DEPARTMENT *of*
PRIMARY INDUSTRIES,
WATER *and* ENVIRONMENT

Tasmania

Hydrological Analysis of the Jordan River Catchment

A report forming part of the requirements for State of Rivers reporting

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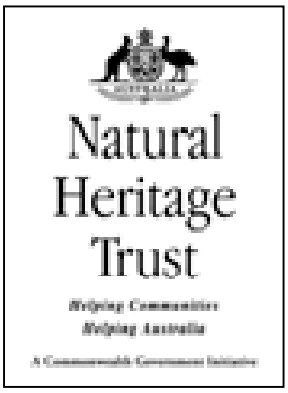

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The Department of Primary Industries, Water and Environment

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The Water Resources Division provides a focus for water management and water development in Tasmania through a diverse range of functions including the design of policy and regulatory frameworks to ensure sustainable use of the surface water and groundwater resources; monitoring, assessment and reporting on the condition of the State's freshwater resources; facilitation of infrastructure development projects to ensure the efficient and sustainable supply of water; and implementation of the *Water Management Act 1999*, related legislation and the State Water Development Plan.

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Hydrological Analysis of the Jordan Catchment

1. Historical Background

1.1 Catchments and Drainage Systems

The Jordan River catchment is located in the southeast of Tasmania and occupies an area of approximately 1246 km^2 (Figure 1.1). The catchment is bordered by the catchments of the Coal River in the east, the Clyde River in the west, the Macquarie River in the north and the Derwent River in the south.

