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HYDROLOGICAL STUDY FOR MINI HYDROS PROJECTS
IN WEST SUMATRA (INDONESIA)

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C O N T E N T S

	PAGE
<u>INTRODUCTION</u>	1
1. CATCHMENTS DESCRIPTION	3
1.1. Location	3
1.2. Characteristics of basins	3
1.3. Climate	10
2. AVAILABLE DATA	10
2.1. Rainfall	10
2.2. Evaporation	13
2.3. River flow	14
3. FLOW DATA ELABORATION	14
3.1. Method	14
3.2. Restoration of daily rainfalls	15
3.3. Model description	15
3.4. Calibration of the model	16
3.5. Transposition to the sites	16
3.6. Generation of flow data	20
4. ANALYSIS OF GENERATION FLOWS	20
4.1. Monthly and yearly flows	20
4.2. Low flows	23
5. FLOOD ESTIMATION	31
5.1. Procedure	31
5.2. Average intensity of the design rainstorm	32
5.3. "Time of concentration"	33
5.4. Runoff coefficient	33
5.5. Computed peak discharges	34
5.6. Design flood	34
<u>APPENDICES</u>	41
Appendix 1 Monthly rainfalls	43
Appendix 2 Computed monthly discharges	51
Appendix 3 Computed monthly discharges in order	59
Appendix 4 Low flows discharges in order	63

INTRODUCTION

- 1 - As part of the second stage of the mini-hydro-projects in WEST SUMATRA (Feasibility study) the purpose of this study was to assess the main hydrological parameters for the six proposed sites.

Because of lack of available data for the concerned catchments, the hydrological study would be carried out using indirect methods based upon the knowledge of climatic and physical data and comparison with similar catchment areas.

As a matter of fact, direct stream measurement have only started in the middle of 1985 on the concerned rivers and at the present time, the first gathered data are not still adequate to be used for such a study.

- 2 - As all the mini-hydros are run-of-river projects, long time series of daily discharges are required and especially low flow data for the firm discharge estimation.

The most interesting formulation of mean daily flows for such run-of-river hydropowers is so-called "duration curve" representing empirical marginal distribution function of mean daily flows.

- 3 - For generation of daily flow data a conceptual rainfall-runoff model has been used.

Unfortunately, only monthly rainfalls records were available on the stations retained as the most representative for each proposed site: and daily records have been collected only for two stations located in the area of the study.

So, in a first step, daily rainfall data, used as input of the hydrological model, have been generated from observed monthly precipitations and the two available series of daily data.

- 4 - After the calibration of the model from records of gaged catchments in the neighboring region (national hydrometric network) and transposition of the parameters to the concerned sites, sequences of simulated daily flows have been generated.
- 5 - At the end a statistical analysis of results has been undertaken to assess the required hydrological parameters.
- 6 - For design flood estimation on each site, the "Rational Method" has been used.

To estimate the design rainstorm required by this procedure, results of a regional precipitations frequency study in peninsular MALAYSIA (under similar climatic conditions) have been transposed to WEST SUMATRA.

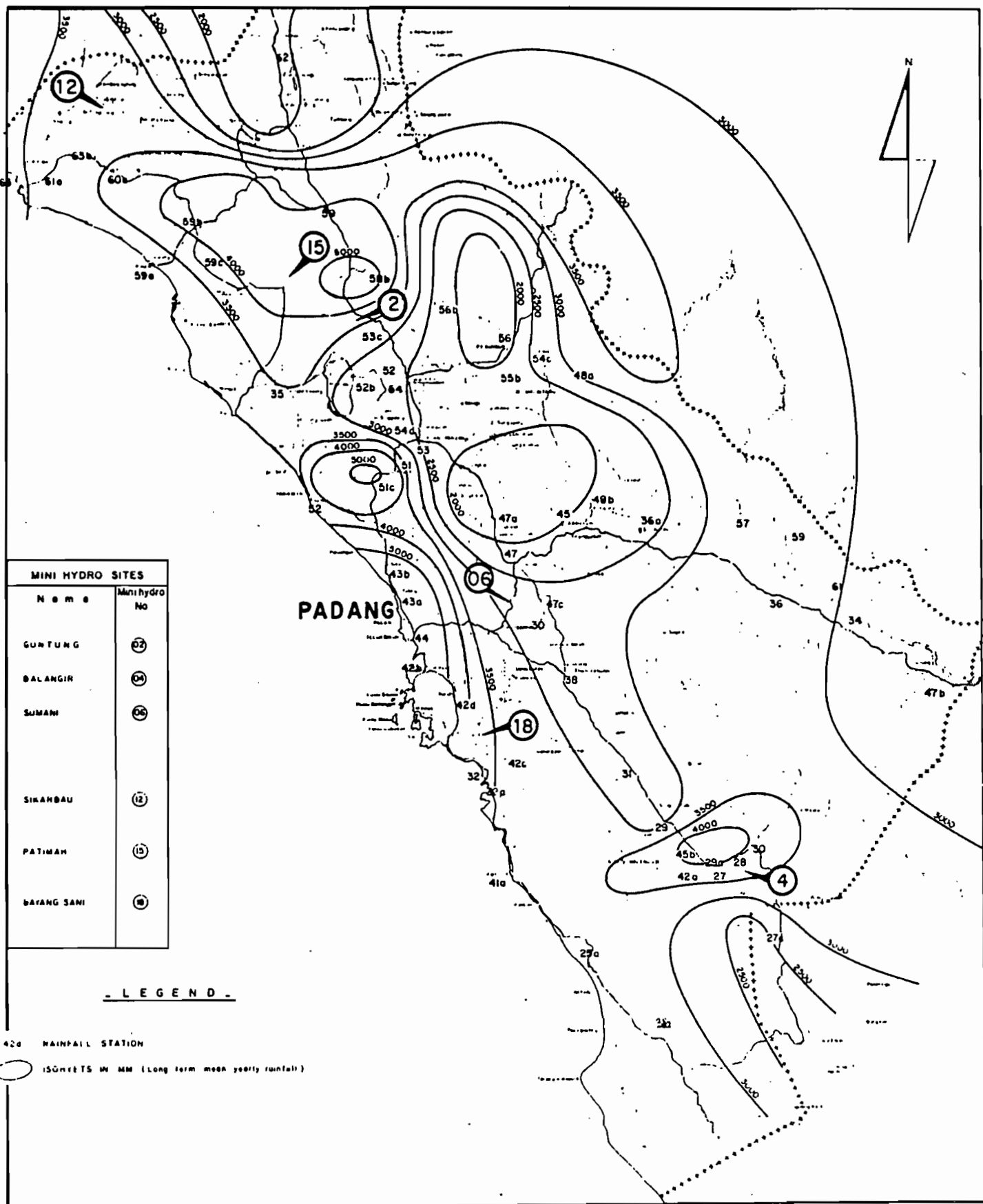


Fig. 1

SITUATION MAP

1. CATCHMENTS DESCRIPTION

1.1. Location

All the sites are located in WEST SUMATRA between the parallel 01° of north latitude and the parallel 02° of south latitude (see situation map fig. 1 and table 1).

TABLE 1. LIST OF THE SITES

CODE N°	NAME	DISTRICT	COORDINATES OF INTAKE
02	Batang Air GUNTUNG	Agam	S 00° 09' 00 E 100° 14' 22
04	Batang BALANGIR	Solok	S 01° 35' 55 E 101° 13' 46
06	Batang SUMANI	Solok	S 00° 54' 08 E 100° 37' 05
12	Batang SIKARBAU	Pasaman	S 00° 24' 06 E 99° 34' 32
15	Sunger PATIMAH	Pasaman	S 00° 00' 50 E 100° 04' 12
18	Batang BAYANG SANI	Pesisir Selatan	S 01° 13' 36 E 100° 34' 11

1.2. Characteristics of basins

The main physical characteristics are given in tables 2a to 2f. All the catchments have a mountainous relief with a steep slope as shown by the global slope index (IG) which remains between 30 and 176 m/km.

Geology is typically volcanic with andesite, tuff, breccia or lava formations and deeply weathered residual soils in surface containing a high proportion of clay in the low parts.

Vegetation cover is mainly constituted by secondary forest, jungle and sometimes plantations (rubber, coffee, cacao). The SUMANI catchment is more cultivated with padi fields in the low part of the basin.

Table 2a PHYSICAL CHARACTERISTICS OF GUNTUNG

HYPSONOMETRY	
elevation greater than (m)	% of basin
450	100
600	96.5
800	61.4
1000	30.4
1200	10.9
1400	2.2
1600	0.8
1850	0.0

RELIEF	Area 147 km ² Perimeter 58.3 km Slope global index 30 m/km Mean elevation 912 m Median elevation 860 m
GEOLOGY	Volcanic tuff (about 50%), andesite, metamorphic sandstones
VEGETATION	Secondary jungle
CLIMATE	Mean annual rainfall 3200 mm Mean annual potential evaporation 1100 mm

Table 2b PHYSICAL CHARACTERISTICS OF BALANGIR

HYPSONOMETRY	
elevation greater than (m)	% of basin
170	100
250	98.5
500	86.2
750	70.8
1000	56.3
1250	35.3
1500	13.9
1750	2.2
1996	0.0

RELIEF	Area Perimeter Slope global index Mean elevation Median elevation	40.6 km ² 29 km 176 m/km 1560 m 1330 m
GEOLOGY	Volcanic rocks, tuff breccia and lava	
VEGETATION	Forest, some rubber plantation near the intake	
CLIMATE	Mean annual rainfall Mean annual potential evaporation	3000 mm 1000 mm

Table 2c PHYSICAL CHARACTERISTICS OF SUMANI

HYPSONOMETRY	
elevation greater than (m)	% of basin
600	100
750	99.0
1000	77.8
1250	28.0
1500	11.2
1750	4.8
2000	2.1
2470	0.0

RELIEF	Area 80.9 km ² Perimeter 36.9 km Slope global index 79 m/km Mean elevation 1190 m Median elevation 2100 m
GEOLOGY	Volcanic formations : undifferentiated flows and colluvial deposits
VEGETATION	Secondary forest with cultivated areas, padi fields very little forest cover remains
CLIMATE	Mean annual rainfall 2750 mm Mean annual potential evaporation 875 mm

Table 2d PHYSICAL CHARACTERISTICS OF SIKARBAU

HYPSONOMETRY	
elevation greater than (m)	% of basin
170	100
250	98.5
500	86.2
750	70.8
1000	56.3
1250	35.3
1500	13.9
1750	2.2
1996	0.0

RELIEF	Area Perimeter Slope global index Mean elevation Median elevation	115 km ² 53 km 63 m/km 1054 m 1090 m
GEOLOGY	Volcanic formations	
VEGETATION	Mainly jungle, very little cultivated areas	
CLIMATE	Mean annual rainfall Mean annual potential evaporation	3500 mm 1050 mm

Table 2f PHYSICAL CHARACTERISTICS OF BAYANG SANI

HYPSOMETRY	
elevation greater than (m)	% of basin
270	100
300	99.3
400	87.4
500	60.4
750	27.2
1000	12.3
1250	4.9
1500	0.3
1520	0.0

RELIEF	Area	9.74 km ²
	Perimeter	17 km
	Slope global index	122 m/km
	Mean elevation	646 m
	Median elevation	560 m
GEOLOGY	Volcanic rocks, tuff, breccia and lava	
VEGETATION	Forest and some rubber plantations	
CLIMATE	Mean annual rainfall	4000 mm
	Mean annual potential evaporation	1270 mm

1.3. Climate

The province of West SUMATRA is situated astride the equator and is bordered by the Indian Ocean. The climate is almost entirely controlled by the monsoon circulations of south east Asia.

West SUMATRA is under two monsoons, the north west monsoon (called the "wet monsoon") from november to march and the south east monsoon (called the "dry monsoon") from march to october. However, local climatic effects due to the relief disturb the monsoonal system.

Due to the structure of the island and its geographical location, the air over the area is warm and moist.

The monthly mean temperature and humidity do not change very much throughout the year (PADANG : mean annual temperature 29°C ; mean annual relative humidity : 80 %).

The very humid and warm air masses produce heavy rainfall by combination of 3 trigger mechanisms : convergence, convection and orographic effects.

West SUMATRA is one of the most rainy place in the world : annual average rainfall exceeds 5000 mm at many locations with recorded values in excess of 6000 mm [1].

Rainfall lows actually occur in february and july, the low in february usually being less pronounced than that of july.

The main wet season occurs from october to january and a secondary peak in rainfall occurs in april.

2. AVAILABLE DATA

2.1. Rainfall

2.1.1. Selected rainfall stations. Monthly records for about 100 rainfall stations in West SUMATRA had been collected for the preliminary screening of the sites (first stage report [2]). The location of these stations and the long time mean isohyets are shown on the situation map (fig. 1).

The following stations (table 3) have been selected for their geographical location and period of records as the most representative for each catchment :

TABLE 3 : SELECTED RAINFALL STATIONS

NUMBER	NAME	PERIOD OF RECORDS
27	LIKI	1916-41 ; 1952-57 ; 1960
28	SUNGEI LANDEI	1916-21
38	ALAHAN PANDJANG	1916-41 ; 1953 ; 1957-75
38a	INDRAPURA	1924-41 ; 1951-57 ; 1961 ; 1963 ; 1966-67 ; 1979-81
42b	BARUNG BALANTAI	1924-41 ; 1953-59 ; 1961 ; 1963 ; 1973 ; 1975
47	SOLOK	1916-41 ; 1951-61 ; 1967-69 ; 1973 ; 1976-78
47c	KUBANGNAN DUA	1924 ; 1926-41
53	PADANG PANJANG	1916-41 ; 1954-60 ; 1963-79
53c	PAALEMBAJAN	1924 ; 1926-41 ; 1954-57
54	BUKITTINGGI	1916-41 ; 1951-66 ; 1981
56	SULIKI	1924 ; 1926-41 ; 1951-56 ; 1974-81
59	LUBUKSIKAPING	1916-41 ; 1951-57 ; 1973-80
59c	BATANG PASAMAN	1930-39 ; 1940-41
63b	PARIT	1924 ; 1926-1938 ; 1940-41

For the stations of table 3, only monthly data and the annual maximal daily rainfall are available.

Fortunately, during this second stage (feasibility study) recent daily data for 2 stations have been collected at the meteorological office of PADANG Airport :

PADANG TABING	1971-1985
SUKARAMI	1975-1985

2.1.2. Critical review. At first rainfall data have been reviewed from a qualitative point of view before to be used.

The temporal and spatial homogeneity of annual records has been checked by using the method of the "Regional vector" [3], [4].

In this method, a reference vector with annual components is computed from all the regional available data.

Then, each station is checked up against such a vector. The elaboration of the vector lies on the principle that the most likely information is that which repeats itself the most frequently.

In West SUMATRA, the quality control indicates that for the most stations, data are not reliable past 1941.

As far as possible the gaps in the time series have been filled from near stations and some corrections have been introduced when systematic errors have been detected (for instance : station 42b from 1937 to 1941). The too uncertain years have been deleted as, for example, the years since 1941 at the station number 59. The resulting operational data set of monthly rainfall is given in appendix 1.

2.1.3. Statistical analysis. A statistical analysis has been undertaken on the main rainfall stations (with long time series) for the annual total rainfall and for the annual maximum daily rainfall.

Each sample of observed values has been fitted to 9 usual distribution models by the method of maximum likelihood :

- Normal distribution (GAUSS)
- GUMBEL distribution
- Log normal distribution (GALTON)
- PEARSON 3 distribution (incomplete gamma in X)
- PEARSON 5 distribution (incomplete gamma in 1/X)
- GOODRICH distribution
- FRECHET distribution
- Log gamma distribution
- Cox and Miller distribution (law of "leaks")

The following tables resume the results obtained with the most adequate distribution model :

- table 4 : for annual total rainfall
- table 5 : for annual maximum daily rainfall

TABLE 4. ANNUAL RAINFALL (mm)

STATIONS		PROBABILITY						
		DRY YEARS			MEDIAN	WET YEARS		
NAME	Nc	0.01	0.02	0.10	0.50	0.90	0.98	0.99
LIKI	27	2611	2778	3270	4047	4704	5043	5154
ALAHANPANDJANG	38	1781	1812	1927	2258	2986	3876	4343
INDRAPURA	38a	2498	2556	2799	3437	4260	4779	4994
BARUNG BALANTAI	42b	2414	2655	3328	3688	5074	5455	5578
SOLOK	47	1464	1508	1648	1952	2386	2738	2884
SUNGEI PANJANG	28	984	1156	1642	2450	3257	3744	3916
PADANG PANJANG	53	2759	2791	2905	3217	3909	4802	5289
PAALEMBAJAN	53c	1735	1839	2140	2597	2970	3160	3221
BUKITTINGGI	54	1717	1745	1845	2123	2638	3143	3372
LUBUKSIKAPING	59	3225	3352	3741	4502	5430	6087	6338

TABLE 5. MAXIMUM DAILY RAINFALL (mm)

STATIONS		PROBABILITY						
		DRY YEARS			MEDIAN	WET YEARS		
NAME	No	0.01	0.02	0.10	0.50	0.90	0.98	0.99
LIKI	27	74.5	76.4	83.2	102	144	195	221
INDRAPURA	38a	80.4	88.2	113	160	215	252	266
BARUNG BALANTAI	42b	90.5	98.0	122	178	265	241	373
SOLOK	47	54.5	57.3	66.9	88.9	122	150	161
PADANG PANJANG	53	65.4	70.2	85.9	121	177	226	246
PAALEMBAJAN	53c	34.4	36.7	45.6	74.2	153	273	345
BUKITTINGGI	54	45.4	47.6	55.1	73.0	102	129	140
LUBUKSIKAPING	59	74.0	77.7	88.4	115	165	214	237

2.2. Evaporation

Because of high intensity rainstorms, accurate pan evaporation records are difficult to achieve in West SUMATRA, especially during the monsoon months.

Pan evaporation (class A) records were available at two climatological stations :

PADANG GUNUNG NAGO (coastal station) : 1977-1984
 SUKARAMI (928 m above the sea level) : 1975

The total depth for 1975 at SUKARAMI is 1668 mm ; average of the monthly and annual values at PADANG are given in the table 6.

TABLE 6. AVERAGE OF PAN EVAPORATION AT PADANG (mm)

J	F	M	A	M	J	J	A	S	O	N	D	∴	YEAR
147	133	143	136	142	138	132	147	132	142	127	141	∴	1660

- According to the location of the station (on the seaside), these values seem to be very low and the reliability of data is questionable.

So, for calculation of evaporation on the forested catchments, only the monthly distribution observed at PADANG have been kept and transposed results of a previous study of evaporation in Peninsular MALAYSIA [5] have been preferred to assess the annual depth of evaporation.

Potential evaporation from forested area is assumed to be a decreasing function of the elevation as shown by the summarised results of the table 7.

TABLE 7. EVAPORATION-ELEVATION RELATIONSHIP FOR FOREST AREA

Mean elevation (m above sea level)	0	250	500	1000	1500
Annual evaporation (mm)	1635	1325	1240	1078	812

2.3. River flow

All the selected sites have been instrumented with staff gauges in the middle of 1985.

The gauging stations are operating since a very short time and the rating curves are still without sufficient reliability to be use for accurate discharge calculation.

There are some permanent recorder stations (national hydrological network) in the study area but most of them are recent stations and data processing of the new records is not still executed.

Four stations are interesting for the study but the quality of the records is somewhat variable, particularly during period of low stage. These stations are the following :

BATANG BATAHAN at SILAPING	(1 170 00 01)	1973-1979
BATANG TONGAR at LUBUK TOREH	(1 165 00 03)	1974-1980
BATANG MASANG at SIPI SANG	(1 164 00 01)	1975, 1978, 1980-1981
BATANG SUMANI at BANDAR PADUNG	(1 006 00 05)	1977-1981

All the gauging stations are instrumented with automatic level recorders (OTT-R10) and the records are send to the Central Office of Hydrology for data processing.

3. FLOW DATA ELABORATION

3.1. Method

The lack of actual site data has necessitated simulating river flows using a rainfall-runoff model.

3.2. Restoration of daily rainfalls

As the conceptual model is working in a daily time step, daily data were requested to be used as input.

To restore daily rainfalls at the selected stations (see paragraph 2.1.) the following procedure has been used :

- a) Ranging the monthly rainfalls RM at the station where daily data were available (PADANG) and RMB at the selected stations where only monthly data were available.
- b) Attributing to each monthly values RMB the observed daily data corresponding to the monthly value RM of the similar rank with a RMB/RM ponderation.

Such generated records are not the true historical values but are approximately equivalent in a statistical sense. They are suitable for low and mean flow data elaboration but frequently high generated values are not very reliable.

3.3. Model description

- A conceptual model is constructed by forming a simplified representation of hydrological processes involved in producing runoff from rainfall on a catchment.

The selected model is a tank model developed by IBIZA [6] and adapted for small steep basins under rainy climates.

The "runoff production function" is based on the water balance equation. The input data are the daily rainfalls and the potential evaporation providing the climate characteristics and some physical parameters providing the watershed characteristics.

- The movement of water over, into and through the soil is simulated by transfers from one level to another through a combination of stores :

The rainfalls supply a first storage at the vegetal layer (upper soil store) in which the vegetation takes evaporation. The water in excess is divided into two parts according to the soil permeability :

- a first part producing the fast runoff EC is determined by the fast flow rate q .
- the second part feeds by infiltration the underground storage constituted by the groundwater body (subsoil store HNO).

