

PART 2
SABAH AND
SARAWAK

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1. INTRODUCTION

The objective of meteorological and hydrological study is the compilation of meteorological and hydrological data and assessment of surface water resources for the use in the agricultural study, irrigation water demand study, flood damage study, water supply and demand balance analysis and the other engineering studies.

In Chapter 2, general climate of Sabah and Sarawak was discussed in relation to surface water resources.

Rainfall characteristics in Sabah and Sarawak were analysed in Chapter 3. Basin mean rainfall was estimated by Thiessen method in a period from 1960 to 1979 in Sabah and from 1963 to 1980 in Sarawak.

In Chapter 4, the reliability of river run-off records was examined. Among 41 stations in Sabah and Sarawak, 12 stations were selected as key stations for the further study. The water balance in 47 basins and the run-off duration curves at the key stations are available.

As a flood analysis, flood frequency of regional floods was prepared on the basis of flood peak observations in Chapter 5. The catchment area versus specific peak discharge relationship was also prepared.

Chapter 6 dealt with the annual yield of suspended load on the basis of the observed duration curve of discharge and suspended load rating curve.

2. CLIMATE

2.1 General

The climate of the States of Sabah and Sarawak is generally characterized by the North-east and South-west monsoons and the successive two inter-monsoons. The North-east monsoon prevails in a period from November to January, hitting with heavy rainfall especially the northern area of Sabah and the southern area of Sarawak. Flood is generally generated by storm rainfall of this monsoon in Sabah and Sarawak. The South-west monsoon prevails in a period from May to July and brings rainfall in the inland of Sabah and Sarawak. The inter-monsoon, which blows from the south to the north after the South-west monsoon season, has stronger effect on rainfall than that of the other inter-monsoon. It generates much rainfall in the east portion of Sabah.

2.2 Meteorological Observations

Meteorological stations have been operated by the Malaysia meteorological services (MMS) and DID in Sabah and Sarawak. Air temperature, relative humidity, wind, sunshine hour and pan evaporation have been observed but they have not been measured at the same stations. Figure 1 shows the location of principal meteorological stations in Sabah and Sarawak.

2.3 Air Temperature

Table 1 shows the monthly mean air temperature recorded from 1968 to 1980 at the 5 principal stations, in which the recorded daily maximum and minimum air temperatures at these stations are also listed.

Air temperature is generally uniform throughout the year in Sabah and Sarawak. Monthly mean air temperature varies from 26.0°C to 27.5°C in the coastal area in Sabah and from 25.4°C to 27.3°C in the coastal area in Sarawak.

The highest air temperature usually occurs from April to May in Sabah and from August to September in Sarawak. The lowest was recorded in January or February in Sabah and Sarawak.

2.4 Relative Humidity

Monthly average relative humidity recorded from 1968 to 1980 at the 5 stations is summarized in Table 2. Relative humidity is uniformly high throughout the year and the monthly mean is 80-85% in Sabah and 82-89% in Sarawak. The seasonal variation of the relative humidity is generally dependent on the rainfall pattern of the area concerned. The highest usually occurs in November and the lowest does in February in Sabah, and they occur from November to February or from July to August in Sarawak respectively.

2.5 Wind

Table 3 shows the monthly mean surface wind speed which was recorded from 1969 to 1980 at the 5 stations. The wind speed is rather low and constant through the year. The monthly mean surface wind speed is 1.1-2.5 m/s in Sabah and 0.8-1.7 m/s in Sarawak.

2.6 Sunshine Hour

Table 4 shows the mean daily sunshine hour which was recorded from 1968 to 1980 at the 6 stations. The monthly mean sunshine hour is 5.5-8 hours in the coastal area in Sabah and 3.5-7 hours in the coastal area in Sarawak. The annual mean daily sunshine hour is 6.5-6.7 hours in Sabah and 5.0-6.3 hours in Sarawak. It is usually shortest in January or February in Sabah and Sarawak coastal area, and it is longest in April or May in Sabah and in the period from April to July in Sarawak.

2.7 Evaporation

Table 5 shows the monthly open water evaporation records of the 18 stations which were recorded in the hydrological data books. The open water evaporation was measured by the U.S. Class A pan at these stations.

In Sabah the monthly open water evaporation is 103-159 mm and the annual mean is 1,452-1,714 mm while they are 98-154 mm and 1,300-1,697 mm in Sarawak respectively. The maximum usually occurs in April, May or August in Sabah and in April or October in Sarawak while the minimum occurs in the period from November to February in Sabah and Sarawak.

3. RAINFALL

3.1 Observations

The number of rainfall gauging stations which are catalogued in the DID inventory of hydrological station is 106 in Sabah and 151 in Sarawak consisting manual and automatic gauging stations as listed in Table 6. The mean area covered by one station is 687 km² in Sabah and 484 km² in Sarawak.

The distribution density of the rainfall stations is high in the area where human activity is brisk such as the west coastal area of Sabah and the area around Kuching in Sarawak, while in the upstream area of particular basins, rainfall gauges are sparsely distributed because of difficulty of access and getting qualified gauge keepers. For example, the Kinabatangan river in Sabah, of which whole catchment area is 16,755 km², is covered by only 4 gauges and the Rajang river in Sarawak, upstream catchment from Kapit is covered by 8 gauges. In these area the record period is rather short and frequency of missing data is high.

The monthly rainfall was collected from the data bank of DID, head quarter, DSID hydrology sections in Sabah and Sarawak and also from hydrological data books published by Sabah and Sarawak DIDs. The collected records cover the period from 1960 to 1979 in Sabah and from 1963 to 1980 in Sarawak.

Substantial amount of records have been missed even at the principal stations.

3.2 General Rainfall Characteristics

Rainfall is abundant in the East Malaysia compared to that in Peninsular Malaysia. The mean annual rainfall was estimated to be 2,664 mm in Sabah and 3,836 mm in Sarawak. It was estimated to be 2,362 mm in Peninsular Malaysia. Monthly rainfall distribution of river system is shown in Fig. 2.

While Peninsular Malaysia was divided into five rainfall regions by Dale (Refs. 1 & 2), no clear rainfall region has been established yet in the East Malaysia. However the river systems in Sabah and Sarawak were divided into 7 types in terms of the monthly rainfall distribution in this study as shown in Fig. 3. The characteristics of these types are briefly as follows:

Type 1 rainfall

High rainfall concentrates between November and February due to the strong effect of the North-east monsoon prevailing in the period. The area under the Type 1 rainfall is distributed in the coastal area of Sabah facing to the Sulu sea.

Type 2 rainfall

The transitional type between Type 1 and Type 3 rainfalls.

The peak of the monthly rainfall takes place in May and October, however, the magnitude of the peaks is almost the same. The distribution is under the influence of the South-west monsoon and the second inter-monsoon. Type 2 rainfall dominates in Kadamaian basin (Basin 218) to Putatan basin (Basin 220) of the west coastal area, Sabah.

Type 3 rainfall

Two rainfall peaks in May and October are similar to Type 2, but the peak is dominant in October. The Type 3 rainfall is generated by the second inter-monsoon followed by the South-west monsoon. The Type 3 rainfall is distributed along the west coastal area of Sabah between Papar basin (Basin 221) and Labuan Island (Basin 225).

Type 4 rainfall

The transitional type between Type 3 and Type 5 rainfall. Type 4 rainfall has a dominant rainfall in September to October and then it is followed by high rainfall months from November to December. A weak rainfall peak is also observed in May in the distribution. These distribution is contributed by the second inter-monsoon, the North-east monsoon and the South-west monsoon in the order.

The Type 4 rainfall region expands in the west coastal areas facing to the Brunei Bay or in the basins from Lakutan in Sabah to the middle area of Baram in Sarawak excluding the upper and lower area of Baram.

Type 5 rainfall

Type 5 rainfall has a high rainfall peak in the period from December to February due to dominant influence of the North-east monsoon and has flat distribution in the smallest period.

This pattern of rainfall takes place in the coastal area of Sabah covering downstream of Baram to Kayan basins.

Type 6 rainfall

Type 6 rainfall has even distribution throughout the year without significant high and low peaks.

Type 6 rainfall area is situated in the central area of Sabah and the upstream area of the Rajang river from Kapit.

Type 7 rainfall

Type 7 rainfall is characterized by much rainfall in the South-west monsoon season. However, the monthly distribution is rather flat. Type 7 rainfall area is distributed along the border area between Sabah and Indonesia and the most upstream of Baram basin.

3.3 Basin Rainfall

The rainfall stations of 146 were selected among the catalogued 257 stations in order to study areal distribution of rainfall considering firstly the distribution of density of stations and secondary the available record period; that is, 52 in Sabah and 94 in Sarawak. The missing data of stations were interperated to make the continuous records by using the records observed at different stations which were located nearby the station to be estimated. The estimation was made between the two stations in terms of the following equation in which the rate of mean annual rainfall at the two sites was taken into account:

$$R_i = R_j \times (R_{ai}/R_{aj})$$

where, R_i : Missing monthly rainfall at i-station
 R_j : Recorded monthly rainfall at j-station
and R_{ai} : Mean annual rainfall at i-station
 R_{aj} : Mean annual rainfall at j-station

An isohyetal map of mean annual rainfall was prepared as shown in Fig. 4 based on the selected 146 rainfall stations.

The basin mean monthly rainfall was calculated by Thiessens' polygon network based on the 146 stations which were shown in Figs. 5 and 6. The record period is from 1960 to 1979 in Sabah and from 1963 to 1980 in Sarawak. The results of the 47 Basins are summarized in Table 7. The mean annual rainfall was estimated to be 2,664 mm in Sabah, 3,836 mm in Sarawak and 3,403 mm, in the whole East Malaysia.

4. RUNOFF

4.1 Observations

Stream flow gauging has been carried out by Sabah and Sarawak DIDs. The data observed at important stations are sent to DID head quarter in Kuala Lumpur after collected and processed by Sabah and Sarawak DIDs. The data are then filed in the DID data bank. Time delay between data collection and filing at Kuala Lumpur is usually very long. Data filing was completed up to 1977 in Sabah and up to 1979 in Sarawak.

The number of stream flow stations filed in the DID data bank is 42 in Sabah and 33 in Sarawak among which automatic gauge occupies 48 in Sabah and Sarawak as shown in Table 6.

The stream flow observation started around 1963 in Sabah and 1964 in Sarawak.

Many of stream flow stations are allocated in the coastal reach of rivers in the two states while they are sparse in the inland area due to hard accessibility to the inland and difficulty of hiring qualified gauging operators.

Among the stations located in the coastal reach, some of them are placed in tidal or tidal affected reach of river, therefore, records of these stations can not be used as runoff data.

4.2 Definitions

- (1) 5-day runoff: For the convenience of analysis, each calendar month was divided into six periods; 1st-5th, 6th-10th, 11th-15th, 16th-20th, 21st-25th and the remainder of the month. Each period was called the 5-day period and the arithmetic mean of daily discharges in each 5-day period was named as the 5-day runoff which might be expressed in m^3/s or 10^6m^3 . This definition was applied if there are daily discharge records in two or more days in a 5-day period but such 5-day period as having daily discharge records in less than two days was regarded as no data was available.
- (2) Water withdrawal: Water use such as domestic and industrial water supply takes water from a river and certain part of used water returns to the river. The net water consumed by the water use was estimated to be the difference between water taken and return flow and it was called the water withdrawal. The water withdrawal in the catchment area of each hydrological station was calculated on monthly basis for 1963-1980 whenever it was.
- (3) Natural run-off: The summation of the runoff discharge measured at a hydrological station and water withdrawal in the catchment area of the station was named the natural runoff.

- (4) Rainfall loss: Rainfall loss is composed of evapotranspiration, increase in soil moisture and ground water recharge. Annual rainfall loss is calculated as the difference between rainfall and natural runoff and therein the increase in soil moisture is negligible.
- (5) Key station: At least one hydrological station was selected for each group of rainfall pattern after the evaluation of discharge records. These stations were named to be the key stations and they were regarded as representing the hydrological conditions in the nearby basins in the resemble rainfall region.
- (6) Supplemental station: All key stations have interruptions of discharge records within 1963-1980. For the purpose of supplementing the lacking records at each of these key stations, another hydrological station was selected from within the resemble rainfall region and it was called to be the supplemental station.

4.3 Evaluation of Run-off Record

In consultation with DID hydrologists, daily stream stage records at 20 stations in Sabah and at 21 stations in Sarawak were extracted from DID data bank for their evaluation in terms of the duration of record and rainfall loss. These stations are listed in Table 8 with respect to location and record period.

Rating curve of the respective stations is studied in the relationship between stream stage and discharge and also studied in historical change with degradation and aggradation of river. The study is made by plotting the whole historical discharge measurement on a graph with normal scale for stream stage and square root scale for discharge. The best fit line to the plots on the graph can be expressed by parabolic equation of $Q = A(H-B)^2$, where Q is discharge, H is stream stage, and A and B are constants. The rating curves were compiled in Tables 9 to 11 together with applicable period and stream range. Daily discharge were estimated from the stream stage record applying these rating curves.

A certain long duration of record is necessary for the evaluation of the reliability of records and further studies including water supply and demand balance study. That is, the records of which continuous record is longer than at least 9-10 years were selected for further evaluation (25 stations).

It is herein assumed that annual rainfall loss remains within a range of 500 mm and 2,000 mm. Annual natural runoff was plotted against annual rainfall for the selected 25 stream-flow stations with the above-mentioned range of annual rainfall loss as shown in Figs. 7 to 11. The data of which points of annual runoff depth are fallen inside the range of annual rainfall loss are regarded as more reliable than those of which points are fallen outside the range.

No large storage dams and no dominant water withdrawal were observed inside the catchment area of the selected 25 stations.

In consequence, 12 most reliable stations were selected as the key stations and 10 additional reliable stations were selected as the supplementary stations.

4.4 Key Stations and Supplemental Stations

The selected key stations, supplemental stations and applied Basins are as shown in Table 12. The relationship among the key stations, supplemental stations and Basins is illustrated in Figs. 12 & 13.

4.5 Supplement of Key Station Record

Five-day natural runoff was calculated for the continuous period of 1963-1980 at each key station, by supplementing data in the interrupted periods based on the records at the corresponding supplemental station. The record period differs station by station. The methods of supplement were as follows:

- (1) The runoff in the corresponding interrupted period of a supplemental station or a key station in the same rainfall region was converted from the key stations or supplemental stations by multiplying the ratio of annual runoff in the year in which the interrupted period was included. Therein the annual runoff at the key station was calculated as the difference between the annual rainfall in the year and average rainfall loss in the recorded period in the catchment area of the key station.
- (2) If a certain period of less than one month of a key station could not be supplemented by the other stations in the same rainfall region or if supplement from the other stations was considered to be seemingly unreliable, the runoff in the interrupted period was assumed to be linear between the runoff in the last day of the antecedent period and that in the first day of the subsequent period.

The method of interpolation of missing data from the other stations is expressed by the following equation:

$$Q_j = Q_i \times \frac{A_j}{A_i} \times \frac{R_j}{R_i} \times \frac{f_j}{f_i}$$

where, Q_j : Discharge to be interpolated at j-station

Q_i : Discharge record at i-station

A: Catchment area at i- or j-station

R: Annual rainfall in the year to be interpolated at i- or j-station

f: Mean runoff coefficient at i- or j-station

i and j: Suffix (i) indicates respective recorded station and suffix (j) indicates the station to be interpolated.

4.6 Natural Flow Records at Key Stations

The estimated natural runoff at the 12 key stations is shown in Tables 13 to 15 on monthly basis and in Tables 16 to 40 on 5-day basis.

The rainfall, natural runoff and rainfall loss at the key stations are shown on annual basis for 1963-1980 in Tables 41 to 46.

4.7 Basin Water Balance

Natural runoff records at the key stations were converted to those in the corresponding basin by being multiplied by the ratio of average basin runoff in 1963-1980 in the same way as in Section 4.5. The basin 5-day runoff data were generated from the 5-day natural runoff records of key stations by multiplying the conversion ratios which were shown in Table 47. Therein the annual rainfall loss of Basins was assumed to be the same as that of the original key station of which discharge record was converted.

The water balance in the 47 basins was calculated as shown in Table 48, in which ground-water recharge was reproduced from Sectoral Report (so ground water resources).

4.8 Flow Duration Curve

Non-dimensional duration curves of natural flow were constructed for the 12 key stations based on the daily discharge records which were not supplemented as shown in Fig. 14. Some details of the duration curves including the coefficients of river regime are shown in Tables 49 to 54. The coefficient of river regime is the ratio of the maximum discharge to the minimum discharge.

5. FLOOD

5.1 Storm Rainfall

5.1.1 Storm rainfall

Major floods in both Sabah and Sarawak are mostly caused by storm rainfalls of the North-east monsoon which prevails from December to February.

Eight major rainfall records were selected in the period from 1963 to 1977 to study the characteristics with respects to the duration, the hyetograph shape and the magnitude. Beside the eight records, another heavy rainfall took place in January 1981 in Sabah which was evaluated as the second largest flood in the Kinabatangan and the Padas river basins. However, those flood records have not been compiled yet by Sabah DID, therefore, the analysis on the data was excluded from this study.

The daily rainfall records of the respective storms were collected and the basin mean daily rainfall was estimated by Thiessen method using the same poligon applied to estimate the monthly mean rainfall in the proceeding section. Missing data in the records were interpolated by the records observed at the most nearby station.

As the period of dominant storm rainfall is generally 5 days from the beginning to the end of storm in Sabah and Sarawak, the frequency analysis of the storm rainfall was done for 5-day rainfall. The rainfall distribution in 5-day period is shown in Fig. 15.

5.1.2 Frequency analysis of storm rainfall

Magnitude of rainfall was assessed by the frequency analysis. The seven basin storm rainfall in successive five days (R5) of the period from 1963 to 1977 were assumed to be the seven largest annual maximum extracted from complete set of annual maximum series ranging from 1963 to 1980.

This assumption was made because no significant larger floods were observed other than these seven floods.

This assumption allows the use of N value (i.e. number of data in annual maximum series) of 18. The frequency analysis was carried out by the Gumbol method and 5-day rainfall corresponding to the return period of 100, 50 and 20 years (R5-100y, R5-50y and R5-20y) were estimated. The results are shown in Tables 55 to 58 and the relationship between the catchment area and the probable storm rainfall is shown in Figs. 16 & 17.

The relationship in general shows decrease of rainfall with the expansion of catchment area. However, it is not common in Sabah and Sarawak due to the fact that areas closer to the coast receive more rainfall than inland area. The typical case is seen in the Baram river in Sarawak where the R5-100y is 270 mm/5-day in the upstream area while 400 m/5-day at the river mouth.

5.2 Flood Frequency Analysis

The values of annual extreme high water level at 16 stations were selected and converted into the annual extreme flood discharge by the rating curves as shown in Tables 9 to 11. These extreme levels and discharge are shown in Tables 59 to 62. The flood frequency analysis was made for these maximum discharge series assuming logarithmic-normal distribution, though the record period of the series was rather short. The peak flood discharges with return period of 20, 50 and 100 years were obtained from the analysis. The specific peak flood discharges ($m^3/s/km^2$) were also calculated and the relation between catchment area and specific peak discharge was plotted for each 100-year, 50-year and 20-year return period as shown in Fig. 18.

Fig. 19 shows the relation between 5-day rainfall and flood runoff coefficient.

6. SEDIMENTATION

6.1 Observations

Suspended load measurement was carried out by DID at 20 gauge sites in Sabah and only one site in Sarawak.

Table 63 shows gauging station where the suspended load data were obtained. Data of bed load measurement was not available.

6.2 Sediment Concentration

The suspended load concentration versus discharge relationship is shown in Figs. 20 to 24. The figures show that suspended load concentration proportionally increases with discharge and the rate of increment is approximately two on the Log-Log (Logarithmic) scale. Therefore, suspended load rating curve is expressed in parabolic equation $Q_s = AQ^2$, where Q_s is suspended load concentration in ppm, Q is discharge in m^3/s and 'A' is proportional constant. The proportional constant is designated in the figure of suspended load rating curve.

6.3 Annual Yield of Suspended Load

Annual yield of suspended load was estimated at 10 stations where suspended load rating curve and discharge duration curve were both available. The annual yield was given by summing up the daily suspended load.

The specific weight of the deposit was assumed to be $1.0 \text{ ton}/m^3$. The sedimentation was assumed to be 120% of the suspended load; that is, the bed load was assumed to be 20% of the suspended load. The annual yields of suspended load and sedimentation were estimated as shown in Table 63. The specific annual yield of sedimentation was estimated to be $30 - 230 \text{ m}^3/\text{km}^2/\text{y}$ and the average was $114 \text{ m}^3/\text{km}^2/\text{y}$.

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TABLES

Table 1 MONTHLY MEAN AIR TEMPERATURE

Unit: °C

Station Name	Elevation (m)	Month												Recorded Daily		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max.	Min.	
<u>Sabah</u>																
Kota Kinabalu	2.3	25.8	26.0	26.7	27.3	27.4	27.1	26.9	26.9	26.7	26.6	26.4	26.3	26.7	34.6	19.3
Sandakan	11.9	26.2	26.3	26.9	27.5	27.5	27.2	27.1	26.9	26.9	26.9	26.6	26.4	26.9	36.2	19.4
<u>Sarawak</u>																
Kuching	25.6	25.4	25.7	26.2	26.5	26.9	26.7	26.7	26.4	26.3	26.1	25.8	25.7	26.2	36.5	18.9
Sibu	7.5	25.4	25.6	26.0	26.4	26.7	26.6	26.4	26.3	26.2	26.1	26.0	25.7	26.1	36.5	16.5
Miri	16.8	25.8	25.9	26.5	27.0	27.3	27.0	26.8	26.7	26.7	26.6	26.3	26.2	26.6	35.0	17.8

Remarks; Record period 1968 - 1980

Table 2 MONTHLY MEAN RELATIVE HUMIDITY

Unit: %

Station Name	Elevation (m)	Month												Mean Daily		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max.	Min.	
<u>Sabah</u>																
Kota Kinabalu	2.3	83.3	82.9	81.1	80.7	80.6	80.2	79.9	79.2	81.2	82.7	83.3	83.1	81.5	94.6	63.5
Sandakan	11.9	85.2	83.9	82.4	82.9	83.9	84.5	83.7	84.0	85.0	85.0	86.4	87.1	84.5	97.6	63.7
<u>Sarawak</u>																
Kuching	25.6	87.5	86.5	85.1	85.2	83.6	83.0	81.9	82.8	83.5	85.2	86.4	87.4	84.8	96.8	59.9
Sibu	7.5	89.3	88.6	87.8	87.7	86.6	86.0	85.5	85.9	86.7	87.0	87.8	89.0	87.3	99.3	59.7
Miri	16.8	87.2	86.6	85.4	85.6	84.9	83.9	84.0	83.7	84.9	86.0	86.6	87.5	85.5	97.3	64.5

Remarks; Record period 1968 - 1980

Table 3 MONTHLY MEAN SURFACE WIND SPEED

Station Name	Month												Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<u>Sabah</u>													Unit: m/s
Kota Kinabalu	1.8	1.8	1.7	1.7	1.6	1.7	1.9	2.1	2.0	2.0	1.7	1.6	1.8
Sandakan	2.5	2.7	2.4	1.7	1.3	1.1	1.1	1.2	1.2	1.3	1.5	1.9	1.7
<u>Sarawak</u>													
Kuching	1.7	1.8	1.5	1.1	1.1	1.1	1.2	1.3	1.3	1.3	1.3	1.4	1.3
Sibu	1.1	1.1	1.0	0.9	0.8	0.9	0.9	0.9	0.9	1.0	1.0	0.9	0.9
Miri	1.3	1.4	1.3	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.4	1.3	1.3

Remarks; Record period 1969 - 1980

Table 4 MEAN DAILY SUNSHINE HOURS

Station Name	Month												Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<u>Sabah</u>													Unit: hour
Kota Kinabalu	6.26	7.04	7.52	8.21	7.43	6.59	6.59	6.28	6.11	6.08	6.38	6.17	6.72
Sandakan	5.30	5.91	7.12	8.04	8.08	6.69	7.00	6.99	6.25	5.97	5.57	4.96	6.49
<u>Sarawak</u>													
Kuching	3.57	4.02	4.53	5.44	6.37	6.23	6.21	5.51	4.97	4.75	4.74	4.06	5.03
Sibu	4.49	4.94	5.00	5.94	6.39	6.23	6.43	5.77	5.28	5.47	5.53	4.94	5.53
Miri	5.41	6.00	6.41	7.12	7.07	6.53	6.81	6.35	6.24	5.83	5.87	5.82	6.29
Bintulu	4.90	5.21	5.74	6.46	6.75	6.50	6.44	5.96	5.81	5.37	5.48	5.22	5.82

Remarks; Record period 1968 - 1980

Table 5 MONTHLY OPEN WATER EVAPORATION

No.	Station No. (DID)	Station Name	Month												Total	
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
<u>Sabah</u>													Unit: mm			
1	4278201	Tawau	112	113	133	126	124	116	122	129	124	129	112	112	112	1,452
2	5274201	Kuamut	107	106	130	144	141	122	125	129	129	132	115	117	117	1,497
3	5361302	Keningau	133	130	150	159	152	139	145	147	148	146	135	129	129	1,714
4	5671201	Trupid	114	114	139	148	154	131	129	136	132	130	115	113	113	1,555
5	5760201	Kaida	123	109	132	128	131	128	133	134	120	119	117	109	109	1,483
6	5777201	Ulu Dusun	111	103	135	137	156	145	146	151	136	136	113	116	116	1,585
7	5873201	Penimban	107	107	130	147	157	134	138	146	138	136	115	110	110	1,565
8	5880201	Sandakan							Not Available							
9	5965301	Kundasan	110	103	127	133	127	130	147	136	130	132	112	107	107	1,494
10	5960302	Kota Kinabalu	148	145	175	179	177	165	167	167	156	162	145	148	148	1,933
<u>Sarawak</u>																
1	1403201	Kuching	108	104	125	127	138	130	135	135	126	130	116	111	111	1,484
2	1204324	Dragon Sch.	105	98	114	114	120	115	121	125	117	127	102	117	117	1,300
3	1214201	Simanggang	134	128	139	143	136	131	132	137	138	149	127	130	130	1,647
4	2318207	Sibu	109	105	127	122	129	127	128	128	126	127	116	111	111	1,453
5	3130202	Bintulu	122	117	141	144	147	138	140	144	138	135	121	127	127	1,620
6	4339205	Miri	122	125	145	152	153	145	152	154	148	146	130	125	125	1,697
7	4650323	Belaga	105	108	139	139	137	126	129	132	123	119	114	117	117	1,471
8	2029301	Kapit	117	116	134	141	139	130	137	135	131	143	122	135	135	1,579

Table 6 NUMBER OF GAUGING STATIONS
IN SABAH AND SARAWAK

State	Manual	Recording	Total
<u>(1) Rainfall Station</u>			
Sabah	80	26	106
Sarawak	86	65	151
Total	166	91	257
<u>(2) Stream Flow Station</u>			
Sabah	7	35	42
Sarawak	20	13	33
Total	27	48	65

Remarks; Catalogued number in DID data bank.

