

## FIGURES



FIG.- II. 1  
LOCATION MAP OF  
GAGING STATIONS

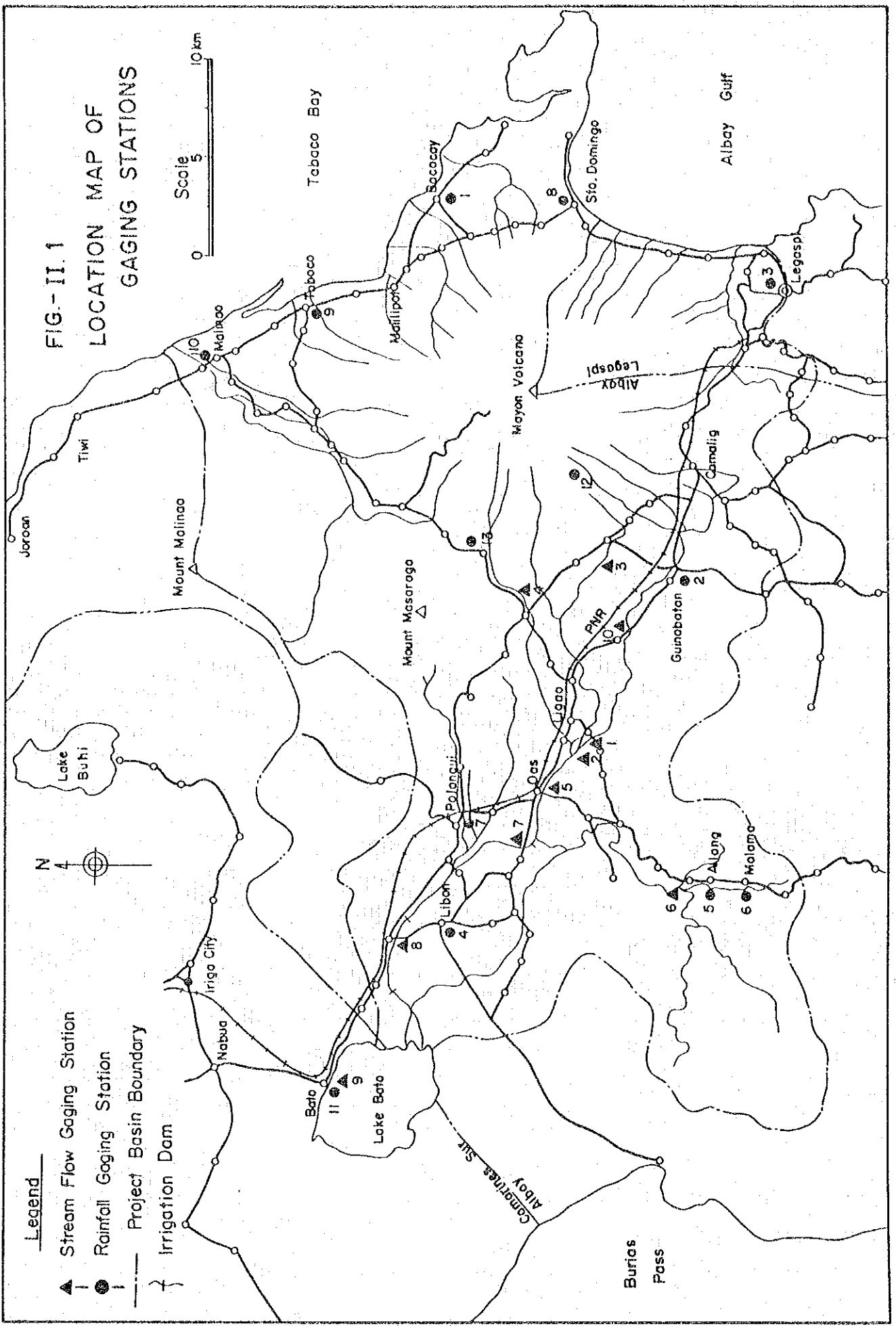
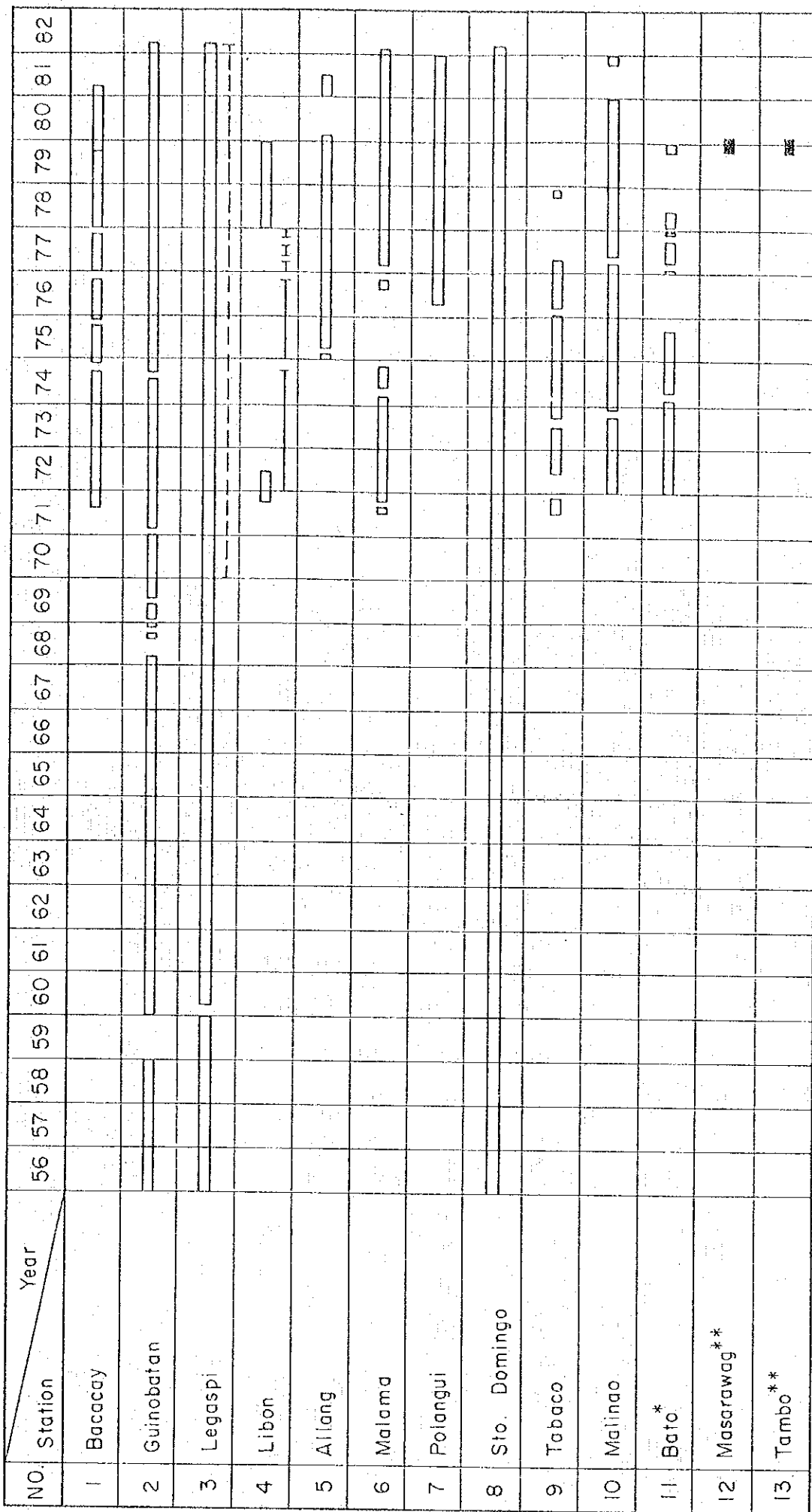


FIG.- II.2 LIST OF RAINFALL RECORD LENGTH



\* Station outside the project area  
 \*\* Stations installed by the study team. (no longer operational)





Legend:  daily record  
 6-hour record  
 monthly record  
 hourly record

FIG.- II. 3 LIST OF STREAM FLOW RECORD LENGTH

NO.	Station	Year	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82						
1	Bobongsuran, San Francisco R. (131km <sup>2</sup> )																																				
2	Bobongsuran, Cabilogan R. (164km <sup>2</sup> )																																				
3	Benantuan, Ogsong River (11 km <sup>2</sup> )																																				
4	Nasisi, Nasisi River (39 km <sup>2</sup> )																																				
5	Obaliw, Irraya River (217 km <sup>2</sup> )																																				
6	Allang, Talisay River (90km <sup>2</sup> )																																				
7	Busac, Quinali River (232 km <sup>2</sup> )																																				
8	San Agustin, San Agustin R. (262km <sup>2</sup> )																																				
9	Poblacion, Lake Bato (874km <sup>2</sup> )																																				
10	Banco Br. San Francisco R. (91 km <sup>2</sup> )																																				

\* Station outside the project area  
 \*\* Stations established by the study team.(no longer operational)  
 Legend : [Solid Line] daily discharge record  
 [Dashed Line] daily gage height record  
 [Dotted Line] hourly gage height record  
 All stations are located in the Quinali (A) River basin.

