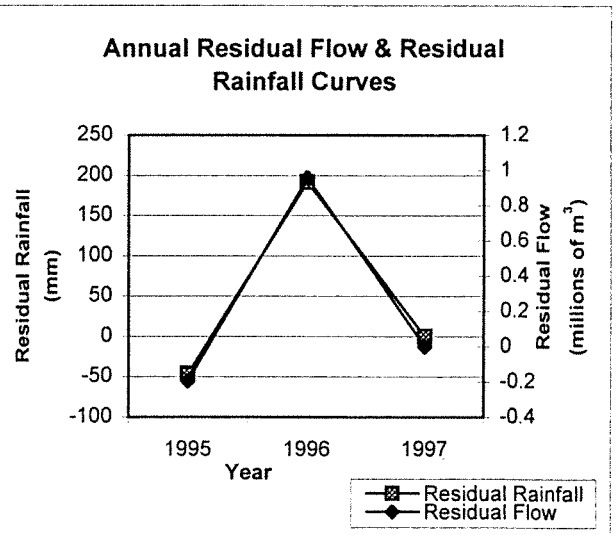




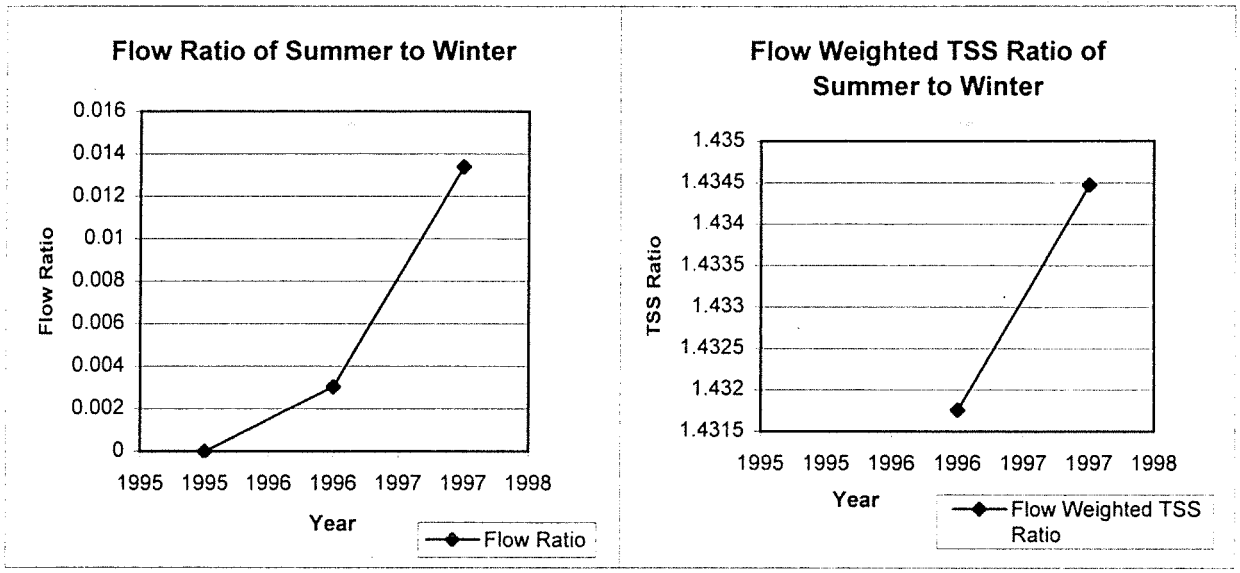


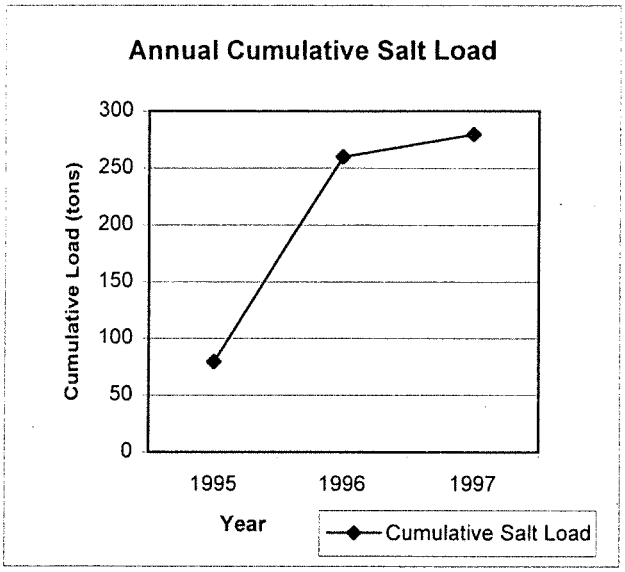




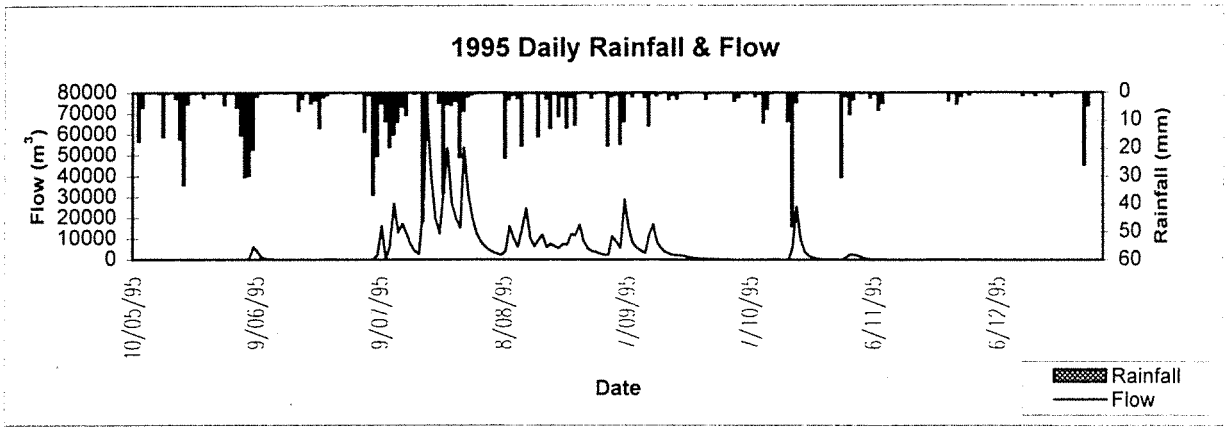


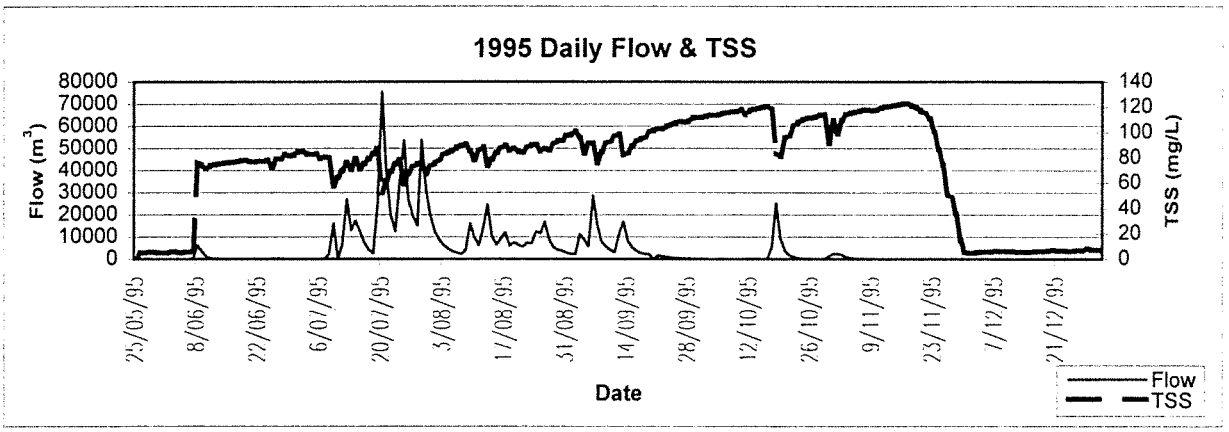
Jayrup Catchment - S 614093

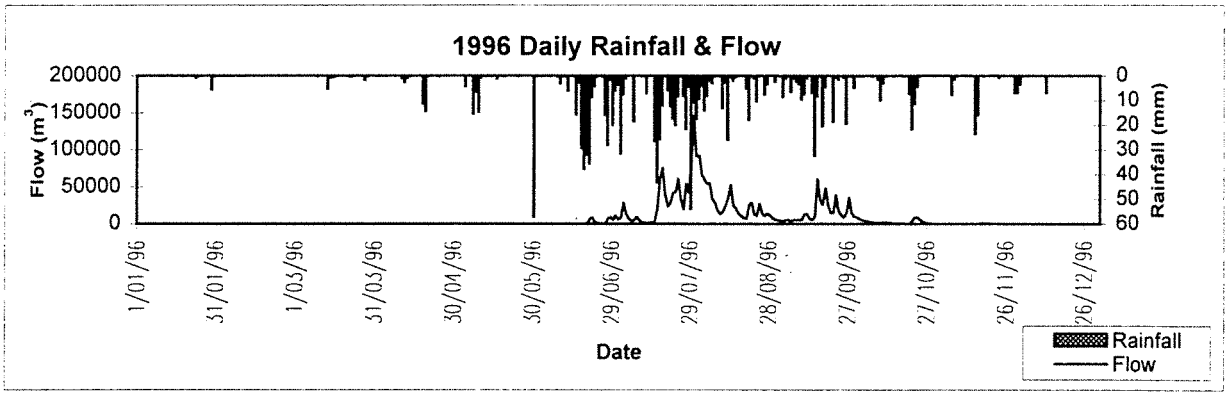


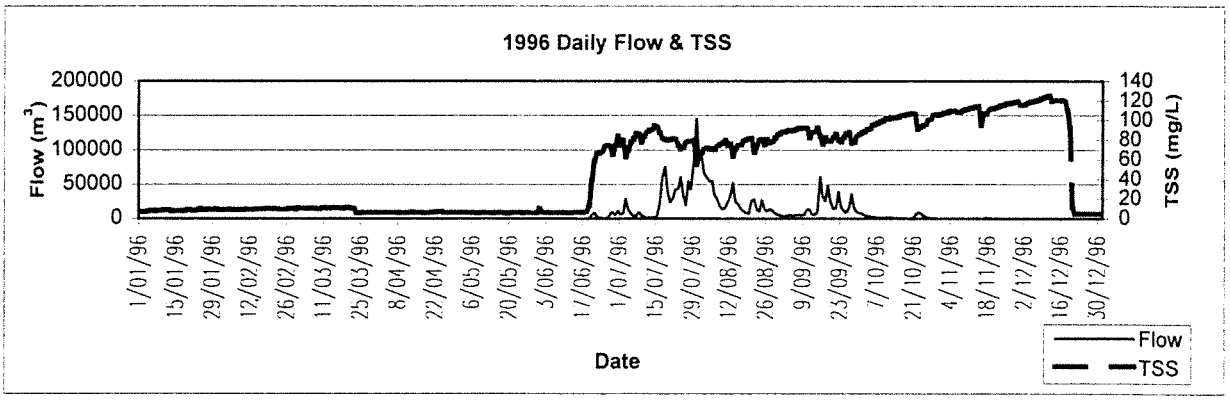


Jayrup Catchment - S 614093

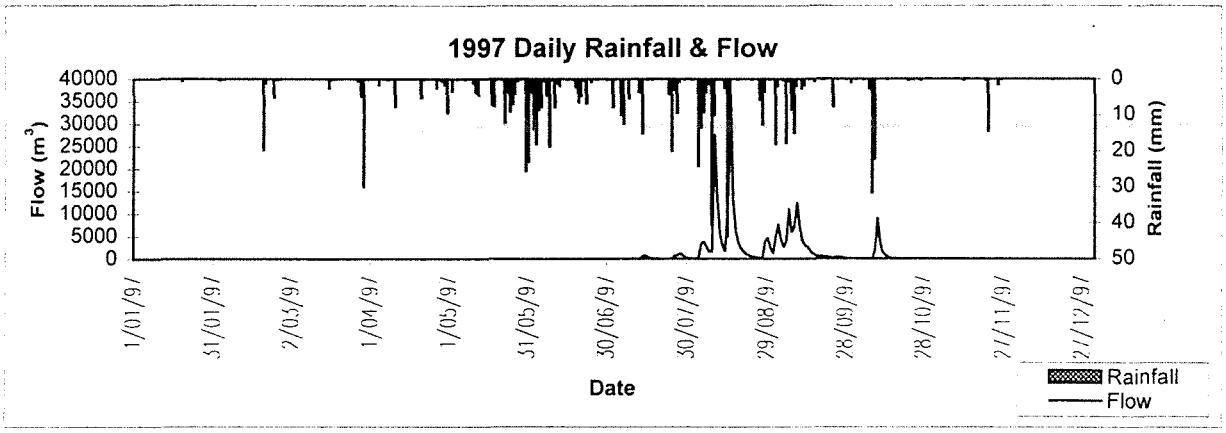


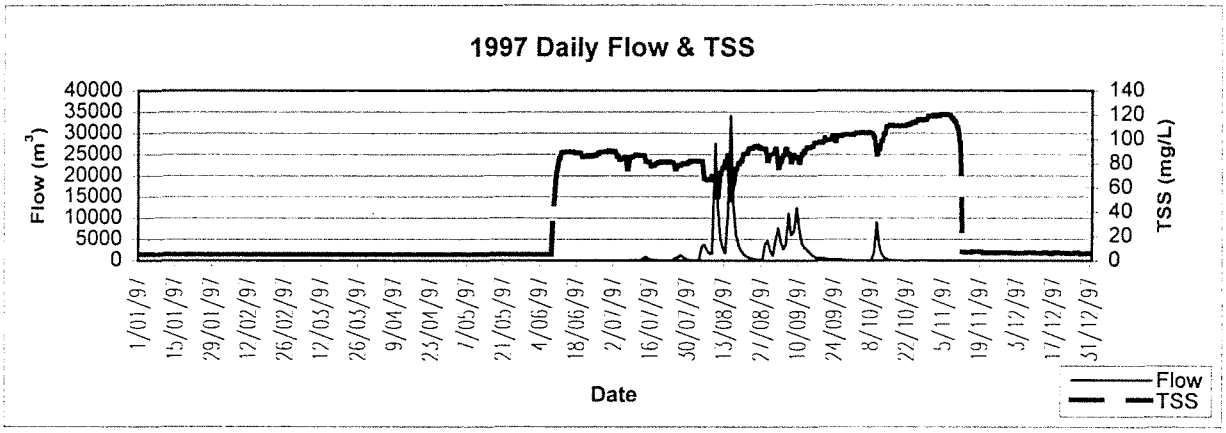




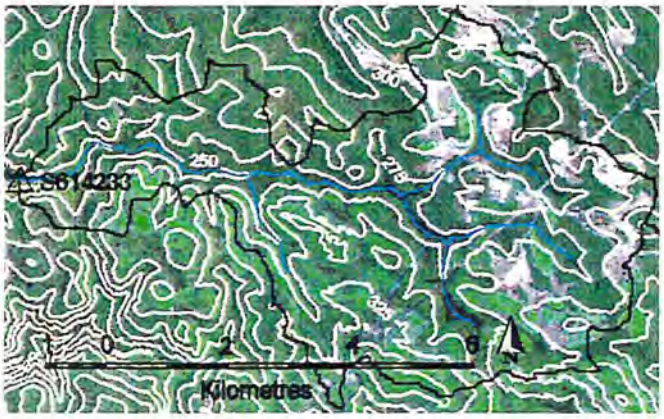


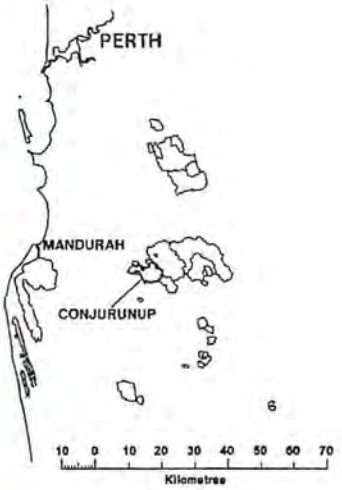
Jayrup Catchment - S 614093





Conjurunup Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

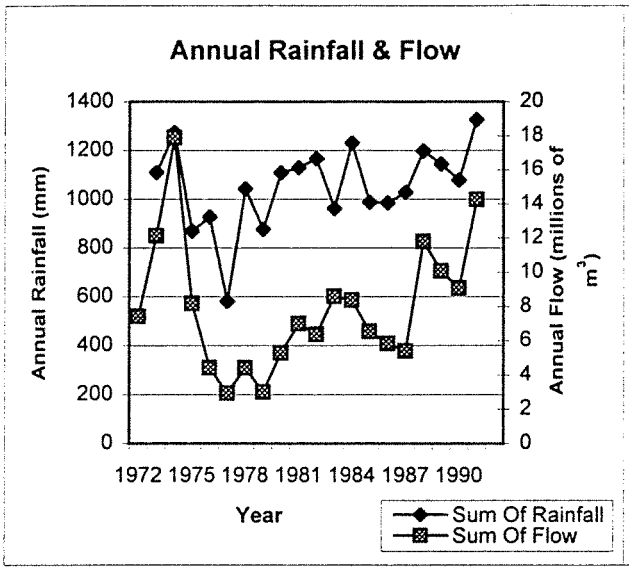
Computer Generated Stream Line

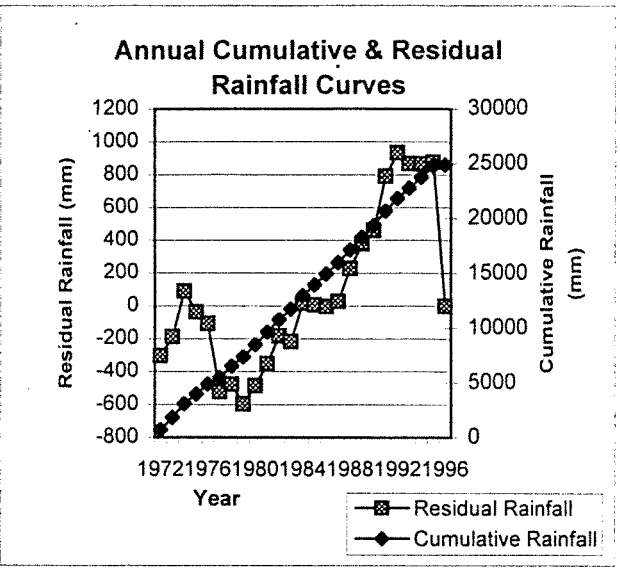
Gauging Station Number	S614233		
Rainfall Gauge Number	M5091126		
Information about catchment			
Catchment area	39.60 km^2		
Gauging Station Coordinates (AMG)	N 6393248	E 406156	
Treatment data	Bauxite mining since late 1970's		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	8768	9123	0
Number of years recorded	25	26	
Number of years with complete records	23	24	
Start date	12/05/72	23/05/67	
Finish date	13/05/96	13/05/92	
Number of days with quality code 1	8151	8676	
Number of days with quality code 2	394	105	
Number of days with quality code 3	70	37	
Number of days with quality code 4	28	45	
Number of days with quality code 157	115	258	
Number of days with quality code 255	10	2	

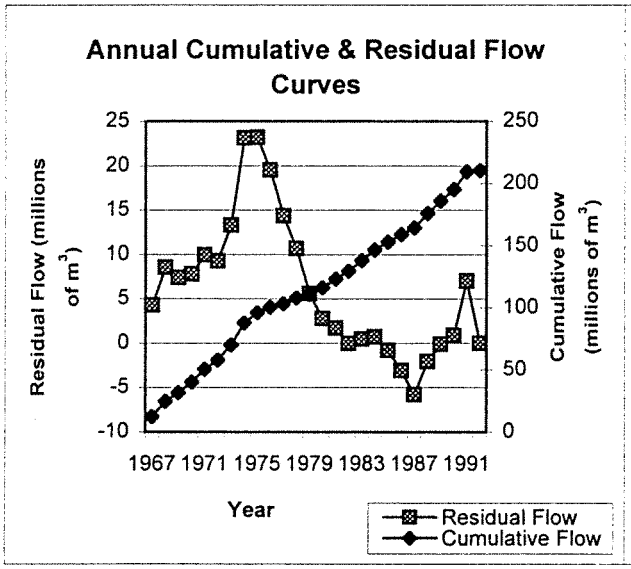
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	1047.5	8.214
Min	581.3	2.941
Max	1326.7	17.905

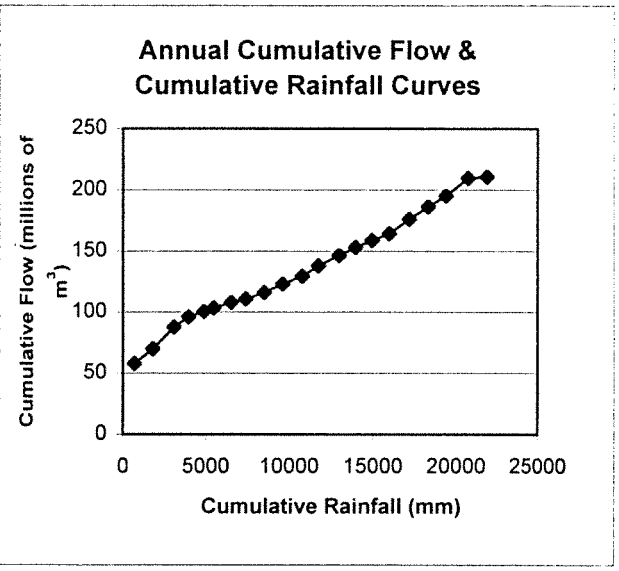
Year	Number of flow days
1968	312
1969	365
1970	323
1971	315
1972	360
1973	337
1974	365
1975	365
1976	366
1977	350
1978	365
1979	365
1980	366
1981	365
1982	365
1983	314
1984	366
1985	365
1986	365
1987	365
1988	366
1989	365
1990	365
1991	365
1992	133
Total	**8520**