Table 7 BASIN MEAN MONTHLY RAINFALL

Unit: mm

Basin No.	Basin	Catchment Area (km ²)	Monthly Rainfall (mm)												Total
			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
201	Pensiangan	5,971	163	155	198	230	266	221	177	210	223	215	243	189	2,491
202	Serudong	1,308	178	124	151	153	193	193	162	182	165	205	200	187	2,093
203	Kalabakan	1,371	194	135	156	158	197	200	160	179	173	213	207	195	2,168
204	Brantian	741	166	126	145	213	180	188	146	161	157	206	200	183	2,071
205	Umas Umas	553	147	119	142	236	175	182	139	154	146	202	197	174	2,013
206	Merutai Besar	558	150	125	146	219	186	181	156	169	152	207	206	183	2,080
207	Tawau	888	162	144	160	205	212	180	182	193	163	222	234	205	2,262
208	Kalumpang	2,792	179	141	148	206	226	196	165	179	180	216	209	188	2,233
209	Silibukan	2,714	381	273	172	158	211	167	147	160	186	240	248	295	2,639
210	Segama	5,558	358	253	166	151	198	167	153	162	188	227	242	283	2,549
211	Kinabatangan	16,755	357	249	174	140	202	179	190	191	215	216	255	294	2,660
212	Segalud	2,335	481	318	196	124	170	192	224	233	248	235	310	431	3,161
213	Labuk	6,829	424	375	218	159	240	243	220	239	240	285	279	350	3,272
214	Sugut	3,094	429	372	221	155	235	241	214	240	237	279	272	361	3,255
215	Paitan	1,474	509	454	236	144	226	235	215	234	238	287	301	427	3,506
216	Bengkoka	1,866	455	389	170	111	162	150	143	139	164	201	243	374	2,700
217	Bongan	2,126	415	345	152	113	164	152	142	138	170	207	236	347	2,582
218	Kadamalan	1,336	281	190	141	176	276	267	248	260	313	390	307	381	3,130
219	Tuaran	1,247	229	151	131	164	274	286	263	270	304	395	307	249	3,023
220	Putatan	629	213	122	118	167	303	330	276	276	317	388	340	275	3,126
221	Papar	805	254	176	150	186	301	304	263	275	311	372	331	265	3,190
222	Kimanis	607	251	138	132	192	278	297	261	270	317	341	361	270	3,106
223	Membakut	736	230	161	167	218	326	272	262	238	297	312	319	261	3,064
224	Padas	9,180	171	140	154	163	216	172	155	159	193	195	203	188	2,110
225	Labuan	86	290	164	143	205	281	279	281	303	349	352	419	310	3,376
226	Lakutan	1,291	259	170	176	204	272	217	231	239	248	296	316	272	2,900
227	Lawas	1,080	365	195	225	243	300	328	249	327	363	342	430	396	3,762
228	Trusan	2,768	266	174	225	225	258	243	200	240	276	281	316	295	2,999
229	Limbang	3,920	386	260	276	325	331	279	263	286	328	379	381	392	3,884
230	Batam	22,325	336	264	296	303	311	283	256	263	315	401	383	385	3,794
231	Miri	788	396	141	136	170	173	218	238	240	229	295	346	391	2,976
232	Sibuti	935	279	172	143	172	183	218	213	266	203	261	312	323	2,745
233	Niah	1,345	299	195	171	206	195	201	195	203	189	236	269	323	2,681
234	Buai	1,440	348	218	206	229	207	213	207	229	213	248	306	369	2,993
235	Similajau	1,268	400	254	229	237	219	250	208	270	249	300	364	399	3,378
236	Kemena	6,000	455	314	289	295	257	243	271	294	278	351	416	456	3,918
237	Tatau	5,150	465	327	337	299	268	227	265	258	298	340	371	458	3,912
238	Balingian	2,518	538	384	339	257	240	228	212	249	279	337	307	459	3,830
239	Mukah	2,625	546	419	370	269	238	214	207	236	289	330	313	483	3,914
240	Oya	2,005	443	317	297	259	223	192	190	214	259	284	295	397	3,369
241	Rajang	51,053	386	328	357	326	296	269	245	281	327	350	392	433	3,991
242	Kerian	1,675	386	297	276	268	314	219	179	266	262	296	440	434	3,637
243	Saribas	1,900	382	307	271	288	264	218	189	262	279	297	353	436	3,547
244	Lupar	6,813	409	318	289	293	258	213	183	263	278	301	369	439	3,612
245	Sadong	3,645	485	415	326	291	243	204	180	218	252	294	358	451	3,716
246	Sarawak	3,358	646	594	357	289	242	206	184	231	252	340	355	496	4,193
247	Kayan	1,838	792	704	422	346	269	217	202	252	261	351	379	597	4,793

Remarks; Record period: Sabah (Basins 1-26) 1960-1979 and Sarawak (Basins 27-47) 1963-1980.

Table 8 INVENTORY OF SELECTED STREAM GAUGING STATIONS

No.	Station Name	Station No.	River	Catchment Area (km ²)	Recorded Period	Recorded Year
<u>The State of Sabah</u>						
1.	Jalan Kuhara	4278401	Tawau	104	1968-1977	10
2.	Masya Bridge	4581401	Kalumpang	544	1968-1977	10
3.	Ulu Kuamut	5174401	Kinabatangan	2,950	1969-1977	9
4.	Tongkulap	5373401	Kinabatangan	5,730	1969-1977	9
5.	Bedukan		Labuk	440	1969-1977	9
6.	Tomboloi	5768401	Labuk	2,460	1963-1977	15
7.	Porong	5872401	Labuk	3,240	1963-1977	15
8.	Basai	6073401	Labuk	700	1963-1977	15
9.	Kobon	6670401	Bengkoka	570	1972-1977	6
10.	Simpangas	6467401	Bandau	228	1967-1977	11
11.	Bridge No.2	6364401	Wairu	243	1965-1977	13
12.	Tamu Darat	6264401	Kadamainan	338	1965-1977	13
13.	Malangang	6162401	Tuaran	564	1965-1977	13
14.	Penampang	5961401	Moyo	200	1965-1977	13
15.	Kaiduan	5760402	Papar	357	1965-1977	13
16.	Kagopon	5760401	Papar	536	1967-1977	11
17.	Ansip	5261401	Pegatan	2,175	1968-1977	10
18.	Biah	5163401	Sook	1,684	1968-1977	10
19.	Kemabang	4959401	Padas	3,180	1968-1977	10
20.	Tenom Lama	5159401	Padas	7,718	1968-1977	10
<u>The State of Sarawak</u>						
21.	Medamit	4449401	Limbang	2,820	1966-1980	15
22.	Long Terawan	3946411	Tutoh	3,360	1966-1980	15
23.	Lio Matu	3152408	Baram	2,630	1966-1980	15
24.	Long Pilah (A)	3444409	Baram	9,300	1966-1980	15
25.	Long Jegan	3541410	Tinjor	2,390	1966-1978	13
26.	Sebiu Bridge	3230412	Sebiu	155	1967-1979	13
27.	Niah	3737415	Niah	725	1969-1980	12
28.	Setapang		Oya	1,000	1969-1972	4
29.	Long Liko		Barui	7,960	1969-1972	4
30.	Nyabong		Linau	9,644	1967-1972	4
31.	Bilong		Rajang	20,793	1966-1975	9
32.	Sg. Gaat		Ga'at	1,478	1966-1975	9
33.	Gassan		Baleh	13,007	1966-1976	11
34.	Kapit	2029401	Rajang	33,800	1967-1980	14
35.	Katibas		Katibas	2,287	1967-1975	8
36.	Lubok Antu	1018401	Ai	1,300	1966-1980	11
37.	Bedup	1006428	Bedup	36.3	1964-1980	17
38.	Serian	1105401	Sadong	941	1964-1980	17
39.	Kg. Git	1302428	Sarawak Kiri	425	1970-1980	11
40.	Pedi	1301426	Sarawak Kanan	123	1970-1980	11
41.	Pk. Buan Bidi	1401427	Sarawak Kanan	217	1970-1980	11

Table 9 RATING CURVES BY STATION (1/3)

Station	Applicable Year	Range of Stream Stage (m)	Coefficient	
			A	B
Mendamit	up to 1974	-1.60 - 99999.99	11.11	-1.60
	up to 1981	-1.00 - 99999.99	11.11	-1.00
L. Matu	up to 1981	0.40 - 99999.99	41.33	0.40
L. Jegan	up to 1981	3.80 - 10.40	7.19	3.80
		10.40 - 99999.99	4.98	2.47
Kapit	up to 1981	0.91 - 6.54	72.66	0.91
		6.54 - 99999.99	72.66	-2.89
Lubuk Antu	up to 1967	0.80 - 99999.99	28.17	0.80
	up to 1973	0.58 - 99999.99	36.95	0.58
	up to 1981	-1.52 - 99999.99	26.84	-1.52
Bedup	up to 1981	-0.04 - 0.46	15.78	-0.04
		0.46 - 99999.99	6.75	0.46
Serian	up to 1968	0.00 - 7.20	4.52	0.00
		7.20 - 99999.99	33.34	4.55
	up to 1974	-0.77 - 7.20	3.78	-0.77
	up to 1980	7.20 - 99999.99	31.98	4.46
		data extracted from the hydrological year book		
K. Git	up to 1981	1.70 - 3.15	33.56	1.70
		3.15 - 99999.99	4.30	-0.90
Pedi	up to 1981	1.12 - 1.66	19.75	1.12
		1.66 - 99999.99	4.79	1.66
Bidi	up to 1981	2.85 - 4.65	11.11	2.85
		4.65 - 99999.99	4.09	4.65
Kemabong	up to 1969	0.38 - 1.34	66.02	-0.38
		1.34 - 99999.99	33.57	0.01
	up to 1973	0.43 - 3.50	43.72	-0.43
		3.50 - 99999.99	33.64	0.00
	up to 1981	0.38 - 1.00	0.68	-0.38
		1.00 - 2.00	103.84	-0.95
2.00 - 99999.99		36.30	-0.22	
S. Sibew	up to 1981	0.00 - 99999.99	2.16	0.00
L. Tawaran	up to 1981	5.33 - 11.40	6.10	-5.33
		11.40 - 99999.99	4.09	-3.98

Table 10 RATING CURVES BY STATION (2/3)

Station	Applicable Year	Range of Stream Stage (m)	Coefficient	
			A	B
Simpangas	up to 1977	1.06 - 99999.99	43.54	-1.06
	up to 1981	0.95 - 99999.99	43.86	-0.95
Tomboloi	up to 1973	-0.05 - 0.80	70.14	0.05
		0.80 - 4.40	81.00	-0.01
		4.40 - 99999.99	16.28	5.39
	up to 1981	-0.29 - 3.99	48.53	0.29
		3.00 - 4.40	140.59	-1.07
		4.40 - 99999.99	16.28	5.39
Tang Kulap	up to 1970	-0.36 - 2.00	19.80	0.36
		2.00 - 99999.99	6.31	2.18
	up to 1972	-0.18 - 2.54	18.76	0.18
		2.54 - 99999.99	6.35	2.14
	up to 1975	-0.36 - 2.00	19.80	0.36
		2.00 - 99999.99	6.31	2.18
	up to 1981	-0.71 - 2.80	12.88	0.71
		2.80 - 99999.99	6.25	2.24
Ulu Kuamut	up to 1970	0.76 - 3.88	46.17	-0.76
		3.88 - 99999.99	26.63	0.23
	up to 1972	0.89 - 4.40	46.36	-0.89
		4.40 - 99999.99	26.56	0.24
	up to 1975	0.76 - 3.88	46.17	-0.76
		3.88 - 99999.99	26.63	0.23
	up to 1981	0.65 - 3.40	46.74	-0.65
		3.40 - 99999.99	26.41	0.26
Mostyn Bridge	up to 1981	-0.09 - 0.70	27.94	0.09
		0.70 - 99999.99	11.28	0.55
Biah (Sook)	up to 1981	0.33 - 99999.99	16.71	-0.33
Tenom Lama	up to 1981	-1.19 - 3.60	27.27	1.19
		3.60 - 99999.99	6.25	6.40

Table 11 RATING CURVES BY STATION (3/3)

Station	Applicable Year	Range of Stream Stage (m)	Coefficient	
			A	B
Kaiduan	up to 1977	0.14 - 1.00	23.85	-0.14
		1.00 - 4.00	39.69	-0.33
		4.00 - 99999.99	11.56	2.79
	up to 1981	0.31 - 2.00	21.30	-0.31
		2.00 - 4.85	40.78	-0.78
		4.85 - 99999.99	11.53	2.81
Kogapon	up to 1968	0.06 - 2.66	52.84	-0.06
		2.66 - 99999.99	32.70	0.65
	up to 1971	-0.01 - 1.62	63.80	0.01
		1.62 - 99999.99	32.58	0.66
	up to 1981	-0.19 - 1.10	61.12	0.19
		1.10 - 99999.99	32.42	0.67
Bridge No. 2	up to 1975	0.20 - 1.00	31.64	-0.20
		1.00 - 99999.99	45.23	-0.33
	up to 1976	0.15 - 2.60	33.12	-0.15
		2.60 - 99999.99	51.96	-0.64
	up to 1981	0.40 - 2.00	37.52	-0.40
		2.00 - 99999.99	51.84	-0.64
Malangang	up to 1973	0.50 - 99999.99	50.57	-0.50
	up to 1975	0.80 - 3.16	64.82	-0.80
		3.16 - 99999.99	49.92	-0.47
	up to 1981	1.00 - 3.40	78.77	-1.00
		3.40 - 99999.99	44.72	-0.21

Table 12 KEY STATIONS, SUPPLEMENTAL STATIONS
AND APPLIED BASINS

Group No.	Key Station		Supplemental Stations	Applied Basins	Record Period (Year)
	Name	River with Basin No.			
I	Jalan Kuhara	207 Tawau		201-210	10
	Tenom Lama	224 Padas	Kemabong	224	10
	Long Pilah(A)	230 Baram	Lio Matu Long Teraman	229,230	15
II	Porong	213 Labuk	Basai Tomboi	212-215	15
	Tang Kulap	211 Kinabatangan	Porong Ulu Kuamut	211	9
III & IV	Bridge No.2	218 Wairu		216,217,218	13
	Malangang	219 Tuaran		219	13
	Penampang	220 Moyo	Kagopon	220-223 & 225-228	13
V	Sebiu Bridge	236 Sebiu	Serian	231-240	13
	Serian	245 Sadong Sarawak		242-245	17
	Pk. Buan Bidi	246 Kanan	Kg. Git	246,247	11
VI	Kapit	241 Rajang	Bilong Sg. Gaat	241	14

Table 15 MONTHLY NATURAL RUNOFF AT KEY STATION (3/3)

Unit: m³/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1964	223.9	255.6	245.6	125.5	137.1	59.1	77.1	73.4	81.6	76.9	142.3	70.7	1568.8
1965	214.3	193.3	201.4	111.2	136.4	79.8	34.0	111.7	63.2	108.2	91.5	252.0	1597.3
1966	345.0	203.5	180.8	119.2	101.8	76.7	59.2	113.6	85.5	151.1	214.4	170.1	1820.8
1967	279.6	158.5	268.9	107.3	155.6	52.1	49.6	21.7	100.3	78.2	173.9	238.6	1684.4
1968	374.4	60.4	257.9	112.2	127.5	110.4	116.2	82.2	46.7	87.6	88.6	189.9	1654.2
1969	157.5	168.9	129.4	157.6	159.6	64.8	85.4	176.2	77.8	222.3	266.7	339.9	2002.1
1970	417.6	181.9	121.1	170.6	162.6	95.4	79.2	212.7	211.2	137.9	271.4	202.8	2253.2
1971	278.8	302.9	148.1	123.8	105.5	111.5	83.6	130.7	176.3	144.1	250.4	384.3	2219.7
1972	199.0	214.5	85.4	192.8	126.4	57.5	28.4	47.7	76.2	108.2	125.2	199.3	1600.7
1973	184.0	28.1	240.9	207.9	133.4	155.3	112.5	150.8	194.5	176.0	180.1	342.3	2185.8
1974	217.8	364.6	269.9	183.0	122.4	113.5	97.8	67.8	125.7	113.3	228.4	218.8	2056.5
1975	216.8	301.4	245.7	87.6	121.3	61.4	49.4	37.8	148.0	139.0	204.8	312.3	1985.5
1976	467.9	95.2	100.7	184.6	76.3	49.5	52.2	37.8	42.2	82.0	186.1	229.0	1603.5
1977	285.2	541.6	164.6	152.4	205.2	75.4	105.3	97.2	49.0	180.5	188.7	286.3	2335.5
1978	280.4	143.7	238.9	201.9	152.1	113.8	93.5	72.3	178.0	72.0	149.0	129.5	1895.8
1979	151.9	156.8	80.1	159.1	133.9	86.8	68.8	32.4	144.4	50.9	189.5	237.0	1491.6
1980	301.6	263.1	126.7	126.2	74.7	63.5	44.2	66.4	91.5	146.0	225.2	226.6	1753.7
AVERAGE	271.5	216.8	181.3	148.4	131.3	83.9	73.4	90.6	111.5	122.0	187.9	218.6	1857.1

STATION 105, BIAN PIOT

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1970	123.5	53.7	35.6	50.3	47.9	28.3	17.9	46.9	48.2	37.5	56.3	39.1	587.2
1971	142.2	94.6	30.8	33.2	25.7	14.8	14.2	27.1	31.9	24.1	43.0	62.7	544.2
1972	82.0	72.4	20.1	28.8	39.4	27.5	13.4	25.2	27.6	32.4	46.0	42.9	455.4
1973	82.0	46.2	60.5	49.8	58.1	21.5	17.4	22.0	35.0	29.5	30.3	174.6	626.9
1974	38.8	104.3	39.6	41.5	20.1	19.2	18.5	14.5	45.4	39.4	36.3	39.1	456.6
1975	55.7	70.4	57.9	17.4	27.6	16.6	25.2	15.8	54.4	30.8	51.8	87.9	511.4
1976	195.8	42.3	37.5	30.8	24.9	18.1	18.2	20.1	13.7	39.1	38.1	61.1	539.8
1977	94.5	260.8	65.6	48.0	41.8	24.9	35.1	19.0	16.8	67.5	87.7	61.6	803.5
1978	110.4	34.6	25.5	35.8	27.6	19.7	21.2	19.6	21.5	18.5	33.4	77.7	495.3
1979	77.1	48.6	26.0	39.7	23.3	25.4	19.0	19.0	55.2	39.4	61.4	87.6	521.7
1980	94.5	68.7	26.2	58.6	26.2	24.9	16.3	28.4	30.8	35.1	45.1	41.0	495.9
AVERAGE	99.7	81.5	43.2	59.4	33.0	21.9	19.7	23.4	34.1	35.7	46.8	70.5	568.9

Table 17 5-DAY NATURAL RUNOFF AT JALAN KUHARA (2/2)

Unit: m³/s

YEAR 1976												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	5.16	4.30	3.70	4.22	6.78	4.90	2.75	2.28	2.52	4.68	7.08	5.64
6-10	5.98	3.54	3.70	6.34	10.16	5.30	2.55	2.24	2.66	7.70	6.44	3.22
11-15	6.68	6.82	3.88	5.32	16.32	4.70	2.38	3.08	2.74	7.38	4.04	3.30
16-20	6.98	4.02	3.10	7.70	15.76	3.52	3.60	3.88	2.92	6.34	4.66	4.82
21-25	6.92	4.54	4.38	3.96	12.30	2.78	2.38	2.28	3.02	8.68	9.02	7.68
26-END	6.83	5.38	3.50	7.56	5.82	2.64	2.32	2.40	2.97	15.30	5.14	7.53

YEAR 1977												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	4.34	4.66	7.34	5.54	6.52*	9.55*	3.63*	1.96*	1.36*	1.51*	7.15*	7.94*
6-10	3.68	7.40	3.92	10.94	5.41*	6.56*	6.04*	2.04*	0.98*	3.73*	7.75*	9.90*
11-15	10.13	6.34	6.18	9.35*	15.63*	9.07*	11.40*	2.05*	0.82*	5.54*	4.10*	19.27*
16-20	8.10	9.04	6.42	8.32*	10.44*	6.09*	5.14*	1.34*	0.83*	3.57*	3.40*	8.76*
21-25	6.36	11.24	6.28	11.69*	4.98*	6.20*	7.95*	2.84*	1.43*	6.52*	2.38*	6.06*
26-END	4.80	8.03	4.60	7.66*	22.99*	4.04*	3.64*	4.41*	1.51*	4.84*	5.76*	1.75*

Remarks; *: Estimated value

Table 19 5-DAY NATURAL RUNOFF AT TANG KULAP (2/2)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1972

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	672.34	154.98	119.50	411.34	139.85*	272.56	44.10	57.90	710.28	654.96	293.90	117.48
6-10	213.14	41.70	127.24	137.98	173.73	166.56	26.56	121.44	389.78	716.54	181.86	111.44
11-15	120.42	49.64	55.94	100.06	169.70	117.72	20.26	201.64	320.36	653.86	244.34	127.06
16-20	560.40	536.60	89.38	54.02	289.98	79.32	67.96	280.46	521.34	489.08	172.75	66.94
21-25	290.12	276.04	151.92	41.64	667.54	82.64	63.54	313.26	933.50	170.54	217.32	88.00
26-END	178.18	198.77	155.53	224.35	345.62	825.66	37.28	567.48	787.30	351.98	124.72	189.92

YEAR 1973

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	117.94	34.79*	12.92	16.18	110.10	78.13*	256.70	174.44	66.22	571.78	793.06	313.20
6-10	277.72	32.13*	12.04	11.32	62.40	41.97	121.86	133.00	144.72	516.32	470.74	208.10
11-15	46.94	38.59*	13.72	10.38	84.20	71.74	47.74	201.44	278.62	295.76	176.48	97.46
16-20	64.84	35.91*	21.40	27.46	39.20	99.88	52.52	162.32	489.98	218.88	220.32	247.90
21-25	30.58	25.64*	24.66	107.97	127.72*	134.54	191.34	53.86	453.54	162.76	177.10	122.48
26-END	24.83	22.60*	15.25	200.42	88.37*	127.70	225.33	33.82	1088.68	232.15	152.50	192.23

YEAR 1974

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	352.42	146.48	412.02	162.42	228.00	185.92	258.45*	272.06	91.64	159.02	38.80	152.46
6-10	275.32	179.12	200.86	232.08	135.40	102.58	90.08*	211.02	75.12	249.24*	28.00	208.06
11-15	175.52	426.32*	511.52	176.80	173.92	98.94	421.33	108.98	74.60	154.87*	45.76	266.24
16-20	41.64	375.37*	126.84	357.92	733.36	116.78	252.04	67.52	168.24	246.98*	123.70	174.62
21-25	121.34	329.42	73.78	458.84	1017.84	181.10	208.34	115.94	171.66	69.83	221.26	174.12
26-END	108.83	248.70	76.68	177.98	548.77	709.80	262.52	160.65	135.36	51.13	87.40	274.40

YEAR 1975

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	183.25	111.24	656.56	109.90	98.95*	355.28*	165.27*	134.50*	264.44	390.64	209.02	320.10
6-10	661.34	63.42	178.52	96.60	229.85*	330.64*	206.53*	76.96	260.92	438.78	414.38	135.22
11-15	420.04	40.10	31.80	51.82	611.28*	211.33*	189.82	109.62	290.18	307.20	198.48	160.74
16-20	200.20	53.44	118.36	52.28	415.19*	225.15*	225.75	91.38	393.20	176.00	221.54	315.70
21-25	171.72	540.42	277.88	82.10	459.50*	193.66*	195.20*	361.64	465.88	137.60	182.14	345.30
26-END	91.08	715.33	141.28	63.00	225.73*	218.62*	202.94*	236.72	422.52	154.93	265.60	141.37

YEAR 1976

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	120.18	140.60	49.68	103.20	131.14*	69.96*	155.78	136.08*	173.84*	77.71*	277.88	151.78
6-10	88.84	68.18	159.94	163.67	171.85*	175.61*	91.90	91.91*	91.84*	99.40*	301.30	60.74
11-15	181.90	108.68	180.95	109.16*	277.21*	166.78	179.18	81.47*	42.30	122.18	99.10	74.86
16-20	163.84	81.12	59.76*	230.04*	202.17*	62.08	64.54	205.72*	39.60	262.04	206.60*	93.44*
21-25	347.32	64.83	92.55	68.43*	119.52*	41.26	81.02	121.76	252.32	283.94	228.62	237.44*
26-END	896.75	72.67	113.13	183.53*	68.18*	83.56	701.20	162.38	80.88*	308.52	179.70	233.84*

YEAR 1977

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	202.22*	88.20	669.72	279.30	85.18	236.53	280.80	128.36	153.49*	46.07	217.75*	593.84
6-10	112.69*	925.93	235.78	113.60	62.42	455.34	241.81*	435.78*	99.65*	816.27	437.22*	702.16
11-15	217.68*	847.72	349.70	188.76	228.90	359.67*	365.54*	483.42	45.80	658.16	375.60*	380.58
16-20	460.10	614.46	121.16	240.84	373.17	482.94	171.89*	180.30*	40.98	681.40	233.00*	154.42
21-25	175.36	1205.98	203.28	76.92	250.11*	562.54	239.30	375.39*	35.44	285.39*	230.13	165.16
26-END	227.52	1246.10	482.08	79.12	287.98	194.34	490.18	518.26*	52.82	192.71*	615.98	131.18

Remarks; *: Estimated value

Table 21 5-DAY NATURAL RUNOFF AT PORONG (2/2)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1972

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	374.55	227.51	107.04	501.95	84.50	149.90	64.50	77.18	213.00	212.40	150.94	425.87*
6-10	183.24	121.12	105.54	165.64	160.06	134.48	45.90	81.86	158.08	300.86	99.28	132.26*
11-15	118.54	46.33	42.24	107.84	129.46	109.24	32.78	102.96	110.52	289.38	121.06	138.41*
16-20	550.00	251.48	119.70	76.74	154.60	76.58	88.32	143.60	166.18	157.46	112.86	87.86
21-25	245.19	254.74	152.46	64.73	185.00	22.72	68.38	151.92	253.98	108.04	171.38	80.18
26-END	157.93	204.41	153.53	56.42	229.27	62.52	49.57	270.58	302.58	171.52	119.42	69.52

YEAR 1973

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	163.80	26.38	14.20	20.54	117.44	59.24	162.52	94.02	116.24	302.20	380.04	144.98
6-10	115.74	24.36	14.47	15.95	119.72	42.46	95.08	72.68	180.92	216.00	321.62	95.50
11-15	60.16	29.24	14.64	12.24	121.64	62.40	49.12	186.24	196.10	204.94	205.38	52.54
16-20	59.72	27.24	15.46	42.66	87.78	39.16	38.68	110.56	535.44	158.68	186.48	86.64
21-25	37.58	49.44	18.44	76.68	87.84	110.54	73.44	52.68	324.84	111.48	126.78	89.16
26-END	30.58	17.13	13.22	119.58	67.00	96.58	125.38	49.80	681.64	125.25	212.50	234.57

YEAR 1974

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	277.62	297.52	318.99*	125.75*	176.52*	112.08*	200.09*	383.85*	90.54	154.00	61.88	115.43
6-10	291.50	244.36	155.51*	179.68*	104.83*	75.97*	69.74*	176.75*	60.12	192.96	65.60	142.48
11-15	207.30	353.35	256.66*	136.58*	123.52*	69.45*	159.27*	75.79*	37.94	119.90	61.12	171.32
16-20	149.78	289.16*	28.20*	277.12*	344.19*	75.41*	230.93*	55.71*	58.56	186.57	122.38	221.06
21-25	144.52	248.17*	57.12*	355.08*	312.21*	222.09*	123.72*	293.46*	138.30	101.78	152.72	120.90
26-END	103.32	223.51*	59.37*	137.79*	226.52*	344.76*	108.15*	166.15	204.62	91.78	77.12	167.70

YEAR 1975

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	197.92	132.96	267.58	80.90	82.06	292.98	137.06	111.54	187.02	334.06	170.44	194.50
6-10	443.90	60.22*	152.24	75.68	190.60	274.20	171.28	92.90	249.00	318.18	281.36	124.96
11-15	308.28	31.75*	97.98	49.52	505.94	175.26	195.48	112.94	381.94	218.58	194.40	240.82
16-20	205.30	120.45	105.98	41.86	344.32	186.72	310.95	219.54	355.20	139.38	138.12	357.90
21-25	216.52	1025.48	185.98	58.90	381.97	180.60	161.88	452.88	291.14	134.33	120.90	267.46
26-END	127.02	311.77	90.19	58.60	187.20	181.30	168.30	181.48	385.63	124.60	180.77	214.48

YEAR 1976

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	179.84	172.12	52.16	56.72	97.74	52.14	99.90	101.42	129.56	57.92	217.08	138.34
6-10	116.70	91.74	61.76	69.30	128.08	130.88	108.96	66.50	68.30	68.08	310.02	62.84
11-15	184.24	136.72	97.92	31.36	206.60	159.76	168.30	60.72	56.80	87.46	286.38	68.28
16-20	149.50	75.12	44.54	171.45	150.68	91.58	90.66	153.32	63.88	151.80	153.98	69.64
21-25	273.90	65.36	68.08	51.00	86.84	64.30	71.30	127.32	126.22	190.84	129.14	176.96
26-END	592.63	72.13	58.52	77.16	50.82	73.08	93.88	187.35	60.28	214.87	140.80	174.28

YEAR 1977

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	173.46	184.54	338.05	65.96	65.16	177.26	257.96	115.30	131.66*	72.84	186.78	127.44
6-10	26.86	379.48	295.78	61.10	65.96	289.06	207.42	373.80	85.48*	207.40	373.04	202.12
11-15	186.70	285.20	193.16	103.66	178.30	308.52	296.40	330.40	39.29*	232.00	322.18	148.04
16-20	239.32	993.83	143.38	109.16	174.90	411.56	147.44	154.66	88.55	178.08	199.86	130.44
21-25	234.42	1447.23	130.82	77.10	214.54	367.60	208.08	322.00	71.04	244.80	327.08	160.68
26-END	224.45	518.50	79.82	92.12	325.32	220.94	253.10	444.55*	69.00	165.30	175.64	92.82

Remarks; *: Estimated value

Table 23 5-DAY NATURAL RUNOFF AT BRIDGE NO. 2 (2/2)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1973

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	3.84	1.44	1.58	2.16	8.38	28.60	32.80	31.90*	27.74	40.04	53.46	41.46
6-10	3.50	1.74	1.10	1.18	20.48	16.30	17.84	22.97	41.74	19.28	50.96	23.78
11-15	2.44	1.74	1.22	2.40	14.24	15.84	16.04*	27.24	42.38	15.82	19.04	19.88
16-20	2.38	1.52	1.14	4.06	12.90	9.18	10.37*	12.33	42.02	13.06	27.08	43.28
21-25	2.50	1.90	1.84	9.64	16.48	12.42	6.51*	9.50	65.36	9.52	28.04	44.84
26-END	1.97	1.37	1.15	14.82	11.35	24.14	17.04*	9.12	57.86	33.07	16.24	32.73

YEAR 1974

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	89.94	25.32	28.00	8.04	27.80	10.76	25.14	37.44	17.22	51.25	14.16	14.00
6-10	44.20	27.08	24.14	11.58	24.48	8.74	10.54	26.34	14.28	40.56*	10.58	39.14
11-15	26.50	213.26	38.94	12.12	22.72	9.84	15.60	12.98	15.16	43.49*	15.96	29.38
16-20	15.54	38.38	16.82	27.38	53.54	16.28	31.52	8.14	30.90	39.48*	15.32	20.26
21-25	13.40	51.58	11.14	14.22	43.24	25.72	23.80	16.00	38.36	20.14*	16.24	18.56
26-END	14.93	17.27	9.02	13.54	23.25	45.98	39.42	24.98	32.92	15.12	15.58	21.83

