

Kelantan River

Map of River

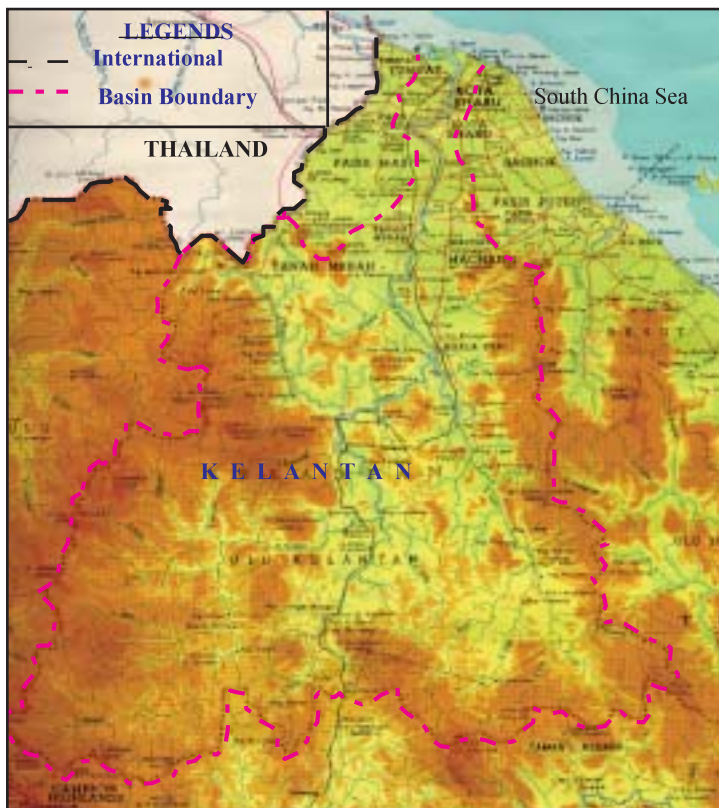


Table of Basic Data

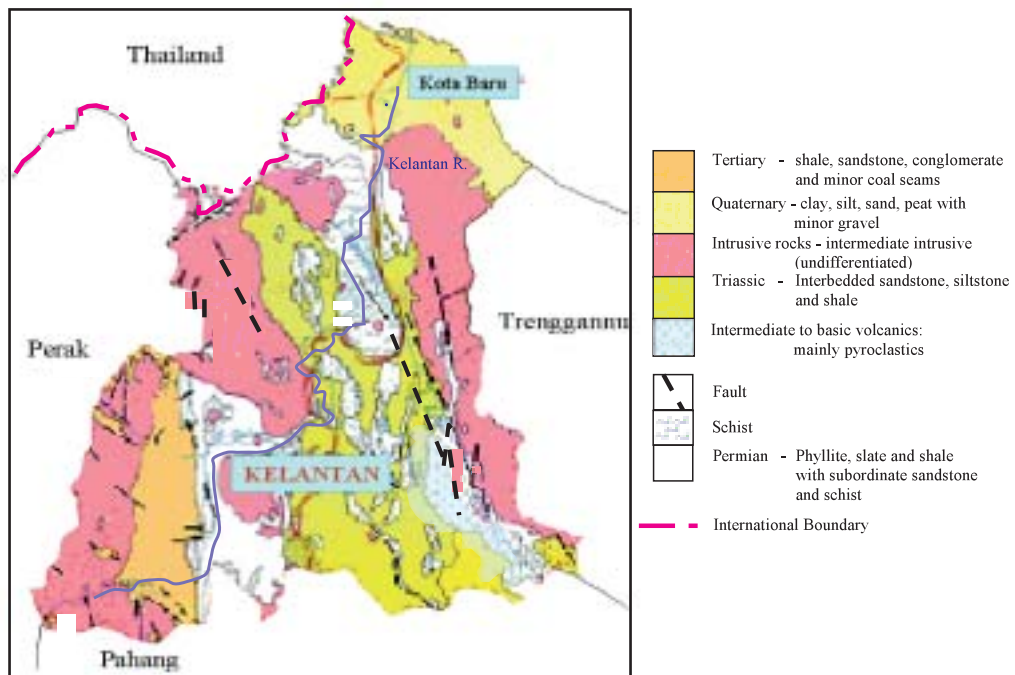
Name: Kelantan River		Serial No. : Malaysia-3
Location: Guillemard Bridge	N 4° 40' ~ 6° 12'	E 101° 20' ~ 102° 20'
Area: 11,900 km ²	Length of main stream: 248 km	
Origin: Mt.Ulu Sepat (2,161 m)	Highest point: Mt. Korbu (2,183 m)	
Outlet: South China Sea	Lowest point: River mouth (0 m)	
Main geological features: shale, mudstone, limestone		
Main tributaries: Lebir river (2,430 km ²), Galas river (7,770 km ²)		
Main reservoirs: Nil		
Mean annual precipitation: 2,505 mm (1970 - 1997)		
Mean annual runoff: 557.5 m ³ /s at Guillemard Bridge (1950 - 1990)		
Population: 810,000	Main cities: Kota Bharu	
Land use: virgin jungle, rubber, paddy, oil palm, tobacco, other agriculture, urban		