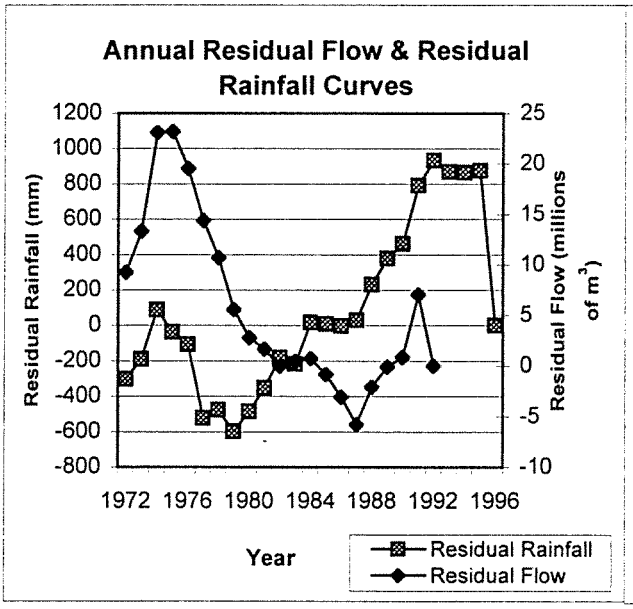
Conjurunup Catchment - S 614233

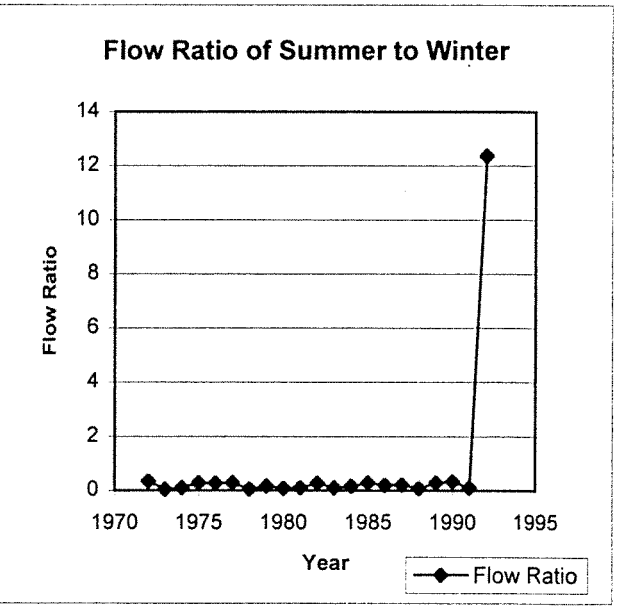




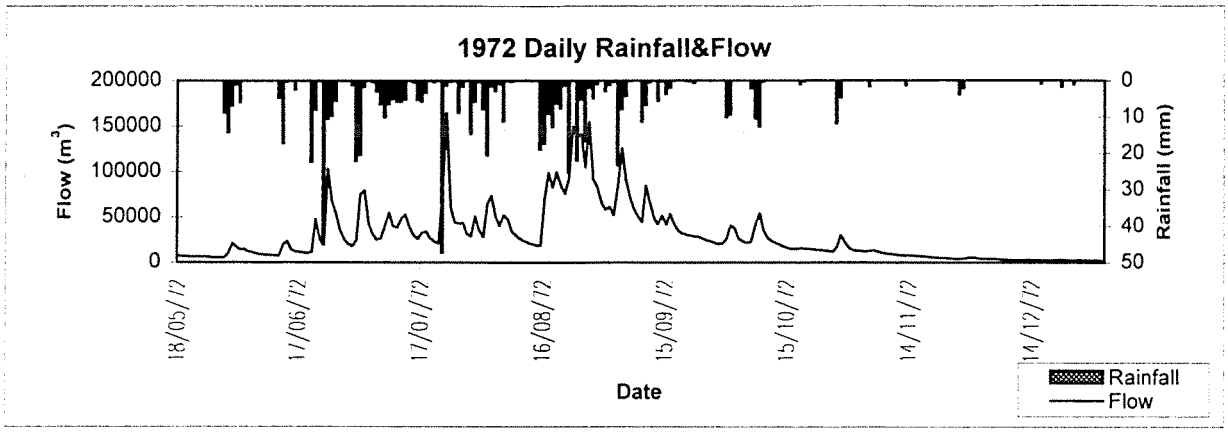


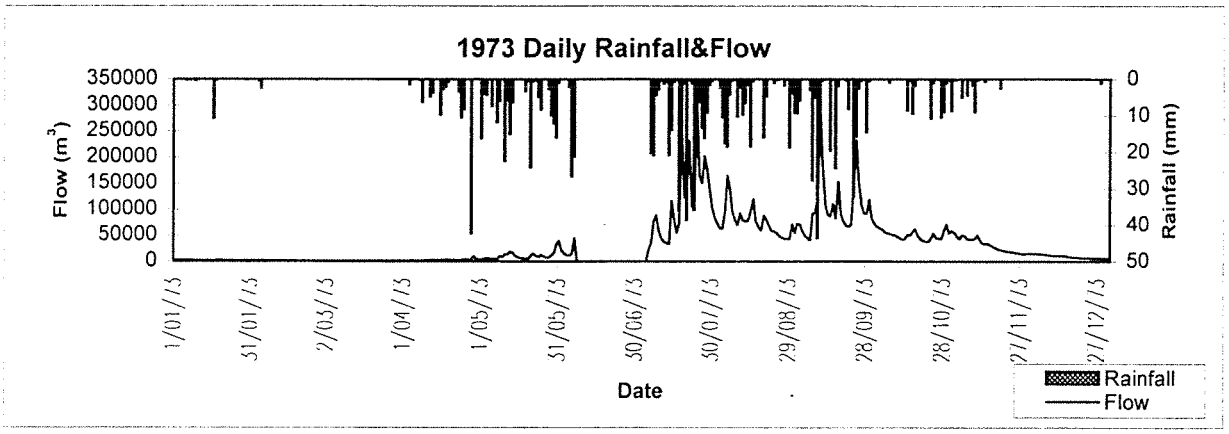


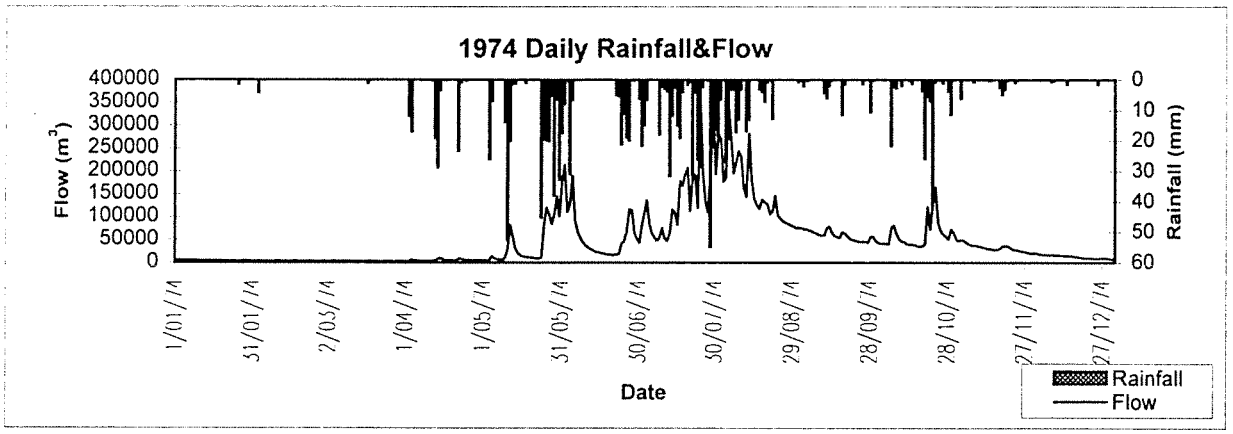


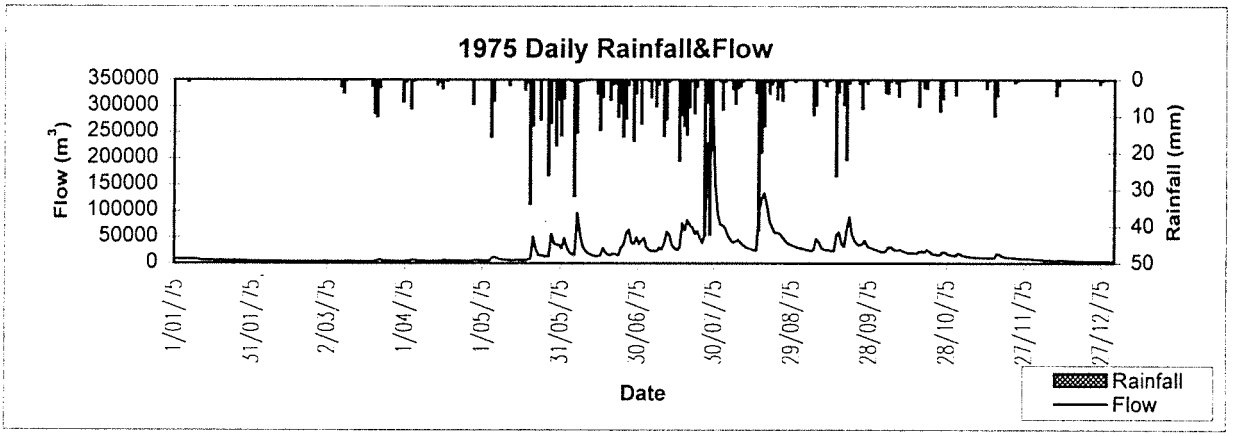


Conjurunup Catchment - S 614233

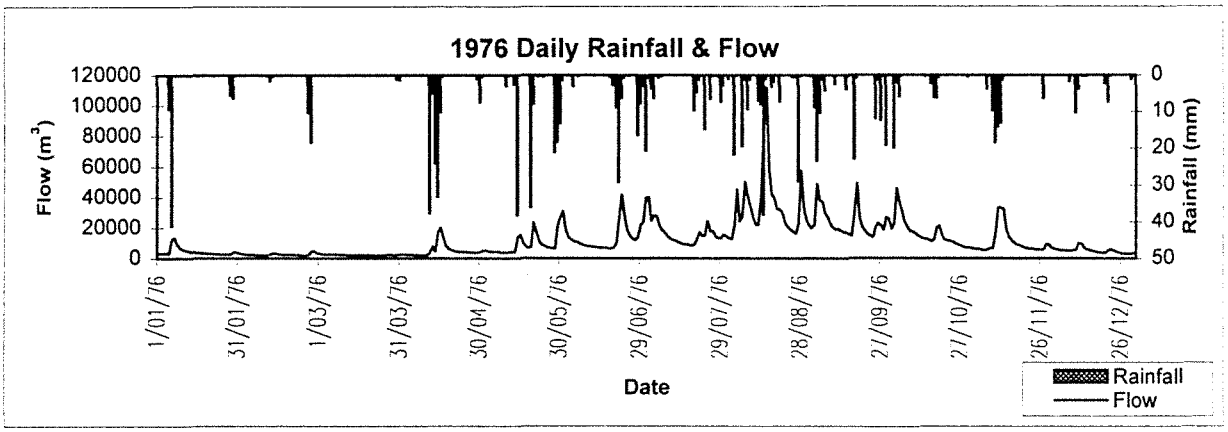


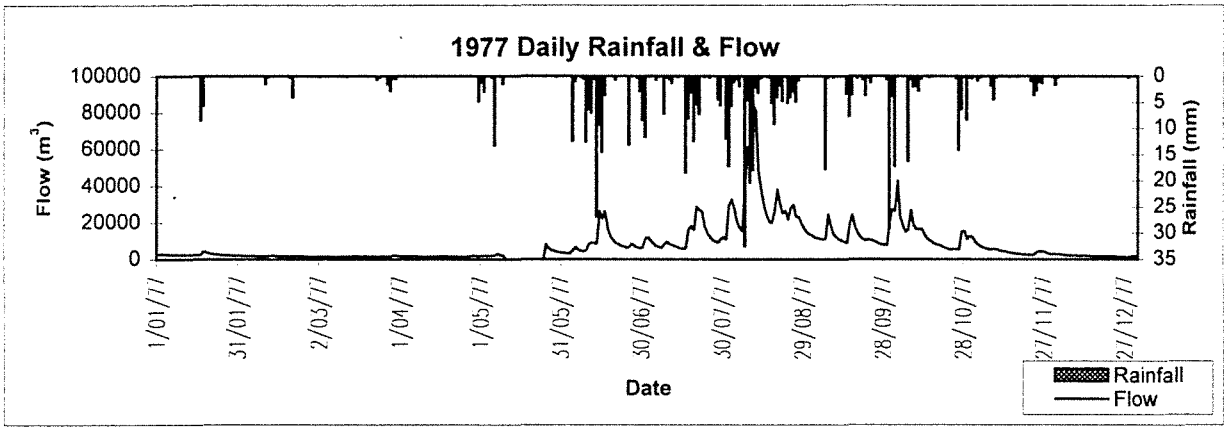


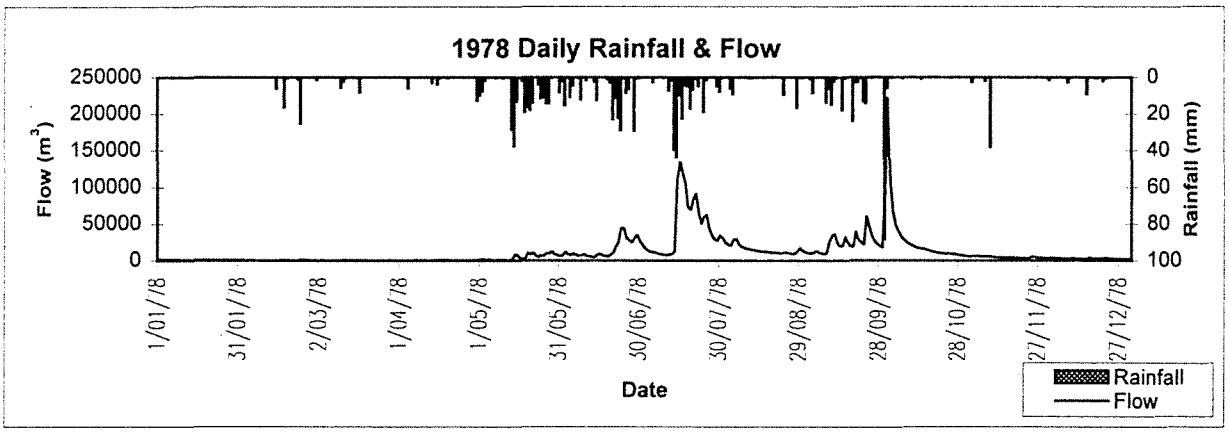


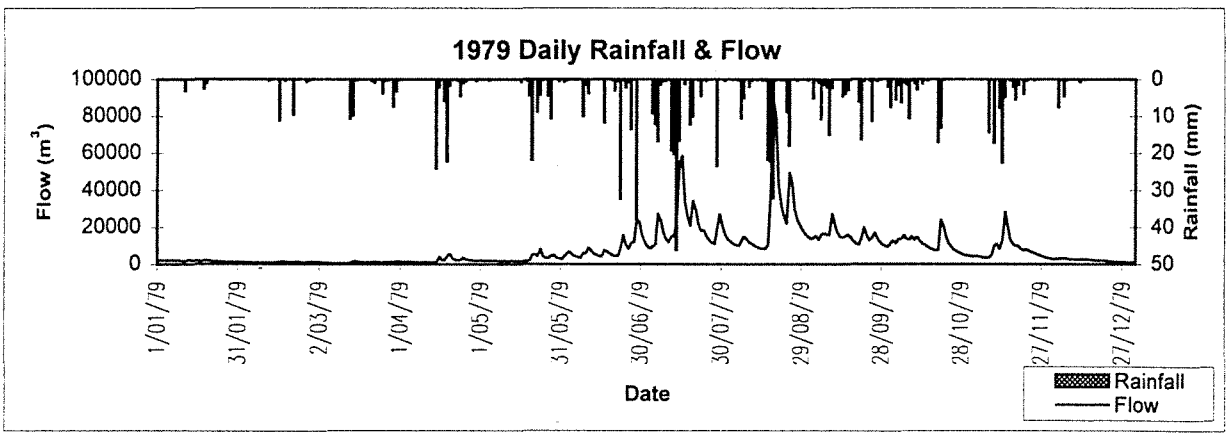


Conjurunup Catchment - S 614233

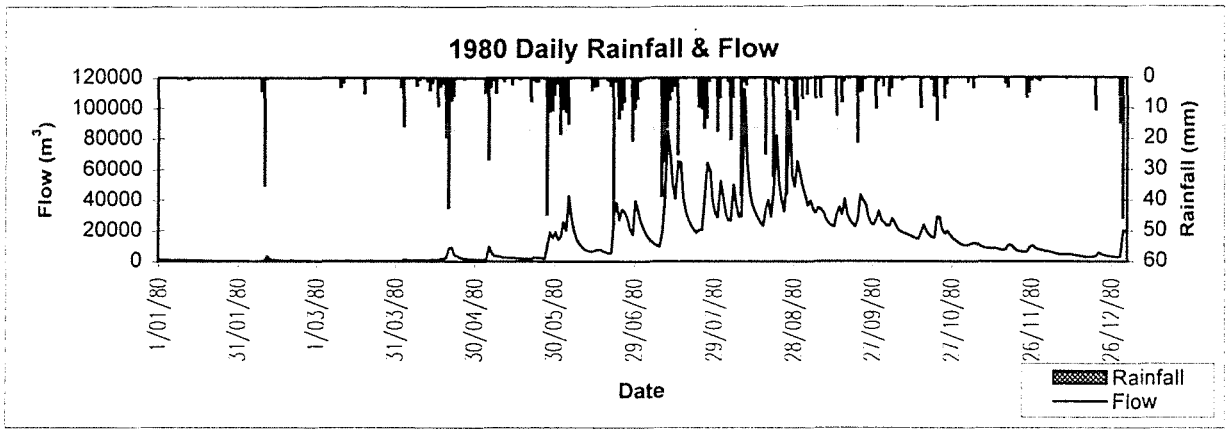


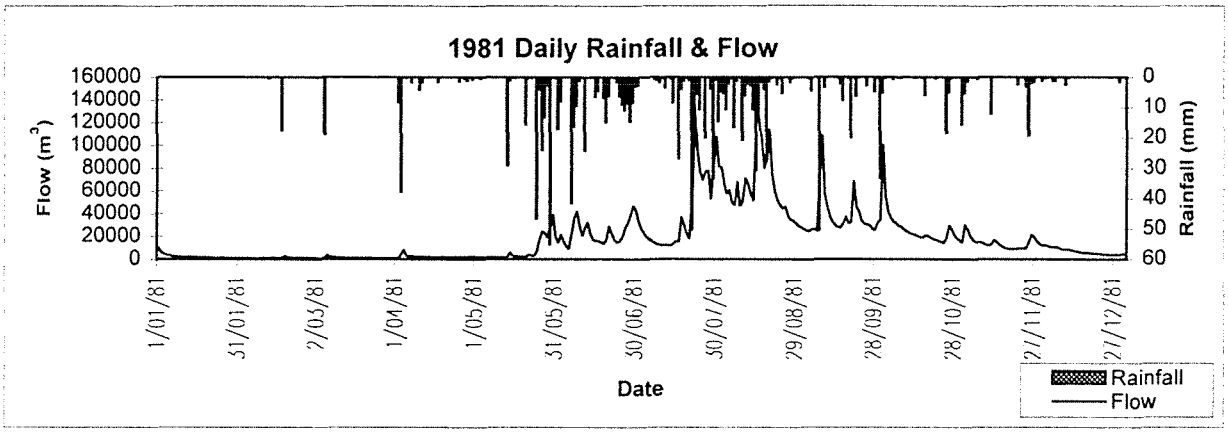


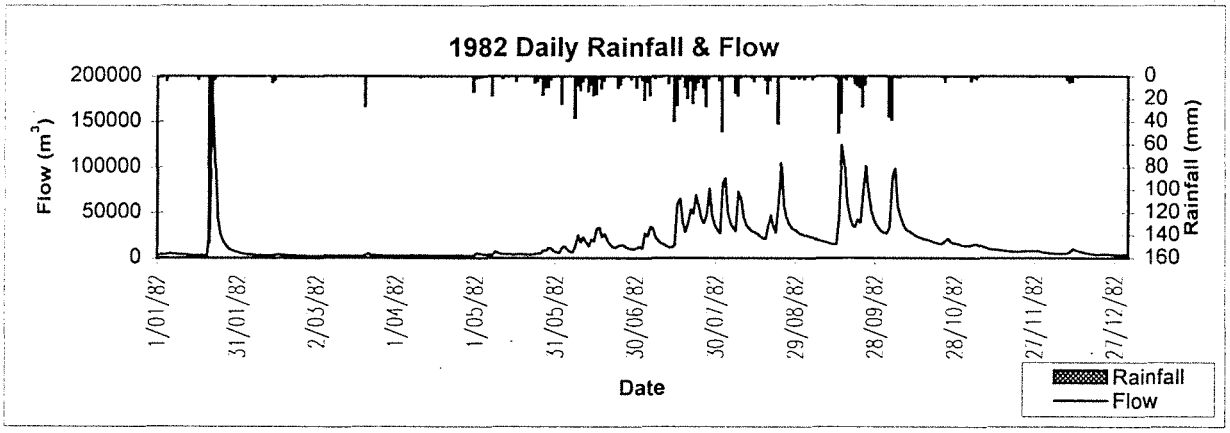


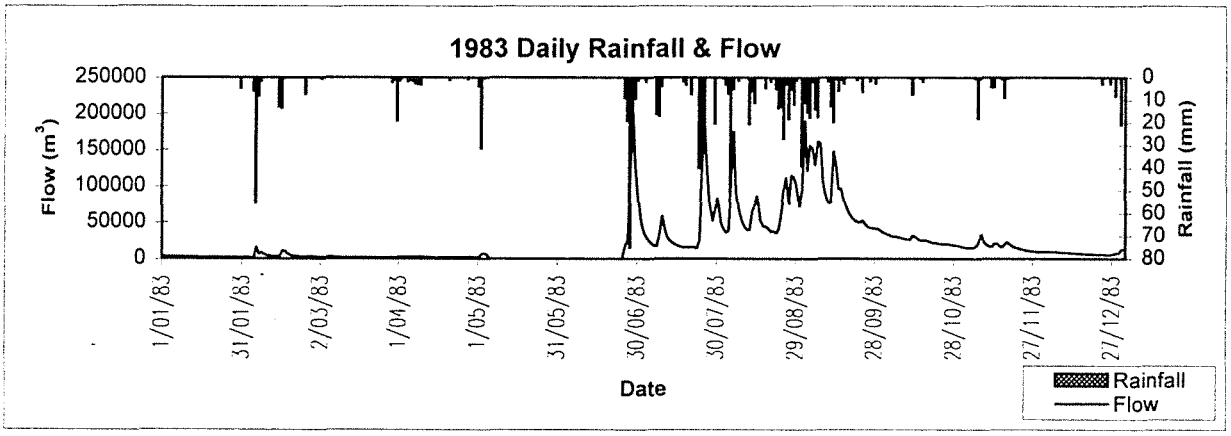


Conjurunup Catchment - S 614233

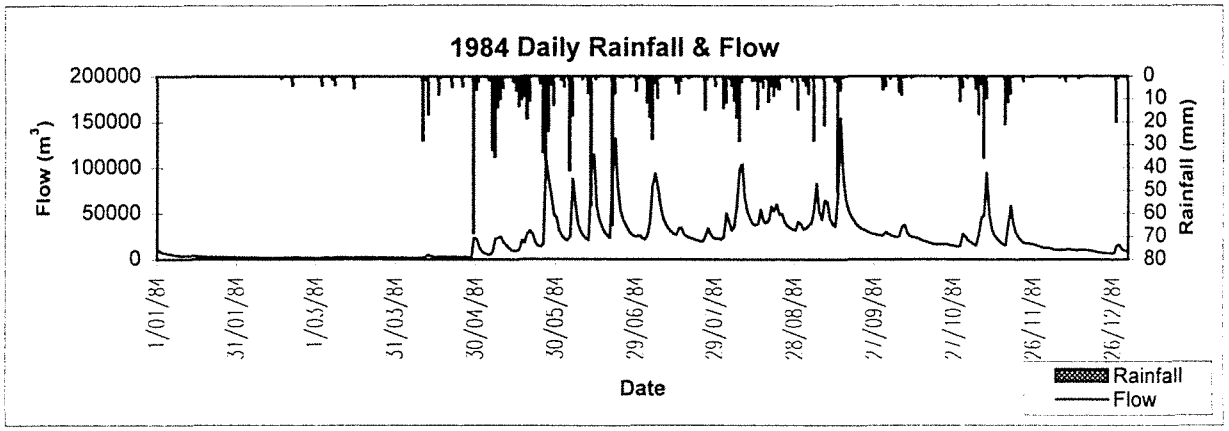


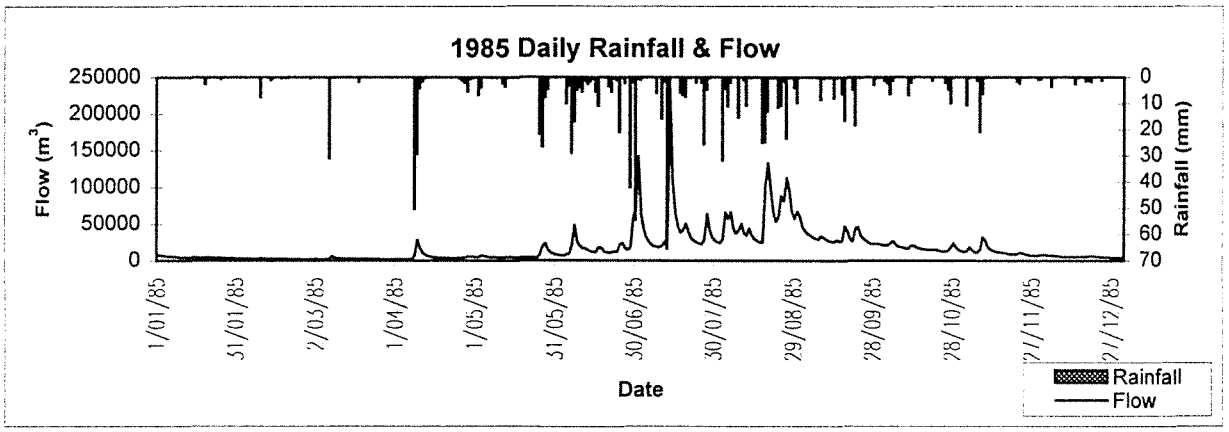


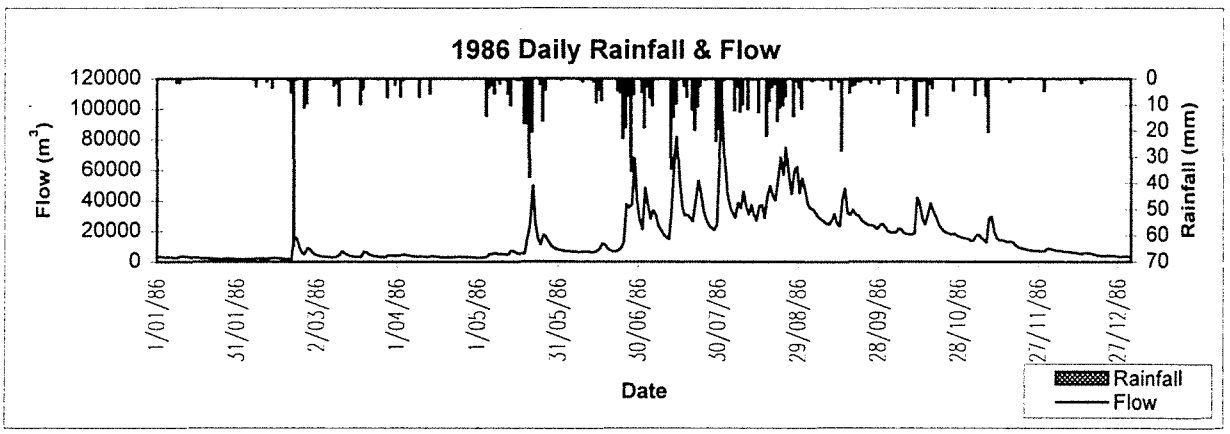


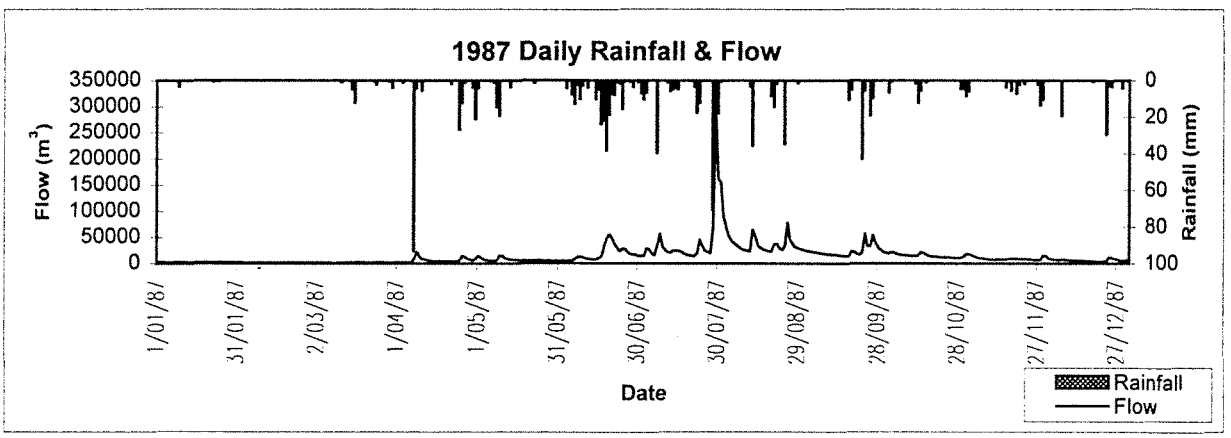


Conjurunup Catchment - S 614233

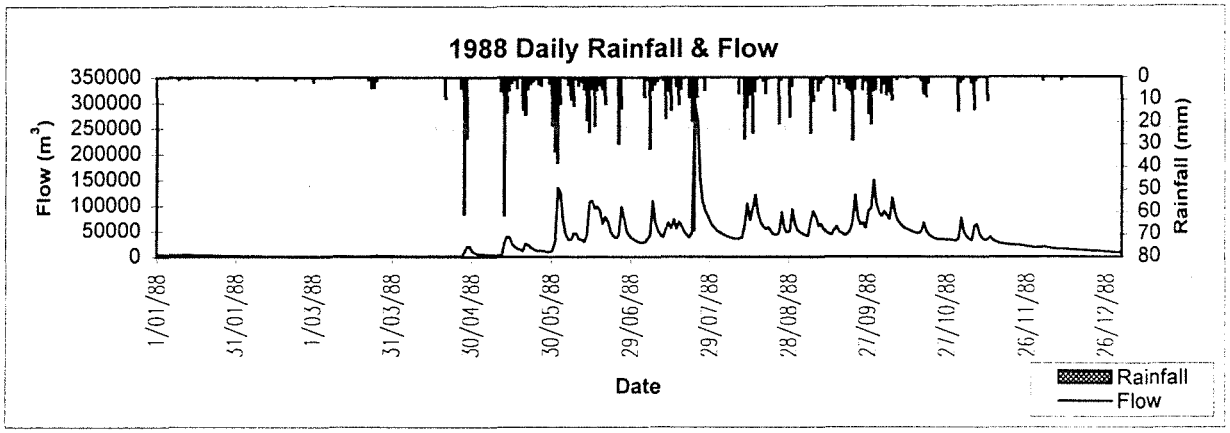


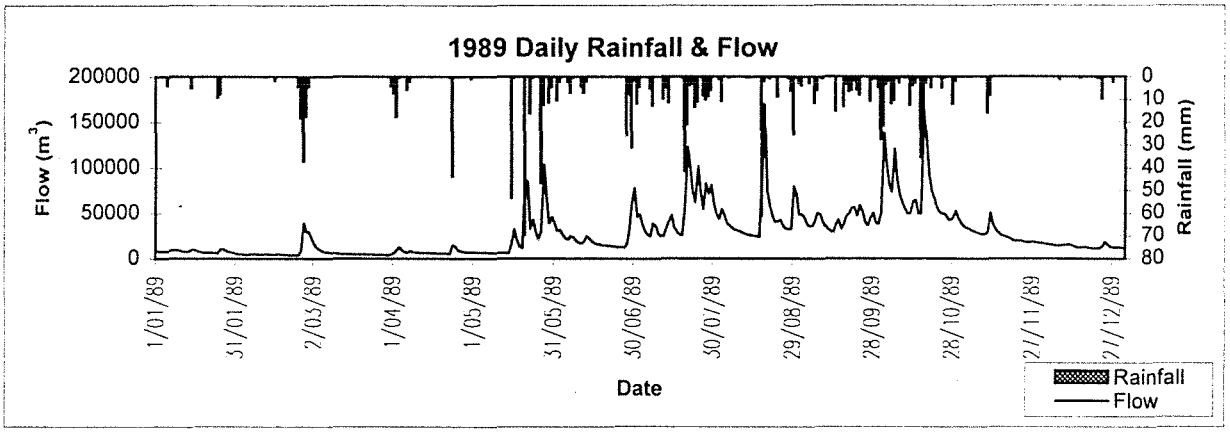


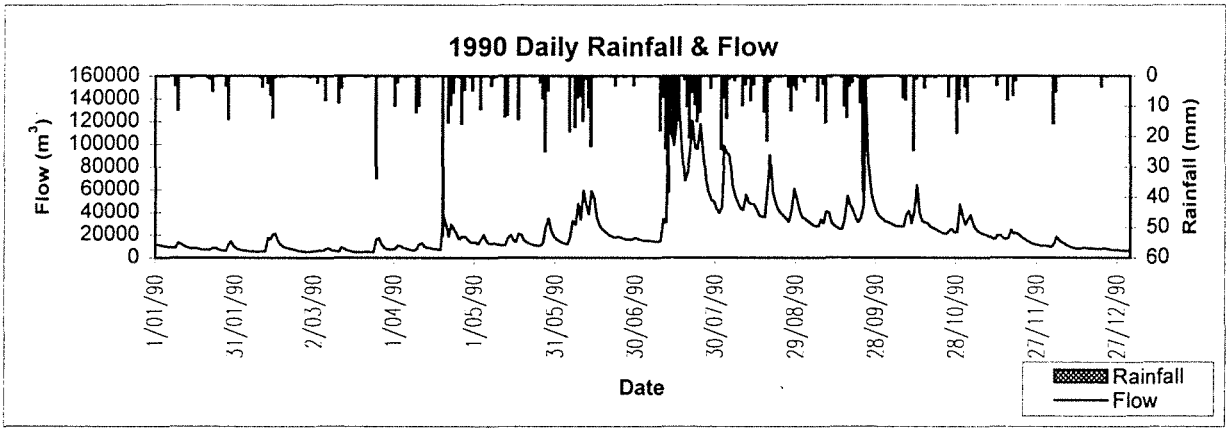


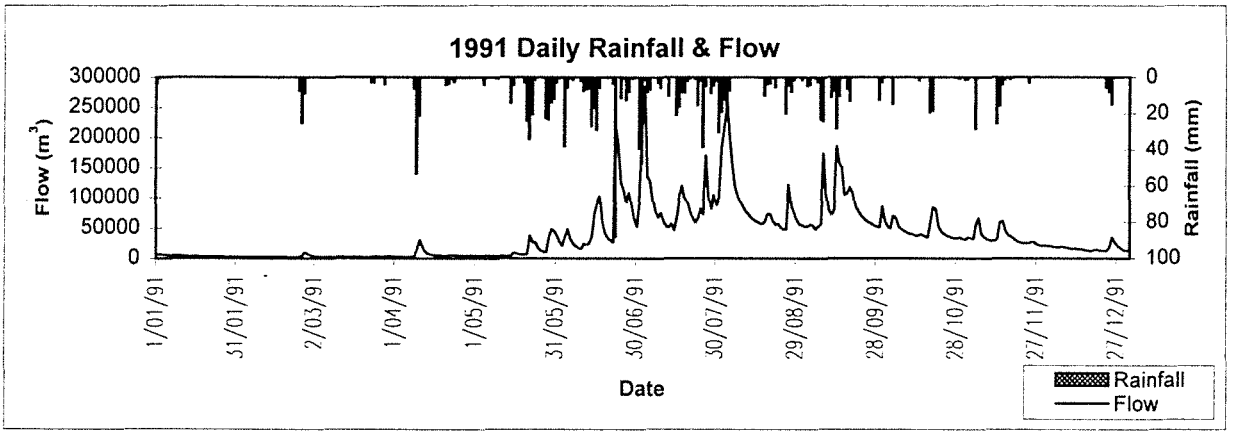


Conjurunup Catchment - S 614233

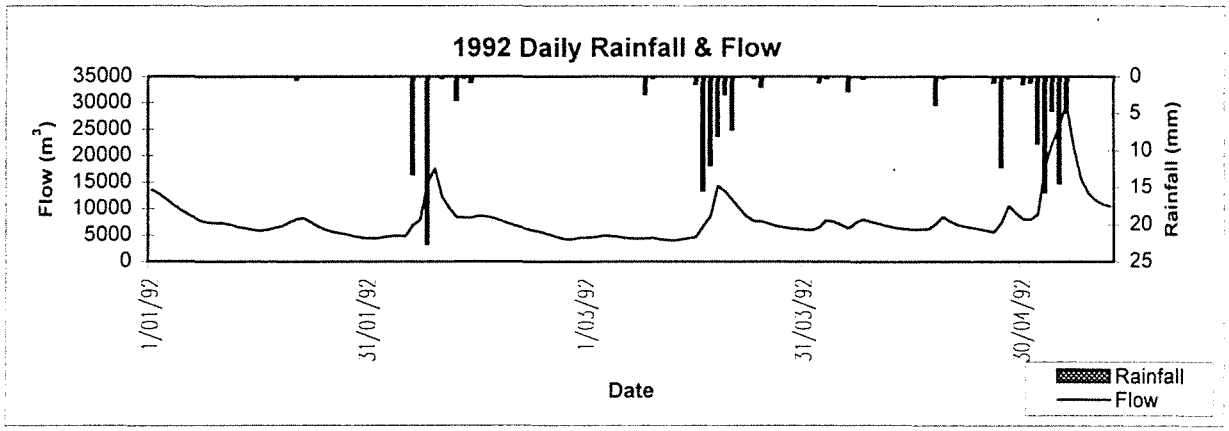








Conjurunup Catchment - S 614233



Seldom Seen Catchment

Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 86

Computer Generated Stream Line

Gauging Station Number	S616021
Rainfall Gauge Number	M509269

Information about catchment

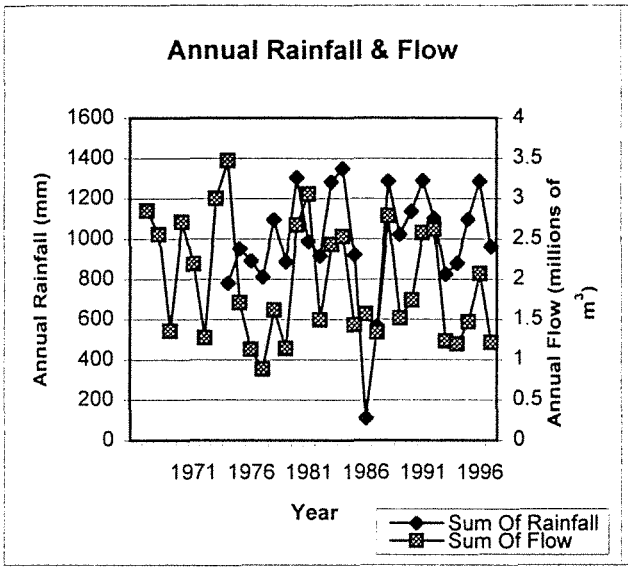
Catchment area	7.53 km^2
Gauging Station Coordinates (AMG)	N 6431500 E414050
Treatment data	Bauxite mining since 1967/68

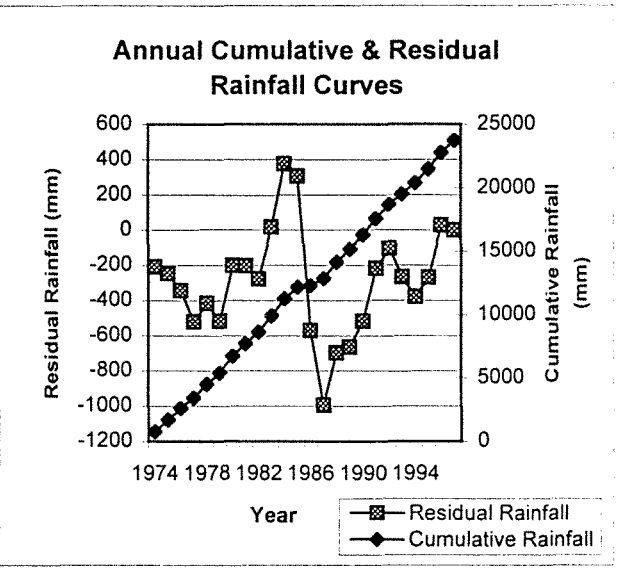
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	8731	11711	0
Number of years recorded	25	33	
Number of years with complete records	23	31	
Start date	10/06/74	13/04/66	
Finish date	5/05/98	5/05/98	
Number of days with quality code 1	7948	11251	
Number of days with quality code 2	93	199	
Number of days with quality code 3	79	139	
Number of days with quality code 4	2	54	
Number of days with quality code 157	38	63	
Number of days with quality code 171	1	0	
Number of days with quality code 255	570	5	

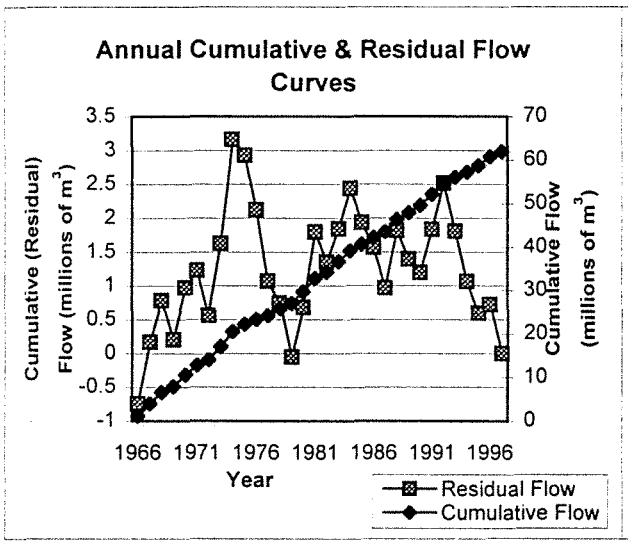
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	998.1	1.962
Min	110.8	0.884
Max	1347.7	3.471

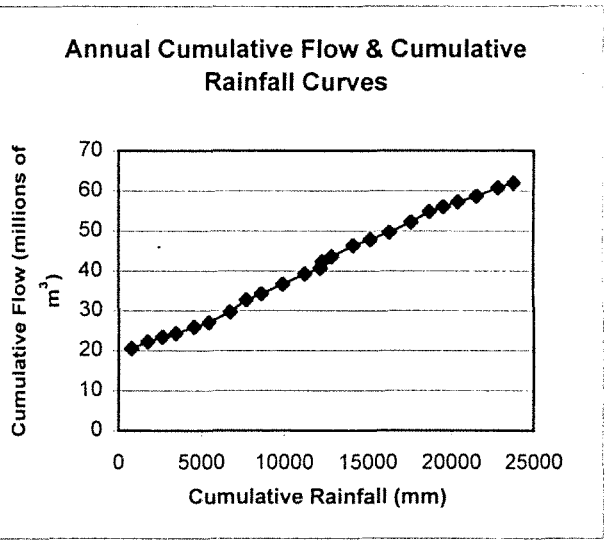
Year	Number of flow days
1967	353
1968	326
1969	365
1970	365
1971	354
1972	366
1973	365
1974	365
1975	365
1976	366
1977	365
1978	365
1979	365
1980	366
1981	365
1982	365
1983	365
1984	366
1985	365
1986	365
1987	365
1988	366
1989	365
1990	365
1991	365
1992	366
1993	364
1994	363
1995	365
1996	366
1997	365
Total	**11257**