This last store HNO produces the base flow with a depletion coefficient AL but can also overflow in another store (interflow store HN01). The store HN01 produces a slow interflow with a coefficient R2 and also fast runoff, added to EC, when it is full.

The slow interflow is interpreted as a supplemental temporary drainage of the watertable by high points ("overflowing of the watertable") and the quantity of overflow is an increasing function of the watertable level.

The saturation of the subsoil store induces a reduction of infiltration which can be revealed by a concept of "rejected infiltration".

So for small basins under rainy climate, a balance occurs between input and output of the watertable which is termed as "maximum balance". Under these conditions the main parameters which govern the different slow flows are linked to one another and to the physical characteristics of the basin (permeability and slope) as shown by figures 2 to 4 which give such graphical relationships drawn from results of analysis of many volcanic basins in humid zone.

3.4. Calibration of the model

The three recorded catchments of BATAHAN (310 km²), TONGAR (266 km²) and MASANG (458 km²) were assumed to be pilot basins for the mountainous areas and have been used to compute the regional values of the model parameters :

- AL coefficient of depletion
- HNO capacity of the subsoil store
- R2 coefficient of slow interflow
- HNO1 capacity of the interflow store.

A first assessment of parameters is given by examination of the hydrographs (in logarithmic coordinates); then calibration is carried out by comparison between observed and computed discharges.

Because daily rainfall input were fictitious elaborated data (see paragraph 3.2) only monthly values have been compared.

Final optimised parameters are given in table 8.

TABLE 8. MAIN MODEL PARAMETERS FOR RECORDED BASINS

BASIN	Area km ²	Slope global index m/km	AL day ⁻¹	HNO mm	R2 day ⁻¹	HNO1	q
BATAHAN	310	30.2	0.008	670	0.168	130	0.30
TONGAR	266	31.6	0.005	870	0.192	100	0.35
MASANG	458	25.0	0.0035	935	0.158	100	0.40

3.5. Transposition to the sites

Figures 2 to 4 indicate that these results are in a good accordance with relationships carried out for volcanic basins in similar conditions.

So it was assumed that the relationships (fig. 2 to 4) between the model parameters and the physical characteristics were suitable for the sites.

Fig. 2 RELATION BETWEEN THE DEPLETION COEFFICIENT
(AL) AND THE SLOPE INDEX (IG)

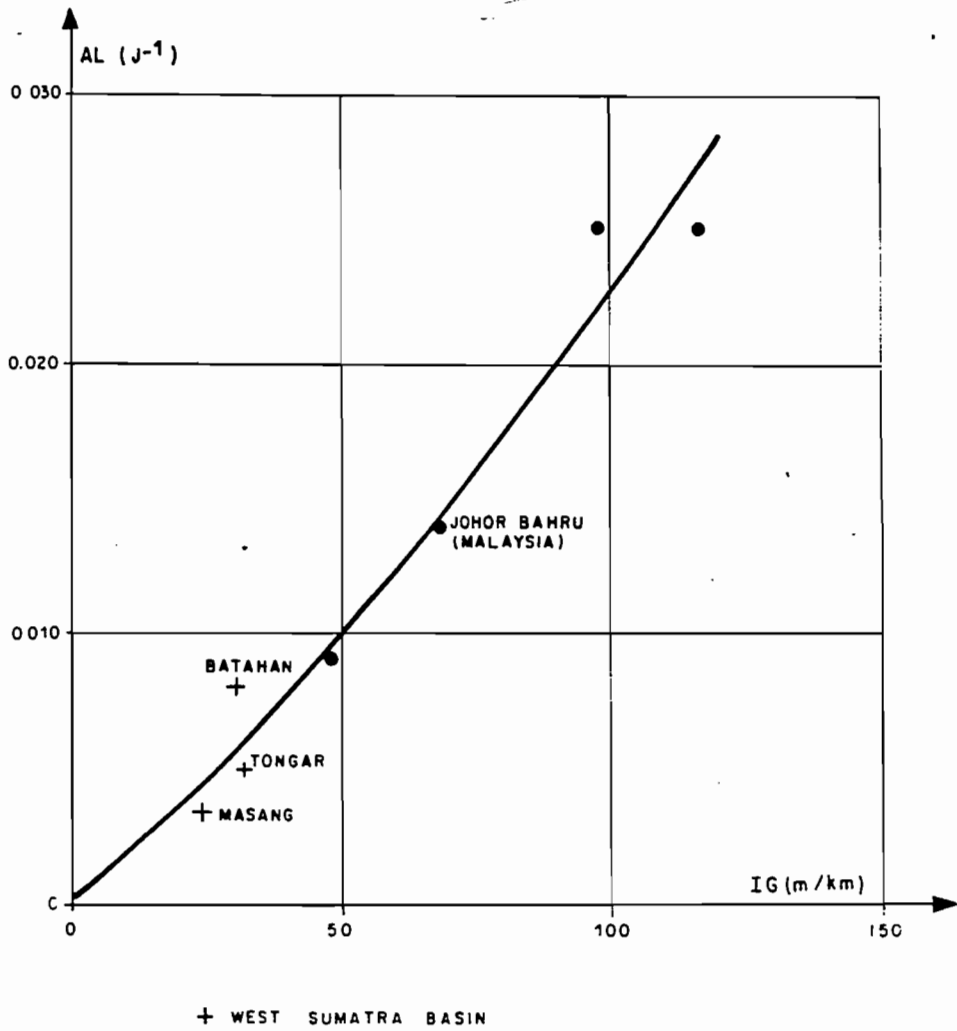


Fig. 3

RELATION BETWEEN THE SUBSOIL STORE CAPACITY (HNO), THE FAST FLOW RATE (q) AND THE DEPLETION COEFFICIENT (AL)

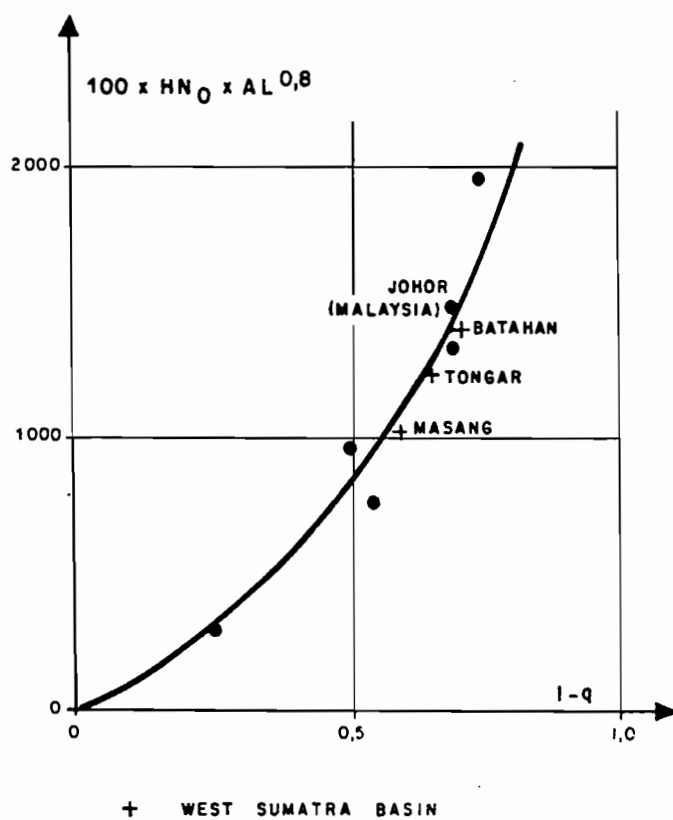
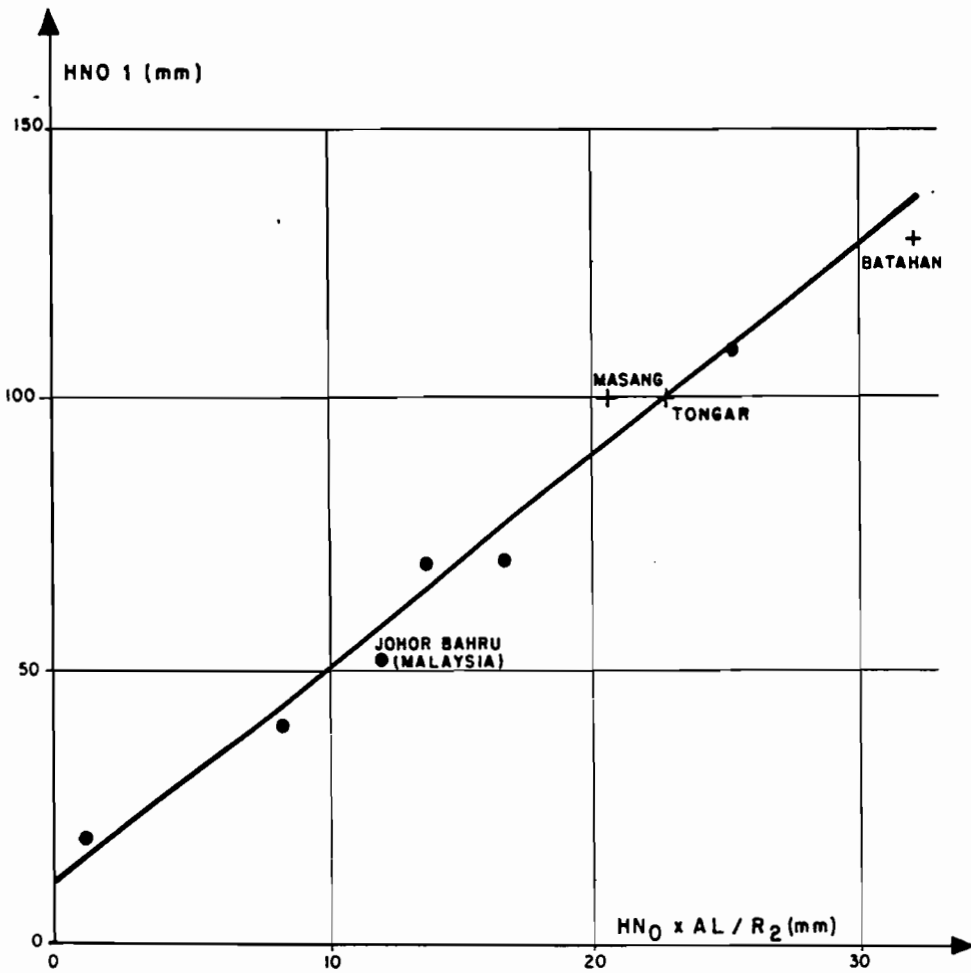


Fig. 4 RELATION BETWEEN THE INTERFLOW STORE CAPACITY (HN_0), THE DEPLETION COEFFICIENT (AL) AND THE INTERFLOW COEFFICIENT (R_2)



+ WEST SUMATRA BASIN

The fast flow rate q was assumed to be constant for the region and equalled to the mean value 0.35 which is in accordance with a great permeability. Then the other parameters have been estimated by using the previous empirical relationships.

3.6. Generation of flow data

The monthly and yearly computed discharges of the 6 sites are given in appendix 2. Mean daily discharges are not included in this report.

4. ANALYSIS OF GENERATED FLOWS

4.1. Monthly and yearly flows

The overall quantity of surface water that is available in each basin for water resources management is well characterized by the mean annual flow.

Mean monthly flows serve as the main tool for describing intra-year distribution of runoff.

Monthly and annual discharges have been put in order by increasing values. Results are given in appendix 3 and are summarised in tables 9a and 9b.

Mean specific discharges are large and range from 106 l/s/km² for PATIMAH to 60.4 l/s/km² for SUMANI.

However, for a low-head water power development, with no or relatively small flow regulating capacity, the total annual electric output will depend much less on the annual volume of runoff than on its distribution throughout the year.

In such case with limited possibilities of water redistribution the main importance is the day-to-day water inventory and especially for the low flows period.

TABLE 9a. SUMMARY OF MEAN MONTHLY AND ANNUAL FLOWS (m³/s)

SITE		J	F	M	A	M	J	J	A	S	O	N	D	ANNUAL
GUNTUNG	Mean	11.2	8.77	9.71	11.2	9.45	6.52	5.43	5.74	8.73	11.8	15.2	16.2	9.98
	Min	6.88	6.02	5.52	5.91	5.26	4.18	3.49	3.45	4.58	7.10	11.9	7.64	6.75
	Max	21.3	12.4	21.9	20.4	16.8	11.2	8.44	7.85	16.0	16.9	24.6	24.5	13.2
BALANGIR	Mean	6.46	4.49	4.60	3.90	3.63	2.78	2.04	2.52	3.54	4.01	4.26	4.59	3.96
	Min	2.97	1.28	1.56	1.98	1.62	0.445	0.256	0.416	1.06	0.833	1.040	0.688	2.52
	Max	13.8	11.1	9.01	9.60	6.71	5.49	5.89	6.46	6.88	7.24	8.73	9.32	5.18
SUMANI	Mean	6.38	4.65	5.87	5.99	5.41	3.43	2.35	2.73	3.48	5.31	6.94	6.33	4.89
	Min	1.85	1.45	1.65	1.29	1.54	1.13	1.18	0.982	1.22	2.22	2.11	2.00	3.12
	Max	16.2	13.7	21.9	10.9	11.7	8.28	4.61	8.55	6.28	9.36	13.0	10.9	7.36

TABLE 9b. SUMMARY OF MEAN MONTHLY AND ANNUAL FLOWS (m³/s)

SITE		J	F	M	A	M	J	J	A	S	O	N	D	ANNUAL
SIKARBAU	Mean	9.97	6.78	8.50	11.3	9.12	6.85	4.85	5.79	8.17	12.1	14.5	11.3	9.09
	Min	4.92	3.14	4.41	6.27	6.04	3.66	2.62	2.50	3.70	5.04	4.77	5.52	6.05
	Max	18.5	15.1	12.5	19.3	18.3	14.4	10.1	10.4	14.2	32.2	34.7	21.4	13.0
PATIMAH	Mean	15.8	10.4	14.1	19.0	14.9	10.7	7.40	9.46	14.0	21.6	24.3	18.3	15.0
	Min	7.96	4.76	7.84	9.48	9.96	5.46	3.91	3.88	6.17	8.35	7.47	8.85	10.0
	Max	29.5	24.4	20.9	32.8	30.4	24.5	16.4	17.6	25.5	57.1	56.2	36.1	21.5
BAYANG SANI	Mean	1.04	0.581	0.873	0.996	0.664	0.425	0.427	0.554	0.934	1.23	1.38	1.39	0.861
	Min	0.206	0.152	0.130	0.301	0.232	0.139	0.068	0.073	0.072	0.070	0.348	0.577	0.471
	Max	2.32	1.44	1.62	2.53	1.79	0.944	1.65	1.50	3.05	2.41	2.59	3.39	1.16

TABLE 10b. LOW FLOW DISCHARGES (m³/s)

SITE : BALANGIR (40.6 km ²)										
Return period (years)	% of Time discharge is equalled or exceeded									
	5	10	20	30	50	70	80	90	95	100
2	12.5	8.52	5.34	3.60	2.35	1.70	1.53	1.20	1.00	0.700
5	9.88	6.64	4.07	3.00	2.00	1.35	1.03	0.710	0.575	0.380
10	8.99	6.32	3.40	2.42	1.70	1.12	0.900	0.575	0.440	0.300
mean year	12.0	8.42	5.09	3.54	2.30	1.71	1.44	1.10	0.950	0.700

TABLE 10c. LOW FLOW DISCHARGES (m³/s)

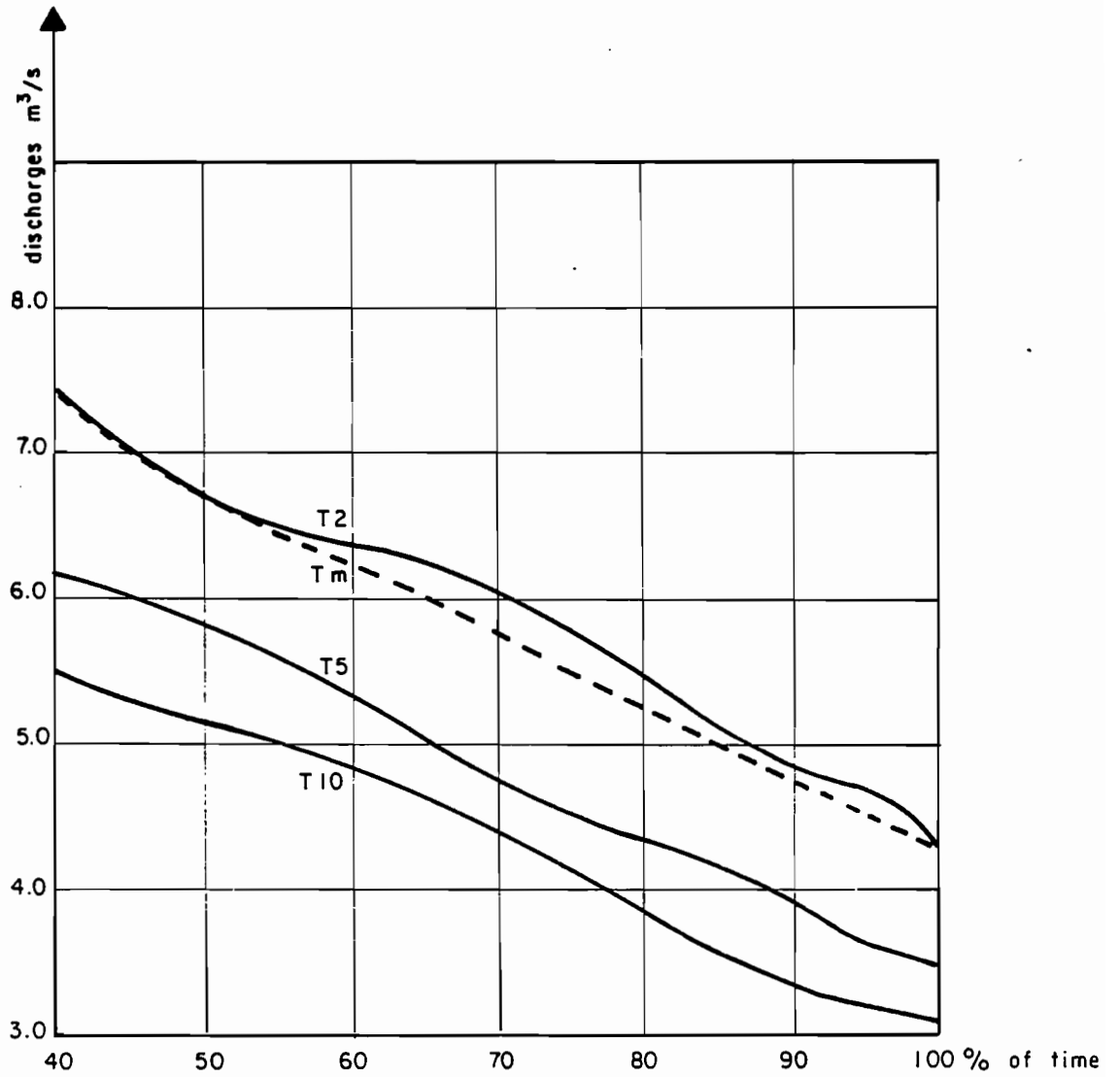
SITE : SUMANI (80.9 km ²)										
Return period (years)	% of Time discharge is equalled or exceeded									
	5	10	20	30	50	70	80	90	95	100
2	13.4	8.36	5.48	4.27	3.50	2.64	2.30	1.85	1.60	1.35
5	10.8	6.61	4.56	3.47	2.65	1.83	1.50	1.20	1.10	1.00
10	10.2	6.29	4.10	3.26	2.35	1.62	1.35	1.10	0.950	0.800
mean year	14.3	8.92	5.65	4.36	3.20	2.50	2.15	1.80	1.60	1.35

TABLE 10d. LOW FLOW DISCHARGES (m³/s)

SITE : SIKARBAU (115 km ²)										
Return period (years)	% of the Time discharge is equalled or exceeded									
	5	10	20	30	50	70	80	90	95	100
2	25.3	17.0	10.2	7.92	5.80	4.87	4.40	3.90	3.60	3.20
5	19.8	12.7	7.98	6.52	5.00	4.36	3.80	3.30	3.05	2.80
10	18.2	10.9	7.54	5.84	4.60	4.04	3.30	2.70	2.45	2.20
mean year	26.2	17.2	10.6	8.03	5.80	4.85	4.40	3.90	3.60	3.20

Fig. 5

SITE : GUNTUNG (147 km²)