1. General Description

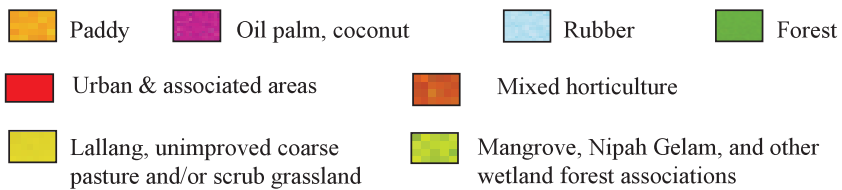
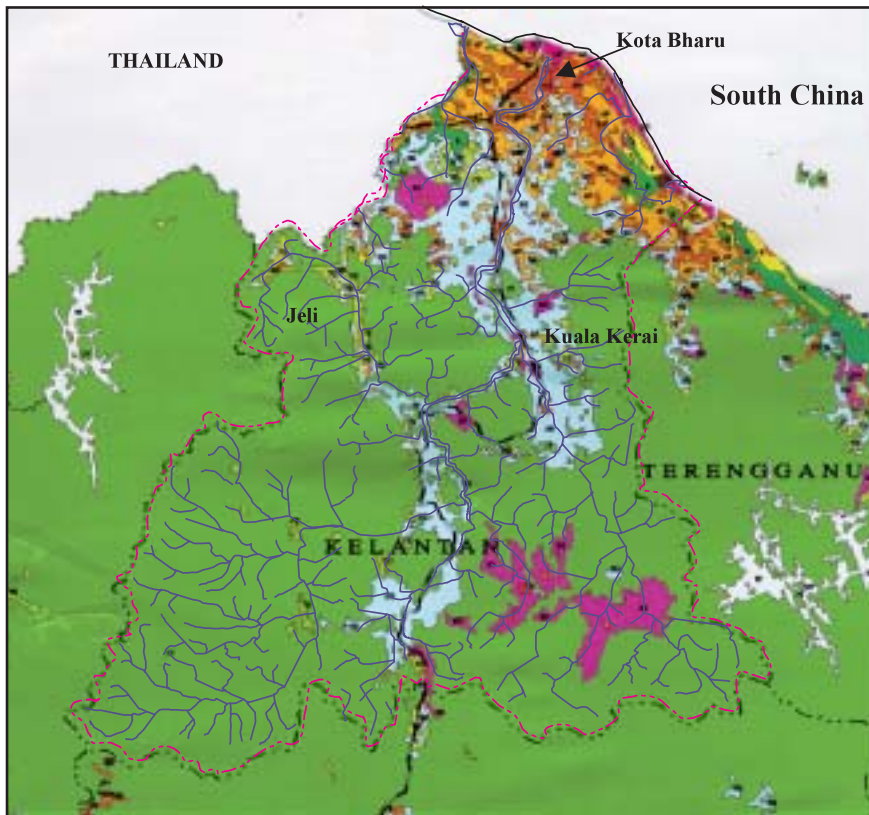
The Kelantan River basin is located in the north eastern part of Peninsular Malaysia between latitudes 4° 40' and 6° 12' North, and longitudes 101° 20' and 102° 20' East. The maximum length and breadth of the catchment are 150 km and 140 km respectively. The river is about 248 km long and drains an area of 13,100 km², occupying more than 85% of the State of Kelantan. It divides into the Galas and Lebir Rivers near Kuala Krai, about 100 km from the river mouth. The Galas River is formed by the junction of the Nenggiri and Pergau Rivers. The Nenggiri River originates in the south western part of the central mountain range (Main Range). The Lebir River originates from the Tahan mountain range. The Kelantan River system flows northward passing through such major towns as Kuala Krai, Tanah Merah, Pasir Mas and Kota Bharu, before finally discharging into the South China Sea. About 95% of the catchment is steep mountainous country rising to a height of 2,135 m while the remainder is undulating land. The mountainous areas are covered with virgin jungle while rubber and some paddy are planted in the lowlands. The eastern and western portions, consisting of mountain ranges, have a granitic soil cover consisting of a mixture of fine to coarse sand and clay. The soil cover is a metre or so deep but depths of more than 18 m may be encountered in localised areas. A fine sandy loam soil is found in the extreme east and west of the southern half of the basin. Its depth seldom exceeds a few metres. The remaining portion, comprising almost one-third of the catchment, is cloaked by a variable soil cover that varies in depth, from a few metres to more than 9 m. The basin has an annual rainfall of about 2,500 mm much of which occurs during the North-East Monsoon between mid-October and mid-January. The mean annual temperature at Kota Bharu is 27.5° C with mean relative humidity of 81%. The mean flow of the Kelantan River measured at Guillemard Bridge is 557.5 m³/s.