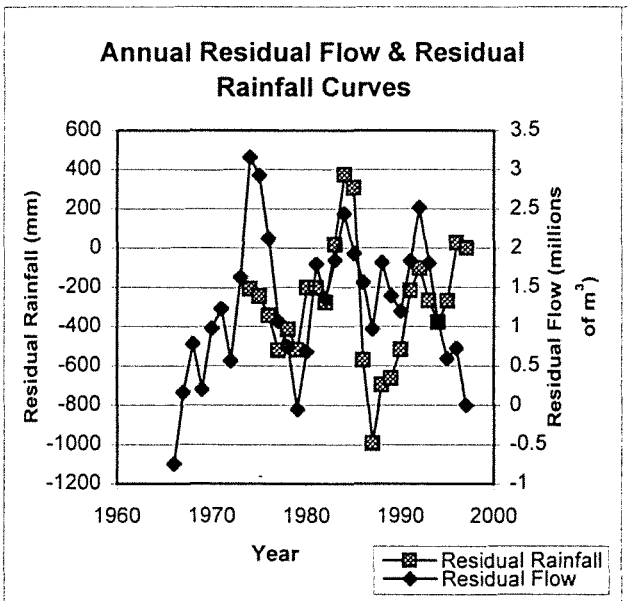
Seldom Seen Catchment - S 616021

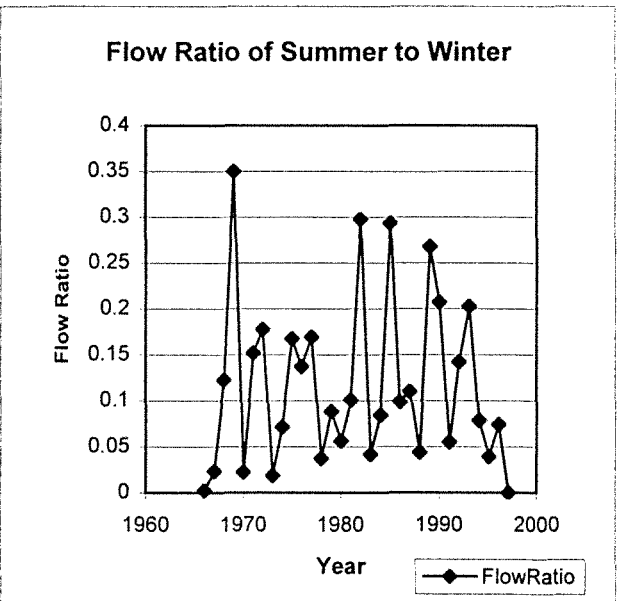




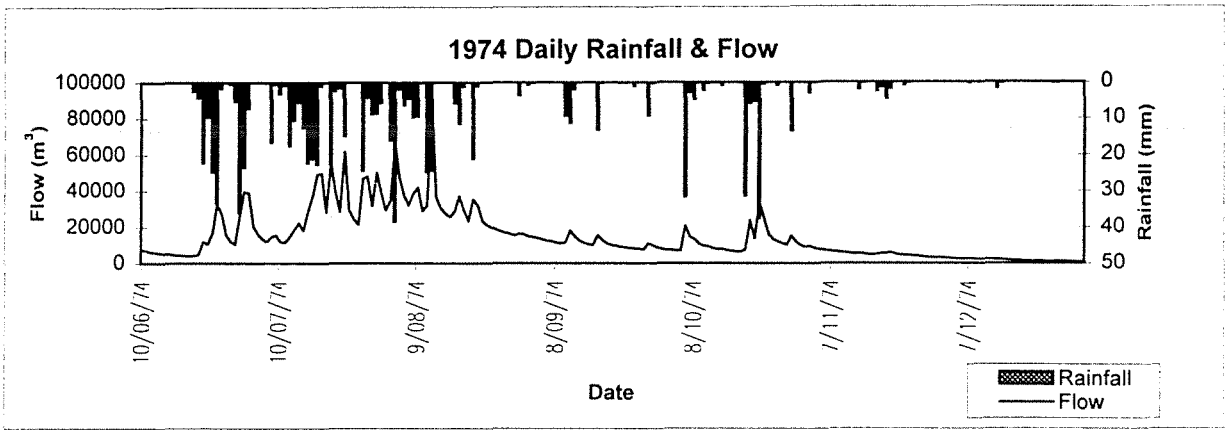


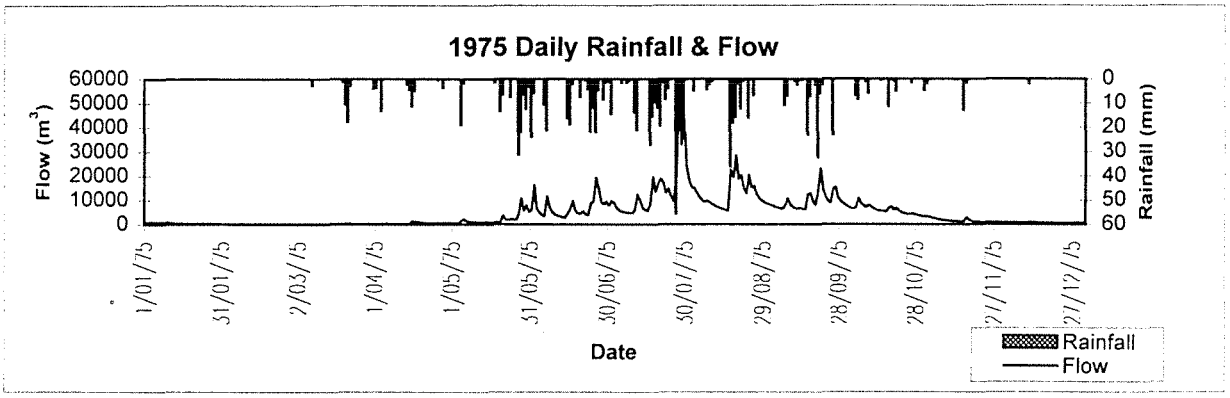


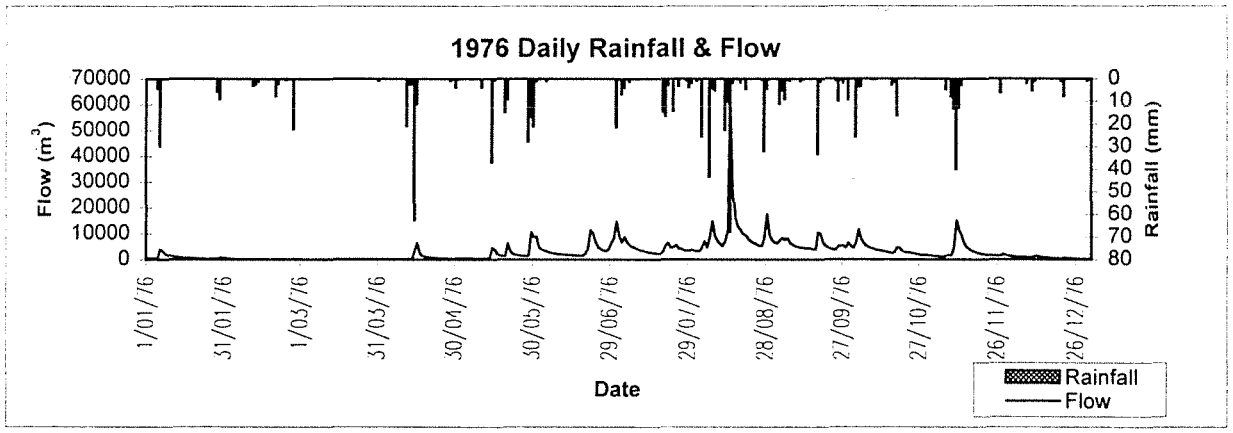


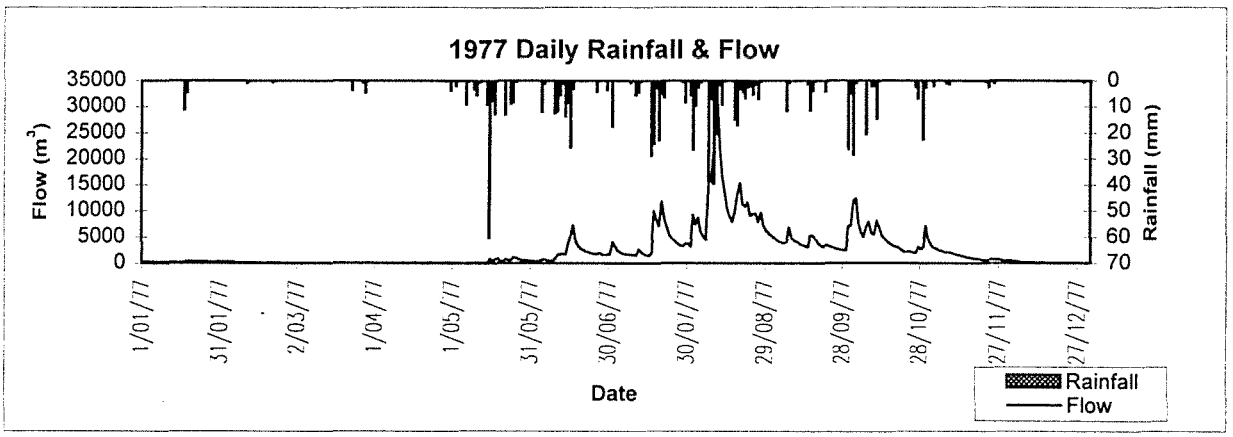


Seldom Seen Catchment - S 616021

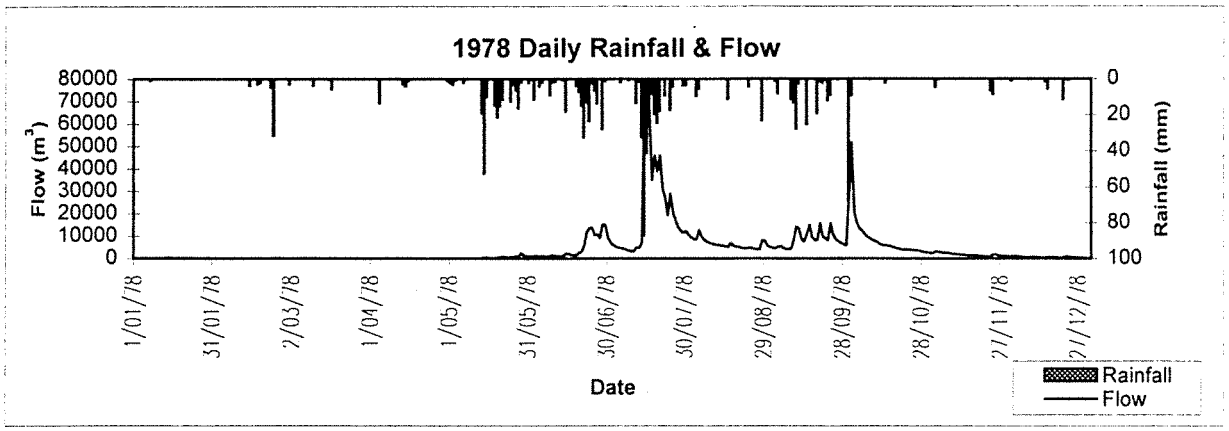


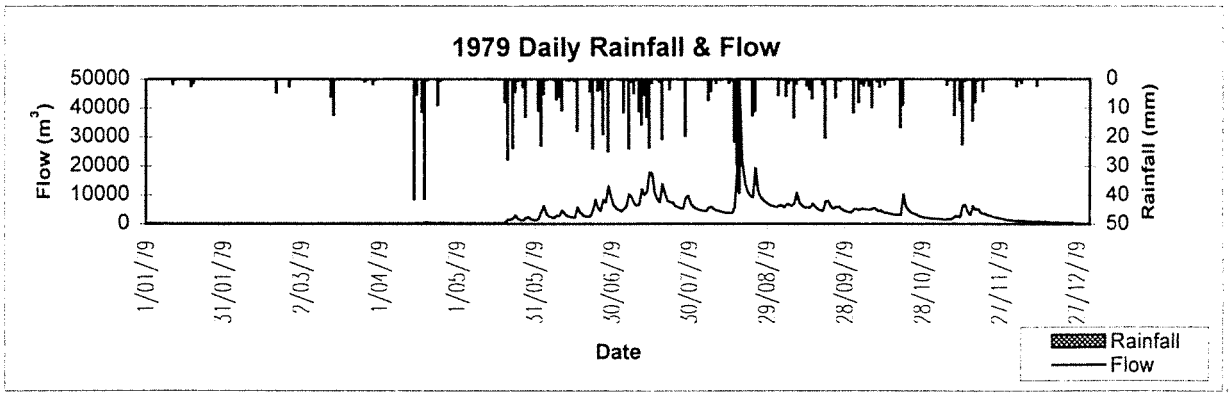


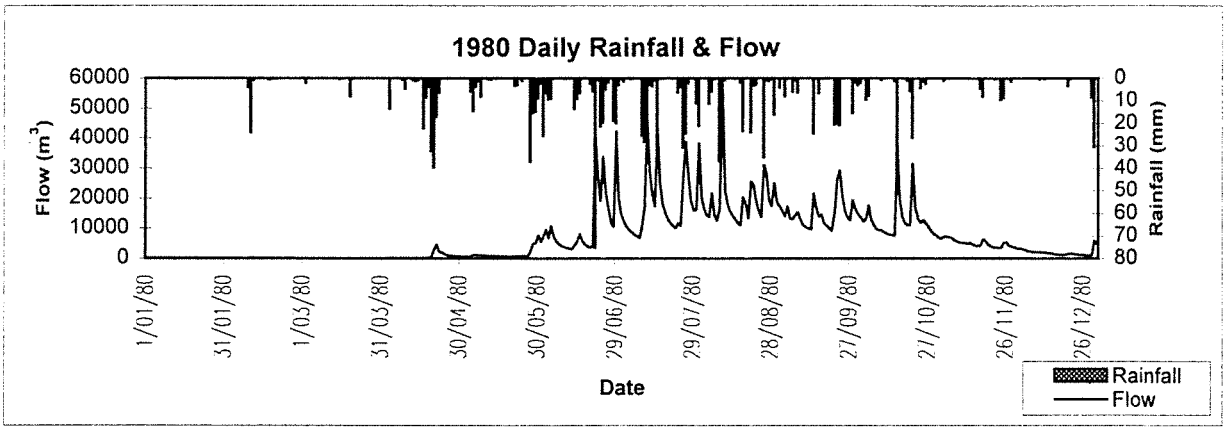


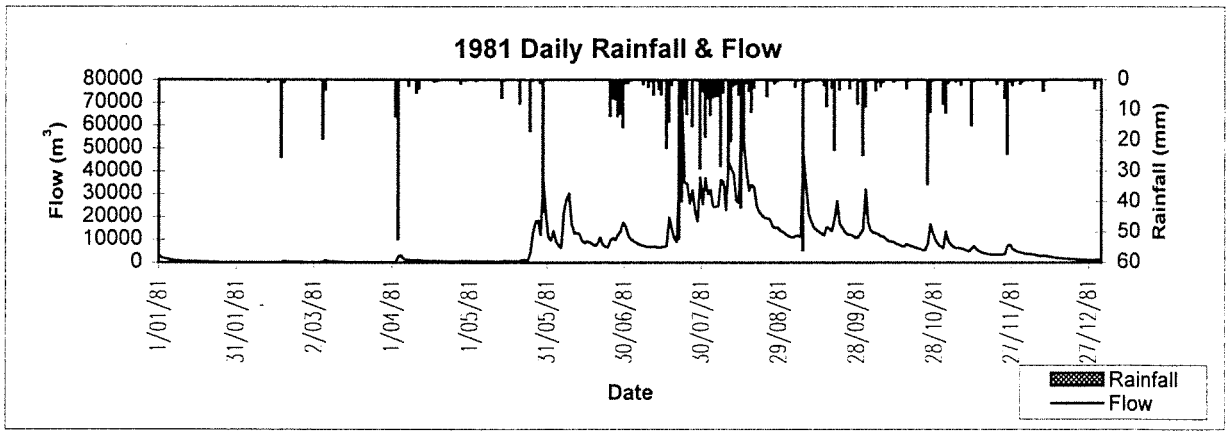


Seldom Seen Catchment - S 616021

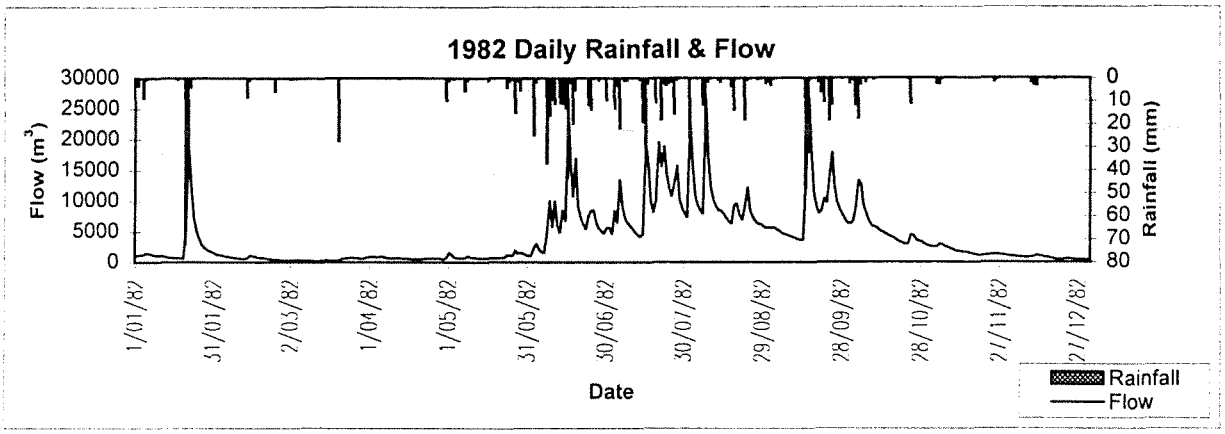


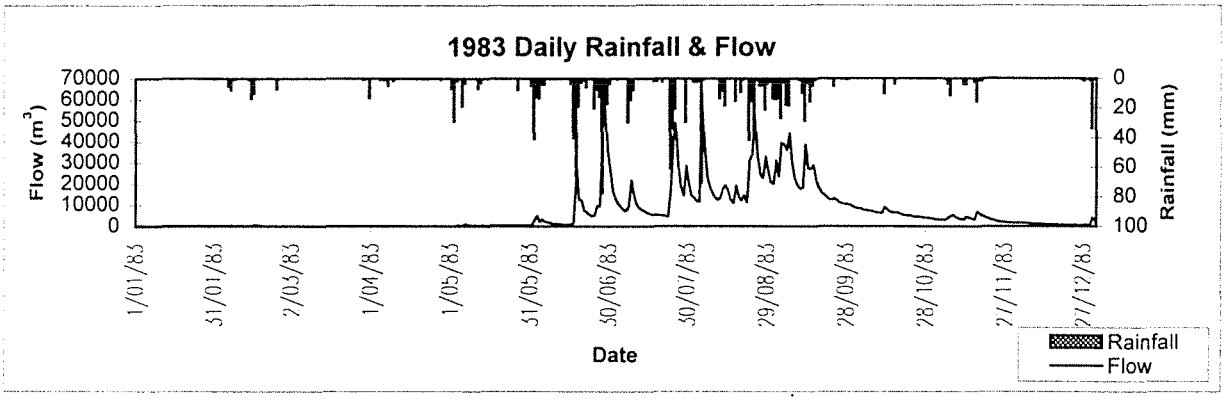


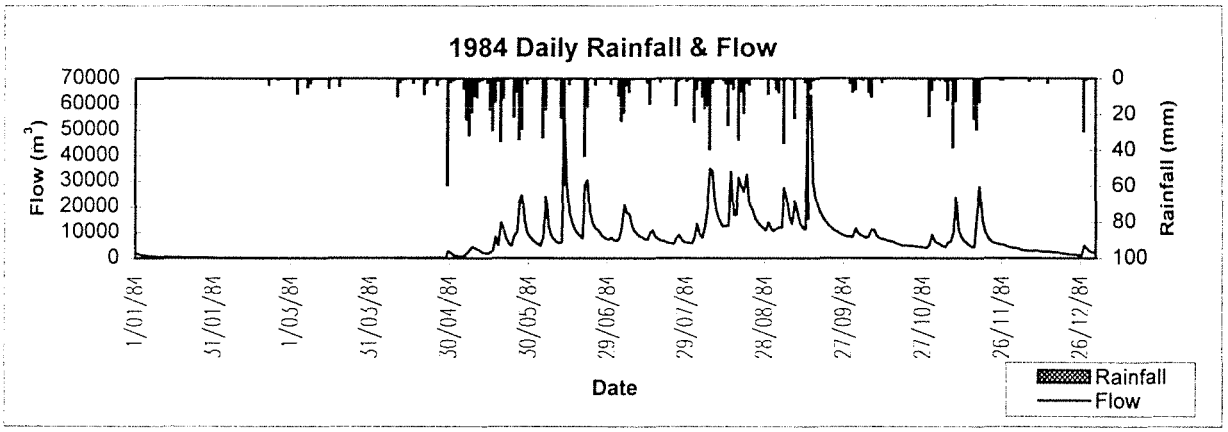


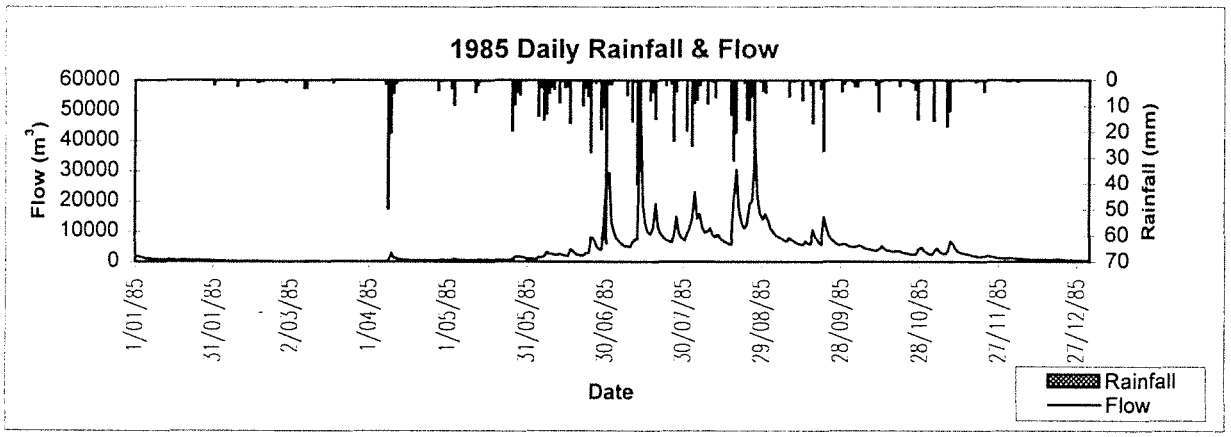


Seldom Seen Catchment - S 616021

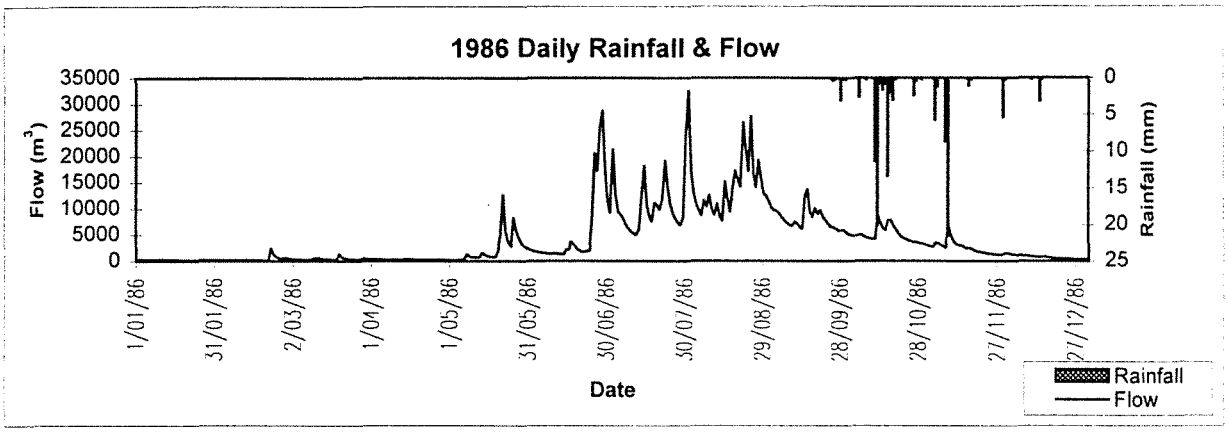


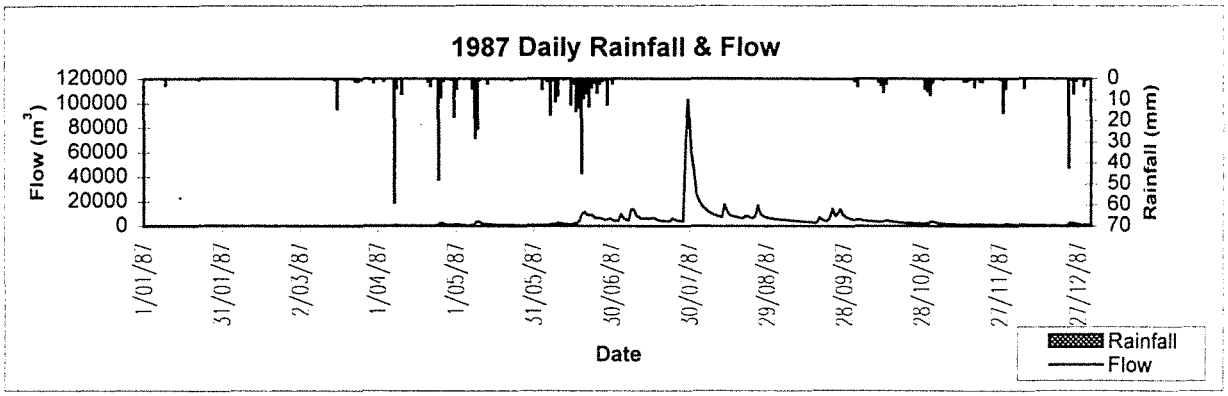


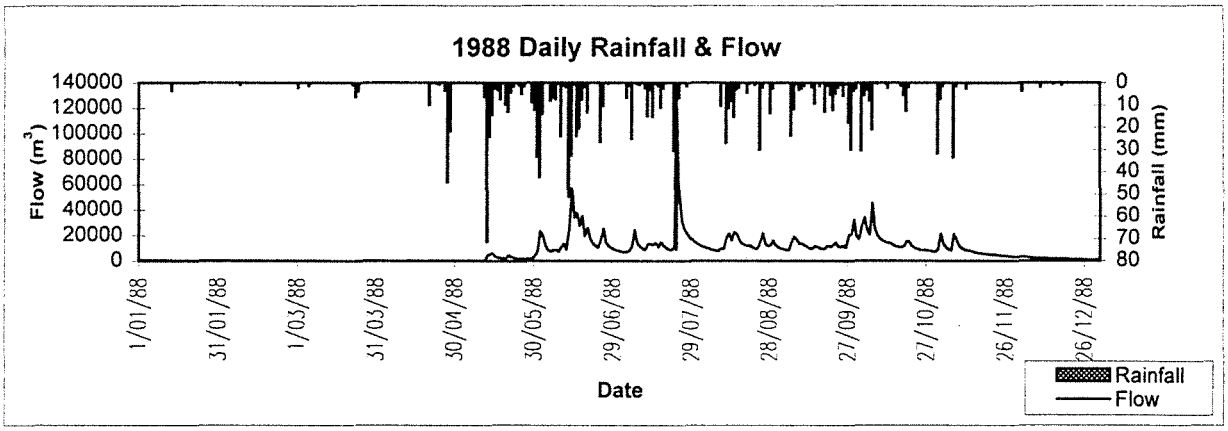


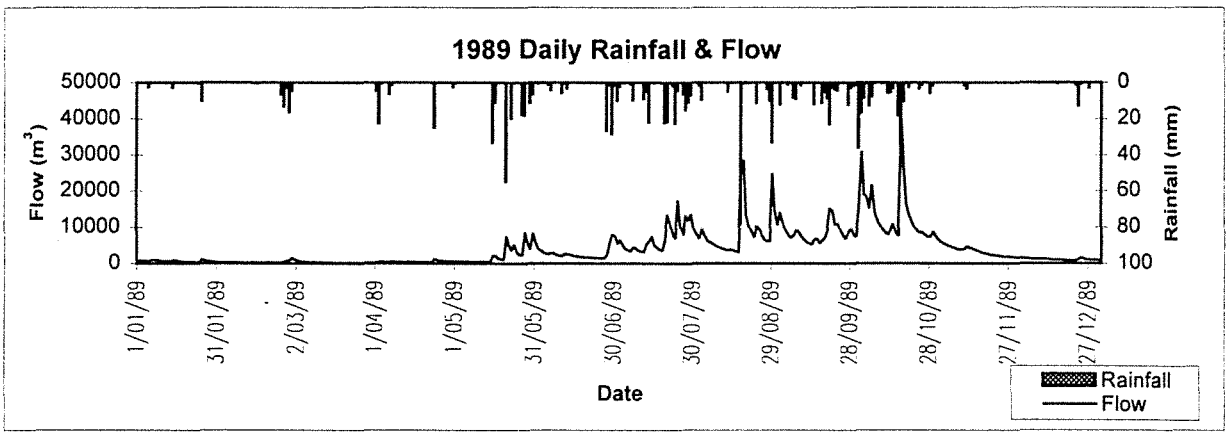


Seldom Seen Catchment - S 616021

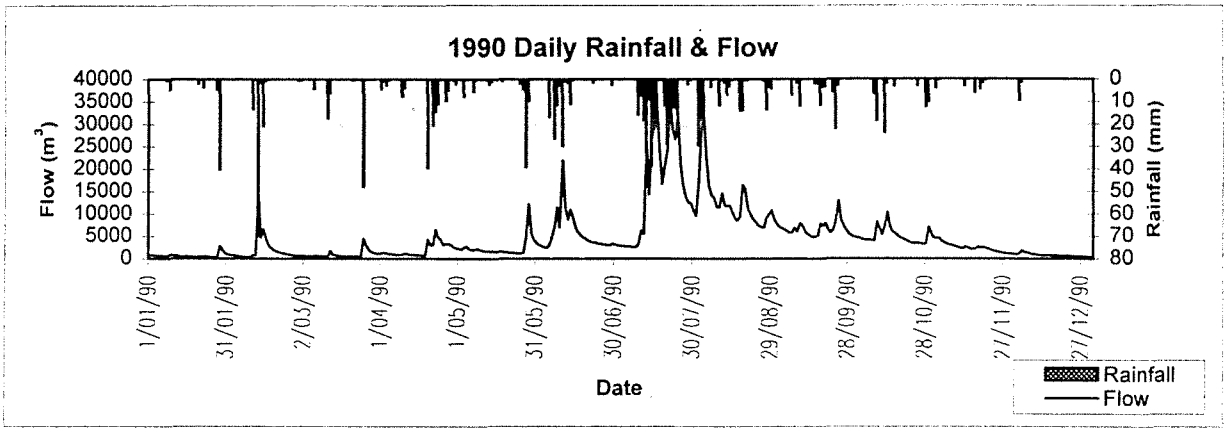


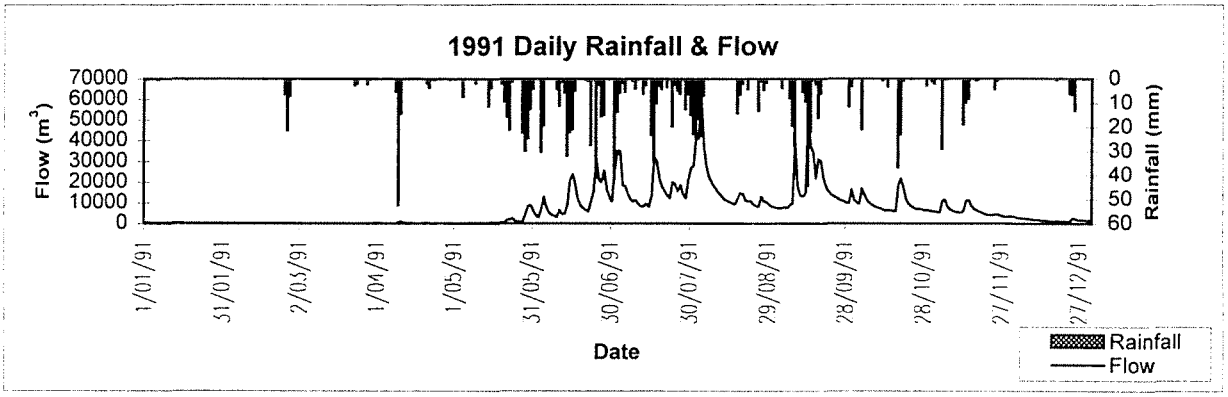


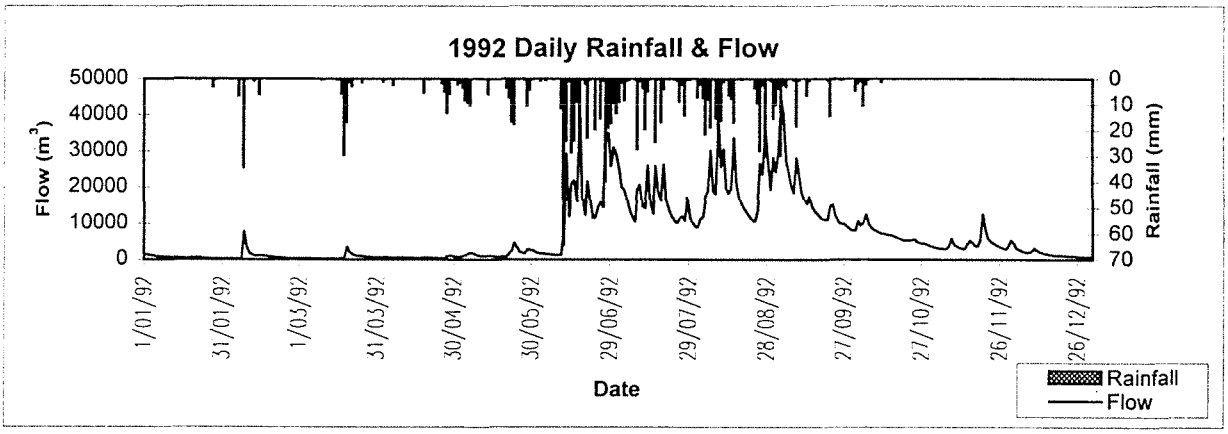


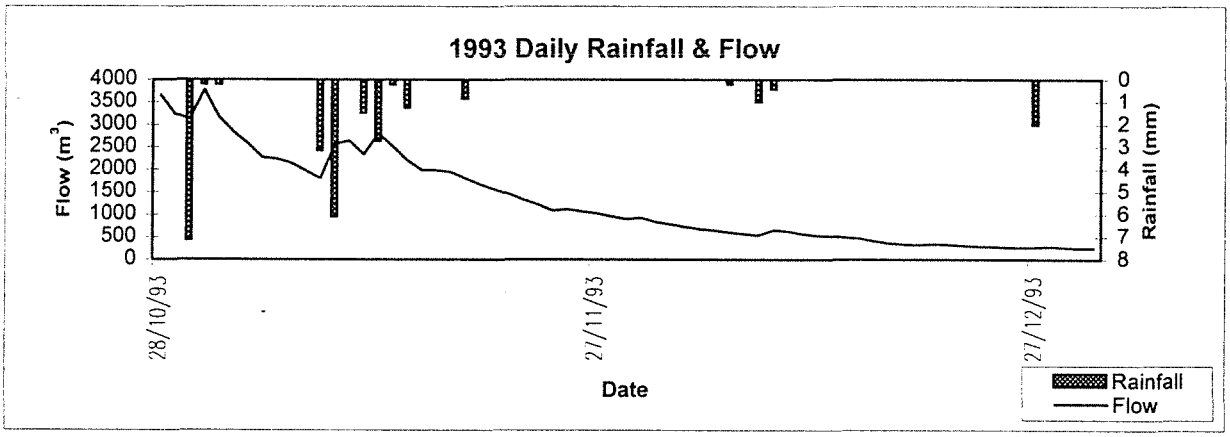


Seldom Seen Catchment - S 616021

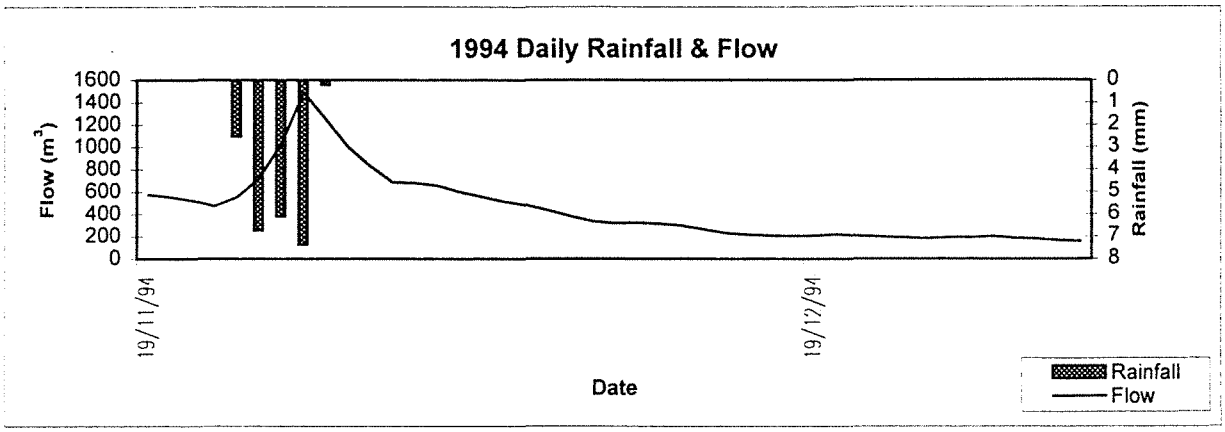


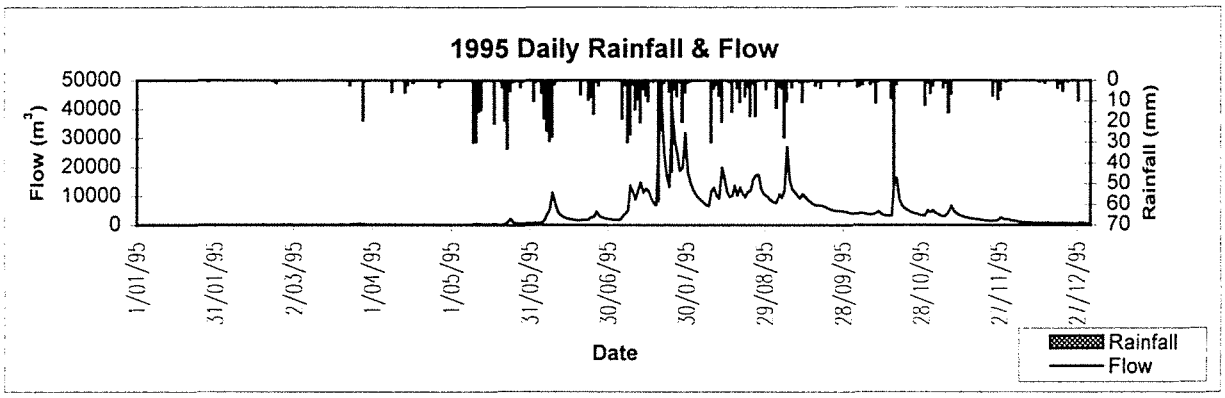


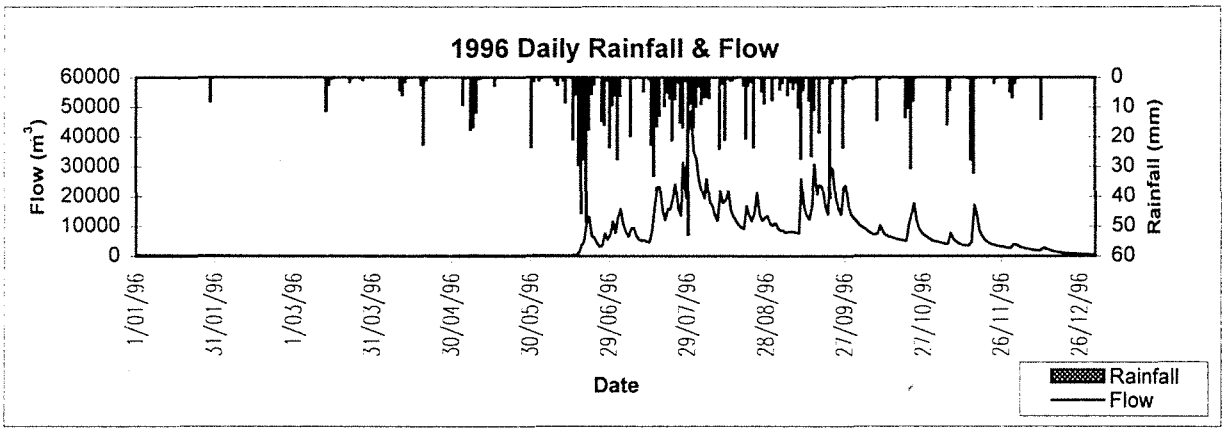


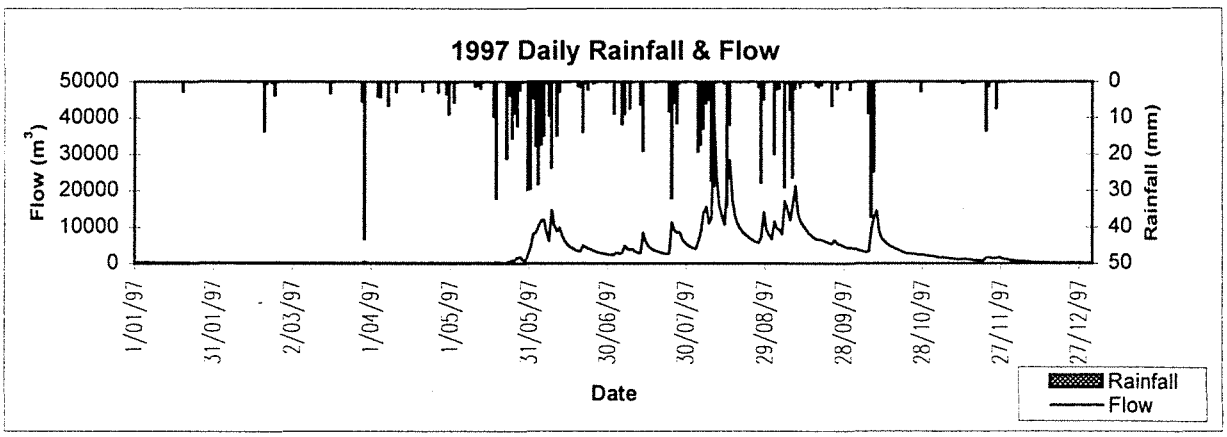


Seldom Seen Catchment - S 616021

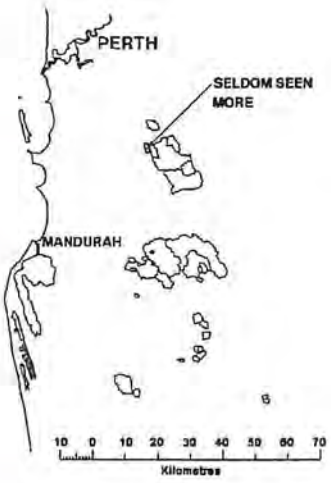








More Seldom Seen Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S616022
Rainfall Gauge Number	M509270

Information about catchment

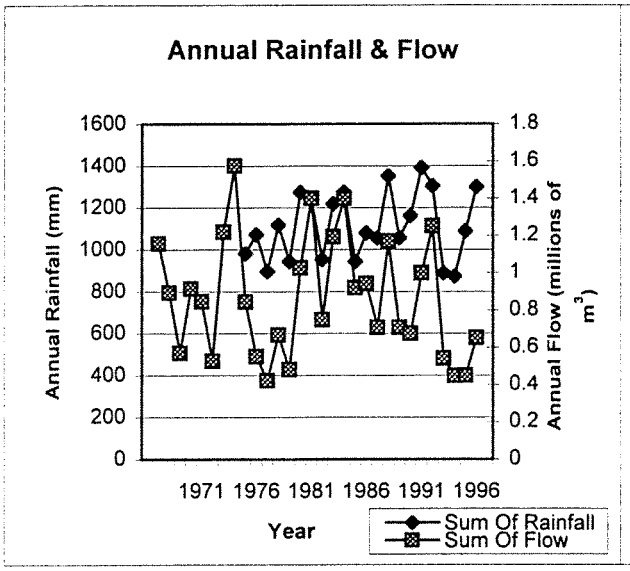
Catchment area	3.27 km^2	
Gauging Station Coordinates (AMG)	N 6430890	E 413220
Treatment data	Bauxite mining since 1967/68.	

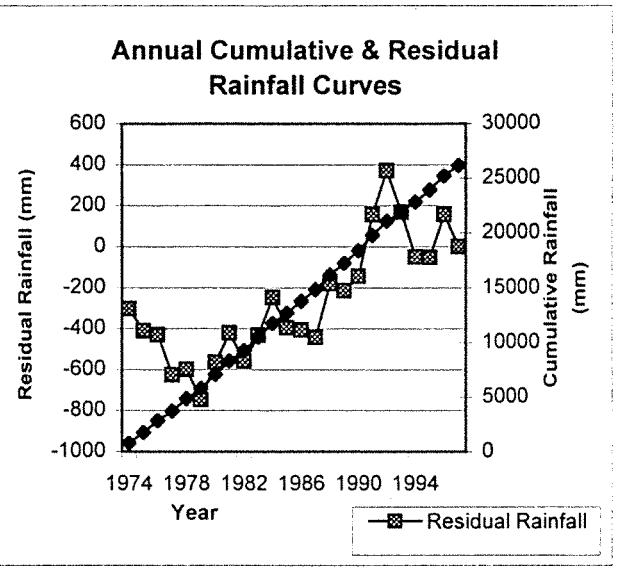
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	8520	11578	0
Number of years recorded	24	32	
Number of years with complete records	22	30	
Start date	25/06/74	30/03/66	
Finish date	21/10/97	9/12/97	
Number of days with quality code 1	7753	10656	
Number of days with quality code 2	356	225	
Number of days with quality code 3	191	223	
Number of days with quality code 4	190	118	
Number of days with quality code 156	0	85	
Number of days with quality code 157	1	248	
Number of days with quality code 255	29	23	

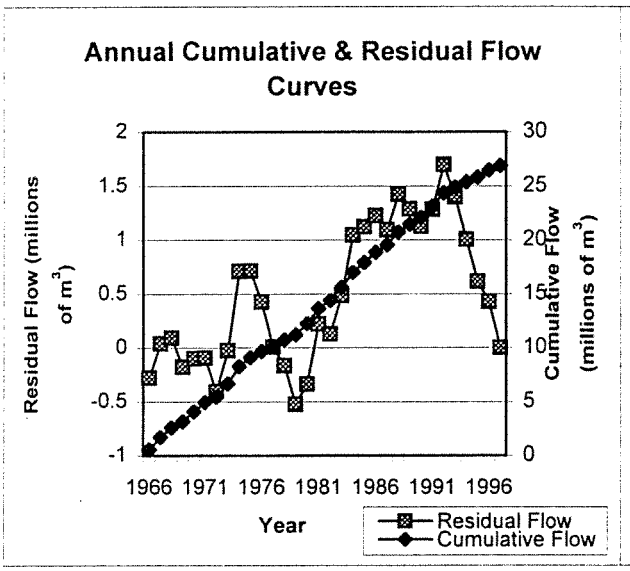
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)
Average	1111.7	0.863
Min	873.5	0.421
Max	1391.7	1.575

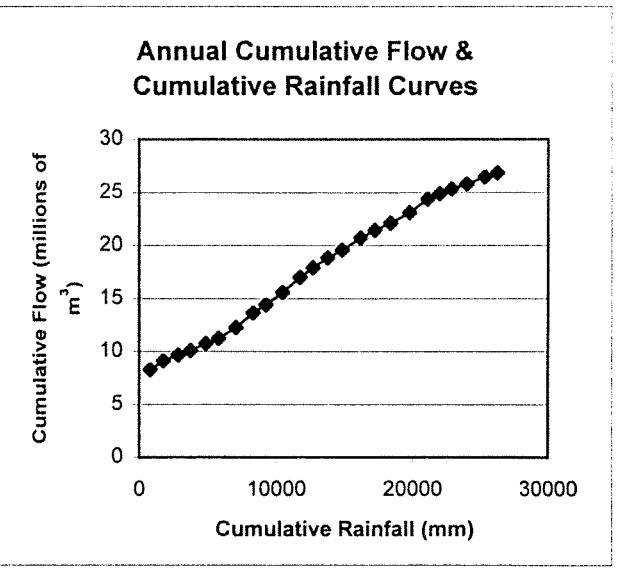
Year	Number of flow days
1967	341
1968	188
1969	349
1970	352
1971	365
1972	355
1973	365
1974	365
1975	365
1976	363
1977	365
1978	365
1979	365
1980	366
1981	365
1982	277
1983	365
1984	366
1985	365
1986	365
1987	365
1988	366
1989	365
1990	365
1991	365
1992	364
1993	349
1994	362
1995	365
1996	366
Total	**10604**