FIG.-II.4 FREQUENCY CURVES FOR ANNUAL MAXIMUM RAINFALL AT GUINOBATAN

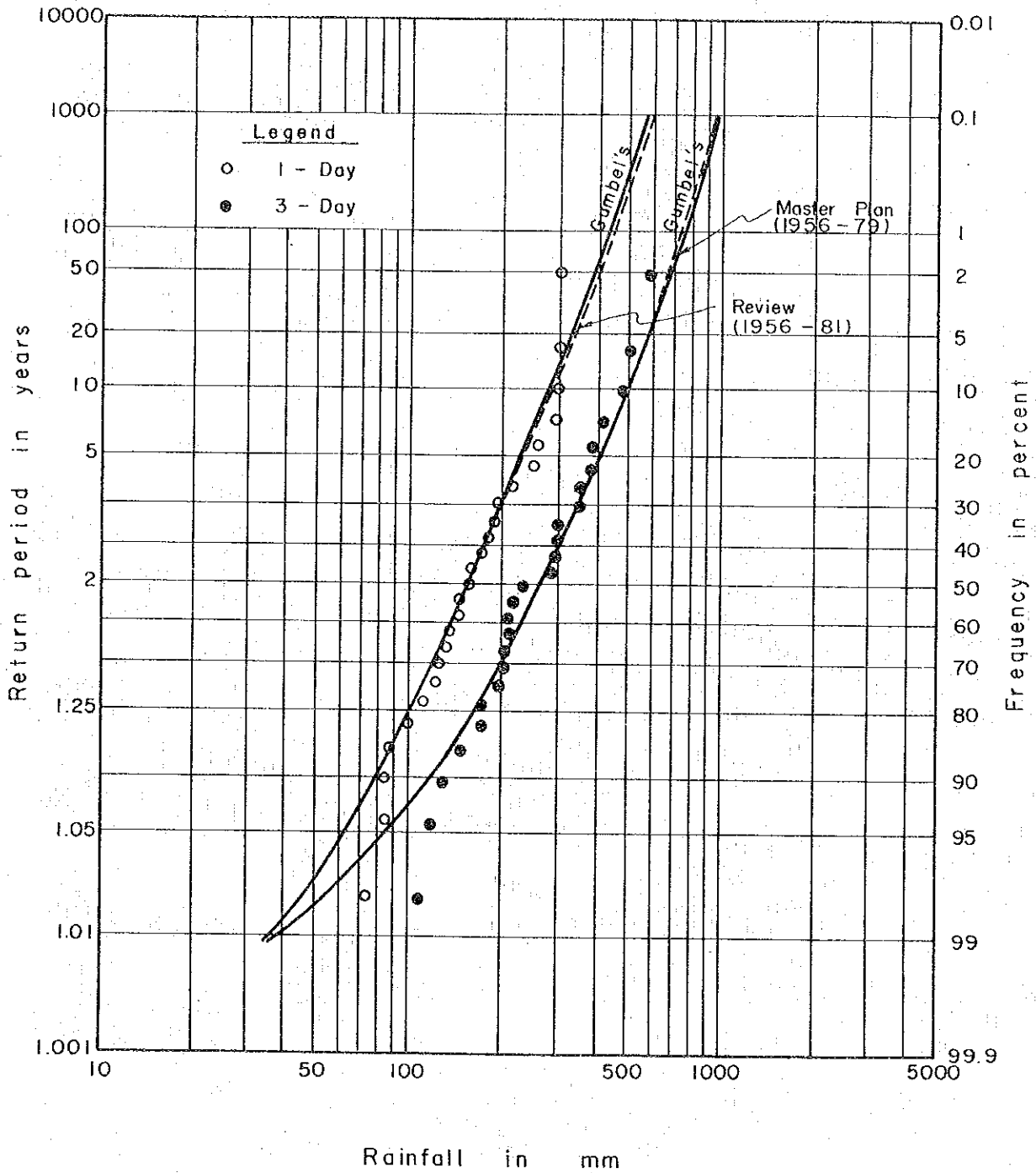


FIG.-II.5 FREQUENCY CURVES FOR ANNUAL MAXIMUM RAINFALL AT LEGAZPI

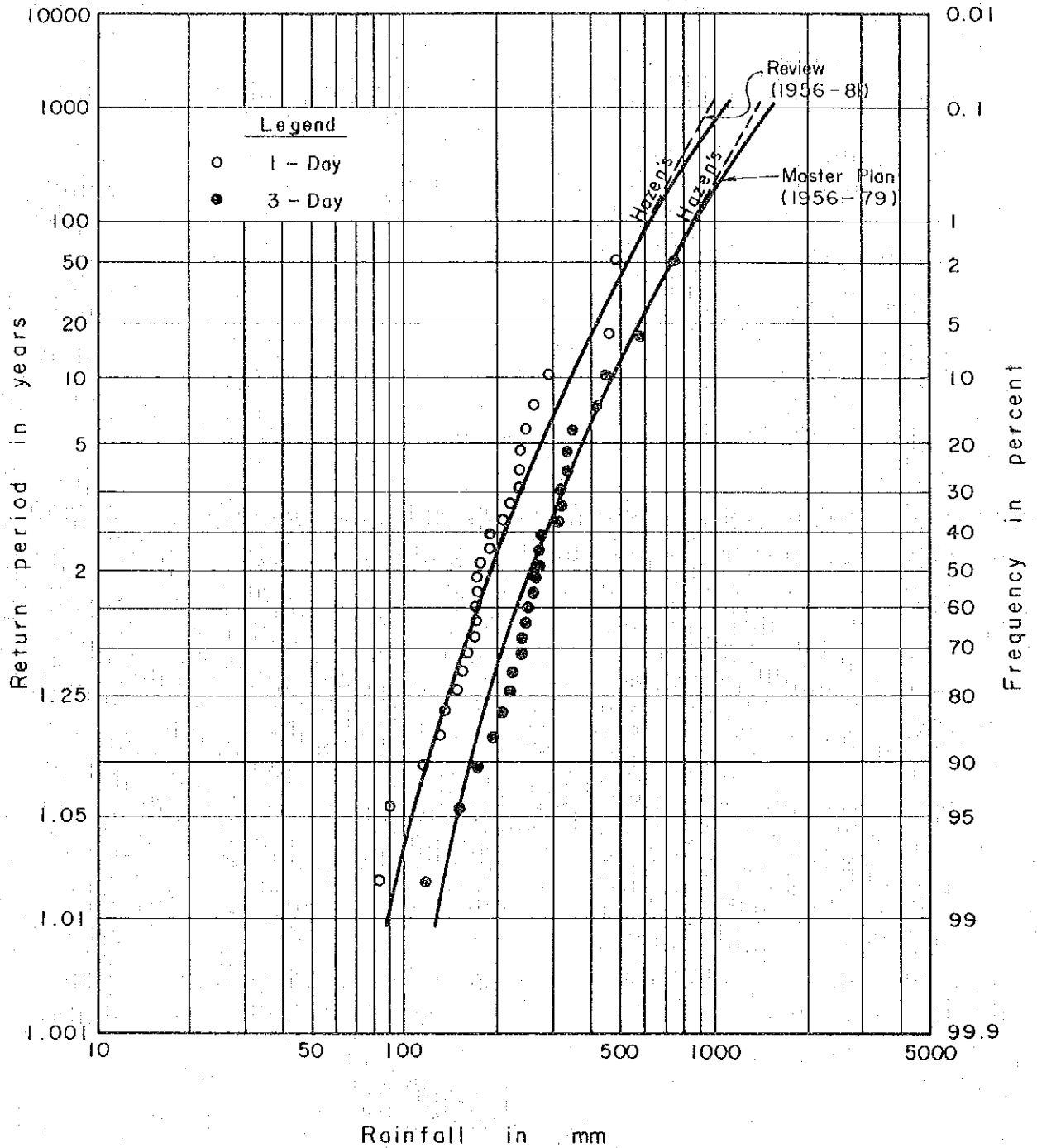


FIG.-II.6 FREQUENCY CURVES FOR ANNUAL MAXIMUM RAINFALL AT LEGAZPI

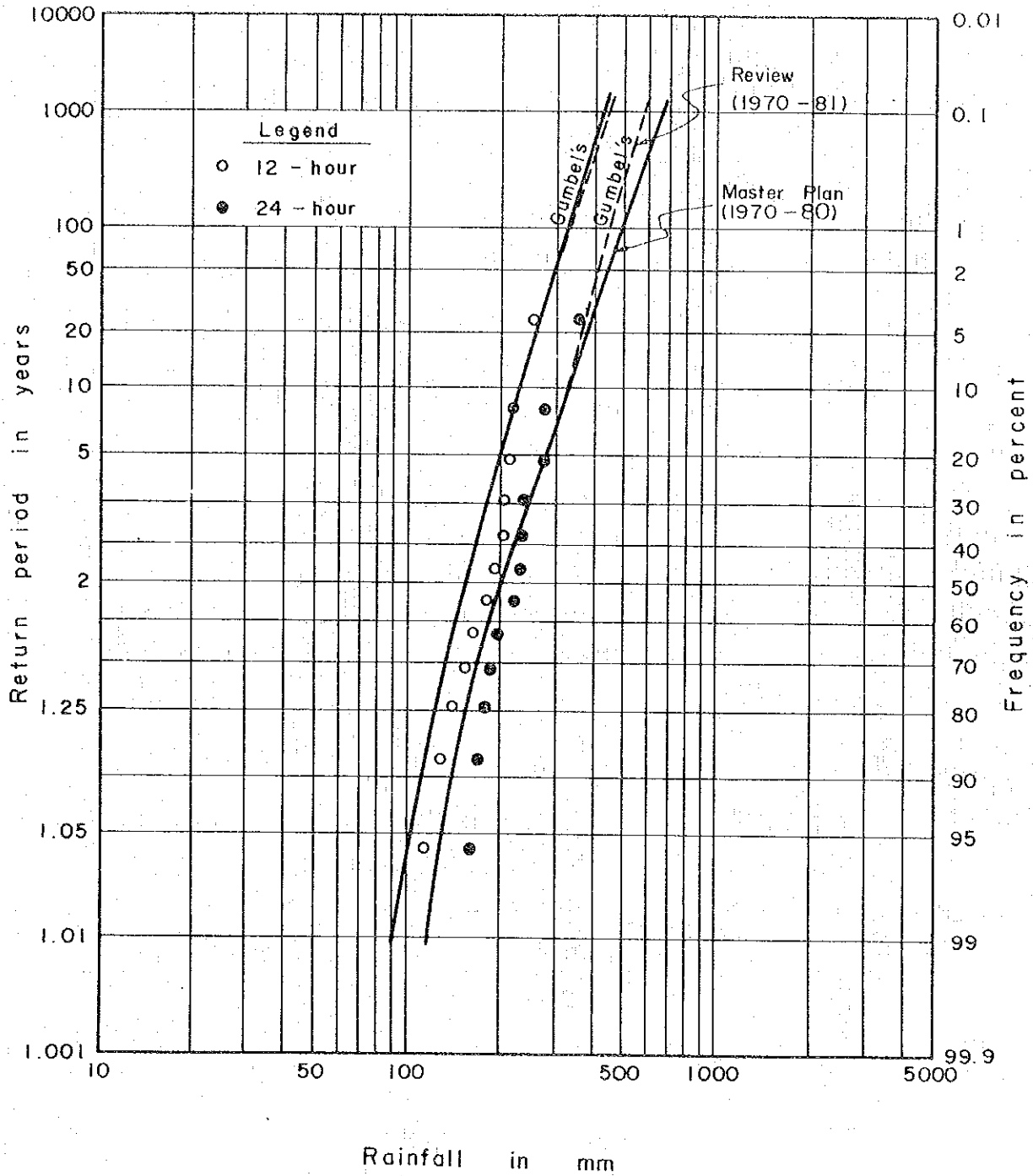




FIG.-II.7 FREQUENCY CURVES FOR ANNUAL MAXIMUM RAINFALL AT LEGAZPI

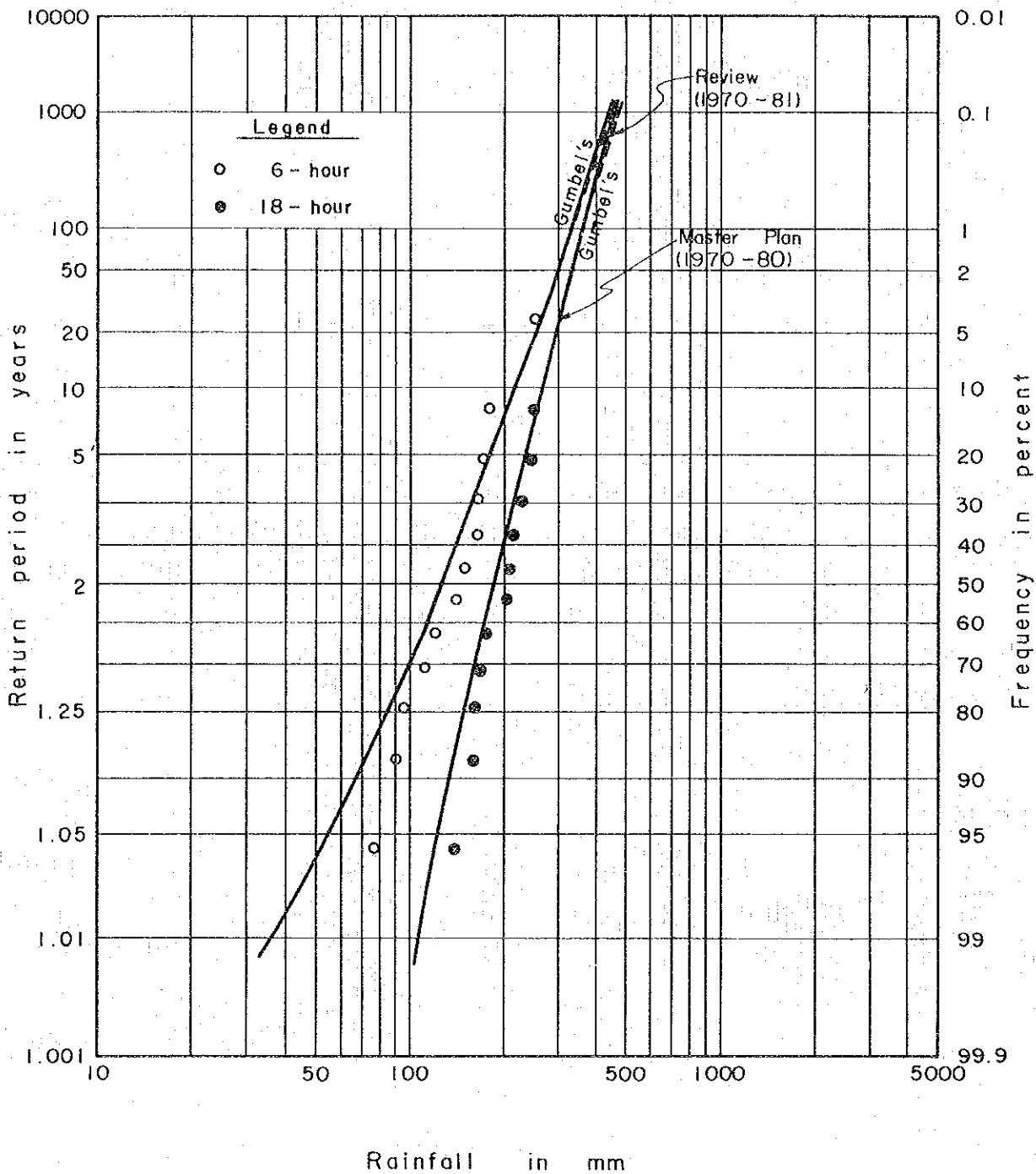


FIG.-II.8 FREQUENCY CURVES FOR ANNUAL MAXIMUM RAINFALL AT ALLANG

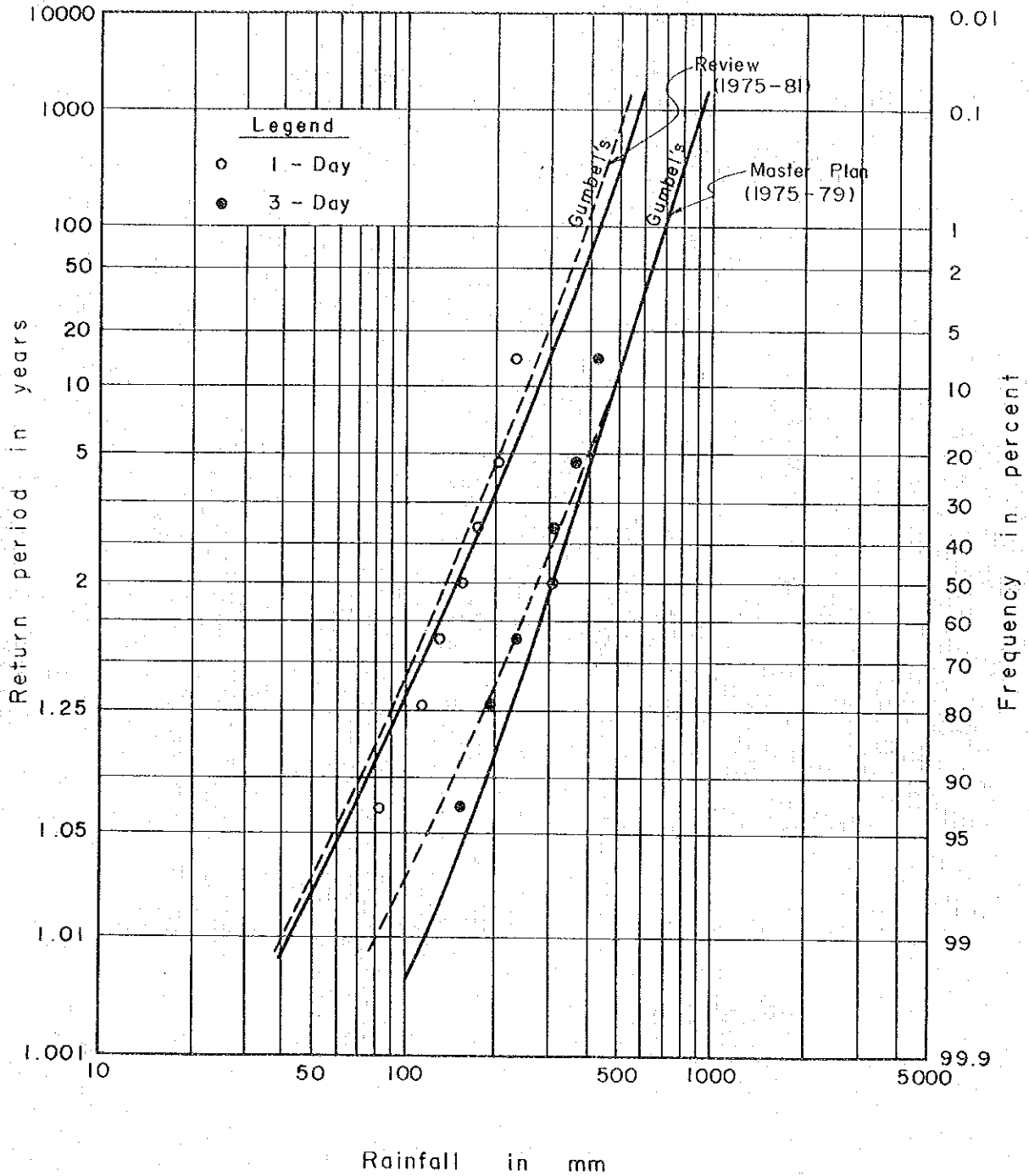


FIG.-II.9 FREQUENCY CURVES FOR ANNUAL MAXIMUM RAINFALL AT STO. DOMINGO

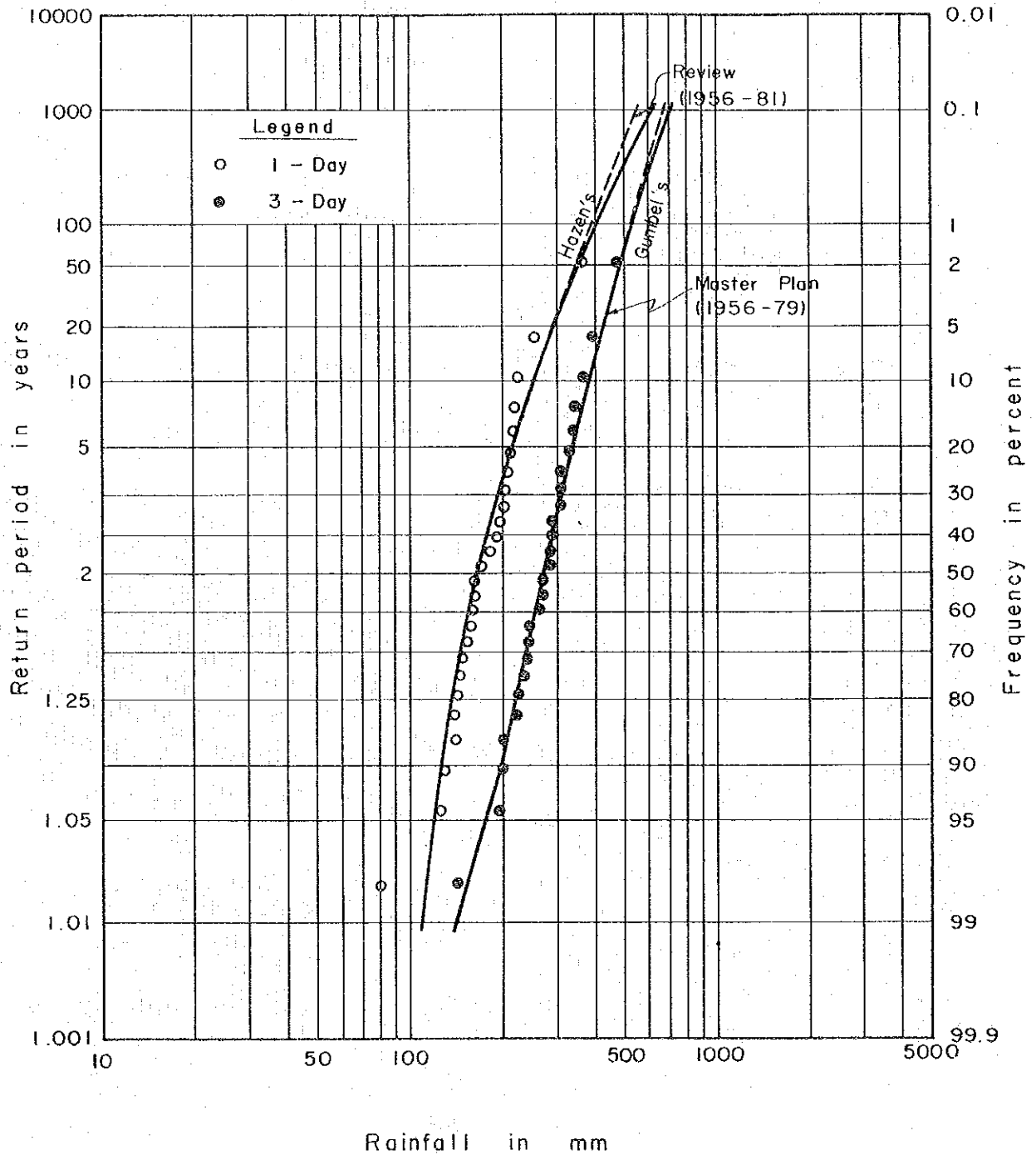


FIG.-II.10 FREQUENCY CURVES FOR ANNUAL MAXIMUM RAINFALL AT MALINAO

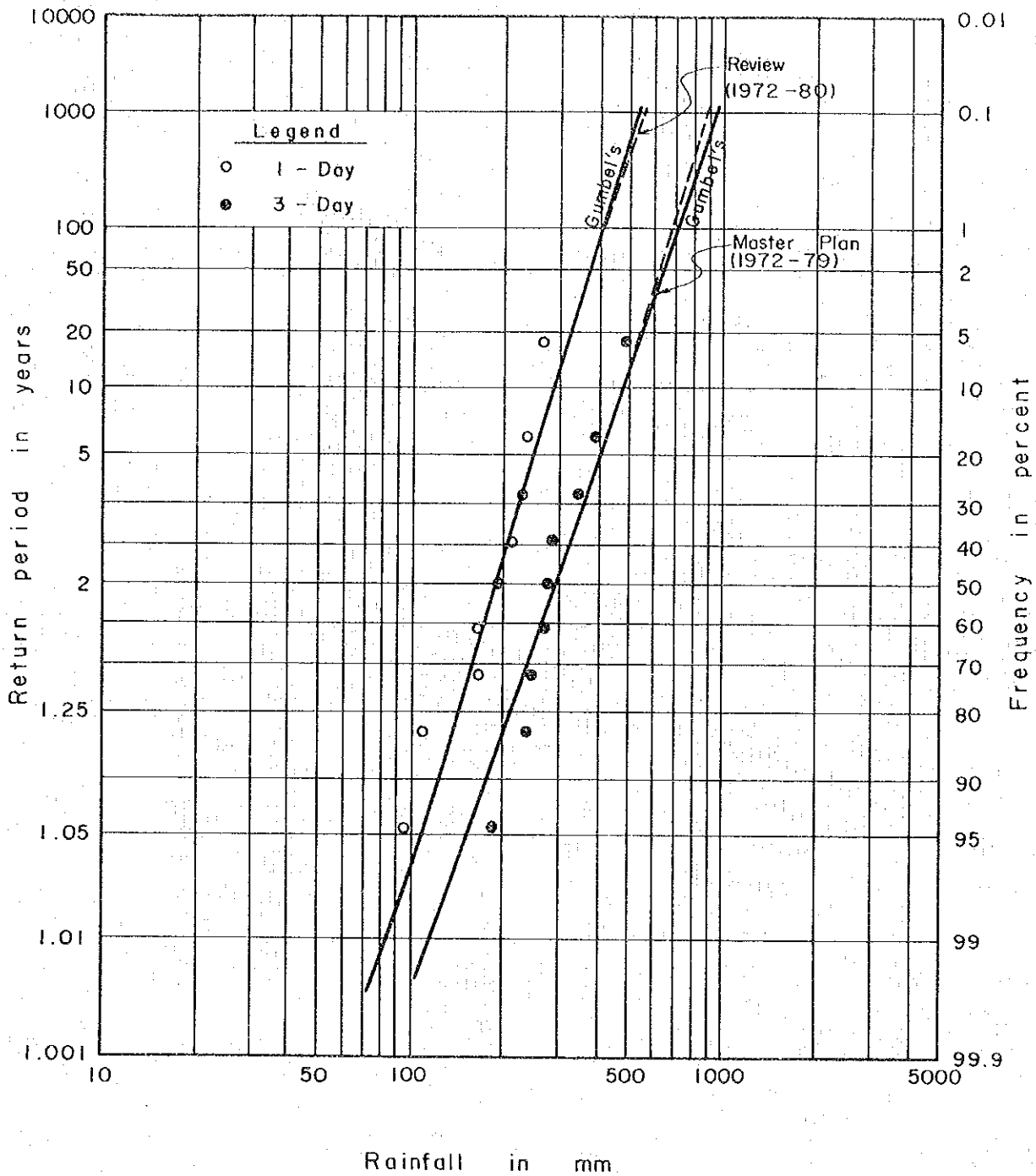


FIG.-II.11 FREQUENCY CURVES FOR ANNUAL MAXIMUM RAINFALL AT QUINALI (A) RIVER

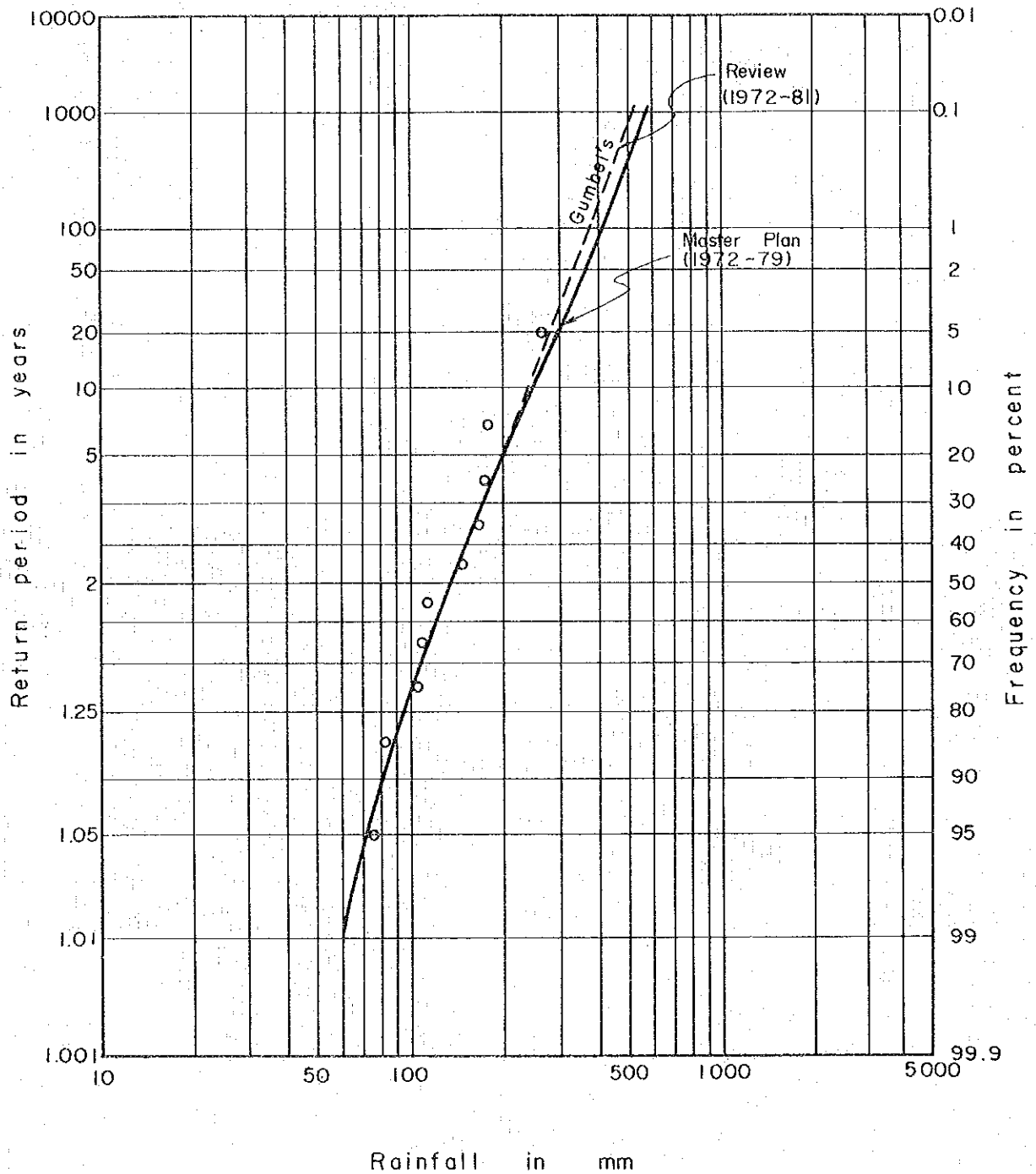


FIG-II.12 RAINFALL RELATION BETWEEN LEGAZPI AND MASARAWAG  
(Difference due to altitude)

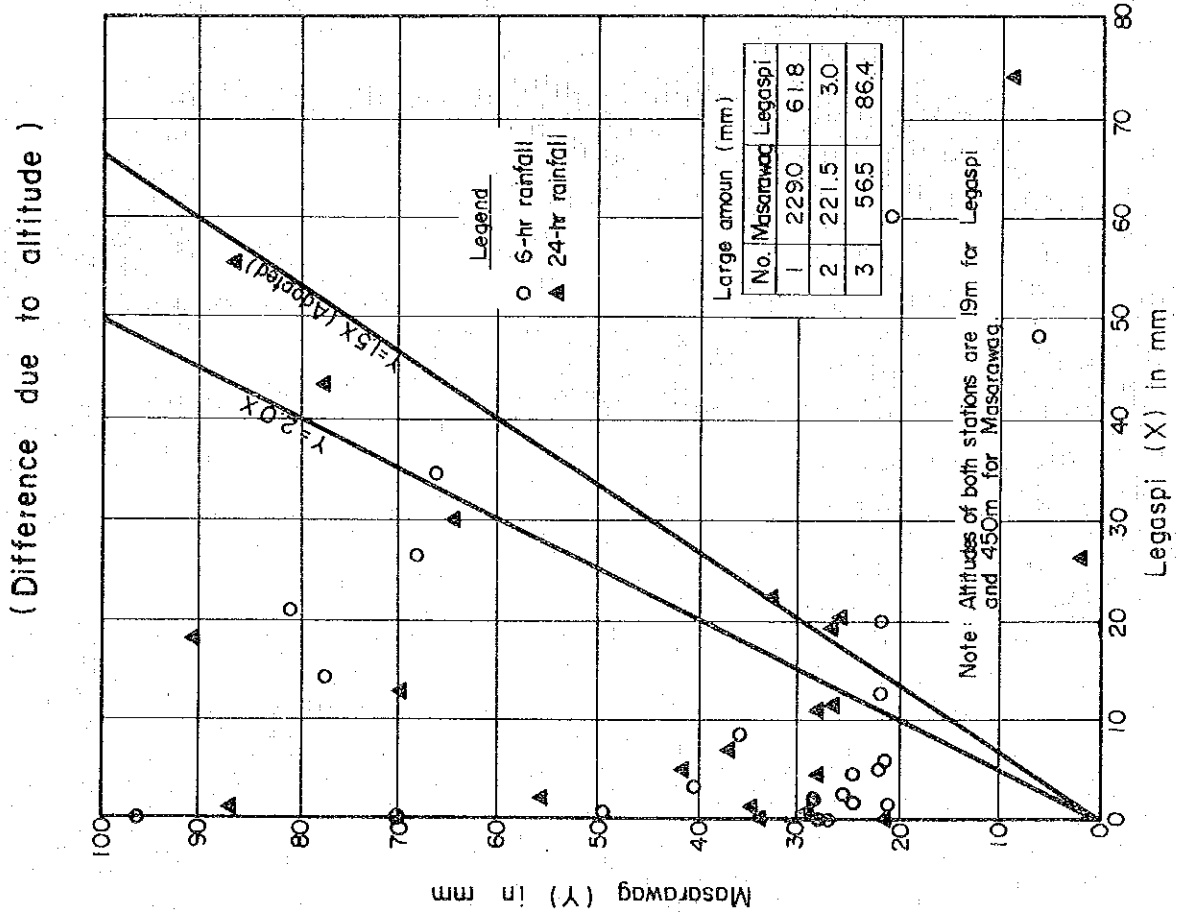


FIG-II.13 RAINFALL RELATION BETWEEN GUINOBATAN AND MASARAWAG  
(Difference due to altitude)

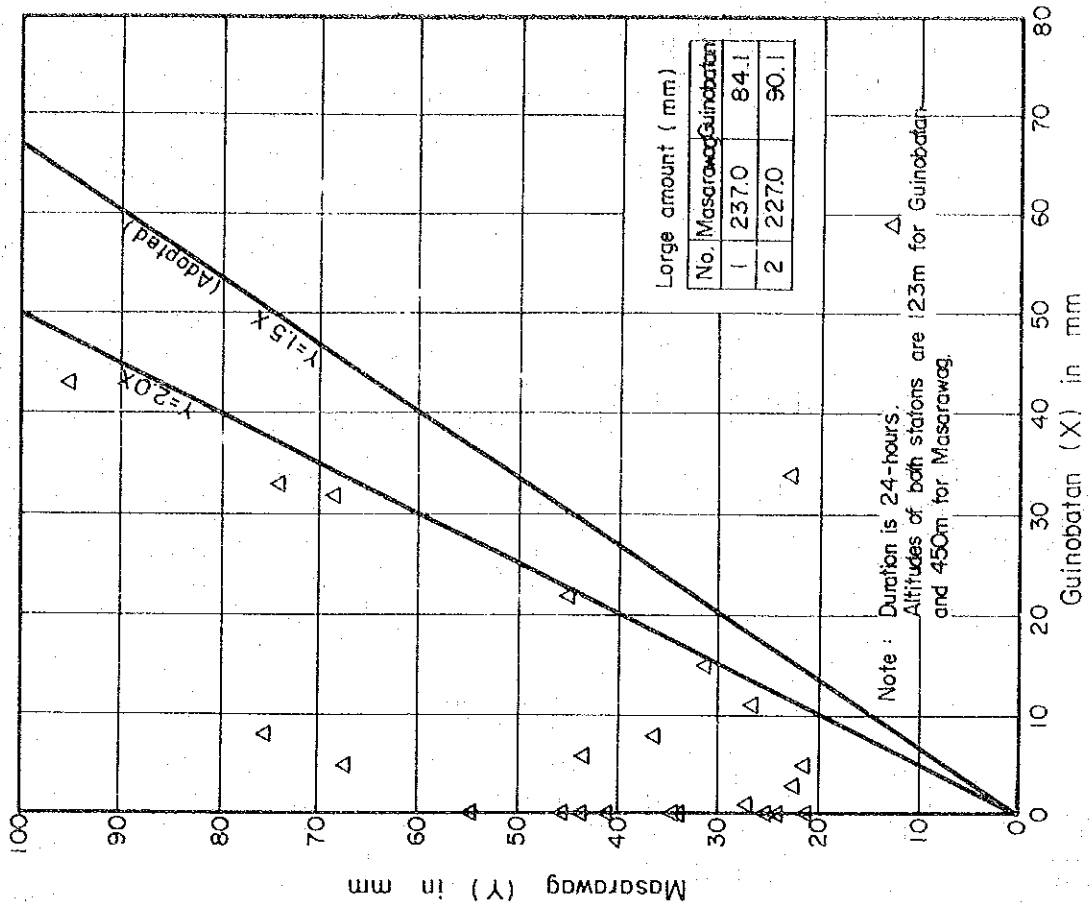


FIG-II.14 PROBABLE DAILY RAINFALL DEPTH-AREA CURVES FOR THE QUINALI (A) RIVER BASIN

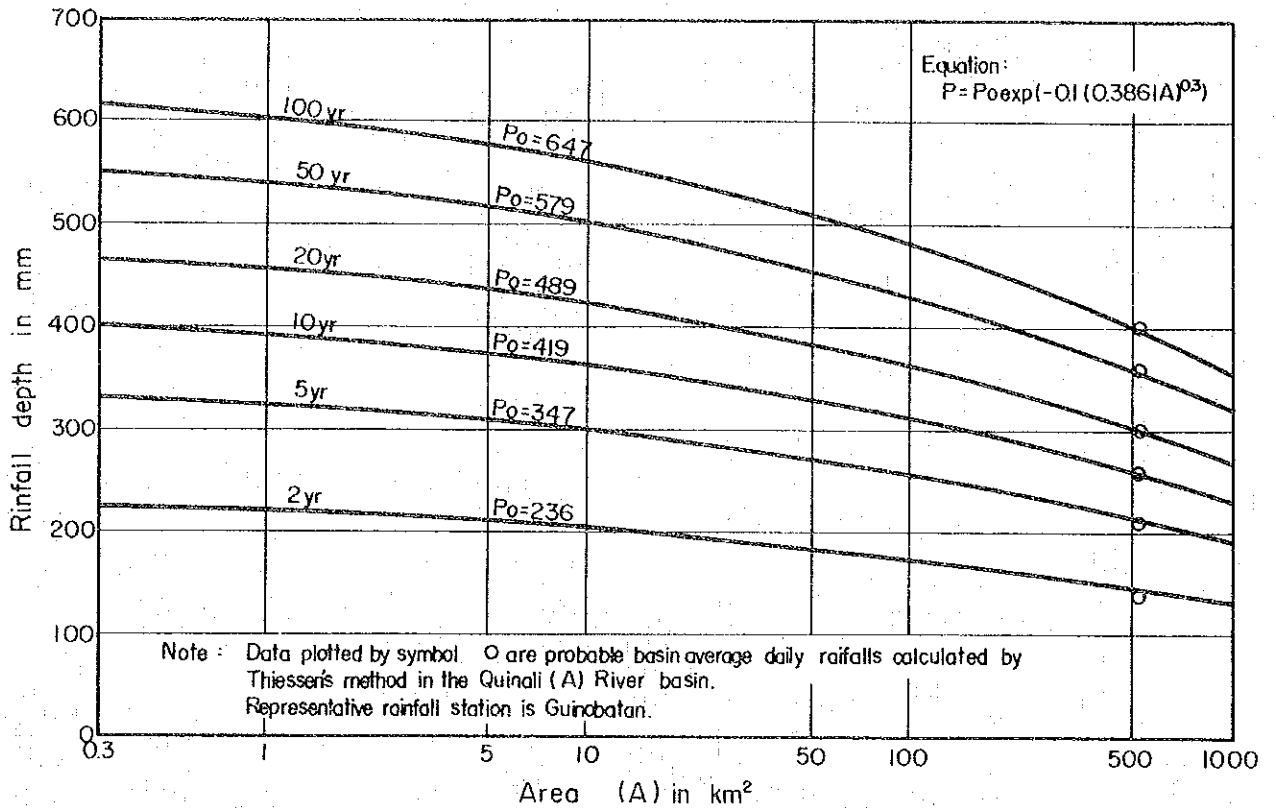


FIG-II.15 DAILY RAINFALL DEPTH - AREA RELATION AFTER HORTON

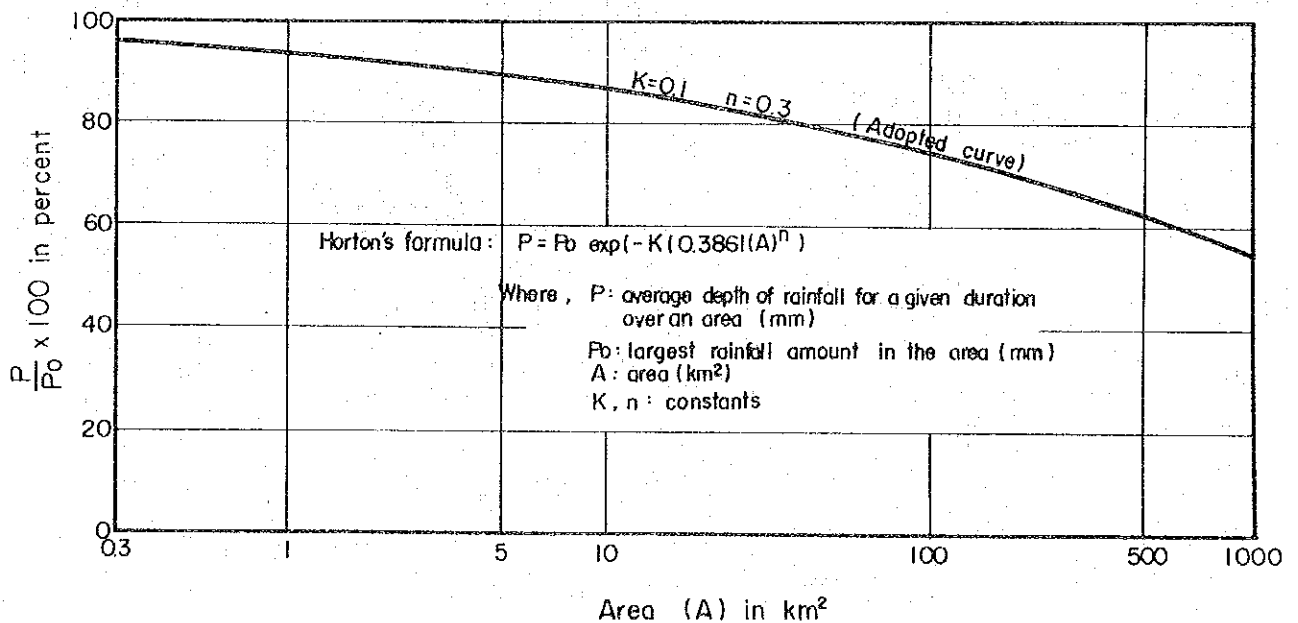
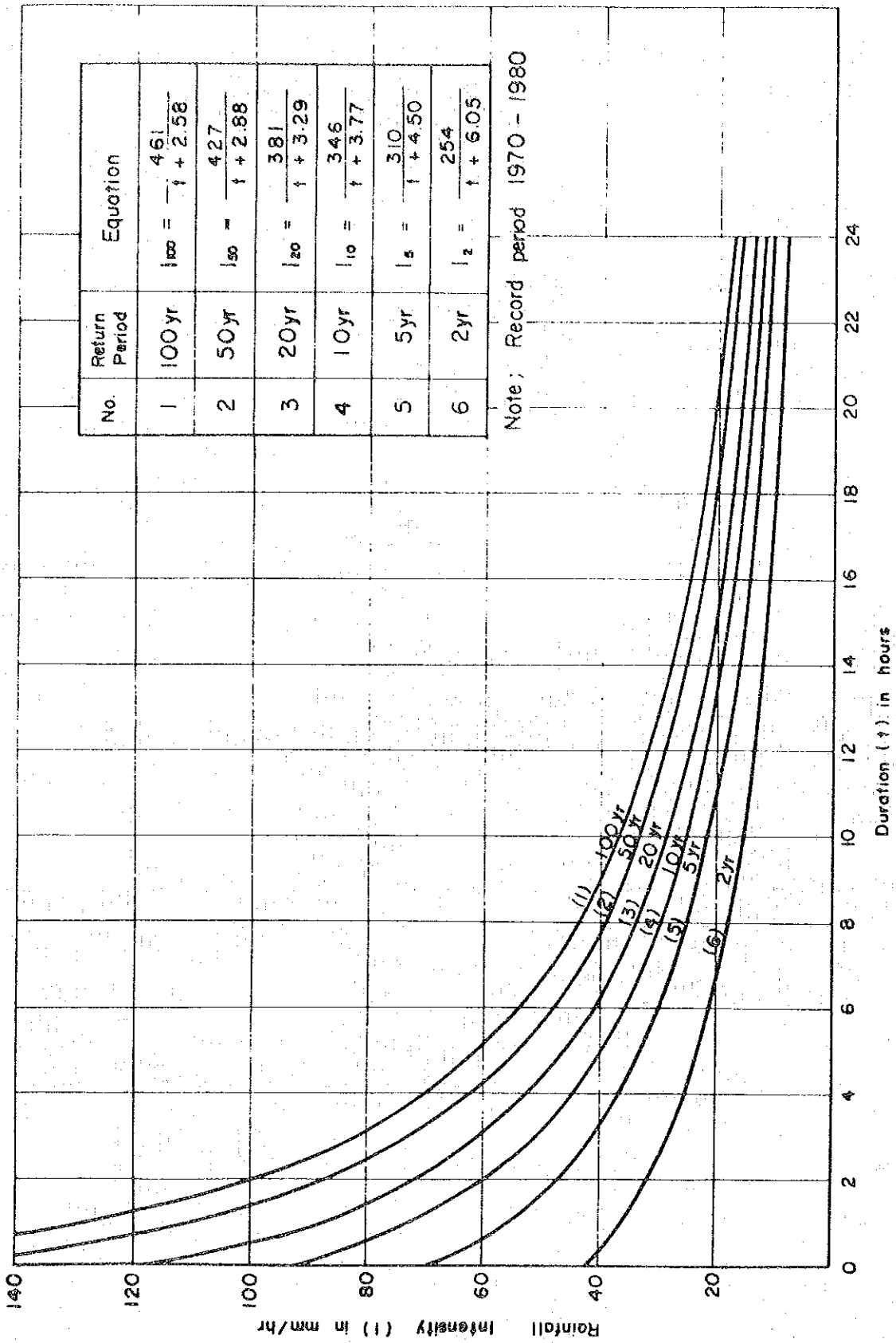


