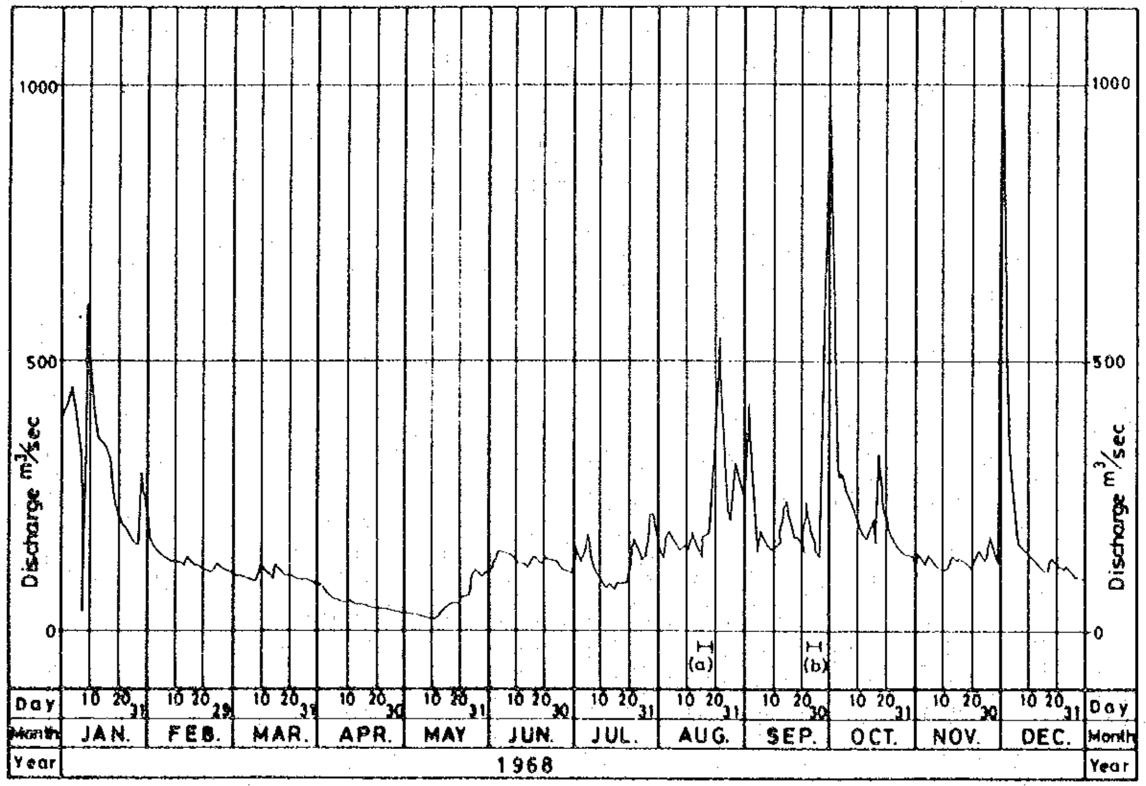
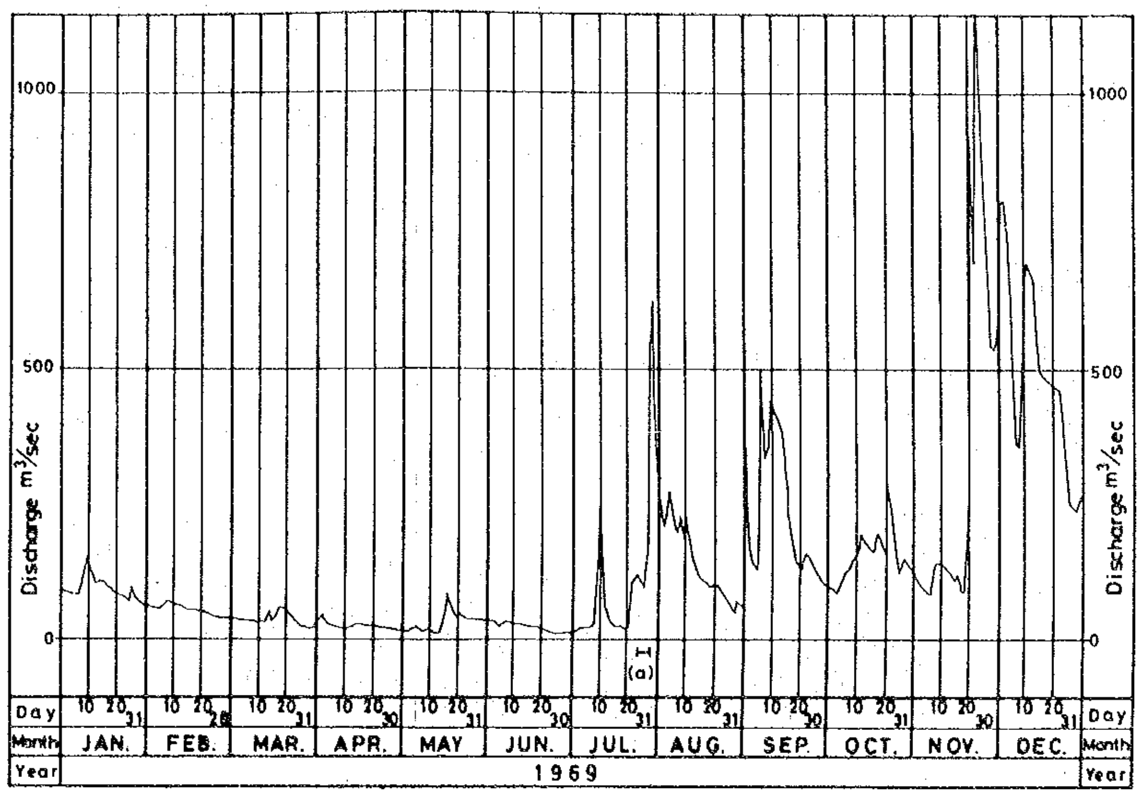
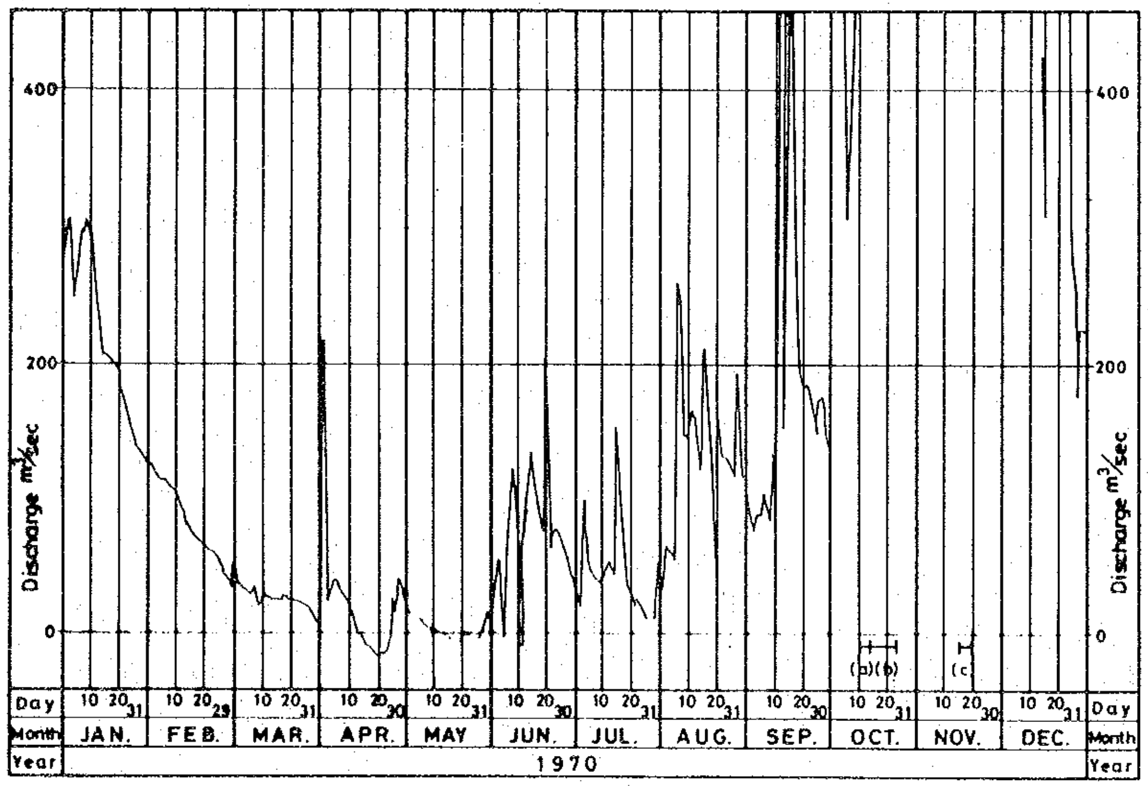
Station Name : Pangal

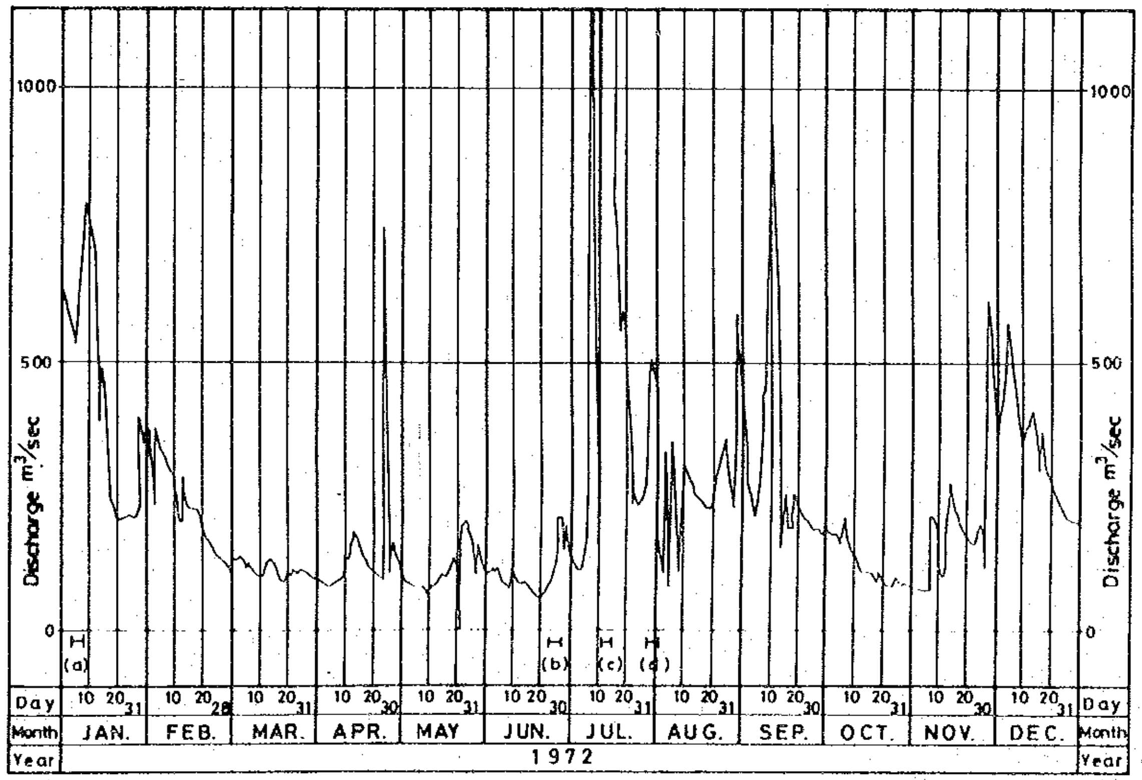
Catchment Area : 4244 km²

Daily Discharge at Pangal (3)









1968

		1	2	3
(a)		70 Kts Tuguegarao	977.8 mb Aparri	384.1mm Baguio
(b)	NITANG	86 Kts Vigan	966.3 mb Aparri	649.7mm Baguio

1969

		1	2	3
(a)	ELANG	113 Kts Calayan	967.7mb Calayan	222.5mm Calayan

1970

		1	2	3
(a)		375 KPH Virac	950.7mb Virac	234.8mm Catbalogan
(b)	SITANG	100KPH Cuyo	988.9mb Cuyo	123.4mm Cuyo
(c)	YOLING	200KPH Central	954.8mb Infanta	204.6mm Virac

1972

		1	2	3
(a)	ASIANG	56 Kts Roxas	993.4mb Roxas	189.2mm Roxas
(b)	KONSING	205 KPH Legaspi	970.7mb Legaspi	238.6mm Legaspi
(c)	GLORING	110 KPH	956.0mb	479.6mm Baguio
(d)	DEPRESSION	35 KPH	999.0mb	217.9mm Science

Diduyon Hydroelectric Project
Upper Cagayan River
Republic of the Philippines

Japan International Cooperation Agency

Daily Discharge at Pangal (3)

October 1980 Fig. 2-4-11 (3)

2.4.2. Low-water Discharge

(1) General

In calculating the maximum and firm outputs and the annual energy generation for the project, the study of river discharge as well as available head which is determined by topographical conditions, one of the most important factors. To determine the riverflow at a certain catchment area, the following two methods are available : (1) using a record of discharges measured at that basin or within the same watershed; and (2) computing the discharge at the catchment basin involved from a record of precipitation measured at the watershed or observed at an adjacent gauging station. In case data in a record of measured discharges, if available, covers only a short period of time or the accuracy is problematic, runoff analysis is also performed to assure the reliability. Depending on the type of power plant (reservoir, pondage, run-of-river), the kind of available hydrological materials, the interval of observation, etc., used discharges may be monthly average, 10-day average, 5-day, 24-hour, and so forth. For the case that annual regulation of the river discharge can be done in a large scale reservoir, monthly average or 10-day average discharge is applied. As for the Diduyon Damsite, low-water discharge should also be included in the study. Although the project is of reservoir type, the importance of low-water discharge cannot be neglected because it has the nature to govern the output and other characteristics of a power plant as well as the size of the reservoir, and also because there is no sufficient record of measured discharges in the vicinity of the watershed involved.

(2) Rainfall

There was no observation record of rainfalls in the watershed of the reservoir until the strat of the current feasibility study.

According to the records taken at the meteorological stations around the watershed (most of them are at low altitude and 20 to 80 km apart from the damsite), the average annual rainfall varies from 600 mm to 2,800 mm, with a noticeably large record of 5,400 mm. There is no clear distinction of wet and dry seasons in the watershed of the Diduyon Reservoir, and even in a day when it is fine in the lowland vicinity there is sometimes considerable rainfall in the form of mist or showers in the highland watershed area. This will be explained by the topographic characteristics of the region, and most of the rainfall is caused by typhoons and tropical atmospheric pressures. The season of typhoons is from July to November, and heavy rainfall accompanied by thunder occurs in the same period of the year. Actual observation of maximum daily rainfall has just been commenced at the site. As stated above, the maximum daily precipitation ever recorded is 1,216 mm gauged in 1967 in Baguio located 100 km west of the Reservoir watershed. This record is helpful material to be incorporated in design computations on the Project Site. Fig. 2-4-8 shows the pattern of rainfall intensity of Baguio storms. In the course of this feasibility study, several precipitation gauge stations were set up in the direct watershed of the Project Site (see Fig. 2-4-12 and Table 2-4-6). Actual observations at the site will be useful to clarify the pattern and magnitude of precipitation in that region. Annual rainfall depth at Kamamasi in 1979, for example, is 3,256 mm as shown in Fig.2-4-13. The daily rainfalls are listed in Table 2-4-7 (1) - (10) with illustrations in Fig. 2-4-14, while the monthly rainfalls are shown in Table 2-4-8. A comparative chart of monthly precipitation for 1979 is presented in Fig.2-4-15. A maximum daily rainfall of 538 mm was observed at Gayan (Alayan), and a maximum monthly precipitation of 1,426 mm was recorded at Kasibu (October, 1978).

(3) Riverflow

Until the start of this feasibility study, there was no riverflow observation record of the Diduyon River, except the measurement at the Aglipay Gauging Station in the watershed of the Addalam River on the lower reaches of the Diduyon River. Then, it was concluded that this survey should include actual observation of riverflow in the watershed of the proposed damsite. After consultation between JICA and NAPOCOR, it was agreed upon that NAPOCOR would assume charge of setting up gauging stations and processing collected data. The locations of the stream gauging stations are shown in Fig.2-4-12. Figs.2-4-16 and 2-4-17, and Table 2-4-9 show the stage discharge curve, measured river stage, and a table of sectional discharges, respectively.

(4) Evapotranspiration

i) Method of calculating evapotranspiration

On the proposed damsite, no data is available for use in the analysis of low-water runoff (calculation of daily discharge). The amount of evapotranspiration at the watershed of a natural river depends on a combination of various factors inherent to that basin, including earth covering, surface soil, topographical and geological features, and meteorological conditions such as insolation, temperature, humidity and wind velocity. Condensation must also be taken into consideration. Accordingly, it is not easy to accurately determine the amount of evapotranspiration. However, since the estimate of this amount is yet indispensable in the study of reservoir design, the following method, which seems practically appropriate, was employed for calculation.

The method of calculation is based on Thornthwaite's formula.

$$E_p = 0.533D_o(10tj/J)^a$$

$$a = 0.000000678J^3 - J0.0000771J^2 + 0.01792J + 0.49236$$

$$J = \sum_{j=1}^{12} (tj/5)^{1.514}$$

Where, E_p : Monthly average evapotranspiration (mm/day)

D_o : Daylight hours (12 hrs/day)

tj : Average monthly temperature for j month (°C)

ii) Dailight hours

At and around the latitude of 16° for the Diduyon region, the following correction numbers are adopted for daylight hours D_o (12 hrs/day).

Month	Jan.	Feb.	Mar.	Apr.	May	June
Do	0.94	0.965	0.998	1.035	1.065	1.077
Month	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Do	1.075	1.05	1.01	0.98	0.95	0.93

iii) Temperature

There was no record of temperature measurement for the Diduyon region until the start of this survey. Since observation has just been commenced during the feasibility study, data collected so far is not sufficient. Accordingly, the temperatures for the watershed of the Diduyon Reservoir are based on the measurement of annual temperatures at Magat (EL 250 m), 60 km north of the proposed site. With possible temperature drops due to the difference in the altitudes of both places taken into consideration, the following values are employed for the Diduyon Damsite.

Month	Jan.	Feb.	Mar.	Apr.	May	June	Total	Mean
Magat	21.3	21	22.3	26.2	27.3	27.3		
Diduyon	17.8	17.5	18.8	22.7	23.8	23.8		
Month	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.		
Magat	27	26.4	24.9	24.5	23.3	21.7	293.2	24.4
Diduyon	23.5	22.9	21.4	21	19.8	18.2	251.2	20.9

iv) Conclusion

As a result of the study using the above values, evapotranspiration is estimated at 964 mm annually, with a monthly average of 80.3 mm. The values in the table hereunder are evapotranspiration for each month developed based on the measurements in the Magat region.

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Total	Mean
Ev.Tr-n	62.4	68.6	94.9	112.5	113.9	88.1		
Month	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.		
Ev.Tr-n	86.8	76.3	76.2	73.8	56.3	53.8	963.6	80.3

As the evapotranspiration for the Diduyon Reservoir, a daily average is obtained by 963.6 mm/365 day = 2.6 mm/day. From this value, a daily evapotranspiration of 3 mm is estimated for a day without precipitation, and this amount will be incorporated in the reservoir design.

V) Runoff analysis

(1) Outline of the tank model method

The tank model method is one of the techniques for runoff analysis, with which the runoff of a subject spot is calculated from a known amount of precipitation in the vicinity. This method can be used for both the computation of flood waveform for a short period and long-term low-water analysis. In the tank model method, a river basin is substituted by several model containers to simulate the runoff mechanism. Normally, the model consists of three to four tanks vertically arrayed in series as illustrated. The opening in the right side of each tank represents the hole for runoff, while that in the bottom is for infiltration. Rain water is poured into the uppermost container of the tank model, and the second and lower tanks receive the water from the upper tank through the infiltration hole. Part of the rain water escapes from each container through the runoff hole in the side, while the rest goes down to the lower tanks.

The river flow is the sum of discharge from the side hole of each container. Suppose the runoff qn (t) and the amount of infiltration Pn (t), then

$$qn\ (t) = 0 \ \ldots\ldots \ hn\ (t) \leqq hn_1$$

$$\text{or,} \quad qn\ (t) = \alpha n_1\ (hn\ (t) - hn_1) \ \ldots\ldots \ hn_1 \leqq hn\ (t) \leqq hn_2,$$

$$\text{or,} \quad qn\ (t) = \alpha n_2\ (hn\ (t) - hn_2) + \alpha n_1\ (hn\ (t) - hn_1) \ \ldots\ldots \ hn_2 \leqq hn\ (t) \quad \text{------ (i)}$$

$$Pn\ (t) = \beta n \cdot hn\ (t) \quad \text{------ (ii)}$$

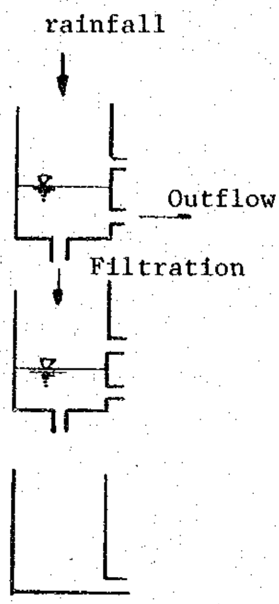
$$Pn\ (t) - qn\ (t) - Pn\ (t) = \frac{dhn\ (t)}{dt} \quad \text{------ (iii)}$$

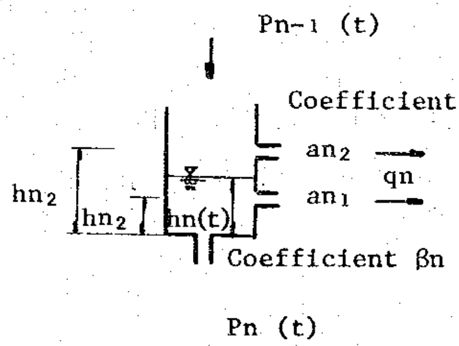
where n_1: Coefficient of runoff hole (Unit: 1/day)

n: Coefficient of infiltration hole (Unit: 1/day)

hn(t) : Water depth of tank for t day (mm)

hn_1: Location of runoff hole (depth from the bottom, mm)

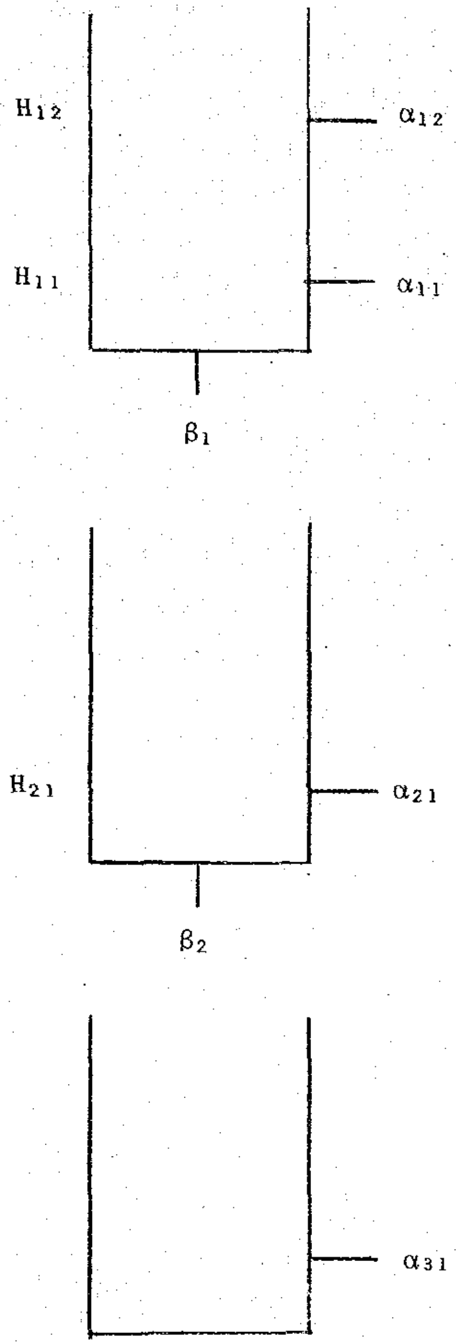




Accordingly, with the above equations (i), (ii), and (iii) set up simultaneously for each tank, $\sum_{n=1}^{n} qn(t)$ and successively integrating, we obtain a riverflow. Though the creation of the tank model is intended to find out some constants including α, β, and h_1, the non-linear nature precludes simple determination of these values. For this reason, it is necessary to use the method of trial and error in order to approximate the runoff qc(t) calculated with actual rainfall to the measured riverflow qo(t).

(2) Conclusion

For the purpose of runoff analysis, a 3-stage, storage-type model was created, as illustrated below.



α_{11} : 0.02

α_{12} : 0.13

α_{21} : 0.01

α_{31} : 0.008

β_1 : 0.22

β_2 : 0.12

H_{11} : 20

H_{12} : 70

H_{21} : 20

As the requirements to be met by a tank model for optimum solution, the rate of discharge, calculated by means of the above model from the precipitation recorded in the Kamamasi region with the riverflow of 1979 at Kamamasi used, must be well reproduced on the hydrograph waveform for low water period, and the mean value of the calcualted discharge during the period of calculation (1979) must equal to that of the measured discharges. Analytical study is conducted with emphasis placed on the above two conditions. As for the rainfall, examination was made for a correlation between the gauging stations located in the watershed. As shwon in Table 2-4-9 and 2-4-10, the values demonstrate a good correlation. Accordingly, together with the rate of riverflow, the rainfall measured at Kamamasi will be adopted. As evident from the hydrograph by calculation given in Fig.2-4-17, the waveforms are adequately coincident with each other. The daily correlation coefficient between the calculated value and the measurement is 0.84, while the mean values are 30.9 m^3/sec and 23.3 m^3/sec for the computed and measured values, respectively. The calculated rate of discharge 30.9 m^3/sec is nearly equal to the average dishcarge of 30.84 m^3/sec described later.

