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FOR
THE STUDY
OF
WIDAS FLOOD CONTROL AND DRAINAGE PROJECT
PART-I STUDY

SUPPORTING REPORT

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SUPPORTING REPORT

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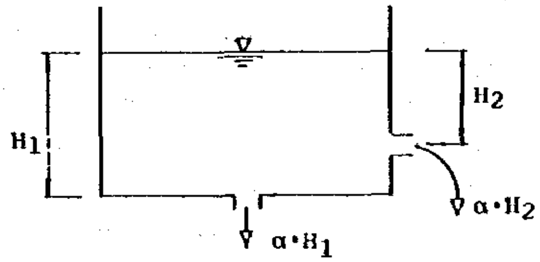
NOTE HY - 1 TANK MODEL

1. Basic concept of Tank Model

The basic idea of Tank Model is very simple. Consider a tank having two holes, one at the bottom and the other at the side.



When the tank is filled with water, the water will be released from these holes. In the run-off analysis, water released from the side hole corresponds to run-off to a stream and water from the bottom hole goes into the groung water zone.

The depth of water released from a hole is given by the following relation.

$I = \alpha \cdot H$ .... (1)

where, I : depth of water released (mm/day)

α : coefficient of hole

H : water depth above the hole (mm)

For the purpose of natural run-off simulation, four tanks combined in series are usually used as shown in Fig. HY-2.13. The top tank corresponds to the surface run-off, the second tank to the sub-surface run-off and the third and fourth to the base flow from the ground water, respectively.

In the simulation process, daily rainfall depth is put into the top tank and the depth of water released from a hole is calculated by the equation (1). The water from the bottom hole is put into the second tank and the same process is repeated to the fourth tank. The depth of the stream run-off is given as the sum of the water released from the side holes. Loss due to evapotranspiration is expressed by subtracting the depth of daily evapotrasnpiration from the storage of top tank.

2. Soil moisture content

The top tank has a special structure simulating soil moisture content in surface soil layers as shown in Fig. HY-1.8. This structure is effective for the area having distinct wet and dry seasons where surface soils are usually dried up in the dry seasons.

In this model soil moisture structure is divided into two parts, the promary and the secondary soil moisture. This soil moisture zones are set in the bottom of the top tank.

Moisture in these two zones is transferable depending on their relative moisture ratio as expressed below.

T2 = TC (XP/PS - XS/SS) .... (2)

Where, T2 : Transfer of moisture between primary and secondary layers (plus sign indicates transfer from primary to secondary and minus sign vice versa)

PS : Primary soil moisture capacity

SS : Secondary soil moisture capacity

XP : Primary soil moisture depth

XS : Secondary soil moisture depth

TC : Constant

When primary soil moisture is not saturated and there is free water in lower tanks, water goes up by capillary action so as to fill the primary soil moisture with the transfer. speed T1 as given below.

T1 : TB (1 - XP/PS) .... (3)

Where, T1 : Transfer of capillary action from lower tanks

TB : Constant

3. Zoning

For the purpose of simulating the area distribution of soil moisture content, the drainage area is divided into four sub-areas as shown in Fig. HY-1.8. In the beginning of the dry season the farthest sub-area (S1) from the river is firstly dried up and the dried up area is expanded to S2, S3 and S4 from mountain to the river sides with the dry seasons goes by.

The vertical structure of each zone is assumed to be expressed by the series of four tanks with the same parameters.

Consequently 4 X 4 are required for a river basin to be simulated as shown in Fig. HY-1.8 in which the direction of water released from each hole is illustrated.

NOTE HY - 2 GUMBEL METHOD

Probable rainfall (x) at any desired return period (T) is calculated with a series of annual max. rainfall (x_i) by the following.

$$X = \bar{X} - \frac{S_Y}{S_x} (\bar{Y} - Y) \qquad \text{(mm)}$$

$$S_x = (1 / N \sum_{i=1}^{N} (X_i - \bar{X}))^{0.5}$$

$$S_y = (1 / N \sum_{i=1}^{N} (Y_i - \bar{Y})^2)^{0.5}$$

$$Y_i = -\ln (- \ln (i / (N+1)))$$

$$Y = -\ln (\ln (T) - \ln (T-1))$$

Where,

$\bar{X}$: Average of rainfall data (X_i)

i : Order of the annual max. rainfalls in magnitude

N : Total number of rainfall data

$\bar{Y}$: Average of Y_i

NOTE HY - 3 HOURLY RAINFALL DISTRIBUTION

The hourly rainfall distribution of probable rainfall is given as follows.

$$n = R_{3\text{-day}} / Ro$$

$$Ri(t) = n \times Rio\ (t)$$

Where, $R_{3\text{-day}}$: 3-day basin average rainfall amount observed in the upstream basin from the base point (mm)

Ro : Probable 3-day basin average rainfall (mm)

Ri (t) : Probable hourly basin a erage rainfall in sub-basin (mm)

Rio (t) : Observed hourly basin average rainfall (mm)

n : Ratio of the observed to the probable rainfall

The above rainfall patterns for design rain storm are modified on the assumption that possible 1-day and 1-hour rainfalls shall be equivalent to or less than the amounts estimated by the following formula.

$$R_{p,\,1\text{-day}} = R_{i\text{-day}} \times \exp(-0.2 \times A^{0.2}) / \exp(-0.1 \times A'^{0.2})$$

Where; Rp, 1-day : Possible 1-day rainfall in a sub-basin

Ri - day : Probable 1-day rainfall at the base point

A : Catchment area of a sub-basin

A' : Catchment area at the base point

$$R_{p.24} = (R_{24/8}) \times (8/1)^{2/3}$$

Where; $R_{p.24}$: Possible 1-hour rainfall in a sub-basin

R_{24} : 24 hours rainfall in a sub-basin

The rainfall which exceeds the above possible rainfall is distributed to other day and/or hour.

NOTE HY - 4 STORAGE FUNCTION

1. Run-off Calculation from Sub - basin

The run-off calculation is performed in accordance with the flow chart shown in Fig. HY-4.1. As seen in this figure, the run-off is calculated by the storage function method. In the succeeding paragraphs, the described are the basin factors, storage function and run-off coefficient which are the major variables as well as rainfall for the run-off calculation.

(1) Basin Factors

The following basin factors are prepared using 1/50,000 or 1/250,000 topographic maps.

- Area of basin / sub-basin (Km^2)
- River length in basin / sub-basin (Km)
- Overall slope of the longest watercourse from the point of interest to watershed divide (S)

(2) Storage Function

The run-off from sub-basin is estimated by the storage function method of which basic equation is descaribed below.

<u>Basin</u>

$$r - q = dSo/dt$$

$$So = K.q^{p}$$

$$q = q_1 \quad (t - T_1)$$

$$Q = 0.2778 \quad (fq + (1-f)\, q_{sa})\, A + Q_B$$

Where, r : Basin average hourly rainfall (mm/hr)

q : Run-off depth from a basin (mm/hr)

Q_1 : Run-off depth from a basin with lag time, T_1 (mm/hr)

q_{sa} : Run-off depth from a basin after saturation rainfall, R_{sa} (mm/hr)

Q : Discharge (m^3/sec)

f : Run-off coefficient
($r \leqq R_{sa}$ $f = f_1$ $r > R_{sa}$ $f = 1.0$)

A : Catchment area (Km^2)

Q_B : Base flow (m^3/sec)

K,P : Coefficient

t : Time (hr)

(3) Coefficient, K and P of Storage Function on Lag-Time

The coefficient of the storage function and lag-time are estimated by the following formula expressed by river length and river bed slope and are calibrated/determined through the simulation of the flood records from the rainfall.

$K = 43.4 \times C \times i^{-1/3} \times L^{1/3}$ ($C = 0.12$)

$P = 1/3$

$T = 0.047 \times L - 0.56$ ($L > 11.9$ km)

$T = 0$ ($L < 11.9$ km)

Where; i : River bed slope

L : River length (cm)

T : Lag-time (hour)

K,P: Constant for a function

(4) Preliminary Run-off Coefficient and Saturated Rainfall

Preliminary run-off coefficient is estimated based on the observed discharge hydrograph and corresponding rainfall records during flood.

Saturated rainfall, which is the changing point of run-off coefficient, is determined based on the above hydrological records and the geological characteristics in sub-basin.

(5) Base Flow

The base flow is estimated from the run-offs as the rise of the recorded discharge fluctuation during rainy season. The base flow of base point and sub-basin is expressed by the specific discharge derived from the relation between the base flow and catchment area.

2. Channel Flow

The run-off from each sub-basin is subject to the retardation effect due to channel storage and lag-time to reach a point of interest.

(1) Flood Retardation by Channel Storage

The computational method used for flood retardation is the storage function method. The storage function method is described in the run-off storage relationship expressed as follows;

$$S = KQ^P$$

$$\frac{dS}{dt} = I - Q$$

Where,

S	:	Channel storage (m^3)
Q	:	Outflow from the channel stretch (m^3/sec)
K,P	:	Storage functions
dt	:	Unit time (sec)
ds	:	Incremental channel storage corresponding to dt (m^3)
I	:	Inflow to the channel stretch (m^3/sec)

In the above equation, the storage functions (K and P) which shows the relationship between the storage and outflow are estimated under the present improved river conditions.

The relationship between the storage and outflow is established using the non-uniform/uniform flow calculation with the aid of several data such as 1/50,000 topographic maps, surveyed cross sections and profiles, and other available topographic maps.

Non - uniform Flow Calculation

The Ida method developed for the non-uniform flow calculation of the compound channel section is applied.

$$He = (H_2 + \frac{D_2}{2g} (\frac{Q_2}{A_2})^2) - (H_1 + \frac{D_1}{2g} (\frac{Q_1}{A_1})^2)$$

$$= 1/2 \left(\frac{N_1{}^2 Q_1{}^2}{A_1{}^2 R_1{}^{4/3}} + \frac{N_2{}^2 Q_2{}^2}{A_2{}^2 R_2{}^{4/3}} \right) dx$$

Where; D : Energy correction factor

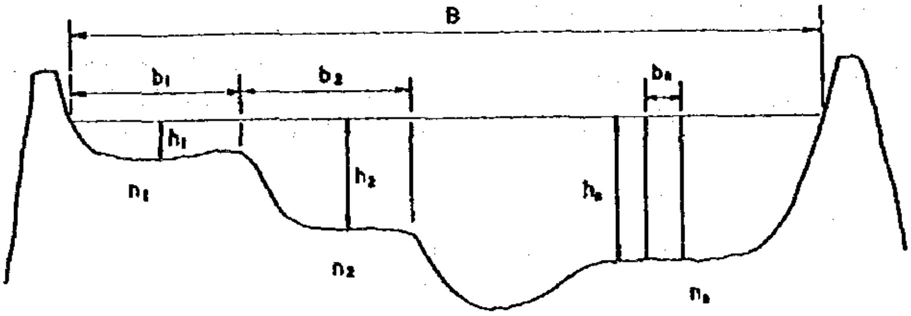
He : Loss of energy head (m)

N : Composite channel roughness (sec, m)

R : Composite channel hydraulic radius (m)

X : Distance between the sections (m)

According to Ida, the energy corrction factor, composite channel roughness, and composite hydraulic radius of compound section are the functions of the depth, roughness, and width of each river sub-section as shown below.



$$D = a \left(A^2 \int_o^B (h^3/n^3)\, db\right) / \left(\int_o^B (h^{5/3}/n)\, db\right)^3$$

$$N = \left(\int_o^B h^{5/3}\, db\right) / \left(\int_o^B (h^{5/3}/n)\, db\right)$$

$$R = \left(\frac{1}{A} \int_o^B h^{5/3}\, db\right)^{3/2}$$

Where; B : Surface width (m)

b,h,n : Width (m), Depth (m), and roughness (sec,m)

a : Velocity distribution coefficient

Uniform Flow Calculation

Manning's uniform flow formula is applied

$$V = \frac{1}{n} R^{2/3} I^{1/2}$$

Where; V : Mean velocity (m/sec)

n : Coefficient of roughness (sec, m)

R : Hydraulic radius (m)

I : Channel slope

(2) Lag-time of Channel Flow

The Lag-time of channel flow is considered to be expressed by the channel length and the river bed slope empirically.
The following formula is adopted for this analysis.

$$T = 7.36 \times L \times i^{1/2} \times 10^{-4}$$

Where; L : River length (km)

i : Average river bed slope

3. Flood Regulation by Reservoir/Dam

The flood regulation by reservoir/dam is expressed by the following equation assuming that the reservoir water level is at NHWL when a flood occurs.

$$ds/dt - I - O$$

Where; S : Storage volume (m^3)

t : Time (hour)

I : Inflow (m^3/sec)

O : Outflow (^{3}/sec)

Reservoir water level caused by increase of inflow discharge, which is unknown quantity in the above equation, is derived from the relation between reservoir water level and storage volume and between reservoir water level and outflow discharge capacity of spillway.

NOTE HY - 5 REFERENCE

LIST OF HYDROLOGICAL DATA (1)

Number	Name of Data	Author	Data of Issue
HY01	Data Klimatologi	Kantor Proyek Brantas	1972-1983
HY02	Stasiun Klimatologi	-"-	1973-1983
HY03	Data Curah Hujan Otomatic Das Brantas	-"-	1966-1984
	Data Curah Hujan Seksi		
HY04	Nganjuk	-"-	1950-1983
HY05	Tulungagung	-"-	-"-
HY06	B l i t a r	-"-	-"-
HY07	K e d i r i	-"-	-"-
HY08	J o m b a n g	-"-	-"-
HY09	M a l a n g	-"-	-"-
HY10	P a r e	-"-	-"-
HY11	Kepanjen	-"-	-"-
HY12	Surabaya	Dinas Pengairan Seksi Sidoarjo	-"-
	Peishal & Debit	Dinas Pengairan Seksi	
HY13	Pengairan Mojokerto	Mojokerto	1951-1983
HY14	Pengairan Tulungagung	Tulungagung	1951-1983
HY15	Pengairan Jombang	Jombang	1950-1983
HY16	Pengairan Pohgajih	Kantor Proyek Brantas	1950-1983
HY17	Stasiun Jong Biru	Kediri	1950-1983
HY18	Stasiun Pakel	Kediri	1950-1983
HY19	Stasiun Jeli	Kediri	1951-1983
Hy20	Stasiun Kali Porong	Sidoarjo	1951-1983
HY21	Stasiun Ploso	Kediri	1951-1983
HY22	Stasiun Jabon	Mojokerto	1951-1983

LIST OF HYDROLOGICAL DATA (2)

Number	Name of Data	Author	Date of Issue
	<u>Pengukuran Debiet</u>	<u>Dinas Pengairan Seksi</u>	
HY23	P a k e l	Kediri	1971-1983
HY24	Jong Biru	Kediri	1971-1983
HY25	Kertosono	Jombang	1971-1983
HY26	P l o s o	Jombang	1972-1983
HY27	Clumprit	Kepanjen	1971-1983
HY28	Gadang	Malang	1977-1983
HY29	K. B i r u	Kepanjen	1979-1983
HY30	Pakuncen	Tulungagung	1977-1983
HY31	K e n d a l	Tulungagung	1972-1983
HY32	Malangsari	Tulungagung	1979-1983
HY33	Senggowar	Tulungagung	1977-1983
HY34	P o r o n g	Sidoarjo	1977-1983
	<u>H - Q Curve</u>		
HY36	P a k e l	Dinas Pengairan Seksi Kediri	
HY37	Jong Biru	-"-	1971-1983
HY38	Kertosono	Jombang	1972-1983
HY39	P l o s o	Jombang	1978-1983
HY40	Terusan	Mojokerto	1972-1978
HY41	Sumberejo	Kepanjen	1977,1978, 1980
HY42	G a d a n g	M a l a n g	1977-1980
HY43N	Ngundikan	N g a n j u k	1976-1977
HY44	Malangsari	N g a n j u k	1979-1980
HY45	K u n c i r	N g a n j u k	1979-1980
HY46	Senggowar	N g a n j u k	1979-1980
HY47	Perning	Mojokerto	1976-1979
HY48	P o r o n g	Sidoarjo	1978-1979
HY49	Kertosono	K e d i r i	1973-1980
HY50	J e l i	K e d i r i	1973-1980
HY51	Lengkong Widas	N g a n j u k	1973-1979
HY52	Result of Water Quality PDAM Test on K. Surabaya		1982-1983
HY53	Hasil Monitoring	Cipta Karya	1982

Table HY-1.1 METEOROLOGICAL RECORDS IN K.BRANTAS BASIN

(1) TEMPERATURE (unit : °C)

Station	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
MALANG	24.0	24.1	24.3	24.4	24.3	23.6	23.0	23.4	23.9	24.8	24.8	24.2	24.1
K.KATES	26.7	26.5	26.5	27.6	26.2	25.6	24.9	25.5	26.0	26.8	27.3	26.4	26.3
MRICAN	26.2	27.1	27.3	28.2	28.1	26.9	26.9	27.3	27.0	27.2	27.8	27.3	27.3
PORONG	25.4	25.7	26.1	26.9	26.4	26.6	26.2	25.9	26.6	27.9	28.4	27.2	26.6

(2) RELATIVE HUMIDITY (unit : %)

Station	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
MALANG	82.1	82.8	82.5	80.2	78.5	78.1	76.7	74.5	73.4	74.4	77.9	80.7	78.5
K.KATES	85.6	84.7	84.8	83.8	83.0	81.3	79.4	78.3	77.9	79.5	82.6	85.5	82.2
MRICAN	79.2	78.7	77.8	73.8	73.5	69.7	71.0	70.4	69.4	69.4	71.1	74.1	73.1
PORONG	76.6	79.6	79.4	78.0	79.1	78.8	79.6	79.8	77.4	79.4	77.2	77.7	78.5

(3) EVAPORATION (Unit : mm/day)

Station	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
MALANG	1.8	1.6	1.7	1.8	2.0	2.3	2.3	2.8	2.6	3.0	1.8	1.7	2.1
K.KATES	1.5	1.6	1.9	1.7	1.8	1.7	2.2	2.6	2.7	2.5	1.8	1.5	2.0
MRICAN	3.4	3.2	3.5	4.7	3.7	4.7	4.6	5.6	5.8	5.8	5.3	3.6	4.5
PORONG	2.0	2.0	2.2	2.2	2.3	2.5	2.7	3.3	3.5	3.6	3.3	2.5	2.7

(4) WIND VELOCITY (unit : km/hour)

Station	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
MALANG	7.4	5.9	6.5	5.2	6.3	6.7	7.5	7.3	7.2	6.8	6.5	6.4	6.6
K.KATES	5.5	3.3	3.4	3.5	3.9	5.4	7.4	7.6	8.2	7.1	5.1	4.2	5.4
MRICAN	1.9	1.6	2.5	2.5	3.9	3.4	3.8	4.9	5.1	6.6	3.7	2.8	3.6
PORONG	2.5	2.3	1.8	1.9	2.0	2.4	2.5	3.0	3.3	3.0	2.0	2.4	2.4

(5) SUNSHINE HOURS (Unit : hour/day)

Station	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
MALANG	3.8	4.2	4.4	4.7	5.8	6.4	6.4	6.6	6.1	5.0	5.2	4.4	5.3
K.KATES	5.4	5.7	5.6	6.3	6.5	7.2	7.3	7.3	6.9	6.4	6.4	5.6	6.4
MRICAN	7.6	4.2	4.7	6.2	5.7	6.3	7.0	7.6	7.6	6.2	5.8	5.1	6.3
PORONG	4.6	4.8	5.9	5.4	6.6	7.0	6.7	6.3	6.8	7.2	6.8	5.2	6.1

Table HY-1.2(1) MONTHLY MEAN DISCHARGE RECORD AT PAKEL

Unit : m^3/sec

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Mean
1951	212.4	296.0	194.6	155.1	117.1	127.9	95.3	69.6	56.7	49.8	47.5	140.8	1,560.8	130.1
52	195.3	236.9	303.2	180.5	110.1	100.0	68.3	37.7	57.3	59.0	197.6	157.7	1,703.6	142.0
53	146.0	156.6	173.1	182.6	227.5	104.6	79.6	56.5	50.3	42.0	59.4	90.9	1,369.1	114.1
Sub - total	553.7	689.5	670.9	518.2	454.7	332.5	241.2	163.8	164.3	150.8	304.5	389.4	4,633.5	128.7
1954	132.1	179.6	181.4	215.7	223.8	156.0	104.9	98.0	72.9	73.0	179.3	287.7	1,904.4	158.7
55	226.9	230.6	210.1	242.3	209.5	194.4	228.9	168.3	129.0	94.3	210.7	184.6	2,329.6	194.1
56	216.7	198.6	164.8	158.7	153.8	173.6	160.8	142.3	100.4	111.0	123.3	186.8	1,870.8	155.9
57	177.7	252.0	241.4	186.7	158.8	94.0	162.4	96.5	60.9	42.3	55.3	119.9	1,647.9	137.3
58	101.6	181.4	213.2	217.3	151.5	122.2	141.6	94.6	61.4	69.7	58.5	224.7	1,637.7	139.6
59	226.1	229.7	260.9	145.5	186.2	133.5	79.1	58.4	51.2	45.8	65.2	191.6	1,673.2	139.4
60	170.3	220.8	245.4	200.7	233.2	123.8	108.3	72.5	58.5	54.4	117.3	98.7	1,703.9	142.0
61	194.1	156.8	156.0	156.5	137.5	81.6	60.3	45.5	38.4	36.5	50.9	102.1	1,196.2	99.7
62	202.5	174.6	176.0	214.8	155.3	98.7	77.8	64.6	40.8	45.8	93.2	212.8	1,569.9	130.8
63	232.1	213.5	254.3	170.8	94.1	68.8	63.2	53.5	44.4	40.2	44.1	75.7	1,354.7	112.9
Sub - total	1,880.1	2,037.6	2,083.5	1,889.0	1,703.7	1,246.6	1,187.3	894.2	665.9	613.0	1,042.8	1,684.6	16,928.3	141.1
1964	68.7	96.0	165.1	162.7	195.5	159.2	62.0	50.4	64.1	117.8	111.0	127.3	1,387.8	115.6
65	214.4	221.5	196.6	169.0	84.5	73.4	63.0	57.1	42.9	40.5	64.9	121.6	1,349.4	112.4
66	134.9	169.4	210.2	183.0	133.9	84.2	67.2	62.1	51.2	65.7	91.0	132.5	1,385.3	115.4
67	229.8	178.1	176.2	195.8	111.8	72.0	56.7	47.1	46.0	44.3	61.9	160.1	1,379.8	115.0
68	168.6	161.1	174.3	170.0	232.6	238.6	208.1	111.3	98.6	124.7	176.8	212.3	2,077.5	173.2
69	217.2	182.0	281.0	221.0	117.7	115.5	76.0	71.8	62.5	62.0	108.7	148.0	1,663.4	138.6
70	187.2	177.5	226.3	195.3	147.7	114.3	75.4	53.4	60.4	73.2	132.0	156.3	1,599.0	133.2
71	213.3	196.1	202.9	136.8	129.1	120.5	92.3	47.8	49.7	91.9	133.6	196.1	1,610.1	134.2
72	188.6	145.9	185.0	137.6	135.5	70.8	30.7	22.8	58.0	65.0	72.1	120.4	1,232.4	102.7
73	122.4	106.1	140.0	235.5	232.8	173.7	136.8	79.9	127.0	148.1	165.5	193.7	1,861.5	155.1
Sub - total	1,745.1	1,633.7	1,957.6	1,806.7	1,521.1	1,222.2	868.2	611.7	660.4	839.2	1,117.5	1,568.3	15,545.7	129.5
1974	135	160	173	176	178	126	110	96.5	117	157	182	193	1,803.5	150
75	225	226	230	231	190	140	103	114	127	203	264	189	2,242.0	187
76	171	173	225	-	-	-	-	-	-	-	-	189	758.0	-
77	-	-	165	187	117	101	67.5	75.1	62.8	56.6	55.4	69.8	957.2	-
78	127	119	157	154	176	232	87.3	117	131	121	147	130	1,698.3	142
79	205	198	155	142	167	172	65.6	68.1	66.4	64.0	66.9	115	1,485.0	124
80	199	145	113	143	92.6	63.0	127	89.3	67.9	56.3	91.7	163	1,350.8	113
81	246	127	109	99.0	129	89.2	68.8	88.9	78.8	92.2	99.6	169	1,296.5	100
82	203	133	150	128	81.2	71.7	72.1	71.4	60.5	59.0	55.1	78.0	1,163.0	96.9
83	-	160	120	157	181	93.3	102	56.9	49.4	78.5	124	101	1,223.1	-
Sub - total	1,411	1,441	1,597	1,417	1,311.8	1,088.2	803.3	777.2	760.8	887.6	1,085.7	1,396.8	13,977.4	131.6
Total	5,589.9	5,801.8	6,309.0	5,630.9	4,991.3	3,889.5	3,100.0	2,446.9	2,251.4	2,484.6	3,550.5	5,039.1	51,084.9	133.8

Table HY-1.2(2) MONTHLY MEAN DISCHARGE RECORD AT JELI

Unit : m^3/sec

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Mean
1951	301.6	565.7	277.9	171.0	117.7	189.4	114.4	80.6	76.7	56.6	59.2	178.5	1,989.3	165.8
52	331.0	449.2	504.9	241.9	141.0	109.8	72.4	65.3	59.3	84.1	342.2	268.5	2,669.6	222.5
53	190.0	251.0	229.9	225.3	271.4	115.8	90.8	57.6	45.4	39.2	61.8	117.0	1,695.2	141.3
Sub-total	822.6	1,065.9	1,012.7	638.2	530.1	415.0	277.6	203.5	181.4	179.9	463.2	564.0	6,354.1	176.5
1954	216.9	210.6	199.5	224.3	306.5	195.6	121.9	100.7	85.1	74.6	353.8	401.4	2,529.1	210.8
55	307.5	320.3	239.6	362.0	285.2	249.0	447.0	292.8	193.7	218.0	473.8	277.6	3,666.5	305.5
56	372.7	286.6	243.0	181.3	211.4	215.9	212.6	177.2	114.8	126.0	153.9	348.4	2,643.8	220.3
57	255.9	338.0	376.0	284.6	184.0	102.6	343.8	137.7	76.1	57.2	66.7	130.1	2,352.6	196.0
58	146.4	266.1	304.0	296.3	195.5	145.5	188.8	150.8	77.1	109.1	147.9	293.5	2,301.0	191.7
59	450.8	433.9	448.8	264.5	297.5	220.1	120.1	63.1	68.7	54.4	95.1	306.5	2,823.5	235.3
60	303.0	293.3	356.6	267.9	344.0	193.4	134.5	88.1	65.2	57.2	158.3	145.9	2,407.4	200.6
61	294.6	240.1	202.8	206.7	192.3	92.1	59.3	51.6	40.7	41.8	62.5	126.7	1,611.2	134.3
62	286.8	258.8	242.0	328.7	209.4	106.9	90.5	76.4	50.4	60.5	192.0	350.6	2,253.0	187.7
63	432.4	349.0	522.5	321.0	139.8	85.0	68.1	54.4	45.6	46.4	55.0	112.0	2,231.2	185.9
Sub-total	3,066.9	3,026.7	3,134.8	2,731.3	2,365.6	1,606.1	1,786.6	1,180.8	817.4	845.4	1,759.0	2,492.7	24,819.3	206.8
1964	102.5	122.8	297.3	302.2	-	157.6	64.3	55.4	84.6	366.8	207.1	156.8	1,917.4	-
65	285.8	357.1	269.1	204.2	113.8	81.8	61.0	53.0	49.7	49.7	65.7	-	1,590.9	-
66	171.8	235.0	383.5	344.2	174.9	126.2	75.0	68.2	55.4	80.1	100.7	257.3	2,072.3	172.7
67	244.5	-	186.8	191.0	134.4	86.8	61.8	54.5	44.6	43.5	65.0	157.8	1,270.7	-
68	209.9	182.2	288.3	260.2	306.6	302.0	295.0	179.3	112.1	162.9	179.6	301.9	2,785.9	232.2
69	255.6	242.6	351.4	279.0	182.1	143.0	84.0	67.2	58.3	67.2	104.9	155.5	1,990.8	165.9
70	-	-	-	-	-	-	-	-	-		-	-	-	-
71	276.7	306.2	290.8	184.4	226.9	182.1	106.1	65.7	70.2	141.8	165.5	231.0	2,247.4	187.3
72	262.0	166.2	269.8	159.1	188.3	76.6	35.3	27.1	62.3	72.3	82.2	155.4	1,556.6	129.7
73	179.3	173.4	192.1	321.7	250.9	400.2	175.6	95.7	183.1	199.4	218.3	243.9	2,632.8	219.4
Sub-total	1,967.3	1,791.5	2,529.1	2,246.0	1,577.9	1,556.3	958.1	666.1	720.3	1,183.6	1,189.0	1,559.6	18,064.8	184.5
1974	197	231	250	278	240	167	145	131	229	295	282	214	2,657	221
75	315	260	307	322	264	138	152	150	178	240	258	259	2,843	237
76	231	-	248	171	123	134	112	106	87.7	100	179	172	-	-
77	222	207	206	210	125	151	82.2	72.6	67.0	55.7	58.9	103	1,560.4	130
78	191	103	221	187	205	314	282	136	154	142	166	199	2,305	192
79	293	-	267	251	294	185	121	117	87.2	-	91.8	157	-	-
80	170	167	129	188	95.5	68.3	71.4	73.0	67.8	79.1	143	202	1,454.1	121
81	191	177	178	165	158	135	176	130	123	124	177	217	1,952.0	163
82	246	248	243	205	123	117	93.4	85.4	72.0	69.6	69.3	85.9	1,658.4	138
83	170	256	184	199	276	121	115	93.8	75.9	123	250	180	2,023.7	169
Sub-total	2,226	1,654	2,233	2,176	1,905.5	1,530.3	1,348	1,094.8	1,142.4	1,228.4	1,655	1,788.9	19,980.3	
Total	8,102.9	7,538.1	8,909.6	7,791.5	6,377.1	5,107.7	4,370.3	3,145.2	2,861.5	3,437.3	5,066.2	6,505.2	69,218.5	188.0

Table HY-1.2(3) MONTHLY MEAN DISCHARGE RECORD AT JONGBIRU

Unit : m^3/sec

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	Mean
1951	290.1	334.6	229.1	129.0	103.2	155.7	96.9	73.9	60.4	43.9	39.9	153.2	1,709.9	142.5
52	267.2	366.5	419.0	203.5	129.2	96.1	41.5	49.7	46.1	73.4	281.3	236.9	2,210.4	184.2
53	171.4	213.9	262.4	211.4	336.0	119.3	82.2	52.9	41.0	35.4	58.5	120.6	1,705.9	142.1
Sub-Total	728.7	915.0	910.5	543.9	568.4	371.1	220.6	176.5	148.3	152.7	379.7	510.7	5,626.1	156.3
54	257.9	257.4	225.1	236.9	291.8	178.6	117.3	116.7	81.6	76.0	335.0	436.3	2,610.6	217.5
55	279.3	297.6	210.1	266.5	221.2	218.9	325.8	230.2	149.7	169.4	393.9	214.4	2,967.1	247.3
56	253.8	235.3	189.8	151.5	156.6	170.6	188.0	152.0	93.1	117.9	132.8	252.2	2,093.6	174.5
57	197.2	282.6	452.9	248.5	167.1	100.1	295.3	123.1	77.6	65.5	73.5	185.5	2,268.9	189.1
58	152.3	248.5	267.7	280.9	190.6	147.7	170.7	123.4	75.6	114.0	159.2	280.0	2,210.6	184.2
59	343.9	318.7	374.7	228.5	283.4	225.6	153.6	96.3	96.2	81.5	128.9	289.8	2,621.1	218.4
60	281.1	312.2	322.9	293.3	394.5	201.7	152.9	105.7	89.8	85.0	185.0	168.7	2,592.8	216.1
61	280.8	237.1	208.3	224.9	201.3	109.7	90.6	75.5	70.1	77.7	73.3	137.6	1,786.9	148.9
62	261.1	248.7	247.6	280.5	195.0	131.0	114.4	91.2	71.8	86.6	158.3	354.7	2,240.9	106.7
63	346.1	351.2	459.7	307.1	150.3	128.2	100.0	82.0	74.8	72.5	84.4	130.9	2,207.2	190.6
Sub-Total	2,653.5	2,779.3	2,958.9	2,518.6	2,251.8	1,612.1	1,700.6	1,196.1	880.3	946.1	1,724.3	2,450.1	23,679.7	197.3
64	119.2	142.4	233.6	230.8	230.3	189.7	94.6	70.9	100.8	306.0	179.1	160.9	2,066.3	172.2
65	278.4	368.0	269.3	195.3	130.9	108.8	95.0	94.5	79.2	69.8	97.0	176.6	1,962.8	163.6
66	207.5	301.6	339.2	313.0	188.5	153.3	110.5	103.7	81.1	114.3	167.6	330.5	2,410.8	200.9
67	328.1	283.1	218.2	227.6	106.1	74.1	72.9	79.2	72.4	77.3	96.1	209.4	1,844.5	153.7
68	232.5	235.3	396.5	284.3	353.5	319.7	373.6	212.9	141.1	186.5	234.1	355.6	3,335.6	278.0
69	325.4	294.7	384.4	390.0	184.1	175.3	114.8	108.1	111.4	113.2	152.4	217.5	2,571.3	214.3
70	273.7	299.1	343.1	319.9	302.4	222.7	140.7	120.0	129.5	133.1	216.8	290.2	2,791.2	232.6
71	316.7	386.2	322.7	238.4	274.5	221.2	161.3	119.1	130.6	232.0	277.4	317.5	2,997.4	249.8
72	339.1	271.5	335.3	213.8	212.5	122.3	56.6	45.1	105.3	90.9	81.3	147.1	2,020.8	168.4
73	213.5	180.9	246.8	324.6	351.4	225.5	168.6	85.1	105.3	171.7	220.2	207.0	2,500.5	208.4
Sub-Total	2,634.1	2,762.0	3,089.1	2,737.7	2,344.2	1,812.6	1,368.6	1,046.6	1,056.5	1,494.8	1,722.0	2,412.3	24,501.3	204.2
74	171	240	189	232	208	128	117	112	127	224	258	228	2,234	186
75	307	368	363	381	309	132	122	132	175	267	314	316	3,186	266
76	277	215	292	169	110	103	82.9	50.5	41.7	63.4	161	138	1,703.5	142
77	166	154	199	229	109	174	85.5	67.3	52.0	51.3	46.8	96.1	1,430.6	119
78	211	163	212	177	229	302	269	135	137	146	216	228	2,425.0	202
79	344	382	263	263	318	324	141	143	82.8	83.7	108.	210	2,662.5	222
80	219	260	193	245	165	103	82.2	84.4	68.2	69.7	216	287	1,992.5	166
81	309	268	248	250	257	198	290	129	170	128	218	341	2,806.0	234
82	323	309	307	237	109	91.2	91.8	89.7	64.4	50.8	56.6	109	1,839.5	153
83	225	341	266	423	430	151	106	84.5	72.9	113	239	187	2,638.4	220
Sub-Total	2,552	2,700	2,532	2,606	2,244	1,706.2	1,307.4	1,027.4	991.8	1,196.9	1,833.4	2,140.1	22,917.2	191
Total	8,568.3	9,157.1	9,490.5	8,406.2	7,408.4	5,502.0	4,705.2	3,446.6	3,076.9	3,790.5	5,659.4	7,513.2	76,224.3	193.

Table HY- 1.2(4) MONTHLY MEAN DISCHARGE RECORD AT KERTOSONO

Unit : m^3/sec

Year	Jan.	Feb.	Mar.	April.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Mean
1951	323.9	424.8	289.5	148.6	109.9	157.1	106.1	74.7	51.3	36.9	35.6	136.5	1,895.1	157.9
52	284.4	447.1	510.8	231.1	134.5	117.7	48.9	27.9	34.1	57.7	295.5	223.5	2,413.2	201.0
53	209.6	263.2	319.3	272.0	377.0	116.6	85.3	52.9	36.1	32.0	53.9	102.4	1,921.1	160.1
Sub - total	817.9	1,135.1	1,119.6	651.7	621.4	391.4	240.3	155.5	121.5	127.4	385.2	462.4	6,229.4	173.0
1954	269.8	266.5	227.1	226.6	299.4	193.2	125.9	125.9	69.8	61.9	337.3	479.4	2,702.8	225.2
55	334.4	345.7	295.3	304.9	267.1	241.5	390.2	270.4	177.0	186.0	424.9	258.8	3,496.2	291.3
56	325.0	311.6	238.0	163.1	185.4	217.9	234.2	184.4	114.7	129.6	162.6	330.8	2,597.3	216.4
57	252.1	301.1	487.4	308.1	225.8	117.5	338.3	191.8	93.3	67.7	87.0	250.6	2,720.7	226.7
58	160.0	294.5	302.6	293.7	210.6	154.7	148.9	122.5	82.7	120.3	160.6	294.3	2,345.4	195.4
59	447.0	385.5	455.5	323.7	392.0	350.9	227.5	137.7	96.8	63.5	91.7	297.0	3,268.2	272.4
60	363.0	213.5	352.4	293.9	395.3	210.4	199.3	117.6	64.6	70.3	200.8	166.1	2,669.4	222.4
61	292.4	269.5	269.1	261.5	212.7	130.1	108.6	82.0	60.8	52.9	58.8	132.1	1,930.5	160.9
62	292.3	301.1	289.2	376.9	288.8	152.1	111.6	69.4	50.5	61.3	168.0	359.9	2,521.1	210.1
63	444.5	425.8	506.6	341.8	201.8	122.6	100.5	89.4	67.2	77.8	82.2	136.6	2,596.8	216.4
Sub - total	3,160.5	3,134.8	3,423.2	2,894.2	2,678.9	1,890.9	1,985.0	1,391.1	897.6	891.3	1,773.9	2,707.6	26,849.0	223.7
1964	181.0	213.5	414.3	350.6	309.4	299.0	140.6	105.6	121.4	384.4	301.4	387.2	3,208.4	267.4
65	552.4	693.4	473.8	562.0	184.2	167.5	125.5	102.0	96.1	85.0	143.4	274.9	3,260.2	271.7
66	315.9	441.2	-	-	-	-	-	-	-	-	-	-	757.1	-
67	353.1	279.1	248.4	300.7	163.7	130.7	108.1	108.4	112.6	110.0	164.3	378.5	2,457.6	204.8
68	358.0	399.6	718.7	544.7	591.0	503.6	574.7	437.3	180.4	242.6	271.3	524.8	5,345.7	445.5
69	612.2	534.1	573.8	676.7	244.0	214.8	159.9	126.8	123.0	122.6	187.9	294.1	3,869.8	322.5
70	326.8	394.0	444.7	461.0	435.2	362.4	215.2	147.1	141.6	141.5	208.1	283.3	3,560.9	296.7
71	458.1	605.8	497.8	376.7	384.1	328.8	199.1	149.1	153.4	230.6	435.1	449.6	4,266.2	355.7
72	429.5	308.5	393.8	196.5	238.9	114.9	55.2	39.0	45.5	48.3	53.5	125.8	2,049.4	170.6
73	186.3	193.0	251.6	348.7	430.3	226.8	168.1	92.9	143.8	130.3	149.4	223.0	2,544.2	212.0
Sub - total	3,773.3	4,061.2	4,016.9	3,617.6	2,980.8	2,348.5	1,746.4	1,308.2	1,117.8	1,495.3	1,914.3	2,941.2	31,321.5	263.0
1974	178	248	212	169	-	115	109	114	130	196	290	360	2,121	177
75	457	484	485	461	348	165	113	112	145	206	241	-	3,217	-
76	254	209	314	210	153	141	127	91.0	82.0	93.5	157	149	1,978.5	165
77	175	175	215	218	164	174	152	139	134	122	114	129	1,911	159
78	168	274	199	181	208	265	235	191	232	198	203	241	2,495	208
79	357	433	313	199	360	266	115	113	83.6	47.9	94.1	146	2,545.6	212
80	222	253	201	241	130	65.3	63.9	65.8	53.9	53.6	118	201	1,668.4	139
81	255	249	214	206	265	158	204	87.1	84.7	35.4	132	266	2,216.2	185
82	170	305	306	257	108	72.1	64.2	51.0	58.7	47.6	42.1	99.9	1,782.6	149
83	184	287	248	278	404	125	51.0	65.7	67.8	76.4	129	116	2,037.9	170
Sub - total	2,524	2,817	2,707	2,420	2,140	1,546.4	1,232.1	1,029.6	1,071.6	1,156.4	1,520.2	1,704.9	21,973.2	173.8
Total	10,395.7	11,148.1	11,266.7	9,583.5	8,421.1	6,177.2	5,203.8	3,884.4	3,208.5	3,670.4	5,593.6	7,820.1	85,373.1	221.5

Table HY-1.2(5) MONTHLY MEAN DISCHARGE RECORD AT JABON

Unit : m^3/sec

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Mean
1951	494.1	683.6	474.8	157.9	117.1	212.4	101.9	67.1	49.6	56.6	32.4	226.6	2,654.1	221.2
52	505.7	654.9	776.0	366.0	153.0	119.0	55.3	40.0	39.8	57.4	425.4	463.2	3,655.7	304.6
53	370.0	395.5	458.4	498.0	660.6	137.1	106.4	45.3	35.2	31.8	54.5	194.5	2,987.3	248.9
54	507.4	496.4	400.9	365.0	434.0	232.9	108.8	121.8	65.6	69.2	502.4	774.7	4,079.1	339.9
Sub - Total	1,877.2	2,230.4	2,110.1	1,386.9	1,364.7	701.4	372.4	274.2	190.2	195.0	1,014.7	1,659.0	13,376.2	278.7
1955	551.9	553.4	519.4	532.6	354.9	318.1	570.8	347.0	176.2	193.7	604.2	333.7	5,055.9	421.3
56	524.0	505.4	359.3	147.9	184.9	341.9	210.8	164.0	87.1	105.1	139.7	413.6	3,185.7	265.3
57	345.3	546.2	866.1	351.1	186.2	88.8	359.0	139.6	52.9	38.9	51.9	302.9	3,328.9	277.4
58	233.0	591.0	569.1	597.2	327.1	141.7	201.3	110.9	51.5	81.5	129.5	392.1	3,425.9	285.5
59	792.3	715.3	661.2	391.6	423.4	268.3	135.6	56.0	45.1	56.3	69.4	436.3	4,056.8	338.1
60	536.2	297.2	645.2	460.9	545.4	150.3	132.1	60.7	41.0	38.0	151.7	173.9	3,232.5	269.4
61	418.[illegible]	447.3	322.1	296.3	246.7	87.3	50.0	37.8	31.3	25.6	37.1	109.0	2,108.8	175.7
62	474.9	499.0	388.7	543.8	306.9	128.3	90.4	56.9	32.7	40.8	147.5	377.8	3,087.6	257.3
63	597.1	727.4	847.8	494.8	163.2	101.3	56.3	44.2	33.0	30.4	33.4	122.9	3,251.8	271.0
Sub - total	4,472.9	4,882.2	5,184.9	3,816.2	2,738.7	1,646.0	1,806.3	1,017.1	550.8	590.3	1,364.4	2,662.2	30,732.0	284.5
1964	129.8	183.4	473.1	278.6	224.4	240.1	62.1	41.2	44.0	375.9	212.1	155.2	2,419.9	201.7
65	393.4	479.3	352.2	197.7	75.0	70.4	44.6	32.6	27.0	23.5	33.7	156.8	1,886.1	157.2
66	263.0	525.6	585.3	411.6	168.4	105.2	54.9	33.8	25.8	45.6	72.1	304.5	2,595.8	216.3
67	460.0	420.9	372.5	381.4	144.9	59.5	40.9	32.7	27.5	22.6	26.9	164.9	2,154.7	179.6
68	219.6	404.5	580.0	476.9	473.0	336.9	386.3	196.6	90.9	103.1	168.5	410.2	3,846.5	320.5
69	385.9	480.7	474.3	482.1	132.8	123.9	53.3	35.7	29.7	33.2	53.5	105.4	2,390.5	199.2
70	275.6	449.0	302.9	374.8	321.2	145.5	82.1	36.6	42.0	40.3	141.2	163.8	2,375.0	197.9
71	487.3	668.8	487.0	321.4	357.6	238.0	75.1	41.4	37.3	110.8	278.9	400.9	3,504.5	292.0
72	368.8	200.5	353.1	139.8	151.2	63.5	19.9	8.8	25.0	27.4	29.4	112.1	1,519.3	126.6
73	319.2	346.2	374.5	460.5	771.3	277.3	153.2	53.9	107.3	113.8	149.2	269.5	3,395.9	283.0
Sub - total	3,322.4	4,158.9	4,354.8	3,524.8	2,919.8	1,660.3	972.4	513.3	456.5	895.2	1,165.5	2,243.3	26,080.2	217.4
1974	368	548	521	400	214	79.1	61.9	69.2	77.0	198	322	367	3,225.2	269
75	322	756	699	758	521	89.6	57.1	51.2	114	329	452	594	4,942.9	412
76	641	358	809	264	68.6	49.3	43.6	31.2	26.8	41.0	178	112	2,632.5	219
77	292	360	470	340	98.3	115	48.9	35.0	33.6	26.0	25.6	132	1,976.4	165
78	414	332	297	227	332	438	377	124	121	98.1	192	361	3,313.1	276
79	754	594	426	445	552	336	78.9	60.7	47.2	50.0	50.9	137	3,531.7	294
80	380	449	298	329	142	487	42.0	56.0	36.7	37.3	117	345	2,719.0	227
81	423	527	376	244	325	145	-	61.0	65.1	103	160	379	2,826.1	-
82	514	508	491	341	105	54.8	49.5	43.8	35.8	34.7	33.0	127	2,337.6	195
83	319	395	399	342	460	166	87.4	43.9	37.5	75.2	243	198	2,767.0	231
Sub - total	4,627	4,938	4,786	3,690	2,817.9	1,957.8	846.3	576.0	594.7	992.3	1,793.5	2,752.0	30,271.5	254.2
Total	14,299.5	16,109.5	16,435.8	12,417.9	9,741.1	5,965.5	3,997.4	2,300.6	1,792.2	2,673.8	5,358.1	9,316.5	100,467.9	

Table HY-1.3 (1) LIST OF THIESEN'S COEFFICIENT FOR SUB-BASIN

	No. of Sub-basin					
Station	1	2	3	4	5	6
1.	0.210					
2.	0.249					
3.	0.070	0.049				
4.		0.008				
5.	0.176					
6.	0.089	0.116				
7.	0.116	0.104			0.377	
8.	0.023	0.596		0.055	0.016	
9.				0.061	0.607	
10.		0.032	0.416	0.841		
11.		0.100	0.584	0.042		0.805
12.						0.034
13.						0.161
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.						
34.						
35.						
36.						
37.						
38.						
39.						
40.						
41.						
42.						
43.						
44.						
45.						
46.						
47.						
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	760.2	156.5	24.5	271.1	381.0	221.0

Table HY-1.3.(2) LIST OF THIESEN'S COEFFICIENT FOR SUB-BASIN

Station	No. of Sub-basin 7	8	9	10	11	12
1.	0.265	0.008				
2.						
3.	0.050					
4.	0.590	0.155				
5.						
6.						
7.						
8.						
9.						
10.						
11.	0.095	0.507				
12.		0.060	0.336	0.061		
13.			0.421	0.150		
14.		0.246	0.243	0.303		0.033
15.		0.016		0.270		0.510
16.				0.061	0.813	0.306
17.				0.036	0.082	
18.					0.105	
19.						0.043
20.						
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.						
34.						
35.						
36.						
37.						
38.						
39.						
40.						
41.						
42.						
43.			0.117			0.048
44.		0.008				
45.						
46.						
47.						
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	236.1	159.5	211.7	244.5	83.5	116.0

Table HY-1.3 (3) LIST OF THIESEN'S COEFFICIENT FOR SUB-BASIN

Station	No. of Sub-basin 13	14	15	16	17	18
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.	0.258					
14.						
15.						
16.						
17.	0.742	0.329	0.040			
18.		0.483	0.210			
19.		0.187	0.099			0.216
20.			0.178			
21.			0.201			
22.			0.176		0.313	0.323
23.			0.096	0.667	0.327	
24.				0.333	0.125	
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.					0.235	
34.						0.461
35.						
36.						
37.						
38.						
39.						
40.						
41.						
42.						
43.						
44.						
45.						
46.						
47.						
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	24.3	127.0	393.0	69.9	163.7	59.4

Table HY-1.3 (4) LIST OF THIESEN'S COEFFICIENT FOR SUB-BASIN

	No. of Sub-basin					
Station	19	20	21	22	23	24
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.		0.097	0.084		0.098	
20.						
21.						
22.						
23.						
24.	0.054					
25.						
26.						
27.						
28.						
29.						
30.						
31.	0.760	0.035				
32.	0.186	0.145				
33.		0.283				
34.		0.280	0.368		0.068	
35.		0.150	0.321	0.046		
36.		0.011	0.226	0.893	0.062	0.124
37.						
38.						
39.						
40.						0.190
41.				0.061	0.460	0.360
42.					0.312	0.209
43.						
44.						0.024
45.						0.032
46.						
47.						0.062
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	109.5	435.7	61.8	138.2	115.1	330.7

Table HY-1.3 (5) LIST OF THIESEN'S COEFICIENT FOR SUB-BASIN

Station	No. of Sub-basin					
	25	26	27	28	29	30
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.						
34.						
35.						
36.						
37.						
38.						
39.					0.141	
40.	0.699			0.047	0.669	
41.		0.037				
42.		0.225				
43.		0.206	0.422			
44.		0.149	0.578			
45.		0.232				
46.	0.055			0.312		
47.	0.246	0.151				
48.				0.641	0.190	0.532
49.						0.332
50.						
51.						
52.						0.136
Catchment Areas (km^2)	114.4	336.2	236.0	133.0	88.8	230.1

Table HY-1.3 (6) LIST OF THIESEN'S COEFFICIENT FOR SUB-BASIN

	No. of Sub-basin					
Station	31	32	33	34	50	51
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
22.						
23.						
24.				0.467		
25.						
26.						
27.						
28.						
29.						
30.				0.042		
31.				0.399		
32.				0.092	0.085	
33.						
34.						
35.					0.142	
36.					0.092	
37.					0.353	
38.						
39.						1.0
40.					0.328	
41.						
42.						
43.						
44.		0.196	0.013			
45.						
46.	0.368	0.159				
47.	0.167	0.038				
48.						
49.	0.208					
50.	0.193	0.270				
51.		0.273	0.888			
52.	0.064	0.065	0.099			
Catchment Area (km^2)	314.3	664.4	468.2	176.8	234.7	43.4

Table HY-1.3 (7) LIST OF THIESEN'S COEFFICIENT FOR SUB-BASIN

	No. of Sub-basin					
Station	52	53	54	55	56	57
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.			0.022			
34.						
35.						
36.						
37.			0.534			
38.			0.136	0.274	1.0	
39.	0.171		0.108	0.726		1.0
40.	0.829	0.171				
41.		0.829				
42.						
43.						
44.						
45.						
46.						
47.						
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	143.0	112.0	275.3	68.3	73.0	42.5

Table HY-1.3 (8) LIST OF THIESEN'S COEFFICIENT FOR SUB-BASIN

Station	No. of Sub-basin 58	59	60	61	62	63
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.						
34.						
35.						
36.						
37.						
38.					0.703	
39.	1.0		1.0	1.0	0.297	1.0
40.		1.0				
41.						
42.						
43.						
44.						
45.						
46.						
47.						
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	27.0	76.3	61.0	109.6	183.1	89.5

Table HY-1.4 (1) LIST OF THIESEN'S COEFFICIENT FOR BASE POINT

Station	Karangkates	Wlingi	Lodoyo	Pakel	C. 17	C. 18
1.	0.108	0.077	0.074	0.065	0.064	0.064
2.	0.092	0.065	0.063	0.055	0.054	0.052
3.	0.038	0.030	0.024	0.021	0.021	0.020
4.	0.069	0.057	0.055	0.048	0.047	0.045
5.	0.065	0.046	0.044	0.039	0.038	0.037
6.	0.042	0.030	0.029	0.025	0.025	0.024
7.	0.121	0.086	0.082	0.073	0.071	0.069
8.	0.064	0.046	0.044	0.039	0.038	0.036
9.	0.121	0.086	0.082	0.039	0.071	0.068
10.	0.119	0.084	0.081	0.073	0.070	0.066
11.	0.118	0.111	0.107	0.094	0.092	0.088
12.	0.004	0.036	0.034	0.030	0.030	0.028
13.	0.017	0.058	0.056	0.049	0.048	0.046
14.		0.058	0.056	0.049	0.048	0.046
15.		0.047	0.045	0.040	0.039	0.037
16.		0.041	0.039	0.035	0.034	0.032
17.		0.012	0.025	0.027	0.026	0.025
18.		0.003	0.023	0.045	0.044	0.042
19.		0.002	0.010	0.020	0.019	0.018
20.				0.021	0.020	0.019
21.				0.023	0.023	0.022
22.				0.020	0.020	0.19
23.				0.011	0.025	0.024
24.					0.007	0.029
25.						
26.						
27.						
28.						
29.						
30.						0.002
31.						0.019
32.						0.114
33.						
34.						
35.						
36.						
37.						
38.						
39.						
40.						
41.						
42.						
43.		0.012	0.011	0.010	0.010	0.009
44.	0.025	0.018	0.017	0.015	0.015	0.014
45.						
46.						
47.						
48.						
49.						
50.						
51.						
52.						
Catchment Area. (km^2)	2,050	288.4	3,014.4	3,482.4	3,659.2	4,016.3