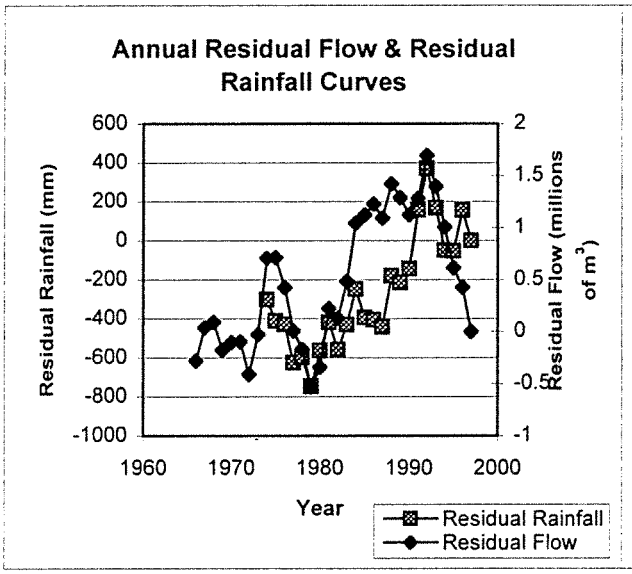
More Seldom Seen Catchment - S 616022

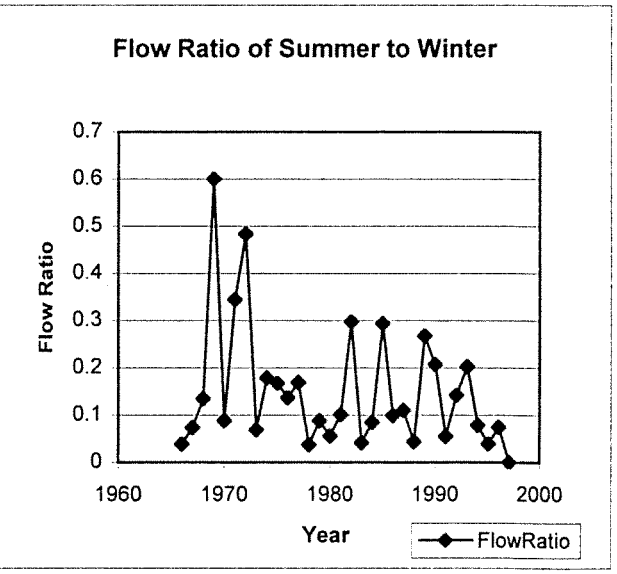




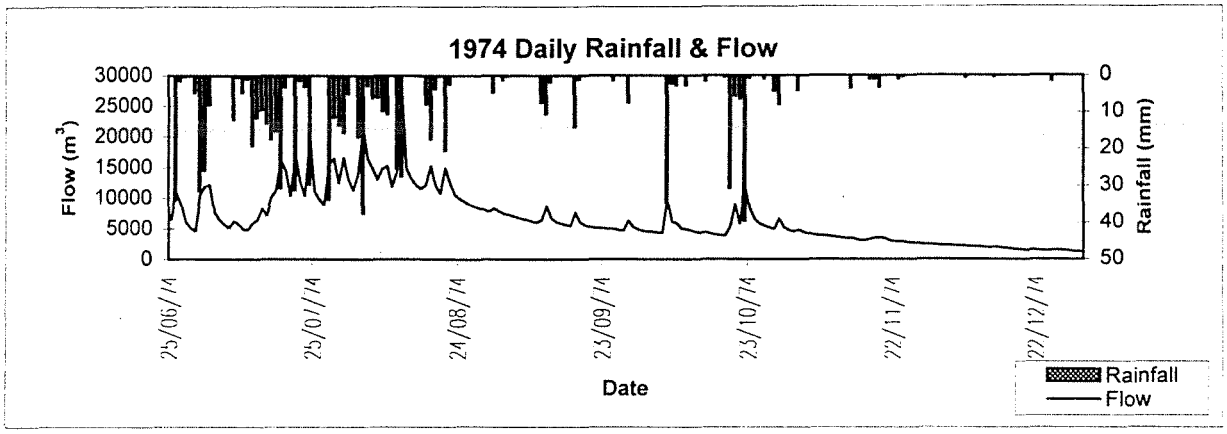


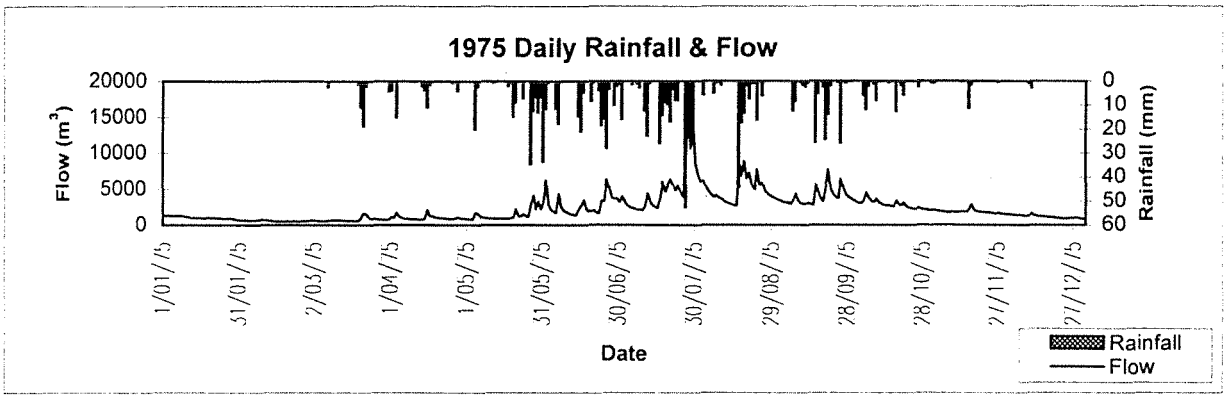


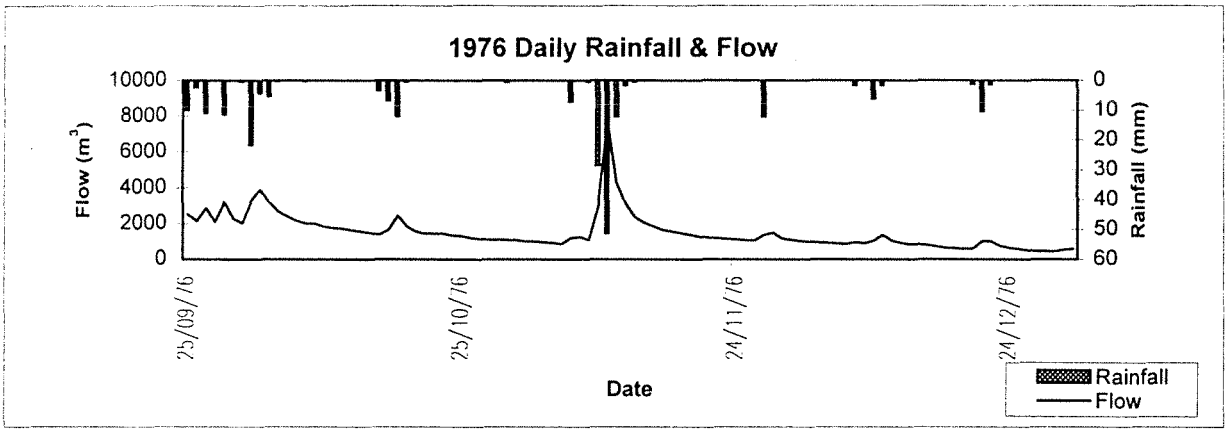


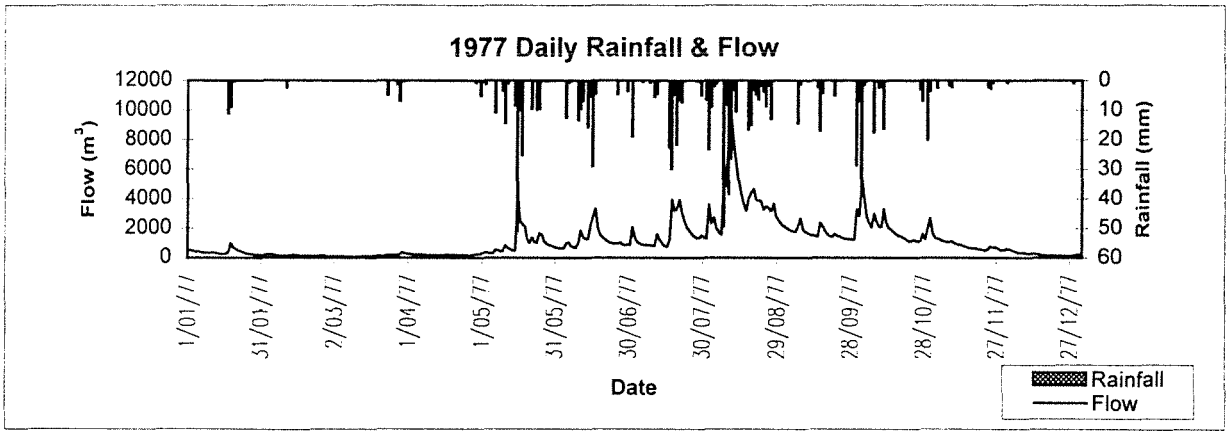


More Seldom Seen Catchment - S 616022

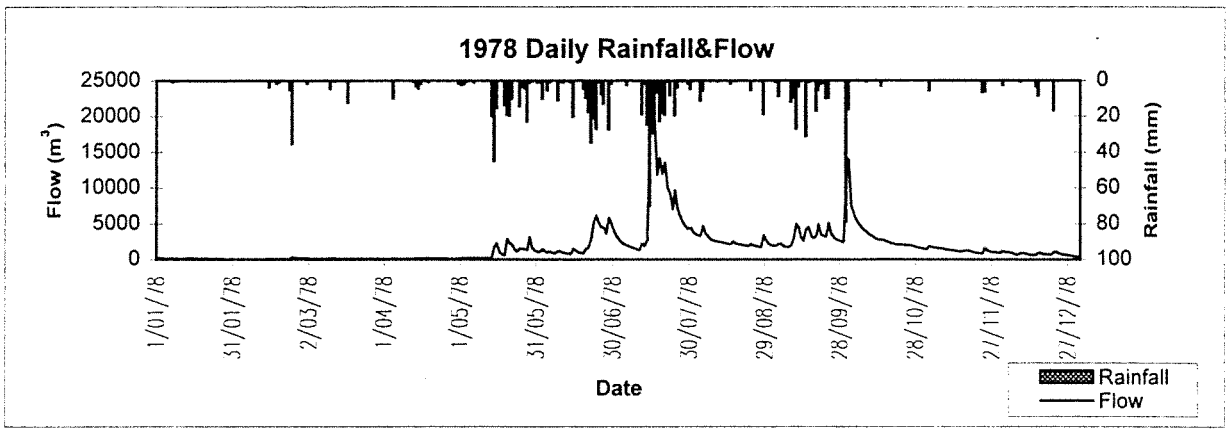


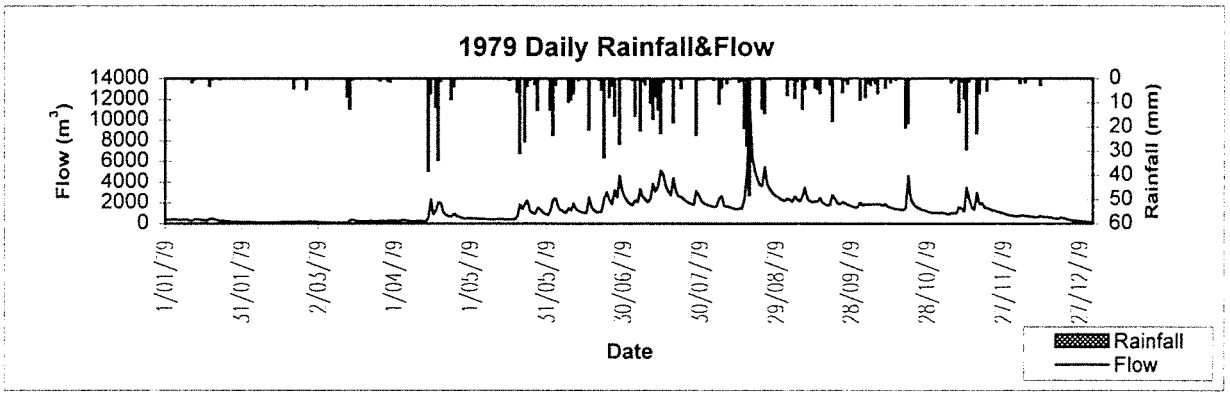


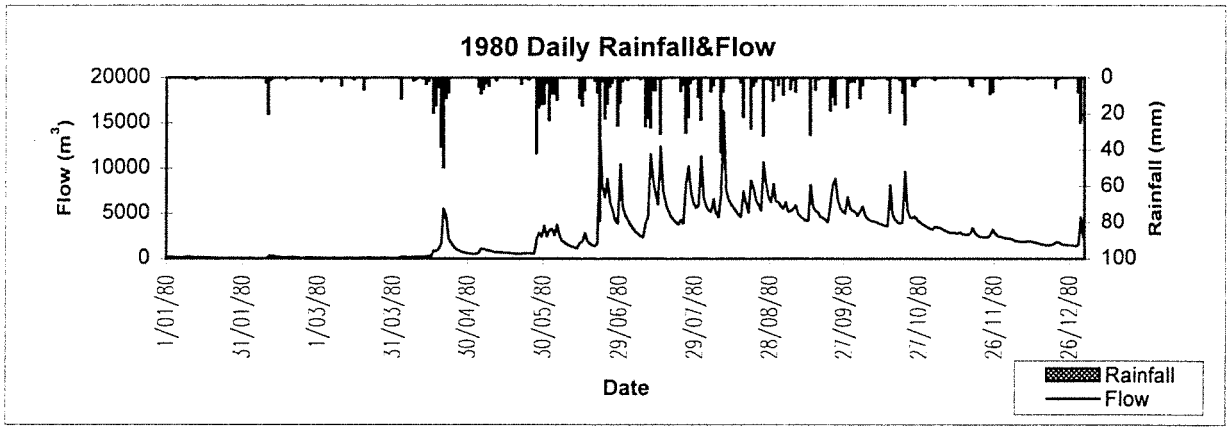


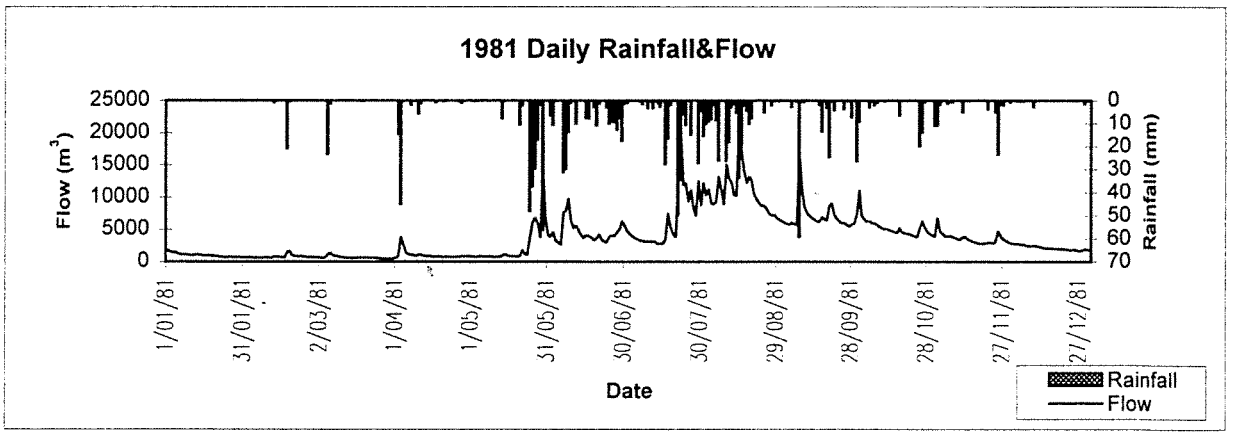


More Seldom Seen Catchment - S 616022

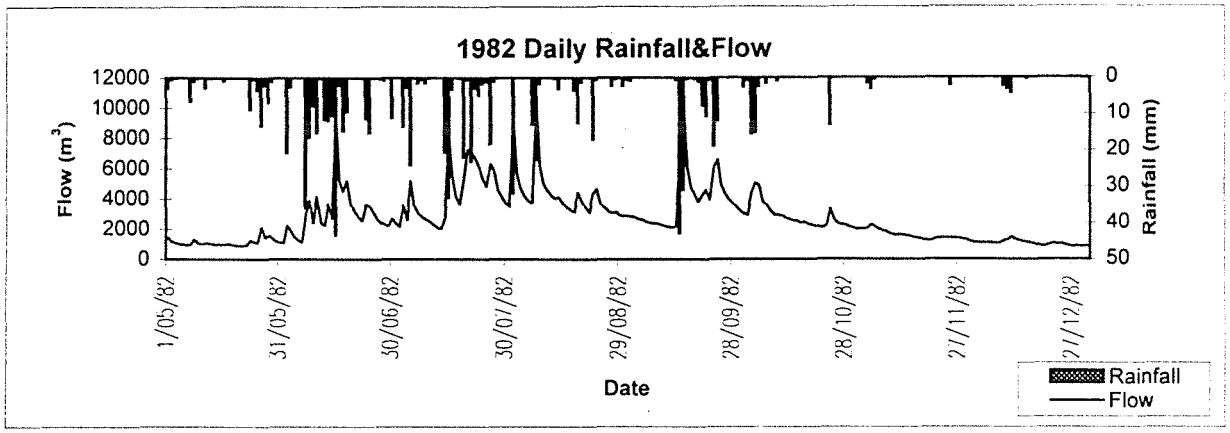


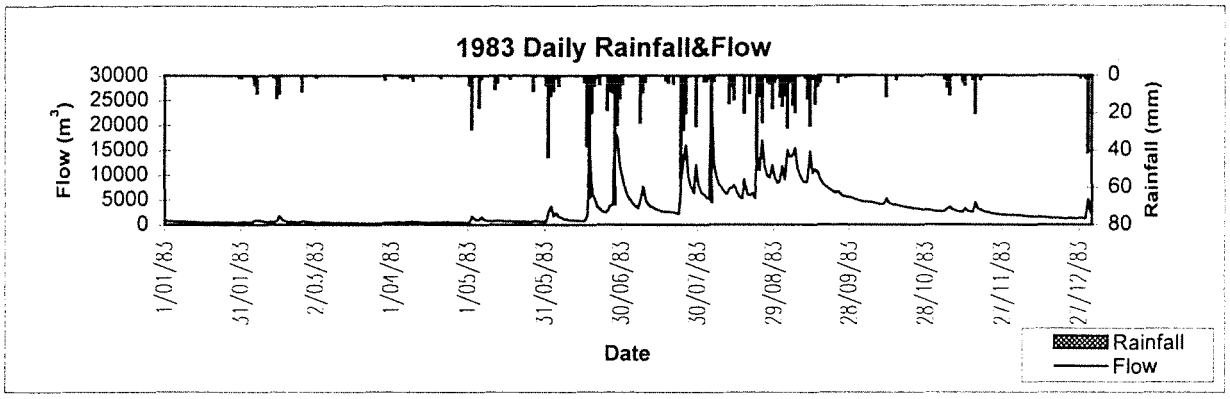


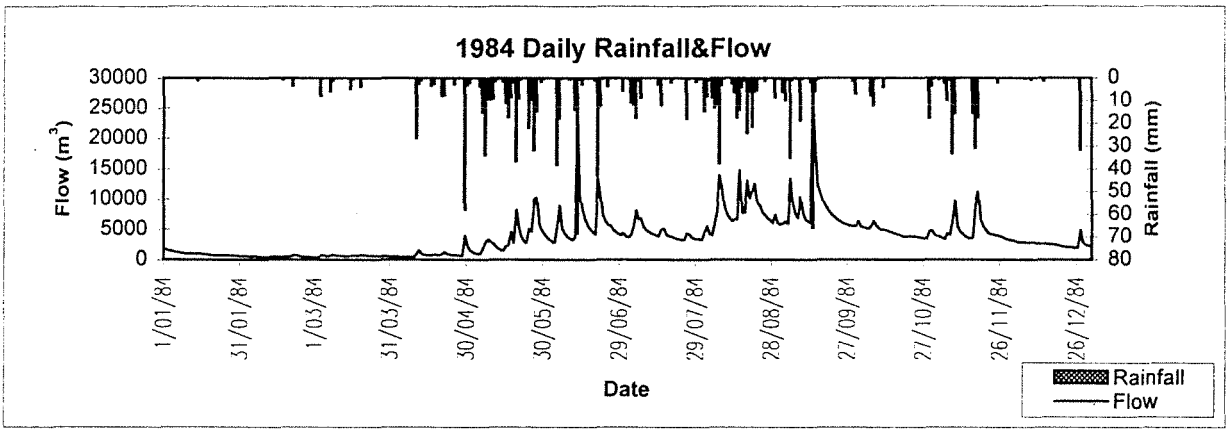


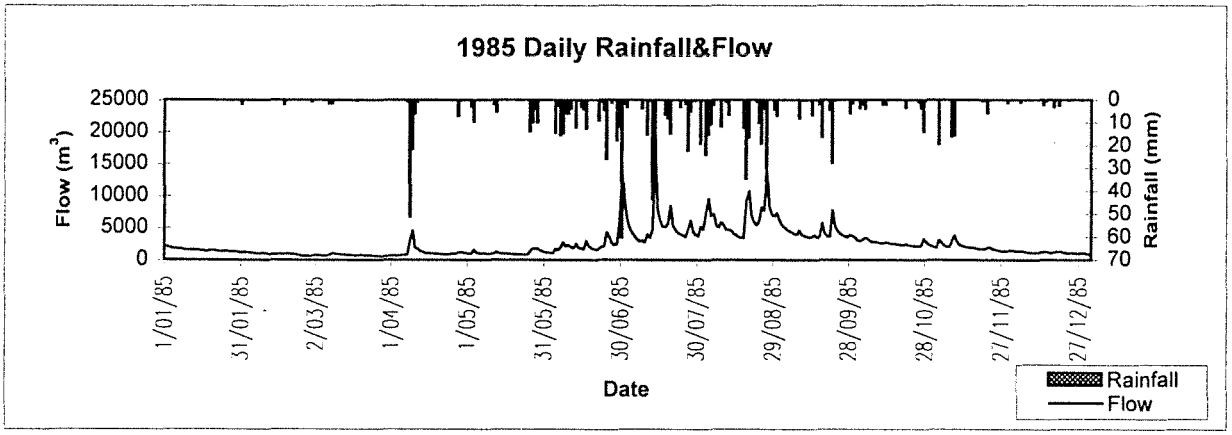


More Seldom Seen Catchment - S 616022

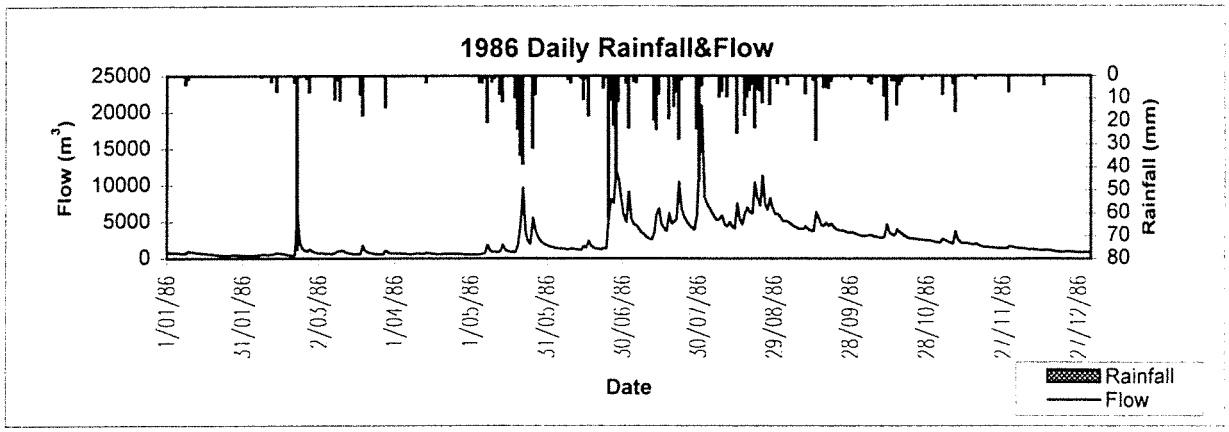


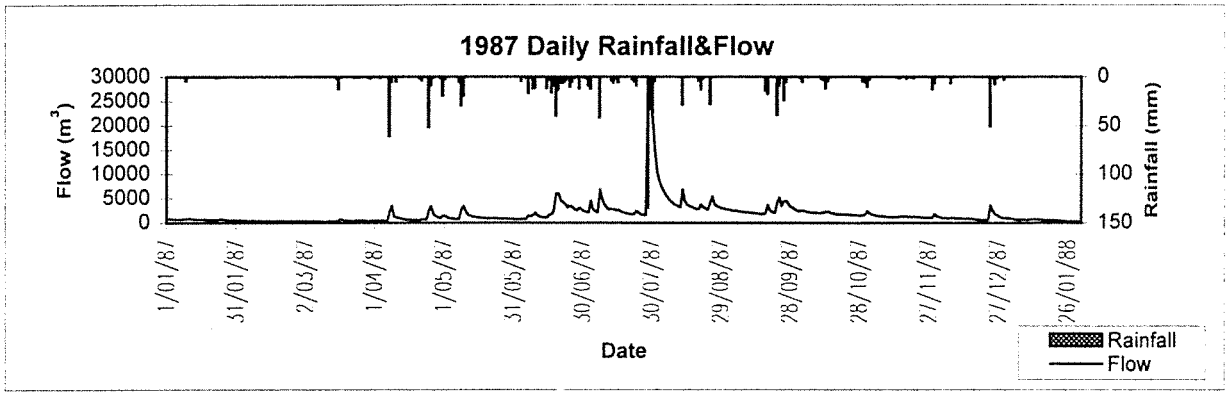


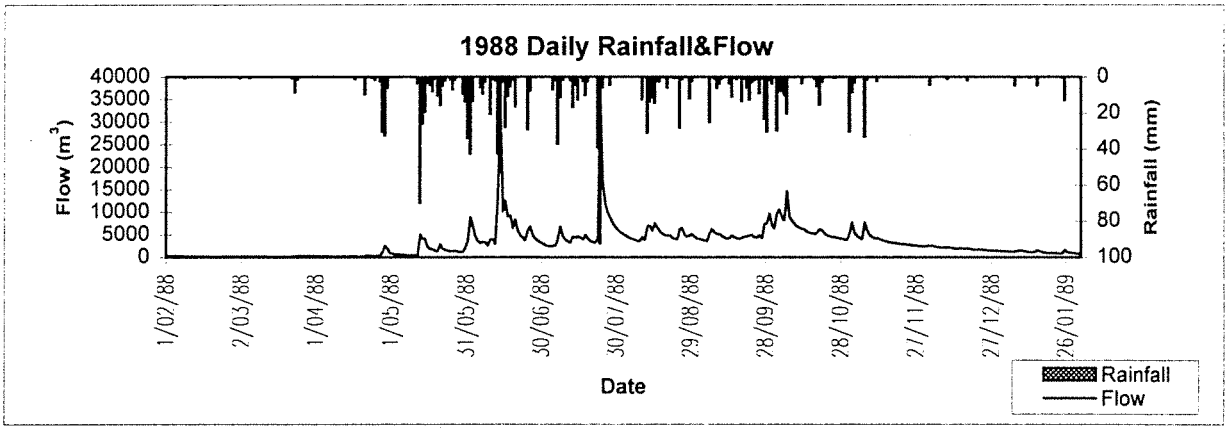


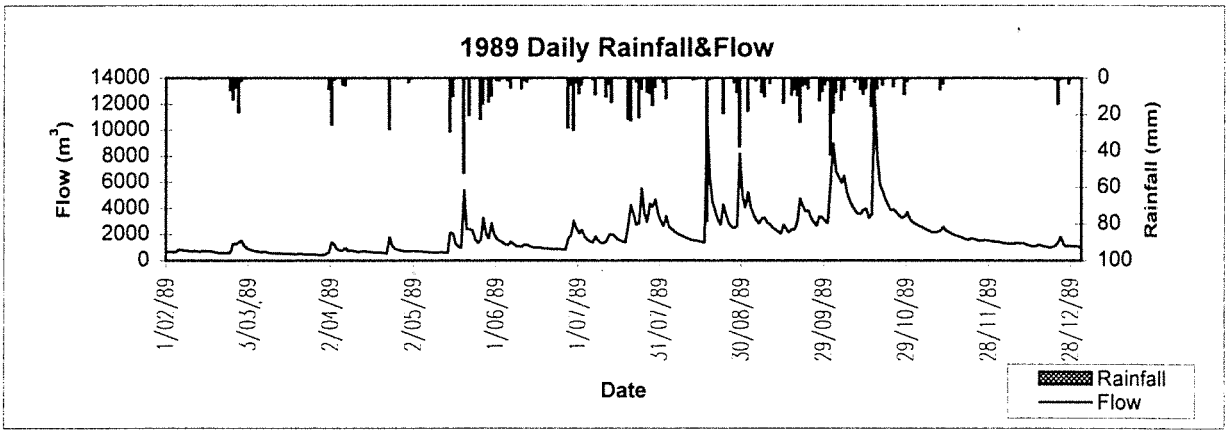


More Seldom Seen Catchment - S 616022

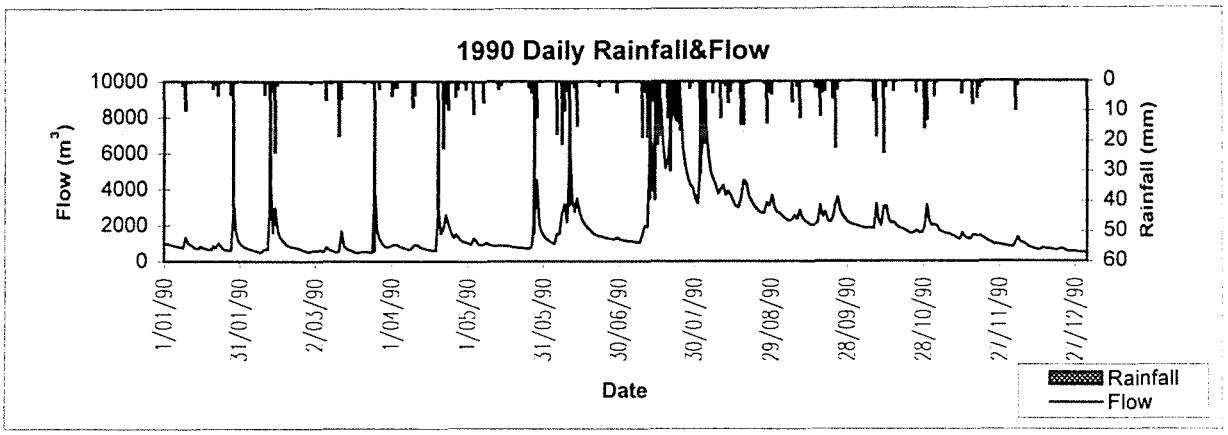


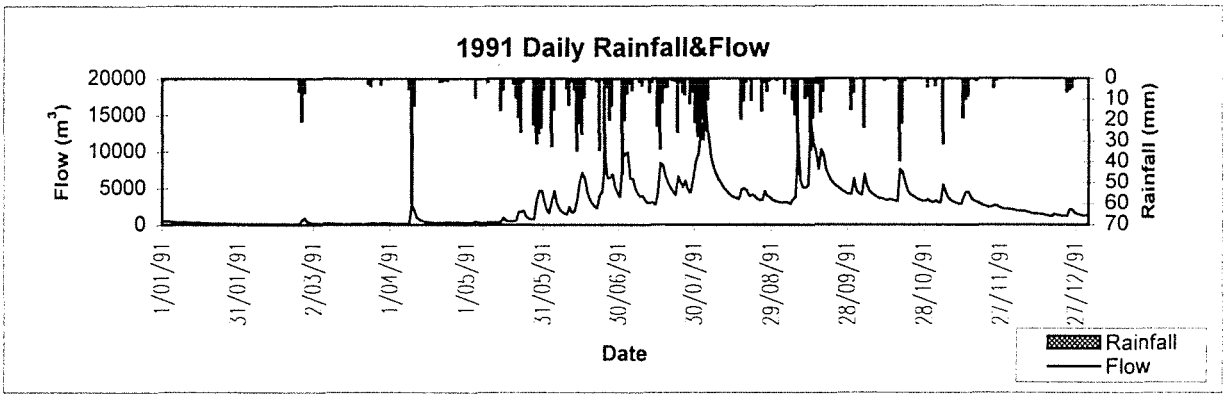


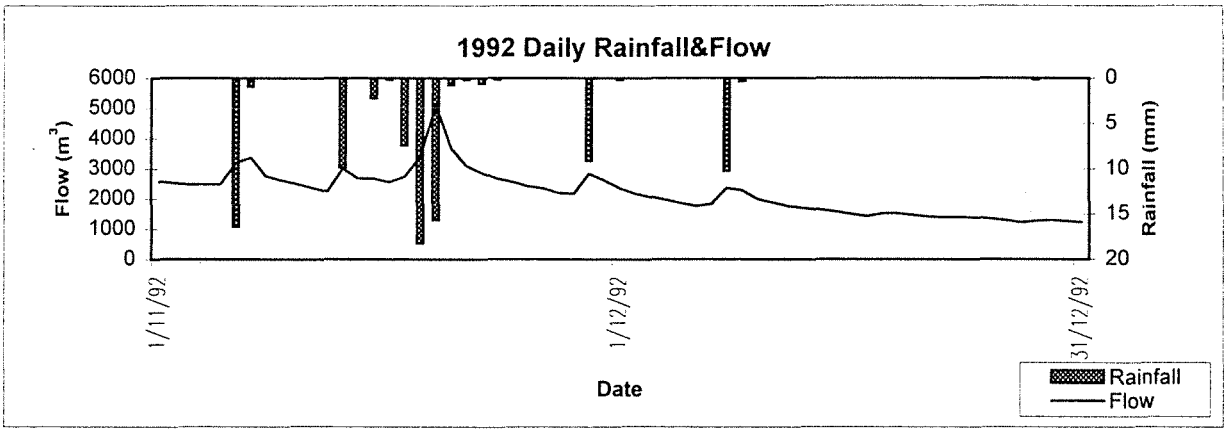


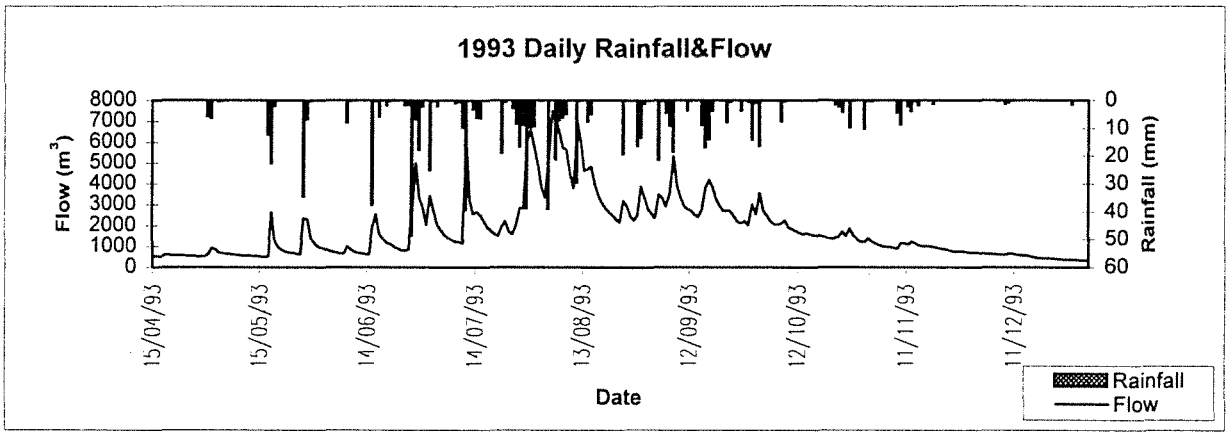


More Seldom Seen Catchment - S 616022

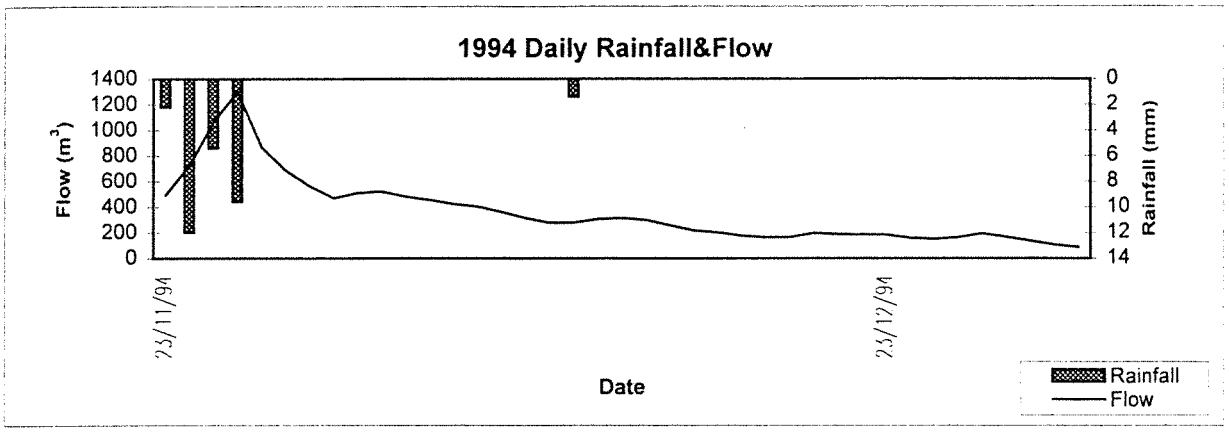


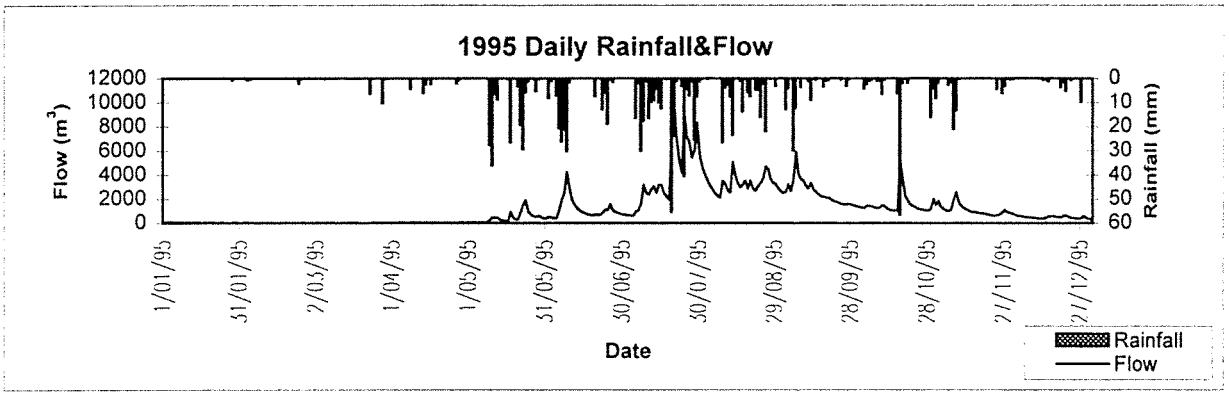


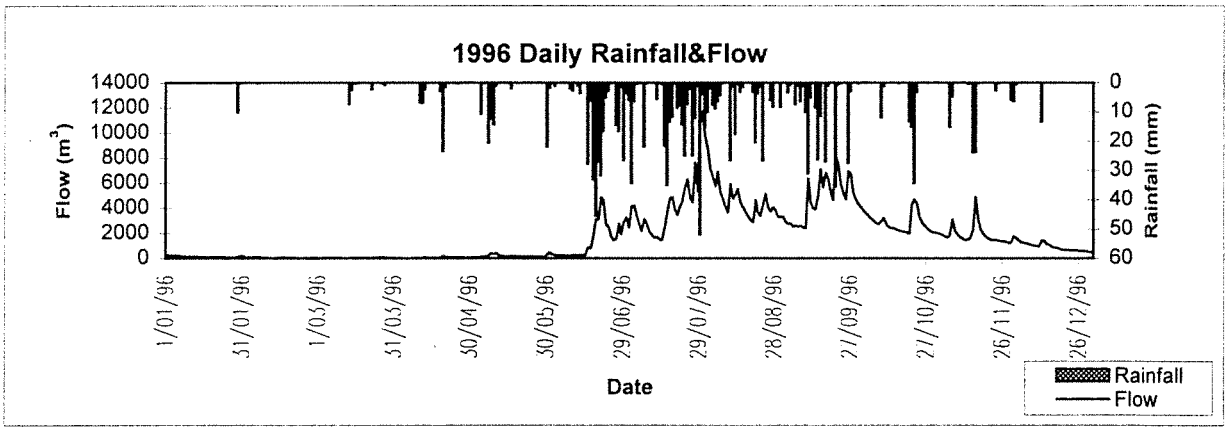


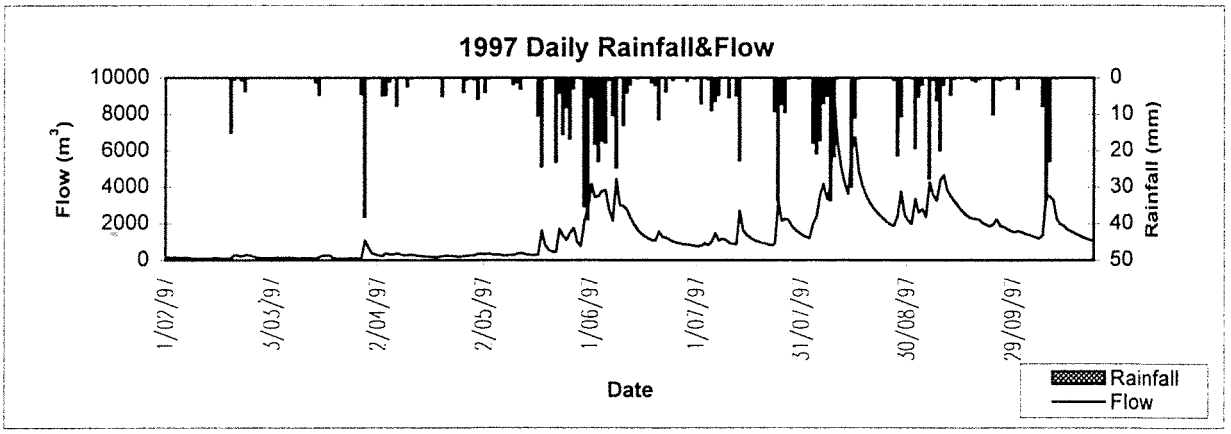


More Seldom Seen Catchment - S 616022

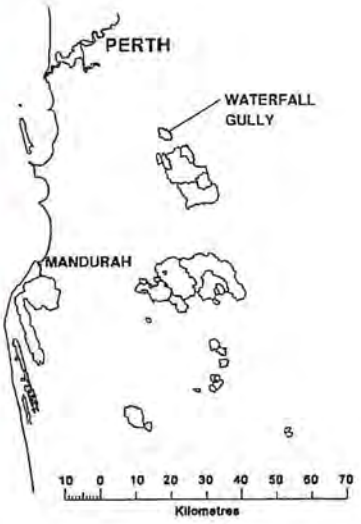








Waterfall Gully Catchment



Legend

Catchment Boundary △ Gauging Station

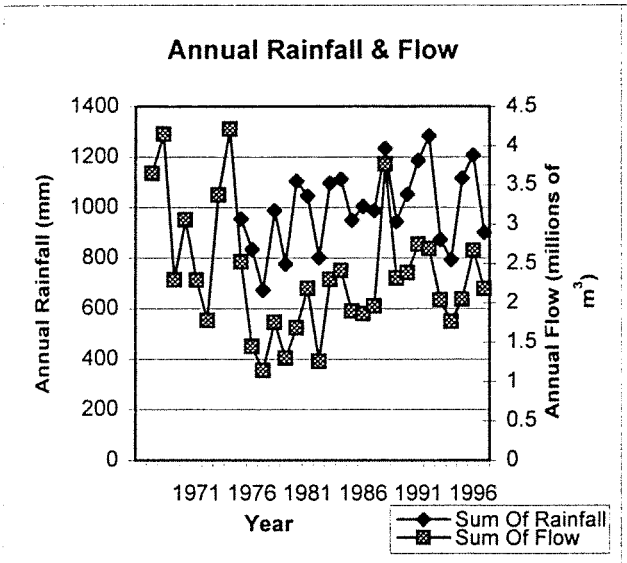
5 m Contours on Landsat Scene Jan 96

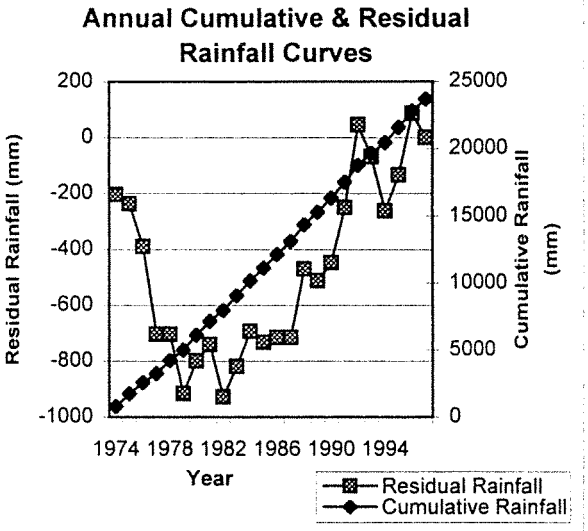
Computer Generated Stream Line

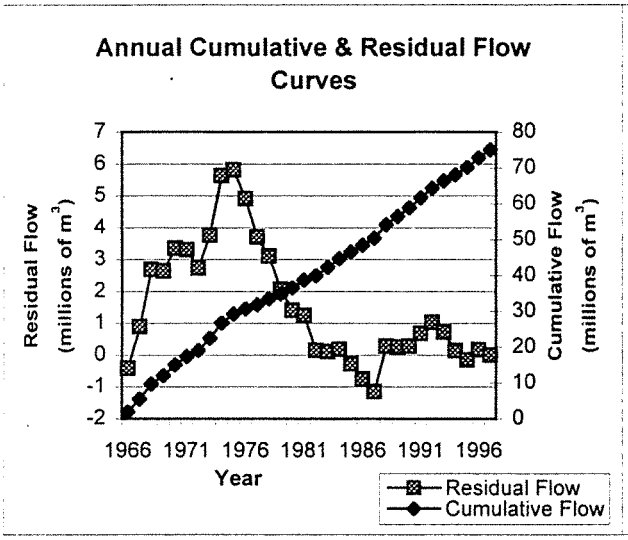
Gauging Station Number	S616023		
Rainfall Gauge Number	M509271		
Information about catchment			
Catchment area	8.74 km^2		
Gauging Station Coordinates (AMG)	N 6436090	E 413205	
Treatment data	Control Catchment		
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	8716	11711	0
Number of years recorded	25	33	
Number of years with complete records	23	31	
Start date	25/06/74	13/04/66	
Finish date	5/05/98	5/05/98	
Number of days with quality code 1	7885	10700	
Number of days with quality code 2	119	354	
Number of days with quality code 3	535	48	
Number of days with quality code 4	42	53	
Number of days with quality code 156	0	77	
Number of days with quality code 157	122	254	
Number of days with quality code 255	13	225	
Annual Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	
Average	996.5	2.35	
Min	673.2	1.14	
Max	1282.8	4.22	

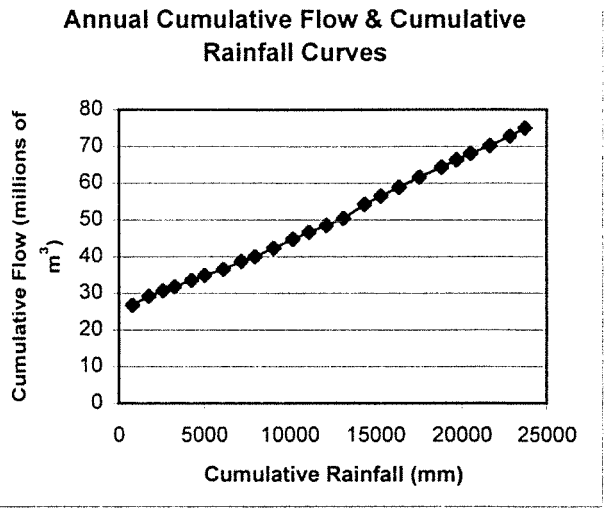
Year	Number of flow days
1967	349
1968	329
1969	343
1970	345
1971	316
1972	355
1973	365
1974	365
1975	365
1976	349
1977	322
1978	365
1979	365
1980	354
1981	365
1982	261
1983	365
1984	366
1985	365
1986	365
1987	365
1988	366
1989	365
1990	365
1991	365
1992	325
1993	362
1994	363
1995	337
1996	217
1997	365
Total	**10769**