Table 2-4-6 **List of Gauging Stations Newly Established for the Diduyon Project**

Name			Approx. EL	Description of site	Item of Observation	Equipment/ Instruments	Observation Frequency	Start of Observation
Meteorological Gauging Stations								
1 KASIBU	A	16°18.96'N 121°17.50'E	701m	Near Mun. Hall, 500m NW of town hall	Rainfall intensity	8"W.B. STD	Twice daily	7-29-1978
	B	16°18.92'N 121°17.64'E	685m	10m from weather obsr. house, fenced	- do -	Leopold Steven, Auto Rainfall, RFC	Continuous	8-09-1978
2 KAMAMASI		16°15.95'N 121°25.35'E	639m	Beside observer's house, on top of tree	- do -	8" W.B. STD	Twice daily	7-19-1978
3 ALAYAN		16°18.64'N 121°24.00'E	653m	At center of rice fields	- do -	- do -	- do -	8-10-1978
4 PACKET (SIGUEM)		16°16.60'N 121°20.25'E	640m	5m NW from observer's house	- do -	- do -	- do -	8-09-1978
5 BIYOY		16°14.50'N 121°24.30'E	623m	10m NW from observer's house	- do -	- do -	- do -	9-04-1978
6 PAPALONGAN		16°15.70'N 121°27.26'E	645m	Near Consultant's bunkhouse, 200m W of house	Wind direction -velocity	SIAP Auto recorder	Continuous	6-22-1979
Discharge Gauging Stations								
	A	16°15.84'N 121°26.30'E	563m	Staff gauge nailed to wooden frame support of auto. W.L. recorder	Water level	Wooden staff gauge	Twice daily	7-20-1978
	B	- do -	-do-	Beside big tree river bank (right side)	- do -	Leopold Auto W.L. recorder	Continuous	9-05-1979
2 AGLIPAY		16°28.62'N 121°37.91'E	95m	Staff gauge bolted to rock at river bank	- do -	Wooden staff gauge	Twice daily	8-26-1979

Table 2-4-7(1) **Daily Rainfall at Kasibu**

(Unit: mm)

Year 1978

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1	-	-	-	-	-	-	-	0	0.20	10.00	40.50	5.00
2	-	-	-	-	-	-	-	0	3.00	8.00	53.00	10.00
3	-	-	-	-	-	-	-	0.03	10.00	8.00	35.00	10.00
4	-	-	-	-	-	-	-	0.02	11.00	2.00	15.00	0
5	-	-	-	-	-	-	-	0.02	0	4.00	0	0
6	-	-	-	-	-	-	-	10.60	26.00	9.00	0	0
7	-	-	-	-	-	-	-	0	25.00	0	0	0
8	-	-	-	-	-	-	-	6.00	8.00	56.00	0	0
9	-	-	-	-	-	-	-	14.00	54.00	70.00	0	0
10	-	-	-	-	-	-	-	53.00	11.00	70.50	0	0
11	-	-	-	-	-	-	-	2.00	0	30.00	0	2.00
12	-	-	-	-	-	-	-	0.30	5.00	32.00	0	3.00
13	-	-	-	-	-	-	-	1.00	2.00	16.00	0	12.00
14	-	-	-	-	-	-	-	11.00	13.00	23.00	0	2.00
15	-	-	-	-	-	-	-	3.00	5.00	25.00	0	9.00
16	-	-	-	-	-	-	-	0	68.00	31.00	0	15.00
17	-	-	-	-	-	-	-	0	67.00	27.00	0	10.00
18	-	-	-	-	-	-	-	0	8.00	38.00	10.00	11.00
19	-	-	-	-	-	-	-	3.00	14.00	41.00	18.00	9.00
20	-	-	-	-	-	-	-	39.00	10.00	97.00	67.00	7.00
21	-	-	-	-	-	-	-	3.00	13.00	13.00	0	10.00
22	-	-	-	-	-	-	-	48.00	55.00	26.00	0	6.00
23	-	-	-	-	-	-	-	64.00	17.00	30.00	0	7.00
24	-	-	-	-	-	-	-	53.00	18.00	29.00	0	15.00
25	-	-	-	-	-	-	-	13.00	14.00	49.00	0	24.50
26	-	-	-	-	-	-	-	0	25.00	134.00	0	0
27	-	-	-	-	-	-	-	0	107.00	130.00	0	0
28	-	-	-	-	-	-	-	0	60.00	102.00	0	0
29	-		-	-	-	-	-	0	1.00	99.00	0	0
30	-		-	-	-	-	-	12.00	0	95.00	0	0
31	-		-		-		0.10	0		92.00		13.00
TOTAL	-	-	-	-	-	-	0.10	336.60	550.20	1426.30	238.50	180.50

Table 2-4-7(2) **Daily Rainfall at Kasibu**

(Unit: mm)

Year 1979

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1			19.0			34.0		28.0	22.0	54.0	9.0	4.0
2					5.0	27.0	10.0	16.0	5.0	55.0	5.0	8.1
3						68.0	50.0	26.0	20.0	50.0	4.1	9.0
4						30.0	77.0	19.0	18.0	72.0	4.0	8.1
5						15.0		23.0	25.0	58.0	5.0	5.2
6		20.0				67.0	11.0	23.0	13.0	67.0	8.0	3.0
7	0.1					93.0	12.0	27.0	8.0	48.0	7.0	9.0
8	0.1					40.0	12.0	32.0	4.0	21.0	8.0	6.0
9								15.0	17.0	34.0	6.0	8.0
10								9.0	11.0	40.0	8.0	6.0
11		3.0						9.0	5.0	33.0	10.0	9.0
12								5.0	27.0	37.0	12.0	
13								33.0		35.0	9.0	
14					10.0			23.0	5.0	20.0		
15					5.0			7.0	14.0	28.0		
16		10.0			10.0				10.0	10.0	3.0	
17					3.0				5.0		3.0	
18				60.0	5.0						13.0	
19				15.0		18.0					14.0	
20				27.0						9.0	15.3	
21			30.0	28.0		3.0	40.0			7.0	12.4	
22				35.0		3.0				10.0	12.2	11.0
23				40.0		12.0				4.0	11.2	7.0
24						14.0				6.0	13.5	3.0
25					20.0	12.0	50.0	15.0	61.0		16.4	9.0
26						3.0	10.0	11.0	61.0		10.4	5.2
27		5.0					14.0		8.0		7.0	
28		8.0	10.0			10.0	21.0		11.0		5.0	
29	0.2		5.0			10.0	13.0	20.0			11.0	
30							3.0	10.0			6.0	
31								6.0				
TOTAL	0.4	46.0	64.0	205.0	58.0	422.0	323.0	357.0	350.0	698.0	248.5	110.6

Table 2-4-7(3) Daily Rainfall at Kamamasi

(Unit: mm)

Year 1978

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1	-	-	-	-	-	-	-	-	2.00	5.60	101.20	10.80
2	-	-	-	-	-	-	-	-	1.20	9.00	90.60	2.60
3	-	-	-	-	-	-	-	-	51.40	9.00	65.20	8.00
4	-	-	-	-	-	-	-	-	6.40	0	12.20	34.80
5	-	-	-	-	-	-	-	-	1.60	3.60	1.00	1.40
6	-	-	-	-	-	-	-	-	39.60	8.20	4.80	5.20
7	-	-	-	-	-	-	-	-	0	12.20	16.20	9.60
8	-	-	-	-	-	-	-	-	43.60	57.80	2.00	0
9	-	-	-	-	-	-	-	6.00	45.40	108.00	0	0
10	-	-	-	-	-	-	-	16.80	9.60	62.00	0	20.00
11	-	-	-	-	-	-	-	3.40	2.40	13.20	0	41.60
12	-	-	-	-	-	-	-	2.20	0	0	0	10.80
13	-	-	-	-	-	-	-	8.40	13.40	0	17.60	21.00
14	-	-	-	-	-	-	-	8.60	17.20	0	0	24.60
15	-	-	-	-	-	-	-	4.40	1.20	8.20	1.00	7.20
16	-	-	-	-	-	-	-	0	8.00	19.40	0	4.60
17	-	-	-	-	-	-	-	0	112.20	4.00	10.20	0
18	-	-	-	-	-	-	-	0	63.20	36.80	11.60	15.00
19	-	-	-	-	-	-	-	5.40	38.80	20.80	20.20	20.20
20	-	-	-	-	-	-	-	30.20	5.80	22.20	15.20	19.60
21	-	-	-	-	-	-	-	11.20	28.00	8.00	21.20	24.80
22	-	-	-	-	-	-	-	13.40	20.60	3.20	23.40	18.60
23	-	-	-	-	-	-	-	48.40	69.60	43.40	0	24.00
24	-	-	-	-	-	-	-	52.80	16.40	3.20	0	23.80
25	-	-	-	-	-	-	-	33.60	24.00	30.60	6.20	19.80
26	-	-	-	-	-	-	-	2.60	9.80	100.40	1.80	0
27	-	-	-	-	-	-	-	0	136.00	52.20	1.00	3.20
28	-	-	-	-	-	-	-	1.40	124.20	0	2.00	4.40
29	-		-	-	-	-	-	1.60	16.80	51.20	24.40	3.40
30	-		-	-	-	-	-	7.20	5.60	86.00	0	5.60
31	-		-		-		-	4.40		100.80		6.60
TOTAL	-	-	-	-	-	-	-	262.00	714.00	879.80	449.00	391.20

Table 2-4-7(4) **Daily Rainfall at Kamanasi**

(Unit: mm)

Year 1979

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	3.0		12.2			24.0	7.2		5.0	71.6	7.4	18.4
2	4.2					15.0	16.8		83.4	110.6	34.0	18.2
3				6.2		22.0	9.8	14.0	16.2	84.6	34.0	8.6
4			1.2	2.6		14.0		2.4	11.2	42.0	15.2	3.0
5		2.0					8.8	4.0	1.8	22.8	23.0	2.0
6							5.2			23.4	33.0	8.4
7	7.0	6.6					31.0	3.0		8.0	6.0	32.0
8	12.6					1.2		6.2		9.2	10.8	6.4
9						2.2		9.6	20.2	3.4	10.2	6.8
10						5.2		5.8	32.0	-	16.0	3.0
11						2.0		1.8		13.0	4.0	3.0
12				2.4	21.4		2.2	5.8	9.0	16.6	12.2	2.4
13				3.8	2.6		24.6		8.8	2.0	41.0	14.6
14	8.2	1.3		2.6	11.2	2.0	26.0		26.4		58.0	7.6
15				5.4	23.2	3.6			11.2		16.0	
16		1.3		3.0	2.6	10.4		1.0	4.6		7.6	
17		1.4		4.2	30.6	23.0			12.6			
18		2.4		6.0			5.2		10.2		6.0	
19	1.2			18.2					27.0		23.4	12.0
20	5.0			31.8			2.0		3.6	4.0	70.6	2.0
21				14.0			1.4		3.6	16.4	61.6	3.0
22				5.0		51.6			2.4	11.6	26.0	21.8
23						13.0				7.0	18.0	21.6
24			51.2		51.0		7.0			15.6	42.4	19.4
25			4.4		89.0		46.0	2.2		8.2	96.2	38.8
26						49.4	33.6	13.6	59.8		42.0	26.0
27		4.4				32.6	6.2				42.4	28.8
28		6.4		9.0		42.0	19.4	1.4	24.6		44.2	
29						2.0	4.8		15.0		46.4	
30	4.6						26.4				23.6	
31								12.6	55.8			
TOTAL	45.8	25.8	69.0	114.2	241.6	315.2	283.6	83.4	444.4	470.0	871.2	307.8

Table 2-4-7(5) **Daily Rainfall at** Siguem

(Unit: mm)

Year 1978

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1	-	-	-	-	-	-	-	-	0	3.80	99.60	6.40
2	-	-	-	-	-	-	-	-	0	54.20	13.40	2.00
3	-	-	-	-	-	-	-	-	23.00	6.00	3.00	3.00
4	-	-	-	-	-	-	-	-	11.00	0	0	17.80
5	-	-	-	-	-	-	-	-	0	0	0	7.80
6	-	-	-	-	-	-	-	-	14.00	10.20	0	0
7	-	-	-	-	-	-	-	-	15.00	38.00	0	0
8	-	-	-	-	-	-	-	-	2.00	74.20	0	1.00
9	-	-	-	-	-	-	-	12.80	40.00	116.00	0	0.80
10	-	-	-	-	-	-	-	55.00	31.20	18.20	0	4.00
11	-	-	-	-	-	-	-	3.80	0	12.80	0	11.20
12	-	-	-	-	-	-	-	2.00	13.00	14.20	0	22.00
13	-	-	-	-	-	-	-	5.40	4.00	1.00	0	31.00
14	-	-	-	-	-	-	-	4.20	12.00	0	0	22.00
15	-	-	-	-	-	-	-	4.60	61.00	2.60	0	11.00
16	-	-	-	-	-	-	-	0	50.00	20.80	0	17.00
17	-	-	-	-	-	-	-	0	93.00	16.00	0	17.00
18	-	-	-	-	-	-	-	0	17.80	10.00	5.00	20.00
19	-	-	-	-	-	-	-	4.00	21.00	3.20	1.20	25.20
20	-	-	-	-	-	-	-	14.00	8.20	1.00	0	32.00
21	-	-	-	-	-	-	-	7.20	5.80	10.40	0	26.00
22	-	-	-	-	-	-	-	37.00	41.20	21.20	0	18.00
23	-	-	-	-	-	-	-	66.00	75.00	45.20	0	12.00
24	-	-	-	-	-	-	-	36.00	34.00	6.00	0	10.00
25	-	-	-	-	-	-	-	25.00	0	6.00	0	7.00
26	-	-	-	-	-	-	-	2.60	40.00	328.40	2.00	0
27	-	-	-	-	-	-	-	0.20	102.00	44.40	2.40	0
28	-	-	-	-	-	-	-	0	81.00	0	1.00	3.00
29	-		-	-	-	-	-	0	2.00	40.00	0.40	8.00
30	-		-	-	-	-	-	13.00	2.00	33.80	0	2.00
31	-		-		-		-	2.00		31.00		0
TOTAL	-	-	-	-	-	-	-	294.80	799.20	968.40	128.00	337.20

Table 2-4-7(6) **Daily Rainfall at Siguem**

(Unit: mm)

Year 1979

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1			13.0		16.0	3.0				28.0	0	3.0
2						69.0	20.0		16.0	26.0	10.0	6.0
3						16.0	25.0	16.0	50.0	37.0		
4						10.0		20.0	45.0	9.0		
5										6.0	28.0	6.0
6				3.0			12.0	20.0		10.0	1.8	11.0
7									22.0	6.0	4.0	7.0
8		4.0				12.0	64.0	15.0	4.0		3.0	
9						51.0			16.0			3.0
10												6.0
11					12.0					38.0		
12					10.0				11.0	20.0	10.0	3.0
13						4.0			10.0		14.0	3.0
14							23.0		9.0		2.0	
15					11.0	11.0	3.0		12.0		20.0	
16		2.0		27.0	8.0					2.0	7.0	
17				2.0	27.0	15.0			22.0			
18					17.0				32.0		6.0	
19							18.0		40.0	9.0	12.0	13.0
20				50.0						6.0	18.0	2.0
21						30.0					27.0	3.0
22			3.0	16.0		29.0			6.0	2.0	20.0	5.0
23									4.0		3.0	13.0
24			50.0		51.0						21.0	12.0
25			3.0			9.0	50.0		2.0	7.0	10.0	17.0
26					13.0	13.0	21.0	39.0	50.0		21.0	13.0
27						20.0	60.0				18.0	18.0
28		7.0				10.0			8.0		19.0	13.0
29							8.0	20.0	11.0		12.0	
30							4.0		3.0		6.0	
31							50.0	14.0				
TOTAL		13.0	69.0	98.0	165.0	302.0	358.0	144.0	373.0	206.0	292.8	157.0

Table 2-4-7(7) Daily Rainfall at Alayam

(Unit: mm)

Year 1978

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1	-	-	-	-	-	-	-	-	1.00	2.40	150.80	11.40
2	-	-	-	-	-	-	-	-	0	25.00	38.00	0
3	-	-	-	-	-	-	-	-	79.60	2.00	10.20	5.20
4	-	-	-	-	-	-	-	-	7.00	0	3.20	15.00
5	-	-	-	-	-	-	-	-	0	4.00	0	0
6	-	-	-	-	-	-	-	-	2.60	2.00	2.00	7.80
7	-	-	-	-	-	-	-	-	37.00	12.00	4.60	1.40
8	-	-	-	-	-	-	-	-	13.00	100.00	2.20	0
9	-	-	-	-	-	-	-	-	11.20	183.00	1.20	0
10	-	-	-	-	-	-	-	15.00	5.40	10.00	0	11.80
11	-	-	-	-	-	-	-	1.00	0	3.00	0	35.60
12	-	-	-	-	-	-	-	2.00	2.80	0	0	14.00
13	-	-	-	-	-	-	-	1.00	22.00	0	11.80	29.80
14	-	-	-	-	-	-	-	2.00	1.20	0	0	6.80
15	-	-	-	-	-	-	-	5.00	0	13.00	1.20	30.60
16	-	-	-	-	-	-	-	0	88.20	13.00	0.80	10.00
17	-	-	-	-	-	-	-	0	44.00	14.20	4.20	2.40
18	-	-	-	-	-	-	-	0	27.40	3.40	0	29.00
19	-	-	-	-	-	-	-	3.00	0	3.00	28.00	5.60
20	-	-	-	-	-	-	-	71.00	3.00	43.80	27.60	9.20
21	-	-	-	-	-	-	-	25.00	1.40	5.40	47.00	11.00
22	-	-	-	-	-	-	-	47.00	82.00	9.00	0	4.00
23	-	-	-	-	-	-	-	63.00	21.80	55.80	0	24.20
24	-	-	-	-	-	-	-	17.00	30.00	9.00	0	4.40
25	-	-	-	-	-	-	-	30.00	0	10.40	10.00	7.60
26	-	-	-	-	-	-	-	1.00	11.40	538.80	0	0
27	-	-	-	-	-	-	-	0	117.60	24.00	0	0.60
28	-	-	-	-	-	-	-	0	30.00	1.40	3.20	6.00
29	-		-	-	-	-	-	1.00	0	49.00	4.60	8.60
30	-		-	-	-	-	-	8.00	14.00	95.60	2.00	5.00
31	-		-		-		-	3.00		81.80		6.60
TOTAL	-	-	-	-	-	-	-	275.00	653.60	1404.00	352.60	311.20

Table 2-4-7 (8) **Daily Rainfall at Alayan**

(Unit: mm)

Year 1979

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	3.6	0.2	7.2			15.2		0.2	5.8	43.6	2.2	25.8
2	2.2	0.6			36.4	15.4			40.0	31.4	27.4	9.2
3	0	1.0	1.0			6.8		11.4	75.8	42.2	4.0	5.2
4	0	0.4				16.0			2.2	67.2	2.0	3.6
5	0	3.4						7.8	8.4	9.4	8.2	2.4
6	0.4	2.2						3.6		8.6	55.4	12.0
7	1.4	2.0				25.0		14.2		4.6	7.2	25.2
8	0.8	2.0				17.0		19.8		3.2	7.8	5.4
9	0	0.4						7.4	20.0	4.2	0.4	2.0
10	0	1.6						0.4	7.4	2.2	0.2	
11	0.8								11.0	8.2	3.0	2.6
12	0.8				23.2			4.4	3.0	7.0	2.6	1.0
13	1.2			1.4	12.4				6.0	8.0	29.0	6.8
14	1.0				4.2				12.0		25.8	2.6
15	0	2.6			22.6	12.4			16.8		11.4	
16	0	0.4		14.6	2.2			3.2	18.2		5.8	0.8
17	0	2.4		28.0	7.8	25.4			14.8			
18	0			4.0	39.6				1.0	2.2	41.0	
19	2.0			48.8	12.0				20.2		16.6	4.2
20	1.6			87.2					5.4	7.4	7.0	1.0
21	0			13.4		17.6			1.0	0.2	2.4	1.8
22	0			7.2		35.8			7.4	2.2	4.4	11.6
23	0			1.0		8.6			2.2	8.2	15.2	19.0
24	0		31.0		67.2					2.8	22.2	23.4
25	0		5.0						18.8	2.2	40.0	30.6
26	0					12.6		2.4	11.2		39.2	16.0
27	0	10.2				15.6		1.4	4.0		15.0	8.6
28	0	5.0		42.0	1.0	15.0			6.2		16.0	0.8
29	0					2.2			18.2		20.0	
30	17.0					2.2		10.4	17.6		18.8	
31	0							23.8		4.0		
TOTAL	32.8	47.4	44.2	247.6	228.6	242.8		100.4	354.6	269.0	450.2	221.6

Table 2-4-7(9) **Daily Rainfall at Biyoy**

(Unit: mm)

Year 1978

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1	-	-	-	-	-	-	-	-	-	4.20	6.20	16.50
2	-	-	-	-	-	-	-	-	-	6.30	5.10	10.50
3	-	-	-	-	-	-	-	-	-	3.70	8.10	14.80
4	-	-	-	-	-	-	-	-	-	8.40	5.40	21.10
5	-	-	-	-	-	-	-	-	-	0	3.40	13.40
6	-	-	-	-	-	-	-	-	12.80	8.20	8.60	3.10
7	-	-	-	-	-	-	-	-	21.60	3.60	16.40	0
8	-	-	-	-	-	-	-	-	2.20	23.60	20.30	0
9	-	-	-	-	-	-	-	-	20.00	59.20	12.20	0
10	-	-	-	-	-	-	-	-	4.60	92.40	9.70	0
11	-	-	-	-	-	-	-	-	0	107.20	8.20	6.30
12	-	-	-	-	-	-	-	-	3.60	51.60	2.00	6.00
13	-	-	-	-	-	-	-	-	20.00	24.80	2.10	6.20
14	-	-	-	-	-	-	-	-	21.80	1.60	4.20	15.50
15	-	-	-	-	-	-	-	-	11.20	0	4.30	17.90
16	-	-	-	-	-	-	-	-	57.00	8.40	10.50	20.00
17	-	-	-	-	-	-	-	-	0	7.80	19.00	23.40
18	-	-	-	-	-	-	-	-	42.40	3.70	13.70	17.90
19	-	-	-	-	-	-	-	-	0	41.60	9.30	0
20	-	-	-	-	-	-	-	-	0	73.20	6.50	0
21	-	-	-	-	-	-	-	-	3.80	42.40	12.80	0
22	-	-	-	-	-	-	-	-	37.40	65.00	10.70	0
23	-	-	-	-	-	-	-	-	53.60	61.72	13.00	0
24	-	-	-	-	-	-	-	-	0	69.50	8.40	1.00
25	-	-	-	-	-	-	-	-	57.00	71.91	5.50	6.40
26	-	-	-	-	-	-	-	-	93.40	110.12	0	2.00
27	-	-	-	-	-	-	-	-	34.60	101.24	0	6.10
28	-	-	-	-	-	-	-	-	5.80	71.21	6.00	0
29	-		-	-	-	-	-	-	8.40	38.80	5.20	0
30	-		-	-	-	-	-	-	1.60	14.10	10.40	0
31	-		-		-		-	-		14.80		0
TOTAL	-	-	-	-	-	-	-	-	512.80	1190.30	237.20	198.10

Table 2-4-7(10) **Daily Rainfall at Biyoy**

(Unit: mm)

Year 1979

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	0	8.5	0	0	3.2	20.6	11.4	0	47.6	0	9.3	1.0
2	0	4.2	0	0	2.1	24.0	5.2	0	34.4	0	5.3	3.0
3	0	4.2	0	0	0	16.6	2.0	0	10.2	0	3.0	6.2
4	0	3.0	0	0	0	11.3	4.2	0	3.0	0	3.2	1.0
5	0	3.2	0	0	4.2	18.8	0	0	0	2.1	5.0	0
6	0	1.0	0	0	8.4	11.5	0	0	0	7.2	9.4	2.1
7	0	0	0	0	2.1	3.0	0	0	0	3.0	3.1	0
8	0	0	0	0	0	0	0	0	0	1.0	5.3	0
9	0	0	0	0	0	0	0	0	8.3	4.1	6.3	0
10	0	0	0	0	0	0	8.3	0	4.1	11.4	5.1	0
11	0	0	0	0	3.2	0	16.6	0	9.4	9.4	14.5	0
12	0	2.1	0	0	1.0	0	10.6	0	0	14.7	10.6	3.2
13	0	2.1	0	0	4.2	0	7.3	0	6.2	13.7	3.2	2.1
14	0	5.1	0	3.2	5.3	0	4.1	0	4.1	5.2	2.1	2.0
15	0	5.3	0	0	0	21.2	10.4	0	4.2	1.0	0	4.2
16	0	7.4	0	0	0	21.2	7.3	0	9.6	0	3.2	4.1
17	0	8.3	0	7.3	0	74.2	2.0	0	4.2	0	3.0	3.0
18	0	2.1	0	2.1	3.2	60.3	4.2	0	6.3	0	4.3	2.0
19	0	0	0	0	1.0	32.4	9.3	0	12.5	0	8.3	0
20	0	0	0	0	8.4	0	5.1	0	8.3	9.4	15.8	0
21	0	0	0	3.2	2.1	0	0	0	3.0	7.2	14.8	0
22	0	0	0	0	3.1	0	0	0	2.0	9.4	15.7	0
23	0	3.2	0	0	0	0	0	0	0	3.0	12.6	0
24	0	4.2	0	0	0	51.2	0	0	0	9.2	19.0	0
25	0	2.1	0	0	0	74.0	0	0	0	0	12.4	0
26	0	2.1	0	0	0	102.6	0	0	0	0	12.6	0
27	0	2.0	0	0	0	83.3	3.2	0	50.4	0	12.5	0
28	0	1.0	0	0	0	32.3	6.3	4.2	0	0	15.8	0
29	0	4.2	0	0	0	13.2	9.4	6.3	0	0	14.7	0
30	0		0	0	0	0	14.6	2.0	0	0	7.9	0
31	0		0		0	3.0	10.6			3.1		0
TOTAL		75.3	0	15.8	51.5	674.7	152.1	12.5	227.8	114.1	258.0	33.9

Table 2-4-8 **Monthly Rainfall in Project Area**

Date	Kamamasi	Gayan (Alayan)	Biyoy	Poblacion (Kasibu)	Siguem	Paguet
1978. 7	-	-	-	0.1	-	-
" 8	262.0	275.0	-	336.6	294.8	-
" 9	-	653.6	512.8	550.2	799.2	-
" 10	879.8	1404.0	1190.3	1426.3	968.4	-
" 11	449.0	352.6	237.2	238.5	128.0	-
" 12	391.2	311.2	198.1	180.5	337.2	-
Total	1982.0	2996.4	2138.4	2732.2	2527.6	-
Mean	495.5	599.3	534.6	455.4	505.5	
1979. 1	45.8	32.8	0.0	0.4	-	-
" 2	25.8	47.4	75.3	46.0	-	13.0
" 3	69.0	44.2	0.0	64.0	-	69.0
" 4	114.2	247.6	15.8	205.0	-	98.0
" 5	241.6	228.6	51.5	58.0	-	165.0
" 6	315.2	242.8	674.7	422.0	-	302.0
" 7	283.6	-	152.1	323.0	-	358.0
" 8	83.4	100.4	12.5	357.0	-	144.0
" 9	444.4	354.6	227.8	350.0	-	373.0
" 10	470.0	269.0	114.1	698.0	-	206.0
" 11	871.2	450.2	258.0	248.5	-	292.8
" 12	307.8	221.6	33.9	110.6	-	157.0
Total	3332.0	2239.2	1615.7	2882.5	-	2177.8
Mean	277.67	203.56	134.64	240.21	-	197.98

Table 2-4-9 Tabulation of Daily Water Level and Discharge at Kamamasi

1979

Drainage area at gaging station 462 Sq. Kms.