YEAR 1975

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	32.32	5.14	29.76	10.36	11.44	35.43	7.44	6.32	21.38	55.90*	50.16	19.83*
6-10	49.78	4.02	13.94	6.34	33.90	24.06	8.52	4.56	14.03	49.36*	46.00	22.62*
11-15	29.84*	3.78	11.36	4.12	39.98	13.58	12.44	4.84	28.20	30.16*	84.37*	15.99*
16-20	21.94*	9.80	15.84	3.98	26.04	14.02	17.78	5.62	32.43	19.58	23.10	21.97*
21-25	8.05	61.06	20.10	4.74	24.52	11.12	11.00	11.32	12.35*	10.90	22.60	12.71*
26-END	7.00	19.57	12.07	3.26	14.43*	9.98	13.38	9.58	41.31*	33.02	23.50	142.32*

YEAR 1976

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	20.80	17.88	6.14	6.66	21.78	15.90	8.44	19.30	15.63	4.52	21.38	7.44
6-10	22.42	11.90	23.04	18.94	21.26	23.02	8.66	8.18	6.80	12.58	37.34	46.30*
11-15	24.84	11.72	9.85	10.20	25.28	21.30	19.24	11.04	4.94	12.26	30.47*	29.87*
16-20	28.44	6.76	5.96	8.48	11.06	8.60	19.30	18.90	3.74	19.34	41.68*	26.31*
21-25	27.00	14.90	16.52	7.76	35.86	8.62	10.22	24.90	7.00	24.12	40.67*	19.40
26-END	30.22	13.98	6.57	14.94	12.00	10.06	10.53	27.32	4.30	22.65	9.34	18.40

YEAR 1977

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	5.02	14.58	16.32	6.06	6.60	14.72	7.28	10.40	10.42	10.38	24.92	24.30
6-10	3.26	26.20	14.10	6.42	6.02	19.18	15.62	15.08	7.34	33.38	30.72	25.00
11-15	31.08	25.68	10.06	9.68	13.55	22.86	24.52	11.08	5.44	26.04	17.62	16.70
16-20	26.10	114.28	10.88	13.38	29.18*	24.80	13.92	7.26	4.48	28.94	17.74	17.50
21-25	32.98	93.82	7.90	7.60	9.64*	17.58	10.82	9.88	7.56	24.68	19.40	9.90
26-END	17.65	22.43	6.40	8.20	20.95	8.80	16.15	29.65	6.94	22.62	34.28	6.47

Remarks; *: Estimated value

Table 25 5-DAY NATURAL RUNOFF AT MALANGANG (2/2)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1973

PERIOD	JAN.	FEB.	MAR.	APP.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	15.32	4.78	4.24	8.10	31.82	57.00	97.90	49.72	92.58	126.86	116.20	62.60
6-10	13.78	7.14	5.94	4.72	53.88	38.94	97.60	41.94	105.70	57.80	112.74	65.10
11-15	12.30	7.30	5.44	8.28	55.34	37.04	40.12	48.64	106.48	38.16	51.32	38.14
16-20	11.46	4.72	5.20	17.46	64.26	21.40	27.80	33.52	159.12	31.04	65.58	68.06
21-25	9.44	6.36	6.33	21.50	90.98	26.76	15.47*	34.26	129.84	22.72	107.58	115.80
26-END	4.28	4.20	4.73	68.64	54.88	48.60	91.02	37.00	161.20	57.78	146.42	95.63

YEAR 1974

PERIOD	JAN.	FEB.	MAR.	APP.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	178.18	19.78	25.62	14.78	39.60	16.10	75.74	48.12	22.60	132.90	56.58*	35.02
6-10	110.12	21.33	14.72	26.42	30.24	17.28	19.40	83.90	21.68	64.52	48.48*	50.34
11-15	42.86	204.25	212.30	22.18	53.10	17.86	25.08	40.94	25.54	91.50	17.67	54.46
16-20	14.32	41.32	44.12	42.50	192.46	55.40	31.50	17.12	67.83	87.10	23.00	39.66
21-25	7.90	49.66	21.74	13.48	191.58	64.32	26.34	16.86	125.48	38.82	95.58	33.34
26-END	10.32	55.57	14.40	12.25	27.43	115.16	37.77	32.07	91.20	96.63	41.28	23.03

YEAR 1975

PERIOD	JAN.	FEB.	MAR.	APP.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	48.42	17.89*	28.98	40.82	21.44	49.62	17.88	17.38	27.94	120.10	87.78	111.84
6-10	74.22	14.26*	23.60	20.32	65.44	37.84	12.88	11.30	35.26	108.42	107.04	105.86
11-15	38.94	3.36	15.52	11.16	91.72	21.00	19.36	6.76	37.02	54.04	223.90	82.40
16-20	43.57*	5.58	28.06	75.62	98.10	24.14	43.05	8.32	33.80	28.08	140.98	88.42
21-25	29.39*	22.52	37.16	13.16	69.40	26.20	38.64*	19.02	52.68	11.64	127.67	137.30
26-END	24.91*	14.73	24.08	6.22	41.70	25.60	36.00	12.05	98.12	96.50	94.50	351.95

YEAR 1976

PERIOD	JAN.	FEB.	MAR.	APP.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	157.94	64.66	60.75	21.98	56.70	34.64	23.27	44.16	53.58*	13.90	49.10	20.52
6-10	67.22	25.44	18.53*	44.23	53.68	53.70	31.99	18.30	37.50*	33.20	53.28	47.76
11-15	54.86	42.16	18.35*	3.39*	58.84	32.30*	42.76	16.72	13.20	49.56	61.38	50.04
16-20	90.06	29.48	19.97	11.12*	21.28	22.61*	58.92	17.00	18.56	70.48	41.42	30.76
21-25	90.48	44.96	20.56	29.65*	97.44	10.24*	27.80	17.08	17.42	65.26	64.18	67.08
26-END	106.52	53.90	14.32	41.72	30.65	33.04*	30.83	60.05	14.84	49.33	31.32	50.03

YEAR 1977

PERIOD	JAN.	FEB.	MAR.	APP.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	51.38	39.40	37.10	16.90	19.12	21.88	23.22	16.68	13.38	38.16	26.50	17.42
6-10	28.50	67.86	29.24	17.38	15.50	43.30	35.74	17.42	7.80	36.22	24.88	16.00
11-15	86.30	92.14	22.04	25.00	80.58	115.80	136.30	13.64	7.80	34.10	23.32	14.74
16-20	67.96	205.90	35.92	30.76	37.94	135.43	49.76	7.89	6.70	32.30	21.62	13.68
21-25	101.74	184.24	37.14	16.84	18.20	49.72	24.44	12.76	16.76	30.50	20.18	12.24
26-END	74.47	55.80	21.22	24.78	24.78	32.36	20.05	39.53	29.64	28.53	18.78	11.00

Remarks; *: Estimated value

Table 27 5-DAY NATURAL RUNOFF AT PENAMPANG (2/2)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1973

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	5.84	1.67	1.42	4.42	14.96	26.85	38.60	25.79*	55.76*	34.30	32.36	12.56
6-10	3.74	3.48	0.92	2.06	19.72	30.56	44.26	32.92*	70.94*	10.08	19.32	12.48
11-15	3.09	3.60	1.68	3.32	28.32	36.72	12.98	33.21*	66.25*	12.36	9.56	11.48
16-20	2.94	3.49	1.90	23.28	44.82	9.56	8.38	22.30*	34.14	7.44	7.82	24.86
21-25	2.02*	1.42	1.36	20.20	19.70	6.46	5.26	24.28*	24.86	6.38	33.86	42.08
26-END	2.78*	1.33	1.55	31.64	16.43	28.70	13.77	20.94*	32.96	28.83	47.70	29.70

YEAR 1974

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	50.04	29.30	7.96	3.22	3.23	5.78	41.28	14.86	14.86	53.02	17.74	14.80
6-10	34.74	12.30	4.34	3.12	3.99	5.82	10.32	33.30	20.96	30.82	15.20	16.50
11-15	10.94	61.68	66.46	9.76	7.38	7.48	12.68	14.72	29.38	33.04	11.38	25.84
16-20	5.73	12.84	6.58	9.78	11.50	16.32	11.26	9.64	31.78	29.98	15.18	13.14
21-25	7.68	12.14	6.16	3.98	15.30	18.64	10.74	12.90	54.08	15.30	46.36	12.12
26-END	11.33	3.43	3.93	11.44*	5.55	41.74	24.07	17.75	33.94	41.53	14.94	11.98

YEAR 1975

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	17.94	5.52	8.44	20.38	6.32	8.90	3.68	6.68	29.56*	34.40	14.82	12.20
6-10	26.32	4.40	11.50	9.72	11.02	10.08	4.74	3.30	14.32	30.36	13.68	13.92
11-15	18.36	3.40	7.18	6.36	13.48	8.58	4.48	1.80	20.78	18.56	51.92	9.84
16-20	13.44	2.78	10.38	5.24	14.60	20.92	6.72	2.08	11.58	12.26	24.70	13.52
21-25	9.04	10.39	7.88	4.42	11.44	9.64	11.92	11.96	7.60	7.88	11.98	7.82
26-END	7.68	6.37	8.97	2.78	3.88	7.28	18.53	5.08	25.42	35.50	6.76	87.58

YEAR 1976

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	38.40	9.56	9.02	1.98	16.48	13.14	7.46	10.19*	17.06	17.12	14.59*	11.29*
6-10	13.04	5.06	5.90	2.88	8.92	9.20	7.16	0.96	11.94	23.56	14.40*	29.32*
11-15	14.76	15.44	5.86	1.58	10.28	10.29*	11.44	3.08	12.28	23.96	19.30*	18.79*
16-20	15.36	6.68	3.40	3.54	3.68	7.20	9.27	7.96	16.54	23.04	26.39*	18.66
21-25	14.18	11.72	5.34	9.44	29.22	3.26	4.26	4.94	12.28	20.90	25.75*	30.06
26-END	18.15	13.48	2.47	12.72	6.05	10.52	2.82	28.90	13.96	14.92*	13.33*	17.35

YEAR 1977

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	14.10	14.44	11.70*	8.63	11.82	7.53	8.79*	6.14	1.76	22.69*	42.18	17.87*
6-10	12.64	15.82	7.95*	9.46	13.22	15.62	11.99*	10.42	1.20	36.74*	22.59*	26.70*
11-15	22.90	28.70	5.14*	10.16	38.32	32.22	26.83*	5.16	1.84	27.52*	12.96*	25.96*
16-20	21.56	25.00	16.40*	19.22	14.84*	37.75	13.73	3.04	3.81*	12.54	13.05*	25.86*
21-25	26.14	23.78	11.80	7.82	7.09*	14.61*	8.84	3.10	8.92*	17.06	14.27*	25.56*
26-END	21.42	13.33	8.80	10.60	9.83	10.42*	6.75	4.50	12.07*	68.00	25.21*	9.64*

Remarks; *: Estimated value

Table 29 5-DAY NATURAL RUNOFF AT TENOM LAMA (2/2)

Unit: m³/s

5 DAY AVERAGE DISCHARGE

YEAR 1976												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	885.75	346.56	157.92	210.12	399.04	75.94	81.00	165.20	134.12	47.93	475.56	96.82
6-10	676.20	152.92	205.28	296.56	251.16	172.16	120.52	79.52	70.50	80.78	345.44	99.84
11-15	388.86	140.52	302.42	123.10	226.22	125.66	100.88	68.66	47.50	77.82	511.60	215.92
16-20	498.58	99.38	116.88	154.24	120.86	87.44	98.50	128.88	41.36	260.90	204.54	121.32
21-25	390.48	279.30	168.26	99.76	183.52	58.40	64.22	219.16	92.96	212.96	348.90	169.22
26-END	551.22	295.95	201.38	200.70	64.38	54.54	82.40	225.10	66.64	317.32	141.70	143.83

YEAR 1977												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	249.84	128.14	517.40	178.78	349.70	512.32	194.54	105.20	72.77	80.88	383.32	426.06
6-10	99.26	285.88	191.46	319.52	289.98	351.40	323.72	109.60	51.66	307.54	415.54	531.14
11-15	388.46	327.52	138.82	528.28	731.26	486.52	611.26	110.00	44.74	296.98	219.80	1033.73*
16-20	332.28	499.44	472.60	446.00	599.17*	358.98	275.46	71.78	44.57	186.58	182.22	470.03*
21-25	278.62	689.72	411.08	626.98	282.76	332.70*	158.20	141.48	78.70	349.52	126.46	323.10*
26-END	280.22	385.80	176.75	409.82	1233.15	216.80*	195.45	236.52	81.12	259.46*	308.80	93.84*

Remarks; *: Estimated value

Table 33 5-DAY NATURAL RUNOFF AT SEBIU BRIDGE (2/2)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1975

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	44.70	5.26	7.25	28.74	2.96	2.88	2.50	3.80	57.42	16.24	5.08	8.86
6-10	12.62	3.96	3.48	10.34	3.70	9.24	2.54	2.96	12.78	3.96	8.88	9.58
11-15	7.74	3.38	3.58	6.24	2.68	2.84	2.92	3.98	3.40	9.14	4.68	16.32
16-20	3.72	4.32	14.52	19.84	16.58	3.24	3.22	9.08	13.14	8.14	15.82	33.00
21-25	11.66	12.14	6.22	5.16	7.50	2.88	21.48	13.10	7.30	5.22	6.86	33.50
26-END	18.22	12.97	9.22	7.12	3.52	3.60	18.08	13.80	34.84	22.13	24.66	16.18

YEAR 1976

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	3.89	6.48	12.89	12.79*	14.94	2.40	6.44	2.54	5.34	7.96	5.68	10.06
6-10	9.86	3.98	4.42	21.35*	6.28	3.30	3.38	1.36	5.94	3.68	15.06	3.74
11-15	43.48	4.62	4.66	19.12*	3.70	1.44	2.75	0.96	1.80	5.00	16.42	20.56
16-20	58.73	7.10	19.32	11.99*	3.20	0.86	3.16	1.70	1.08	2.64	20.64	41.78
21-25	18.78	3.76	3.46	9.99*	3.60	0.54	1.32	5.74	2.90	7.92	12.52	6.16
26-END	19.33	31.55	3.98	16.32*	1.27	0.52	2.03	24.60	5.40	13.33	20.80	4.97

YEAR 1977

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	5.70	23.64	27.88	26.10	3.82	2.18	1.56	2.08	4.42	8.72	14.84	18.78
6-10	3.52	10.44	34.28	7.20	4.94	3.30	1.46	3.34	4.82	10.04	6.38	26.54
11-15	31.42	6.08	21.74	4.70	5.32	6.08	0.70	1.28	16.82	10.96	4.28	21.10
16-20	65.38	34.34*	7.32	4.66	3.64	5.44	2.70	1.02	3.46	8.18	3.74	13.78
21-25	36.26	43.42	5.62	3.08	1.10	4.02	4.52	5.20	4.84	6.16	20.54	9.02
26-END	18.92	17.97	10.90	1.74	1.02	2.94	3.92	5.75	6.32	5.02	51.48	5.47

YEAR 1978

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	5.48	7.72	5.72	29.44	6.90	12.04	7.08	20.48	9.58	20.86	23.62	8.16
6-10	7.06	8.06	5.12	18.82	7.74	21.12	8.64	10.54	20.62	9.64	23.02	9.90
11-15	6.52	7.18	7.52	10.26	26.60	8.48	8.08	7.06	26.08	9.24	22.66	25.04
16-20	7.32	6.68	28.82	9.82	15.30	10.82	6.30	6.68	18.02	10.74	37.24	25.14
21-25	6.28	21.28	29.24	13.60	7.36	10.34	7.10	5.96	26.66	12.18	40.34	27.72
26-END	6.30	11.47	20.22	12.75	8.85	8.60	8.62	3.30	26.06	9.80	9.28	8.65

YEAR 1979

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	28.86	7.62	7.84	25.88	7.80	6.68	15.46	7.04	10.52*	6.36	12.84	8.66
6-10	8.86	8.36	8.40	26.88	7.44	6.30	10.96	5.92	8.89*	6.10	12.34	10.02
11-15	8.68	19.50	5.22	16.60	7.24	6.44	8.54	5.42	7.85*	6.70	10.30	10.02
16-20	7.28	8.44	5.18	6.80	7.52	7.62	7.48	5.32	14.28*	5.84	7.16	19.30
21-25	9.28	8.36	7.02	6.94	7.64	7.68	7.30	6.50	13.27*	9.26	7.38	10.32
26-END	9.06	4.47	19.70	7.18	6.68	6.80	6.57	25.18	19.16*	13.95	8.36	13.30

Remarks; *: Estimated value

Table 35 5-DAY NATURAL RUNOFF AT KAPIT (2/2)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1975

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	4433.92	4258.12	2457.22	3467.29	3301.06	2030.88	1063.98	2330.06	4282.52	4903.70	2769.56	1675.50
6-10	4068.46	1638.58	2634.94	3052.50	2081.60	3112.74	1174.60	1398.02	4426.88	3365.20	3005.10	1997.24
11-15	4328.99	1647.66	1817.52	2699.10	2125.82	1632.80	1206.48	1372.20	4157.30	3031.44	5556.08	4409.62
16-20	1905.10	1274.64	1947.24	2937.22	2062.64	1860.64	1803.56	1449.36	2734.58	2082.26	4624.44	4358.92
21-25	1930.62	2437.54	2354.54	2459.36	2577.34	1321.26	4169.18	1995.62	2131.06	3086.84	3971.02	3307.52
26-END	2907.85	2495.23	2070.08	1330.26	3215.60	1199.36	3528.36	2377.85	3993.38	3341.03	2641.62	4512.08

YEAR 1976

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	3704.32	4692.80	3776.12	2265.30	5902.86	1065.76	1397.50	1378.10	3084.86	1673.74	3026.86	3242.30
6-10	2530.44	1705.64	2327.38	2091.94	5158.90	2106.32	2101.84	1569.72	1348.66	2823.08	4094.50	2380.52
11-15	3970.10	1754.50	2581.56	1811.16	1677.30	1863.30	2096.16	1260.12	1221.82	6819.14	4780.66	2096.52
16-20	3672.60	2532.74	2124.14	2263.42	1454.74	1793.92	1236.24	1309.66	1072.78	3734.76	5174.76	3046.10
21-25	4603.56	3167.52	2951.28	2435.28	1140.78	1099.68	1002.12	1407.26	1258.16	2803.66	3772.60	4321.30
26-END	4519.63	4425.03	1994.72	3187.42	1054.30	1171.04	1156.28	3000.27	1394.06	2860.60	4673.44	2845.87

YEAR 1977

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	3615.36	2035.26	5886.76	5577.54	3615.66	1802.58	1714.45*	1175.22	1749.24	2086.30	3875.02	5732.40
6-10	1809.90	3230.40	3139.54	4057.00	2288.62	2306.64	2080.63	1182.42	1114.32	3973.80	5359.38	4463.64
11-15	1736.66	2621.58	4028.90	3387.20	5179.66	2242.74	4409.84	1277.90	1146.20	3462.34	4314.00	3616.56
16-20	3096.86	3256.30	4775.84	1559.96	3578.88	1914.70	2440.78	1287.68	1084.57	2524.20	3156.66	3786.74
21-25	5164.66	4866.74	4780.04	2638.48	1643.30	1620.22	1259.12	1500.86	1108.16	2438.32	3323.98	4268.56
26-END	3942.98	6891.50	4619.85	2534.52	1534.03	1348.26	1400.93	2653.28	1288.60	1626.08	5683.86	2862.30

YEAR 1978

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	2513.74	1429.78	3416.84	2223.92	2603.94	3354.34	1320.88	1489.40	2637.97	1489.80	3239.06	1399.94
6-10	2396.82	1328.74	3642.64	2147.88	4377.94	2696.92	1964.24	1135.66	2866.82	1313.78	6176.88	2213.18
11-15	4650.78	2466.54	4656.26	1964.38	6421.02	2673.72	3552.52	1049.22	2705.08	1154.62	4298.58	2901.18
16-20	3070.90	3452.20	5077.96	2430.30	3158.46	1961.06	3133.42	1565.72	1685.24	1160.48	3622.64	3594.92
21-25	4271.36	1777.90	3573.38	2870.08	2468.18	1251.66	2905.70	1194.75	1854.96	2556.12	2843.50	6381.10
26-END	3802.93	2926.07	4174.15	1766.94	1648.00	1161.78	2667.90	1916.36	2547.18	4678.93	1622.32	3933.47

YEAR 1979

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	5420.96	3489.14	1874.14	3369.58	3517.28	1772.60	1397.12	1712.66	3822.50	1933.28	3860.16	4588.12
6-10	4824.62	3377.88	3556.24	4740.72	3338.84	2706.08	1628.38*	1196.73	4598.14	1347.16	4423.24	3614.88
11-15	2696.52	3643.48	2564.96	3116.74	2576.48	3234.86	1859.65	1133.95	4330.54	1275.18	3995.36	2751.60
16-20	1342.84	4191.56	2011.60	1712.70	1180.72	4051.42	2637.56	1118.15	4502.72	1340.42	4948.62	3120.46
21-25	1350.74	2981.52	1786.38	1331.52	1095.78	4833.60	3622.78	1410.70*	4193.56	2254.58	6796.70	3025.92
26-END	2338.23	2545.17	2315.42	2324.66	1434.29*	2138.40	2290.27	1703.43	3812.54	2772.33	6701.96	3091.12

YEAR 1980

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	3191.00	1885.68	2384.62	3058.24	3489.60	3304.00	1490.10	3123.42	1825.24	1459.18	2691.58	4479.26
6-10	4337.48	1777.88	2049.06	3064.24	4449.02	3925.46	1383.00	3878.96	1546.62	1848.26	3004.78	3476.90
11-15	4408.82	1699.36	1852.28	3763.32	3683.40	2370.58	1414.16	3600.60	1381.76	3334.60	3454.36	2640.28
16-20	3536.36	4054.06	2399.80	4725.34	2252.98	3746.66	1457.72	2796.80	1483.82	6001.04	2935.20	2002.10
21-25	3554.86	4385.52	1628.66	2851.16	1675.24	1879.62	1811.00	3813.86	1678.94	2718.66	4868.26	2820.82
26-END	4373.90	3107.42	2031.53	2549.04	2121.47	2265.62	2379.53	2562.92	2259.06	2009.13	5262.72	2462.42

Remarks; *: Estimated value

Table 36 5-DAY NATURAL RUNOFF AT SERIAN (1/3)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1964												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	38.2A	87.0R	181.1A	34.82	47.50	17.42	13.42	98.84	27.76	13.32	81.36	24.16
6-10	79.14	170.20	55.4R	52.7R	85.7R	25.70	13.20	19.8R	70.0R	16.04	122.60	14.3R
11-15	137.74	86.7R	181.9A	18.00	104.7R	36.56	18.22	13.64	30.0R	59.80	47.32	15.7R
16-20	151.6R	86.9R	98.8R	55.3R	18.22	24.94	44.0R	11.5R	21.02	26.8R	26.0R	35.32
21-25	46.34	54.12	29.06	64.30	24.72	16.0R	31.12	11.66	21.86	33.50	29.42	53.56
26-END	56.15	157.55	54.80	35.10	14.0R	15.90	46.52	11.82	18.1R	23.72	47.50	153.53
YEAR 1965												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	144.26	18.12	78.36	47.24	87.26	14.0R	12.42	7.82	9.40	46.2R	60.20	27.16
6-10	105.6R	118.9R	75.4R	50.0R	52.7A	43.10	10.96	18.06	25.22	12.3R	30.56	97.6R
11-15	74.12	165.1A	84.5A	33.10	78.32	32.5R	8.73	85.15	16.83	36.27	32.17	60.30A
16-20	171.54	105.12	158.54	26.62	49.52	36.7R	8.50*	66.20*	24.19*	42.25*	30.91*	91.44*
21-25	30.02	25.6R	37.3A	30.72	28.66	16.1R	8.2R*	47.27*	31.56*	48.23*	29.66*	122.59*
26-END	15.53	23.50	26.80	69.74	16.33	24.44	8.05*	28.33*	38.92*	54.22*	28.41*	153.74*
YEAR 1966												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	184.8R	89.7R	33.8R	45.1R	62.60	32.92	17.7R	8.14	25.4R	131.30	55.84	78.80
6-10	120.44	54.7R	74.26	52.9R	39.20	16.66	57.62	29.02	30.24	49.70	96.06	37.02
11-15	61.16	64.24	55.56	51.36	23.24	29.72	17.70	9.52	46.2R	62.84	116.96	80.70
16-20	106.72	160.7A	35.14	37.34	36.40	60.7R	18.30	82.54	25.76	38.04	119.74	43.64
21-25	128.32	93.84	124.40	40.5A	27.2R	43.84	8.50	70.12	21.72	38.90	49.60	46.66
26-END	164.45	29.75	79.20	68.1R	40.07	13.72	14.5R	52.82	48.36	74.17	58.04	89.00
YEAR 1967												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	118.02	119.9R	182.24	23.52	40.16	13.14	14.74	8.70	16.42	8.46	107.96	57.34
6-10	146.1R	42.54	129.20	45.70	39.00	11.26	9.1R	9.6R	8.16	9.56	80.70	154.74
11-15	168.26	41.10	174.56	18.30	53.1R	15.84	8.06	6.7R	19.64*	14.32	68.0R	79.44
16-20	105.30	52.44	79.44	56.84	116.88	33.74	24.56	11.64	49.68*	9.94	66.1R	84.7R
21-25	51.1R	61.36	32.32	72.04	60.9R	13.10	30.40	7.40	33.34	82.3R	70.06	65.9R
26-END	47.1R	81.63	20.72	102.14	74.95	13.66	23.04*	4.93	105.44	46.90	29.4R	91.92
YEAR 1968												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	143.5R	17.7R	50.20	40.12	57.94	77.06	69.80	20.14	19.14	25.60	37.10	35.94
6-10	162.70	18.46	68.10	22.2R	23.00	42.72	23.82	13.16	13.2R	41.76	54.46	75.60
11-15	241.60	71.40	65.74	20.52	17.9R	24.16	32.36	31.52	22.64	60.20	18.9R	67.1R
16-20	230.16	14.66	141.1R	45.3R	32.4R	40.20	80.4R	44.70	19.44	21.02	37.64	60.96
21-25	56.74	8.94	104.5R	48.9R	41.50	27.44	32.70	39.26	17.2R	20.7R	53.22	98.54
26-END	22.45	11.05	119.35	87.42	102.07	44.04	25.02	34.73	16.1R	27.53	24.04	84.62
YEAR 1969												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	61.8A	44.1R	50.86	56.04	72.21*	34.60	29.4R	22.36	63.40	34.14	172.1R	47.94
6-10	46.64	28.12	47.0R	80.8R	40.06	29.74	10.72	22.86	29.34	29.5R	149.40	41.02
11-15	86.74	155.16	63.96	53.55	55.5R	21.42	47.90	61.56	19.5R	87.76	92.26	94.74
16-20	56.4R	97.30	57.00	62.9R	97.12	19.44	17.74	79.30	25.66	53.92	97.66	146.74
21-25	45.7R	41.7R	28.04	54.26	47.2R	26.74	32.74	76.64	20.5R	79.70	60.40	270.06
26-END	55.82	43.92	43.95	57.35	66.35	17.22	16.15	121.13	21.54	191.02	45.72	147.52
YEAR 1970												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	162.2R	120.7R	24.04	38.40	54.36	45.02	36.1R	55.42	36.94	41.9R	80.94	103.52
6-10	120.46	129.72	34.92	102.92	109.56	37.3R	18.30	107.32	62.32	48.1R	112.14	67.44
11-15	173.6R	68.02	38.14	38.3R	49.5R	53.94	15.8R	48.06	38.30	56.54	64.82	60.24
16-20	188.12	55.92	29.10	43.30	58.16	30.12	12.70	140.9R*	157.2R	37.52	76.82	73.82
21-25	188.24	32.42	42.70	84.56	53.20	24.10	47.3R	28.64*	120.74	43.46	182.82	101.86
26-END	111.5R	23.22	92.47	87.00	43.05	30.12	28.45	73.45	73.54	76.47	110.62	51.94
YEAR 1971												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	58.82	142.3A	63.12	67.94	32.62	81.2R	52.94	28.94	45.10	56.8R	121.70	86.80
6-10	101.30	202.62	45.1R	43.30	34.92	50.5R	25.54	34.1R	67.90	28.00	126.72	177.1A
11-15	143.50	83.40	29.6A	39.90	35.04	28.94	38.82	19.86	94.40	35.76	88.74	154.9R
16-20	56.34	71.94	27.62	55.16	50.54	24.44	30.9R	73.80	57.8R	67.4R	81.74	122.80
21-25	143.92	153.44	111.50	36.16	28.04	20.9R	70.6R	98.00	67.76	52.36	72.82	165.10
26-END	119.53	78.60	63.35	48.74	52.72	51.44	20.57	39.63	76.1R	77.33	85.9R	113.47

Remarks; *: Estimated value

Table 38 5-DAY NATURAL RUNOFF AT SERIAN (3/3)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1980

PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1- 5	195.64	23.90	61.18	51.28	35.98	20.68	30.70	12.30	16.08	26.08	72.72	165.62
6-10	170.44	24.40	66.86	29.84	47.18	32.76	10.80	30.38	53.96	30.46	85.30	82.76
11-15	80.10	111.66	37.20	37.40	30.48	20.38	11.22	36.88	19.38	50.60	67.56	76.86
16-20	94.68	100.34	49.68	72.60	15.88	41.60	14.94	26.50	20.24	146.08	50.78	41.14
21-25	113.08	224.92	26.50	54.94	8.32	19.52	11.82	25.58	24.24	49.04	135.62	97.36
26-END	36.80	152.25	43.12	47.46	29.72	12.18	18.88	18.65	77.82	29.53	105.24	50.63

Table 40 5-DAY NATURAL RUNOFF AT PK. BUAN BIDI (2/2)

Unit: m³/s

*** 5 DAY AVERAGE DISCHARGE ***

YEAR 1978												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	32.62	6.64	33.90	28.64	11.24	5.64	4.02	12.38	3.80	4.80	24.04	17.98
6-10	37.32	7.38	15.32	14.26	9.70	11.58	4.72	8.32	9.00	2.98	12.50	12.32
11-15	28.92	7.68	16.08	16.38	14.30	9.76	10.70	7.02	11.86	2.30	8.16	13.32
16-20	16.48	4.14	18.42	8.12	10.16	8.88	6.86	6.12	4.72	4.30	12.22	40.38
21-25	120.28	4.22	38.10	0.50	8.82	5.34	9.44	7.36	16.26	9.14	10.28	51.84
26-END	13.57	12.03	29.42	9.12	8.25	4.54	9.22	3.30	4.26	18.10	9.84	20.13

YEAR 1979												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	52.68	21.16	9.96	15.38	17.78	5.44	8.08	7.22	26.58	6.26	18.06	23.20
6-10	26.66	30.08	23.28	24.30	9.92	14.40	5.04	3.80	24.12	9.28	27.46	27.88
11-15	11.92	20.08	6.68	20.66	7.30	8.70	5.50	2.80	31.94	9.68	19.74	40.88
16-20	7.86	26.10	6.24	8.74	4.16	12.02	4.10	5.46	13.60	23.92	17.64	16.74
21-25	47.70	10.20	5.42	7.98	5.90	7.38	11.70	7.46	16.86	21.38	22.96	18.84
26-END	28.40	8.43	7.03	14.80	6.42	10.88	8.05	14.35	14.66	14.53	36.28	42.92

YEAR 1980												
PERIOD	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1-5	61.30	9.20	15.60	14.14	9.66	10.02	7.28	9.60	7.54	7.64	20.90	14.02
6-10	34.54	11.84	11.42	20.70	8.84	23.24	3.28	10.14	14.58	6.14	20.30	11.06
11-15	23.66	15.10	7.12	18.20	8.64	9.06	5.16	12.84	5.78	7.50	12.68	17.36
16-20	52.08	57.36	9.72	33.66	4.90	5.68	8.96	8.12	17.68	18.24	11.96	7.28
21-25	25.78	40.08	7.18	33.62	4.86	4.84	5.26	13.36	11.56	29.12	21.44	30.74
26-END	17.67	31.72	8.05	14.58	20.05	5.78	9.77	9.72	14.26	10.40	17.02	11.42

Table 41 RAINFALL, RUNOFF RELATION AT KEY STATIONS (1/6)

Station: Jalan Kuhara
 Catchment Area: 104 (km²)

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Unit: mm
					Loss
1968	2,189	-	0	-	-
1969	1,932	849	0	849	1,083
1970	2,498	1,051	0	1,051	1,447
1971	2,464	923	0	923	1,541
1972	2,155	831	0	831	1,324
1973	2,138	-	-	-	-
1974	2,326	1,430	0	1,430	896
1975	2,294	-	0	-	-
1976	2,220	1,646	0	1,646	574
1977	2,524	-	-	-	-
Mean	2,274.0				1,144.2

Station: Tang Kulap
 Catchment Area: 5,730 (km²)

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Unit: mm
					Loss
1969	2,015	-	-	-	-
1970	2,812	-	-	-	-
1971	2,744	1,656	0	1,656	1,088
1972	2,879	1,386	0	1,386	1,493
1973	2,250	910	0	910	1,340
1974	2,736	1,161	0	1,161	1,575
1975	2,506	-	-	-	-
1976	2,155	824	0	824	1,331
1977	2,644	1,911	0	1,911	733
Mean	2,526.8				1,260.0

Table 42 RAINFALL, RUNOFF RELATION AT KEY STATIONS (2/6)

Station: Porong
 Catchment Area: 3,240 (km²)

Unit: mm

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Loss
1964	2,288	1,538	0	1,538	750
1965	2,684	1,938	0	1,938	746
1966	2,600	1,442	0	1,442	1,158
1967	2,725	1,812	0	1,812	913
1968	2,205	1,634	0	1,634	571
1969	2,088	1,149	0	1,149	939
1970	2,485	1,859	0	1,859	626
1971	2,875	1,732	0	1,732	1,143
1972	2,439	1,442	0	1,442	997
1973	2,392	1,153	0	1,153	1,239
1974	2,970	-	-	-	-
1975	2,914	2,138	0	2,138	776
1976	2,252	1,209	0	1,209	1,043
1977	3,180	2,238	0	2,238	942
Mean	2,578.4				911.0

Station: Bridge No. 2
 Catchment Area: 243 (km²)

Unit: mm

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Loss
1965	4,070	2,645	0	2,645	1,425
1966	4,281	2,586	0	2,586	1,695
1967	4,081	1,921	0	1,921	2,160
1968	3,080	2,033	0	2,033	1,047
1969	3,492	1,930	0	1,930	1,562
1970	4,459	-	-	-	-
1971	5,020	2,651	0	2,651	2,369
1972	3,900	2,191	0	2,191	1,709
1973	3,999	2,467	0	2,467	1,532
1974	4,178	3,503	0	3,503	675
1975	5,117	2,407	0	2,407	2,710
1976	4,164	2,112	0	2,112	2,052
1977	4,110	2,358	0	2,358	1,752
Mean	4,150.0				1,724.0

Table 43 RAINFALL, RUNOFF RELATION AT KEY STATIONS (3/6)

Station: Malangang
 Catchment Area: 564 (km²)

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Unit: mm
					Loss
1965	3,101	2,696	0	2,696	405
1966	3,704	2,828	0	2,828	876
1967	3,157	1,876	0	1,876	1,281
1968	2,518	1,703	0	1,703	815
1969	3,227	2,196	0	2,196	1,031
1970	3,859	2,615	0	2,615	1,244
1971	3,977	2,617	0	2,617	1,360
1972	3,289	2,373	0	2,373	916
1973	3,737	2,813	0	2,813	924
1974	3,979	2,827	0	2,827	1,152
1975	4,012	3,062	0	3,062	950
1976	3,255	2,390	0	2,390	865
1977	3,782	2,226	0	2,226	1,556
Mean	3,507.5				1,028.0

Station: Penampang
 Catchment Area: 200 (km²)

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Unit: mm
					Loss
1965	3,184	1,694	0	1,694	1,490
1966	4,005	2,293	0	2,293	1,712
1967	3,370	1,813	0	1,813	1,557
1968	2,805	1,749	0	1,749	1,056
1969	3,833	2,666	0	2,666	1,167
1970	4,150	2,457	0	2,457	1,693
1971	3,906	2,865	0	2,865	1,041
1972	3,189	2,102	0	2,102	1,087
1973	3,934	2,625	0	2,625	1,309
1974	3,863	2,852	0	2,852	1,011
1975	3,832	2,112	0	2,112	1,720
1976	3,209	1,926	0	1,926	1,283
1977	3,678	2,593	0	2,593	1,085
Mean	3,612.2				1,323.9

Table 44 RAINFALL, RUNOFF RELATION AT KEY STATIONS (4/6)

Station: Tenom Lama
 Catchment Area: 7,718 (km²)

Unit: mm

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Loss
1968	2,089	-	-	-	-
1969	1,731	680	0	680	1,051
1970	2,285	1,094	0	1,094	1,191
1971	2,059	967	0	967	1,092
1972	1,603	781	0	781	822
1973	2,308	943	0	943	1,365
1974	2,394	927	0	927	1,467
1975	1,945	-	-	-	-
1976	1,801	820	0	820	981
1977	1,909	1,333	0	1,333	576
Mean	2,012.4				1,068.1

Station: Long Pilah (A)
 Catchment Area: 9,300 (km²)

Unit: mm

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Loss
1966	3,942	2,467	0	2,467	1,475
1967	3,550	2,108	0	2,108	1,442
1968	4,413	2,674	0	2,674	1,739
1969	4,014	2,923	0	2,923	1,091
1970	4,411	3,322	0	3,322	1,089
1971	3,785	2,699	0	2,699	1,086
1972	3,008	2,120	0	2,120	888
1973	3,236	2,265	0	2,265	971
1974	3,597	2,285	0	2,285	1,312
1975	4,064	2,417	0	2,417	1,647
1976	3,932	2,607	0	2,607	1,325
1977	3,984	2,779	0	2,779	1,205
1978	3,423	2,190	0	2,190	1,233
1979	4,286	2,731	0	2,731	1,555
1980	3,990	-	-	-	-
Mean	3,842.3				1,289.9

Table 45 RAINFALL, RUNOFF RELATION AT KEY STATIONS (5/6)

Station: Sebin Bridge
 Catchment Area: 155 (km²)

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Unit: mm
					Loss
1967	4,045	2,904	0	2,904	1,141
1968	3,171	2,510	0	2,510	661
1969	3,859	2,388	0	2,388	1,471
1970	3,571	2,713	0	2,713	858
1971	3,975	-	-	-	-
1972	2,886	1,349	0	1,349	1,537
1973	3,847	1,939	0	1,939	1,908
1974	3,553	2,077	0	2,077	1,476
1975	4,055	2,248	0	2,248	1,807
1976	3,697	-	-	-	-
1977	4,493	-	-	-	-
1978	2,389	-	-	-	-
1979	3,884	1,973	0	1,973	1,911
Mean	3,648.1				1,418.9

Station: Kapit
 Catchment Area: 33,800 (km²)

Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Unit: mm
					Loss
1967	4,654	2,672	0	2,672	1,982
1968	4,500	2,853	0	2,853	1,647
1969	4,268	3,114	0	3,114	1,154
1970	4,883	3,105	0	3,105	1,778
1971	4,093	2,547	0	2,547	1,546
1972	3,851	2,162	0	2,162	1,689
1973	4,905	2,889	0	2,889	2,016
1974	3,988	2,519	0	2,519	1,469
1975	4,125	2,581	0	2,581	1,544
1976	3,759	2,463	0	2,463	1,296
1977	4,021	2,737	0	2,737	1,284
1978	4,370	2,493	0	2,493	1,877
1979	3,924	2,732	0	2,732	1,192
1980	4,457	2,648	0	2,648	1,809
Mean	4,271.3				1,591.6

Table 46 RAINFALL, RUNOFF RELATION AT KEY STATIONS (6/6)

Station: Serian
 Catchment Area: 941 (km²)

Unit: mm					
Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Loss
1964	3,706	-	-	-	-
1965	3,329	1,576	0	1,576	1,753
1966	3,516	1,935	0	1,935	1,581
1967	3,101	1,793	0	1,793	1,308
1968	3,256	1,758	0	1,758	1,498
1969	3,299	2,121	0	2,121	1,178
1970	3,205	2,389	0	2,389	816
1971	3,436	2,359	0	2,359	1,077
1972	2,728	1,552	0	1,552	1,176
1973	3,844	2,323	0	2,323	1,521
1974	3,558	2,108	0	2,188	1,370
1975	3,607	2,110	0	2,110	1,497
1976	3,243	1,704	0	1,704	1,539
1977	3,914	2,441	0	2,441	1,473
1978	3,560	1,925	0	1,925	1,635
1979	3,137	1,608	0	1,608	1,529
1980	3,308	1,864	0	1,864	1,444
Mean	3,396.9			1,977.9	1,399.7

Station: P.K. Buan Bidi
 Catchment Area: 217 (km²)

Unit: mm					
Year	Rainfall	Gauge Runoff	Irrigation Withdrawals	Total Runoff	Loss
1970	3,898	-	-	-	-
1971	4,703	-	-	-	-
1972	3,431	2,099	0	2,099	1,332
1973	4,231	2,889	0	2,889	1,342
1974	3,471	2,104	0	2,104	1,367
1975	4,299	2,357	0	2,357	1,942
1976	3,889	2,488	0	2,488	1,401
1977	5,363	3,702	0	3,702	1,661
1978	3,032	2,282	0	2,282	750
1979	4,060	2,404	0	2,404	1,656
1980	4,168	2,285	0	2,285	1,883
Mean	4,049.5				1,481.6

Table 47 CONVERSION RATIO FROM KEY STATION TO BASINS

Station Name	Key Station					Applied Basin					*
	Co Catch- ment Area (km ²)	Ro Rain- fall (mm)	Qo Run- off (mm)	Lo Loss (mm)	fo Run- off Ratio	Basin No.	Ci Catch- ment Area (km ²)	Ri Rain- fall (mm)	fi Run- off Ratio	Qi Run- off (mm)	
Jalan Kuhara	104	2,266	1,122	1,144	0.495	201	5,971	2,491	0.541	1,347	68.98
						202	1,308	2,093	0.453	949	10.63
						203	1,371	2,168	0.472	1,024	12.03
						204	741	2,071	0.448	927	5.89
						205	553	2,013	0.432	869	4.12
						206	558	2,080	0.450	936	4.48
						207	888	2,262	0.494	1,118	8.51
						208	2,792	2,233	0.488	1,089	26.08
						209	2,714	2,639	0.567	1,495	34.81
						210	5,558	2,549	0.551	1,405	66.92
Tang Kulap	5,730	2,568	1,308	1,260	0.509	211	16,755	2,660	0.526	1,400	3.13
Porong	3,240	2,548	1,637	911	0.642	212	2,335	3,161	0.712	2,250	0.992
						213	6,829	3,272	0.722	2,361	3.04
						214	3,094	3,255	0.720	2,344	1.37
						215	1,474	3,506	0.740	2,595	0.722
Bridge No.2	243	3,889	2,464	1,425	0.634	216	1,866	2,700	0.472	1,275	3.97
						217	2,126	2,582	0.448	1,157	4.10
						218	1,336	3,130	0.545	1,705	3.80
Malangang	564	3,541	2,461	1,080	0.695	219	1,247	3,023	0.643	1,943	1.75
Penampang	200	3,612	2,288	1,324	0.633	220	629	3,126	0.576	1,802	2.48
						221	805	3,190	0.585	1,866	3.29
						222	607	3,106	0.574	1,782	2.37
						223	736	3,064	0.568	1,740	2.80
Tenom Lama	7,718	2,011	943	1,068	0.469	224	9,180	2,110	0.494	1,042	1.31
Penampang	200	3,612	2,288	1,324	0.633	225	86	3,376	0.608	2,052	0.386
						226	1,291	2,900	0.543	1,576	4.45
						227	1,080	3,762	0.648	2,438	5.76
						228	2,768	2,999	0.559	1,675	10.15
Long Pilah(A)	9,300	3,743	2,499	1,244	0.633	229	3,920	3,884	0.680	2,640	0.449
						230	22,325	3,794	0.672	2,550	2.47
Sebiu Bridge	155	3,652	2,233	1,419	0.611	231	788	2,976	0.523	1,557	3.55
						232	935	2,745	0.483	1,326	3.58
						233	1,345	2,681	0.471	1,262	4.91
						234	1,440	2,993	0.526	1,574	6.55
						235	1,268	3,378	0.580	1,959	7.18
						236	6,000	3,918	0.638	2,499	43.36
						237	5,150	3,912	0.637	2,493	37.11
						238	2,518	3,830	0.630	2,411	17.57
						239	2,625	3,914	0.637	2,495	18.92
						240	2,005	3,369	0.579	1,950	11.31
Kapit	33,800	4,170	2,680	1,490	0.643	241	51,053	3,991	0.627	2,501	1.41
Serian	941	3,378	1,978	1,400	0.586	242	1,675	3,637	0.615	2,237	2.01
						243	1,900	3,547	0.605	2,147	2.19
						244	6,813	3,612	0.612	2,212	8.09
						245	3,645	3,716	0.633	2,316	4.53
Pk. Buan Bidi	217	3,994	2,512	1,482	0.629	246	3,358	4,193	0.647	2,711	16.71
						247	1,838	4,793	0.691	3,311	11.17

Remarks; *: Conversion ratio = (Ci·Ri·fi)/(Co·Ro·Fo);

Qi = Ri - Lo; fi = Qi/Ri

Table 48 WATER BALANCE BY RIVER BASIN

Unit: 10⁹ m³/year

Basin No.	Name of Basin	Catchment Area (km ²)	Rainfall	Evapo-transpiration	Ground-water Recharge	Surface Runoff
201	Pensiangan	5,971	14.87	5.84	0.12	8.91
202	Serudong	1,308	2.74	1.33	0.03	1.38
203	Kalaban	1,371	2.97	1.39	0.02	1.56
204	Brantian	741	1.53	0.75	0.02	0.76
205	Umas Umas	553	1.11	0.56	0.02	0.53
206	Merutai Besar	558	1.16	0.56	0.02	0.58
207	Tawau	888	2.01	0.84	0.07	1.10
208	Kalumpang	2,792	6.23	2.75	0.11	3.37
209	Silibukan	2,714	7.16	2.43	0.24	4.49
210	Segama	5,558	14.17	5.13	0.39	8.65
211	Kinabatangan	16,755	44.57	21.56	0.69	22.32
212	Segaliud	2,335	7.38	1.97	0.10	5.31
213	Labuk	6,829	22.34	5.62	0.41	16.31
214	Sugut	3,094	10.07	2.56	0.17	7.34
215	Paitan	1,474	5.17	1.14	0.16	3.87
216	Bengkoka	1,866	5.04	2.62	0.05	2.37
217	Bongan	2,126	5.49	2.84	0.20	2.45
218	Kadamajan	1,336	4.18	1.78	0.13	2.27
219	Tuaran	1,247	3.77	1.28	0.06	2.43
220	Putatan	629	1.97	0.75	0.07	1.15
221	Papar	805	2.57	1.00	0.04	1.53
222	Kimanis	607	1.89	0.74	0.05	1.10
223	Membakut	736	2.26	0.85	0.11	1.30
224	Padas	9,180	19.37	9.49	0.45	9.43
225	Labuan	86	0.29	0.10	0.01	0.18
226	Lakutan	1,291	3.74	1.61	0.06	2.07
227	Lawas	1,080	4.06	1.35	0.03	2.68
228	Trusan	2,768	8.30	3.52	0.07	4.71
229	Limbang	3,920	15.23	4.42	0.23	10.58
230	Baram	22,325	84.70	24.95	1.54	58.21
231	Miri	788	2.35	0.90	0.15	1.30
232	Sibuti	935	2.57	1.19	0.07	1.31
233	Niah	1,345	3.61	1.77	0.05	1.79
234	Buai	1,440	4.31	1.85	0.07	2.39
235	Similajau	1,268	4.28	1.59	0.07	2.62
236	Kemena	6,000	23.51	7.51	0.17	15.84
237	Tatau	5,150	20.15	6.27	0.32	13.55
238	Balingian	2,518	9.64	2.79	0.44	6.42
239	Mukah	2,625	10.27	2.88	0.47	6.92
240	Oya	2,005	6.75	2.35	0.27	4.13
241	Rajang	51,053	203.75	73.24	3.31	127.20
242	Kerian	1,675	6.09	2.07	0.22	3.73
243	Saribas	1,900	6.74	2.29	0.31	4.07
244	Lupar	6,813	24.61	8.46	0.88	15.01
245	Sadong	3,645	13.54	4.42	0.57	8.40
246	Sarawak	3,358	14.08	4.48	0.43	9.17
247	Kayan	1,838	8.81	2.49	0.19	6.13

Table 49 DETAILS OF FLOW DURATION CURVE
AT KEY STATIONS (1/6)

Station	: Jalan Kuhara	Station	: Tang Kulap
Year	: 1968 - 1977	Year	: 1964 - 1977
Total	: 2,514 days	Total	: 2,276 days
Maximum	: 47.0 m ³ /s	Maximum	: 2,772.1 m ³ /s
Minimum	: 0.8 m ³ /s	Minimum	: 9.1 m ³ /s
Average	: 4.1 m ³ /s	Average	: 233.3 m ³ /s
Coefficient of River Regime	: 58.8	Coefficient of River Regime	: 304.6

Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)	Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)
5	10.3	250	5	728.0	312
10	7.9	191	10	521.0	223
15	6.5	157	15	379.7	162
20	5.7	138	20	319.9	137
25	5.0	121	25	276.6	118
30	4.5	109	30	244.2	104
35	4.1	99	35	218.9	93
40	3.7	89	40	197.2	84
45	3.3	80	45	175.9	75
50	3.0	72	50	160.8	68
55	2.7	65	55	144.6	61
60	2.5	60	60	127.3	54
65	2.4	58	65	112.9	48
70	2.2	53	70	96.7	41
75	2.0	48	75	81.6	34
80	1.8	43	80	70.2	30
85	1.6	38	85	57.9	24
90	1.4	34	90	46.0	19
95	1.2	29	95	33.4	14
96	1.2	29	96	28.5	12
97	1.1	26	97	25.4	10
98	1.1	26	98	20.2	8
99	1.0	24	99	13.0	5

Table 50 DETAILS OF FLOW DURATION CURVE
AT KEY STATIONS (2/6)

Station	: Porong	Station	: Bridge No. 2
Year	: 1964 - 1977	Year	: 1965 - 1977
Total	: 4,552 days	Total	: 4,460 days
Maximum	: 2,639.4 m ³ /s	Maximum	: 612.2 m ³ /s
Minimum	: 10.8 m ³ /s	Minimum	: 0.7 m ³ /s
Average	: 167.9 m ³ /s	Average	: 18.3 m ³ /s
Coefficient of River Regime	: 244.4	Coefficient of River Regime	: 874.6

Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)	Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)
5	398.9	237	5	45.7	249
10	307.2	182	10	35.8	195
15	261.4	155	15	30.3	165
20	228.1	135	20	26.8	146
25	201.9	120	25	23.8	129
30	184.4	109	30	20.9	114
35	169.0	100	35	19.0	103
40	156.3	93	40	17.3	94
45	144.0	85	45	15.5	84
50	133.8	79	50	14.2	77
55	122.8	73	55	13.0	70
60	112.9	67	60	11.7	63
65	103.2	61	65	10.3	56
70	92.6	55	70	9.0	49
75	80.8	48	75	7.9	43
80	69.8	41	80	6.6	36
85	59.6	35	85	5.4	29
90	50.3	29	90	4.1	22
95	38.5	22	95	2.8	15
96	35.8	21	96	2.6	14
97	32.4	19	97	2.2	12
98	25.6	15	98	1.7	9
99	17.5	10	99	1.4	7

Table 51 DETAILS OF FLOW DURATION CURVE
AT KEY STATIONS (3/6)

Station	: Malangang	Station	: Penampang
Year	: 1965 - 1977	Year	: 1965 - 1977
Total	: 4,405 days	Total	: 4,359 days
Maximum	: 546.6 m ³ /s	Maximum	: 194.1 m ³ /s
Minimum	: 1.3 m ³ /s	Minimum	: 0.4 m ³ /s
Average	: 44.3 m ³ /s	Average	: 14.4 m ³ /s
Coefficient of River Regime	: 420.5	Coefficient of River Regime	: 485.3

Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)	Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)
5	121.5	274	5	40.9	283
10	93.6	211	10	28.5	197
15	77.8	175	15	23.2	160
20	65.7	148	20	19.7	136
25	57.9	130	25	17.4	120
30	50.6	114	30	15.7	108
35	45.4	102	35	13.9	96
40	40.8	92	40	12.8	88
45	36.4	82	45	11.5	79
50	32.2	72	50	10.2	70
55	28.4	64	55	9.1	63
60	24.8	56	60	8.2	56
65	21.9	49	65	7.2	49
70	18.9	42	70	6.4	44
75	16.2	36	75	5.4	37
80	13.9	31	80	4.6	31
85	12.0	27	85	3.8	26
90	9.0	20	90	3.1	21
95	5.9	13	95	2.0	13
96	5.3	11	96	1.7	11
97	4.9	11	97	1.5	10
98	4.0	9	98	1.3	9
99	3.2	7	99	0.9	6

Table 52 DETAILS OF FLOW DURATION CURVE
AT KEY STATIONS (4/6)

Station	: Tenom Lama	Station	: Long Pilah (A)
Year	: 1968 - 1977	Year	: 1966 - 1980
Total	: 2,809 days	Total	: 5,148 days
Maximum	: 1,879.2 m ³ /s	Maximum	: 5,822.0 m ³ /s
Minimum	: 38.4 m ³ /s	Minimum	: 80.9 m ³ /s
Average	: 229.4 m ³ /s	Average	: 747.9 m ³ /s
Coefficient of River Regime	: 48.9	Coefficient of River Regime	: 72.0

Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)	Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)
5	622.4	271	5	2,016.5	269
10	475.9	207	10	1,494.4	199
15	391.2	170	15	1,201.9	160
20	333.5	145	20	1,024.5	136
25	292.9	127	25	910.0	121
30	259.9	113	30	814.0	108
35	233.7	101	35	739.8	98
40	207.3	90	40	669.3	89
45	189.7	82	45	613.5	82
50	174.2	75	50	561.4	75
55	159.4	69	55	510.6	68
60	147.7	64	60	464.3	62
65	134.1	58	65	426.6	57
70	121.1	52	70	389.4	52
75	108.8	47	75	353.9	47
80	95.1	41	80	320.1	42
85	83.3	36	85	277.7	37
90	68.7	29	90	232.0	31
95	52.5	22	95	183.8	24
96	51.0	22	96	171.2	22
97	47.3	20	97	160.6	21
98	44.5	19	98	146.0	19
99	41.8	18	99	127.2	17

Table 53 DETAILS OF FLOW DURATION CURVE
AT KEY STATIONS (5/6)

Station	: Sebiu Bridge	Station	: Kapit
Year	: 1967 - 1979	Year	: 1967 - 1980
Total	: 4,450 days	Total	: 4,989 days
Maximum	: 151.9 m ³ /s	Maximum	: 10,098.0 m ³ /s
Minimum	: 0.1 m ³ /s	Minimum	: 748.0 m ³ /s
Average	: 11.5 m ³ /s	Average	: 2,891.6 m ³ /s
Coefficient of River Regime	: 1,519.0	Coefficient of River Regime	: 13.5

Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)	Duration (%)	Runoff (m ³ /s)	Non-Dimensional Runoff (%)
5	40.8	356	5	5,565.9	192
10	27.7	241	10	4,849.6	167
15	20.7	180	15	4,365.2	150
20	15.1	131	20	3,945.1	136
25	11.9	103	25	3,688.0	127
30	10.3	89	30	3,450.8	119
35	8.9	77	35	3,239.1	112
40	8.1	70	40	3,050.4	105
45	7.4	64	45	2,845.5	98
50	6.9	60	50	2,666.3	92
55	6.2	54	55	2,463.1	85
60	5.6	48	60	2,258.5	78
65	5.1	44	65	2,092.1	72
70	4.6	40	70	1,925.2	66
75	4.1	35	75	1,746.3	60
80	3.7	32	80	1,581.2	54
85	3.3	28	85	1,436.6	49
90	2.8	24	90	1,304.5	45
95	1.9	16	95	1,162.8	40
96	1.7	14	96	1,136.5	39
97	1.5	13	97	1,107.9	38
98	1.3	11	98	1,069.5	36
99	1.0	8	99	1,009.5	34

Table 54 DETAILS OF FLOW DURATION CURVE
AT KEY STATIONS (6/6)

STATION : Serian
 YEAR : 1964 - 1980
 TOTAL : 6027 DAYS
 MAXIMUM : 1297.0 m³/s
 MINIMUM : 1.6 m³/s
 AVERAGE : 58.9 m³/s
 COEFFICIENT OF
 RIVER REGIME : 810.6

STATION : PK. Buan Bidi
 YEAR : 1970 - 1980
 TOTAL : 3821 DAYS
 MAXIMUM : 354.4 m³/s
 MINIMUM : 1.3 m³/s
 AVERAGE : 17.2 m³/s
 COEFFICIENT OF
 RIVER REGIME : 272.6

DURATION (%)	RUN-OFF (m ³ /S)	NON-DIMENSIONAL RUN-OFF (%)	DURATION (%)	RUN-OFF (m ³ /S)	NON-DIMENSIONAL RUN-OFF (%)
5	165.0	280	5	49.2	285
10	132.5	224	10	32.1	186
15	107.0	181	15	23.7	137
20	89.4	151	20	19.5	113
25	76.0	129	25	16.9	98
30	65.1	110	30	15.2	88
35	57.3	97	35	13.7	79
40	51.1	86	40	12.3	71
45	45.3	76	45	11.2	64
50	40.5	68	50	10.2	59
55	37.0	62	55	9.3	53
60	33.3	56	60	8.4	48
65	29.9	50	65	7.8	45
70	26.7	45	70	7.0	40
75	23.7	40	75	6.3	36
80	20.7	35	80	5.7	33
85	17.8	30	85	5.1	29
90	14.7	24	90	4.6	26
95	10.8	18	95	3.7	21
96	9.9	16	96	3.5	20
97	9.1	15	97	3.4	19
98	8.1	13	98	3.1	17
99	6.9	11	99	2.8	16

Table 55 PROBABLE STORM RAINFALL DEPTH OF 5 DAYS IN SABAH (1/2)

Unit: mm/5 days

Basin No.	River System	Site	Catchment (km ²)	Return Period			Duration Curve
				100-y	50-y	20-y	
201	S.Pensiangan	Malaysian Territory	5,463	180	150	120	3
204	S.Brantion	River mouth	741	390	325	250	2
207	S.Tawau	River mouth	888	415	345	260	2
208	S.Kalumpuang	Mostym Bridge*	544	410	375	270	2
		River mouth	2,792	380	330	270	2-1
210	S.Segama	Ulu Segama*	2,450	520	460	370	1
		River mouth	5,558	(470)	(400)	(320)	1
211	S.Kinabatangan	Ulu Kuamut*	2,950	520	450	360	1
		Tanglup*	5,730	460	400	320	1
		Barat*	10,800	(410)	(340)	(280)	1
		Balic Manis*	12,300	(400)	(330)	(270)	1
		River mouth*	16,755	(380)	(320)	(260)	1
212	S.Segarid	River mouth	2,335	(560)	(460)	(380)	1
213	S.Labuk	Bedukan*	440	560	485	380	2-1
		Tomboloi*	2,460	600	510	400	1
		Porog*	3,240	530	470	390	1
		Basai, Tungud*	700	(700)	(620)	(510)	1
		River mouth	6,829	(450)	(360)	(300)	1
214	S.Sugut	Ulu Sugut*	2,150	560	490	400	1
		River mouth	3,094	(520)	(440)	(370)	1
216	S.Bengkoka	Kobon*	570	(730)	(610)	(500)	1
		River mouth	1,866	(590)	(480)	(390)	1
217	S.Bengian	Simpangas*	228	940	830	660	1
		River mouth	2,126	(560)	(460)	(380)	1
218	S.Kadamaian	Bridge No. 2*	243	860	740	575	1
		Tamu Darat*	338	760	655	512	1
219	S. Tuaran	Melangong*	564	705	595	450	1
		River mouth	1,247	590	500	380	1
220	S.Patatan	Penampang*	200	590	450	330	2
		River mouth	629	410	340	270	2

Table 56 PROBABLE STORM RAINFALL DEPTH OF 5 DAYS IN SABAH (2/2)

Unit: mm/5 days

Basin No.	River System	Site	Catchment (km ²)	Return Period			Dura- ^{**} tion Curve
				100-y	50-y	20-y	
221	S.Papar	Penampang*	357	470	400	300	2
		Kagopan*	536	465	390	295	2
		River mouth	805	430	360	270	2
222	S.Kimanis	River mouth	607	(460)	(440)	(270)	2
224	S. Padas	Ansip*	2,175	240	210	170	3
		Sook, Biah*	1,684	240	210	165	3
		Kemabong*	3,185	200	170	130	3
		Tenom*	7,718	155	135	110	3
		River mouth	9,180	170	145	120	3
226	S.Lakutan	Mengalong*	522	(450)	(350)	(280)	2
		Mesapol Quarry*	317	(520)	(480)	(310)	2
		River mouth	1,291	240	295	225	2

- Remarks; (1) Site with * is Stream flow gauging station
 (2) Values in () are interpolated from the area-duration curves (Figs
 (3) ** means the number of curves in Fig. 16.