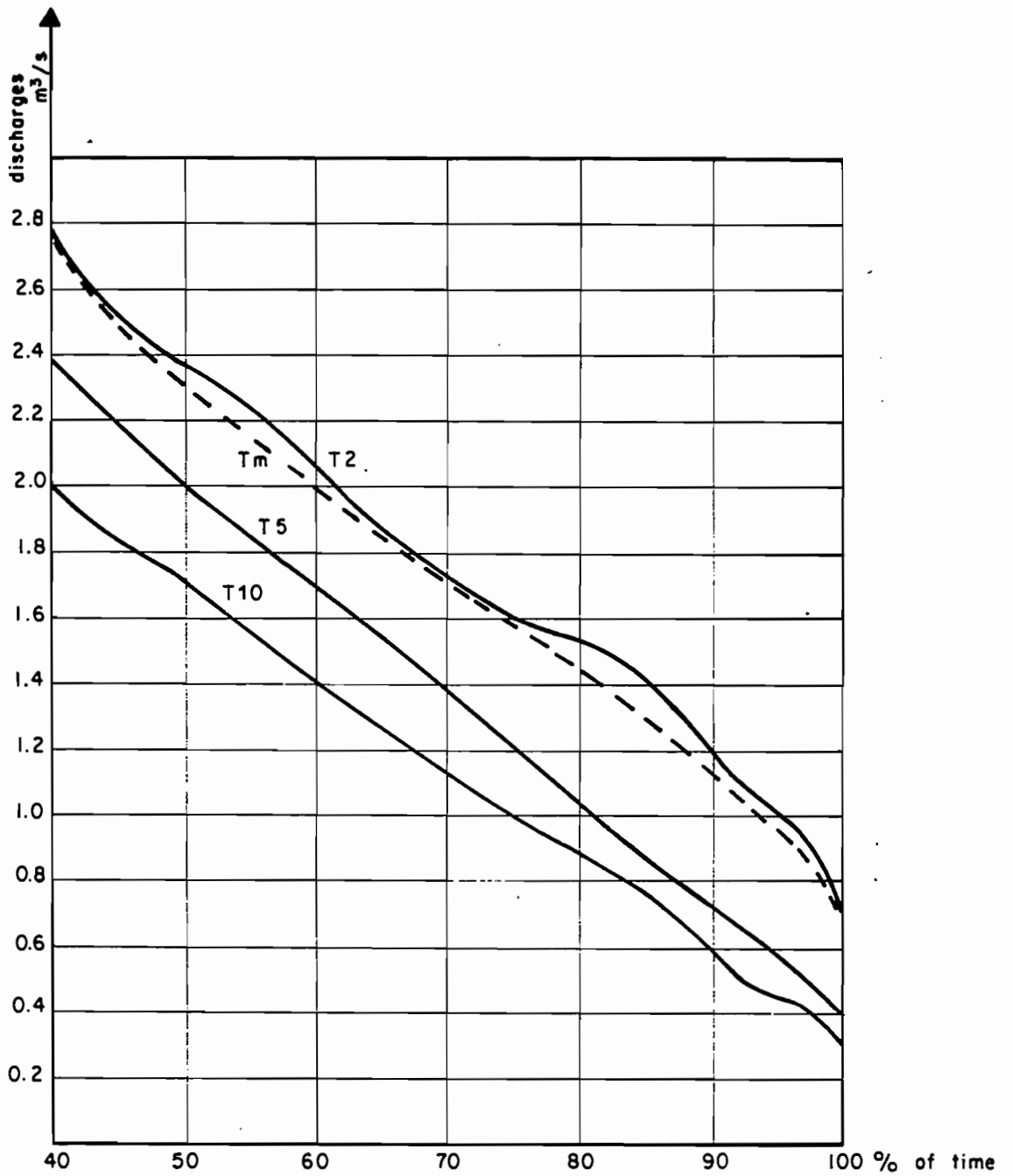


T_m : mean
T₂ : 2 - year return period
T₅ : 5 - year return period
T₁₀ : 10 - year return period

LOW FLOW DURATION CURVES

Fig. 6

SITE : BALANGIR (40.6 km²)

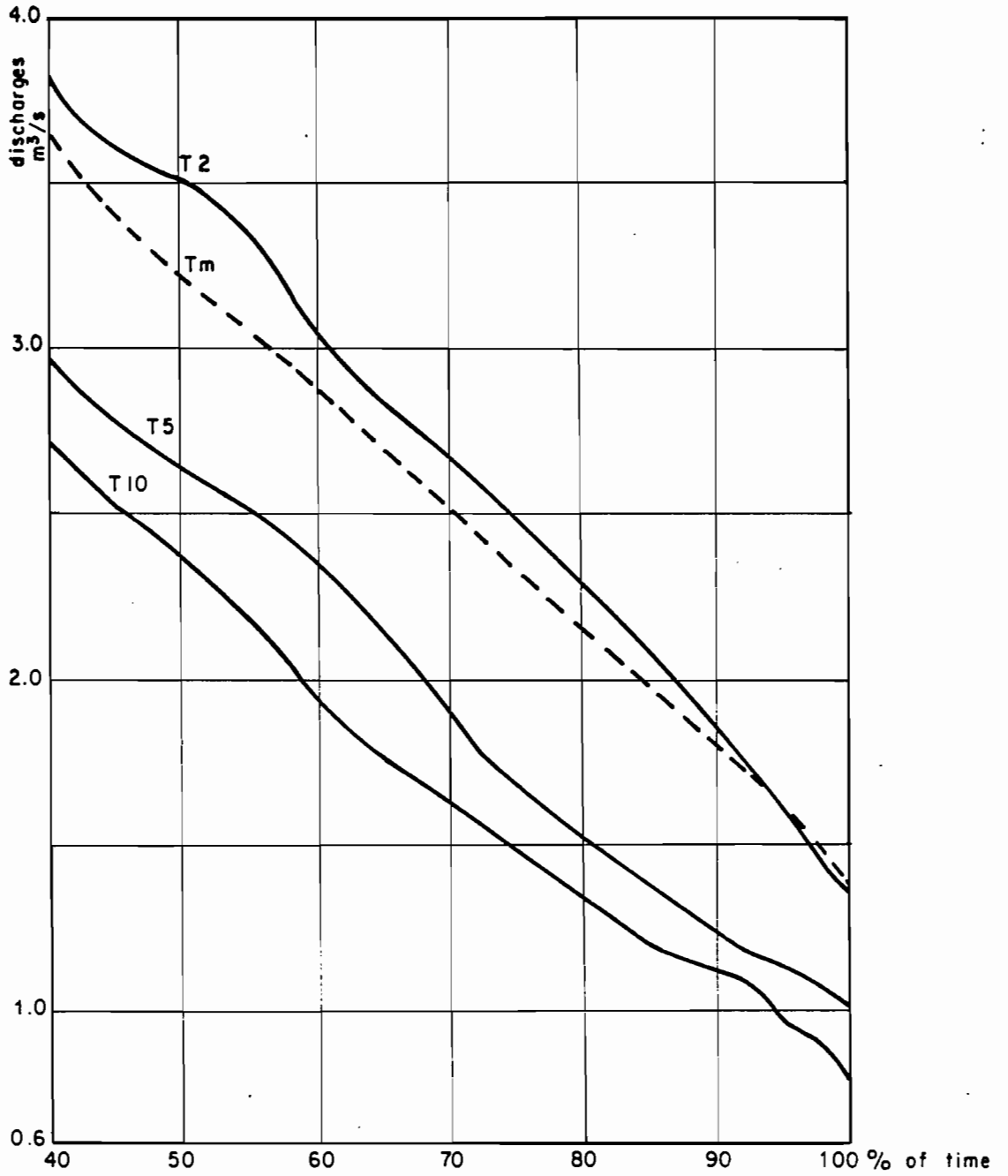


T_m : mean
T₂ : 2-year return period
T₅ : 5-year return period
T₁₀ : 10-year return period

LOW FLOW DURATION CURVES

Fig. 7

SITE : SUMANI (80.9 km²)

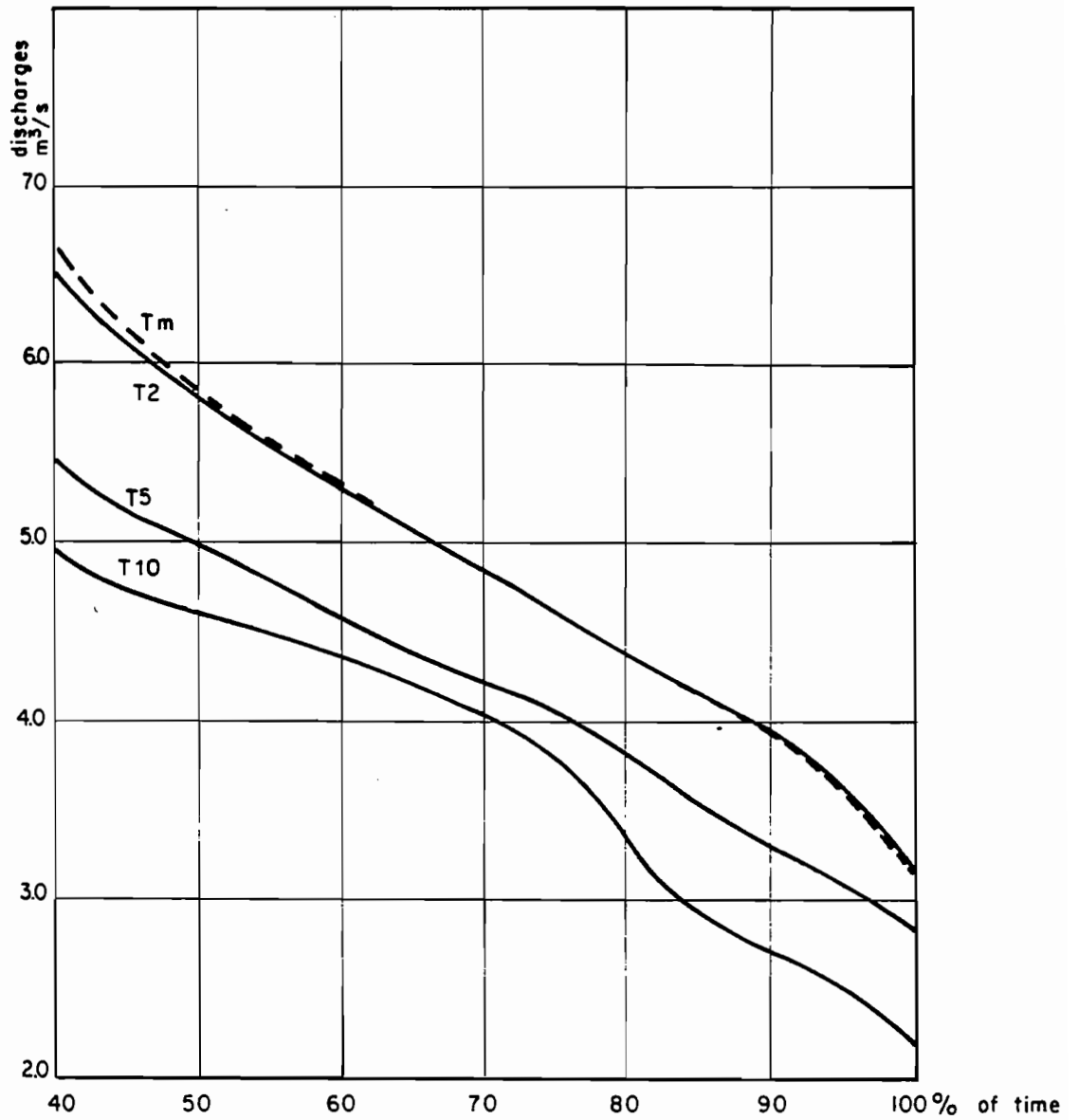


Tm : mean
T2 : 2-year return period
T5 : 5-year return period
T10 : 10-year return period

LOW FLOW DURATION CURVES

Fig. 8

SITE : SIKARBAU (115 km²)

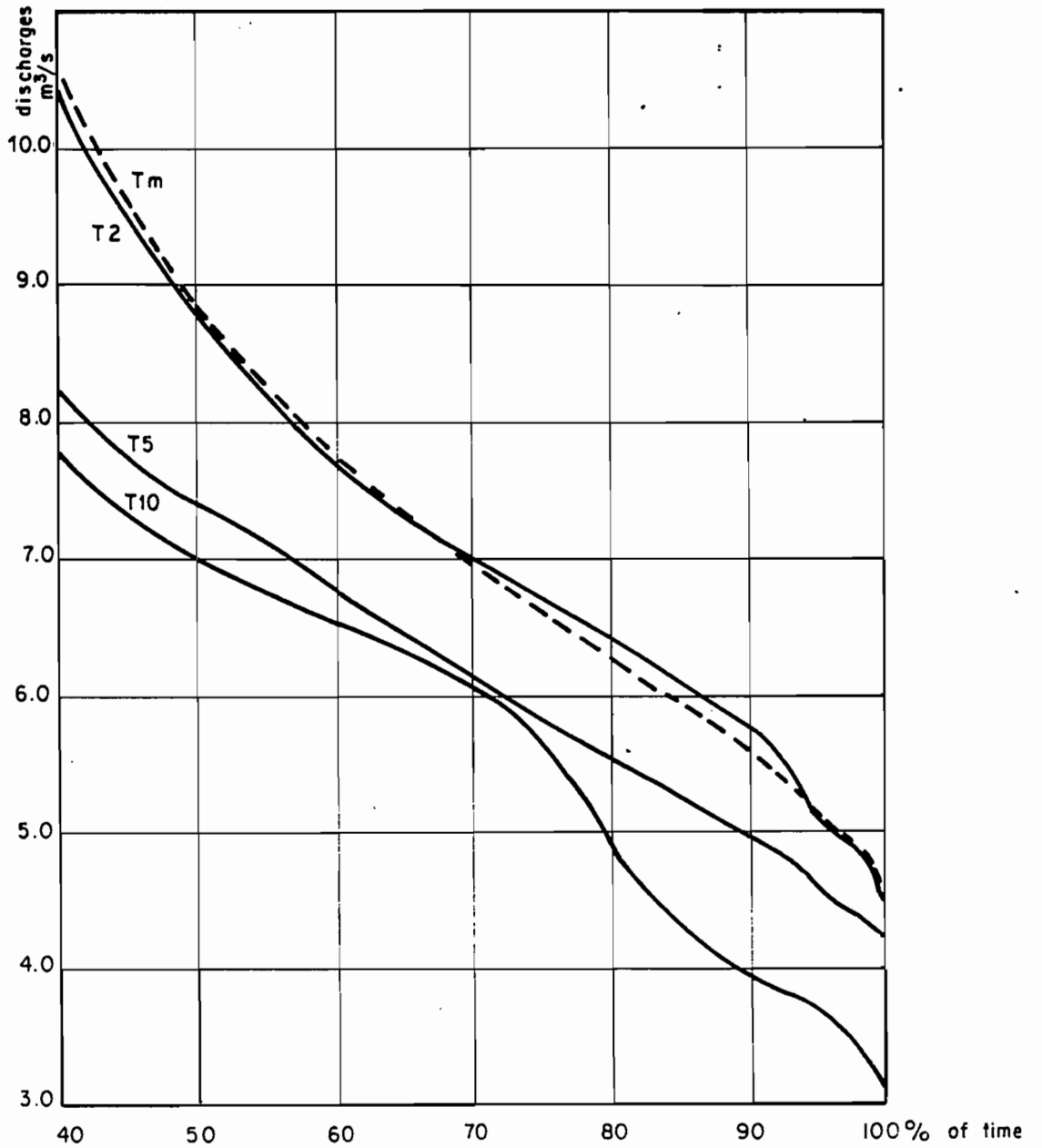


Tm : mean
T 2 : 2 - year return period
T 5 : 5 - year return period
T 10 : 10 - year return period

LOW FLOW DURATION CURVES

Fig. 9

SITE: PATIMAH (142 km²)

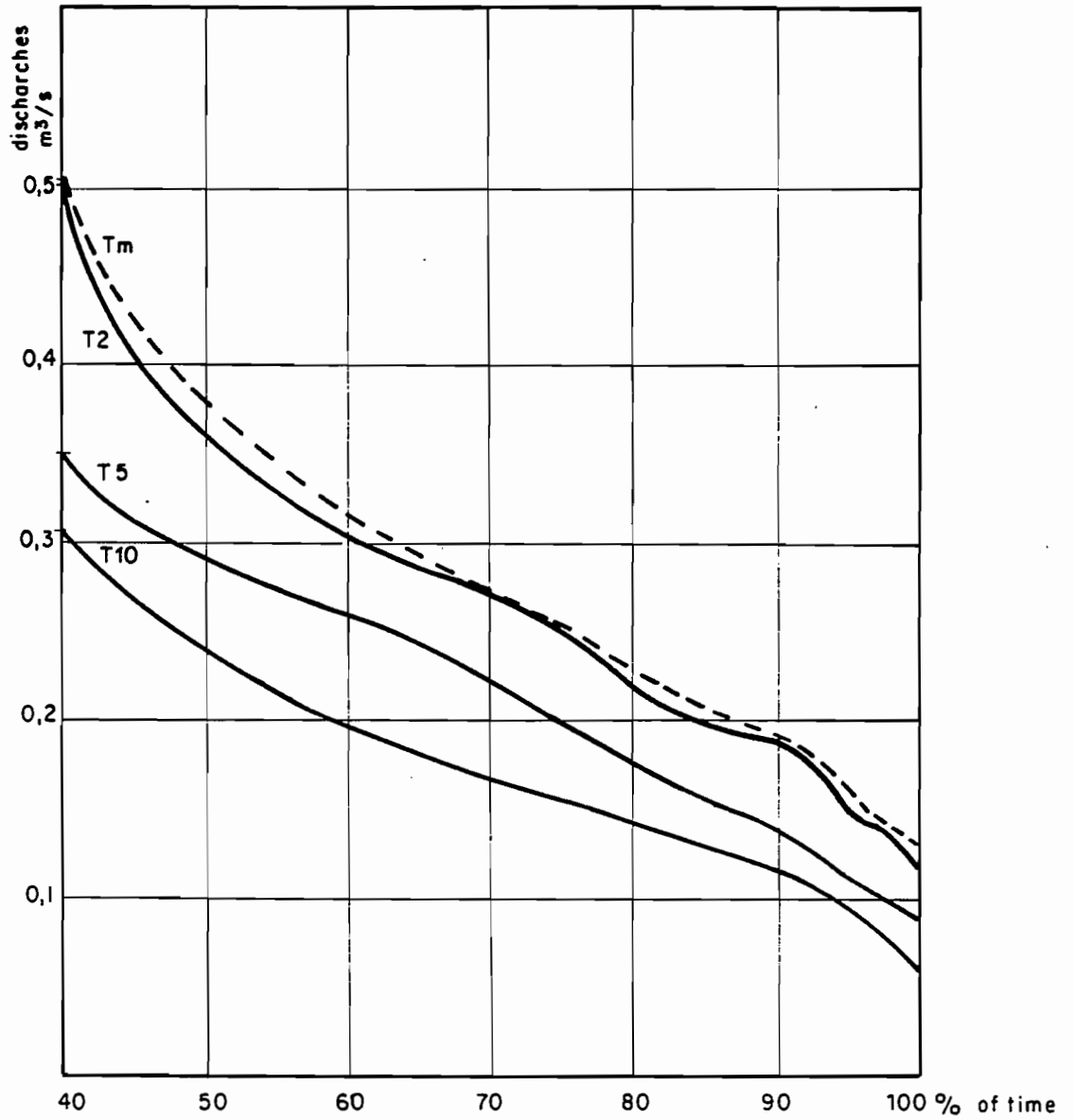


Tm : mean
T2 : 2 - year return period
T5 : 5 - year return period
T10 : 10 - year return period

LOW FLOW DURATION CURVES

Fig. 10

SITE : BAYANG SANI (9.74 km²)



Tm : mean
T2 : 2-year return period
T5 : 5-year return period
T10 : 10-year return period

LOW FLOW DURATION CURVES

TABLE 10e. LOW FLOW DISCHARGES (m³/s)

SITE : PATIMAH (142 km ²)										
Return period (years)	% of Time discharge is equalled or exceeded									
	5	10	20	30	50	70	80	90	95	100
2	42.6	29.4	18.7	13.1	8.80	6.98	6.40	5.75	5.05	4.40
5	34.3	23.6	13.8	10.0	7.40	6.12	5.50	4.95	4.55	4.20
10	32.4	20.3	12.4	9.05	7.00	6.04	4.85	3.95	3.70	3.15
mean year	44.7	29.4	18.4	13.2	8.80	6.97	6.25	5.60	5.10	4.40

TABLE 10f. LOW FLOW DISCHARGES (m³/s)

SITE : BAYANG SANI (9.74 km ²)										
Return period (years)	% of Time discharge is equalled or exceeded									
	5	10	20	30	50	70	80	90	95	100
2	2.89	2.09	1.26	0.810	0.360	0.270	0.220	0.185	0.150	0.115
5	2.25	1.36	0.734	0.454	0.290	0.220	0.175	0.140	0.110	0.900
10	2.11	1.27	0.624	0.394	0.240	0.164	0.140	0.115	0.950	0.600
mean year	2.94	1.89	1.15	0.735	0.380	0.270	0.230	0.190	0.160	0.130

5. FLOOD ESTIMATION

5.1. Procedure

To estimate the design flood peaks at the different sites, the "Rational Method" has been used by considering the following conventional formula :

$$Q_T = u C i_T A$$

where :

Q_T is the peak discharge of the design flood with return period T years.

i_T is the average intensity of the design rainstorm of duration equal to the "time of concentration" (T_c) and of return period T years.

A is the area of the supplying catchment.

C is the runoff coefficient which is a dimensionless coefficient normally considered to be a function of the catchment and design storm characteristics.

u is a constant coefficient depending of the units.

If Q_T is in m^3/s , i_T in mm/h , A in km^2 , u is equal to 0,278.