Day	January		February		March		April		May		June		July		August		September		October		November		December		Day
1	22.46	1.00	14.00	0.72	11.28	0.62	13.16	0.69	16.00	0.79	16.80	0.82	22.14	0.99	31.34	1.26	22.79	1.01	37.22	1.42	23.77	1.04	43.41	1.58	1
2	21.82	0.98	13.72	0.71	11.55	0.63	12.89	0.68	14.84	0.75	19.61	0.91	20.55	0.94	25.10	1.08	33.51	1.32	67.65	2.15	24.10	1.05	44.20	1.60	2
3	21.50	0.97	13.44	0.70	11.55	0.63	12.62	0.67	13.72	0.71	27.13	1.14	33.51	1.32	23.44	1.03	29.56	1.21	73.15	2.27	26.11	1.11	42.23	1.55	3
4	21.18	0.96	13.16	0.69	8.52	0.51	12.62	0.67	14.28	0.73	28.51	1.18	37.22	1.42	34.24	1.34	24.76	1.07	78.31	2.38	22.79	1.01	39.51	1.48	4
5	20.86	0.95	12.89	0.68	10.51	0.59	12.62	0.67	14.00	0.72	24.76	1.07	28.51	1.18	29.21	1.20	27.86	1.16	62.28	2.03	24.10	1.05	37.22	1.42	5
6	20.55	0.94	12.62	0.67	10.51	0.59	12.62	0.67	13.72	0.71	20.86	0.95	24.10	1.05	25.43	1.09	26.11	1.11	50.71	1.76	33.14	1.31	35.72	1.38	6
7	20.23	0.93	12.62	0.67	10.25	0.58	12.89	0.68	13.44	0.70	18.99	0.89	25.10	1.08	25.43	1.09	27.47	1.15	44.60	1.61	34.24	1.34	36.85	1.41	7
8	19.92	0.92	12.62	0.67	10.00	0.57	12.62	0.67	13.16	0.69	23.11	1.02	35.72	1.38	23.44	1.03	23.44	1.03	40.67	1.51	29.91	1.22	45.00	1.62	8
9	19.30	0.90	12.89	0.68	9.75	0.56	12.62	0.67	12.89	0.68	36.85	1.41	28.51	1.18	28.16	1.17	24.43	1.06	37.98	1.44	29.21	1.20	39.51	1.48	9
10	18.99	0.89	12.62	0.67	9.50	0.55	12.35	0.66	12.89	0.68	37.60	1.43	24.10	1.05	29.21	1.20	26.79	1.13	35.72	1.38	27.13	1.14	38.36	1.45	10
11	18.69	0.88	12.35	0.66	9.25	0.54	12.08	0.65	12.62	0.67	27.13	1.14	22.79	1.01	27.13	1.14	26.11	1.11	34.98	1.36	27.47	1.15	36.10	1.39	11
12	18.38	0.87	12.08	0.65	9.25	0.54	12.08	0.65	12.62	0.67	22.79	1.01	22.14	0.99	24.10	1.05	22.46	1.00	38.74	1.46	26.79	1.13	33.51	1.32	12
13	18.08	0.86	11.81	0.64	9.00	0.53	11.81	0.64	14.84	0.75	19.61	0.91	21.82	0.98	23.11	1.02	22.14	0.99	33.87	1.33	26.45	1.12	33.14	1.31	13
14	17.78	0.85	11.55	0.63	9.00	0.53	11.81	0.64	16.00	0.79	18.08	0.86	25.43	1.09	22.14	0.99	22.46	1.00	22.46	1.00	32.78	1.30	32.78	1.30	14
15	17.48	0.84	12.08	0.65	8.76	0.52	12.08	0.65	16.00	0.79	19.61	0.91	29.56	1.21	20.86	0.95	25.43	1.09	26.79	1.13	38.36	1.45	32.05	1.28	15
16	17.18	0.83	12.08	0.65	13.72	0.71	12.08	0.65	17.18	0.83	17.78	0.85	24.43	1.06	20.23	0.93	24.76	1.07	32.05	1.28	35.72	1.38	31.34	1.26	16
17	16.58	0.81	12.08	0.65	13.72	0.71	14.56	0.74	14.84	0.75	18.08	0.86	21.18	0.96	19.61	0.91	31.34	1.26	30.98	1.25	33.87	1.33	30.62	1.24	17
18	16.58	0.81	12.08	0.65	13.44	0.70	14.28	0.73	24.10	1.05	18.69	0.88	19.92	0.92	18.99	0.89	28.16	1.17	29.56	1.21	32.05	1.28	29.21	1.20	18
19	16.00	0.79	12.08	0.65	13.16	0.69	13.72	0.71	23.44	1.03	17.78	0.85	19.30	0.90	18.69	0.88	30.27	1.23	28.86	1.19	35.72	1.38	29.56	1.21	19
20	16.58	0.81	11.55	0.63	13.16	0.69	15.13	0.76	18.08	0.86	16.88	0.82	19.61	0.91	18.08	0.86	33.51	1.32	28.16	1.17	37.60	1.43	28.86	1.19	20
21	16.00	0.79	11.28	0.62	13.44	0.70	30.27	1.23	16.00	0.79	16.29	0.80	25.77	1.10	17.78	0.85	28.51	1.18	28.51	1.18	39.12	1.47	28.86	1.19	21
22	15.42	0.77	11.02	0.61	13.72	0.71	21.50	0.97	14.84	0.75	15.71	0.78	21.82	0.98	17.18	0.83	25.43	1.09	28.16	1.17	35.72	1.38	29.91	1.22	22
23	14.84	0.75	10.76	0.60	13.72	0.71	33.87	1.33	14.00	0.72	27.47	1.15	19.30	0.90	16.88	0.82	27.47	1.15	27.47	1.15	36.47	1.40	30.98	1.25	23
24	14.56	0.74	10.51	0.59	17.18	0.83	22.46	1.00	14.28	0.73	20.86	0.95	18.38	0.87	16.58	0.81	26.11	1.11	28.51	1.18	37.22	1.42	33.87	1.33	24
25	14.28	0.73	10.25	0.58	22.46	1.00	13.90	0.90	33.87	1.33	19.61	0.91	18.38	0.87	16.29	0.80	24.10	1.05	28.16	1.17	37.98	1.44	36.85	1.41	25
26	14.00	0.72	10.00	0.57	17.48	0.84	16.58	0.81	26.11	1.11	21.50	0.97	31.69	1.27	16.58	0.81	23.11	1.02	26.79	1.13	49.06	1.72	38.36	1.45	26
27	13.72	0.71	10.00	0.57	15.42	0.77	15.42	0.77	20.86	0.95	23.77	1.04	45.80	1.64	21.82	0.98	38.36	1.45	26.11	1.11	47.83	1.69	39.89	1.49	27
28	13.16	0.69	10.00	0.57	14.28	0.73	15.42	0.77	18.38	0.87	28.86	1.19	35.35	1.37	18.38	0.87	32.78	1.30	25.77	1.10	45.80	1.64	41.44	1.53	28
29	13.16	0.69			11.02	0.61	29.21	1.20	17.18	0.83	26.11	1.11	27.47	1.15	17.18	0.83	34.61	1.35	25.77	1.10	43.41	1.58	39.51	1.48	29
30	13.16	0.69			13.44	0.70	18.38	0.87	17.78	0.85	21.50	0.97	25.10	1.08	20.23	0.93	36.10	1.39	25.10	1.08	43.01	1.57	34.61	1.35	30
31	13.16	0.69			13.16	0.69			16.00	0.79			25.77	1.10	18.99	0.89			24.10	1.05			33.14	1.31	31
Total	535.60		334.14		381.20		473.65		517.96		672.41		800.47		685.83		829.90		1,129.19		1,016.93		1,106.6		
Mean	17.28		11.93		12.30		15.79		16.71		22.41		25.82		22.12		27.66		36.43		33.90		35.70		
Max.	22.46		14.00		22.46		33.87		33.87		37.60		45.80		34.24		38.36		78.31		49.06		45.00		
Min.	13.16		10.00		8.52		11.81		12.62		15.71		18.38		16.29		22.14		22.46		22.79		28.86		

REMARKS: Discharges based on rating curve,

$Q = 22.46330825\ h^{1.440225614}$

Discharge measurements from May 1979 to January 1980 were used to develop the rating curve.

Total	8,483.88
Mean	23.44
Max.	78.31
Min.	8.52

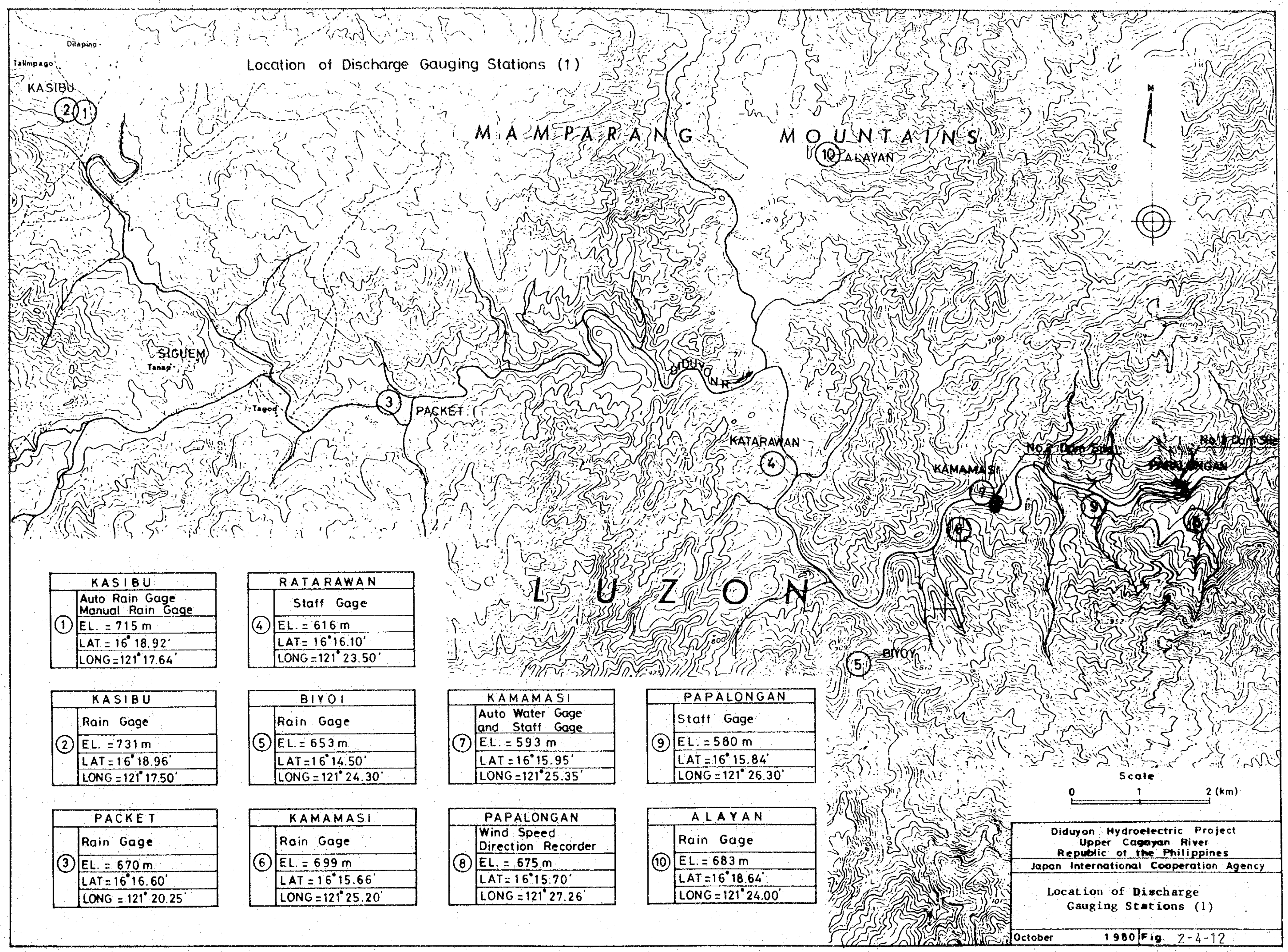
Table 2-4-10 Correlation of Daily Rainfall

x \ y	Kamamasi	Gayan Alayan	Biyoy	Poblacion Kasibu	Siguem	Paquet
Kumamasi		r=0.602 y=-0.775 +1.060x	r=0.289 y=5.087 +0.234x	r=0.536 y=4.912 +0.513x	r=0.647 y=1.351 +0.805x	r=0.445 y=3.470 +0.317x
Gayan	n=234		r=0.444 y=7.986 +0.213x	r=0.609 y=7.780 +0.350x	r=0.895 y=5.421 +0.594x	r=0.933 y=-0.532 +1.442x
Biyoy	n=484	n=209		r=0.434 y=6.988 +0.509x	r=0.406 y=7.756 +0.596x	r=0.0942 y=6.046 +0.0948x
Poblacion	n=510	n-234	n=484		r=0.604 y=3.308 +0.735x	r=0.238 y=4.841 +0.195x
Siguem	n=145	n=144	n=119	n=145		
Paquet	n=334	n=59	n=334	n=334		

Table 2-4-11 **Correlation of Monthly Rainfall**

y	Kamamasi	(Alayan) Gayan	Biyoy	(Kasibu) Poblacion	Siguem	Paquet
Kamamasi		r=0.80171 y=-19.30780 +0.98013x	r=0.67992 y=-53.961550 +0.81144x	r=0.66344 y=27.34985 +0.88062x	r=0.88482 y=-171.47540 +1.21811x	r=0.66263 y=102.38142 +0.32596x
(Alayan) Gayan	n=15		r=0.88403 y=-42.10709 +0.85345x	r=0.88216 y=23.84888 +0.93781x	r=0.87852 y=106.86182 +0.66523x	r=0.81082 y=25.62321 +0.70865x
Biyoy	n=15	n=15		r=0.84634 y=111.53108 +0.93058x	r=0.86400 y=164.05872 +0.73726x	r=0.60156 y=144.01553 +0.36741x
(Kasibu) Poblacion	n=16	n=16	n=16		r=0.85794 y=176.48051 +0.60217x	r=0.52156 y=115.33820 +0.31542x
Siguem	n=4	n=5	n=4	n=5		-
Paquet	n=11	n=10	n=11	n=11	-	

Location of Discharge Gauging Stations (1)



KASIBU	
①	Auto Rain Gage Manual Rain Gage
	EL. = 715 m
	LAT = 16° 18.92'
	LONG = 121° 17.64'

RATARAWAN	
④	Staff Gage
	EL. = 616 m
	LAT = 16° 16.10'
	LONG = 121° 23.50'

KASIBU	
②	Rain Gage
	EL. = 731 m
	LAT = 16° 18.96'
	LONG = 121° 17.50'

BIYOI	
⑤	Rain Gage
	EL. = 653 m
	LAT = 16° 14.50'
	LONG = 121° 24.30'

KAMAMASI	
⑦	Auto Water Gage and Staff Gage
	EL. = 593 m
	LAT = 16° 15.95'
	LONG = 121° 25.35'

PAPALONGAN	
⑨	Staff Gage
	EL. = 580 m
	LAT = 16° 15.84'
	LONG = 121° 26.30'

PACKET	
③	Rain Gage
	EL. = 670 m
	LAT = 16° 16.60'
	LONG = 121° 20.25'

KAMAMASI	
⑥	Rain Gage
	EL. = 699 m
	LAT = 16° 15.66'
	LONG = 121° 25.20'

PAPALONGAN	
⑧	Wind Speed Direction Recorder
	EL. = 675 m
	LAT = 16° 15.70'
	LONG = 121° 27.26'

ALAYAN	
⑩	Rain Gage
	EL. = 683 m
	LAT = 16° 18.64'
	LONG = 121° 24.00'

Diduyon Hydroelectric Project
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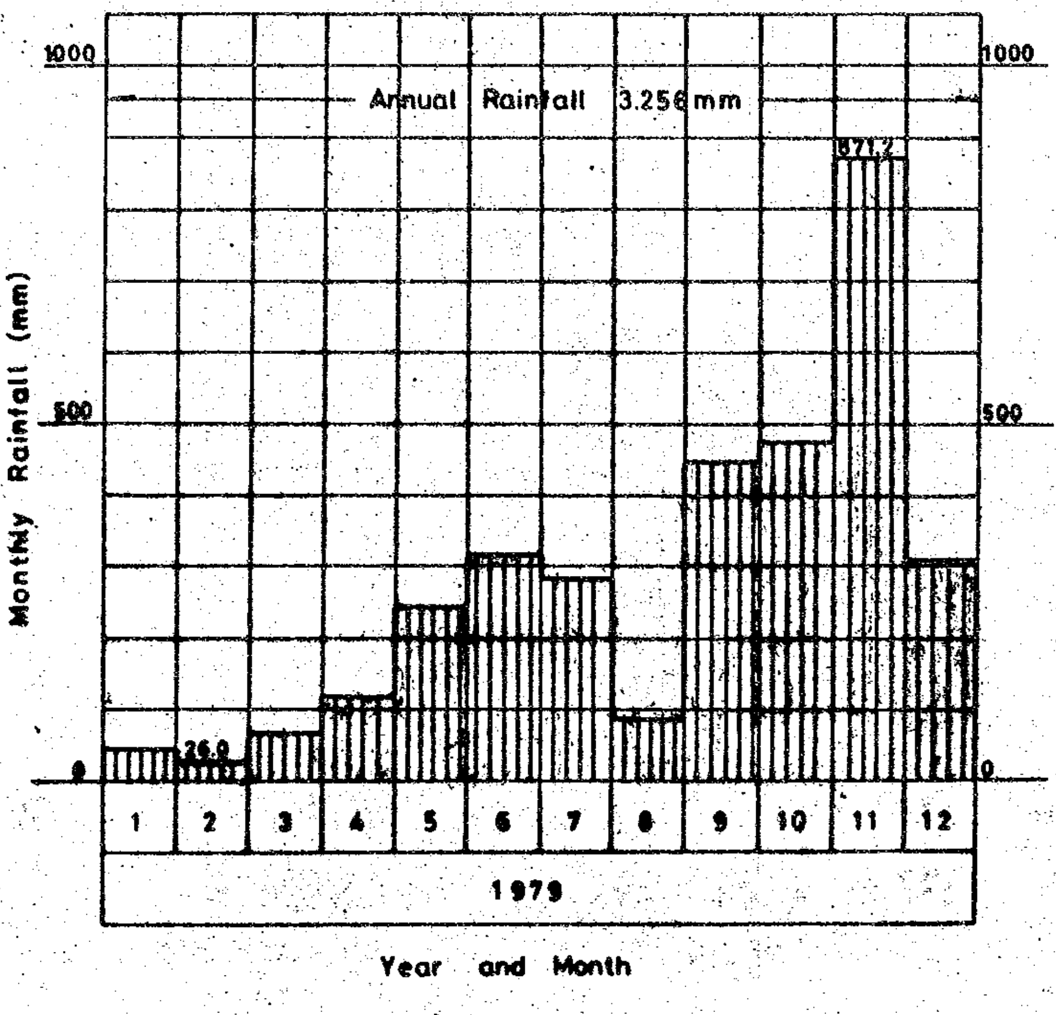
Location of Discharge Gauging Stations (1)

October 1980 Fig. 2-4-12

Monthly Rainfall Record at Kamamasi



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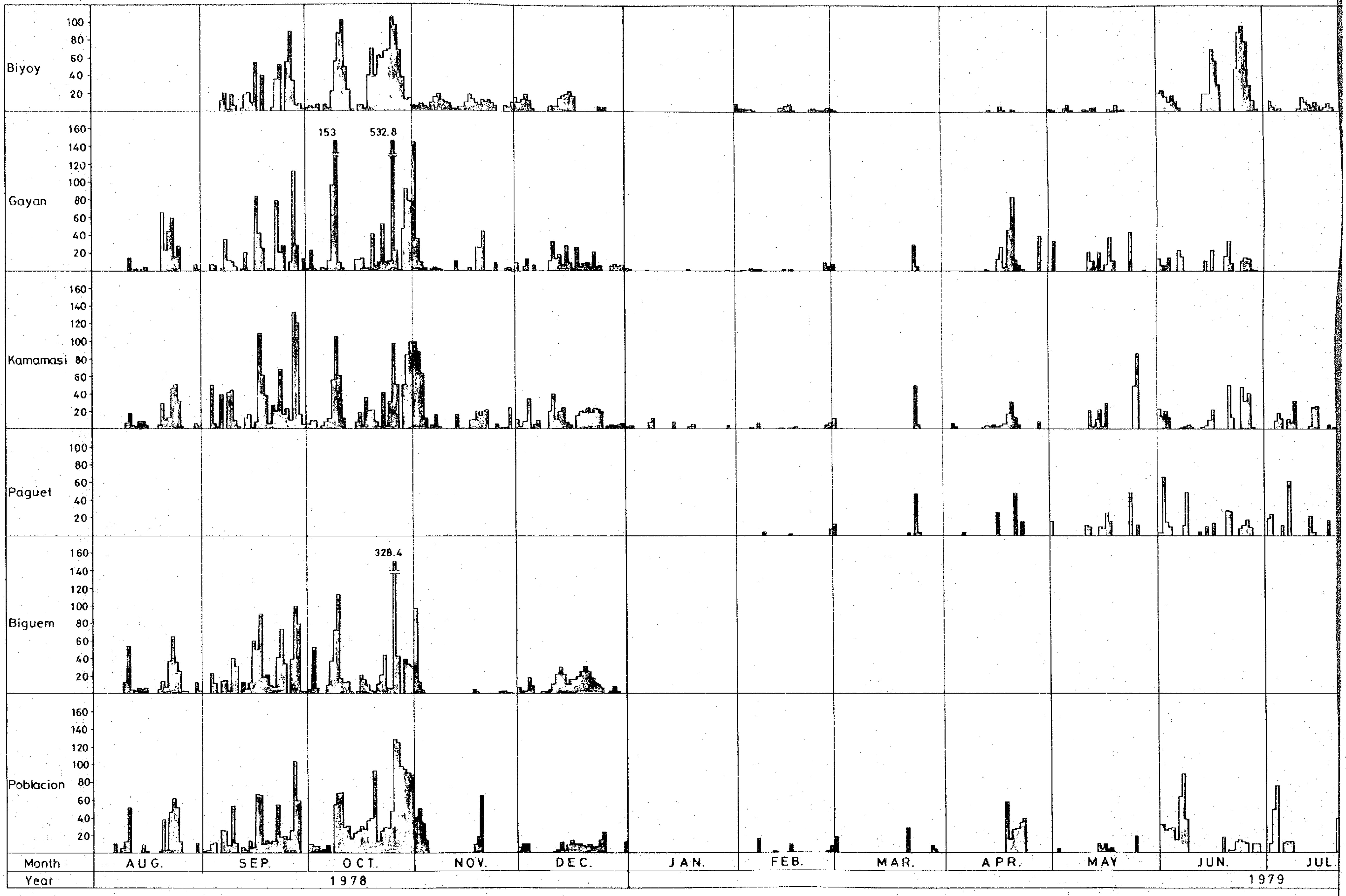
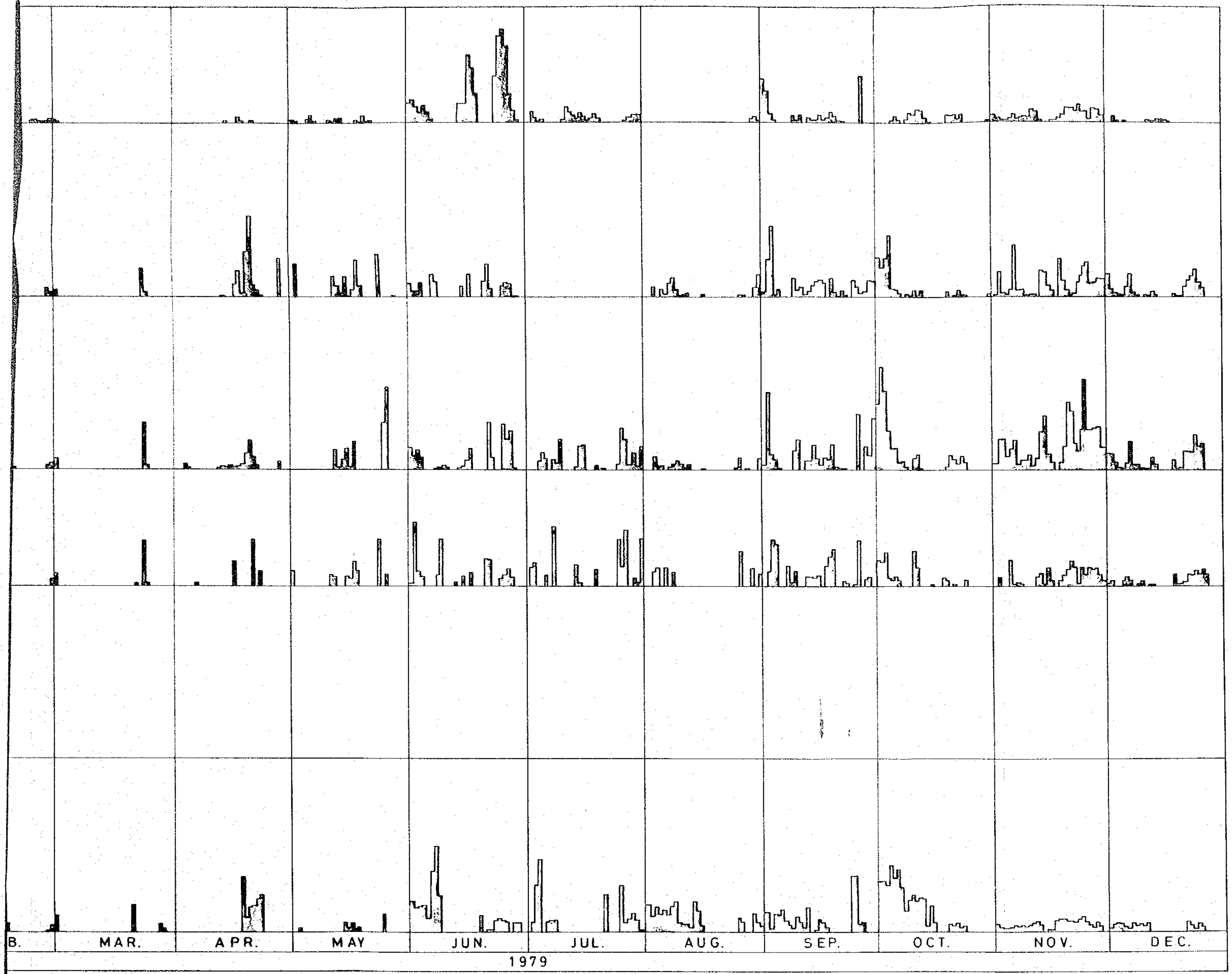
Monthly Rainfall Record at Kamamasi
October 1980 Fig. 2-4-13