Table 57 PROBABLE STORM RAINFALL DEPTH OF 5 DAYS IN SARAWAK (1/2)

Unit: mm/5 days

Basin No.	River System	Site	Catchment (km ²)	Return Period			Duration** Curve
				100-y	50-y	20-y	
227	S.Lawas	River mouth	1,080	(330)	(300)	(240)	2
228	B.Trusan	River mouth	2,768	315	270	210	2
229	S.Limbang	NG.Medamit*	1,950	500	430	340	2-1
		River mouth	3,920	470	360	290	2-1
230	S.Baram	Long Tawaran*	3,360	395	330	250	2-1
		Lio Matu*	2,580	270	230	195	2
		Long Pilah	9,300	420	360	280	1
		Long Jegan*	2,390	470	380	290	2-1
		Confluence of B.Baram - B.Timiar	17,993	380	330	250	1
		River mouth	22,325	375	320	240	1
233	S.Niah	River mouth	1,345	(620)	(500)	(420)	1
236	S.Kemana	Sebiu (W)*	155	560	490	370	2-1
		River mouth	6,073	370	350	300	2-1
240	S.Oya	Confluence of S.Linau - S.Balui	2,603	270	230	180	2
		Long Liko*	7,041	200	190	170	2
		Nyabon*	9,644	180	170	160	2
		Belaga*	12,879	210	190	170	2
		P.Bilong*	21,294	200	190	170	2
		Gast*	1,478	305	260	205	2-1
		Gassan*	10,300	260	230	180	2-1
		Kapit*	33,800	240	210	170	2-1
		Katibas*	2,287	310	270	210	2
		River mouth	51,053	210	190	160	2-1
244	S.Lupar	Lubuk Antu*	1,300	320	300	230	2
		Confluence of B.Ai - B.Sekarang	1,898	345	300	230	2-1
		River mouth	6,813	425	370	290	1
245	S.Sadong	Serian	941	580	490	380	2
		Confluence of S.Sadong - S.Bedup	977	500	490	380	2
		River mouth	3,645	580	500	390	2

Table 58 PROBABLE STORM RAINFALL DEPTH OF 5 DAYS IN SARAWAK (2/2)

Unit: mm/5 days

Basin No.	River System	Site	Catchment (km ²)	Return Period			Duration** Curve
				100-y	50-y	30-y	
246	S.Sarawak	KG. Git*	425	(760)	(630)	(540)	1
		Bia*	217	(900)	(720)	(610)	1
		Kuching	1,633	830	720	560	1
		River mouth	3,358	840	730	580	1
247	B.Kayan	River mouth	1,837	960	840	620	1

- Remarks; (1) Site with * is Stream flow gauging station
 (2) Values in () are interpolated from the area-duration curves (Figs
 (3) ** means the number of curves in Fig. 17.

Table 59 ANNUAL EXTREME HIGH WATER LEVEL AND DISCHARGE (1/4)

Station	Year	Date	Water Level (m)	Discharge (m ³ /s)	Probability of Occurrence (%)
Lubuk Antu	1967	11.28	5.16	535	60.0
	1968	10.31	5.77	995	26.7
	1969	4.20	4.44	551	53.3
	1970	1.04	4.15	471	66.7
	1971	-	0.00	0	80.0
	1972	-	0.00	0	86.7
	1973	-	0.00	0	93.3
	1974	9.09	3.73	740	40.0
	1975	12.24	1.59	260	73.3
	1976	4.05	3.69	729	46.7
	1977	2.09	5.30	1,248	6.7
	1978	12.27	3.92	794	33.3
	1979	-	4.69	1,035	20.0
	1980	-	4.71	1,042	13.3
K. Git	1970	12.31	4.51	126	84.6
	1971	1.23	12.68	793	15.4
	1972	1.21	8.66	393	69.2
	1973	12.28	11.49	660	38.5
	1974	2.13	9.66	479	61.5
	1975	12.24	12.10	326	23.1
	1976	1.13	13.41	880	7.7
	1977	2.07	11.55	666	30.8
	1978	1.22	10.64	572	46.2
	1979	-	6.75	252	76.9
	1980	-	10.02	513	53.8
1981	-	0.00	0	92.3	
Pedi	1970	11.05	7.31	218	91.7
	1971	1.09	9.75	404	25.0
	1972	1.23	9.45	378	41.7
	1973	12.28	9.20	357	50.0
	1974	3.01	8.93	335	66.7
	1975	12.24	10.36	460	8.3
	1976	1.12	10.06	432	16.7
	1977	2.06	9.60	391	33.3
	1978	1.24	8.96	338	58.3
	1979	-	8.05	269	75.0
1980	-	7.92	259	83.3	

Table 60: ANNUAL EXTREME HIGH WATER LEVEL AND DISCHARGE (2/4)

Station	Year	Date	Water Level (m)	Discharge (m ³ /s)	Probability of Occurrence (%)
Bidi	1970	11.05	8.47	188	91.7
	1971	1.23	10.88	346	41.7
	1972	1.23	10.36	308	50.0
	1973	12.25	10.91	348	33.3
	1974	3.01	8.66	199	75.0
	1975	12.24	12.10	444	8.3
	1976	1.12	11.34	382	16.7
	1977	2.07	11.25	374	25.0
	1978	1.24	9.54	253	58.3
	1979	-	8.72	203	66.7
1980	-	8.66	199	83.3	
L. Matu	1967	1.18	7.54	2,107	53.3
	1968	4.15	9.75	3,613	13.3
	1969	12.01	6.71	1,645	86.7
	1970	4.24	7.31	1,973	60.0
	1971	10.28	7.01	1,806	73.3
	1972	3.28	5.79	1,201	93.3
	1973	9.25	7.62	2,154	46.7
	1974	12.06	9.60	3,498	26.7
	1975	3.18	9.75	3,613	20.0
	1976	1.18	8.38	2,632	40.0
	1977	7.28	7.01	1,806	80.0
	1978	11.16	7.31	1,973	66.7
	1979	-	12.16	5,715	6.7
1980	-	8.84	2,944	33.3	
L. Jegan	1967	12.21	15.48	843.28	75.0
	1968	12.25	15.39	831.65	83.3
	1969	11.17	15.60	858.91	50.0
	1970	1.11	16.09	924.21	25.0
	1971	2.18	18.23	1,237.47	8.3
	1972	4.11	15.51	847.17	58.3
	1973	11.03	15.51	847.17	66.7
	1974	11.22	15.03	785.95	91.7
	1975	12.31	15.85	891.93	41.7
	1976	1.01	16.31	954.31	16.7
1977	2.19	16.07	921.50	33.3	

Table 61 ANNUAL EXTREME HIGH WATER LEVEL AND DISCHARGE (3/4)

Station	Year	Date	Water Level (m)	Discharge (m ³ /s)	Probability of Occurrence (%)
Mendamit	1966	12.14	8.93	1,232	81.3
	1967	2.10	10.55	1,640	50.0
	1968	12.28	9.76	1,434	68.8
	1969	7.09	9.75	1,431	75.0
	1970	7.11	10.09	1,518	62.5
	1971	10.28	11.28	1,843	18.8
	1972	9.38	11.00	1,764	25.0
	1973	11.04	10.42	1,605	56.3
	1974	3.02	11.52	1,913	12.5
	1975	12.29	11.16	1,643	37.5
	1976	1.19	11.16	1,643	43.8
	1977	-	0.00	0	87.5
	1978	-	0.00	0	93.8
	1979	-	12.24	1,948	6.3
1980	-	11.28	1,676	31.3	
Kapit	1967	12.23	11.88	5,653	93.3
	1968	12.25	15.01	8,304	40.0
	1969	11.16	16.79	10,038	6.7
	1970	6.02	16.40	9,644	26.7
	1971	8.26	16.58	9,825	13.3
	1972	11.21	13.29	6,785	80.0
	1973	6.03	15.33	8,603	33.3
	1974	9.25	14.17	7,543	60.0
	1975	8.26	16.58	9,825	20.0
	1976	5.05	14.01	7,402	66.7
	1977	11.28	12.95	6,502	86.7
	1978	12.24	14.93	8,230	46.7
	1979	-	14.01	7,402	73.3
1980	-	14.32	7,676	53.3	
Serian	1962	2.20	7.92	379	25.0
	1963	1.30	7.93	381	20.0
	1964	3.03	6.92	216	70.0
	1965	3.18	6.71	203	75.0
	1966	1.29	6.65	200	85.0
	1967	3.02	6.65	200	90.0
	1968	1.17	7.40	271	50.0
	1969	12.23	7.62	320	35.0
	1970	1.23	6.82	218	65.0
	1971	2.08	6.94	225	60.0
	1972	1.29	6.71	212	80.0
	1973	12.31	7.41	278	45.0
	1974	12.14	7.97	394	15.0
	1975	2.26	9.30	520	10.0
	1976	1.14	9.70	1,297	5.0
	1977	2.22	9.00	375	30.0
1978	1.25	8.60	282	40.0	
1979	12.07	7.60	180	95.0	
1980	2.23	8.60	269	55.0	

Table 62 ANNUAL EXTREME HIGH WATER LEVEL AND DISCHARGE (4/4)

Station	Year	Date	Water Level (m)	Discharge (m ³ /s)	Probability of Occurrence (%)
Bedup	1963	12.02	0.61	6	94.7
	1964	2.04	1.98	35	57.9
	1965	2.11	2.71	62	26.3
	1966	8.16	2.62	58	36.8
	1967	3.10	2.26	45	42.1
	1968	1.11	2.12	40	47.4
	1969	12.22	2.77	64	21.1
	1970	1.22	2.00	36	52.6
	1971	2.08	1.87	32	73.7
	1972	1.29	1.39	20	89.5
	1973	9.13	1.62	25	78.9
	1974	3.01	2.90	70	5.3
	1975	2.24	2.67	60	31.6
	1976	3.01	2.90	70	10.5
	1977	2.20	2.80	65	15.8
	1978	1.12	1.89	33	68.4
	1979	-	1.97	35	63.2
	1980	-	1.53	23	84.2

Table 63 ANNUAL SEDIMENT YIELD

Station Name	Catchment Area (km ²)	Annual Yield of Suspended Load (10 ⁶ m ³ /y)	Annual Yield of Sediment (10 ⁶ m ³ /y)	Specific Annual Yield of Sediment (m ³ /km ² /y)	Basin No. Located
<u>Sabah</u>					
Tenom Lana	7,718	873	1,048	136	24
Kemabong	3,180	218	262	82	24
Tangkular	5,730	1,103	1,324	231	11
Porong	3,240	374	449	139	13
Bridge No.2	243	6	7.2	30	18
Penampang	200	22	26.4	132	20
Kagopon	536	42	50.4	94	21
Basai	700	46	55.2	79	13
Biah	1,684	89	107	64	24
Melangang	564	74	88.8	157	19
			Average	114	
<u>Sarawak</u>					
Lubok Antu			not estimated		

FIGURES

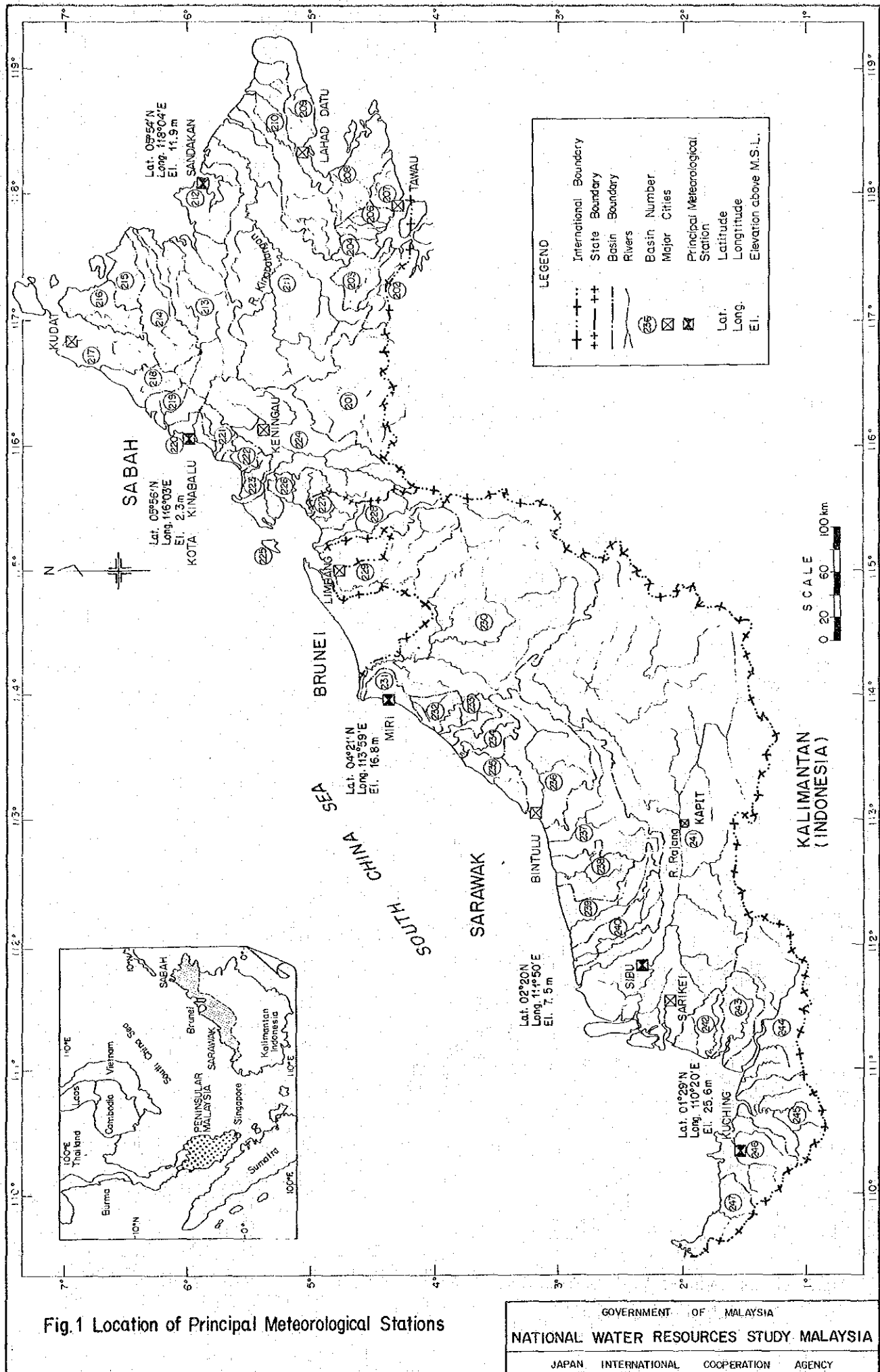


Fig.1 Location of Principal Meteorological Stations

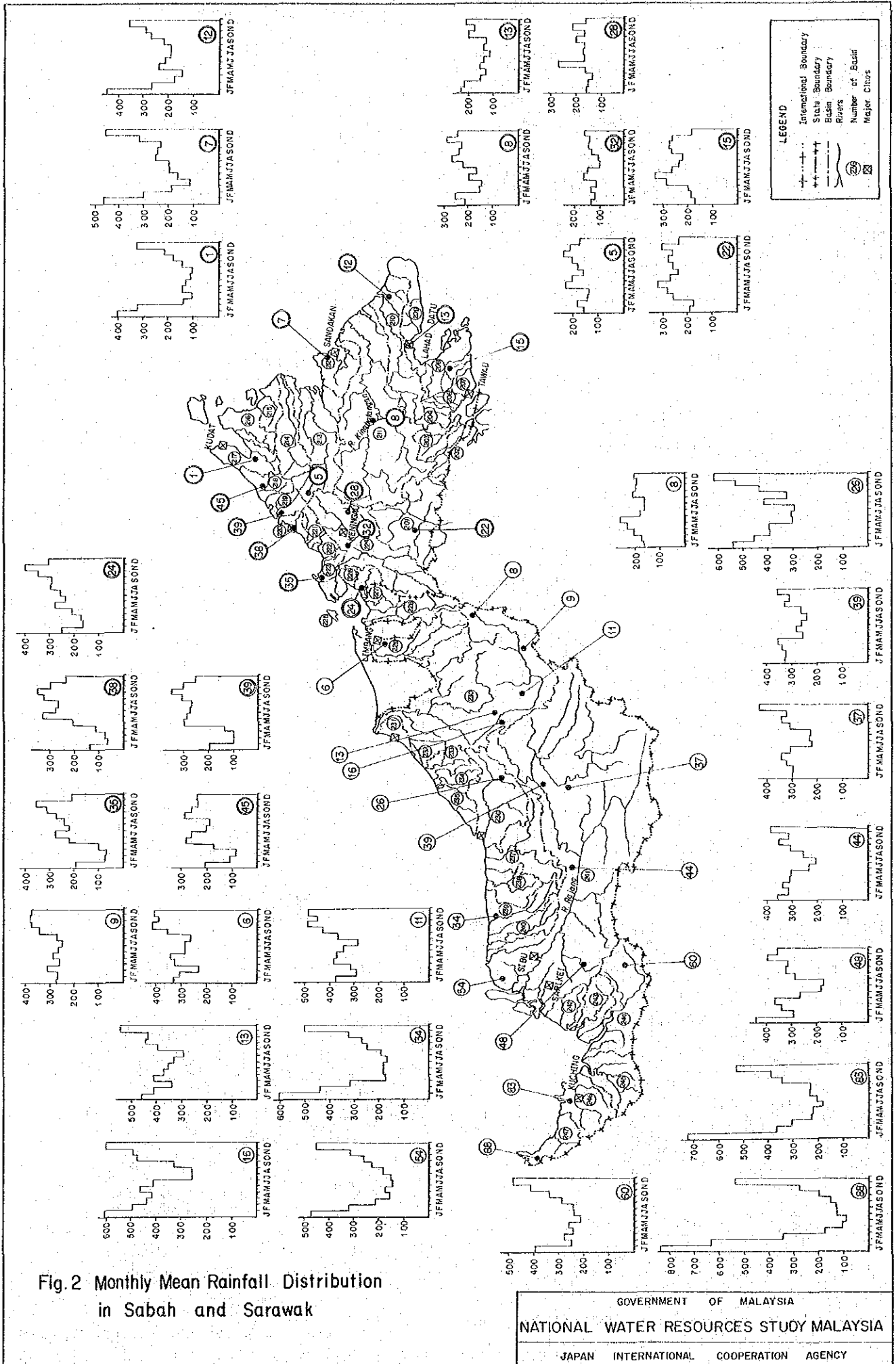
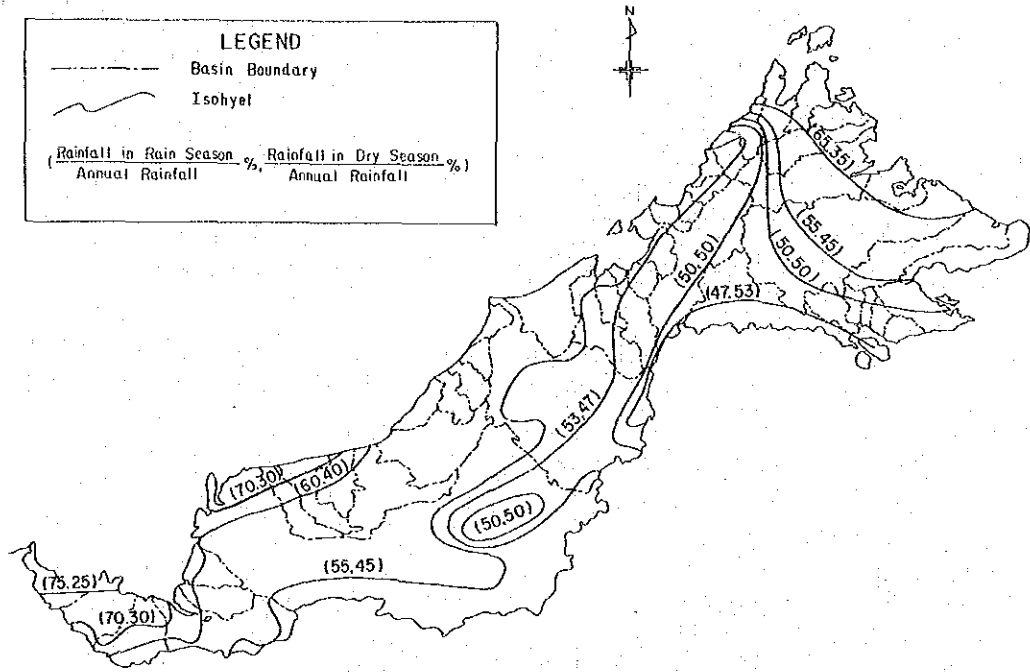
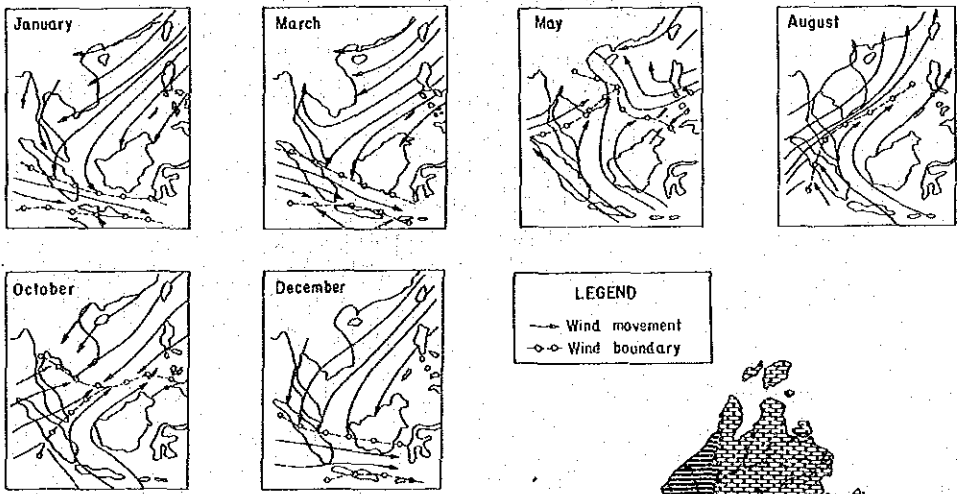