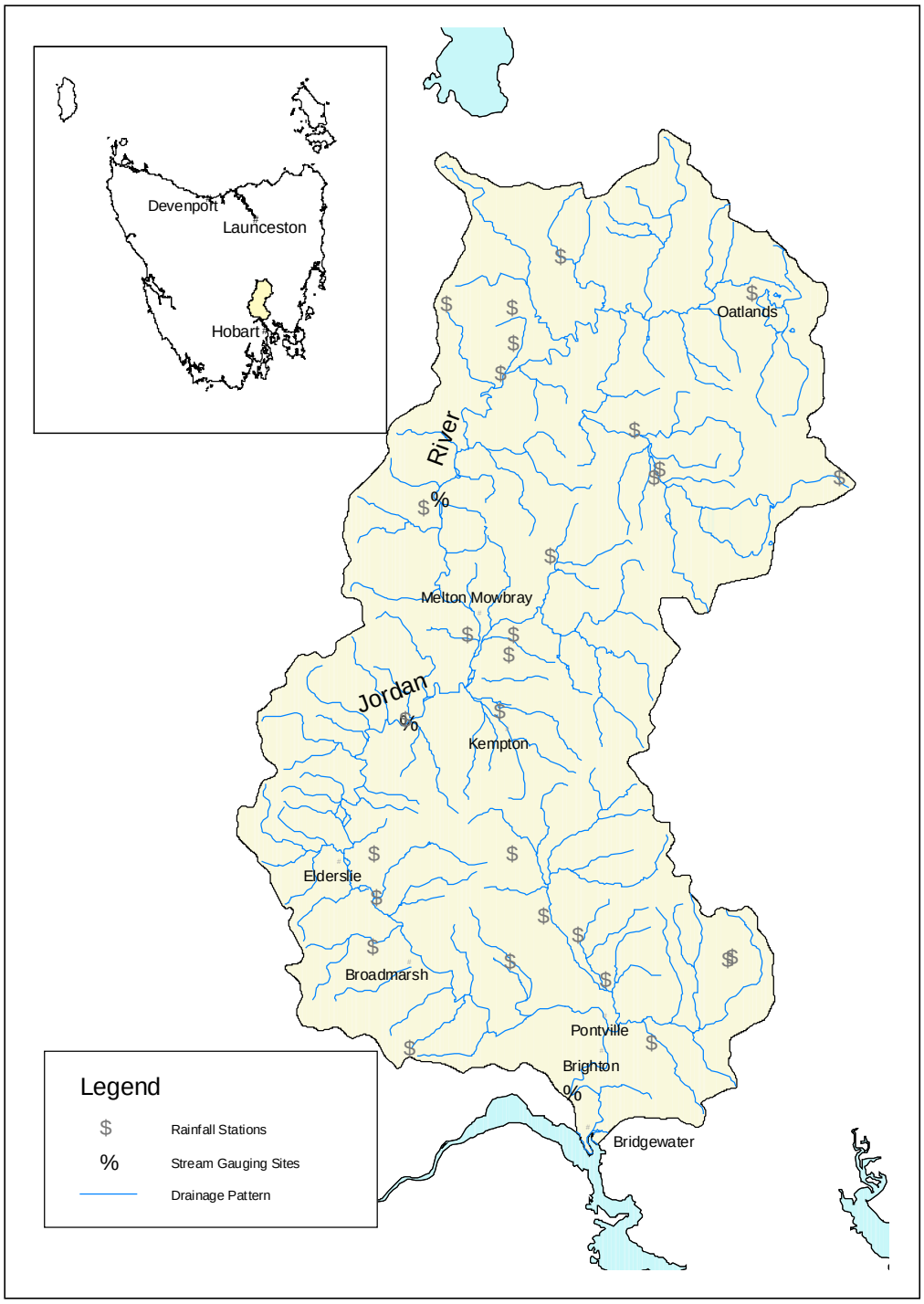

Figure 1.1 Map of the Jordan River catchment.

The Jordan River commences at Lake Tiberias approximately 15 km south of Oatlands in the southern midlands. It winds its way through some of the driest country in Tasmania, accepting flow from two significant tributaries, Exe Rivulet and Bagdad Rivulet, before draining into the Derwent River at Bridgewater. The Jordan River is ephemeral and is usually dry during the summer months. Flow during the winter is dependent on rainfall from easterly winds that are generated by low-pressure systems in the Tasman Sea bringing in moist air from the east.

1.2 Rainfall

The Jordan catchment is one of the driest catchments in the state. The average annual rainfall across the catchment is approximately 500 – 600 mm, and there is very little spatial variation across the catchment. Oatlands in the upper catchment (430m AHD) receives similar rainfall to Bagdad (130m AHD) which is located in the lower catchment. Average monthly rainfall distribution is relatively uniform, with totals ranging between 32 mm and 58 mm as shown for Oatlands, Mauriceton and Bagdad (Figure 1.2). There is no significant difference observed in the winter and summer rainfall in the catchment.

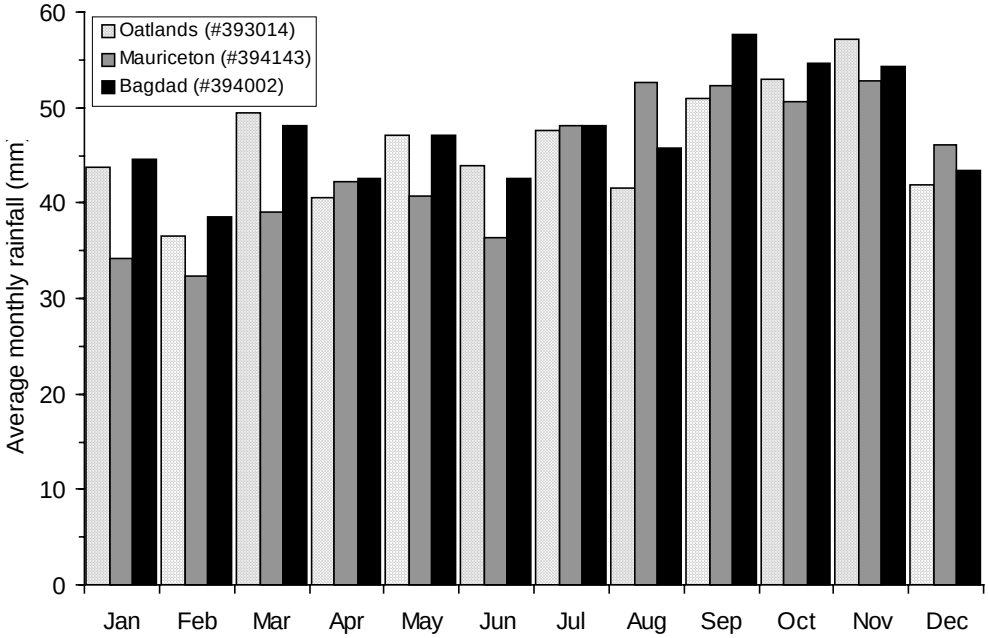

Figure 1. 2 Average monthly rainfall at selected sites in the Jordan River catchment.