Two calculations have been undertaken using this procedure and corresponding to different approaches for estimation of the "time of concentration" (or characteristic time) and the runoff coefficient :

- method 1 is based on results of a regional study of flood estimation for rural cathments in Peninsular MALAYSIA [7].
- method 2 is based on results of similar studies carried out by ORSTOM [6], [8] on small volcanic basins under same climatic conditions.

5.2. Average intensity of the design rainstorm (i_T)

The rainfall depths corresponding to selected return periods and a range of durations from minutes up to several days are required for flood design purpose.

Unfortunately, until very recently, there were few automatic rainrecorders in West SUMATRA an not any results of regional statistical analysis of rain-records are available for a duration less than the day.

Therefore, results of such a frequency analysis of short duration rainfall data in MALAYSIA [9] have been adapted and used.

The design intensity for a ponctual station has been adjusted to take account of the reduction in storm intensity with catchment area. Table 11 give values of the point rainfall depths adopted for all the sites.

TABLE 11. RAINFALL DEPTHS (in mm)

Return Period (years)	STORM DURATION (hours)						
	1/4	1/2	1	2	3	6	24
5	33	46	62	-	99	143	155
10	39	53	70	-	118	174	190
20	46	59	79	109	136	205	220
50	54	67	90	-	160	243	260

where :

F_I is the daily capacity of infiltration which is estimated as a result of the hydrological model

R_T is the point daily rainfall for the return period T

a is the reduction in rainstorm with catchment area.

5.5. Computed peak discharges

Peak discharges for each site have been computed by the two methods for return period corresponding to the available rainstorms (5, 10, 20, 50 years).

Estimation of peak discharges for the 100 year-return period has been obtained by fitting a GALTON distribution model. Results are given in table 12 for method 1 and table 13 for method 2.

5.6. Design flood

For design flood estimation the higher value resulting of the 2 methods of calculation for the 100 years return period has been retained. Results are given in table 14.

Specific flood discharges are relatively high and range from 5,31 m³/s for the GUNTUNG (147 km²) to 18,5 m³/s/km² for the BAYANG SANI (10 km²).

These high values, due to the very steep gradient of the catchments and to the heavy rainfall intensities, are in agreement with other results of observed maximum floods in this part of INDONESIA [10] having regard to the areas of the drainage basins.

TABLE 12. PEAK DISCHARGE Q_T WITH RETURN PERIOD T YEARS (method 1)

SITE	Q_5		Q_{10}		Q_{20}		Q_{50}		Q_{100}	
	m^3/s	$m^3/s.km^2$	m^3/s	$m^3/1.Km^2$	m^3/s	$m^3/1.km^2$	m^3/s	$m^3/1.km^2$	m^3/s	$m^3/1.km^2$
GUNTUNG 147 km^2	274	1.87	330	2.25	392	2.67	464	3.16	520	3.54
BALANGIR 40.6 km^2	332	8.18	375	9.23	428	10.55	493	12.1	540	13.3
SUMANI 80.9 km^2	360	4.44	410	5.07	475	5.87	553	6.84	620	7.66
SIKARBAU 115 km^2	415	3.61	495	4.30	575	5.00	666	5.79	730	6.35
PATIMAH 142 km^2	501	3.53	598	4.21	694	4.89	804	5.66	880	6.20
BAYANG SANI 9.74 km^2	115	11.8	126	12.7	143	14.7	165	16.9	180	18.5

TABLE 13. PEAK DISCHARGE Q_T WITH RETURN PERIOD T YEARS (method 2)

SITE	Q_5		Q_{10}		Q_{20}		Q_{50}		Q_{100}	
	m ³ /s	m ³ /s.km ²	m ³ /s	m ³ /s.km ²	m ³ /s	m ³ /s.km ²	m ³ /s	m ³ /s.km ²	m ³ /s	m ³ /s.km ²
GÜNTUNG 147 km ²	393	2.7	465	3.16	542	3.69	691	4.70	780	5.31
BALANGIR 40.6 km ²	198	4.9	292	7.19	381	9.4	485	11.9	580	14.3
SUMANI 80.9 km ²	289	3.6	335	4.14	433	5.4	629	7.8	810	10.0
SIKARBAU 115 km ²	368	3.2	435	3.8	498	4.3	748	6.5	1020	8.87
PATIMAH 142 km ²	439	3.1	511	3.6	589	4.1	852	6.0	1150	8.10
BAYANG SANI 9.74 km ²	70	7.1	9.3	9.5	116	11.9	147	15.1	176	18.1

TABLE 14. ESTIMATION OF THE DESIGN FLOOD

SITE	AREA (km ²)	PEAK DISCHARGE	
		m ³ /s	m ³ /s.km ² .
GUNTUNG	147	780	5.31
BALANGIR	40.6	580	14.3
SUMANI	80.9	810	10.0
SIKARBAU	115	1020	8.87
PATIMAH	142	1150	8.10
BAYANG SANI	9.74	180	18.5

APPENDICES

APPENDIX 1

MONTHLY RAINFALLS
(Operational data set)

STATION NUMBER 540381

INDONESIA SUMATRA

INDRAPURA

MONTHLY RAINFALLS (IN MM)

: YEAR:	JAN:	FEB:	MAR:	APR:	MAY:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	TOTAL:
: 1924:	395:	380:	184:	273:	287:	138:	185:	556:	264:	387:	394:	263:	3706:
: 1926:	404:	218:	192:	457:	216:	166:	69:	144:	122:	665:	357:	218:	3228:
: 1929:	479:	283:	221:	295:	54:	69:	7:	176:	311:	272:	486:	297:	2950:
: 1930:	257:	125:	284:	372:	140:	198:	26:	198:	370:	532:	290:	198:	2990:
: 1931:	343:	458:	290:	518:	218:	290:	276:	97:	235:	346:	167:	290:	3528:
: 1932:	161:	119:	156:	213:	135:	221:	27:	97:	364:	742:	235:	182:	2652:
: 1933:	387:	449:	78:	113:	60:	112:	158:	236:	342:	324:	347:	319:	2925:
: 1934:	356:	74:	387:	506:	51:	285:	277:	141:	118:	195:	451:	248:	3089:
: 1935:	409:	549:	236:	306:	99:	384:	139:	128:	417:	413:	466:	450:	3996:
: 1936:	386:	403:	284:	211:	203:	70:	181:	285:	196:	336:	266:	300:	3121:
: 1937:	226:	252:	270:	377:	169:	135:	108:	355:	471:	532:	603:	633:	4131:
: 1938:	236:	105:	376:	204:	310:	115:	419:	266:	337:	436:	784:	420:	4008:
: 1939:	383:	168:	107:	155:	125:	123:	104:	161:	144:	251:	322:	498:	2541:
: 1940:	145:	136:	415:	147:	288:	133:	72:	107:	307:	483:	460:	772:	3465:
: 1941:	321:	378:	295:	326:	388:	112:	178:	308:	438:	415:	598:	389:	4146:
: 1951:	487:	335:	173:	235:	192:	312:	182:	259:	588:	390:	582:	542:	4277:
: 1952:	437:	231:	447:	301:	208:	177:	188:	233:	402:	553:	644:	162:	3983:
: 1953:	250:	232:	631:	206:	73:	120:	131:	115:	113:	154:	554:	434:	3013:
: 1954:	161:	132:	67:	250:	123:	178:	308:	497:	496:	433:	413:	174:	3232:
: 1955:	221:	142:	57:	105:	50:	45:	60:	230:	130:	795:	780:	750:	3365:
: 1956:	192:	134:	238:	85:	40:	95:	165:	235:	472:	275:	375:	492:	2798:
: 1957:	200:	245:	370:	425:	235:	115:	345:	280:	520:	585:	564:	415:	4299:
: 1979:	326:	330:	229:	566:	156:	317:	496:	287:	223:	569:	640:	253:	4392:
: MEAN:	311:	256:	260:	289:	166:	170:	178:	234:	321:	438:	469:	378:	3471:

STATION NUMBER 540422

INDONESIA SUMATRA

BARUNG BALANTAI

MONTHLY RAINFALLS (IN MM)

: YEAR:	JAN:	FEB:	MAR:	APR:	MAY:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	TOTAL:
: 1924:	484:	364:	573:	156:	454:	184:	347:	251:	417:	602:	417:	478:	4727:
: 1926:	150:	266:	405:	804:	126:	183:	324:	352:	321:	594:	323:	611:	4459:
: 1927:	213:	262:	504:	330:	221:	71:	123:	333:	506:	493:	618:	342:	4016:
: 1928:	305:	166:	418:	214:	230:	163:	192:	396:	327:	335:	631:	198:	3575:
: 1929:	454:	336:	301:	330:	350:	70:	24:	345:	353:	626:	653:	625:	4467:
: 1930:	382:	302:	408:	435:	277:	258:	233:	225:	483:	694:	378:	258:	4333:
: 1931:	503:	379:	375:	301:	221:	355:	244:	142:	441:	611:	394:	750:	4716:
: 1932:	159:	127:	125:	400:	159:	120:	0:	241:	236:	600:	481:	400:	3048:
: 1933:	521:	230:	280:	300:	272:	119:	86:	248:	229:	228:	515:	275:	3303:
: 1934:	383:	10:	184:	357:	239:	414:	359:	76:	197:	571:	714:	363:	3867:
: 1935:	207:	394:	430:	450:	348:	368:	361:	458:	537:	823:	407:	587:	5370:
: 1936:	425:	377:	268:	446:	458:	141:	301:	376:	376:	381:	560:	348:	4457:
: 1937:	375:	340:	120:	488:	191:	175:	91:	79:	324:	311:	407:	365:	3266:
: 1938:	81:	114:	532:	226:	244:	152:	276:	249:	698:	530:	801:	1115:	5018:
: 1939:	722:	393:	274:	517:	164:	138:	49:	421:	497:	741:	211:	464:	4591:
: 1940:	353:	291:	494:	364:	340:	284:	113:	402:	426:	771:	485:	565:	4888:
: 1941:	269:	261:	402:	677:	301:	154:	160:	421:	406:	518:	603:	712:	4884:
: 1953:	439:	116:	560:	404:	135:	293:	575:	120:	1095:	760:	277:	500:	5274:
: 1954:	708:	278:	189:	495:	185:	213:	391:	560:	260:	295:	859:	262:	4695:
: 1955:	390:	425:	249:	585:	610:	215:	90:	165:	205:	165:	380:	270:	3749:
: 1956:	525:	135:	395:	115:	100:	315:	410:	315:	305:	100:	511:	875:	4101:
: 1957:	210:	150:	615:	413:	335:	120:	205:	205:	315:	425:	320:	645:	3958:
: 1958:	385:	270:	520:	150:	165:	60:	0:	100:	85:	70:	425:	445:	2675:
: MEAN:	376:	260:	375:	389:	266:	198:	215:	282:	393:	489:	494:	498:	4236:

STATION NUMBER 540530

INDONESIA SUMATRA

PADANG PANJANG

MONTHLY RAINFALLS (IN MM)

: YEAR:	JAN:	FEB:	MAR:	APR:	MAY:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	TOTAL:
: 1916:	415:	105:	273:	291:	140:	98:	206:	194:	282:	332:	440:	476:	3252:
: 1917:	396:	370:	238:	360:	169:	86:	134:	285:	250:	244:	160:	486:	3178:
: 1918:	263:	194:	239:	195:	136:	199:	139:	125:	236:	258:	476:	348:	2808:
: 1920:	311:	339:	244:	293:	201:	111:	250:	200:	154:	237:	259:	282:	2881:
: 1921:	401:	303:	212:	364:	239:	86:	99:	150:	194:	244:	321:	249:	2862:
: 1922:	275:	217:	326:	268:	137:	54:	98:	277:	342:	490:	561:	430:	3475:
: 1924:	226:	228:	440:	175:	331:	58:	97:	254:	225:	297:	290:	400:	3021:
: 1926:	258:	210:	329:	267:	329:	207:	127:	130:	162:	412:	341:	217:	2989:
: 1927:	245:	153:	290:	306:	96:	71:	111:	78:	385:	264:	576:	543:	3118:
: 1928:	331:	204:	324:	334:	233:	84:	233:	156:	272:	316:	471:	209:	3167:
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: 1938:	311:	134:	266:	496:	304:	105:	75:	133:	261:	299:	488:	400:	3272:
: 1939:	266:	218:	311:	335:	280:	224:	88:	194:	219:	424:	326:	521:	3406:
: 1940:	218:	204:	224:	309:	298:	146:	191:	239:	264:	223:	252:	475:	3043:
: 1941:	212:	205:	245:	531:	349:	137:	129:	423:	162:	210:	307:	440:	3350:
: 1954:	147:	424:	418:	584:	295:	380:	179:	184:	300:	458:	509:	277:	4155:
: 1955:	465:	233:	341:	473:	296:	286:	160:	235:	196:	295:	451:	628:	4059:
: 1956:	358:	204:	211:	173:	85:	78:	216:	192:	296:	245:	590:	409:	3057:
: 1957:	227:	103:	281:	490:	291:	41:	252:	169:	239:	256:	282:	498:	3129:
: 1959:	129:	151:	345:	248:	143:	60:	20:	231:	172:	167:	315:	822:	2803:
: 1960:	324:	165:	135:	374:	123:	164:	360:	230:	460:	322:	234:	493:	3384:
: 1963:	240:	155:	278:	353:	595:	92:	289:	47:	160:	503:	349:	732:	3793:
: 1964:	405:	413:	333:	502:	201:	101:	443:	204:	370:	490:	413:	622:	4497:
: 1965:	202:	192:	563:	270:	563:	317:	146:	236:	346:	388:	382:	457:	4062:
: 1966:	864:	119:	317:	597:	202:	186:	160:	211:	165:	326:	541:	299:	3987:
: 1967:	406:	121:	195:	255:	251:	146:	406:	129:	294:	164:	357:	444:	3168:
: 1969:	371:	392:	431:	459:	339:	301:	415:	417:	206:	204:	582:	465:	4582:
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: 1975:	224:	236:	134:	339:	169:	86:	203:	308:	321:	262:	287:	354:	2923:
: 1976:	161:	112:	393:	329:	112:	260:	324:	217:	421:	490:	709:	193:	3721:
: 1977:	240:	228:	162:	308:	153:	112:	80:	163:	380:	245:	567:	398:	3036:
: 1979:	162:	208:	170:	356:	245:	312:	218:	165:	141:	498:	423:	216:	3114:
: MEAN:	296:	222:	288:	343:	238:	162:	182:	193:	261:	323:	412:	418:	3339:

STATION NUMBER 540533

INDONESIA SUMATRA

PAALEMBAJAN

MONTHLY RAINFALLS (IN MM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1924	335	253	402	118	330	228	105	119	390	403	229	160	3072
1927	187	197	191	266	148	27	38	31	550	327	384	333	2679
1928	237	212	176	273	219	74	170	60	328	327	153	289	2289
1929	109	286	111	113	74	87	14	139	234	253	343	235	1998
1933	280	220	159	285	347	40	38	248	387	167	265	345	2781
1934	101	53	279	313	101	175	66	75	344	353	286	252	2398
1935	94	215	88	224	54	108	114	217	165	246	344	417	2286
1936	160	88	207	106	124	47	64	114	284	279	318	139	1930
1937	168	149	125	179	151	55	37	71	246	446	475	398	2500
1938	115	45	247	344	220	120	168	150	194	405	428	417	2853
1939	284	43	197	293	245	32	39	130	267	477	224	459	2690
1940	157	204	279	349	233	103	113	187	219	423	453	364	3084
1941	141	140	169	190	202	195	73	215	263	267	333	440	2628
1955	131	217	245	404	166	64	71	218	108	377	342	329	2672
1956	211	211	297	116	140	75	160	196	223	281	418	368	2696
MEAN	181	169	211	238	184	95	85	145	262	335	345	321	2570

STATION NUMBER 540540

INDONESIA SUMATRA

BUKITTINGGI

MONTHLY RAINFALLS (IN MM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1916	170	50	194	173	174	110	101	212	203	237	153	172	1949
1917	262	292	230	155	128	161	165	296	164	80	28	189	2150
1918	209	58	242	138	209	188	154	227	179	280	395	94	2373
1920	140	74	236	285	151	214	50	75	168	142	290	53	1878
1921	261	142	166	196	94	94	105	94	215	153	156	249	1925
1922	206	105	74	247	96	42	59	68	228	313	149	214	1801
1924	264	163	440	175	231	58	97	254	225	297	290	400	2894
1926	181	135	190	117	169	59	67	87	130	164	234	195	1728
1927	112	61	174	224	77	13	80	90	300	249	274	196	1850
1928	324	234	146	251	133	53	112	99	72	206	280	77	1987
1929	96	195	140	338	211	148	23	101	233	303	214	155	2157
1930	253	55	231	219	116	181	21	83	213	418	278	290	2358
1931	456	275	258	154	130	213	150	53	270	271	152	408	2790
1932	141	62	262	383	99	169	44	172	154	229	197	258	2170
1933	263	119	236	253	241	67	117	203	97	224	234	87	2141
1934	258	64	159	216	128	126	92	187	183	243	199	140	1995
1935	104	291	180	283	112	82	101	257	191	302	296	313	2512
1936	184	114	213	138	211	82	61	115	255	178	249	187	1987
1938	94	111	371	244	98	67	48	139	213	214	176	158	1933
1940	118	172	148	280	206	30	82	164	113	259	291	282	2145
1941	184	116	212	299	127	84	90	146	256	163	185	275	2137
1954	454	340	250	215	49	88	159	106	103	310	303	154	2531
1955	399	168	138	252	151	65	112	169	130	275	206	376	2441
1957	200	176	317	322	287	83	154	195	140	352	403	306	2935
1960	180	239	226	237	7	103	226	102	289	202	210	355	2376
1963	234	300	140	322	374	83	93	13	47	340	211	380	2537
1964	158	366	145	279	123	117	140	82	95	148	88	269	2010
1965	96	175	136	182	106	46	44	132	182	173	408	152	1832
1966	308	71	135	348	74	225	87	326	146	113	230	66	2129
MEAN	218	163	207	239	149	105	98	146	179	236	234	222	2195

STATION NUMBER 540590

INDONESIA SUMATRA

LUBUKSIKAPING

MONTHLY RAINFALLS (IN MM)

: YEAR:	JAN:	FEB:	MAR:	APR:	MAY:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	TOTAL:
: 1916:	224:	106:	347:	525:	311:	156:	284:	222:	347:	312:	382:	575:	3791:
: 1917:	409:	283:	273:	331:	338:	99:	231:	476:	260:	345:	146:	382:	3573:
: 1918:	216:	117:	458:	386:	417:	450:	239:	197:	516:	668:	1070:	333:	5067:
: 1920:	367:	294:	550:	684:	286:	256:	231:	214:	212:	387:	623:	438:	4542:
: 1921:	401:	359:	327:	349:	290:	260:	203:	295:	394:	583:	406:	254:	4121:
: 1922:	441:	227:	283:	535:	267:	98:	44:	329:	264:	782:	367:	492:	4129:
: 1924:	311:	253:	571:	177:	372:	246:	241:	314:	484:	235:	404:	302:	3910:
: 1926:	203:	183:	293:	388:	425:	255:	274:	144:	345:	289:	385:	197:	3381:
: 1927:	178:	106:	387:	476:	115:	88:	98:	186:	723:	720:	539:	366:	3982:
: 1928:	511:	199:	290:	578:	274:	121:	232:	175:	264:	382:	536:	387:	3949:
: 1929:	179:	385:	292:	581:	356:	288:	115:	320:	537:	719:	732:	227:	4731:
: 1930:	557:	169:	447:	578:	408:	341:	140:	377:	356:	1315:	569:	369:	5626:
: 1931:	580:	496:	442:	643:	290:	601:	471:	77:	491:	599:	610:	760:	6060:
: 1932:	260:	222:	486:	636:	679:	248:	88:	507:	310:	745:	529:	631:	5341:
: 1933:	618:	202:	523:	522:	542:	209:	390:	347:	260:	317:	532:	336:	4798:
: 1934:	395:	83:	438:	506:	126:	537:	164:	252:	364:	703:	605:	260:	4433:
: 1935:	230:	447:	363:	464:	237:	349:	124:	403:	426:	606:	889:	581:	5119:
: 1936:	420:	96:	365:	297:	390:	239:	207:	229:	690:	638:	497:	332:	4400:
: 1937:	338:	442:	480:	339:	216:	82:	133:	296:	512:	499:	487:	639:	4463:
: 1938:	325:	198:	543:	437:	485:	122:	360:	465:	451:	494:	403:	434:	4717:
: 1940:	262:	407:	419:	428:	415:	159:	129:	492:	365:	696:	656:	450:	4878:
: 1941:	390:	365:	535:	534:	436:	207:	198:	221:	552:	673:	626:	419:	5156:
: 1952:	215:	214:	195:	277:	276:	18:	92:	161:	311:	201:	212:	207:	2379:
: 1953:	189:	280:	376:	284:	370:	56:	332:	154:	317:	646:	286:	324:	3614:
: 1954:	467:	288:	488:	408:	244:	221:	348:	304:	153:	510:	284:	324:	4039:
: 1955:	224:	216:	383:	431:	176:	76:	131:	274:	371:	462:	307:	483:	3534:
: 1956:	368:	244:	564:	191:	82:	208:	246:	216:	333:	238:	472:	323:	3485:
: 1974:	89:	205:	200:	446:	328:	108:	188:	214:	620:	205:	410:	444:	3457:
: 1975:	117:	288:	284:	403:	287:	117:	478:	236:	405:	237:	250:	203:	3305:
: 1976:	146:	119:	182:	375:	207:	332:	369:	414:	316:	516:	491:	230:	3697:
: 1977:	285:	202:	265:	844:	211:	268:	155:	307:	295:	523:	600:	252:	4207:
: 1978:	274:	239:	547:	625:	687:	199:	335:	246:	219:	550:	756:	354:	5031:
: 1979:	204:	264:	279:	300:	136:	354:	551:	312:	282:	372:	716:	247:	4017:
: 1980:	177:	219:	589:	587:	555:	262:	300:	256:	292:	469:	391:	501:	4598:
: MEAN:	311:	248:	396:	458:	330:	224:	239:	283:	383:	519:	505:	384:	4280:

APPENDIX 2

COMPUTED MONTHLY DISCHARGES

INDONESIA WEST-SUMATRA SITE OF GUNTUNG (147.0 Km2)

STATION NUMBER 11000002

COMPUTED MEAN MONTHLY AND ANNUAL DISCHARGES (M3/S)

YEAR:	JAN:	FEB:	MAR:	APR:	MAI:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	ANNUAL:
: 24	:21.3:	:12.4:	:21.9:	:7.69:	:15.2:	:11.2:	:6.97:	:6.48:	:16.0:	:16.9:	:14.2:	:8.65:	: 13.3:
: 25	:	:	:	:	:	:	:	:	:	:	:	:	:
: 26	:	:	:	:	:	:	:	:	:	:	:	:	:
: 27	:10.3:	:8.69:	:8.81:	:12.9:	:7.27:	:5.62:	:4.77:	:4.01:	:13.1:	:13.6:	:17.1:	:21.3:	: 10.6:
: 28	:11.8:	:10.6:	:10.3:	:10.5:	:10.0:	:6.99:	:8.44:	:5.29:	:4.58:	:8.74:	:12.8:	:7.98:	: 9.00:
: 29	:6.88:	:11.6:	:5.52:	:5.91:	:5.26:	:4.18:	:3.49:	:3.45:	:5.32:	:7.10:	:12.2:	:10.7:	: 6.76:
: 30	:	:	:	:	:	:	:	:	:	:	:	:	:
: 31	:	:	:	:	:	:	:	:	:	:	:	:	:
: 32	:	:	:	:	:	:	:	:	:	:	:	:	:
: 33	:	:	:	:	:	:	:	:	:	:	:	:	:
: 34	:11.7:	:9.81:	:9.68:	:12.0:	:16.8:	:6.41:	:5.31:	:6.44:	:13.9:	:8.06:	:11.9:	:15.1:	: 10.6:
: 35	:8.14:	:6.02:	:9.61:	:13.4:	:8.13:	:7.08:	:5.14:	:4.59:	:10.1:	:12.5:	:12.0:	:12.1:	: 9.08:
: 36	:7.88:	:8.99:	:5.98:	:7.99:	:6.35:	:5.00:	:4.56:	:7.85:	:6.14:	:8.12:	:13.6:	:17.2:	: 8.30:
: 37	:9.89:	:6.43:	:7.72:	:6.63:	:5.92:	:4.58:	:4.08:	:3.81:	:7.48:	:8.67:	:12.4:	:7.64:	: 7.10:
: 38	:7.18:	:7.37:	:6.44:	:6.63:	:6.05:	:4.54:	:3.82:	:3.57:	:5.46:	:13.9:	:19.7:	:19.1:	: 8.65:
: 39	:9.16:	:6.25:	:8.24:	:15.5:	:11.0:	:7.27:	:6.94:	:7.17:	:7.69:	:14.3:	:20.8:	:24.5:	: 11.6:
: 40	:17.2:	:6.98:	:7.34:	:12.8:	:11.0:	:6.20:	:5.26:	:5.01:	:8.75:	:15.7:	:11.9:	:20.4:	: 10.8:
: 41	:12.2:	:8.53:	:12.8:	:18.9:	:12.5:	:7.23:	:6.07:	:7.50:	:8.56:	:15.4:	:24.6:	:19.7:	: 12.8:
: 42	:12.1:	:6.99:	:7.67:	:8.23:	:10.1:	:9.37:	:5.38:	:7.07:	:10.3:	:11.3:	:12.2:	:23.1:	: 10.3:
: 43	:	:	:	:	:	:	:	:	:	:	:	:	:
: 44	:	:	:	:	:	:	:	:	:	:	:	:	:
: 45	:	:	:	:	:	:	:	:	:	:	:	:	:
: 46	:	:	:	:	:	:	:	:	:	:	:	:	:
: 47	:	:	:	:	:	:	:	:	:	:	:	:	:
: 48	:	:	:	:	:	:	:	:	:	:	:	:	:
: 49	:	:	:	:	:	:	:	:	:	:	:	:	:
: 50	:	:	:	:	:	:	:	:	:	:	:	:	:
: 51	:	:	:	:	:	:	:	:	:	:	:	:	:
: 52	:	:	:	:	:	:	:	:	:	:	:	:	:
: 53	:	:	:	:	:	:	:	:	:	:	:	:	:
: 54	:	:	:	:	:	:	:	:	:	:	:	:	:
: 55	:9.70:	:10.4:	:11.2:	:20.4:	:9.67:	:6.36:	:5.48:	:6.99:	:5.02:	:12.3:	:15.5:	:17.2:	: 10.8:
: 56	:12.0:	:10.5:	:12.5:	:8.28:	:6.57:	:5.73:	:5.69:	:6.89:	:8.62:	:11.2:	:16.5:	:19.0:	: 10.3:
: MEAN:	:	:	:	:	:	:	:	:	:	:	:	:	:
:24-56:	:11.2:	:8.77:	:9.71:	:11.2:	:9.45:	:6.52:	:5.43:	:5.74:	:8.73:	:11.9:	:15.2:	:16.2:	: 10.0:

INDONESIA WEST-SUMATRA SITE OF BALANGIR (40.6 Km2)

STATION NUMBER 11000004

COMPUTED MEAN MONTHLY AND ANNUAL DISCHARGES (M3/S)

YEAR:	JAN:	FEB:	MAR:	APR:	MAI:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	ANNUAL:
: 16	:11.5	:2.68	:3.37	:8.06	:6.20	:3.29	:4.32	:6.46	:3.94	:4.50	:3.21	:4.63	: 5.20:
: 17	:10.5	:8.42	:4.30	:9.47	:2.40	:2.70	:1.73	:4.80	:5.60	:1.77	:1.25	:1.51	: 4.50:
: 18	:6.61	:1.36	:2.89	:3.20	:4.77	:3.83	:3.28	:5.57	:3.25	:3.53	:8.63	:2.52	: 4.14:
: 19	:	:	:	:	:	:	:	:	:	:	:	:	:
: 20	:5.65	:1.70	:7.01	:2.77	:1.97	:2.68	:1.08	:.870	:1.14	:.833	:3.33	:1.34	: 2.54:
: 21	:4.00	:2.23	:3.14	:2.92	:4.17	:2.28	:.752	:.416	:2.60	:4.96	:3.85	:4.38	: 2.98:
: 22	:6.69	:1.92	:2.71	:9.60	:2.56	:5.49	:2.32	:3.35	:5.20	:4.69	:4.26	:2.33	: 4.26:
: 23	:	:	:	:	:	:	:	:	:	:	:	:	:
: 24	:4.94	:3.58	:6.00	:5.65	:4.91	:2.77	:1.16	:1.84	:3.50	:1.76	:1.04	:.688	: 3.15:
: 25	:	:	:	:	:	:	:	:	:	:	:	:	:
: 26	:2.97	:6.72	:8.36	:3.75	:4.83	:3.16	:2.13	:3.48	:3.09	:5.21	:4.50	:4.18	: 4.35:
: 27	:4.38	:5.10	:1.56	:2.76	:1.62	:.445	:.255	:.453	:1.06	:4.72	:5.15	:5.28	: 2.72:
: 28	:	:	:	:	:	:	:	:	:	:	:	:	:
: 29	:3.01	:2.35	:3.17	:6.87	:3.51	:3.87	:2.45	:2.41	:2.53	:5.54	:5.91	:7.08	: 4.06:
: 30	:4.37	:3.27	:6.20	:3.77	:6.57	:2.45	:.953	:.438	:2.78	:7.22	:5.12	:2.52	: 3.81:
: 31	:7.06	:11.1	:5.25	:4.27	:4.29	:4.71	:2.88	:2.83	:4.39	:1.49	:4.24	:7.65	: 4.97:
: 32	:6.22	:2.24	:1.85	:3.44	:2.41	:1.70	:1.46	:3.25	:3.88	:7.24	:4.85	:3.44	: 3.51:
: 33	:12.9	:3.93	:4.00	:4.43	:5.21	:2.90	:3.34	:4.77	:6.40	:2.54	:1.58	:1.22	: 4.45:
: 34	:7.36	:2.53	:2.38	:3.10	:2.61	:1.70	:1.60	:1.81	:4.20	:6.37	:2.40	:4.30	: 3.38:
: 35	:5.84	:5.19	:3.95	:3.45	:1.73	:5.00	:2.04	:2.41	:4.44	:3.04	:5.14	:9.32	: 4.29:
: 36	:4.54	:7.37	:6.31	:3.55	:6.71	:2.62	:.936	:1.85	:4.97	:5.77	:5.35	:6.14	: 4.67:
: 37	:7.88	:7.33	:4.89	:5.27	:4.15	:1.87	:1.78	:2.08	:6.88	:5.87	:5.94	:6.25	: 5.00:
: 38	:6.02	:2.60	:5.28	:6.04	:2.39	:2.17	:1.73	:2.53	:3.52	:3.60	:3.45	:4.58	: 3.67:
: 39	:4.44	:1.28	:2.14	:4.20	:2.89	:1.95	:.868	:.604	:2.82	:3.08	:2.55	:8.07	: 2.92:
: 40	:4.25	:5.59	:4.00	:6.57	:2.43	:1.99	:.908	:1.22	:4.51	:3.40	:7.10	:8.04	: 4.15:
: 41	:5.87	:5.94	:4.08	:5.80	:3.63	:2.73	:2.15	:2.39	:3.18	:3.26	:5.99	:4.75	: 4.13:
: 42	:	:	:	:	:	:	:	:	:	:	:	:	:
: 43	:	:	:	:	:	:	:	:	:	:	:	:	:
: 44	:	:	:	:	:	:	:	:	:	:	:	:	:
: 45	:	:	:	:	:	:	:	:	:	:	:	:	:
: 46	:	:	:	:	:	:	:	:	:	:	:	:	:
: 47	:	:	:	:	:	:	:	:	:	:	:	:	:
: 48	:	:	:	:	:	:	:	:	:	:	:	:	:
: 49	:	:	:	:	:	:	:	:	:	:	:	:	:
: 50	:	:	:	:	:	:	:	:	:	:	:	:	:
: 51	:	:	:	:	:	:	:	:	:	:	:	:	:
: 52	:7.21	:6.48	:2.26	:1.99	:3.06	:1.59	:1.55	:1.24	:2.38	:1.65	:2.31	:3.64	: 2.94:
: 53	:3.77	:5.80	:7.08	:5.29	:5.12	:3.25	:5.89	:1.17	:2.19	:4.46	:3.38	:4.84	: 4.35:
: 54	:8.68	:6.75	:9.01	:2.81	:1.77	:3.90	:3.26	:3.24	:1.92	:4.56	:2.31	:2.92	: 4.26:
: 55	:13.8	:2.97	:8.85	:6.19	:2.29	:3.66	:4.63	:5.98	:4.72	:2.96	:1.36	:3.09	: 5.07:
: 56	:4.56	:5.28	:5.13	:3.20	:2.58	:.835	:.737	:2.02	:2.57	:3.58	:6.32	:4.55	: 3.44:
: 57	:5.86	:3.95	:3.71	:8.67	:5.00	:2.31	:.995	:.944	:1.40	:4.62	:8.73	:9.32	: 4.62:
: MEAN:	:	:	:	:	:	:	:	:	:	:	:	:	:
: 16-57	:6.46	:4.49	:4.60	:4.90	:3.63	:2.78	:2.04	:2.52	:3.54	:4.01	:4.26	:4.59	: 3.98:

INDONESIA WEST-SUMATRA SITE OF SUMANI (80.9 Km2)
 STATION NUMBER 11000006

COMPUTED MEAN MONTHLY AND ANNUAL DISCHARGES (M3/S)

: YEAR:	JAN:	FEB:	MAR:	APR:	MAI:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	ANNUAL:
: 16	:5.94	:2.97	:2.65	:7.59	:3.93	:3.47	:4.61	:5.86	:5.35	:3.74	:3.32	:5.12	4.55:
: 17	:7.32	:8.57	:5.98	:5.00	:5.47	:3.99	:3.01	:8.55	:6.12	:3.01	:2.11	:2.00	5.07:
: 18	:2.89	:1.72	:7.05	:4.36	:4.27	:4.48	:2.54	:3.20	:4.13	:5.84	:13.0	:4.31	4.82:
: 19	:	:	:	:	:	:	:	:	:	:	:	:	:
: 20	:6.45	:5.08	:12.3	:10.9	:5.12	:8.28	:3.38	:2.27	:2.26	:2.22	:5.63	:3.26	5.59:
: 21	:1.85	:1.45	:1.65	:1.29	:1.54	:1.13	:1.57	:1.40	:5.19	:8.69	:5.91	:5.89	3.14:
: 22	:4.55	:2.50	:1.79	:3.53	:3.95	:2.41	:1.58	:1.34	:1.22	:8.41	:6.89	:10.9	4.11:
: 23	:	:	:	:	:	:	:	:	:	:	:	:	:
: 24	:6.15	:4.07	:6.54	:4.88	:7.63	:3.97	:2.88	:3.42	:5.92	:5.71	:3.65	:5.38	5.03:
: 25	:	:	:	:	:	:	:	:	:	:	:	:	:
: 26	:5.46	:13.7	:21.9	:9.46	:8.06	:3.38	:3.50	:2.55	:3.82	:5.65	:7.42	:4.12	7.38:
: 27	:3.07	:5.44	:2.89	:4.10	:3.57	:1.68	:1.18	:1.14	:1.65	:4.50	:9.89	:7.68	3.88:
: 28	:16.2	:3.60	:3.47	:10.2	:6.51	:3.05	:2.02	:2.77	:6.28	:9.36	:11.5	:10.8	7.16:
: 29	:	:	:	:	:	:	:	:	:	:	:	:	:
: 30	:	:	:	:	:	:	:	:	:	:	:	:	:
: 31	:	:	:	:	:	:	:	:	:	:	:	:	:
: 32	:	:	:	:	:	:	:	:	:	:	:	:	:
: 33	:12.6	:3.92	:4.28	:5.93	:5.21	:2.34	:1.57	:4.10	:2.60	:5.73	:4.87	:4.79	4.85:
: 34	:6.24	:2.82	:2.96	:3.52	:3.36	:4.58	:2.05	:1.96	:4.45	:4.23	:3.66	:4.65	3.71:
: 35	:2.78	:4.28	:4.08	:3.59	:3.47	:3.49	:2.80	:3.68	:3.47	:6.17	:7.93	:10.6	4.70:
: 36	:6.40	:5.12	:6.78	:5.07	:6.30	:2.93	:1.90	:1.52	:1.64	:4.46	:3.65	:3.06	4.07:
: 37	:10.8	:7.41	:4.80	:4.72	:5.07	:3.89	:2.17	:1.52	:3.18	:6.02	:9.37	:7.31	5.51:
: 38	:5.91	:3.06	:8.39	:8.27	:6.20	:2.73	:1.82	:1.54	:2.43	:4.48	:7.46	:6.11	4.88:
: 39	:4.29	:2.38	:2.31	:5.06	:3.33	:2.45	:1.56	:.982	:2.00	:4.48	:5.90	:10.0	3.74:
: 40	:4.51	:5.44	:7.62	:6.12	:11.7	:3.62	:2.29	:2.25	:2.28	:3.93	:7.62	:7.83	5.44:
: 41	:7.84	:4.87	:4.17	:10.2	:8.03	:3.36	:2.29	:1.74	:2.11	:4.25	:12.0	:6.47	5.60:
: MEAN:	:	:	:	:	:	:	:	:	:	:	:	:	:
: 16-41:	6.38	4.65	5.87	5.99	5.41	3.43	2.35	2.73	3.48	5.31	6.94	6.33	4.91:

INDONESIA WEST-SUMATRA SITE OF SIKARBAU (115.0 Km2)
STATION NUMBER 11000012

COMPUTED MEAN MONTHLY AND ANNUAL DISCHARGES (M3/S)

YEAR:	JAN:	FEB:	MAR:	APR:	MAI:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	ANNUAL:
: 16	:10.1	:4.64	:5.84	:10.8	:7.32	:4.73	:4.84	:4.97	:6.96	:6.27	:7.19	:12.5	: 7.19:
: 17	:10.8	:7.69	:7.62	:6.65	:8.43	:3.98	:3.70	:8.60	:5.88	:6.43	:4.77	:6.47	: 6.76:
: 18	:5.40	:3.41	:7.09	:8.23	:9.57	:10.8	:5.76	:5.19	:9.45	:13.0	:34.4	:11.2	: 10.3:
: 19	:	:	:	:	:	:	:	:	:	:	:	:	:
: 20	:9.78	:6.66	:11.8	:19.2	:7.37	:7.69	:5.11	:4.47	:3.88	:7.14	:12.1	:11.4	: 8.88:
: 21	:10.6	:9.27	:8.98	:7.99	:6.95	:5.69	:4.62	:5.59	:9.20	:11.2	:10.8	:7.74	: 8.21:
: 22	:9.35	:5.52	:7.46	:11.0	:6.76	:4.89	:3.01	:2.99	:3.70	:15.4	:8.66	:11.4	: 7.53:
: 23	:	:	:	:	:	:	:	:	:	:	:	:	:
: 24	:8.56	:8.13	:11.6	:6.27	:6.68	:7.13	:4.77	:5.69	:10.7	:5.54	:9.05	:7.01	: 7.58:
: 25	:	:	:	:	:	:	:	:	:	:	:	:	:
: 26	:5.13	:4.48	:5.00	:7.09	:9.99	:6.87	:5.37	:3.92	:6.18	:5.04	:8.11	:5.52	: 6.06:
: 27	:4.92	:3.14	:4.41	:8.00	:6.04	:3.66	:2.62	:2.50	:9.01	:18.3	:15.0	:9.57	: 7.28:
: 28	:13.1	:5.88	:6.06	:13.6	:7.03	:4.55	:3.83	:3.96	:4.58	:6.17	:11.0	:9.39	: 7.43:
: 29	:6.98	:6.72	:6.52	:13.7	:10.0	:6.90	:4.27	:4.74	:10.4	:15.7	:22.6	:8.13	: 9.71:
: 30	:13.3	:5.58	:9.10	:14.4	:10.9	:8.88	:4.68	:6.53	:8.11	:32.2	:19.4	:9.48	: 11.9:
: 31	:15.3	:15.1	:9.75	:18.3	:7.36	:14.4	:10.1	:6.89	:9.75	:12.5	:15.6	:21.9	: 13.0:
: 32	:10.1	:5.02	:9.32	:17.6	:18.3	:7.81	:4.34	:7.91	:6.90	:17.7	:13.6	:17.4	: 11.4:
: 33	:18.5	:6.12	:11.0	:13.9	:14.3	:6.82	:7.05	:8.49	:6.09	:7.47	:11.2	:9.86	: 10.1:
: 34	:10.3	:4.47	:6.21	:9.49	:7.03	:10.6	:5.38	:5.19	:6.65	:13.3	:16.3	:8.86	: 8.66:
: 35	:7.35	:8.95	:8.43	:9.66	:7.42	:8.65	:4.48	:7.86	:8.81	:12.2	:25.4	:16.7	: 10.5:
: 36	:11.4	:5.32	:6.25	:7.28	:8.46	:6.16	:4.22	:4.22	:14.2	:14.5	:15.0	:9.77	: 8.90:
: 37	:7.51	:10.5	:10.8	:9.34	:6.64	:3.95	:3.05	:3.71	:9.49	:9.45	:10.6	:18.2	: 8.59:
: 38	:9.07	:6.34	:12.2	:11.6	:11.0	:5.33	:6.53	:10.4	:10.9	:10.5	:11.2	:10.1	: 9.62:
: 39	:	:	:	:	:	:	:	:	:	:	:	:	:
: 40	:8.78	:8.50	:9.17	:9.36	:12.0	:5.36	:4.05	:8.86	:7.77	:12.9	:19.6	:12.7	: 9.92:
: 41	:13.1	:7.73	:12.5	:14.6	:11.2	:5.95	:4.99	:4.64	:11.2	:12.8	:18.1	:12.6	: 10.8:
: MEAN:	:	:	:	:	:	:	:	:	:	:	:	:	:
: 16-41	:9.97	:6.78	:8.50	:11.3	:9.12	:6.85	:4.85	:5.79	:8.17	:12.1	:14.5	:11.3	: 9.10:

INDONESIA WEST-SUMATRA SITE OF PATIMAH (142.0 Km2)

STATION NUMBER 11000015

COMPUTED MEAN MONTHLY AND ANNUAL DISCHARGES (M3/S)