Daily Rainfall in Project Area



infall in Project Area



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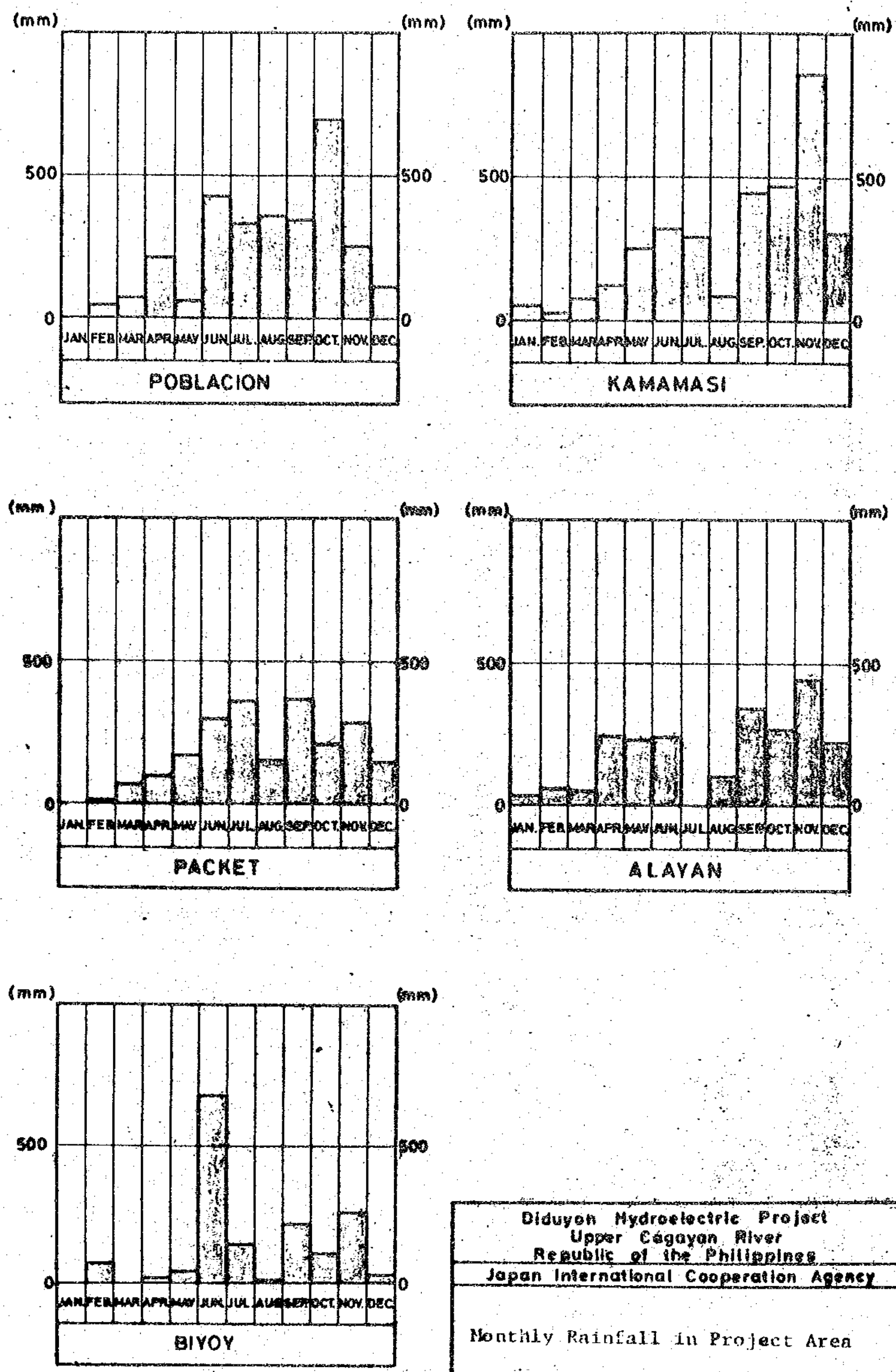
Daily Rainfall in Project Area

October 1980 Fig. 2-4-14

Monthly Rainfall in Project Area

(1979)



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Upper Cagayan River
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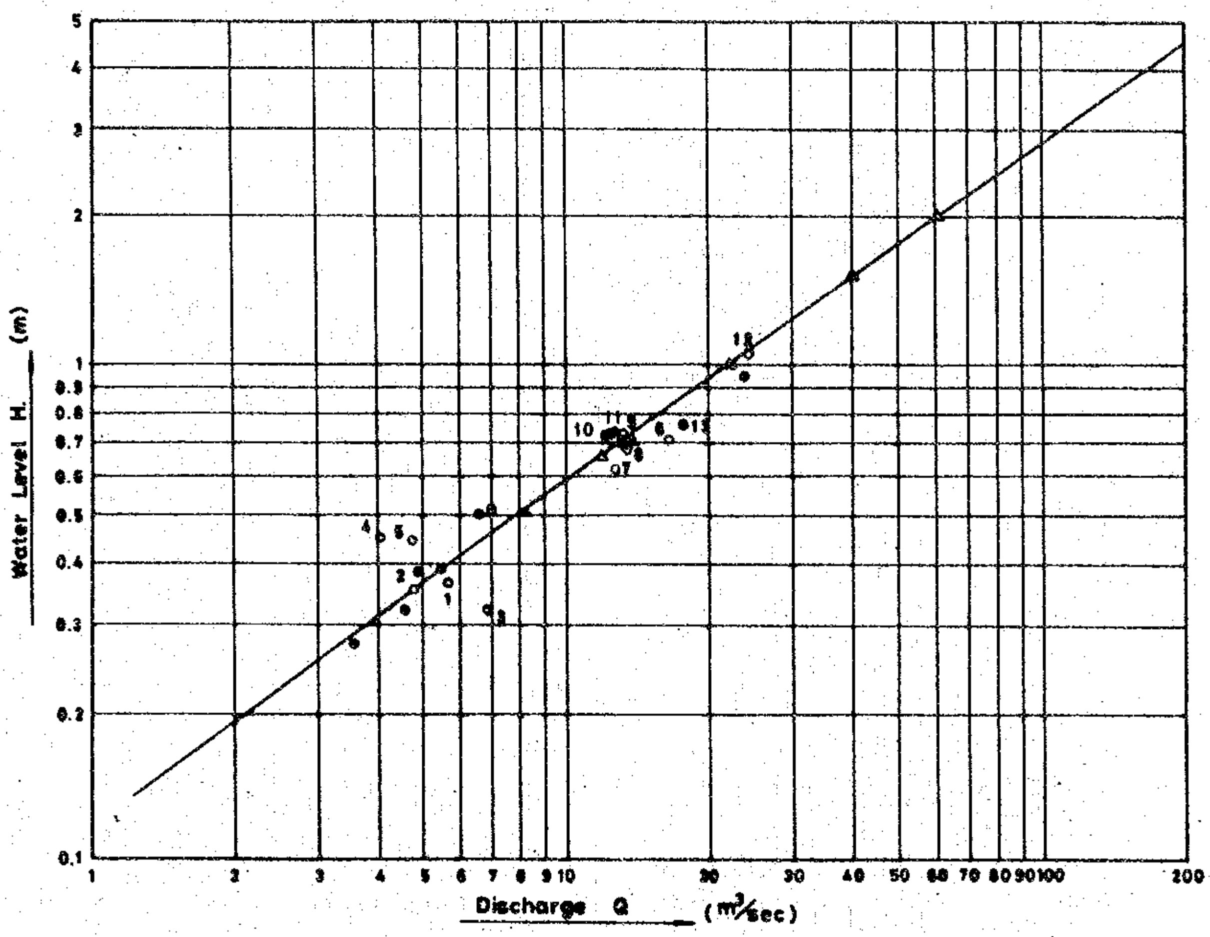
Monthly Rainfall in Project Area

October 1980 Fig. 2-4-15

Discharge Rating Curve at Kamamasi



* Note : Curve Fitted by Power Equation

$$Q = 22.4633H^{1.44023}$$

Δ - Points Derived from Power Equation

o - Points Derived from Actual Discharge Measurements from May 1979 to January 1980

● - Points Derived from Discharge Measurements for 1980

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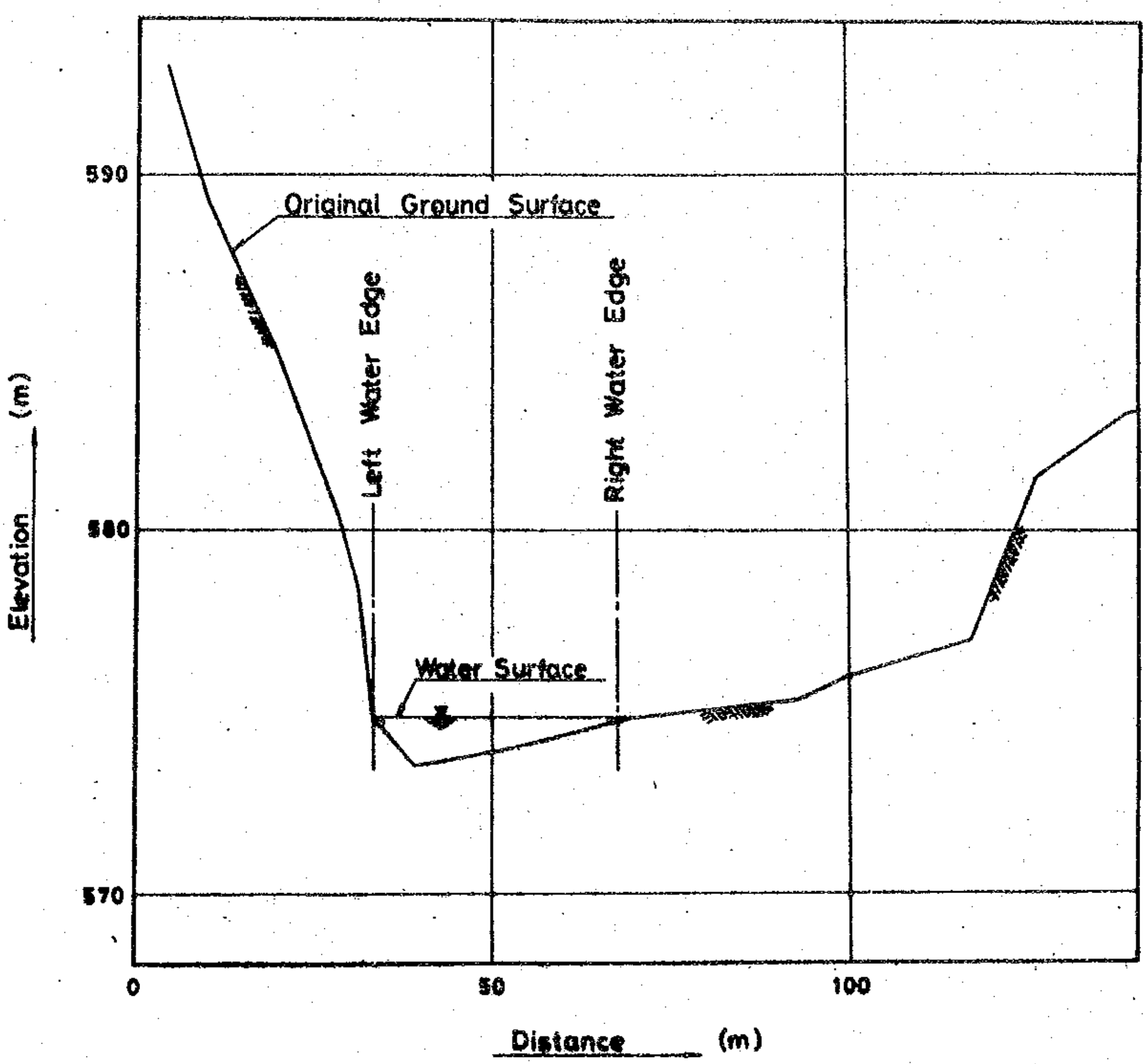
Japan International Cooperation Agency
Discharge Rating Curve at Kamamasi
October 1980 Fig. 2-4-16

Cross-Section of Kamamasi Gauging Station



Note :

Gauge Height	: 0.34 m
Date	: June 23, 1980
B.M.Elevation	: 578.89 m
Time	: 6:00 a.m.
"O" Level of Staff Gauge	: 574.5 m

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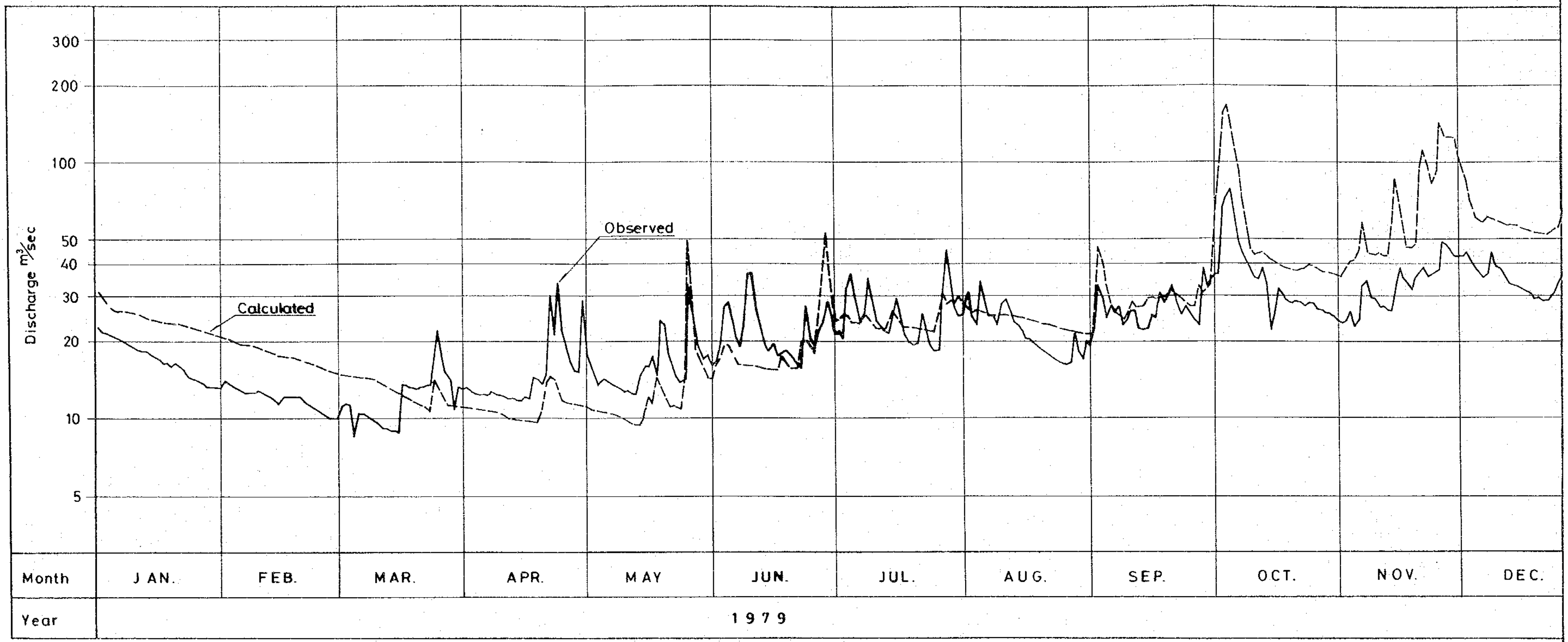
Cross-Section of
Kamamasi Gauging Station

October 1980 Fig. 2-4-17

Daily Discharge at Kamamasi, Observed and Calculated



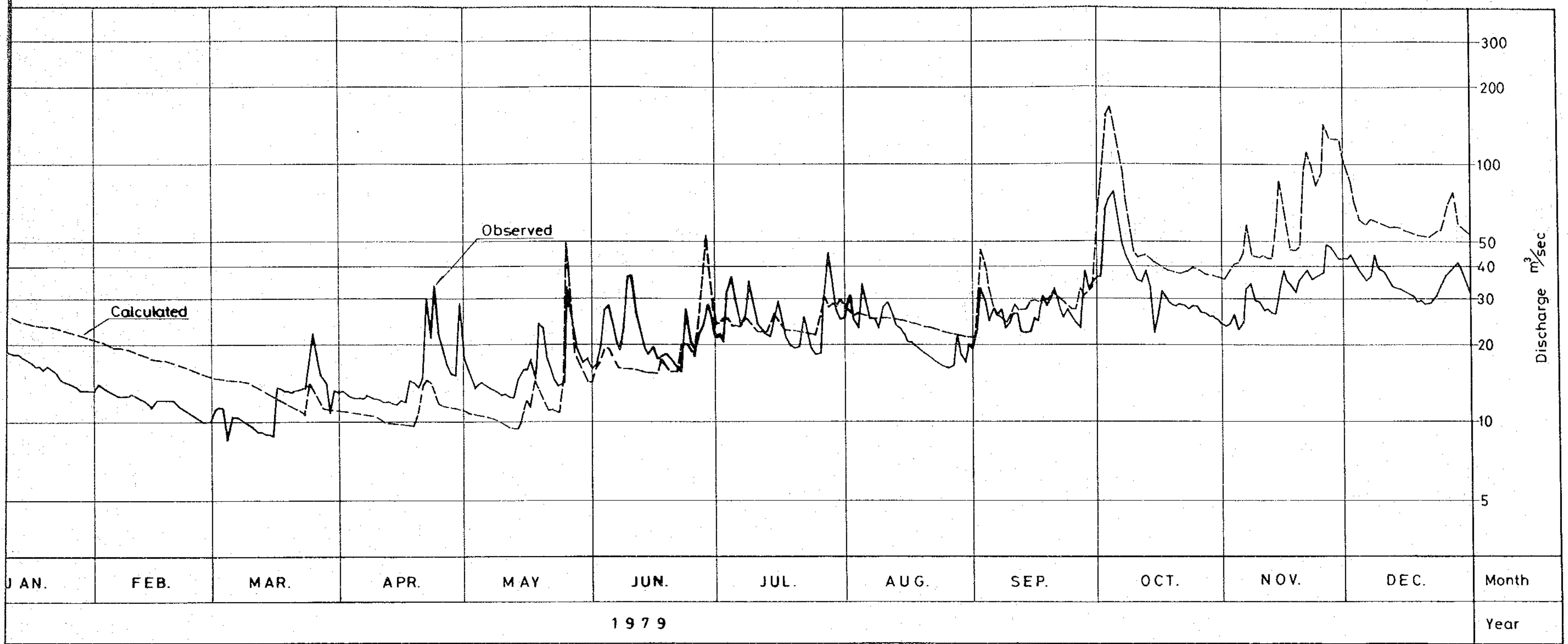
Station : Kamamasi

Drainage area : 462 km^2

——— Observed Daily Discharge

- - - - Calculated by Tank Model Method

Daily Discharge at Kamamasi, Observed and Calculated



Station : Kamamasi

Drainage area : 462 km²

——— Observed Daily Discharge

- - - - Calculated by Tank Model Method

Diduyon Hydroelectric Project
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Daily Discharge at Kamamasi
Observed and Calculated

October 1980 Fig. 2-4-18

2.4.3. Hydrological Basic Discharge to be Used in the Hydroelectric Power Project

In the project for this site, riverflow is planned to be annually regulated by means of a large-scale storage reservoir. Accordingly, management of the reservoir will be considered on a monthly basis. For more reliable simulation of output and the annually possible power generation, it is desirable to use data collected over a period of time as long as possible. However, for lack of data on precipitation in this stage, it is difficult to calculate from the amount of rainfall the rate of discharge for the site involved. In addition, data available from the gauging stations downstream on this river is considered the minimum to serve the purpose of the power project (records of riverflow actually observed for some ten years). In view of the above situation, only the measured discharges will be incorporated in the design, without attempting a long-term synthesis of riverflow variables. As stated above, there was no riverflow observation record of the Diduyon reservoir site itself until this survey was started. Table 2-4-12 shows the name and location of riverflow gauging stations in the vicinity of the project site. As shown in this table, the rate of discharge downstream on the Diduyon River has been observed at the Aglipay Gauging Station located 39 km downstream from the proposed damsite. Adding to this, river discharge relevant to the Diduyon River was measured at the Pangal Gauging Station located 17.5 km downstream of the confluences of the Cagayan River with the Diduyon (Addalam) River. The records at both stations are daily discharge measurements taken at a fixed time every day, and do not include any records on flood hydrograph. Observations at both stations are currently suspended. The periods of observation at the stream gauging stations are as follows:

Gauging Station	Observation Commenced from	Records Available for
Aglipay	June, 1964	10.5 years
Pangal	January, 1960	12 years

Since the records at both gauging stations show a good correlation as shown below, it is relatively easy to estimate the discharges in the period of suspension at one gauging station from the existing records for the corresponding period taken at the other gauging stations.

The correlation between the two stations is as follows:

i) Correlation coefficient by daily discharge:

$r = 0.56$, and number of data $n = 2,702$.
Then, expressed by the Barvais-Pearson linear equation,
$y = 0.08602x + 22.39873$
where, y = Discharge at Aglipay and x = Discharge at Pangal.

ii) Correlation coefficient by monthly discharge:

$r = 0.895$, and number of data $n = 88$.
Then, expressed by the Barvais-Pearson linear equation,
$y = 0.16544x - 0.19141$.

Thus, as values of r are larger than 0.5 in both cases, a good correlation is proved to exist.

In the course of the feasibility study on the Diduyon, a river-flow gauging station was installed at Kamamasi near the reservoir site, and thereby it has become possible to obtain river discharge directly at the proposed damsite. The name and location of the new gauging station are shown in Table 2-4-6.

Name of gauging station	:	Kamamasi Gauging Station
Observation commenced from	:	June, 1979
Method of observation	:	Daily observation of water stage and periodic measurement of river section and riverflow velocity

Data produced at these three gauging stations are processed through the method shown in Fig.2-4-19 to prepare records for the past 16 years. Using the records, it is possible to rationally obtain the inflow to the Diduyon Reservoir. The discharges for the Diduyon No. 3 Damsite are listed in Table 2-4-13 (1) - (16), and the discharge diagram is given in Fig. 2-5-20 (1) - (4). From the tabulated annual riverflow for a period of 16 years, the average annual inflow to the reservoir is estimated at 30.8 m^3/sec daily, and the rates of maximum and minimum annual riverflows to the average are calculated to be 69% and 41%, respectively (see Fig. 2-4-21). The droughty years experienced in 1969 and 1963 will inevitably have an influence on the study of reservoir planning. The types of river discharge at the Diduyon No. 3 Damsite are shown in Table 2-4-14, and the discharge duration curve for each year is given in Fig. 2-4-22 (1) - (8). Fig.2-4-23 shows the years of the maximum and minimum riverflows, and the average river discharge. The annual average flow of 30.8 m^3/sec corresponds to some one billion cubic meters per year. The droughty flow (discharge for 355 days) of 10.7 m^3/sec, as compared with the high water flow of 32.0 m^3/sec, signifies the discharge characteristics of this river. To determine the basic discharge for power project at the No. 3 Damsite, the average monthly riverflows shown in Table 2-4-15 are used in the calculation of reservoir management. The discharge diagram and the discharge mass curve are presented in Fig.2-4-24.