Table HY-1.4 (2) LIST OF THIESEN'S COEFFICIENT FOR BASE POINT

Station	C.21	C.22	C.23	C.26	C.27	Kertosono
1.	0.065	0.050	0.050	0.047	0.045	0.039
2.	0.047	0.043	0.042	0.040	0.038	0.033
3.	0.018	0.016	0.016	0.015	0.014	0.013
4.	0.041	0.037	0.037	0.035	0.033	0.029
5.	0.033	0.030	0.030	0.028	0.027	0.024
6.	0.021	0.020	0.019	0.018	0.017	0.015
7.	0.062	0.056	0.056	0.053	0.050	0.044
8.	0.033	0.030	0.029	0.028	0.026	0.023
9.	0.062	0.056	0.055	0.053	0.050	0.044
10.	0.061	0.055	0.054	0.052	0.049	0.043
11.	0.080	0.073	0.072	0.068	0.064	0.057
12.	0.026	0.023	0.023	0.022	0.021	0.018
13.	0.042	0.038	0.038	0.036	0.034	0.030
14.	0.042	0.038	0.038	0.036	0.034	0.030
15.	0.034	0.031	0.030	0.029	0.027	0.024
16.	0.030	0.027	0.017	0.025	0.024	0.021
17.	0.023	0.021	0.020	0.019	0.018	0.016
18.	0.038	0.035	0.034	0.032	0.031	0.027
19.	0.020	0.029	0.030	0.030	0.029	0.025
20.	0.017	0.016	0.016	0.015	0.014	0.012
21.	0.020	0.018	0.018	0.017	0.016	0.014
22.	0.036	0.033	0.032	0.031	0.029	0.025
23.	0.036	0.033	0.032	0.031	0.029	0.026
24.	0.034	0.031	0.030	0.029	0.027	0.024
25.						
26.						
27.						
28.						
29.						
30.	0.002	0.002	0.002	0.002	0.001	0.001
31.	0.040	0.040	0.039	0.038	0.035	0.031
32.	0.010	0.024	0.024	0.023	0.021	0.019
33.	0.010	0.039	0.039	0.037	0.035	0.031
34.	0.007	0.036	0.041	0.046	0.038	0.034
35.			0.005	0.006	0.005	0.005
36.			0.003	0.028	0.033	0.029
37.						
38.						
39.						
40.					0.011	0.024
41.				0.012	0.032	0.030
42.				0.007	0.019	0.030
43.	0.009	0.008	0.008	0.007	0.007	0.036
44.	0.013	0.012	0.011	0.011	0.010	0.043
45.					0.002	0.015
46.						0.001
47.					0.004	0.017
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	4,408.8		4,475.1	4,699.6	4,985.9	5,679.4

Table HY-1.4 (3) LIST OF THIESEN'S COEFFICIENT FOR BASE POINT

Station	C.32	Ploso	C.36	Lengkong	Porong	C.25
1.	0.031	0.030	0.029	0.026	0.023	
2.	0.026	0.025	0.025	0.022	0.021	
3.	0.010	0.010	0.009	0.008	0.008	
4.	0.023	0.022	0.022	0.019	0.018	
5.	0.019	0.018	0.017	0.015	0.015	
6.	0.012	0.012	0.011	0.010	0.009	
7.	0.034	0.033	0.032	0.029	0.027	
8.	0.018	0.018	0.017	0.015	0.014	
9.	0.034	0.033	0.032	0.029	0.027	
10.	0.034	0.033	0.032	0.028	0.028	
11.	0.045	0.043	0.042	0.037	0.035	
12.	0.014	0.014	0.013	0.017	0.011	
13.	0.023	0.023	0.022	0.019	0.018	
14.	0.023	0.023	0.022	0.019	0.018	
15.	0.019	0.018	0.018	0.016	0.015	
16.	0.016	0.016	0.015	0.014	0.013	
17.	0.013	0.012	0.012	0.011	0.010	
18.	0.021	0.021	0.020	0.018	0.017	
19.	0.020	0.019	0.019	0.016	0.016	0.045
20.	0.010	0.009	0.009	0.008	0.008	
21.	0.011	0.011	0.010	0.009	0.009	
22.	0.020	0.019	0.019	0.017	0.016	
23.	0.020	0.020	0.019	0.017	0.016	
24.	0.019	0.018	0.018	0.016	0.015	
25.						
26.						
27.						
28.						
29.						
30.	0.001	0.001	0.001	0.001	0.001	
31.	0.024	0.024	0.023	0.020	0.019	
32.	0.017	0.017	0.016	0.015	0.014	
33.	0.033	0.032	0.031	0.027	0.026	
34.	0.027	0.026	0.023	0.022	0.021	0.031
35.	0.008	0.008	0.008	0.007	0.007	0.025
36.	0.026	0.025	0.025	0.022	0.021	0.515
37.	0.032	0.031	0.030	0.027	0.025	
38.	0.040	0.038	0.037	0.033	0.031	
39.	0.079	0.078	0.077	0.067	0.064	
40.	0.062	0.069	0.067	0.060	0.057	
41.	0.024	0.023	0.022	0.020	0.019	0.242
42.	0.023	0.023	0.022	0.020	0.019	0.142
43.	0.028	0.027	0.027	0.024	0.022	
44.	0.034	0.033	0.032	0.043	0.042	
45.	0.012	0.012	0.011	0.010	0.010	
46.	0.001	0.006	0.006	0.031	0.030	
47.	0.013	0.013	0.013	0.020	0.019	
48.		0.014	0.029	0.026	0.025	
49.			0.010	0.016	0.016	
50.				0.028	0.026	
51.				0.021	0.015	
52.			0.004	0.011	0.015	
Catchment Area (km²)	7,219.4	7,441.2	7,671.3	8,650.0	9,121.6	224.5

Table HY-1.4 (4) LIST OF THIESEN'S COEFFICIENT FOR BASE POINT

Station	C.13	C.20	C.30	Selorejo	Bening	C.76
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.	0.019					
15.	0.332					
16.	0.518					
17.	0.034					
18.	0.044					
19.	0.025	0.058				
20.						
21.						
22.		0.316				
23.		0.240				
24.		0.091				
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.		0.172				
34.		0.123				
35.						
36.						
37.					1.000	0.202
38.						0.291
39.						0.307
40.			0.117			0.147
41.			0.018			
42.			0.110			
43.			0.246	0.422		
44.			0.272	0.578		
45.			0.114			
46.			0.009			
47.			0.115			
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	200.2	239.5	686.6	236.0	89.5	443.2

Table HY-1.4 (5) LIST OF THIESEN'S COEFFICIENT FOR BASE POINT

Station	C. 75	C. 72	C. 64	C. 63	P. 81	Kuncir
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.					0.013	
33.			0.049	0.047	0.040	
34.						
35.					0.022	
36.					0.014	
37.	0.172	0.151	0.188	0.182	0.207	
38.	0.248	0.219	0.227	0.219	0.186	1.0
39.	0.433	0.500	0.383	0.370	0.313	
40.	0.130	0.068	0.155	0.183		
41.						
42.						
43.						
44.						
45.						
46.						
47.						
48.						
49.						
50.						
51.						
52.						
Catchment Area (km^2)	519.5	589.0	1,260.6	1,304.0	1,538.7	85.0

Table HY-1.4 (6) LIST OF THIESEN'S COEFFICIENT FOR BASE POINT

Station	C. 70	C. 69	C. 68	C. 66
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				
31.				
32.				
33.		0.222	0.147	0.166
34.				
35.				
36.				
37.		0.333	0.353	0.278
38.	0.711	0.136	0.331	0.297
39.	0.289	0.108	0.169	0.309
40.				
41.				
42.				
43.				
44.				
45.				
46.				
47.				
48.				
49.				
50.				
51.				
52.				
Catchment Area (km^2)	141.3	275.3	416.6	528.6

Table HY-1.5(1) AVERAGE DEPTH OF RAINFALL OVER AREA (Pakel)

(Unit: mm)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1954	320.6	311.2	279.4	313.6	239.6	99.5	46.4	109.4	63.5	151.5	495.5	451.3	2,881.5
1955	271.3	298.6	243.7	248.2	145.7	163.7	355.1	96.0	79.7	191.9	485.8	298.8	2,878.5
1956	318.2	226.2	134.9	118.4	104.5	132.0	162.8	131.6	38.7	124.7	213.9	355.2	2,061.1
1957	294.7	306.5	423.6	116.8	65.5	5.1	267.7	28.8	4.1	11.0	130.2	314.0	1,968.0
1958	239.3	266.2	303.3	252.9	115.3	81.3	124.5	46.6	23.4	92.6	183.0	483.1	2,211.5
1959	344.5	306.4	352.8	125.4	219.7	89.4	20.3	0.5	31.1	41.3	186.8	493.8	2,212.0
1960	323.3	285.5	331.0	228.6	245.3	75.6	31.4	9.9	8.5	56.1	296.7	246.2	2,138.1
1961	364.8	255.5	203.8	189.9	93.4	3.1	6.2	0.0	2.4	13.0	131.0	340.1	1,603.2
1962	434.9	275.6	288.8	298.8	83.9	45.7	22.5	31.7	1.4	116.2	215.3	520.4	2,335.2
1963	350.5	283.6	347.1	143.1	12.0	5.6	0.0	0.0	1.5	14.0	61.0	261.5	1,479.9
Sub-total	3,262.1	2,815.3	2,908.4	2,035.7	1,324.9	701.0	1,036.9	454.5	254.3	812.3	2,399.2	3,764.4	21,769.0
1964	162.9	184.5	351.1	184.9	130.2	84.0	2.2	55.3	50.6	450.9	195.9	221.9	2,034.4
1965	328.8	303.4	224.3	130.7	68.8	1.8	3.6	0.0	1.6	5.6	162.5	304.3	1,535.4
1966	328.3	349.8	387.5	227.6	60.1	61.5	0.9	5.5	4.1	92.6	233.3	398.8	2,150.0
1967	397.0	263.8	202.4	188.3	25.5	0.0	0.0	0.0	0.7	34.6	128.0	396.1	1,636.4
1968	320.1	253.6	390.3	247.4	292.4	237.6	203.5	42.7	27.9	126.3	260.7	401.1	2,803.6
1969	354.0	240.9	423.0	195.1	63.4	37.3	3.3	3.3	11.9	65.8	157.4	296.9	1,852.3
1970	365.8	270.4	278.5	230.2	168.8	62.8	31.4	0.1	48.1	88.4	247.6	289.5	2,081.6
1971	318.0	268.6	320.5	100.5	177.8	76.1	8.5	3.6	33.5	213.3	276.0	356.5	2,152.9
1972	308.8	172.6	313.1	87.7	135.0	0.3	0.0	0.2	0.0	1.4	96.5	265.7	1,381.3
1973	334.7	250.9	286.0	298.7	372.8	101.3	53.3	25.0	192.2	158.1	242.6	266.5	2,582.1
Sub-total	3,218.6	2,558.5	3,176.7	1,891.1	1,494.8	662.7	306.7	95.7	370.6	1,237.0	2,000.5	3,197.3	20,210.0
1974	220.1	328.0	175.9	197.8	173.6	42.5	27.8	59.7	116.0	252.0	297.6	230.4	2,121.4
1975	378.4	355.7	356.3	289.6	168.2	18.0	20.1	14.8	248.3	374.6	386.8	303.0	2,913.8
1976	284.9	204.6	293.8	82.3	25.6	4.0	11.4	2.2	5.4	119.5	283.3	127.0	1,444.0
1977	268.7	261.6	320.7	162.2	48.6	71.4	1.0	0.2	1.3	3.6	91.0	330.0	1,562.3
1978	423.4	244.4	336.3	213.8	270.5	252.0	140.8	57.3	84.2	146.2	237.1	302.5	2,708.5
1979	344.2	249.4	278.6	202.2	272.0	127.3	5.4	4.4	10.3	69.4	155.3	323.2	2,041.7
1980	280.1	233.9	181.6	236.7	35.6	2.1	4.8	7.1	5.9	66.3	330.3	371.9	1,756.3
1981	326.3	251.2	211.6	179.4	146.8	79.8	122.0	25.9	83.5	120.2	348.3	291.0	2,186.0
1982	291.4	292.4	206.9	183.9	1.5	2.5	0.4	0.6	0.5	1.8	42.8	317.1	1,341.8
1983	365.8	353.5	251.7	239.0	302.4	31.8	4.5	1.0	4.9	194.5	295.6	301.8	2,346.5
Sub-total	3,183.3	2,776.7	2,613.4	1,986.9	1,444.8	631.4	338.2	173.2	560.3	1,348.1	2,468.1	2,897.9	20,422.3
Total	9,663.8	8,150.5	8,698.5	5,913.7	4,264.5	1,995.1	1,681.8	723.4	1,185.2	3,397.4	6,867.8	9,859.6	62,401.3
Ave.	322.1	271.7	290.0	197.1	142.1	66.5	56.1	24.1	39.5	113.2	228.9	328.7	2,080.0

Tabel HY-1.5(2) AVERAGE DEPTH OF RAINFALL OVER AREA (Jeli)

(Unit: mm)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1954	325.5	309.2	278.3	312.9	247.0	98.5	45.1	107.4	63.1	148.8	486.6	439.2	2,861.6
1955	281.6	290.8	247.3	252.3	145.7	168.6	358.9	93.9	77.9	195.1	467.0	295.5	2,874.6
1956	313.1	224.7	138.4	120.8	109.6	130.9	164.6	134.7	37.4	123.9	214.4	355.1	2,067.6
1957	297.2	304.0	429.5	117.6	66.1	6.1	277.0	30.2	3.9	11.6	132.7	323.1	1,999.0
1958	243.5	272.7	308.3	256.6	118.4	78.1	123.4	48.1	23.2	93.1	180.8	487.0	2,233.2
1959	355.2	307.0	355.7	123.5	223.3	92.3	23.0	0.6	30.7	40.3	187.9	495.4	2,234.9
1960	327.8	282.9	336.7	225.5	253.5	73.0	30.9	9.8	8.7	55.3	298.1	242.9	2,145.1
1961	359.4	252.7	204.2	190.4	97.6	3.0	5.8	0.0	2.2	12.9	124.7	336.5	1,589.4
1962	435.2	284.7	293.7	300.1	84.6	47.5	24.0	30.4	1.4	118.9	214.0	514.1	2,348.6
1963	355.9	292.2	350.9	145.1	12.6	7.4	0.0	0.0	1.4	13.1	57.5	251.2	1,487.3
Sub-total	3,294.4	2,820.9	2,943.0	2,044.8	1,358.4	705.4	1,052.7	455.1	249.9	813.0	2,363.7	3,740.0	21,841.3
1964	163.7	204.4	365.8	183.8	137.9	85.2	2.2	16.1	60.9	459.4	198.3	220.5	2,098.2
1965	338.1	302.6	222.4	133.3	67.5	1.9	3.6	0.0	1.5	5.4	157.8	306.0	1,540.1
1966	340.8	348.5	391.5	232.9	61.1	58.8	0.9	5.4	4.3	93.9	231.1	412.7	2,181.9
1967	400.3	271.4	208.2	190.9	24.2	0.0	0.0	0.0	0.7	33.5	121.8	391.3	1,642.3
1968	320.7	252.7	402.2	251.3	299.6	237.1	204.3	44.9	26.6	123.5	258.4	410.9	2,832.2
1969	357.6	245.0	410.6	205.1	65.5	38.2	3.0	3.1	11.9	65.2	156.0	299.7	1,860.9
1970	372.6	271.2	282.0	240.2	167.9	63.8	30.6	0.1	48.0	84.9	251.1	287.6	2,100.0
1971	317.4	270.0	326.3	106.3	187.4	74.0	8.1	3.4	32.8	212.6	276.6	351.4	2,166.3
1972	312.3	178.9	317.7	86.1	134.1	0.3	0.0	0.2	0.0	1.7	91.2	264.9	1,387.4
1973	331.7	253.8	284.8	293.4	362.5	98.0	51.6	24.9	186.2	150.7	238.8	258.6	2,535.0
Sub-total	3,255.2	2,598.5	3,211.5	1,923.3	1,507.7	657.3	304.3	98.1	372.9	1,230.8	1,981.1	3,203.6	20,344.3
1974	217.6	325.0	179.2	196.5	172.6	41.1	28.2	59.9	116.3	251.1	295.4	227.4	2,110.3
1975	369.3	353.7	360.3	294.2	174.9	19.5	19.4	15.0	242.6	371.4	378.4	304.3	2,903.0
1976	278.6	214.6	219.9	83.4	24.1	3.8	10.6	2.0	5.7	115.9	280.9	128.1	1,439.6
1977	267.1	259.9	321.9	163.3	45.9	79.3	1.1	0.2	2.0	3.9	88.7	336.6	1,569.9
1978	416.0	242.8	334.5	214.3	266.5	263.9	145.7	61.2	86.2	145.8	235.3	301.1	2,713.3
1979	346.0	260.3	285.5	211.6	281.9	128.3	5.7	9.3	10.1	68.7	152.1	319.9	2,079.4
1980	278.3	235.3	183.9	231.4	35.7	2.3	6.0	7.5	5.9	64.7	329.7	365.2	1,745.9
1981	322.9	251.2	215.4	184.6	151.0	86.9	128.9	28.0	84.0	121.5	339.0	285.1	2,198.5
1982	290.3	297.5	213.7	179.6	1.5	3.0	0.3	0.6	0.4	1.7	41.0	332.3	1,361.9
1983	369.9	350.0	255.5	239.6	307.4	30.9	4.7	1.0	4.6	192.5	288.0	298.0	2,342.1
Sub-total	3,156.0	2,790.3	2,641.8	1,998.5	1,461.5	659.0	350.6	184.7	557.8	1,337.2	2,428.5	2,898.0	20,463.9
Total	9,705.6	8,209.7	8,796.3	5,966.6	4,327.6	2,021.7	1,707.6	737.9	1,180.6	3,381.0	6,773.3	9,841.6	62,649.5
Ave.	323.5	273.7	293.2	198.9	144.2	67.4	56.9	24.6	39.4	112.7	255.8	328.0	2,088.3

Table HY-1.5 (3) AVERAGE DEPTH OF RAINFALL OVER AREA (Jongoiru)

(Unit: mm)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1955	291.4	282.7	252.5	256.0	147.1	174.1	376.4	94.5	78.5	198.9	448.4	295.9	2,896.4
1956	304.9	227.1	143.3	122.0	118.9	133.5	166.4	139.2	37.5	123.8	217.6	355.9	2,090.1
1957	301.6	300.4	439.8	121.8	69.0	7.4	280.9	31.3	3.8	12.9	136.2	334.4	2,039.5
1958	250.0	279.5	312.7	259.2	123.1	75.3	123.7	51.2	23.6	96.4	179.6	491.1	2,265.4
1959	363.0	309.6	362.4	124.1	227.4	94.6	27.2	0.8	30.7	39.4	192.0	497.7	2,268.9
1960	333.4	279.9	341.3	222.9	261.7	70.8	31.3	9.9	8.7	54.3	299.0	242.3	2,155.5
1961	349.5	250.7	212.1	190.4	100.1	3.2	5.4	0.0	2.0	13.5	119.3	333.9	1,580.1
1962	433.6	289.3	300.0	302.6	87.0	50.2	26.0	28.4	1.5	121.6	210.2	505.3	2,355.5
1963	363.1	296.5	352.9	150.3	15.4	8.9	0.0	0.0	1.3	12.6	56.8	238.9	1,496.7
Sub-total	2,990.5	2,515.7	2,717.0	1,749.3	1,149.7	618.0	1,037.3	355.3	187.6	673.2	1,859.1	3,295.4	19,148.1
1964	168.3	211.6	371.8	184.2	150.0	86.2	2.3	18.3	72.1	466.3	199.6	220.0	2,150.7
1965	343.4	304.6	221.8	137.6	66.8	2.1	3.7	0.0	1.4	5.6	155.5	306.4	1,548.7
1966	349.9	346.7	398.5	241.3	61.7	56.1	0.8	5.2	4.8	96.5	228.0	432.9	2,222.4
1967	404.0	279.8	214.4	194.5	23.0	0.0	0.0	0.0	0.7	31.8	117.9	382.6	1,648.7
1968	324.5	255.0	417.3	252.8	305.8	233.6	209.6	47.5	25.4	124.2	258.8	420.6	2,875.1
1969	363.8	247.9	400.3	217.7	69.3	39.2	2.9	3.0	12.7	63.6	157.1	299.8	1,877.3
1970	377.8	277.6	288.2	255.2	172.9	64.4	29.8	0.1	48.3	82.3	257.0	290.2	2,143.8
1971	314.9	272.0	330.6	111.8	194.9	72.2	8.7	3.1	32.2	215.8	279.6	341.3	2,177.1
1972	316.3	183.8	321.6	88.8	138.4	0.3	0.0	0.2	0.0	1.7	86.4	266.2	1,403.7
1973	326.5	254.2	283.4	286.0	354.1	96.3	49.2	24.8	179.5	144.0	232.5	255.0	2,485.5
Sub-total	3,289.4	2,633.2	3,247.9	1,969.9	1,536.9	650.4	307.0	102.2	377.1	1,231.6	1,972.4	3,215.0	20,533.0
1974	215.7	321.8	184.5	196.4	176.1	40.6	28.1	59.1	117.4	252.5	292.6	226.4	2,111.2
1975	365.6	352.6	362.2	301.2	180.9	21.7	18.8	15.1	238.9	369.2	366.6	306.8	2,900.6
1976	276.6	219.6	294.3	85.5	22.7	3.7	9.9	1.9	5.4	114.8	279.8	129.0	1,443.2
1977	266.5	255.9	320.6	165.9	43.2	86.6	1.8	0.2	2.2	4.3	87.4	341.8	1,576.4
1978	408.5	241.7	330.1	216.9	262.4	269.2	150.6	64.4	86.9	144.8	234.0	298.7	2,708.2
1979	346.2	274.3	290.2	223.5	293.0	132.0	6.0	14.5	9.8	68.0	147.8	311.8	2,117.1
1980	282.1	241.1	188.9	229.5	37.3	2.7	7.8	8.7	5.9	61.9	330.8	361.1	1,757.8
1981	324.0	252.2	224.6	193.4	152.6	92.2	130.7	29.5	85.3	120.9	334.1	280.9	2,220.4
1982	288.8	302.9	221.9	175.6	1.4	3.2	0.3	0.5	0.5	1.5	40.0	352.2	1,388.8
1983	374.2	349.5	264.8	239.7	314.0	30.0	5.0	0.9	4.2	193.1	282.6	296.8	2,354.8
Sub-total	3,149.2	2,811.6	2,682.1	2,027.6	1,483.6	681.9	359.0	194.8	536.5	1,331.0	2,395.7	2,905.5	20,578.5
Total	9,429.1	7,960.5	8,647.0	5,746.8	4,170.2	1,950.3	1,703.3	652.3	1,212.2	3,235.8	6,227.2	9,415.9	60,259.6
Ave.	325.1	274.5	298.2	198.1	143.8	67.3	58.7	22.5	38.7	111.6	214.7	324.7	2,077.9

Table HY-1.5 (4) AVERAGE DEPTH OF RAINFALL OVER AREA (Kertosono)

(Unit: mm)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1960	335.5	296.3	350.6	223.6	272.7	67.2	31.5	12.1	10.9	50.8	288.2	231.2	2,170.6
1961	328.7	252.0	225.6	195.7	106.0	6.6	5.1	0.0	1.7	16.3	118.7	328.6	1,585.0
1962	417.0	273.5	294.1	303.2	84.2	53.8	26.9	27.0	1.9	110.2	203.9	458.2	2,253.9
1963	361.0	305.7	357.3	155.8	23.8	10.0	0.0	0.0	1.0	14.2	58.2	239.6	1,526.6
Sub-total	1,442.2	1,127.5	1,227.6	878.3	486.7	137.6	63.5	39.1	15.5	191.5	669.0	1,257.6	7,536.1
1964	172.4	207.8	379.3	176.5	166.8	84.0	3.2	22.9	72.5	436.3	194.2	215.8	2,131.7
1965	326.4	289.6	220.5	140.9	68.9	3.3	4.9	0.2	1.2	7.0	142.0	295.1	1,500.0
1966	325.7	350.4	400.0	239.1	66.1	52.7	0.8	5.6	5.8	98.1	196.9	417.2	2,158.4
1967	400.5	294.8	200.0	200.1	22.5	0.0	0.0	0.0	1.0	29.4	110.2	361.1	1,619.6
1968	317.9	274.8	421.2	238.9	285.6	220.7	207.3	45.4	30.5	120.7	252.6	393.6	2,809.2
1969	350.3	246.0	389.1	223.4	65.9	34.8	5.0	2.5	12.1	61.8	153.3	283.9	1,828.1
1970	375.3	274.8	300.5	253.3	176.2	59.6	27.3	0.1	45.3	75.2	255.1	291.6	2,134.3
1971	328.4	285.6	313.5	115.7	210.0	72.9	15.0	2.6	30.4	228.6	271.2	316.1	2,190.0
1972	313.4	178.7	314.9	97.3	153.3	0.5	0.0	0.2	0.0	1.6	87.8	275.8	1,423.5
1973	325.4	263.4	288.7	282.0	365.4	92.8	44.1	24.0	175.4	134.0	219.5	257.3	2,472.0
Sub-total	3,235.7	2,665.9	3,227.7	1,967.2	1,580.7	621.3	307.6	103.5	374.2	1,192.7	1,882.8	3,107.5	20,266.8
1974	220.0	318.3	190.8	191.5	184.8	44.0	31.8	57.8	123.7	245.5	273.3	220.2	2,101.7
1975	373.2	359.6	359.0	309.4	186.8	23.1	18.4	14.5	222.1	356.9	335.1	302.8	2,860.9
1976	275.3	229.4	292.6	89.4	24.4	3.6	9.5	3.4	4.6	111.6	271.8	121.4	1,437.0
1977	275.5	236.3	315.8	161.2	41.4	87.0	2.7	0.3	3.0	5.1	82.5	330.9	1,541.7
1978	391.6	239.4	300.2	213.5	250.2	254.5	139.9	59.6	80.3	131.9	218.2	295.4	2,574.7
1979	329.9	290.7	274.6	228.4	272.4	130.0	5.1	12.8	8.8	61.1	130.2	262.8	2,006.8
1980	293.1	263.1	207.6	241.5	44.0	4.1	12.0	14.3	6.0	53.7	319.0	346.4	1,804.8
1981	334.7	263.8	232.6	204.8	155.0	99.2	127.7	27.9	89.3	111.4	318.7	280.0	2,245.1
1982	305.7	302.6	225.0	178.9	1.9	3.6	0.4	0.8	0.6	2.0	41.7	337.0	1,400.2
1983	377.0	353.3	275.8	248.8	317.7	29.5	6.3	0.8	3.4	180.6	280.3	284.3	2,357.8
Sub-total	3,176.0	2,856.5	2,674.0	2,067.4	1,478.6	678.6	353.8	192.2	541.8	1,259.8	2,270.8	2,781.2	20,330.7
Total	7,853.9	6,649.9	7,129.3	4,912.9	3,546.0	1,437.5	724.9	334.8	931.5	2,644.0	4,822.6	7,146.3	48,133.6
Ave.	327.2	277.1	297.0	204.7	147.8	59.9	30.2	14.0	38.8	110.2	200.9	297.8	2,005.6

Table HY-1.5 (5) AVERAGE DEPTH OF RAINFALL OVER AREA (Jabon)

(Unit: mm)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1955	281.3	251.1	288.8	250.6	137.2	135.7	285.2	75.7	49.2	149.5	319.1	258.8	2,482.2
1956	264.6	261.0	154.7	102.5	122.7	154.9	114.3	101.8	34.8	108.9	199.5	321.8	1,941.5
1957	298.7	278.4	413.2	120.2	70.3	10.1	197.3	40.5	3.4	10.9	119.9	316.6	1,879.5
1958	232.0	293.5	331.0	251.0	145.7	64.5	105.3	49.1	18.6	90.9	133.2	430.3	2,145.1
1959	380.0	359.3	323.5	151.2	216.6	72.8	37.7	1.1	19.4	29.4	145.1	436.8	2,172.9
1960	338.9	330.8	364.2	248.6	248.9	49.9	25.2	9.5	10.3	37.7	251.7	207.5	2,123.2
1961	318.5	272.4	215.5	200.1	110.1	8.4	4.3	0.0	2.1	13.1	103.8	284.3	1,532.2
1962	417.5	302.8	274.4	315.4	67.5	64.1	26.7	26.9	2.5	82.1	193.0	399.9	2,172.8
1963	340.8	328.4	374.3	162.5	34.7	9.7	0.0	0.0	0.6	16.2	39.9	256.6	1,563.7
Sub-total	2,872.3	2,677.7	2,739.2	1,802.1	1,153.7	570.1	796.0	304.6	140.9	538.7	1,505.2	2,912.6	18,013.1
1964	190.4	205.9	404.2	167.9	161.4	85.0	11.5	18.7	60.9	348.0	195.6	203.1	2,052.6
1965	311.0	264.5	219.7	125.5	52.1	6.3	3.3	3.7	1.1	5.4	101.7	279.8	1,374.1
1966	308.7	346.9	375.9	198.0	63.0	47.3	1.6	10.7	4.2	102.9	170.0	344.5	1,973.6
1967	412.8	325.0	196.0	192.6	20.6	0.0	0.0	0.0	1.2	22.6	87.4	355.2	1,613.4
1968	287.3	310.2	439.4	217.8	252.3	185.3	198.2	45.4	28.2	84.2	223.1	326.2	2,597.6
1969	336.1	280.5	357.6	193.2	57.5	24.5	4.9	1.7	8.3	46.8	122.3	257.1	1,690.5
1970	361.1	310.4	330.8	231.1	159.3	42.8	23.2	0.3	34.3	54.1	221.3	260.6	2,029.3
1971	351.3	330.8	298.2	128.2	223.1	92.0	10.5	4.4	21.7	202.4	236.4	310.7	2,209.7
1972	320.1	185.3	312.7	87.3	143.6	1.6	0.0	2.1	0.0	3.2	72.0	291.8	1,419.7
1973	335.2	303.1	314.9	259.5	341.6	71.7	39.0	22.6	133.8	99.8	191.9	240.6	2,353.7
Sub-total	3,214.0	2,862.6	3,249.4	1,801.1	1,474.5	556.5	292.2	109.6	293.7	969.4	1,621.7	2,869.5	19,314.2
1974	262.5	346.5	215.8	192.9	157.9	34.0	30.9	70.8	105.4	214.5	235.3	244.7	2,111.2
1975	374.0	361.7	368.7	318.2	184.4	16.2	12.7	15.7	177.7	314.0	300.7	282.1	2,726.1
1976	297.3	250.5	352.8	91.0	23.1	3.2	7.1	4.1	3.6	93.9	240.2	131.4	1,498.2
1977	297.1	251.9	352.5	153.1	54.1	77.7	5.8	1.7	7.4	5.0	80.7	326.1	1,613.1
1978	393.6	297.5	290.3	157.4	210.0	200.7	126.8	45.1	67.8	89.3	178.2	331.8	2,390.5
1979	350.9	291.8	255.1	254.5	254.7	112.2	5.7	8.4	9.6	40.4	94.3	179.7	1,857.3
1980	311.0	291.4	205.9	223.3	39.2	5.4	17.2	16.2	4.3	44.5	282.7	332.0	1,773.1
1981	342.1	277.1	232.9	178.4	140.3	101.2	102.2	26.3	88.2	82.5	279.5	290.0	2,140.7
1982	332.9	307.5	235.6	175.7	3.4	2.7	0.5	1.4	0.9	1.3	30.0	310.4	1,402.3
1983	367.1	350.4	291.3	241.2	276.6	22.0	4.9	0.5	2.7	138.1	265.3	246.3	2,206.4
Sub-total	3,328.5	3,026.3	2,800.9	1,985.7	1,343.7	575.3	313.8	190.2	467.6	1,023.5	1,986.9	2,676.5	19,718.9
Total	9,414.8	8,566.6	8,789.5	5,588.9	3,971.9	1,701.9	1,402.0	604.4	902.2	2,531.6	5,113.8	8,458.6	57,046.2
Ave.	324.7	295.4	303.1	192.7	137.0	58.7	48.3	20.8	31.1	87.3	176.3	291.2	1,967.1

Table HY-1.6 RUNOFF COEFFICIENT AT JABON

Year	Annual Rainfall(mm)	Annual Runoff(mm)	Runoff coefficient
1955/56	1,878.5	665.2	0.354
56/57	1,884.7	932.7	0.495
57/58	2,031.4	886.8	0.437
58/59	2,166.4	1084.6	0.501
59/60	2,352.5	955.1	0.406
60/61	1,455.8	585.7	0.402
61/62	2057.2	759.3	0.369
62/63	1,707.0	945.4	0.554
63/64	2,106.1	650.8	0.309
64/65	1,297.4	505.0	0.389
65/66	1,909.0	658.2	0.345
66/67	1,602.6	619.4	0.386
67/68	2,626.6	665.5	0.253
68/69	1,759.6	727.1	0.413
69/70	2,025.8	623.0	0.308
70/71	2,159.6	878.8	0.407
71/72	1,438.6	494.7	0.344
72/73	2,404.9	878.3	0.365
73/74	2,107.1	843.3	0.400
74/75	2,688.7	1,272.7	0.473
75/76	1,648.9	851.0	0.516
76/77	1,418.4	502.4	0.354
77/78	2,382.8	836.2	0.351
78/79	2,011.4	1,016.0	0.505
79/80	1,620.8	678.5	0.419
80/81	2,182.7	-	-
81/82	1,381.9	699.1	0.506
82/83	2,270.5	728.7	0.321
Average	1,949.2	775.7	0.403

Note (1) Annual : December to November.
(2) - : no data.

Table HY-1.7 AVERAGE DEPTH OF RAINFALL OVER AREA

(Unit : mm)

Period	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Pakel													
1954-63	326.1	281.5	290.9	203.6	132.5	70.1	103.7	45.5	25.4	81.2	240.0	376.4	2,176.9
	(15.0)	(12.9)	(13.4)	(9.3)	(6.1)	(3.2)	(4.8)	(2.1)	(1.2)	(3.7)	(11.3)	(17.3)	(100.0)
1964-73	321.8	255.8	317.7	189.1	149.5	66.3	30.7	9.6	37.1	123.7	200.0	319.7	2,021.0
	(15.6)	(12.7)	(15.7)	(9.4)	(7.4)	(3.3)	(1.5)	(0.5)	(1.8)	(6.1)	(9.9)	(15.8)	(100.0)
1974-83	318.3	277.7	261.3	195.7	144.5	63.1	33.8	17.3	56.0	134.8	246.8	289.8	2,042.2
	(15.6)	(13.6)	(12.8)	(9.7)	(7.1)	(3.1)	(1.7)	(0.8)	(2.7)	(6.6)	(12.1)	(14.2)	(100.0)
Average	322.1	271.7	290.0	197.1	142.1	66.5	56.1	24.1	39.5	113.2	228.9	328.7	2,080.0
	(15.5)	(13.1)	(13.9)	(9.5)	(6.8)	(3.2)	(2.7)	(1.2)	(1.9)	(5.4)	(11.0)	(15.8)	(100.0)
Jabon													
1955-63	319.1	297.5	304.4	200.2	128.2	63.3	88.5	33.8	15.7	59.9	167.2	323.6	2,001.4
	(15.9)	(14.8)	(15.2)	(10.0)	(6.4)	(3.2)	(4.4)	(1.7)	(0.8)	(3.0)	(8.4)	(16.2)	(100.0)
1964-73	321.4	286.3	324.9	180.1	147.5	55.6	29.2	11.0	29.4	96.9	162.2	286.9	1,931.4
	(16.7)	(14.8)	(16.8)	(9.3)	(7.6)	(2.9)	(1.5)	(0.6)	(1.5)	(5.0)	(8.4)	(14.9)	(100.0)
1974-83	332.8	302.6	280.1	198.6	134.4	57.5	31.4	19.0	46.8	102.4	198.7	267.6	1,971.9
	(16.9)	(15.3)	(14.2)	(10.1)	(6.8)	(2.9)	(1.6)	(1.0)	(2.4)	(5.2)	(10.1)	(13.5)	(100.0)
Average	324.7	295.4	303.1	192.7	137.0	58.7	48.3	20.8	31.1	87.3	176.3	291.2	1,967.1
	(16.5)	(15.0)	(15.4)	(9.8)	(7.0)	(3.0)	(2.5)	(1.1)	(1.6)	(4.4)	(8.9)	(14.8)	(100.0)

Note : Figures in parenthesis are percentages in a calender year.

Table HY-1.8 MONTHLY INFLOW AND OUTFLOW

(Unit: m^3/s)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
(1) Karangkates and Lahor Dam													
Revised Inflow													
1978	81.1	69.1	91.0	65.3	84.5	118.0	93.0	57.1	55.9	56.2	77.8	97.5	78.9
1979	128.2	121.5	109.2	102.8	124.8	95.5	52.3	42.2	36.1	32.3	47.1	77.7	80.8
1980	82.6	73.6	69.7	75.9	48.8	34.4	30.0	28.5	22.6	27.0	57.2	83.6	52.8
1981	94.7	74.4	68.5	63.0	67.7	56.9	85.2	41.5	42.0	45.9	80.7	111.1	69.3
1982	113.8	116.5	106.6	88.2	48.0	40.1	36.3	32.7	25.3	21.2	22.4	64.7	59.7
1983	93.0	102.2	,88.6	93.3	119.8	66.2	45.6	34.7	27.7	53.3	74.6	78.7	73.1
Mean	98.9	92.9	88.9	81.4	82.3	68.5	57.1	39.5	34.9	39.3	60.0	85.6	69.1
Revised Outflow from Karangkates Dam													
1978	56.9	51.1	67.7	71.6	66.2	108.1	98.7	62.7	68.2	71.7	92.1	73.4	74.0
1979	134.8	143.8	78.9	70.2	112.2	92.9	63.6	54.0	57.9	41.0	50.8	62.7	80.2
1980	85.6	63.4	43.8	64.3	51.4	36.9	49.8	50.3	48.3	41.3	48.4	61.2	53.7
1981	72.9	64.7	54.0	53.8	72.8	61.1	77.8	67.2	61.8	59.9	60.2	111.1	68.1
1982	119.1	73.8	99.5	86.4	46.2	43.7	55.9	52.7	43.8	37.1	37.1	38.7	61.2
1983	59.0	87.0	75.9	90.5	112.2	75.1	70.9	50.5	43.0	46.8	81.5	62.5	71.2
Mean	88.1	80.6	70.0	72.8	76.8	69.6	69.5	56.2	53.8	49.6	61.7	68.3	68.1
Revised Outflow from Lahor Dam													
1978	0	0	1.6	0	6.4	11.8	6.9	0	0	0	0	0	2.2
1979	0.3	0	0	1.2	10.8	6.8	0	0	0	0	0	0	1.6
1980	0	0	0	1.9	0.3	0	0	0	0	0	0	0	0.2
1981	0	0	0	0.2	1.2	0	1.6	0	0	0	0	0	0.3
1982	0	0	0	0	0	0	0	0	0	0	0	0	0.0
1983	0	0	0	0	5.9	0.6	0	0	0	0	0	0	0.5
Mean	0.1	0	0.3	0.6	4.1	3.2	1.4	0	0	0	0	0	0.8
(2) Selorejo Dam													
Inflow													
1974	22.6	20.2	20.5	15.2	13.5	10.3	8.4	8.5	9.0	10.0	11.1	12.1	13.5
1975	17.1	21.1	21.7	19.2	18.4	12.4	10.3	9.6	10.8	12.5	14.8	14.3	15.2
1976	27.3	20.1	22.8	14.2	13.7	11.2	9.8	8.5	7.9	9.3	10.6	8.8	13.7
1977	12.5	17.7	27.0	14.4	12.4	10.8	8.2	7.2	6.5	6.2	5.8	8.2	11.4
1978	15.3	14.0	13.0	10.2	10.9	11.7	9.0	7.2	7.3	6.9	7.2	10.1	10.2
1979	16.7	12.2	12.7	12.5	12.9	9.2	7.5	6.9	6.2	6.1	6.0	6.6	9.5
1980	11.1	13.1	10.5	9.0	7.8	5.9	5.6	5.1	4.7	5.5	7.1	10.1	8.0
1981	25.5	20.1	13.6	13.1	12.2	10.1	8.9	6.7	8.8	8.5	11.5	14.7	12.8
1982	25.9	25.9	7.5	17.0	-7.0	8.7	8.1	7.3	6.5	6.1	.6.3	8.4	11.2
1983	10.2	11.9	11.6	12.3	11.1	7.1	6.7	5.8	5.6	6.9	8.4	7.2	8.7
Mean	18.2	17.6	16.1	13.7	12.0	9.7	8.3	7.3	7.3	7.8	8.9	10.1	11.4
Outflow													
1974	15.1	19.8	21.2	15.1	10.5	10.3	8.7	10.5	12.9	13.8	13.0	13.5	13.7
1975	13.7	13.8	21.3	19.5	16.2	12.6	11.0	11.3	13.4	14.0	13.3	14.2	14.5
1976	25.3	19.9	22.9	15.0	11.0	10.8	10.4	10.3	11.2	14.3	13.9	11.9	14.7
1977	11.2	10.9	14.2	13.8	12.4	12.5	10.9	9.2	9.8	10.5	7.5	8.9	11.0
1978	10.8	10.9	6.9	10.2	11.2	10.7	11.3	11.7	11.2	9.7	9.1	10.4	10.3
1979	10.2	7.2	8.7	12.3	10.9	9.0	9.7	9.5	10.7	9.8	7.3	6.4	9.3
1980	7.5	7.9	7.5	8.3	8.6	7.5	7.1	4.9	8.1	8.6	10.9	8.4	7.9
1981	11.5	23.9	13.9	9.1	11.8	9.6	10.3	8.3	13.1	14.6	11.6	13.0	12.6
1982	17.7	25.8	19.7	17.4	11.3	8.1	8.0	9.1	10.0	9.6	9.0	8.4	12.8
1983	8.9	9.0	7.9	5.9	11.3	10.2	8.1	9.2	8.1	8.4	10.4	7.6	8.8
Mean	13.2	14.9	14.4	12.7	11.5	10.1	10.0	9.4	10.9	11.3	10.6	10.3	11.6
(3) Bening Dam													
Inflow													
1982	-	-	-	-	0.05	-	0.08	0.01	0.00	0.01	0.05	2.24	-
1983	2.85	3.43	3.22	3.78	5.16	0	0	0	0	0.25	0.87	1.56	1.75
Outflow													
1982	-	-	-	-	1.14	-	0.85	0.24	0.19	0.18	0.39	1.29	-
1983	0.03	1.60	1.53	2.40	4.81	0.38	0.79	0.89	0.97	1.05	2.38	0.19	1.42

Note : - no data.

Table HY-1.9 INCREASE DISCHARGE OF KARANGKATES DAM

(Unit: m^3/s)

Year	Month	Inflow	Outflow	Increase of discharge
1978	Jun.	118.0	119.9	1.9
	Jul.	93.0	105.6	12.6
	Aug.	57.1	62.7	5.6
	Sep.	55.9	68.2	12.3
	Oct.	56.2	71.7	15.5
	Nov.	77.8	92.1	14.3
1979	Jun.	95.5	99.7	4.2
	Jul.	52.3	63.6	11.3
	Aug.	42.2	54.0	11.8
	Sep.	36.1	57.9	21.8
	Oct.	32.3	41.0	8.7
	Nov.	47.1	50.8	3.7
1980	Jun.	34.4	36.9	2.5
	Jul.	30.0	49.8	19.8
	Aug.	28.5	50.3	21.8
	Sep.	22.6	48.3	25.7
	Oct.	27.0	41.3	14.2
	Nov.	57.2	48.4	-8.8
1981	Jun.	56.9	61.1	4.2
	Jul.	85.2	79.4	-5.8
	Aug.	41.5	67.2	25.7
	Sep.	42.0	61.8	19.8
	Oct.	45.9	59.9	14.0
	Nov.	80.7	60.2	-20.5
1982	Jun.	40.1	43.7	3.6
	Jul.	36.3	55.9	19.6
	Aug.	32.7	52.7	20.0
	Sep.	25.3	43.8	18.5
	Oct.	21.2	37.1	15.9
	Nov.	22.4	37.1	14.7
1983	Jun.	66.2	75.7	9.5
	Jul.	45.6	70.9	25.3
	Aug.	34.7	50.5	15.8
	Sep.	27.7	43.0	15.3
	Oct.	53.3	46.8	-6.5
	Nov.	74.6	81.5	6.9

Table HY-1.10(1) CALCULATION OF NATURALIZED FLOW

1981

Unit : m^3/s

Month		Irr. Molek	K. Kates Dam In	K. Kates Dam Out	K. Kates Dam Storage	1+4	Irr. Lodoyo	5+6	Irr. Mrican	7+8	Irr.	9+10	Irr.	11+12	Jabon Ob. D	Jabon 13+14
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Jan.	-1	6.5	149.8	65.5	84.3	90.8	4	94.8	11.7	106.5	11.4	117.9	2.8	120.7	403.7	524.4
	-2	7.3	73.6	76.1	-2.5	4.8	4	8.8	11.8	20.6	10.6	31.2	2.8	34.0	417.9	451.9
	-3	7.5	63.7	76.8	-13.1	-5.6	4	-1.6	11.7	10.1	8.6	18.7	2.4	21.1	479.6	500.7
Feb.	-1	5.3	72.0	73.4	-1.4	3.9	4	7.9	12.2	20.1	9.4	29.5	2.9	32.4	445.9	478.3
	-2	7.5	68.1	61.9	6.2	13.7	4	17.7	11.4	29.1	9.7	38.8	2.4	41.2	330.9	372.1
	-3	6.7	85.1	57.3	27.8	34.5	4	38.5	11.8	50.3	10.1	60.4	2.4	62.8	515.4	578.2
Mar.	-1	7.6	74.0	49.4	24.6	32.2	4	36.2	8.9	45.1	9.9	55.0	2.3	57.3	476.5	533.8
	-2	7.4	64.3	61.7	2.6	10.0	4	14.0	10.4	24.4	9.4	33.8	2.3	36.1	366.2	402.3
	-3	7.4	67.3	51.0	16.3	23.7	5.7	29.4	10.4	39.8	8.8	48.6	2.4	51.0	297.2	348.2
Apr.	-1	6.2	65.8	57.4	8.4	14.6	6	20.6	10.1	30.7	8.1	38.8	1.8	40.6	339.5	380.1
	-2	6.6	47.9	50.8	-2.9	3.7	6	9.7	10.2	19.9	6.7	26.6	1.9	28.5	183.7	212.2
	-3	6.7	75.3	53.4	21.9	28.6	6	34.6	9.5	44.1	7.7	51.8	1.6	53.4	227.8	281.2
May	-1	6.0	64.1	64.6	-0.5	5.5	6	11.5	10.0	21.5	9.2	30.7	0.9	31.6	393.2	424.8
	-2	5.0	85.3	87.5	-2.2	2.8	6	8.8	10.5	19.3	8.9	28.2	0.8	29.0	398.2	427.2
	-3	5.4	55.0	70.2	-15.2	-9.8	6	-3.8	10.4	6.6	9.7	16.3	0.6	16.9	167.8	184.7
Jun.	-1	5.1	49.9	67.4	-17.5	-12.4	6	-6.4	9.6	3.2	9.5	12.7	0.6	13.3	94.3	107.6
	-2	5.3	55.7	58.1	-2.4	2.9	6.5	9.4	8.6	18.0	9.0	27.0	0.4	27.4	65.2	92.6
	-3	5.6	65.2	62.5	2.7	8.3	6.5	14.8	9.7	24.5	9.3	33.8	0.4	34.2	281.7	315.9
Jul.	-1	5.1	69.1	52.2	16.9	22.0	6.5	28.5	10.4	38.9	9.3	48.2	0.5	48.7	-	-
	-2	3.7	133.4	106.4	27.0	30.7	6.5	37.2	9.1	46.3	9.5	55.8	0.7	56.5	-	-
	-3	4.4	56.0	75.0	-19.0	-14.6	6.5	-8.1	9.1	1.0	9.6	10.6	0.6	11.2	-	-
Aug.	-1	4.5	43.6	64.3	-20.7	-16.2	6.5	-9.7	9.5	-0.2	10.0	9.8	0.7	10.5	63.0	73.5
	-2	4.6	40.4	53.5	-13.1	-8.5	6.5	-2.0	9.3	7.3	9.3	16.6	0.8	17.4	53.0	70.4
	-3	4.6	40.5	78.9	-38.4	-33.8	6.5	-27.3	9.6	-17.7	7.0	-10.7	0.7	-10.0	65.4	55.4
Sep.	-1	4.7	34.4	61.4	-27.0	-22.3	6.5	-15.8	8.9	-6.9	6.8	-0.1	0.7	0.6	48.5	49.1
	-2	5.9	30.9	67.8	-36.9	-31.0	6.5	-24.5	9.2	-15.3	5.8	-9.5	0.7	-8.8	46.5	37.7
	-3	4.4	60.8	56.1	4.7	9.1	6.5	15.6	8.9	24.5	6.5	31.0	0.8	31.8	104.6	136.4
Oct.	-1	5.0	52.8	62.4	-9.6	-4.6	6.5	1.9	7.6	9.5	0.1	9.6	0.6	10.2	163.6	173.8
	-2	5.4	39.3	59.6	-20.3	-14.9	6.5	-8.4	8.6	0.2	2.3	2.5	0.8	3.3	78.7	82.0
	-3	5.6	45.7	57.8	-12.1	-6.5	6.5	0	7.6	7.6	6.7	14.3	0.7	15.0	69.1	84.1
Nov.	-1	5.0	37.9	53.2	-15.3	-10.3	6.5	-3.8	8.6	4.8	6.0	10.8	0.7	11.5	54.0	65.5
	-2	5.4	69.3	54.1	15.2	20.6	6.5	27.1	8.8	35.9	6.7	42.6	0.8	43.4	174.0	217.4
	-3	5.6	134.9	73.3	61.6	67.2	6.5	73.7	8.4	82.1	7.3	89.4	1.0	90.4	288.3	378.7
Dec.	-1	5.7	105.3	75.6	29.7	35.4	6.5	41.9	9.7	51.6	8.5	60.1	1.4	61.5	332.8	394.3
	-2	5.8	120.6	118.5	2.1	7.9	6.5	14.4	10.7	25.1	9.0	34.1	2.2	36.3	458.3	494.6
	-3	6.9	107.9	136.8	-28.9	-22.0	7.7	-14.3	10.9	-3.4	9.2	5.8	2.9	8.7	341.0	349.7