2. Geographical Information

2.1 Geological Map



2.2 Land Use Map



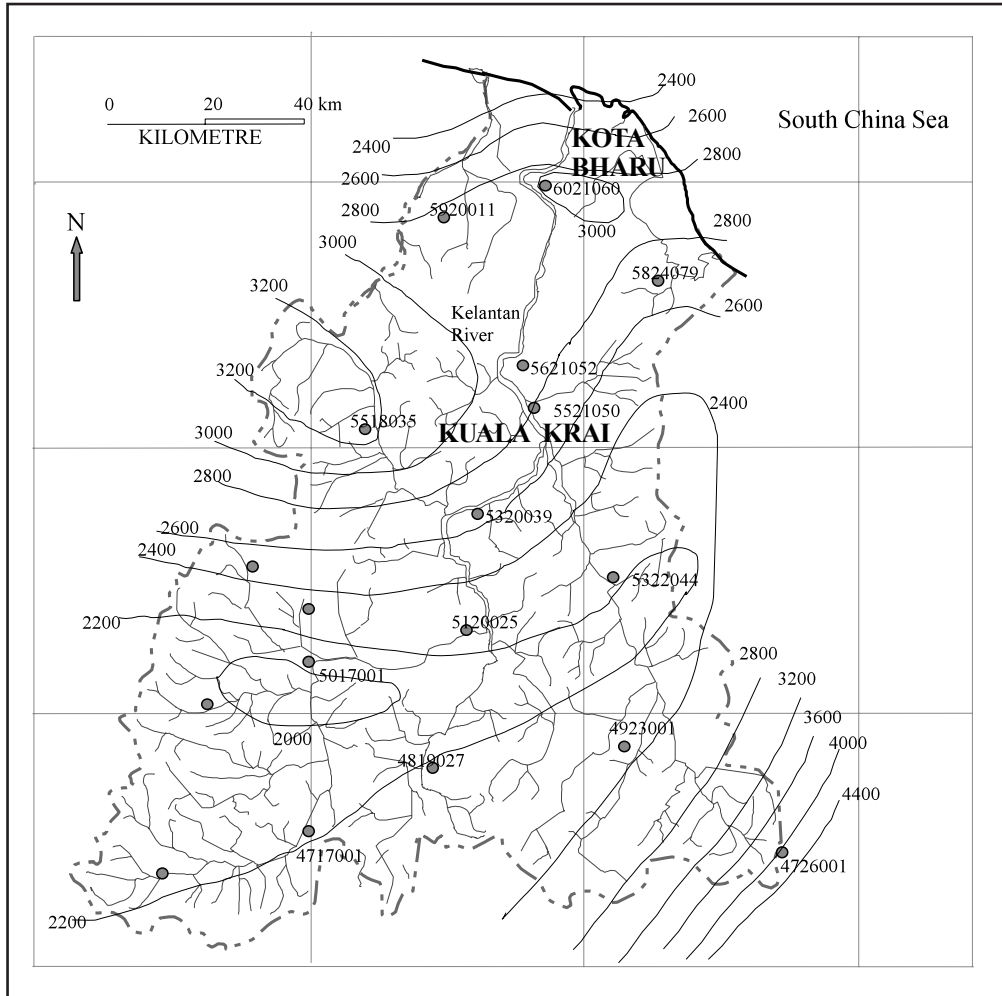
2.3 Characteristics of the River and the Main Tributaries

No.	Name of river	Length [km] Catchment area [km ²]	Highest peak [m] Lowest point [m]	Land use [%] (1990)
1	Kelantan River (Main river)	248 11,900	Mt.Korbu (2,183 m)	F (73.2), U (0.1), L (10), OP (4), R (10), P (2.2), A (0.5)
2	Galas River (Tributary)	178 7,770	Mt Setong (1,422 m)	F (85), OP (2), R (4), L (9).
3	Lebir River (Tributary)	91 2,430	Cintawasa Hill (1,185 m)	F (66), OP (12), R (13), L (9)

A: Other agricultural field (vegetable, grass) F: Forest L: Lake, River, Marsh O: Orchard P: Paddy field
U: Urban R: Rubber OP: Oil Palm.