FIG. - II.16 PROBABLE RAINFALL INTENSITY - DURATION CURVES FOR LEGAZPI







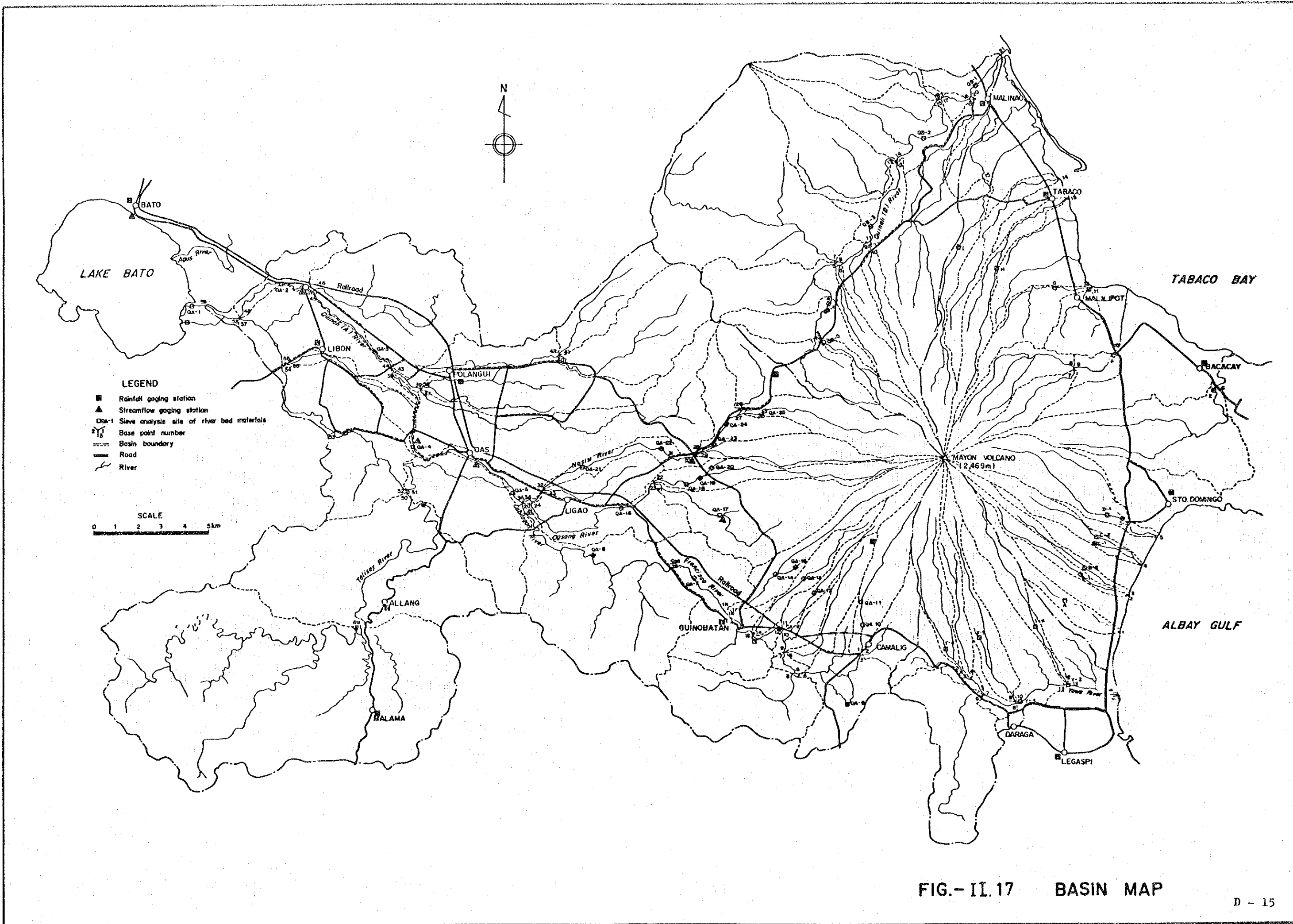


FIG.-II.20 FREQUENCY CURVES FOR  
DRAUGHT ANNUAL RAINFALL  
BY WEIBULL'S METHOD

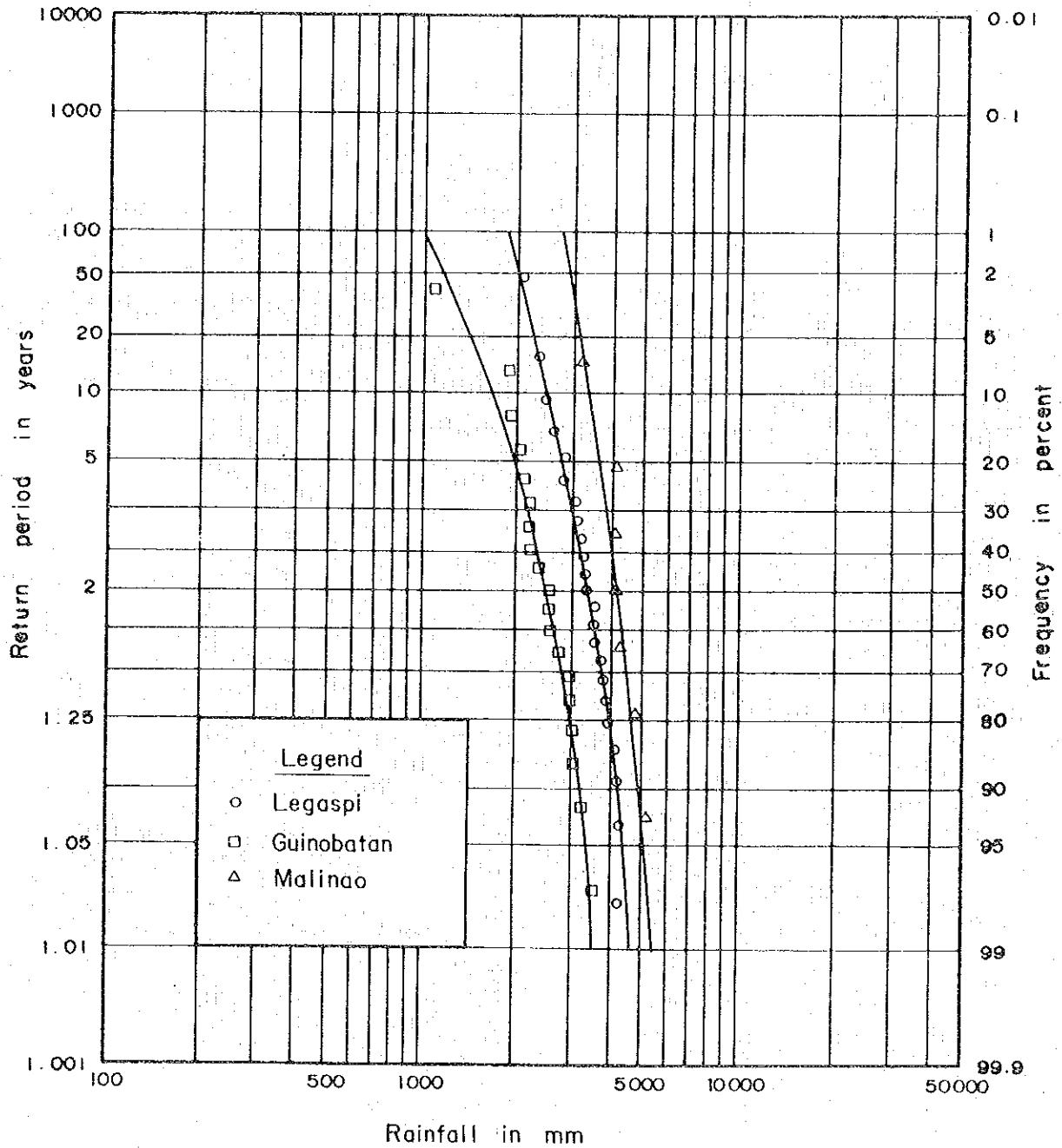


FIG.-II.21 FREQUENCY CURVES FOR ANNUAL MINIMUM MONTHLY RAINFALL BY WEIBULL'S METHOD

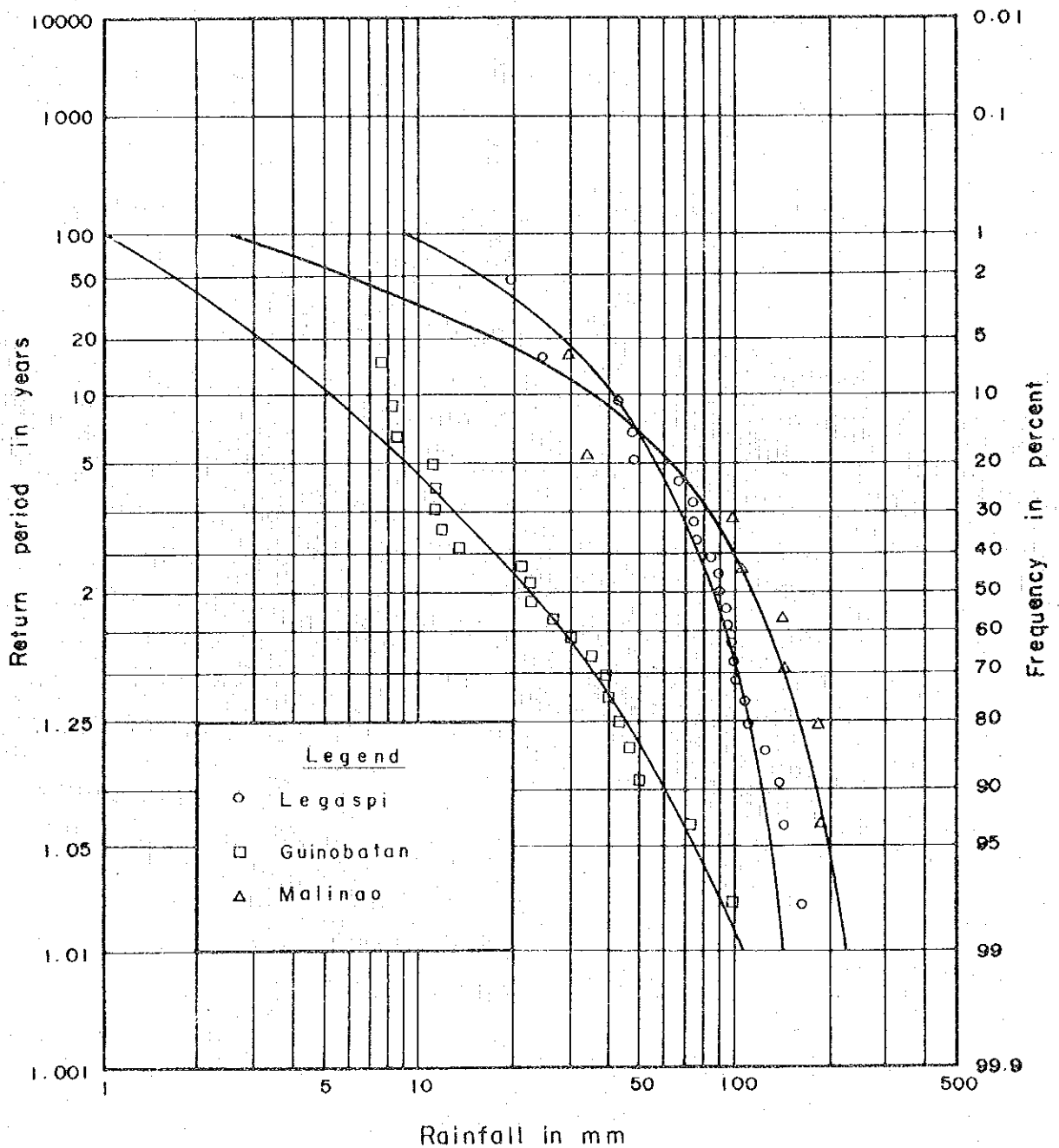


FIG.- II.22 FREQUENCY CURVES FOR ANNUAL MINIMUM MONTHLY MEAN RUNOFF BY WEIBULL'S METHOD

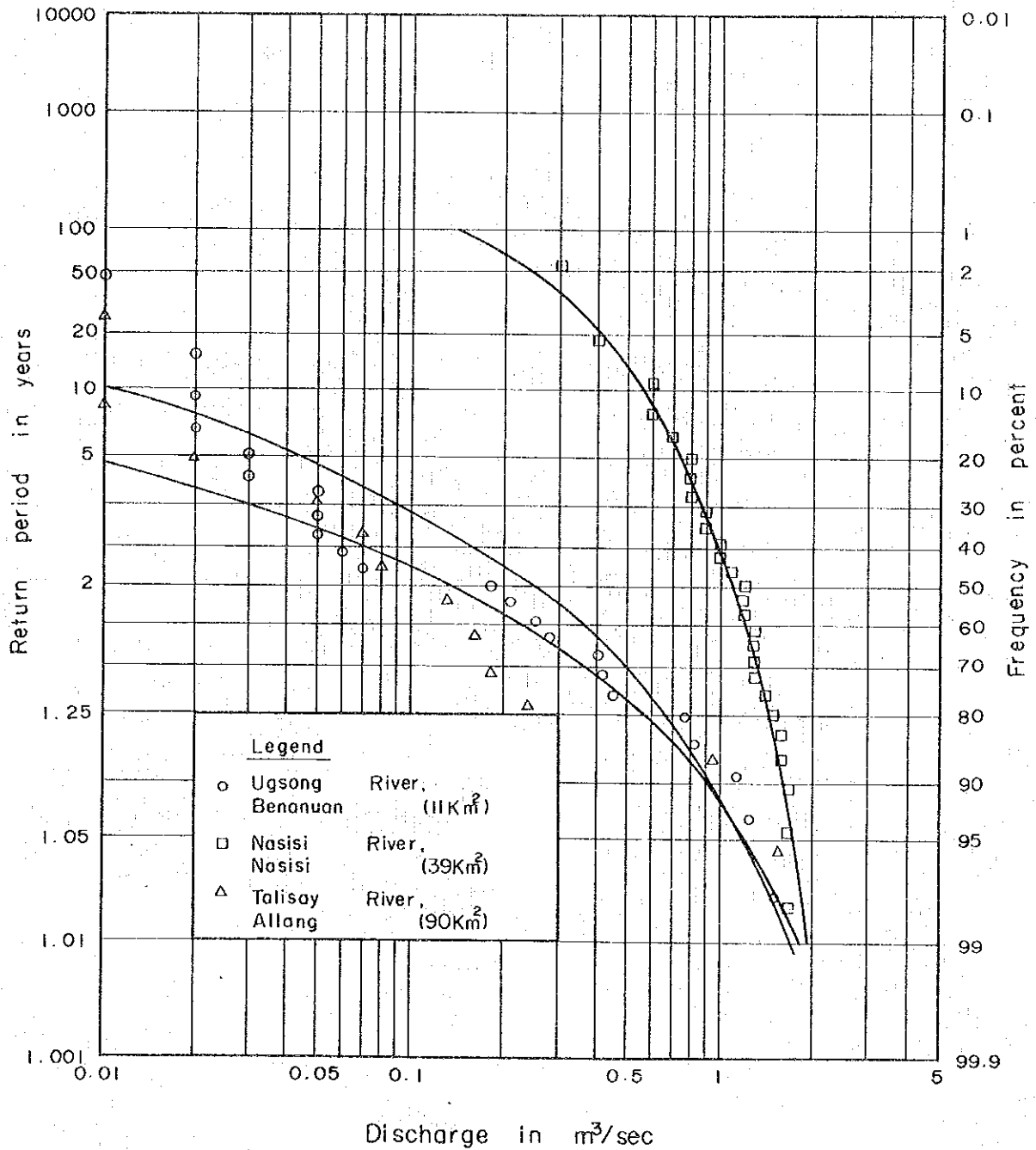


FIG-II.23 FREQUENCY CURVES FOR ANNUAL MINIMUM MONTHLY MEAN RUNOFF BY WEIBULL'S METHOD

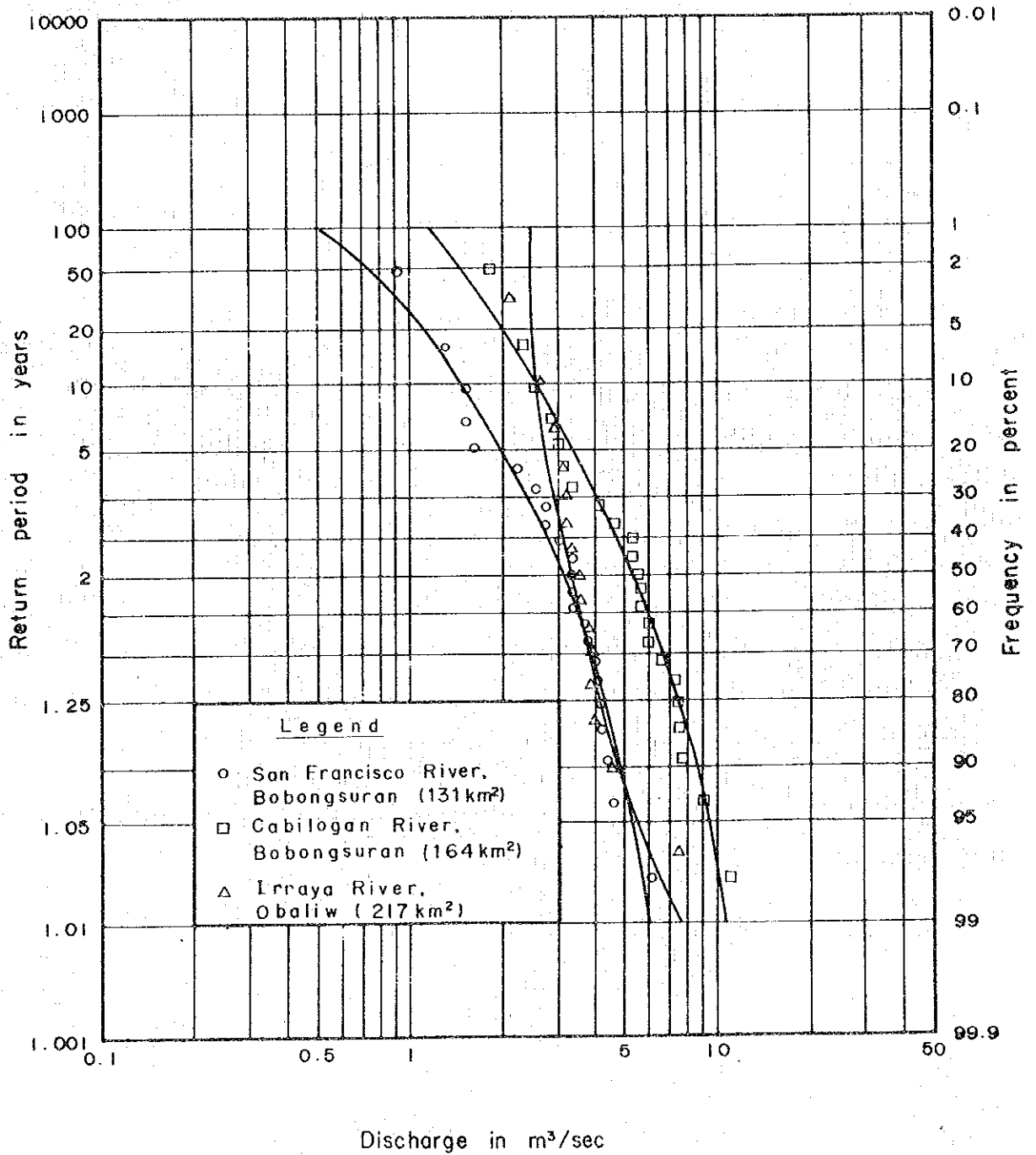


FIG.-II.24 FREQUENCY CURVES FOR ANNUAL MINIMUM MONTHLY MEAN RUNOFF BY WEIBULL'S METHOD

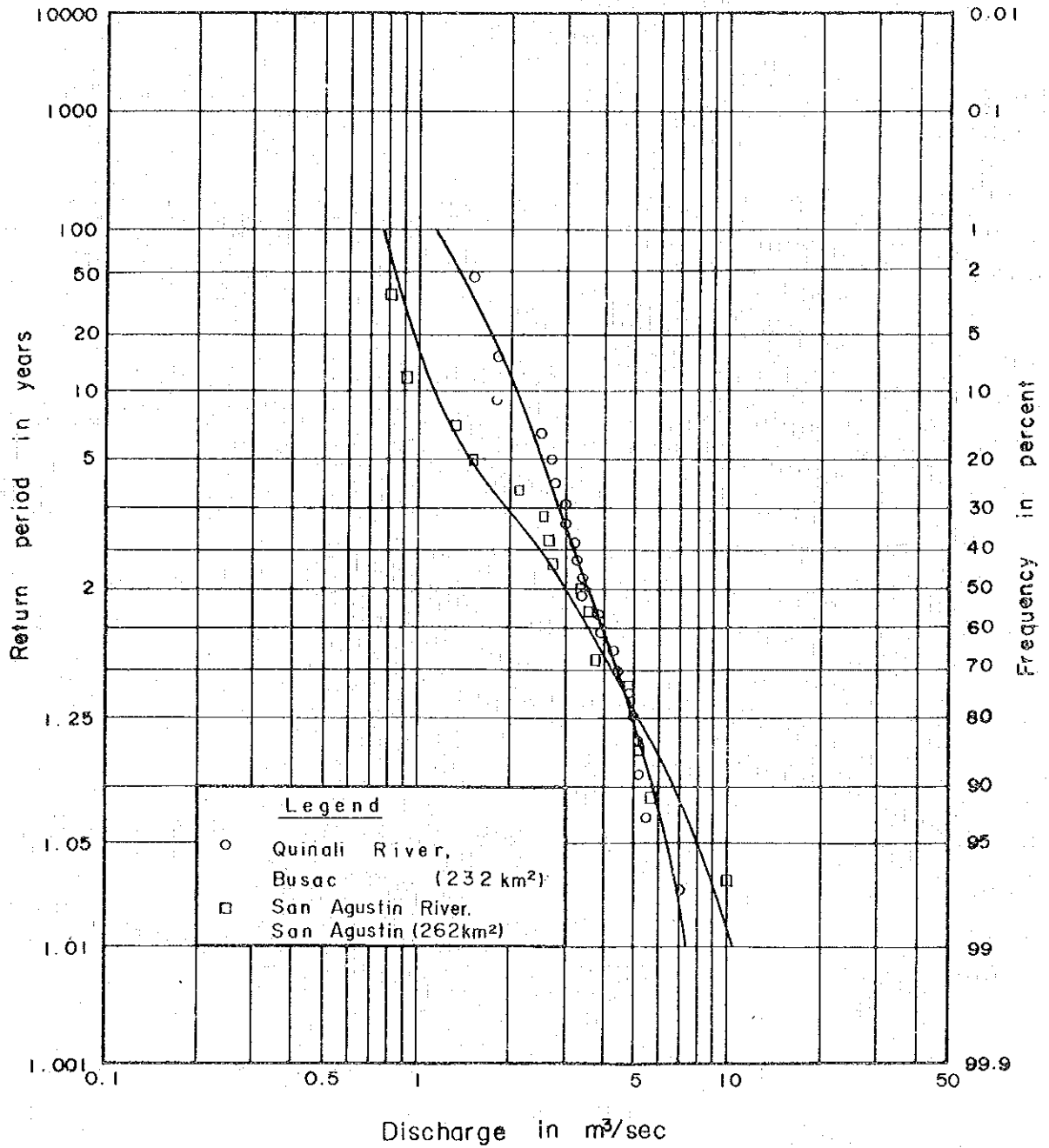


FIG.-II.25

REGIONAL DRAUGHT FREQUENCY CURVE  
 FOR SELECTED STATIONS IN THE  
 QUINALI (A) RIVER BASIN  
 (Annual minimum monthly mean runoff )

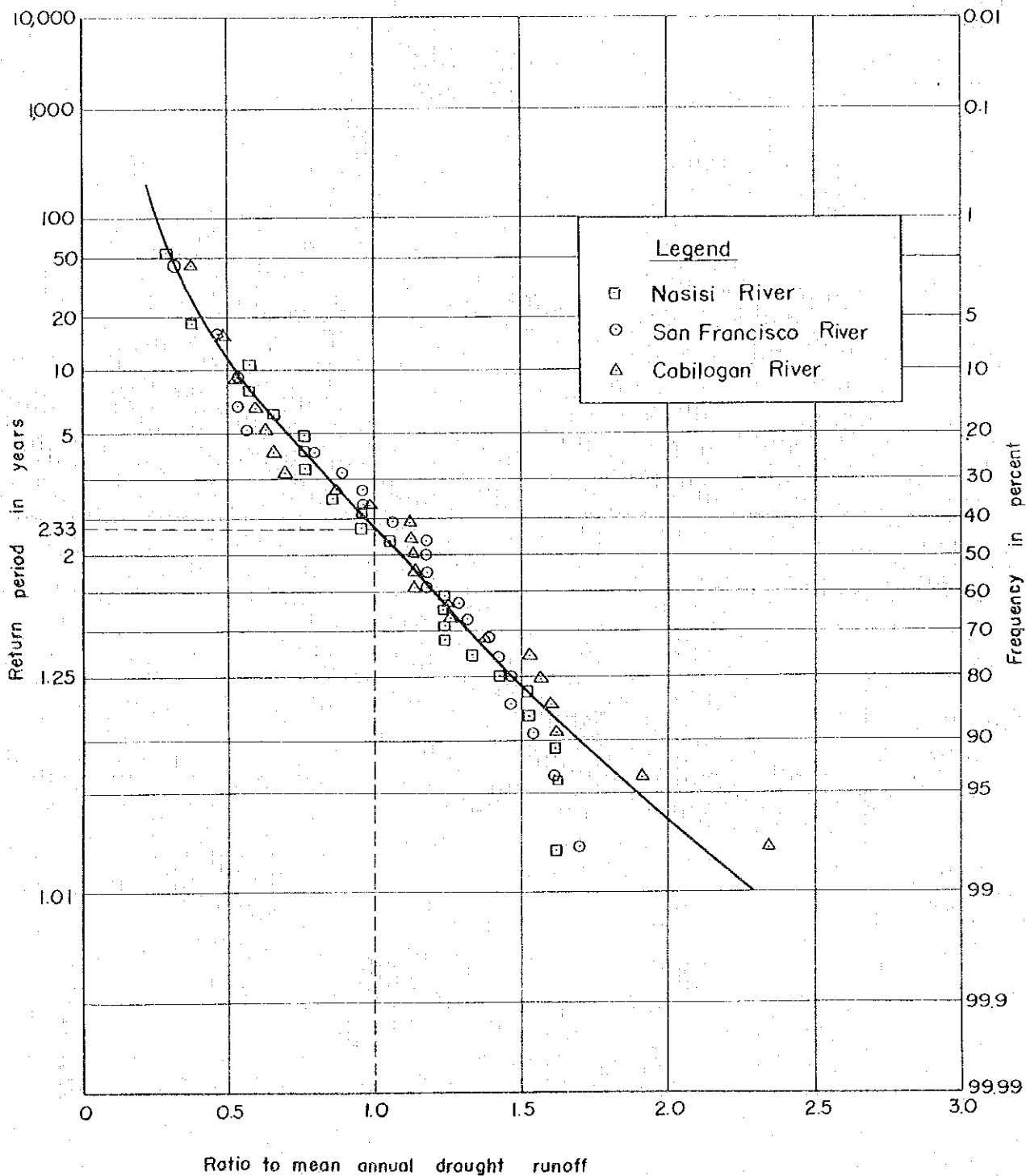




FIG-II26 VARIATION OF MEAN ANNUAL DRAUGHT RUNOFF (2.33-yr) WITH DRAINAGE AREA (Annual minimum monthly mean runoff)