Due to its location in the rain shadow of the mountainous areas in the state's west, the Jordan catchment is sheltered from the westerly weather that is largely responsible for the rain that falls in most parts of Tasmania.

1.3 Water Usage and Diversions

Land use activities in the catchment include pastural grazing, irrigated cropland, forestry, and some industrial and rural residential developments. Water usage in the catchment is primarily for irrigation purposes. Direct offtake and farm storage dams have traditionally provided the major irrigation and stock water supply over dry summers in the Jordan River catchment. The bulk of the water allocation is for irrigation purposes during the summer months. A summary of the licensed water allocations in the Jordan River catchment is presented in Table 1.1.

Table 1.1 A Summary of licensed water allocations in the Jordan River catchment.

Source	Intended Use	License Volume (ML)
Jordan River & tributaries	Irrigation	7061
	Stock & Domestic	469
	Total	7530

Data source: Water Information Management System, http://wims.dpiwe.tas.gov.au .

2. Hydrological Monitoring in the Catchment

2.1 Rainfall Monitoring

As part of the statewide rainfall-monitoring network, the Bureau of Meteorology currently has 14 operating stations in the Jordan catchment. Historical records are also available for a number of stations that are no longer operational. The Bureau of Meteorology data can be accessed from the Internet site http://www.bom.gov.au or from the regional Bureau of Meteorology office at Hobart.

Table 2.1 Bureau of Meteorology rainfall stations in the Jordan River catchment

Station	Station Name	AHD (m)	Start Record	End Record
93001	Oatlands	427	07/31/1910	06/30/1977
93002	Jericho	400	04/30/1934	Current
93012	Mt Seymour	527	12/31/1906	12/31/1970
93013	Jericho	390	08/31/1947	Current
93014	Oatlands Post Office	406	12/31/1906	Current
93024	Lower Marshes	280	09/30/1961	08/16/1980
93028	Jericho		12/31/1907	12/31/1932
93040	Rotherwood	480	04/30/1972	Current
93047	Lower Marshes	335	01/31/1990	08/23/1997
93057	Lower Marshes		05/31/1998	01/05/2000
94001	Apsley	265	12/31/1914	Current
94002	Bagdad	130	07/31/1922	Current
94006	Brighton		11/30/1936	02/26/1977
94042	Mangalore	110	31/12/1898	02/28/1900
94046	Melton Mowbray	183	06/30/1936	12/27/1976
94081	Mangalore	100	12/31/1954	Current
94106	Melton Mowbray		01/01/1930	12/28/1945
94140	Melton Mowbray	275	03/31/1904	Current
94143	Mauricton	186	04/30/1945	Current
94144	Pontville	53	05/31/1972	09/30/1976
94172	Teatree	315	04/30/1986	Current
94201	Melton Mowbray	215	10/31/1996	Current
94204	Teatree	330	04/02/1998	Current
94214	Mount Romedary	462	09/30/1999	Current
95055	Eldersle South	100	02/29/1968	Current

AHD: Australian Height Datum in metres.

2.2 River Flow Monitoring

Table 2.2 lists the past and current flow monitoring sites in the Jordan River catchment. There is currently only one stream gauging site operational in the catchment. Flow data from other gauging sites are discontinuous or are daily measurements for short periods.

Table 2.2 Stream Flow Monitoring Sites in the Jordan River Catchment

Site	Site Name	Area (km^2)	Start Record	End Record
15	Jordan at Apsley	481	12/12/1920	30/09/1930
4210	Jordan at Bridgewater		10/06/1983	02/07/1992
4201	Jordan at Mauriceton	742	29/11/1965	Current

3. Catchment Yields and Distribution of Flows

3.1 Catchment Yields

The historical annual discharge volumes at Jordan River at Mauriceton (site 4201) are shown in Figure 3.1. Blank sections in the figure indicate periods for which there was no flow at this site or no data was recorded. The annual discharge from this location on the Jordan River is highly variable and does not show any long-term trend over the period of record. Annual discharge ranges from 800 ML in very dry years to 75,000 ML in wet years, with an annual average of 21,000 ML.