3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



3.2 List of Meteorological Observation Stations

No. ^{*)}	Station	Elevation [m]	Location	Observation period	Mean annual precipitation ¹⁾ [mm]	Observation items ²⁾
6021060	Peng. Kubor Pumphouse	-	N 06° 01' 05" E 102° 10' 40"	1951 - present	3,086 (1952 - 1997)	(P) SM
5518035	Luboh Bungor	-	N 5° 42' 05" E 101° 50' 20"	1956 - present	3,220 (1957 - 1996)	(P) SM
5322044	Kg. Laloh	541	N 05° 18' 30" E 102° 16' 30"	1971 - present	2,222 (1971 - 1996)	(P) PAT
5320039	Ldg Kuala Garis	1,422	N 05° 22' 40" E 102° 00' 55"	1967 - present	2,022 (1971 - 1996)	(P) SM
4923001	Kg Aring	1,200	N 04° 50' 15" E 102° 21' 10"	1975 - present	2,404 (1975 - 1998)	(P) PAT
4819027	Gua Musang	1,539	N 04° 53' 05" E 101° 58' 10"	1970 - present	2,258 (1972 - 1998)	(P) PAET
4726001	Gunung Gagau	1,376	N 04° 45' 25" E 102° 39' 20"	1982 - present	4,339 (1985 - 1996)	(P) SAT
4717001	Blau	898	N 04° 46' 00" E 101° 45' 25"	1975 - present	2,116.6 (1980 - 1995)	(P) SA

*) Serial number used by Department of Irrigation and Drainage, Malaysia.

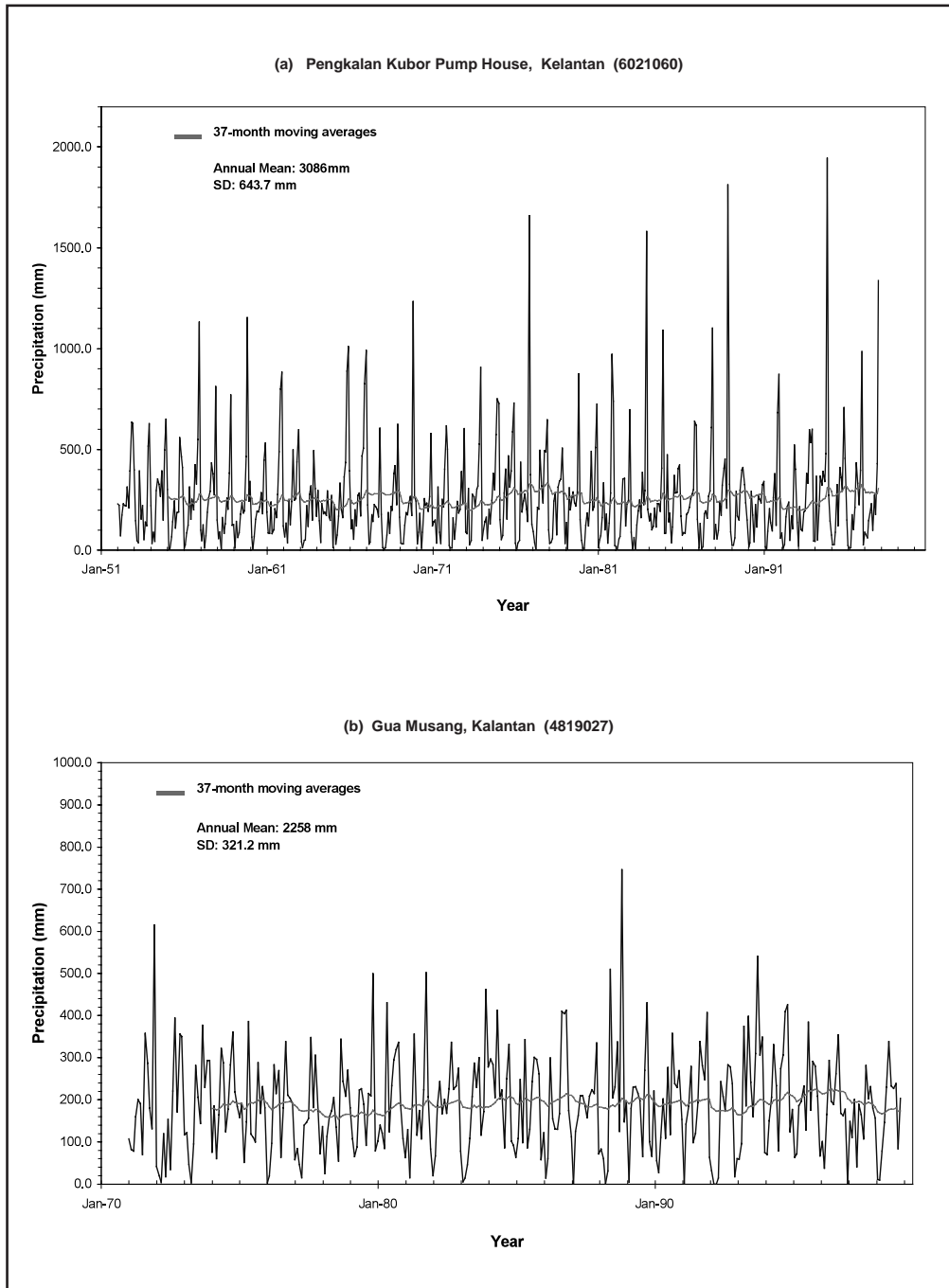
1) Period for the mean is from the beginning of the observation period to 1996.