Table 2-4-12 <u>Location of Existing Discharge Gauging Stations</u>

Name of Station			C.A. (km^2)	Period of observation
A 1	Cagayan R.	Pangal, Echague, Isabela	4,244	1959 -
B 2	Addalam R.	Guinalvin, Aglipay, Nueva Viscaya	721	1965 -
C 3	Diduluan R.	Minuri, Jones, Isabela	272	1965 -
D 4	Dabubu R.	Dabubu, Pequino, San Agustin Isabela	162	1965 -
E 5	Cagayan R.	Dipaddiw Maddela, Nueva Viscava	2,323	1968 -

Table 2-4-13 (1) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1960

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	36.0	44.3	43.9	21.2	19.8	20.8	28.7	20.4	22.6	30.6	27.0	26.9
2	47.4	37.9	39.9	21.2	21.3	21.5	47.0	24.4	22.9	30.0	26.9	26.1
3	43.5	33.9	35.8	22.5	20.6	20.2	47.4	24.6	25.4	28.0	26.4	25.8
4	38.2	31.7	33.8	22.0	19.6	19.5	32.2	23.2	30.9	26.4	25.6	25.4
5	34.4	30.6	32.8	22.7	19.1	18.9	28.9	23.6	27.1	26.3	25.0	24.9
6	40.5	29.3	31.2	23.2	18.8	19.0	26.0	28.7	35.1	29.5	24.6	24.5
7	55.8	28.3	29.8	23.9	18.6	20.4	24.6	47.4	26.6	66.8	26.9	25.6
8	50.8	57.8	28.9	24.0	18.2	22.8	24.4	46.6	28.4	76.4	27.3	28.9
9	43.7	58.1	28.0	23.4	18.0	22.0	25.4	40.3	29.6	63.4	27.6	27.4
10	39.9	43.1	27.4	22.5	18.2	21.8	23.4	48.8	30.3	45.0	34.1	27.0
11	35.8	37.5	26.6	21.9	18.5	20.4	22.7	47.0	28.6	37.9	30.2	27.4
12	33.6	33.8	26.0	21.4	19.0	18.7	22.1	39.9	27.4	100.7	29.8	28.0
13	35.8	46.4	25.6	20.6	20.2	18.7	21.5	36.1	26.0	233.6	28.7	27.1
14	33.4	43.5	25.3	19.9	19.4	19.5	21.9	34.4	24.9	221.1	36.5	28.0
15	31.5	47.0	24.9	19.5	18.9	19.3	21.5	38.2	25.4	91.2	38.8	29.2
16	29.8	78.0	24.9	19.2	18.7	18.7	20.9	35.1	25.1	64.8	40.7	28.6
17	28.6	62.7	24.4	20.1	18.4	19.3	20.6	36.7	24.1	53.6	34.8	27.0
18	28.0	53.2	24.1	19.7	18.2	19.1	20.5	42.6	32.2	46.8	31.4	32.8
19	28.6	56.2	23.9	19.5	17.9	18.9	20.6	38.1	33.9	54.5	31.4	46.6
20	28.3	59.2	23.6	19.7	18.2	18.6	21.5	36.8	38.4	44.1	30.0	44.8
21	27.1	50.4	23.0	19.7	18.3	18.4	22.3	53.4	39.7	38.4	28.9	39.2
22	26.0	55.3	22.7	20.4	19.1	17.7	22.5	57.6	45.0	35.3	27.4	35.4
23	25.4	53.2	22.5	19.6	19.6	17.4	22.2	59.0	36.7	36.0	26.7	33.0
24	26.0	61.5	22.1	22.9	19.1	17.5	21.9	40.5	33.3	38.6	26.6	30.9
25	36.3	60.4	21.8	24.4	18.7	18.1	21.2	32.5	31.5	37.2	25.8	30.0
26	33.1	53.6	21.5	22.2	18.3	25.0	20.6	36.1	33.0	33.0	25.1	29.9
27	36.7	55.3	22.2	21.3	18.2	45.0	20.8	26.9	31.8	31.7	25.0	39.7
28	34.9	49.8	21.9	20.9	18.5	102.4	21.9	25.7	32.8	30.2	30.0	47.0
29	38.1	45.8	21.3	19.9	24.4	52.3	21.3	24.4	31.1	29.6	30.2	36.8
30	50.0		21.3	19.9	28.6	53.9	22.0	23.6	25.4	29.2	28.3	32.2
31	55.3		21.5		21.3		21.1	22.9		28.0		31.7

Table 2-4-13 (2) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1961

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	30.5	23.4	20.1	18.9	16.7	18.5	25.0	20.8	22.8	24.6	25.1	33.4
2	29.9	24.4	19.9	18.7	16.7	18.2	32.2	20.4	24.9	29.0	24.9	31.8
3	30.9	24.2	20.8	18.6	16.6	18.2	33.4	19.8	24.5	30.5	25.1	30.5
4	30.0	24.4	23.3	18.6	16.3	18.2	39.5	19.4	23.0	27.3	24.7	29.5
5	28.4	27.9	21.3	18.5	16.5	18.3	25.4	19.1	24.7	24.7	24.2	36.8
6	28.3	30.8	24.4	18.4	16.4	18.2	23.2	18.8	27.7	23.9	24.1	44.3
7	28.0	28.2	24.2	18.2	16.4	17.8	22.3	18.9	24.4	23.2	25.4	43.9
8	27.1	25.0	24.5	18.2	16.5	16.8	41.4	18.5	22.3	27.1	27.7	44.8
9	26.6	23.3	26.6	18.0	16.3	17.4	34.9	20.2	21.9	33.4	28.0	51.4
10	26.0	22.6	29.6	18.0	16.2	17.4	29.8	22.8	21.3	29.9	25.8	88.6
11	25.3	22.1	48.4	17.8	16.2	17.8	26.0	20.1	22.2	36.8	24.6	94.7
12	24.7	21.8	47.4	17.8	16.5	17.4	23.5	20.7	22.1	30.5	27.1	60.4
13	25.3	21.5	30.9	17.8	16.9	17.1	24.2	23.2	30.2	49.2	27.3	45.0
14	26.3	21.3	26.9	17.4	17.6	16.9	24.3	26.6	22.6	68.7	27.4	45.4
15	26.0	21.1	24.9	17.4	18.0	16.9	25.1	27.9	20.7	43.9	26.6	44.6
16	26.6	20.7	23.4	18.3	34.6	16.8	23.9	29.0	20.4	37.5	25.1	39.6
17	28.0	20.5	22.5	18.2	38.1	16.7	26.0	28.7	22.3	34.1	24.4	34.7
18	33.6	20.4	21.9	18.0	42.8	16.6	59.4	28.0	23.4	53.2	23.6	32.5
19	33.6	20.3	21.8	19.0	32.2	16.8	42.0	27.1	21.1	62.2	23.4	30.6
20	31.1	20.1	21.6	19.0	26.7	17.1	32.3	25.4	23.0	47.2	22.7	29.8
21	29.2	19.9	21.8	18.2	24.0	18.2	29.3	24.1	25.4	39.4	22.5	28.6
22	27.7	19.8	21.6	18.6	28.9	18.5	28.0	28.6	39.4	36.8	25.0	27.0
23	26.4	19.7	21.5	19.3	25.0	18.1	25.6	31.6	62.7	35.4	136.3	58.5
24	25.7	19.5	21.8	18.8	21.5	17.3	25.7	32.2	38.8	33.3	264.0	62.7
25	24.9	20.2	20.8	17.9	20.7	16.8	26.0	29.2	34.2	33.4	193.9	34.1
26	24.4	20.9	19.9	17.4	20.3	17.8	27.4	29.2	28.6	32.2	78.3	31.2
27	26.7	21.4	19.5	16.9	19.6	50.4	25.1	30.6	25.2	29.8	56.2	28.9
28	25.7	20.7	19.7	16.8	22.9	32.6	23.5	28.7	24.4	28.7	46.8	27.7
29	24.6		19.5	17.1	20.8	28.0	22.6	25.7	23.4	27.3	39.0	28.9
30	23.9		19.3	16.9	19.9	25.6	22.1	23.9	23.4	26.1	32.0	41.2
31	23.6		19.1		19.0		21.4	22.9		25.4		35.1

Table 2-4-13 (3) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1962

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	34.1	26.3	19.9	21.4	21.1	18.9	17.3	24.1	29.8	36.5	27.7	93.8
2	31.5	26.3	21.8	22.8	21.5	18.2	17.3	28.6	27.9	32.8	26.9	72.1
3	30.3	25.3	26.9	21.4	21.3	18.9	16.9	27.7	25.4	29.8	25.7	69.6
4	29.5	24.5	29.2	23.2	20.5	18.9	17.4	31.1	23.9	27.9	24.9	61.3
5	28.9	23.9	25.4	22.7	19.7	18.5	17.6	29.6	22.9	43.3	24.2	58.3
6	30.6	23.6	23.7	21.8	19.1	18.9	17.4	26.3	27.7	34.4	29.0	57.8
7	30.6	23.3	22.5	20.8	18.8	19.7	17.4	26.3	30.3	30.2	89.2	52.7
8	29.8	23.2	21.8	19.9	18.5	19.3	17.4	26.0	28.6	28.6	330.5	47.8
9	30.5	22.9	21.2	19.5	18.3	18.3	17.6	45.0	27.1	29.3	115.7	41.6
10	31.1	23.5	20.8	19.2	18.2	18.3	17.4	47.0	26.3	27.1	74.3	38.1
11	32.2	22.9	20.6	18.9	18.0	18.7	17.4	36.7	24.2	26.9	54.7	36.1
12	30.6	22.6	20.6	18.9	18.2	18.2	25.7	32.2	22.9	25.1	43.5	34.6
13	28.6	22.0	20.2	18.8	18.0	18.2	21.2	34.4	22.0	29.2	39.9	33.6
14	27.4	21.5	19.8	21.5	17.9	18.1	19.8	39.7	22.1	25.1	36.7	33.0
15	26.6	21.5	19.5	23.9	18.1	19.1	19.2	53.2	24.7	25.7	34.4	32.6
16	25.7	25.7	19.5	23.9	17.6	18.2	19.9	59.0	24.1	26.4	52.5	52.3
17	25.1	27.6	19.3	22.5	17.5	17.8	20.1	44.1	23.6	31.5	32.5	31.7
18	24.9	25.1	19.2	24.4	17.4	17.8	21.4	44.6	23.0	33.0	31.2	30.3
19	27.4	23.6	19.1	36.7	28.9	18.0	23.6	47.8	32.8	35.1	31.5	30.5
20	27.6	22.9	18.9	26.0	28.3	17.8	28.3	47.8	33.1	32.8	29.6	29.5
21	27.9	22.3	18.7	26.1	22.5	17.4	70.8	36.0	28.3	34.2	28.4	28.4
22	27.1	21.9	18.7	23.4	21.1	17.2	115.7	32.6	25.8	48.0	28.2	27.9
23	25.7	21.3	19.1	22.3	20.4	18.2	62.2	30.8	24.4	48.2	31.5	27.9
24	25.1	20.6	21.9	21.5	19.5	19.3	39.7	28.3	24.1	35.4	42.8	28.4
25	26.7	20.7	20.8	20.8	18.8	18.5	31.2	26.6	49.8	31.4	62.2	27.6
26	25.7	20.4	19.9	21.5	18.3	18.2	29.8	26.3	66.1	30.6	53.6	27.1
27	25.0	20.3	19.3	24.6	18.2	17.3	31.7	26.7	56.2	37.9	40.3	26.6
28	24.5	20.2	19.3	22.2	18.1	16.9	30.8	24.6	46.6	40.5	40.3	25.8
29	25.7		19.3	22.7	19.7	16.8	27.6	24.4	42.8	33.6	105.3	25.6
30	24.7		21.3	21.6	20.2	16.8	26.3	24.9	40.7	30.5	89.8	24.9
31	24.4		21.8		19.7		23.9	25.7		28.9		25.6

Table 2-4-13 (4) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1963

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	27.1	27.9	24.1	18.6	16.8	17.5	37.9	23.0	33.9	30.5	24.4	24.2
2	26.1	28.4	23.5	18.3	16.7	17.9	35.8	22.8	33.0	29.8	24.5	22.3
3	25.3	29.3	23.0	18.2	16.6	17.6	34.1	27.4	32.3	28.7	26.1	21.9
4	25.1	29.0	22.6	18.0	16.5	17.0	31.7	26.0	35.6	28.2	26.6	21.1
5	24.9	29.3	22.5	17.9	16.4	16.9	29.3	25.6	36.0	27.4	25.3	20.7
6	24.2	29.8	21.9	17.7	16.3	17.0	28.4	30.6	37.0	26.3	24.5	22.5
7	24.7	29.8	22.2	17.6	16.2	17.4	25.3	40.1	45.0	25.8	24.0	24.6
8	25.6	29.2	21.8	17.6	16.2	24.9	24.2	29.8	42.2	25.1	23.3	24.1
9	26.0	28.0	21.2	18.2	16.1	27.4	24.7	27.1	41.1	24.6	22.8	24.9
10	26.3	26.6	20.8	21.5	16.0	26,6	29.5	24.6	40.5	23.9	22.3	47.2
11	25.6	25.6	20.5	21.3	16.2	23.2	32.0	23.2	38.6	23.4	22.1	45.4
12	26.9	25.0	20.3	20.4	16.2	19.8	28.2	23.0	36.8	23.2	21.9	79.1
13	28.9	25.3	20.2	19.7	16.6	24.4	24.6	23.3	34.9	23.2	21.6	298.3
14	30.3	25.3	20.1	18.8	16.6	20.6	35.4	86.0	33.9	23.0	21.2	93.0
15	31.7	24.7	19.9	18.4	16.6	19.6	33.9	151.8	32.2	23.0	21.3	56.9
16	29.9	24.2	19.7	19.5	16.1	18.8	29.9	70.6	30.9	22.8	21.6	49.6
17	28.5	24.1	19.4	19.3	15.9	18.3	24.5	63.8	29.9	22.7	21.4	40.9
18	27.6	24.2	19.5	18.4	15.8	18.4	23.4	105.9	29.0	23.7	21.1	42.9
19	26.4	24.7	20.1	18.1	15.7	21.8	22.8	94.5	28.2	24.6	20.8	53.2
20	26.0	26.4	19.7	17.9	15.7	20.4	23.4	68.3	27.3	24.5	20.6	47.6
21	25.1	29.8	19.2	17.7	15.6	19.6	28.3	65.5	27.1	24.7	20.4	42.8
22	26.0	30.0	18.9	17.4	15.5	19.6	26.4	72.3	27.7	26.6	20.2	38.8
23	29.5	31.7	18.7	17.3	15.7	21.6	24.1	57.5	28.2	35.1	19.9	36.1
24	24.9	30.3	18.6	17.2	16.2	20.7	23.9	47.8	33.4	31.5	20.2	32.5
25	34.1	28.0	19.6	17.1	15.6	19.9	23.5	39.4	34.1	32.8	20.2	30.9
26	33.2	26.6	19.8	17.0	15.7	19.3	22.6	37.0	44.3	29.2	19.8	29.9
27	31.9	25.3	19.4	16.9	15.6	18.9	22.3	35.4	39.9	27.0	20.4	32.2
28	29.9	25.1	19.1	16.9	16.2	114.3	22.6	46.8	35.4	27.7	21.4	35.6
29	28.6		18.9	16.9	16.6	137.4	27.6	41.8	33.0	26.4	21.6	36.8
30	27.3		18.8	16.9	16.5	56.0	24.7	38.3	31.4	25.0	26.1	33.9
31	27.0		18.7		17.4		23.5	35.3		24.5		31.2

Table 2-4-13 (5) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1964

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	28.6	23.0	25.0	19.4	16.6	17.7	215.7	24.3	17.1	60.2	96.7	155.5
2	26.4	22.7	24.9	19.1	16.6	18.3	83.0	19.8	17.1	43.2	185.6	122.8
3	25.8	25.3	25.0	18.9	16.6	18.2	38.7	53.9	14.5	36.1	120.1	102.0
4	27.3	26.4	24.5	18.8	16.6	17.2	24.8	28.8	12.9	30.2	89.3	90.4
5	26.7	26.3	24.9	18.7	16.8	16.8	18.7	24.8	12.2	298.8	74.8	88.3
6	24.2	25.1	24.5	18.6	18.5	16.5	15.4	23.2	12.6	176.8	242.2	77.7
7	29.3	24.1	22.7	18.2	18.5	16.4	15.8	53.9	12.6	109.0	232.1	46.7
8	29.2	23.7	22.6	18.0	17.6	16.5	13.7	87.2	11.2	78.7	209.5	43.8
9	28.9	23.3	22.5	18.2	17.0	16.8	22.6	53.0	11.9	97.8	161.8	40.6
10	36.5	23.2	22.0	18.4	16.7	16.6	16.7	60.2	17.1	92.5	200.7	39.3
11	44.4	22.7	21.5	18.2	16.6	18.3	13.7	58.4	12.9	77.7	139.1	39.3
12	40.1	22.8	20.7	18.0	16.4	17.6	12.2	36.1	13.2	83.0	194.4	38.7
13	35.1	26.4	21.3	18.4	16.3	17.0	16.7	29.5	18.1	53.9	239.7	40.4
14	31.4	26.7	21.9	18.6	16.2	16.8	13.7	25.4	23.2	47.7	303.8	49.4
15	29.2	27.0	22.2	18.3	16.6	16.6	17.1	24.3	30.2	39.6	413.2	94.5
16	35.6	25.7	21.1	17.8	16.9	17.0	41.4	21.5	31.7	34.6	336.5	259.5
17	26.9	25.4	20.1	17.6	18.0	17.6	28.2	19.8	50.3	31.7	332.7	128.6
18	25.7	25.7	19.4	17.4	17.9	18.2	18.1	18.1	60.2	29.5	263.6	83.1
19	24.7	24.2	20.2	17.4	17.2	17.9	17.5	17.1	53.0	27.7	198.2	84.0
20	24.1	23.0	20.6	18.2	18.7	17.1	13.7	16.2	34.6	33.1	170.6	64.3
21	24.1	22.5	21.1	17.8	19.7	16.6	13.2	16.2	66.0	222.1	379.2	61.3
22	23.6	21.9	20.5	18.4	20.2	16.6	11.9	16.7	65.0	132.8	199.5	56.9
23	23.9	21.6	19.8	18.0	20.6	17.8	11.6	15.4	45.9	81.9	184.4	52.5
24	23.9	21.1	20.8	17.4	20.2	9.9	11.6	14.1	38.7	60.2	203.2	48.2
25	23.9	20.8	20.8	17.2	20.7	9.1	12.6	17.5	54.8	50.3	283.7	44.8
26	23.9	23.5	20.4	17.1	21.5	8.6	14.5	16.2	36.9	51.2	229.6	43.3
27	23.9	26.1	20.6	16.9	20.5	11.2	32.4	18.7	33.1	49.5	288.7	43.3
28	23.7	25.8	20.8	16.9	19.8	10.6	51.2	38.7	53.9	42.3	202.0	40.7
29	23.7	24.6	21.3	16.8	19.3	19.8	31.0	30.2	62.9	56.6	311.3	39.7
30	23.6		20.7	16.7	18.7	273.6	35.3	19.8	68.1	86.1	207.0	39.7
31	23.4		20.1		17.4		31.2	25.3		56.4		44.1

Table 2-4-13 (6) **Daily Discharge at No.3 Damsite**

Year 1965

(Unit: cms)

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	43.7	33.1	25.4	17.5	22.0	13.2	13.2	13.4	52.1	20.9	20.9	62.9
2	40.7	41.4	24.3	16.7	15.4	12.6	71.3	22.6	45.0	65.0	20.3	73.4
3	36.1	34.6	23.7	16.7	14.1	13.7	22.0	14.5	40.5	43.2	19.8	55.7
4	32.3	40.5	24.8	16.7	19.2	13.2	18.1	13.2	37.8	34.6	18.7	45.0
5	30.8	60.2	23.2	15.8	15.8	15.0	16.7	12.6	34.6	31.7	26.5	45.0
6	29.6	54.8	22.0	15.8	14.1	13.2	15.8	12.6	36.1	30.2	21.5	36.9
7	29.6	48.6	20.9	15.0	13.2	12.6	15.0	12.6	53.9	28.2	36.9	38.7
8	29.2	48.6	23.7	15.0	15.0	12.6	15.8	12.6	33.1	54.4	109.0	34.6
9	29.2	45.0	26.5	14.1	13.7	13.2	15.0	12.6	22.6	34.6	81.9	31.7
10	29.0	43.2	26.5	14.5	12.6	18.7	15.0	11.9	26.0	40.5	57.5	28.8
11	28.9	41.4	26.5	14.1	13.7	14.1	58.4	11.6	26.5	30.2	45.0	27.7
12	28.6	39.6	24.3	14.1	12.6	12.6	24.3	11.9	103.1	26.5	30.2	26.5
13	28.4	37.8	23.2	13.2	13.2	11.9	27.1	10.9	59.3	25.4	30.2	41.4
14	50.3	33.1	22.0	13.2	13.7	12.6	71.3	15.4	33.1	24.3	28.8	37.8
15	46.8	30.2	20.9	12.6	15.0	14.1	52.1	26.5	26.5	22.6	25.4	30.2
16	53.9	29.5	21.5	16.7	14.1	13.2	39.6	29.5	23.7	22.0	24.3	27.7
17	75.6	30.2	20.9	15.8	13.7	13.2	35.3	53.9	33.1	19.8	23.2	30.2
18	137.9	27.1	20.9	15.0	14.1	12.6	33.1	31.7	48.6	19.2	22.0	114.0
19	96.7	31.7	20.9	14.1	13.2	11.9	27.1	23.2	53.9	43.2	39.6	50.3
20	87.2	31.7	19.8	24.8	12.6	11.6	24.3	19.8	37.8	36.9	26.5	43.2
21	62.9	30.2	19.8	12.9	11.9	11.2	29.5	16.7	52.1	34.6	23.7	35.3
22	51.2	28.8	19.2	33.1	11.2	11.9	17.5	43.2	43.2	33.9	22.0	31.7
23	58.4	27.7	19.8	27.7	11.2	15.0	16.7	26.0	28.8	31.7	31.0	29.5
24	45.0	28.8	18.7	26.5	10.6	15.0	15.8	24.3	29.5	30.2	53.9	27.7
25	31.7	29.5	18.7	16.7	11.9	13.2	20.3	23.2	48.6	28.8	81.9	27.7
26	81.9	28.8	18.1	15.0	12.6	12.6	15.8	20.9	27.7	26.5	36.1	42.3
27	45.0	27.7	18.7	15.0	11.9	11.9	15.8	22.0	26.5	24.3	67.1	48.6
28	25.4	26.5	23.2	14.1	11.9	11.9	15.0	22.0	24.3	24.3	60.2	41.4
29	19.8		21.5	13.2	11.9	11.6	14.1	20.9	23.2	23.2	45.9	55.3
30	13.2		18.7	11.2	11.6	12.6	15.0	23.7	22.0	22.0	36.9	41.4
31	11.9		17.5		11.2		14.1	81.9		21.5		36.1

Table 2-4-13 (7) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1966

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	55.7	17.5	12.9	12.6	11.2	25.4	13.2	20.9	16.7	12.6	31.7	213.3
2	44.1	17.1	12.6	11.9	11.2	24.3	12.6	27.7	15.8	12.2	25.4	218.3
3	37.8	16.7	11.9	11.2	10.6	21.5	11.9	25.4	57.5	11.9	22.6	386.8
4	31.0	16.2	11.9	10.6	10.6	19.8	13.2	24.3	20.9	11.9	20.9	282.4
5	31.7	15.8	12.6	10.6	11.2	30.2	11.2	31.0	16.7	12.6	19.8	169.3
6	30.2	15.4	12.2	9.9	12.6	20.9	11.2	40.5	15.8	13.2	19.2	173.1
7	28.8	16.7	12.2	9.9	12.2	28.9	14.1	52.1	15.4	19.8	18.7	124.0
8	27.7	24.3	12.9	9.4	11.2	28.2	14.1	57.5	15.0	23.2	17.1	110.2
9	26.5	26.5	10.9	9.4	11.2	30.2	15.0	49.5	15.0	19.2	15.8	92.5
10	24.8	23.7	10.3	9.7	12.6	19.8	15.0	55.7	15.0	16.2	28.8	96.7
11	24.3	19.2	9.9	9.9	14.1	23.7	15.8	46.8	14.5	15.0	31.7	57.5
12	22.6	16.7	9.4	9.9	12.2	19.8	22.0	33.9	15.8	14.5	28.2	24.3
13	22.0	17.1	10.9	9.7	11.2	17.1	17.5	28.2	17.1	14.1	25.4	71.3
14	21.5	15.8	11.9	9.4	10.6	15.8	19.8	29.5	16.7	14.5	22.6	71.3
15	20.9	15.8	12.2	9.4	10.6	15.0	16.7	26.0	15.8	14.5	20.9	81.9
16	20.3	15.8	11.9	9.4	9.9	15.0	19.2	24.3	15.8	56.6	23.2	77.7
17	19.8	15.0	11.2	9.4	23.2	15.8	22.0	22.0	16.2	46.8	22.0	72.4
18	17.5	15.0	10.6	9.1	11.2	14.1	16.7	20.9	16.7	37.8	24.3	67.1
19	16.7	14.1	10.6	9.4	23.2	14.1	33.1	20.3	15.8	29.5	31.0	67.1
20	16.2	14.1	10.6	9.4	69.2	19.8	37.8	18.7	15.0	25.4	28.2	65.0
21	24.3	14.1	10.9	9.4	58.4	17.5	23.2	17.5	14.1	39.6	607.3	62.0
22	25.4	13.7	10.3	9.1	12.6	18.1	19.8	17.1	13.2	32.4	464.0	83.0
23	20.9	13.2	10.3	8.9	53.9	16.7	23.2	16.2	12.9	29.5	361.6	77.7
24	18.7	15.4	9.9	8.9	86.1	14.1	30.2	17.1	12.6	27.5	301.3	62.9
25	18.1	15.4	9.7	9.7	90.4	15.0	24.3	23.7	15.8	27.1	19.3	37.8
26	17.5	13.7	9.7	9.9	256.0	27.7	19.8	41.4	14.5	23.7	88.3	33.1
27	17.1	13.7	10.3	9.4	230.9	17.1	17.5	26.0	13.2	22.0	188.2	110.2
28	26.0	12.9	16.2	9.4	89.3	15.4	31.0	19.8	13.7	20.3	359.1	168.0
29	18.7		18.1	9.4	52.1	15.0	26.5	20.9	13.2	20.3	262.3	234.7
30	18.7		12.9	9.1	33.1	13.7	23.7	18.7	13.2	39.6	168.0	205.8
31	18.1		14.1		28.8		27.1	17.5		31.0		149.2

Table 2-4-13 (8) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1967

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	101.0	30.2	19.2	13.2	10.6	9.9	9.7	12.9	13.2	41.4	20.3	37.7
2	57.5	28.8	18.7	13.2	10.6	9.7	9.4	12.2	15.0	29.5	18.7	37.7
3	106.4	26.5	17.8	13.2	10.3	9.4	11.2	11.9	18.7	33.9	20.9	46.3
4	107.7	35.3	16.7	12.6	10.3	9.1	9.7	13.2	20.9	30.2	332.7	41.5
5	86.1	30.2	16.7	12.6	9.9	9.9	9.4	11.9	25.4	45.9	602.4	36.4
6	70.3	27.1	20.9	12.2	9.9	9.7	9.4	11.2	25.4	28.2	284.9	48.7
7	67.1	25.4	25.4	11.9	9.9	9.7	9.1	12.6	32.4	92.5	180.1	39.2
8	52.1	24.3	33.1	11.9	9.9	11.2	8.9	32.4	24.3	37.8	104.3	38.4
9	50.3	23.7	27.7	16.2	9.7	14.1	10.6	21.5	36.1	27.7	105.3	37.0
10	53.9	23.2	23.7	12.6	9.7	11.2	10.9	27.7	34.6	56.6	82.0	40.0
11	46.8	24.3	20.9	12.2	10.3	9.9	9.4	20.9	26.0	45.0	70.0	99.0
12	42.3	25.4	19.8	11.9	9.9	9.7	8.6	15.0	24.3	39.6	67.2	87.3
13	46.8	26.5	20.3	11.9	9.9	9.4	8.6	13.2	31.7	34.6	64.4	43.1
14	51.2	24.3	18.7	11.6	9.7	9.4	8.6	15.0	25.4	45.0	62.6	49.5
15	88.3	23.2	17.5	11.2	9.7	9.1	8.3	14.5	24.3	36.9	66.3	43.9
16	112.7	22.0	17.1	11.2	11.2	9.1	8.3	14.1	23.7	49.5	65.4	44.7
17	80.8	24.3	16.7	11.9	11.9	8.9	8.3	52.1	34.6	124.0	72.8	46.3
18	71.3	23.7	16.2	12.6	12.9	8.9	3.3	20.9	51.2	68.1	67.2	42.3
19	61.1	20.9	15.8	11.9	11.6	8.6	13.2	39.6	34.6	52.1	62.6	38.4
20	53.9	23.2	15.8	11.6	11.9	8.3	25.4	31.7	25.4	39.6	68.1	35.7
21	61.1	21.5	15.4	11.2	10.6	11.2	14.5	23.2	22.0	34.6	68.1	34.4
22	74.5	20.9	15.0	16.2	10.3	9.4	14.5	17.1	46.8	35.3	51.9	34.4
23	59.3	19.8	17.1	12.9	9.9	9.4	14.1	15.8	30.2	32.4	52.7	31.8
24	51.2	19.2	17.5	11.9	9.7	11.2	14.1	16.7	54.8	28.2	52.7	30.6
25	45.0	18.7	15.4	16.7	11.2	10.6	15.8	18.1	28.8	25.4	51.9	37.0
26	40.5	18.1	15.0	12.2	10.6	9.9	14.1	33.1	67.1	24.3	51.9	37.0
27	36.9	17.5	14.1	11.9	9.9	9.7	20.3	22.0	234.7	23.2	37.7	40.0
28	34.6	17.5	15.0	11.6	9.7	9.4	20.3	19.2	107.7	22.0	45.5	36.4
29	31.7		13.7	11.2	16.7	9.4	26.5	17.1	59.3	23.2	46.3	34.4
30	30.2		13.2	10.9	11.2	8.9	22.0	15.0	41.4	22.0	43.1	33.1
31	34.6		13.2		9.9		15.8	14.1		22.0		37.7