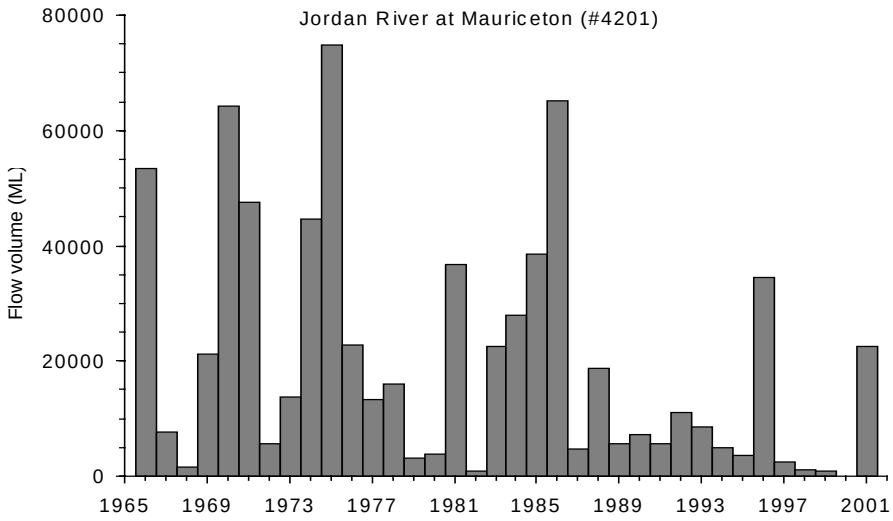

Figure 3.1 Annual flow volumes at Jordan River at Mauriceton.

The seasonal (winter/summer) flow pattern in the Jordan River is also highly variable (Figure 3.2). The winter flow volumes range from 480 to 51,000 ML and are generally much higher than the summer flows, although this is not always the case (as was evident in 1972, 1976, 1994 and 1996). The total summer discharge at the Jordan River at Mauriceton is in the range 15 to 35,000 ML with a average summer discharge volume of 5,400 ML. The average catchment yield for summer and winter are 9000 ML and 24,400 ML respectively.

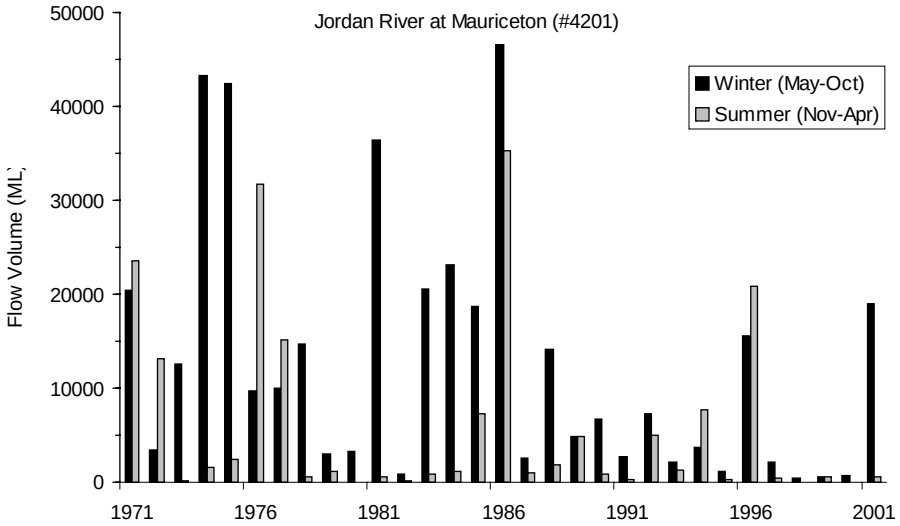

Figure 3.2 Seasonal flow volumes at Jordan River at Mauriceton.

3.2 Monthly Yields

The variability of monthly flows in the Jordan River catchment is shown in Figure 3.3, which provides box and whisker plots of monthly average flow data. Extreme outliers have been excluded in the plot. The horizontal line across the box represents the median flow whereas the bottom and top edges of the box mark the first and third quartiles respectively. The ends of the whiskers show the spread of 95% of the data. The crosses beyond the whiskers indicate high and low outliers.