Fig. 2 Monthly Mean Rainfall Distribution in Sabah and Sarawak

Distribution of Dry Season Rainfall and Wet Season Rainfall

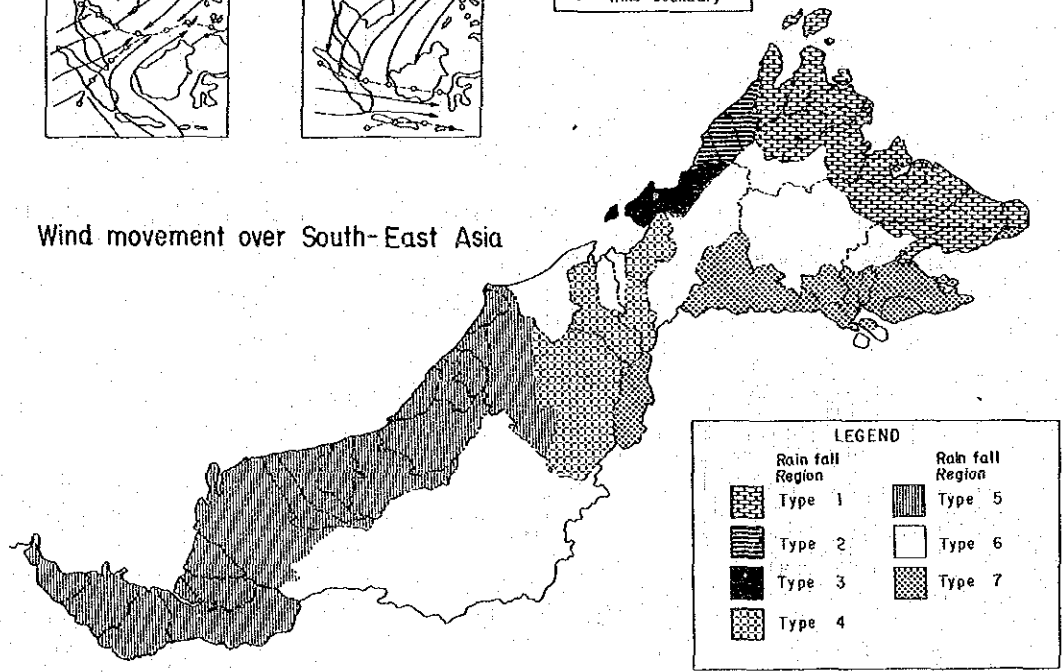


LEGEND
 - - - Basin Boundary
 ~~~~~ Isohyet  
 $\left( \frac{\text{Rainfall in Rain Season}}{\text{Annual Rainfall}} \%, \frac{\text{Rainfall in Dry Season}}{\text{Annual Rainfall}} \% \right)$



**LEGEND**  
 - - - Wind movement  
 - - - Wind boundary

### Wind movement over South-East Asia



**LEGEND**

| Rain fall Region |        |
|------------------|--------|
| Type 1           | Type 5 |
| Type 2           | Type 6 |
| Type 3           | Type 7 |
| Type 4           |        |

Fig.3 Rainfall Region in Sabah and Sarawak

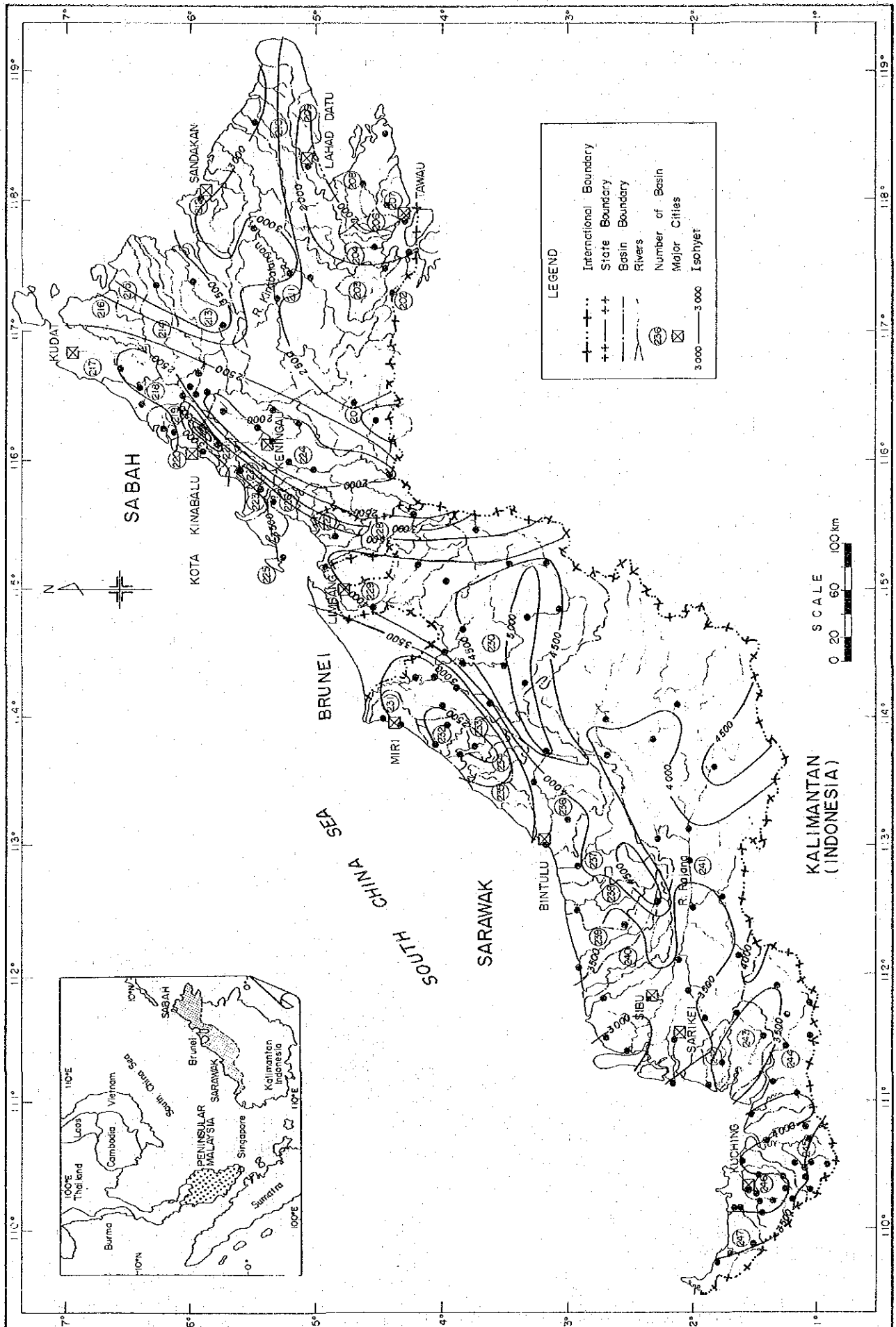


Fig.4 Isohyetal Map of Mean Annal Rainfall

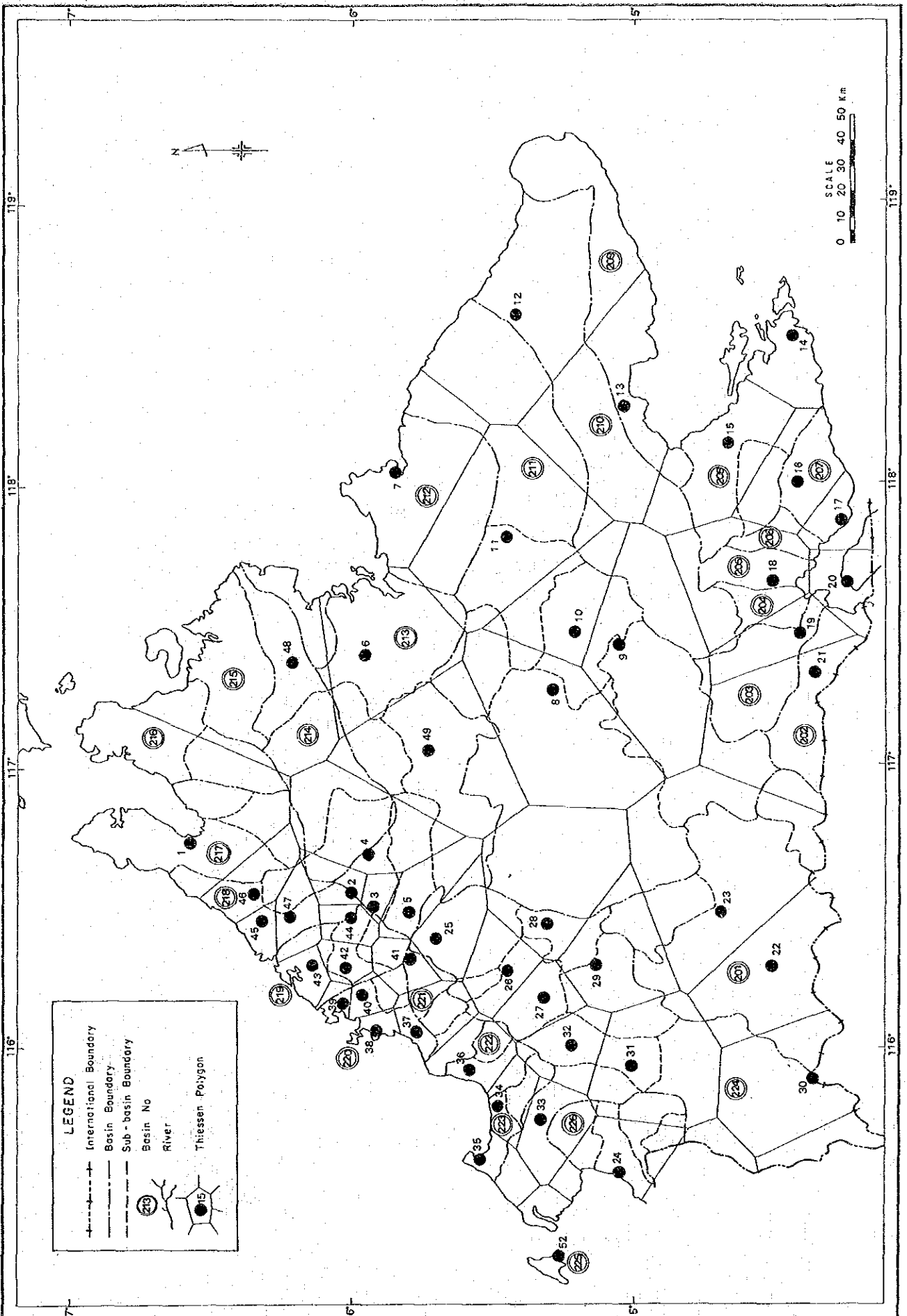


Fig.5 Thiessen Polygon Network in Sabah

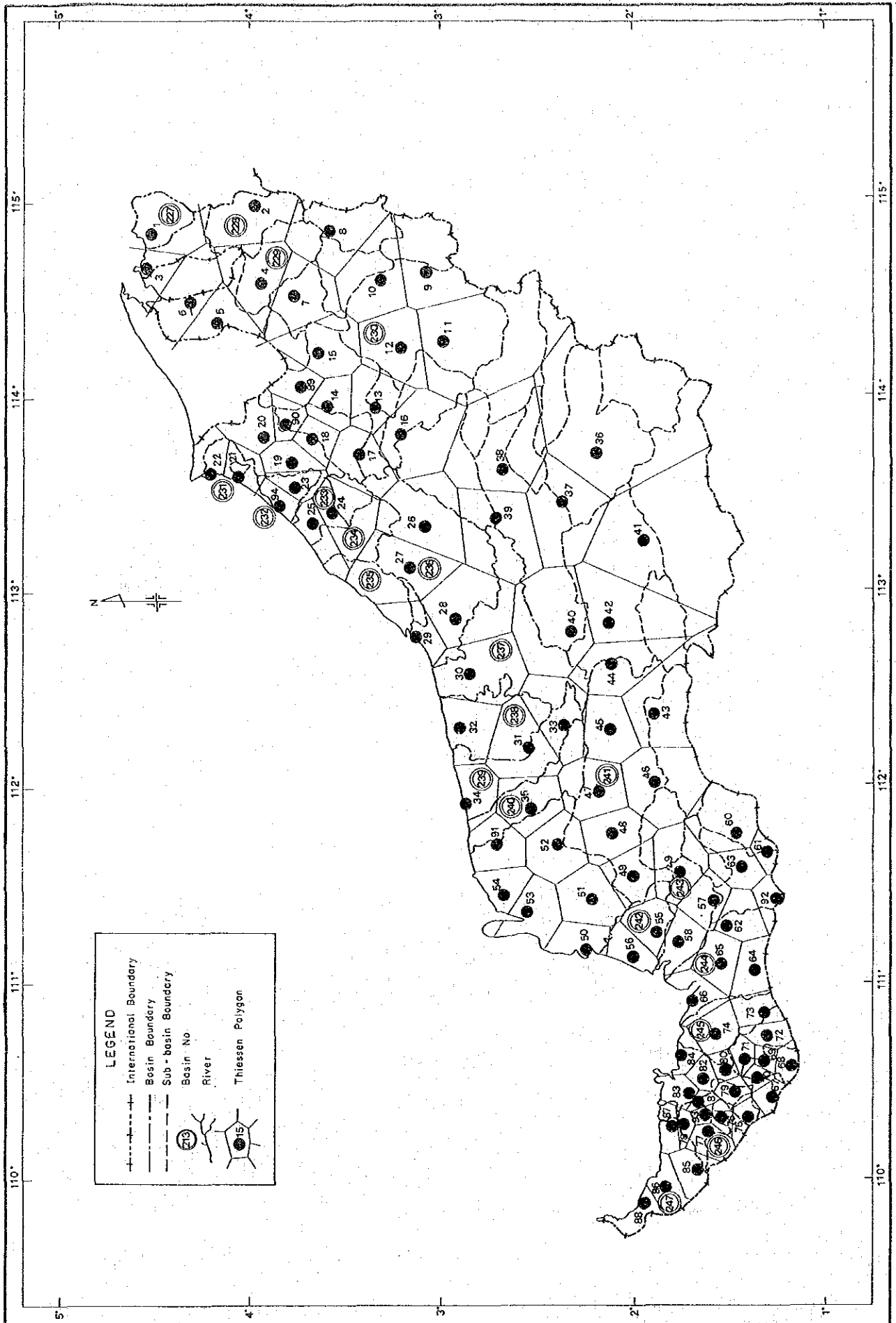


Fig.6 Thiessen Polygon Network in Sarawak

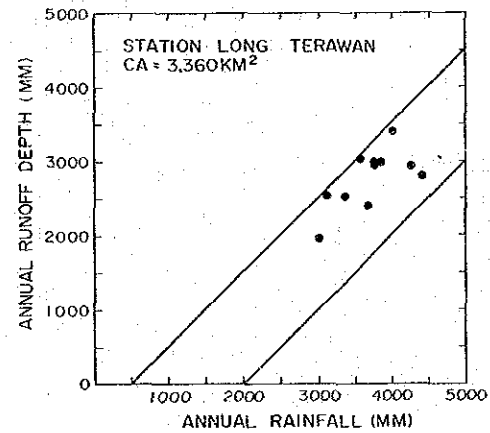
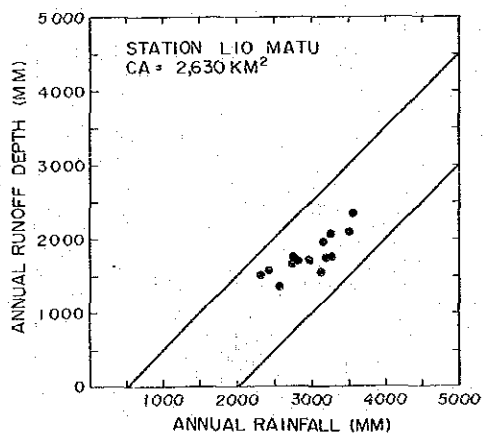
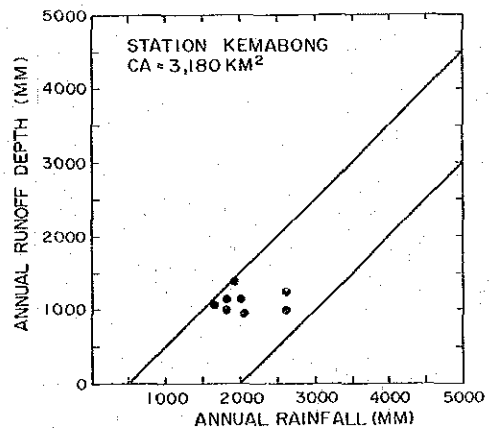
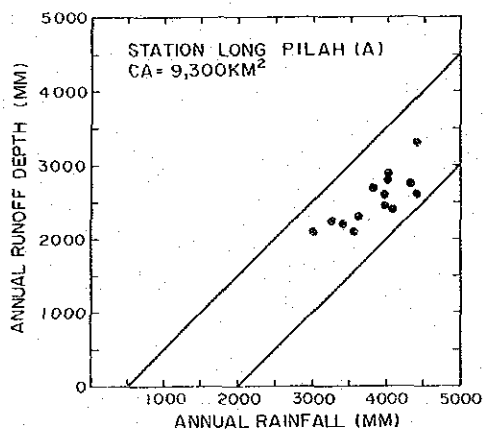
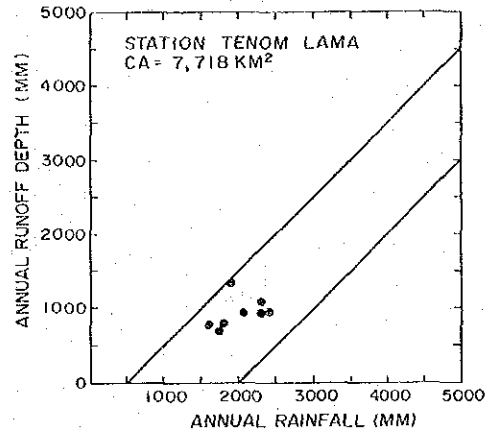
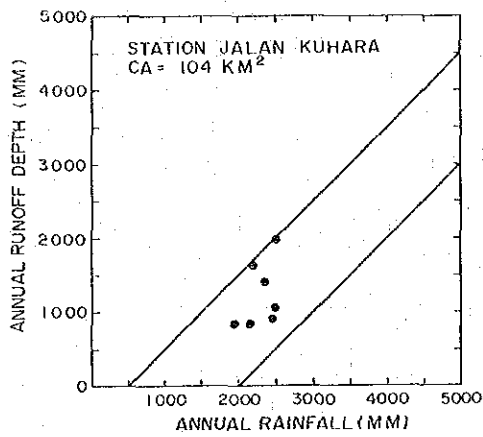


Fig.7 Rainfall-Runoff  
Relation (1/5)

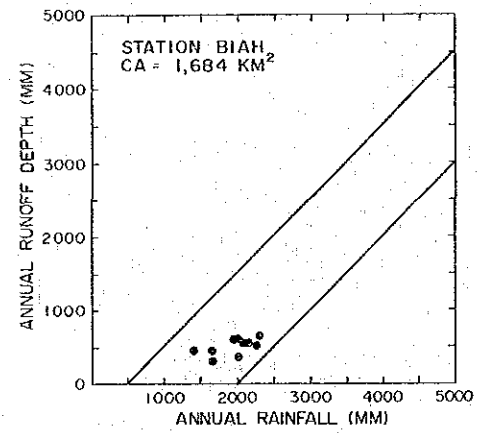
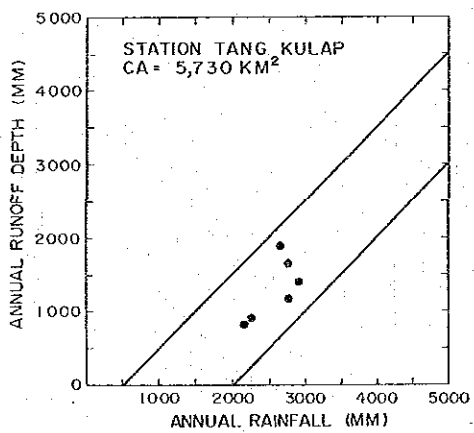
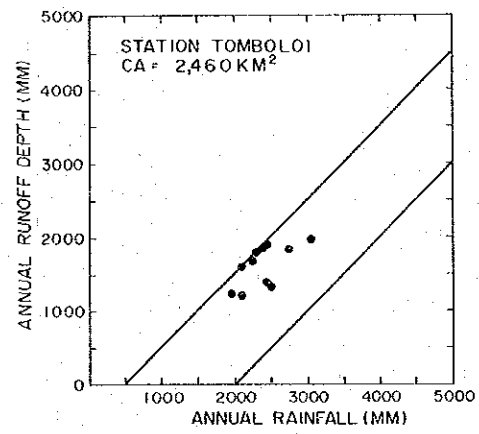
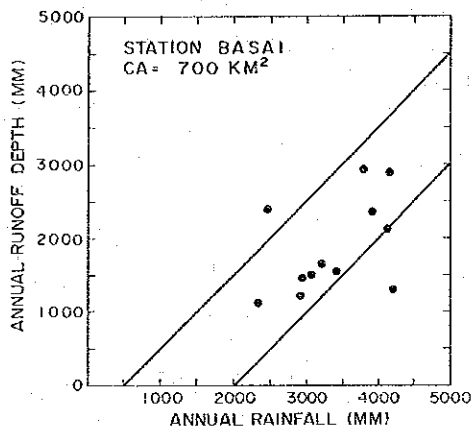
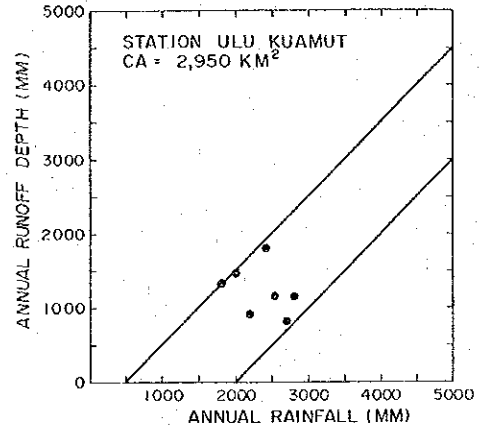
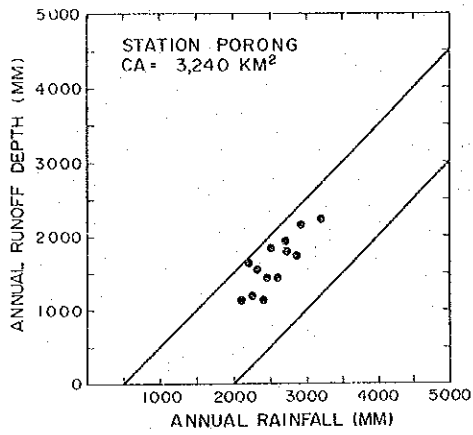