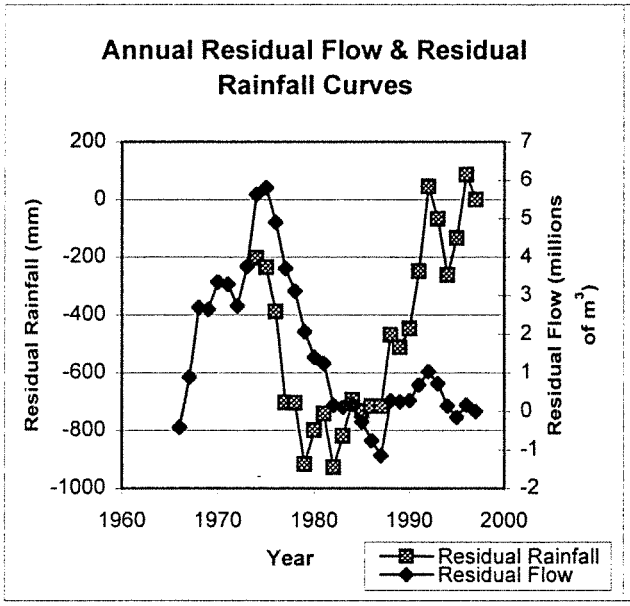
Waterfall Gully Catchment - S 616023

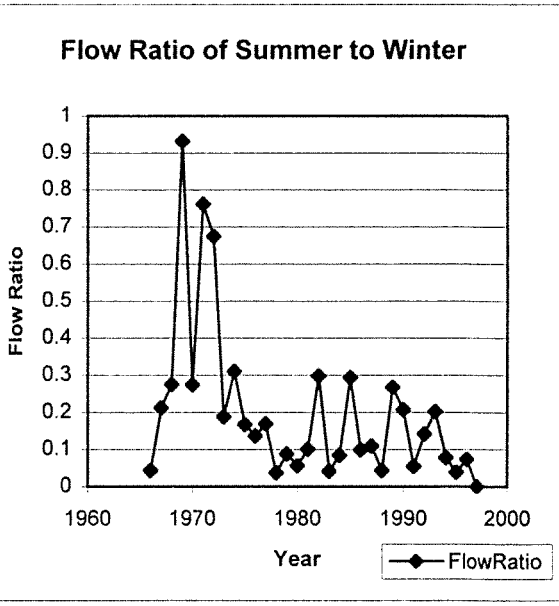




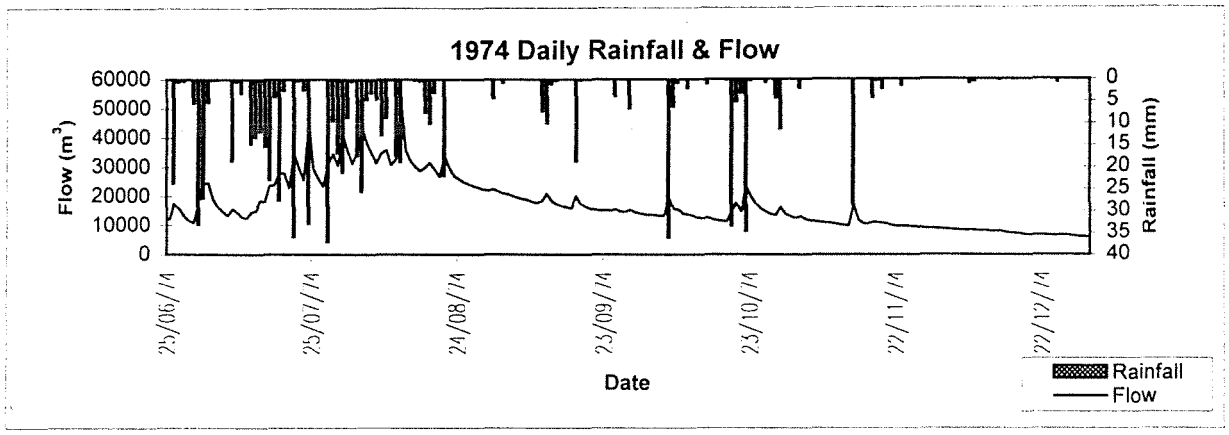


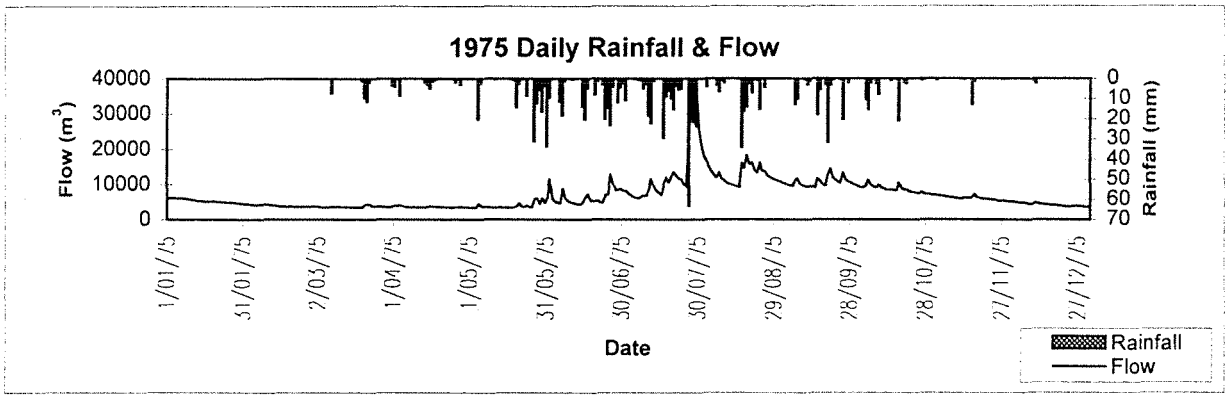


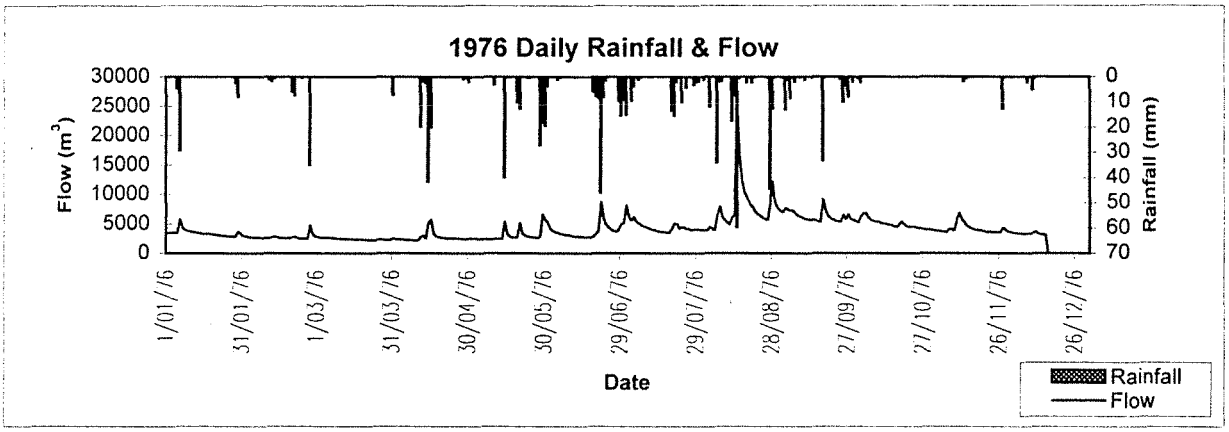


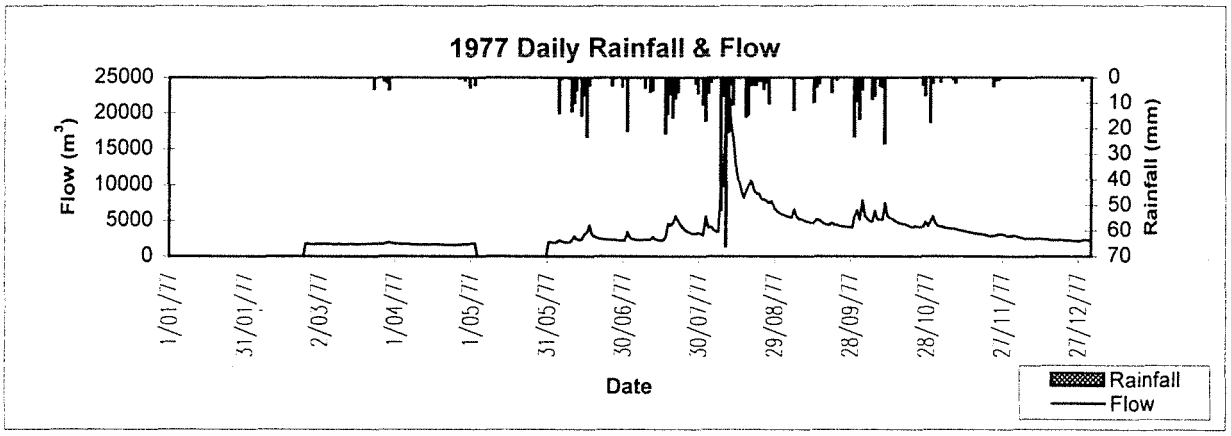


Waterfall Catchment - S 616023

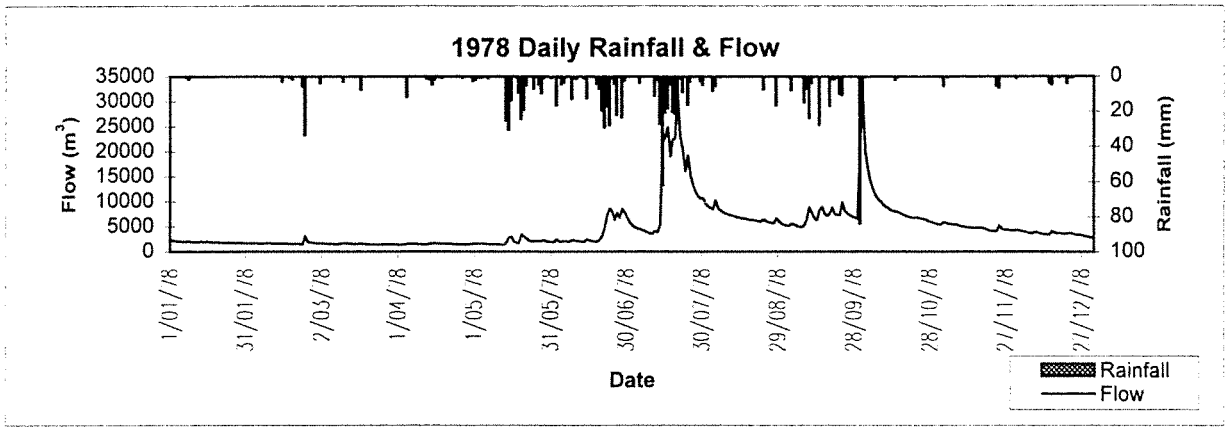


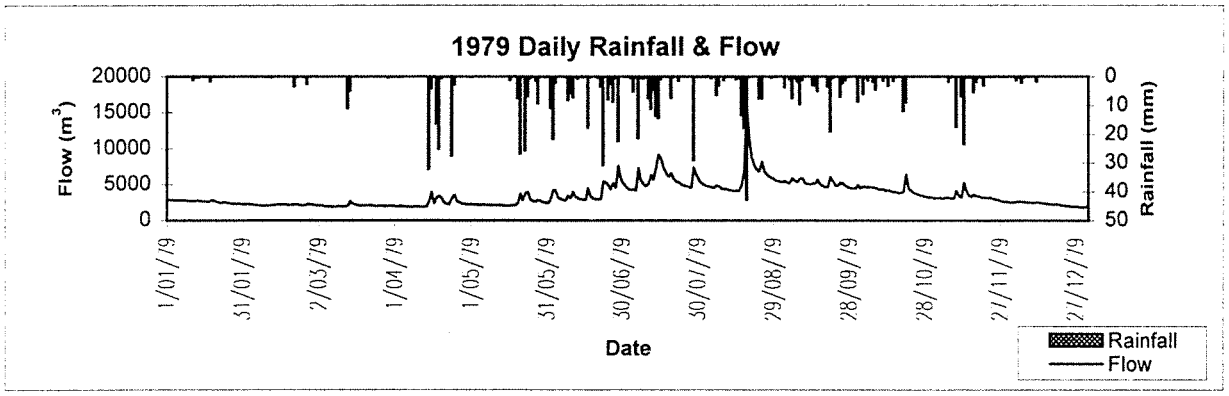


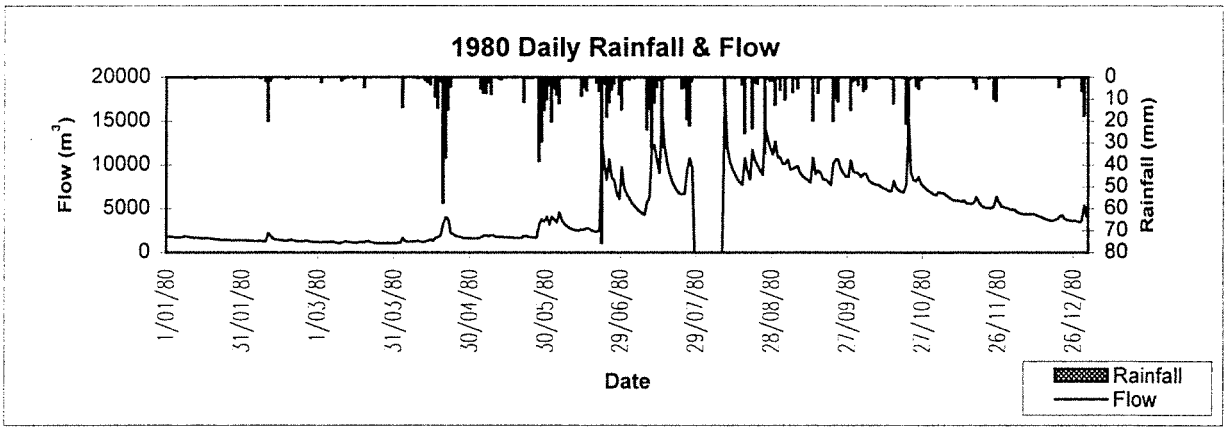


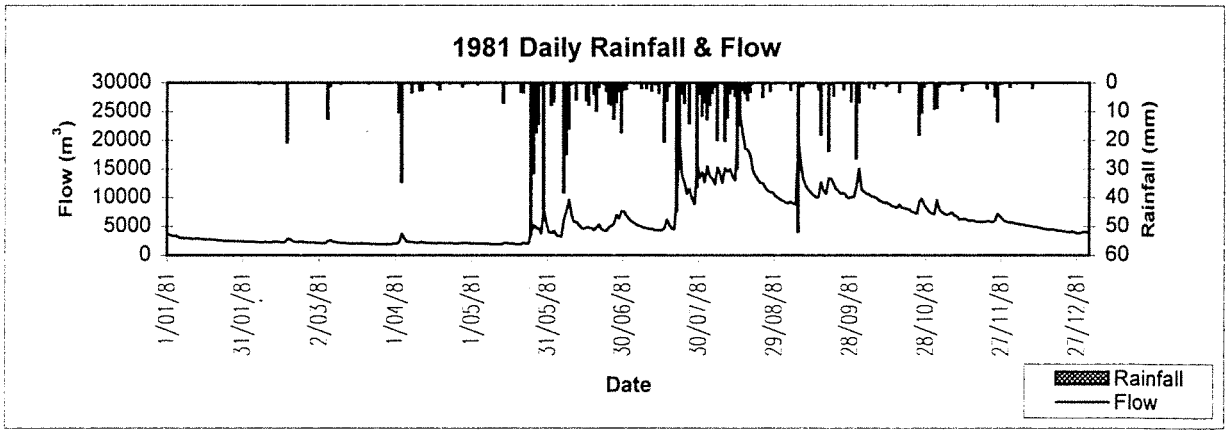


Waterfall Catchment - S 616023

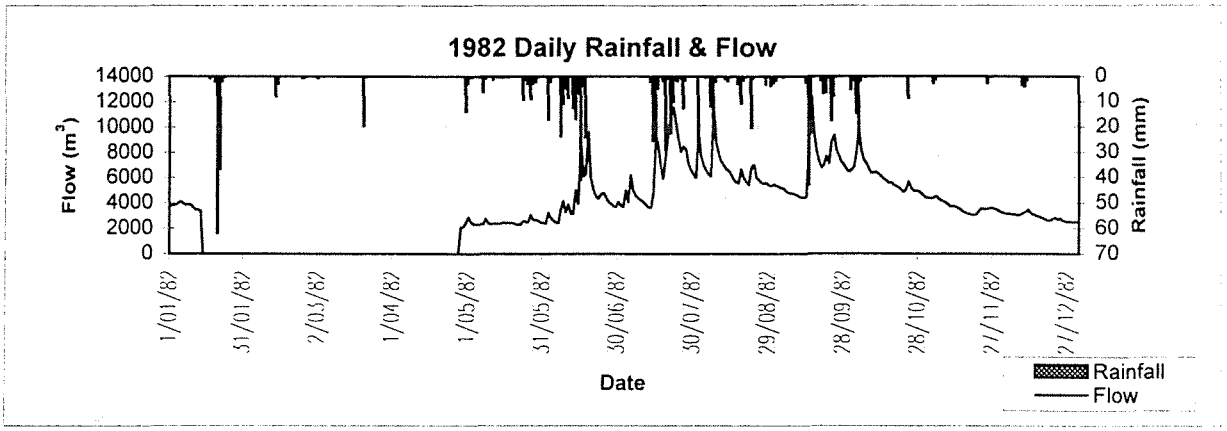


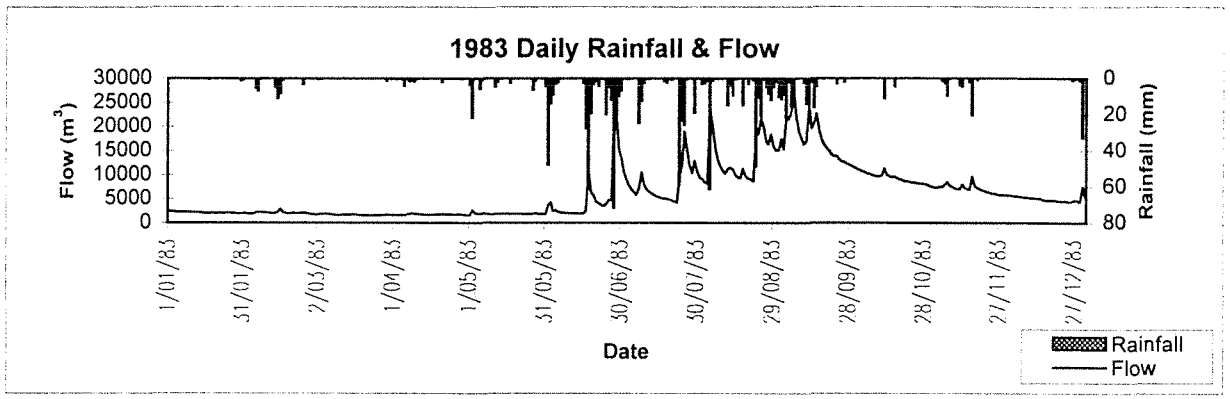


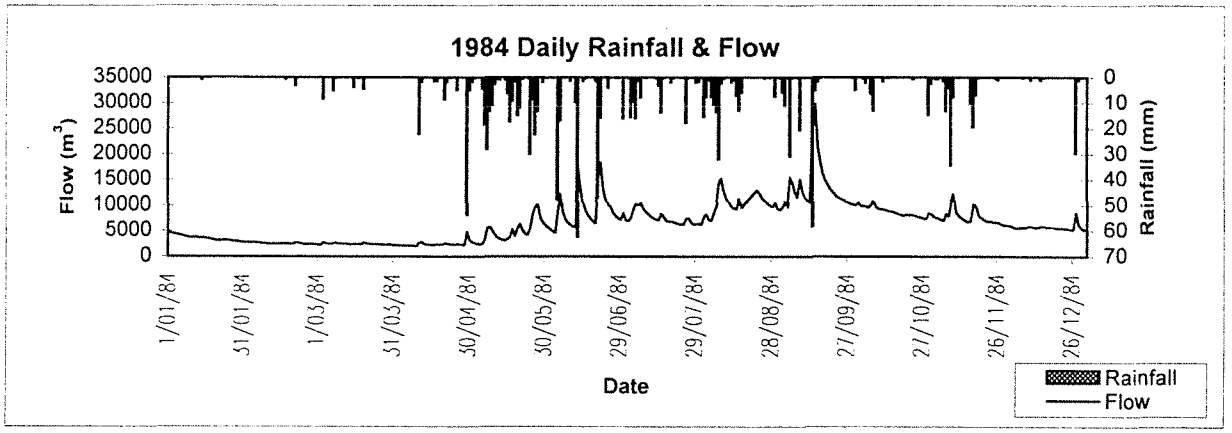


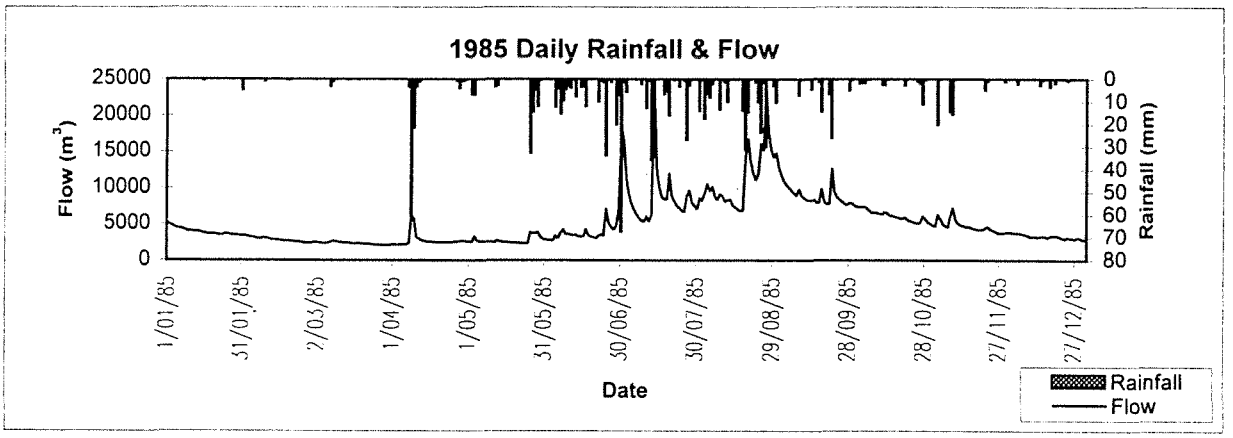


Waterfall Catchment - S 616023

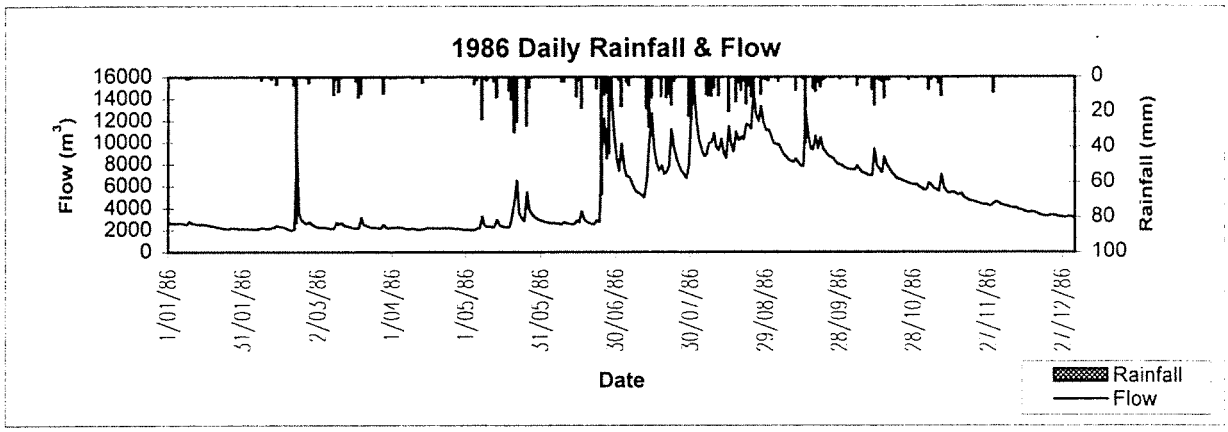


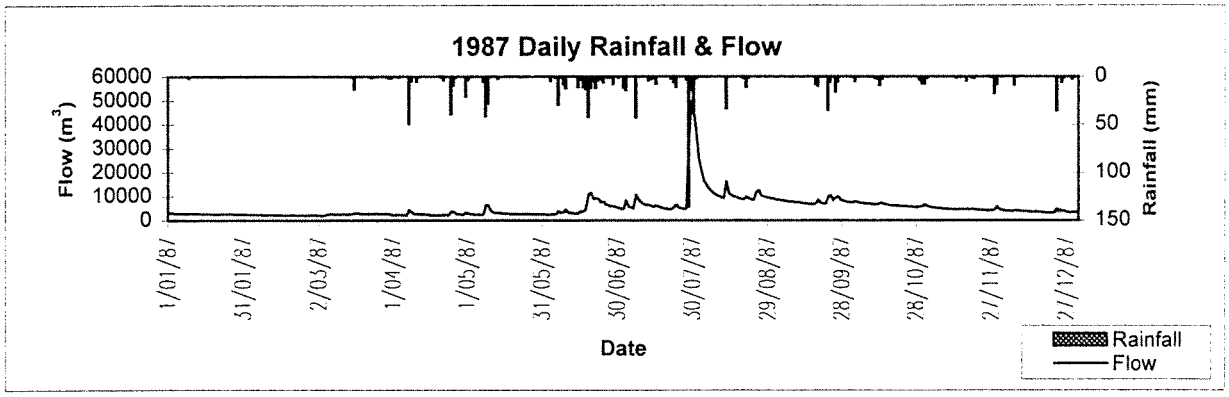


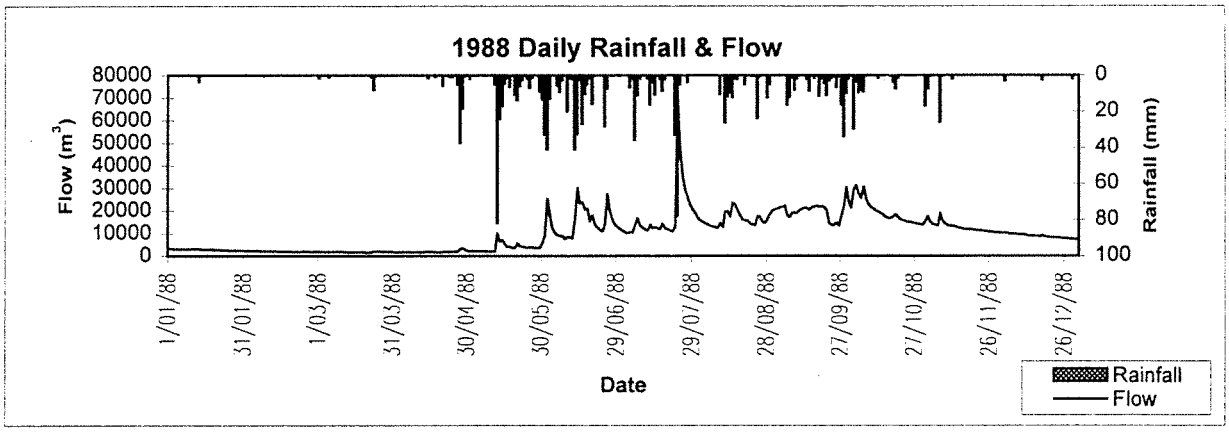


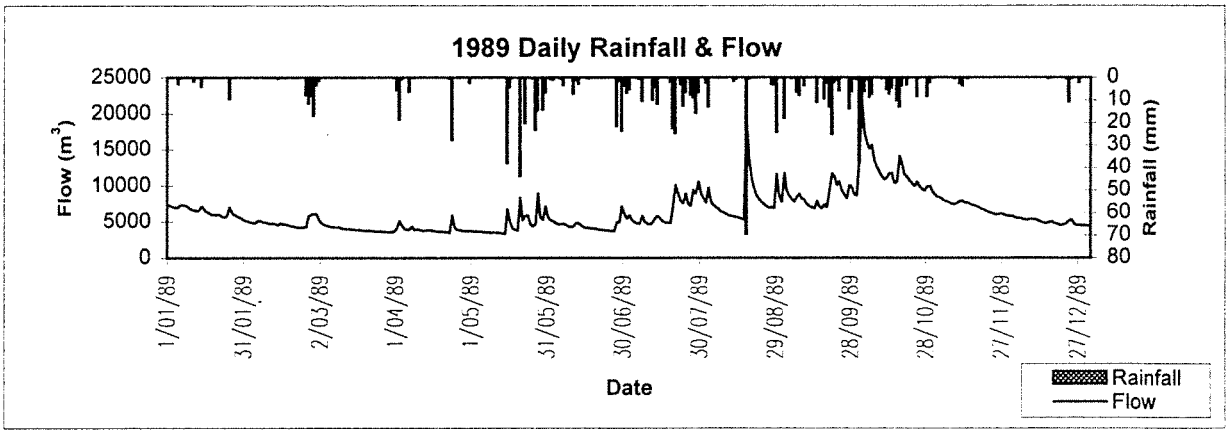


Waterfall Catchment - S 616023

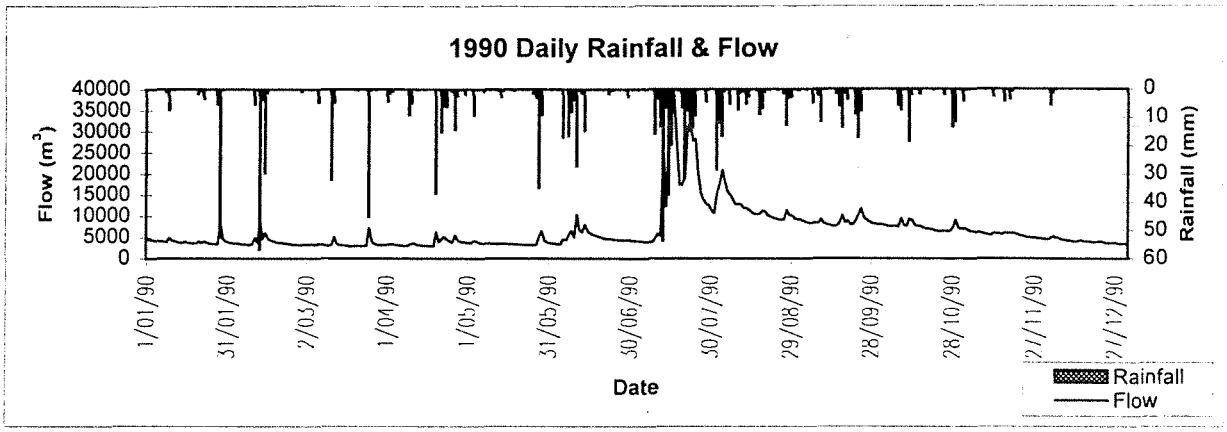


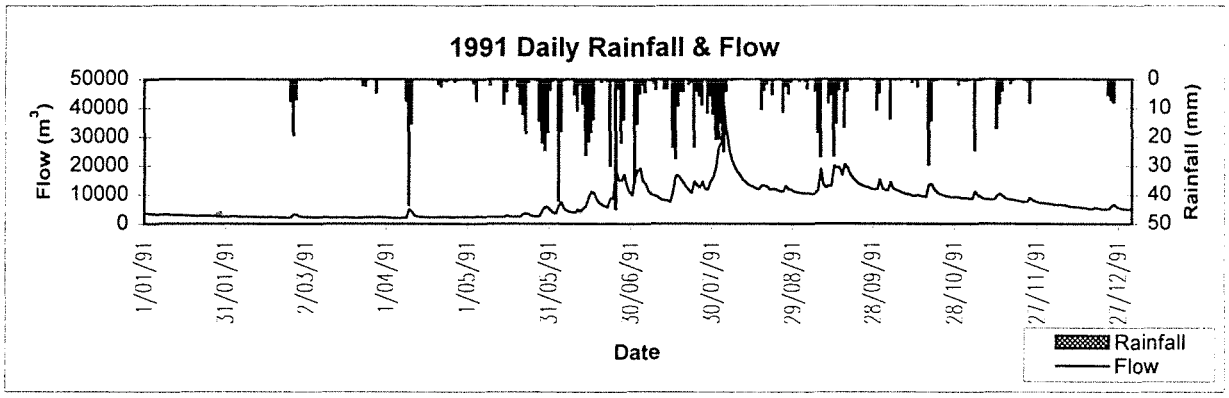


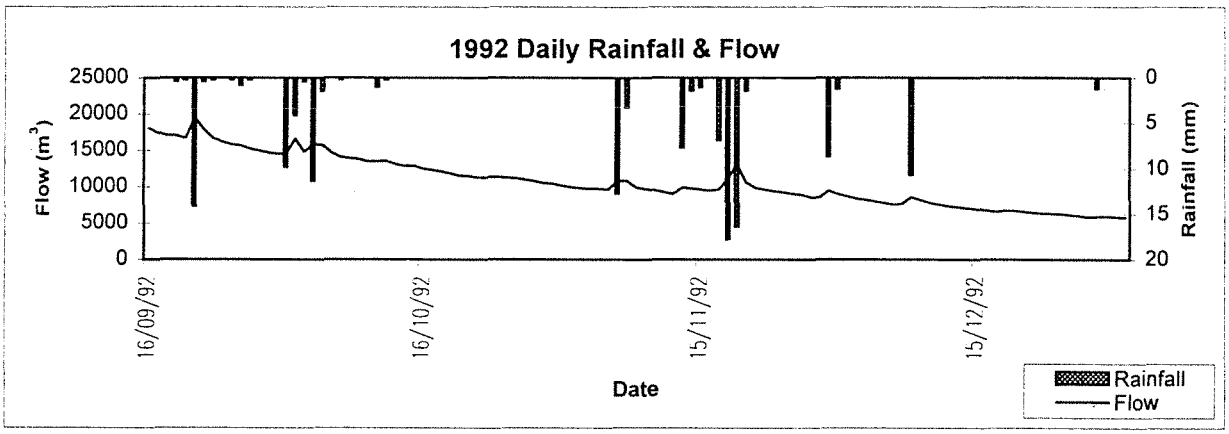


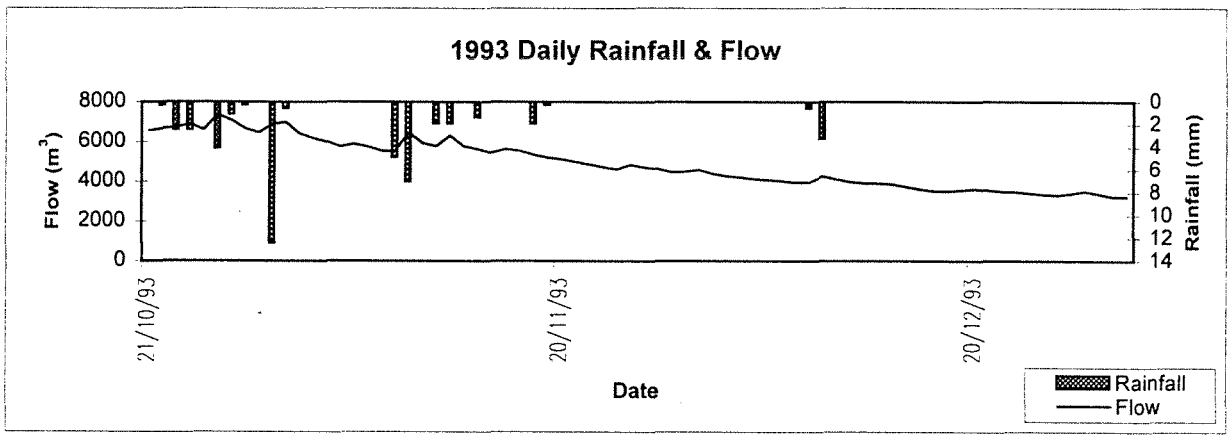


Waterfall Catchment - S 616023

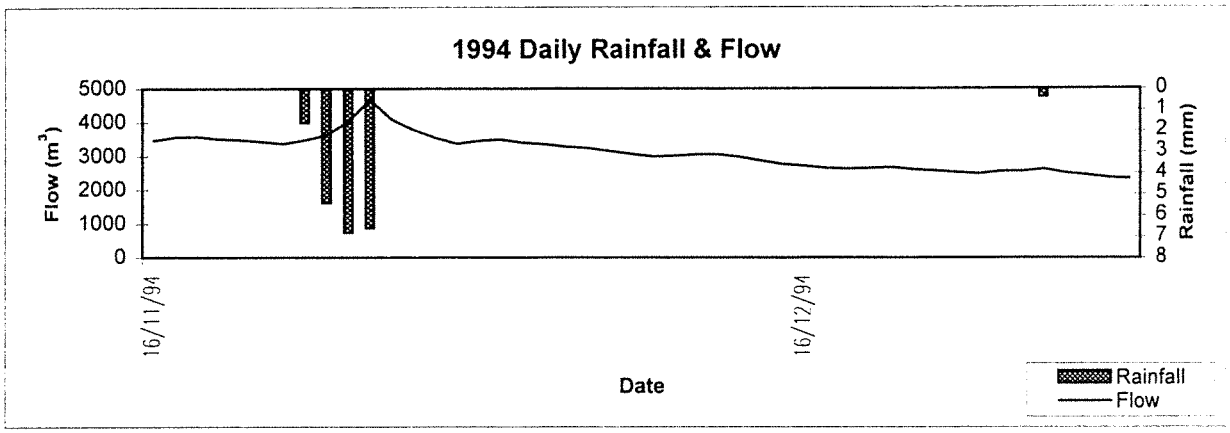


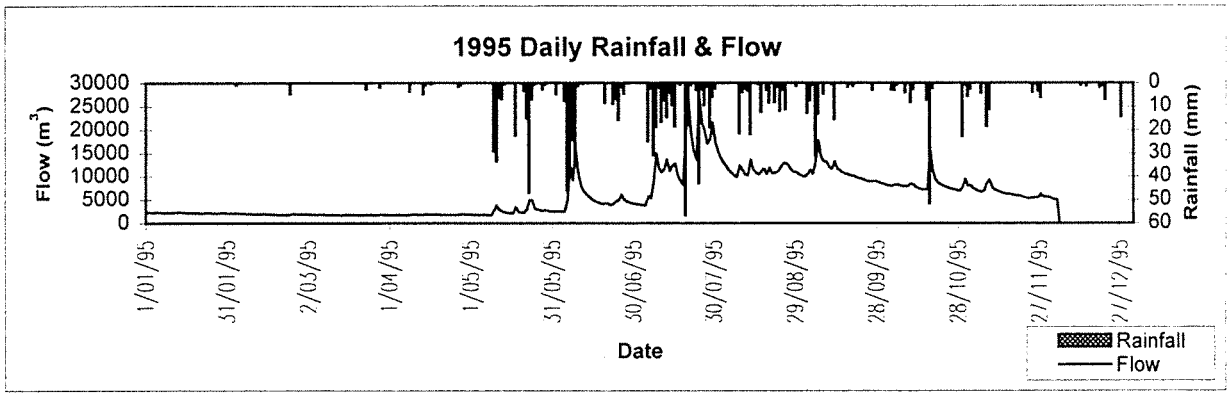


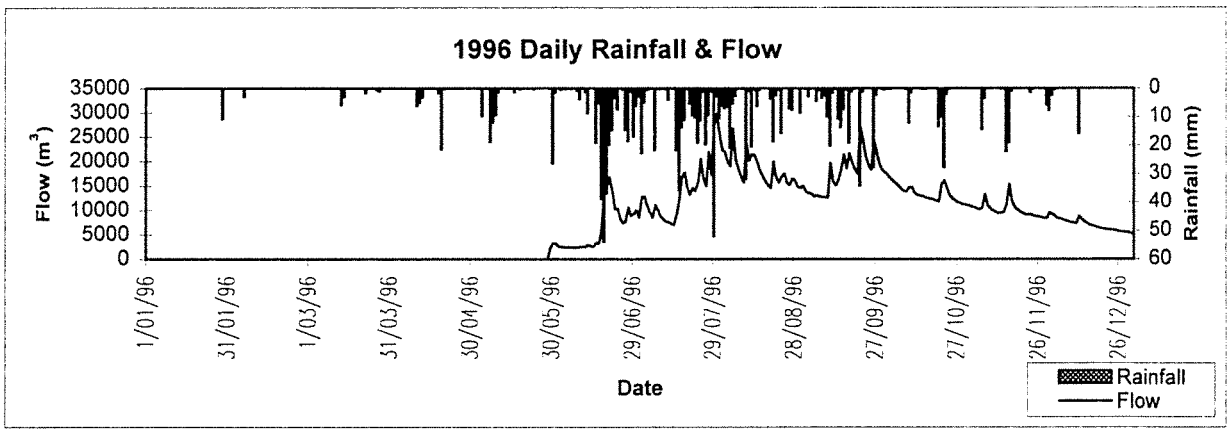


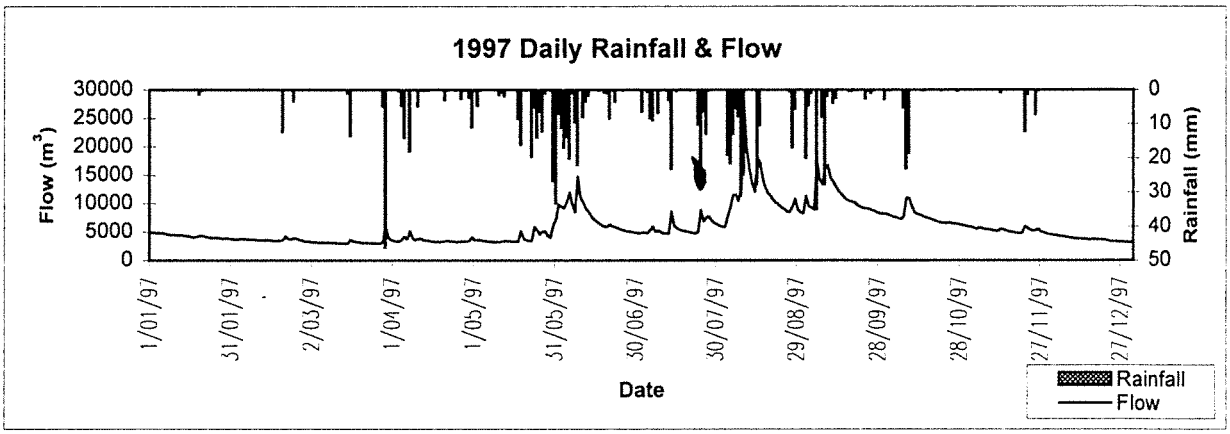


Waterfall Catchment - S 616023

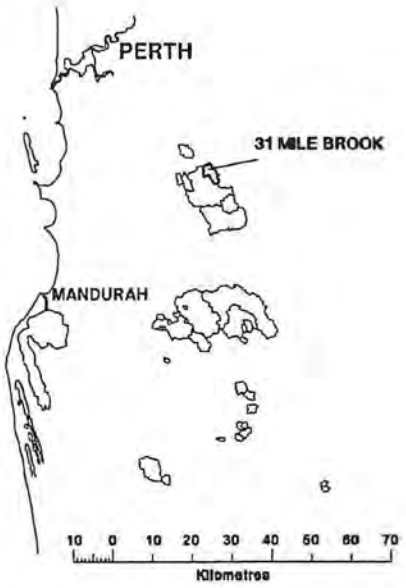








31Mile Brook Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

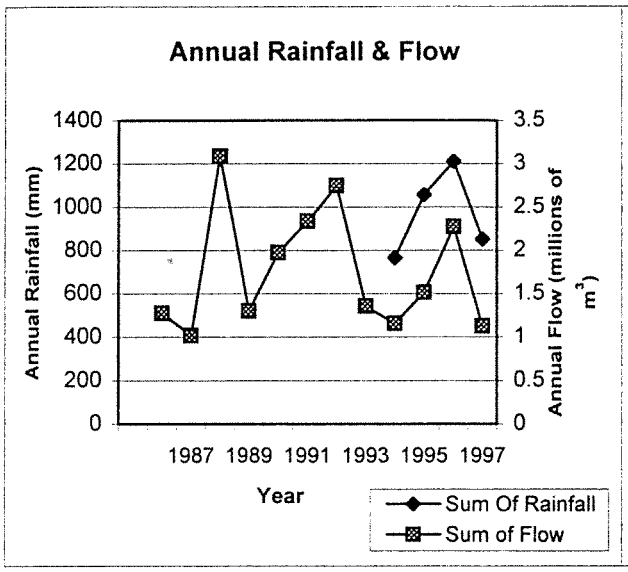
Gauging Station Number	S616026
	Cobiac (M 509576) rainfall data
Information about catchment	
Catchment area	11.8 km^2
Gauging Station Coordinates (AMG)	N 6433860
	E 420670
Treatment data	Control Catchment

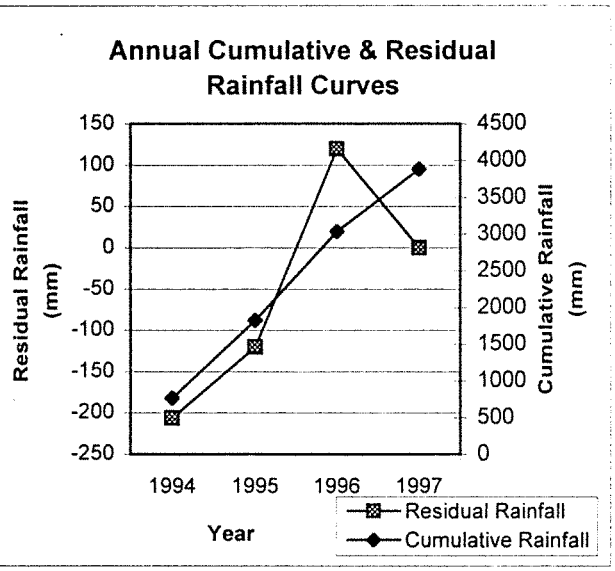
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	0	4751	0
Number of years recorded	0	14	0
Number of years with complete records	0	12	0
Start date		7/06/85	
Finish date		9/06/98	
Number of days with quality code 1		4578	
Number of days with quality code 2		59	
Number of days with quality code 3		89	
Number of days with quality code 4		20	
Number of days with quality code 255		5	

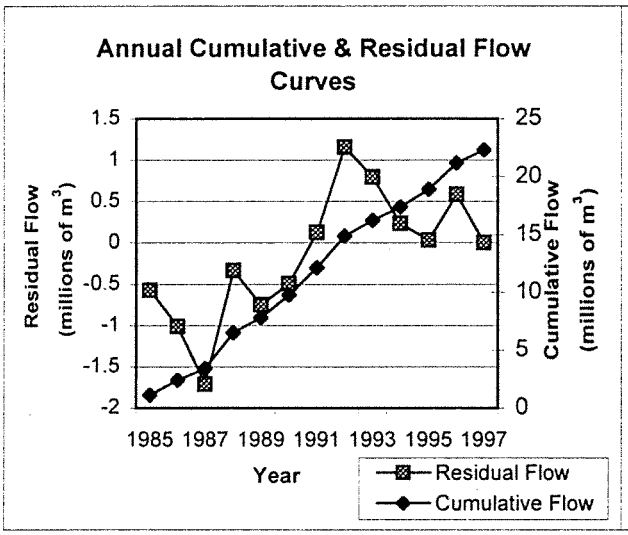
Annual Basic Statistics	Flow (millions of m^3)
Average	1.764
Min	1.019
Max	3.092

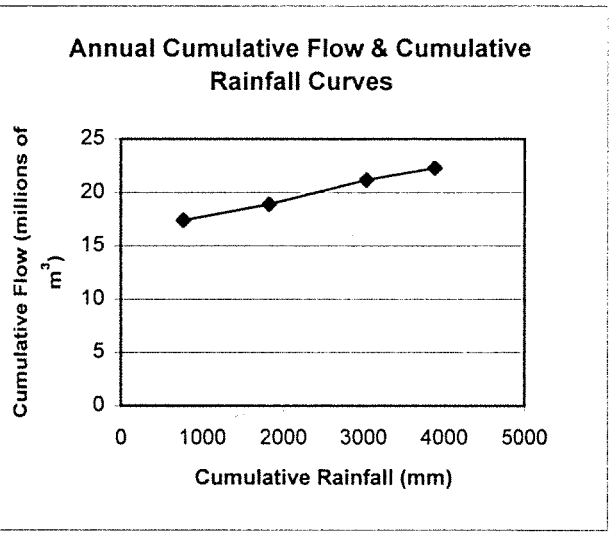
Year	**Number of flow days**
1986	332
1987	301
1988	273
1989	365
1990	365
1991	365
1992	366
1993	364
1994	351
1995	238
1996	259
1997	310
Total	**3889**

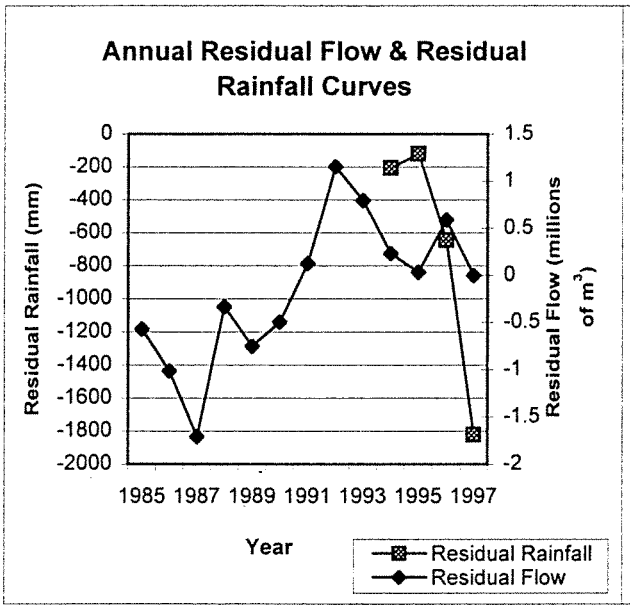
31Mile Brook Catchment - S 616026

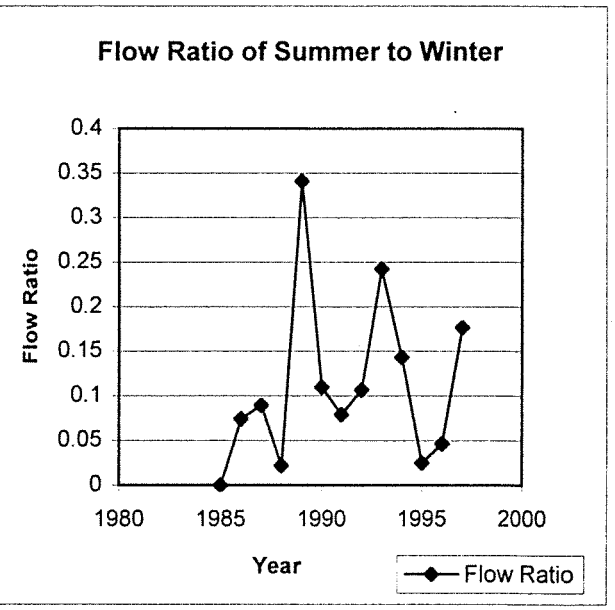




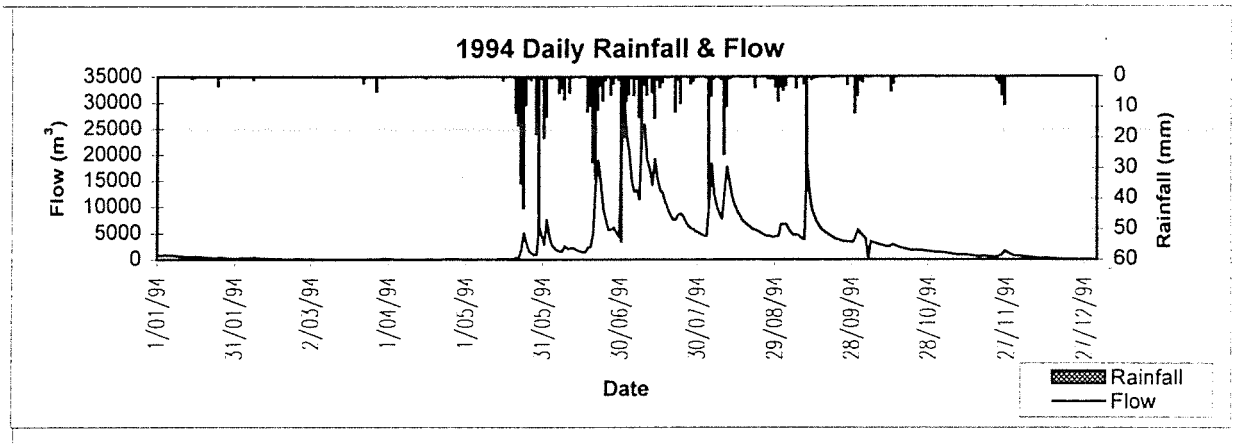


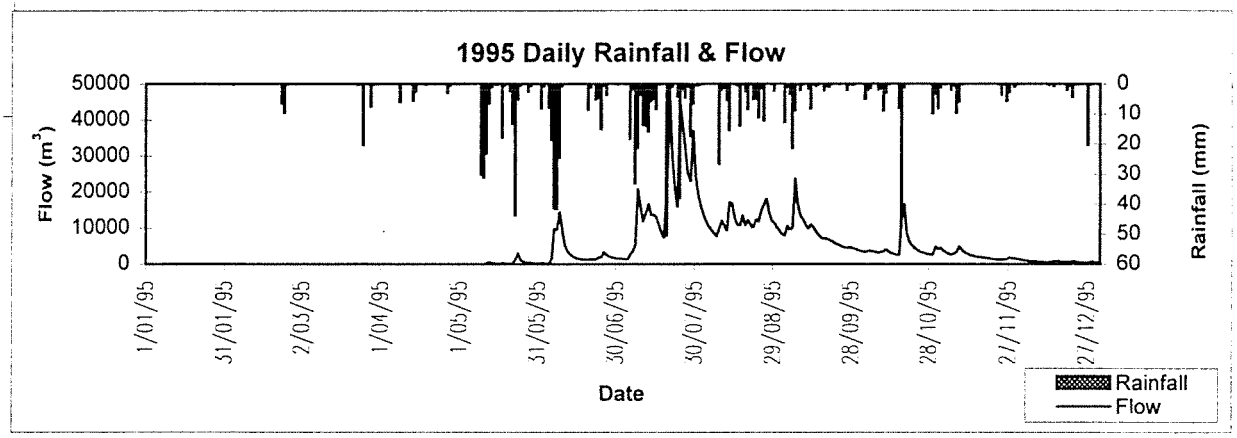


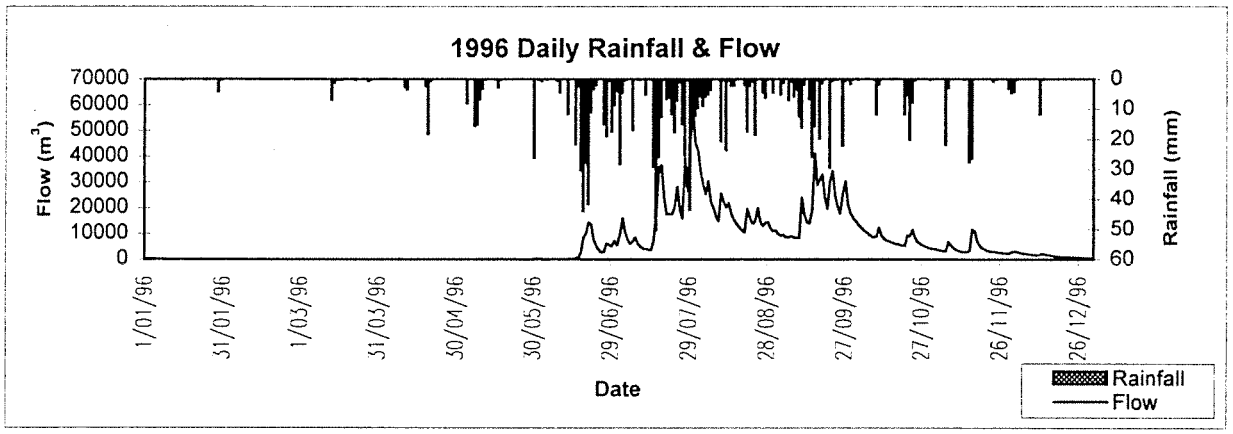


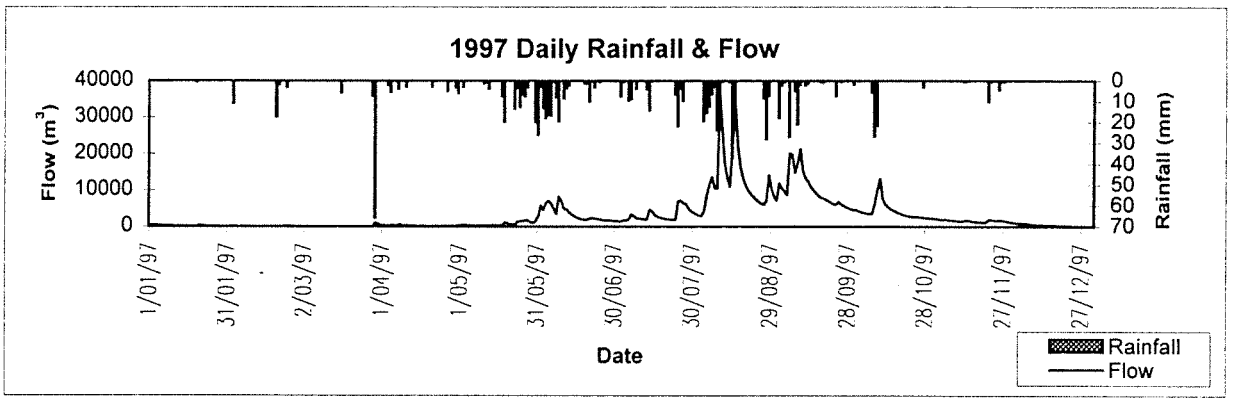


31 Mile Brook Catchment - S 616026

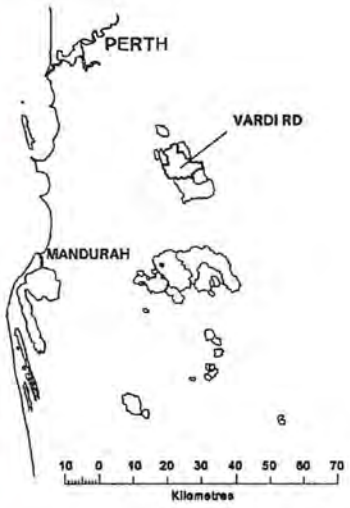








Vardi Road Catchment



Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

Gauging Station Number	S616041
	Cobiac (M 509576) rainfall data
Information about catchment	
Catchment area	80.33 km^2
Gauging Station Coordinates (AMG)	N 6431560 E 416240
Treatment data	Bauxite mining since 1970's.

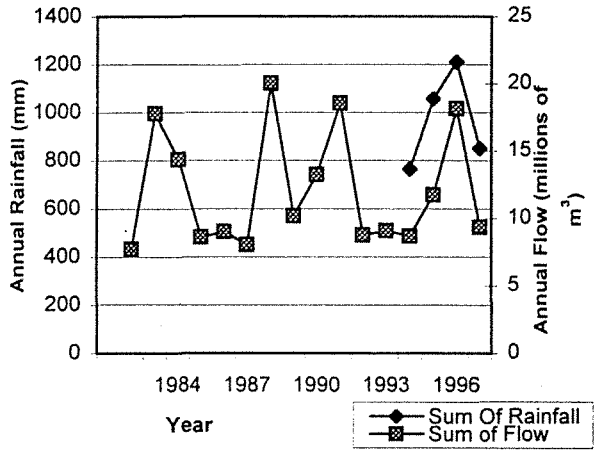
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	0	6214	0
Number of years recorded		18	
Number of years with complete records		16	
Start date		1/05/81	
Finish date		5/05/98	
Number of days with quality code 1		5724	
Number of days with quality code 2		305	
Number of days with quality code 3		40	
Number of days with quality code 4		49	
Number of days with quality code 255		96	

Annual Basic Statistics	Flow (millions of m^3)
Average	12.084
Min	7.720
Max	20.034

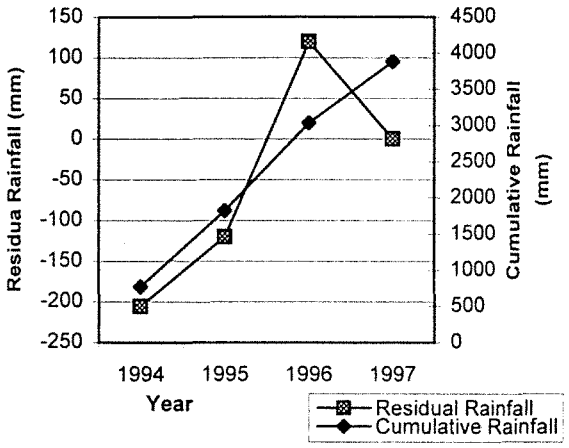
Year	**Number of flow days**
1982	365
1983	365
1984	366
1985	365
1986	365
1987	365
1988	366
1989	365
1990	365
1991	365
1992	277
1993	361
1994	364
1995	365
1996	366
1997	365
1998	124
Total	**5874**

Vardi Road Catchment - S 616041

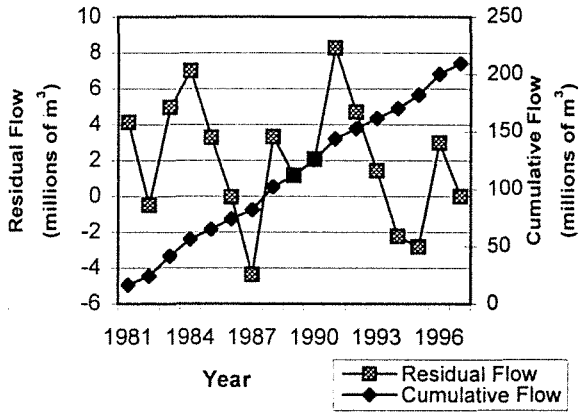
Annual Rainfall & Flow



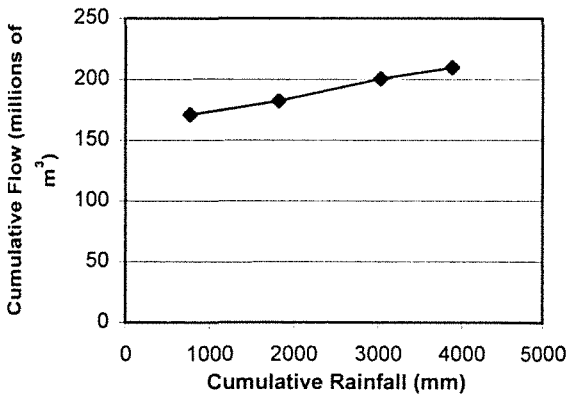
Annual Cumulative & Residual Rainfall Curves



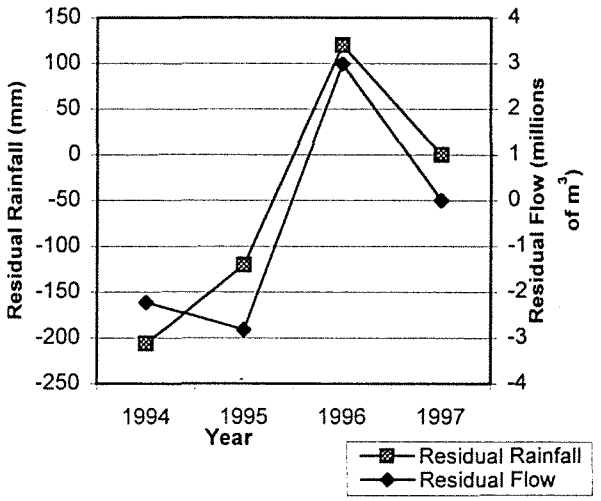
Annual Cumulative & Residual Flow Curves



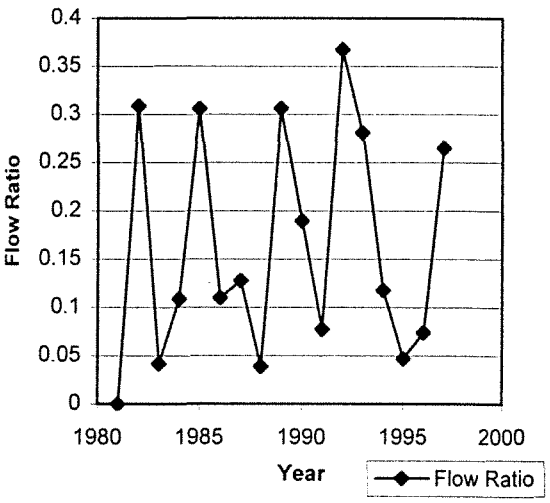
Annual Cumulative Flow & Cumulative Rainfall Curves



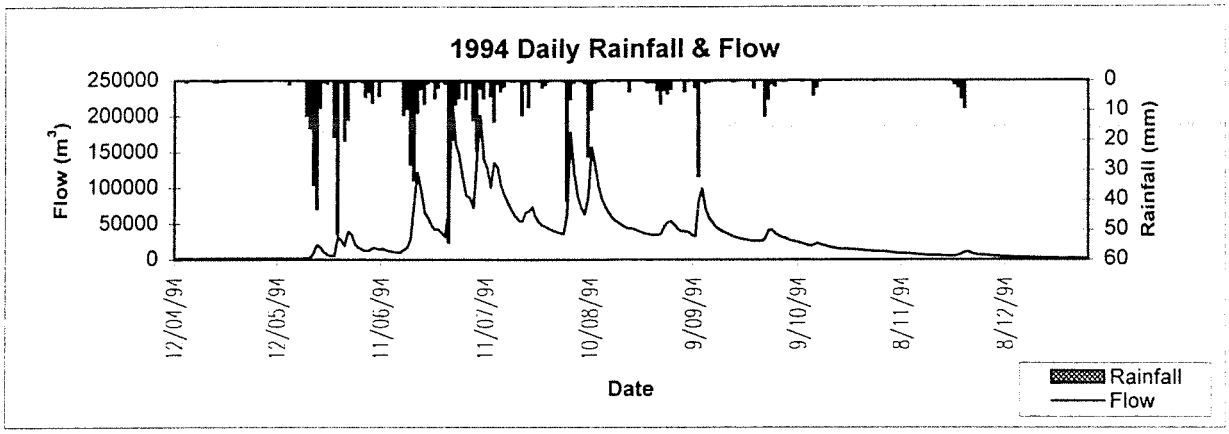
Annual Residual Flow & Residual Rainfall Curves