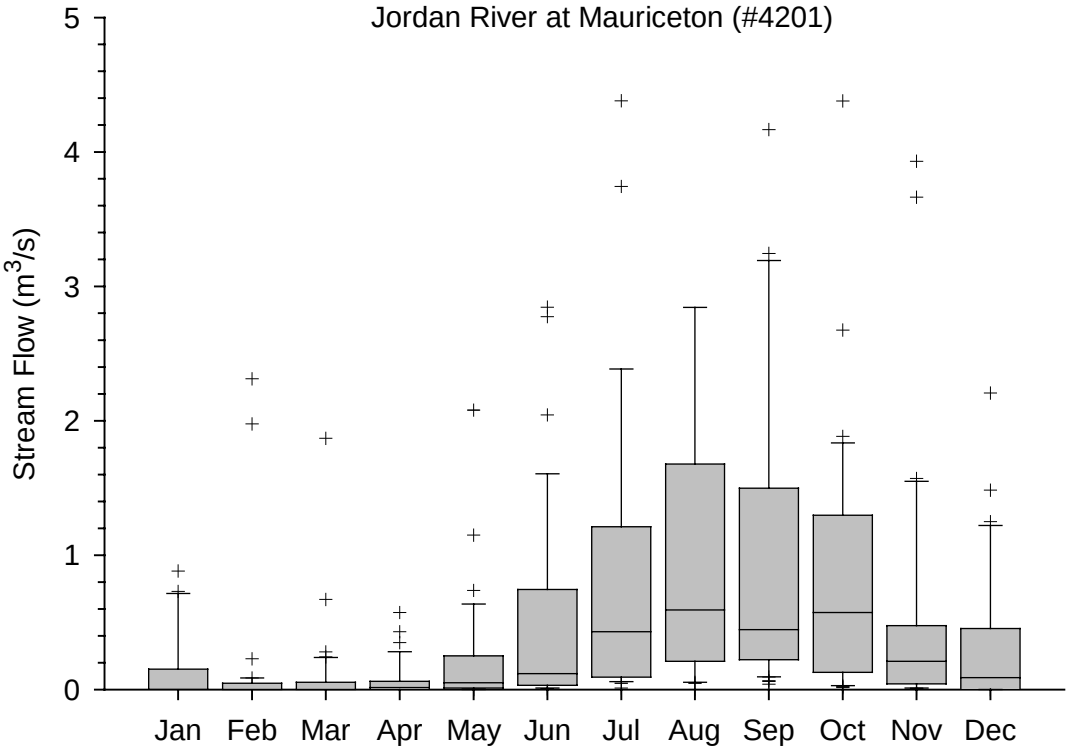

Figure 3.3 Monthly flow analysis from Jordan River at Mauriceton.

Monthly flows from the Jordan River at this site are highly variable, but there is a distinct (though substantially dampened) seasonal variation, with higher flows during the winter periods followed by

low to zero flows during the summer. Monthly median flows from the Jordan River site ranged from zero in summer to around 0.5 m^3/s during winter. As a comparison, the median flow in the Jordan River at the Bridgewater site (4210) ranged from zero flows during the summer months to high of 2.0 m^3/s during mid-winter.

4. Comparison between Study Period and Historical Data

Figure 4.1 shows a comparison between the monthly average discharge volumes experienced in the Jordan River at Mauriceton (4201) site during the study period (1999-2001) with the historical flow data record. The bar chart shows that the monthly flows during most of the study period were generally lower than the historical flow record. The monthly flows during the study period ranged from zero to 1.0 m^3/s with an average of 0.3 m^3/s. The overall monthly average flows during the study periods were approximately 56% lower than the historical average flows.