- : no data Ob. D : Observed Discharge

Table HY-1.10 (2) CALCULATION OF NATURALIZED FLOW

1982 Unit : m^3/s

Month		Irr. Malek	K. Kates Dam In	K. Kates Dam Out	K. Kates Dam Storage	1+4	Irr. Lodoyo	5+6	Irr. Mrican	7+8	Irr.	9+10	Irr.	11+12	Jabon Ob. D	Jabon 13+14
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Jan.	-1	6.9	153.9	111.8	42.1	49.0	9	58.0	11.5	69.5	9.8	79.3	3.7	83.0	467.5	550.5
	-2	6.0	126.2	127.9	-1.7	4.3	9	13.3	11.9	25.2	10.2	35.4	3.2	38.6	562.4	601.0
	-3	6.5	85.5	117.7	-32.2	-25.7	9	-16.7	11.3	-5.4	10.3	4.9	2.9	7.8	511.6	519.4
Feb.	-1	6.5	121.2	67.2	54.0	60.5	9	69.5	10.5	80.0	10.5	90.5	2.9	93.4	586.8	680.2
	-2	5.9	127.0	71.6	55.4	61.3	9	70.3	9.5	79.8	10.4	90.2	2.9	93.1	510.3	603.4
	-3	6.5	97.4	84.8	12.6	19.1	9	28.1	9.3	37.4	10.5	47.9	2.8	50.7	425.9	476.6
Mar.	-1	6.5	124.9	105.7	19.2	25.7	9	34.7	8.8	43.5	11.0	54.5	2.9	57.4	544.2	601.6
	-2	5.6	122.0	132.6	-10.6	-5.0	9	4.0	9.2	13.2	8.8	22.0	2.9	24.9	609.3	634.2
	-3	5.6	75.9	63.8	12.1	17.7	9	26.7	6.7	33.4	8.3	41.7	2.6	44.3	319.8	364.1
Apr.	-1	5.7	87.9	78.9	9.0	14.7	9	23.7	8.3	32.0	8.5	40.5	2.1	42.6	354.0	396.6
	-2	5.6	88.2	94.2	-6.0	-0.4	9	8.6	10.2	18.8	6.5	25.3	1.7	27.0	408.5	435.5
	-3	5.6	88.4	86.2	2.2	7.8	9	16.8	10.9	27.7	5.1	32.8	1.0	33.8	260.7	294.5
May	-1	5.0	52.8	47.4	5.4	10.4	9	19.4	8.4	27.8	8.9	36.7	0.5	37.2	187.0	224.2
	-2	5.3	46.8	45.6	1.2	6.5	9	15.5	7.8	23.3	9.4	32.7	0.4	33.1	66.0	99.1
	-3	5.3	44.7	45.5	-0.8	4.5	9	13.5	6.9	20.4	9.0	29.4	0.4	29.8	60.6	90.4
Jun.	-1	5.4	42.4	43.6	-1.2	4.2	9	13.2	8.6	21.8	7.6	29.4	0.4	29.8	68.3	98.1
	-2	5.3	39.4	41.8	-2.4	2.9	9	11.9	8.9	20.8	6.7	27.5	0.2	27.7	52.2	79.9
	-3	5.3	38.5	45.8	-7.3	-2.0	9	7.0	8.1	15.1	6.4	21.5	0.3	21.8	44.0	65.8
Jul.	-1	5.5	36.2	44.4	-8.2	-2.7	9	6.3	6.7	13.0	7.1	20.1	0.3	20.4	39.8	60.2
	-2	5.5	35.7	46.4	-10.7	-5.2	7.6	2.4	6.9	9.3	6.3	15.6	0.2	15.8	39.8	55.6
	-3	5.6	37.1	75.0	-37.9	-32.3	6	-26.3	7.5	-18.8	9.1	-9.7	0.1	-9.6	69.0	59.4
Aug.	-1	5.2	37.1	54.9	-17.8	-12.6	6	-6.6	7.0	0.4	6.3	6.7	0.2	6.9	43.7	50.6
	-2	4.6	31.6	51.4	-19.8	-15.2	6	-9.2	6.5	-2.4	5.7	3.3	0.2	3.5	41.4	44.9
	-3	4.3	29.7	51.9	-22.2	-17.9	6	-11.9	6.9	-5.0	5.2	0.2	0.2	0.4	46.2	46.6
Sep.	-1	3.9	25.8	44.9	-19.1	-15.2	6	-9.2	6.9	-2.3	4.3	2.0	0.2	2.2	36.0	38.2
	-2	3.9	27.0	44.4	-17.4	-13.5	6	-7.5	6.8	-0.7	5.1	4.4	0.2	4.6	36.2	40.8
	-3	4.2	23.2	42.3	-19.1	-14.9	6	-8.9	6.8	-2.1	3.7	1.6	0.2	1.8	35.3	37.1
Oct.	-1	3.7	22.1	38.2	-16.1	-12.4	6	-6.4	6.9	0.5	-	0.5	0.2	0.7	35.9	36.6
	-2	3.4	20.5	38.2	-17.7	-14.3	6	-8.3	7.0	-1.3	1.4	0.1	0.2	0.3	34.1	34.4
	-3	3.3	21.4	35.0	-13.6	-10.3	6	-4.3	6.6	2.3	3.4	5.7	0.2	5.9	34.1	40.0
Nov.	-1	3.6	20.6	38.1	-17.5	-13.9	6	-7.9	6.4	-1.5	3.1	1.6	0.2	1.8	29.1	30.4
	-2	4.0	25.0	37.8	-12.8	-8.8	6	-2.8	6.6	3.8	3.5	7.3	0.2	7.5	32.1	39.6
	-3	3.8	21.4	35.5	-14.1	-10.3	6	-4.3	6.1	1.8	3.8	5.6	0.2	5.8	37.7	43.5
Dec.	-1	5.0	40.3	34.0	6.3	11.3	6	17.3	5.2	22.5	3.6	26.1	0.3	26.4	39.0	65.4
	-2	4.6	65.6	38.1	27.5	32.1	6	38.1	10.0	48.1	4.6	52.7	0.5	53.2	116.8	170.0
	-3	6.6	86.1	43.5	42.6	49.2	6	55.2	12.9	68.1	6.7	74.8	0.8	75.6	225.4	301.0

- : no data   Ob. D : Observed Discharge

Table HY-1.10 (3) CALCULATION OF NATURALIZED FLOW

1983 Unit : m^3/s

Month	Irr. Molek	K. Kates Dam In	K. Kates Dam Out	K. Kates Dam Storage	1+4	Irr. Lodoyo	5+6	Irr. Mrican	7+8	Irr.	9+10	Irr.	11+12	Jabon Ob. D	Jabon 13+14
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Jan. -1	6.8	104.8	55.4	49.4	56.2	6	62.2	13.2	75.4	8.5	83.9	1.3	85.2	385.0	470.2
-2	13.8	112.9	63.9	49.0	62.8	6	68.8	13.2	82.0	9.8	91.8	2.1	93.9	354.6	448.5
-3	6.4	64.1	57.8	6.3	12.7	6	18.7	13.2	31.9	9.5	41.4	2.0	43.4	228.0	271.4
Feb. -1	7.8	113.1	62.0	51.1	58.9	7.5	66.4	13.5	79.9	10.3	90.2	2.5	92.7	401.5	494.2
-2	7.1	94.6	99.5	-4.9	2.2	8	10.2	13.4	23.6	10.9	34.5	2.2	36.7	411.1	447.8
-3	8.8	98.2	102.4	-4.2	4.6	6.8	11.4	13.5	24.9	11.2	36.1	2.2	38.3	386.3	424.6
Mar. -1	7.5	99.2	84.7	14.5	22.0	9	31.0	13.3	44.3	10.6	54.9	2.1	57.0	407.6	464.6
-2	15.3	82.8	69.4	13.4	28.7	9	37.7	13.2	50.9	10.0	60.9	2.1	63.0	387.6	450.6
-3	-	84.2	73.8	10.4		9		12.6		9.8		2.2		438.9	
Apr. -1	5.2	92.4	80.9	11.5	16.7	9	25.7	10.7	36.4	8.0	44.4	2.1	46.5	376.8	423.3
-2	7.9	75.2	86.6	-11.4	-3.5	9	5.5	11.0	16.5	7.3	23.8	1.6	25.4	321.1	346.5
-3	7.6	112.3	104.0	8.3	15.9	9	24.9	9.6	34.5	6.9	41.4	1.6	43.0	329.4	372.4
May -1	5.4	133.3	135.3	-2.0	3.4	9	12.4	9.7	22.1	9.3	31.4	1.4	32.8	531.1	563.9
-2	6.1	110.3	103.6	6.7	12.8	9	21.8	9.7	31.5	9.6	41.1	0.9	42.0	431.5	473.5
-3	5.8	116.1	115.9	0.2	6.0	9	15.0	9.8	24.8	9.4	34.2	0.6	34.8	422.9	457.7
Jun. -1	6.1	79.9	74.1	5.8	11.9	9	20.9	9.9	30.8	9.4	40.2	0.6	40.8	224.0	264.8
-2	5.9	67.1	73.0	-5.9	0	9	9.0	10.8	19.8	9.5	29.3	0.7	30.0	176.2	206.2
-3	5.4	51.5	80.3	-28.8	-23.4	9	-14.4	10.9	-3.5	9.5	6.0	0.8	6.8	96.3	103.1
Jul. -1	5.5	52.3	94.3	-42.0	-13.0	9	-4.0	10.3	6.3	10.6	16.9	0.5	17.4	103.8	121.2
-2	5.5	45.1	76.7	-31.6	-26.1	9	-17.1	8.2	-8.9	8.7	-0.2	0.7	0.5	108.3	108.8
-3	4.9	39.8	44.5	-4.7	0.2	9	9.2	7.0	16.2	6.5	22.7	0.5	23.2	53.6	76.8
Aug. -1	3.8	37.3	51.0	-13.7	-9.9	8.4	-1.5	10.6	9.1	5.5	14.6	0.2	14.8	43.3	58.1
-2	3.9	34.3	50.4	-16.1	-12.2	8	-4.2	8.3	4.1	4.9	9.0	0.3	65.3	45.7	111.0
-3	3.6	32.6	55.0	-22.4	-18.8	8	-10.8	7.5	-3.3	4.3	1.0	0.3	1.3	42.8	44.1
Sep. -1	3.2	29.6	44.3	-14.7	-11.5	8	-3.5	8.1	4.6	3.8	8.4	0.4	8.8	40.8	49.6
-2	3.3	26.5	40.5	-14.0	-10.7	8	-2.7	7.2	4.5	2.4	6.9	0.2	7.1	36.9	44.0
-3	3.5	27.0	44.0	-17.0	-13.5	8	-5.5	6.6	1.1	2.6	3.7	0.5	4.2	34.7	38.9
Oct. -1	3.4	26.1	44.3	-18.2	-14.8	8	-6.8	7.6	0.8	2.3	3.1	0.5	3.6	38.3	41.9
-2	5.0	57.4	42.0	15.4	20.4	7.5	27.9	7.5	35.4	1.1	36.5	0.2	36.7	49.3	86.0
-3	4.1	74.2	53.4	20.8	24.9	6.5	31.4	7.6	39.0	0.3	39.3	0.1	39.4	127.0	166.4
Nov. -1	6.8	63.3	63.4	-0.1	6.7	6.5	13.2	9.3	22.5	2.9	25.4	0.3	25.7	189.9	215.6
-2	6.6	70.3	78.3	-8.0	-1.4	6.5	5.1	10.2	15.3	3.9	19.2	0.7	19.9	238.0	257.9
-3	6.1	90.2	102.8	-12.6	-6.5	6.5	0	11.7	11.7	6.9	18.6	0.9	19.5	322.0	341.5
Dec. -1	-	61.2	57.4	3.8		6.5		11.0		7.9		1.5		149.3	
-2	-	57.3	53.0	4.3		7.5		11.4		9.1		1.4		140.2	
-3	-	114.2	75.7	38.5		8		11.9		10.0		1.6		295.8	

- : no data Ob. D : Observed Discharge

Table HY-1.10 (4) CALCULATION OF NATURALIZED FLOW

(Unit: m^3/sec)

Month	Karangkates 1981	Karangkates 1982	Karangkates 1983	Jabon 1981	Jabon 1982	Jabon 1983
Jan. 1-10	156.3	160.8	111.6	524.4	550.5	470.2
11-20	80.9	132.2	126.7	451.9	601.0	448.5
21-31	71.2	92.0	70.5	500.7	519.4	271.4
Feb. 1-10	77.3	127.7	120.9	478.3	680.2	494.2
11-20	75.6	132.9	101.7	372.1	603.4	447.8
21-28	91.8	103.9	107.0	578.2	476.6	424.6
Mar. 1-10	81.6	131.4	106.7	533.8	601.6	464.6
11-20	71.7	127.6	98.1	402.3	634.2	450.6
21-31	74.7	81.5	84.2	348.2	364.1	-
Apr. 1-10	72.0	93.6	97.6	380.1	396.6	423.3
11-20	54.5	93.8	83.1	212.2	435.5	346.5
21-30	82.0	94.0	119.9	281.2	294.5	372.4
May 1-10	70.1	57.8	138.7	424,8	224.2	563.9
11-20	90.3	52.1	116.4	427.2	99.1	473.5
21-31	60.4	50.0	121.9	184.7	90.4	457.7
Jun. 1-10	55.0	47.8	86.0	107.6	98.1	264.8
11-20	61.0	44.7	73.0	92.6	79.9	206.2
21-30	70.8	43.8	56.9	315.9	65.8	103.1
Jul. 1-10	74.2	41.7	57.8	-	60.2	121.2
11-20	137.1	41.2	50.6	-	55.6	108.8
21-31	60.4	42.7	44.7	-	59.4	76.8
Aug. 1-10	48.1	42.3	41.1	73.5	50.6	58.1
11-20	45.0	36.2	38.2	70.4	44.9	111.0
21-31	45.1	34.0	36.2	55.4	46.6	44.1
Sep. 1-10	39.1	29.7	32.8	49.1	38.2	49.6
11-20	36.8	30.9	29.8	37.7	40.8	44.0
21-30	65.2	27.4	30.5	136.4	37.1	38.9
Oct. 1-10	57.8	25.8	29.5	173.8	36.6	41.9
11-20	44.7	23.9	62.4	82.0	34.4	86.0
21-31	51.3	24.7	78.3	84.1	40.0	166.4
Nov. 1-10	42.9	24.2	70.1	65.5	30.9	215.6
11-20	74.7	29.0	76.9	217.4	39.6	257.9
21-30	140.5	25.2	96.3	378.7	43.5	341.5
Dec 1-10	111.0	45.3	61.2	394.3	65.4	-
11-20	126.4	70.2	57.3	494.6	170.0	-
21-31	114.8	92.7	114.2	349.7	301.0	-

Note: - no data

Table HY-1.11 (1) 10-DAY BASIN RAINFALL

(Unit : mm)

Year		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Biobo													
1978	1-10	162.34	80.22	90.10	37.76	33.33	77.91	58.94	3.26	25.30	67.03	60.69	136.38
	11-20	95.35	94.27	94.09	43.43	126.00	51.96	1.11	29.97	14.82	39.57	99.73	96.63
	21-31	120.57	60.98	74.56	33.39	69.97	66.72	10.90	2.41	13.15	45.17	66.50	74.27
	Total	378.26	235.47	258.75	114.58	229.30	196.59	70.95	35.64	53.27	151.77	226.92	307.28
											Annual = 2,258.76 mm		
1979	1-10	82.27	87.98	77.85	31.80	98.67	72.60	0.93	3.60	0.00	0.73	24.87	107.61
	11-20	157.02	70.63	51.59	84.78	20.10	0.07	0.68	0.00	0.24	1.74	48.25	61.22
	21-31	145.57	35.08	116.62	44.63	109.84	5.56	0.00	0.00	19.27	38.31	100.17	125.72
	Total	384.86	193.69	246.06	161.21	228.61	78.23	1.61	3.60	19.51	40.78	173.29	294.55
											Annual = 1,826.00 mm		
1980	1-10	53.62	68.14	56.64	27.69	21.76	1.51	0.95	0.80	0.17	3.14	63.55	150.98
	11-20	75.07	49.51	56.95	88.07	0.00	0.00	4.49	1.96	0.26	53.39	75.40	45.26
	21-31	89.39	77.31	64.66	72.75	14.14	0.00	4.52	0.00	3.29	23.10	112.71	138.14
	Total	218.08	194.96	178.25	188.51	35.90	1.51	9.96	2.76	3.72	79.63	251.66	334.38
											Annual = 1,500.32 mm		
1981	1-10	117.30	88.68	56.15	66.52	57.99	0.35	25.46	0.03	7.20	57.46	40.80	126.65
	11-20	151.69	76.76	45.14	33.67	56.17	39.84	64.04	3.37	14.51	29.87	117.83	111.18
	21-31	98.82	86.15	89.45	65.66	11.53	76.74	0.01	1.42	97.56	18.94	188.11	79.04
	Total	367.81	251.59	190.74	165.85	125.69	116.93	89.51	4.82	119.27	106.27	346.74	316.87
											Annual = 2,202.09 mm		
1982	1-10	173.02	139.51	149.19	86.60	0.00	0.26	0.00	0.00	0.00	0.00	7.92	99.38
	11-20	71.05	143.16	91.32	45.49	0.00	0.00	0.77	0.00	0.00	0.00	39.29	141.91
	21-31	79.88	44.79	23.47	76.07	0.53	0.65	0.00	1.03	0.00	1.19	15.60	109.39
	Total	323.95	327.46	263.98	208.16	0.53	0.91	0.77	1.03	0.00	1.19	62.81	350.68
											Annual = 1,541.47 mm		
1983	1-10	184.96	179.76	99.63	82.15	71.64	15.15	0.25	0.00	0.00	9.11	51.94	65.57
	11-20	228.74	90.29	75.85	51.52	60.19	4.40	3.56	0.00	0.00	45.31	83.05	58.51
	21-31	60.63	99.20	77.34	124.37	67.81	0.00	0.00	0.33	13.67	68.73	127.90	196.05
	Total	474.33	369.25	252.82	258.04	199.64	19.55	3.81	0.33	13.67	123.15	262.89	320.13
											Annual = 2,207.81 mm		
Clusorit													
1977	1-10	93.77	122.53	56.79	155.27	10.78	11.60	0.04	0.00	0.00	1.06	0.65	260.10
	11-20	153.52	115.55	105.90	5.20	0.00	11.12	0.00	0.00	0.00	0.00	16.54	108.91
	21-31	187.68	112.85	210.51	71.87	41.10	14.15	0.00	0.00	0.07	0.00	105.57	169.25
	Total	434.97	350.93	373.20	232.34	51.88	36.87	0.04	0.00	0.07	1.06	122.76	538.26
											Annual = 2,142.38 mm		
1978	1-10	197.07	93.15	160.47	94.06	74.59	117.77	171.52	31.35	32.59	61.44	83.58	169.17
	11-20	55.84	80.14	128.82	39.54	142.35	156.62	1.27	32.99	25.15	24.61	151.82	64.07
	21-31	70.88	89.50	203.53	95.33	120.63	46.60	40.18	21.09	43.49	22.28	105.79	115.24
	Total	323.79	262.79	492.82	228.93	337.57	320.99	212.97	85.43	101.23	108.33	341.19	348.48
											Annual = 3,164.52 mm		
1979	1-10	110.86	105.32	58.20	32.70	130.20	106.73	0.00	6.11	0.00	0.00	31.74	72.94
	11-20	146.66	80.34	103.91	80.67	7.86	0.00	0.00	0.00	5.76	1.63	13.76	42.84
	21-31	114.96	33.17	147.09	54.39	83.86	62.08	0.00	0.00	0.00	35.97	48.17	101.83
	Total	372.48	218.83	309.20	167.76	221.92	163.81	0.00	6.11	5.76	37.60	93.67	217.61
											Annual = 1,819.75 mm		
1980	1-10	50.84	26.07	24.36	33.91	12.77	0.17	0.04	0.00	0.00	0.00	31.85	74.42
	11-20	11.47	17.70	20.05	46.97	0.00	0.00	0.00	0.65	0.00	12.12	107.59	21.04
	21-31	13.97	38.17	28.75	37.20	2.16	0.00	0.00	0.00	5.27	76.40	140.38	114.44
	Total	76.28	81.94	73.16	118.08	14.93	0.17	0.04	0.65	5.27	88.52	279.82	209.90
											Annual = 948.76 mm		
1981	1-10	130.32	59.41	56.04	28.30	40.00	25.59	27.58	9.99	0.00	22.47	37.95	101.32
	11-20	107.06	111.79	26.58	4.72	243.25	6.93	221.98	40.44	3.71	9.02	118.07	83.92
	21-31	40.12	47.86	63.08	120.29	68.06	52.18	0.56	2.56	56.59	61.76	211.82	71.10
	Total	277.50	219.06	145.70	153.31	351.31	85.00	253.12	52.99	60.30	93.25	367.84	253.34
											Annual = 2,315.72 mm		
1982	1-10	142.94	110.08	83.31	46.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.74
	11-20	22.86	143.21	39.78	32.70	0.00	0.00	0.07	0.00	0.00	0.00	6.95	129.26
	21-31	26.72	22.30	8.10	84.12	4.11	0.00	0.00	0.00	0.00	0.00	9.63	187.69
	Total	192.52	275.99	131.69	163.09	4.11	0.00	0.07	0.00	0.00	0.00	16.58	379.69
											Annual = 1,164.07 mm		

Table HY-1.11 (2) 10-DAY BASIN RAINFALL

(Unit : mm)

Year		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Metro													
1978	1-10	270.93	88.62	110.82	46.70	51.96	46.05	102.43	1.16	38.82	26.30	50.22	164.31
	11-20	95.62	123.67	71.41	26.78	86.47	49.88	0.46	2.11	5.32	38.60	116.62	36.32
	21-31	114.98	80.11	91.41	38.34	87.62	65.83	15.29	7.38	6.36	48.09	51.10	44.31
	Total	481.53	292.40	273.64	111.82	226.05	161.76	118.18	10.65	50.50	112.99	217.94	244.94
													Annual = 2,302.40 mm
1979	1-10	75.42	145.02	79.59	87.67	134.50	107.11	0.52	0.00	0.00	4.04	37.23	66.38
	11-20	197.02	115.95	48.86	68.48	21.38	0.74	0.93	0.00	0.46	0.94	33.92	67.63
	21-31	124.94	47.54	82.25	90.11	121.10	4.36	0.00	0.00	5.10	76.29	94.98	81.02
	Total	397.38	308.51	210.70	246.26	276.98	112.21	1.45	0.00	5.56	81.27	166.13	215.03
													Annual = 2,021.48 mm
1980	1-10	64.46	79.80	22.87	46.59	20.25	0.00	0.47	17.85	0.00	0.10	39.68	156.62
	11-20	126.26	64.92	49.74	76.82	0.00	0.00	0.00	12.58	20.18	42.87	110.33	52.44
	21-31	80.70	102.43	88.71	92.98	16.29	0.00	5.03	0.00	0.00	65.69	131.94	155.76
	Total	271.42	247.15	161.32	216.39	36.54	0.00	5.50	30.43	20.18	108.66	281.95	364.82
													Annual = 1,744.36 mm
1981	1-10	108.44	95.50	69.99	33.79	12.46	0.74	74.93	18.05	2.71	33.90	31.46	120.19
	11-20	102.52	27.12	112.54	33.33	50.57	21.79	55.85	0.00	0.00	23.42	103.16	99.09
	21-31	82.96	110.72	58.33	69.88	9.42	43.82	2.66	22.83	97.30	55.61	208.15	98.72
	Total	293.92	233.34	240.86	137.00	72.45	66.35	133.44	40.88	100.01	112.93	342.77	318.00
													Annual = 2,091.95 mm
1982	1-10	105.59	116.23	97.84	131.60	0.00	2.78	0.00	0.00	0.00	0.00	0.68	28.01
	11-20	73.65	131.14	68.22	56.63	0.00	0.00	0.00	0.00	0.00	0.00	57.90	112.30
	21-31	162.68	61.49	21.78	18.12	0.93	0.37	0.00	2.09	0.00	13.15	41.20	207.30
	Total	341.92	308.86	187.84	206.40	0.93	3.15	0.00	2.09	0.00	13.15	99.78	347.61
													Annual = 1,511.73 mm
1983	1-10	202.84	145.06	110.51	49.35	47.68	26.48	1.67	0.00	0.00	1.89	65.69	60.88
	11-20	171.87	62.65	59.79	50.83	72.88	0.00	2.01	0.00	0.00	63.33	88.85	47.82
	21-31	65.58	78.38	92.54	138.49	97.43	0.00	0.00	0.26	7.17	77.45	123.24	215.76
	Total	440.29	286.09	262.84	238.67	217.99	26.48	3.68	0.26	7.17	142.67	277.78	324.46
													Annual = 2,223.38 mm
Karaonkkates													
1978	1-10	229.77	83.23	116.37	60.19	47.42	91.02	103.22	10.33	41.68	51.39	64.54	145.57
	11-20	80.97	85.07	102.29	40.13	121.90	79.45	1.01	25.76	16.79	41.51	132.13	73.42
	21-31	109.16	77.41	133.97	70.45	86.74	57.07	25.60	7.70	18.69	42.34	70.27	95.52
	Total	419.90	245.71	352.63	171.07	256.06	227.54	129.83	43.79	77.16	135.24	266.91	314.51
													Annual = 2,640.38 mm
1979	1-10	84.88	101.36	69.50	47.61	120.60	90.30	0.48	2.97	0.01	1.47	35.10	92.25
	11-20	150.19	85.69	71.56	75.86	17.31	0.49	1.06	0.00	1.66	1.39	34.45	60.42
	21-31	135.42	41.88	134.44	71.47	109.26	20.59	0.23	0.00	9.86	46.10	76.10	125.23
	Total	370.49	223.93	275.50	194.94	247.17	111.38	1.77	2.97	11.53	48.96	145.65	277.90
													Annual = 1,917.19 mm
1980	1-10	61.91	62.89	39.21	50.57	20.44	0.79	0.51	3.09	0.08	1.41	45.97	144.13
	11-20	74.64	46.82	43.18	76.99	0.19	0.00	2.01	4.46	2.72	35.14	89.70	45.64
	21-31	81.28	75.85	64.98	82.72	10.69	0.14	3.18	0.00	2.64	41.65	141.82	142.88
	Total	217.83	185.56	147.37	210.28	31.32	0.93	5.70	7.55	5.44	78.20	277.49	332.65
													Annual = 1,500.32 mm
1981	1-10	135.80	75.29	52.46	50.45	45.27	7.75	42.18	4.55	4.04	51.83	36.01	111.35
	11-20	118.30	82.71	51.83	22.52	105.05	26.09	100.86	11.85	7.37	28.06	125.32	96.25
	21-31	78.10	79.69	84.46	90.64	32.63	59.28	0.55	6.55	90.57	51.08	203.78	96.61
	Total	322.20	237.69	188.75	163.61	182.95	93.12	143.59	22.95	101.98	130.97	365.11	304.24
													Annual = 2,267.16 mm
1982	1-10	151.93	120.10	132.41	76.91	0.00	1.77	0.00	0.00	0.00	0.00	3.51	74.14
	11-20	56.10	131.27	69.54	53.65	0.00	0.00	0.40	0.00	0.00	0.00	32.03	126.04
	21-31	69.22	49.82	22.19	69.38	1.77	0.54	0.00	0.97	0.00	2.24	16.66	160.47
	Total	277.25	301.19	224.14	199.94	1.77	2.31	0.40	0.97	0.00	2.24	52.20	360.65
													Annual = 1,426.06 mm
1983	1-10	174.06	165.32	100.08	76.01	71.38	28.40	1.14	0.00	0.00	5.14	62.35	54.69
	11-20	185.93	86.22	76.69	71.43	84.41	1.97	2.67	0.48	0.00	55.73	82.18	61.74
	21-31	62.45	107.72	75.56	109.92	104.62	0.00	0.00	0.18	7.33	90.53	123.32	187.45
	Total	422.44	359.26	252.33	257.36	260.41	30.37	4.11	0.66	7.33	151.40	267.35	303.88
													Annual = 2,317.90 mm

Table HY-1.11 (3) 10-DAY BASIN RAINFALL

(Unit : mm)

Year		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Selorejo													
1978	1-10	146.69	109.16	86.10	40.83	63.34	70.06	35.24	19.19	6.94	8.09	24.28	54.33
	11-20	97.35	64.00	145.45	24.90	96.27	81.95	4.05	0.00	12.14	1.73	47.97	101.15
	21-31	361.35	108.93	92.91	5.06	63.79	67.59	20.45	8.62	0.00	23.70	23.12	63.58
	Total	605.39	282.09	324.46	70.79	223.40	219.60	59.74	27.81	19.08	33.52	95.37	219.06
													Annual = 2,180.31 mm
1979	1-10	100.93	126.51	125.76	57.80	133.04	38.04	9.22	0.00	0.00	9.91	57.91	114.91
	11-20	173.62	79.02	56.25	36.40	36.50	0.00	2.31	0.00	0.00	0.00	19.42	26.07
	21-31	99.38	40.30	71.07	61.42	94.86	2.31	0.00	0.00	8.09	9.71	84.56	150.40
	Total	373.93	245.83	253.08	155.62	264.40	40.35	11.53	0.00	8.09	19.62	161.89	291.38
													Annual = 1,825.72 mm
1980	1-10	74.28	106.05	101.61	66.24	33.72	25.05	0.00	5.49	1.73	0.00	42.87	217.64
	11-20	104.20	87.47	83.92	83.89	0.00	6.33	19.51	0.00	6.53	56.87	84.01	69.92
	21-31	228.93	160.48	123.97	79.38	13.50	0.00	8.47	0.00	0.00	31.76	99.10	159.31
	Total	407.41	354.00	309.50	229.51	47.22	31.38	27.98	5.49	8.26	88.63	225.98	446.87
													Annual = 2,182.23 mm
1981	1-10	204.38	164.63	136.11	68.67	115.83	2.31	6.36	0.00	10.02	14.53	63.55	104.45
	11-20	252.83	37.25	89.09	57.79	69.33	43.74	55.13	0.00	20.64	39.28	156.86	132.56
	21-31	242.67	91.09	37.02	109.78	0.00	90.05	0.00	18.61	126.03	46.84	169.40	136.34
	Total	699.88	292.97	262.22	236.24	185.16	136.10	61.49	18.61	156.69	100.65	389.81	373.35
													Annual = 2,913.17 mm
1982	1-10	238.29	155.46	87.55	90.92	0.00	0.00	0.00	0.00	0.00	0.00	21.96	84.44
	11-20	164.43	202.43	136.29	20.36	0.00	0.00	1.73	0.00	0.00	0.00	42.23	181.21
	21-31	158.82	118.46	33.79	61.99	5.89	0.00	0.00	0.00	0.00	0.00	0.00	131.84
	Total	561.54	476.35	257.63	173.27	5.89	0.00	1.73	0.00	0.00	0.00	64.19	397.49
													Annual = 1,938.09 mm
1983	1-10	235.93	147.77	109.22	105.26	50.69	8.60	0.00	0.00	0.00	4.62	76.46	29.94
	11-20	173.80	87.06	62.02	67.16	108.27	0.00	0.00	0.00	0.00	34.82	51.59	52.20
	21-31	34.76	125.03	71.06	226.95	35.39	0.00	1.69	0.00	10.40	104.41	183.50	192.71
	Total	444.49	359.86	242.30	399.37	194.35	8.60	1.69	0.00	10.40	143.85	311.55	274.85
													Annual = 2,391.31 mm
Wonorejo													
1977	1-10	5.12	61.32	61.92	248.51	32.34	84.06	11.09	0.00	78.30	10.16	0.00	156.11
	11-20	61.18	2.58	61.38	70.29	0.00	42.70	0.00	0.00	0.00	0.00	0.00	65.85
	21-31	118.04	108.39	190.88	26.46	15.71	78.57	0.00	0.00	0.00	0.00	91.93	375.57
	Total	184.64	172.29	314.68	345.26	48.05	205.33	11.09	0.00	78.30	10.16	91.93	597.53
													Annual = 2,059.26 mm
1978	1-10	117.45	51.24	65.60	51.82	8.99	165.66	71.37	2.13	71.49	119.72	114.10	198.82
	11-20	38.89	32.95	81.81	26.32	52.11	276.79	37.33	6.61	116.70	90.86	174.69	160.21
	21-31	61.76	53.96	89.46	57.05	179.86	203.21	133.39	0.00	44.35	81.96	0.00	78.60
	Total	218.10	138.15	236.87	135.19	240.96	645.66	242.09	8.74	232.54	292.54	288.79	437.63
													Annual = 3,117.26 mm
1979	1-10	162.11	166.20	70.72	63.54	354.28	332.76	0.92	66.44	11.24	0.15	98.21	177.41
	11-20	100.80	5.40	138.96	196.41	14.44	0.00	8.32	2.77	41.58	16.63	91.08	82.66
	21-31	58.44	143.31	125.15	161.51	77.86	26.87	27.72	0.00	0.00	73.44	22.78	173.58
	Total	321.35	314.91	334.83	421.46	446.58	359.63	36.96	69.21	52.82	90.22	212.07	433.65
													Annual = 3,098.69 mm
1980	1-10	36.54	53.04	48.20	103.38	24.95	0.00	0.00	16.63	0.00	0.15	30.73	188.48
	11-20	62.27	134.69	41.02	191.62	0.00	0.00	9.54	1.85	0.00	37.72	128.17	67.04
	21-31	131.04	198.55	96.06	42.72	9.24	21.25	11.39	0.00	0.00	106.25	220.88	149.15
	Total	229.85	386.28	186.18	337.72	34.19	21.25	20.93	18.48	0.00	144.12	388.78	404.67
													Annual = 2,172.45 mm

Table HY-1.11 (4) 10-DAY BASIN RAINFALL

(Unit : mm)

Year		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Bentas													
1979	1-10	72.0	38.0	59.0	115.0	150.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0
	11-20	59.0	25.0	90.0	178.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	21-31	153.0	146.0	77.0	63.0	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	284.0	209.0	226.0	356.0	207.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0
											Annual = 1,410.0 mm		
1980	1-10	49.0	31.0	70.0	63.0	0.0	0.0	0.0	13.0	0.0	0.0	42.0	155.0
	11-20	133.0	55.0	111.0	74.0	0.0	0.0	2.0	0.0	0.0	0.0	85.0	68.0
	21-31	84.0	144.0	79.0	32.0	6.0	0.0	0.0	0.0	0.0	10.0	320.0	187.0
	Total	266.0	230.0	260.0	169.0	6.0	0.0	2.0	13.0	0.0	10.0	447.0	410.0
											Annual = 1,813.0 mm		
1981	1-10	72.0	59.0	112.0	53.0	127.0	12.0	6.0	0.0	9.0	3.0	0.0	72.0
	11-20	59.0	57.0	36.0	25.0	0.0	33.0	27.0	0.0	38.0	0.0	100.0	37.0
	21-31	143.0	27.0	111.0	49.0	0.0	102.0	0.0	14.0	0.0	44.0	73.0	99.0
	Total	274.0	143.0	259.0	127.0	127.0	147.0	33.0	14.0	47.0	47.0	173.0	208.0
											Annual = 1,599.0 mm		
1982	1-10	81.0	118.0	140.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.0
	11-20	58.0	58.0	121.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85.0
	21-31	53.0	76.0	65.0	88.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	185.0
	Total	192.0	252.0	326.0	158.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	319.0
											Annual = 1,247.0 mm		
1983	1-10	126.0	118.0	60.0	96.0	100.0	0.0	0.0	0.0	0.0	0.0	130.0	49.0
	11-20	109.0	75.0	103.0	56.0	128.0	6.0	0.0	0.0	0.0	86.0	33.0	0.0
	21-31	92.0	244.0	96.0	50.0	97.0	0.0	0.0	0.0	0.0	47.0	142.0	226.0
	Total	327.0	437.0	259.0	202.0	325.0	6.0	0.0	0.0	0.0	133.0	305.0	275.0
											Annual = 2,269.0 mm		
Naudikan													
1972	1-10	90.67	70.17	132.00	16.67	64.67	0.00	0.00	0.00	0.00	0.00	21.67	105.00
	11-20	90.67	70.17	132.00	16.67	64.67	0.00	0.00	0.00	0.00	0.00	21.67	105.00
	21-31	90.67	70.17	132.00	16.67	64.67	0.00	0.00	0.00	0.00	0.00	21.67	105.00
	Total	272.0	210.5	396.0	50.0	194.0	0.0	0.0	0.0	0.0	0.0	65.0	315.0
											Annual = 1,502.5 mm		
1973	1-10	68.17	127.00	77.67	45.17	55.17	5.50	9.83	5.50	11.00	8.00	26.83	57.17
	11-20	68.17	127.00	77.67	45.17	55.17	5.50	9.83	5.50	11.00	8.00	26.83	57.17
	21-31	68.17	127.00	77.67	45.17	55.17	5.50	9.82	5.50	11.00	8.00	26.33	57.17
	Total	204.5	381.0	233.0	135.5	165.5	16.5	29.5	16.5	33.0	24.0	80.5	171.5
											Annual = 1,491.0 mm		
1974	1-10	74.83	140.00	90.33	96.50	56.83	2.83	15.33	7.33	13.17	67.33	47.33	82.50
	11-20	74.83	140.00	90.33	96.50	56.83	2.83	15.33	7.33	13.17	67.33	47.33	82.50
	21-31	74.83	140.00	90.33	96.50	56.83	2.83	15.33	7.33	13.17	67.83	47.83	82.50
	Total	224.5	420.0	271.0	289.5	170.5	8.5	46.0	22.0	39.5	203.5	143.5	247.5
											Annual = 2,085.0 mm		
1975	1-10	111.50	115.00	129.33	184.50	103.33	0.00	6.33	0.00	19.50	89.33	54.33	92.83
	11-20	111.50	115.00	129.33	184.50	103.33	0.00	6.33	0.00	19.50	89.33	54.33	92.83
	21-31	111.50	115.00	129.33	184.50	103.33	0.00	6.33	0.00	19.50	89.33	54.33	92.83
	Total	334.5	345.0	388.0	553.5	310.0	0.0	19.0	0.0	58.5	268.0	163.0	278.5
											Annual = 2,713.0 mm		

Table HY-1.11 (5) 10-DAY BASIN RAINFALL (Unit : m^3/s)

Year		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Blobo													
1978	1-10	30.45	16.50	15.95	12.70	13.45	22.70	21.40	7.70	7.70	11.80	12.50	22.45
	11-20	20.10	19.55	18.25	12.30	21.80	18.65	12.45	7.95	7.25	7.05	18.55	18.40
	21-31	19.55	16.63	16.98	9.70	18.65	18.90	9.87	6.02	6.90	9.66	15.70	19.34
	Mean	23.24	17.63	17.06	11.57	17.99	20.08	14.42	7.18	7.28	9.51	15.58	20.04
											Annual =		477.08 MCM
1979	1-10	18.45	28.15	25.55	19.75	27.65	29.90	11.65	8.05	5.50	4.95	9.15	16.15
	11-20	30.45	26.25	23.05	26.50	19.70	15.05	11.40	6.40	5.55	4.65	7.45	11.50
	21-31	37.53	21.36	25.60	21.10	26.29	12.55	7.41	5.88	6.70	6.53	11.95	18.16
	Mean	29.11	25.53	24.76	22.45	24.60	19.17	10.06	6.75	5.92	5.41	9.52	15.36
											Annual =		520.50 MCM
1980	1-10	16.10	14.90	14.85	10.30	9.85	5.10	4.70	4.80	3.70	3.50	6.55	20.50
	11-20	19.20	12.90	14.85	14.50	5.65	4.90	4.70	4.45	3.35	5.20	10.05	11.75
	21-31	20.65	16.90	14.75	16.50	7.73	4.75	4.72	4.10	3.35	5.20	16.25	17.46
	Mean	18.71	14.83	14.81	13.77	7.74	4.92	4.71	4.44	3.47	4.65	10.95	16.60
											Annual =		314.91 MCM
1981	1-10	31.95	15.50	12.45	12.90	11.60	5.65	9.40	5.65	4.75	9.65	7.00	22.10
	11-20	19.75	14.90	11.90	8.55	12.20	8.80	15.40	3.95	5.00	8.20	11.75	20.40
	21-31	13.13	19.11	14.06	11.35	6.77	13.75	7.26	4.69	11.95	6.35	22.50	15.50
	Mean	21.34	16.32	12.84	10.93	10.08	9.40	10.58	4.76	7.23	8.01	13.75	19.21
											Annual =		379.10 MCM
1982	1-10	33.00	29.35	27.45	20.00	10.30	7.05	6.00	5.70	4.05	3.95	4.00	9.35
	11-20	25.75	37.60	27.00	17.20	8.45	6.35	6.10	4.90	4.55	3.70	5.25	13.70
	21-31	16.27	21.40	13.99	19.25	7.70	5.85	7.11	4.44	4.35	3.65	4.10	13.28
	Mean	24.72	30.02	22.53	18.82	8.78	6.42	6.43	4.99	4.32	3.76	4.45	12.15
											Annual =		384.05 MCM
1983	1-10	25.30	30.80	17.25	23.90	22.25	10.35	9.00	4.45	3.70	4.00	17.85	9.75
	11-20	30.50	20.55	19.25	18.25	17.95	10.40	9.25	4.45	3.45	9.00	15.10	8.95
	21-31	16.63	21.86	0.00	24.95	17.95	7.15	6.47	4.15	4.00	17.91	21.00	20.70
	Mean	23.90	24.59	11.77	22.37	19.34	9.30	8.18	4.34	3.72	10.55	17.98	13.38
											Annual =		442.78 MCM
Cluserit													
1977	1-10	8.37	8.14	9.07	14.88	9.30	7.32	0.00	0.00	0.00	0.00	0.00	0.00
	11-20	8.14	11.04	9.65	11.27	8.48	7.32	0.00	0.00	0.00	0.00	0.00	0.00
	21-31	9.65	10.69	11.74	10.46	8.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	8.75	9.90	10.20	12.20	8.71	4.88	0.00	0.00	0.00	0.00	0.00	0.00
											Annual =		142.32 MCM
1978	1-10	18.25	14.99	18.36	22.66	21.62	0.00	0.00	28.24	26.62	24.76	18.71	25.45
	11-20	17.55	14.99	21.74	21.39	25.92	0.00	28.94	27.20	26.15	21.97	24.99	20.22
	21-31	15.34	16.04	22.90	21.97	28.24	0.00	31.15	25.45	24.29	19.88	21.74	22.55
	Mean	16.99	15.29	21.06	22.01	25.36	0.00	20.39	26.91	25.69	22.13	21.81	22.73
											Annual =		633.84 MCM
1979	1-10	24.06	26.62	23.25	25.45	28.36	24.41	18.25	0.00	0.00	0.00	0.00	0.00
	11-20	28.24	27.43	22.20	24.06	21.85	19.53	18.02	0.00	0.00	0.00	0.00	0.00
	21-31	27.08	26.85	25.92	25.22	24.06	19.76	18.02	0.00	0.00	0.00	0.00	0.00
	Mean	26.48	26.97	23.86	24.91	24.73	21.23	18.09	0.00	0.00	0.00	0.00	0.00
											Annual =		434.40 MCM
1980	1-10	17.55	16.74	19.41	23.48	18.95	15.34	14.65	13.48	11.86	10.23	17.87	21.15
	11-20	14.65	17.73	20.81	20.46	16.39	15.11	14.41	13.25	7.44	10.00	10.93	13.37
	21-31	14.76	18.02	23.25	18.25	16.16	14.41	13.95	13.72	10.34	14.65	18.02	16.39
	Mean	15.62	17.50	21.22	20.73	17.13	14.95	14.32	13.49	9.88	11.72	15.54	16.95
											Annual =		498.11 MCM
1981	1-10	56.02	19.53	18.60	13.95	12.79	13.95	19.53	19.41	11.86	16.39	22.20	43.35
	11-20	24.99	20.57	14.53	11.62	32.43	21.04	36.03	19.18	10.00	13.25	28.71	40.80
	21-31	17.43	18.71	15.34	18.60	18.83	15.92	25.45	18.02	14.76	30.80	37.89	33.71
	Mean	32.32	19.67	16.13	14.72	21.27	18.64	26.95	18.84	12.21	20.49	29.60	39.11
											Annual =		711.42 MCM
1982	1-10	40.45	29.75	30.10	23.13	16.16	13.25	10.93	11.04	9.76	8.37	8.25	10.93
	11-20	31.03	36.15	29.37	22.08	13.95	13.37	10.81	10.58	9.41	8.37	8.83	12.44
	21-31	26.15	26.33	22.90	20.69	13.60	11.16	10.58	10.34	9.41	8.25	8.25	15.23
	Mean	32.34	31.07	27.47	21.97	14.54	12.59	10.77	10.64	9.53	8.33	8.44	12.94
											Annual =		524.73 MCM

Table HY-1.11 (6) 10-DAY BASIN RAINFALL

(Unit : m^3/s)

Year		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Matro.													
1978	1-10	23.52	9.91	13.08	10.93	11.16	12.27	14.30	9.80	9.66	7.41	9.10	11.50
	11-20	11.25	13.41	11.79	11.09	12.16	12.76	11.64	9.12	8.33	8.25	9.55	10.04
	21-31	10.58	17.31	11.81	10.60	11.79	13.37	11.09	8.51	8.06	9.30	9.08	11.05
	Mean	14.97	13.27	12.21	10.87	11.71	12.81	12.46	9.12	8.68	8.35	9.24	10.87
											Annual = 353.43 MCM		
1979	1-10	13.31	18.80	14.56	15.71	16.40	17.63	11.67	11.25	10.42	8.78	11.72	10.19
	11-20	17.95	18.16	14.81	14.05	14.77	13.66	12.04	11.19	10.29	8.48	9.74	10.54
	21-31	23.84	14.95	15.47	14.70	18.41	11.22	10.66	10.14	9.41	9.96	9.89	13.71
	Mean	18.54	17.47	14.96	14.82	16.59	14.17	11.43	10.84	10.04	9.10	10.45	11.55
											Annual = 419.65 MCM		
1980	1-10	11.78	12.23	12.49	11.52	10.74	9.70	9.42	8.83	8.25	7.98	8.98	17.46
	11-20	16.84	11.54	12.02	11.87	9.81	9.06	9.09	8.78	8.43	9.05	10.95	13.33
	21-31	13.70	15.11	11.33	12.16	10.49	8.86	8.62	8.52	7.98	8.74	14.68	13.37
	Mean	14.09	12.89	11.93	11.85	10.35	9.21	9.03	8.70	8.22	8.59	11.54	14.68
											Annual = 345.32 MCM		
1981	1-10	15.94	11.43	13.19	12.23	13.16	10.60	0.00	0.00	0.00	0.00	0.00	0.00
	11-20	13.57	11.70	13.96	10.45	11.97	10.94	0.00	0.00	0.00	0.00	0.00	0.00
	21-31	11.12	15.35	11.61	12.32	12.42	12.28	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	13.47	12.65	12.88	11.67	12.51	11.27	0.00	0.00	0.00	0.00	0.00	0.00
											Annual = 194.13 MCM		
Karanakates.													
1978	1-10	95.08	61.39	73.29	72.63	62.67	134.15	138.68	56.87	63.58	58.73	69.13	103.01
	11-20	71.82	66.41	88.61	63.59	101.77	117.04	72.49	62.34	57.73	57.79	91.88	84.75
	21-31	61.36	66.59	93.87	64.35	79.56	104.56	79.64	56.56	55.77	63.10	82.33	87.80
	Mean	75.61	64.67	85.53	66.86	81.28	118.58	96.38	58.52	59.03	59.98	81.11	91.72
											Annual = 2,470.86 MCM		
1979	1-10	100.58	143.45	100.24	86.59	132.95	145.06	58.48	50.18	44.67	34.51	47.93	71.62
	11-20	133.48	122.94	94.98	97.30	94.01	79.96	57.07	45.77	40.35	29.60	42.98	62.02
	21-31	152.85	109.93	110.22	100.77	144.12	64.43	50.53	39.32	39.13	38.23	52.67	88.09
	Mean	129.74	126.55	102.08	94.89	124.35	96.48	55.20	45.08	41.38	34.25	47.86	74.37
											Annual = 2,546.99 MCM		
1980	1-10	68.07	72.65	62.31	54.33	65.18	36.54	34.71	34.68	29.31	27.84	31.16	97.74
	11-20	90.79	65.63	66.67	73.75	41.65	34.51	34.70	32.48	26.25	27.55	48.23	53.43
	21-31	90.15	75.85	61.57	92.35	42.21	34.02	35.47	31.40	28.05	33.71	87.67	80.05
	Mean	83.23	71.22	63.45	73.49	49.43	35.06	35.01	33.37	27.87	29.83	55.69	78.78
											Annual = 1,677.07 MCM		
1981	1-10	131.17	72.32	68.93	63.92	64.17	53.81	64.97	48.49	40.13	55.03	40.80	99.18
	11-20	74.38	66.28	63.51	48.58	88.29	55.25	127.74	40.42	38.81	43.41	66.23	121.01
	21-31	66.79	78.87	63.22	70.24	56.68	64.31	61.15	49.82	59.38	48.24	121.90	114.35
	Mean	90.01	72.03	65.16	60.91	69.29	57.79	83.86	46.36	46.11	48.87	76.31	111.60
											Annual = 2,179.03 MCM		
1982	1-10	144.27	103.55	120.45	85.75	51.13	42.65	38.15	41.05	30.04	25.43	23.91	39.19
	11-20	110.04	113.65	124.80	89.79	46.62	39.96	33.33	35.18	30.74	24.09	27.38	60.20
	21-31	92.41	94.80	72.25	87.94	44.92	40.37	46.44	34.79	27.27	23.85	24.24	78.15
	Mean	114.83	106.44	104.75	87.83	47.47	40.99	41.15	37.26	29.35	24.44	25.18	59.82
											Annual = 1,383.69 MCM		
1983	1-10	93.74	100.92	95.17	89.50	133.74	78.32	62.62	40.50	32.69	29.73	63.29	59.85
	11-20	102.04	96.77	79.62	78.25	108.57	68.50	52.11	37.92	29.47	54.36	71.79	56.31
	21-31	62.57	93.70	81.91	110.26	115.96	53.95	40.66	36.40	30.53	70.13	93.58	106.31
	Mean	85.36	98.80	85.45	92.57	119.31	63.59	51.44	38.21	30.90	52.01	76.22	75.20
											Annual = 2,292.56 MCM		
Salorola.													
1978	1-10	12.32	16.23	11.39	11.69	10.33	11.16	10.56	7.79	8.04	7.49	8.11	8.32
	11-20	10.63	12.83	13.41	10.16	10.33	12.32	7.38	7.44	7.43	6.26	7.46	9.53
	21-31	22.13	13.03	14.04	8.62	11.93	11.66	8.61	6.34	6.55	6.33	6.04	11.66
	Mean	15.26	14.10	12.93	10.16	10.90	11.71	9.00	7.16	7.34	6.36	7.20	10.07
											Annual = 321.98 MCM		
1979	1-10	10.32	12.50	15.53	12.74	14.72	11.19	7.78	7.12	5.30	6.06	6.50	6.95
	11-20	20.10	11.54	12.15	12.45	11.35	8.63	7.41	7.00	6.07	5.59	5.30	4.31
	21-31	13.38	12.12	10.52	12.44	12.52	7.37	7.20	6.51	6.70	6.67	5.56	7.07
	Mean	14.66	12.13	12.68	12.54	12.86	9.25	7.45	6.86	6.22	6.12	5.95	6.56
											Annual = 297.34 MCM		

Table HY-1.11 (7) 10-DAY BASIN RAINFALL

(Unit : m^3/s)

Year		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Selorejo													
1980	1-10	7.97	12.86	10.99	10.84	8.96	6.26	5.60	5.51	4.74	4.51	5.41	0.00
	11-20	8.24	11.83	10.67	8.90	7.13	5.79	5.82	5.20	4.95	5.99	0.00	0.00
	21-31	16.62	14.61	9.98	7.36	7.33	5.67	5.35	4.62	4.44	6.07	0.00	0.00
	Mean	11.13	13.05	10.53	9.03	7.79	5.91	5.58	5.09	4.71	5.54	1.80	0.00
											Annual =		210.61 MCM
1981	1-10	16.17	24.87	16.25	12.15	14.52	9.15	8.77	7.18	6.73	9.40	8.85	12.87
	11-20	31.84	15.70	13.43	12.27	12.40	10.04	10.02	6.07	8.06	8.91	11.42	15.65
	21-31	28.32	19.63	11.39	14.78	9.98	10.94	7.85	6.70	11.51	7.43	14.13	15.50
	Mean	25.54	20.10	.13.62	13.07	12.23	10.04	8.85	6.65	8.77	8.54	11.47	14.70
											Annual =		402.34 MCM
1982	1-10	23.92	22.78	22.22	19.84	11.71	9.34	7.90	7.58	6.76	5.97	6.14	7.53
	11-20	28.60	29.98	22.37	14.75	9.94	8.58	7.96	7.37	6.43	6.31	6.51	8.01
	21-31	25.31	24.61	17.02	16.55	9.65	8.17	8.23	7.19	6.42	6.15	6.18	9.62
	Mean	25.92	25.87	20.42	17.05	10.41	8.70	8.05	7.37	6.54	6.14	6.28	8.43
											Annual =		394.39 MCM
1983	1-10	12.73	12.15	11.91	11.73	11.82	8.43	6.62	6.46	5.72	5.88	7.95	7.09
	11-20	10.81	11.15	12.74	10.07	11.66	6.79	6.70	5.72	5.47	6.90	7.17	7.03
	21-31	7.48	12.63	10.42	15.00	10.05	6.04	6.90	5.41	5.48	7.80	10.08	7.33
	Mean	10.25	11.93	11.65	12.27	11.14	7.10	6.75	5.85	5.56	6.89	8.40	7.16
											Annual =		275.08 MCM
Wonorejo													
1979	1-10	0.00	0.00	0.00	0.00	9.21	5.23	0.92	3.07	0.45	0.31	1.26	0.99
	11-20	0.00	0.00	0.00	4.77	5.33	2.28	0.76	0.87	0.43	0.25	0.75	1.42
	21-31	0.00	0.00	0.00	4.51	6.01	1.39	0.61	0.42	0.38	0.61	0.79	2.74
	Mean	0.00	0.00	0.00	3.09	6.82	2.97	0.76	1.42	0.42	0.40	0.93	1.75
											Annual =		49.07 MCM
1980	1-10	0.96	2.17	2.12	2.84	1.33	0.51	0.38	0.45	0.27	0.20	0.32	3.43
	11-20	1.41	1.95	1.26	2.22	0.71	0.48	0.41	0.35	0.19	0.14	1.33	1.33
	21-31	2.22	3.87	1.51	1.39	0.58	0.50	0.45	0.23	0.20	0.85	4.19	1.97
	Mean	1.55	2.62	1.63	2.15	0.88	0.50	0.41	0.36	0.22	0.41	1.95	2.23
											Annual =		39.07 MCM
Bening													
1982	1-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.44
	11-20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	2.74
	21-31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.12	3.41
	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.05	2.24
											Annual =		6.17 MCM
1983	1-10	5.02	6.87	2.39	1.05	5.00	0.00	0.00	0.00	0.00	0.00	1.06	2.07
	11-20	3.52	1.18	3.04	5.58	2.64	0.00	0.00	0.00	0.00	0.06	0.33	0.35
	21-31	0.26	2.20	3.69	4.73	7.60	0.00	0.00	0.00	0.00	0.66	1.23	2.20
	Mean	2.85	3.43	3.22	3.79	5.16	0.00	0.00	0.00	0.00	0.25	0.87	1.56
											Annual =		55.32 MCM
Kedungkan													
1972	1-10	10.3	14.8	14.8	2.2	3.8	2.4	0.5	0.4	0.3	0.3	1.2	6.7
	11-20	10.3	14.8	14.8	2.2	3.8	2.4	0.5	0.4	0.3	0.3	1.2	6.7
	21-31	10.3	14.8	14.8	2.2	3.8	2.4	0.5	0.4	0.3	0.3	1.2	6.7
	Mean	10.3	14.8	14.8	2.2	3.8	2.4	0.5	0.4	0.3	0.3	1.2	6.7
											Annual =		151.46 MCM
1973	1-10	13.3	15.3	22.0	11.0	13.7	1.4	1.5	1.3	0.6	0.4	2.5	10.0
	11-20	13.3	15.3	22.0	11.0	13.7	1.4	1.5	1.3	0.6	0.4	2.5	10.0
	21-31	13.3	15.3	22.0	11.0	13.7	1.4	1.5	1.3	0.6	0.4	2.5	10.0
	Mean	13.3	15.3	22.0	11.0	13.7	1.4	1.5	1.3	0.6	0.4	2.5	10.0
											Annual =		243.79 MCM
1974	1-10	12.9	14.7	18.4	12.5	4.9	0.9	0.7	0.7	0.6	4.7	5.2	6.2
	11-20	12.9	14.7	18.4	12.5	4.9	0.9	0.7	0.7	0.6	4.7	5.2	6.2
	21-31	12.9	14.7	18.4	12.5	4.9	0.9	0.7	0.7	0.6	4.7	5.2	6.2
	Mean	12.9	14.7	18.4	12.5	4.9	0.9	0.7	0.7	0.6	4.7	5.2	6.2
											Annual =		215.23 MCM
1975	1-10	13.3	9.9	11.4	11.5	7.8	1.0	0.9	0.6	1.0	6.2	5.0	0.1
	11-20	13.3	9.9	11.1	11.5	7.8	1.0	0.9	0.6	1.0	6.2	5.0	0.1
	21-31	13.3	9.9	11.1	11.5	7.8	1.0	0.9	0.6	1.0	6.2	5.0	0.1
	Mean	13.3	9.9	11.1	11.5	7.8	1.0	0.9	0.6	1.0	6.2	5.0	0.1
											Annual =		179.31 MCM

Table HY-1.12 THIESEN RATIOS FOR CALIBRATION BASIN

Basin	Rain gauge		Covering area (km^2)	Thiessen ratio
Blobo	1	Batu	159.3	0.174
	2	Singosari	189.1	0.207
	3	Kayutangan	59.8	0.065
	4	Wagir	1.3	0.001
	5	Jabung	133.6	0.146
	6	Tumpang	86.0	0.094
	7	Poncokusumo	104.8	0.114
	8	Tangkil	110.6	0.121
	10	Gondang Legi	5.0	0.005
	11	Kepanjen I	15.6	0.017
	44	Pujon	51.0	0.056
	Total		916.1	1.000
Clumprit	7	Poncokusumo	143.6	0.325
	8	Tangkil	6.1	0.014
	9	Dampit	244.7	0.555
	10	Gondang Legi	46.6	0.106
	Total		441.0	1.000
Metro	1	Batu	62.6	0.232
	3	Kayutangan	13.9	0.052
	4	Wagir	143.7	0.531
	11	Kepanjen I	49.9	0.185
	Total		270.2	1.000
Selorejo	43	Sekar	99.5	0.422
	44	Pujon	136.5	0.578
	Total		236.0	1.000
Wonorejo	24	Tulungagung	3.3	0.076
	30	Bendungan	40.3	0.924
	Total		43.6	1.000
Bening	9	Karangan	89.5	1.000

Table HY-1.13 RAINFALL RATIO

Sub-basin No.	Rainfall ratio	Mean elevation (m,SHVP)	
		Sub-basin	Rainfall station
5	1.2	790	590
7	1.3	850	540
8	1.3	600	330
10	1.2	600	370
21	1.1	350	190
23	1.1	430	250
26	1.2	600	400
27	1.2	1,010	930
56	1.3	1,020	670

Table HY-1.14 NET WATER CONSUMPTION IN DRY SEASON, 1982

		Molek	Mrican	Besuk	Turi Tunggorono	Bandar Jati Mlerek	Gottan Losari	Total
M	I	2.86	0.19	0.19	3.83	0.45	0.67	8.19
	II	1.21	2.58	0	0.01	0	0	3.80
	III	1.63	7.30	0.01	0.15	0	1.60	10.69
A	I	1.56	10.26	0.14	5.66	0.39	2.52	20.53
	II	2.30	10.97	0.32	7.53	0.42	2.18	23.72
	III	1.35	6.67	0.36	7.38	0.58	1.94	18.28
M	I	2.29	6.69	0.44	6.72	0.71	1.65	18.50
	II	1.34	7.97	0.51	7.09	0.85	1.40	19.16
	III	1.74	8.14	0.60	5.66	1.02	1.12	18.28
J	I	1.47	7.99	0.34	3.76	0.50	0.86	14.92
	II	1.13	8.00	0.48	5.69	0.74	0.69	16.73
	III	1.38	7.92	0.50	5.78	0.76	0.72	17.06
J	I	1.41	7.73	0.53	6.18	0.82	0.82	17.49
	II	1.14	7.69	0.53	6.12	0.83	0.80	17.11
	III	1.54	6.78	0.53	5.45	0.81	0.71	15.82
A	I	2.08	7.00	0.48	4.88	0.89	0.90	16.23
	II	2.12	5.42	0.38	3.92	0.78	0.92	13.54
	III	2.12	4.91	0.27	3.10	0.58	0.92	11.90
S	I	1.64	5.74	0.19	2.56	0.42	1.03	11.58
	II	1.59	5.75	0.08	2.15	0.24	1.05	10.86
	III	1.67	5.71	0.03	2.31	0.17	1.08	10.97
O	I	1.64	5.68	0.03	2.50	0.22	1.15	12.02
	II	0.79	5.46	0.03	2.33	0.20	1.15	3.71
	III	1.56	0.27	0.03	2.19	0.16	1.14	5.35
N	I	1.38	4.45	0.03	1.88	0.12	1.05	3.05
	II	2.35	1.39	0.05	1.60	0.14	0.98	6.51
	III	1.41	0.29	0.02	1.30	0.15	0.75	3.92
D	I	1.28	4.61	0.24	0.15	0.45	0.77	7.50
	II	0.77	6.96	0.21	2.02	0.42	0.06	10.44
	III	0.76	8.94	0.28	2.34	0.51	0.78	13.61

TABLE HY-2.1 LIST OF MAJOR FLOOD ALONG THE BRANTAS

Date of Occurrence	Peak Discharge (m^3/sec)					
	Karangkates	Pakel	Kediri	Ploso	Porong	Rainfall(mm)
Apr.25 - 30 '73	-	448	568	743	743	37 /1
May 5 - 11 '73	-	387	694	754	882	46
Jan. 9 - 15 '75	-	525	721	823	-	72
Jan.26 - 31 '75	-	474	699	692	917	56
Feb. 3 - 21 '75	-	485	731	964	972	31
Jan. 5 - 10 '76	419	478	-	842	-	73
Mar. 7 - 14 '76	537	513	685	1,011	1,093	79
Apr. 8 - 12 '76	198	466	530	699	615	3
Jul. 3 - 8 '78	396	466	-	739	744	35
Jan.24 - 27 '79	461	485	641	931	1,190	72
Feb. 7 - 10 '79	256	-	668	788	901	59
May 5 - 9 '79	231	485	667	990	1,134	71
Jan. 6 - 8 '81	1,179	541	510	830	987	80
Dec.14 - 16 '81	538	700	621	821	789	44
Jan. 6 - 12 '82	266	716	631	839	852	54
Feb. 3 - 8 '84	396	539	903	1,227	1,419	-
Mar. 2 - 5 '84	426	1,096	1,022	1,089	1,282	61
Apr.13 - 16 '84	447	758	979	1,230	1,470	90

/1 This value means the largest 3-Day basin mean rainfall during flood upstream of Porong.