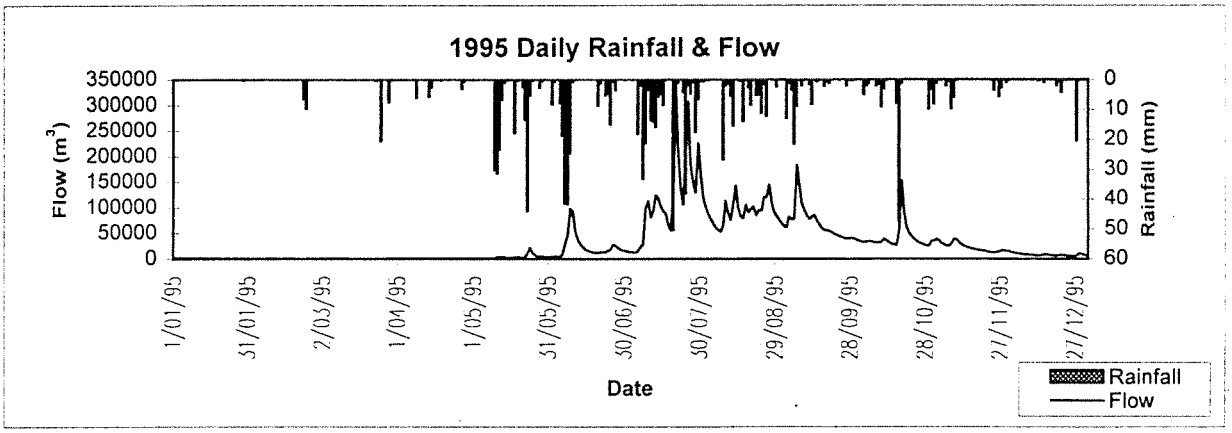


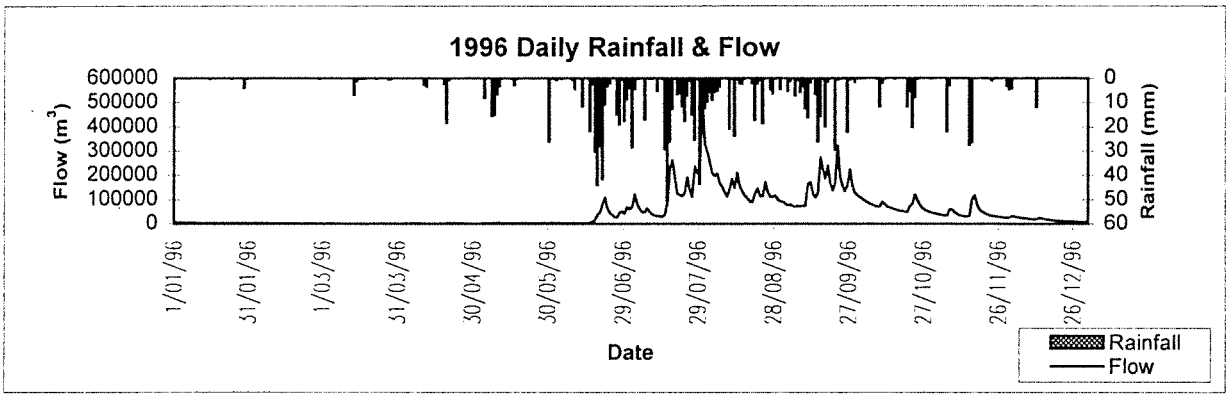
Flow Ratio of Summer to Winter

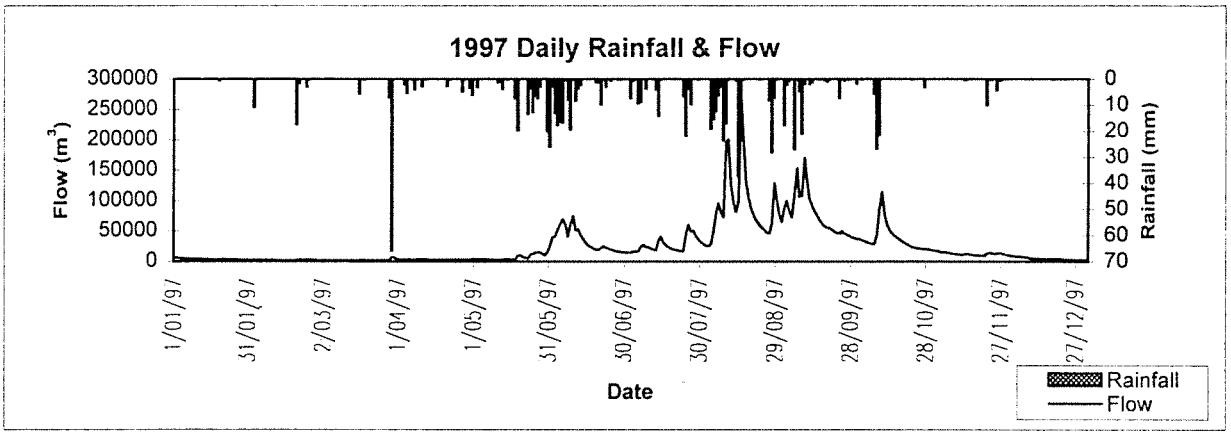


Vardi Road Catchment - S 616041

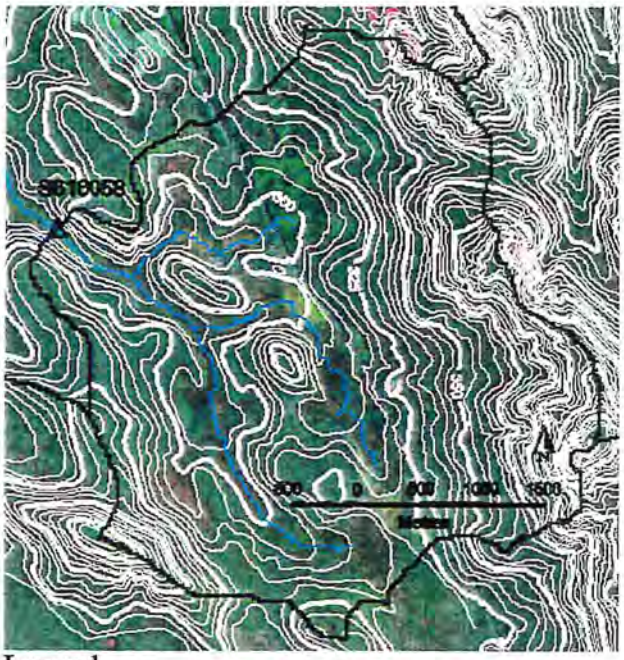


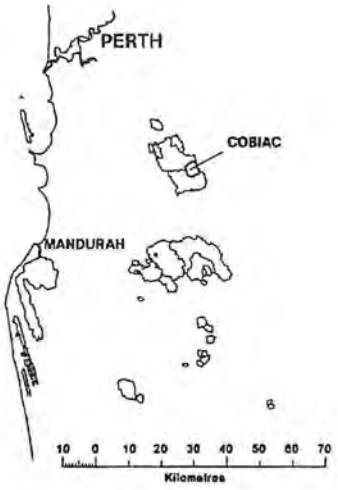






Cobiac Catchment





Legend

Catchment Boundary △ Gauging Station

5 m Contours on Landsat Scene Jan 96

Computer Generated Stream Line

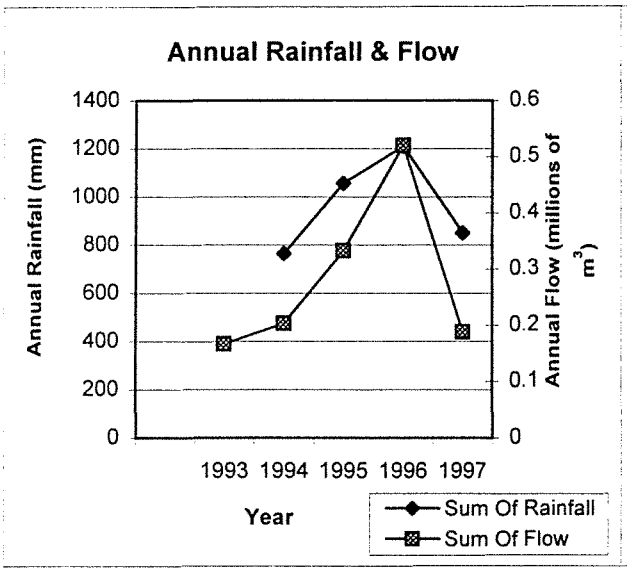
Gauging Station Number	S616058	
Rainfall Gauge Number	M509576	
Information about catchment		
Catchment area	3.30 km^2	
Gauging Station Coordinates (AMG)	N 6424520	E 423500
Treatment data	Control Catchment	

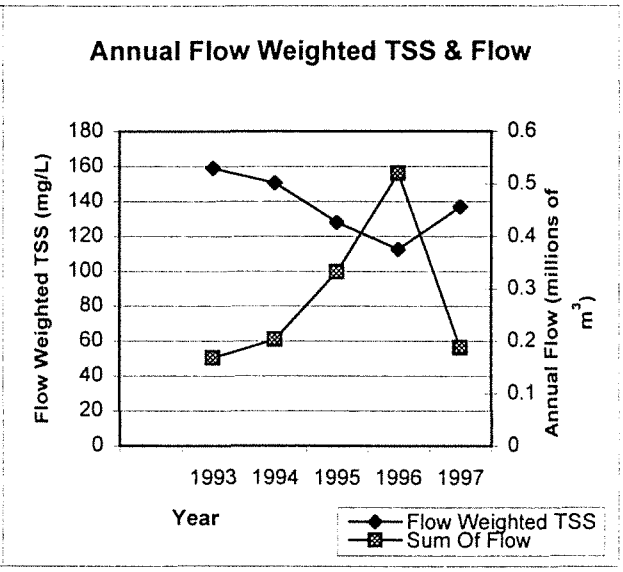
Information about records	**Rainfall**	**Flow**	**Salinity**
Number of days recorded	1503	2141	2142
Number of years recorded	5	7	7
Number of years with complete records	4	5	5
Start date	1/01/94	3/04/92	3/04/92
Finish date	11/02/98	11/02/98	12/02/98
Number of days with quality code 1	1501	2135	1981
Number of days with quality code 2	1	0	60
Number of days with quality code 3	0	0	4
Number of days with quality code 4	0	0	95
Number of days with quality code 255	1	6	2

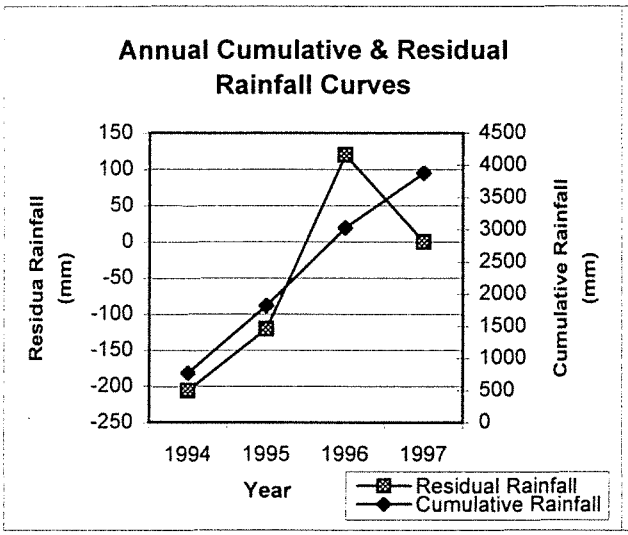
Year	**Number of flow days**
1993	135
1994	135
1995	175
1996	179
1997	166
Total	**790**

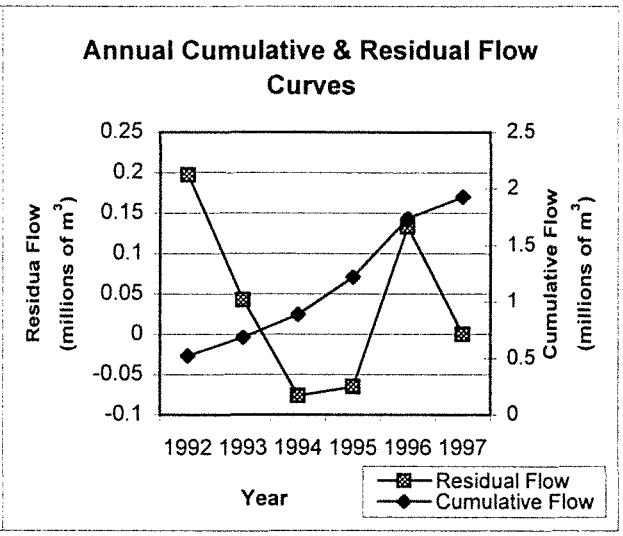
Basic Statistics	Rainfall (mm)	Flow (millions of m^3)	Salinity (mg/L)
Average	971.2	0.282	137.41
Min	765.1	0.167	112.55
Max	1211.2	0.520	158.72

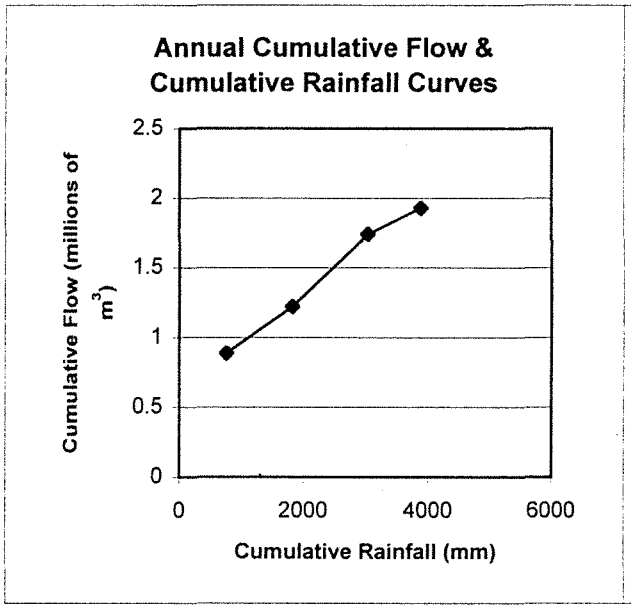
Cobiac Catchment - S 616058

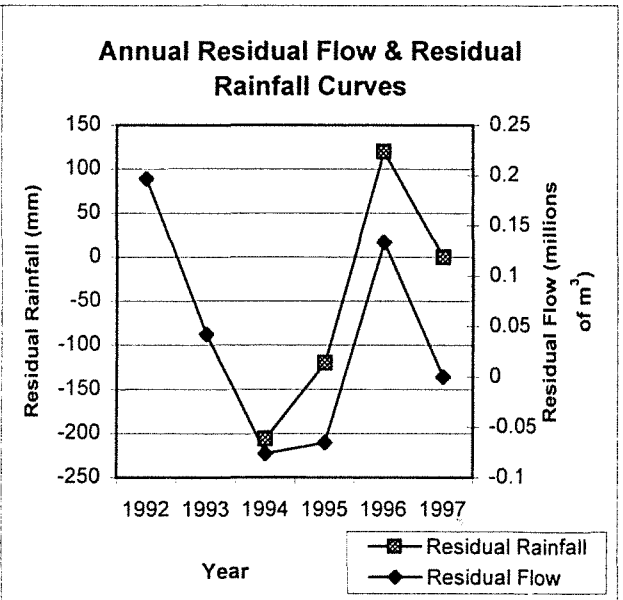




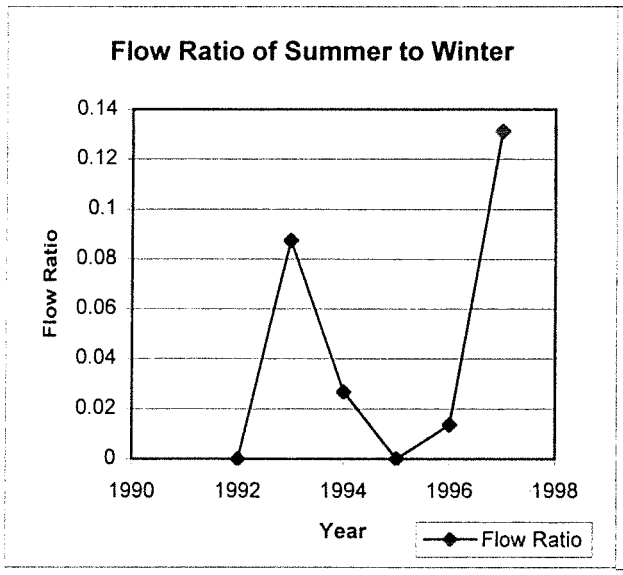


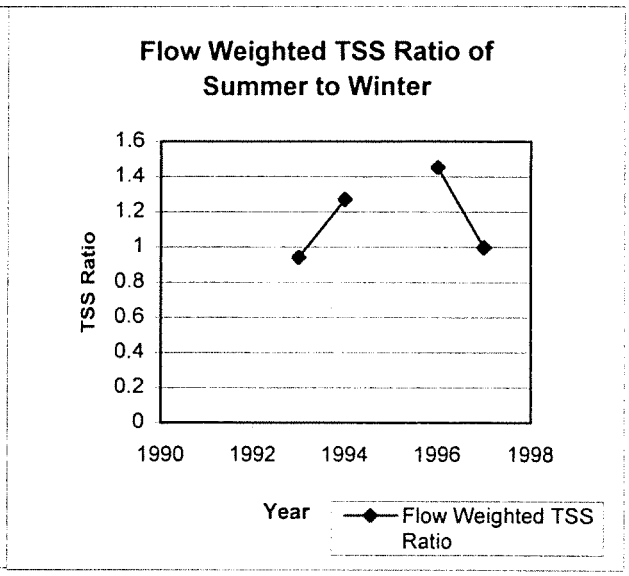


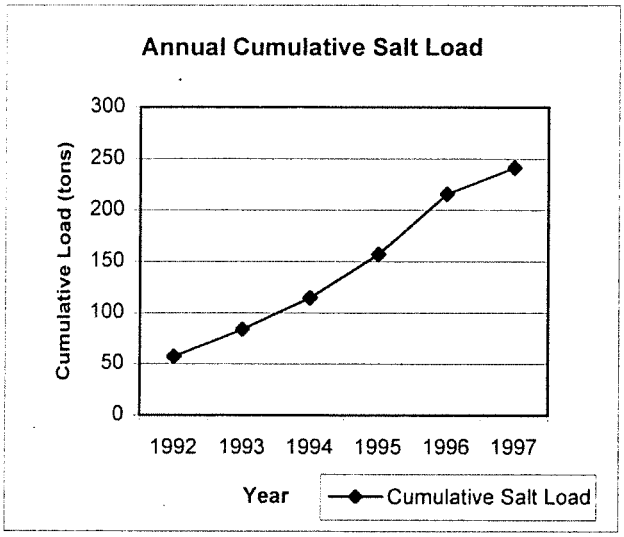




Cobiac Catchment - S 616058

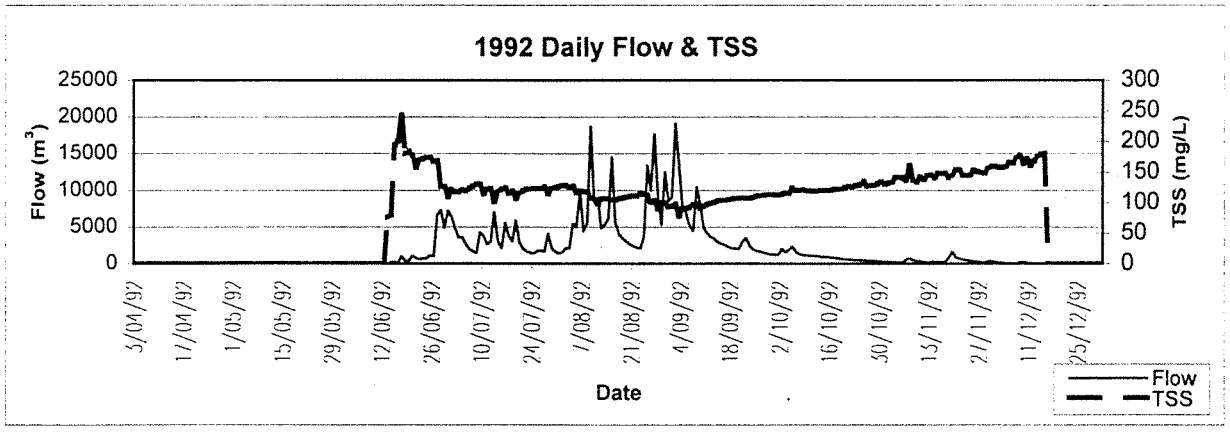




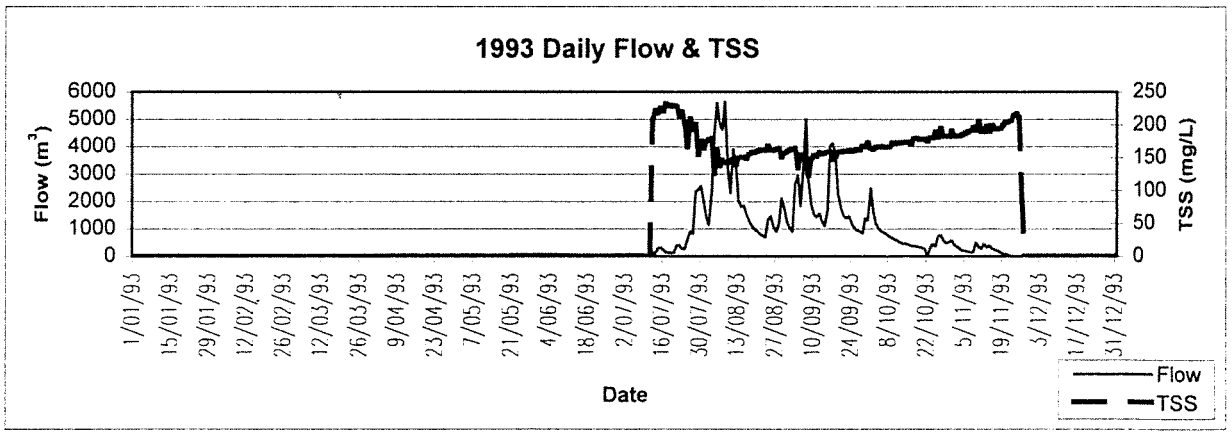


Cobiac Catchment - S 616058

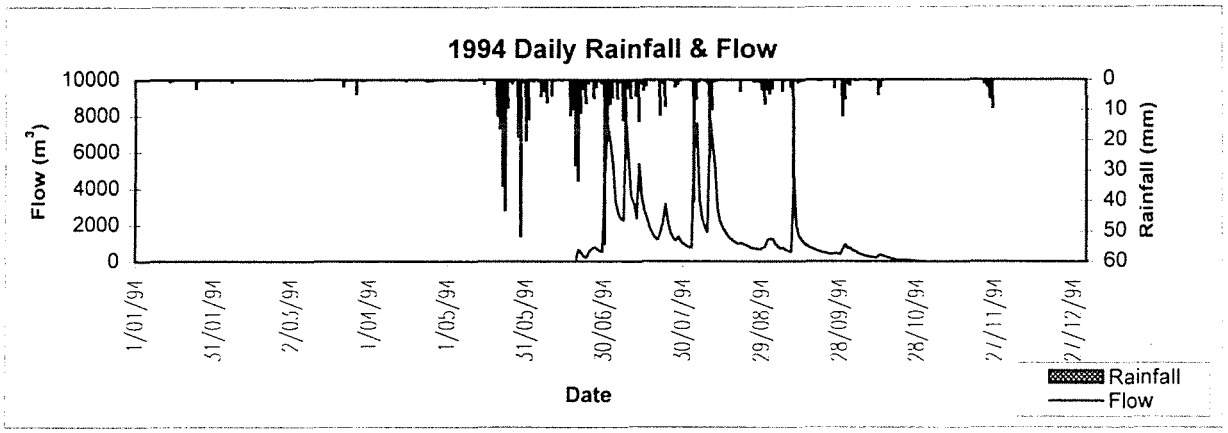
Rainfall data not available for 1992

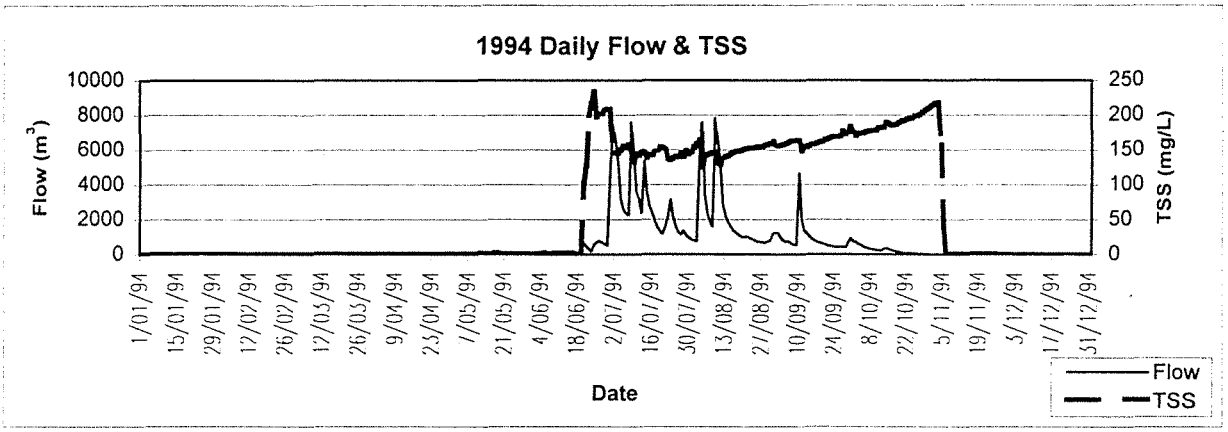


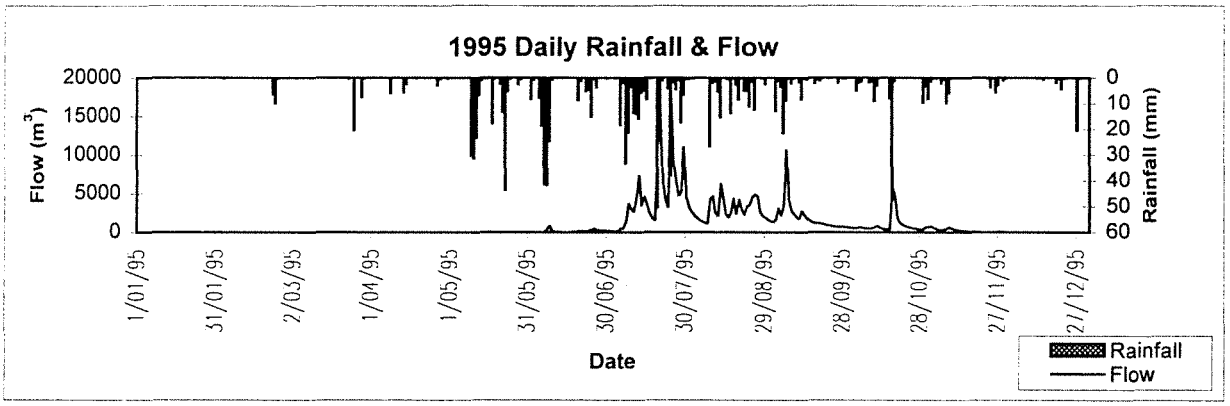
Rainfall data not available for 1993

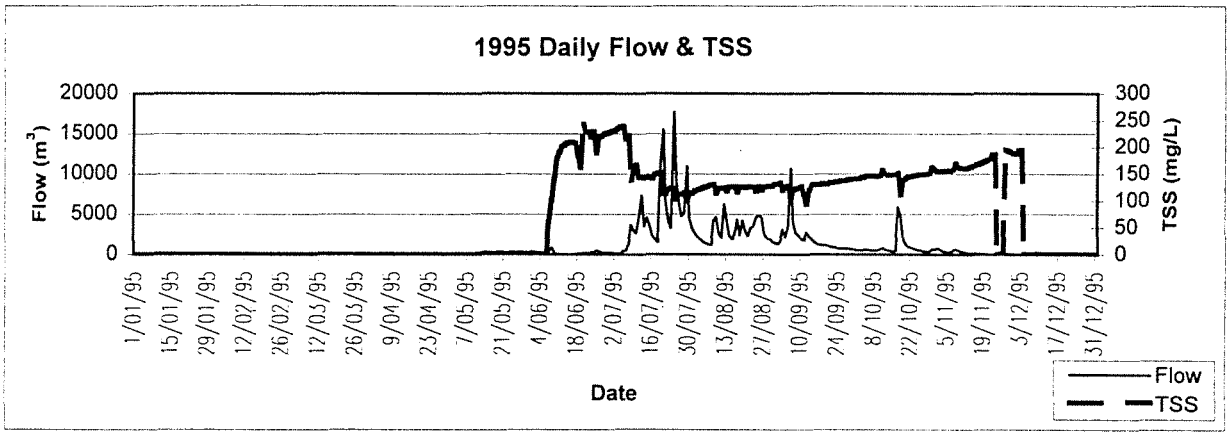


Cobiac Catchment - S 616058

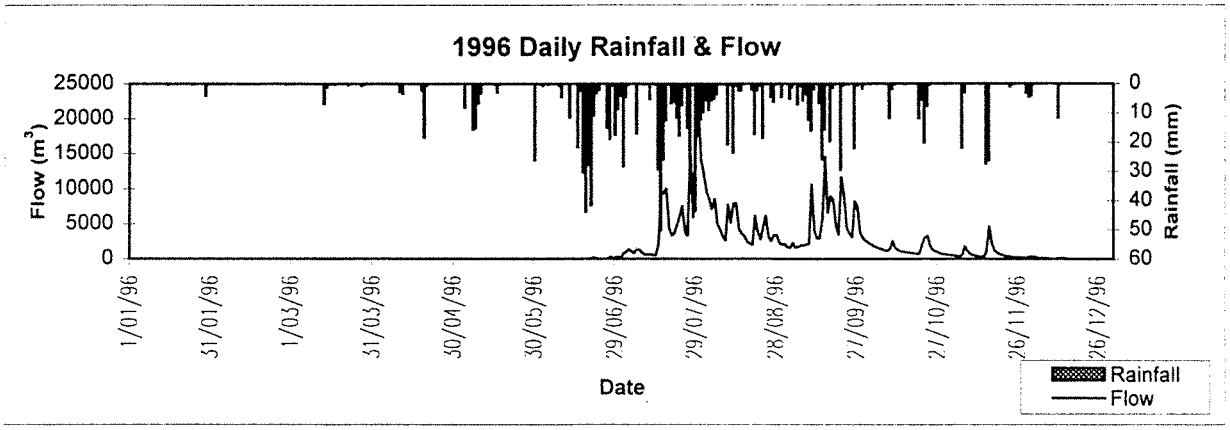


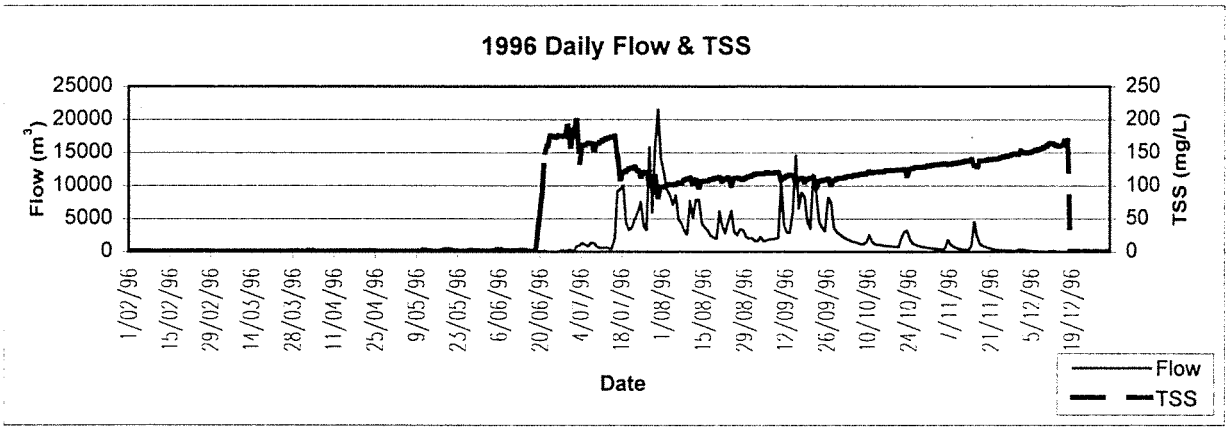


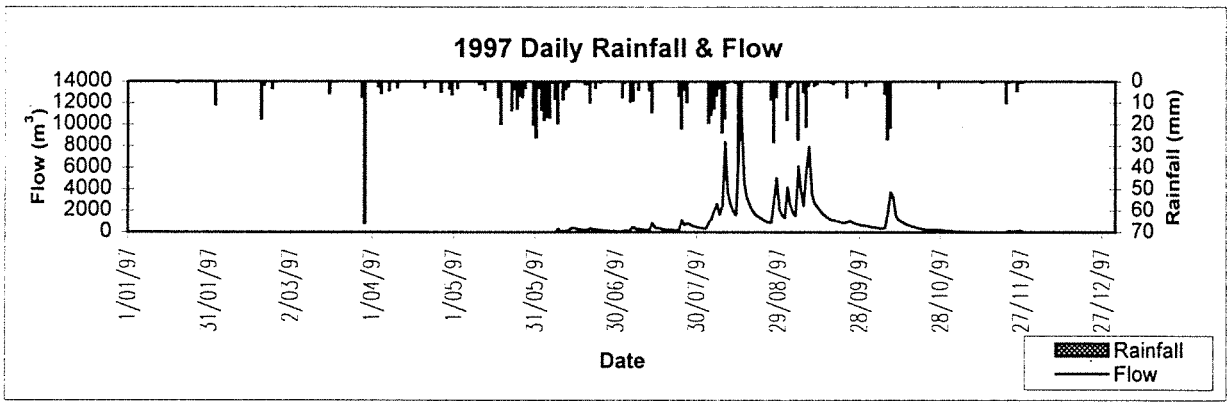


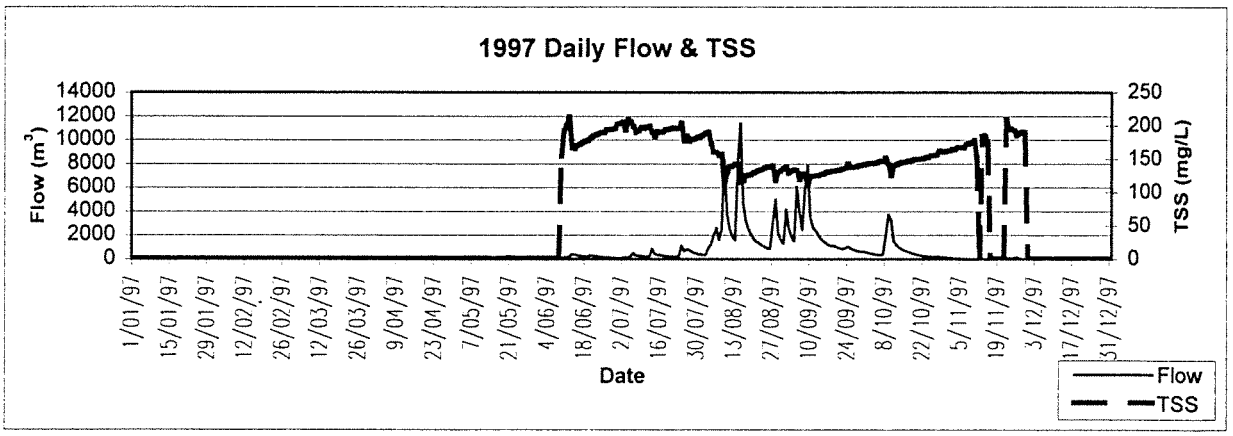


Cobiac Catchment - S 616058



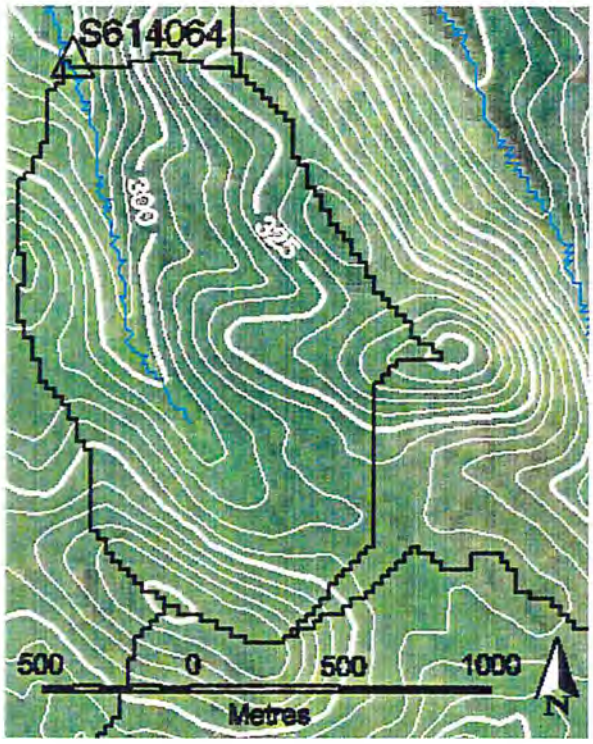




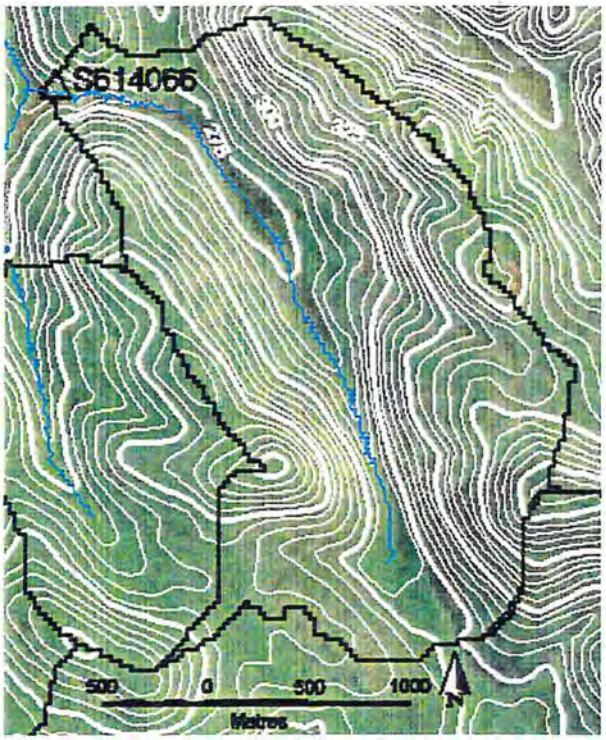


5. Comparison

Cameron West Catchment



Cameron Central Catchment



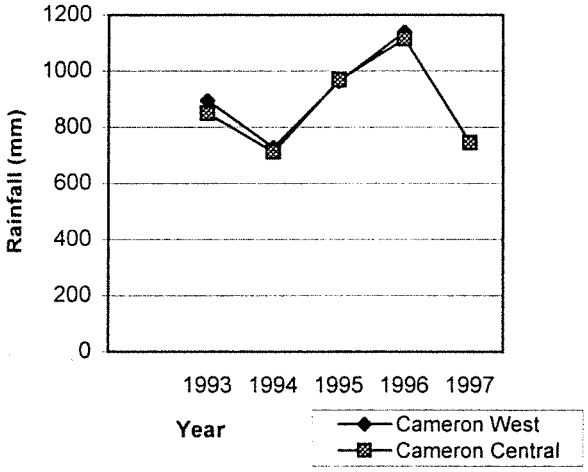
Comparison: Cameron West Catchment v Cameron Central Catchment

	Cameron West Catchment	Cameron Central Catchment
Gauging Station Number	S614064	S614066
Rainfall Gauge Number	M509569	M509577
General Information about Catchments		
Catchment area	2.09 (km^2)	4.94 (km^2)
Treatment Data	Logging in '95-'96	Logging in '95-'96
Annual Basic Statistics		
Average rainfall (mm)	782.4	867.3
Average flow (millions of m^3)	0.016	0.049
Average salinity (mg/L)	93.19	94.62

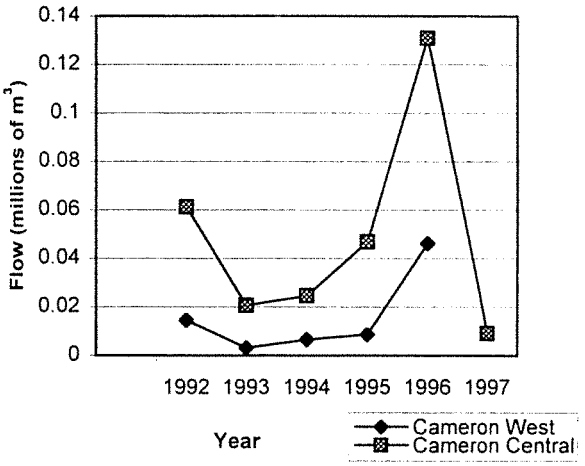
	Cameron West Catchment			Cameron Central Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)
1991	-	0.035	92.34	-	-	-
1992	887.72	0.015	97.00	815.23	0.061	59.51
1993	894.77	0.003	109.06	848.68	0.021	116.88
1994	727.49	0.007	103.15	712.32	0.025	111.52
1995	963.08	0.009	99.84	968.20	0.047	108.92
1996	1139.16	0.046	88.42	1114.05	0.131	97.77
1997	-	-	-	745.15	0.009	115.39

Comparison: Cameron West Catchment v Cameron Central Catchment

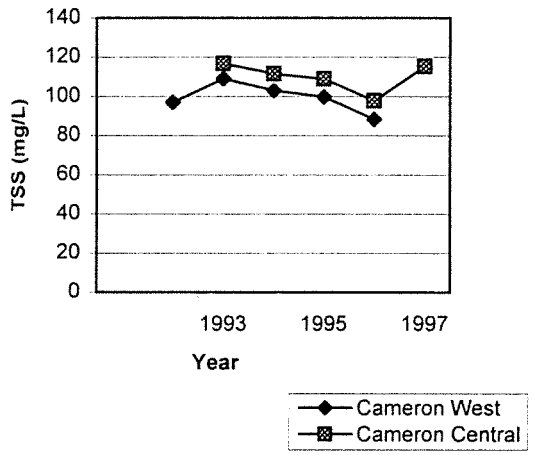
Annual Rainfall



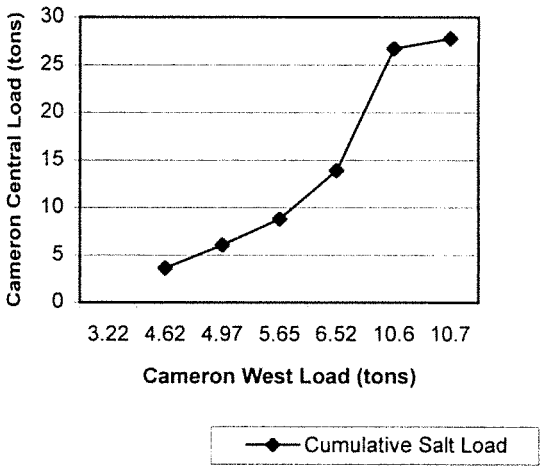
Annual Flow



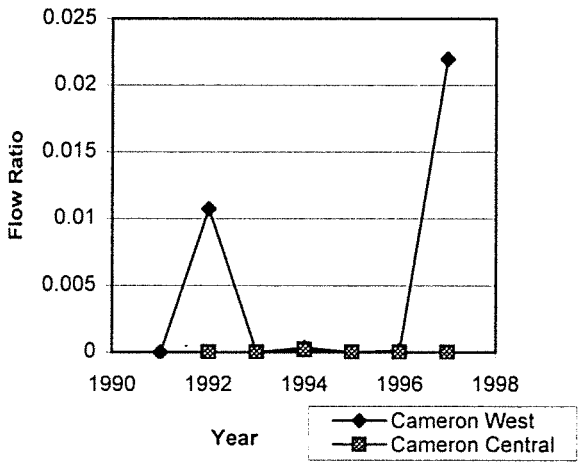
Annual Flow Weighted TSS



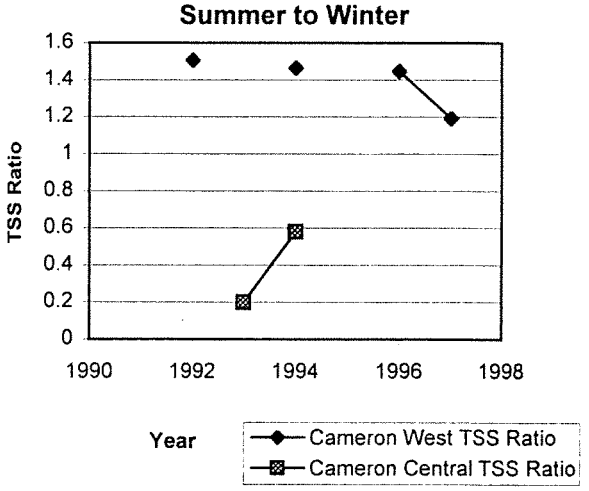
Annual Cumulative Salt Load



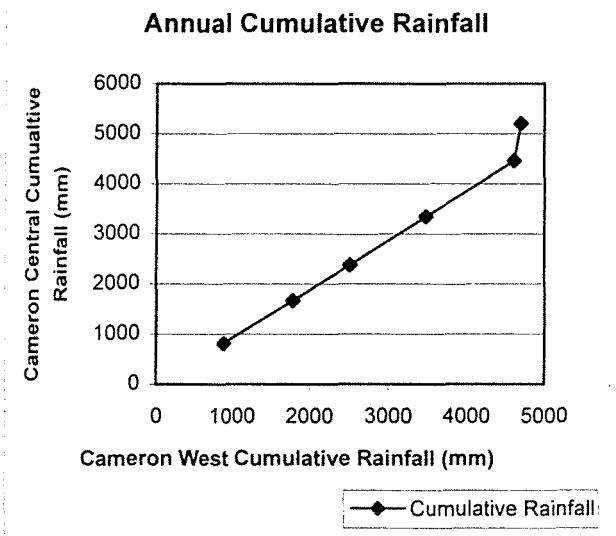
Flow Ratio Of Summer to Winter

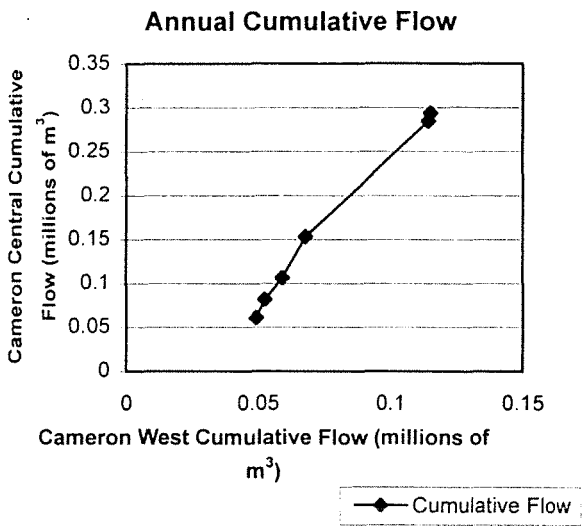


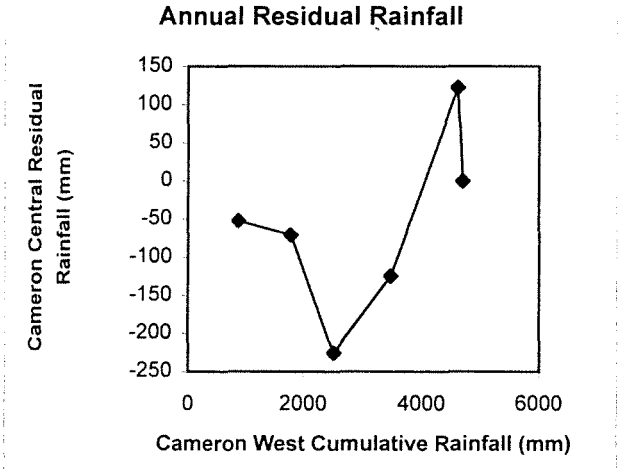
Flow Weighted TSS Ratio Of Summer to Winter