2) (P): Precipitation, SM: Secondary Manual, PAT: Primary Auto telemetric, PAET: Primary auto, evaporation and telemetric, SA: Secondary Auto, SAT: Secondary auto telemetric

3.3 Monthly Climate Data

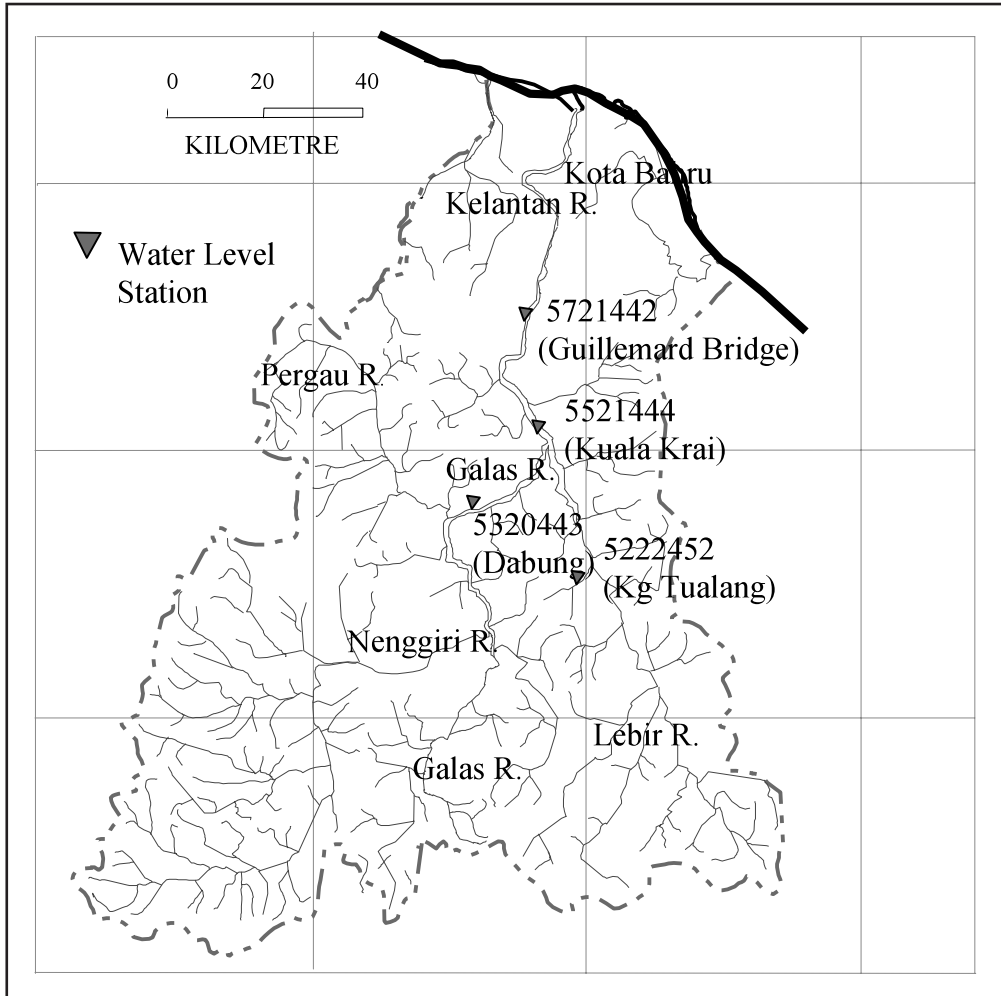
Observation item	Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	Kota Bharu	25.7	26.2	27.9	28.1	27.7	27.2	27	26.8	26.7	26	25.8	26.8	26.8	1968 - 1997
Precipitation [mm]	Peng. Kubor Pumphouse	169	74	87	83	178	187	212	257	280	302	640	618	3,086	1952 - 1997
Evaporation [mm]		96.5	98.5	123.7	129	119.5	113.4	114.3	112.8	112.2	104.6	85.2	86.5	1,296.2	1975 - 1196
Duration of sunshine [hr]		7.1	8.1	8.4	8.8	7.9	7.0	7.0	6.8	6.5	5.9	4.6	4.8	6.9	1968 - 1997