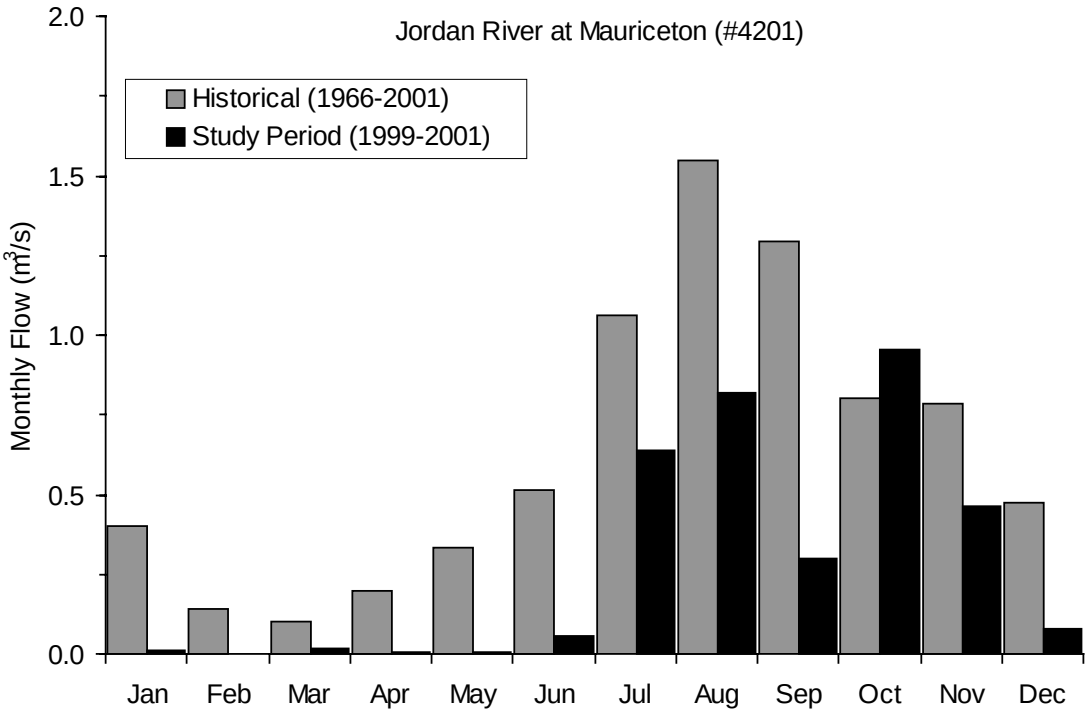

Figure 4.1 Comparison of monthly flows from Jordan River at Mauriceton.

5. Recessions and Low Flows

Segments of peak flow hydrographs covering the study period were analysed to describe the recession flows for the Jordan River at Mauriceton (4201). The recession curves are segments of hydrographs, which show how the water storage in the river decreases over time following peak river flows. Using several recession segments for the analysis, a 'recession curve' can be generated which represents the basic pattern of decrease of flow in the river. The recession curve also reflects the groundwater discharge to the river and how groundwater storage influences and sustains flows in rivers.

The winter and summer recession curves for the Jordan River at Mauriceton are presented in Figure 5.1. The upper part of the recession curves is comprised mostly of surface water flow. With time, the surface flow contribution gradually decreases until the flow within the river is sustained almost entirely of groundwater flow (or base flow) which is depicted on the lower section of the curves.