YEAR:	JAN:	FEB:	MAR:	APR:	MAI:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	ANNUAL:
: 16	:14.4:	5.95:	9.28:	18.3:	11.8:	7.22:	7.65:	8.34:	11.8:	10.5:	12.1:	22.5:	11.7:
: 17	:18.4:	11.9:	12.0:	10.6:	14.0:	5.75:	5.98:	14.7:	9.61:	10.9:	7.47:	11.1:	11.1:
: 18	:8.87:	5.26:	12.4:	14.2:	16.8:	18.2:	8.89:	8.01:	16.2:	25.1:	55.8:	16.9:	17.2:
: 19	:	:	:	:	:	:	:	:	:	:	:	:	:
: 20	:15.2:	10.1:	20.0:	32.8:	10.8:	11.9:	7.74:	6.88:	6.17:	12.2:	21.3:	20.0:	14.6:
: 21	:17.5:	14.8:	14.2:	12.9:	11.1:	9.07:	7.29:	9.32:	15.8:	19.8:	18.4:	12.0:	13.5:
: 22	:15.4:	8.46:	12.0:	19.1:	10.7:	7.36:	4.31:	4.72:	6.45:	28.6:	14.2:	20.3:	12.7:
: 23	:	:	:	:	:	:	:	:	:	:	:	:	:
: 24	:12.9:	12.7:	19.8:	9.48:	10.5:	11.6:	7.70:	9.29:	19.5:	8.35:	15.2:	11.4:	12.3:
: 25	:	:	:	:	:	:	:	:	:	:	:	:	:
: 26	:8.11:	7.01:	8.38:	12.1:	17.9:	11.0:	8.51:	6.09:	10.4:	8.44:	14.0:	8.85:	10.1:
: 27	:7.96:	4.76:	7.84:	14.1:	10.1:	5.46:	3.91:	3.88:	16.7:	34.2:	24.7:	14.9:	12.4:
: 28	:21.6:	8.37:	9.26:	23.0:	11.1:	6.70:	6.12:	6.39:	7.62:	10.6:	19.5:	16.0:	12.2:
: 29	:11.0:	10.9:	10.7:	23.7:	16.7:	10.7:	6.28:	7.68:	18.2:	29.4:	36.6:	11.6:	16.1:
: 30	:22.0:	7.81:	14.9:	24.3:	17.8:	14.3:	6.54:	10.9:	13.6:	57.1:	30.2:	14.3:	19.6:
: 31	:25.7:	24.4:	15.6:	30.8:	10.8:	24.5:	16.4:	9.99:	16.5:	21.5:	26.3:	36.1:	21.5:
: 32	:15.4:	6.96:	15.5:	30.4:	30.4:	11.3:	5.68:	13.3:	11.2:	31.8:	22.1:	28.9:	18.6:
: 33	:29.5:	8.63:	18.0:	23.9:	23.7:	9.67:	10.8:	14.2:	9.53:	12.3:	19.4:	16.4:	16.4:
: 34	:17.1:	6.00:	10.3:	16.5:	11.5:	17.9:	8.14:	8.29:	11.2:	24.6:	29.0:	12.3:	14.4:
: 35	:11.0:	14.6:	13.9:	16.4:	12.1:	14.0:	6.37:	13.2:	14.9:	21.5:	43.6:	26.6:	17.3:
: 36	:18.0:	7.00:	9.80:	11.7:	14.1:	9.74:	6.73:	6.88:	25.5:	26.5:	24.2:	14.8:	14.6:
: 37	:11.3:	17.7:	18.5:	15.0:	9.96:	5.48:	4.35:	6.52:	16.7:	16.3:	19.5:	30.9:	14.3:
: 38	:13.4:	9.48:	20.7:	19.5:	18.1:	7.40:	10.3:	17.6:	18.7:	17.2:	18.9:	17.0:	15.7:
: 39	:	:	:	:	:	:	:	:	:	:	:	:	:
: 40	:13.6:	13.6:	15.3:	15.4:	20.9:	7.49:	5.72:	14.8:	12.9:	24.8:	32.1:	20.4:	16.4:
: 41	:20.3:	11.7:	20.9:	24.9:	17.9:	8.45:	7.40:	7.10:	19.3:	24.3:	29.1:	20.5:	17.7:
: MEAN:	:	:	:	:	:	:	:	:	:	:	:	:	:
:16-41:	15.8:	10.4:	14.1:	19.0:	14.9:	10.7:	7.40:	9.46:	14.0:	21.6:	24.3:	18.4:	15.0:

INDONESIA WEST-SUMATRA SITE OF BAYANG SANI (9.74 Km2)

STATION NUMBER 11000018

COMPUTED MEAN MONTHLY AND ANNUAL DISCHARGES (M3/S)

YEAR:	JAN:	FEB:	MAR:	APR:	MAY:	JUN:	JUL:	AUG:	SEP:	OCT:	NOV:	DEC:	ANNUAL:
: 24	:1.33	:1.27	:1.62	:1.03	:1.13	:.755	:.926	:.541	:1.27	:1.35	:1.14	:1.34	: 1.14
: 25	:	:	:	:	:	:	:	:	:	:	:	:	:
: 26	:.468	:.391	:.931	:2.53	:.479	:.211	:.367	:.932	:.765	:1.61	:.968	:1.45	: 0.927
: 27	:.618	:.526	:1.30	:.774	:.488	:.305	:.159	:.398	:1.26	:1.23	:1.83	:1.04	: 0.827
: 28	:.851	:.223	:.807	:.575	:.310	:.267	:.293	:.834	:.810	:.758	:1.72	:.637	: 0.674
: 29	:1.24	:.642	:.770	:.618	:.943	:.222	:.110	:.227	:.864	:1.51	:2.01	:1.85	: 0.919
: 30	:1.18	:.536	:.957	:1.29	:.461	:.603	:.450	:.424	:1.39	:1.74	:1.06	:.716	: 0.902
: 31	:1.27	:.845	:1.01	:.746	:.419	:.917	:.399	:.321	:1.01	:1.63	:1.05	:2.16	: 0.983
: 32	:.557	:.190	:.130	:.742	:.359	:.168	:.088	:.137	:.211	:1.43	:1.58	:1.08	: 0.557
: 33	:1.27	:.534	:.652	:.585	:.706	:.336	:.134	:.242	:.333	:.296	:1.48	:.654	: 0.601
: 34	:.849	:.195	:.183	:.451	:.665	:.944	:.850	:.256	:.194	:1.33	:2.12	:1.18	: 0.771
: 35	:.492	:.716	:1.10	:1.28	:.904	:.850	:.786	:1.27	:1.39	:2.41	:1.16	:1.64	: 1.17
: 36	:1.32	:.788	:.703	:1.12	:1.21	:.276	:.475	:.806	:1.06	:.998	:1.62	:.780	: 0.929
: 37	:1.12	:.680	:.251	:1.11	:.389	:.372	:.162	:.113	:.314	:.667	:.955	:1.11	: 0.602
: 38	:.206	:.152	:1.00	:.404	:.593	:.239	:.395	:.596	:1.94	:1.36	:2.55	:3.39	: 1.07
: 39	:2.32	:.839	:.660	:1.52	:.393	:.204	:.116	:.674	:1.32	:1.95	:.644	:1.17	: 0.986
: 40	:.985	:.612	:1.10	:.836	:1.08	:.559	:.243	:.704	:1.35	:2.05	:1.37	:1.56	: 1.04
: 41	:.679	:.546	:.889	:2.17	:.536	:.345	:.238	:1.07	:.914	:1.24	:1.92	:2.07	: 1.05
: 42	:	:	:	:	:	:	:	:	:	:	:	:	:
: 43	:	:	:	:	:	:	:	:	:	:	:	:	:
: 44	:	:	:	:	:	:	:	:	:	:	:	:	:
: 45	:	:	:	:	:	:	:	:	:	:	:	:	:
: 46	:	:	:	:	:	:	:	:	:	:	:	:	:
: 47	:	:	:	:	:	:	:	:	:	:	:	:	:
: 48	:	:	:	:	:	:	:	:	:	:	:	:	:
: 49	:	:	:	:	:	:	:	:	:	:	:	:	:
: 50	:	:	:	:	:	:	:	:	:	:	:	:	:
: 51	:	:	:	:	:	:	:	:	:	:	:	:	:
: 52	:	:	:	:	:	:	:	:	:	:	:	:	:
: 53	:1.36	:.226	:1.30	:.858	:.550	:.403	:1.65	:.241	:3.05	:2.29	:.821	:1.21	: 1.17
: 54	:2.19	:.750	:.375	:1.13	:.425	:.450	:.738	:1.50	:.512	:.832	:2.59	:.577	: 1.01
: 55	:.858	:1.44	:.568	:1.51	:1.79	:.503	:.185	:.170	:.197	:.152	:.739	:.652	: 0.724
: 56	:1.41	:.280	:.773	:.301	:.232	:.460	:.720	:.911	:.646	:.282	:1.19	:2.63	: 0.824
: 57	:.476	:.301	:1.62	:.905	:.937	:.249	:.260	:.303	:.617	:1.14	:.832	:1.70	: 0.784
: 58	:.888	:.690	:1.38	:.423	:.265	:.139	:.068	:.073	:.072	:.070	:.348	:1.37	: 0.483
: MEAN:	:	:	:	:	:	:	:	:	:	:	:	:	:
:24-58:	:1.04	:.581	:.873	:.996	:.664	:.425	:.427	:.554	:.934	:1.23	:1.38	:1.39	: 0.875

APPENDIX 3

COMPUTED MONTHLY DISCHARGES IN ORDER

STATION NUMBER 11000002

INDONESIA WEST-SUMATRA SITE OF GUNTUNG

(147.0 Km²)

MONTHLY AND ANNUAL DISCHARGES IN ORDER (M³/S)

R	P	JAN	FEB	MAR	APR	MAI	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1	0.033	6.88	6.02	5.52	5.91	5.26	4.18	3.49	3.45	4.58	7.10	11.90	7.64	6.75
2	0.100	7.18	6.25	5.98	6.63	5.92	4.54	3.82	3.57	5.02	8.06	11.90	7.98	7.08
3	0.167	7.88	6.43	6.44	6.63	6.05	4.58	4.08	3.81	5.32	8.12	12.00	8.68	8.28
4	0.233	8.14	6.98	7.34	7.59	6.35	5.00	4.56	4.01	5.46	8.67	12.20	10.70	8.63
5	0.300	9.16	6.99	7.67	7.99	6.57	5.62	4.77	4.59	6.14	8.74	12.20	12.10	8.97
6	0.367	9.70	7.37	7.72	8.23	7.27	5.73	5.14	5.01	7.48	11.20	12.40	15.10	9.06
7	0.433	9.89	8.53	8.24	8.28	8.13	6.20	5.26	5.29	7.69	11.30	12.80	17.20	10.27
8	0.500	10.30	8.69	8.81	10.50	9.67	6.36	5.31	6.44	8.56	12.30	13.60	17.20	10.33
9	0.567	11.70	8.99	9.61	12.00	10.00	6.41	5.38	6.48	8.62	12.50	14.20	19.00	10.57
10	0.633	11.80	9.81	9.68	12.80	10.10	6.99	5.48	6.89	8.75	13.60	15.50	19.10	10.60
11	0.700	12.00	10.40	10.30	12.90	11.00	7.08	5.69	6.99	10.10	13.90	16.50	19.70	10.73
12	0.767	12.10	10.50	11.20	13.40	11.00	7.23	6.07	7.07	10.30	14.30	17.10	20.40	10.82
13	0.833	12.20	10.60	12.50	15.50	12.50	7.27	6.94	7.17	13.10	15.40	19.70	21.30	11.81
14	0.900	17.20	11.60	12.80	18.90	15.20	9.37	6.97	7.50	13.90	15.70	20.80	23.10	12.81
15	0.967	21.30	12.40	21.90	20.40	16.80	11.20	8.44	7.85	16.00	16.90	24.60	24.50	13.23
AVERAGE		11.16	8.77	9.71	11.18	9.45	6.52	5.43	5.74	8.73	11.85	15.16	16.24	9.98

R = RANK

P = PROBABILITY

STATION NUMBER 11000004

INDONESIA WEST-SUMATRA SITE OF BALANGIR

(40.6 Km²)

MONTHLY AND ANNUAL DISCHARGES IN ORDER (M³/S)

R	P	JAN	FEB	MAR	APR	MAI	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1	0.018	2.970	1.280	1.560	1.990	1.620	0.445	0.255	0.416	1.060	0.833	1.040	0.688	2.522
2	0.054	3.010	1.360	1.850	2.760	1.730	0.835	0.737	0.438	1.140	1.490	1.250	1.220	2.699
3	0.089	3.770	1.700	2.140	2.770	1.770	1.590	0.752	0.453	1.400	1.650	1.360	1.340	3.901
4	0.125	4.000	1.920	2.260	3.810	1.970	1.700	0.868	0.604	1.920	1.760	1.560	1.510	3.921
5	0.161	4.250	2.230	2.380	3.920	2.290	1.700	0.908	0.870	2.190	1.770	1.310	2.330	3.962
6	0.196	4.370	2.240	2.710	3.100	2.390	1.870	0.936	0.944	2.380	2.540	2.310	2.330	4.134
7	0.232	4.380	2.350	2.890	3.200	2.400	1.950	0.953	1.170	2.530	2.600	2.400	2.520	4.353
8	0.268	4.440	2.530	3.140	3.200	2.410	1.990	0.995	1.220	2.570	3.040	2.550	2.920	4.423
9	0.304	4.54	2.60	3.17	3.44	2.43	2.17	1.08	1.24	2.60	3.08	3.21	3.09	3.49
10	0.339	4.56	2.68	3.37	3.45	2.56	2.28	1.16	1.81	2.78	3.26	3.33	3.44	3.65
11	0.375	4.94	2.97	3.71	3.55	2.58	2.31	1.46	1.84	2.82	3.40	3.38	3.64	3.80
12	0.411	5.65	3.27	3.95	3.75	2.61	2.45	1.55	1.85	3.09	3.53	3.45	4.18	4.05
13	0.446	5.84	3.58	4.00	3.77	2.89	2.62	1.60	2.02	3.18	3.58	3.85	4.30	4.11
14	0.482	5.86	3.93	4.00	4.20	3.06	2.68	1.73	2.08	3.25	3.60	4.24	4.38	4.12
15	0.518	5.87	3.95	4.08	4.27	3.51	2.70	1.73	2.39	3.50	4.46	4.26	4.55	4.13
16	0.554	6.02	4.10	4.30	4.43	3.63	2.73	1.78	2.41	3.52	4.50	4.50	4.58	4.24
17	0.589	6.22	4.19	4.89	5.27	4.15	2.77	2.04	2.41	3.88	4.56	4.85	4.63	4.24
18	0.625	6.61	4.28	5.13	5.29	4.17	2.90	2.13	2.53	3.94	4.62	5.12	4.75	4.27
19	0.661	6.69	4.59	5.65	6.65	4.29	3.16	2.15	2.83	4.20	4.69	5.14	4.84	4.33
20	0.696	7.06	4.80	6.04	6.80	4.77	3.25	2.32	2.24	4.39	4.72	5.15	5.28	4.34
21	0.732	7.21	4.94	6.00	6.04	4.83	3.25	2.45	2.44	4.44	4.96	5.15	6.14	4.42
22	0.768	7.36	4.48	6.20	6.19	4.91	3.66	2.68	3.35	4.51	5.21	5.91	6.25	4.48
23	0.804	7.68	6.72	6.31	6.57	5.00	3.63	2.88	3.48	4.72	5.21	5.91	7.08	4.61
24	0.839	8.68	6.75	7.01	6.87	5.12	4.21	3.36	3.25	4.97	5.77	6.39	7.65	4.66
25	0.875	10.50	7.33	7.08	6.06	5.20	4.90	4.44	4.77	5.60	6.00	6.37	8.04	4.95
26	0.911	11.50	7.37	8.36	8.07	5.20	4.71	4.63	5.57	6.40	6.60	7.37	8.32	5.08
27	0.946	12.90	8.42	8.85	9.47	6.57	5.00	4.63	5.98	6.60	6.60	8.63	8.32	5.08
28	0.982	13.80	11.10	9.01	9.60	6.71	5.49	5.89	6.46	6.88	7.24	8.73	8.32	5.18
AVERAGE		6.46	4.49	4.60	4.90	3.63	2.78	2.04	2.52	3.54	4.01	4.26	4.59	3.96

R = RANK

P = PROBABILITY

STATION NUMBER 11000006

INDONESIA WEST-SUMATRA

SITE OF SUMANI

(80.9 Km²)

MONTHLY AND ANNUAL DISCHARGES IN ORDER (M³/S)

R	P	JAN	FEB	MAR	APR	MAI	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1	0.026	1.850	1.450	1.650	1.290	1.540	1.130	1.180	0.982	1.220	2.220	2.110	2.000	3.123
2	0.079	2.78	1.72	1.79	3.52	3.33	1.68	1.56	1.14	1.64	3.01	3.32	3.06	3.69
3	0.132	2.89	2.38	2.31	3.53	3.36	2.34	1.57	1.34	1.65	3.74	3.65	3.26	3.72
4	0.184	3.07	2.50	2.65	3.59	3.47	2.41	1.57	1.40	2.00	3.93	3.65	4.12	3.87
5	0.237	4.29	2.82	2.89	4.10	3.57	2.45	1.58	1.52	2.11	4.23	3.66	4.31	4.06
6	0.289	4.51	2.97	2.96	4.36	3.93	2.73	1.82	1.52	2.26	4.25	4.87	4.65	4.09
7	0.342	4.55	3.06	3.47	4.72	3.95	2.93	1.90	1.54	2.28	4.46	5.63	4.79	4.53
8	0.395	5.46	3.60	4.08	4.88	4.27	3.05	2.02	1.74	2.43	4.48	5.90	5.12	4.68
9	0.447	5.91	3.92	4.17	5.00	5.07	3.36	2.05	1.96	2.60	4.48	5.91	5.38	4.81
10	0.500	5.94	4.07	4.28	5.06	5.12	3.36	1.7	2.25	2.47	4.50	6.89	5.89	4.83
11	0.553	6.15	4.28	4.80	5.07	5.21	3.47	2.29	2.27	2.82	4.65	7.42	6.11	4.88
12	0.605	6.24	4.57	5.98	5.93	5.47	3.49	2.54	2.55	3.82	4.71	7.46	6.47	5.01
13	0.658	6.40	5.08	6.54	6.12	5.20	3.82	2.77	2.77	4.13	5.73	7.62	7.31	5.05
14	0.711	6.45	5.12	7.78	7.59	6.30	3.89	2.80	3.30	4.45	5.84	7.93	7.68	5.42
15	0.763	7.32	5.44	8.27	8.27	6.51	3.97	2.88	4.42	5.19	6.02	9.37	7.83	4.49
16	0.816	7.84	5.44	7.62	9.46	7.63	3.99	3.01	4.10	5.35	6.17	9.89	10.00	5.57
17	0.868	10.80	7.41	8.39	10.20	8.03	4.48	3.88	4.10	5.92	8.41	11.50	10.60	6.33
18	0.921	12.60	8.57	12.30	10.20	8.06	4.58	3.50	5.86	6.12	8.69	12.00	10.80	7.14
19	0.974	16.20	13.70	21.90	10.90	11.70	8.28	4.61	8.55	6.28	9.36	13.00	10.90	7.36
AVERAGE	6.38	4.65	5.87	5.99	5.41	3.43	2.35	2.73	3.48	5.31	6.94	6.33	4.89	

R = RANK

P = PROBABILITY

STATION NUMBER 11000012

INDONESIA WEST-SUMATRA

SITE OF SIKARBAU

(115.0 Km²)

MONTHLY AND ANNUAL DISCHARGES IN ORDER (M³/S)

R	P	JAN	FEB	MAR	APR	MAI	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1	0.023	4.92	3.14	4.41	6.27	6.04	3.66	2.62	2.50	3.70	5.04	4.77	5.52	6.05
2	0.068	5.13	3.41	5.00	6.65	6.64	3.95	3.01	2.99	3.88	5.54	7.19	6.47	6.75
3	0.114	5.40	4.47	5.84	7.09	6.68	3.98	3.05	3.71	4.58	6.17	8.11	7.01	7.17
4	0.159	6.98	4.48	6.06	7.28	6.76	4.55	3.70	3.92	5.88	6.27	8.66	7.74	7.26
5	0.205	7.35	4.64	6.21	7.99	6.95	4.73	3.83	3.96	6.09	6.43	9.05	8.13	7.41
6	0.250	7.51	5.02	6.25	8.00	7.03	4.89	4.05	4.22	6.18	7.47	10.60	8.86	7.51
7	0.295	8.56	5.32	6.52	8.23	7.03	5.33	4.22	4.47	6.65	7.47	10.80	9.39	7.57
8	0.341	8.78	5.52	7.09	9.34	7.32	5.36	4.27	4.64	6.90	9.45	11.00	9.48	8.19
9	0.386	9.07	5.58	7.46	9.36	7.36	5.69	4.34	4.74	6.96	10.50	11.20	9.57	8.57
10	0.432	9.35	5.88	7.62	9.49	7.37	5.95	4.48	4.97	7.77	11.20	11.20	9.77	8.64
11	0.477	9.78	6.12	8.43	9.66	7.42	6.16	4.62	5.19	8.11	12.20	12.10	9.66	8.86
12	0.523	10.10	6.34	8.98	10.80	8.43	6.82	4.68	5.99	8.81	12.50	13.60	10.10	8.88
13	0.568	10.10	6.65	9.10	11.00	8.46	6.87	4.77	6.59	9.01	12.80	15.00	11.20	9.60
14	0.614	10.30	7.72	9.17	11.60	9.57	6.90	4.84	6.69	9.20	13.90	15.00	11.40	9.68
15	0.659	10.60	7.69	9.32	13.60	9.99	7.13	4.99	6.89	9.45	13.00	15.60	11.40	9.90
16	0.705	10.80	7.73	9.75	13.70	10.00	7.61	5.11	6.89	9.49	13.30	16.30	12.50	10.08
17	0.750	11.40	8.13	10.80	13.90	10.90	7.81	5.37	7.86	9.75	14.50	18.10	12.60	10.27
18	0.795	13.10	8.50	11.00	14.40	11.00	8.55	5.38	7.91	10.40	15.40	19.40	12.70	10.46
19	0.841	13.10	8.95	11.60	14.60	11.20	8.88	5.75	8.49	10.70	15.70	19.60	16.70	10.77
20	0.886	13.30	9.27	11.80	17.60	12.00	10.60	6.53	8.60	10.90	17.70	22.60	17.40	11.35
21	0.932	15.30	10.50	12.20	18.30	14.30	10.80	7.05	8.86	11.20	18.30	25.40	18.20	11.91
22	0.977	18.5	15.1	12.5	19.2	18.3	14.4	10.1	10.4	14.2	32.2	34.4	21.9	13.0
AVERAGE	9.97	6.78	8.50	11.28	9.12	6.85	4.85	5.79	8.17	12.08	14.53	11.27	9.09	