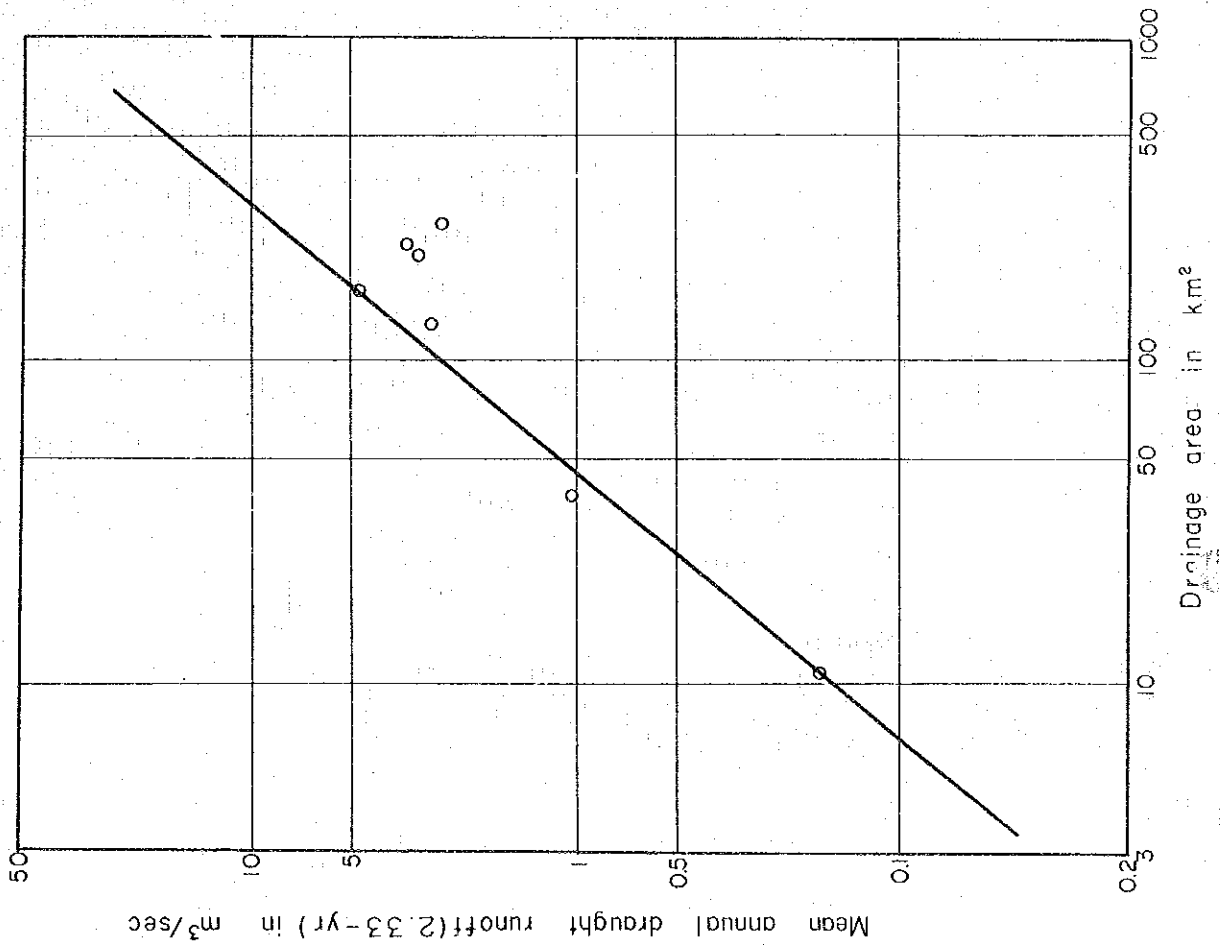


FIG-II27 RELATIONSHIP BETWEEN DRAINAGE AREA AND ANNUAL MEAN RUNOFF IN THE QUINALI (A) RIVER BASIN

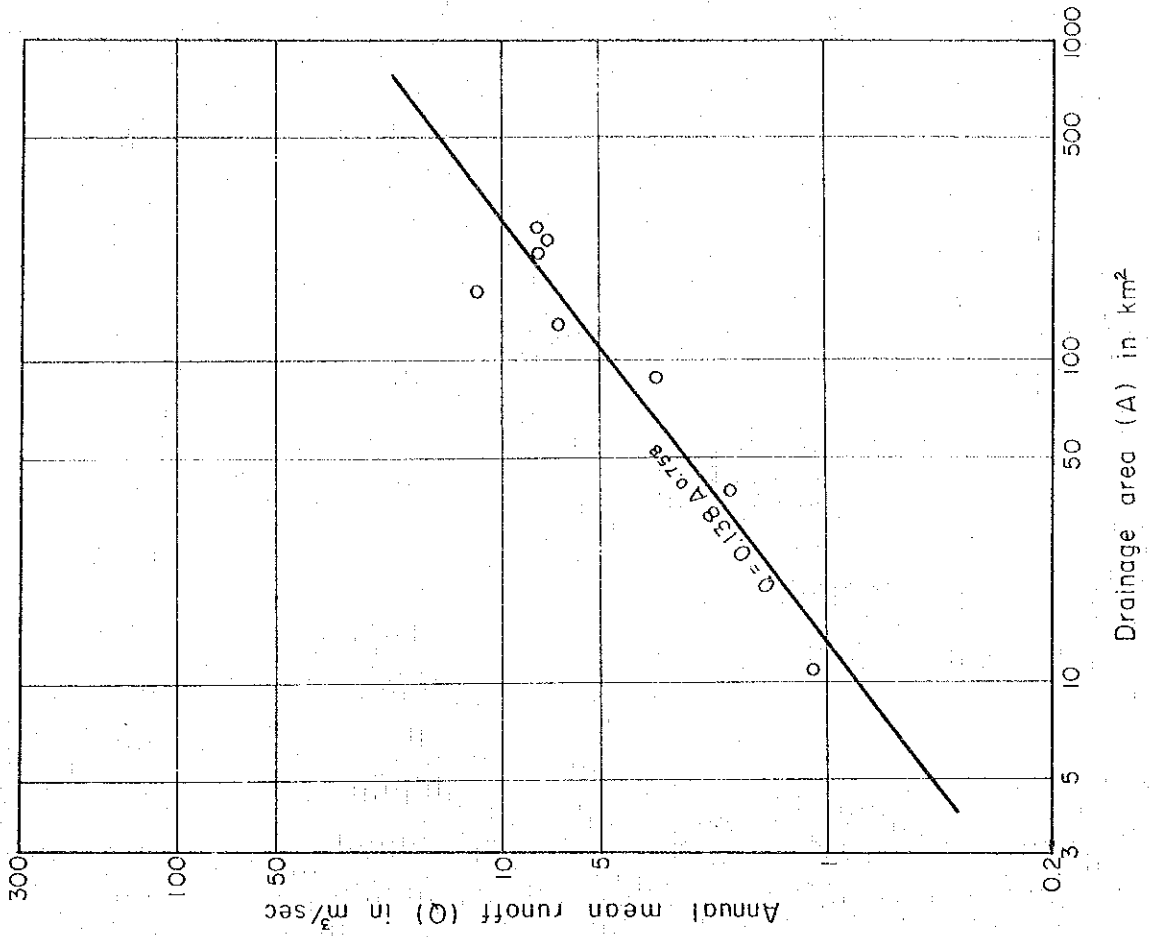


FIG-II.28 SUSPENDED LOAD RATING CURVE FOR THE QUINALI (A) RIVER AT BUSAC

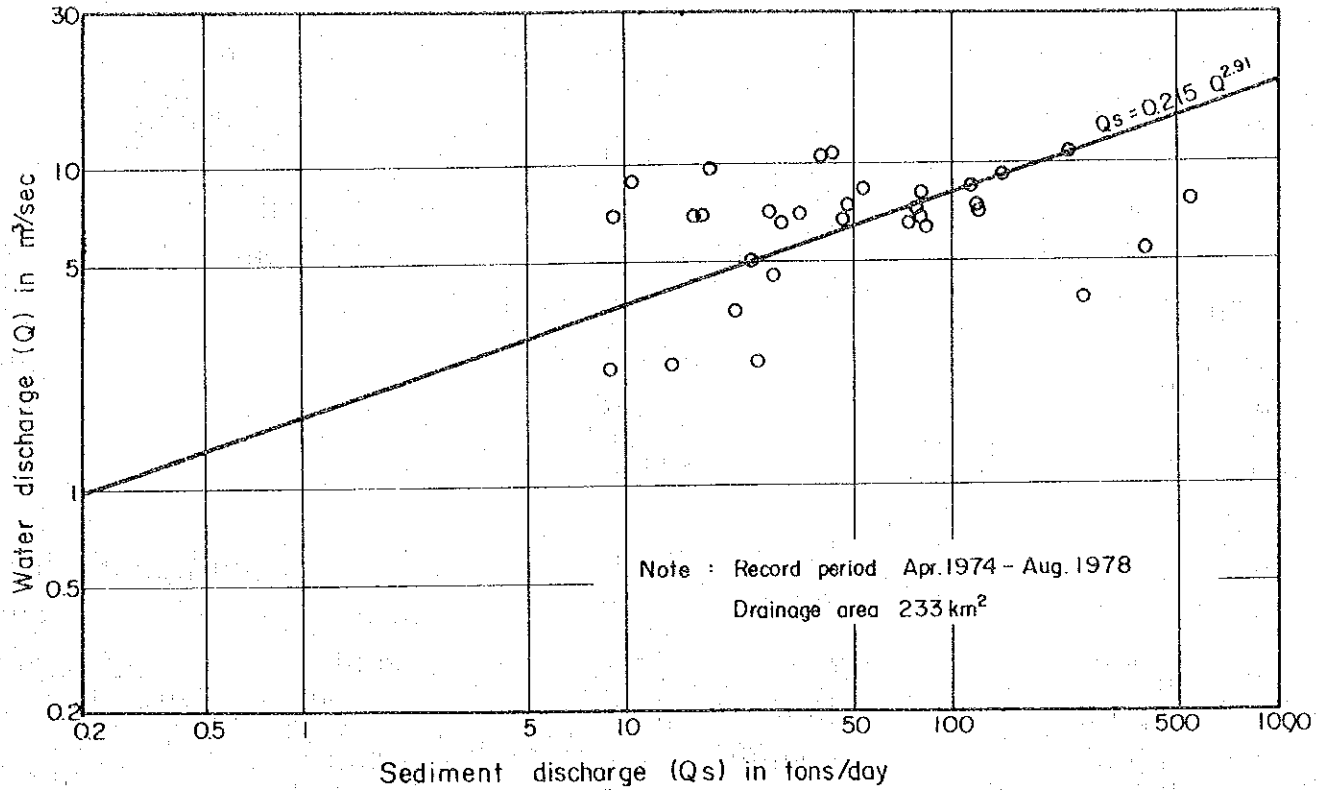


FIG-II.29 SUSPENDED LOAD RATING CURVE FOR THE TALISAY RIVER AT ALLANG

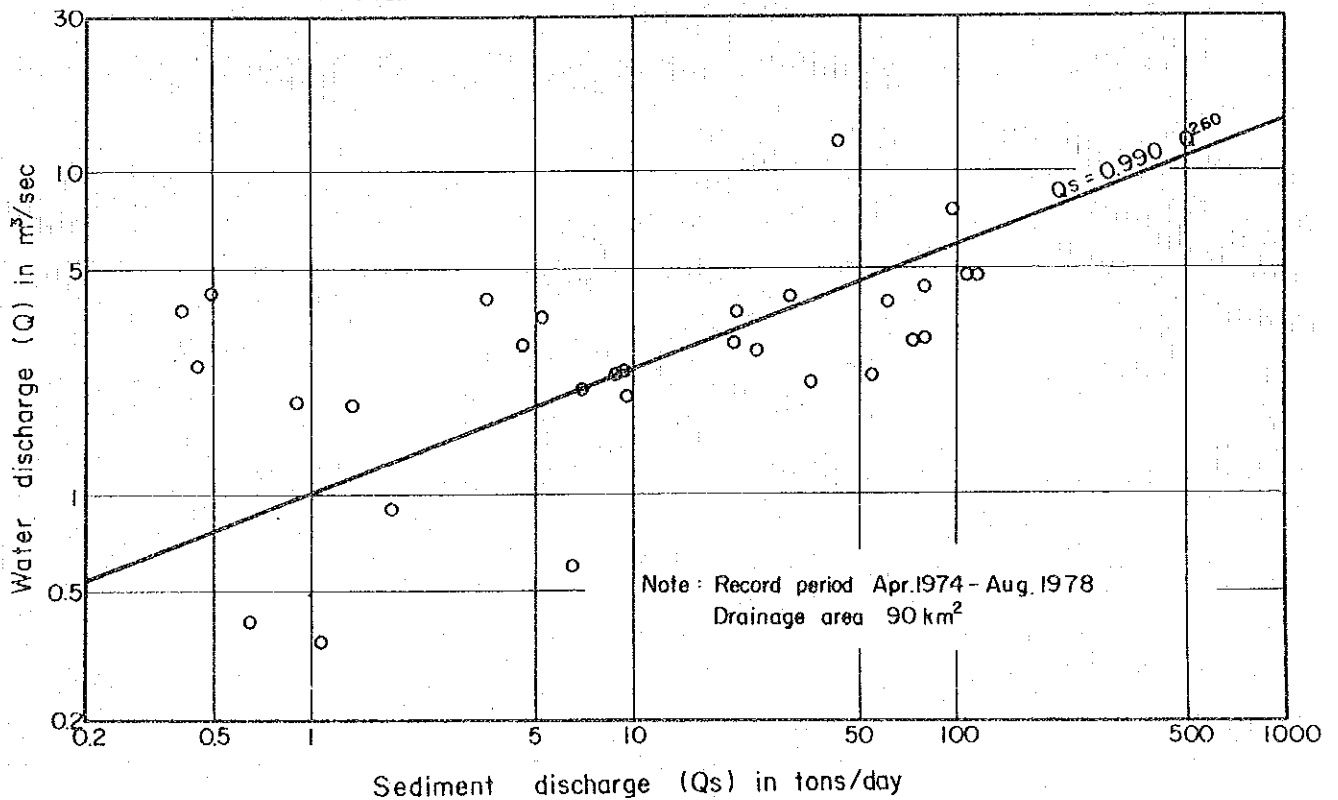


FIG.-II.30 BED LOAD RATING CURVES UNDER PRESENT RIVER CONDITIONS

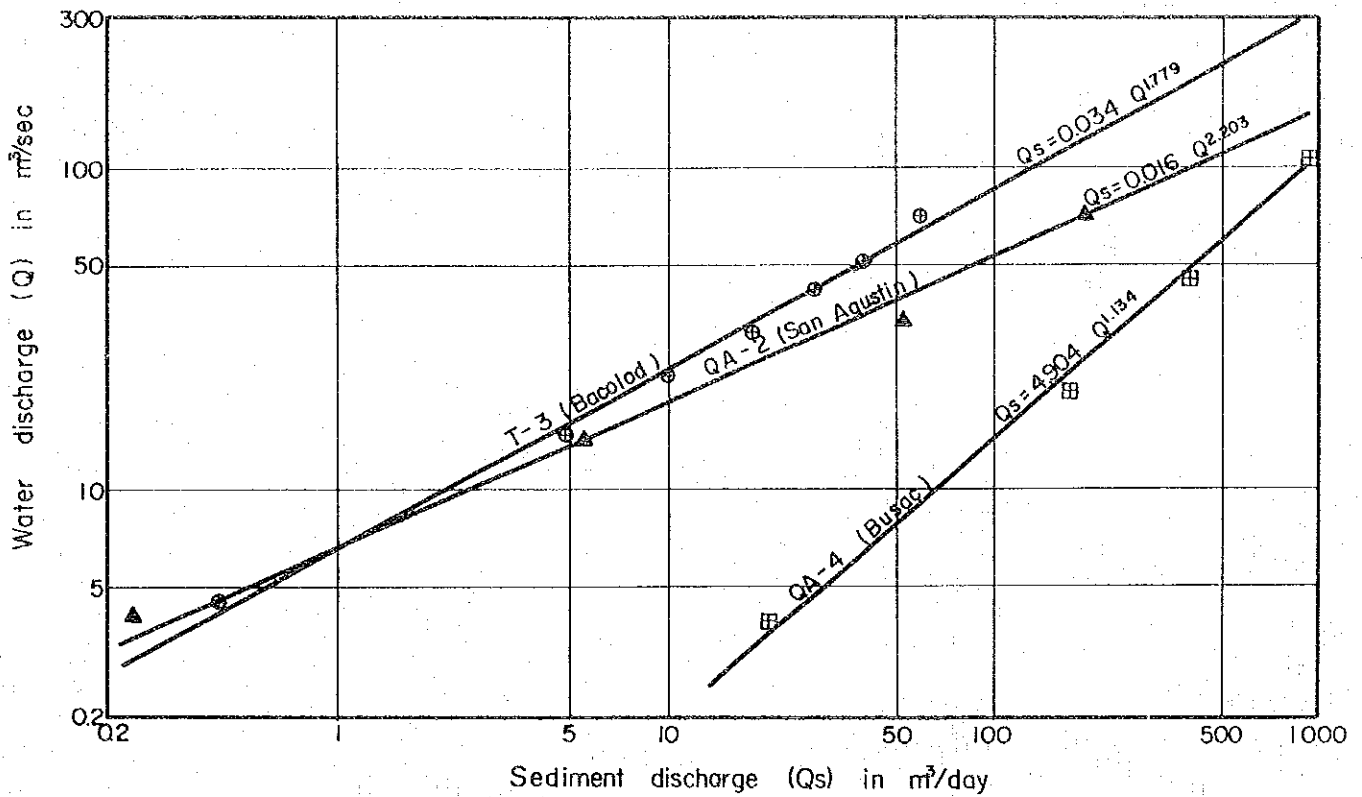


FIG.-II.31 GRAIN SIZE DISTRIBUTION CURVES OF RIVER BED MATERIALS

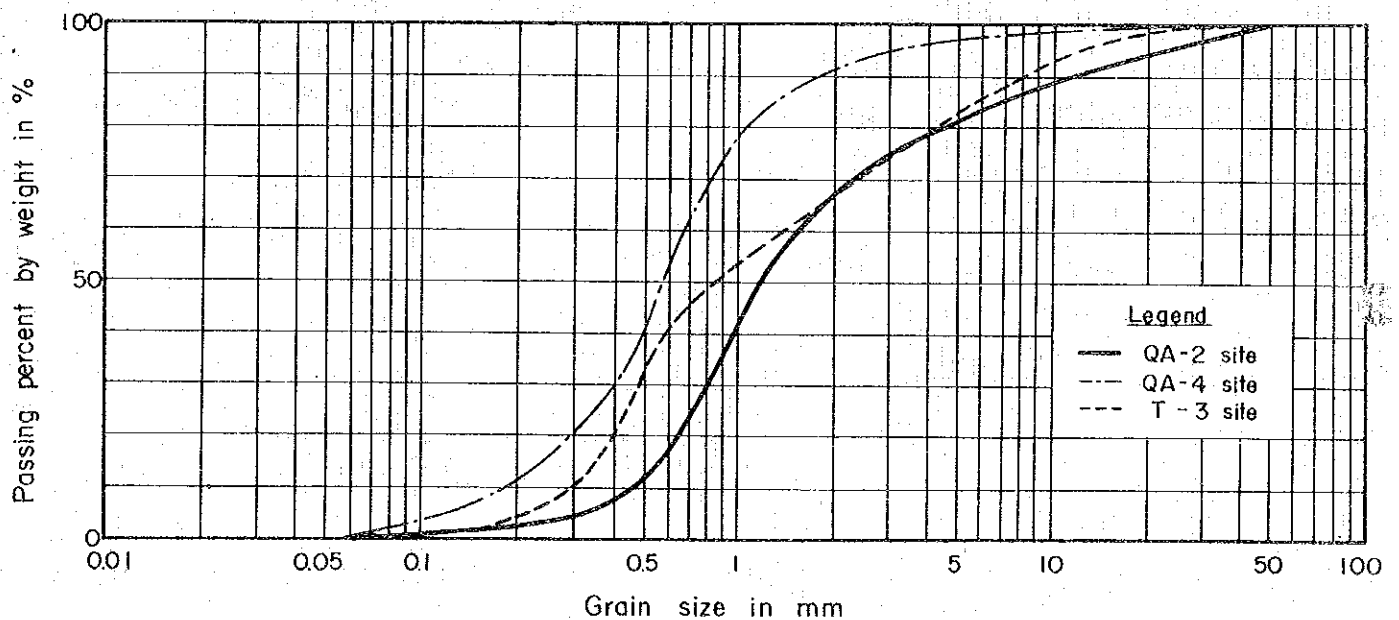


FIG.- II.32 MEAN ANNUAL RAINFALL IN THE PROJECT AREA

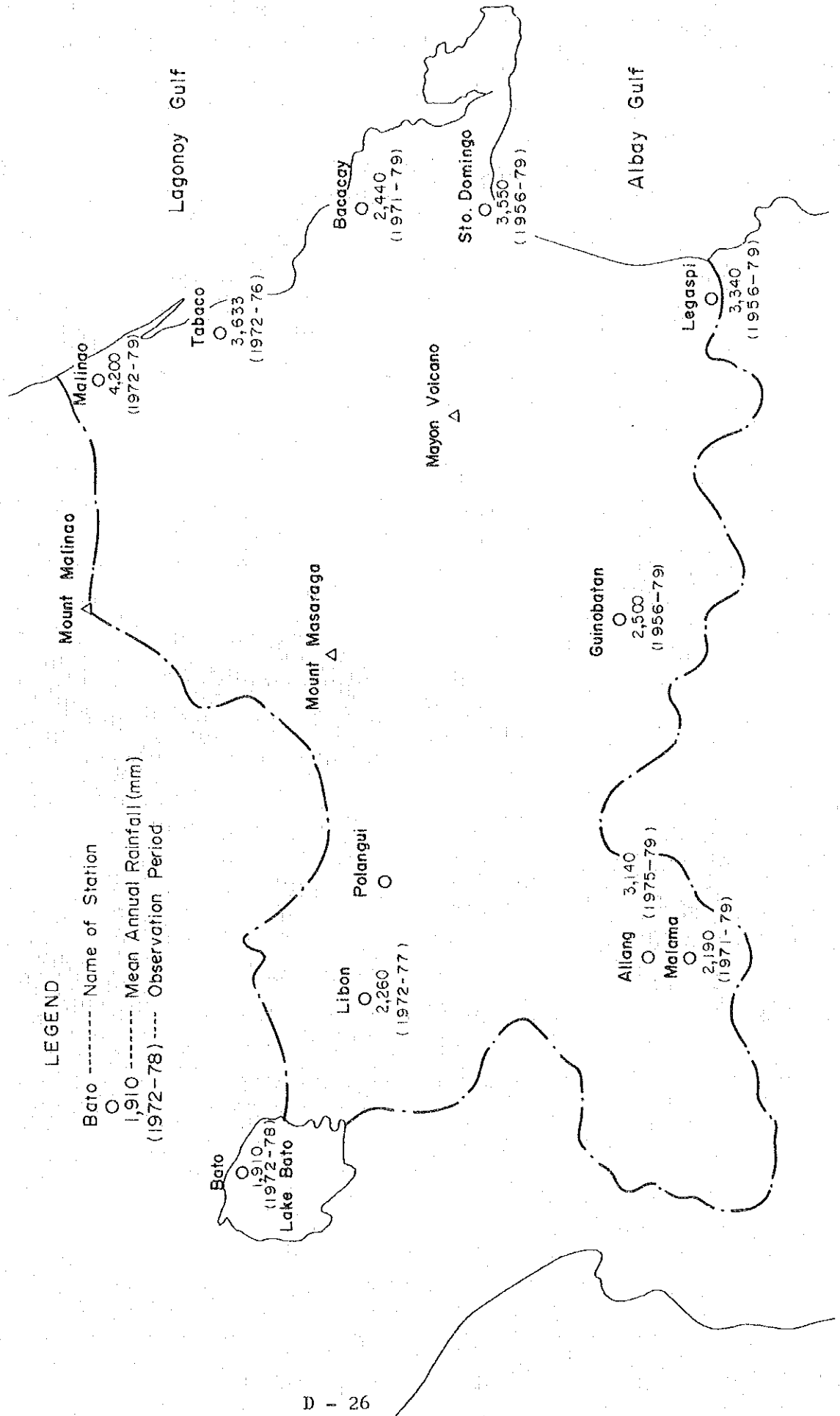


FIG.- II.33

MONTHLY MEAN RUNOFF IN THE  
QUINALI (A) RIVER BASIN

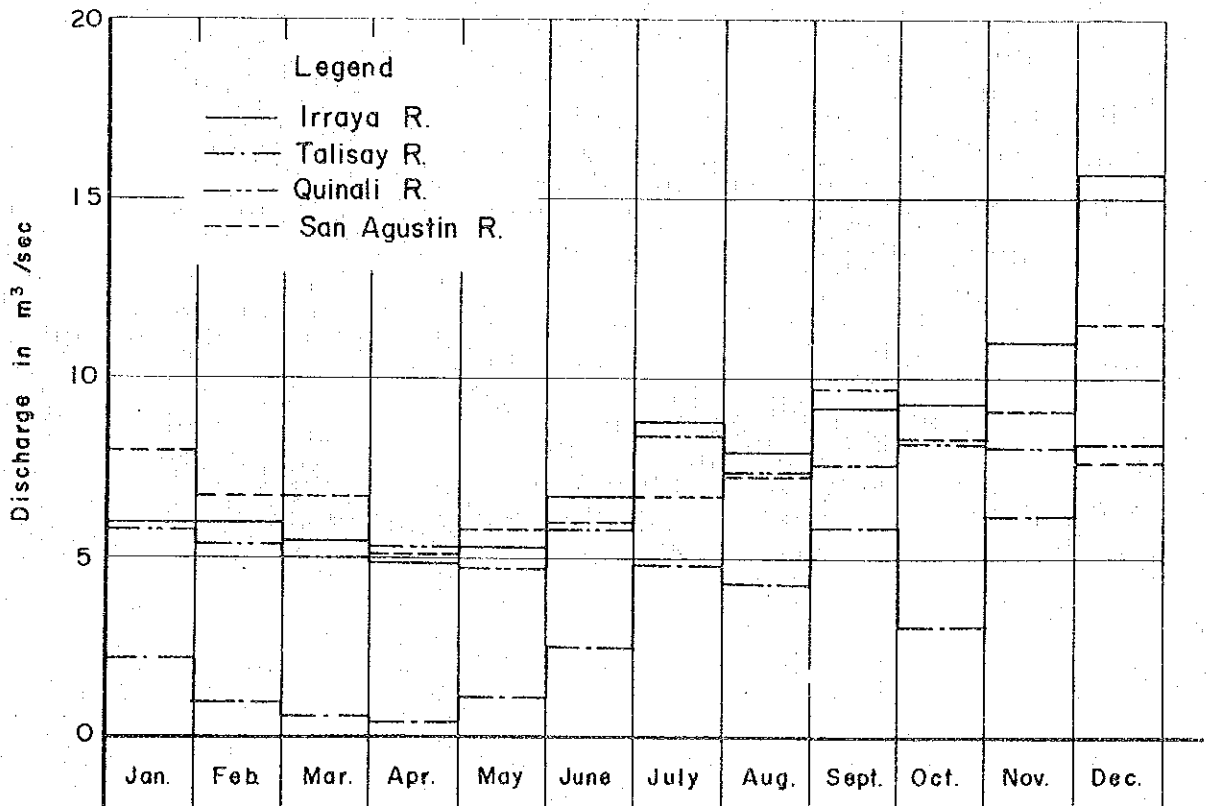
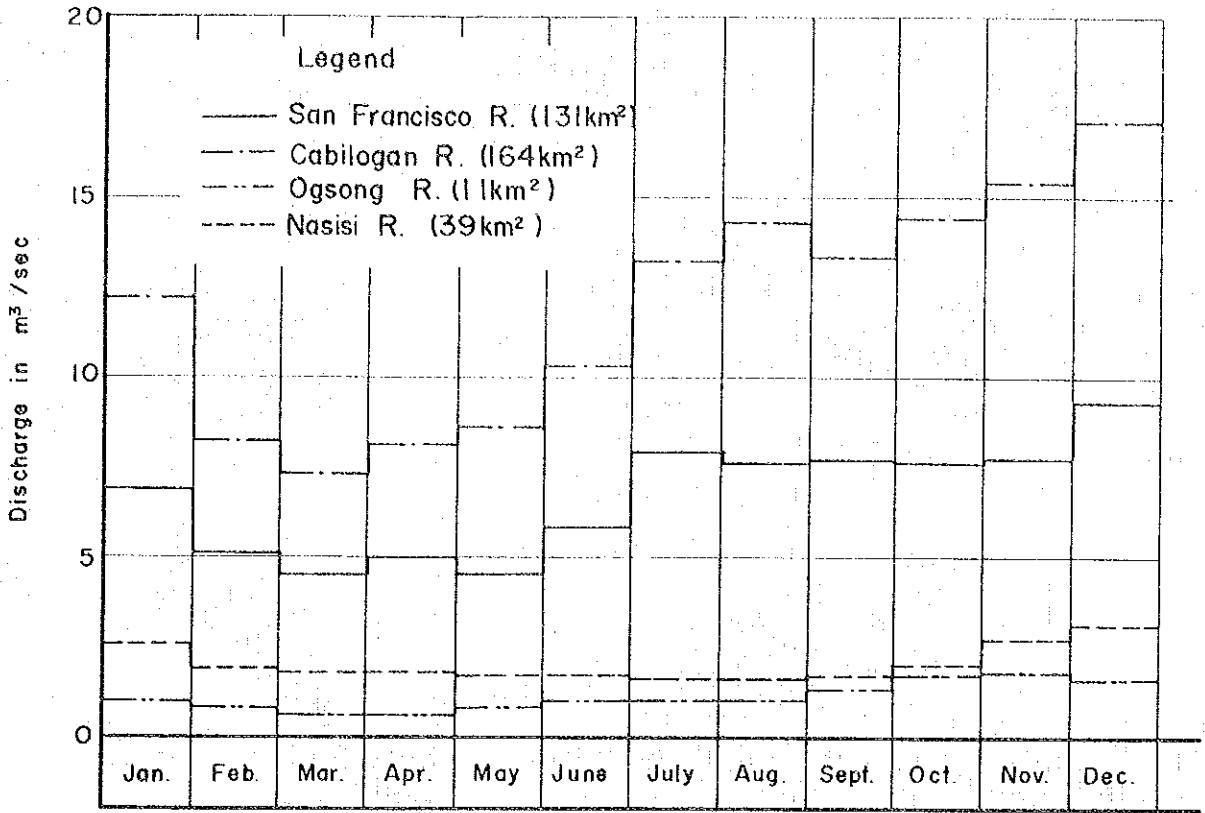


FIG-II.34 DAILY RUNOFF DURATION CURVES

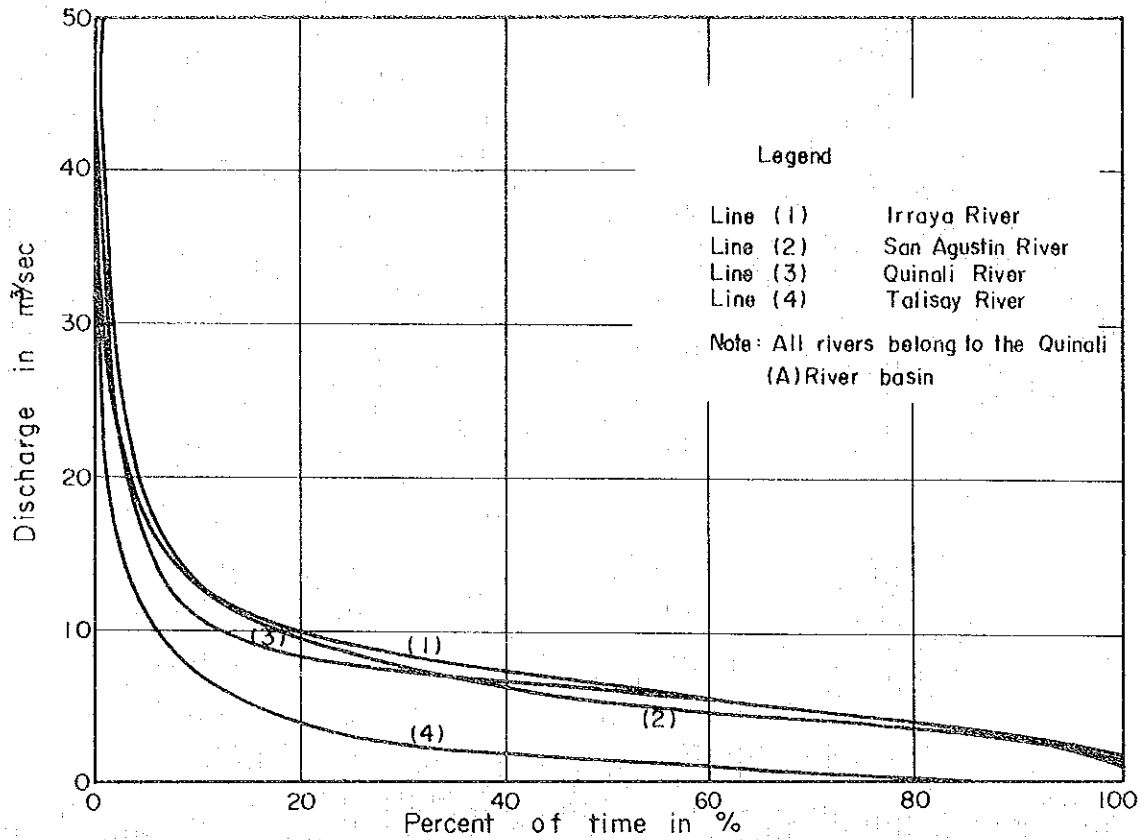


FIG-II.35 DAILY RUNOFF DURATION CURVES

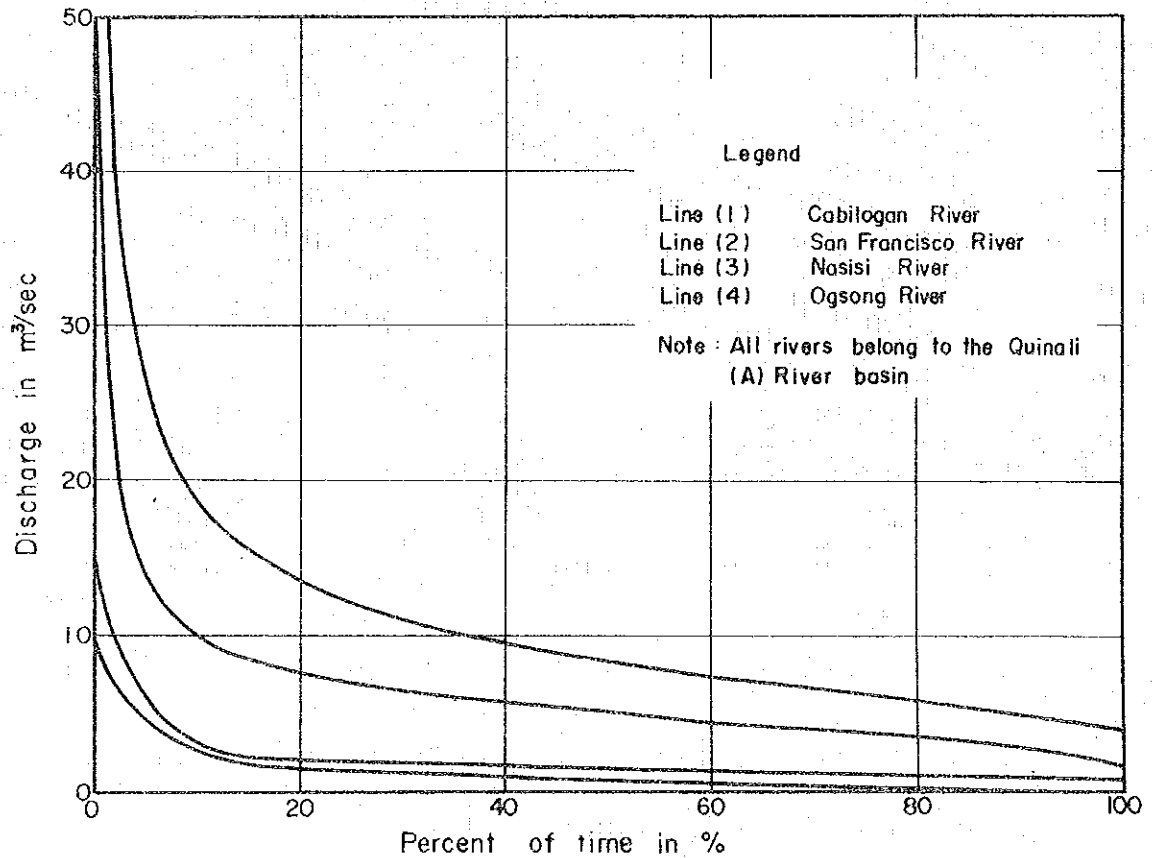


FIG.-II.36 FREQUENCY CURVE FOR WATER LEVEL OF LAKE BATO (1960-1979)