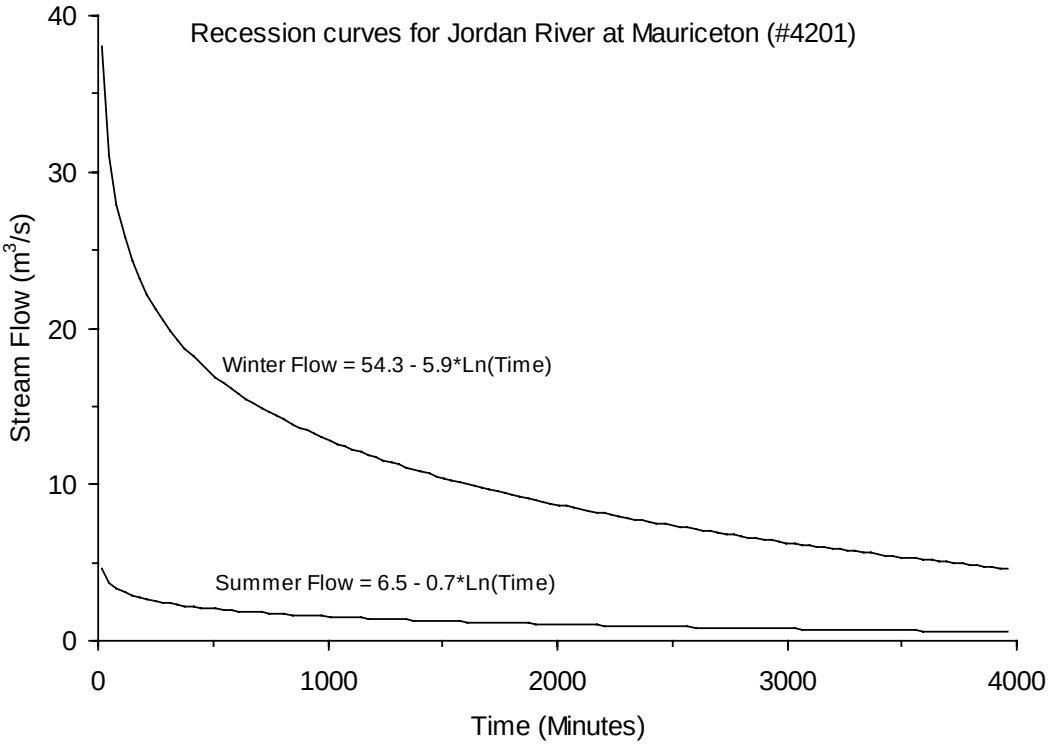

Figure 5.1 Recession curves for Jordan River at Mauriceton.

The flow recession at Jordan River at Mauriceton roughly follows a lognormal fitted curves described by the following equations:

*Winter Flow = 54.3 - 5.9*Ln(Time in minutes),* $R^2 = 0.89$

*Summer Flow = 6.5 - 0.7*Ln(Time in minutes),* $R^2 = 0.95$

The curves demonstrate that it takes approximately 4000 minutes (3 days) for the flow to recede from 37 m^3/s to 5 m^3/s during winter. During the summer the recession period was considerably shorter (1 day) for flows to recede from approximately 5 m^3/s to base flow of around 2 m^3/s.

Low flow frequency curves were derived for 10, 30, 60 and 90 days durations (Figures 5.1). The curves are intended to indicate probability of minimum flow occurrence over various time periods. For example, the probability that a minimum average daily flow of 0.1 m^3/s will occur over 60 days in any given year is approximately 89%, while over a longer period such as 90 days this probability decreases to around 77%.

The information from these low flow probability curves has implications for the establishment of environmental flow allocations for the Jordan River catchment and for the assessment of risk in supply of water from the rivers for purposes such as irrigation and domestic use.