Table HY-2.20 ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

STATION

YEAR	K.KATES DATE	1-DAY	3-DAY	WLINGI DATE	1-DAY	3-DAY	LODOYO DATE	1-DAY	3-DAY	PAKEL DATE	1-DAY	3-DAY	C.17 DATE	1-DAY	3-DAY
1960	23 30 MAR	65	70	23 25 MAR	65	55	24 26 MAR	66	72	24 26 MAR	69	73	24 26 MAR	69	73
1961	7 9 FEB	45	104	2 4 JAN	50	119	2 4 JAN	49	117	2 4 JAN	46	110	2 4 JAN	48	108
1962	1 3 DEC	128	156	1 3 DEC	117	147	1 3 DEC	118	149	1 3 DEC	111	128	1 3 DEC	110	121
1963	14 16 DEC	56	94	15 17 DEC	37	87	14 16 DEC	58	97	14 16 DEC	56	92	14 16 JAN	55	90
1964	10 12 NOV	56	103	3 5 OCT	59	135	3 5 OCT	58	135	3 5 OCT	57	140	3 5 OCT	59	151
1965	7 9 APR	36	40	4 6 MAR	32	51	20 22 JAN	32	63	20 22 JAN	27	63	20 22 JAN	32	63
1966	24 26 FEB	45	97	24 26	49	95	24 26 FEB	50	97	24 26 FEB	49	94	24 26 FEB	49	94
1967	2 4 JAN	67	123	2 4 JAN	59	112	2 4 JAN	59	112	1 3 JAN	59	112	2 4 JAN	59	108
1968	6 8 JAN	46	78	4 6 JAN	47	78	4 6 JAN	47	80	5 7 JAN	46	77	5 7 JAN	48	77
1969	25 27 FEB	49	80	26 28	44	73	24 26 MAR	42	87	14 16 DEC	41	76	30 1 MAR	41	78
1970	20 22 JAN	46	90	20 22 JAN	42	80	20 22 JAN	42	81	20 22 JAN	40	75	20 22 JAN	41	77
1971	18 20 JAN	60	75	12 14 JAN	35	65	18 20 NOV	34	74	18 20 NOV	37	98	18 20 NOV	38	98
1972	6 8 MAR	32	62	6 8 MAR	39	72	6 8 MAR	38	71	6 8 MAR	34	68	6 8 MAR	33	67
1973	18 20 APR	41	69	18 20 APR	37	65	18 20 MAR	36	65	13 15 MAR	35	59	13 15 MAR	35	59
1974	6 8 NOV	42	85	19 21 NOV	50	77	19 21 NOV	48	78	19 21 NOV	43	69	6 8 NOV	42	71
1975	28 30 OCT	68	99	27 29 OCT	63	85	10 12 SEP	45	110	28 30 OCT	58	95	10 12 SEP	43	104
1976	1 3 MAR	62	90	12 14 NOV	39	65	1 3 MAR	38	78	8 10 MAR	37	74	8 10 MAR	36	73
1977	18 20 JAN	48	95	18 20 JAN	46	93	18 20 JAN	46	91	18 20 JAN	44	87	18 20 JAN	45	86
1978	1 3 JAN	74	122	1 3 JAN	72	127	1 3 JAN	70	128	1 3 JAN	66	120	1 3 JAN	66	120
1979	28 30 NOV	42	51	24 26 JAN	41	75	24 26 JAN	42	77	24 26 JAN	47	77	24 26 JAN	46	77
1980	21 23 DEC	35	65	1 3 DEC	35	69	1 3 DEC	34	70	1 3 DEC	33	67	4 6 DEC	33	56
1981	6 8 JAN	51	96	6 8 JAN	51	90	6 8 JAN	49	98	6 8 JAN	45	98	6 8 JAN	45	98
1982	12 14 FEB	52	81	12 14 FEB	47	75	12 24 FEB	46	71	12 14 FEB	46	68	12 14 FEB	46	62
1983	27 29 DEC	50	96	27 29 DEC	44	98	27 29 DEC	44	99	27 29 DEC	42	92	27 29 DEC	41	90

STATION

YEAR	P.16 DATE	1-DAY	3-DAY	C.21 DATE	1-DAY	3-DAY	C.22 DATE	1-DAY	3-DAY	C.23 DATE	1-DAY	3-DAY	C.26 DATE	1-DAY	3-DAY
1960	27 29 NOV	49	70	1 3 MAR	48	72	1 3 JAN	53	79	1 3 JAN	48	73	1 3 JAN	49	73
1961	2 3 JAN	46	104	2 4 JAN	42	96	2 4 JAN	42	94	1 3 JAN	39	87	2 4 JAN	39	86
1962	2 3 DEC	107	136	2 4 DEC	100	132	2 4 DEC	99	130	2 4 DEC	93	123	2 4 DEC	89	118
1963	15 17 DEC	53	81	14 16 DEC	49	82	1 3 FEB	48	71	15 7 DEC	45	69	14 16 DEC	48	74
1964	3 5 OCT	61	136	2 4 NOV	50	140	3 5 OCT	67	151	3 5 DEC	62	136	3 5 OCT	61	131
1965	3 5 FEB	31	65	3 5 FEB	28	69	3 5 FEB	37	76	3 5 FEB	33	71	3 5 FEB	35	72
1966	24 26 FEB	48	92	24 26 JAN	45	88	24 26 FEB	44	89	24 26 FEB	42	84	24 26 FEB	40	80
1967	2 4 FEB	58	105	2 4 JAN	55	101	2 4 JAN	56	107	2 4 JAN	54	103	2 4 JAN	51	99
1968	5 7 JAN	45	75	14 16 OCT	42	74	5 7 JAN	41	78	14 16 DEC	39	74	14 16 DEC	38	74
1969	24 26 MAR	40	80	22 24 JAN	41	82	22 24 JAN	39	83	22 24 JAN	36	77	30 1 MAR	40	80
1970	20 22 JAN	42	76	24 26 DEC	43	89	20 22 JAN	50	83	20 22 JAN	46	78	19 21 JAN	45	81
1971	18 20 NOV	39	99	18 20 NOV	41	100	18 20 NOV	43	111	18 20 NOV	42	102	18 20 NOV	41	101
1972	6 8 MAR	32	85	2 3 JAN	29	65	6 8 MAR	32	79	6 8 NOV	29	63	6 8 MAR	30	76
1973	18 20 APR	36	58	23 25 FEB	33	64	23 25 FEB	35	71	23 25 FEB	33	66	23 25 FEB	32	65
1974	22 24 FEB	42	68	26 28 FEB	39	68	6 8 NOV	38	67	22 24 FEB	26	57	22 24 FEB	35	67
1975	10 12 SEP	55	102	9 11 JAN	51	94	9 11 JAN	52	99	9 11 JAN	48	95	9 11 JAN	46	94
1976	8 10 MAR	35	72	1 3 MAR	33	71	8 10 MAR	33	74	1 3 MAR	30	67	8 10 MAR	31	71
1977	18 20 JAN	42	83	18 20 JAN	39	69	18 20 JAN	45	87	18 20 JAN	39	80	18 20 JAN	41	83
1978	3 5 JAN	61	96	1 3 JAN	56	109	1 3 JAN	54	108	1 3 JAN	51	102	1 3 JAN	49	99
1979	24 26 JAN	46	80	5 7 NOV	45	74	24 26 JAN	52	92	24 26 JAN	43	82	24 26 JAN	42	79
1980	4 6 DEC	32	67	3 5 DEC	32	65	3 5 DEC	33	71	4 6 DEC	31	66	4 6 DEC	31	65
1981	6 8 JAN	44	97	6 8 JAN	45	96	6 8 JAN	48	94	6 8 JAN	48	96	6 8 NOV	49	96
1982	12 14 FEB	45	67	5 7 FEB	45	65	17 19 JAN	47	70	18 20 DEC	46	68	18 20 DEC	45	66
1983	27 29 DEC	42	91	27 30 DEC	41	89	27 29 DEC	44	93	27 29 DEC	41	89	27 29 DEC	40	87

STATION

YEAR	C.27 DATE	1-DAY	3-DAY	C.31 DATE	1-DAY	3-DAY	C.32 DATE	1-DAY	3-DAY	C.35 DATE	1-DAY	3-DAY	C.36 DATE	1-DAY	3-DAY
1960	22 24 MAR	49	71	1 3 MAR	50	77	1 3 JAN	57	82	1 3 MAR	56	81	1 3 MAR	55	80
1961	2 4 JAN	39	83	1 3 JAN	39	79	17 19 FEB	44	94	17 19 FEB	45	92	17 19 FEB	44	90
1962	2 4 DEC	85	115	2 4 DEC	81	106	2 4 DEC	69	94	1 3 DEC	67	88	21 23 JAN	65	86
1963	1 3 FEB	49	73	3 5 MAR	30	67	1 3 FEB	50	70	3 5 MAR	48	68	1 3 FEB	47	66
1964	3 5 OCT	60	127	2 4 MAR	38	120	3 5 OCT	53	115	2 4 MAR	52	110	3 5 OCT	51	119
1965	3 5 FEB	37	71	4 6 FEB	33	61	2 4 FEB	34	65	3 5 FEB	34	63	2 4 FEB	34	63
1966	14 16 MAR	38	90	14 16 MAR	39	91	14 16 MAR	39	89	14 16 MAR	38	86	14 16 MAR	38	84
1967	2 4 JAN	49	95	2 4 JAN	49	95	2 4 JAN	46	81	2 4 JAN	40	78	2 4 JAN	39	75
1968	5 7 JAN	38	66	14 16 DEC	33	70	5 7 FEB	32	63	5 7 FEB	31	63	25 27 MAR	32	65
1969	26 28 MAR	39	75	22 24 JAN	38	71	22 24 JAN	37	77	22 24 JAN	36	75	22 24 JAN	36	74
1970	19 21 JAN	43	82	21 23 JAN	42	80	19 21 JAN	36	71	24 26 DEC	35	73	24 26 DEC	34	72
1971	18 20 NOV	40	99	12 14 JAN	37	66	18 10 NOV	38	94	18 20 NOV	37	92	18 20 NOV	36	95
1972	12 14 JAN	28	56	6 8 MAR	28	70	6 8 MAR	32	82	3 5 JAN	27	57	6 8 MAR	27	58
1973	13 15 MAR	32	51	23 25 FEB	31	61	23 25 FEB	35	62	23 25 FEB	30	61	1 3 MAR	30	66
1974	22 24 FEB	33	77	26 28 FEB	24	65	22 24 FEB	28	61	26 28 FEB	27	61	26 28 FEB	29	65
1975	9 11 JAN	44	92	9 11 JAN	35	88	23 25 OCT	42	80	10 12 JAN	33	75	9 11 JAN	40	78
1976	5 7 JAN	29	68	1 3 MAR	30	94	1 3 MAR	47	98	1 3 MAR	46	96	1 3 MAR	45	94
1977	18 20 JAN	42	84	18 20 JAN	44	89	18 20 JAN	42	85	18 20 JAN	41	84	18 20 JAN	40	83
1978	1 3 JAN	45	95	1 3 JAN	42	87	1 3 JAN	36	78	1 3 JAN	35	78	1 3 JAN	34	79
1979	24 26 JAN	40	79	24 26 JAN	38	77	24 26 JAN	35	76	24 26 JAN	36	74	24 26 JAN	37	73
1980	20 22 JAN	30	59	3 5 DEC	32	68	20 22 FEB	34	67	20 22 FEB	34	67	20 22 FEB	35	67
1981	6 8 JAN	50	93	6 8 JAN	51	94	6 8 JAN	47	87	6 8 JAN	47	86	6 8 JAN	46	85
1982	17 19 DEC	42	62	24 26 DEC	38	61	24 26 DEC	36	69	24 26 DEC	35	68	24 26 DEC	35	68
1983	27 29 DEC	39	85	27 29 DEC	38	82		38	75	27 29 DEC	37	73	24 29 DEC	36	72

Table HY-2.2(2) ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

STATION

YEAR	LENGKONG DATE	1-DAY	3-DAY	PORONG DATE	1-DAY	3-DAY	C.15 DATE	1-DAY	3-DAY	C.20 DATE	1-DAY	3-DAY	C.25 DATE	1-DAY	3-DAY
1960	1 3 MAR	31	81	1 3 JAN	49	72	27 29 NOV	75	94	1 3 MAR	65	94	2 4 MAR	68	98
1961	17 19 FEB	45	92	17 19 FEB	43	86	2 4 JAN	77	135	3 5 MAR	52	69	2 4 FEB	52	82
1962	21 23 JAN	60	88	2 4 DEC	57	81	20 22 JAN	78	128	20 22 JAN	52	105	6 8 JAN	51	118
1963	1 3 FEB	46	68	1 3 FEB	44	42	3 5 MAR	59	90	5 7 JAN	53	90	1 3 FEB	97	138
1964	2 4 MAR	50	109	2 4 MAR	47	100	4 6 OCT	52	136	4 6 OCT	104	192	2 4 MAR	69	135
1965	2 4 FEB	38	72	2 4 FEB	36	67	27 29 MAR	70	122	3 5 FEB	78	125	2 4 FEB	61	85
1966	14 16 MAR	39	83	13 15 FEB	36	81	16 18 MAR	107	160	1 3 JAN	88	112	14 16 MAR	67	129
1967	2 4 JAN	38	77	2 4 JAN	36	71	2 4 DEC	49	125	21 23 FEB	57	103	8 10 JAN	73	93
1968	5 7 FEB	32	72	5 7 FEB	30	67	4 6 DEC	50	141	20 22 OCT	91	146	29 31 MAR	39	81
1969	22 24 JAN	35	76	22 24 JAN	33	70	3 5 NOV	73	127	24 26 JAN	73	121	20 22 JAN	70	122
1970	20 22 JAN	32	88	24 26 DEC	30	65	24 26 DEC	60	84	19 21 JAN	70	127	12 14 JAN	39	98
1971	18 20 NOV	37	86	18 20 NOV	34	67	18 20 NOV	83	169	18 20 NOV	78	135	18 20 JAN	65	100
1972	6 8 MAR	30	73	6 8 MAR	25	60	24 26 DEC	56	87	6 8 MAR	46	106	7 9 MAR	56	102
1973	1 3 MAR	29	64	23 25 FEB	22	55	28 30 OCT	84	115	24 26 FEB	52	107	4 6 FEB	65	99
1974	26 28 FEB	30	82	26 28 FEB	29	58	26 28 FEB	85	90	11 13 MAR	105	110	27 29 JAN	60	88
1975	23 25 DEC	37	73	9 11 JAN	35	68	9 11 JAN	85	208	12 14 DEC	52	116	18 20 APR	111	129
1976	1 3 MAR	53	104	1 3 MAR	51	97	21 23 NOV	85	160	9 11 MAR	49	113	5 7 JAN	49	95
1977	18 20 JAN	42	87	18 20 JAN	39	81	7 9 APR	64	130	10 12 OCT	55	98	18 20 JAN	78	150
1978	1 3 JAN	31	80	1 3 JAN	30	74	4 6 JAN	81	153	1 3 JAN	40	69	16 18 JAN	58	93
1979	5 7 MAR	41	78	24 26 JAN	38	71	24 26 JAN	81	103	5 7 MAR	46	108	8 10 FEB	72	110
1980	20 22 FEB	55	68	20 22 FEB	33	64	16 18 NOV	57	102	21 23 JAN	61	89	21 23 FEB	72	107
1981	6 8 JAN	44	80	6 8 JAN	42	80	6 8 JAN	45	83	6 8 JAN	51	89	6 8 JAN	65	73
1982	24 26 DEC	34	67	24 26 DEC	32	63	8 10 JAN	50	78	24 26 OCT	39	88	9 11 JAN	59	97
1983	28 30 DEC	35	71	27 29 DEC	33	66	10 12 FEB	74	93	2 4 JAN	41	92	29 31 APR	90	93

STATION

YEAR	SELOREJO DATE	1-DAY	3-DAY	C.30 DATE	1-DAY	3-DAY	C.40 DATE	1-DAY	3-DAY	F.81 DATE	1-DAY	3-DAY	C.65 DATE	1-DAY	3-DAY
1960	22 24 FEB	89	187	22 24 FEB	88	115	24 26 FEB	99	107	1 3 JAN	81	105	1 3 JAN	85	106
1961	2 4 JAN	110	142	18 20 JAN	58	116	7 9 JAN	74	167	17 19 JAN	61	120	17 19 FEB	65	128
1962	23 25 JAN	116	194	21 23 JAN	65	119	23 25 NOV	76	129	21 23 JAN	53	90	21 23 JAN	74	97
1963	17 19 JAN	76	154	12 14 DEC	92	123	7 9 APR	93	139	23 25 DEC	42	53	16 18 MAR	50	65
1964	11 13 OCT	61	106	1 3 MAR	54	100	2 4 MAR	91	136	22 24 DEC	79	96	1 3 NOV	74	142
1965	21 23 JAN	67	121	21 23 JAN	41	82	7 9 DEC	49	109	17 19 DEC	55	48	21 23 DEC	35	54
1966	13 15 FEB	53	114	14 16 MAR	48	108	11 13 APR	81	135	28 30 JAN	42	66	13 15 FEB	54	103
1967	25 27 JAN	70	108	23 27 JAN	50	106	1 3 DEC	61	106	1 3 APR	58	87	1 4 APR	63	95
1968	28 30 JAN	80	94	28 30 JAN	61	70	14 16 DEC	58	110	3 5	58	74	17 19 MAR	61	95
1969	24 26 JAN	51	67	11 13 MAR	44	81	15 17 DEC	61	110	22 24 JAN	46	95	13 15 JAN	84	110
1970	17 19 MAR	69	111	19 21 JAN	48	80	10 12 JAN	79	127	24 26 DEC	57	70	5 7 FEB	57	115
1971	10 12 FEB	69	126	12 14 JAN	51	91	27 29 OCT	94	156	18 20 NOV	59	91	14 16 FEB	60	101
1972	6 8 MAR	55	118	6 8 MAR	46	92	15 17 DEC	69	98	6 8 MAR	68	128	5 7 JAN	48	105
1973	1 3 MAR	62	97	1 3 MAR	36	58	13 15 FEB	59	87	11 13 JAN	69	81	12 14 FEB	47	83
1974	11 13 JAN	86	149	11 13 JAN	58	106	15 17 NOV	101	131	9 11 DEC	47	88	9 11 DEC	49	95
1975	11 13 JAN	58	87	11 13 JAN	42	94	3 5 FEB	62	95	27 31 MAR	55	104	29 31 MAR	64	107
1976	1 3 MAR	57	125	9 11 MAR	55	85	11 13 FEB	67	89	5 7 JAN	51	92	21 23 NOV	51	97
1977	18 20 JAN	111	157	18 20 JAN	73	124	29 31 DEC	105	112	23 25 DEC	50	153	23 25 DEC	55	106
1978	26 28 JAN	57	113	26 28 JAN	38	95	12 14 JAN	78	139	27 31 DEC	67	110	29 31 DEC	66	154
1979	26 28 DEC	46	79	8 10 FEB	41	80	8 10 JAN	78	163	11 13 APR	44	84	24 26 FEB	41	78
1980	22 24 JAN	79	112	22 24 JAN	44	83	3 5 DEC	57	109	20 22 FEB	48	103	20 22 FEB	31	104
1981	6 8 JAN	73	122	6 8 JAN	55	97	14 16 JAN	119	164	26 28 JAN	47	67	26 28 JAN	46	71
1982	5 7 JAN	78	131	5 7 JAN	53	85	DEC	161	226	24 26 DEC	65	92	24 26 DEC	69	101
1983	12 14 JAN	105	114	7 9 JAN	57	84	19 21 JAN	91	102	26 28 JAN	39	66	31 2 JAN	48	73

STATION

YEAR	C.66 DATE	1-DAY	3-DAY	C.72 DATE	1-DAY	3-DAY	C.75 DATE	1-DAY	3-DAY	F.76 DATE	1-DAY	3-DAY	C.86 DATE	1-DAY	3-DAY
1960	1 3 JAN	85	105	1 3 JAN	84	98	1 3 JAN	87	100	1 2 JAN	88	102	1 3 JAN	88	112
1961	17 19 FEB	63	128	17 19 FEB	70	143	17 19 FEB	65	155	17 19 FEB	62	156	17 19 FEB	67	113
1962	21 23 JAN	74	99	21 23 JAN	76	94	21 23 JAN	72	98	21 23 JAN	77	114	21 23 JAN	71	124
1963	16 18 MAR	50	62	17 19 MAR	64	70	15 17 FEB	56	69	16 18 JAN	59	62	16 18 MAR	57	68
1964	1 3 MAR	74	140	1 3 MAR	80	142	1 3 MAR	75	181	22 24 DEC	81	94	1 3 MAR	75	145
1965	15 17 DEC	35	45	15 17 DEC	35	46	21 23 DEC	33	52	21 23 DEC	35	60	21 23 DEC	35	62
1966	13 15 FEB	51	98	13 15 FEB	84	106	13 15 FEB	44	108	28 30 JAN	61	86	28 30 JAN	58	92
1967	1 3 APR	65	93	1 3 DEC	69	96	1 3 DEC	65	95	2 4 DEC	77	94	1 3 APR	74	105
1968	25 27 MAR	62	79	17 19 MAR	62	86	25 27 MAR	59	86	25 27 MAR	88	99	25 27 MAR	74	135
1969	14 16 FEB	84	110	14 16 FEB	86	119	14 16 FEB	82	118	22 24 JAN	81	152	22 24 JAN	77	117
1970	5 7 FEB	57	109	5 7 FEB	53	98	5 7 FEB	50	95	4 6 MAR	51	92	5 7 FEB	65	120
1971	14 16 FEB	60	89	14 16 FEB	41	92	14 16 FEB	41	93	25 27 MAR	70	84	8 10 MAR	62	87
1972	6 8 MAR	50	136	6 8 MAR	53	137	5 7 JAN	66	99	6 8 MAR	49	177	6 8 MAR	65	147
1973	1 3 MAR	47	84	10 12 FEB	50	91	10 12 FEB	31	87	25 27 APR	31	91	1 3 MAR	63	89
1974	9 11 DEC	50	94	9 11 DEC	51	90	9 11 DEC	46	88	9 11 DEC	50	96	9 11 DEC	54	110
1975	29 31 MAR	65	109	29 31 MAR	60	105	29 31 MAR	61	107	29 31 MAR	67	113	29 31 MAR	82	119
1976	21 23 NOV	51	99	1 3 MAR	50	112	1 3 MAR	65	107	9 11 MAR	50	107	21 23 NOV	88	120
1977	23 25 DEC	53	104	23 25 DEC	58	107	23 25 DEC	57	104	3 5 JAN	81	105	23 25 DEC	61	106
1978	29 31 DEC	67	155	29 31 DEC	77	189	29 31 DEC	75	174	29 31 DEC	88	197	29 31 DEC	88	141
1979	24 26 APR	48	86	10 12 APR	49	99	13 15 APR	63	94	21 23 JAN	50	82	24 26 APR	74	117
1980	20 22 FEB	50	99	25 27 NOV	57	112	26 28 NOV	55	105	26 28 NOV	50	105	22 24 DEC	47	85
1981	26 28 JAN	46	73	26 28 JAN	48	72	6 8 JAN	48	65	26 28 JAN	50	79	11 13 NOV	47	86
1982	24 26 DEC	60	100	24 26 DEC	79	118	24 26 DEC	77	121	24 26 DEC	78	119	11 13 JAN	55	96
1983	26 28 FEB	48	76	25 27 DEC	58	90	13 15 JAN	55	77	26 28 FEB	46	95	2 4 MAR	49	76

Table HY-2.2(5) ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

STATION

YEAR	C.67 DATE	C.67 1-DAY	C.67 3-DAY	C.68 DATE	C.68 1-DAY	C.68 3-DAY	C.69 DATE	C.69 1-DAY	C.69 3-DAY	C.70 DATE	C.70 1-DAY	C.70 3-DAY	BENING DATE	BENING 1-DAY	BENING 3-DAY
1960	23 25 MAR	96	115	1 3 JAN	89	117	24 26 DEC	61	93	1 3 JAN	137	141	22 24 MAR	112	137
1961	17 19 FEB	94	144	17 19 FEB	72	109	11 13 APR	49	117	17 19 FEB	78	122	16 18 FEB	114	175
1962	30 2 APR	91	103	21 23 JAN	67	134	21 23 FEB	70	110	21 23 JAN	67	208	28 30 APR	100	101
1963	24 DEC	98	98	14 16 JAN	56	69	22 24 APR	48	70	16 18 JAN	100	111	24 26 DEC	110	119
1964	2 4 MAR	111	159	1 3 MAR	82	139	29 31 DEC	76	133	1 3 MAR	128	158	22 24 DEC	77	128
1965	6 8 APR	59	68	21 23 DEC	36	63	28 30 JAN	40	75	21 23 DEC	57	87	6 8 APR	67	79
1966	13 15 FEB	64	94	28 30 JAN	54	96	14 16 MAR	41	107	28 30 JAN	69	133	13 15 FEB	77	99
1967	13 15 APR	85	107	1 3 APR	69	105	24 26 JAN	59	96	1 3 APR	87	124	25 27 DEC	103	117
1968	17 19 MAR	83	112	25 27 MAR	77	143	25 27 MAR	88	139	25 27 MAR	81	143	17 19 MAR	88	109
1969	22 24 JAN	108	129	22 24 JAN	76	113	8 10 APR	93	153	14 16 FEB	106	183	22 24 JAN	122	126
1970	2 4 MAR	70	128	5 7 FEB	63	126	5 7 FEB	73	176	5 7 FEB	53	120	2 4 MAR	78	144
1971	10 12 MAR	89	111	18 20 NOV	55	97	9 11 MAR	62	116	5 7 FEB	84	118	10 12 MAR	107	132
1972	6 8 MAR	73	188	6 8 MAR	61	137	5 7 MAR	71	133	22 24 MAR	86	152	6 8 MAR	83	193
1973	10 12 FEB	72	117	25 27 APR	41	79	24 26 FEB	61	115	8 10 MAR	68	114	10 12 FEB	83	122
1974	10 12 DEC	75	128	9 11 DEC	51	107	9 11 DEC	52	110	13 15 FEB	76	98	10 12 DEC	85	142
1975	17 19 DEC	76	95	29 31 MAR	86	123	28 30 JAN	82	115	28 30 JAN	94	107	17 19 JAN	92	106
1976	2 4 MAR	76	153	21 23 NOV	73	120	21 23 NOV	78	118	9 11 MAR	78	133	2 4 MAR	91	172
1977	23 25 DEC	83	133	23 25 DEC	59	102	23 25 APR	59	123	3 5 JAN	94	164	23 25 DEC	97	121
1978	29 31 DEC	108	265	15 17 FEB	60	174	30 2 NOV	55	92	15 17 FEB	122	190	29 31 DEC	129	292
1979	10 12 APR	81	144	24 26 APR	86	128	30 1 MAR	76	107	24 26 APR	105	161	10 12 APR	98	174
1970	25 27 NOV	66	155	25 27 NOV	56	94	23 25 DEC	60	99	22 24 JAN	77	104	25 27 NOV	75	171
1981	25 27 JAN	70	83	26 28 JAN	53	86	10 12 MAR	63	74	26 28 JAN	63	97	24 26 JAN	84	86
1982	24 26 DEC	94	135	11 13 JAN	47	108	25 27 JAN	42	103	24 26 DEC	83	122	24 26 DEC	98	150
1983	26 28 FEB	78	127	12 14 MAR	44	82	12 14 MAR	36	54	12 14 MAR	22	165	26 28 FEB	90	135

STATION

YEAR	KUNCIR DATE	KUNCIR 1-DAY	KUNCIR 3-DAY
1960	1 3 JAN	187	171
1961	17 19 FEB	95	110
1962	21 23 JAN	120	269
1963	16 18 JAN	131	155
1964	12 14 JAN	175	175
1965	21 23 DEC	80	103
1966	28 31 JAN	95	179
1967	25 25 FEB	87	163
1968	25 27 MAR	100	185
1969	14 16 FEB	165	204
1970	6 8 MAR	70	132
1971	3 5 FEB	116	151
1972	22 24 MAR	113	209
1973	1 3 DEC	92	151
1974	13 15 FEB	105	139
1975	16 18 FEB	110	126
1976	8 10 MAR	110	150
1977	19 21 FEB	131	210
1978	15 17 FEB	168	236
1979	24 26 APR	148	206
1970	22 24 JAN	106	136
1981	23 25 FEB	85	96
1982	11 13 JAN	90	118
1983	12 14 MAR	118	226

Table HY-2.3 BASE FLOW AT PAKEL/KEDIRI

Year	Discharge (m^3/sec) Kediri	Pakel
1951	98.1	122
1952	111	86.4
1953	115	105
1954	125	61.3
1955	100	146
1956	111	114
1957	116	93.8
1958	76.0	61.6
1959	157	78.4
1960	146	85.4
1961	121	86.6
1962	101	101
1963	184	107
1964	67.8	47.7
1965	118	103
1966	95.7	63.0
1967	79.8	98.0
1968	144	98.3
1969	100	112
1970	125	76.7
1971	156	97.5
1972	177	109
1973	71.0	62.5
1974	103	94.6
1975	178	153
1976	121	64.0
1977	81.1	121
Mean	118	92.1

Table HY-2.4 BASE FLOW AT PLOSO

No.	Base Flow (m^3/sec) Jan.	Feb.	Mar.
1	310	418	292
2	364	418	408
3	372	408	330
4	334	420	412
5	412	400	478
6	425	550	480
7	342	742	460
8	458	574	460
9	478	590	640
10	795	640	678
11	670	492	558
12	500	412	580
13	408	510	622
14	394	400	630
15	315	372	572
16	328	364	478
17	352	358	392
18	315	324	
19	326	355	
20	315	360	
21	344	350	
22	344	292	
23	410	260	
24	478	264	
25	476	360	
26	550	366	
27	450	352	
28	412	422	
29	428	442	
30	450	384	
31		312	
Average	435 m^3/sec		

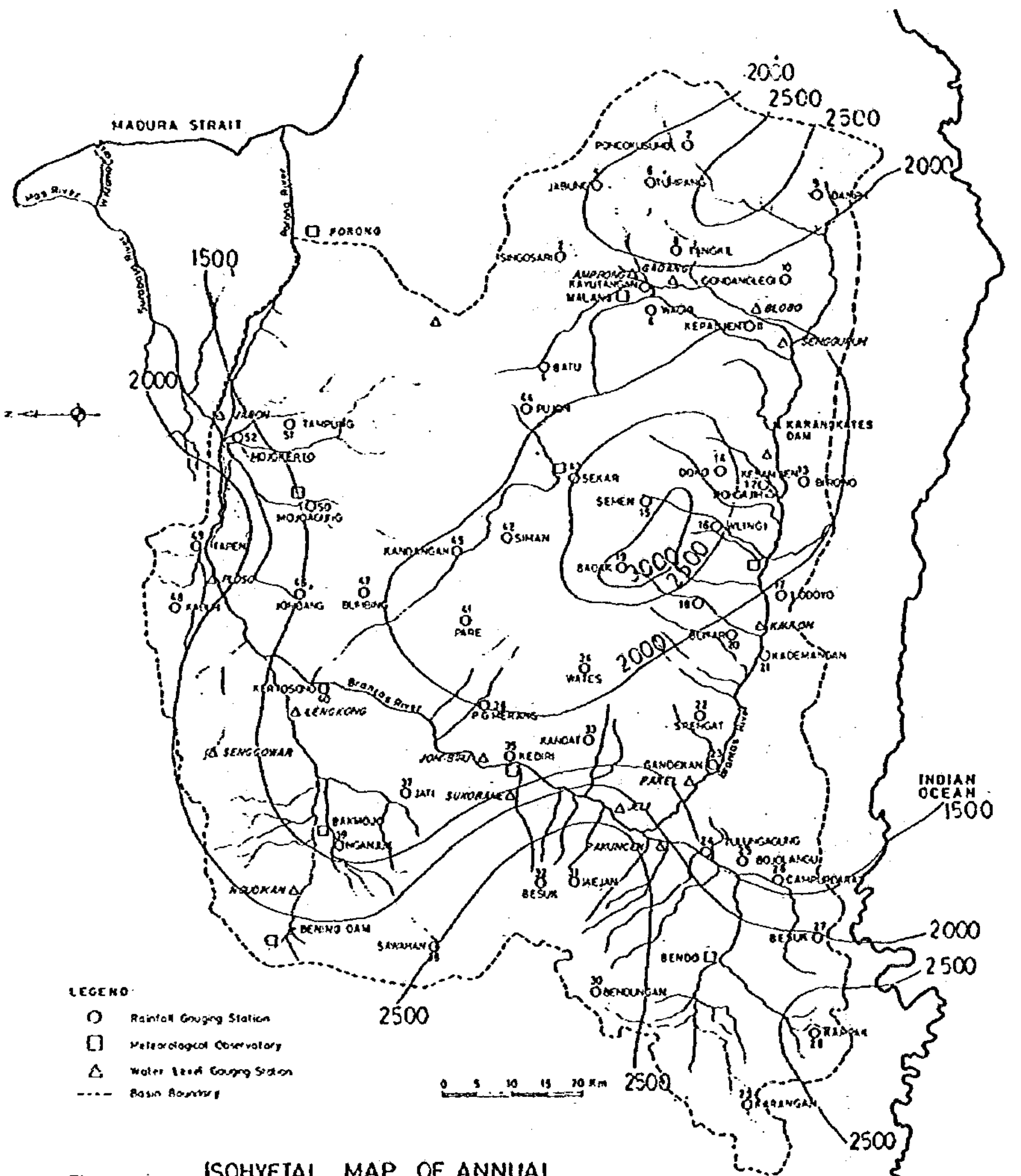
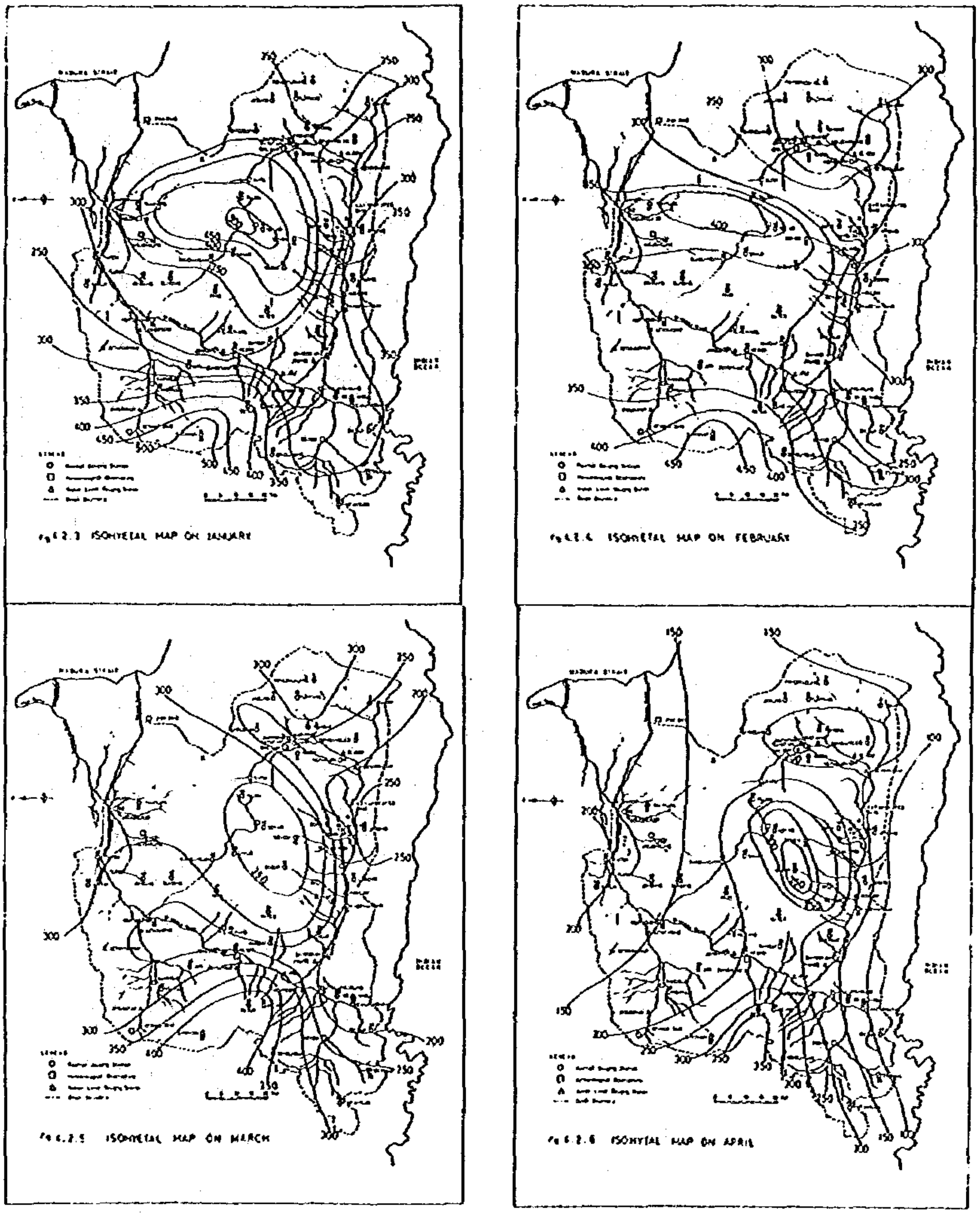
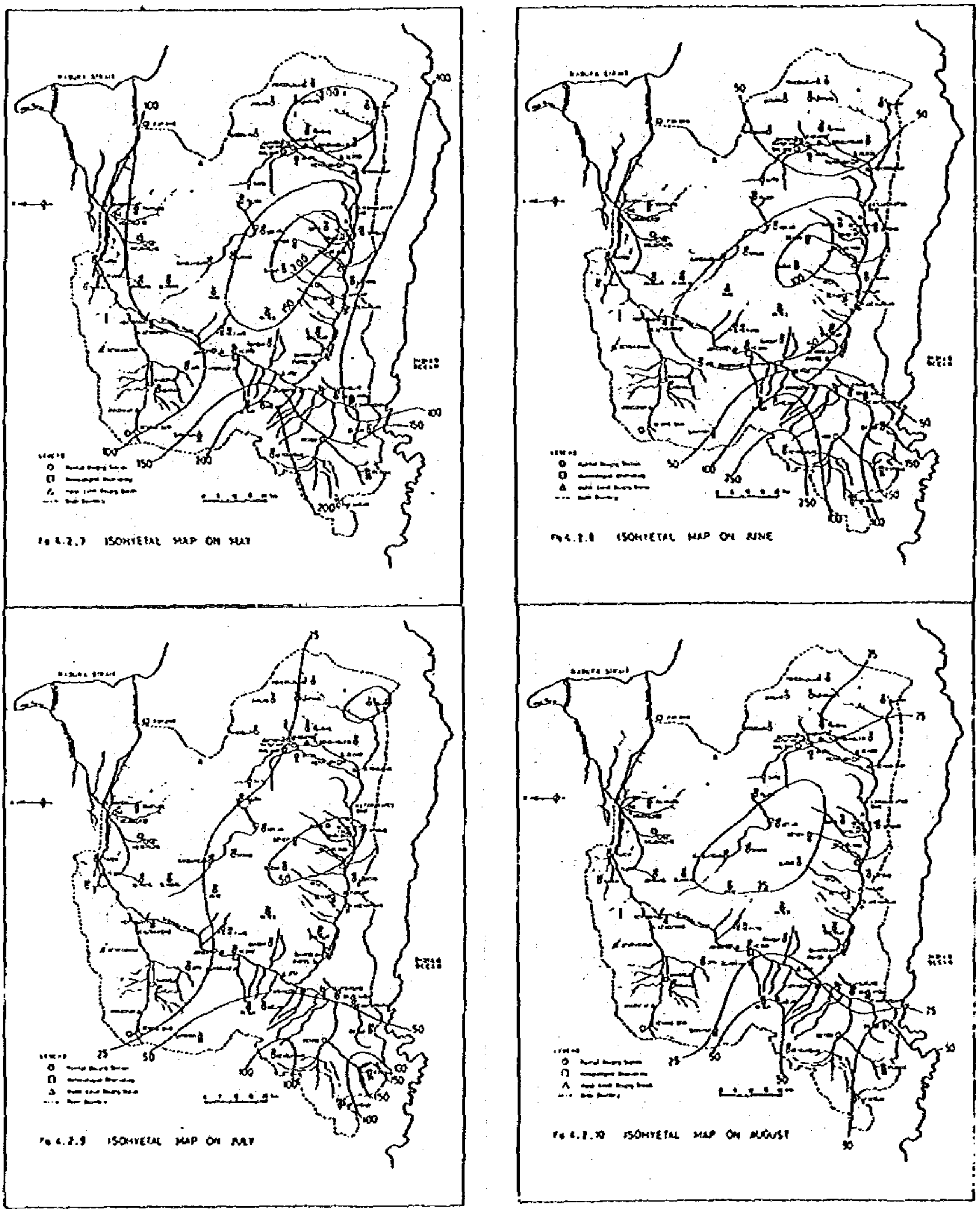