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



4.2 List of Hydrological Observation Stations

No.*	Station	Location	Catchment area (A) [km ²]	Observation period	Observation items ¹⁾ (frequency)
5222452	Kg Tualang	N 05° 16' 30" E 102° 18' 00"	2,430	1973 - present	WL/Q (A), SS (Wk), WQ (Wk)
5320443	Dabong	N 05° 22' 55" E 102° 00' 55"	7,770	1972 - present	WL/Q (A), SS (Wk), WQ (Wk)
5521446	K.Krai	N 05° 32' 05" E 102° 10' 50"	10,950	1979 - present	WL (A)
5721442	Guillemard Bridge	N 05° 45' 45" E 102° 09' 00"	11,900	1959 - present	WL/Q (A), SS (Wk), WQ (Wk)

No.*	\bar{Q} ²⁾ [m ³ /s]	Q_{max} ³⁾ [m ³ /s]	\bar{Q}_{max} ⁴⁾ [m ³ /s]	\bar{Q}_{min} ⁵⁾ [m ³ /s]	\bar{Q}/A [m ³ /s/100km ²]	Q_{max}/A [m ³ /s/100km ²]	Period of ²⁾ statistics
5222452	109.8	4,020	1,636	32.4	4.52	165.4	1950 - 1990
5721442	557.5	12,900	5,387	153	4.68	108.4	1950 - 1990

* Serial number used by Dept. of Irrigation and Drainage Malaysia.