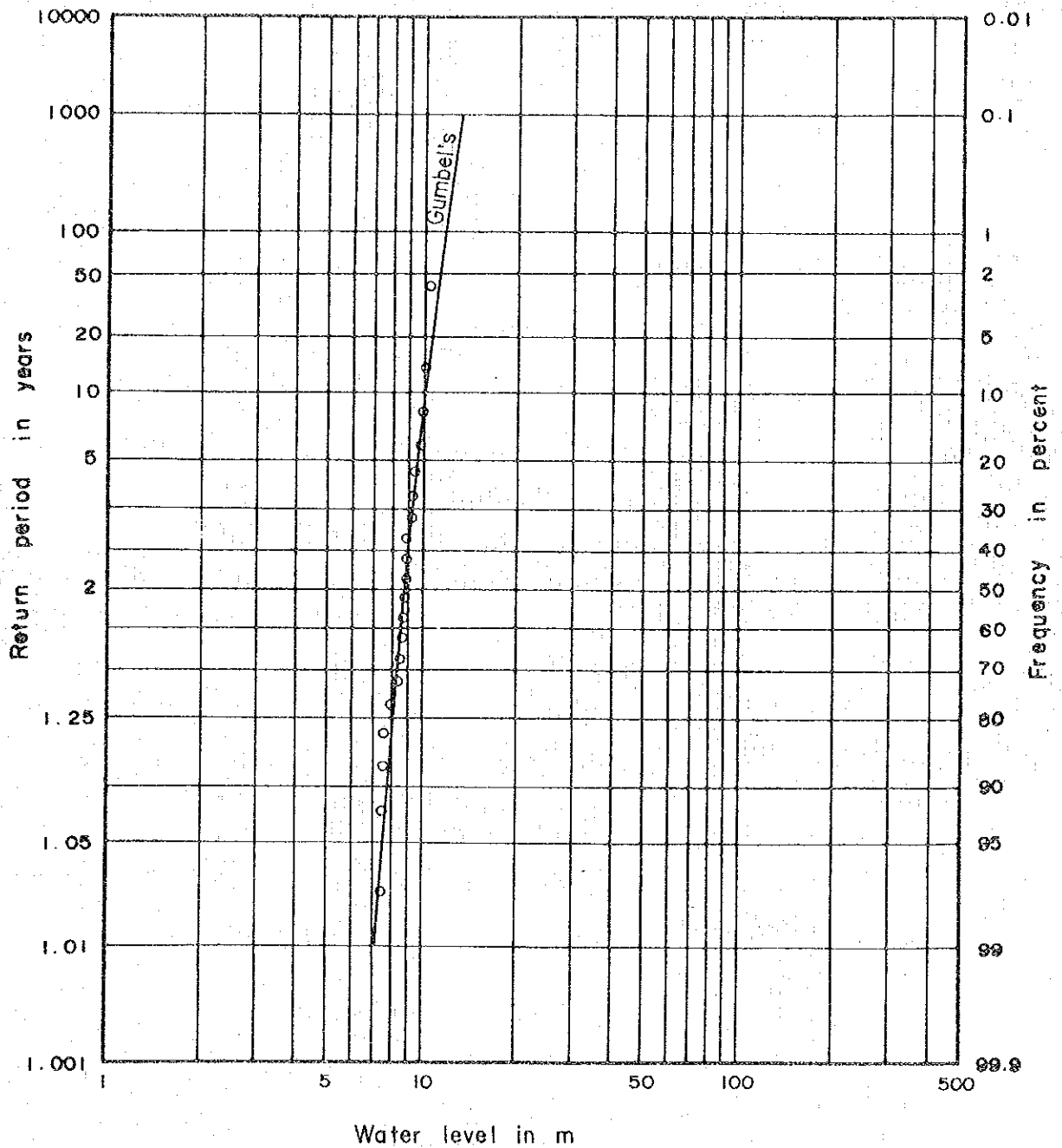


FIG.-II.37 ANNUAL FREQUENCY OF TROPICAL CYCLONES  
IN THE PHILIPPINE AREA OF RESPONSIBILITY

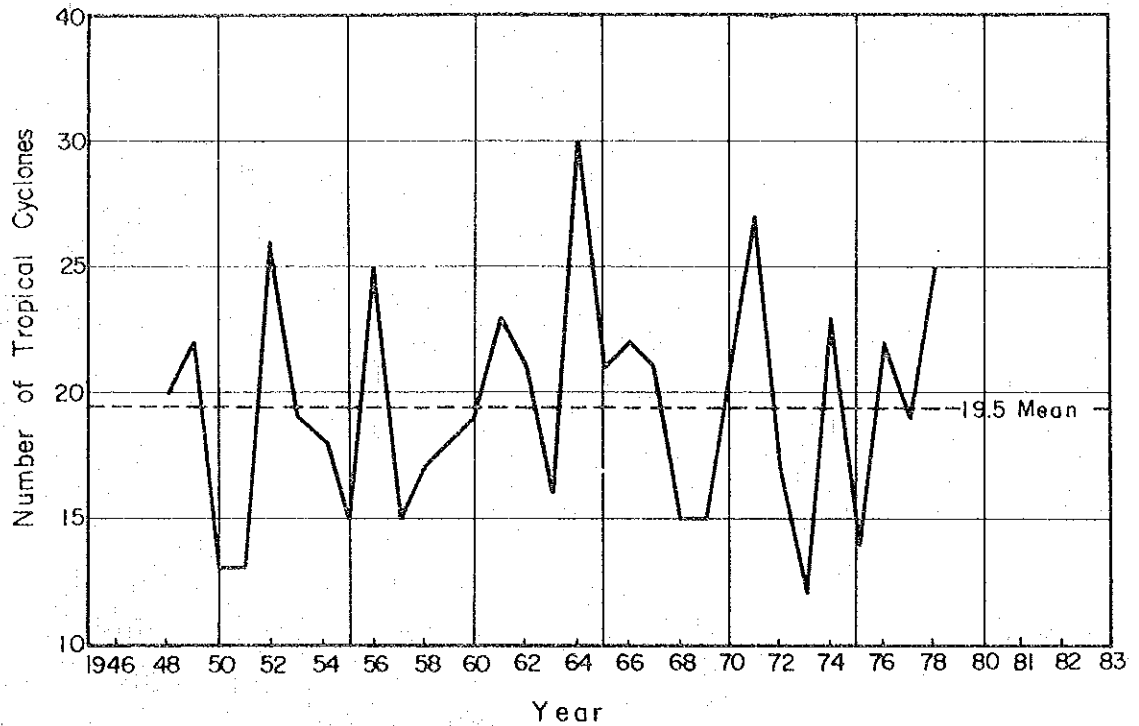
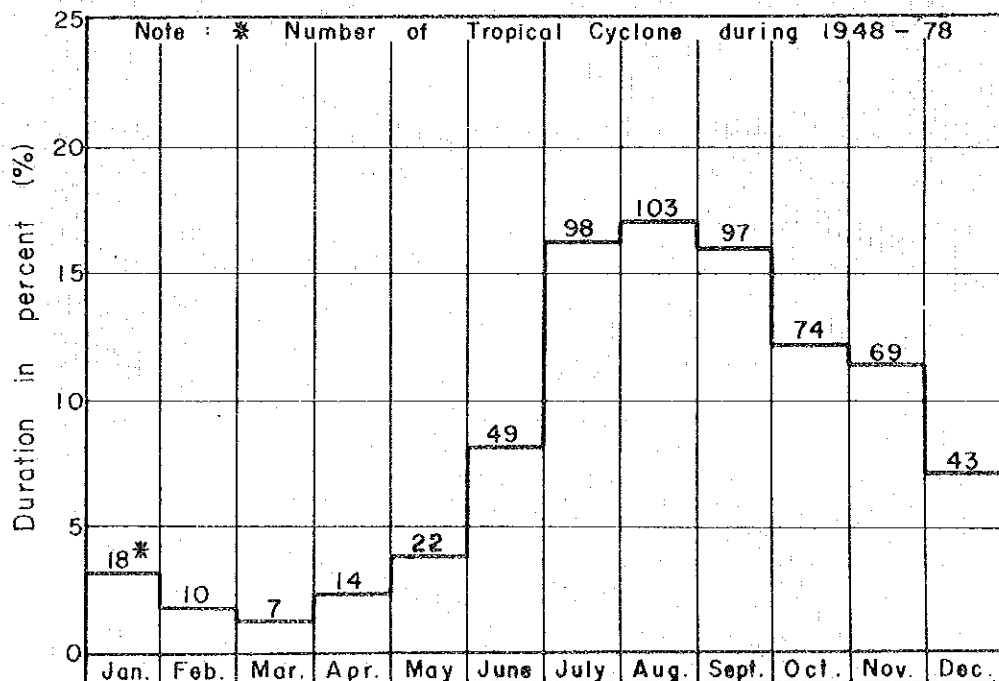


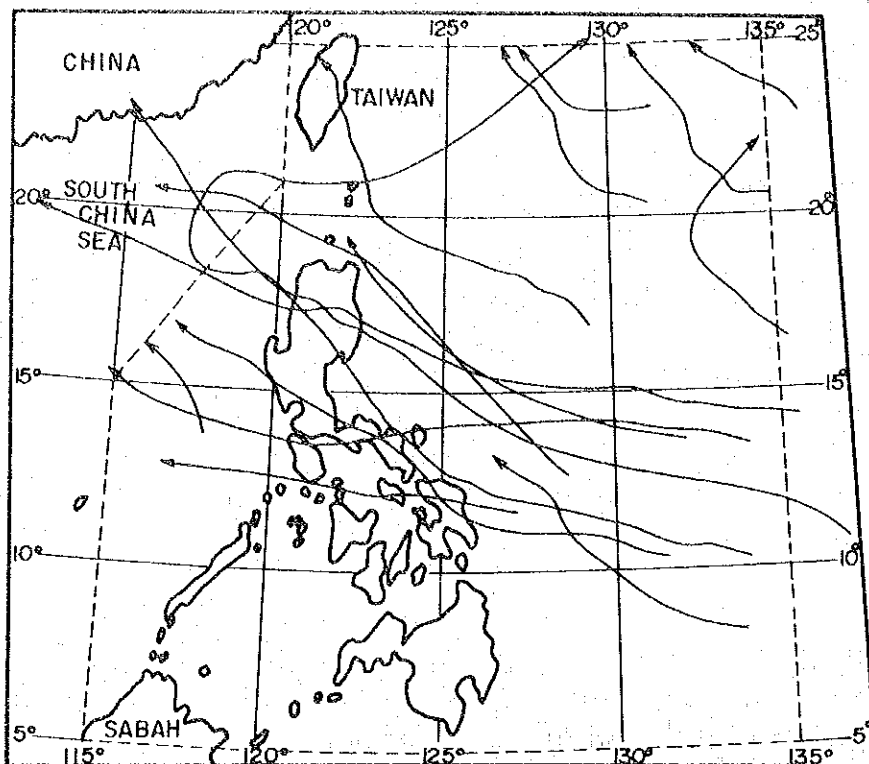
FIG.-II.38 MONTHLY DISTRIBUTION OF TROPICAL CYCLONES  
(1948 - 78)





# FIG.-II.39 TROPICAL CYCLONE TRACKS

a) June and July



b) October and November

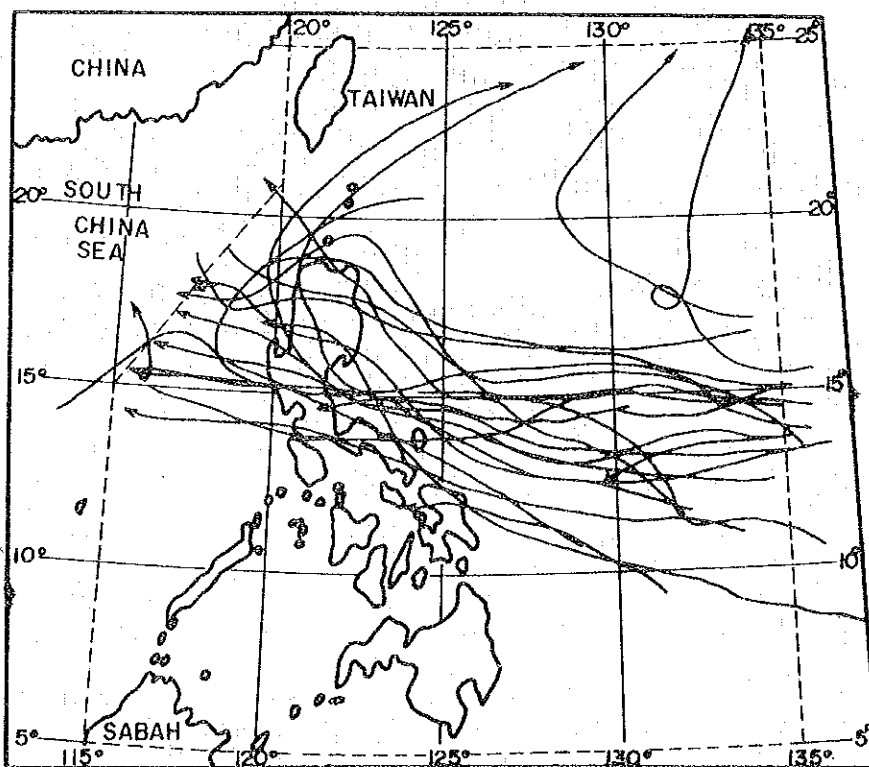


FIG- II40 TRACKS OF TYPHOONS AFFECTING THE PROJECT AREA SINCE 1971

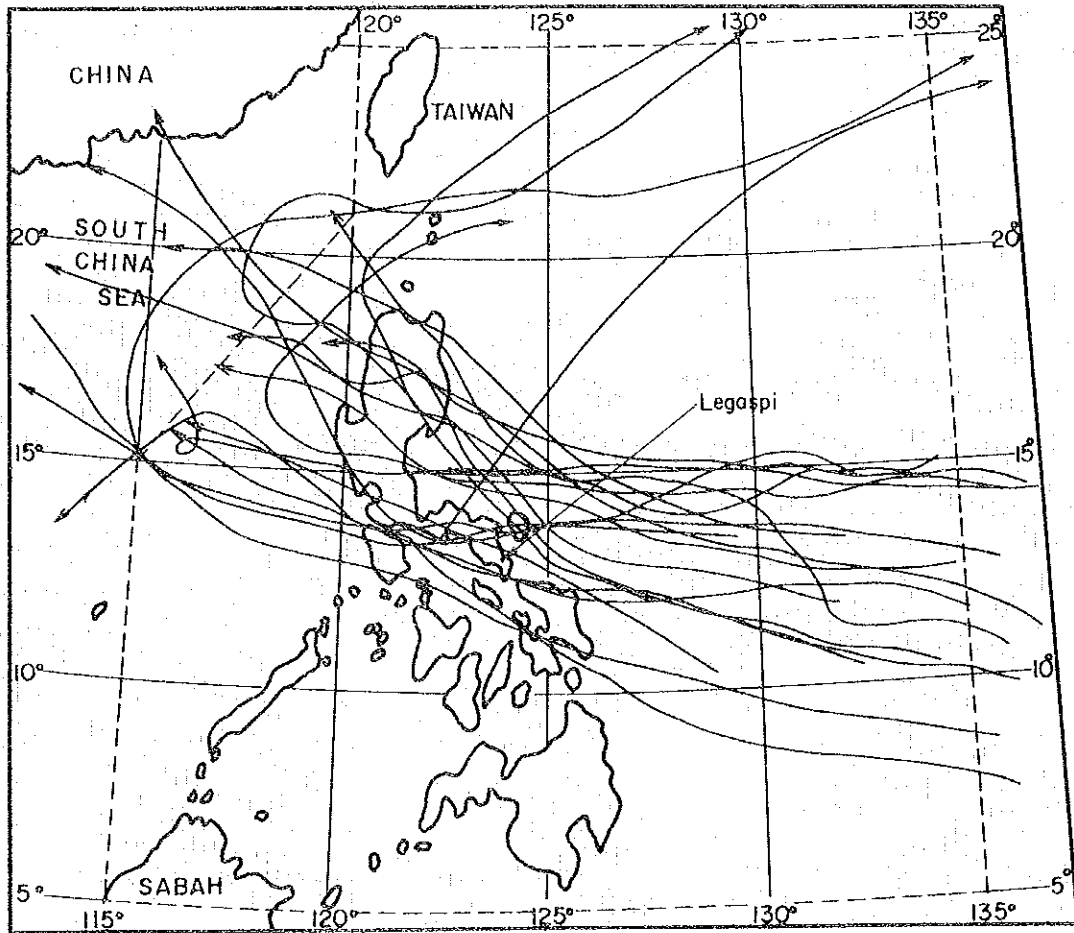


FIG- II.4] ACCUMULATED RAINFALL CURVES AT LEGAZPI

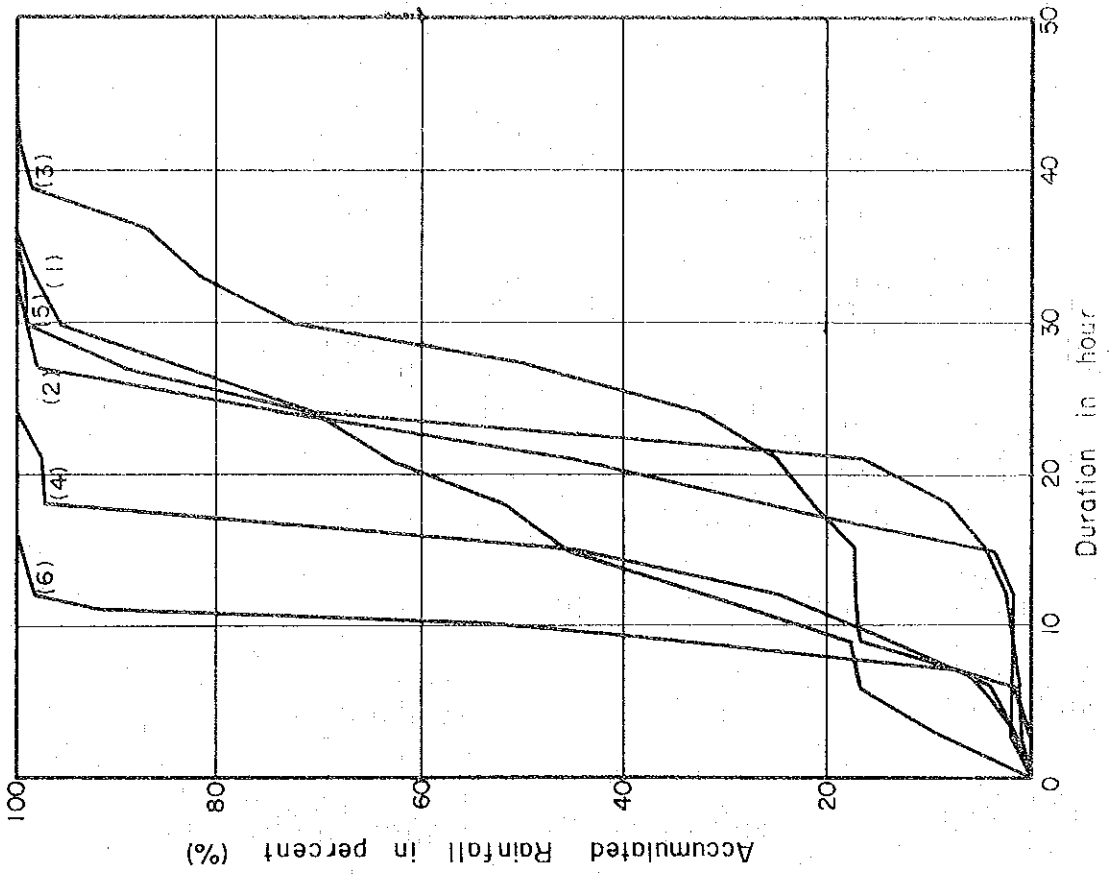
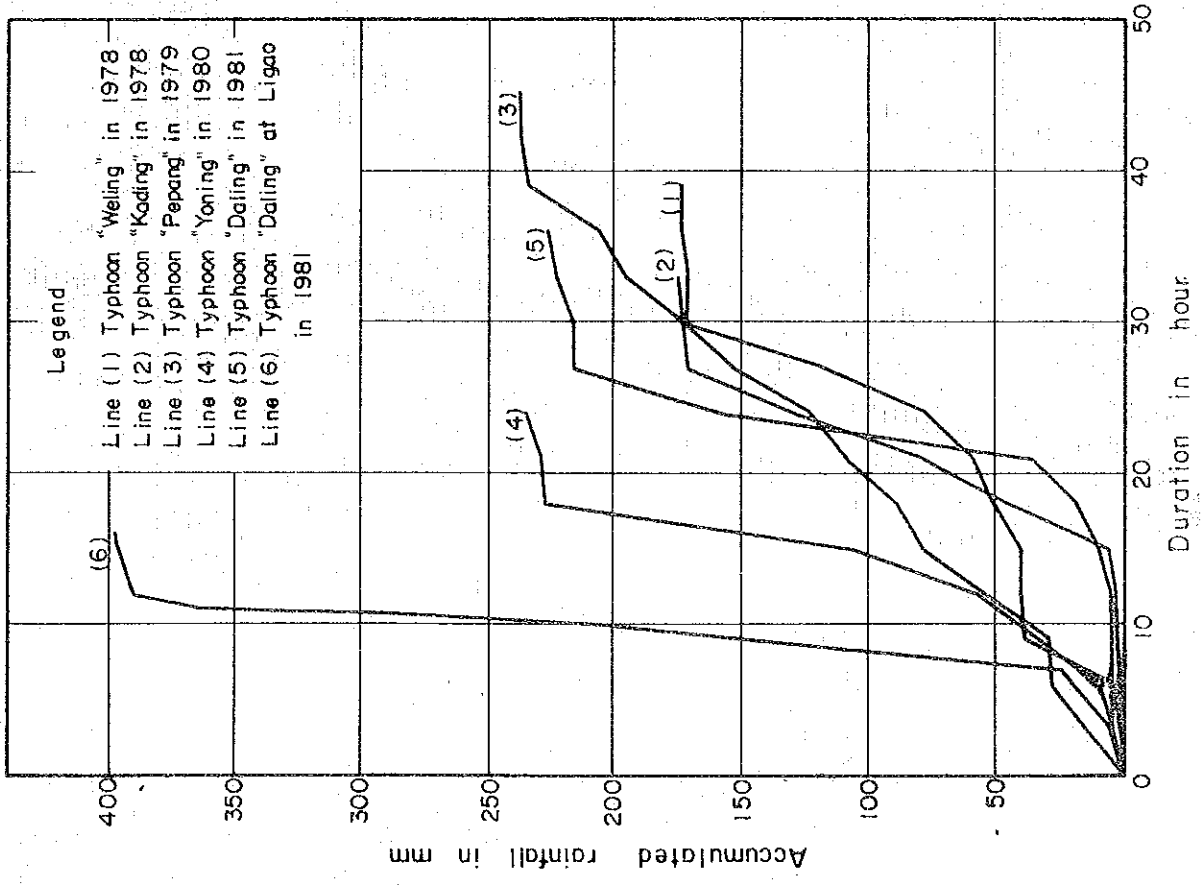


FIG-II.42 RELATION BETWEEN TYPHOON TRACKS AND RAINFALL AT LEGAZPI

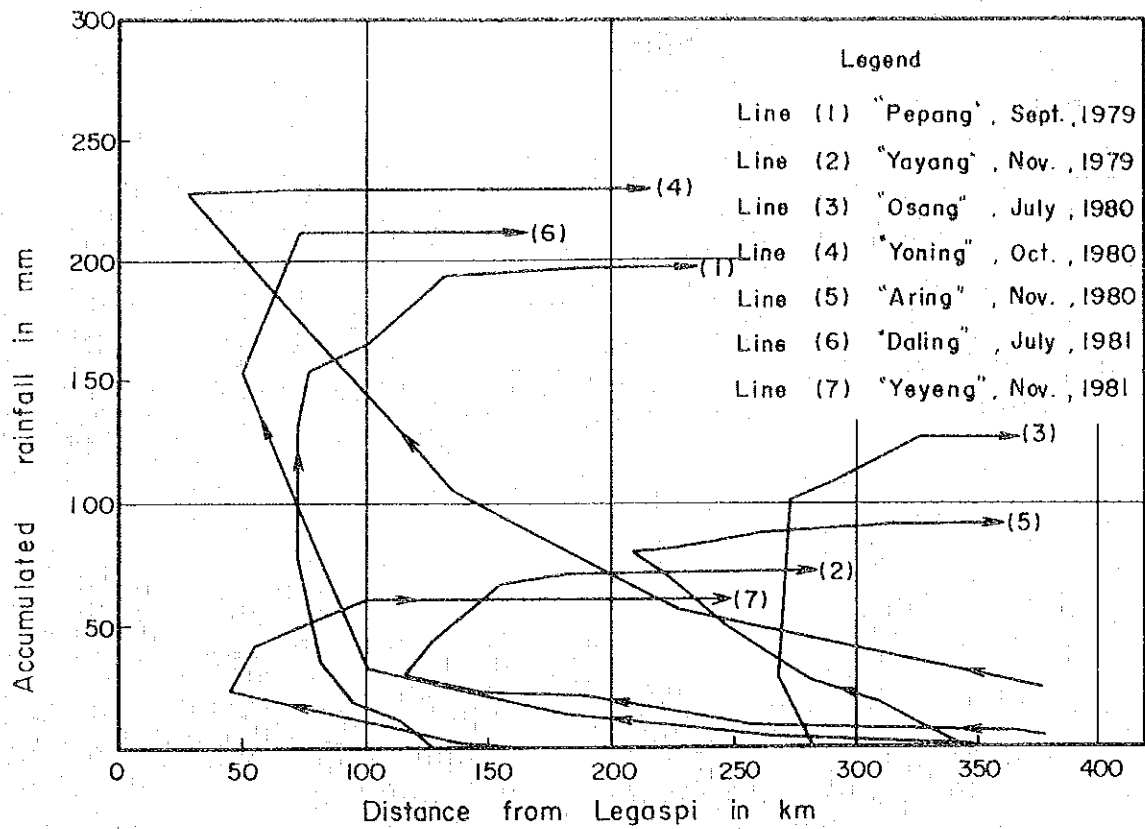


FIG-II.43 TYPHOON TRACKS

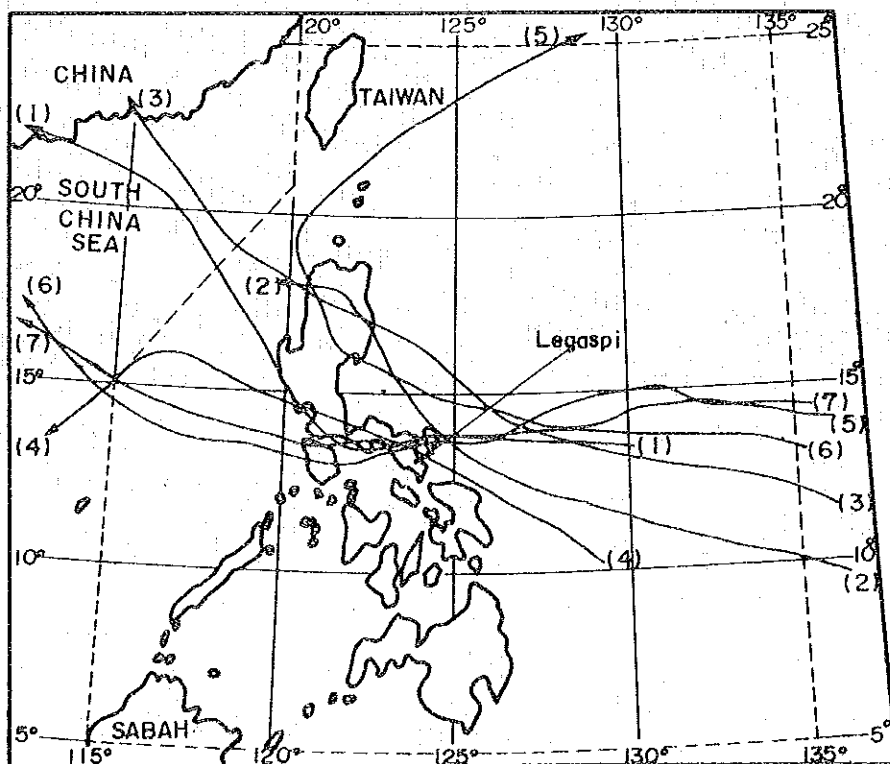


FIG.- IV.1 SEDIMENT BALANCE DIAGRAM IN THE QUNALI (A) RIVER BASIN  
( Present River Condition )