Fig HY-1.1 ISOHYETAL MAP OF ANNUAL RAINFALL IN THE BRANTAS RIVER BASIN



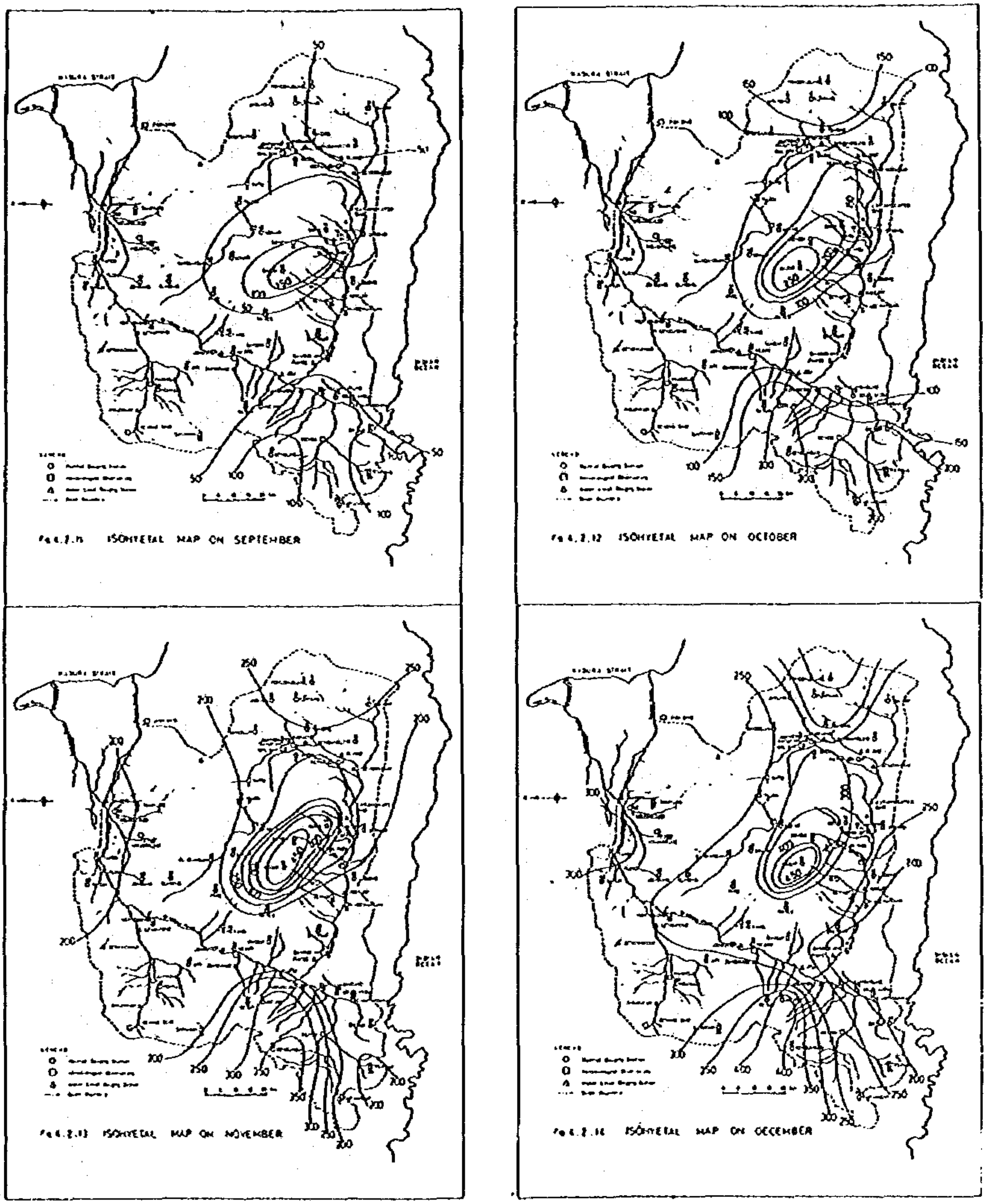
Source : HY04-HY12

Fig. HY-1.2(1) ISOHYETAL MAP OF MONTHLY RAINFALL



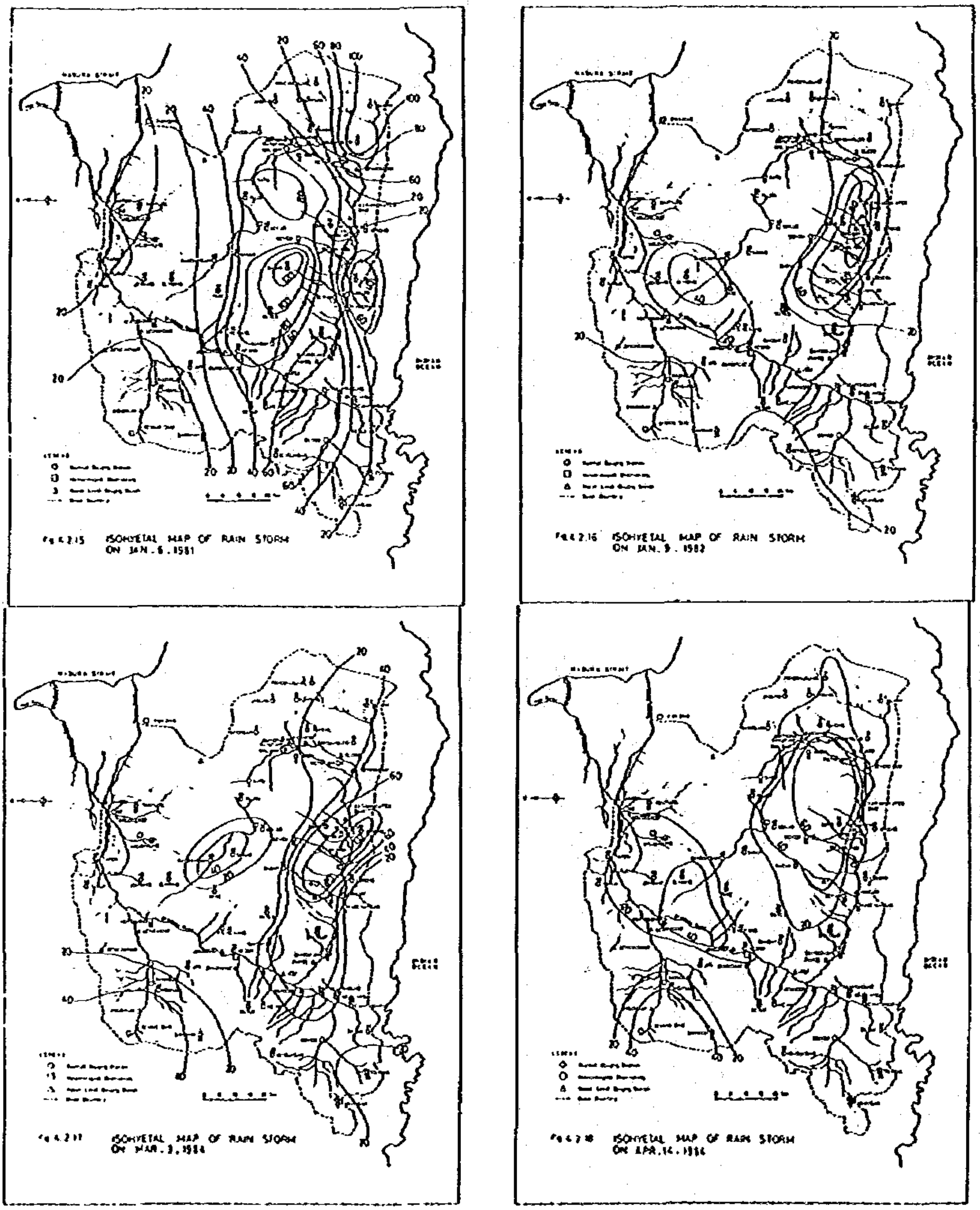
Source : HY04-HY12

Fig. HY-1.2(2) ISOHYETAL MAP OF MONTHLY RAINFALL



Source : HY-4-HY12

Fig. HY-1.2(3) ISOHYETAL MAP OF MONTHLY RAINFALL



Source : HY03

Fig. HY-1.2(4) ISOHYETAL MAP OF RAIN STORM

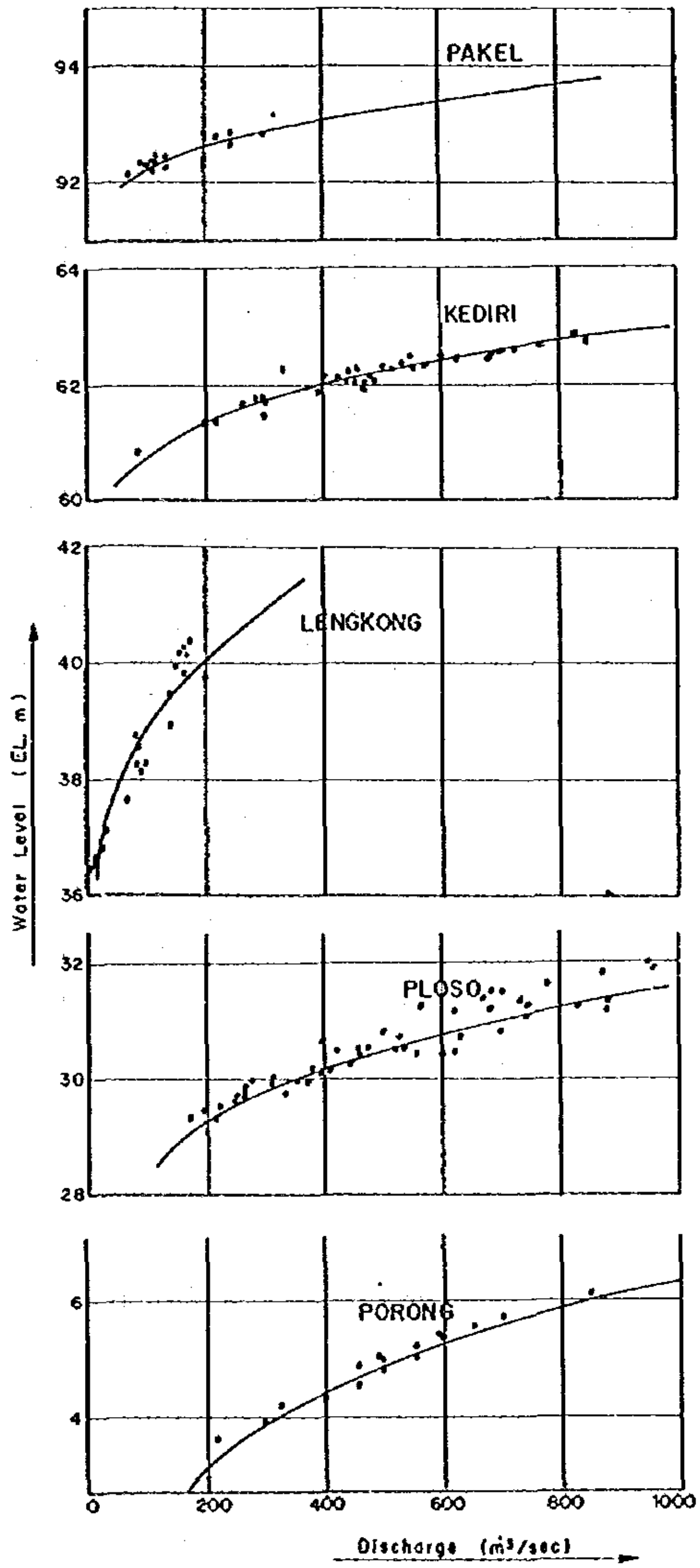


Fig. HY-1.3 DISCHARGE RATING CURVE

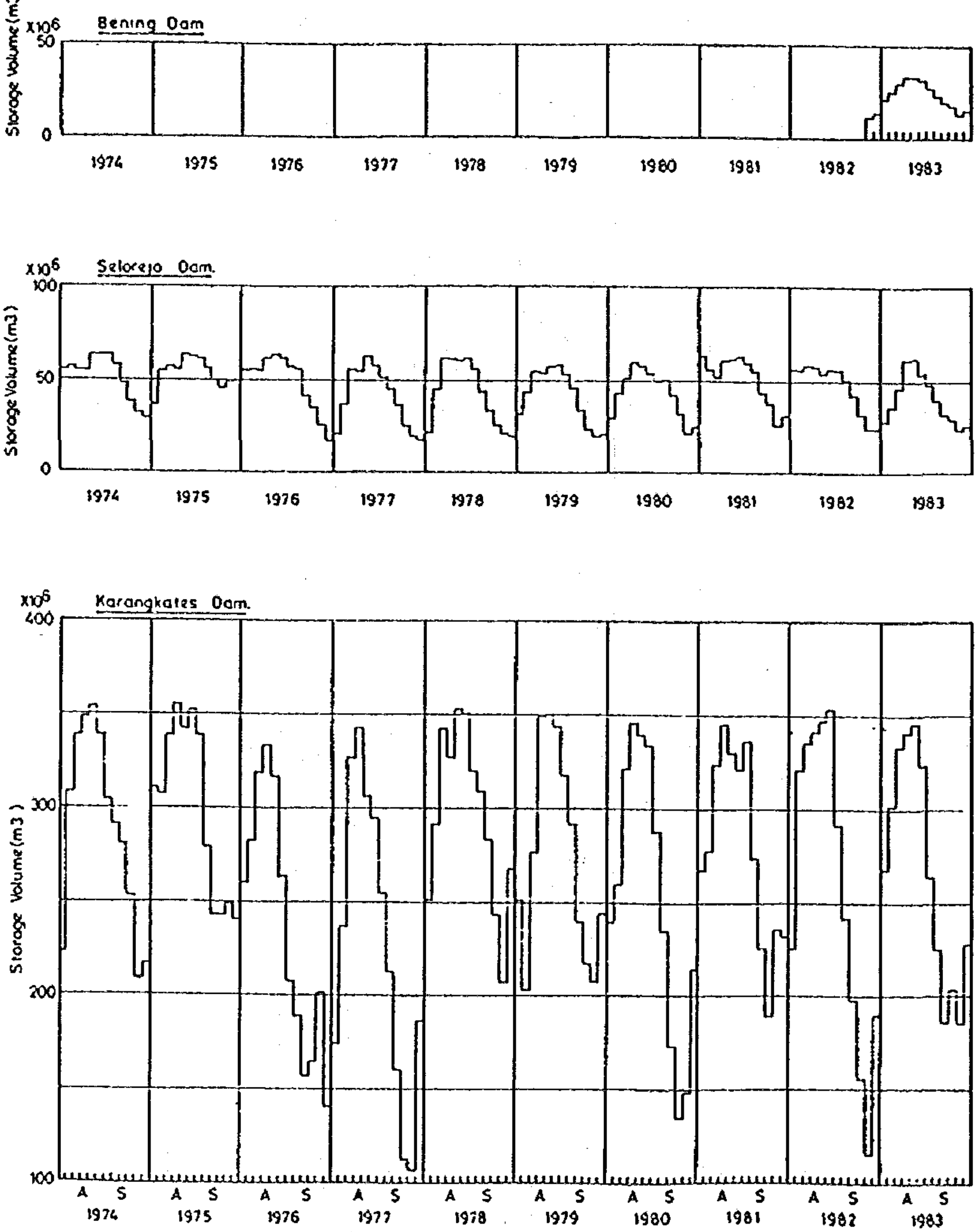


Fig. HY-1.4 STORAGE VOLUME IN RESERVOIRS

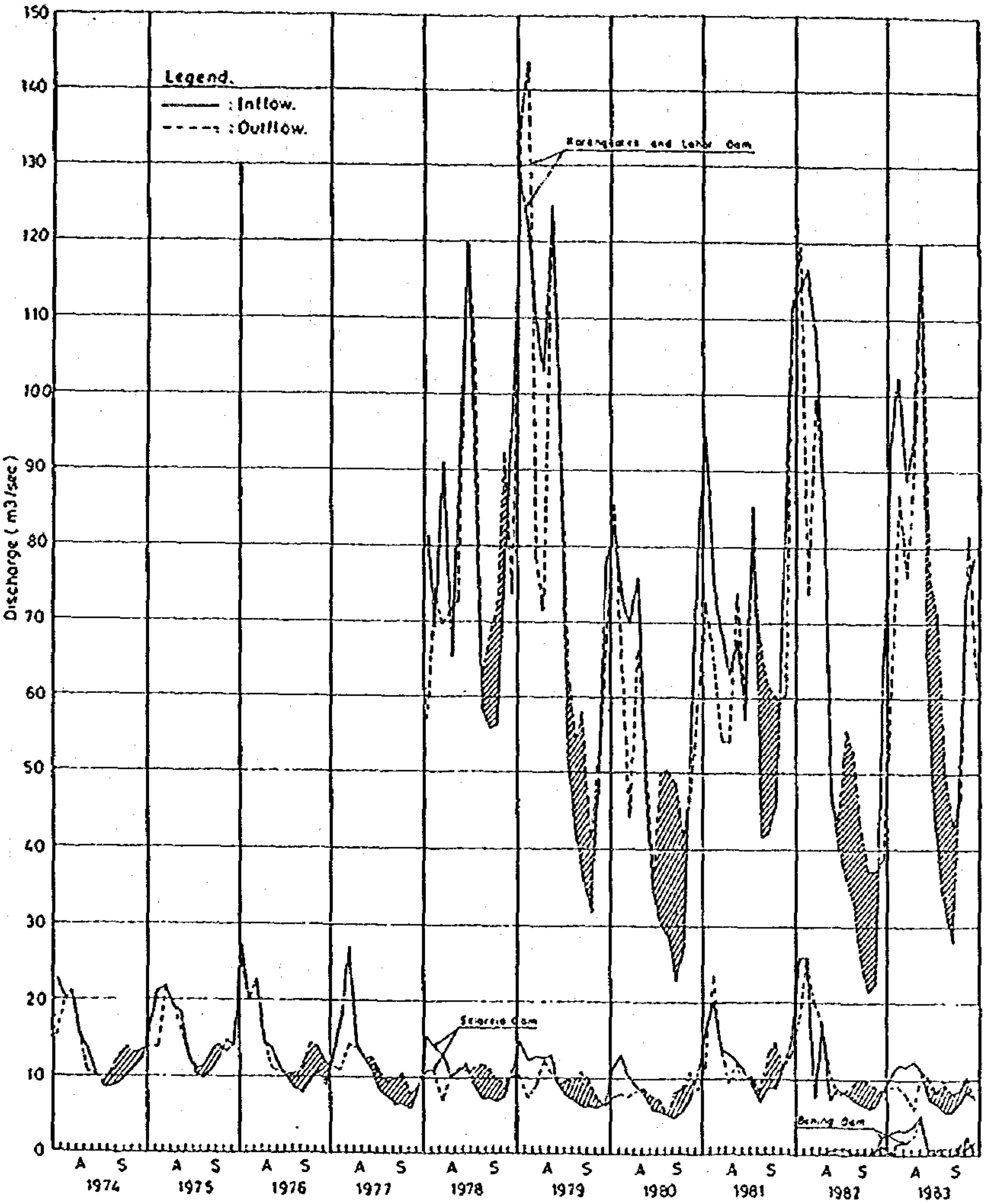


Fig. HY-1.5 MONTHLY AVERAGE DISCHARGE AT DAMS

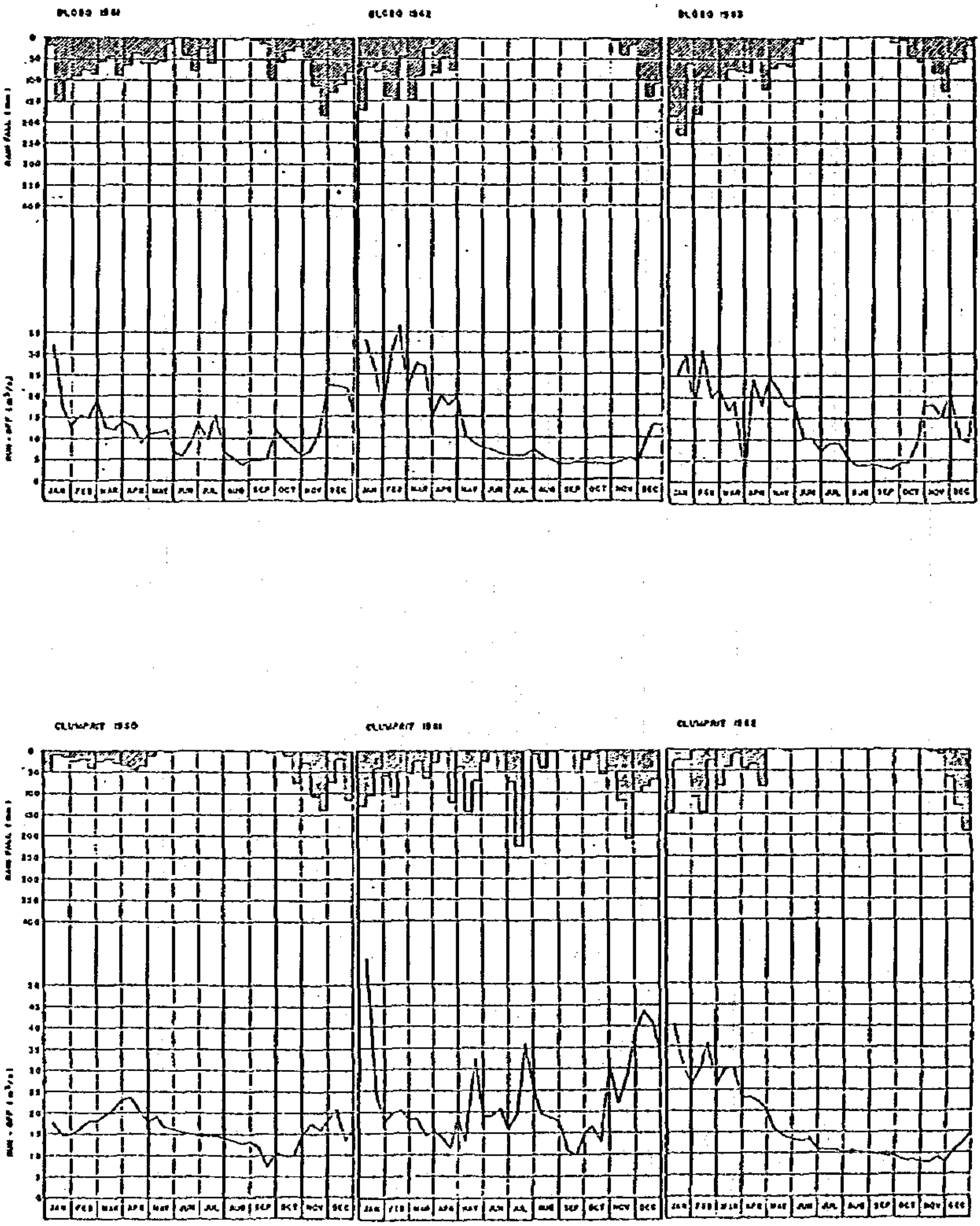


Fig. HY-1.6(1) RAINFALL AND RUNOFF

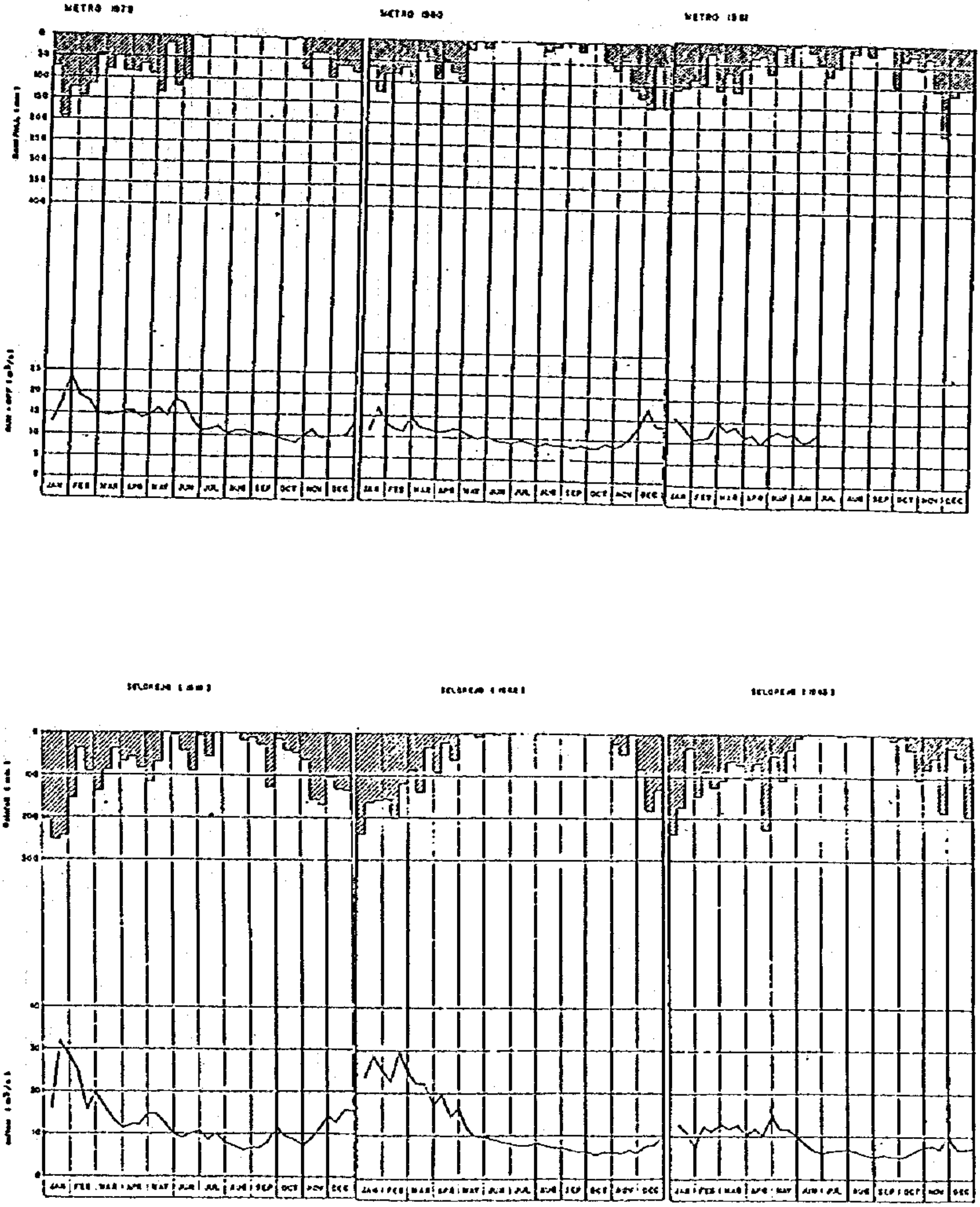


Fig. HY-1.6(2) RAINFALL AND RUNOFF

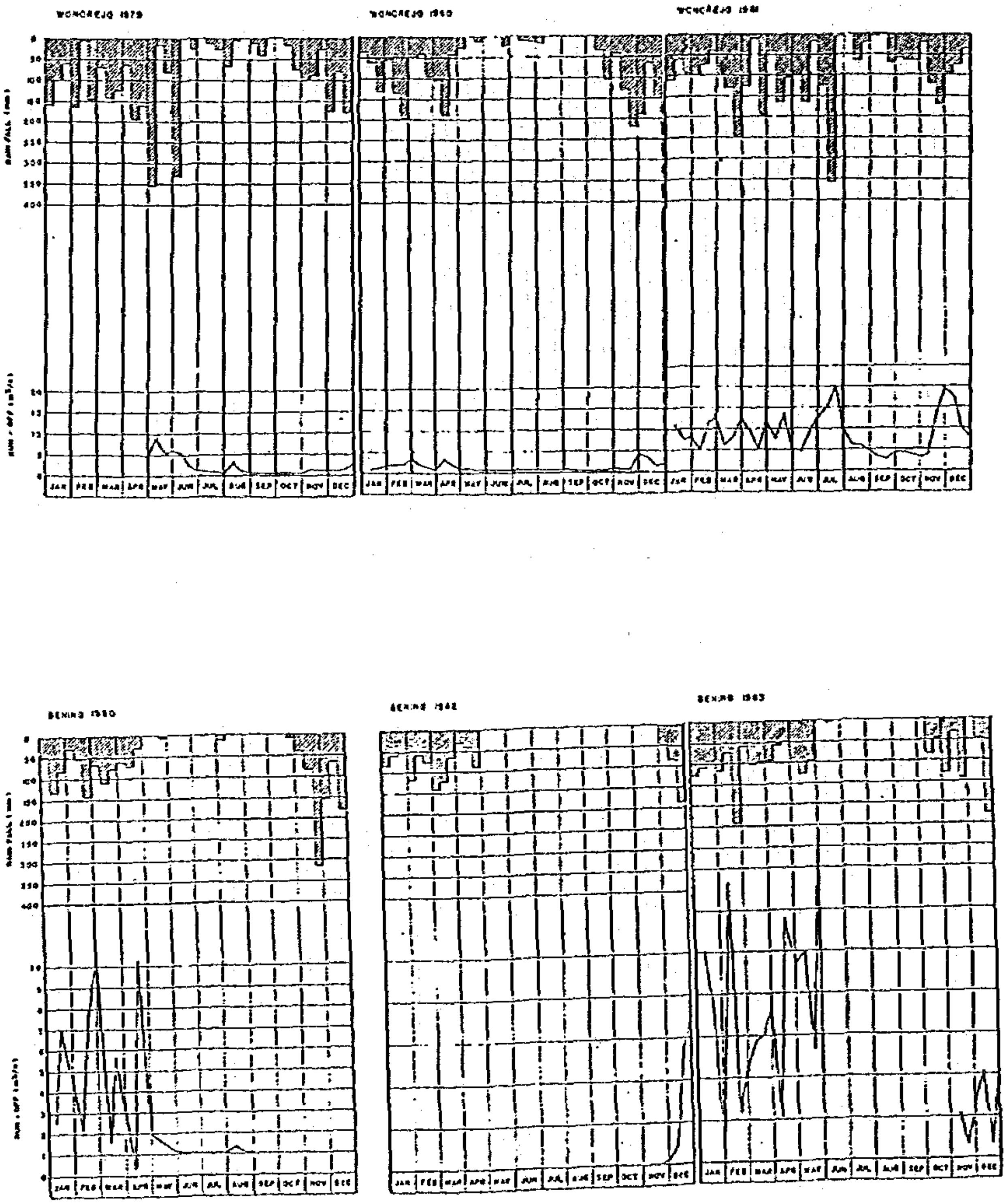


Fig. IV-1.6(3) RAINFALL AND RUNOFF

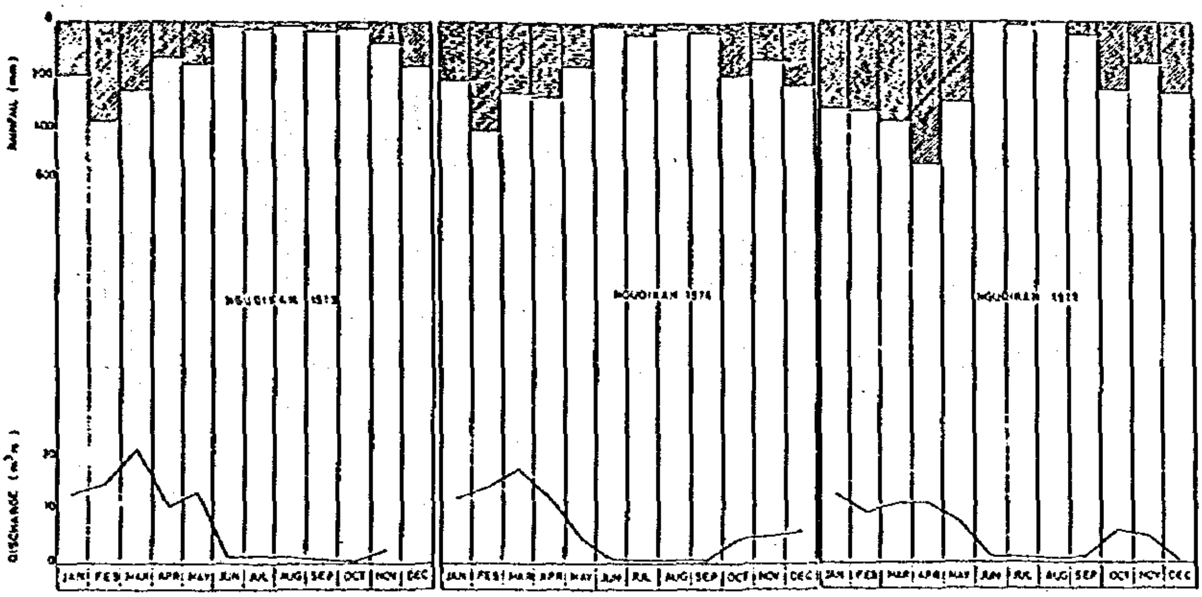


Fig. HY-1.6(4)　　RAINFALL AND RUNOFF

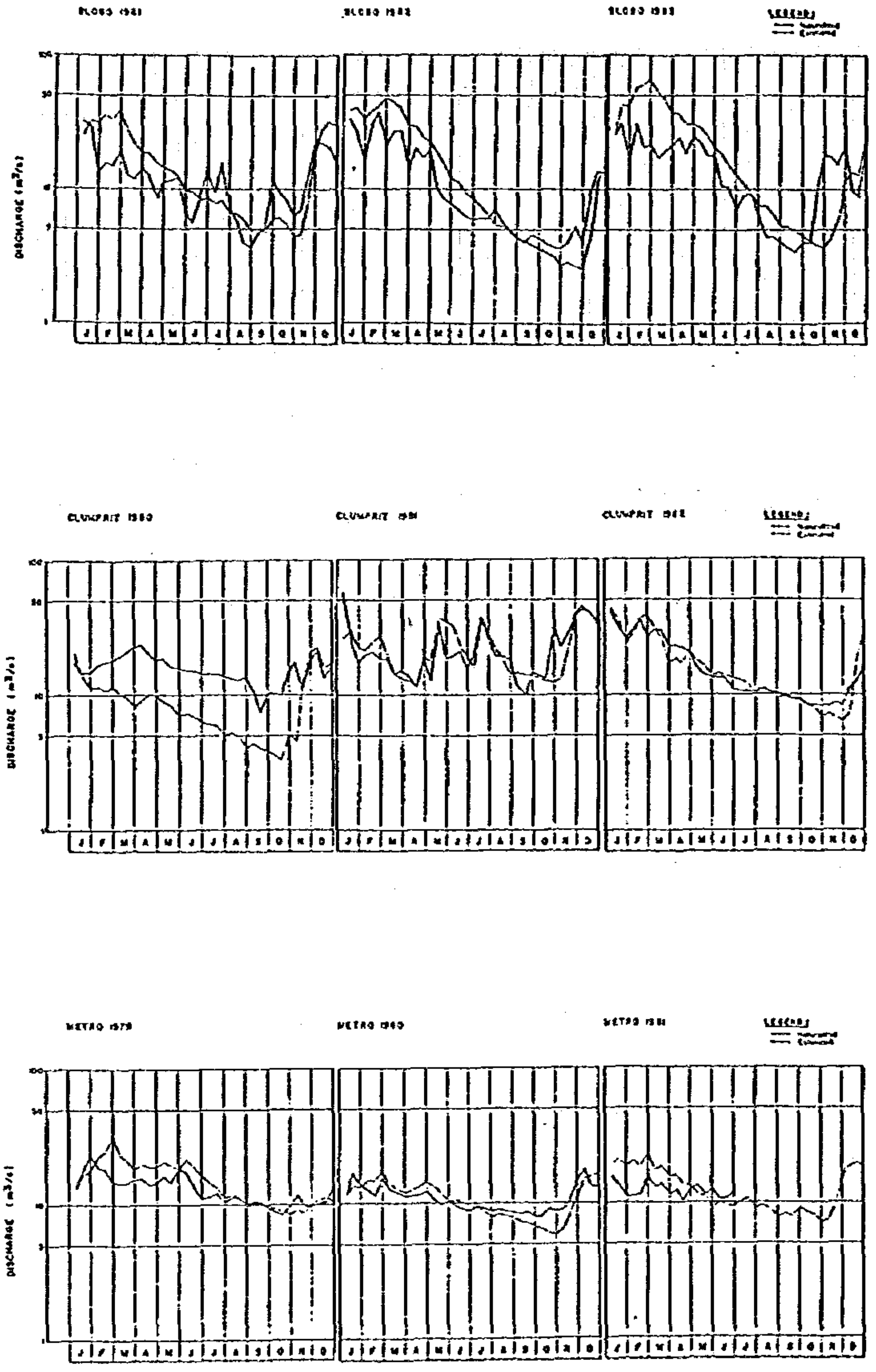


Fig. HY-1.7(1) COMPARISON BETWEEN OBSERVED AND ESTIMATED RUNOFF

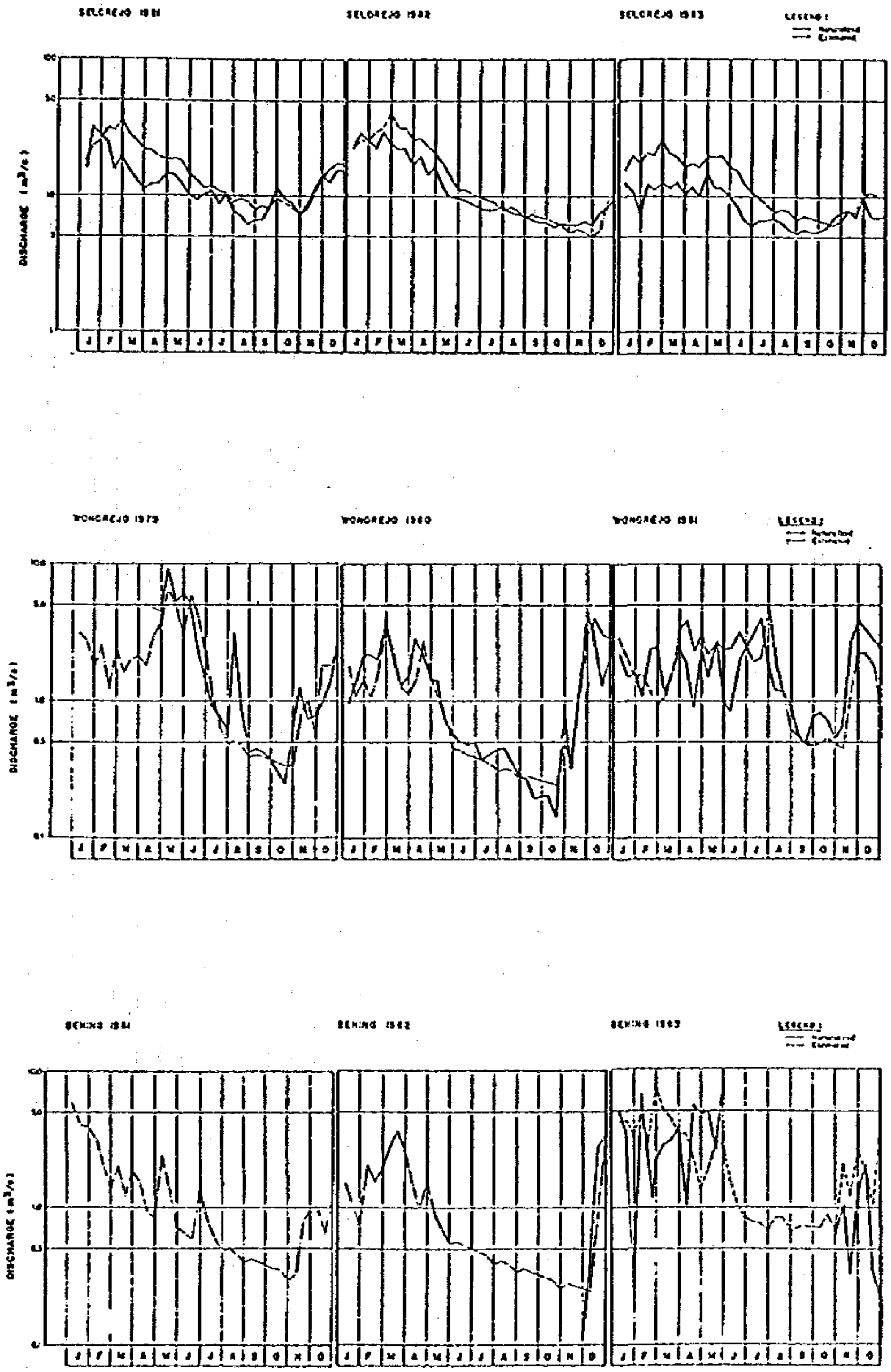


Fig. HY-1.7(2) COMPARISON BETWEEN OBSERVED AND ESTIMATED RUNOFF

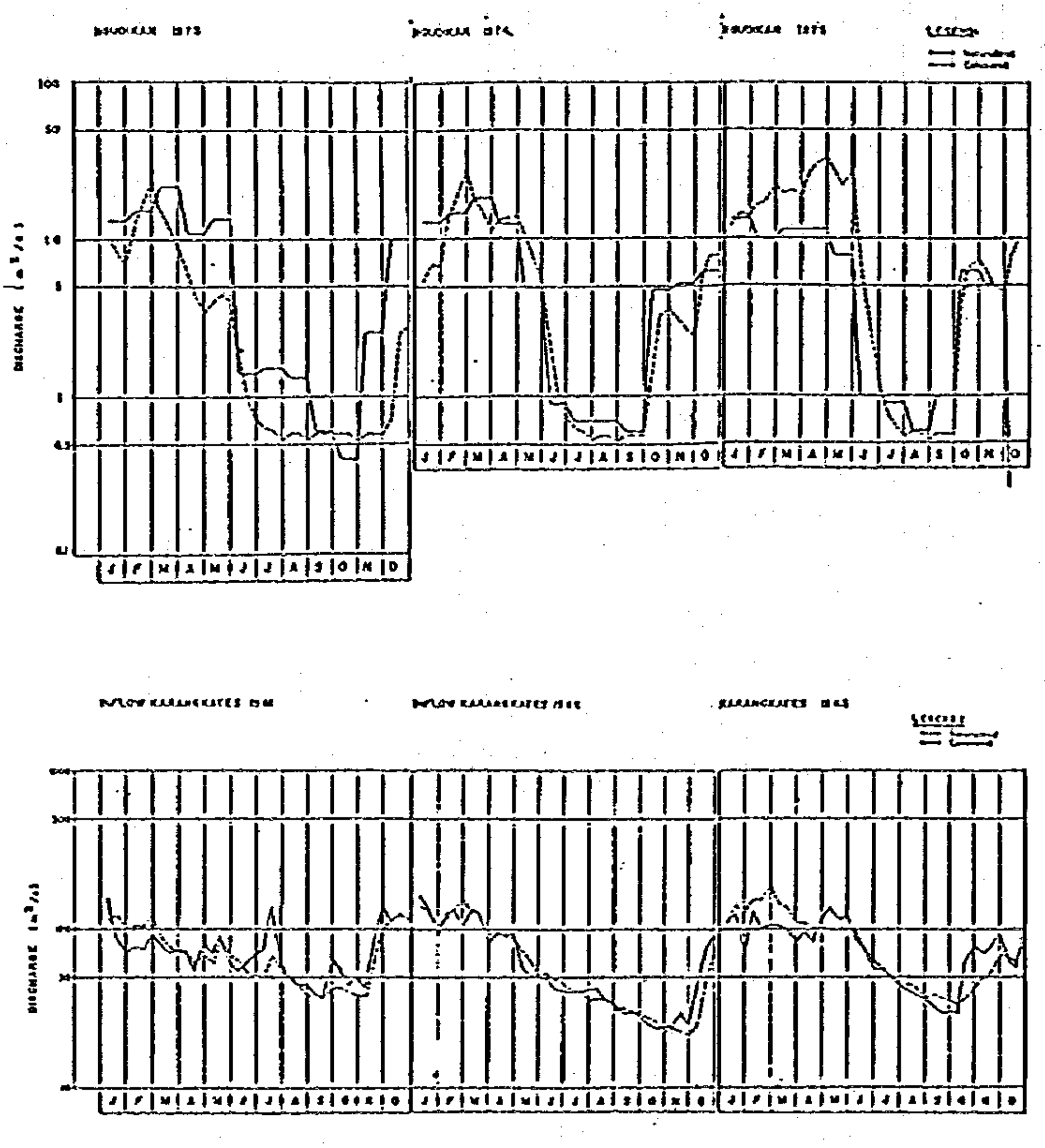


Fig. HY-1.7(3) COMPARISON BETWEEN OBSERVED AND ESTIMATED RUNOFF

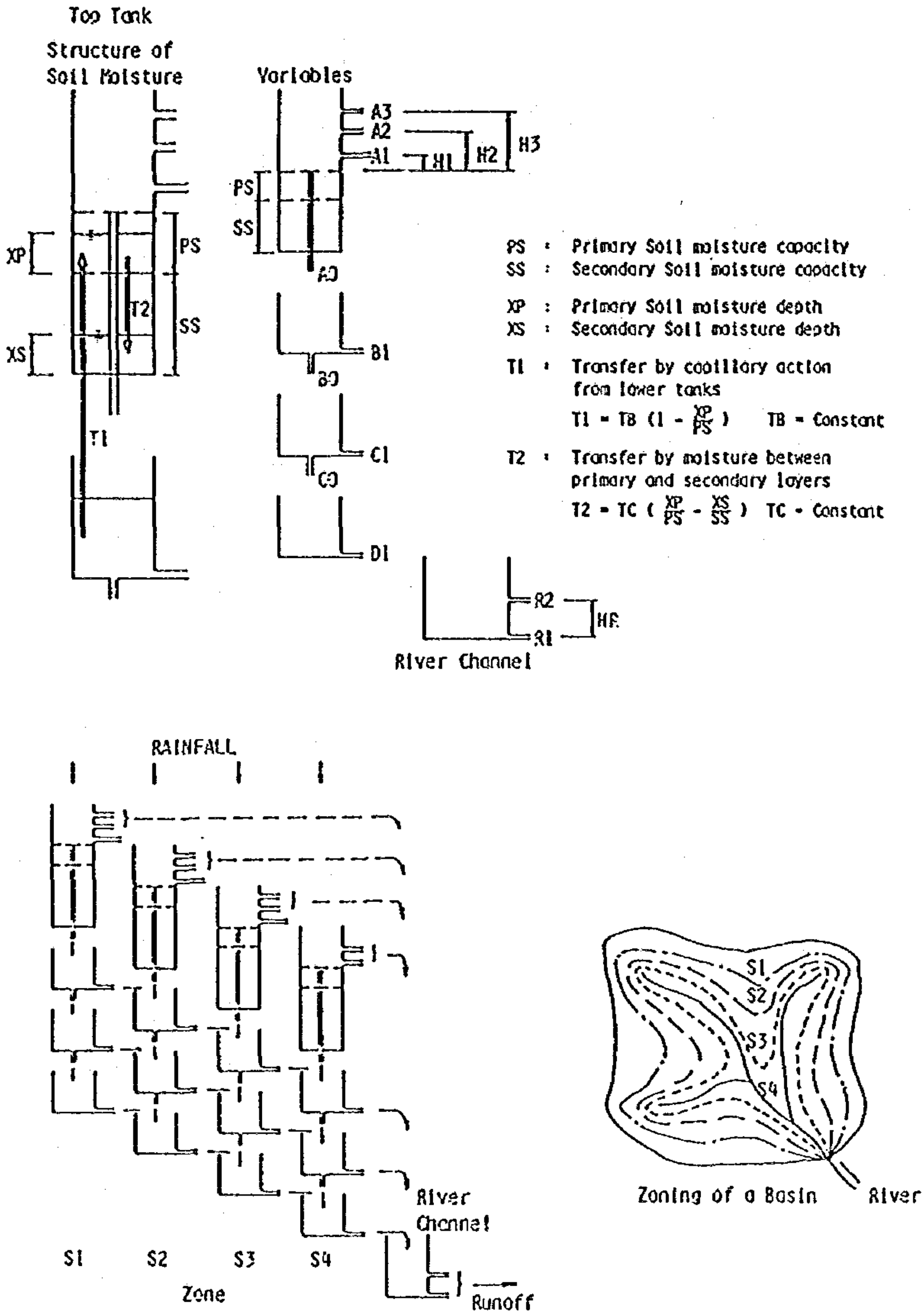
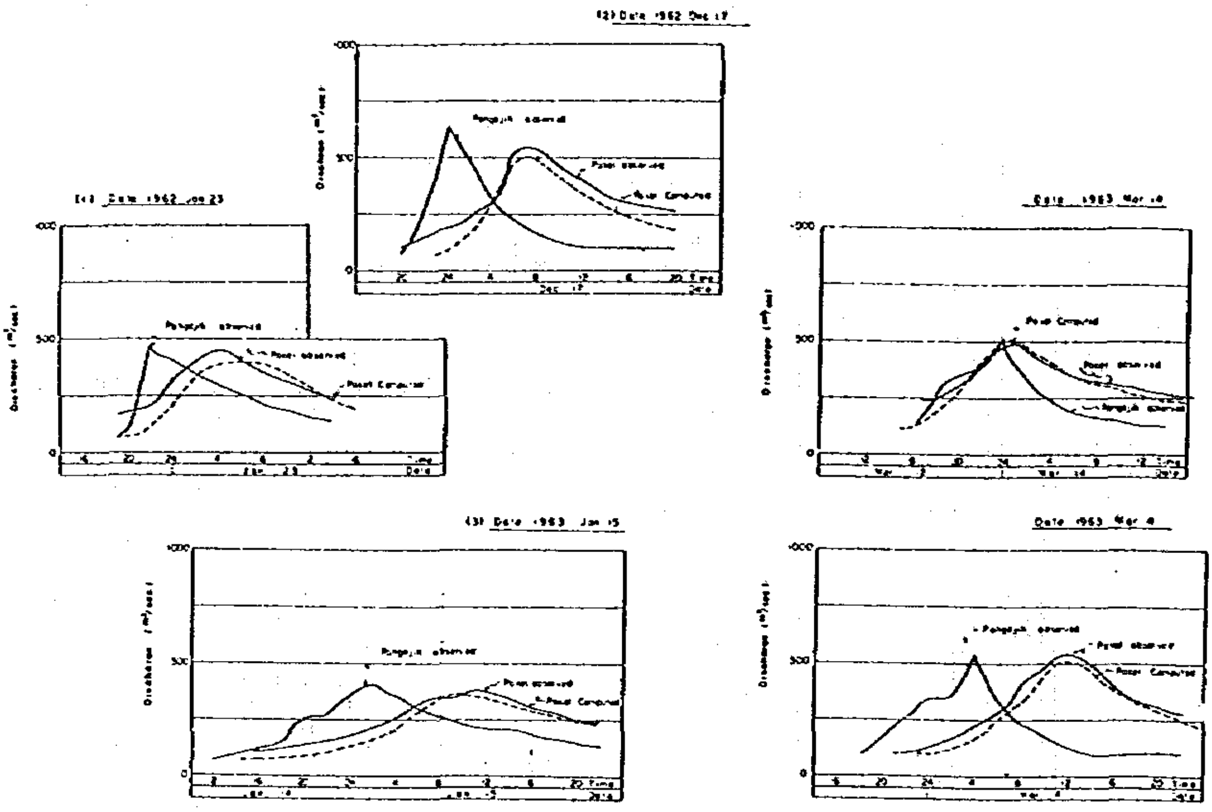


Fig. HY-1.8 STRUCTURE OF TANK MODEL AND TANK ARRANGEMENT IN A BASIN



Source: THE BRANTAS RIVER BASIN DEVELOPMENT PLAN

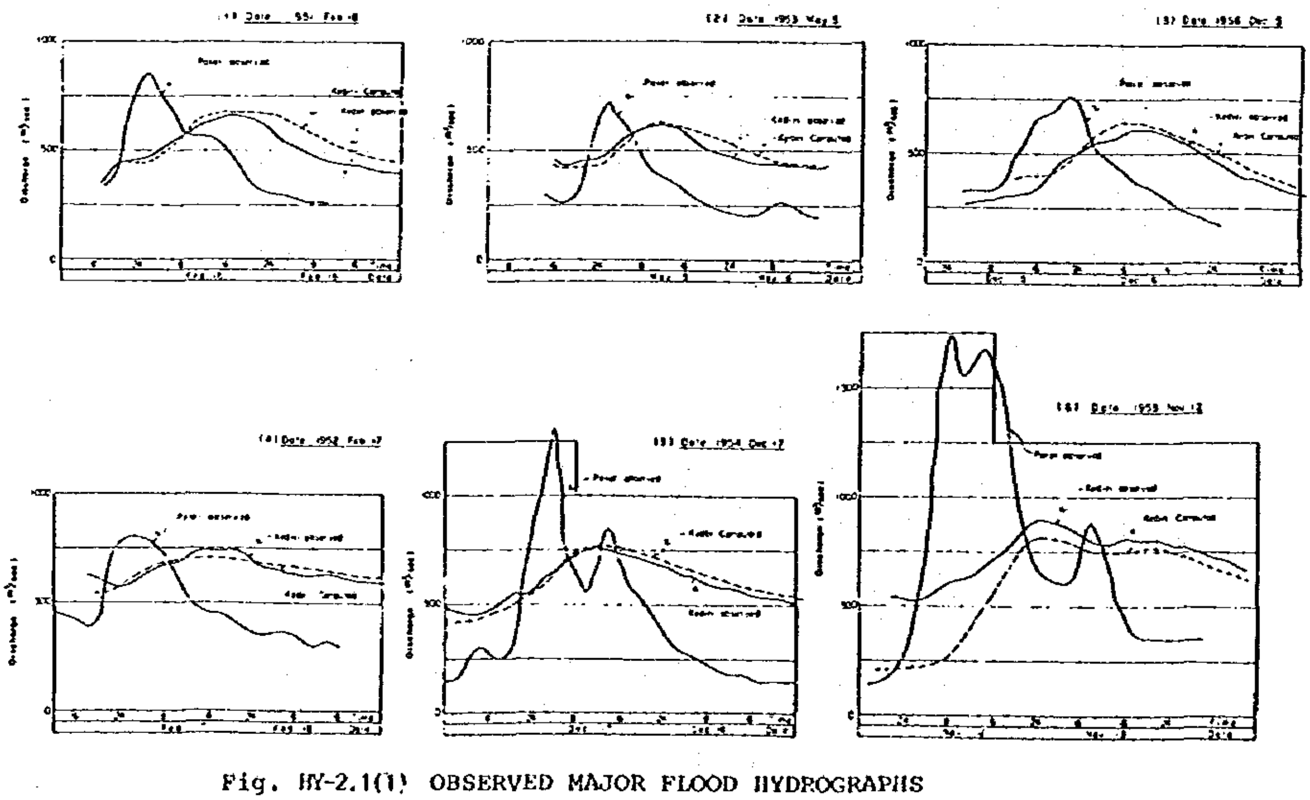
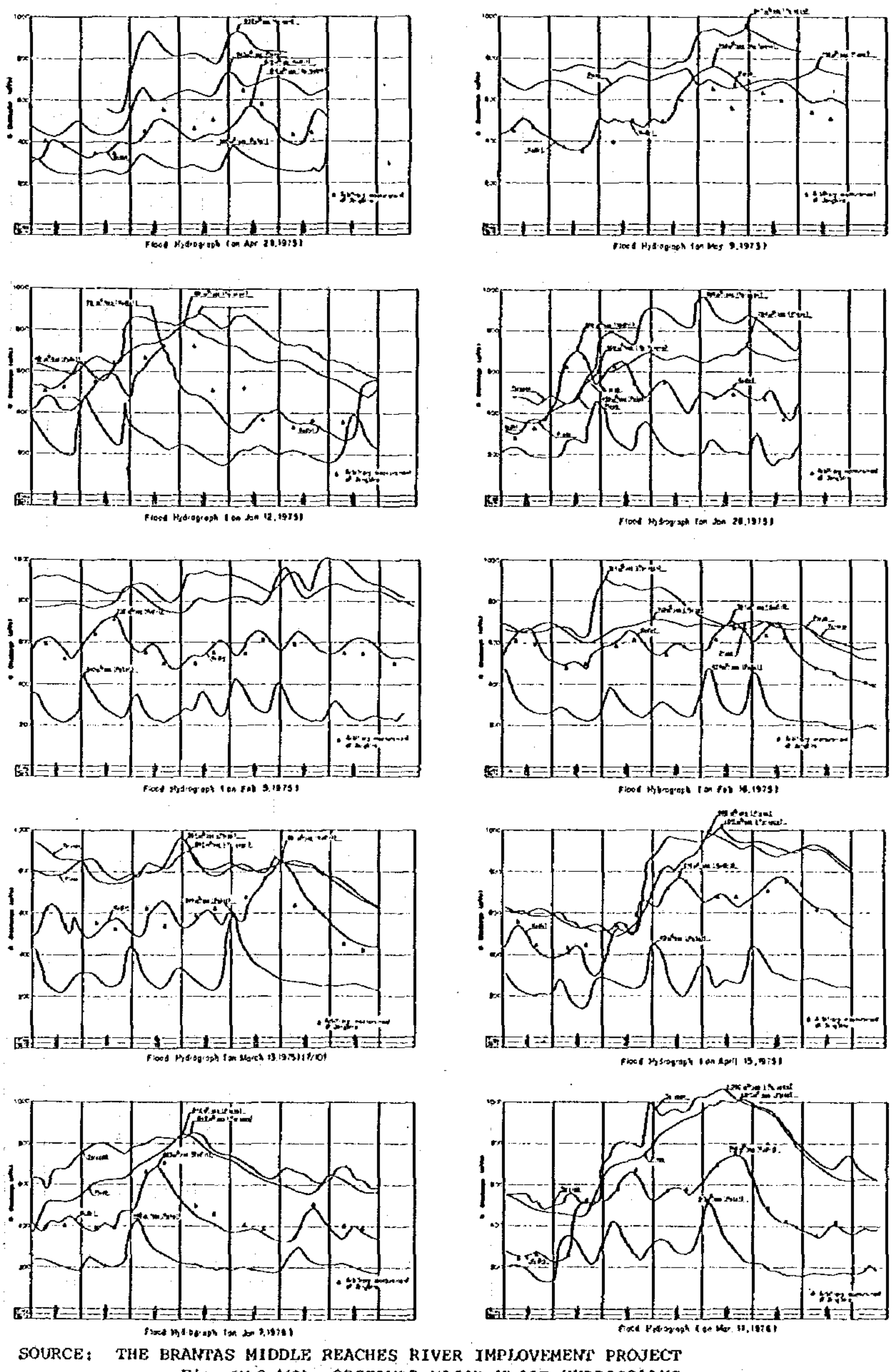