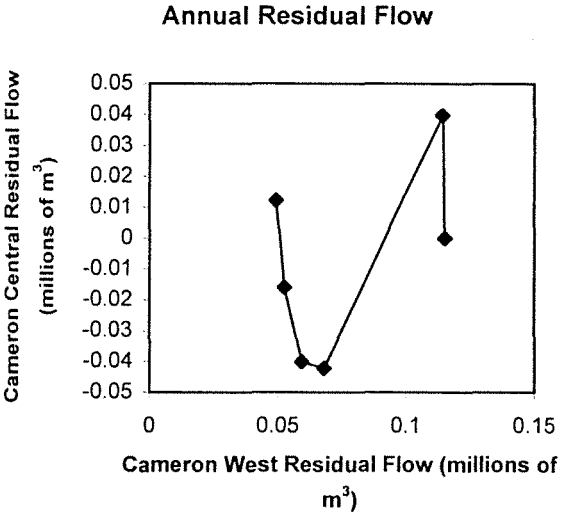


Comparison: Cameron West Catchment v Cameron Central Catchment

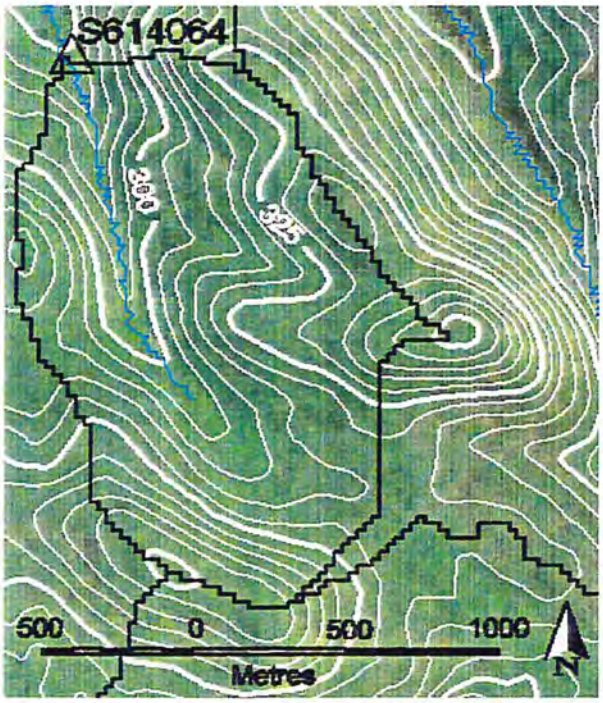




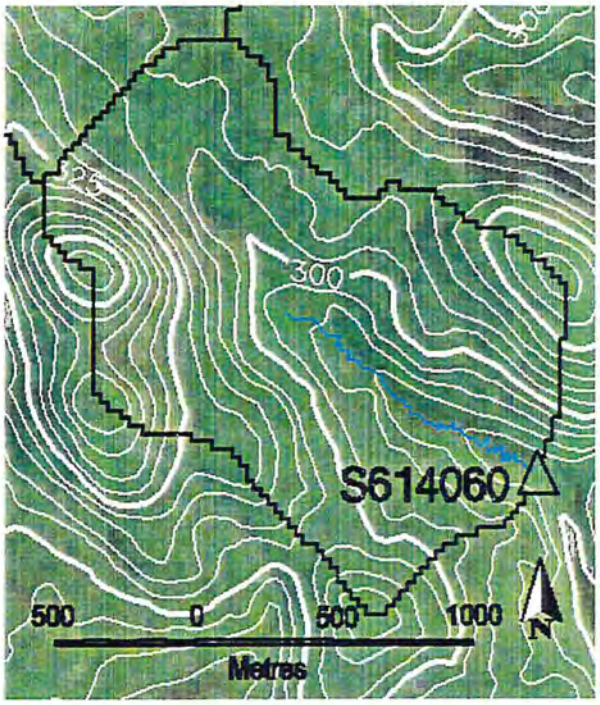




Cameron West Catchment



Gordon Catchment

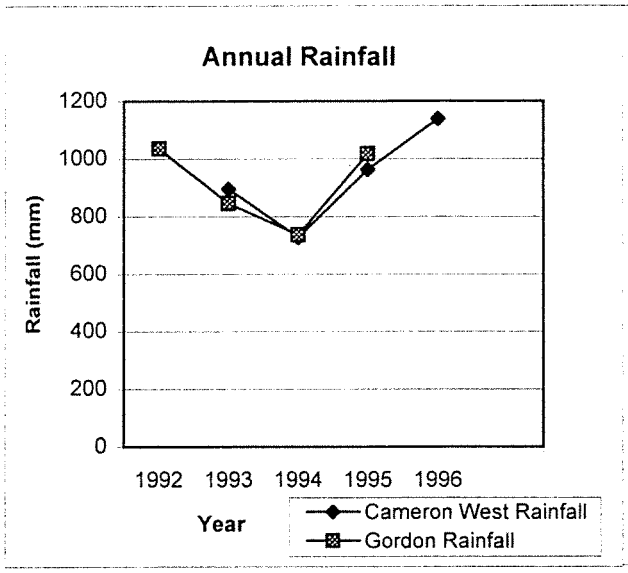


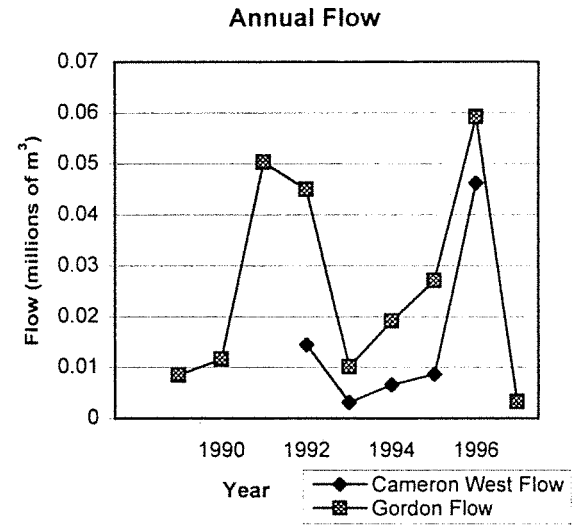
Comparison: Cameron West Catchment v Gordon Catchment

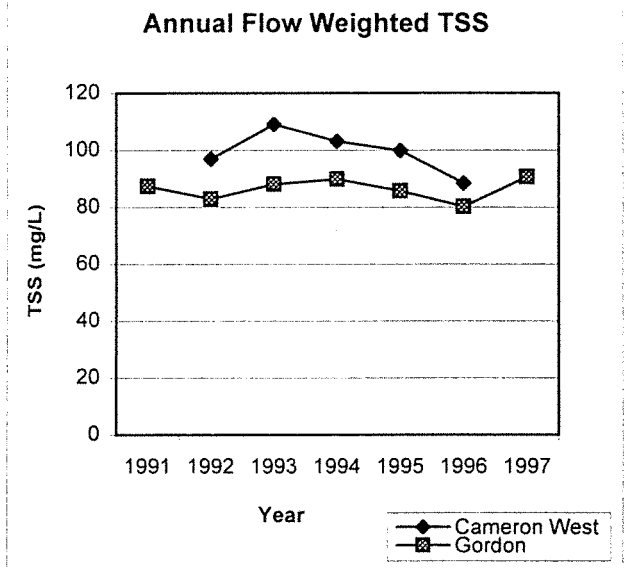
	Cameron West Catchment	Gordon Catchment
Gauging Station Number	S614064	S614060
Rainfall Gauge Number	M509569	M509568
General Information about Catchments		
Catchment area	2.09 (km^2)	2.1 (km^2)
Treatment Data	Logging in '95-'96	Control catchment
Annual Basic Statistics		
Average rainfall (mm)	931.1	908.5
Average flow (millions of m^3)	0.016	0.026
Average salinity (mg/L)	93.19	84.58

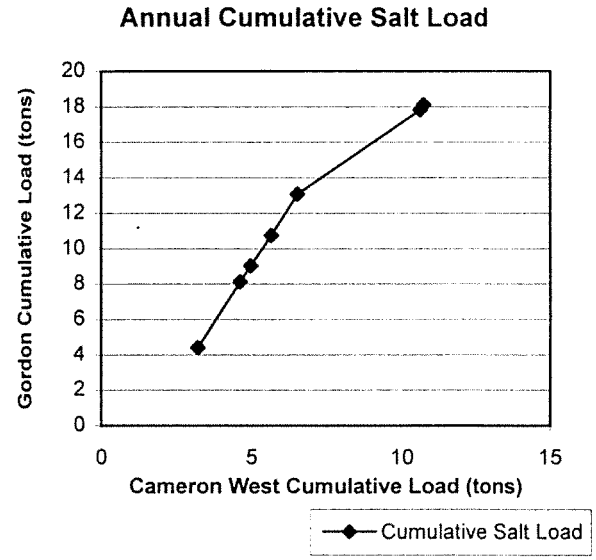
	Cameron West Catchment			Gordon Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)
1989	-	-	-	-	0.009	-
1990	-	-	-	-	0.012	-
1991	-	-	-	-	0.050	87.40
1992	-	0.015	97.00	1035	0.045	82.92
1993	894.77	0.003	109.06	845	0.010	88.07
1994	727.49	0.007	103.15	736	0.019	89.86
1995	963.08	0.009	99.84	1018	0.027	85.67
1996	1139.16	0.046	88.42	-	0.059	80.28
1997	-	-	-	-	0.003	90.72

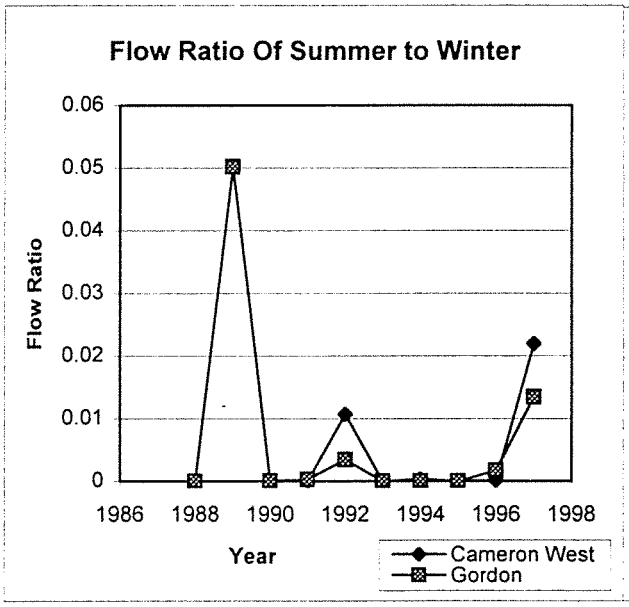
Comparison: Cameron West Catchment v Gordon Catchment

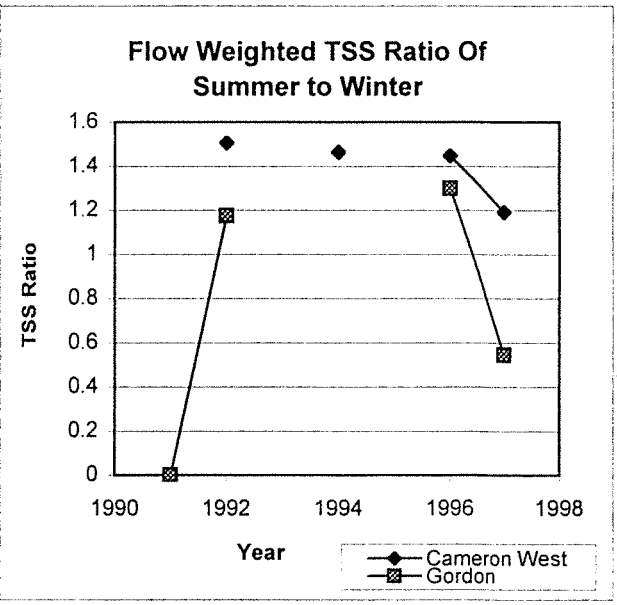




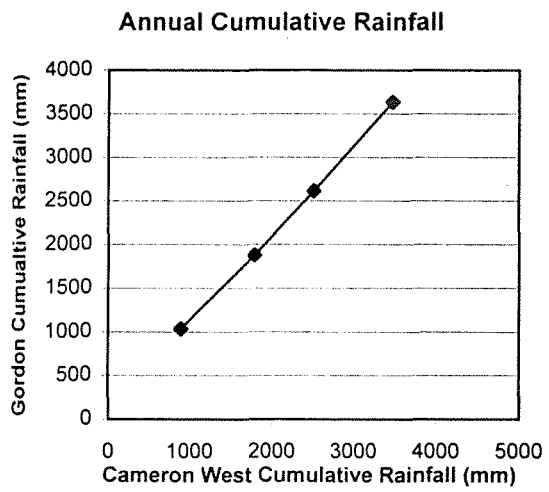


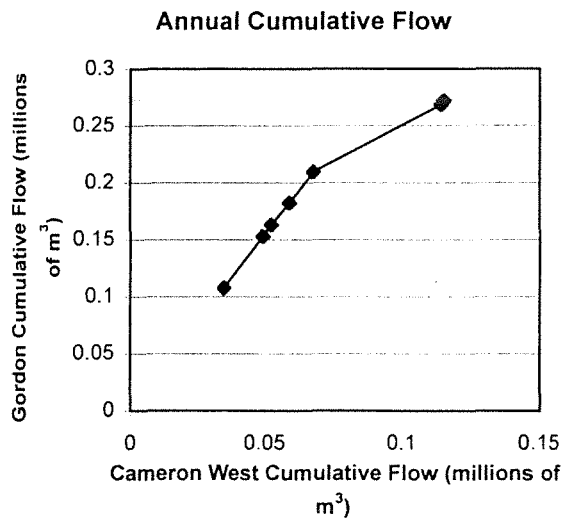


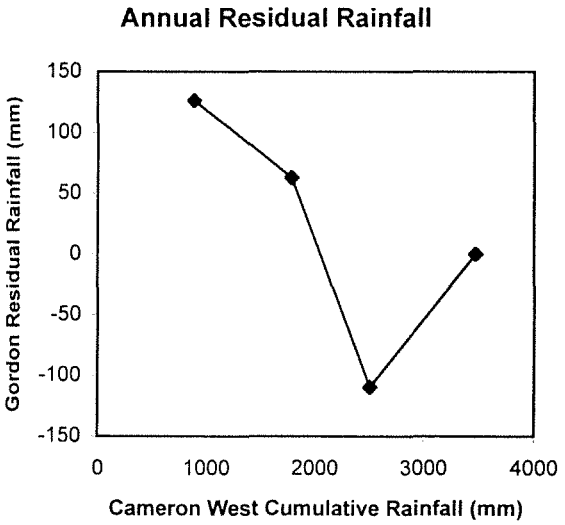


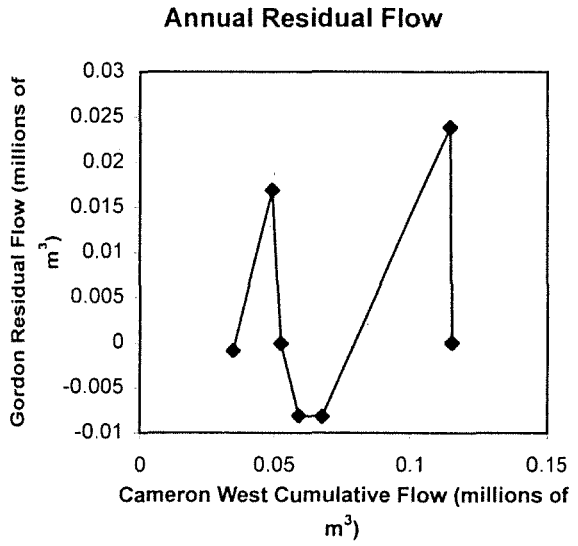


Comparison: Cameron West Catchment v Gordon Catchment

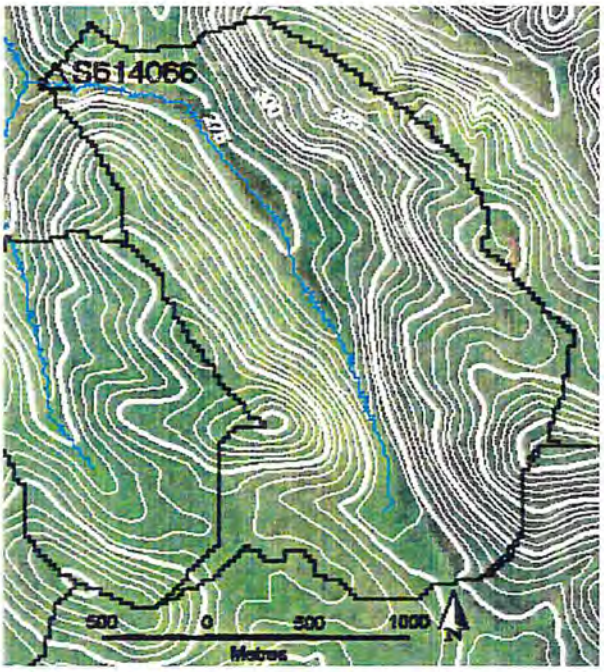




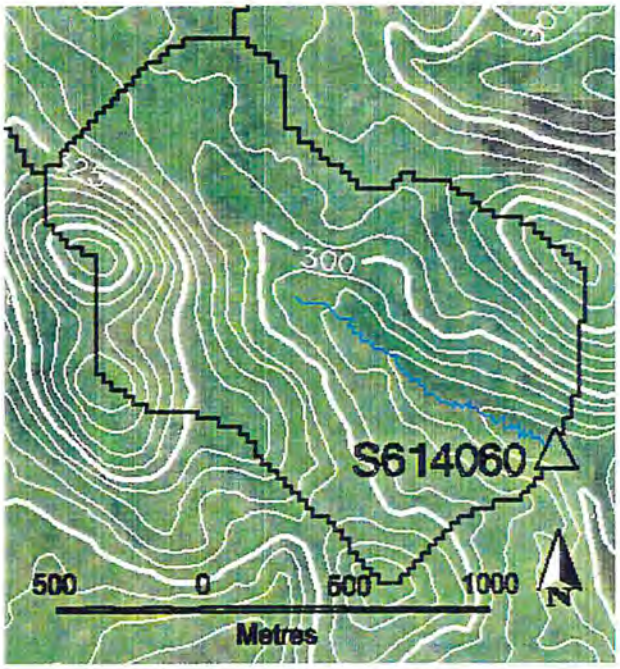




Cameron Central Catchment



Gordon Catchment

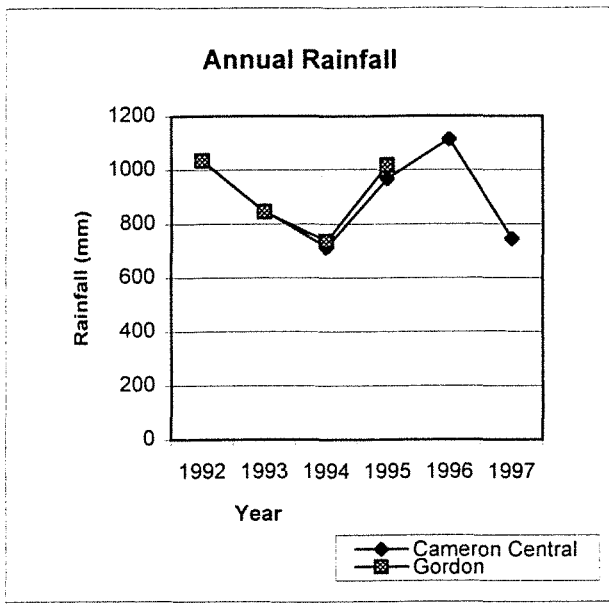


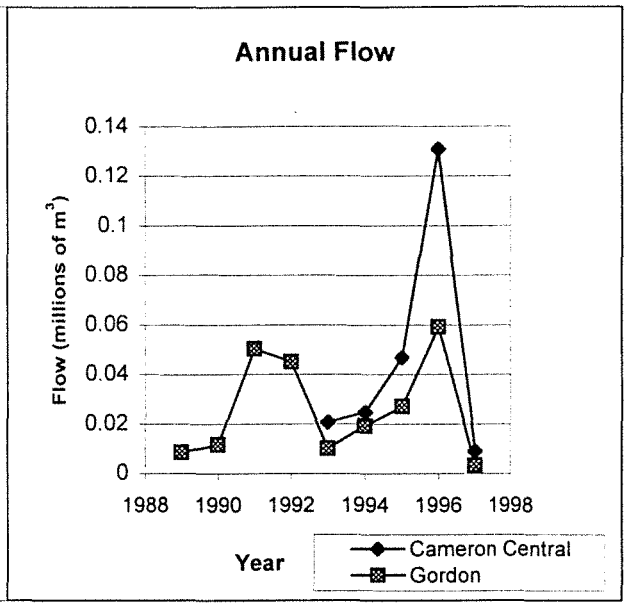
Comparison: Cameron Central Catchment v Gordon Catchment

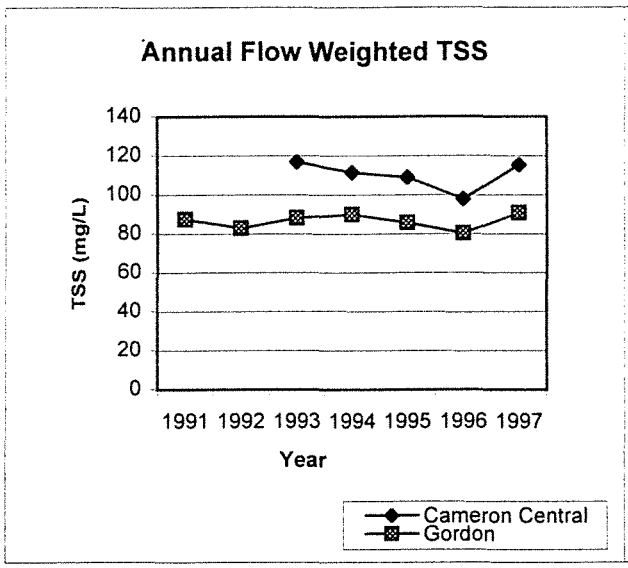
	Cameron Central Catchment	Gordon Catchment
Gauging Station Number	S614066	S614060
Rainfall Gauge Number	M509577	M509568
General Information about Catchments		
Catchment area	4.94 (km^2)	2.1 (km^2)
Treatment Data	Logging in '95-'96	Control catchment
Annual Basic Statistics		
Average rainfall (mm)	867.3	908.5
Average flow (millions of m^3)	0.049	0.025
Average salinity (mg/L)	94.62	84.58

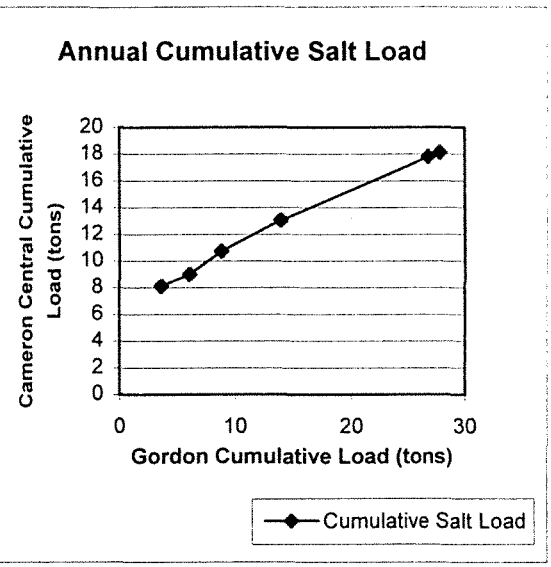
	Cameron Central Catchment			Gordon Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)			
1989	-	-	-	-	0.009	-
1990	-	-	-	-	0.012	-
1991	-	-	-	-	0.050	87.40
1992	-	-	-	1035	0.045	82.92
1993	848.68	0.021	116.88	845	0.010	88.07
1994	712.32	0.025	111.52	736	0.019	89.86
1995	968.20	0.047	108.92	1018	0.027	85.67
1996	1114.05	0.131	97.77	-	0.059	80.28
1997	745.15	0.009	115.39	-	0.003	90.72

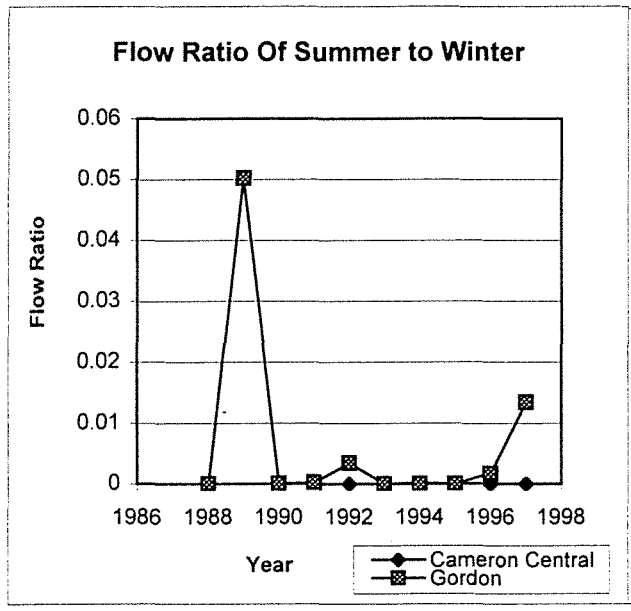
Comparison: Cameron Central Catchment v Gordon Catchment

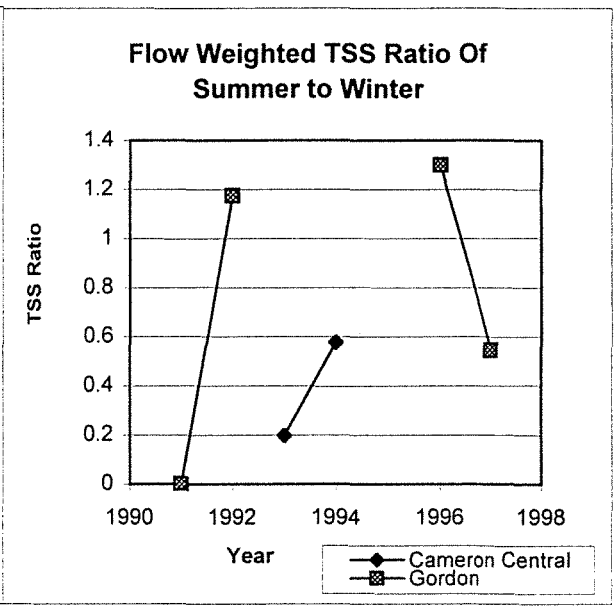






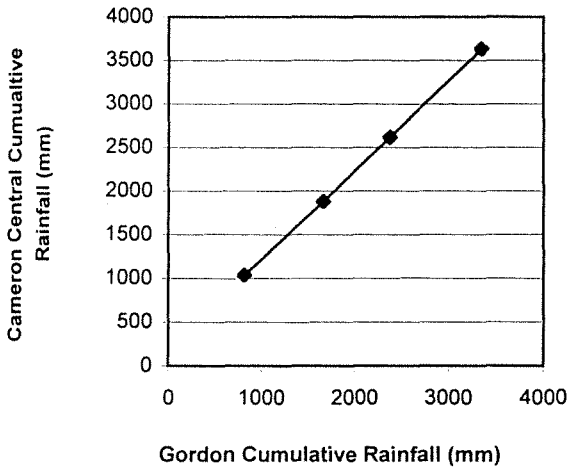




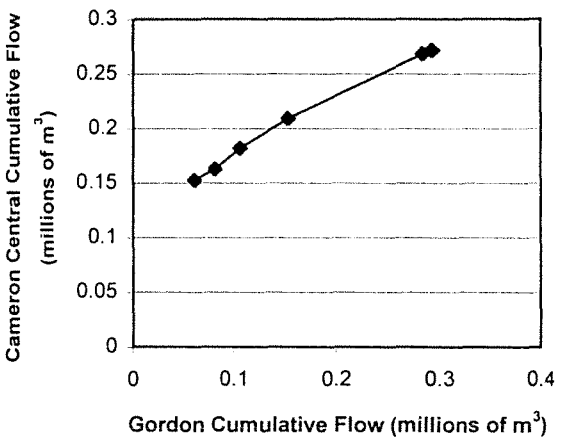


Comparison: Cameron Central Catchment v Gordon Catchment

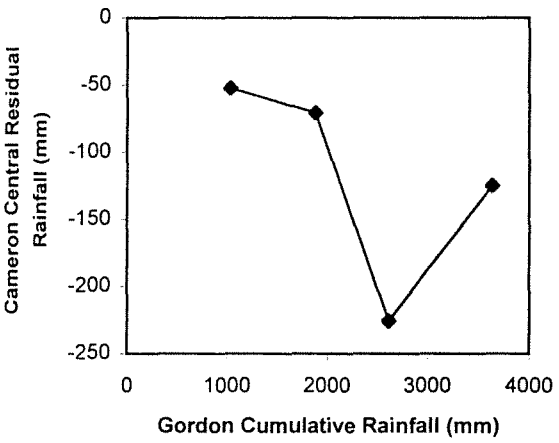
Annual Cumulative Rainfall



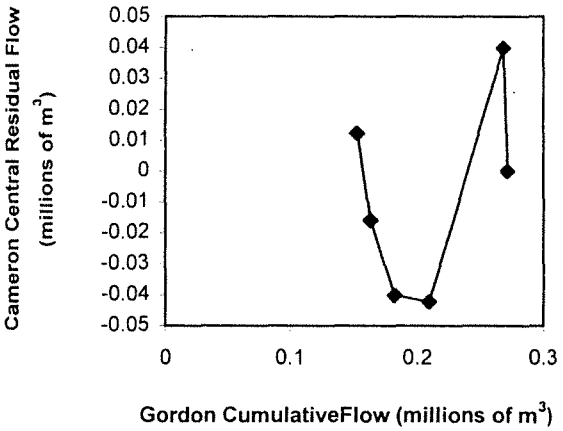
Annual Cumulative Flow



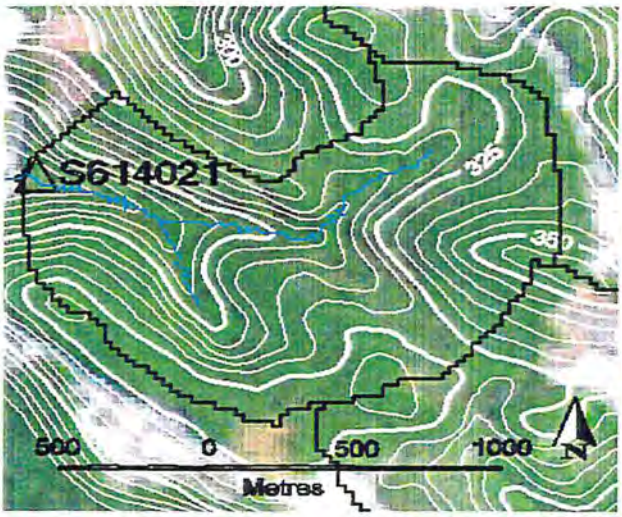
Annual Residual Rainfall



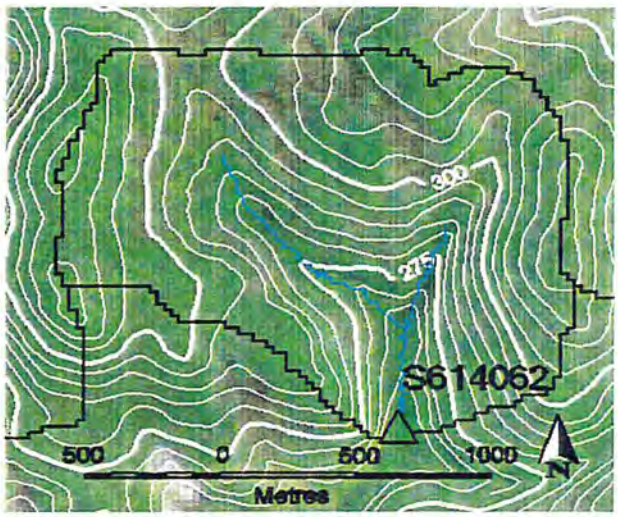
Annual Residual Flow



Lewis Catchment



Bates Catchment

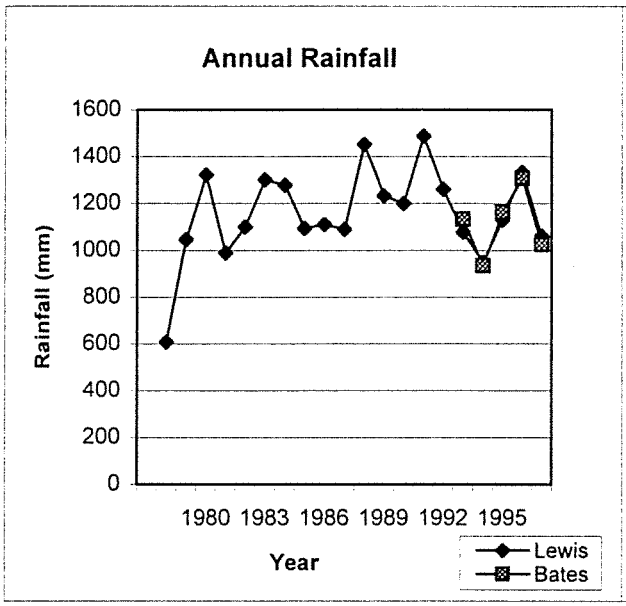


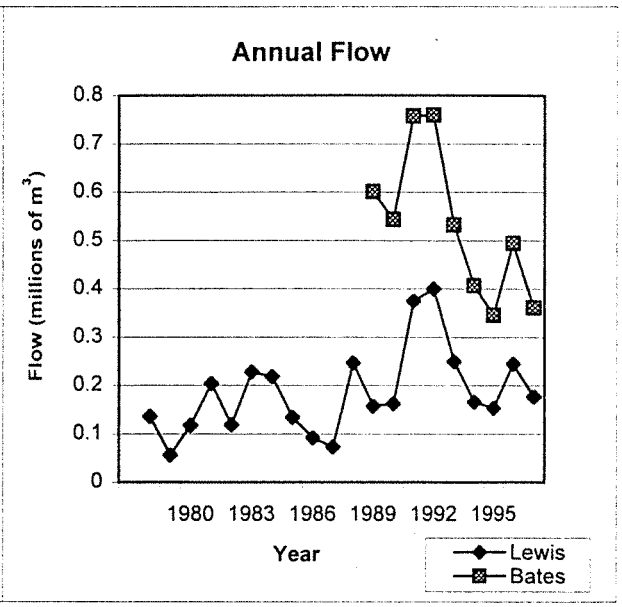
Comparison: Lewis Catchment v Bates Catchment

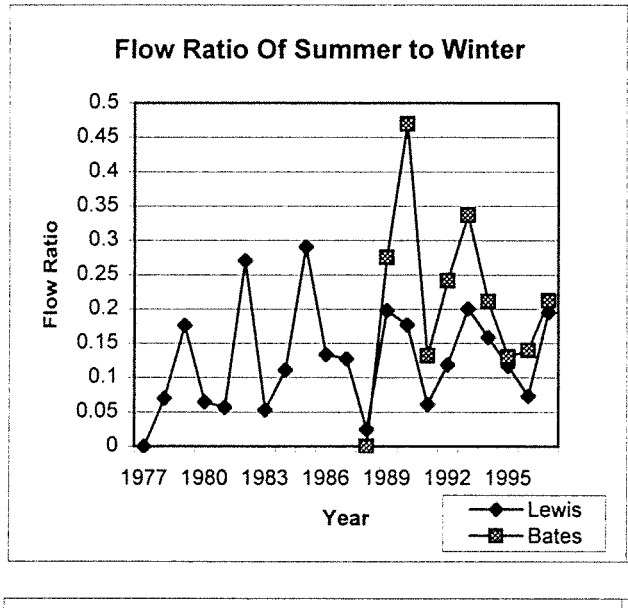
	Lewis Catchment	Bates Catchment
Gauging Station Number	S614021	S614062
Rainfall Gauge Number	M509349	M509579
General Information about Catchments		
Catchment area	2.01 km^2	2.23 km^2
Treatment Data	1. Severe dieback. 2. Untreated. 3. Mined from'96	Control Catchment
Annual Basic Statistics		
Average rainfall (mm)	1156.1	1111.9
Average flow (millions of m^3)	0.186	0.533
Average salinity (mg/L)	102.31	-

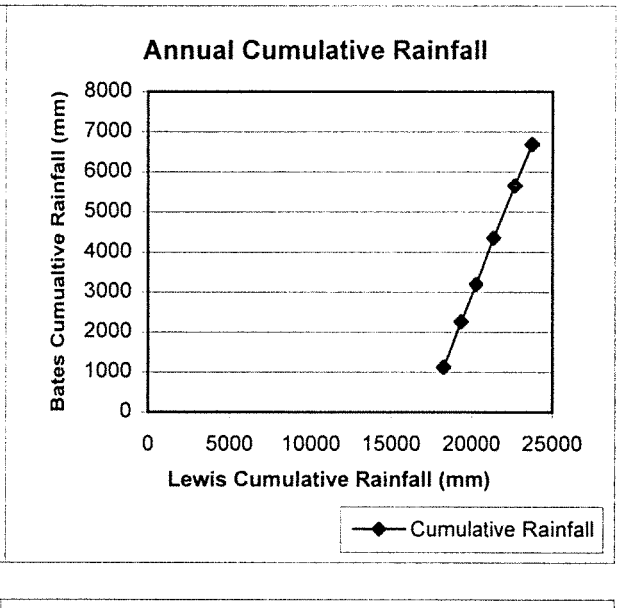
	Lewis Catchment			Bates Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)
1978	609.2	0.136	-	-	-	-
1979	1045.6	0.056	-	-	-	-
1980	1321.5	0.118	-	-	-	-
1981	988.6	0.204	-	-	-	-
1982	1099.3	0.119	-	-	-	-
1983	1300.9	0.228	-	-	-	-
1984	1278.0	0.218	-	-	-	-
1985	1094.1	0.134	-	-	-	-
1986	1110.8	0.092	-	-	-	-
1987	1090.1	0.073	-	-	-	-
1988	1451.9	0.247	-	-	-	-
1989	1232.9	0.158	-	-	0.600	-
1990	1199.0	0.163	-	-	0.544	-
1991	1487.6	0.375	-	-	0.757	-
1992	1260.6	0.400	85.33	-	0.759	-
1993	1077.8	0.250	103.68	1133.0	0.532	-
1994	950.0	0.166	104.02	933.2	0.407	-
1995	1129.6	0.153	109.61	1162.2	0.346	-
1996	1332.8	0.244	109.85	1306.7	0.495	-
1997	1060.8	0.177	104.42	1024.3	0.361	-

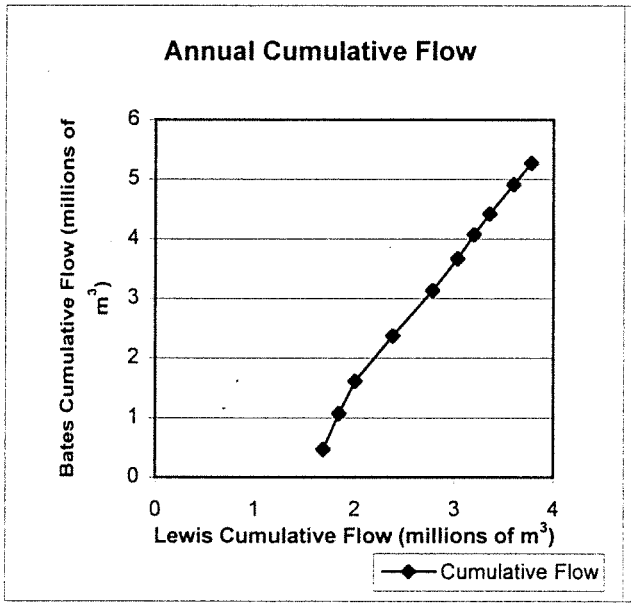
Comparison: Lewis Catchment v Bates Catchment

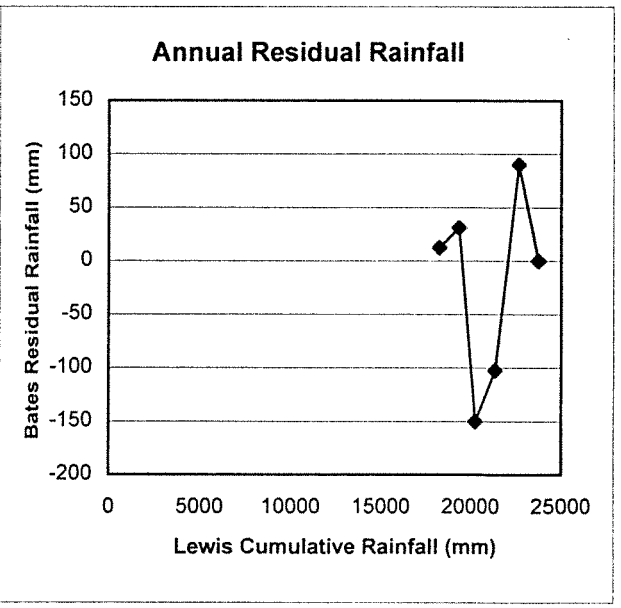




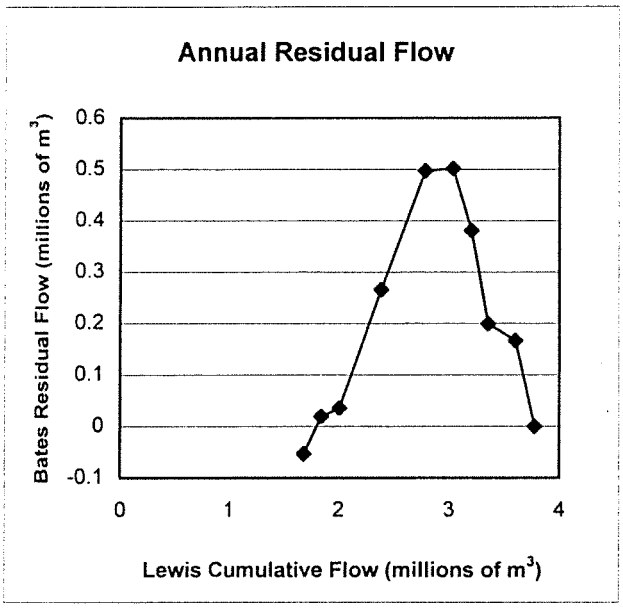




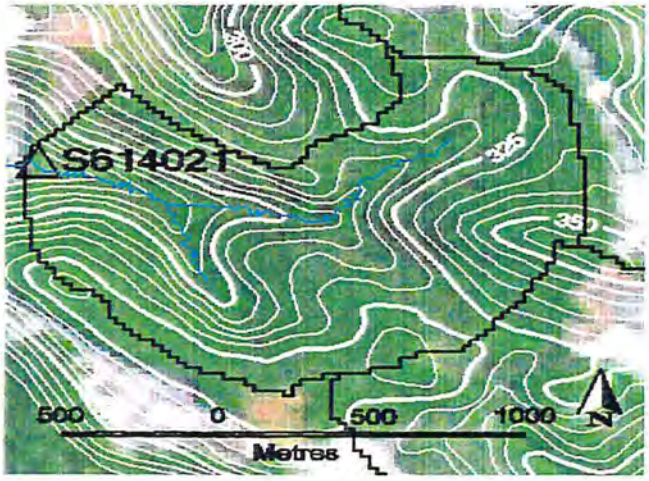




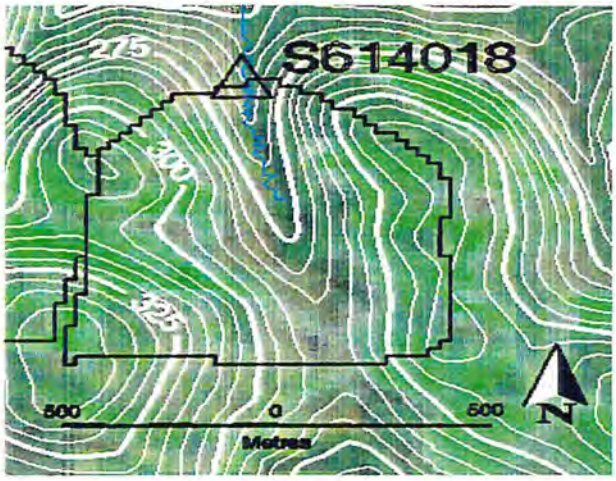
Comparison: Lewis Catchment v Bates Catchment



Lewis Catchment



Bennetts Catchment

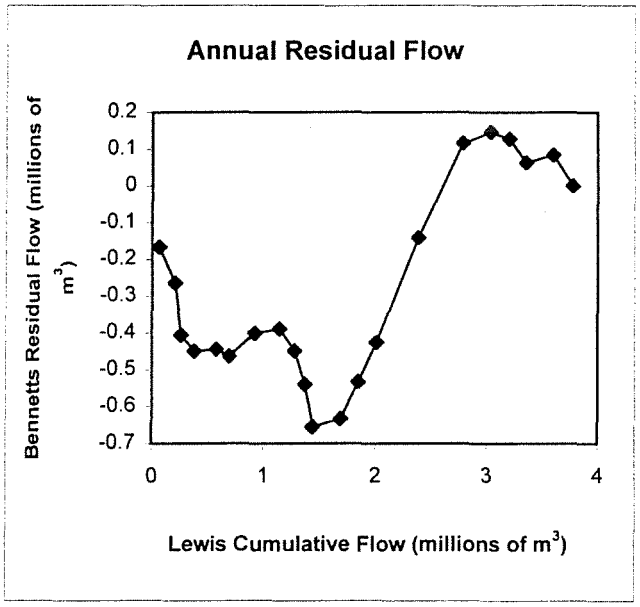


Comparison: Lewis Catchment v Bennetts Catchment

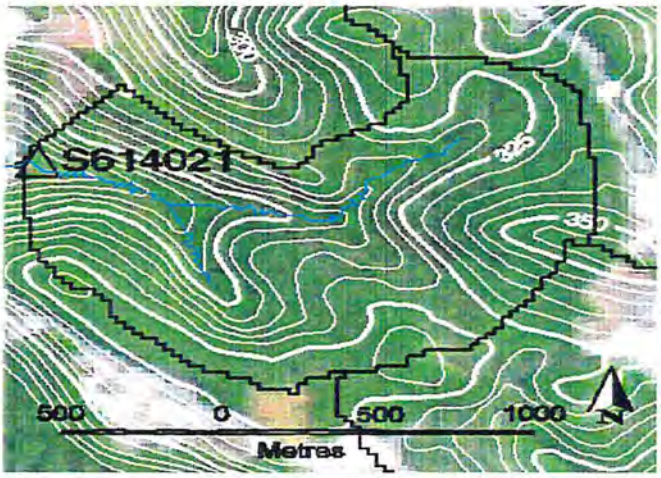
	Lewis Catchment	Bennetts Catchment
Gauging Station Number	S614021	S614018
Rainfall Gauge Number	M509349	M509346
General Information about Catchments		
Catchment area	2.01 km^2	0.88 km^2
Treatment Data	1. Severe dieback.	1. Severe dieback.
	2. Untreated.	2. Mined in '89-'92
	3. Mined from'96	3. Rehabilitated in'92
Annual Basic Statistics		
Average rainfall (mm)	1156.1	1173.8
Average flow (millions of m^3)	0.186	0.232
Average salinity (mg/L)	102.31	-