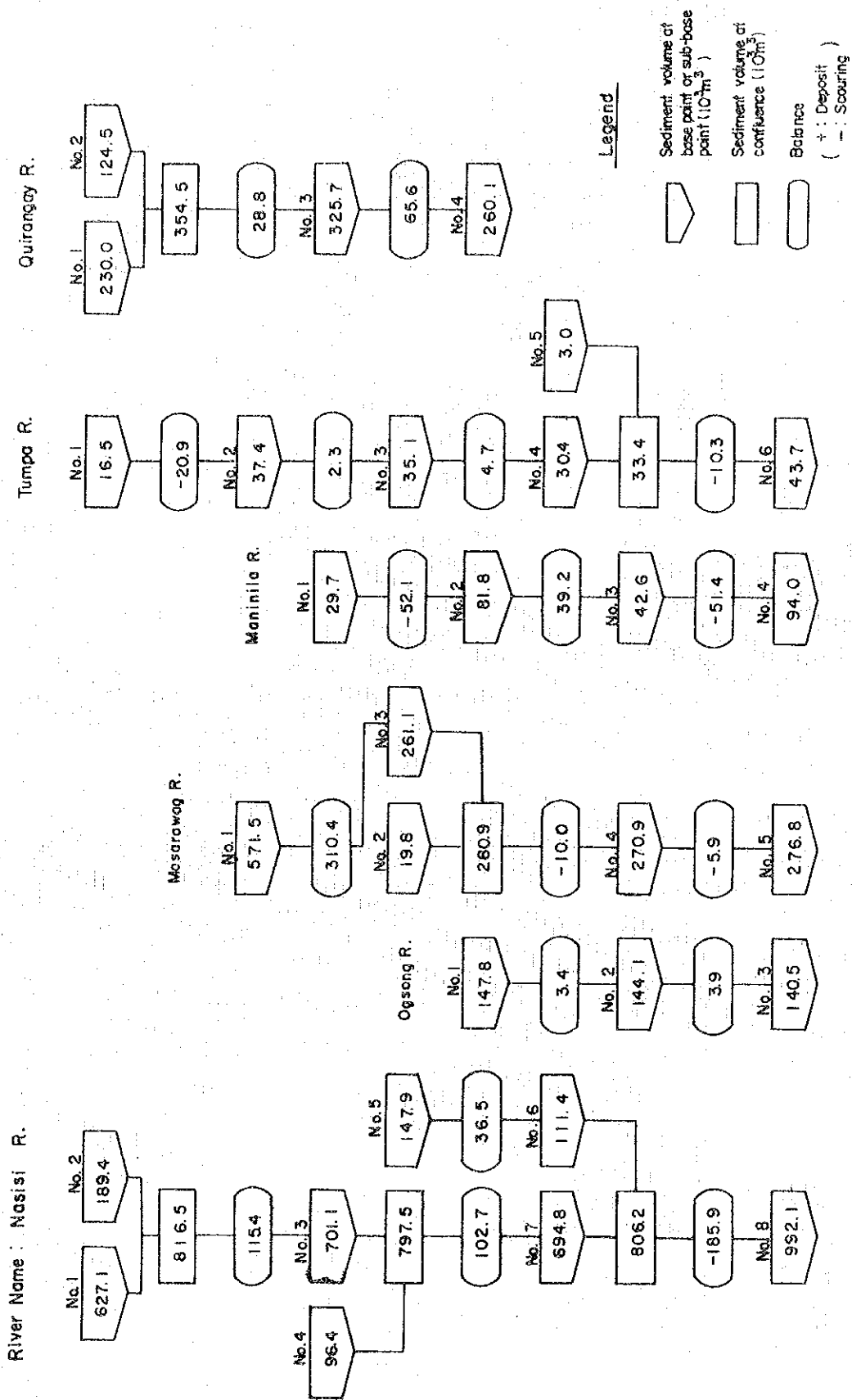
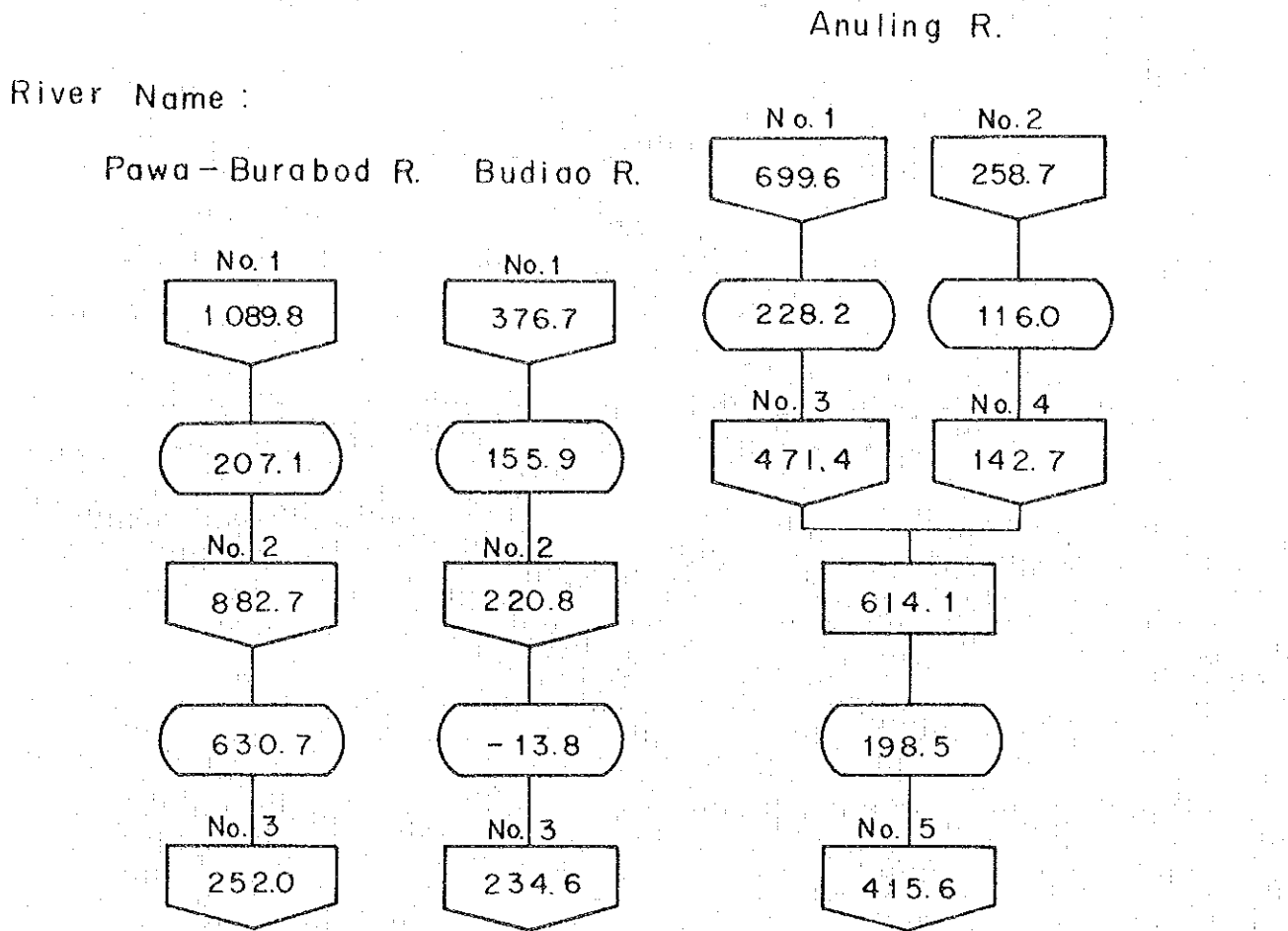


FIG.-IV.2 SEDIMENT BALANCE DIAGRAM IN THE YAWA RIVER BASIN  
( Present River Condition )



Legend

- Sediment volume at base point or sub-base point ( $10^3 \text{ m}^3$ )
- Sediment volume at confluence ( $10^3 \text{ m}^3$ )
- Balance  
( + : Deposit )  
( - : Scouring )

FIG.- IV 3 SEDIMENT BALANCE DIAGRAM IN THE QUINALI (A) RIVER BASIN  
( With Project )

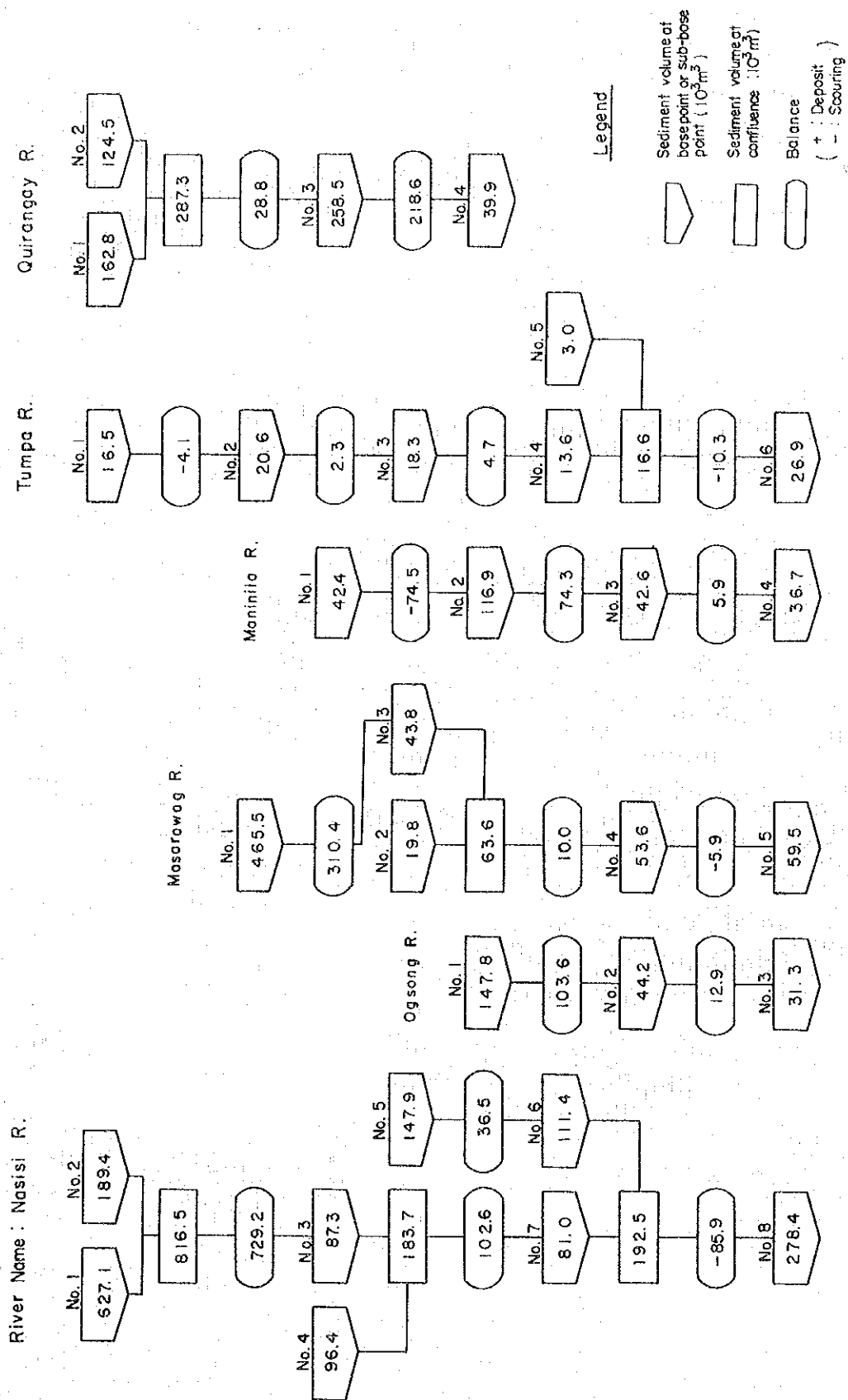


FIG.-IV.4 SEDIMENT BALANCE DIAGRAM IN THE YAWA RIVER BASIN  
( With project )

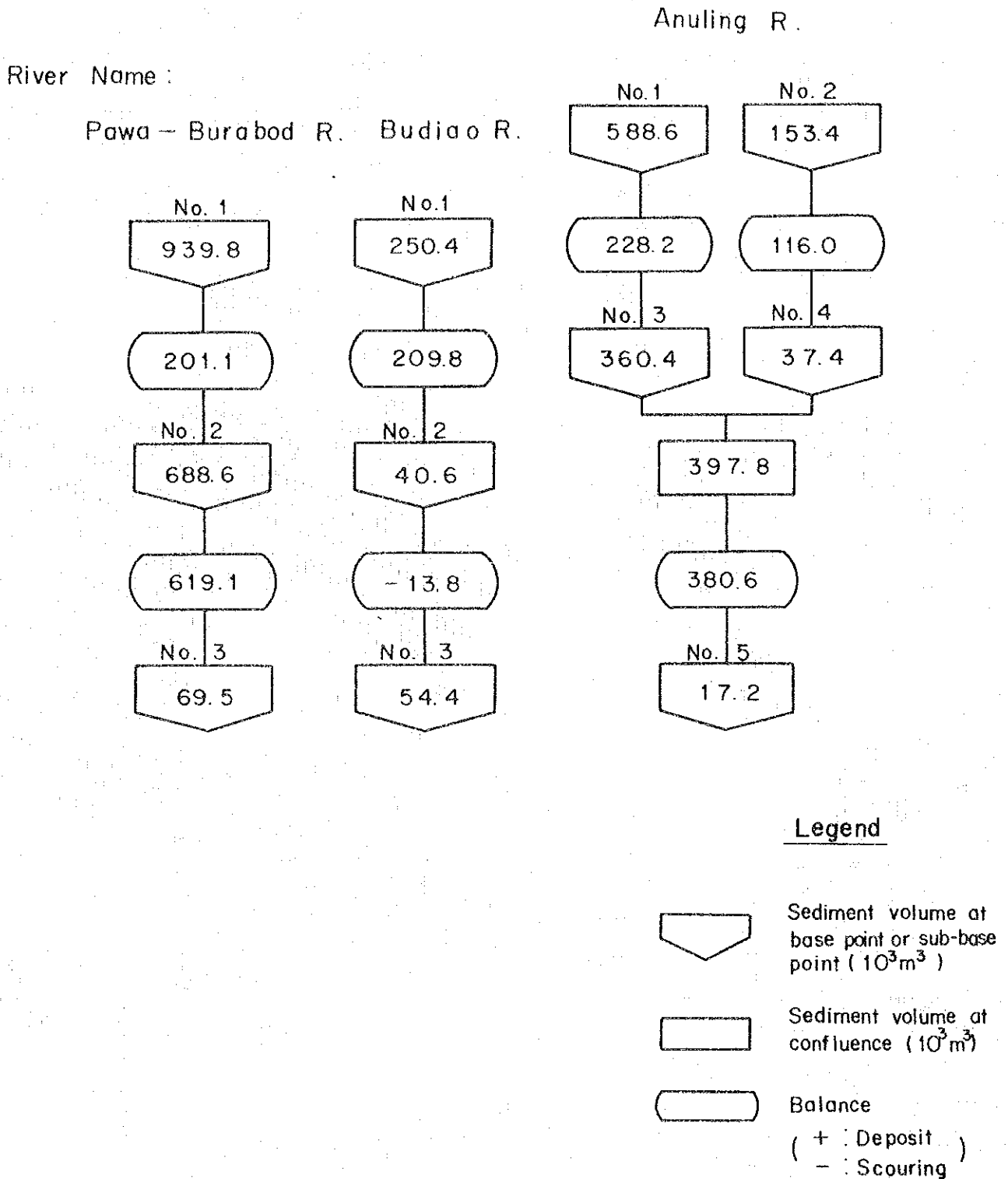






FIG.- V.1

INUNDATION AREA IN THE QUINALI (A) RIVER BASIN

Legend

-  Inundation Area due to The Quinali (A) River
-  Inundation Area Mainly due to Lake Bato and Other Rivers

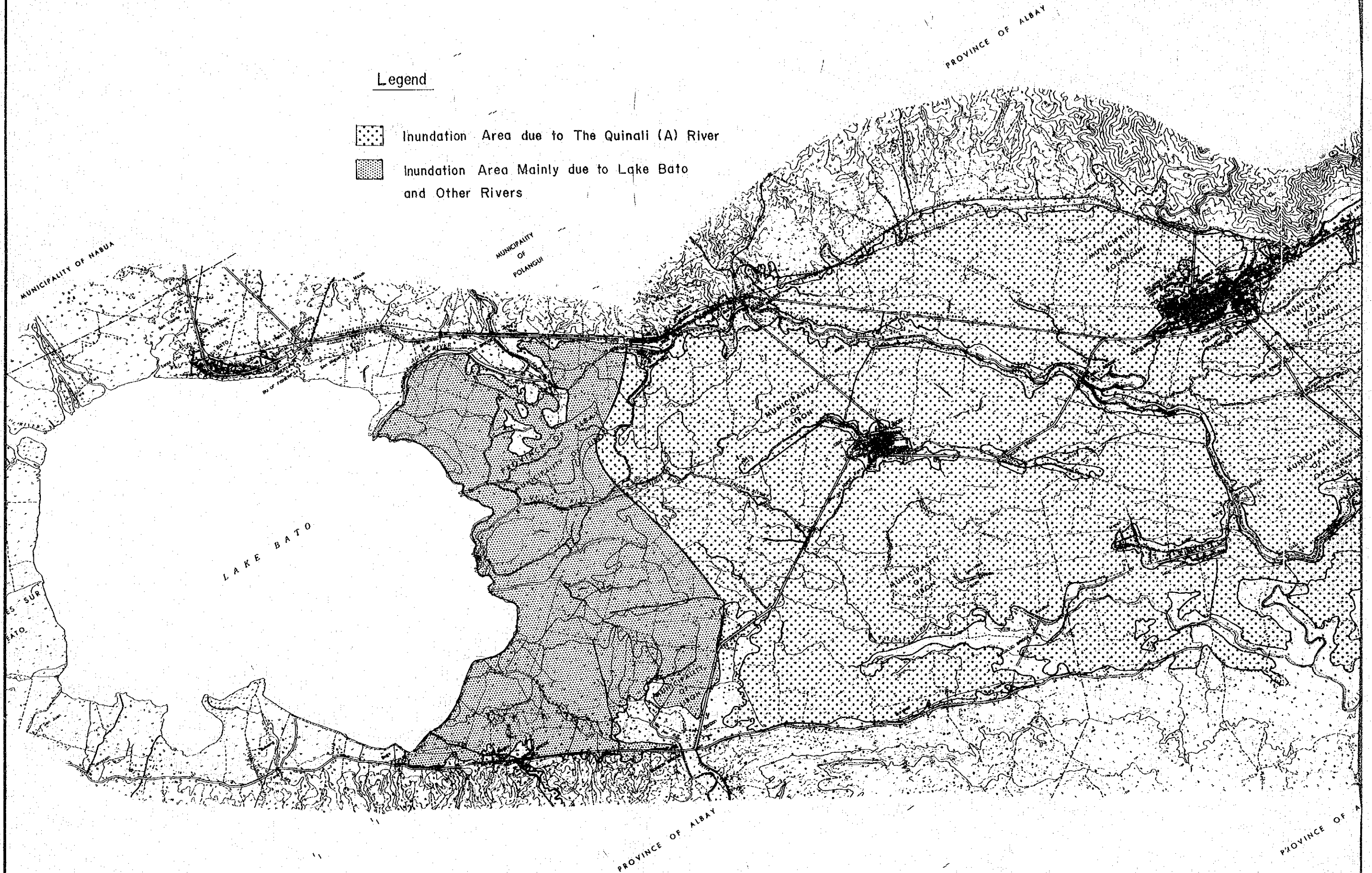


FIG.-V.1

INUNDATION AREA IN THE QUINALI (A) RIVER BASIN

Area due to The Quinali (A) River  
Area Mainly due to Lake Bato  
Rivers

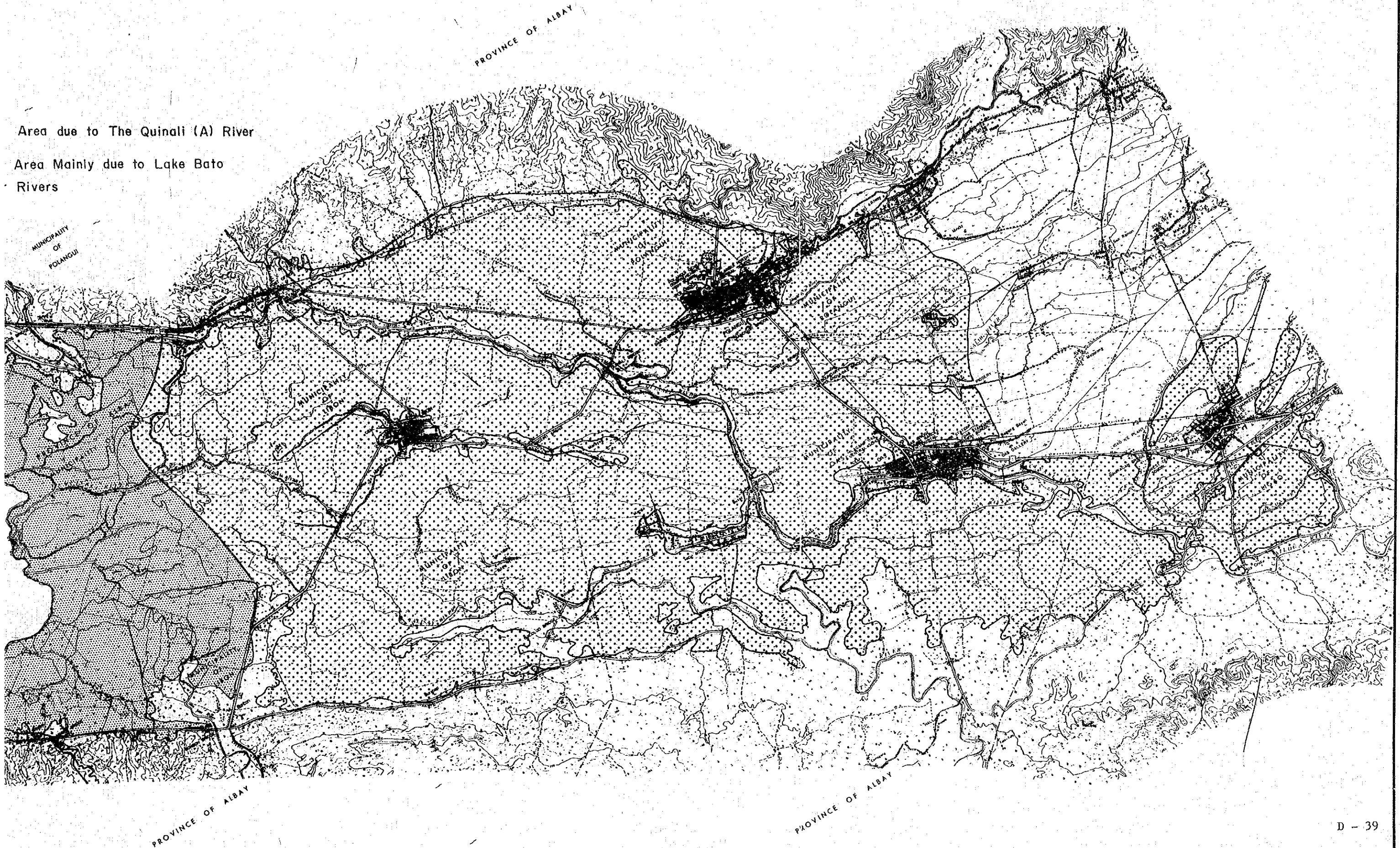
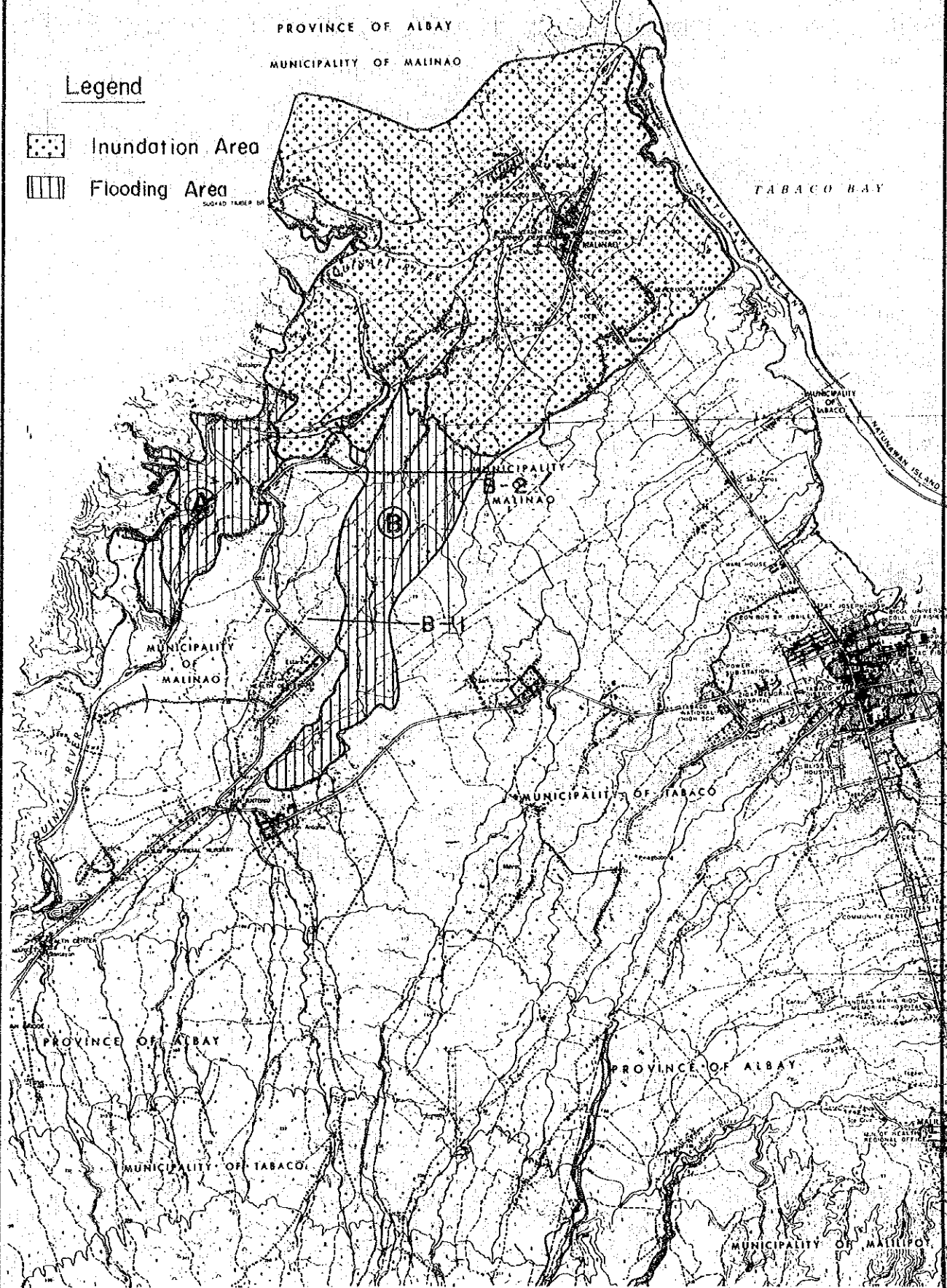