R = RANK

P = PROBABILITY

STATION NUMBER 11000015

INDONESIA WEST-SUMATRA SITE OF PATIMAH

(142.0 Km2)

MONTHLY AND ANNUAL DISCHARGES IN ORDER (M3/S)

R	P	JAN	FEB	MAR	APR	MAI	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1	0.023	7.96	4.76	7.84	9.48	9.96	5.46	3.91	3.88	6.17	8.35	7.47	8.85	10.05
2	0.068	8.11	5.26	8.38	10.60	10.10	5.48	4.31	4.72	6.45	8.44	12.10	11.10	11.04
3	0.114	8.87	5.95	9.26	11.70	10.50	5.75	4.35	6.09	7.62	10.50	14.00	11.40	11.66
4	0.159	11.00	6.00	9.28	12.10	10.70	6.70	5.68	6.39	9.53	10.60	14.20	11.60	12.17
5	0.205	11.00	6.96	9.80	12.90	10.80	7.22	5.72	6.52	9.61	10.90	15.20	12.00	12.33
6	0.250	11.30	7.00	10.30	14.10	10.80	7.36	5.98	6.88	10.40	12.20	18.40	12.30	12.39
7	0.295	12.90	7.01	10.70	14.20	11.10	7.40	6.12	6.88	11.20	12.30	18.90	14.30	12.65
8	0.341	13.40	7.81	12.00	15.00	11.10	7.49	6.26	7.10	11.20	16.30	19.40	14.80	13.48
9	0.386	13.60	8.37	12.00	15.40	11.50	8.45	6.37	7.68	11.80	17.20	19.50	14.90	14.30
10	0.432	14.40	8.46	12.40	16.40	11.80	9.07	6.54	8.01	12.90	19.80	19.50	16.00	14.40
11	0.477	15.20	8.63	13.90	16.50	12.10	9.67	6.73	8.29	13.60	21.50	21.30	16.40	14.55
12	0.523	15.40	9.48	14.20	18.30	14.00	9.74	7.29	8.34	14.90	21.50	22.10	16.90	14.56
13	0.568	15.40	10.10	14.90	19.10	14.10	10.70	7.40	9.29	15.80	24.30	24.20	17.00	15.72
14	0.614	17.10	10.90	15.30	19.50	16.70	11.00	7.65	9.32	16.20	24.60	24.70	20.00	16.07
15	0.659	17.50	11.70	15.50	23.00	16.80	11.30	7.70	9.99	16.50	24.80	26.30	20.30	16.39
16	0.705	18.00	11.90	15.60	23.70	17.80	11.60	7.74	10.90	16.70	25.10	29.00	20.40	16.40
17	0.750	18.40	12.70	18.00	23.90	17.90	11.90	8.14	13.20	16.70	26.50	29.10	20.50	17.20
18	0.795	20.30	13.60	18.50	24.30	17.90	14.00	8.51	13.30	18.20	28.60	30.20	22.50	17.29
19	0.841	21.60	14.60	19.80	24.90	18.10	14.30	8.89	14.20	18.70	29.40	32.10	26.60	17.65
20	0.886	22.0	14.8	20.0	30.4	20.9	17.9	10.3	14.7	19.3	31.8	36.6	28.9	18.6
21	0.932	25.7	17.7	20.7	30.8	23.7	18.2	10.8	14.8	19.5	34.2	43.6	30.9	19.5
22	0.977	29.5	24.4	20.9	32.8	30.4	24.5	16.4	17.6	25.5	57.1	55.8	36.1	21.5
AVERAGE		15.85	10.37	14.06	19.05	14.94	10.69	7.40	9.46	14.02	21.64	24.26	18.35	15.00

R = RANK P = PROBABILITY

STATION NUMBER 11000018

INDONESIA WEST-SUMATRA SITE OF BAYANG SANI

(9.74 Km2)

MONTHLY AND ANNUAL DISCHARGES IN ORDER (M3/S)

R	P	JAN	FEB	MAR	APR	MAI	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1	0.022	0.206	0.152	0.130	0.301	0.232	0.139	0.068	0.073	0.072	0.070	0.348	0.577	0.471
2	0.065	0.468	0.190	0.183	0.404	0.265	0.168	0.088	0.113	0.194	0.152	0.644	0.637	0.546
3	0.109	0.476	0.195	0.251	0.423	0.310	0.204	0.110	0.137	0.197	0.282	0.739	0.652	0.586
4	0.152	0.492	0.223	0.375	0.451	0.359	0.211	0.116	0.170	0.211	0.296	0.821	0.654	0.589
5	0.196	0.557	0.226	0.368	0.575	0.389	0.222	0.134	0.227	0.314	0.657	0.832	0.716	0.561
6	0.239	0.618	0.280	0.652	0.585	0.393	0.239	0.159	0.241	0.333	0.758	0.955	0.780	0.710
7	0.283	0.679	0.301	0.660	0.618	0.419	0.249	0.162	0.242	0.512	0.832	0.968	1.040	0.753
8	0.326	0.849	0.391	0.703	0.742	0.425	0.267	0.185	0.256	0.617	0.998	1.050	1.080	0.770
9	0.370	0.851	0.526	0.770	0.746	0.461	0.276	0.238	0.303	0.646	1.140	1.060	1.110	0.809
10	0.413	0.858	0.534	0.773	0.774	0.479	0.305	0.243	0.321	0.765	1.230	1.140	1.170	0.814
11	0.457	0.888	0.536	0.807	0.836	0.488	0.336	0.260	0.398	0.810	1.240	1.160	1.180	0.885
12	0.500	0.985	0.546	0.889	0.858	0.536	0.345	0.293	0.424	0.864	1.330	1.190	1.210	0.901
13	0.543	1.120	0.612	0.931	0.905	0.556	0.372	0.367	0.541	0.914	1.350	1.370	1.340	0.904
14	0.587	1.180	0.642	0.957	1.030	0.593	0.403	0.395	0.596	1.010	1.360	1.480	1.370	0.907
15	0.630	1.240	0.680	1.000	1.110	0.665	0.450	0.399	0.674	1.060	1.430	1.580	1.450	0.964
16	0.674	1.270	0.690	1.010	1.120	0.706	0.460	0.450	0.704	1.260	1.510	1.620	1.560	0.970
17	0.717	1.270	0.716	1.100	1.130	0.904	0.503	0.475	0.806	1.270	1.610	1.720	1.640	0.984
18	0.761	1.320	0.750	1.100	1.280	0.937	0.559	0.720	0.834	1.320	1.630	1.830	1.700	1.025
19	0.804	1.330	0.788	1.300	1.290	0.943	0.603	0.738	0.911	1.350	1.740	1.920	1.850	1.041
20	0.848	1.360	0.839	1.300	1.510	1.080	0.755	0.786	0.932	1.390	1.950	2.010	2.070	1.063
21	0.891	1.410	0.845	1.380	1.520	1.130	0.850	0.850	1.070	1.390	2.050	2.120	2.160	1.126
22	0.935	2.190	1.270	1.620	2.170	1.210	0.917	0.926	1.270	1.940	2.290	2.550	2.630	1.156
23	0.978	2.320	1.440	1.620	2.530	1.790	0.944	1.650	1.500	3.050	2.410	2.590	3.390	1.156
AVERAGE		1.041	0.581	0.873	0.996	0.664	0.425	0.427	0.554	0.934	1.232	1.378	1.390	0.861

R = RANK P = PROBABILITY

APPENDIX 4

LOW FLOW DISCHARGES IN ORDER

11000002

INDONESIA WEST-SUMATRA SITE OF GUNTUNG

(147.0 Km²)

DISCHARGES DDn NOT EXCEEDED n DAYS BY YEAR (M³/S)

YEAR	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
24	5.480	5.660	5.860	6.170	6.370	6.470	6.620	7.150	9.150	17.200	35.900
27	3.650	3.760	3.850	4.0970	4.180	4.400	4.630	5.750	7.020	12.400	35.900
28	4.050	4.260	4.440	4.590	4.780	5.010	5.170	5.950	6.830	9.730	25.000
29	3.020	3.060	3.100	3.140	3.190	3.270	3.370	3.870	5.110	7.070	18.200
33	4.580	4.740	4.950	5.140	5.310	5.420	5.710	6.110	7.350	12.500	32.200
34	4.190	4.370	4.550	4.750	4.920	5.070	5.250	6.440	6.870	9.520	26.000
35	3.980	4.110	4.170	4.270	4.340	4.410	4.490	4.780	6.040	8.240	30.800
36	3.420	3.490	3.580	3.710	3.890	4.050	4.140	4.550	6.020	7.710	17.100
37	3.100	3.210	3.260	3.340	3.470	3.650	3.790	4.450	5.400	10.300	28.500
38	4.910	5.050	5.190	5.340	5.460	5.490	5.580	5.980	7.310	16.400	37.500
39	4.330	4.590	4.690	4.770	4.900	5.020	5.150	5.850	7.450	13.100	33.100
40	5.300	5.440	5.550	5.630	5.700	5.800	5.930	6.560	8.640	17.400	39.700
41	4.990	5.170	5.260	5.400	5.490	5.610	5.680	6.040	7.030	13.000	28.400
55	4.540	4.720	4.860	5.040	5.140	5.240	5.390	6.100	7.690	13.000	34.400
56	4.540	4.670	4.760	4.820	4.910	5.000	5.080	5.580	6.940	12.200	31.500

11000002

INDONESIA WEST-SUMATRA SITE OF GUNTUNG

(147.0 Km²)

DISCHARGES DDn NOT EXCEEDED n DAYS BY YEAR IN ORDER (M³/S)

R	P	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
1	0.033	3.020	3.060	3.100	3.140	3.190	3.270	3.370	3.870	5.110	7.070	17.100
2	0.100	3.100	3.210	3.260	3.340	3.470	3.650	3.790	4.450	5.400	7.710	18.200
3	0.167	3.420	3.490	3.580	3.710	3.890	4.050	4.140	4.550	6.020	8.240	25.000
4	0.233	3.650	3.760	3.850	3.970	4.160	4.400	4.490	4.780	6.040	9.520	26.000
5	0.300	3.980	4.110	4.170	4.270	4.340	4.410	4.630	5.580	6.830	9.730	28.400
6	0.367	4.050	4.260	4.440	4.590	4.780	5.000	5.080	5.640	6.870	10.300	28.500
7	0.433	4.190	4.370	4.550	4.750	4.900	5.010	5.150	5.750	6.940	12.400	30.800
8	0.500	4.330	4.590	4.690	4.770	4.910	5.020	5.170	5.950	7.020	12.400	31.500
9	0.567	4.540	4.670	4.760	4.820	4.920	5.070	5.250	6.110	7.350	12.500	32.200
10	0.633	4.540	4.720	4.860	5.040	5.140	5.240	5.390	6.080	7.310	13.000	33.100
11	0.700	4.580	4.740	4.950	5.140	5.310	5.420	5.580	6.040	7.350	13.000	34.400
12	0.767	4.910	5.050	5.190	5.340	5.460	5.490	5.680	6.100	7.450	13.100	35.900
13	0.833	4.990	5.170	5.260	5.400	5.490	5.610	5.710	6.110	7.690	16.400	35.900
14	0.900	5.300	5.440	5.550	5.630	5.700	5.800	5.930	6.560	8.640	17.200	37.500
15	0.967	5.480	5.660	5.860	6.170	6.370	6.470	6.620	7.150	9.150	17.400	39.700
AVERAGE		4.272	4.420	4.538	4.672	4.802	4.927	5.065	5.624	6.990	11.985	30.280

R = RANK P = PROBABILITY

11000004

INDONESIA WEST-SUMATRA SITE OF BALANGIR

(40.6 Km²)

DISCHARGES DD_n NOT EXCEEDED n DAYS BY YEAR (M³/S)

YEAR	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
16	1.460	1.710	1.860	1.940	2.070	2.180	2.320	2.810	3.440	6.260	15.500
17	0.660	0.740	0.830	0.900	1.000	1.070	1.140	1.470	2.210	6.350	18.900
18	0.870	1.130	1.230	1.380	1.500	1.590	1.660	1.850	2.510	5.840	12.300
20	0.510	0.600	0.670	0.710	0.750	0.790	0.810	0.960	1.510	2.980	9.480
21	0.320	0.380	0.410	0.460	0.560	0.620	0.710	1.200	2.250	4.610	10.000
22	1.100	1.200	1.300	1.380	1.460	1.550	1.670	1.940	2.810	5.590	13.800
24	0.400	0.490	0.630	0.720	0.810	0.870	0.950	1.230	2.080	4.200	10.800
26	0.910	1.070	1.260	1.420	1.580	1.730	1.830	2.190	2.910	6.010	13.200
27	0.170	0.210	0.240	0.260	0.270	0.300	0.390	0.620	1.810	3.850	10.300
29	0.890	1.110	1.200	1.280	1.400	1.510	1.570	1.760	2.550	5.960	13.400
30	0.300	0.410	0.450	0.500	0.600	0.860	1.160	1.610	2.590	6.060	13.600
31	0.970	1.170	1.340	1.450	1.550	1.610	1.680	2.020	2.910	7.140	15.100
32	0.510	0.620	0.770	1.010	1.060	1.180	1.220	1.570	2.790	5.110	12.200
33	0.760	1.020	1.130	1.240	1.350	1.420	1.490	1.680	2.350	5.930	14.900
34	0.920	0.970	1.040	1.090	1.160	1.230	1.260	1.500	2.250	4.500	10.500
35	0.930	1.100	1.200	1.270	1.310	1.390	1.460	1.630	2.470	6.010	14.400
36	0.520	0.670	0.850	1.000	1.050	1.240	1.450	1.890	3.010	7.320	14.100
37	0.850	1.040	1.130	1.240	1.340	1.450	1.520	1.970	3.220	7.990	17.800
38	0.800	1.030	1.200	1.350	1.460	1.520	1.580	1.780	2.550	5.340	11.100
39	0.280	0.410	0.510	0.590	0.700	0.810	0.870	1.060	1.850	4.020	10.600
40	0.630	0.710	0.810	0.870	1.010	1.150	1.220	1.590	2.650	6.130	13.700
41	0.930	1.240	1.350	1.440	1.520	1.580	1.640	1.900	2.690	5.930	13.400
52	0.610	0.870	0.970	1.010	1.050	1.080	1.120	1.300	1.830	3.530	9.200
53	0.690	0.890	1.010	1.080	1.350	1.550	1.640	1.890	2.540	6.310	15.600
54	1.020	1.200	1.330	1.400	1.490	1.540	1.560	1.790	2.480	5.410	13.600
55	0.830	1.000	1.110	1.190	1.260	1.370	1.480	1.800	2.650	6.640	18.800
56	0.460	0.500	0.580	0.660	0.740	0.810	0.900	1.410	2.310	4.950	11.100
57	0.380	0.490	0.560	0.640	0.720	0.810	0.880	1.450	2.710	6.890	16.300

11000004

INDONESIA WEST-SUMATRA SITE OF BALANGIR

(40.6 Km²)

DISCHARGES DD_n NOT EXCEEDED n DAYS BY YEAR IN ORDER (M³/S)

R	P	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
1	0.018	0.170	0.210	0.240	0.260	0.270	0.300	0.390	0.620	1.510	2.980	9.200
2	0.054	0.280	0.380	0.410	0.460	0.560	0.620	0.710	0.960	1.810	3.530	9.480
3	0.089	0.300	0.410	0.450	0.500	0.600	0.790	0.810	1.060	1.830	3.850	10.000
4	0.125	0.320	0.410	0.510	0.590	0.700	0.810	0.870	1.200	1.850	4.020	10.300
5	0.161	0.380	0.490	0.560	0.640	0.720	0.810	0.880	1.230	2.080	4.200	10.500
6	0.196	0.400	0.490	0.580	0.660	0.740	0.810	0.900	1.300	2.210	4.500	10.600
7	0.232	0.460	0.500	0.630	0.710	0.750	0.860	0.950	1.410	2.250	4.610	10.800
8	0.268	0.510	0.600	0.670	0.720	0.810	0.870	1.120	1.450	2.250	4.950	11.100
9	0.304	0.510	0.620	0.770	0.870	1.000	1.070	1.140	1.470	2.290	5.110	11.100
10	0.339	0.520	0.670	0.810	0.900	1.010	1.080	1.160	1.500	2.310	5.340	12.200
11	0.375	0.610	0.710	0.830	1.000	1.050	1.150	1.220	1.570	2.350	5.410	12.300
12	0.411	0.630	0.740	0.850	1.010	1.050	1.180	1.220	1.590	2.470	5.590	13.200
13	0.446	0.660	0.870	0.970	1.010	1.060	1.230	1.260	1.610	2.480	5.840	13.400
14	0.482	0.690	0.890	1.010	1.080	1.160	1.240	1.450	1.630	2.510	5.930	13.400
15	0.518	0.760	0.970	1.040	1.090	1.260	1.370	1.460	1.680	2.540	5.930	13.600
16	0.554	0.800	1.000	1.110	1.190	1.310	1.390	1.480	1.780	2.550	5.960	13.600
17	0.589	0.830	1.020	1.130	1.240	1.340	1.420	1.490	1.780	2.550	6.010	13.700
18	0.625	0.850	1.030	1.130	1.240	1.350	1.450	1.520	1.790	2.590	6.010	13.800
19	0.661	0.870	1.040	1.200	1.270	1.350	1.510	1.560	1.800	2.650	6.060	14.100
20	0.696	0.890	1.070	1.200	1.280	1.400	1.520	1.570	1.850	2.650	6.130	14.400
21	0.732	0.910	1.100	1.200	1.350	1.460	1.540	1.580	1.890	2.690	6.260	14.900
22	0.768	0.920	1.110	1.230	1.380	1.460	1.550	1.640	1.890	2.710	6.310	15.100
23	0.804	0.930	1.130	1.260	1.380	1.490	1.550	1.640	1.900	2.810	6.350	15.500
24	0.839	0.930	1.170	1.300	1.400	1.500	1.580	1.660	1.940	2.910	6.640	15.600
25	0.875	0.970	1.200	1.330	1.420	1.520	1.590	1.670	1.970	2.910	6.890	16.300
26	0.911	1.020	1.200	1.340	1.440	1.550	1.610	1.680	2.020	3.010	7.140	17.800
27	0.946	1.100	1.240	1.350	1.450	1.580	1.730	1.830	2.190	3.220	7.320	18.800
28	0.982	1.460	1.710	1.860	1.940	2.070	2.180	2.320	2.810	3.440	7.990	18.900
AVERAGE	0.703	0.857	0.963	1.053	1.147	1.243	1.328	1.639	2.480	5.602	13.346	

R = RANK

P = PROBABILITY

11000006

INDONESIA WEST-SUMATRA SITE OF SUMANI

(80.9 Km²)

DISCHARGES DD_n NOT EXCEEDED n DAYS BY YEAR (M³/S)