2)Mean annual discharge

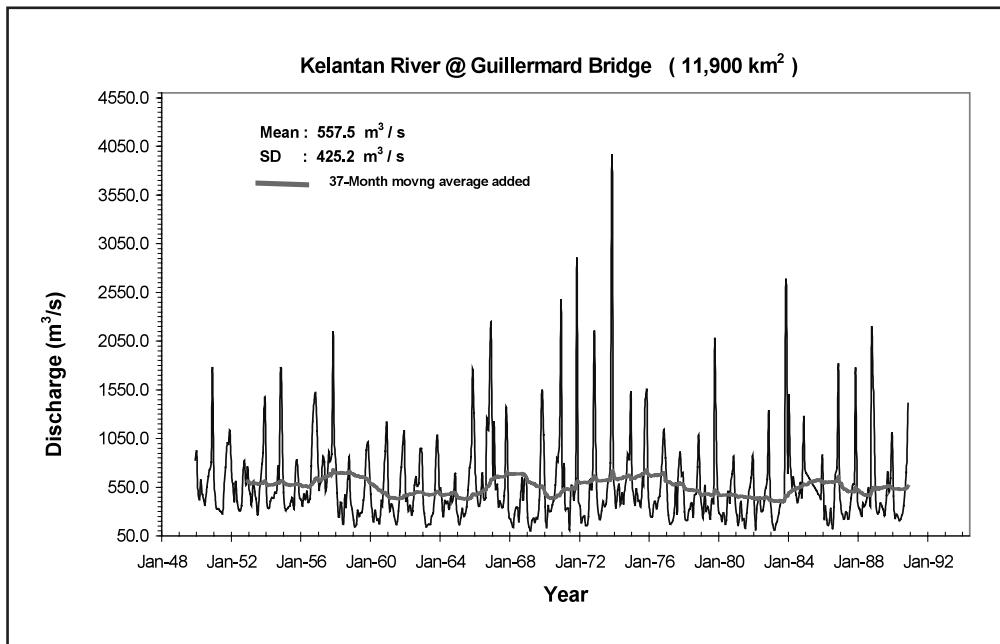
3)Maximum discharge

4)Mean maximum discharge

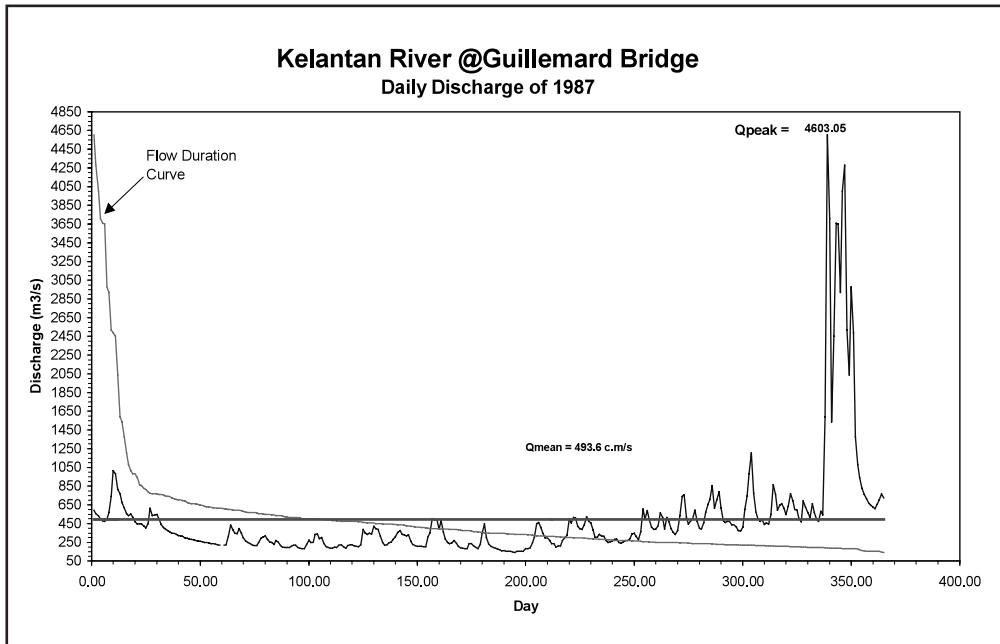
5)Mean minimum discharge

1) WL: Water Level; Q: Discharge; SS: Suspended sediment; WQ: Water quality; (A): Automatic; (Wk): 2- weekly.