Table 2-4-13 (9) **Daily Discharge at No. 3 Damsite**

(Unit: cms)

Year 1968

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	50.3	21.6	13.9	8.3	15.9	33.1	25.8	15.1	20.0	23.2	20.0	28.8
2	44.3	21.6	13.5	8.3	15.1	33.1	18.7	16.8	18.7	21.0	18.7	28.8
3	42.3	20.5	13.5	7.9	14.3	37.0	16.8	30.0	17.7	23.2	18.7	25.4
4	39.2	19.1	12.7	8.7	13.9	22.6	23.8	25.3	20.5	30.6	17.7	17.1
5	40.8	18.7	12.7	9.5	13.9	37.0	20.5	20.5	21.0	25.8	17.7	16.2
6	44.7	18.2	12.3	8.7	13.1	35.1	18.2	18.7	18.7	45.8	17.3	15.0
7	40.8	18.2	11.9	9.5	13.1	35.1	20.5	17.7	18.7	24.2	17.7	15.0
8	36.4	18.2	11.9	9.5	12.3	25.3	20.5	18.2	17.7	20.5	17.7	15.4
9	42.3	17.7	11.5	9.5	12.3	46.3	18.2	18.7	16.8	19.6	17.5	15.0
10	47.9	17.3	20.5	9.5	11.5	26.4	16.8	20.5	16.3	18.7	19.6	15.0
11	46.3	17.7	20.0	9.5	12.7	27.0	16.3	20.0	19.6	17.7	23.2	14.5
12	40.0	17.3	15.1	9.5	13.5	23.2	15.9	17.7	21.6	17.7	21.6	14.5
13	37.7	16.8	13.5	9.5	12.7	20.0	17.3	17.7	22.6	18.7	21.6	13.7
14	36.4	19.6	12.3	9.5	12.3	18.7	16.3	19.6	49.5	19.6	18.7	12.9
15	33.1	17.3	11.5	9.5	12.7	17.7	15.9	20.5	42.3	23.7	19.6	14.5
16	31.8	16.8	11.5	9.5	13.9	16.8	16.3	20.5	31.8	33.1	21.6	15.8
17	31.8	16.3	19.1	9.5	13.1	15.9	15.9	24.7	27.0	30.0	20.5	17.5
18	30.6	15.9	15.9	9.5	12.3	17.3	15.5	34.4	23.7	31.2	19.6	15.8
19	28.2	15.1	12.3	9.5	26.4	17.7	15.1	28.2	22.6	24.7	18.7	14.1
20	27.0	14.7	11.5	9.5	15.9	22.1	15.1	37.7	20.5	23.2	20.5	13.7
21	26.4	14.7	11.1	9.1	16.3	17.7	20.5	31.2	21.0	22.1	23.2	13.7
22	25.3	14.7	11.1	9.1	13.5	18.7	20.5	27.0	20.5	21.0	21.6	13.7
23	24.7	15.1	10.7	9.1	15.1	22.6	24.2	21.6	22.6	20.8	22.6	13.7
24	24.2	15.5	10.3	9.5	13.9	19.6	19.1	18.7	18.7	17.8	23.7	15.4
25	23.2	15.5	10.3	10.3	28.8	17.7	17.7	19.6	17.7	19.6	26.4	14.5
26	22.6	15.5	9.1	9.9	19.1	17.7	16.8	17.7	16.8	18.7	26.4	14.1
27	22.1	15.5	9.1	9.9	16.3	17.3	18.2	16.8	16.3	18.7	25.3	13.2
28	21.6	14.7	9.1	9.9	15.2	16.8	16.8	18.7	26.4	17.7	27.0	12.9
29	33.1	14.3	9.1	22.1	14.3	21.0	16.8	20.5	30.0	18.7	47.1	12.9
30	28.2		9.1	16.3	31.8	24.7	15.9	20.5	28.2	18.7	199.5	12.9
31	22.6		8.3		36.4		15.9	20.5		18.7		12.9

Table 2-4-13 (10) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1969

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	12.6	12.6	9.1	8.9	4.1	3.8	2.0	8.3	14.1	10.7	24.7	59.8
2	12.6	12.2	9.1	8.1	4.1	3.8	2.0	6.7	8.9	11.1	23.7	69.1
3	12.6	12.6	9.1	7.3	4.1	4.1	2.2	4.6	8.6	10.3	22.6	81.1
4	12.6	11.9	8.6	7.0	4.1	4.1	2.2	5.7	9.1	10.3	21.6	80.2
5	12.6	12.2	8.6	6.7	4.1	6.7	2.0	5.7	9.9	15.1	19.6	82.0
6	12.6	12.2	8.6	6.2	4.0	5.7	5.2	5.2	31.0	13.9	25.8	126.5
7	13.7	11.9	8.6	6.2	4.6	6.2	8.1	5.2	86.1	12.7	27.0	52.7
8	20.9	11.6	8.6	6.2	4.1	5.7	6.7	5.2	31.2	30.6	26.4	47.9
9	22.6	11.6	8.6	6.2	3.8	5.2	5.7	5.2	20.5	28.2	22.6	63.5
10	27.1	11.6	8.6	6.7	3.8	4.6	5.2	5.7	16.8	24.7	21.6	101.1
11	19.8	10.9	8.1	6.5	3.8	4.1	4.4	4.9	14.7	20.0	24.2	144.5
12	17.1	10.9	8.1	6.2	3.8	3.6	3.8	4.6	13.9	18.2	25.8	118.0
13	17.1	10.9	8.1	5.7	3.8	3.6	3.6	4.9	13.1	21.0	22.6	87.3
14	18.7	10.6	8.1	5.7	3.8	3.6	3.6	4.9	12.3	21.0	21.6	104.3
15	17.5	10.6	7.5	5.2	4.1	3.6	3.6	4.9	12.3	17.3	20.5	85.2
16	17.5	10.6	7.5	5.2	5.4	3.6	3.6	4.6	12.3	16.3	18.7	69.1
17	34.5	10.6	7.5	5.2	4.9	4.9	3.3	4.6	11.9	17.3	17.7	61.7
18	15.8	9.9	9.1	5.2	4.4	3.6	5.7	4.6	11.5	53.5	17.7	55.2
19	15.8	9.9	8.3	5.2	6.5	3.3	4.4	4.6	11.5	31.2	25.8	65.4
20	15.0	9.9	7.8	4.6	5.4	3.3	4.1	4.6	11.5	64.4	44.7	73.7
21	14.5	9.7	7.5	4.6	6.0	3.3	4.6	6.7	11.9	53.5	74.6	65.4
22	14.1	9.7	7.3	4.6	7.0	3.0	5.7	6.0	13.5	45.5	61.7	75.6
23	14.5	9.7	7.0	4.6	7.5	3.0	4.9	3.8	12.7	39.2	40.0	61.7
24	14.1	9.7	7.0	4.6	5.7	3.0	9.1	6.2	14.3	33.1	167.0	51.1
25	14.1	9.7	6.7	4.4	4.9	3.0	8.3	5.7	12.7	9.5	133.9	43.9
26	14.1	9.7	6.7	4.4	4.6	2.8	6.5	5.7	11.9	25.8	181.3	37.0
27	13.7	9.7	6.7	4.4	4.4	2.2	6.5	5.2	11.1	24.7	101.1	37.7
28	13.7	9.7	6.7	4.4	4.4	2.2	12.9	4.9	11.1	22.6	63.5	40.8
29	12.9		6.7	4.4	4.4	2.2	917	4.9	11.1	22.6	52.7	43.1
30	12.9		6.7	4.1	4.1	2.0	9.7	4.9	10.7	33.1	54.2	46.3
31	12.6		6.7		3.8		9.4	5.2		28.2		83.1

Table 2-4-13 (11) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1970

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	52.7	20.5	16.3	12.7	18.5	11.1	12.7	11.9	17.3	52.7	146.7	80.2
2	49.5	20.5	17.7	12.7	15.9	15.5	12.3	10.7	16.8	37.0	124.4	254.8
3	58.9	20.5	16.3	12.7	14.3	19.1	11.9	10.3	16.3	58.9	104.3	110.6
4	60.7	20.0	15.5	12.7	13.5	23.7	7.3	10.3	15.1	51.1	89.4	89.4
5	52.7	19.6	15.5	15.5	12.7	21.0	7.3	10.3	14.7	58.0	78.3	77.4
6	51.9	21.6	16.8	14.3	13.9	19.6	11.5	12.3	15.1	59.8	72.8	68.1
7	53.5	21.0	15.9	13.5	13.9	22.6	11.5	14.3	13.5	56.1	76.5	59.8
8	51.9	18.2	15.5	12.7	13.9	21.6	11.5	15.5	14.2	38.4	97.9	44.7
9	52.7	20.0	15.9	12.7	13.5	19.6	11.1	13.5	12.7	34.4	119.1	54.2
10	44.7	18.2	15.9	12.7	13.1	19.6	11.1	15.1	16.3	35.1	108.5	54.0
11	58.9	20.0	15.1	12.7	12.7	18.7	11.1	18.7	50.3	40.0	86.3	47.9
12	47.1	19.1	14.7	12.3	13.1	19.6	11.9	37.0	116.7	70.0	120.1	69.1
13	41.5	19.1	14.3	12.3	15.5	20.1	13.9	25.3	118.0	97.9	90.5	57.0
14	38.4	18.7	14.3	11.9	15.9	29.1	15.1	19.6	43.0	545.5	79.3	56.1
15	37.0	18.2	13.9	11.9	16.8	18.2	13.9	20.5	34.4	248.5	71.8	27.0
16	35.7	17.7	13.9	11.9	13.5	17.7	12.7	25.8	31.2	218.3	135.0	21.0
17	35.1	17.3	13.5	11.9	13.5	16.8	11.5	27.6	38.4	133.9	137.1	102.1
18	33.7	17.3	13.5	11.9	13.5	16.8	10.7	21.6	35.7	101.1	122.3	108.5
19	32.4	16.8	13.5	11.9	13.9	19.1	9.9	18.2	30.0	79.3	327.7	96.9
20	31.2	16.3	13.5	11.9	14.3	17.1	9.9	16.8	27.6	65.4	372.9	90.5
21	28.2	16.3	13.5	13.5	13.9	15.1	9.5	17.3	25.3	55.2	136.0	80.2
22	28.8	16.3	13.1	15.1	12.7	16.8	11.9	28.2	23.7	51.1	111.7	74.6
23	27.0	16.3	13.1	17.7	12.3	18.1	11.1	22.6	22.6	86.3	95.8	69.1
24	26.4	15.9	13.1	14.7	11.9	17.7	9.5	19.6	21.6	61.7	108.5	59.8
25	25.8	15.5	13.9	13.1	11.5	15.9	9.1	21.0	23.2	57.0	100.0	56.1
26	24.7	16.3	13.5	14.3	11.9	15.1	8.7	31.8	27.6	58.0	87.3	55.2
27	23.7	15.9	13.5	15.1	12.7	14.3	8.7	36.4	25.3	82.0	76.5	54.2
28	23.2	15.9	13.1	14.7	13.5	13.5	8.3	25.8	23.2	82.0	94.7	52.7
29	22.6		12.7	17.3	13.5	13.1	8.7	20.5	22.1	86.3	92.6	51.1
30	22.1		12.7	17.7	12.7	13.1	15.5	19.1	45.5	113.8	79.3	50.3
31	20.5		12.7		12.3		15.5	19.1		211.7		49.5

Table 2-4-13 (12) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1971

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	65.4	21.0	20.0	38.4	22.1	33.7	30.3	41.5	264.0	51.1	38.4	142.4
2	92.6	21.0	19.6	37.7	23.2	47.1	26.4	37.0	50.3	40.8	32.4	121.2
3	95.8	20.5	19.1	34.4	24.7	40.8	24.7	25.8	52.7	23.2	36.4	102.1
4	165.8	21.0	18.7	31.8	28.8	35.1	29.4	28.2	48.7	31.2	37.0	82.0
5	58.9	27.6	20.0	28.2	25.3	31.8	35.1	24.2	41.5	209.5	34.4	78.3
6	55.2	28.2	19.6	30.0	28.2	28.6	28.2	23.2	47.1	144.5	35.1	67.2
7	47.1	28.8	17.7	29.4	33.1	29.4	45.5	24.7	30.6	86.3	33.1	147.9
8	43.1	29.4	17.7	25.3	27.0	30.6	37.0	23.7	31.8	69.1	35.7	70.0
9	39.2	31.2	17.3	30.0	28.2	30.0	35.7	23.2	37.0	60.7	44.7	92.6
10	43.1	28.8	16.8	30.6	35.1	28.8	60.7	22.6	40.8	613.9	91.6	144.5
11	40.8	28.2	16.8	28.8	36.4	27.0	35.1	21.6	36.4	334.0	225.9	243.5
12	37.0	27.0	42.3	27.0	58.9	31.8	79.3	21.0	34.4	242.2	84.2	140.3
13	33.7	27.6	81.1	32.4	70.0	31.8	55.2	20.5	30.6	213.3	59.8	93.7
14	30.6	23.7	178.9	30.6	43.9	32.4	58.0	21.0	38.4	152.7	47.9	75.6
15	28.8	22.8	120.1	26.4	72.8	37.0	57.0	21.0	30.6	133.9	40.8	69.1
16	28.2	21.6	79.3	25.3	62.6	59.8	60.7	20.5	33.7	120.1	35.7	60.7
17	27.0	22.6	65.4	28.8	53.5	68.1	55.2	20.0	27.6	93.7	31.2	67.2
18	27.0	30.0	53.5	28.2	55.2	40.8	109.6	19.6	23.2	81.1	82.0	79.3
19	26.4	51.9	45.5	24.2	47.1	36.4	78.3	18.2	20.5	69.1	195.2	90.5
20	25.3	45.5	42.3	25.3	68.1	34.4	58.0	17.7	19.6	60.7	85.2	78.3
21	24.2	32.4	39.2	23.7	64.4	32.4	44.7	17.7	14.3	52.7	139.2	68.1
22	23.2	30.0	34.4	27.0	67.2	29.4	35.1	17.3	43.1	60.7	74.6	101.1
23	22.6	27.6	33.1	27.6	36.4	28.2	33.7	17.3	24.2	68.1	87.3	90.5
24	22.1	25.3	35.7	27.0	31.2	28.2	43.1	17.3	23.7	79.3	243.5	73.7
25	21.6	23.7	33.7	27.6	28.2	31.2	37.7	17.3	24.2	86.3	486.9	62.6
26	21.0	22.6	32.4	25.8	28.2	28.2	35.7	16.3	20.0	73.7	213.3	52.7
27	22.6	21.0	30.6	24.2	30.6	30.0	31.2	16.3	26.4	67.2	165.8	47.9
28	23.7	20.5	33.1	23.7	34.4	28.2	28.2	16.3	37.7	61.7	125.4	40.8
29	28.8		32.4	21.6	57.0	35.7	27.0	15.9	47.1	57.0	111.1	35.1
30	26.4		34.4	22.1	28.8	51.9	27.0	15.9	35.1	43.9	126.5	31.2
31	23.2		37.0		28.2		30.0	15.9		39.2		61.5

Table 2-4-13 (13) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1972

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	95.7	14.1	6.5	5.7	6.5	9.4	9.1	22.0	11.9	9.9	7.0	55.7
2	113.9	13.7	6.5	10.9	6.2	8.1	8.1	19.8	11.6	9.7	6.7	54.8
3	78.7	12.9	6.7	9.1	6.2	7.3	8.6	18.7	11.6	10.9	6.5	53.0
4	59.3	11.9	6.7	8.3	6.0	7.0	7.8	15.8	12.6	10.3	6.2	50.3
5	51.2	10.9	7.0	6.5	6.0	9.7	8.3	13.7	11.9	10.3	7.3	49.5
6	47.7	9.9	6.7	6.2	6.0	8.3	7.3	11.9	11.6	9.9	9.4	46.8
7	52.1	9.4	6.7	6.2	5.7	7.5	414.4	11.2	11.2	39.6	131.6	45.0
8	58.4	8.9	6.5	6.0	5.7	7.0	92.5	10.9	19.8	18.7	26.5	41.4
9	57.5	8.9	6.5	6.5	5.7	6.2	55.7	9.7	19.2	11.9	26.0	38.7
10	62.0	8.6	6.5	7.8	5.7	6.0	23.2	34.6	18.7	11.2	34.7	37.8
11	53.9	7.9	6.2	8.1	6.6	5.7	28.8	30.2	49.5	11.2	18.1	36.1
12	34.6	8.1	6.2	9.1	8.1	5.4	23.7	28.2	43.2	10.3	16.7	35.3
13	29.5	8.1	6.5	11.2	6.0	5.4	23.7	27.1	33.9	9.1	15.8	59.3
14	30.2	8.1	7.0	9.1	5.7	5.4	19.8	24.8	22.6	8.6	14.5	79.8
15	25.4	8.1	6.5	8.1	6.2	5.7	17.5	19.8	19.8	8.6	15.4	68.1
16	24.3	8.3	6.2	8.3	5.7	6.0	16.7	15.0	18.1	8.3	14.5	58.4
17	20.3	7.8	6.2	7.5	11.9	8.3	17.1	13.2	17.1	7.8	13.7	47.7
18	17.1	8.1	6.2	6.5	9.4	8.1	47.7	12.6	16.2	7.5	16.2	45.0
19	16.2	7.3	6.0	6.5	12.2	8.1	66.0	11.9	15.0	7.5	13.7	43.2
20	15.4	7.3	6.7	6.2	14.5	7.8	26.0	15.4	13.7	7.3	15.0	41.4
21	15.0	7.3	6.9	6.0	13.7	7.5	17.1	14.5	12.9	7.3	14.5	37.8
22	14.5	7.0	8.3	6.0	19.8	7.0	17.5	13.2	12.6	7.0	14.5	39.6
23	14.5	7.0	7.0	5.7	15.4	7.0	15.4	69.2	11.9	8.3	15.8	31.7
24	14.1	7.0	6.7	5.7	15.8	6.7	13.2	16.7	11.6	8.1	15.5	28.8
25	14.5	6.7	6.5	6.5	19.2	8.1	11.9	13.7	11.2	7.8	52.1	27.7
26	12.9	6.7	6.2	8.1	15.8	13.2	10.9	12.9	10.9	7.8	74.5	23.7
27	11.6	6.7	6.2	7.3	14.5	8.6	10.3	12.6	10.9	7.5	73.4	26.5
28	11.2	6.7	6.0	6.7	12.9	10.6	9.7	12.6	11.9	7.5	68.1	26.0
29	14.1	6.5	6.0	6.5	14.1	10.6	38.7	12.2	10.9	7.3	63.9	47.7
30	18.1		6.0	6.7	13.2	9.7	62.9	11.9	10.6	7.3	60.2	24.3
31	16.2		6.0		10.9		25.4	11.9		7.0		24.3

Table 2-4-13 (14) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1973

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	23.7	15.4	7.8	6.0	8.1	6.0	6.0	5.4	3.8	4.4	28.8	53.0
2	23.2	14.5	7.8	5.7	7.8	6.2	5.4	4.9	3.8	3.6	23.2	45.9
3	22.6	14.1	7.5	5.4	7.8	6.2	5.2	6.0	3.6	3.8	22.0	38.7
4	22.0	13.7	7.5	5.4	7.5	6.2	4.9	6.0	2.5	4.6	21.5	31.7
5	22.0	13.2	7.5	5.7	7.5	5.4	4.6	6.0	1.7	5.4	20.3	33.1
6	22.6	13.2	6.7	5.7	7.0	5.2	5.7	5.7	0.9	13.2	31.0	31.7
7	22.0	12.9	6.7	5.7	7.0	5.2	5.4	5.4	4.1	25.4	29.5	30.2
8	24.3	11.9	6.7	5.7	6.7	5.4	5.2	5.2	7.5	26.5	39.6	57.5
9	24.8	11.9	6.7	5.7	6.7	5.7	4.9	7.5	9.9	17.5	29.5	60.2
10	23.2	12.6	6.5	5.7	7.0	5.4	6.2	6.2	9.1	14.1	28.8	67.1
11	22.0	12.2	6.5	5.4	6.7	5.2	5.2	6.5	6.0	11.6	24.8	48.6
12	22.6	10.9	6.5	6.7	6.7	4.4	7.0	5.4	5.2	10.9	22.6	46.8
13	21.5	10.6	6.2	6.2	6.5	4.1	7.3	5.2	4.9	9.9	22.0	45.9
14	20.9	9.9	6.2	6.0	9.4	4.6	7.0	4.9	6.7	87.2	33.9	43.2
15	21.5	9.7	6.2	6.0	9.1	4.9	6.7	3.0	3.8	180.6	17.5	39.6
16	20.9	9.7	6.5	6.0	8.3	4.4	6.7	2.5	6.5	212.0	57.5	34.6
17	20.3	9.4	7.0	6.0	8.1	4.4	5.7	2.0	4.4	163.0	50.3	29.5
18	18.7	9.4	8.1	5.7	7.8	4.1	4.1	11.2	3.6	74.5	47.7	27.7
19	18.1	10.6	8.1	5.7	8.3	4.4	3.0	4.1	2.8	48.6	104.1	27.1
20	17.5	8.9	7.8	8.1	9.9	4.1	2.8	7.0	5.2	41.4	110.2	34.6
21	17.5	8.9	7.0	8.1	7.5	4.1	2.5	19.2	4.4	27.7	262.3	52.1
22	16.2	8.9	6.5	8.3	7.3	4.1	2.2	16.2	4.1	16.2	331.5	93.8
23	16.2	8.6	6.2	8.3	7.0	3.8	2.2	6.2	3.8	13.7	490.2	169.3
24	15.8	8.6	6.0	8.3	6.7	3.8	2.0	4.4	8.1	11.9	253.5	96.7
25	15.8	8.6	6.0	8.3	6.5	4.1	2.0	3.6	6.0	13.2	114.0	61.1
26	15.4	8.6	5.7	8.1	6.5	3.8	1.7	3.3	4.9	21.5	109.0	51.2
27	15.4	8.6	5.7	7.8	6.2	3.8	2.2	3.0	4.1	15.0	90.4	60.2
28	15.0	8.6	6.0	7.8	6.0	3.8	2.0	3.8	3.6	13.7	57.5	60.2
29	16.2		5.7	7.8	6.0	3.8	1.7	3.6	3.3	17.5	48.6	35.3
30	17.5		5.7	8.1	5.7	3.6	1.7	3.6	7.8	21.5	43.2	127.8
31	17.1		6.0		5.7		6.2	4.1		60.2		104.1

Table 2-4-13 (15) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1974

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	91.4	11.2	11.6	3.6	7.3	3.8	12.6	14.1	12.6	14.5	38.7	129.1
2	76.6	10.6	4.6	4.1	6.7	3.8	12.2	13.7	12.2	14.1	62.9	105.2
3	69.2	9.9	9.7	4.6	6.2	3.8	11.9	13.2	11.9	14.1	126.7	99.9
4	56.6	9.7	8.3	4.4	5.4	3.6	11.6	13.2	11.2	13.7	139.1	93.5
5	57.5	9.4	7.8	4.4	5.2	3.6	11.2	13.2	10.3	13.2	134.1	87.2
6	51.2	9.1	7.5	4.1	4.9	3.3	11.2	12.9	9.9	13.2	127.8	77.7
7	41.4	9.1	7.3	4.1	4.4	3.0	10.9	18.1	9.9	12.9	120.3	59.3
8	42.3	8.9	7.0	3.8	4.1	3.0	11.9	16.7	9.7	12.9	110.2	55.7
9	40.5	8.6	6.5	3.6	3.8	2.8	11.9	16.2	9.7	12.6	300.0	11.5
10	36.9	8.3	6.2	3.6	3.8	264.8	12.2	15.8	9.4	12.2	180.6	49.5
11	34.6	9.4	6.0	3.6	3.6	439.3	12.2	15.0	9.1	20.3	89.3	25.4
12	33.1	9.9	6.0	3.3	3.6	180.6	11.9	14.5	10.3	31.0	67.1	117.8
13	32.4	9.4	5.7	3.3	4.1	105.2	11.6	16.1	14.5	25.3	63.9	115.2
14	31.0	9.1	5.7	3.3	3.8	40.5	11.2	18.7	43.2	22.6	61.1	114.0
15	34.6	8.9	5.4	3.0	3.6	31.0	10.9	18.7	36.9	24.3	153.0	111.5
16	26.0	8.6	5.4	3.6	3.3	20.9	10.6	16.7	31.0	27.7	89.3	175.6
17	25.4	8.6	5.4	3.8	3.3	12.2	10.3	25.4	25.4	406.9	47.7	155.5
18	24.8	8.3	5.2	3.6	3.0	11.2	15.0	26.0	21.5	186.9	46.8	153.0
19	22.0	8.3	5.2	3.3	3.0	10.9	15.0	22.0	20.3	58.4	49.5	150.4
20	19.8	8.1	4.9	3.3	2.8	10.6	53.9	19.8	19.2	40.5	53.9	149.2
21	18.7	8.1	4.9	3.0	2.8	10.3	45.0	17.1	18.7	37.8	62.0	184.4
22	17.1	7.8	4.9	3.0	2.5	9.9	26.5	15.8	18.1	34.6	60.2	183.1
23	16.2	7.5	4.6	2.8	2.5	9.9	18.7	14.1	17.5	33.9	56.6	163.0
24	16.7	7.0	4.6	2.8	2.2	9.7	17.1	13.7	17.1	33.9	53.0	161.8
25	17.5	6.7	4.4	2.8	2.2	9.4	16.2	13.2	16.7	33.1	48.6	160.5
26	16.2	6.5	4.1	2.5	3.6	9.4	15.8	12.9	16.2	33.1	45.9	159.2
27	15.8	8.9	4.1	2.5	4.6	9.1	15.4	12.6	15.8	32.4	42.3	154.2
28	15.8	11.9	4.1	3.3	3.3	8.9	15.4	12.2	15.8	47.7	39.6	150.4
29	15.4		3.8	3.0	3.3	8.9	15.0	13.2	15.4	40.5	215.8	147.9
30	13.7		3.8	3.0	4.4	8.6	14.5	12.9	15.0	43.2	155.5	144.2
31	11.9		3.6		4.1		14.1	12.6		57.5		141.6