	Lewis Catchment			Bennetts Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)
1978	609.2	0.136	-	1099.8	0.126	-
1979	1045.6	0.056	-	1010.0	0.083	-
1980	1321.5	0.118	-	1338.8	0.180	-
1981	988.6	0.204	-	1198.9	0.229	-
1982	1099.3	0.119	-	1116.2	0.206	-
1983	1300.9	0.228	-	1365.7	0.285	-
1984	1278.0	0.218	-	1318.9	0.235	-
1985	1094.1	0.134	-	1055.3	0.165	-
1986	1110.8	0.092	-	1058.8	0.133	-
1987	1090.1	0.073	-	1032.2	0.110	-
1988	1451.9	0.247	-	1360.9	0.245	-
1989	1232.9	0.158	-	956.4	0.325	-
1990	1199.0	0.163	-	1187.4	0.331	-
1991	1487.6	0.375	-	1437.7	0.508	-
1992	1260.6	0.400	85.33	1325.6	0.481	-
1993	1077.8	0.250	103.68	1051.3	0.254	-
1994	950.0	0.166	104.02	973.3	0.205	-
1995	1129.6	0.153	109.61	1156.8	0.160	-
1996	1332.8	0.244	109.85	1348.8	0.245	-
1997	1060.8	0.177	104.42	1083.5	0.140	-

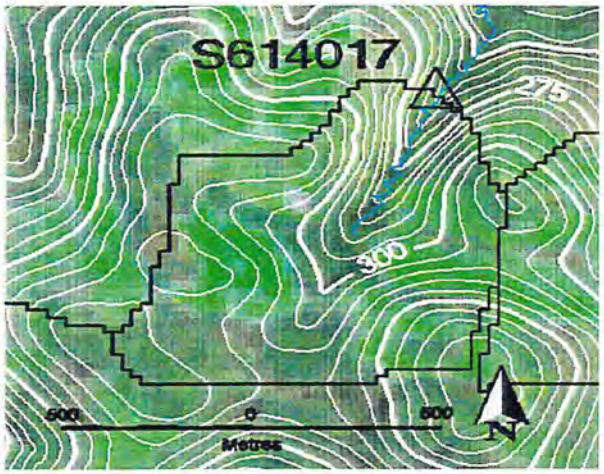
Comparison: Lewis Catchment v Bennetts Catchment



Lewis Catchment



Warren Catchment

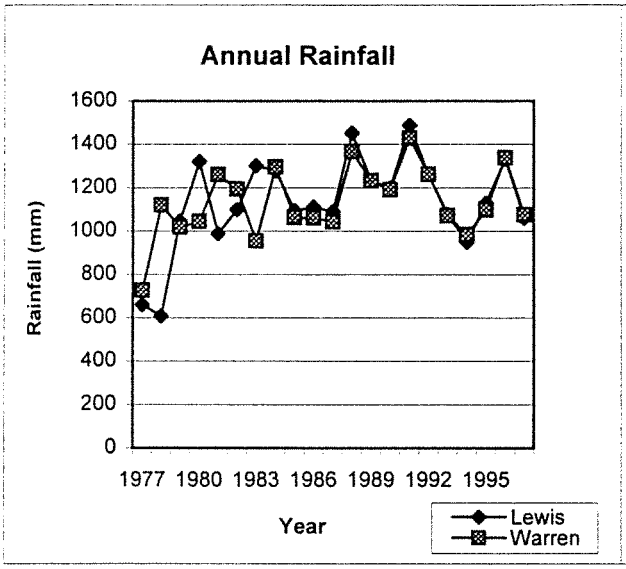


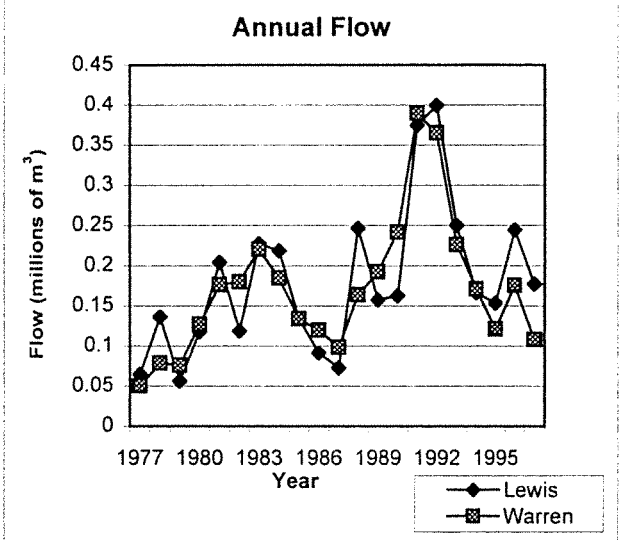
Comparison: Lewis Catchment v Warren Catchment

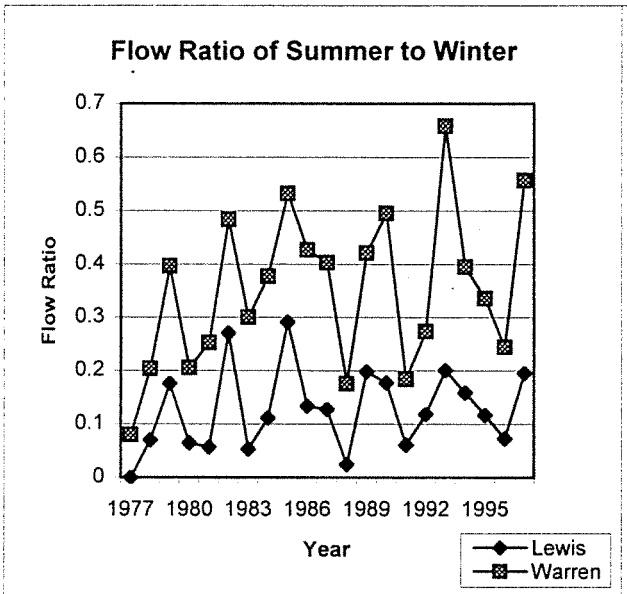
	Lewis Catchment	Warren Catchment
Gauging Station Number	S614021	S614017
Rainfall Gauge Number	M509349	M509345
General Information about Catchments		
Catchment area	2.01 km^2	0.87 km^2
Treatment Data	1. Severe dieback. 2. Untreated. 3. Mined from'96	1. Severe dieback 2. Mined in '89-'92 3. Rehabilitated in'92
Annual Basic Statistics		
Average rainfall (mm)	1132.4	1134.5
Average flow (millions of m^3)	0.172	0.171
Average salinity (mg/L)	102.85	

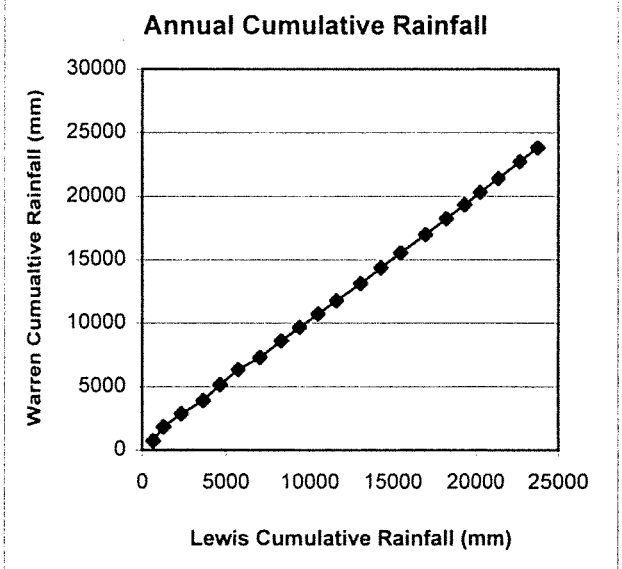
	Lewis Catchment			Warren Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)
1977	659.7	0.065	-	727.1	0.050	-
1978	609.2	0.136	-	1119.4	0.079	-
1979	1045.6	0.056	-	1017.2	0.076	-
1980	1321.5	0.118	-	1044.8	0.127	-
1981	988.6	0.204	-	1260.6	0.176	-
1982	1099.3	0.119	-	1193.5	0.180	-
1983	1300.9	0.228	-	954.0	0.220	-
1984	1278.0	0.218	-	1295.0	0.184	-
1985	1094.1	0.134	-	1061.7	0.134	-
1986	1110.8	0.092	-	1060.7	0.120	-
1987	1090.1	0.073	-	1042.5	0.098	-
1988	1451.9	0.247	-	1367.2	0.164	-
1989	1232.9	0.158	-	1231.9	0.192	-
1990	1199.0	0.163	-	1191.4	0.242	-
1991	1487.6	0.375	-	1428.0	0.390	-
1992	1260.6	0.400	85.33	1261.0	0.365	-
1993	1077.8	0.250	103.68	1070.8	0.226	-
1994	950.0	0.166	104.02	984.2	0.171	-
1995	1129.6	0.153	109.61	1097.7	0.121	-
1996	1332.8	0.244	109.85	1339.0	0.175	-
1997	1060.8	0.177	104.42	1076.1	0.108	-

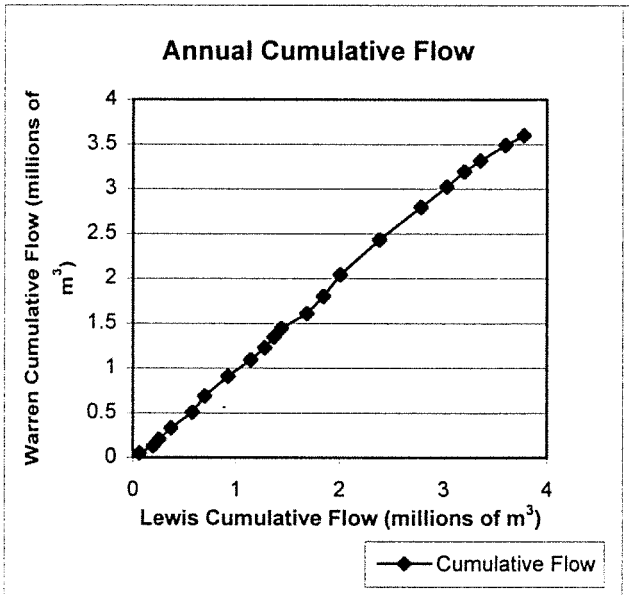
Comparison: Lewis Catchment v Warren Catchment

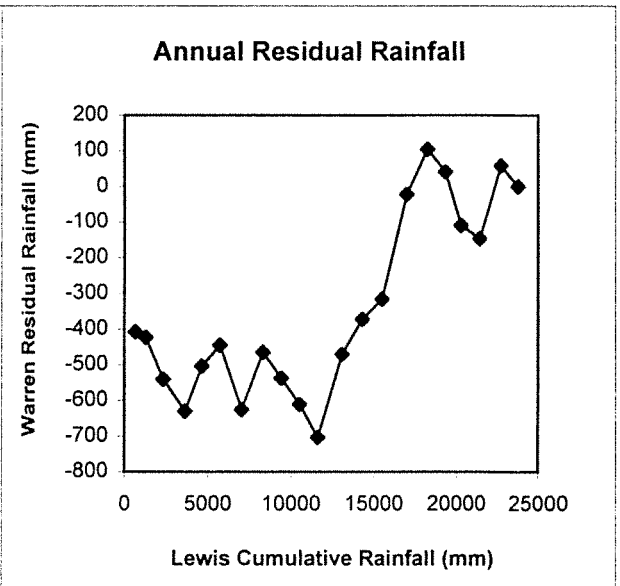




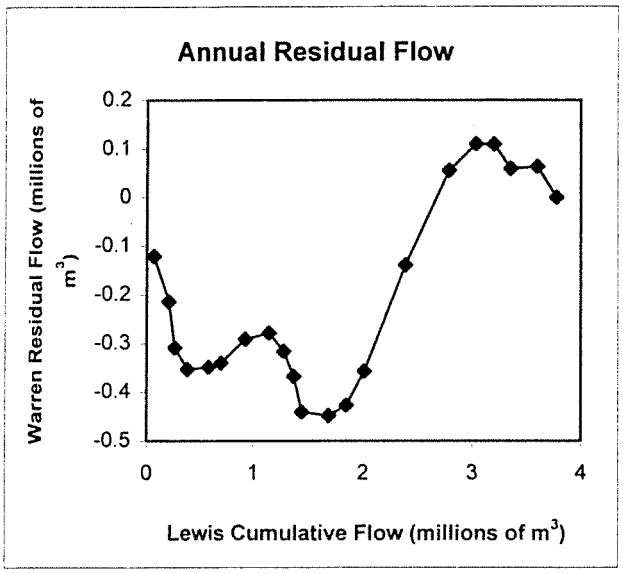




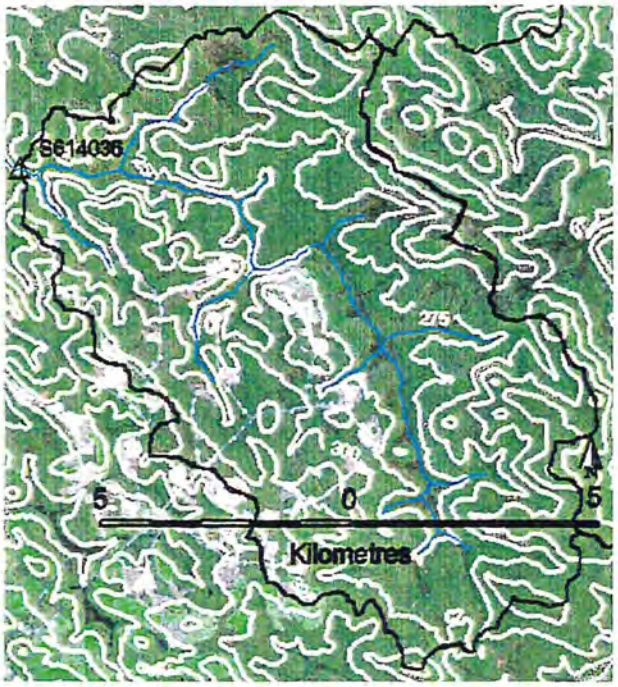




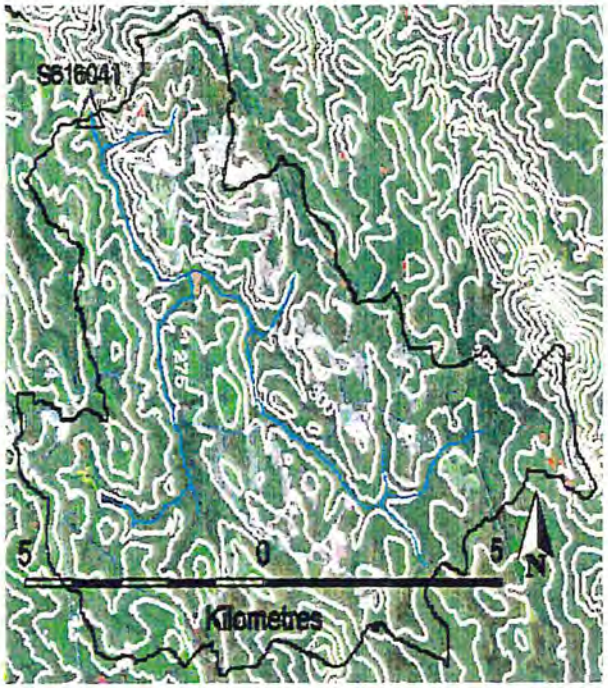
Comparison: Lewis Catchment v Warren Catchment



North Road Catchment



Vardi Road Catchment

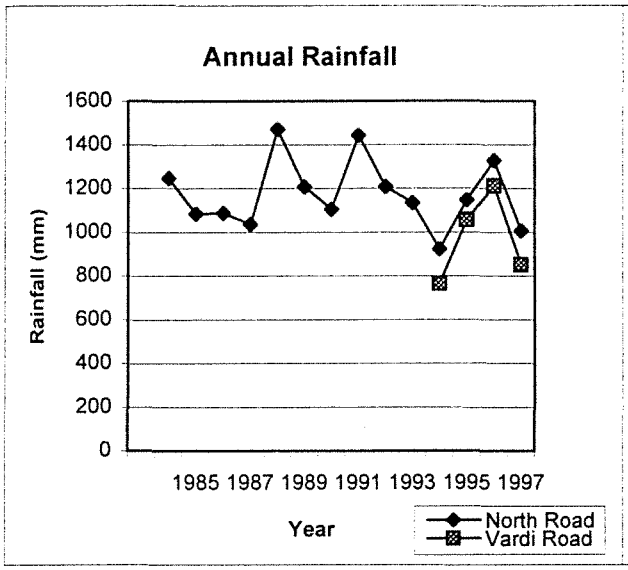


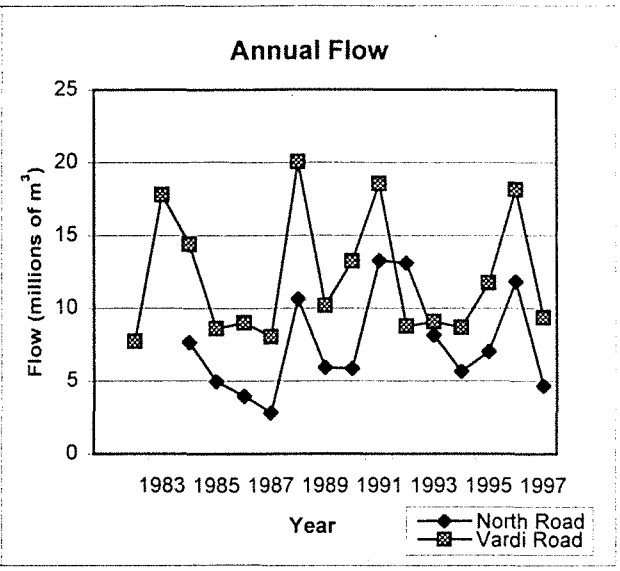
Comparison: North Road Catchment v Vardi Road Catchment

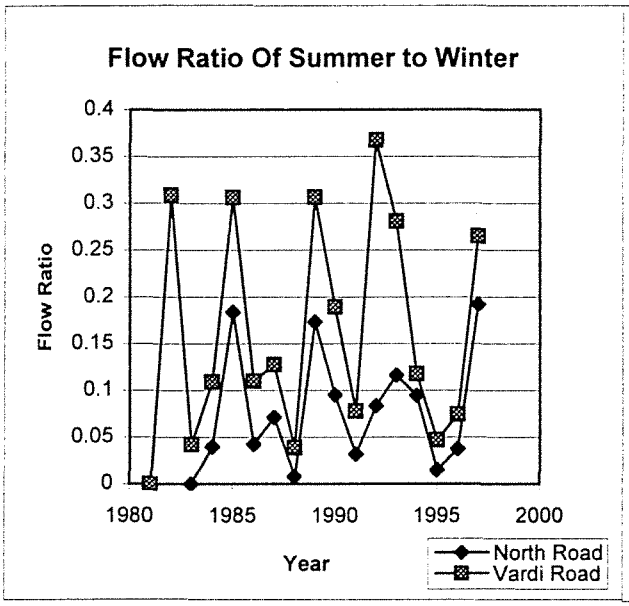
	North Road	Vardi Road
Gauging Station Number	S614036	S616041
Rainfall Gauge Number		
General Information about Catchments		
Catchment area	81.6 km^2	80.33 km^2
Treatment Data	Bauxite mining since 1980's	Bauxite mining since 1970's
Annual Basic Statistics		
Average rainfall (mm)	-	-
Average flow (millions of m^3)	7.541	12.342
Average salinity (mg/L)	-	-

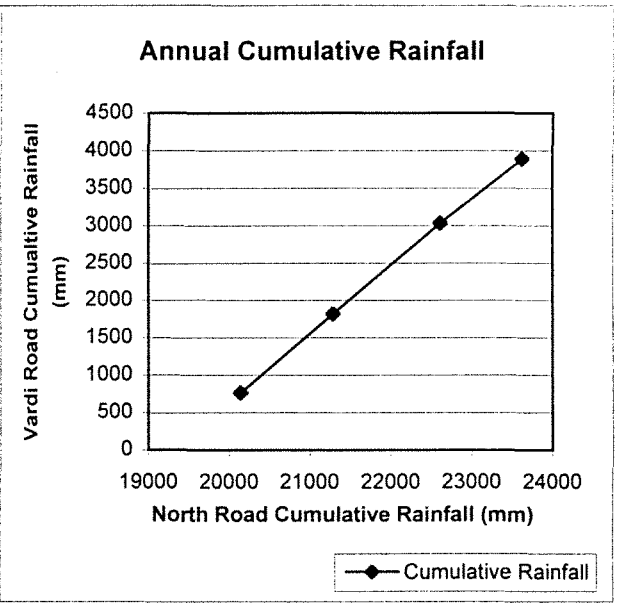
	North Road Catchment			Vardi Road Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)
1982	-		-	-	7.720	-
1983	-		-	-	17.799	-
1984	-	7.667	-	-	14.378	-
1985	-	4.973	-	-	8.617	-
1986	-	3.966	-	-	9.006	-
1987	-	2.827	-	-	8.033	-
1988	-	10.636	-	-	20.034	-
1989	-	5.916	-	-	10.184	-
1990	-	5.865	-	-	13.247	-
1991	-	13.285	-	-	18.543	-
1992	-	13.107	-	-	8.759	-
1993	-	8.157	-	-	9.084	-
1994	-	5.657	-	-	8.687	-
1995	-	7.027	-	-	11.744	-
1996	-	11.821	-	-	18.153	-
1997	-	4.674	-	-	9.354	-

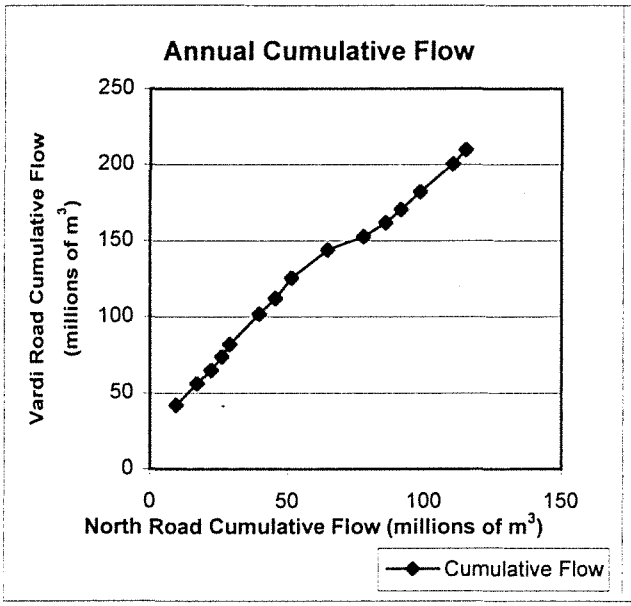
Comparison: North Road Catchment v Vardi Road Catchment

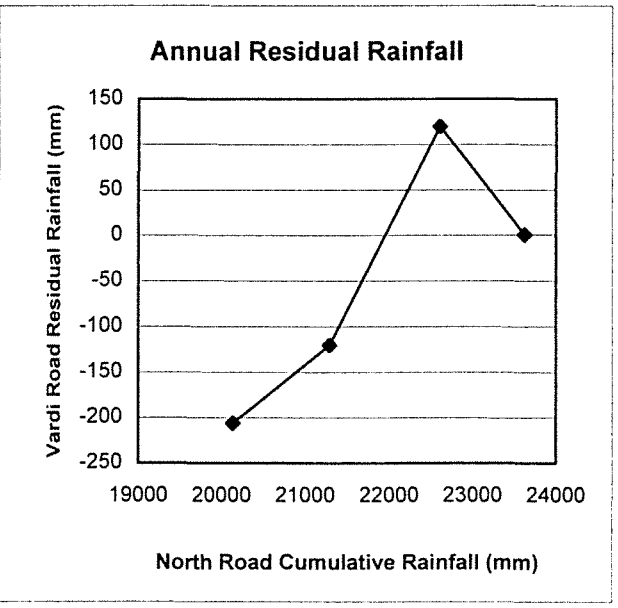




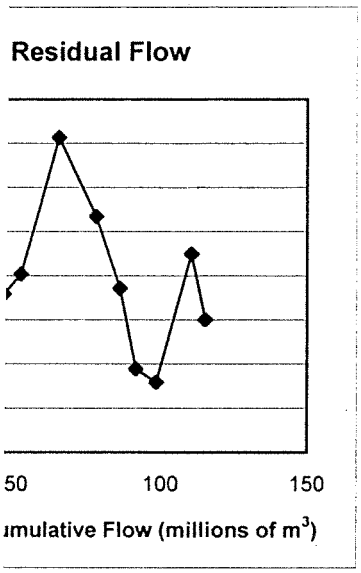




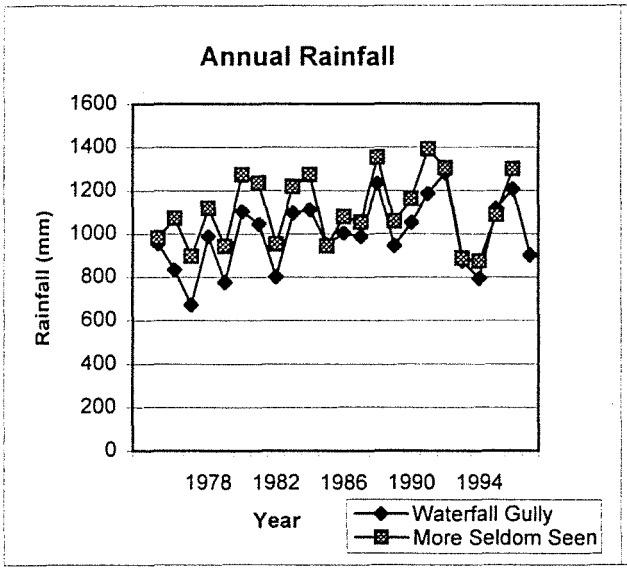


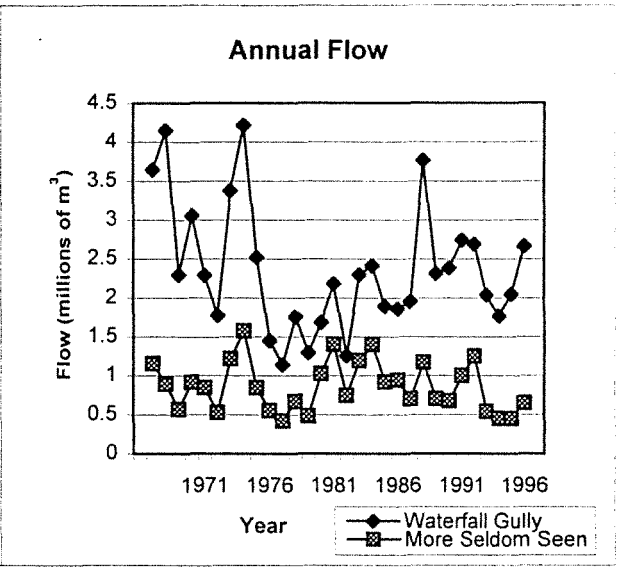


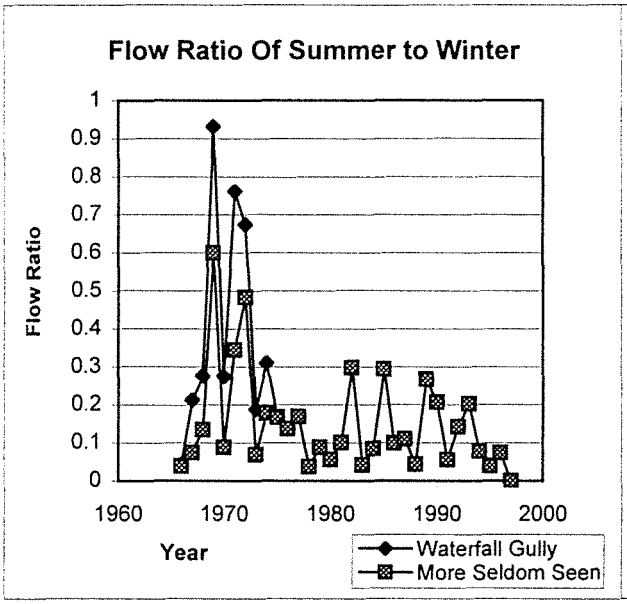
ɾoad Catchment v Vardi Road Catchment

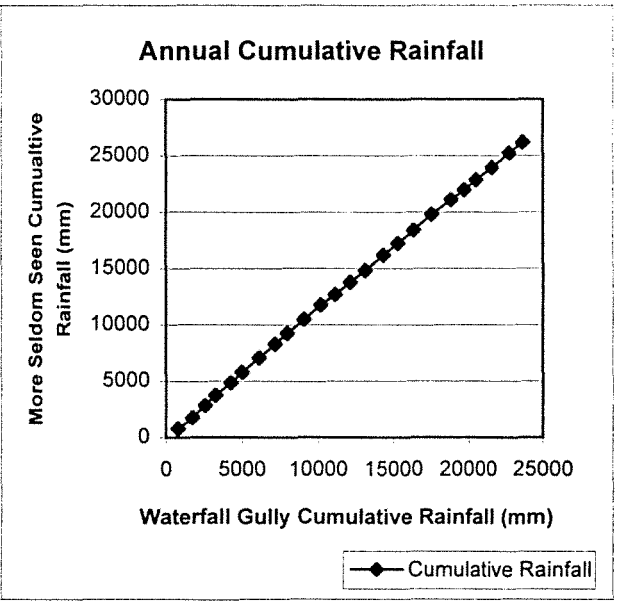


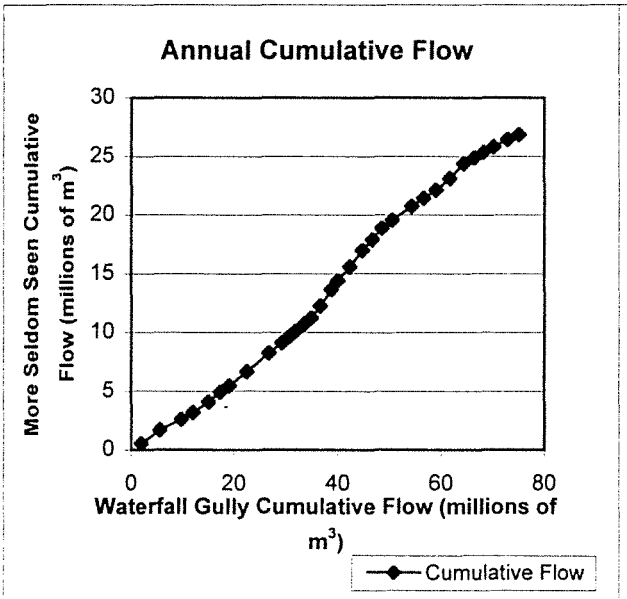
Comparison: Waterfall Gully Catchment v More Seldom Seen Catchment

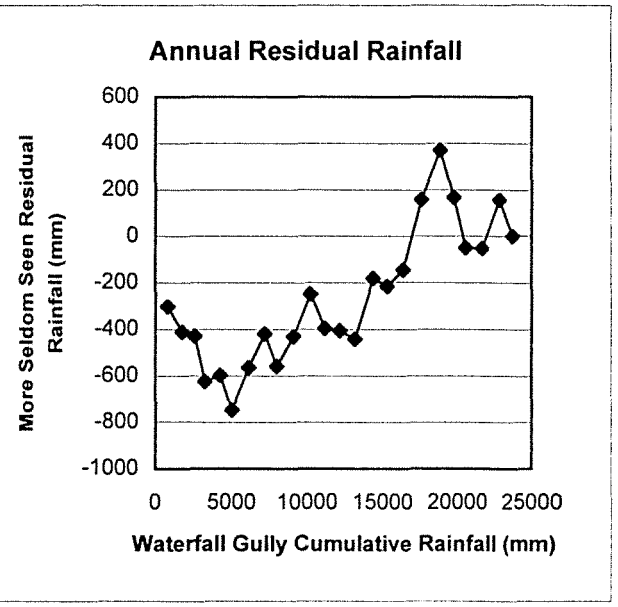




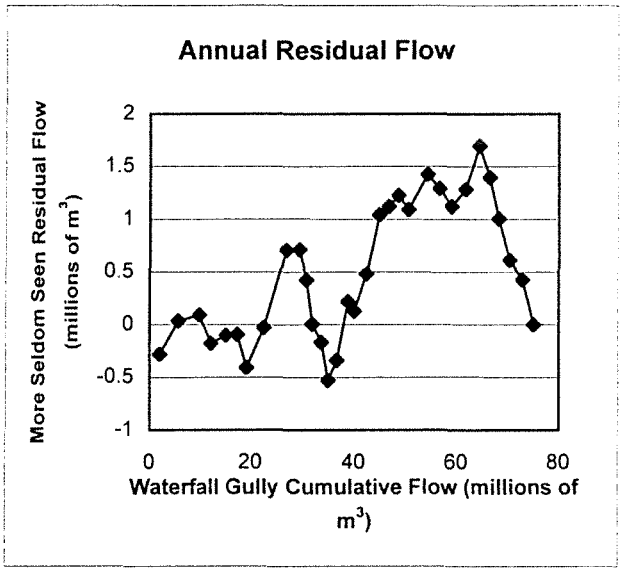






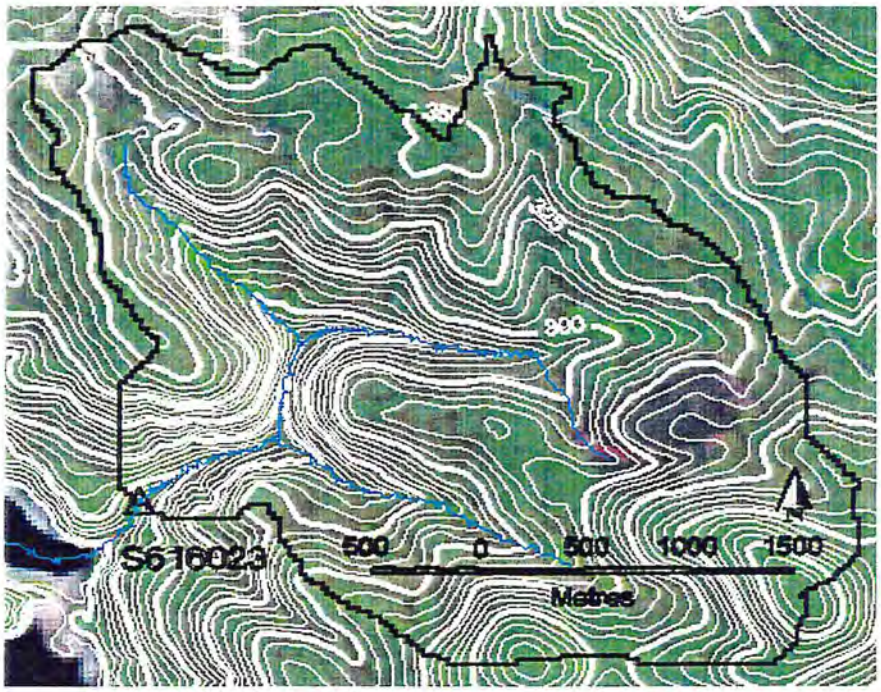


Comparison: Waterfall Gully Catchment v More Seldom Seen Catchment

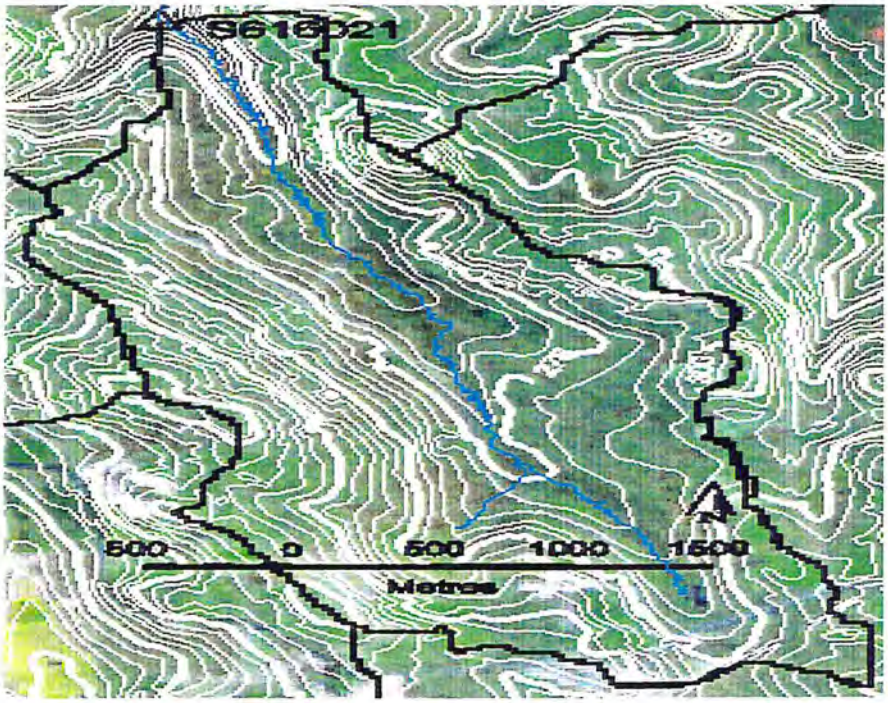


Comparison: Waterfall Gully Catchment v Seldom Seen Catchment

Waterfall Gully Catchment



Seldom Seen Catchment

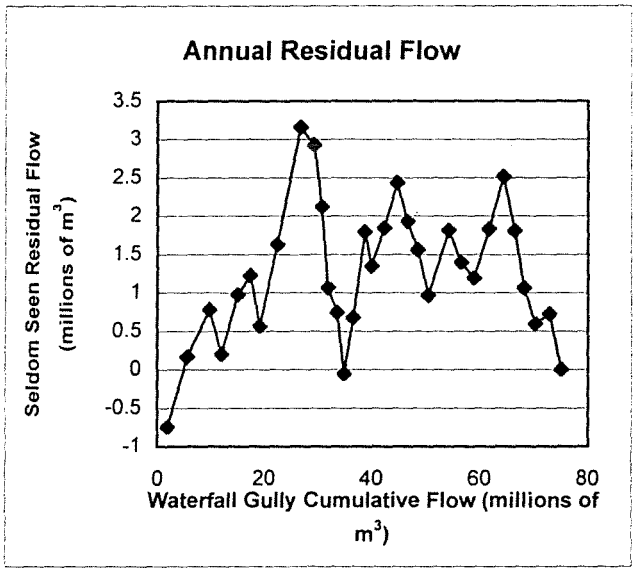


Comparison: Waterfall Gully Catchment v Seldom Seen Catchment

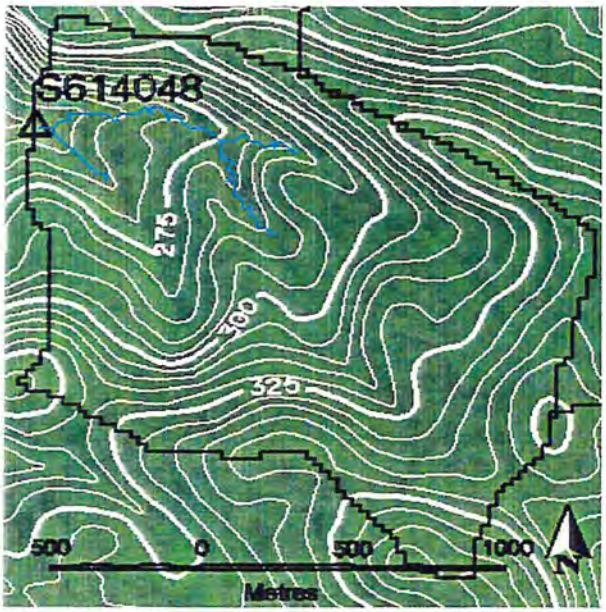
	Waterfall Gully Catchment	Seldom Seen Catchment
Gauging Station Number	S616023	S616021
Rainfall Gauge Number	M509271	M509269
General Information about Catchments		
Catchment area	8.74 km^2	7.53 km^2
Treatment Data	Control Catchment	Bauxite mining
Annual Basic Statistics		
Average rainfall (mm)	996.5	998.1
Average flow (millions of m^3)	2.346	1.962
Average salinity (mg/L)	-	-

	Waterfall Gully Catchment			Seldom Seen Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)
1967	-	3.646	-	-	2.851	-
1968	-	4.151	-	-	2.554	-
1969	-	2.295	-	-	1.355	-
1970	-	3.059	-	-	2.712	-
1971	-	2.291	-	-	2.191	-
1972	-	1.776	-	-	1.272	-
1973	-	3.377	-	-	3.001	-
1974	-	4.217	-	780.1	3.471	-
1975	954.5	2.523	-	952.2	1.707	-
1976	834.3	1.449	-	891.0	1.129	-
1977	673.2	1.141	-	812.4	0.884	-
1978	987.6	1.753	-	1094.9	1.615	-
1979	775.8	1.295	-	886.7	1.139	-
1980	1104.6	1.683	-	1304.6	2.670	-
1981	1045.7	2.184	-	987.0	3.056	-
1982	801.1	1.257	-	915.5	1.491	-
1983	1096.6	2.299	-	1283.5	2.433	-
1984	1112.5	2.413	-	1347.7	2.529	-
1985	949.7	1.897	-	921.3	1.432	-
1986	1004.4	1.861	-	110.8	1.568	-
1987	987.6	1.959	-	566.1	1.343	-
1988	1233.5	3.767	-	1286.8	2.786	-
1989	944.6	2.315	-	1021.9	1.515	-
1990	1052.7	2.384	-	1136.6	1.739	-
1991	1185.8	2.746	-	1289.3	2.577	-
1992	1282.8	2.690	-	1102.3	2.619	-
1993	874.1	2.038	-	824.5	1.229	-
1994	793.6	1.766	-	879.3	1.192	-
1995	1116.5	2.048	-	1096.8	1.469	-
1996	1206.7	2.667	-	1286.0	2.068	-
1997	901.8	2.180	-	962.0	1.213	-

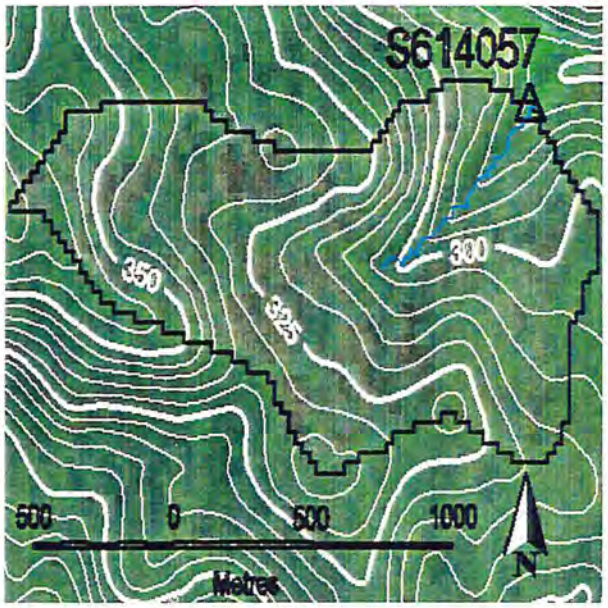
Comparison: Waterfall Gully Catchment v Seldom Seen Catchment



Yarragil 4X Catchment



Yarragil 4L Catchment



Comparison: Yarragil 4X Catchment v Yarragil 4L Catchment

	Yarragil 4X Catchment	Yarragil 4L Catchment
Gauging Station Number	S614048	S614057
Rainfall Gauge Number	M509236	M509225
General Information about Catchments		
Catchment area	2.73 km^2	1.28 km^2
Treatment Data	Logging in 1940's	Logging in 1983

Annual Basic Statistics

Average rainfall (mm)	909.4	969.3
Average flow (millions of m^3)	0.039	0.095
Average salinity (mg/L)	82.27	-

	Yarragil 4X Catchment			Yarragil 4L Catchment		
Year	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)	Annual Rainfall (mm)	Annual Flow (millions of m^3)	Flow Weighted TSS (mg/L)
1981	-	-	-	-	-	-
1982	-	-	-	748.4	-	-
1983	-	-	-	1173.6	-	-
1984	903.0	-	-	1032.9	-	-
1985	914.0	0.045	-	769.7	-	-
1986	735.0	0.006	-	775.8	-	-
1987	725.0	0.011	-	777.8	-	-
1988	1169.0	0.107	-	1261.7	0.099	-
1989	876.0	0.010	-	934.1	0.021	-
1990	954.0	0.028	0.00	975.3	0.090	-
1991	1063.0	0.066	145.19	1140.2	0.141	-
1992	1067.0	0.088	132.26	1130.5	0.182	-
1993	821.0	0.010	374.00	863.2	0.124	-
1994	715.0	0.012	248.47	768.2	0.071	-
1995	971.0	0.033	160.81	1008.3	0.057	-
1996	1094.0	0.079	119.65	1179.1	0.112	-
1997	724.0	0.007	180.73	-	0.053	-

References

Jim Davis & Associates Pty. Ltd. 1995 *Review of the impacts of land use management on the hydrology of the Seldom Seen and More Seldom Seen catchments Western Australia.* Ref no. J224, ACN 067295569, Subiaco.

Mauger, G. W. 1996b *Modelling Dryland Salinity with the M.A.G.I.C. System,* Water and Rivers Commission, Water Resources Technical Series No WRT 7.

Mauger, G. W., Day, J. E. & Croton, J. T. (eds) 1998, *Hydrological and associated research related to bauxite mining in the Darling Range of Western Australia – 1997 review,* Water and Rivers Commission, Water Resource Technical Series No WRT 26.

Water and Rivers Commission Regional Services Division 1996, *Catalogue of water resources information 1996, Volume 1: the South West Drainage Division.* ISBN 0 7309 7240 2, Perth.