FIG. - V.2 INUNDATION AND FLOODING AREA IN THE QUINALI (B) RIVER BASIN



Legend



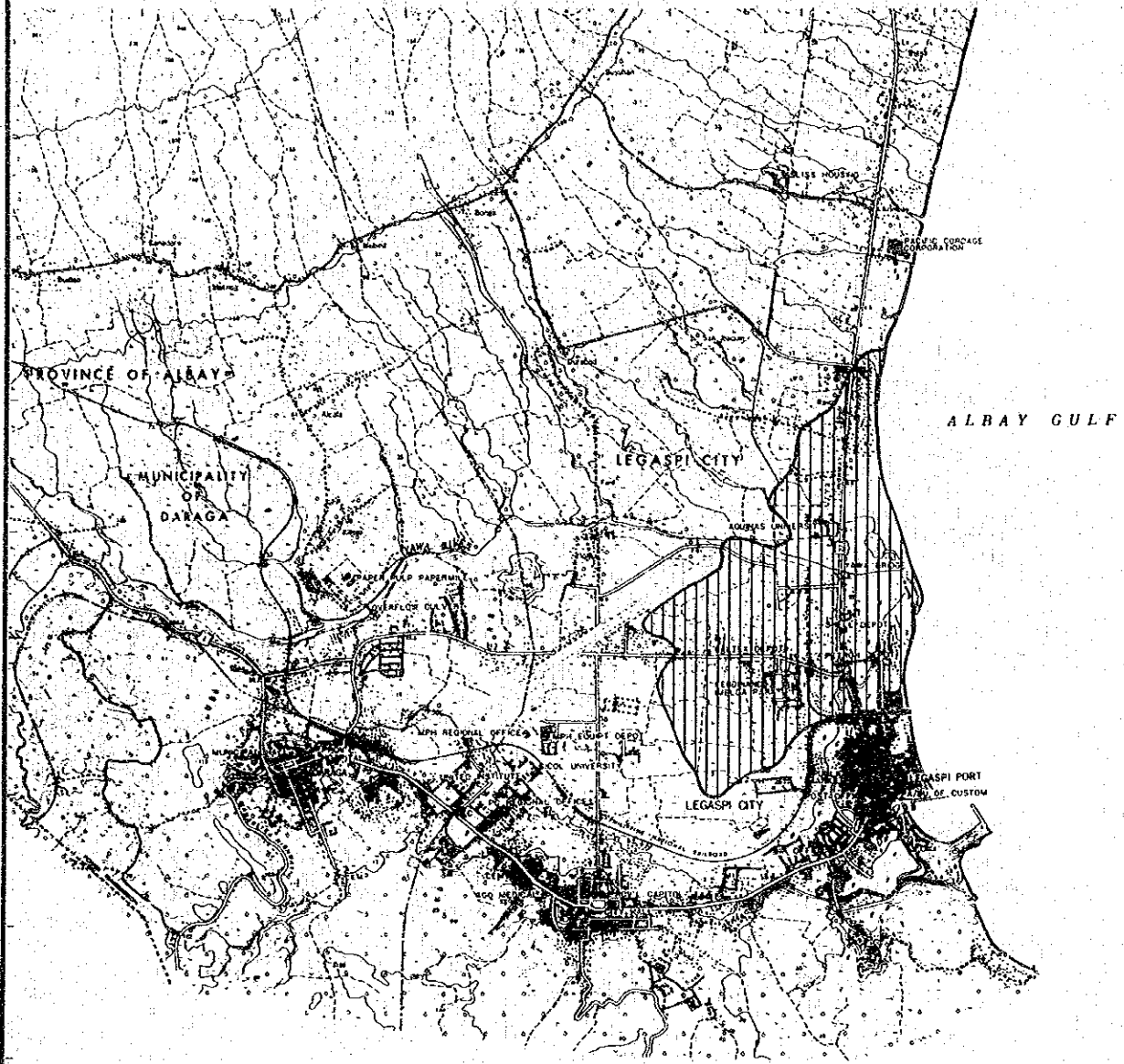
-  Inundation Area
-  Flooding Area

FIG.- V.3 FLOODING AREA IN THE YAWA RIVER BASIN



Legend


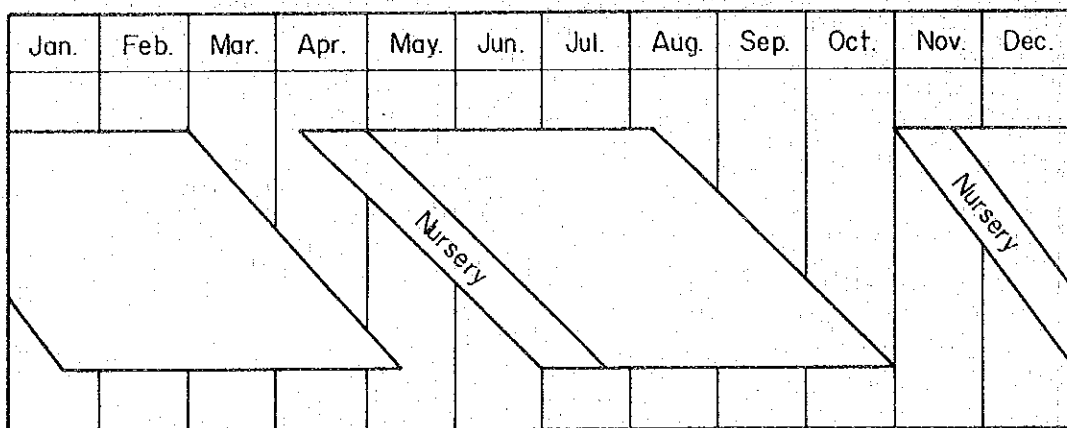
 Flooding Area

FIG.- VI. 1 PRESENT CROPPING PATTERN OF PALAY

QUINALI (A) RIVER BASIN



QUINALI (B) RIVER BASIN

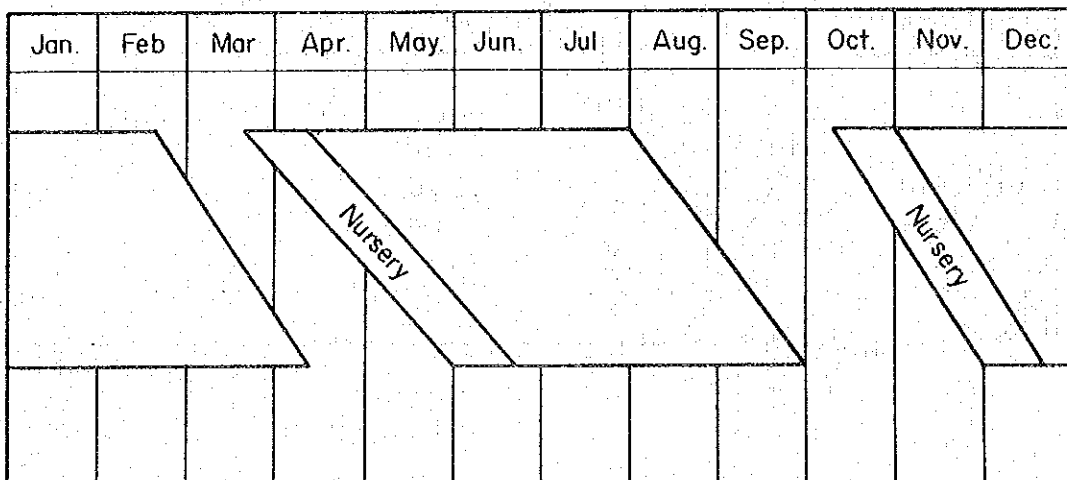


FIG. - VI. 2 PROPOSED CROPPING PATTERN

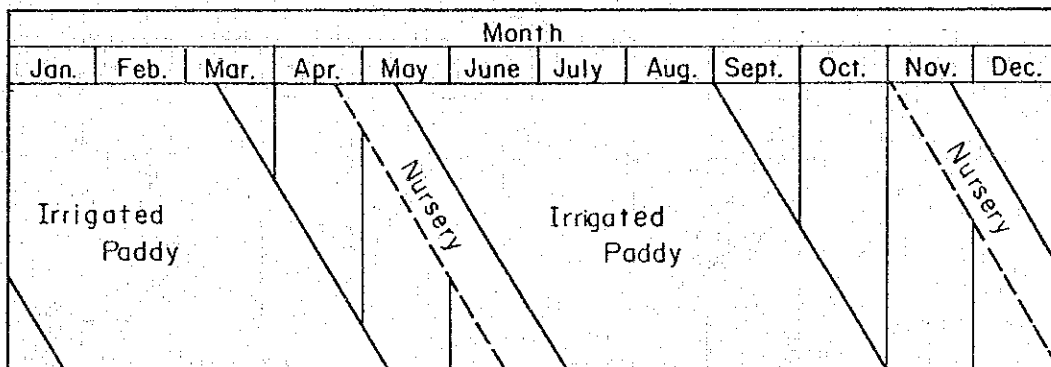
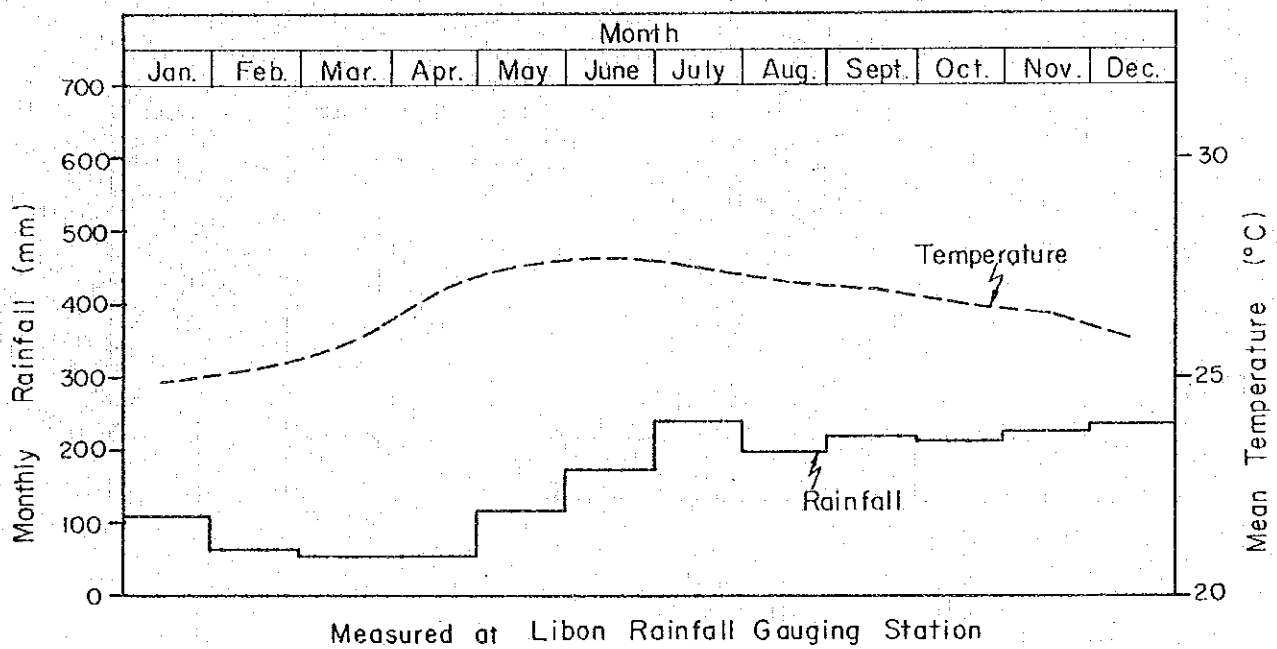
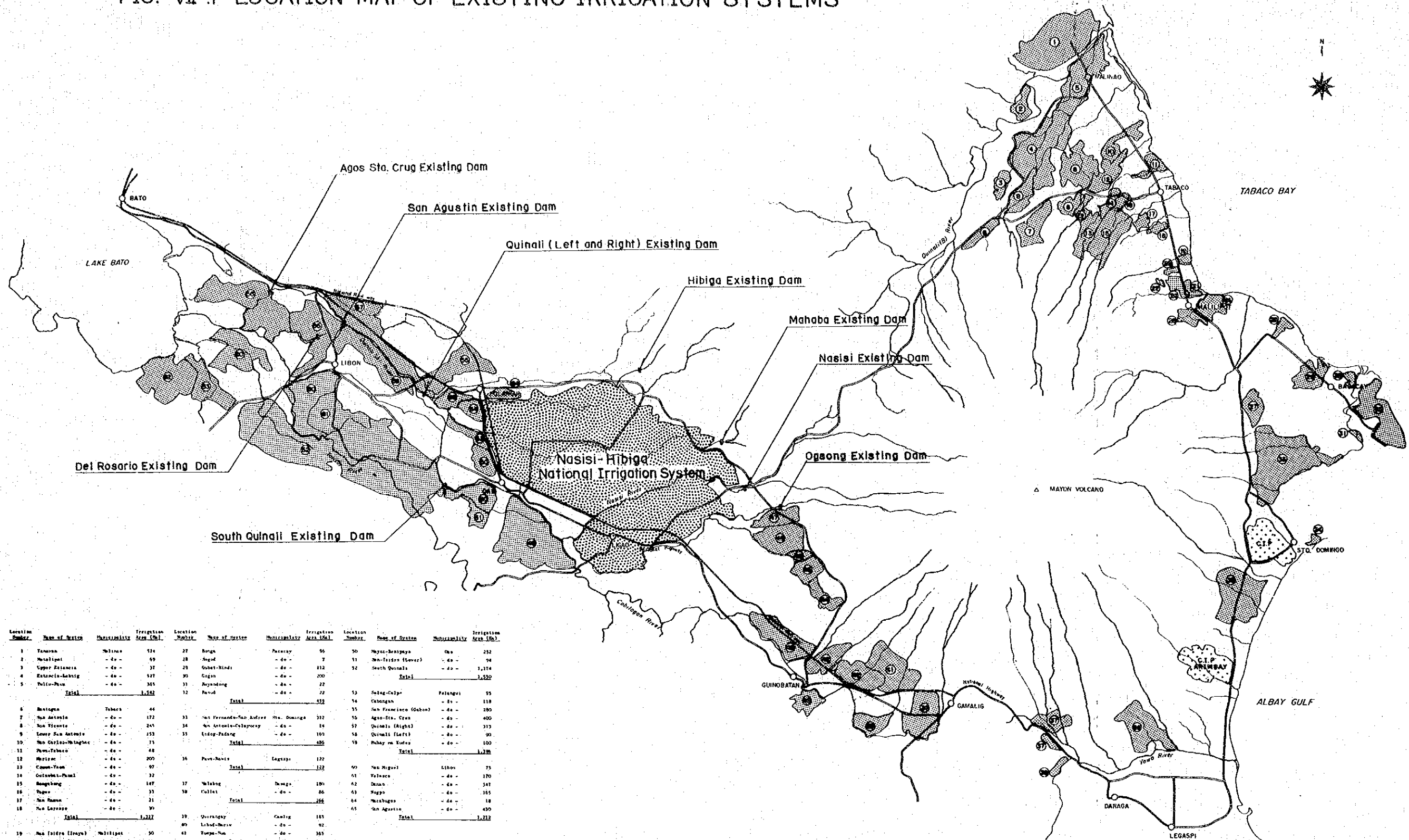


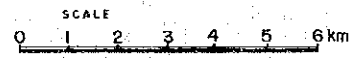




FIG.-VII.1 LOCATION MAP OF EXISTING IRRIGATION SYSTEMS



Location Number	Name of System	Municipality	Irrigation Area (Ha.)	Location Number	Name of System	Municipality	Irrigation Area (Ha.)	Location Number	Name of System	Municipality	Irrigation Area (Ha.)
1	Tomasan	Malinao	524	27	Banga	Paterosay	56	50	Huyco-Sanluis	Ona	252
2	Matalipet	- do -	59	28	Sagud	- do -	7	51	San Isidro (Lower)	- do -	94
3	Upper Estancia	- do -	37	29	Gubat-Rindi	- do -	112	52	South Quinali	- do -	1,174
4	Estancia-Mahabig	- do -	127	30	Gagan	- do -	200	<b>Total</b>			<b>1,532</b>
5	Palto-Piso	- do -	365	31	Buyanding	- do -	22	53	Saling-Culpa	Palangui	55
<b>Total</b>			<b>1,552</b>	32	Parad	- do -	72	54	Cabangan	- do -	118
6	Matagan	Tabaco	44	<b>Total</b>			<b>512</b>	55	San Francisco (Gokbo)	- do -	280
7	San Antonio	- do -	172	33	San Fernando-San Andres	Sta. Domingo	312	56	Agos-Sta. Cruz	- do -	400
8	San Vicente	- do -	245	34	San Antonio-Catapanay	- do -	14	57	Quinali (Right)	- do -	313
9	Lower San Antonio	- do -	153	35	Litop-Pudang	- do -	163	58	Quinali (Left)	- do -	90
10	San Carlos-Malagay	- do -	73	<b>Total</b>			<b>486</b>	59	Pukay-in-Sukas	- do -	100
11	Phon-Tabaco	- do -	48	36	Pant-Savita	Laganao	122	<b>Total</b>			<b>1,328</b>
12	Morzon	- do -	200	<b>Total</b>			<b>122</b>	60	San Miguel	Libon	75
13	Capan-Yam	- do -	97	37	Malabog	Davao	180	61	Yalocan	- do -	170
14	Oulabat-Phul	- do -	32	38	Cullat	- do -	86	62	Danan	- do -	347
15	Bangbang	- do -	147	<b>Total</b>			<b>266</b>	63	Sagpa	- do -	165
16	Phay	- do -	33	39	Quirangay	Cauig	145	64	Mashugas	- do -	18
17	San Ramon	- do -	21	40	Libod-Baraw	- do -	92	65	San Agustin	- do -	430
18	San Lorenzo	- do -	30	41	Purpa-Nun	- do -	365	<b>Total</b>			<b>1,212</b>
<b>Total</b>			<b>1,212</b>	<b>Total</b>			<b>542</b>	42	Tandorera-Matruita	Guinobatan	281
19	San Isidro (Lower)	Mabilpet	50	43	Quinara-Magliron	- do -	118	44	Nasorang (Lower)	- do -	84
20	San Isidro (Upper)	- do -	50	45	Duan-Tamra	- do -	90	46	Maid-burad (Pagueta)	- do -	120
21	Pagay	- do -	50	47	Maid-burad (Grande)	- do -	123	48	Buhilawa	- do -	29
22	Upper Pagay	- do -	4	<b>Total</b>			<b>817</b>	<b>Total</b>			<b>480</b>
23	San Cruz-Tampay	- do -	48	49	Cabilagan	Bigay	480	<b>Total</b>			<b>480</b>
24	San Taran	- do -	55	<b>Total</b>			<b>480</b>	<b>Total</b>			<b>480</b>
25	San Jose	- do -	5	<b>Total</b>			<b>480</b>	<b>Total</b>			<b>480</b>
26	Mabilpet-Palacion	- do -	23	<b>Total</b>			<b>480</b>	<b>Total</b>			<b>480</b>
<b>Total</b>			<b>771</b>	<b>Total</b>			<b>480</b>	<b>Total</b>			<b>480</b>



**LEGEND**

- National Irrigation System.
- Communal Irrigation System.
- On-going Small Scaled Scheme



FIG.-VII.2 CORRELATION OF MONTHLY RAINFALL

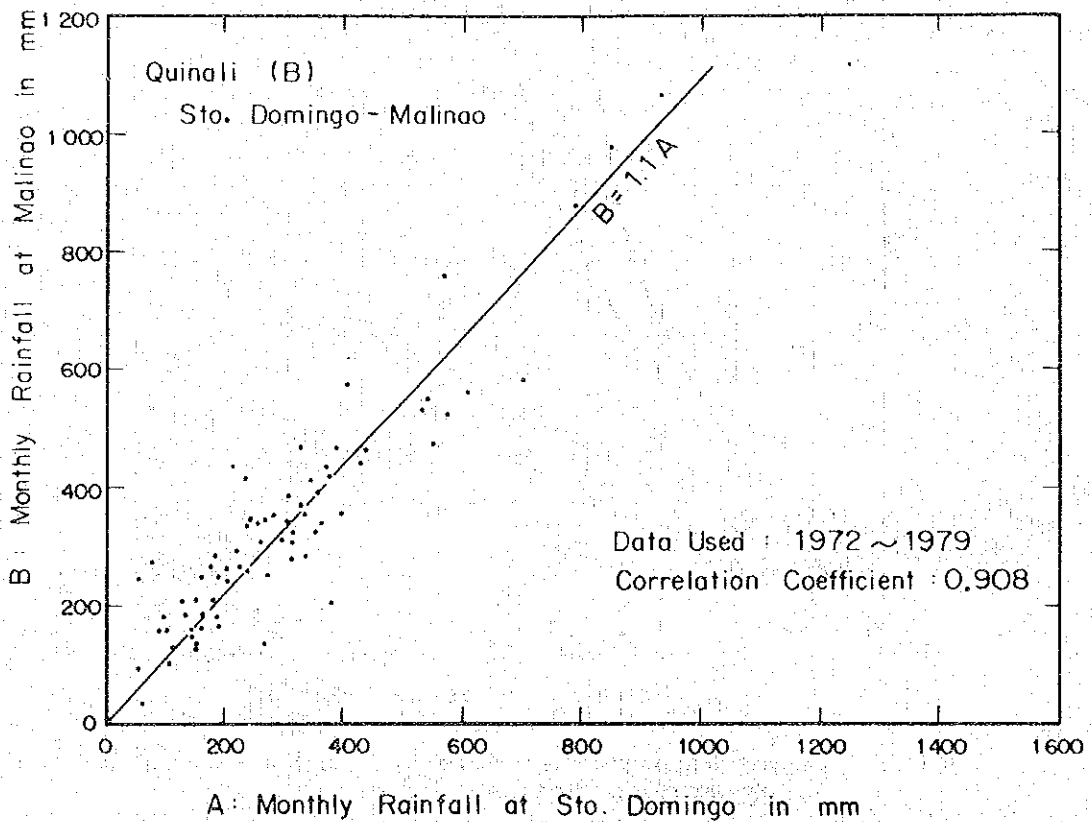
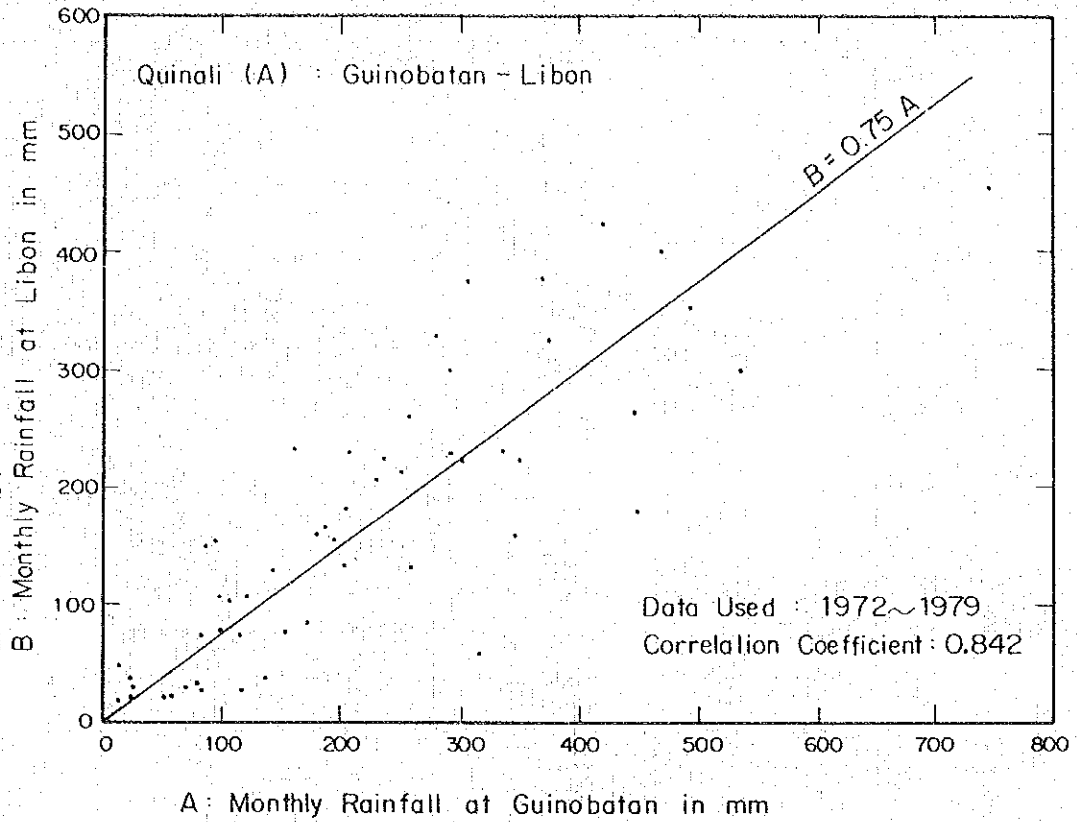
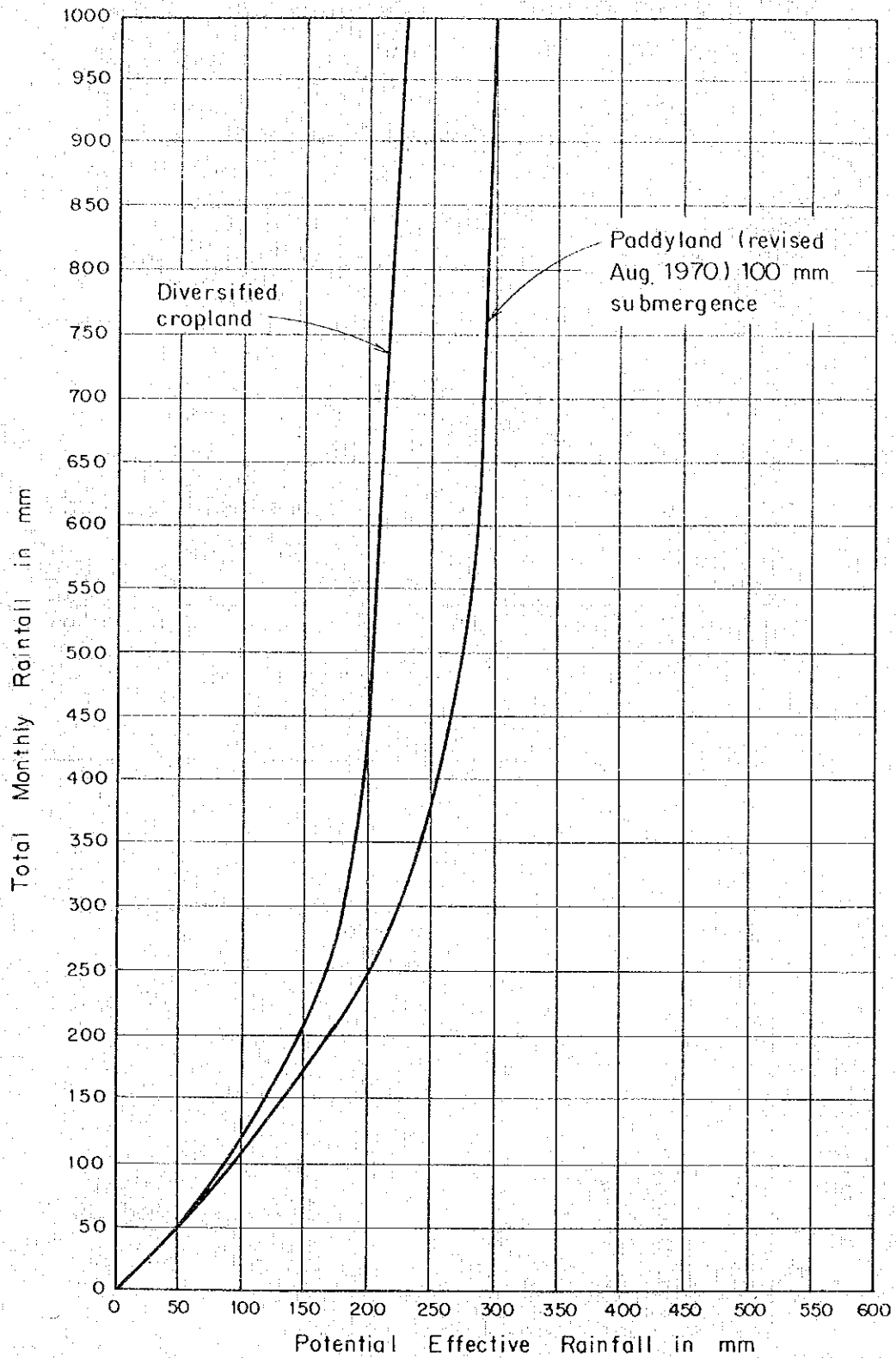


FIG. VII. 3 POTENTIAL EFFECTIVE RAINFALL CURVES



Source = Upper Pampanga River Project, Irrigation - Agriculture Study by ECI - EDCOP, 1975

FIG. - VII. 4

VARIATION OF MEAN ANNUAL DRAUGHT  
RUNOFF (2.33 -yr) WITH DRAINAGE AREA

( Annual minimum monthly mean runoff )

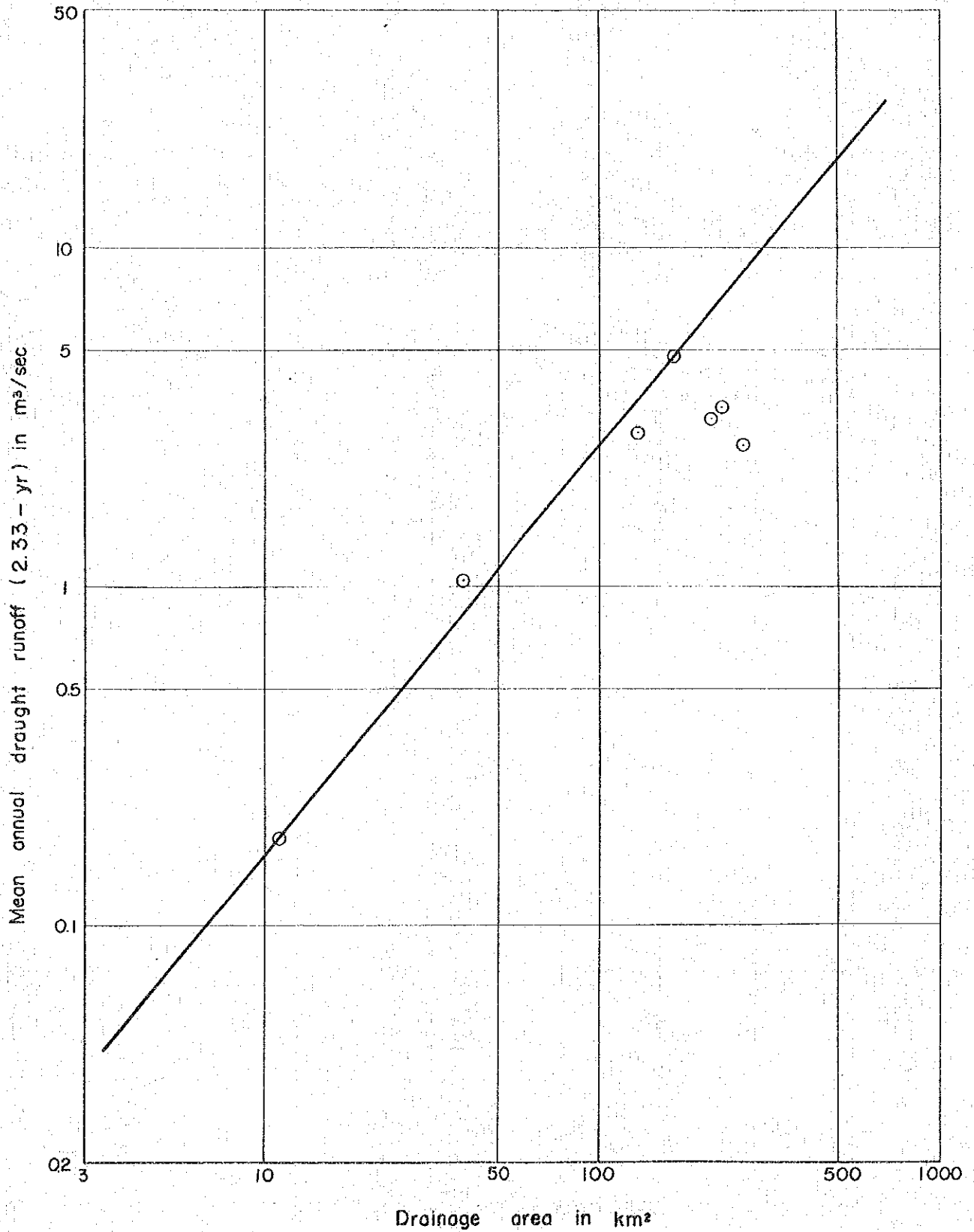


FIG - VI.5 MONTHLY WATER BALANCE AT CABILOGAN HEADWORKS (1/2)