Fig. HY-2.1(1) OBSERVED MAJOR FLOOD HYDROGRAPHS



SOURCE: THE BRANTAS MIDDLE REACHES RIVER IMPLOVEMENT PROJECT

Fig. HY-2.1(2) OBSERVED MAJOR FLOOD HYDROGRAPHS

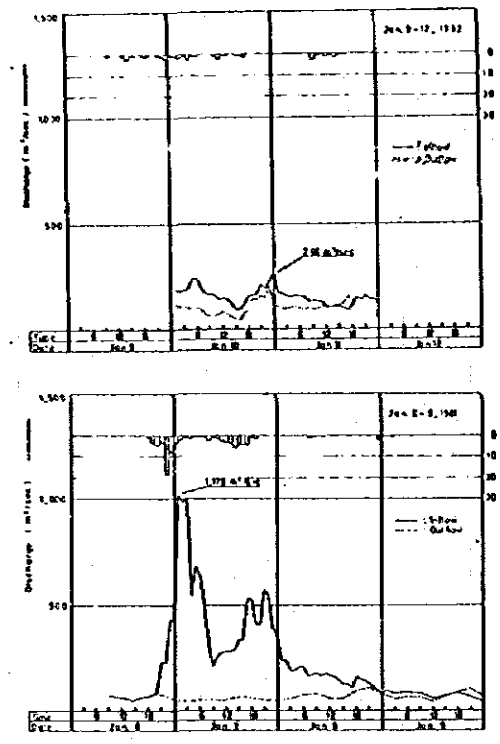


Fig.4.2.27. OBSERVED FLOOD HYDROGRAPH AT KARANGKATES DAM

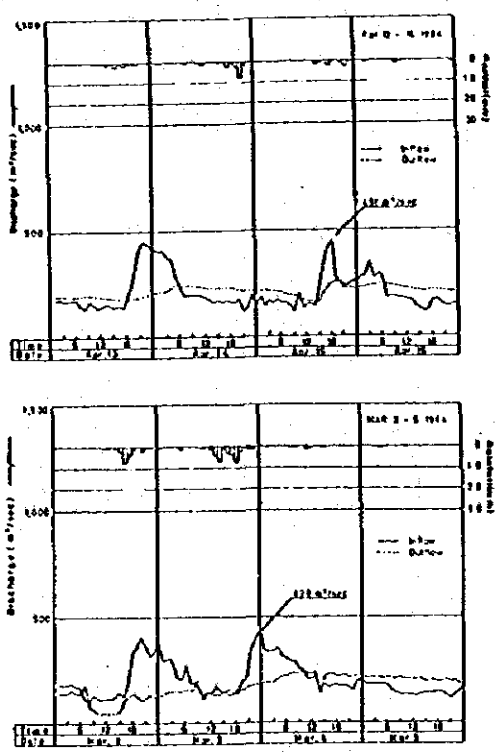


Fig.4.2.26. OBSERVED FLOOD HYDROGRAP AT K.KATES

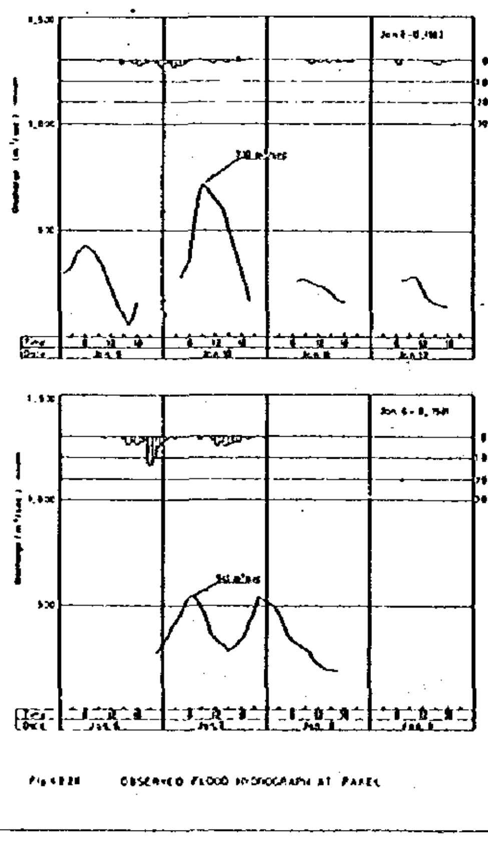


Fig.4.2.28 OBSERVED FLOOD HYDROGRAPH AT PAKEL

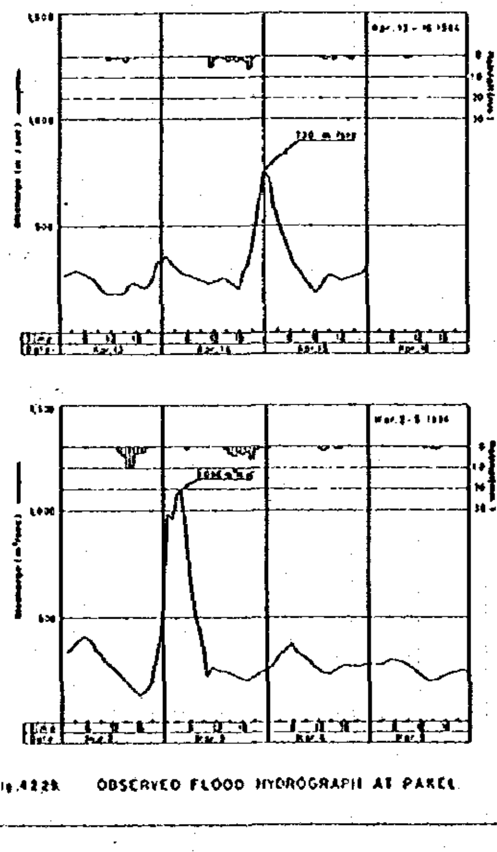


Fig.4.2.28 OBSERVED FLOOD HYDROGRAPH AT PAKEL

Fig. HY-2.1(3) OBSERVED MAJOR FLOOD HYDROGRAPHS

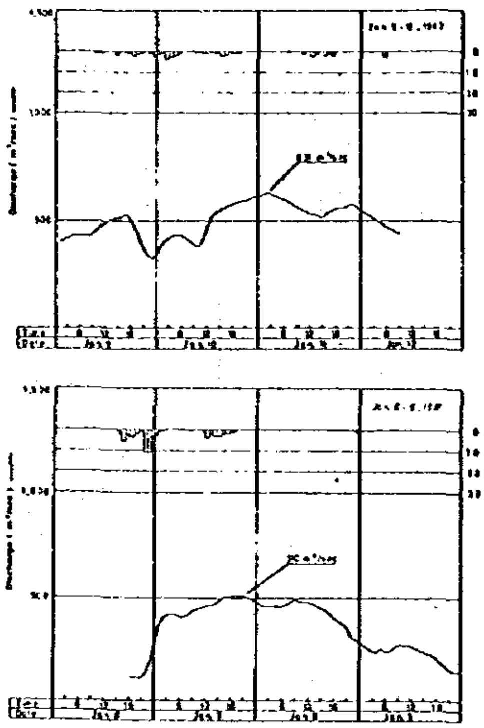


Fig 4.2.30 OBSERVED FLOOD HYDROGRAPH AT KEDIRI

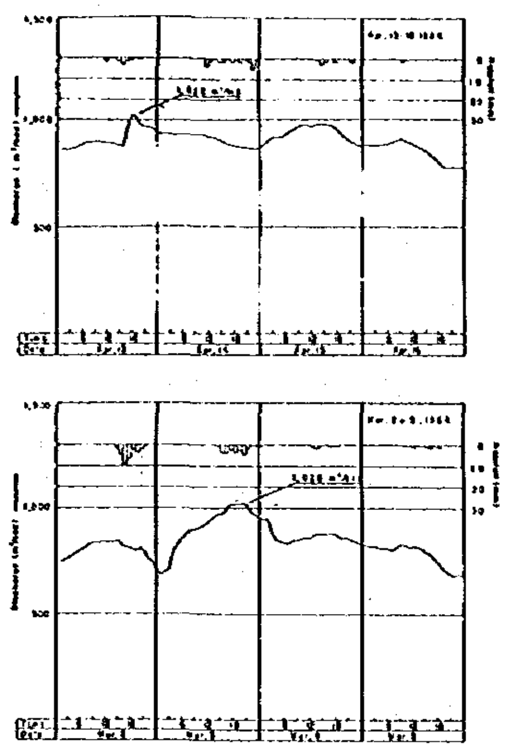


Fig 4.2.31. OBSERVED FLOOD HYDROGRAPH AT KEDIRI.

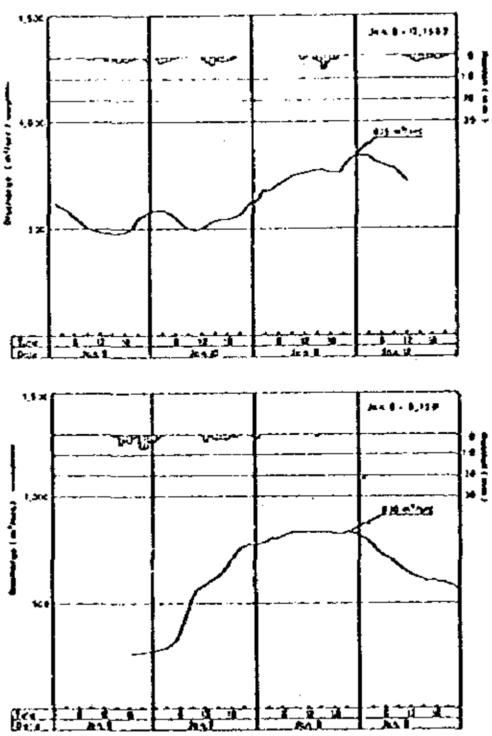


Fig 4.2.32 OBSERVED FLOOD HYDROGRAPH AT PLOSO

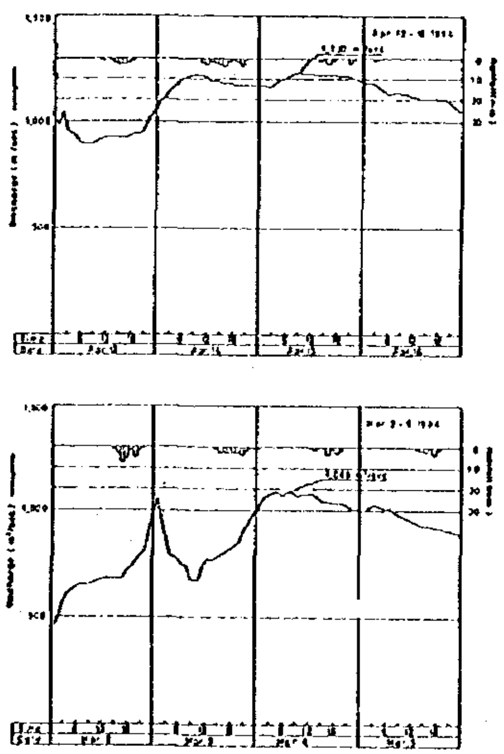


Fig 4.2.33. OBSERVED FLOOD HYDROGRAPH AT PLOSO.

Fig. HY-2.1(4) OBSERVED MAJOR FLOOD HYDROGRAPHS

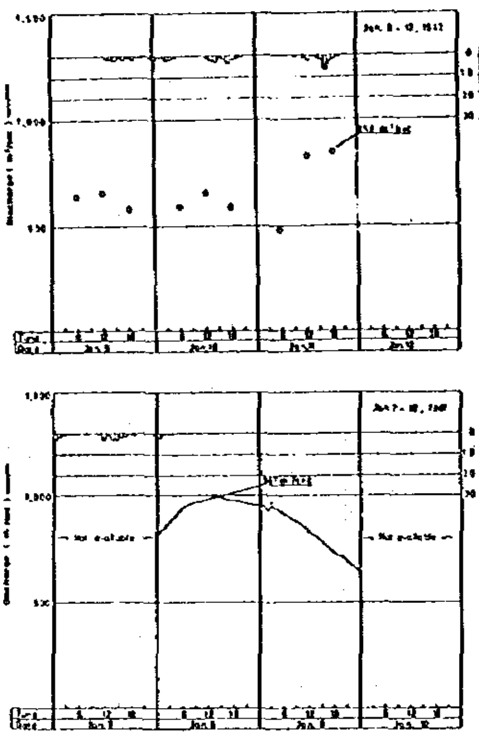


Fig 4.234 OBSERVED FLOOD HYDROGRAPH AT PORONG

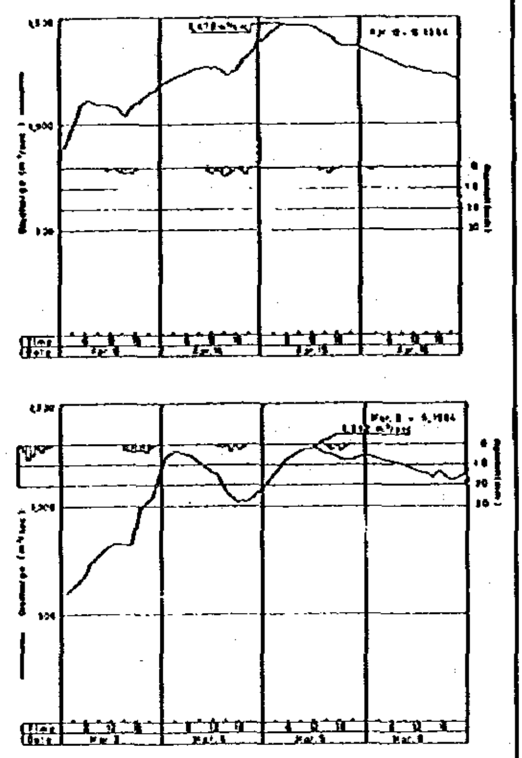


Fig4.235. OBSERVED FLOOD HYDROGRAPH AT PORONG

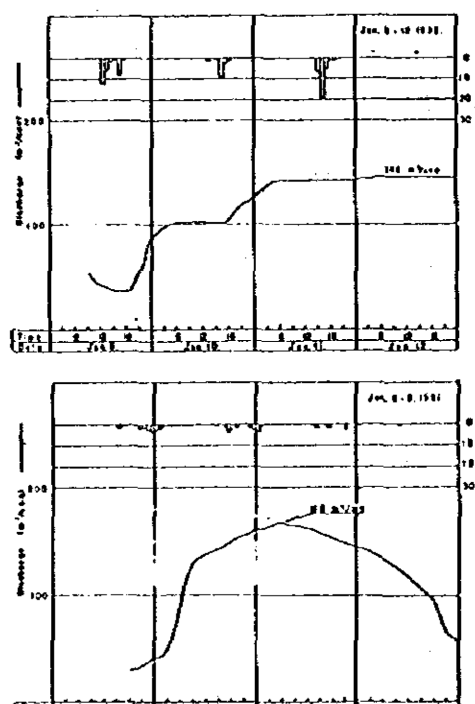
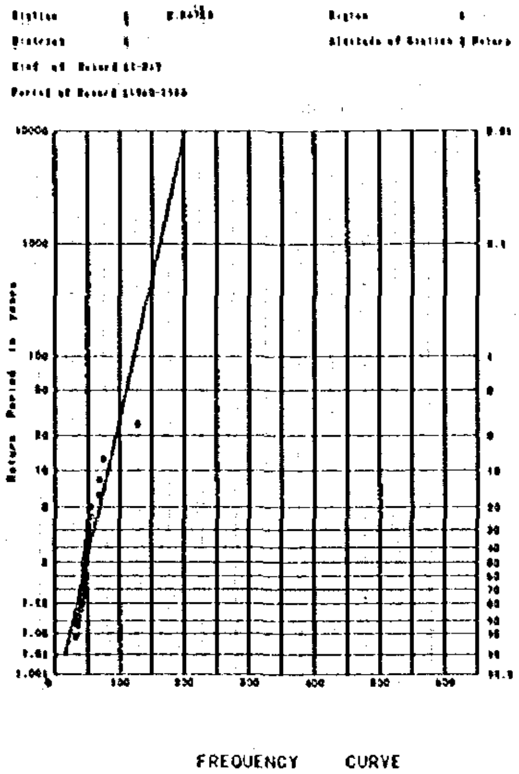
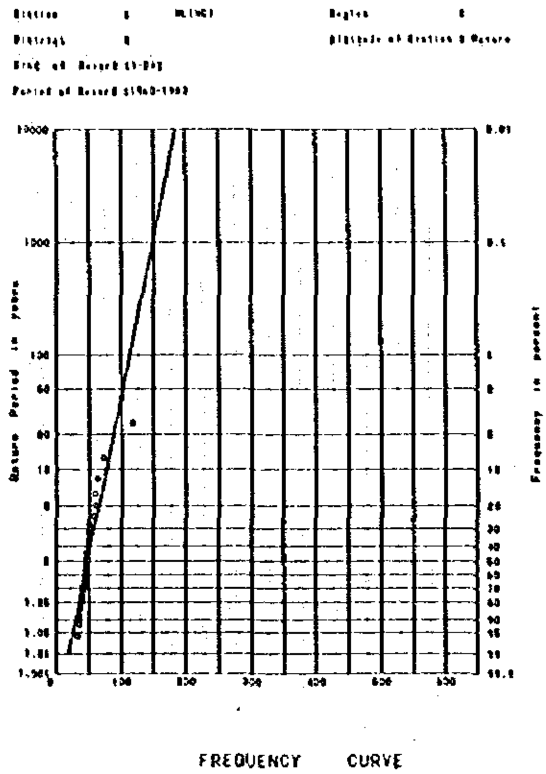
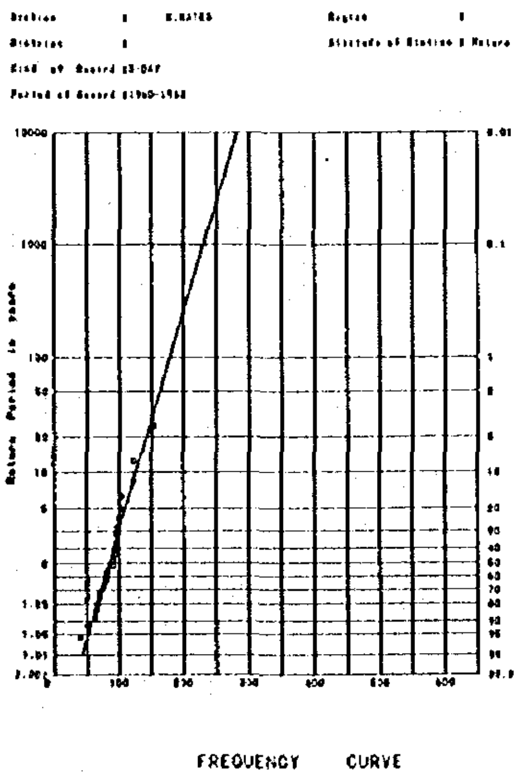


Fig 4.236. OBSERVED FLOOD HYDROGRAPH AT LENGKONG WIDAS

Fig. HY-2.1(5) OBSERVED MAJOR FLOOD HYDROGRAPHS







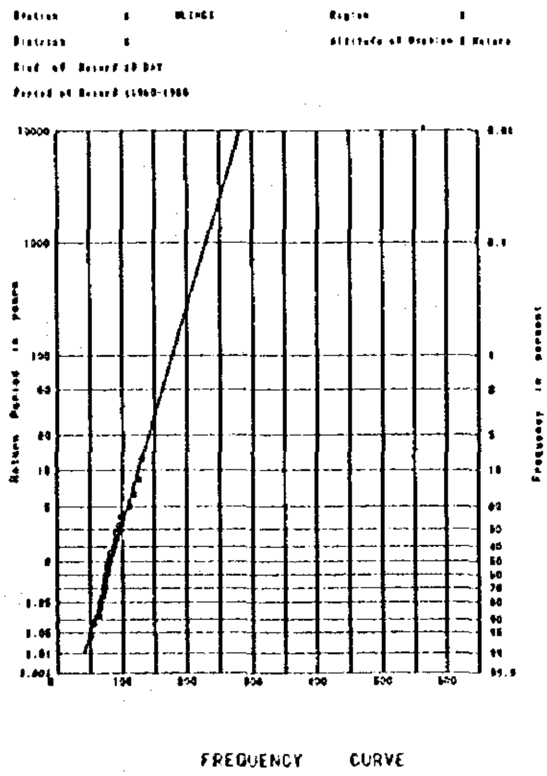


Fig. HY-2.2(1) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

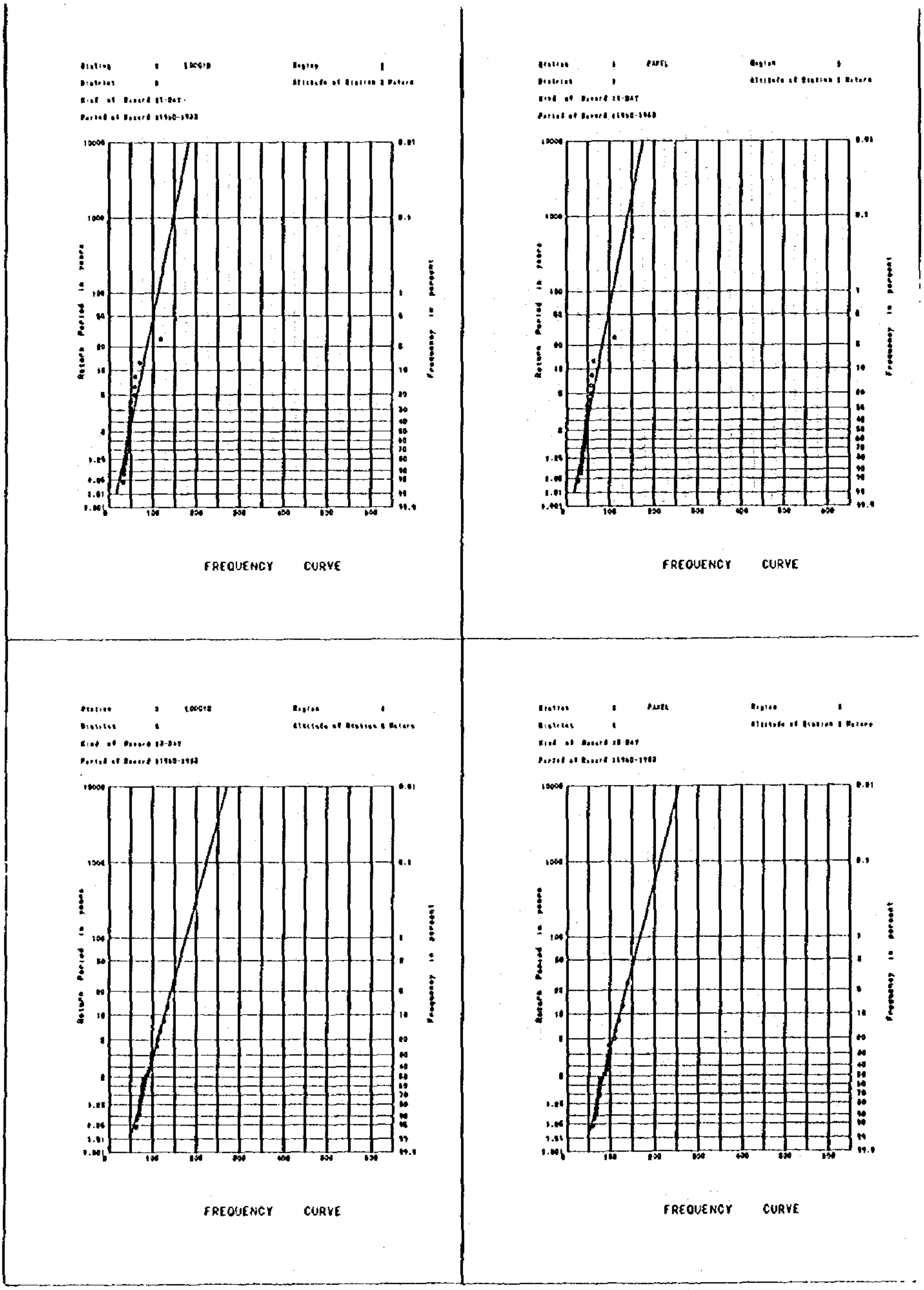


Fig. HY-2.2(2) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

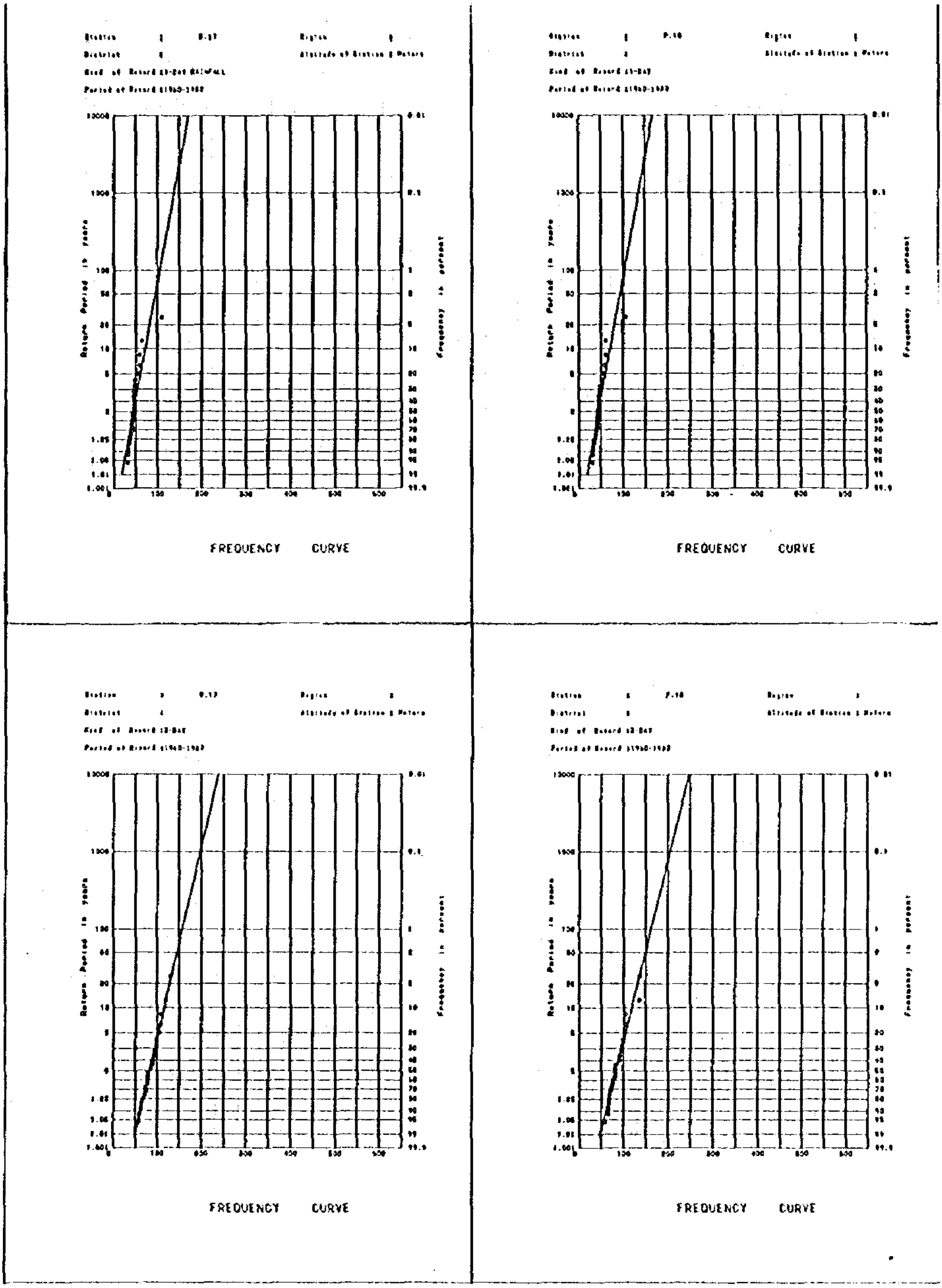


Fig. HY-2.2(3) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

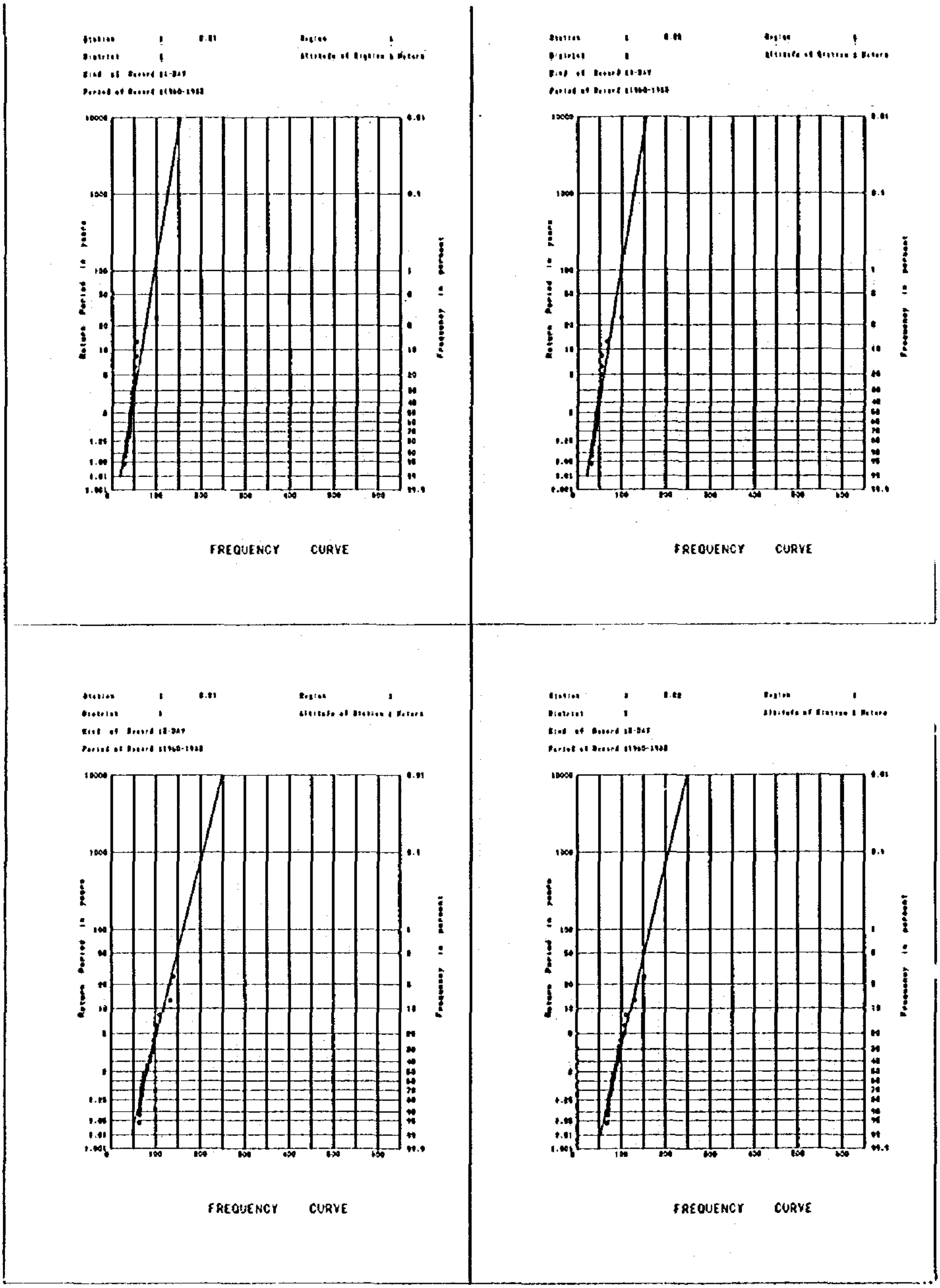
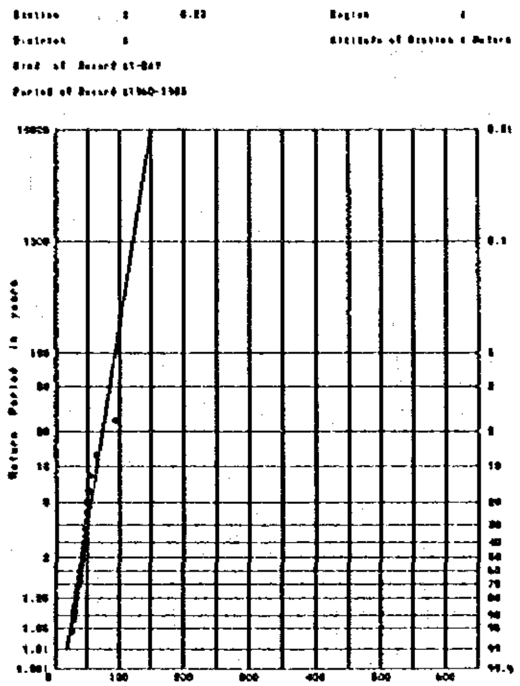
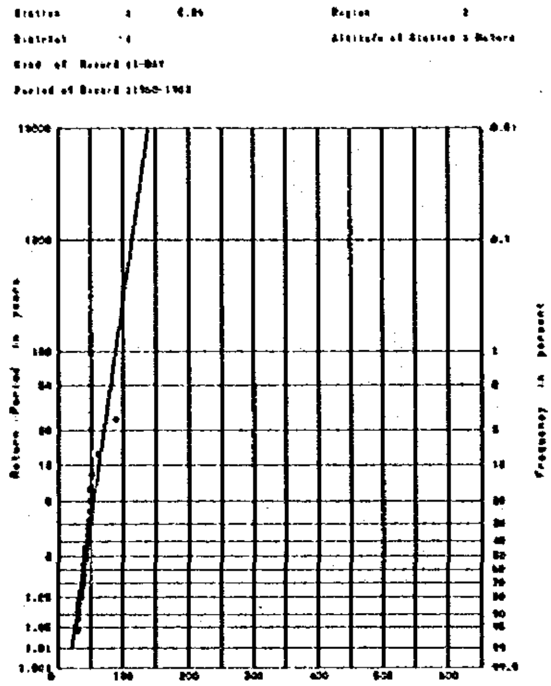


Fig. HY-2.2(4) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL



FREQUENCY CURVE



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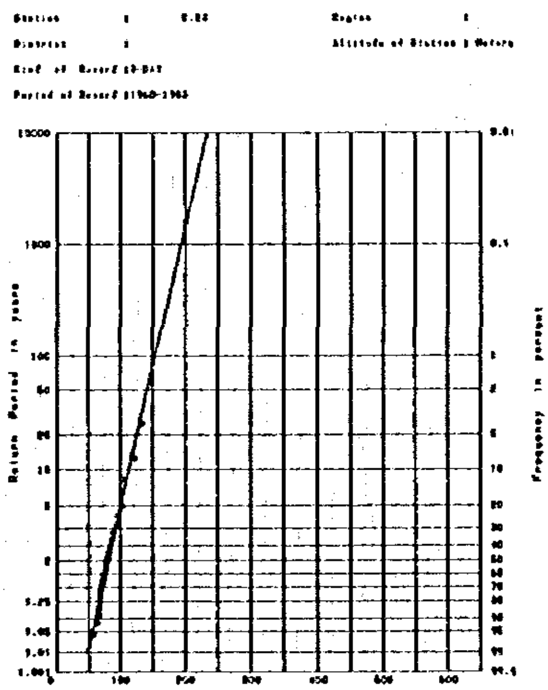

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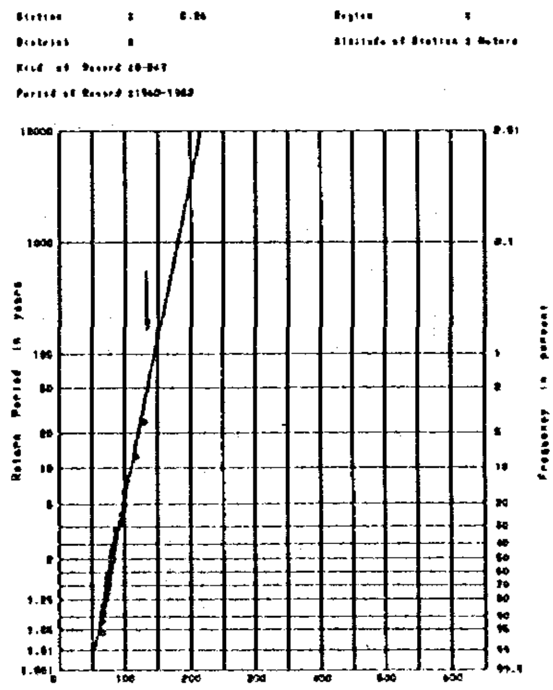
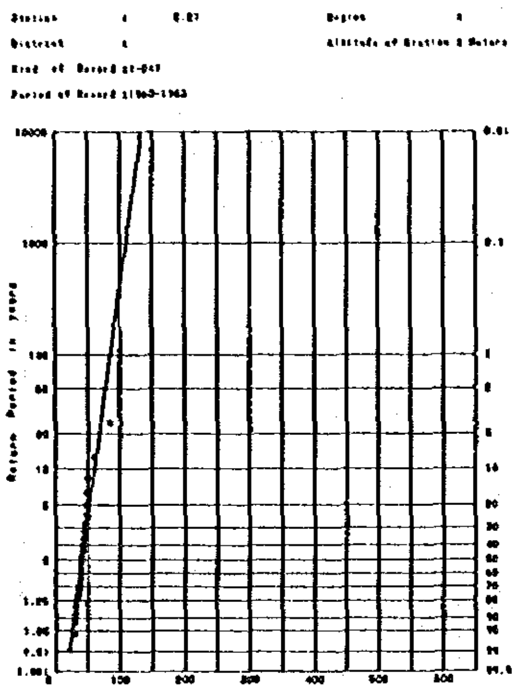
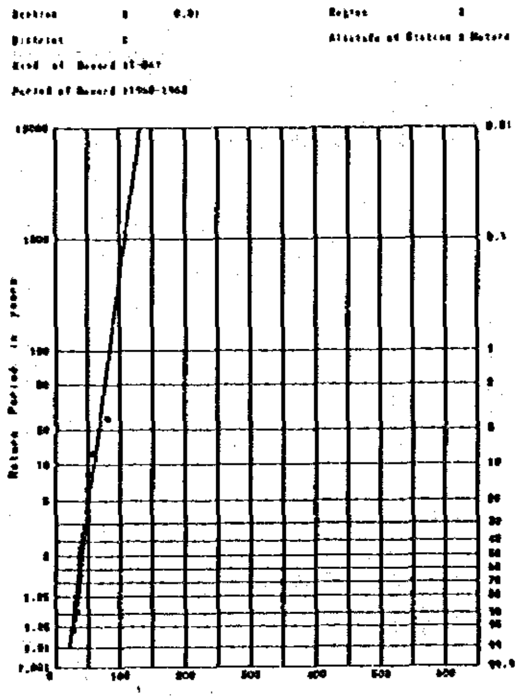


FREQUENCY CURVE

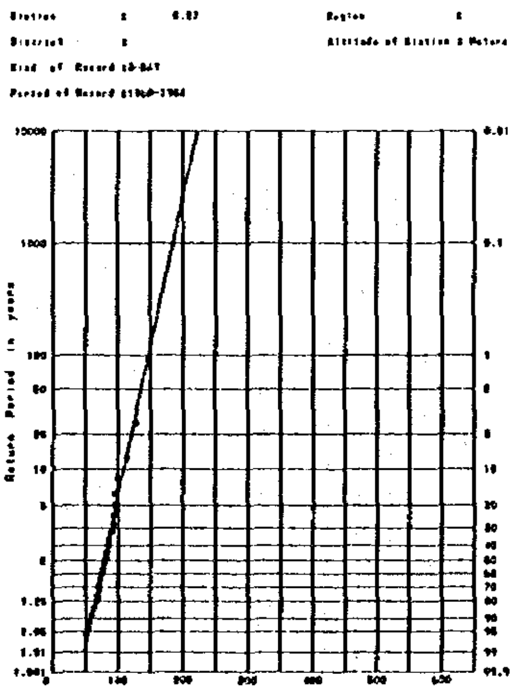
Fig. HY-2.2(5) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL



FREQUENCY CURVE



FREQUENCY CURVE



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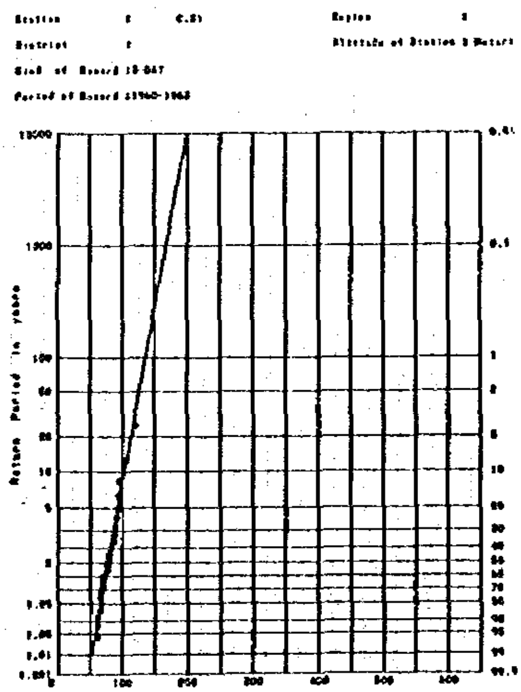
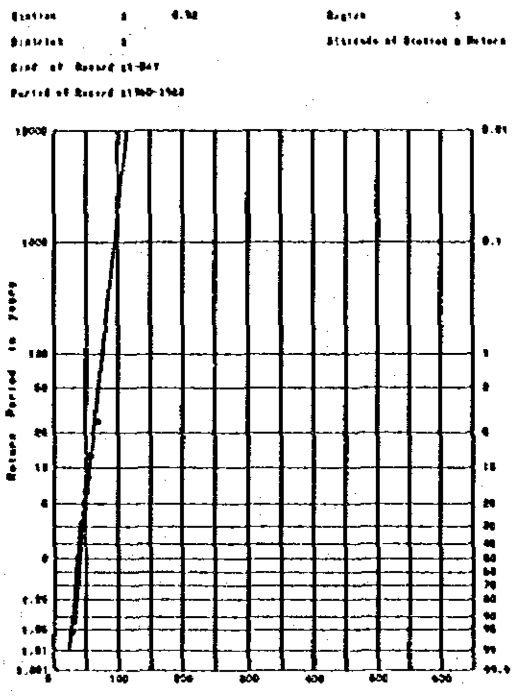


FREQUENCY CURVE

Fig. HY-2.2(6) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL



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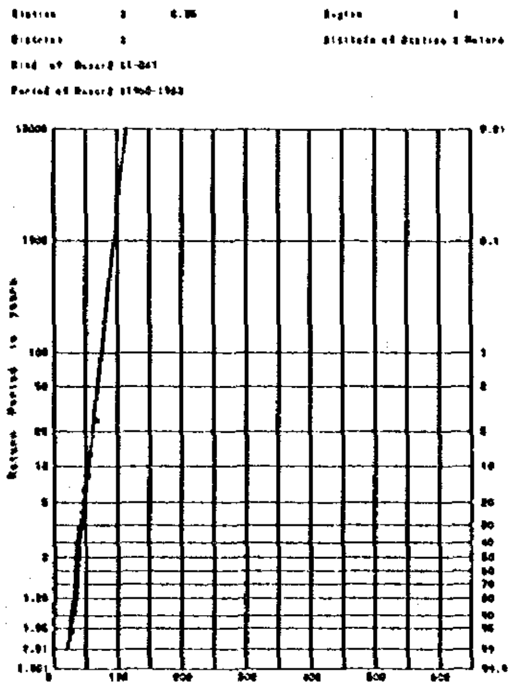

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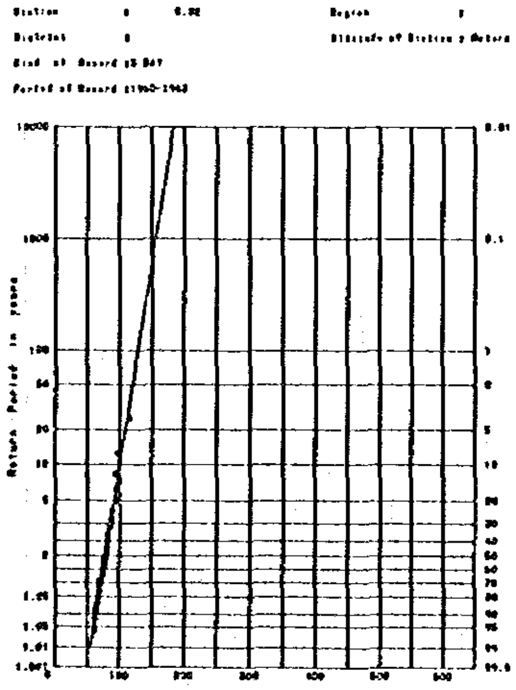

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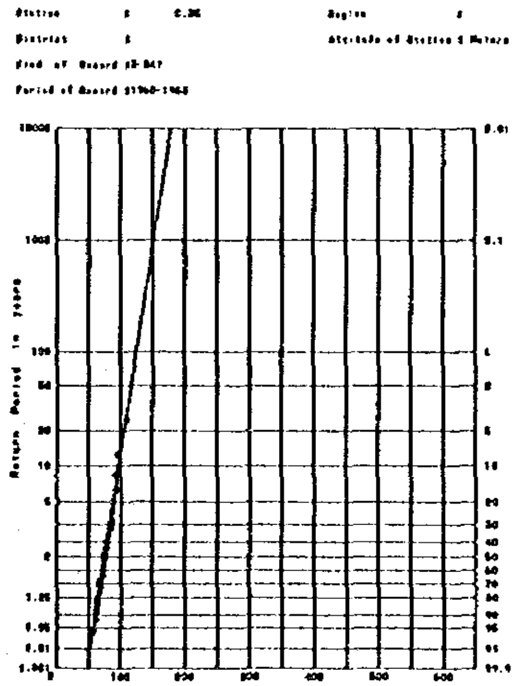


FREQUENCY CURVE

Fig. HY-2.2(7) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

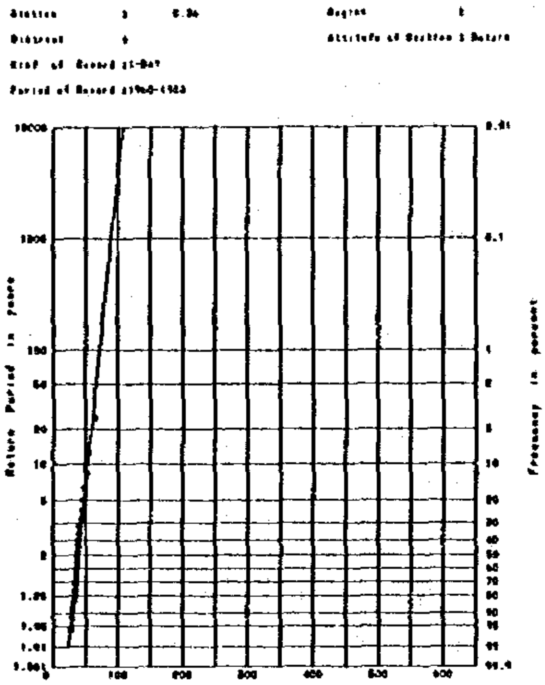
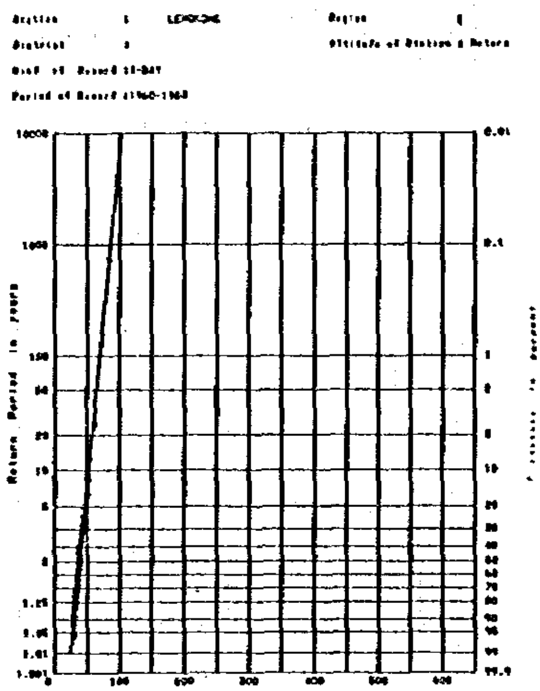


Fig.- FREQUENCY CURVE



FREQUENCY CURVE .