YEAR	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
16	1.870	1.970	2.270	2.340	2.410	2.470	2.550	2.790	3.330	5.000	12.600
17	1.500	1.650	1.760	1.890	2.050	2.160	2.300	2.640	3.970	6.670	14.200
18	1.400	1.530	1.650	1.760	1.960	2.020	2.120	2.460	3.300	6.210	14.800
20	1.360	1.510	1.620	1.790	1.860	1.920	2.000	2.560	3.700	6.490	18.100
21	0.790	0.880	0.910	0.990	1.090	1.110	1.140	1.230	1.540	4.570	11.000
22	1.020	1.080	1.130	1.170	1.250	1.310	1.380	1.600	2.520	5.410	14.600
24	2.080	2.300	2.420	2.520	2.740	2.830	2.880	3.100	3.730	5.900	15.600
26	2.060	2.190	2.270	2.360	2.430	2.520	2.610	3.010	4.310	5.110	24.900
27	0.900	0.990	1.030	1.090	1.150	1.170	1.220	1.540	2.780	5.030	13.300
28	1.760	1.850	1.970	2.080	2.210	2.260	2.310	2.740	4.370	5.840	25.400
33	1.380	1.450	1.520	1.660	1.850	2.040	2.190	2.710	3.620	5.750	13.700
34	1.290	1.450	1.630	1.850	2.000	2.110	2.170	2.440	3.020	4.230	10.100
35	1.870	2.050	2.150	2.210	2.260	2.330	2.370	2.540	3.050	5.570	14.900
36	1.130	1.190	1.240	1.300	1.400	1.490	1.570	2.360	3.260	5.010	12.200
37	1.240	1.350	1.440	1.630	1.920	2.080	2.160	2.660	3.890	7.400	16.900
38	1.260	1.360	1.420	1.470	1.530	1.610	1.720	2.520	3.800	6.250	16.900
39	0.800	0.910	0.950	1.110	1.290	1.350	1.420	1.760	2.540	4.420	14.000
40	1.400	1.490	1.600	1.730	1.820	1.960	2.080	2.570	3.970	6.640	16.600
41	1.240	1.340	1.450	1.590	1.720	1.840	1.960	2.620	3.920	6.870	18.100

11000006

INDONESIA WEST-SUMATRA SITE OF SUMANI

(80.9 Km²)

DISCHARGES DD_n NOT EXCEEDED n DAYS BY YEAR IN ORDER (M³/S)

R	P	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
1	0.026	0.790	0.880	0.910	0.990	1.090	1.110	1.140	1.230	1.540	4.230	10.100
2	0.079	0.800	0.910	0.950	1.090	1.150	1.170	1.220	1.540	2.520	4.420	11.000
3	0.132	0.900	0.990	1.030	1.110	1.250	1.310	1.380	1.600	2.540	4.570	12.200
4	0.184	1.020	1.080	1.130	1.170	1.290	1.350	1.420	1.760	2.780	5.000	12.600
5	0.237	1.130	1.190	1.240	1.300	1.400	1.490	1.570	2.360	3.020	5.010	13.300
6	0.289	1.240	1.340	1.420	1.470	1.530	1.610	1.720	2.440	3.050	5.030	13.700
7	0.342	1.240	1.350	1.440	1.590	1.720	1.840	1.960	2.460	3.260	5.410	14.000
8	0.395	1.260	1.360	1.450	1.630	1.820	1.920	2.000	2.520	3.300	5.70	14.200
9	0.447	1.290	1.450	1.520	1.660	1.850	1.960	2.080	2.540	3.330	5.750	14.600
10	0.500	1.360	1.450	1.600	1.730	1.860	2.020	2.120	2.560	3.620	5.900	14.800
11	0.553	1.380	1.490	1.620	1.760	1.920	2.040	2.160	2.570	3.700	6.210	14.900
12	0.605	1.400	1.510	1.630	1.790	1.960	2.080	2.170	2.620	3.730	6.250	15.600
13	0.658	1.400	1.530	1.650	1.850	2.000	2.080	2.190	2.640	3.800	6.490	16.600
14	0.711	1.500	1.650	1.760	1.890	2.050	2.160	2.300	2.660	3.890	6.640	16.900
15	0.763	1.760	1.850	1.970	2.080	2.210	2.260	2.310	2.710	3.920	6.670	16.900
16	0.816	1.870	1.970	2.150	2.210	2.260	2.330	2.370	2.740	3.970	6.870	18.100
17	0.868	1.870	2.050	2.270	2.340	2.410	2.470	2.550	2.790	3.970	7.400	18.100
18	0.921	2.060	2.190	2.270	2.360	2.430	2.520	2.610	3.010	4.310	9.110	24.900
19	0.974	2.080	2.300	2.420	2.520	2.740	2.830	2.880	3.100	4.370	9.840	25.400
AVERAGE		1.387	1.502	1.602	1.713	1.839	1.925	2.008	2.413	3.401	6.125	15.679

R = RANK P = PROBABILITY

11000012

INDONESIA WEST-SUMATRA SITE OF SIKARBAU

(115.0 Km2)

DISCHARGES DDn NOT EXCEEDED n DAYS BY YEAR (M3/S)

YEAR	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
16	2.900	3.110	3.410	3.530	3.580	3.690	3.790	4.140	4.960	5.040	22.300
17	2.910	3.070	3.220	3.380	3.540	3.700	3.770	4.160	5.200	7.810	19.600
18	2.950	3.120	3.330	3.750	3.940	4.080	4.170	4.600	6.060	11.800	35.600
20	2.860	3.070	3.260	3.330	3.520	3.700	3.900	4.600	6.090	11.000	26.200
21	3.160	3.520	3.770	3.900	3.970	4.090	4.200	4.840	6.060	10.000	22.900
22	2.180	2.280	2.400	2.550	2.670	2.750	2.810	4.130	5.490	9.390	22.300
24	3.590	3.810	3.970	4.100	4.260	4.330	4.400	4.710	5.650	8.710	20.800
26	2.990	3.240	3.350	3.420	3.490	3.550	3.620	3.950	4.600	6.260	17.900
27	1.850	1.980	2.070	2.150	2.220	2.330	2.390	2.800	4.240	10.400	28.500
28	2.730	2.850	2.990	3.030	3.170	3.260	3.370	3.940	5.150	6.550	22.500
29	3.040	3.320	3.470	3.790	4.080	4.190	4.280	4.770	6.150	13.400	32.600
30	3.950	4.240	4.450	4.620	4.730	4.840	4.920	5.320	6.940	14.800	43.900
31	4.540	4.830	5.160	5.330	5.440	5.580	5.730	6.210	8.270	17.600	42.900
32	3.210	3.460	3.830	4.190	4.370	4.490	4.620	5.220	7.220	15.500	40.800
33	3.860	4.150	4.320	4.450	4.590	4.690	4.840	5.260	6.750	12.300	33.000
34	3.630	3.800	3.880	3.980	4.050	4.140	4.220	4.620	5.750	11.200	25.600
35	3.450	3.810	4.190	4.490	4.600	4.760	4.970	5.320	6.930	14.300	32.700
36	3.280	3.420	3.560	3.660	3.780	3.940	4.110	4.550	6.430	10.800	26.900
37	2.200	2.470	2.650	2.770	3.030	3.250	3.540	4.700	6.460	11.400	26.800
38	3.750	3.990	4.220	4.780	4.940	5.080	5.210	5.670	7.160	11.500	28.500
40	3.290	3.490	3.710	4.060	4.450	4.680	4.800	5.250	6.990	13.700	27.500
41	3.340	3.650	3.850	4.090	4.270	4.440	4.650	5.390	7.400	14.900	33.000

11000012

INDONESIA WEST-SUMATRA SITE OF SIKARBAU

(115.0 Km2)

DISCHARGES DDn NOT EXCEEDED n DAYS BY YEAR IN ORDER (M3/S)

R	P	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
1	0.023	1.850	1.980	2.070	2.150	2.220	2.330	2.390	2.800	4.240	6.260	17.900
2	0.068	2.180	2.280	2.400	2.550	2.670	2.750	2.810	3.940	4.600	7.810	19.600
3	0.114	2.200	2.470	2.650	2.770	3.030	3.250	3.370	3.950	4.960	8.040	20.800
4	0.159	2.730	2.850	2.930	3.030	3.170	3.260	3.540	4.130	5.150	8.550	22.300
5	0.205	2.860	3.070	3.220	3.330	3.490	3.550	3.620	4.140	5.200	8.710	22.300
6	0.250	2.900	3.070	3.260	3.380	3.520	3.690	3.770	4.160	5.490	9.390	22.500
7	0.295	2.910	3.110	3.330	3.420	3.540	3.700	3.790	4.550	5.650	10.000	22.900
8	0.341	2.950	3.120	3.350	3.530	3.580	3.700	3.900	4.600	5.750	10.400	25.600
9	0.386	2.990	3.240	3.410	3.660	3.780	3.940	4.110	4.600	6.060	10.800	26.200
10	0.432	3.040	3.320	3.470	3.750	3.940	4.080	4.170	4.620	6.060	11.000	26.800
11	0.477	3.160	3.420	3.560	3.790	3.970	4.090	4.200	4.700	6.090	11.200	26.900
12	0.523	3.210	3.460	3.710	3.900	4.050	4.140	4.220	4.710	6.150	11.400	27.500
13	0.568	3.280	3.490	3.770	3.980	4.080	4.190	4.280	4.770	6.430	11.500	28.500
14	0.614	3.290	3.520	3.830	4.060	4.250	4.330	4.400	4.840	6.460	11.800	28.500
15	0.659	3.340	3.650	3.850	4.090	4.270	4.440	4.620	5.250	6.750	12.300	32.600
16	0.705	3.450	3.800	3.880	4.100	4.370	4.490	4.650	5.250	6.930	13.400	32.700
17	0.750	3.590	3.810	3.970	4.190	4.450	4.680	4.800	5.260	6.940	13.700	33.000
18	0.795	3.630	3.810	4.190	4.450	4.590	4.690	4.840	5.320	6.990	14.300	33.000
19	0.841	3.750	3.990	4.220	4.490	4.600	4.760	4.920	5.320	7.160	14.800	35.600
20	0.886	3.860	4.150	4.320	4.620	4.730	4.840	4.970	5.390	7.220	14.900	40.800
21	0.932	3.950	4.240	4.450	4.780	4.940	5.080	5.210	5.670	7.400	15.500	42.900
22	0.977	4.540	4.830	5.160	5.330	5.440	5.580	5.730	6.210	8.270	17.600	43.900
AVERAGE		3.166	3.395	3.591	3.789	3.941	4.071	4.196	4.734	6.180	11.516	28.764

R = RANK

P = PROBABILITY

11000015

INDONESIA WEST-SUMATRA SITE OF PATIMAH

(142.0 Km²)

DISCHARGES DD_n NOT EXCEEDED n DAYS BY YEAR (M³/S)

YEAR	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
16	4.190	4.490	4.660	4.990	5.200	5.300	5.420	5.930	7.410	14.500	39.100
17	4.210	4.460	4.710	5.050	5.350	5.530	5.640	6.200	7.910	13.800	32.600
18	4.500	4.740	5.030	5.560	5.890	6.140	6.310	7.090	9.800	20.100	64.600
20	4.320	4.600	4.830	4.980	5.170	5.480	5.620	6.590	8.800	19.000	45.600
21	4.710	5.310	5.580	5.740	5.990	6.220	6.390	6.990	9.240	18.600	40.400
22	3.290	3.480	3.670	3.800	3.960	4.060	4.180	5.920	8.260	16.900	43.100
24	5.340	5.620	5.840	5.970	6.110	6.240	6.350	6.750	8.580	15.900	36.100
26	4.520	4.860	5.090	5.180	5.250	5.340	5.450	5.930	7.240	11.100	31.500
27	2.760	2.950	3.130	3.260	3.380	3.530	3.640	4.250	6.660	17.500	52.000
28	4.190	4.350	4.470	4.640	4.740	4.900	5.120	5.970	7.440	14.300	39.500
29	4.450	4.810	5.060	5.560	5.810	5.910	6.100	6.950	9.370	23.600	53.600
30	5.480	5.810	6.190	6.330	6.530	6.730	6.870	7.500	10.800	24.700	68.500
31	6.040	6.400	6.870	7.050	7.320	7.590	7.850	8.650	13.200	27.900	72.400
32	4.250	4.550	4.930	5.640	5.870	6.060	6.190	7.160	10.700	25.400	69.600
33	5.330	5.640	5.930	6.330	6.480	6.600	6.700	7.450	10.100	21.100	56.400
34	5.080	5.350	5.550	5.720	5.870	6.000	6.140	6.650	8.620	20.400	54.400
35	4.870	5.350	5.890	6.250	6.450	6.620	6.900	7.590	11.400	25.500	54.800
36	4.940	5.160	5.390	5.570	5.720	5.840	5.980	6.560	9.640	18.100	46.900
37	3.100	3.480	3.740	3.930	4.270	4.680	5.150	6.420	10.200	20.400	44.600
38	5.140	5.480	5.800	6.360	6.670	6.830	7.010	8.010	11.300	20.800	48.400
40	4.520	4.880	5.140	5.520	6.320	6.500	6.620	7.470	11.300	22.300	46.900
41	4.700	5.280	5.580	5.810	5.980	6.170	6.400	7.330	11.500	25.100	53.300

11000015

INDONESIA WEST-SUMATRA SITE OF PATIMAH

(142.0 Km²)

DISCHARGES DD_n NOT EXCEEDED n DAYS BY YEAR IN DRDR (M³/S)

R	P	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
1	0.023	2.760	2.950	3.130	3.260	3.380	3.530	3.640	4.250	6.660	11.100	31.500
2	0.068	3.100	3.480	3.670	3.800	3.960	4.060	4.180	5.920	7.240	13.800	32.600
3	0.114	3.290	3.480	3.740	3.930	4.270	4.680	5.120	5.930	7.410	14.300	36.100
4	0.159	4.190	4.350	4.470	4.640	4.740	4.900	5.150	5.930	7.440	14.500	39.100
5	0.205	4.190	4.460	4.660	4.980	5.170	5.300	5.420	5.970	7.910	15.900	39.500
6	0.250	4.210	4.490	4.710	4.990	5.200	5.340	5.450	6.200	8.260	16.900	40.400
7	0.295	4.250	4.550	4.830	5.050	5.250	5.480	5.620	6.420	8.580	17.500	43.100
8	0.341	4.320	4.600	4.830	5.180	5.350	5.530	5.640	6.590	8.620	18.100	43.400
9	0.386	4.450	4.740	5.060	5.520	5.720	5.840	5.980	6.590	8.800	18.600	44.600
10	0.432	4.500	4.810	5.060	5.560	5.810	5.910	6.100	6.650	9.240	19.000	45.600
11	0.477	4.520	4.860	5.090	5.560	5.870	6.000	6.140	6.750	9.370	20.100	46.900
12	0.523	4.520	4.880	5.140	5.570	5.870	6.060	6.190	6.950	9.640	20.400	46.900
13	0.568	4.700	5.160	5.390	5.640	5.890	6.140	6.310	6.990	9.800	20.400	48.400
14	0.614	4.710	5.280	5.550	5.720	5.980	6.170	6.350	7.090	10.100	20.800	52.000
15	0.659	4.870	5.310	5.580	5.740	5.990	6.220	6.390	7.160	10.200	21.100	53.300
16	0.705	4.940	5.350	5.580	5.810	6.110	6.240	6.400	7.330	10.700	22.300	53.600
17	0.750	5.080	5.360	5.800	5.970	6.320	6.500	6.620	7.450	10.800	23.600	54.800
18	0.795	5.140	5.480	5.840	6.250	6.450	6.600	6.700	7.470	11.300	24.700	56.400
19	0.841	5.330	5.620	5.890	6.330	6.480	6.620	6.870	7.500	11.300	25.100	64.600
20	0.886	5.340	5.640	5.930	6.330	6.530	6.730	6.900	7.590	11.400	25.400	68.500
21	0.932	5.480	5.810	6.190	6.360	6.670	6.830	7.010	8.010	11.500	25.500	69.600
22	0.977	6.040	6.400	6.870	7.050	7.320	7.590	7.850	8.650	13.200	27.900	72.400
AVERAGE		4.542	4.866	5.146	5.420	5.651	5.831	6.001	6.789	9.521	19.864	49.241

R = RANK

P = PROBABILITY

11000018

INDONESIA WEST-SUMATRA SITE OF BAYANG SANI (9.74 Km²)
DISCHARGES DD_n NOT EXCEEDED n DAYS BY YEAR (M³/S)

YEAR	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
24	0.250	0.260	0.290	0.320	0.350	0.360	0.400	0.570	0.950	1.490	2.920
26	0.100	0.120	0.140	0.160	0.170	0.190	0.200	0.260	0.430	1.410	3.550
27	0.086	0.100	0.130	0.150	0.160	0.180	0.200	0.270	0.470	1.270	3.030
28	0.150	0.170	0.180	0.180	0.190	0.200	0.210	0.250	0.370	1.000	2.170
29	0.074	0.097	0.110	0.140	0.170	0.180	0.190	0.240	0.380	1.460	3.340
30	0.180	0.210	0.230	0.240	0.250	0.260	0.270	0.290	0.500	1.350	3.200
31	0.190	0.210	0.230	0.250	0.250	0.260	0.280	0.320	0.530	1.510	3.560
32	0.054	0.068	0.086	0.100	0.110	0.110	0.120	0.140	0.220	0.670	2.650
33	0.095	0.100	0.110	0.130	0.150	0.160	0.170	0.220	0.310	0.810	2.390
34	0.094	0.110	0.130	0.140	0.150	0.160	0.160	0.200	0.340	1.370	3.040
35	0.180	0.220	0.250	0.260	0.270	0.290	0.300	0.340	0.640	1.780	4.410
36	0.150	0.180	0.210	0.230	0.240	0.250	0.260	0.290	0.480	1.530	3.140
37	0.091	0.100	0.110	0.120	0.130	0.140	0.150	0.210	0.300	0.780	2.290
38	0.110	0.130	0.140	0.150	0.160	0.160	0.170	0.220	0.370	1.600	4.180
39	0.088	0.100	0.110	0.130	0.150	0.160	0.180	0.260	0.420	1.380	4.040
40	0.160	0.200	0.220	0.230	0.240	0.250	0.260	0.290	0.560	1.720	3.860
41	0.170	0.190	0.200	0.210	0.220	0.230	0.240	0.270	0.430	1.590	4.750
53	0.180	0.200	0.210	0.200	0.210	0.210	0.220	0.260	0.430	1.760	5.080
54	0.180	0.200	0.210	0.230	0.240	0.250	0.260	0.280	0.400	1.250	4.110
55	0.110	0.120	0.130	0.140	0.140	0.150	0.150	0.190	0.310	0.830	2.630
56	0.120	0.140	0.150	0.180	0.190	0.200	0.200	0.230	0.360	1.010	2.760
57	0.140	0.160	0.170	0.180	0.190	0.200	0.210	0.250	0.360	1.270	3.090
58	0.030	0.039	0.046	0.054	0.060	0.064	0.067	0.084	0.250	0.610	2.020

11000018

INDONESIA WEST-SUMATRA SITE OF BAYANG SANI (9.74 Km²)
DISCHARGES DD_n NOT EXCEEDED n DAYS BY YEAR IN ORDER (M³/S)

R	P	DD 1	DD 10	DD 20	DD 30	DD 40	DD 50	DD 60	DD100	DD200	DD300	DD350
1	0.022	0.030	0.039	0.046	0.054	0.060	0.064	0.067	0.084	0.220	0.610	2.020
2	0.065	0.054	0.068	0.086	0.100	0.110	0.110	0.120	0.140	0.250	0.670	2.170
3	0.109	0.074	0.097	0.110	0.120	0.130	0.140	0.150	0.190	0.300	0.780	2.290
4	0.152	0.086	0.100	0.110	0.130	0.140	0.150	0.150	0.200	0.310	0.810	2.390
5	0.196	0.088	0.100	0.110	0.130	0.150	0.160	0.160	0.210	0.310	0.830	2.630
6	0.239	0.091	0.100	0.110	0.140	0.150	0.160	0.170	0.220	0.340	1.000	2.650
7	0.283	0.094	0.100	0.130	0.140	0.150	0.160	0.170	0.220	0.360	1.010	2.760
8	0.326	0.095	0.110	0.130	0.140	0.160	0.180	0.190	0.230	0.360	1.250	2.920
9	0.370	0.100	0.120	0.130	0.150	0.160	0.180	0.190	0.240	0.370	1.270	3.030
10	0.413	0.110	0.120	0.140	0.150	0.170	0.180	0.200	0.250	0.370	1.270	3.040
11	0.457	0.110	0.130	0.140	0.160	0.170	0.190	0.200	0.250	0.380	1.350	3.090
12	0.500	0.120	0.140	0.150	0.180	0.190	0.200	0.200	0.260	0.400	1.370	3.140
13	0.543	0.140	0.160	0.170	0.180	0.190	0.200	0.210	0.260	0.420	1.380	3.200
14	0.587	0.150	0.170	0.180	0.180	0.190	0.200	0.210	0.260	0.430	1.410	3.340
15	0.630	0.150	0.180	0.190	0.200	0.210	0.210	0.220	0.270	0.430	1.460	3.550
16	0.674	0.160	0.180	0.200	0.210	0.220	0.230	0.240	0.270	0.430	1.490	3.560
17	0.717	0.160	0.190	0.210	0.230	0.240	0.250	0.260	0.280	0.470	1.510	3.860
18	0.761	0.170	0.200	0.210	0.230	0.240	0.250	0.260	0.290	0.480	1.530	4.040
19	0.804	0.180	0.200	0.220	0.230	0.240	0.250	0.260	0.290	0.500	1.590	4.110
20	0.848	0.180	0.210	0.230	0.240	0.250	0.260	0.270	0.290	0.530	1.600	4.160
21	0.891	0.180	0.210	0.230	0.250	0.250	0.260	0.280	0.320	0.560	1.720	4.410
22	0.935	0.190	0.220	0.250	0.260	0.270	0.290	0.300	0.340	0.640	1.760	4.750
23	0.978	0.250	0.260	0.290	0.320	0.350	0.360	0.400	0.570	0.950	1.780	5.080
AVERAGE	0.129	0.148	0.164	0.179	0.191	0.202	0.212	0.258	0.427	1.281	3.314	

R = RANK

P = PROBABILITY