Fig.8 Rainfall-Runoff Relation (2/5)



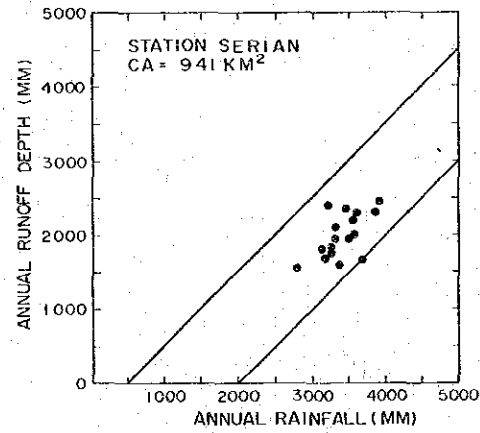
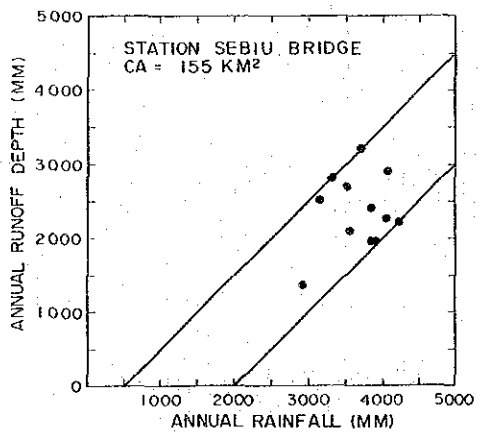
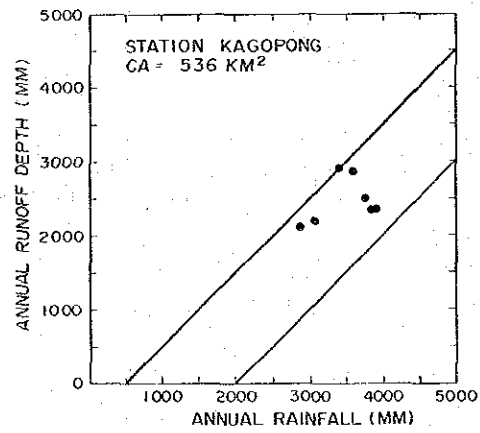
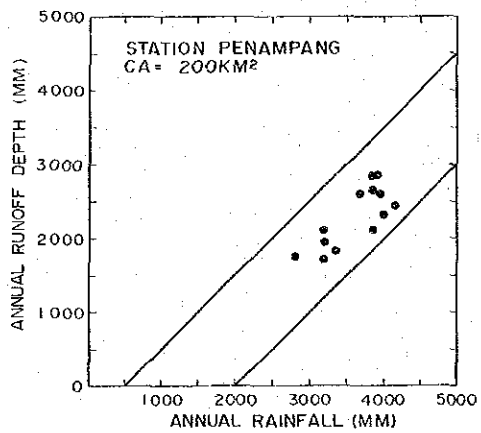
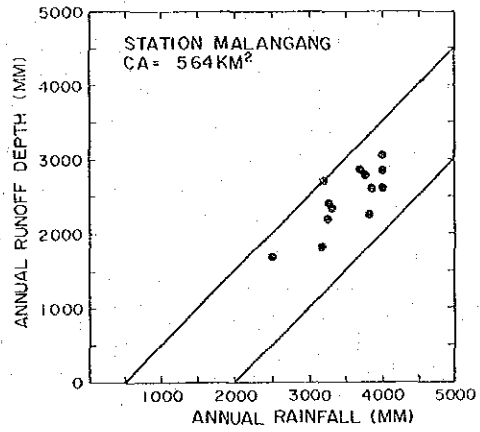
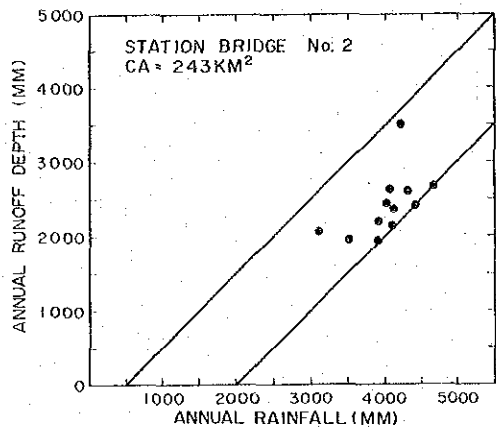


Fig.9 Rainfall-Runoff Relation (3/5)

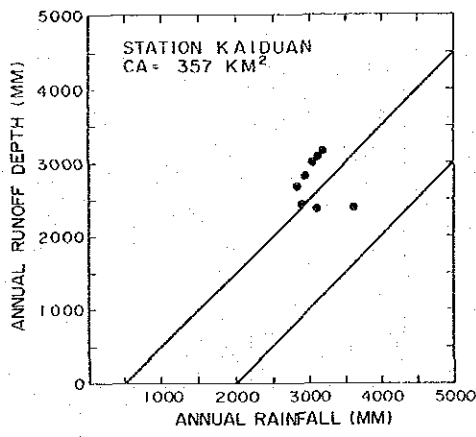
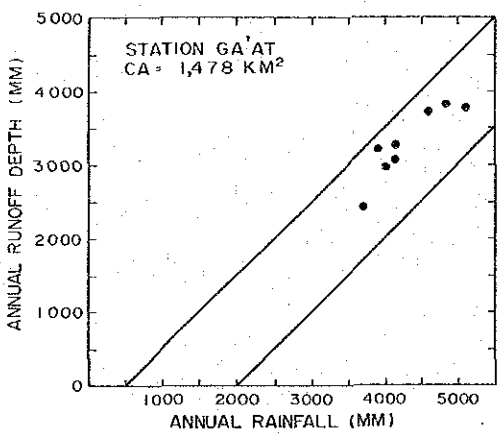
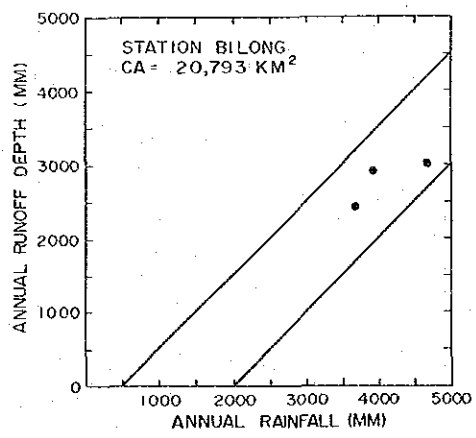
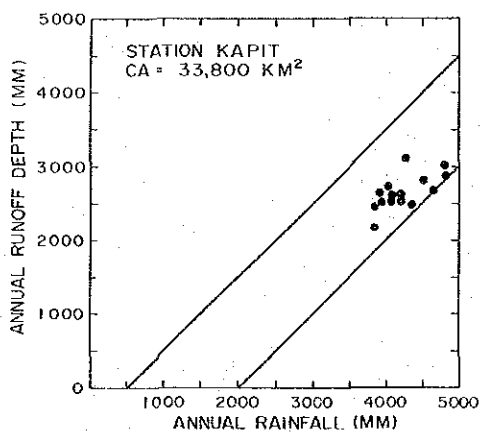
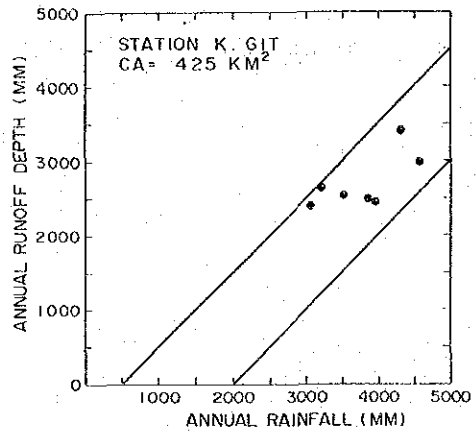
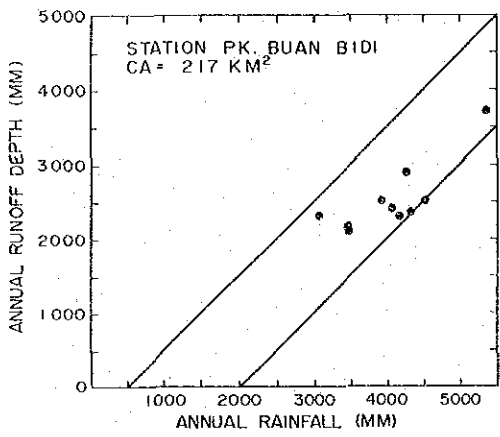


Fig.10 Rainfall-Runoff Relation (4/5)

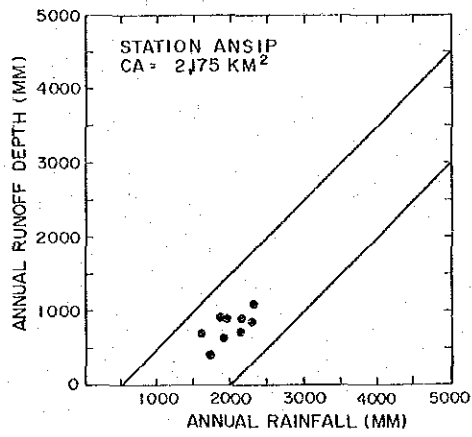


Fig.11 Rainfall-Runoff  
Relation (5/5)

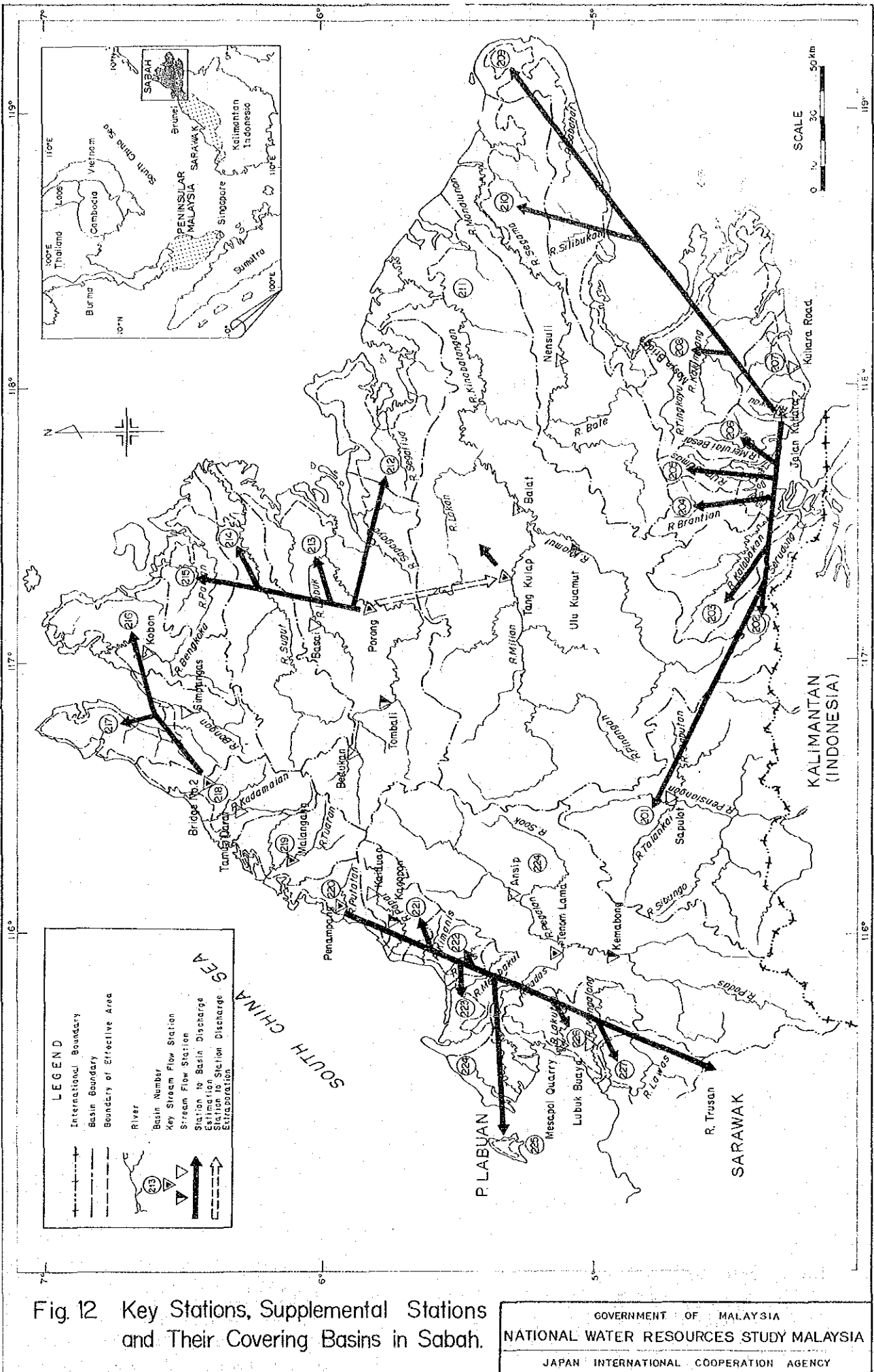


Fig. 12 Key Stations, Supplemental Stations and Their Covering Basins in Sabah.

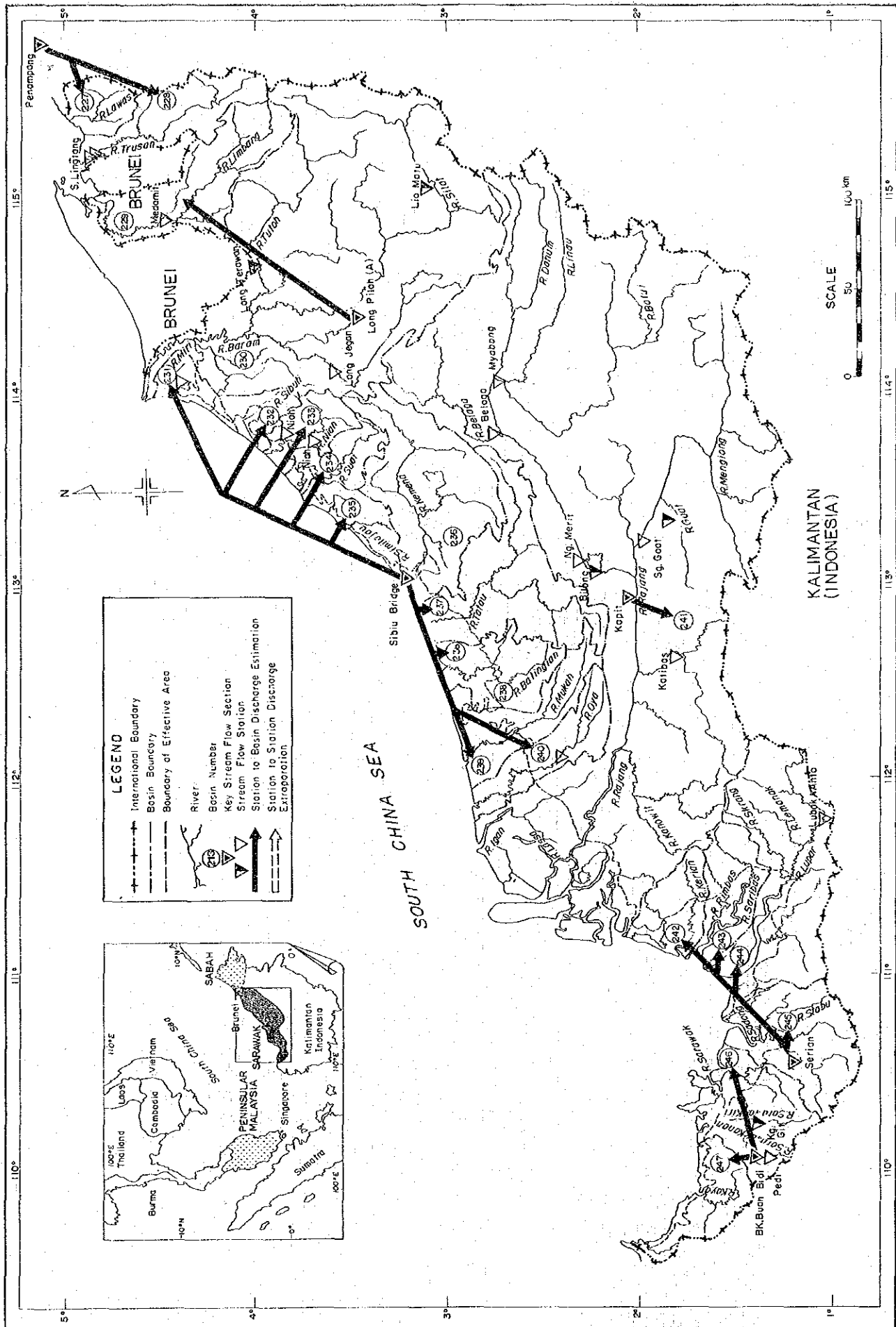


Fig. 13 Key Stations, Supplemental Stations and Their Covering Basins in Sarawak

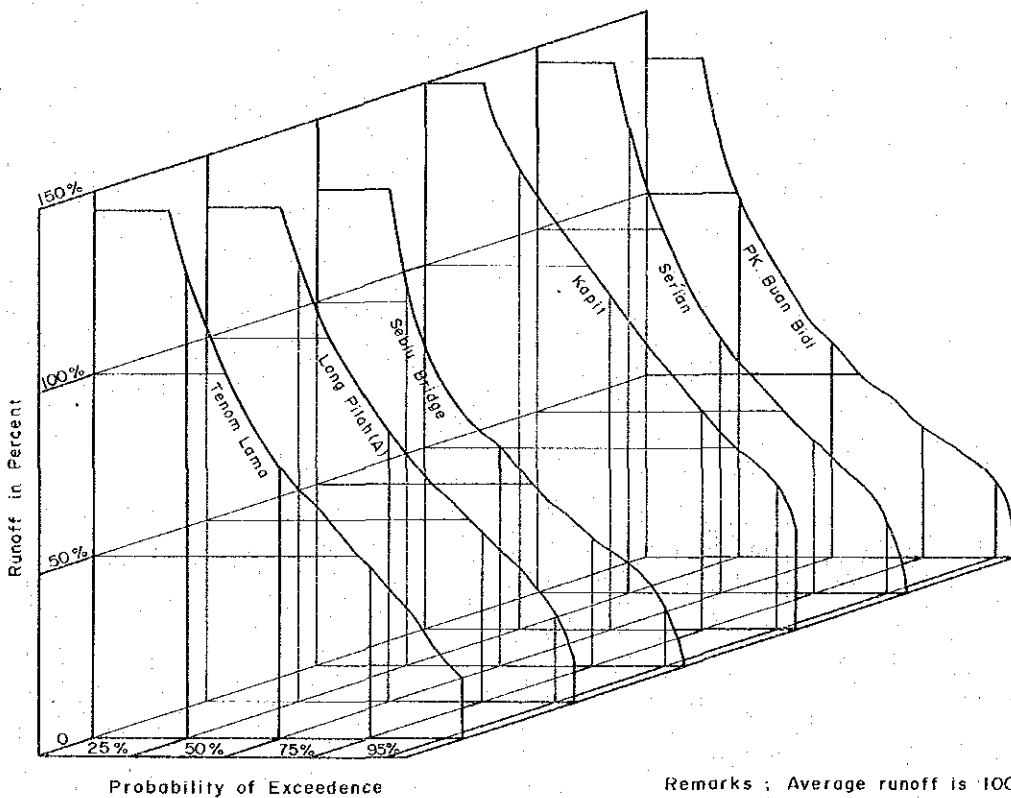
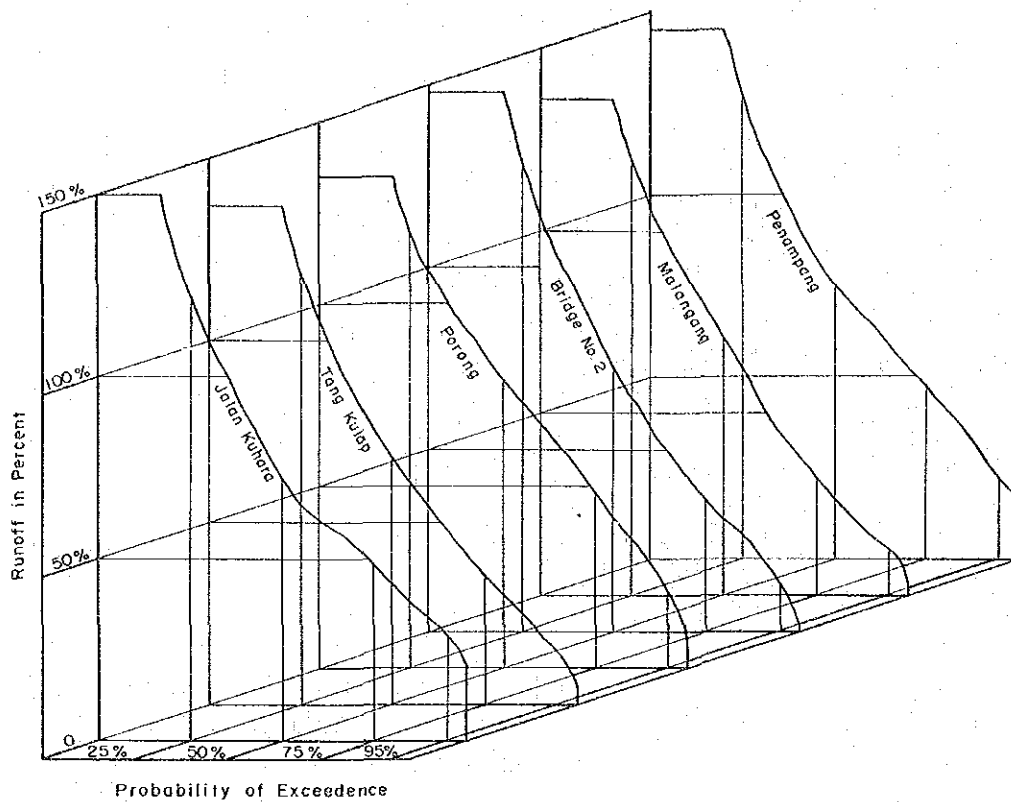


Fig.14 Non-dimensional Flow Duration Curves

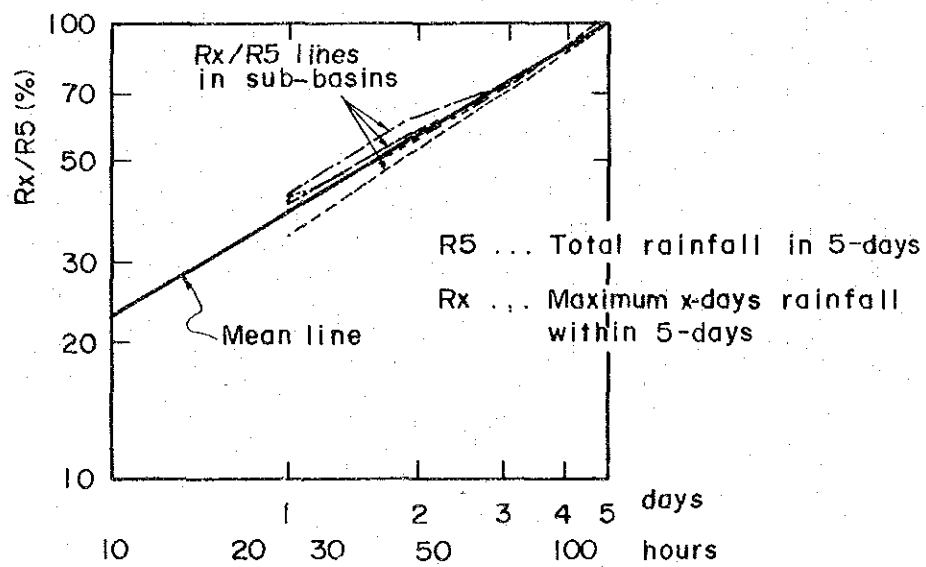


Fig.15 Rainfall Distribution of 5-day Storm Rainfall

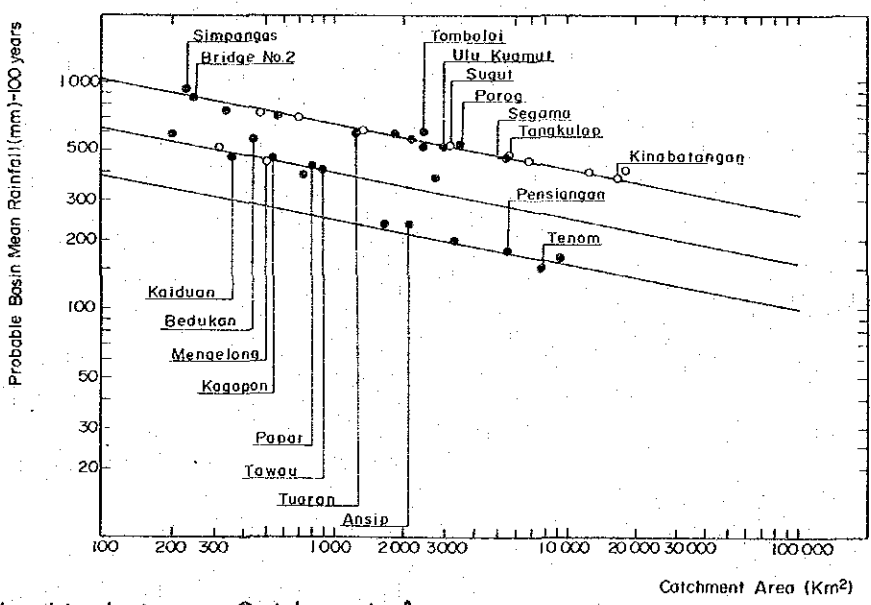
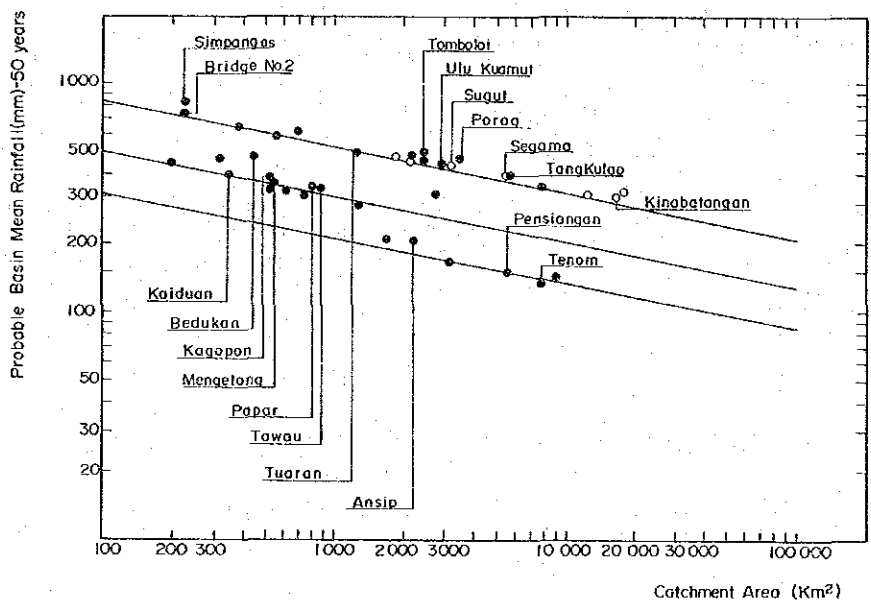
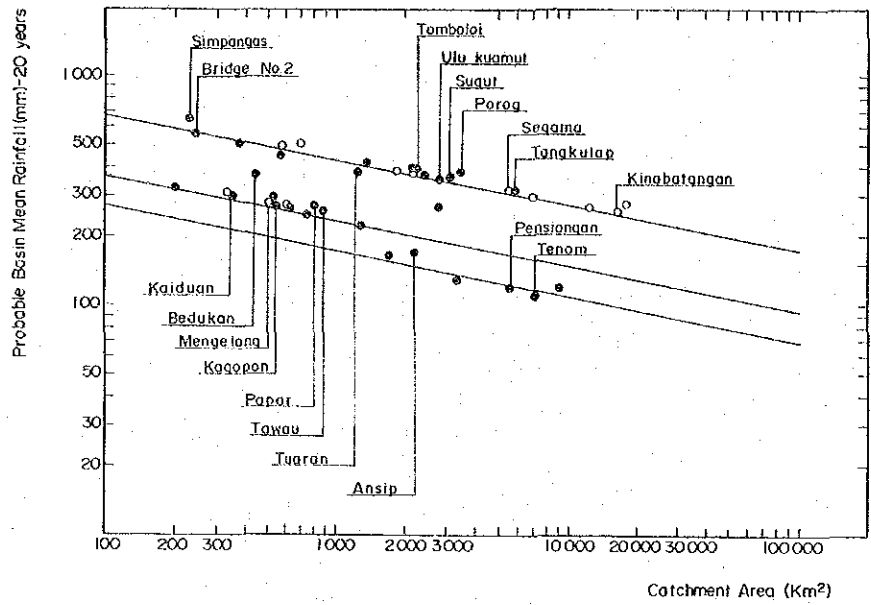


Fig.16 Relationship between Catchment Area and Storm Rainfall (1/2)



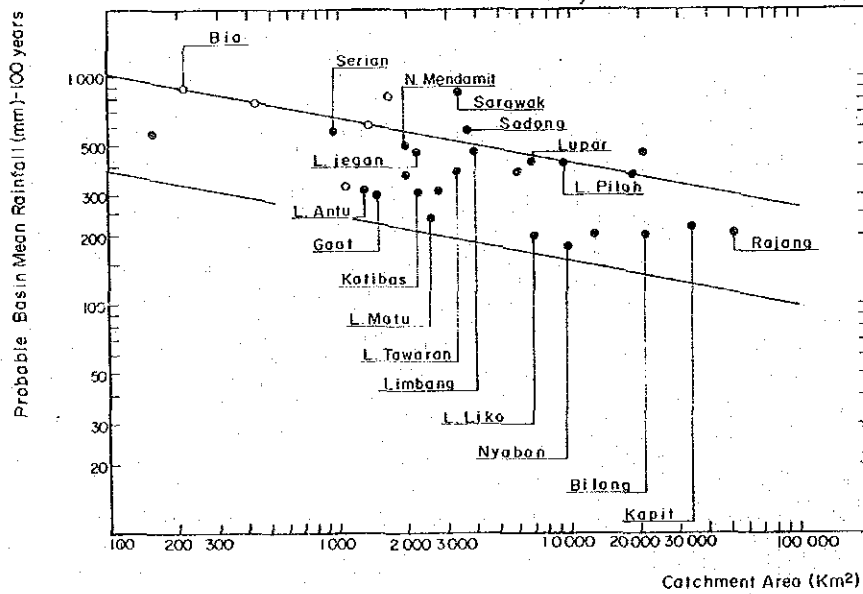
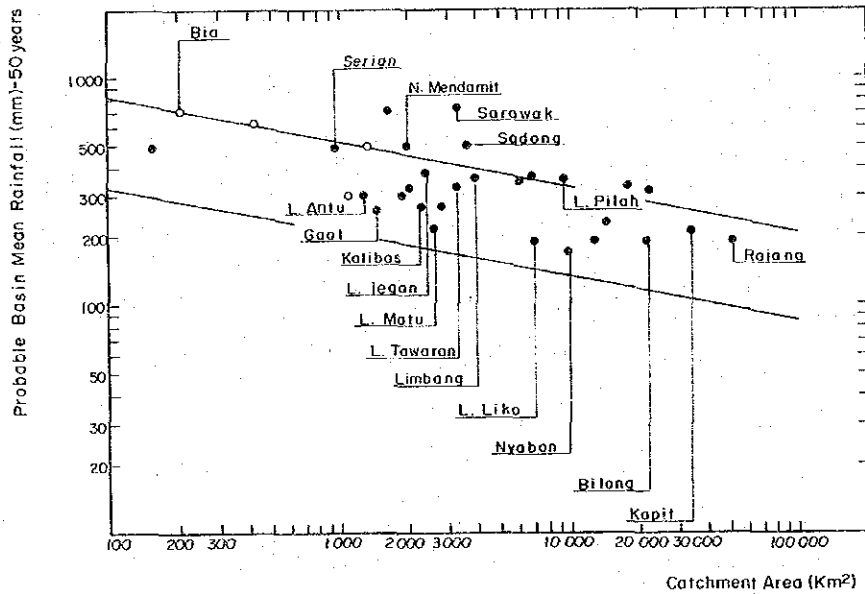