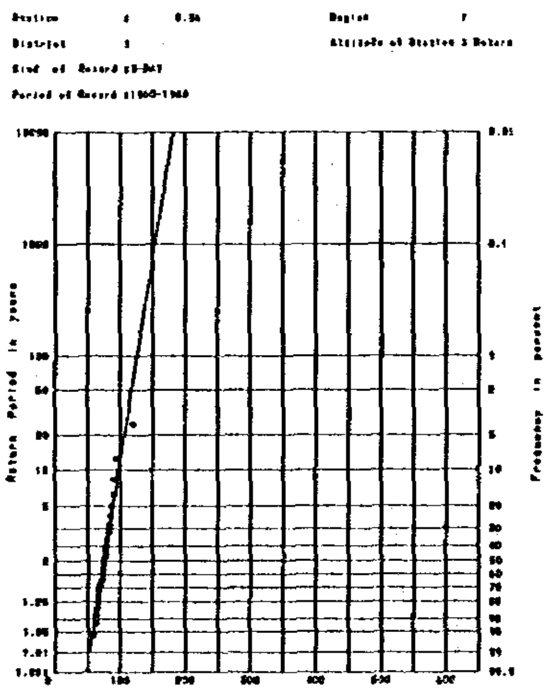
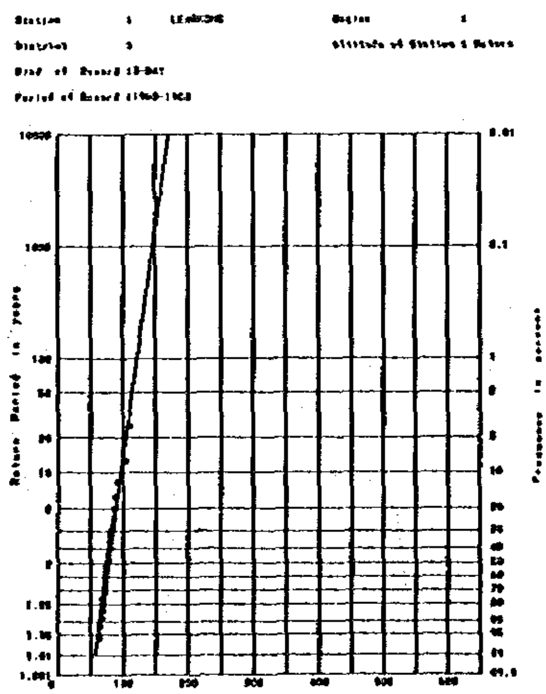


Fig.- FREQUENCY CURVE



FREQUENCY CURVE

Fig. HY-2.2(8) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

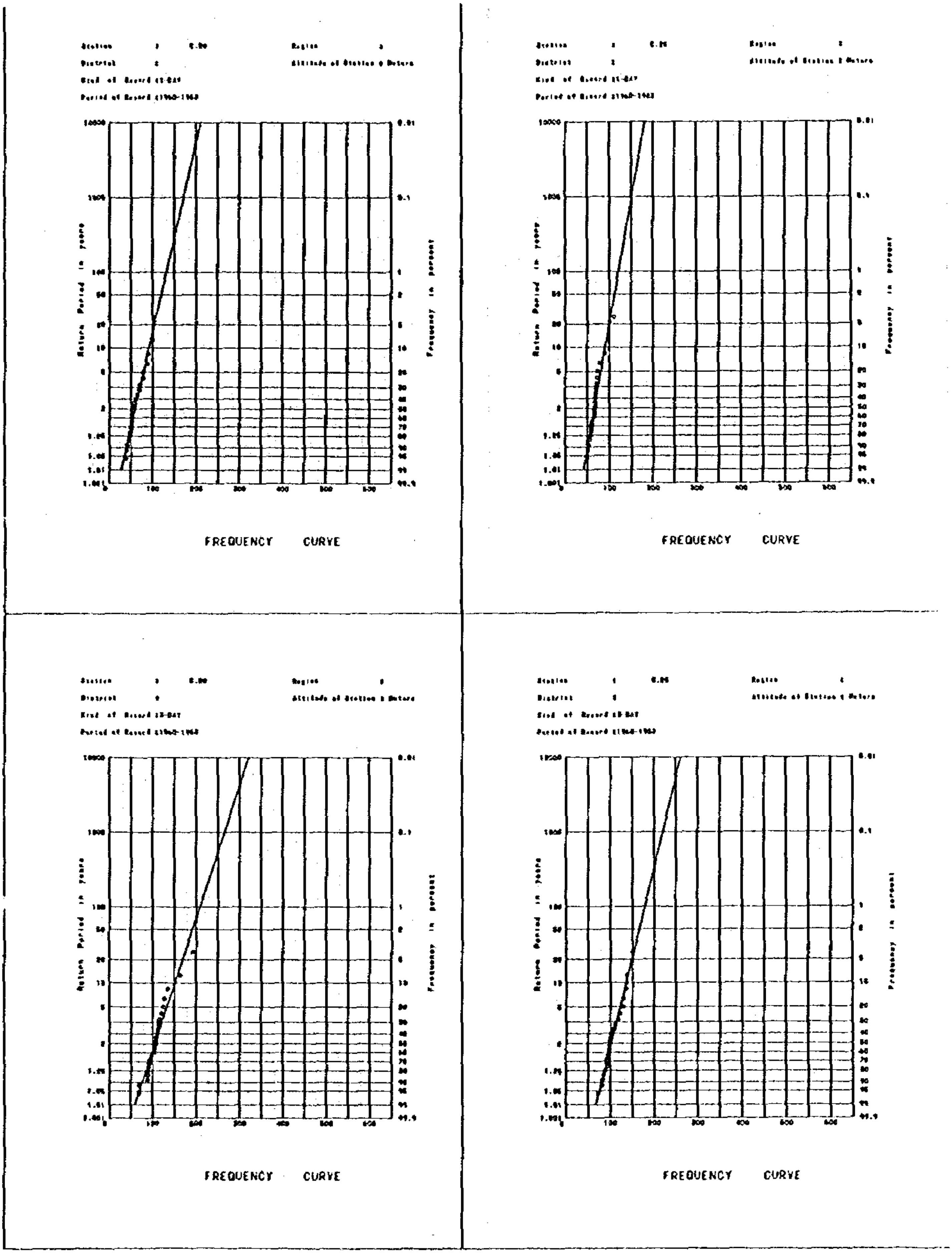


Fig. HY-2.2(9) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

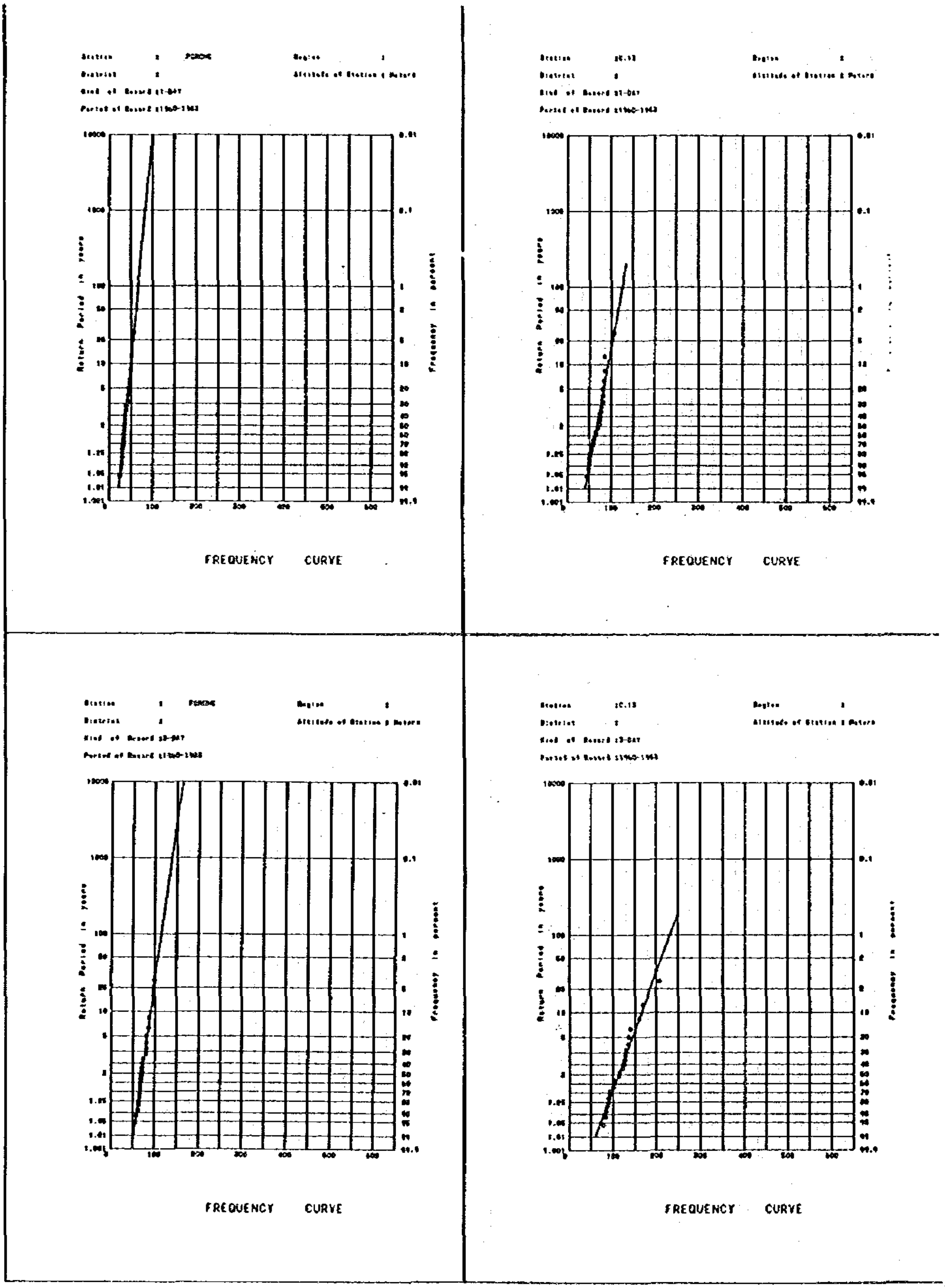
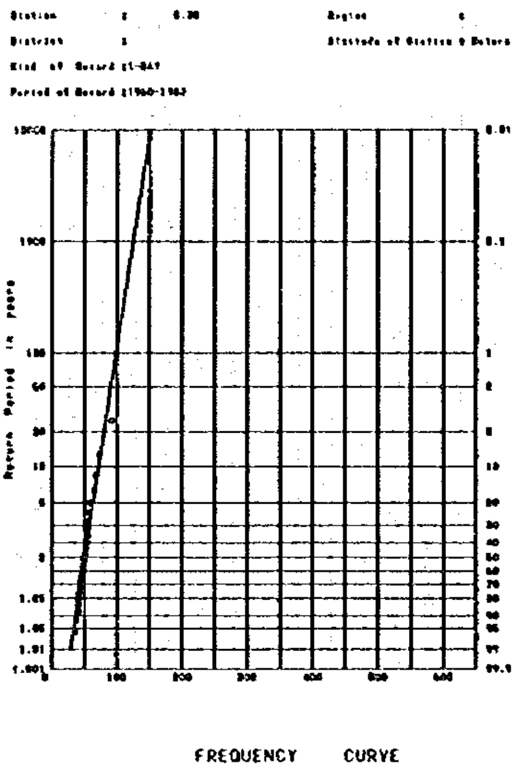
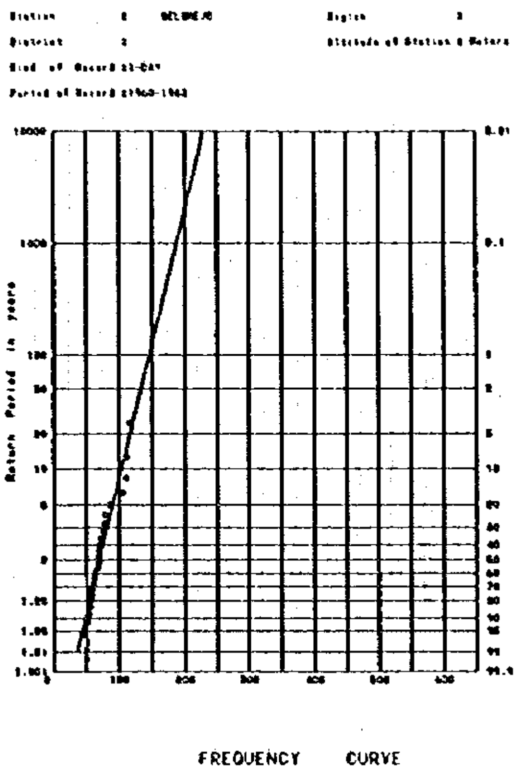
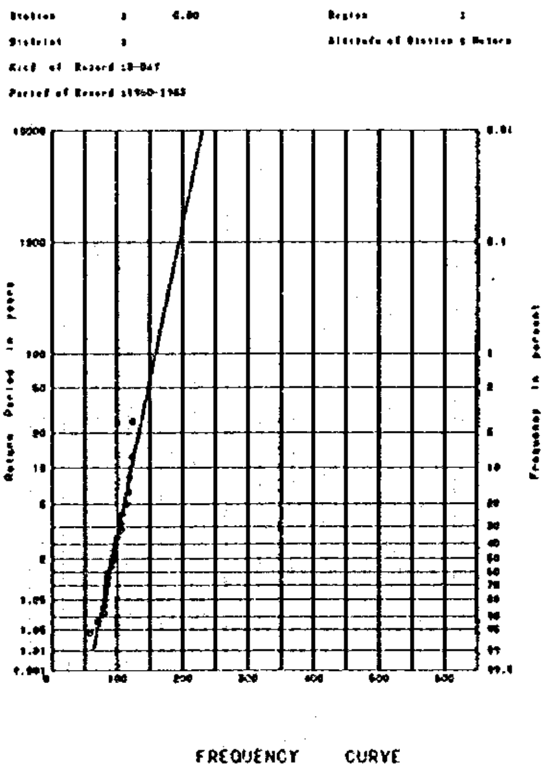


Fig. HY-2,2(10) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL







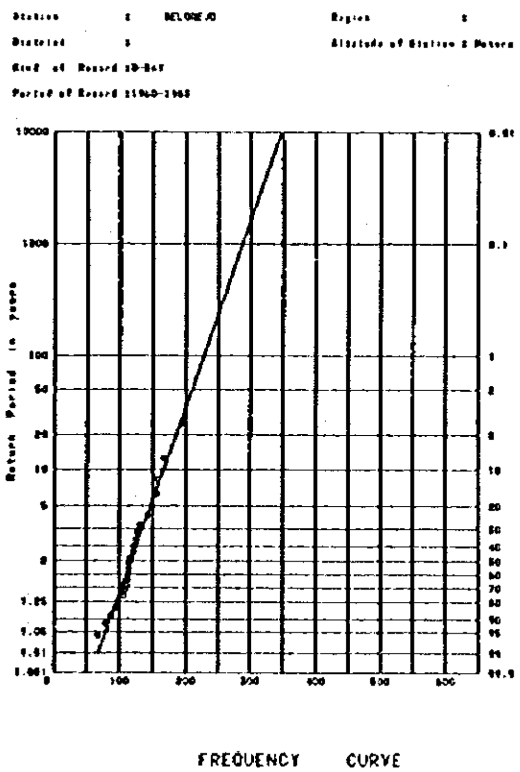


Fig. HY-2.2(11) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

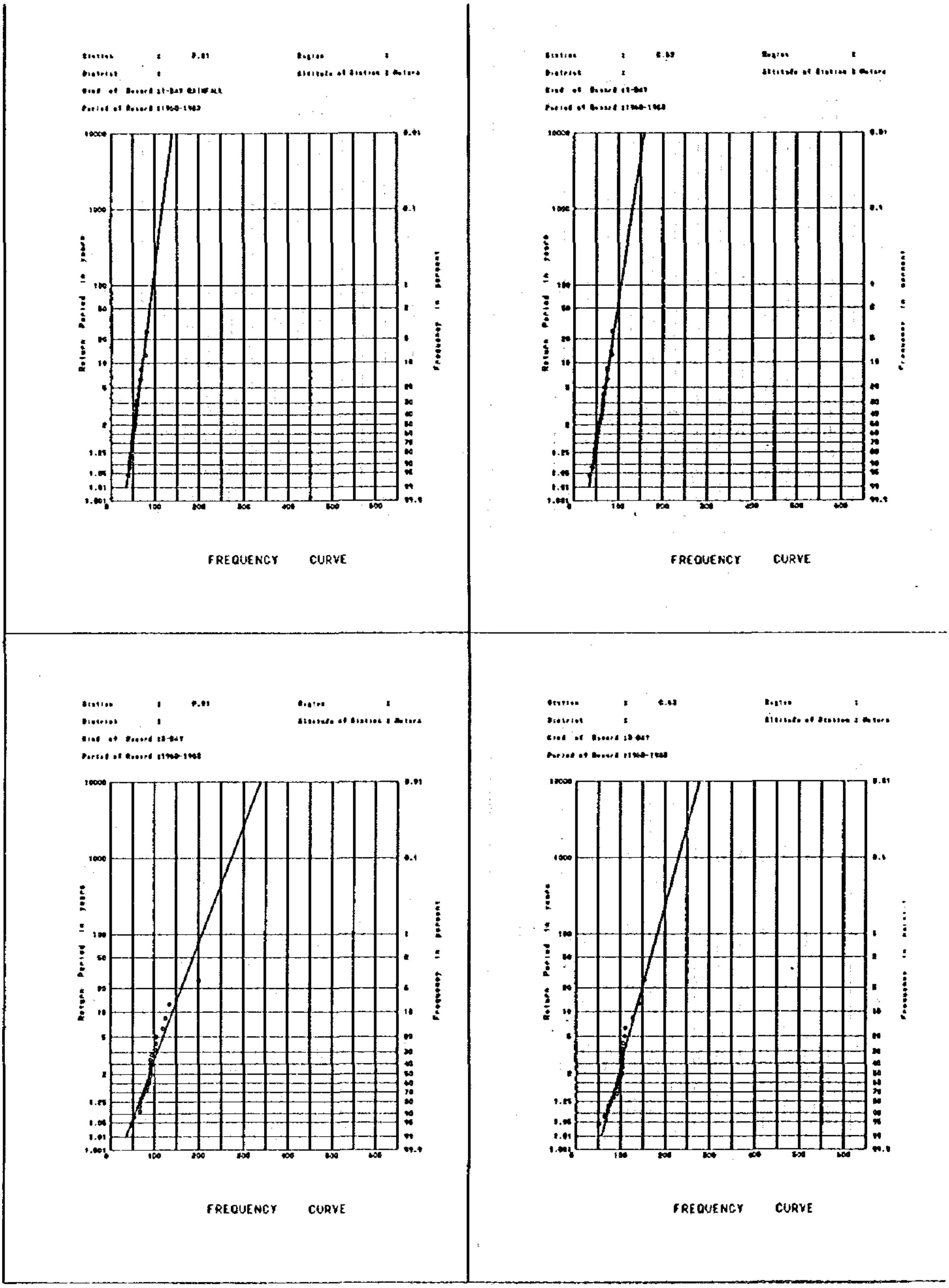


Fig. HY-2.2(12) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

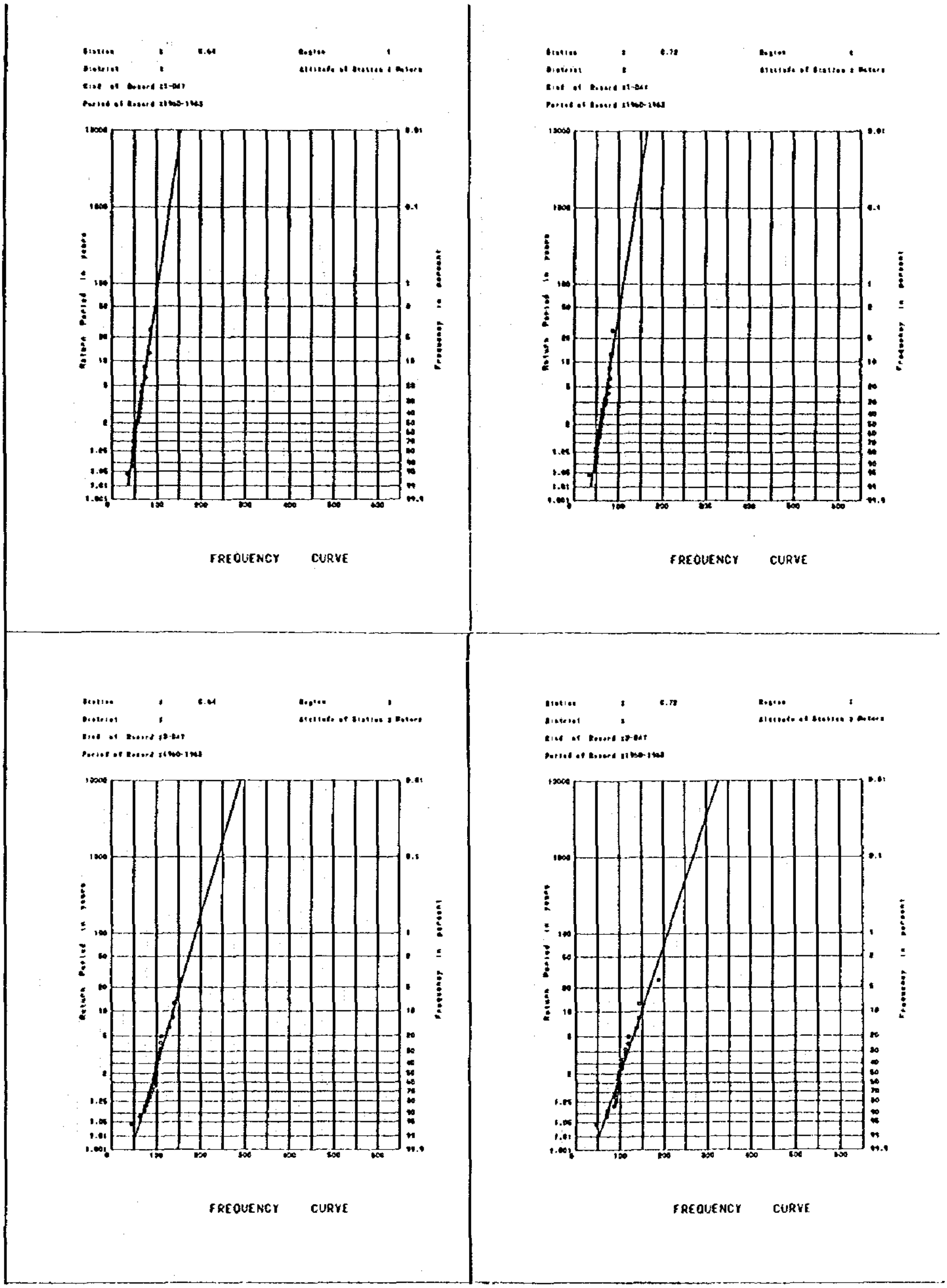


Fig. HY-2.2(13) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL

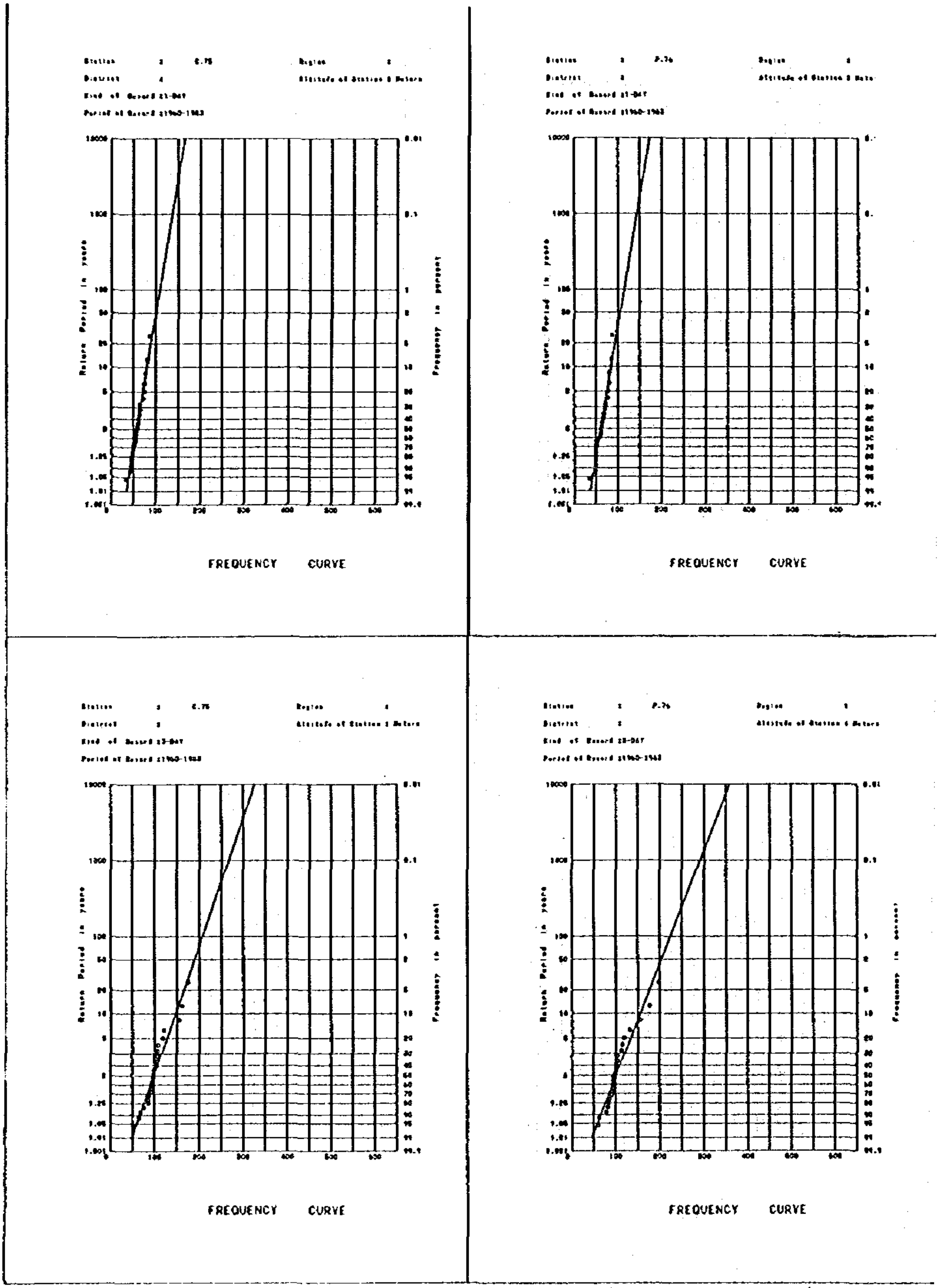
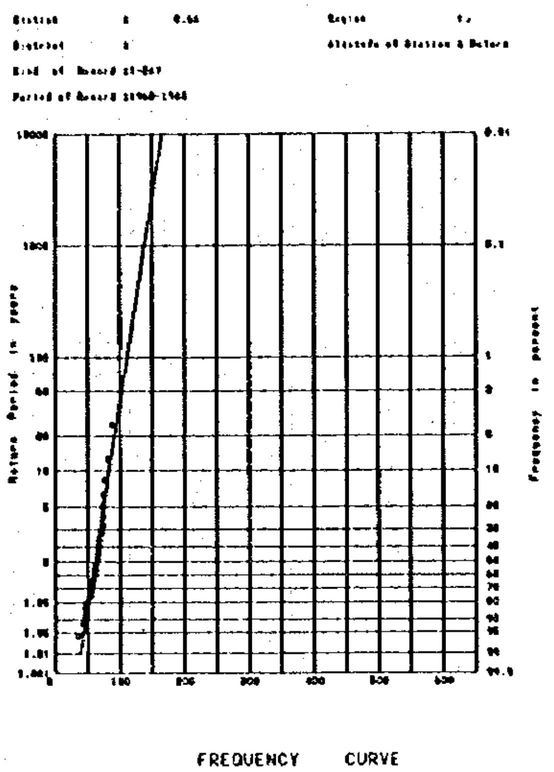
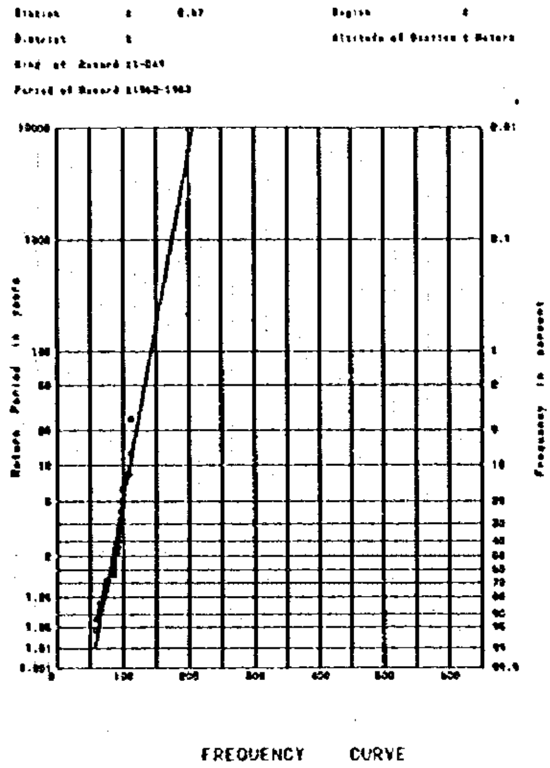
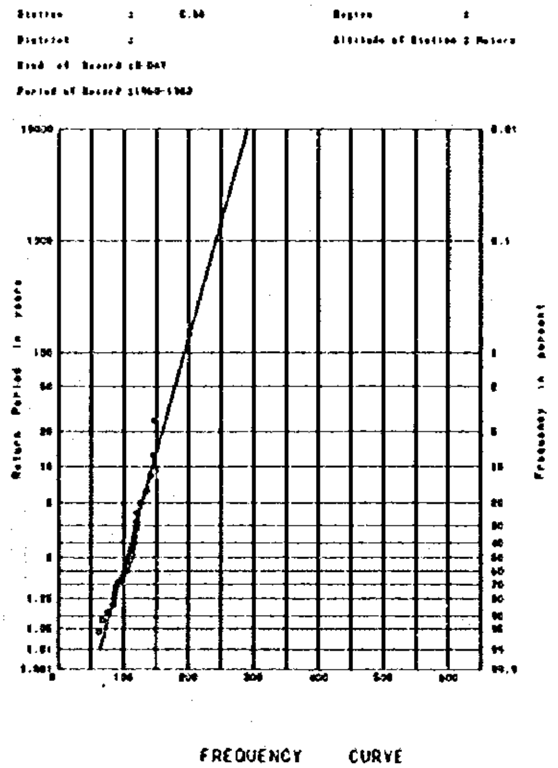


Fig. HY-2.2(14) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL







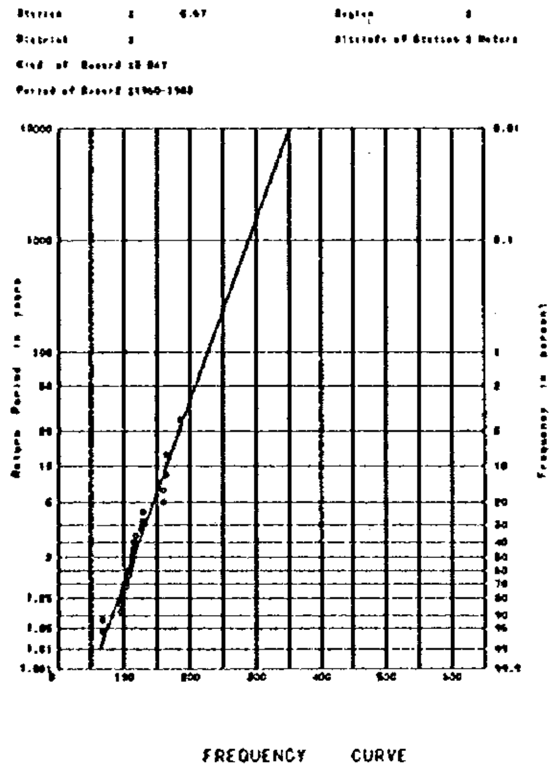
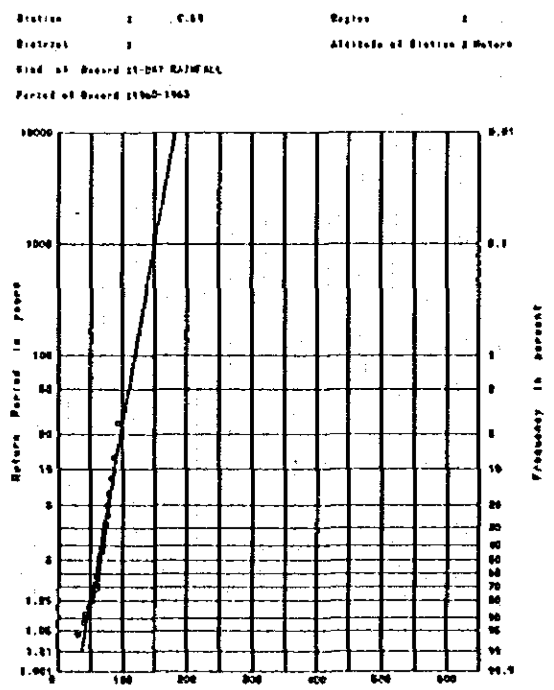
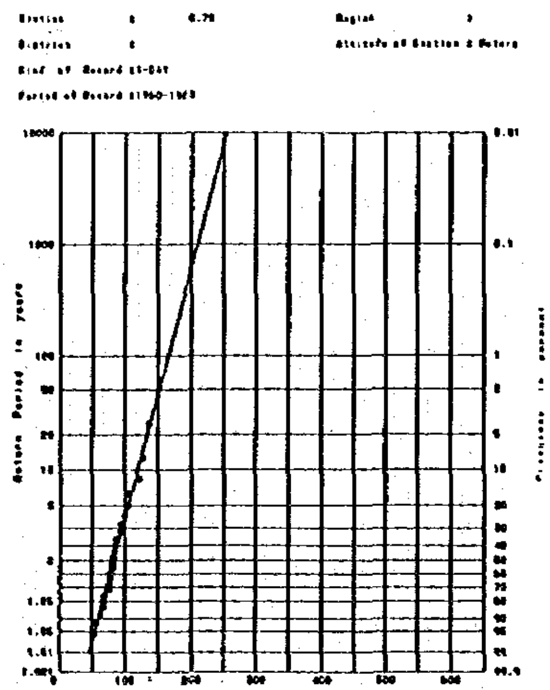


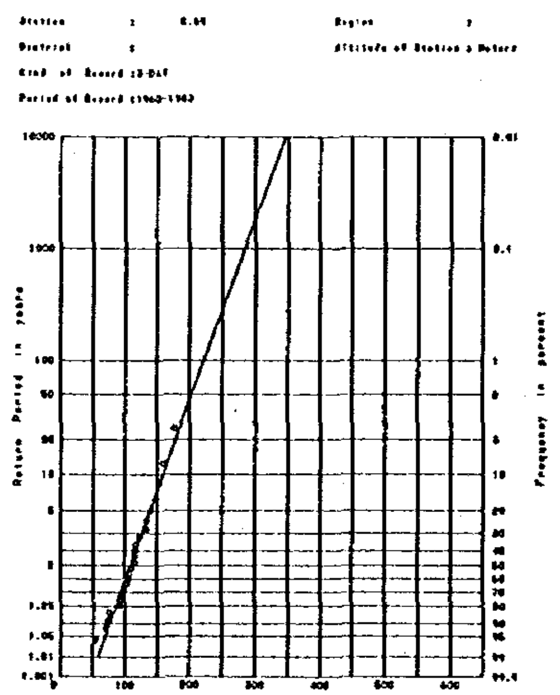
Fig. HY-2.2(15) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL



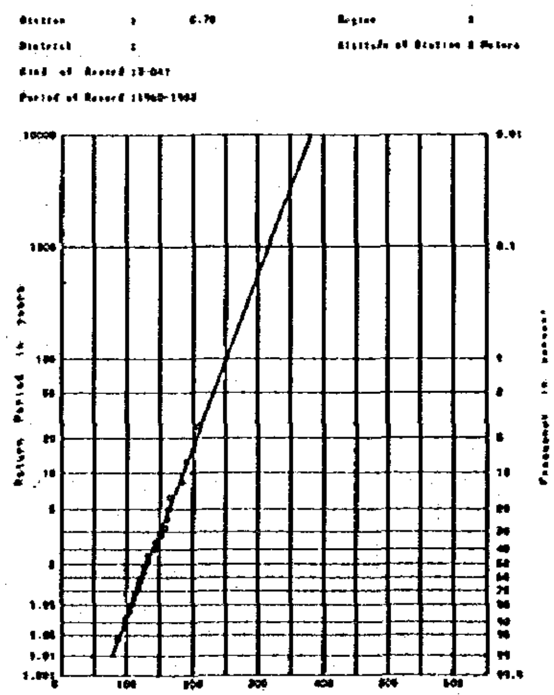
FREQUENCY CURVE



FREQUENCY CURVE

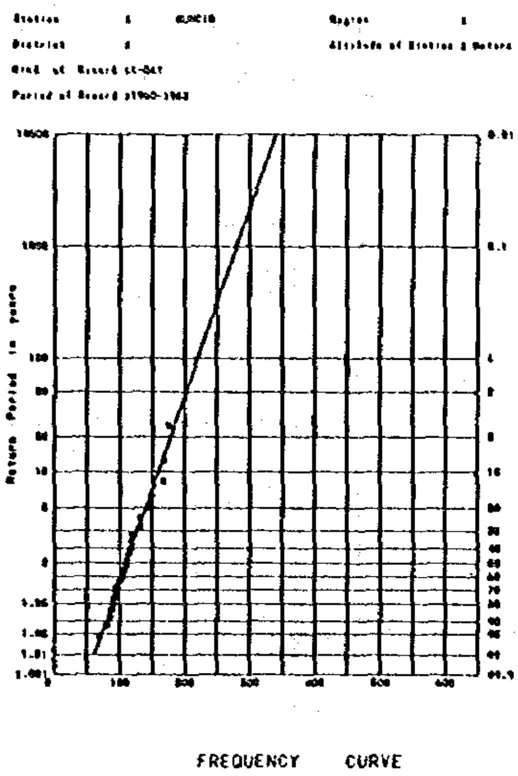


FREQUENCY CURVE



FREQUENCY CURVE

Fig. HY-2.2(16) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN 1-DAY/3-DAY RAINFALL