Table 2-4-13 (16) **Daily Discharge at No.3 Damsite**

(Unit: cms)

Year 1979

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	20.9	14.5	11.6	13.6	16.5	17.4	22.9	32.4	23.5	38.4	24.5	44.8
2	20.6	14.2	11.9	13.3	15.3	20.2	21.2	25.9	34.6	69.8	24.9	45.6
3	19.9	13.9	11.9	13.0	14.2	28.0	34.6	24.2	30.5	75.5	27.0	43.6
4	19.6	13.6	8.8	13.0	14.7	29.4	38.4	35.4	25.6	80.9	23.5	40.8
5	19.3	13.3	10.9	13.0	14.5	25.6	29.4	30.2	28.7	64.3	24.9	38.4
6	19.0	13.0	10.9	13.0	14.2	21.5	24.9	26.3	27.0	52.4	34.2	36.9
7	23.2	13.0	10.6	13.3	13.9	19.6	25.9	26.3	28.4	46.0	35.4	38.0
8	22.5	13.0	10.3	13.0	13.6	23.9	36.9	24.2	24.2	42.0	30.9	46.5
9	22.2	13.3	10.1	13.0	13.3	38.0	29.4	29.1	25.2	39.2	30.2	40.8
10	21.9	13.0	9.8	12.8	13.3	38.8	24.9	30.2	27.7	36.9	28.0	39.6
11	21.5	12.8	9.6	12.5	13.0	28.0	23.5	28.0	27.0	36.1	28.4	37.3
12	21.2	12.5	9.6	12.5	13.0	23.5	22.9	24.9	23.2	40.0	27.7	34.6
13	18.7	12.2	9.3	12.2	15.3	20.2	22.5	23.9	22.9	35.0	27.3	34.2
14	18.4	11.9	9.3	12.2	16.5	18.7	26.3	22.9	23.2	23.2	33.8	33.8
15	18.0	12.5	9.0	12.5	16.5	20.2	30.5	21.5	26.3	27.7	39.6	33.1
16	17.7	12.5	14.2	12.5	17.7	18.4	25.2	20.9	25.6	33.1	36.9	32.4
17	17.1	12.5	14.2	15.0	15.3	18.7	21.9	20.2	32.4	32.0	35.0	31.6
18	17.1	12.5	13.9	14.7	24.9	19.3	20.6	19.6	29.1	30.5	33.1	30.2
19	16.5	12.5	13.6	14.2	24.2	18.4	19.9	19.3	31.3	29.8	36.9	30.5
20	17.1	11.9	13.6	15.6	18.7	17.4	20.2	18.7	34.6	29.1	38.8	29.8
21	16.5	11.6	13.9	31.3	16.5	16.8	26.6	18.4	29.4	29.4	40.4	29.8
22	15.9	11.4	14.2	22.2	15.3	16.2	22.5	17.7	26.3	29.1	36.9	30.9
23	15.3	11.1	14.2	35.0	14.5	28.4	19.9	17.4	28.4	28.4	37.7	32.0
24	15.0	10.9	17.7	23.2	14.7	21.5	19.0	17.1	27.0	29.4	38.4	35.0
25	14.7	10.6	23.2	19.9	35.0	20.2	19.0	16.8	24.9	29.1	39.2	38.0
26	14.5	10.3	18.0	17.1	27.0	22.2	32.7	17.1	23.9	27.7	50.7	39.6
27	14.2	10.3	15.9	15.9	21.5	24.5	47.3	22.5	39.6	27.0	49.4	41.2
28	13.6	10.3	14.7	15.9	19.0	29.8	36.5	19.0	33.8	26.6	47.3	42.8
29	13.6		11.4	30.2	17.7	27.0	28.4	17.7	35.7	26.6	44.8	40.8
30	13.6		13.9	19.0	18.4	22.2	25.9	20.9	37.3	25.9	44.4	35.7
31	13.6		13.6		16.5		26.6	19.6		24.9		34.2

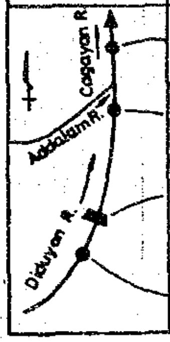
Table 2-4-14 Discharge Duration at No.3 Damsite

Year	Maximum Discharge (m^3/sec.)	95-day Discharge (m^3/sec.)	185-day Discharge (m^3/sec.)	275-day Discharge (m^3/sec.)	355-day Discharge (m^3/sec.)	Minimum Discharge (m^3/sec.)	Annual Mean Discharge (m^3/sec.)
1960	233.56	35.78	27.14	21.88	18.33	17.53	32.0
1961	264.04	29.03	24.36	19.95	16.55	16.17	28.0
1962	330.51	30.49	25.14	20.27	17.44	16.78	29.4
1963	298.31	29.76	24.49	19.95	16.02	15.53	28.6
1964	413.16	43.31	23.74	17.97	12.24	9.13	49.8
1965	137.87	33.87	24.28	14.95	11.58	10.59	28.7
1966	607.33	27.52	17.53	13.23	9.39	8.87	37.0
1967	602.37	37.71	20.91	11.91	8.87	8.34	32.6
1968	199.47	22.10	17.73	14.69	9.13	8.34	20.2
1969	181.27	17.27	9.13	4.90	3.04	1.98	18.3
1970	545.54	49.49	18.66	13.50	9.92	7.28	38.8
1971	613.95	57.03	33.74	26.40	17.27	14.29	52.1
1972	414.41	18.09	11.25	7.28	5.69	5.42	19.2
1973	490.23	17.53	7.54	5.42	2.25	0.93	20.9
1974	439.29	33.15	12.90	6.22	2.78	2.25	34.0
1979	80.85	29.80	22.20	14.74	10.32	8.80	23.9
Average	365.76	32.00	20.05	14.58	10.68	9.51	30.8

Table 2-4-15 Monthly Riverflow at No.3 Damsite for 1960 ~ 1974 & 1979

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Mean
1960	36.534	28.204	26.528	21.311	19.476	24.866	24.503	35.981	30.179	56.057	29.253	31.223	384.115	22.010
1961	27.387	22.355	24.158	18.093	21.502	19.742	28.406	24.587	26.369	24.991	46.718	41.815	336.123	28.010
1962	27.922	23.066	20.970	22.501	19.786	18.213	28.394	34.123	30.914	32.574	55.235	39.134	352.832	29.403
1963	27.567	27.274	20.413	18.228	16.180	28.433	27.373	48.530	34.425	26.290	22.253	46.487	343.453	28.621
1964	27.796	24.165	21.752	17.985	18.099	24.635	29.477	29.814	33.071	76.488	223.107	71,081	597.472	49.789
1965	45.512	36.084	21.795	16.555	13.509	13.081	25.809	22.568	38.444	30.790	38.898	41.895	344.940	28.745
1966	24.630	16.413	11.676	9.778	41.996	19.380	19.951	28.743	16.650	23.702	109.895	120.853	443.667	36.972
1967	61.528	23.774	18.167	12.487	10.624	9.811	12.826	19.869	41.329	40.352	97.333	42.580	390.680	32.557
1968	33.730	17.028	12.412	10.014	16.179	24.042	18.121	21.781	22.853	22.694	27.687	15.752	242.293	20.191
1969	16.116	10.805	7.866	5.619	4.635	3.802	5.436	5.288	16.076	25.345	46.829	71.412	219.229	18.269
1970	38.485	18.203	14.897	13.534	13.701	17.709	11.149	19.892	31.242	97.619	118.110	71.683	465.724	38.810
1971	40.975	27.191	41.543	28.888	41.242	35.282	44.281	21.254	41.170	113.572	102.675	87.467	624.740	52.062
1972	35.492	8.618	6.516	7.302	10.038	7.714	37.255	18.318	16.814	10.052	28.937	42.759	229.810	19.151
1973	19.763	10.856	6.680	6.642	7.269	4.675	4.375	6.843	4.869	38.397	85.499	56.244	251.112	20.926
1974	32.985	8.856	5.751	3.440	3.923	41.738	15.934	15.749	16.816	45.325	95.377	122.145	408.039	34.003
1979	17.838	12.321	12.696	16.487	17.251	23.141	26.660	22.842	28.561	37.608	34.998	36.856	287.259	23.938
Total	514.260	335.213	273.320	228.064	275.410	316.264	359.950	375.182	429.782	711.856	1162.806	939.381	5921.488	493.457
Mean	32.141	20.951	17.083	14.254	17.213	19.767	22.497	23.449	26.861	44.491	72.675	58.711	370.093	30.841

Method of Obtaining Inflow to Diduyon Reservoir

Location	Site	C.A. (km^2)	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1979	Equation for Conversion
	Pangal (BPW)	4,244	●	●	●	●	●	●	●	●	●	●	●		●				$y = ax + b$
	Aglipay (BPW)	721	◌	◌	◌	◌	◌	●	●	●	●	●	●	●	●	●	●		$y = ax$
	Diduyon Damsite	477	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	$y - ax$
	Kamamasi (NPC)	462																●	

Remarks:

- ● - Actually observed data
- ◌ - Arithmetically computated Data
- ○ - Obtained inflow to reservoir
- ↓ - Way of conversion

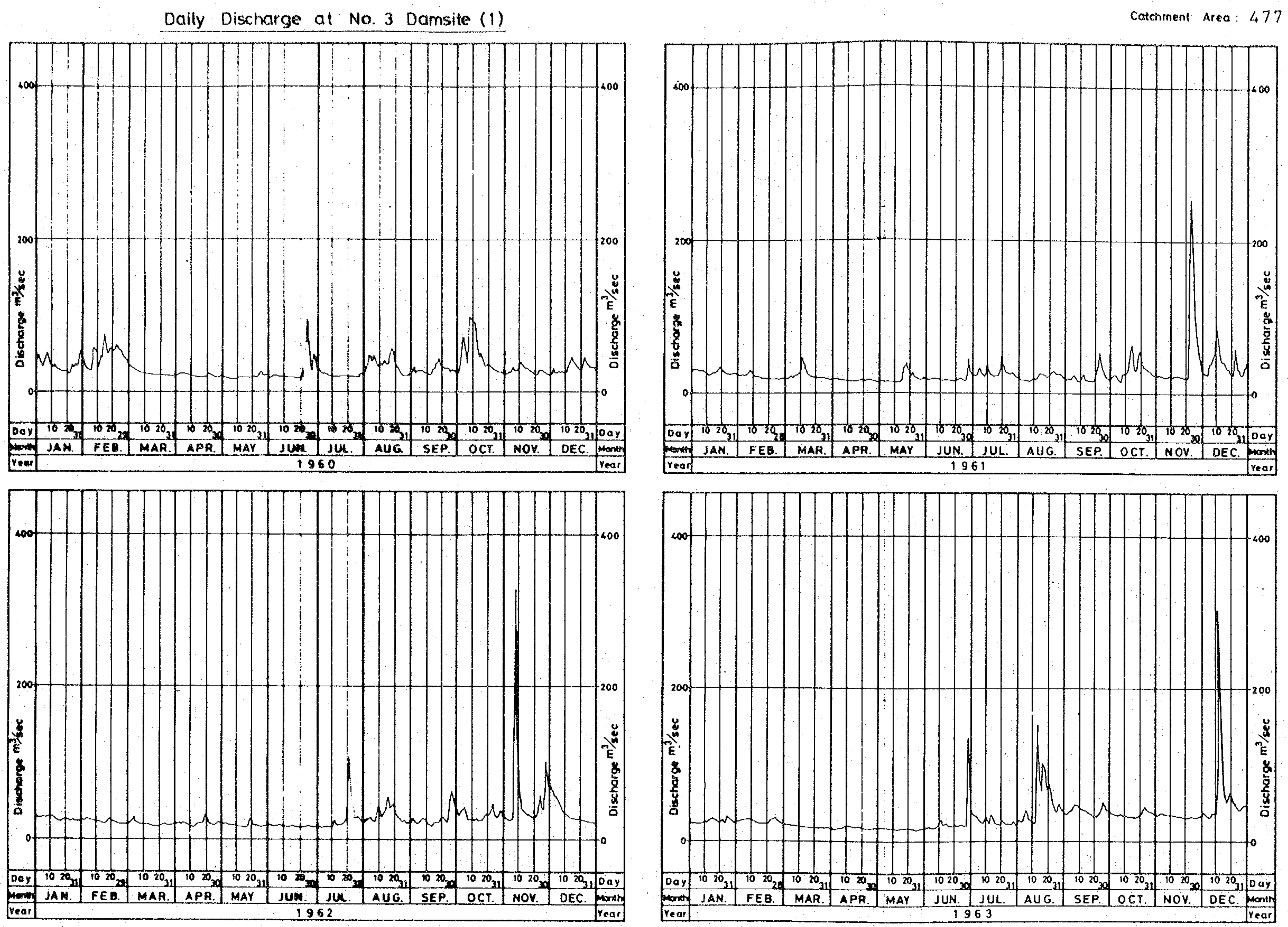
Diduyon Hydroelectric Project
Upper Cagayan River
Republic of the Philippines

Japan International Cooperation Agency

Method of Obtaining Inflow to Diduyon Reservoir

October 1980 Fig. 2-4-19

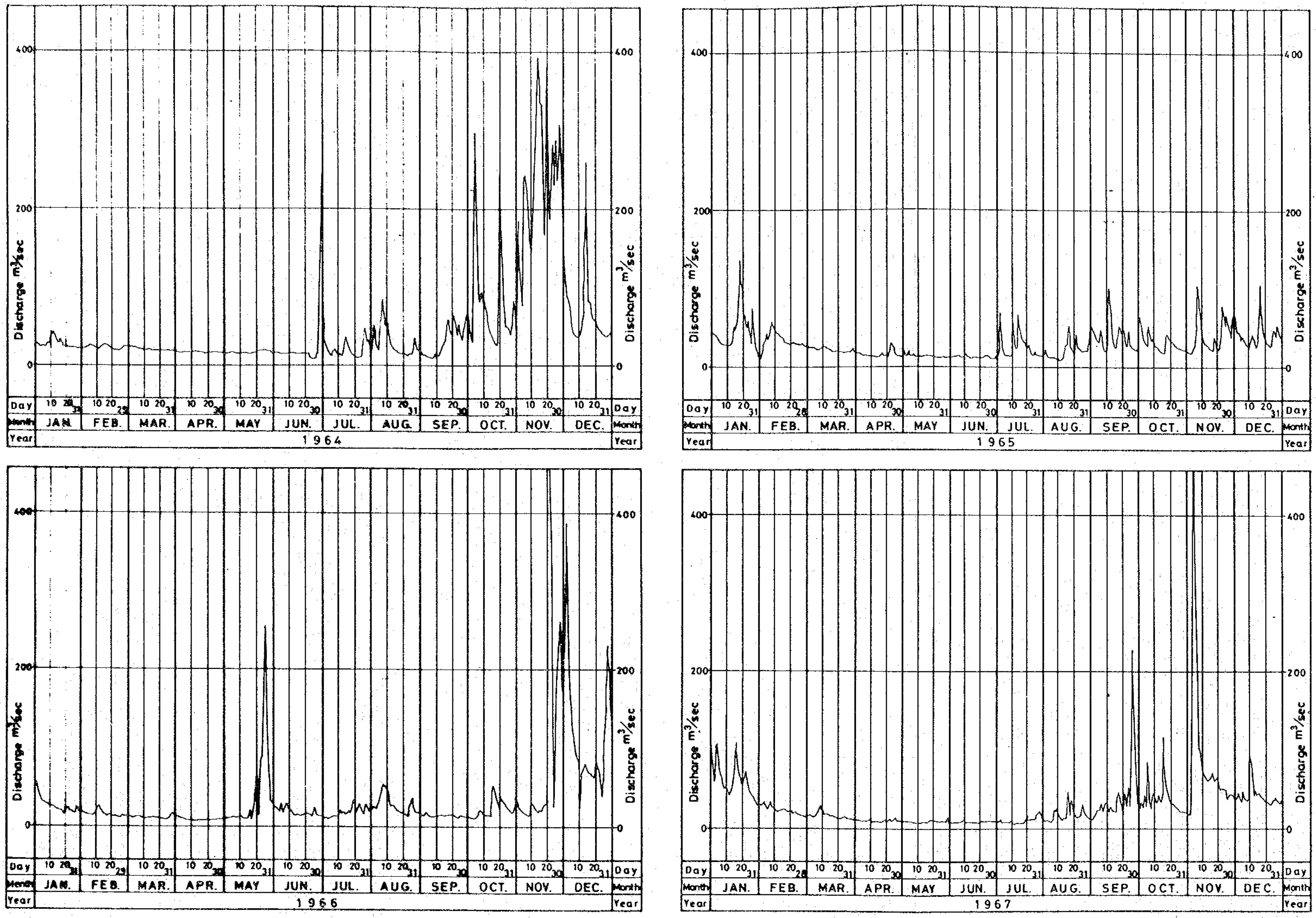
Station Name : No. 3 Damsite
Catchment Area : 477 km²



Diduyon Hydroelectric Project Upper Cagayan River Republic of the Philippines	
Japan International Cooperation Agency	
Daily Discharge at No. 3 Damsite (1)	
October 1980	Fig. 2-4-20 (1)

Station Name : No. 3 Damsite
Catchment Area : 477 km²

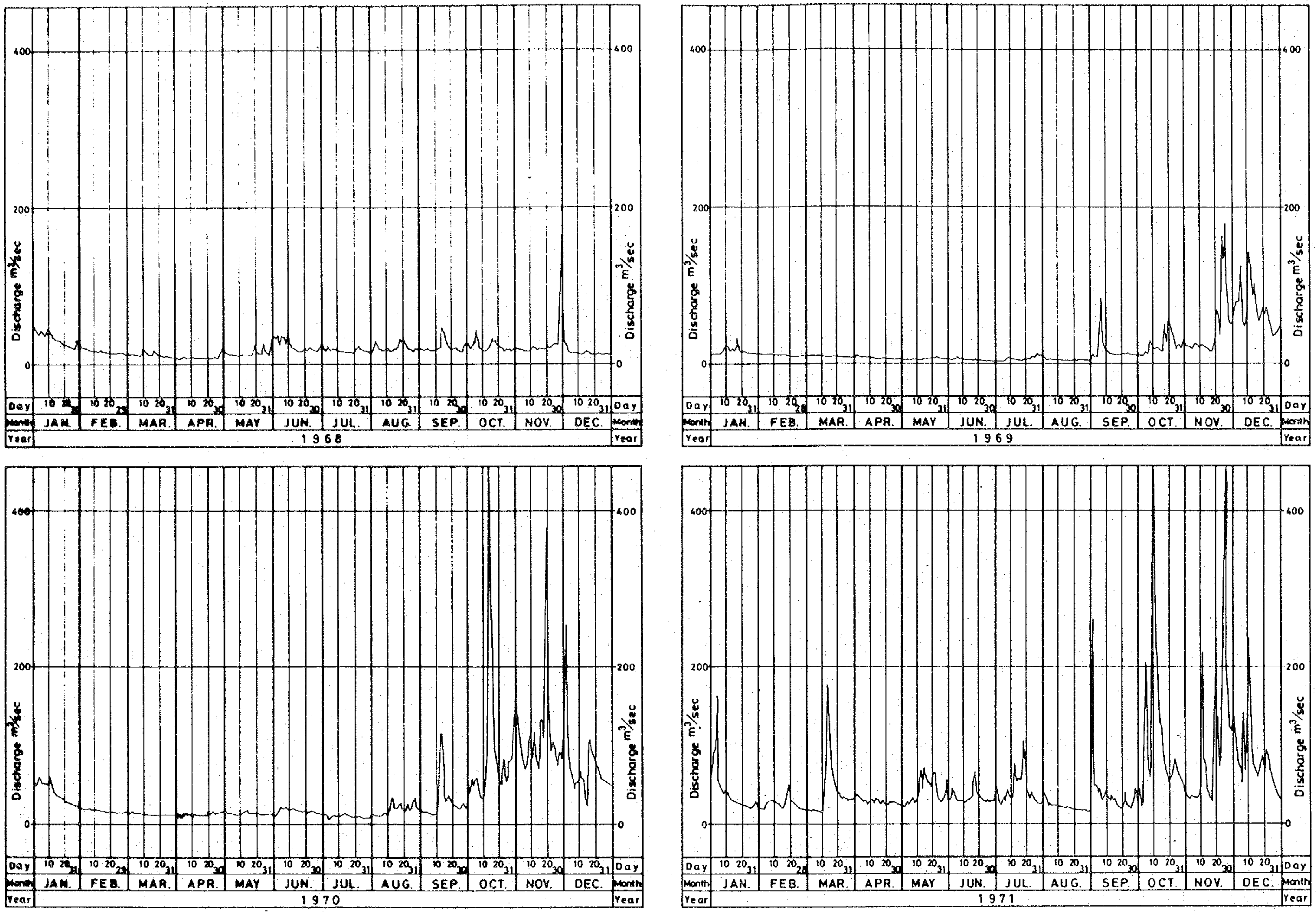
Daily Discharge at No. 3 Damsite (2)



Diduyon Hydroelectric Project Upper Cagayan River Republic of the Philippines	
Japan International Cooperation Agency	
Daily Discharge at No. 3 Damsite (2)	
October 1980	Fig. 2-4-20 (2)

Station Name : No. 3 Damsite
Catchment Area : 477 km²

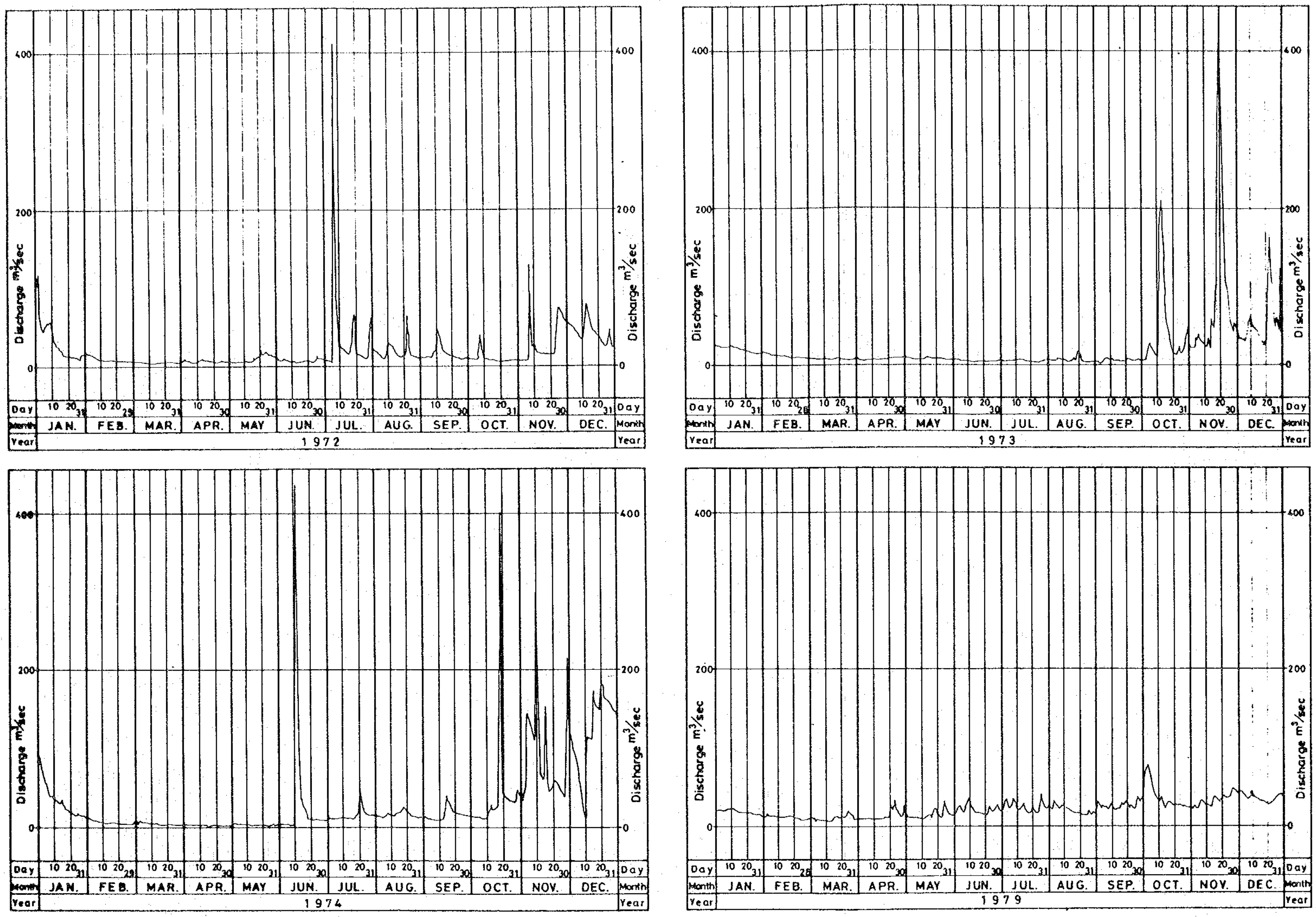
Daily Discharge at No. 3 Damsite (3)



Diduyon Hydroelectric Project Upper Cagayan River Republic of the Philippines
Japan International Cooperation Agency
Daily Discharge at No. 3 Damsite (3)
October 1980 Fig. 2-4-20 (3)