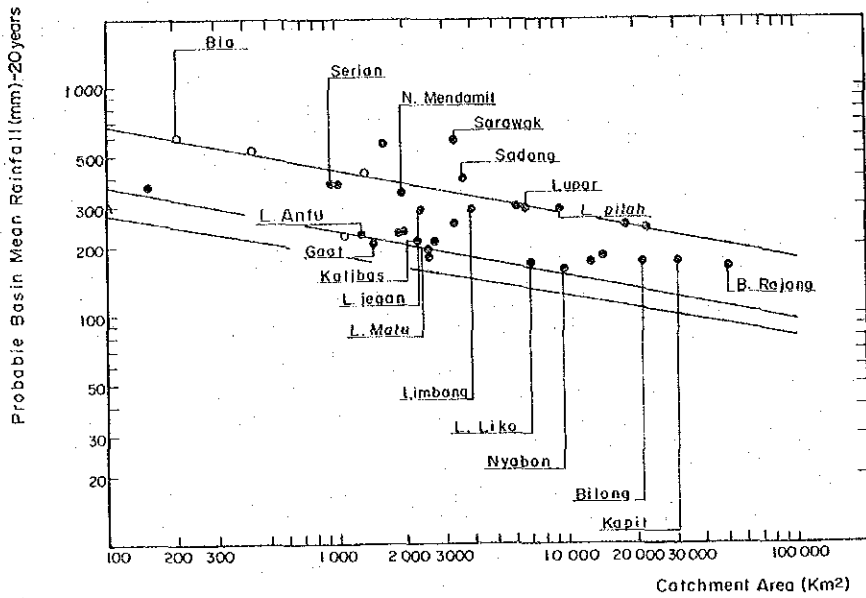


Fig.17 Relationship between Catchment Area and Storm Rainfall (2/2)

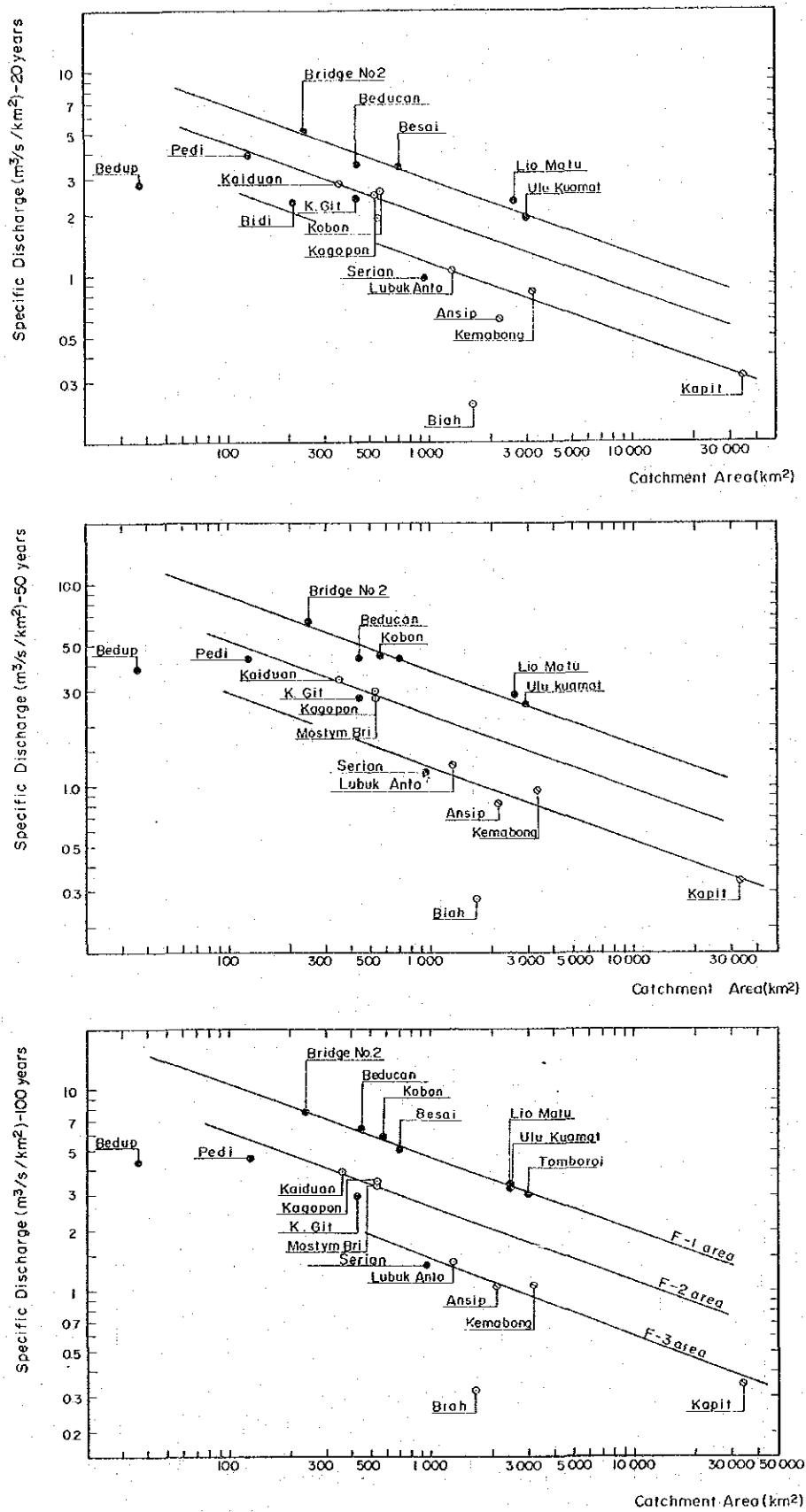


Fig.18 Relation between Catchment Area and Specific Peak Discharge

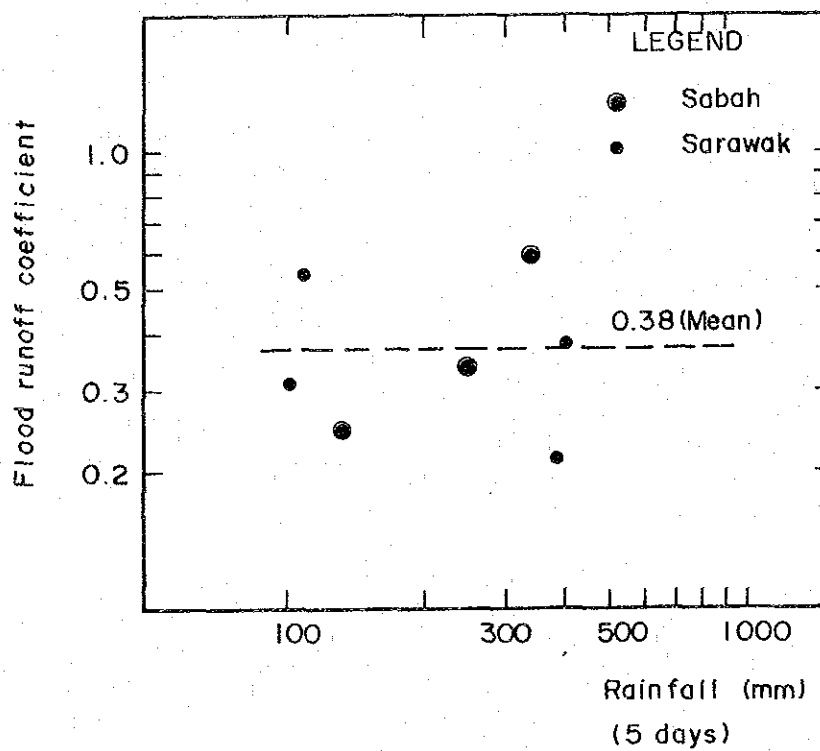


Fig.19 Relation between 5-day Rainfall and Flood Runoff Coefficient

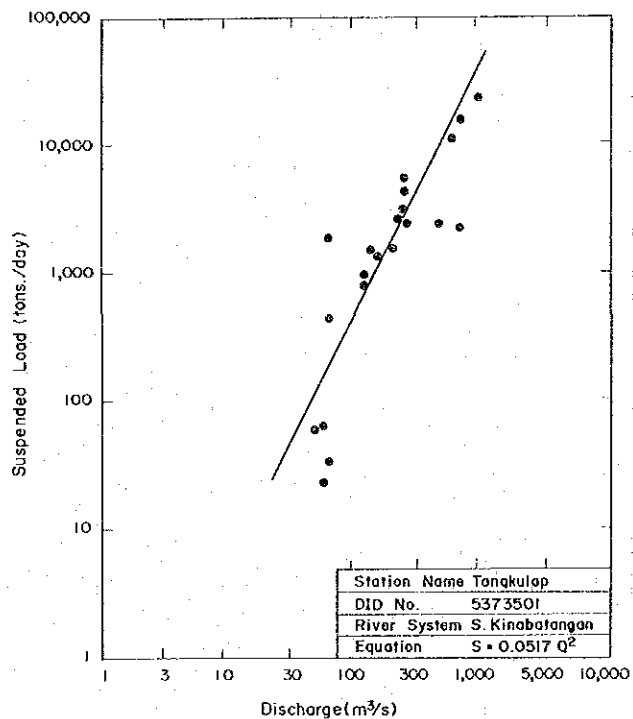
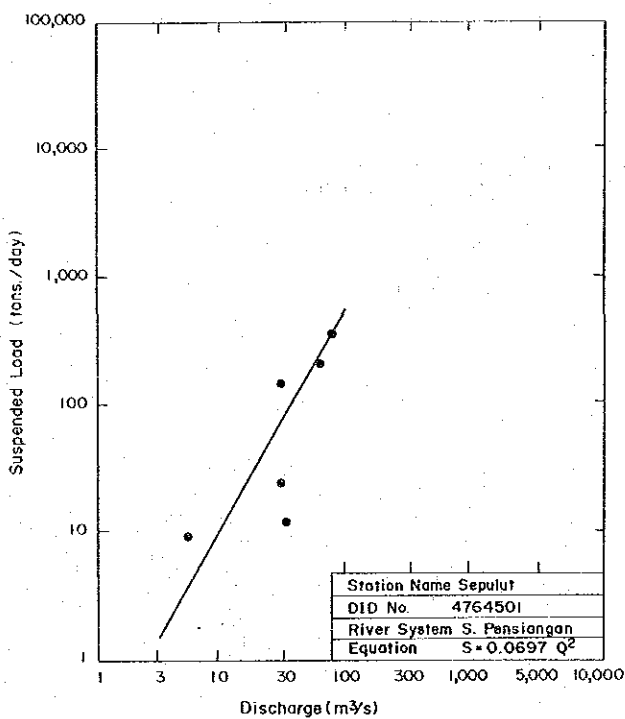
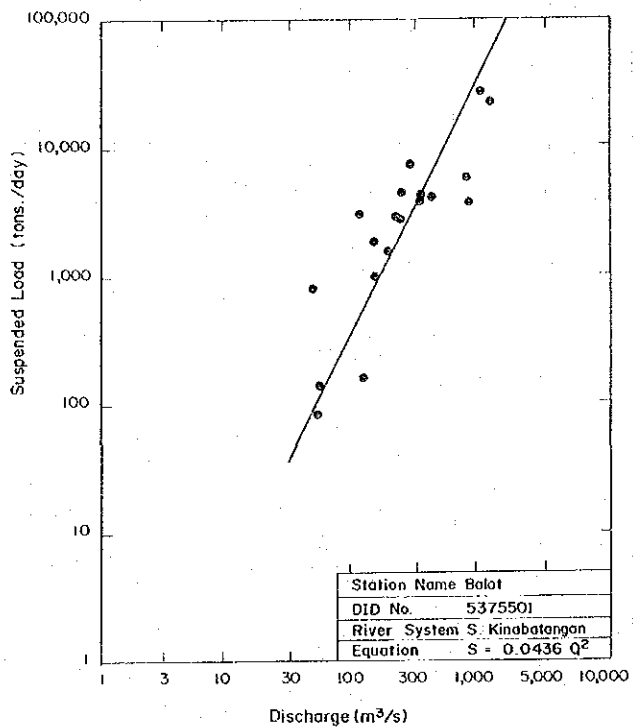
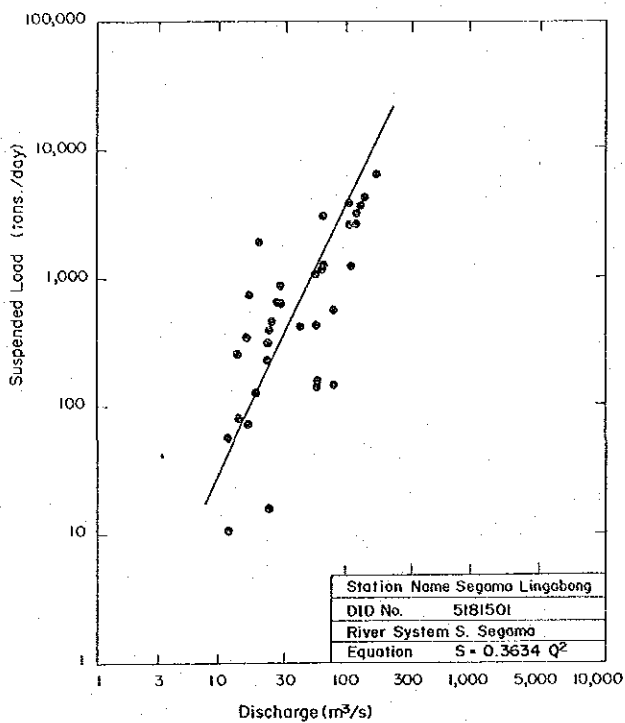


Fig.20 Suspended Load Concentration Discharge Relation (1/5)

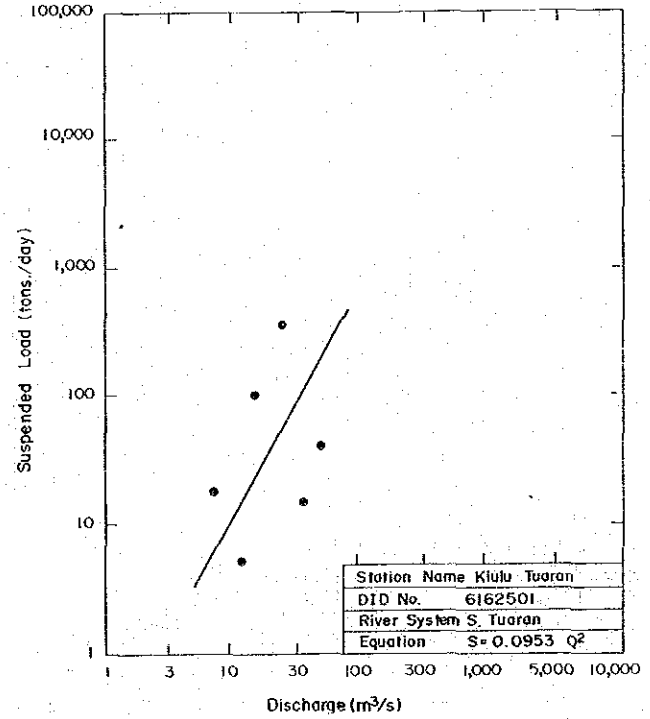
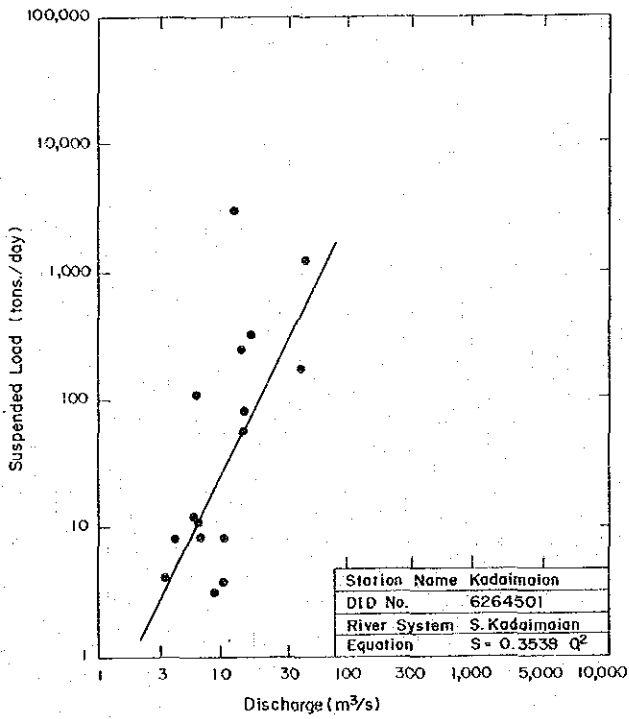
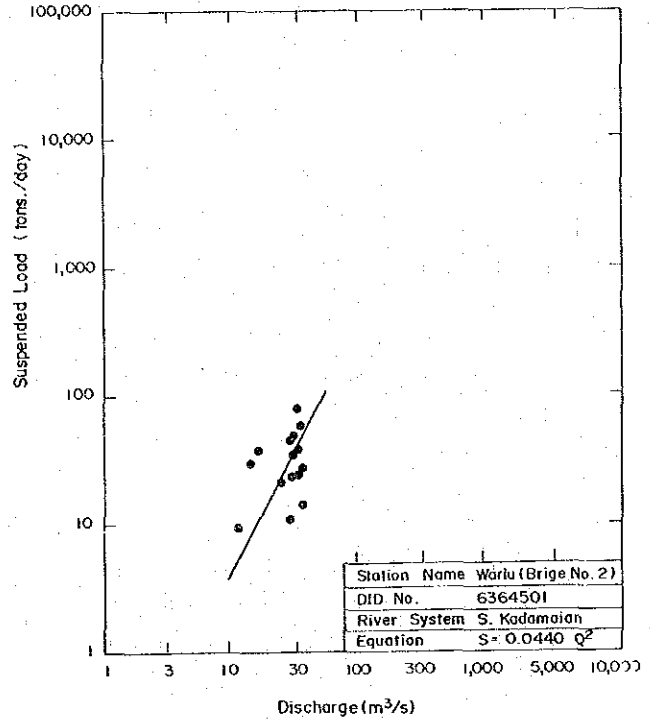
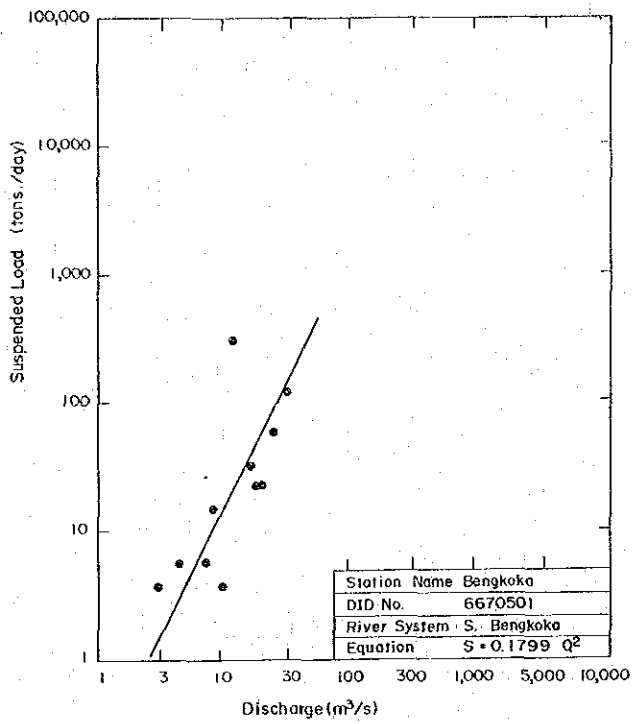


Fig.21 Suspended Load Concentration Discharge Relation (2/5)

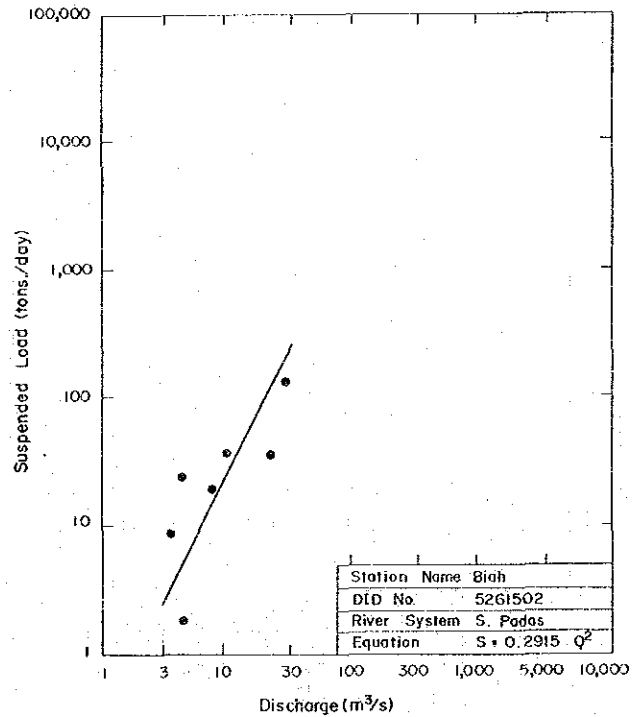
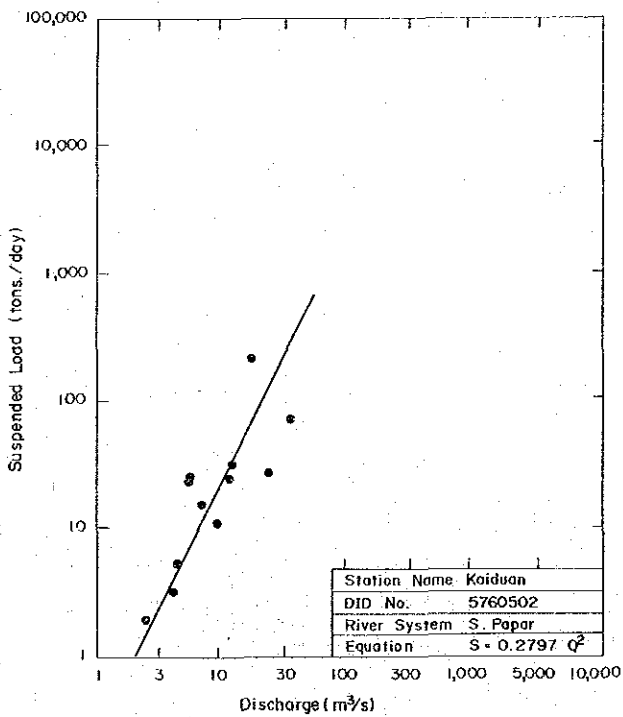
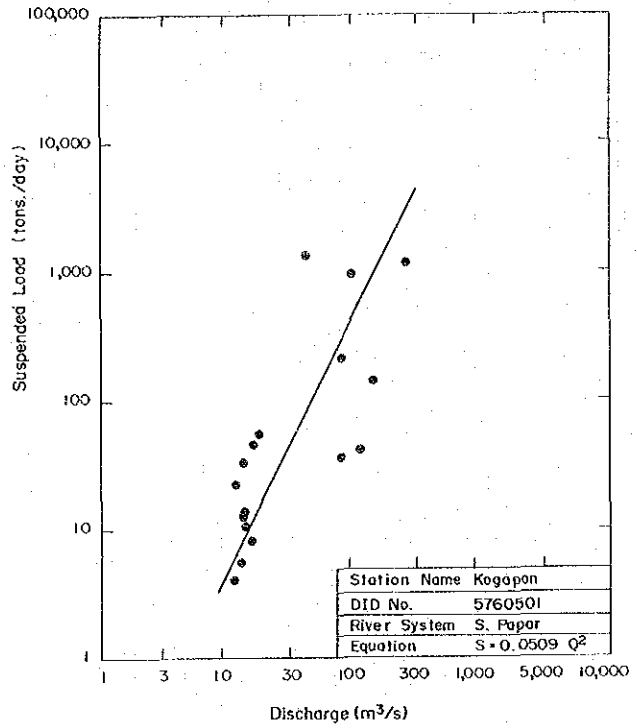
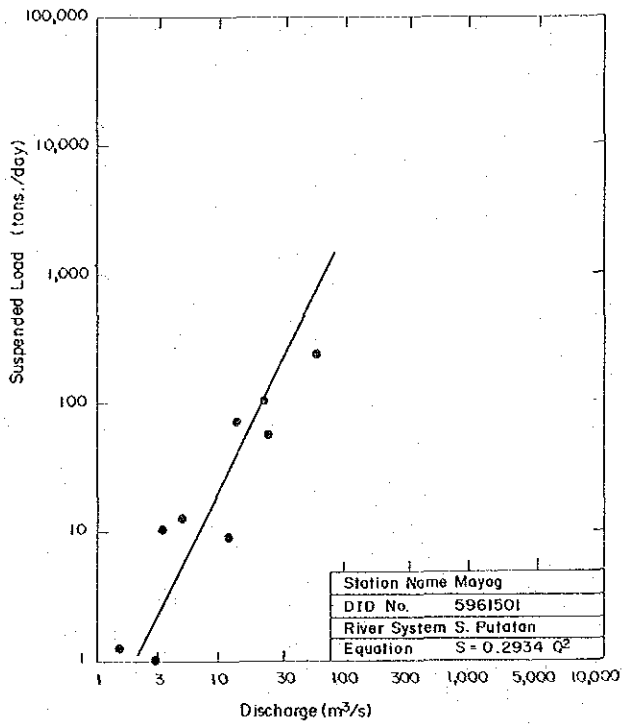


Fig.22 Suspended Load Concentration Discharge Relation (3/5)

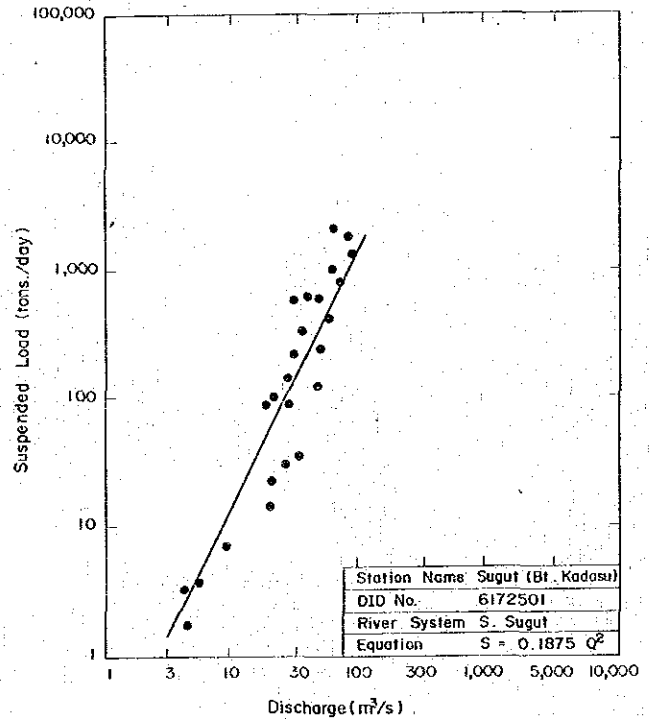
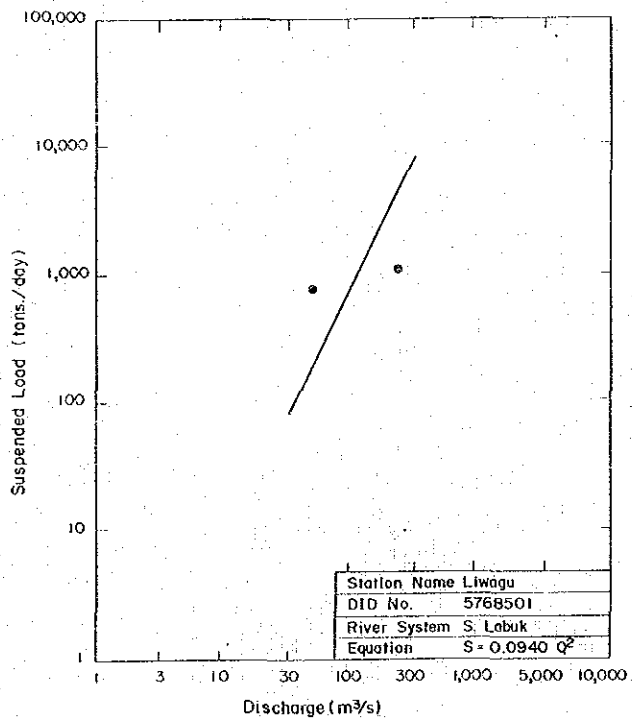
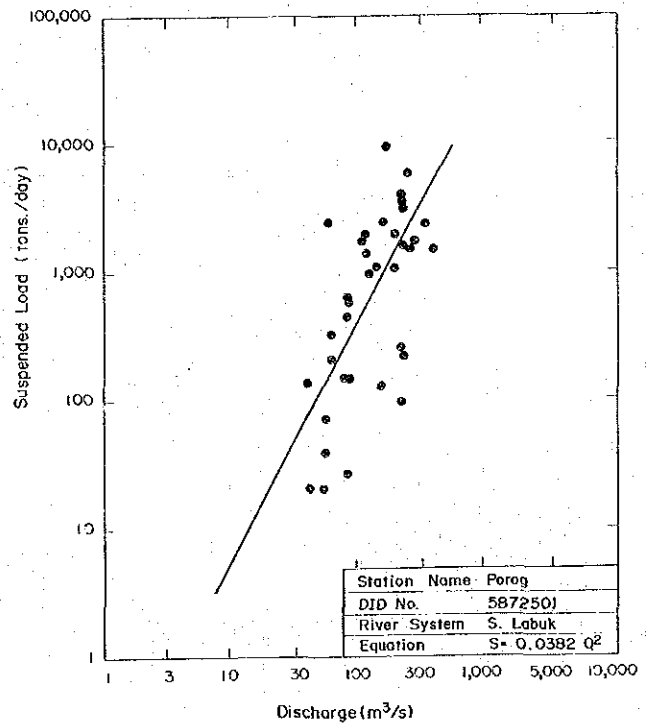
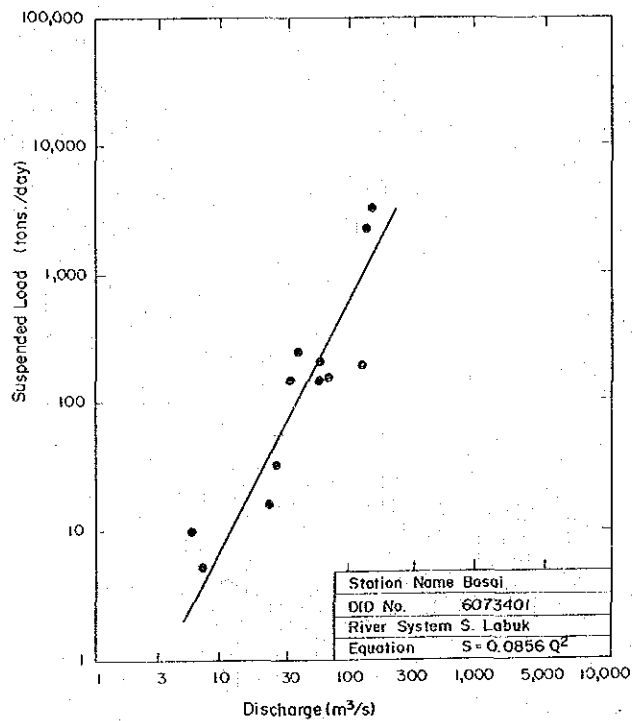


Fig.23 Suspended Load Concentration Discharge Relation (4/5)

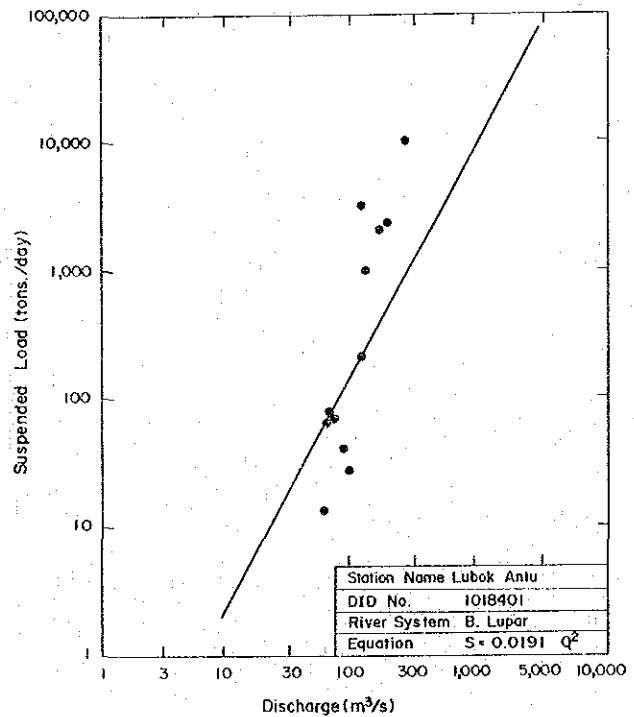
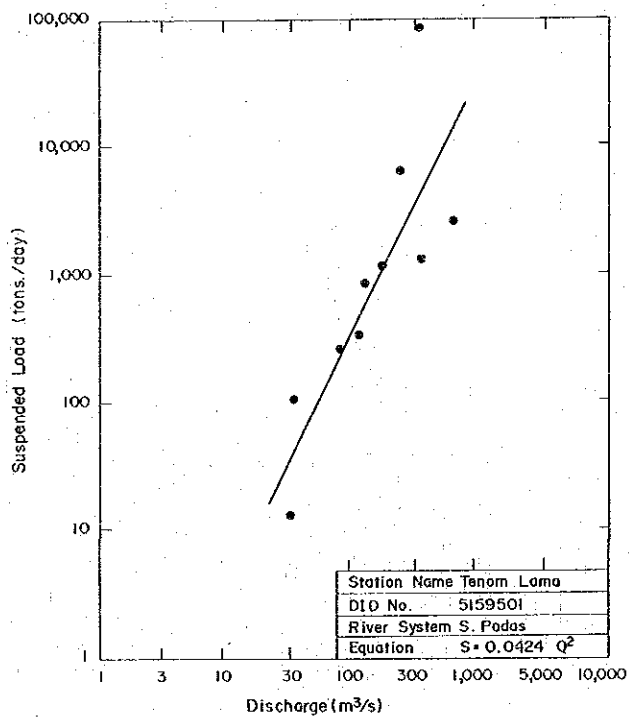
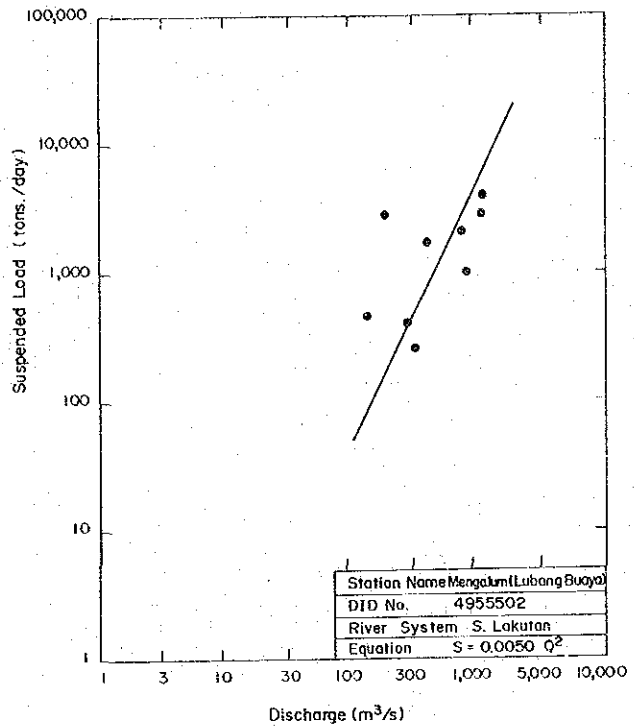
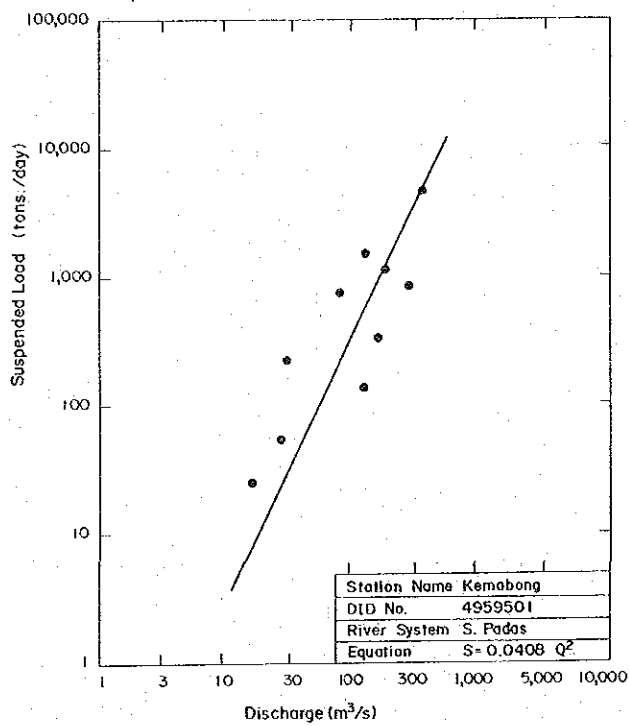


Fig.24 Suspended Load Concentration  
Discharge Relation (5/5)