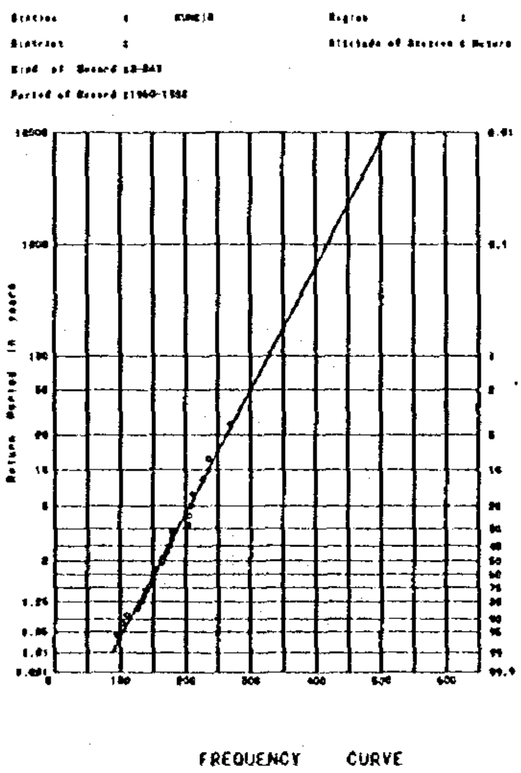


Fig. HY-2.2(17) FREQUENCY CURVE OF ANNUAL MAXIMUM BASIN MEAN }-DAY/3-DAY RAINFALL

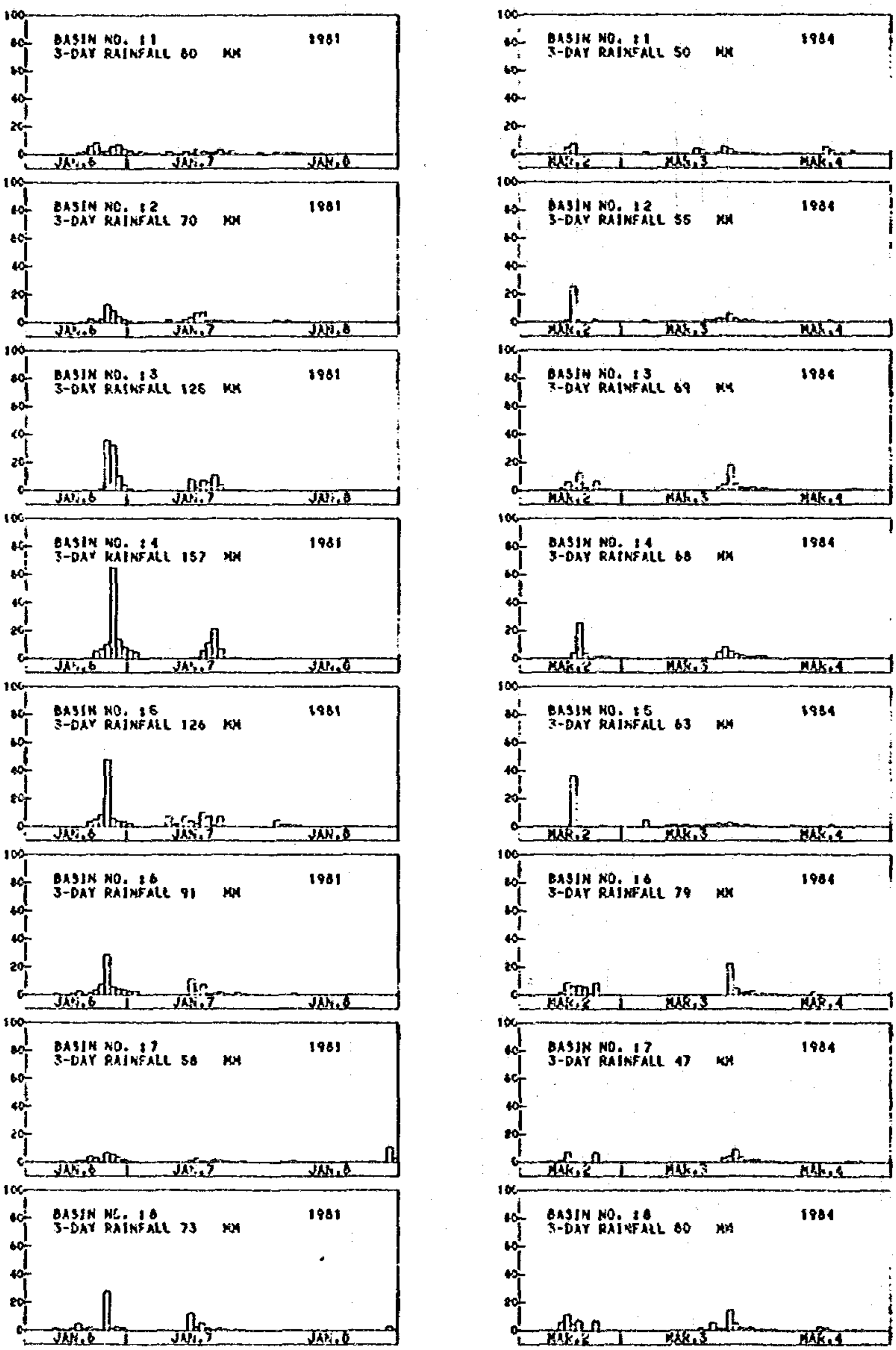


Fig. HY-2.3(1) HOURLY RAINFALL DISTRIBUTION OF SUB-BASIN

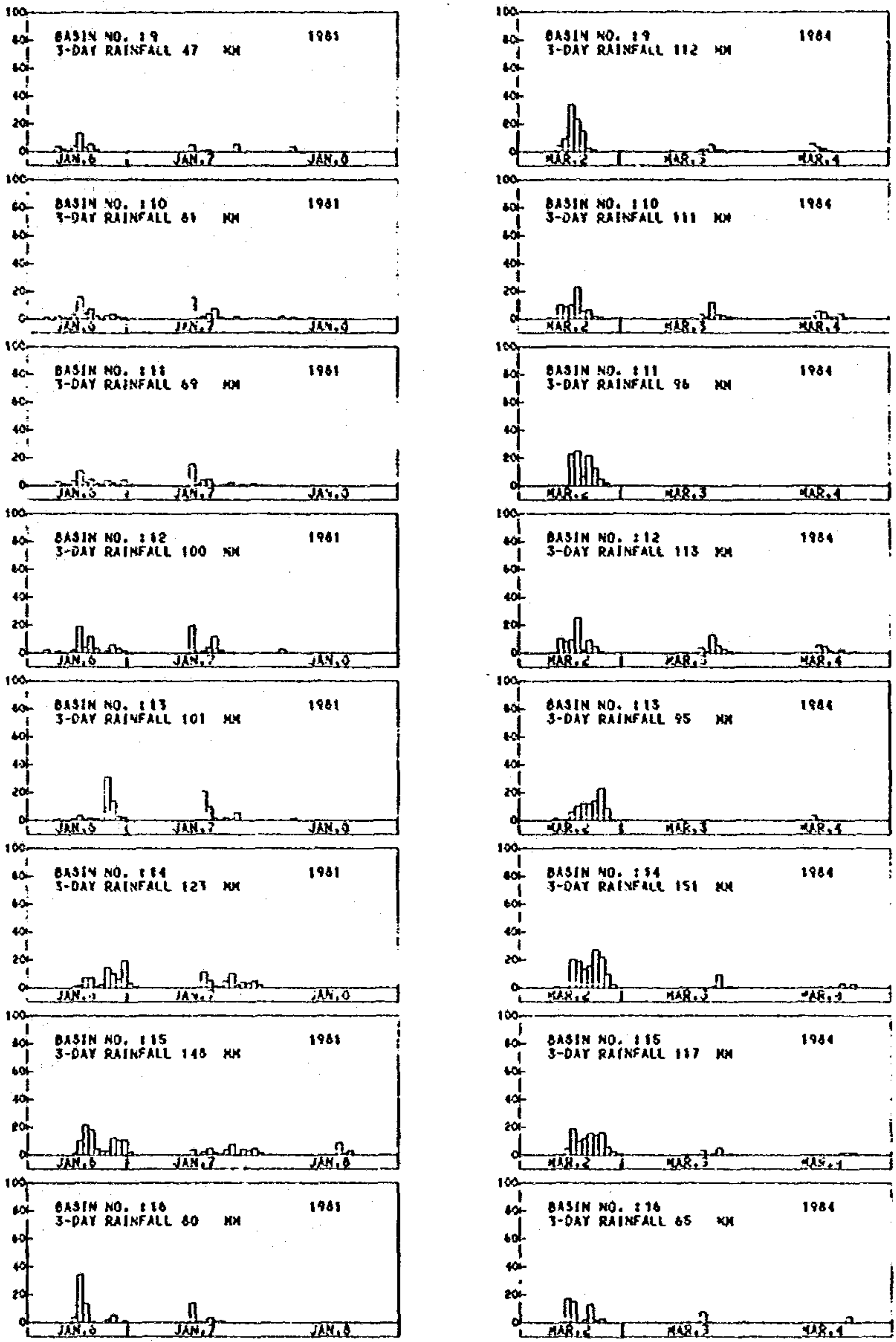


Fig. HY-2.3(2) HOURLY RAINFALL DISTRIBUTION OF SUB-BASIN

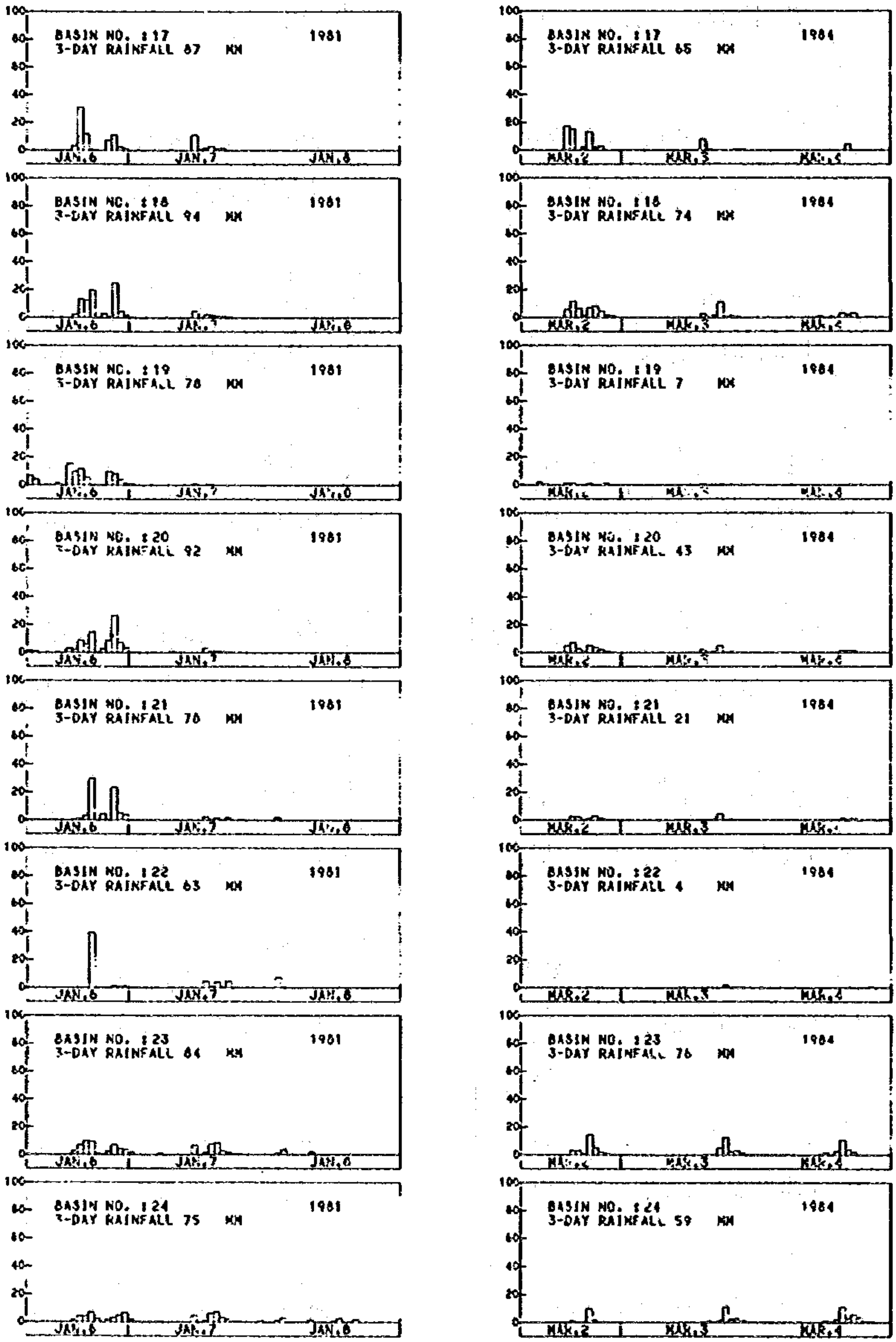


Fig. HY-2.3(3) HOURLY RAINFALL DISTRIBUTION OF SUB-BASIN

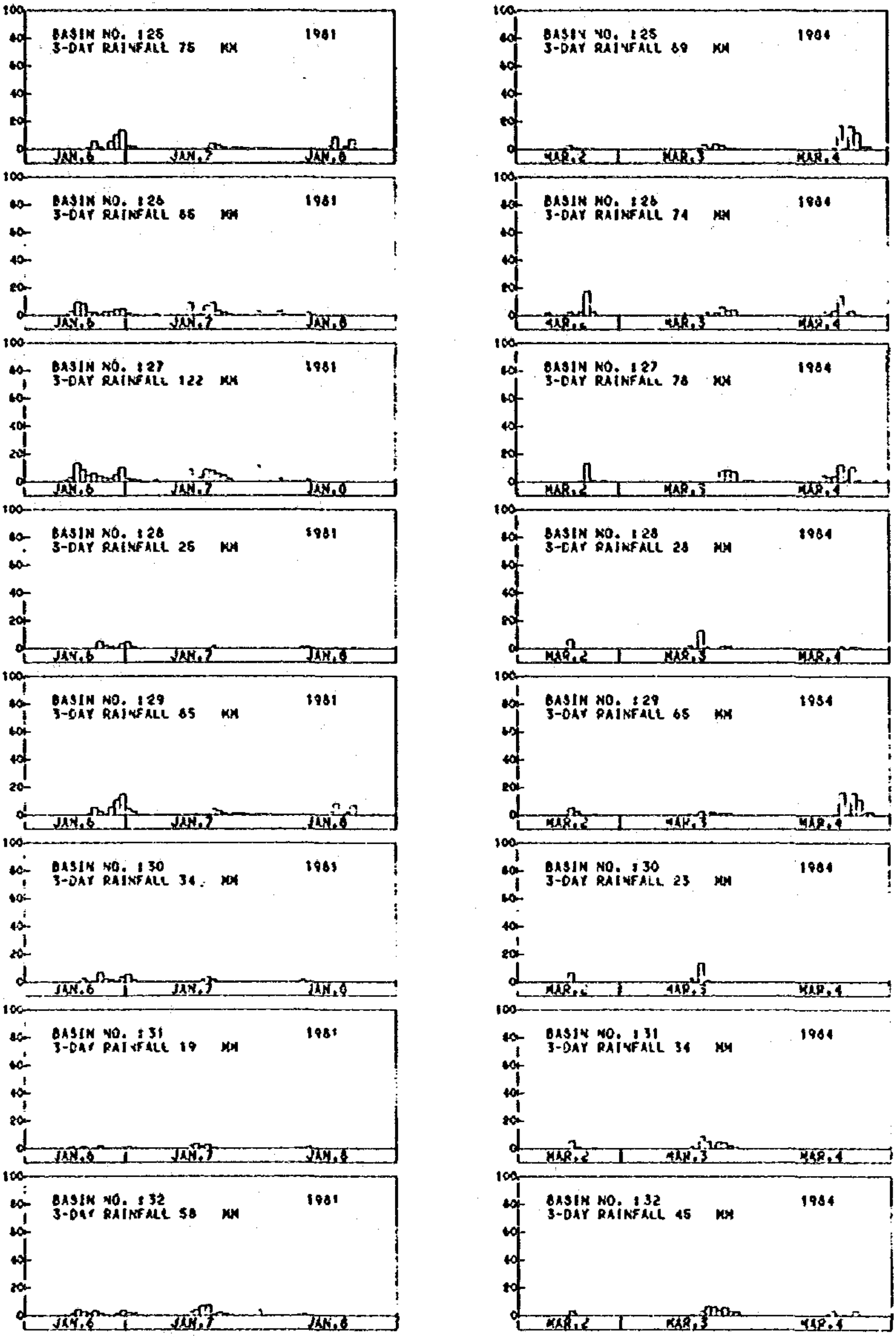


Fig. HY-2.3(4) HOURLY RAINFALL DISTRIBUTION OF SUB-BASIN

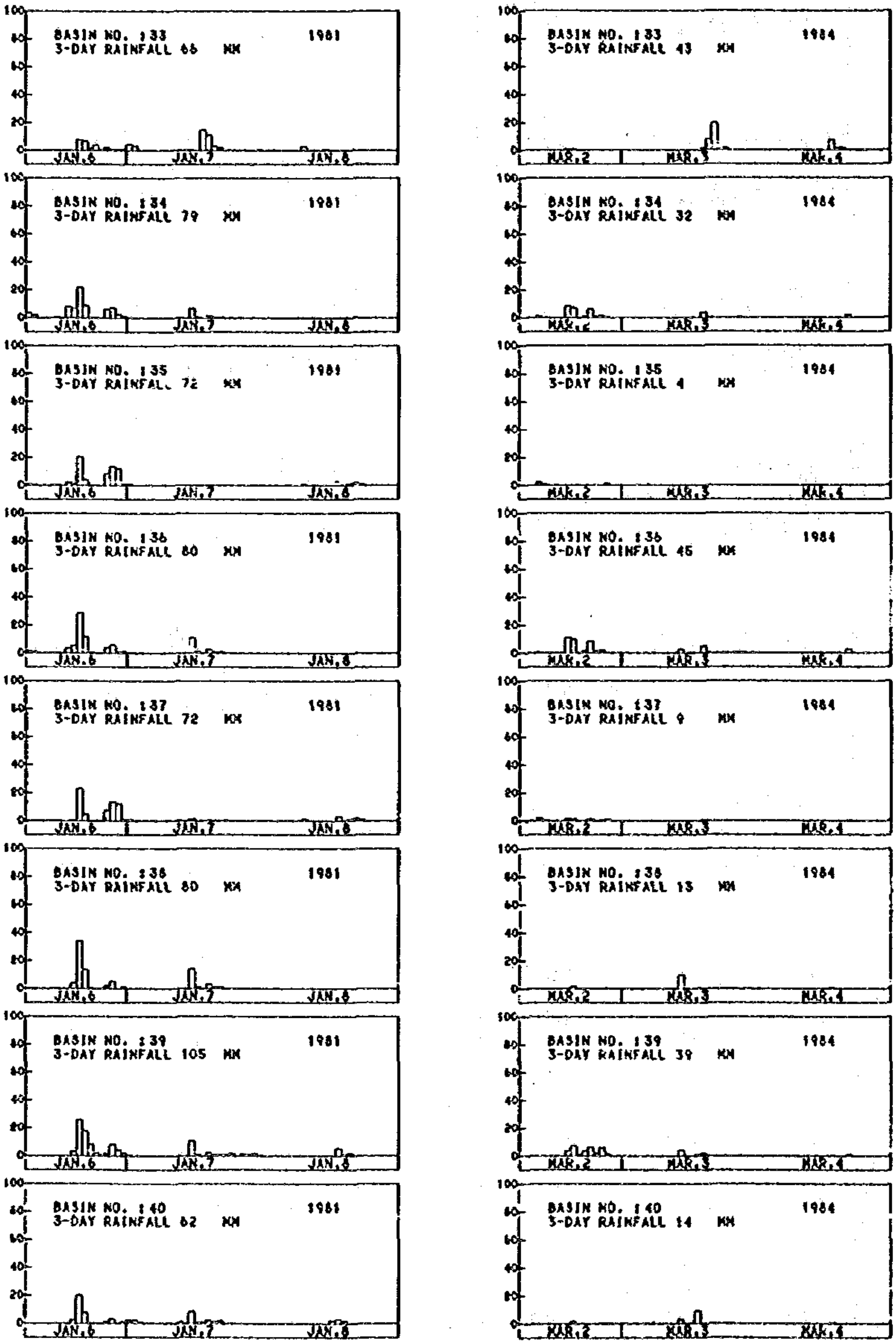


Fig. HY-2.3(5) HOURLY RAINFALL DISTRIBUTION OF SUB-BASIN

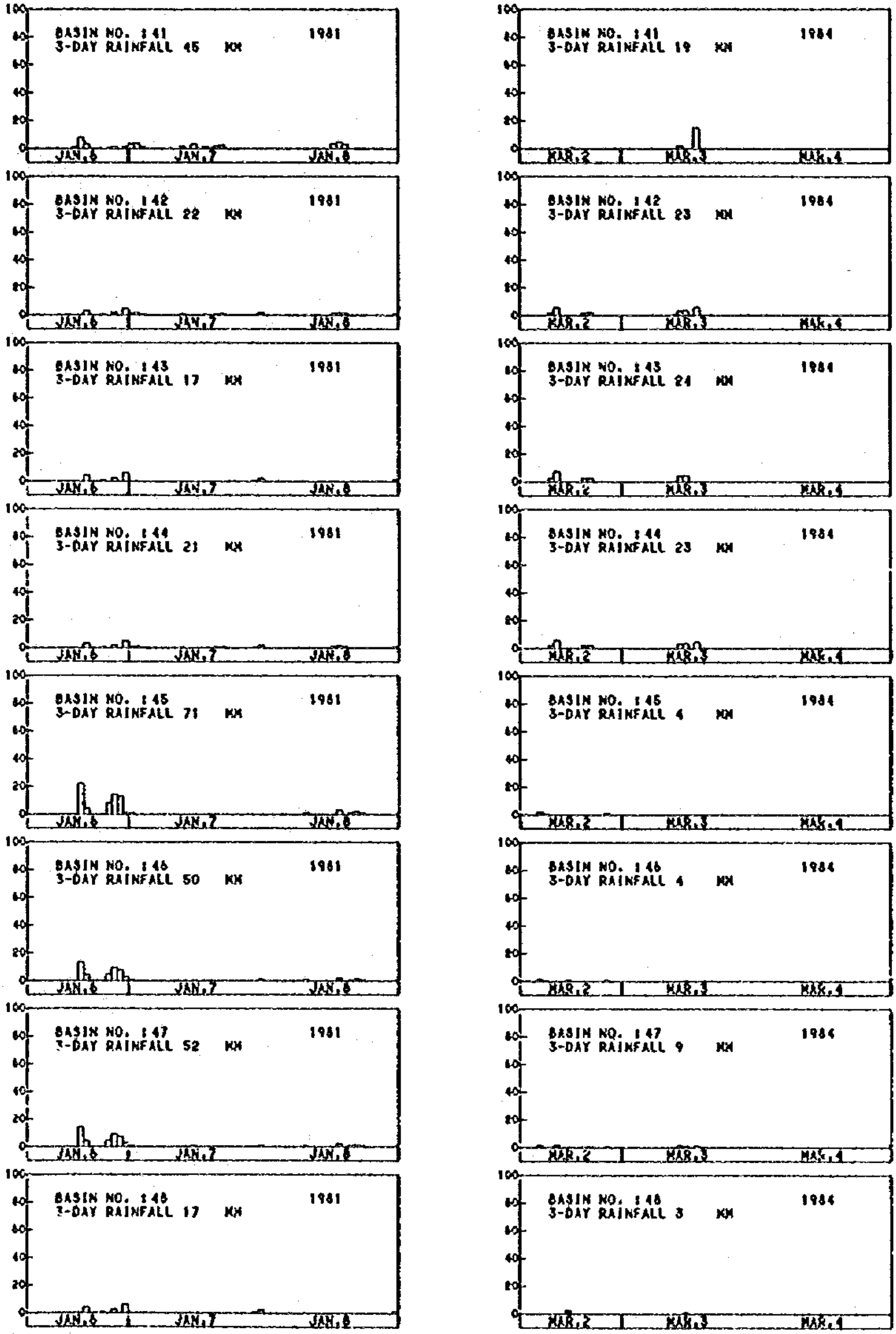


Fig. HY-2.3(6) HOURLY RAINFALL DISTRIBUTION OF SUB-BASIN

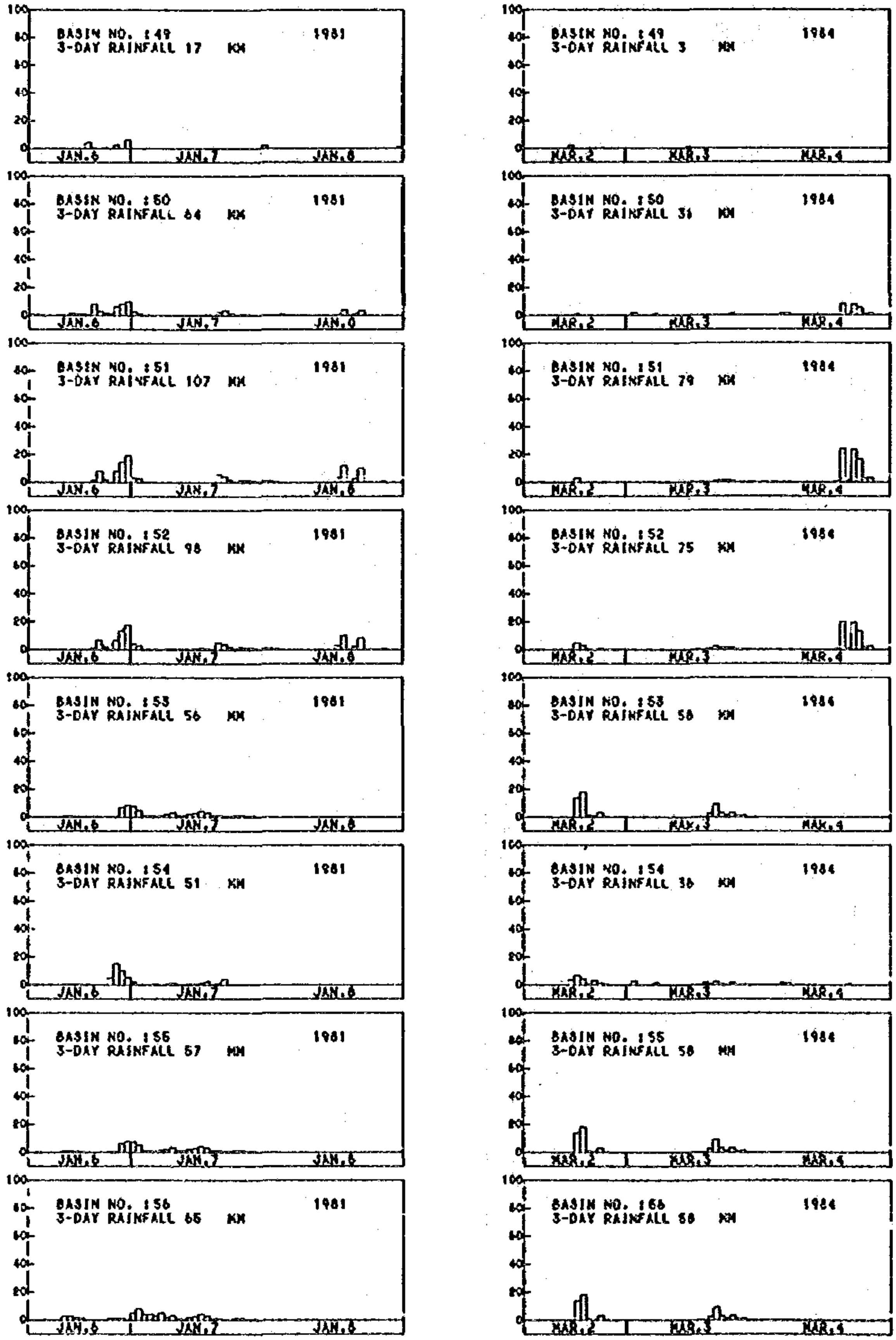


Fig. HY-2.3(7) HOURLY RAINFALL DISTRIBUTION OF SUB-BASIN

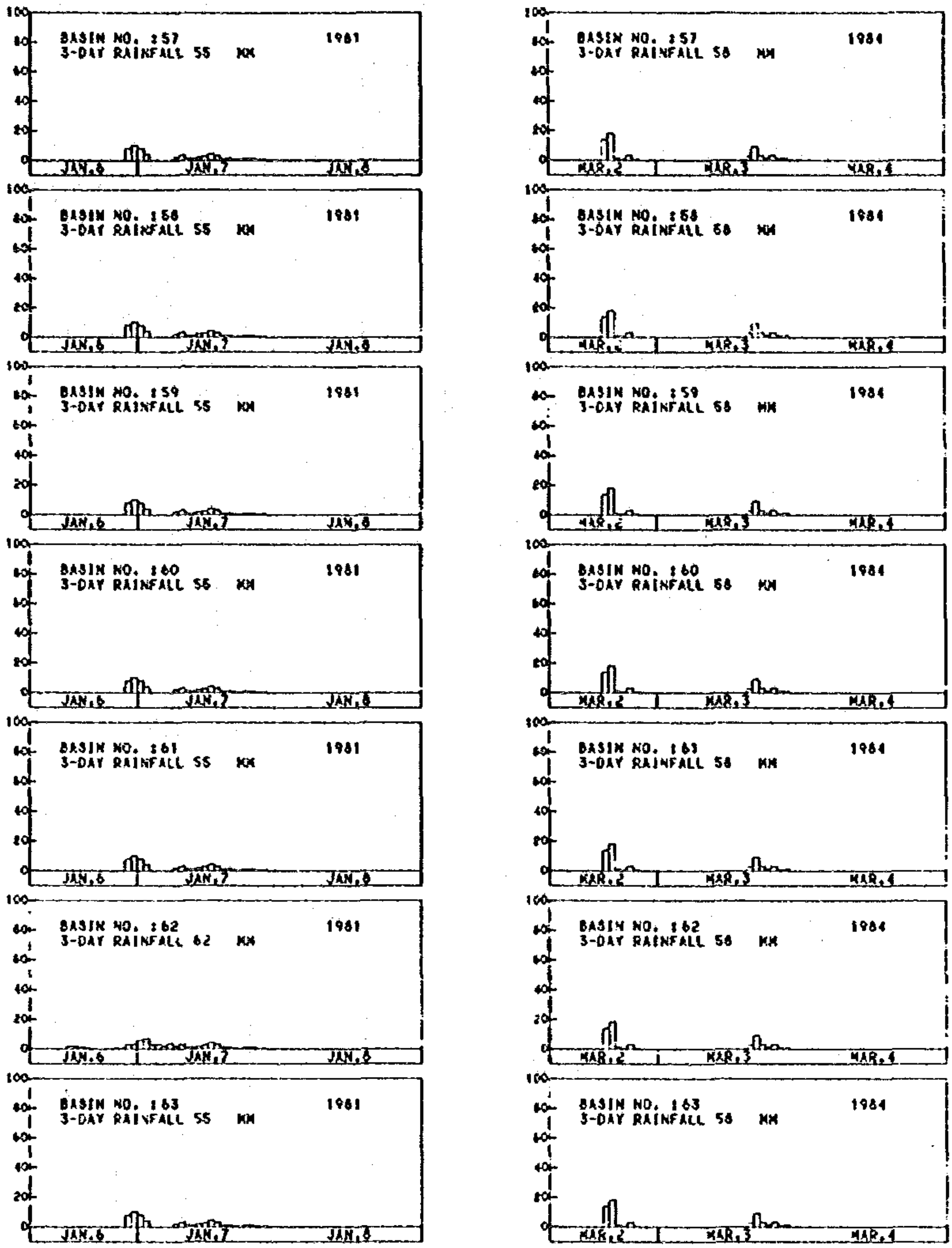


Fig. HY-2.3(8) HOURLY RAINFALL DISTRIBUTION OF SUB-BASIN

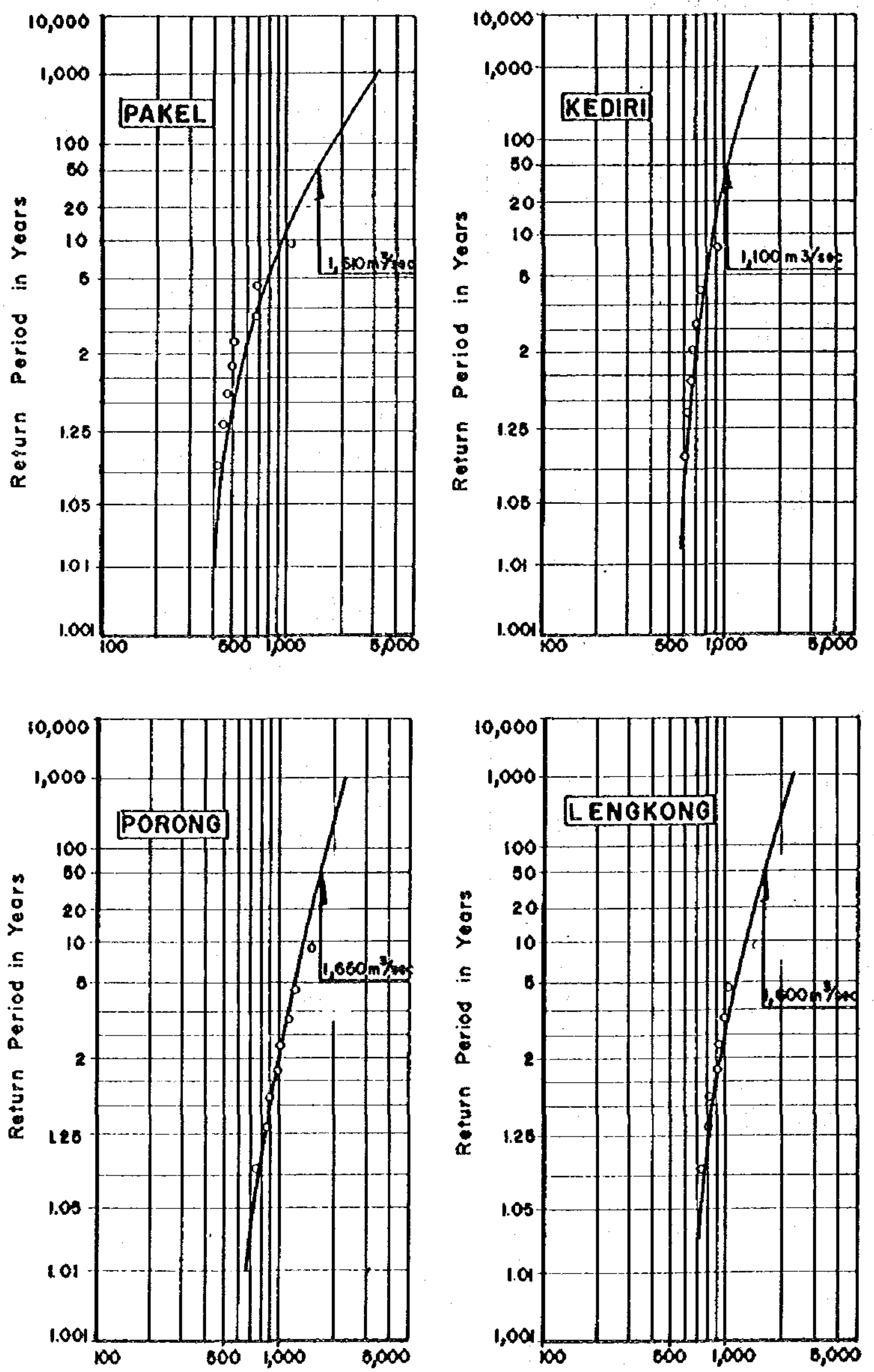


Fig. HY-2.4 FREQUENCY CURVE OF ANNUAL MAXIMUM PEAK DISCHARGE

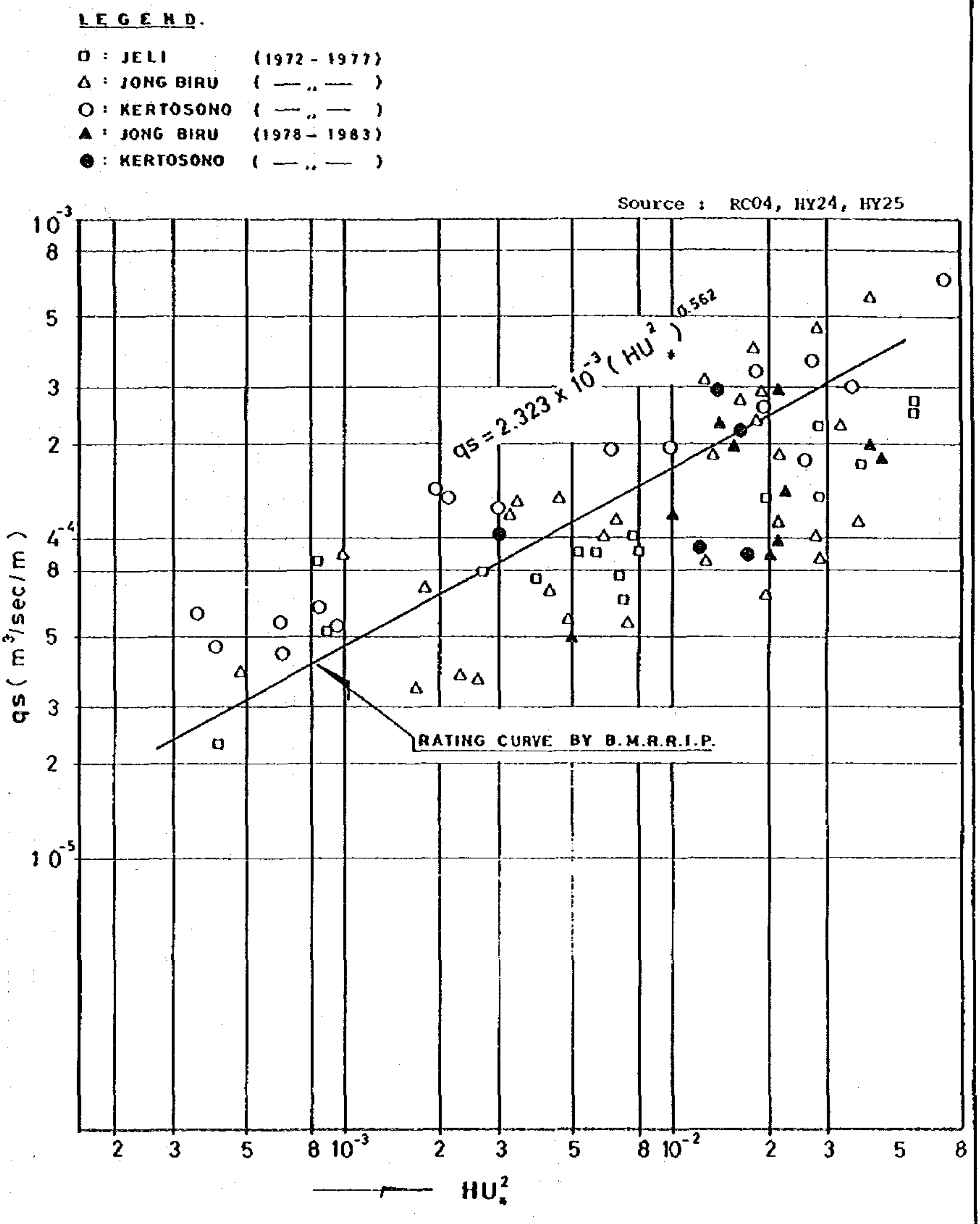


Fig. HY-3.1(1) RELATION BETWEEN (HU_*^2) AND qs

Source : RC04, HY24, HY25

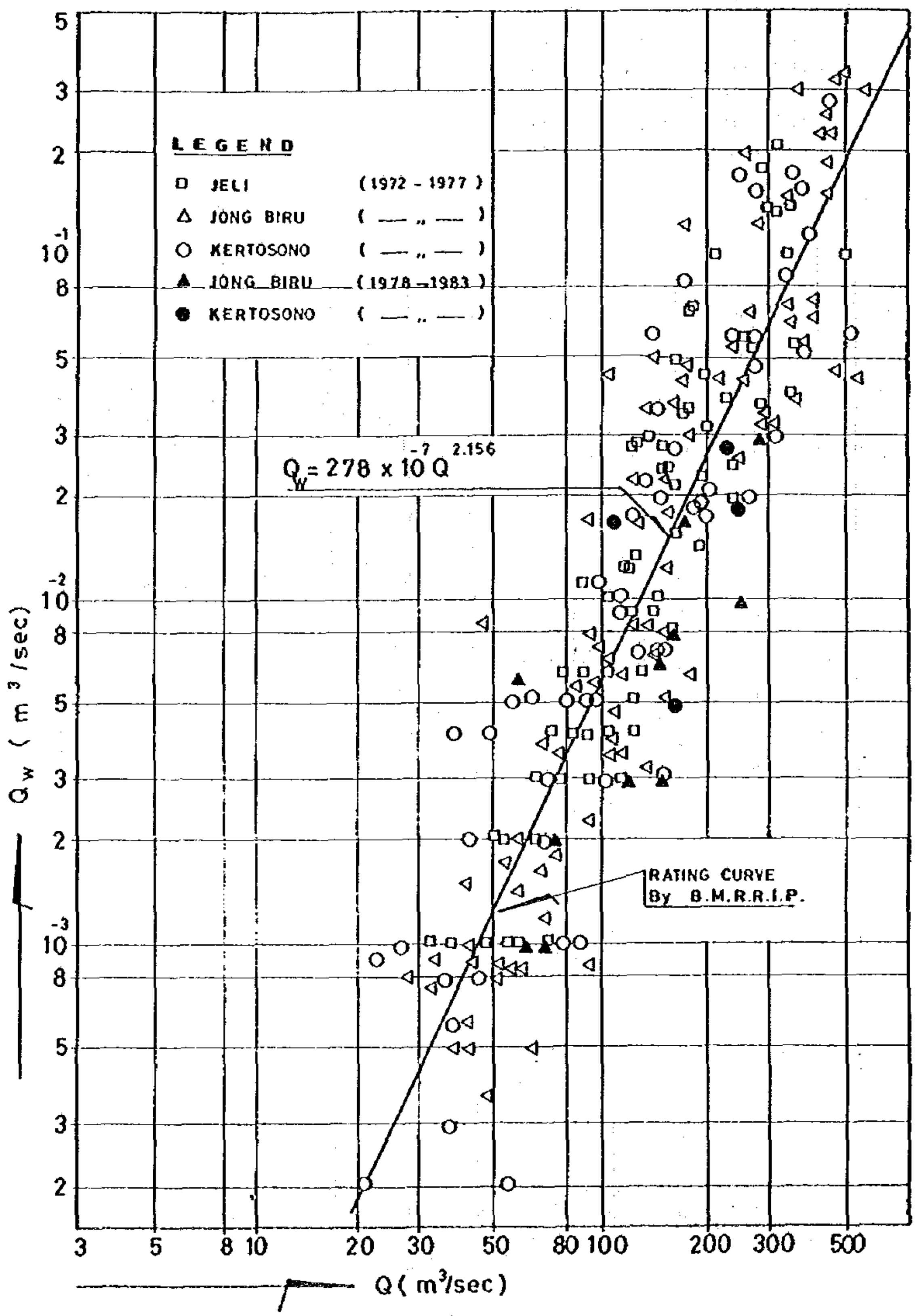


Fig. HY-3.1(2) RELATION BETWEEN Q AND Qw

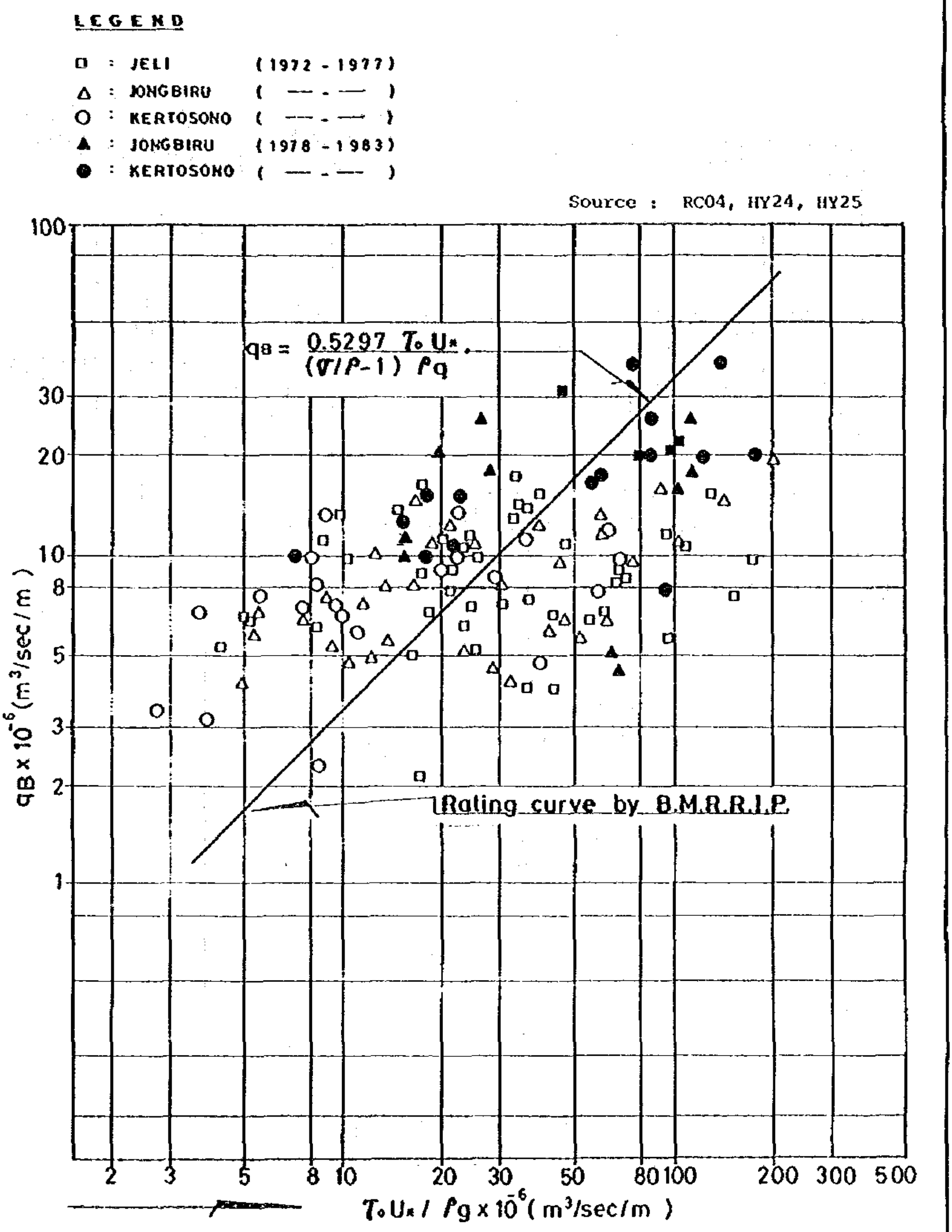


Fig. HY-3.1(3) RELATION BETWEEN $(\tau_0/\rho)/g$ AND q_B

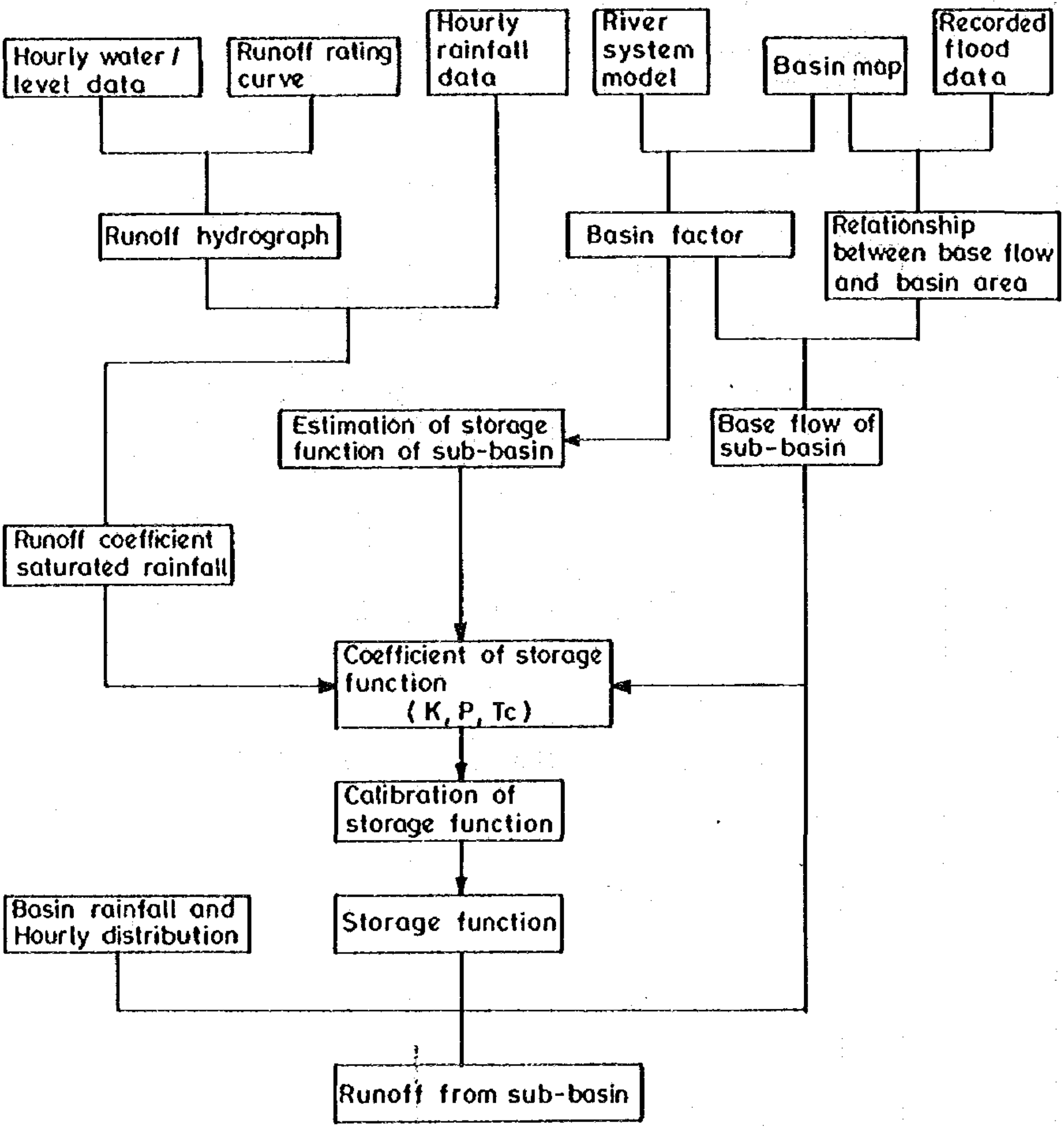


Fig. HY-4.1 RUNOFF FROM SUB-BASIN

ANNEX AI

AGRICULTURE AND IRRIGATION STUDY

ANNEX AI

The Supporting Report of Agriculture and Irrigation (ANNEX AI) comprises of 18 series. The contents of ANNEX AI are compiled in the form of NOTE-AI. In ANNEX AI, a series of NOTE-AI is taken up as an independent chapter. Therefore, Tables and Figures are attached to each related NOTE-AI. The title of each NOTE-AI forming ANNEX AI is shown as follows:

NOTE AI-1	SOIL
NOTE AI-2	PRESENT CROPPING PATTERN AND FARMING PRACTICES
NOTE AI-3	YIELD AND CROP PRODUCTION
NOTE AI-4	INVENTORY OF IRRIGATION FACILITIES, CLASSIFICATION OF IRRIGATION AREA, AND INTAKE DISCHARGE
NOTE AI-5	EXISTING IRRIGATION PROJECT
NOTE AI-6	SELECTION OF AREA TO BE DEVELOPED
NOTE AI-7	PRESENT CONDITION OF SELECTED AREA
NOTE AI-8	FUTURE LAND USE, TARGET YIELD AND PRODUCTION IN SELECTED AREA
NOTE AI-9	BENEFIT ESTIMATE OF FUTURE PROJECTS
NOTE AI-10	PROPOSED IRRIGATION SYSTEM IN WIDAS EXTENSION AREA
NOTE AI-11	PROPOSED IRRIGATION SYSTEM OF BENG IRRIGATION AREA
NOTE AI-12	PROPOSED IRRIGATION SYSTEM OF GOTTAN-LOSARI AREA
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NOTE AI-15	COST ESTIMATE
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SOIL

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NOTE AI-1 Soil

According to the soil map prepared on a scale of 1/250,000 by the Central Soil Research Institute of Bogor in 1967, the soils in the basin are classified into nine soil groups, namely i) Alluvials, ii) Mediterranean soils, iii) Lithosols, iv) Regosols, v) Andosols, vi) Grumusols, vii) Humic grey soils, viii) Latosols and ix) Brown forest soils. The acreage of these soils is shown in Table 1. The characteristics of the major soils are explained as follows,

(1) Alluvial soils ; These soils extend over the flat alluvial plain along the Brantas river and its tributaries,and are cultivated mainly with paddy at present. They occupy 347,000 ha or 29.4% of the basin. The soils have medium to fine soil texture. The effective soil depth is very deep and inherent soil fertility is rich. The productivity of these soils can be greatly increased by appropriate fertilizer application under proper management of irrigation. In low land area where groundwater table is high, drainage is required.

(2) Mediterranean soils; These soils develop over the piedmont area of Mt. Wilis, Lima and Butak which exist between Alluvials and Latosols. They occupy 129,000 ha or 10.9 % of the basin. They are mainly upland farms and forest lands.

(3) Lithosols; These soils occupy the southern hilly area of the Brantas river basin covering 95,000 ha or 8.1 % of the basin. The agricultural potential is very low due to very shallow effective soil depth and topographical limitation. The land covered with these soils is mostly the forest, upland crops and or waste land.

(4) Regosols; These soils extend over the middle slopes of mountains such as Mt.Kawi, Kelud and Arjuno, being adjacent to alluvials. They occupy 288,000 ha or 24.4% of the basin. They are light in soil texture and high in soil permeability. Sometimes they are affected by drought in the dry season due to low water-holding capacity. Generally these soils have low agricultural potential and are not suitable for paddy cultivation . They permit intensive farming for groundnut and cassava as the main crops.

(5) Andosols; These soils are volcanic ash soils having high humus content and medium texture. They are found near the summits of Mt. Wilis, Lamas, Lima and Butak and occupy 93,000 ha or 7.9 % of the basin. They are rich in soil fertility and have high water holding capacity. However, they are subject to erosion. The land is at present used as forest land and for upland crop cultivation.

(6) Latosols; These soils are the so-called "Laterite". They are enclosed between Andosols and Mediterranean Soils. The Latosols occupy 185,000 ha or 15.7 % of the basin. They are productive soils in view of their excellent physical properties and deep soil depth. However the inherent soil fertility is low. They are suitable for growing food crops such as peanuts, sweet potato, beans, cassava

as well as industrial crops and fruits. They respond well to nitrogen and phosphorus element. Minor elements such as boron, copper, nickle, chloride are sometimes necessary for certain crops. The areas covered with these soils are used under present forests and uplands.

Table 1

SOIL CLASSIFICATION

Soil Group	Area (ha)	Percentage
Alluvial	347,000	29.4
Mediterranean Soils	129,000	10.9
Lithosols	95,000	8.1
Regosols	288,000	24.4
Andosols	93,000	7.9
Grumosols	31,000	2.6
Humic gley soils	5,000	0.4
Latosols	185,000	15.7
Brown forest soils	7,000	0.6
Total	1,180,000	100.0

Source : Compiled based on 1 : 250,000 soil map, Bogor Soil Institute.

NOTE AI-2

PRESENT CROPPING PATTERN AND FARMING PRACTICES

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Note AI - 2 Present Cropping Pattern and Farming Practices.

1. Present Cropping Pattern and Intensity.

Present cropping pattern and cropping Intensity in paddy fields were clarifled based on the data; Daftar Pertanaman (Keadaan Irrigasi) prepared by Irrigation Service.

Fig 1 shows the present cropping status for each of irrigation sections in the basin together with the rain fall distribution. As recognized in these figures, the regional variation on cropping pattern is not so distinctive. Wet season paddy in cultivating area increases as rainfall increases and dry season paddy scarcely utilize rainffal water.

Table 1 and 2 shows the cropping intensity in each Irrigation Section and Table 3 shows the cropping intensity in each irrigation unit being low intensity.

Present cropping patterns is irrigation areas fed from the main Brantas river are shown in Note AI - 17.

2. Farming practices.

Farming practices are studied through interview survey fo officers in Agricultural service office and by reforming according to the existing reports of irrigation projects.

(1) <u>Paddy</u>

Owing to recent prevalence of BIMAS and INMAS programmes, high yielding varieties have been widely spread to the Basin. Most predominant rice varieties are IR - 36 followed by Cisedance, IR - 50, Semeru and IR - 52. Growth period of these varieties is from 115 to 125 days except Semeru, growing period of which is 120 to 130 days. The average seed amount per ha applied is estimated at about 30 kg. Application of fertilizer and chemicals is practiced over the Basin. The estimated dosages of fertilizer per ha are about 200 - 250 kg of urea and 50 - 80 kg of TSP. About 4 ℓ/ha of agricultural chemicals are used.

Farming practices from seeding to harvesting are carried out by manpower. The estimated labor requirement is 210 man-days per ha per crop. Land preparation is practiced by draft animal and animal power requirement is estimated at about 8 animal days per ha.

(2) <u>Soybeans</u>

Soybeans are representative crop of polowijo crop and planted immediately after harverst of wet season paddy or dry season paddy. Varieties are No. 27, No. 29, OCTAV, Ringgit, Sumbing, Merapi, TK 5 etc. Their growth period ranges from 80 to 110 days. The estimated dosages per ha are 50 kg of seed, about 50 kg of Urea, about 75 kg of TSP and 1 ℓ of agricultural chemicals respectively. Labor requirement is estimated at about 80 man-days/ha.

(3) Maize

Maize is also representative crop of polowijo crop. Maize is also commenced immediately after harverst of wet season paddy and or dry season paddy. Major varieties are Abimayu, Hibrida C1, Parikesit, Metro, Perta, Harapan etc.. Their grouwth period ranges from 80 to 105 days. Dosages per ha are estimated at 30 kg of seed, 100 kg of urea, 50 kg of TSP and 72 man-days of labor requirement.

(4) Cassava

Cassava is mostly grown in upland. Seeding is usually done from Feb. to Apr. Crop is harvested from Sept, to Nov. the growth period is about 7 months. Application of fertilizer and chemicals is scarcely practiced.

(5) Peanut

Peanuts are also one of the representative crops of polowijo crops. Since cultivation of peanuts is mostly depending on the remaining moisture of paddy, planting starts after harvest of paddy. major varieties are Gajah, Macan, Banteng, Kidang, etc.. Their growth period is about 100 days. Estimated dosage per ha are 70 kg of seed, 70 kg of urea, 80 kg of TSP and 1 ℓ of agricultural chemicals. Labor requirement is about 100 man-days/ha.

(6) Sugar-cane

Sugarcane is an important crop in the Basin. Major varieties are PS 41, PS 56, BZ 142, POJ 2878 and POJ 3016. Their growth period is from 14 to 16 months. Estimated dosages per ha are 22,500 stalk, 150 kg of TSP, 450 kg ammonium sulfate and about 30 ℓ of agricultural chemicals. The labor and animal power requirement are estimated at about 300 man-days and 150 animal days per ha respectively.

TABLE 1. AVERAGE CROPPING INTENSITY FROM 1980 TO 1983

(Unit : %)

IRRIGATION SECTION	INTENSITY							
	WSP	DSP	WSP + DSP	SUGAR CANE	(3) + (4)	Po I	Po II	(3)+(6) + (7)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Malang	86.0	58.4	144.4	2.2	146.6	38.2	35.4	220.2
Kepanjen	77.9	47.0	124.9	17.1	141.9	27.2	27.4	196.5
Blitar	86.9	44.9	131.8	4.4	136.2	43.8	59.8	239.9
Tulungagung	74.3	37.6	111.9	5.8	117.7	31.2	35.2	184.1
Kediri	72.7	32.8	105.5	19.8	125.3	46.9	53.5	225.7
Nganjuk	88.7	36.9	125.6	8.3	133.9	43.2	63.7	240.4
Jombang	76.8	30.4	107.2	21.0	128.2	31.1	49.6	208.9
P a r e	81.9	35.2	117.1	12.1	129.2	45.0	73.7	247.9
Mojoagung	85.7	23.6	109.3	15.1	124.4	36.8	64.0	225.2
Mojokerto	82.1	33.4	115.5	15.0	130.5	37.4	56.5	224.4
sidoarjo	71.6	45.1	116.7	26.5	143.2	2.7	28.1	174.0
Wonokromo	83.1	44.5	127.6	0	127.6	5.6	8.7	141.9
AVERAGE	80.4	38.5	118.9	14.8	133.7	29.7	48.0	211.4

WSP : Wet Season Paddy
DSP : Dry Season Paddy
Po I : Polowijo I
Po II : Polowijo II

Table 2 (1) HARVESTED AREA AND CROPPING INTENSITY IN IRRIGATION SECTIONS

(Unit : ha)

IRR.SECTION		MALANG	KEDIRI	BLITAR	T.AGUNG	KEDIRI	NGANJUK
Area		17,159	26,887	34,197	30,182	29,241	38,719
1980/81	WSP	15,201	21,165	27,650	25,735	22,283	34,801
	DSP	10,951	12,742	14,632	13,381	9,117	10,000
	Po I	7,056	8,677	15,948	10,222	15,768	17,829
	Po II	5,121	7,365	21,379	9,025	17,578	26,128
	S	324	4,224	991	543	4,474	1,975
Cropping Intensity I		1.52	1.36	1.24	1.30	1.07	1.16
Cropping Intensity II		2.54	1.42	1.27	1.31	1.23	1.21
Cropping Intensity III		2.25	2.01	2.36	1.95	2.37	2.34
Area		17,104	28,250	34,777	33,842	29,241	38,710
1981/82	WSP	15,130	22,465	31,271	22,455	21,063	34,703
	DSP	9,565	11,598	16,137	10,291	9,820	17,276
	Po I	6,565	7,870	15,530	12,860	15,461	21,399
	Po II	7,458	9,040	20,702	15,464	13,983	21,246
	S	398	4,768	1,739	2,030	6,345	3,368
Cropping Intensity I		1.44	1.21	1.36	0.97	1.06	1.34
Cropping Intensity II		1.47	1.37	1.41	1.03	1.27	1.43
Cropping Intensity III		1.19	1.97	2.46	1.86	2.28	2.53
Area		16.712	28,250	34,777	34,953	29,196	38,710
1982/83	WSP	13,515	21,354	31,239	25,346	20,435	33,472
	DSP	9,240	14,826	15,787	13,560	9,788	15,563
	Po I	5,838	6,118	13,987	7,784	9,885	11,600
	Po II	5,482	6,480	19,834	10,368	15,374	25,432
	S	411	5,211	1,808	3,180	6,540	4,335
Cropping Intensity I		1.36	1.28	1.35	1.11	1.04	1.26
Cropping Intensity II		1.39	1.47	1.40	1.20	1.26	1.38
Cropping Intensity III		2.06	1.91	2.38	1.72	2.12	2.34

Po I : Polowijo I   Po II : Polowijo II

WSP : Wet Season Paddy ; DSP : Dry Season Paddy S : sugarcane

Cropping Intensity I = (WSP + DSP) / Area

-do- II = (WSP + DSP + Sugarcane) / Area

-do- III = (WSP + DSP + Sugarcane + Polowijo I + PolowijoII)/ Area

Table 2 (2) HARVESTED AREA AND CROPPING INTENSITY IN IRRIGATION SECTIONS

(Unit : Ha)

IRR.SECTION		JOMBANG	P A R E	M'AGUNG	M'KERTO	S'ARJO	W'KROMO	TOTAL OR AVERAGE
Area		24,311	19,301	23,222	32,194	32,609	4,976	312,887
1980/81	WSP	19,770	16,530	20,173	27,796	23,978	3,840	258,922
	DSP	8,126	7,198	6,334	9,935	14,456	1,591	118,463
	Po I	7,703	9,726	10,583	-	-	-	-
	Po II	12,129	15,341	16,619	-	-	-	-
	S	3,646	1,814	2,067	3,219	-	0	-
Cropping Intensity	I	1.15	1.23	1.14	1.17	1.18	1.09	1.21
-do-	II	1.30	1.32	1.23	1.32	-	1.09	-
-do-	III	2.15	2.62	2.40	-	-	-	-
Area		24,266	19,300	23,198	32,170	32,048	3,738	316,644
1981/82	WSP	18,103	15,546	20,570	26,336	22,193	3,310	253,345
	DSP	7,549	6,554	6,309	10,754	13,694	1,997	121,544
	Po I	8,242	8,323	9,572	11,183	746	89	98,580
	Po II	11,217	14,446	13,668	18,571	9,445	256	155,496
	S	5,775	2,509	3,920	5,212	8,749	0	44,813
Cropping Intensity	I	1.06	1.15	1.16	1.15	1.13	1.42	1.18
-do-	II	1.30	1.28	1.33	1.32	1.40	1.42	1.35
-do-	III	2.10	2.45	2.33	2.24	1.72	1.51	2.13
Area		24,264	19,298	23,198	32,076	31.874	3,328	316,636
1982/83	WSP	18,098	15,351	18,891	25,058	22,899	2,856	248,514
	DSP	6,489	6,631	3,753	11,520	15,385	1,774	124,316
	Po I	6,683	8,023	5,475	12,832	1,007	308	89,548
	Po II	11,772	12,898	24,253	17,712	8,521	356	148,482
	S	5,872	2,701	4,523	6,062	8,159	0	48,802
Cropping Intensity	I	1.01	1.14	0.98	1.14	1.20	1.39	1.18
-do-	II	1.26	1.28	1.17	1.33	1.45	1.39	1.33
-do-	III	2.02	2.36	2.02	2.28	1.76	1.59	2.08

Po I : Polowijo I　　Po II : Polowijo II
WSP : Wet Season Paddy　　DSP : Dry Season Paddy　　S : Sugarcane

Cropping Intensity I = (WSP +DSP) / Area
Cropping Intensity II = (WSP +DSP + Sugarcane) / Area
Cropping Intensity III = (WSP + DSP + Sugarcane + Polowijo I + Polowijo II)/ Area

Table 3 (1) AREA WITH LOW CROPPING INTENSITY

NAME OF DAERAH IRIGASI (DI)	No. of Code DI	CROPPING INTENSITY		
		81/82	82/83	Average
1. Seksi Malang				
1. K. Brantas Atas	52a	74	73	74
2. Sbr. Brantas	52	68	86	77
3. Sumber Metro	72	121	124	123
2. Seksi Kepanjen				
1. K.Jaruman Kebon Atas	69	132	107	120
2. K.Biru	77	146	109	128
3. K.Gombong	76	143	113	128
4. Sbr.Kemanten	67	112	105	109
5. Sbr.Meri	64	118	140	129
3. Seksi Blitar				
1. Temas	63	92	123	108
2. Gedog	64	81	98	90
3. Kajar	65	108	105	107
4. Srengat Barat	66	115	123	119
5. Putih	80	112	116	114
6. Jimbe	90	85	90	88
7. Judeg	91	89	78	84
8. Lemon	94	94	82	88
9. Jolosutro	85	94	90	92
10. Ngrenang	89	35	179	104
11. Cerme	71	148	100	124

Source : Al 04

Cropping Intensity = (Total harvested area of paddy and sugarcane/Total area

Table 3 (2) AREA WITH LOW CROPPING INTENSITY

(Unit : %)

NAME OF DI	No. of Code DI	CROPPING INTENSITY 1981/82	1982/83	Average
4. Seksi Tulungagung				
1. Mlijon	51	83	89	86
2. Ngepeh	49	51	66	59
3. Bendo	48	79	91	85
4. Babaan	40	126	116	121
5. Klantur	41	116	124	120
6. Sakun	45	69	127	98
7. Sbr.Gpl.Lodagung	50	117	103	110
8. J a t i		120	140	130
5. Seksi Kediri				
1. Genjeng	15	104	112	108
2. Bakung	16	107	120	114
3. Bendomongal	19	91	100	96
4. Bendokrosok	20	127	96	112
5. K e d o k	21	109	104	107
6. B r u n o	22	110	101	106
7. Pandansari	25	119	97	108
8. Toyoaning	26	115	105	110
9. Kresek Bawah	31a	107	114	111
10. Tawang	32	106	117	112
11. Selodono	36	91	112	102
12. Putung	37	103	109	106
13. Kalasan	30	139	106	123
14. Sekarrejo	29	140	109	125
15. Dermo	27	145	84	115
16. Mantren	28	130	113	122
17. Segaran	33	141	114	128

Source : AI 04

Table 3 (3) AREA WITH LOW CROPPING INTENSITY

NAME OF DI	No. of Code DI	CROPPING I 1981/82	1982/83	Average
6. Seksi Nganjuk				
1. Jurang Dandang	8	120	81	101
2. Ketandan	8a	123	127	125
3. Jenggowar	6	95	89	92
4. Kedung Gupit	10	95	106	101
5. Perning	9	153	100	127
6. Rejoso	4	91	101	96
7. Tretes	7	92	96	94
8. Kedung Maron	3	101	104	103
9. Kedung Padang	5	81	104	93
10. Kuncir	11	120	136	128
11. Bodor	12	108	137	123
7. Seksi Pare				
1. S.Gresikan	76b	112	127	120
2. Palempayaman II	69b	103	120	112
3. S.Srimping	67b	124	120	122
4. Konto Atas & GS	82a	116	120	118
5. K.Pulosari	70	96	119	108
6. K.Ngino	72	100	118	109
7. S.Wonorejo	76a	111	122	117
8. S.Bringin	71b	92	126	109
9. S.Ketengi	71c	138	118	128
10. Palempayaman I	69a	107	116	112
11. Mejono Bangi	68	91	93	92
12. Kunden	71d	133	117	125
13. Ampomangiran	71a	119	131	125
14. S.Siman	67a	117	137	127
8. Seksi Jombang				
1. Rejoagung IV	64b	120	114	117
2. Konto Sby. Atas	69/67	138	118	128
3. Konto Sby. Tengah	67a	115	112	114
4. Rejoagung III	64a	110	118	117
5. Luar Brantas	74	99	96	98
6. Wangkal	70b	113	114	114
7. Gottan I + II	73c	111	122	117
8. Dungus	81/68	143	99	121
9. Konto Kediri	71a	116	119	118
10. Afi Simo/Besuk	71c	123	130	127

Source : AI 04

Table 3 (4) AREA WITH LOW CROPPING INTENSITY

(Unit : %)

NAME OF DI	No. of Code DI	CROPPING INTENSITY 1981/82	1982/83	Average
9. Seksi Mojoangung				
1. Sal Sentul	72a	157	92	125
2. Sal Tanggal Rejo	57	118	91	105
3. Sal Bareng	54	130	105	118
4. Sal Slumbung	56	111	122	117
5. Sal Rejoagung I	64a	118	103	111
6. K.Sembung	60	141	102	122
7. K.Pakel	52	140	102	121
8. K.Gogor	53	129	98	114
9. Sal Polorejo II	65a	89	96	93
10. K.pamcir	55	116	112	114
11. Sal Sbr. Buntung	63	124	108	116
10. Seksi Mojokerto				
1. Sal Ketintang	41	102	114	108
2. Sal Ngares I - IV	73a	112	119	116
3. Sal Candilimo	50	112	111	112
4. Sal Pangaran	49	96	110	103
5. Sal Cumpleng	33	108	129	119
6. San Subantoro	42	126	92	109
7. Sal Sengon	42a	93	24	59
8. Sal Kwanger	73a	144	100	122
9. Losari	73d	107	136	122
10. Sal Wates Pinggir	73c	107	143	125
11. Sal Kromong II	35			
12. Sal Penewon	51	117	130	124
13. Sal Jurong Cetot	47a	128	-	
11. Seksi Sidoarjo				
1. Sbr.Pompa		90	117	104
12. Seksi Wonokromo				
1. Rowo Wiyung		38	73	56

Source : AI 04