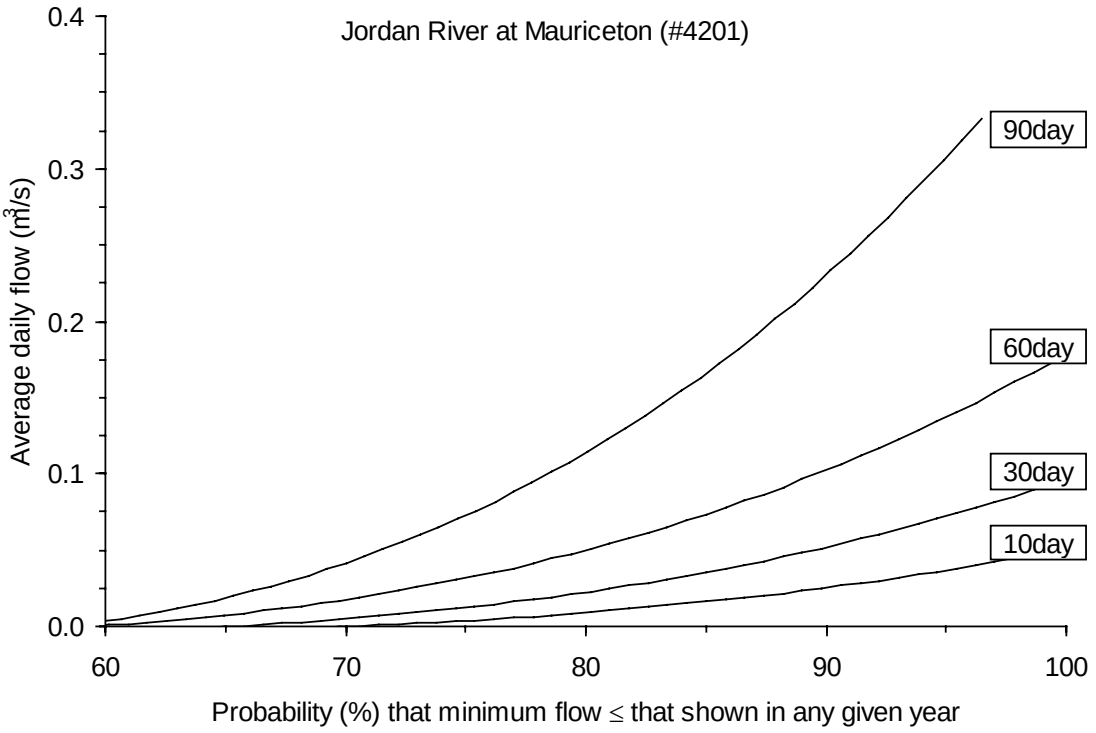

Figure 5.2 Low flow frequency curves for Jordan River at Mauriceton.

6. Floods

Flood frequency analysis for the Jordan River at Mauriceton (4201) was carried out to indicate the likelihood of floods in this part of the catchment. The result of this analysis is presented in Figure 6.1. An example of how to read this graph is that the magnitude of 1 in 10 year flood event in the catchment is approximately 65 m^3/s. The historical annual peak floods ranged from 2 m^3/s to 111 m^3/s over 36 years of record period (1966-2001). During the study period, the highest discharge was 31 m^3/s (1.6 m river level) which occurred on 13 October, 2001. Discharge of this magnitude is equivalent to less than a 1 in 5 years flood event for this part of the catchment.

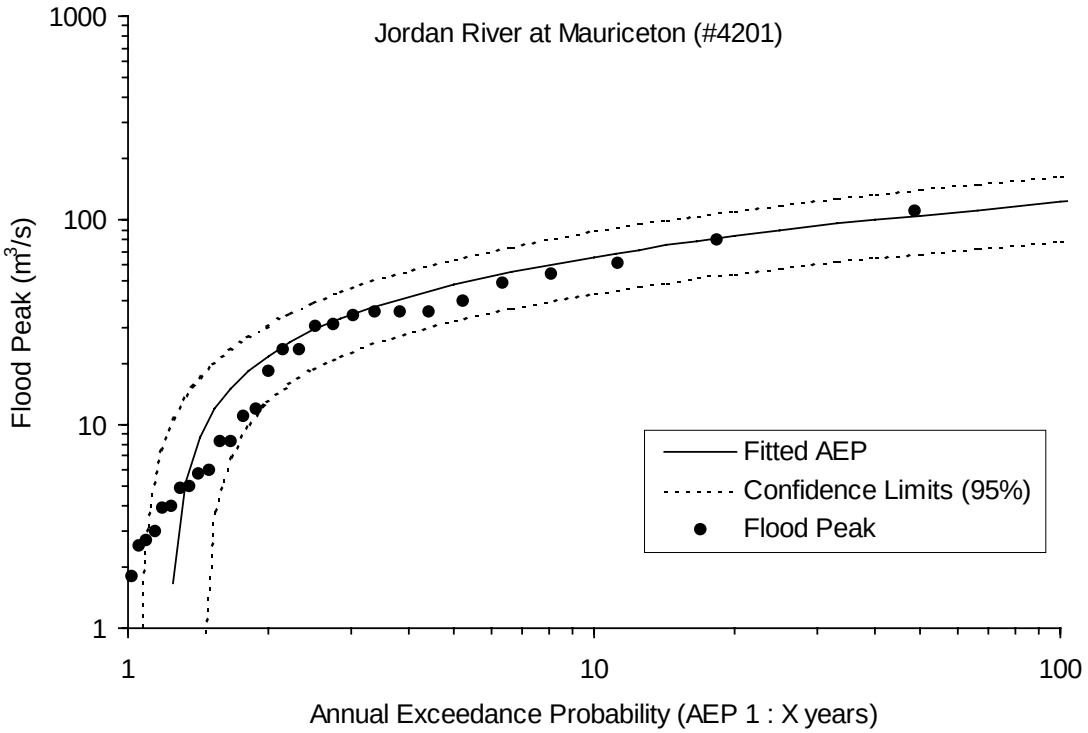

Figure 6.1 Flood frequency curves for Jordan River gauging site.

7. References

WIMS: Water Information Management System, http://wims.dpiwe.tas.gov.au

BOM, 2001. Bureau of Meteorology rainfall data, http://www.bom.gov.au

HYDROL: DPIWE Water Quantity and Quality Database.