4.3 Long-term Variation of Monthly Discharge



4.4 Annual Pattern of Discharge

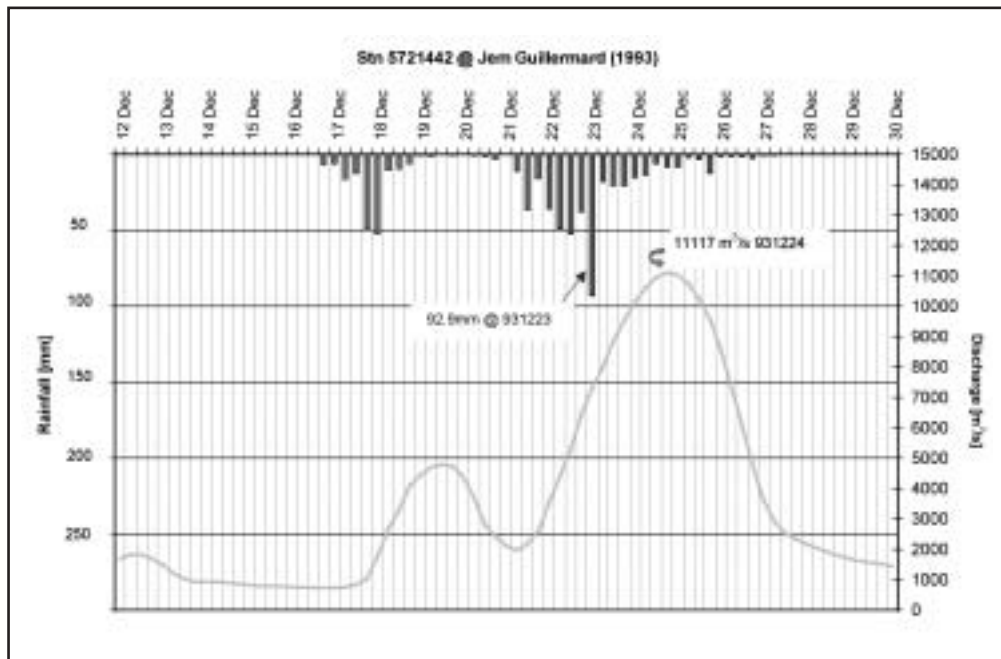


4.6 Annual Maximum and Minimum Discharges

Year	Maximum ¹⁾		Minimum ²⁾		Year	Maximum ¹⁾		Minimum ²⁾	
	Date	[m ³ /s]	Month	[m ³ /s]		Date	[m ³ /s]	Month	[m ³ /s]
1960	10/12	3,322	7	53.4	1979	29/11	10,252	8	170.1
1961	05/01	2,777	8	102.9	1980	20/12	1,709	4	138.3
1962	18/12	2,737	6	183.7	1981	03/12	2,029	8	102.5
1963	9/12	3,088	5	70.4	1982	16/12	7,186	3	90.9
1964	29/12	1,222	4	175.9	1983	07/12	12,007	4	80.4
1965	29/11	6,170	3	102.9	1984	25/12	7,744	8	236.1
1966	24/12	3,154	9	233.2	1985	16/03	2,665	8	167.8
1967	03/01	8,280	8	233.2	1986	02/12	6,957	8	88.0
1968	08/12	1,254	4	113.4	1987	12/12	4,785	7	135.7
1969	29/11	6,650	4	62.5	1988	22/11	12,900	4	214.7
1970	29/12	8,800	6	147.3	1989	03/01	1,275	8	190.6
1971	05/01	8,191	10	229.7	1990	14/12	6,064	7	105.6
1972	18/12	10,260	8	164.6	1991	13/12	3,846	7	122.7
1973	09/12	11,180	4	178.8	1992	13/11	5,409	5	111.8
1974	29/12	4,019	3	245.3	1993	24/12	11,117	5	179.6
1975	29/11	5,676	8	261.4	1994	24/11	5,282	4	214.7
1976	24/12	2,605	4	163.8	1995	29/12	3,075	8	190.6
1977	03/01	2,717	5	142.1	1996	12/12	2,412	7	105.6
1978	08/12	3,277	4	166.2	1997	05/12	2,619	7	122.7

1), 2) Instantaneous observation by recording charts

4.7 Hyetographs and Hydrographs of Major Floods



5. Water Resources

5.1 General Description

Water of the Kelantan River is at present used for four major irrigation schemes, i.e the Kemubu, Salor, Lemal and Pasir Mas, all of which lie in the lower reaches of the Kelantan River. The present irrigable area for these schemes is about 31,000 ha and takes about 72 m³/s at maximum water use if entire double cropping is to be achieved.

The Kelantan River and other surface flows were sought as water sources to solve the quantitative and qualitative restriction on groundwater use and to cope with the rapidly increasing domestic and industrial water demand of the area. The present maximum demand is about 134 ML/d in the lower reaches of the Kelantan River covering the districts of Kota Bharu, Tumpat, Pasir Mas, Machang, Bachok, Pasir Putih and Kuala Krai.

5.4 Major Floods and Droughts

There are no major historical droughts experienced in the Kelantan River basin.

Major Floods

Date	Water level [m]	Meteorological cause	Dead and missing	Major damages [Districts affected]
27.11.90	16.82 m at Guillemard Bridge 5.41 m at Kota Bharu	Heavy rainfall	4 died	4,581 people were evacuated. Road closed for 1-3 days
1991	10.12 m at Rantau Panjang at Golok River.	Heavy rainfall	2 died	Agricultural land inundated with total damages of RM200 thousand. Road and structural damages RM135 thousand.
13.11.92	25.45 m at Tangga Krai	Heavy rainfall		743 people were evacuated, roads, bridge side drains and culverts were flooded and damaged. Damages cost RM560 thousand.
23.12.93	5.49 m at Kota Bharu	Heavy rainfall	14 died	Villages and roads were flooded and damaged. 13,587 people were evacuated Damage cost RM1.5 million.
24.11.94	24.37 m at Kuala Krai 5.15 m at Kota Bharu	Heavy rainfall	14died	1,184 people were evacuated. Roads were flooded to a dept of 2 m for 3-5 days.

6. Socio-cultural Characteristics

The State of Kelantan belongs to the Eastern Region of Peninsular Malaysia and is one of eleven States in Peninsular Malaysia. The State of Kelantan is normally divided into North and South, and is composed of ten Districts. Kota Bharu is the capital of Kelantan as well as the development centre of North Kelantan. The population of the State is 1,181,680 as recorded in 1993. About 68.5 per cent of the population live in the Kelantan River Basin. The others are found in the Golok and Kemubu River basins and in the northern coastal plain of the State. The population of Kota Bharu and Kuala Krai districts are 366,800 and 90,800 respectively. The major economic activities in Kelantan State are agricultural based, mainly the cultivation of paddy rice, rubber, oil palm and tobacco. Fishing and livestock farming are also an important occupation found in this area.