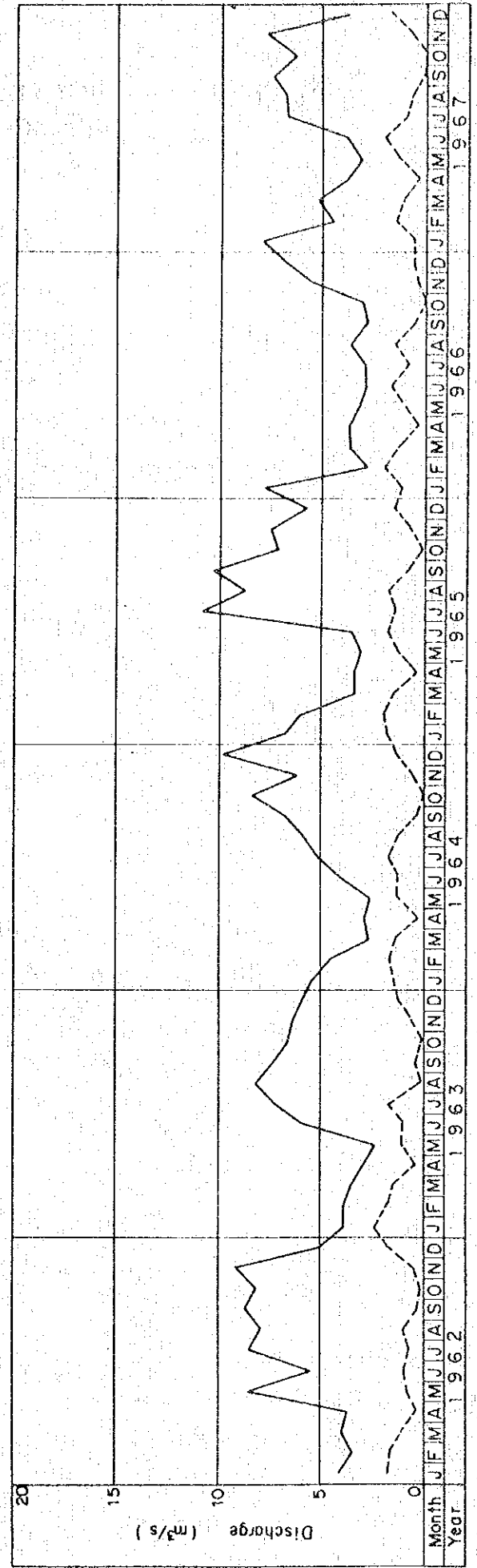
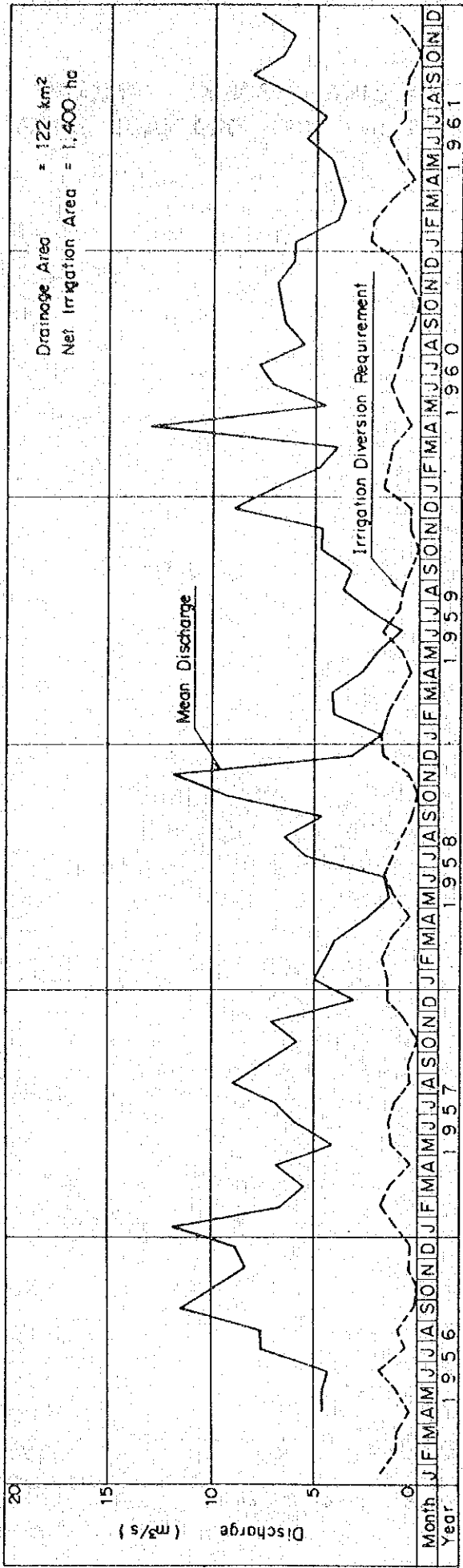


FIG.-VII.6 MONTHLY WATER BALANCE AT CABILOGAN HEADWORKS (2/2)

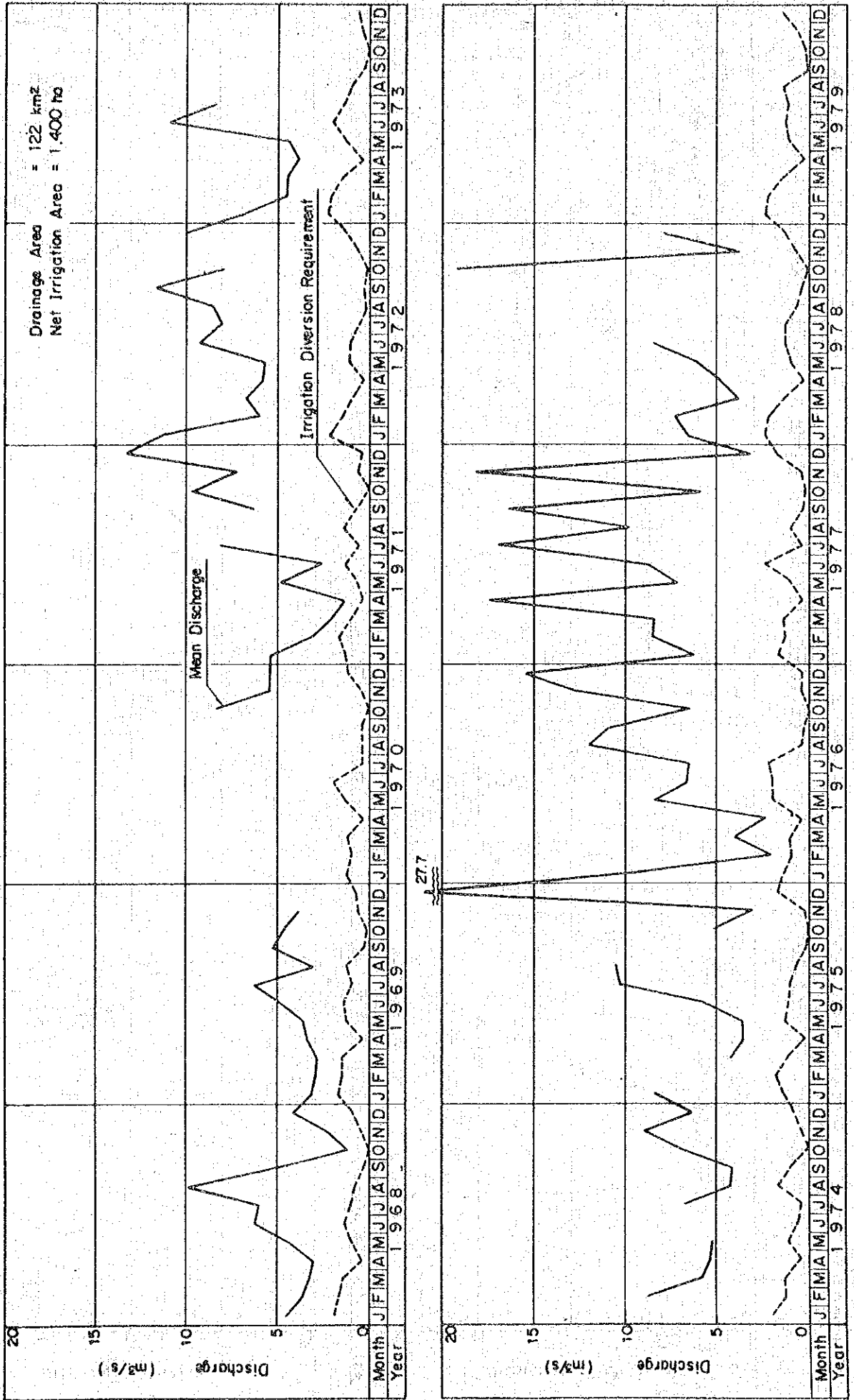


FIG.-VII.7 MONTHLY WATER BALANCE AT SOUTH QUINALI HEADWORKS (1/2)

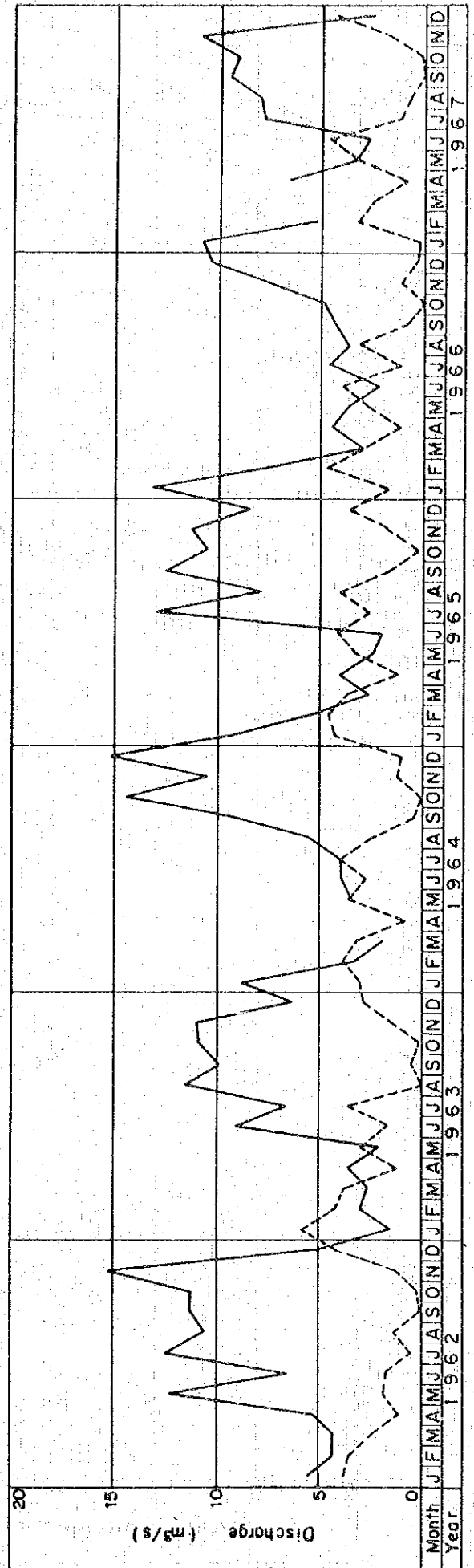
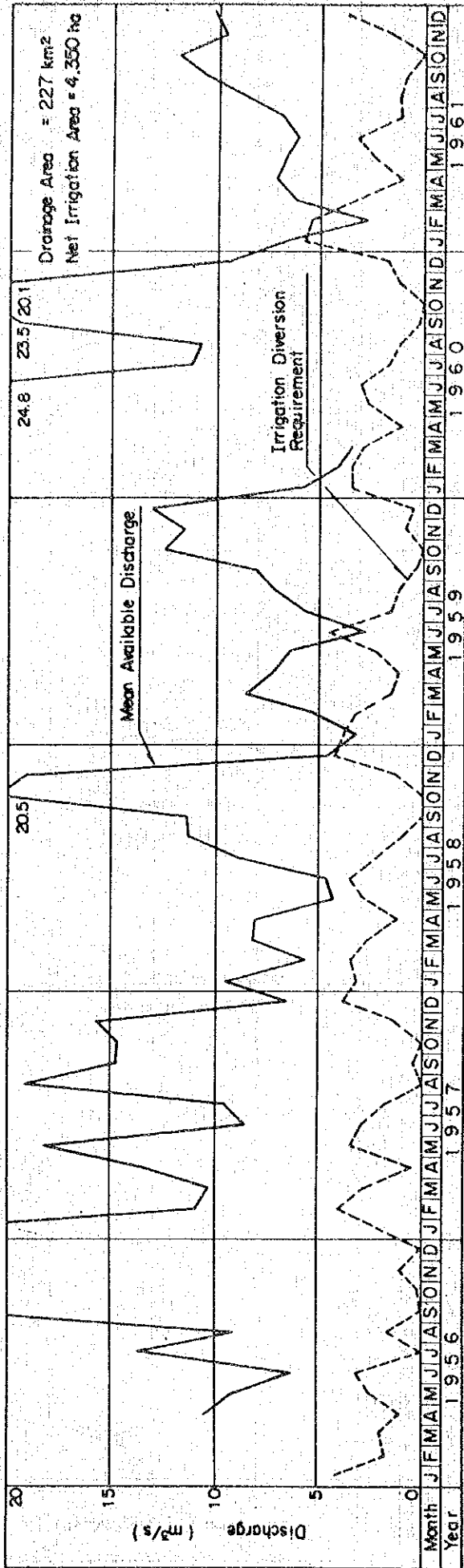




FIG. -VI.8 MONTHLY WATER BALANCE AT SOUTH QUINALI HEADWORKS (2/2)

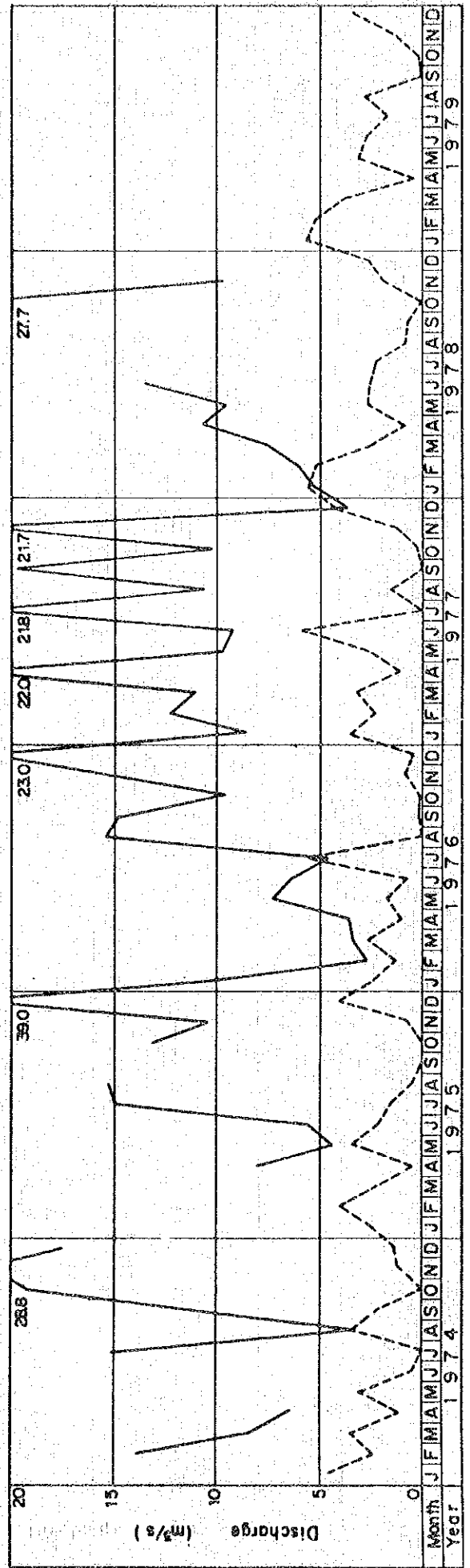
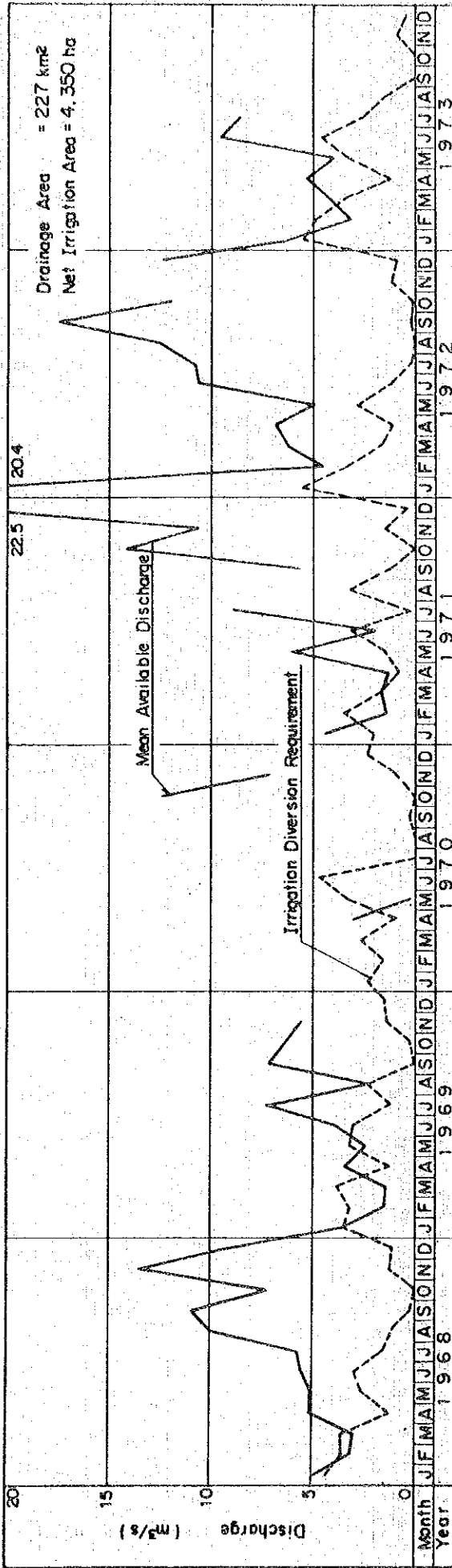


FIG. - VII. 9 MONTHLY WATER BALANCE AT QUINALI HEADWORKS ( 1/2 )

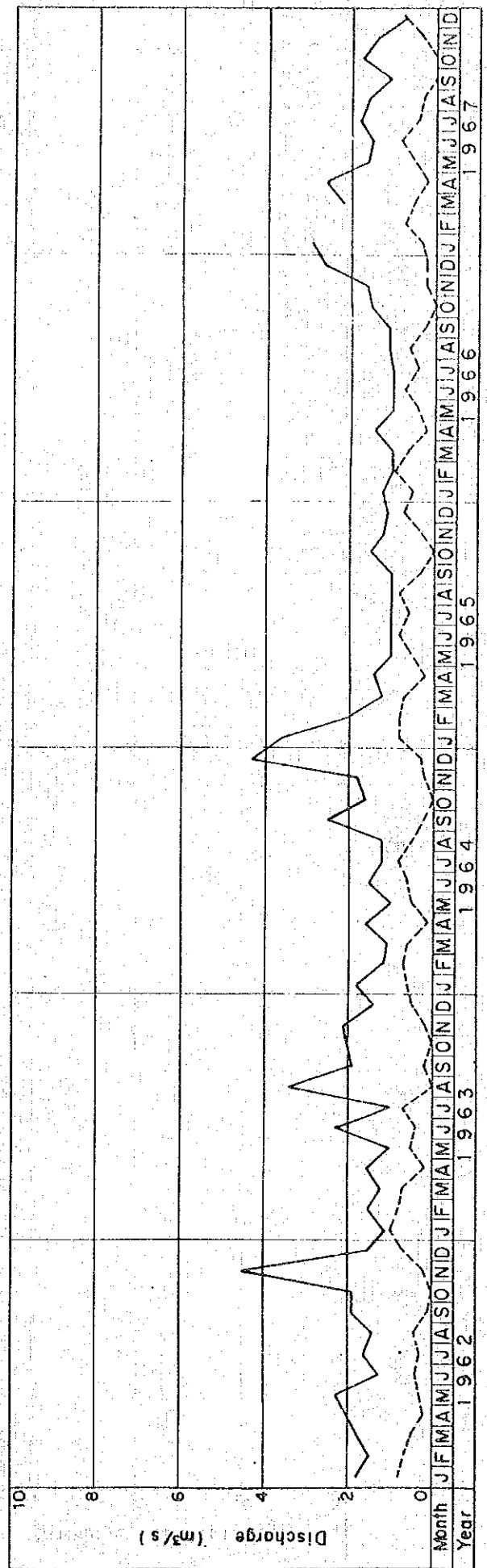
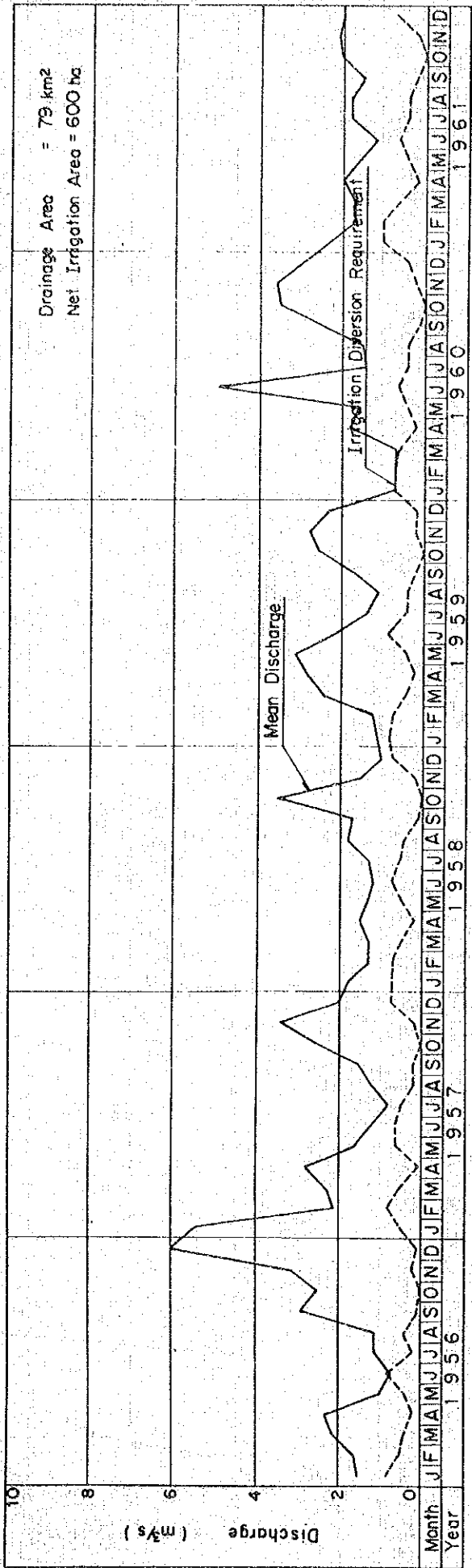


FIG.-VII.10 MONTHLY WATER BALANCE AT QUINALI HEADWORKS ( 2/2 )

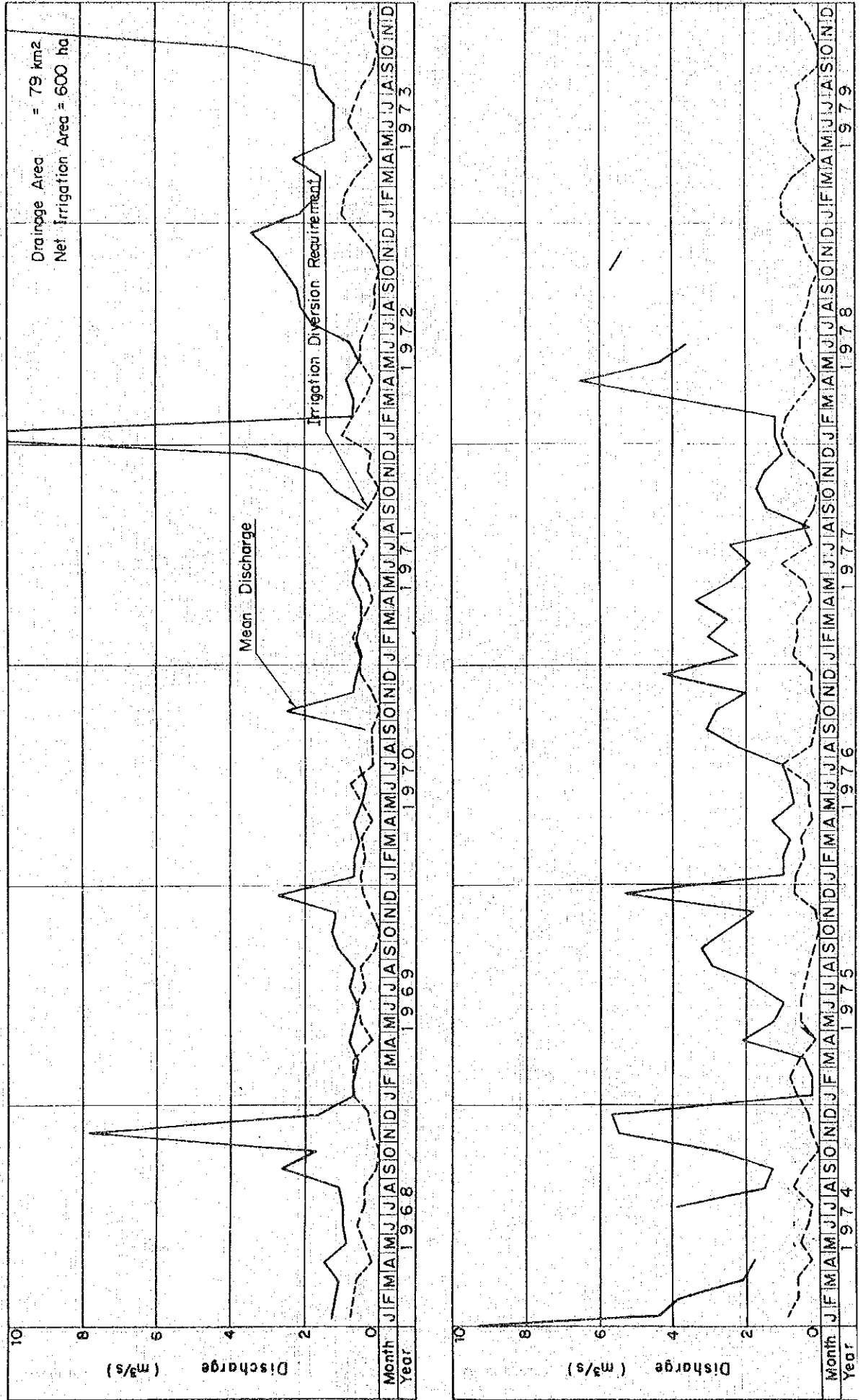


FIG - VII II MONTHLY WATER BALANCE AT BANTAYAN HEADWORKS ( 1 / 2 )

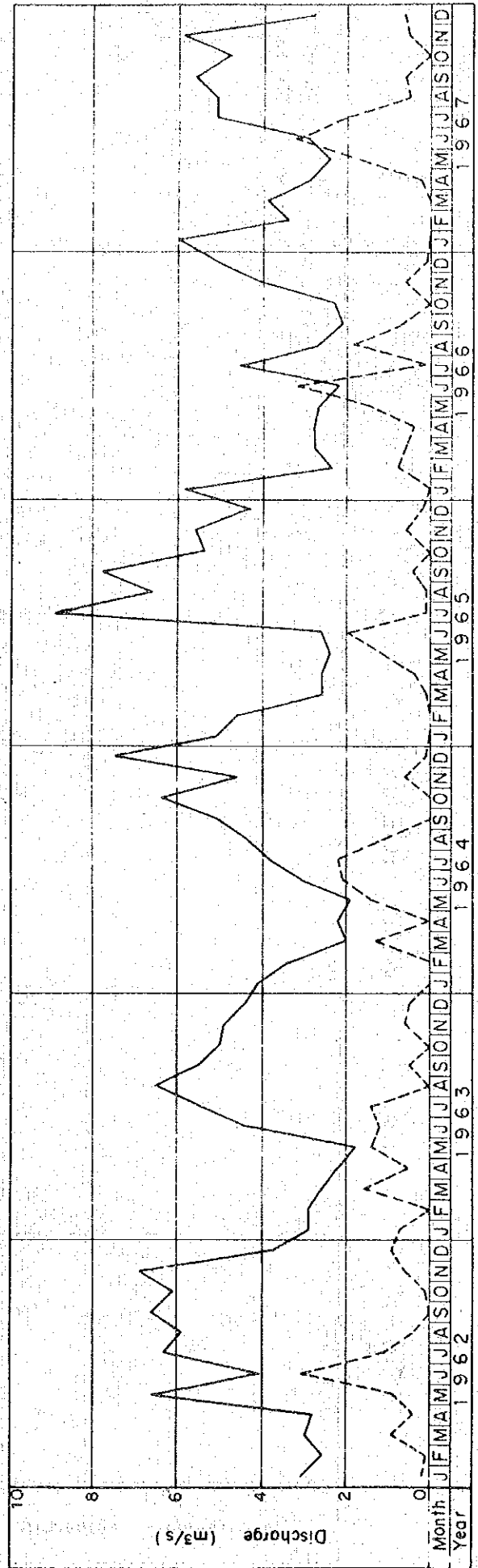
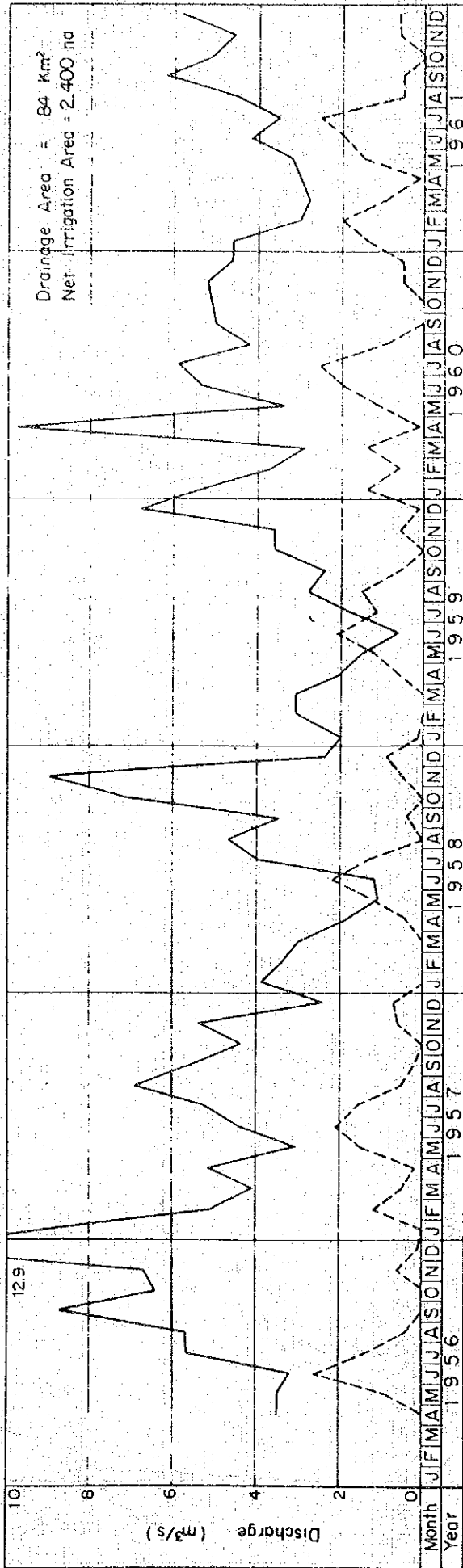


FIG.-VII.12 MONTHLY WATER BALANCE AT BANTAYAN HEADWORKS (2/2)