Station Name : No.3 Damsite
Catchment Area : 477 km^2

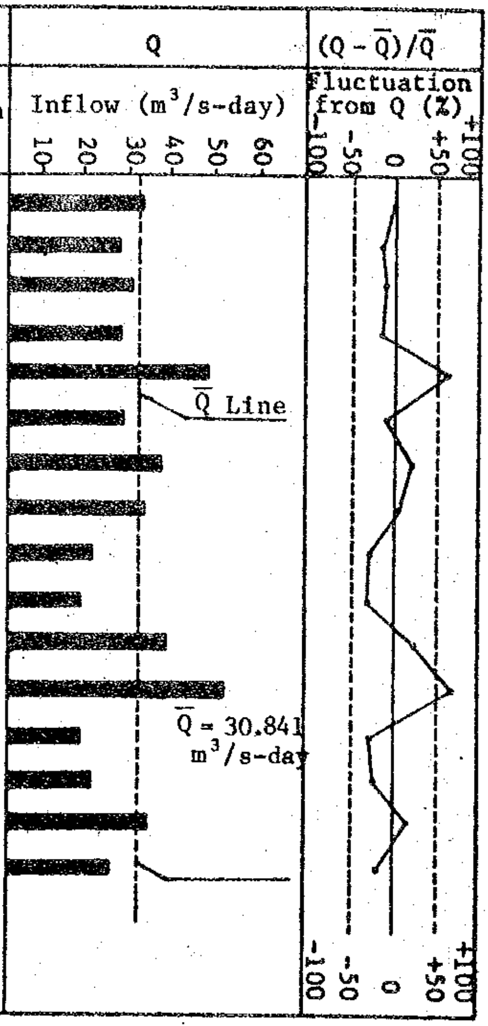
Daily Discharge at No. 3 Damsite (4)



Diduyon Hydroelectric Project Upper Cagayan River Republic of the Philippines
Japan International Cooperation Agency
Daily Discharge at No. 3 Damsite (4)
October 1980 Fig. 2-4-20 (4)

Inflow to Diduyon Reservoir at Damsite

Year	Q Daily Average Inflow to Reservoir (m^3/s - day)	$Q - \bar{Q}$ Excess from Q (m^3/s - day)	$(Q - \bar{Q})/\bar{Q}$ Fructu-ation from Q (%)
1960	32.009	+ 1.168	+ 3.9
1961	28.010	- 2.831	- 9.2
1962	29.403	- 1.438	- 4.7
1963	28.621	- 2.220	- 7.2
1964	49.789	+18.948	+61.4
1965	28.745	- 2.096	- 6.8
1966	36.972	+ 6.131	+19.9
1967	32.557	+ 1.716	+ 5.6
1968	20.191	-10.650	-34.5
1969	18.269	-12.572	-40.8
1970	38.810	+ 7.969	+25.8
1971	52.062	+21.221	+68.8
1972	19.151	-11.690	-37.9
1973	20.926	- 9.915	-32.1
1974	34.003	+ 3.162	+10.3
1979	23.938	- 6.903	-22.4
16 years	Σ:493.456 $\bar{Q}$: 30.841		



Diduyon Hydroelectric Project
Upper Cagayan River
Republic of the Philippines

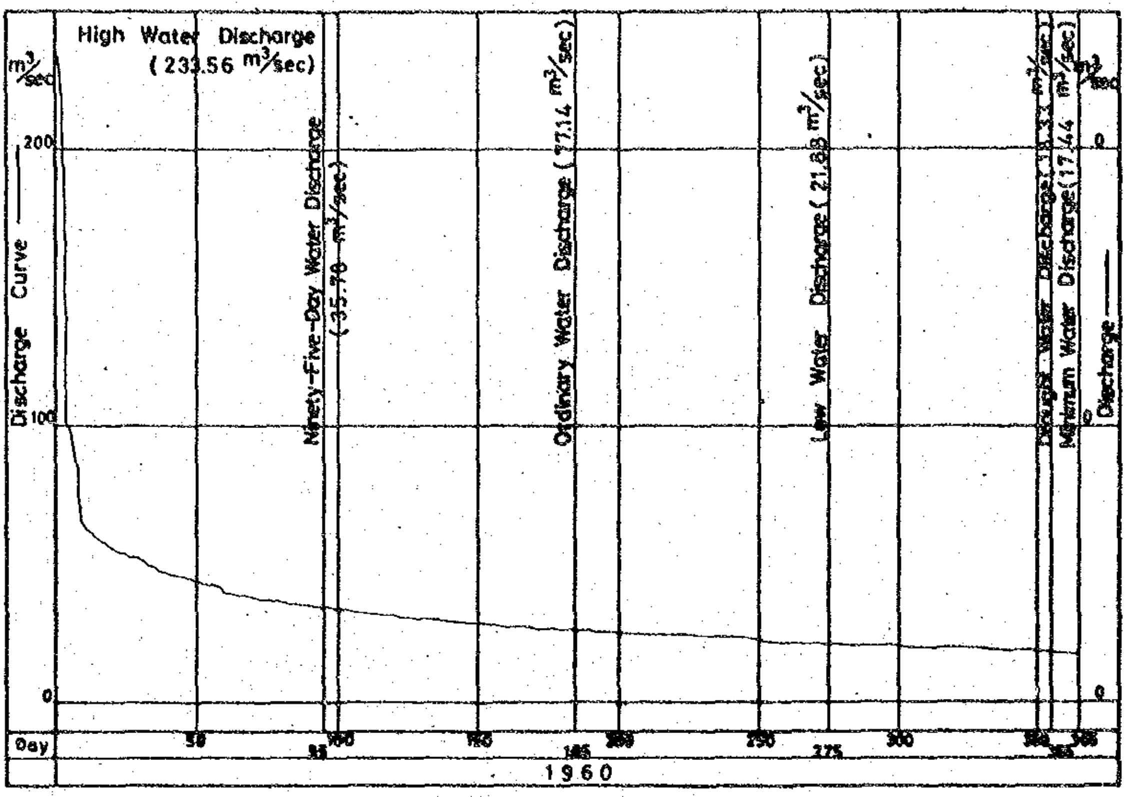
Japan International Cooperation Agency

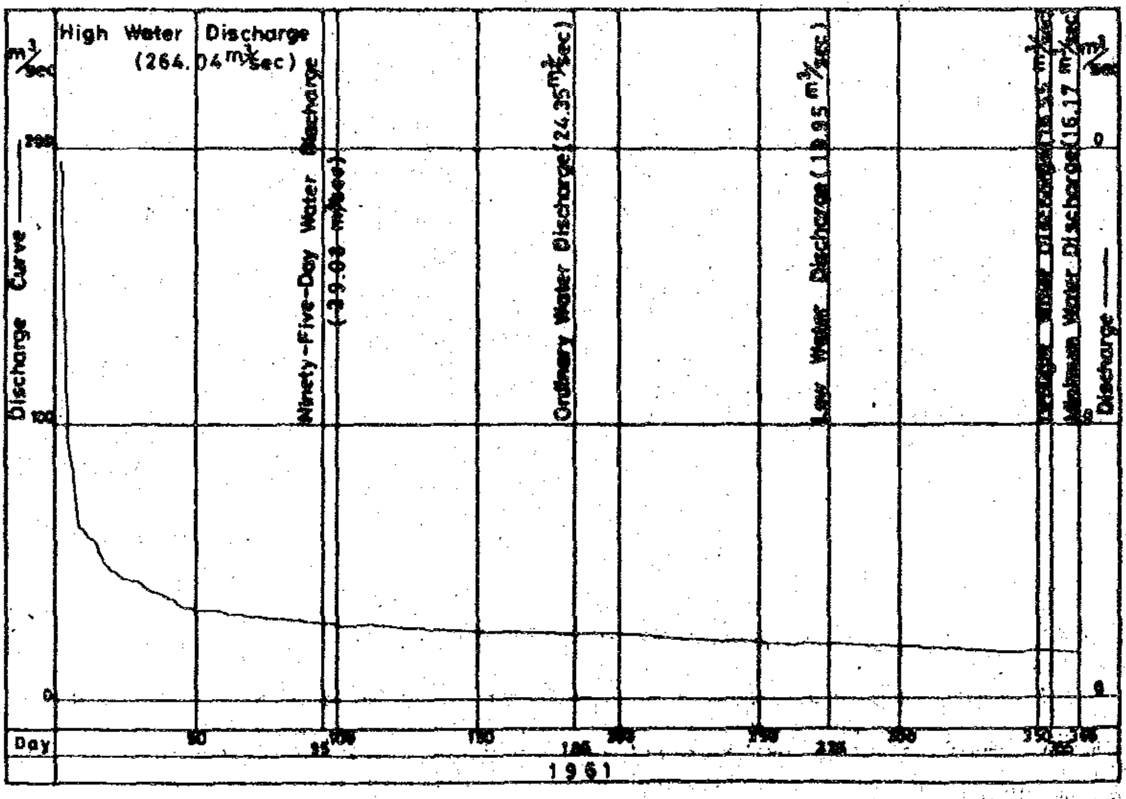
Inflow to Diduyon Reservoir at Damsite

October 1980 Fig. 2-4-21

Station Name : No.3 Damsite
Catchment Area : 477 km²

Duration Curve at No.3 Damsite (1)

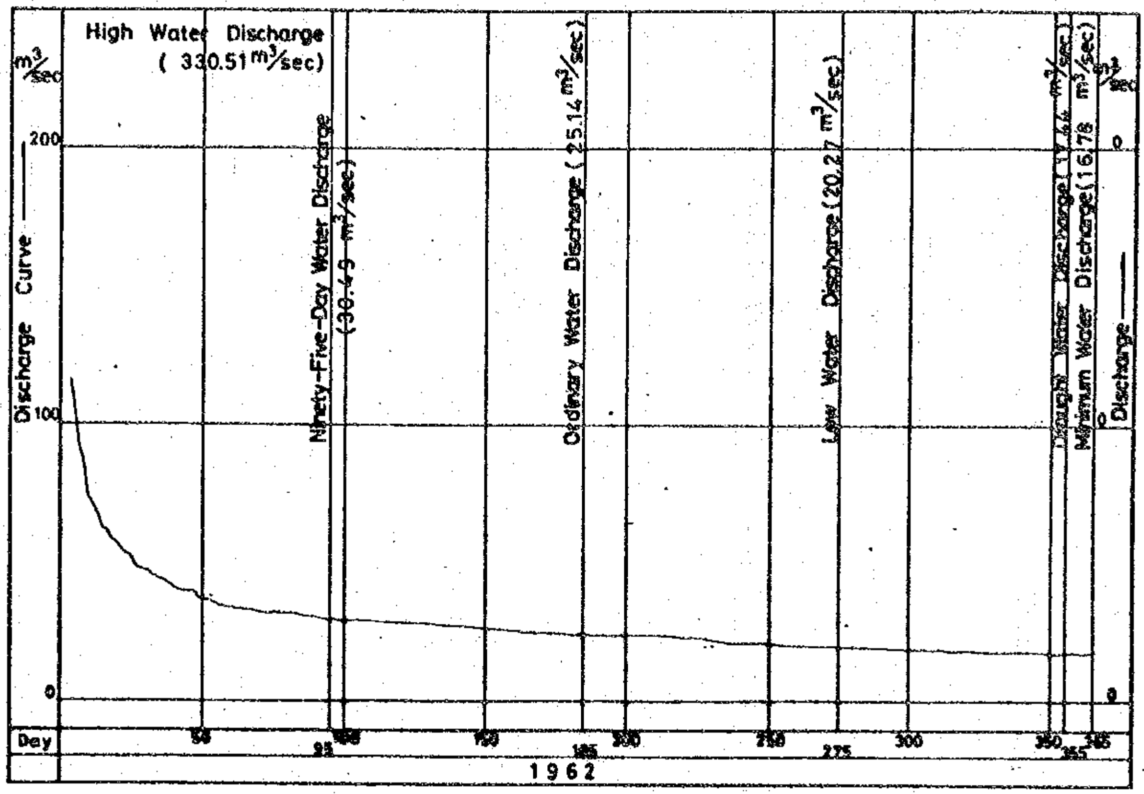


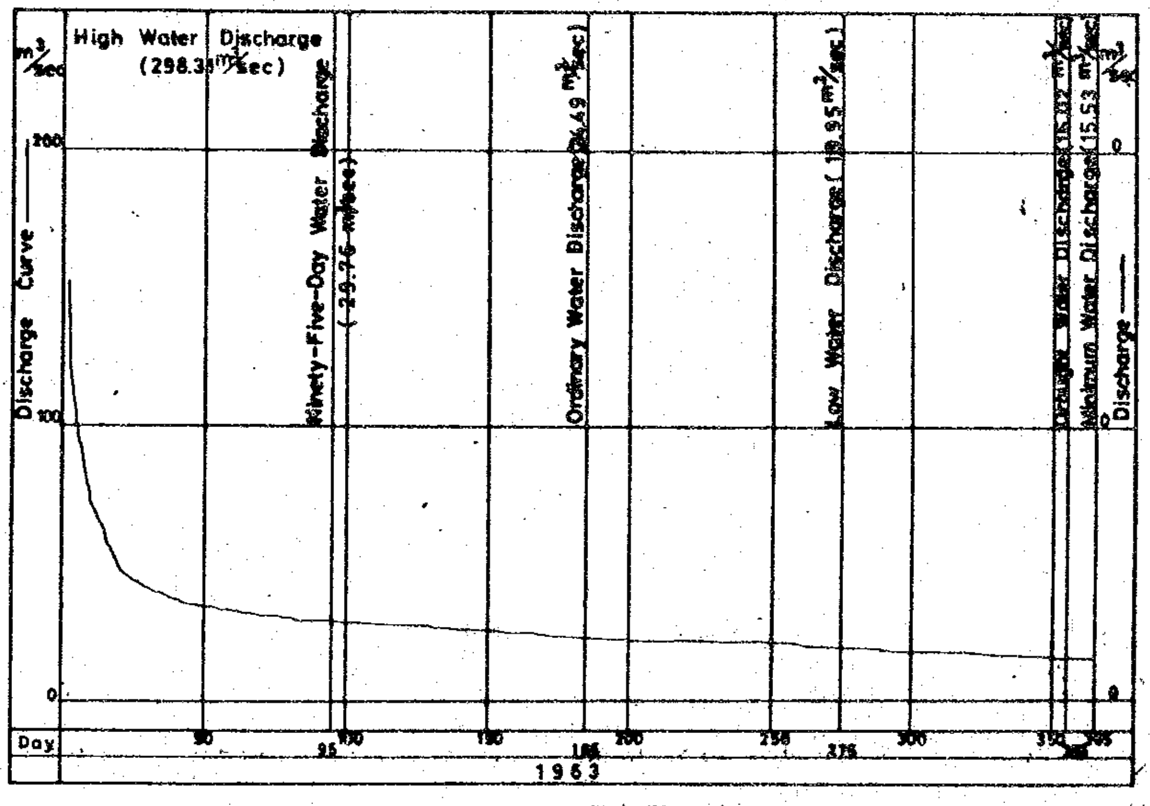


Diduyon Hydroelectric Project Upper Cagayan River Republic of the Philippines	
Japan International Cooperation Agency	
Duration Curve at No.3 Damsite (1)	
October 1980	Fig. 2-4-22 (1)

Duration Curve at No.3 Damsite (2)

Station Name : No.3 Damsite
Catchment Area : 477 km^2

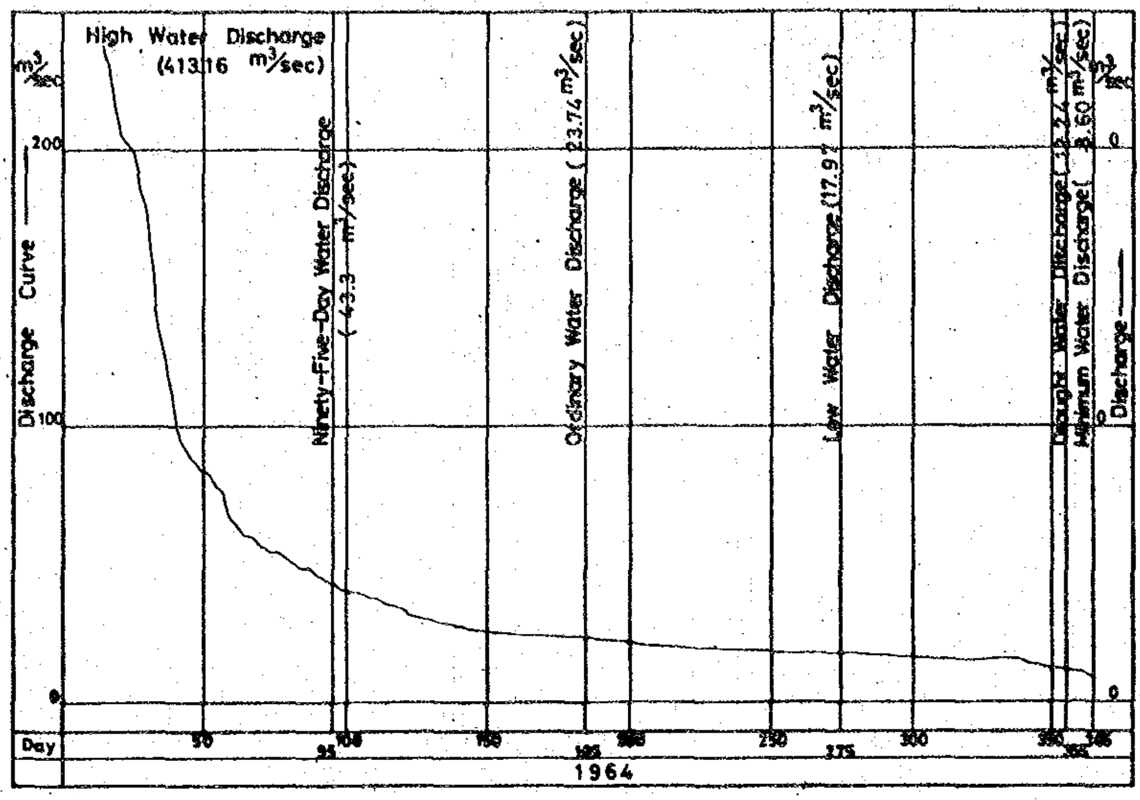


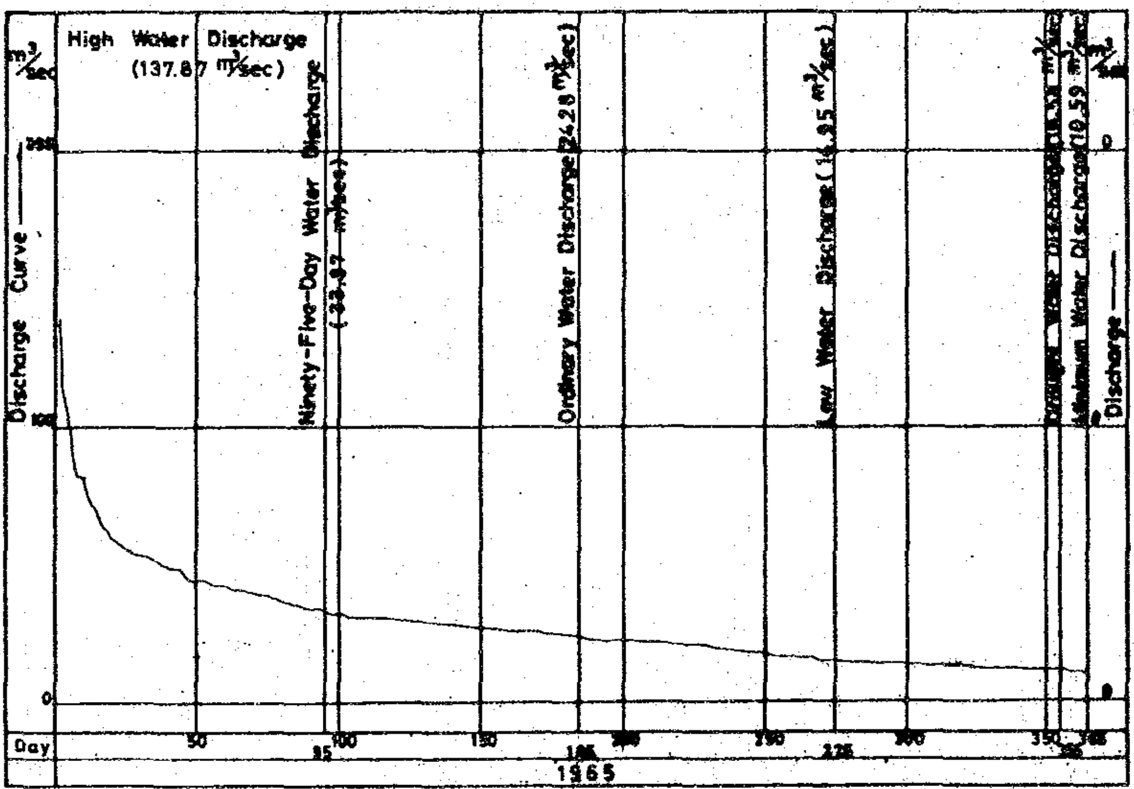


Diduyon Hydroelectric Project Upper Cagayan River Republic of the Philippines	
Japan International Cooperation Agency	
Duration Curve at No.3 Damsite (2)	
October 1980	Fig. 2-4-22 (2)

Duration Curve at No.3 Damsite (3)

Station Name : No.3 Damsite
Catchment Area : 477 km²





Diduyon Hydroelectric Project
Upper Cagayan River
Republic of the Philippines

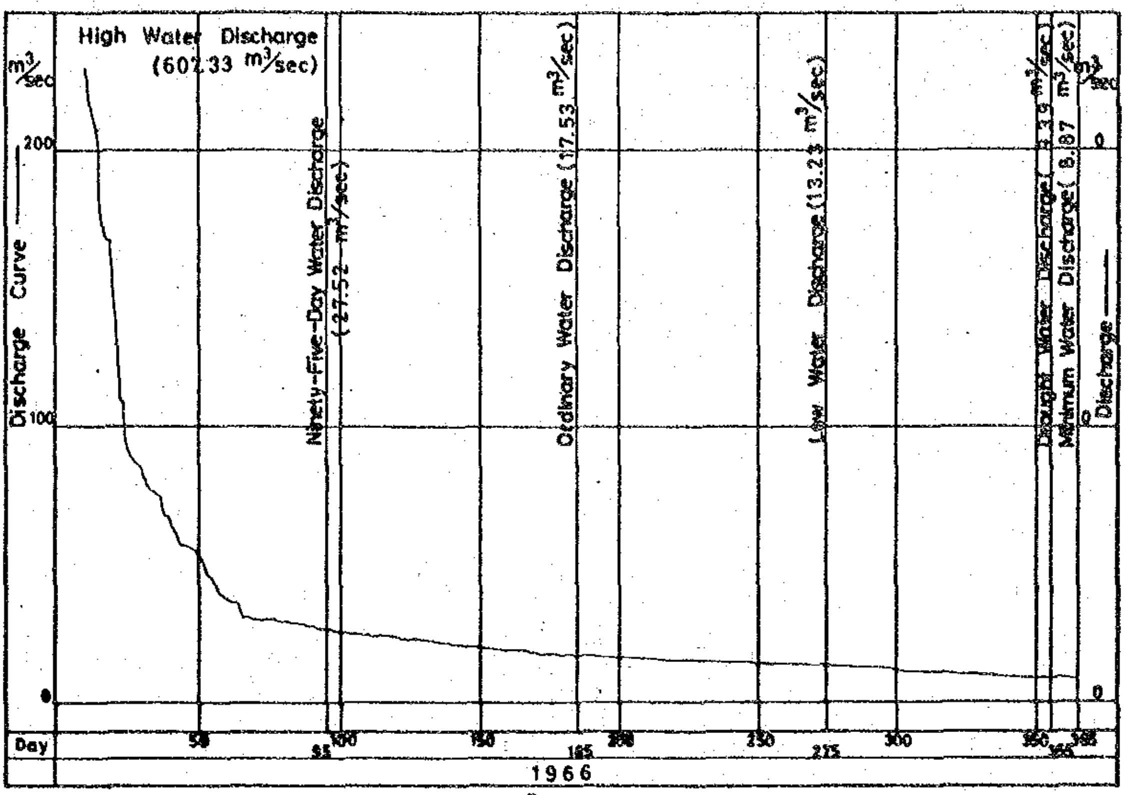
Japan International Cooperation Agency

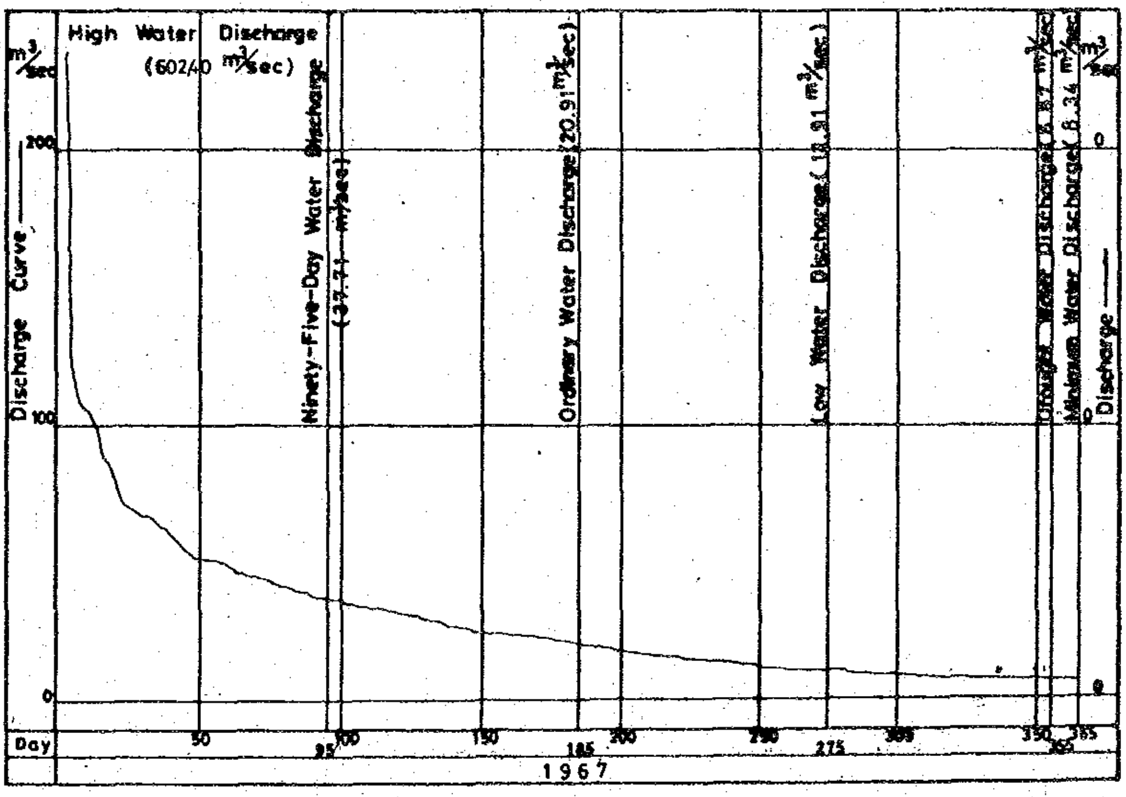
Duration Curve at No.3 Damsite (3)

October	1980	Fig. 2-4-22 (3)

Duration Curve at No.3 Damsite (4)

Station Name : No. 3 Damsite
Catchment Area : 477 km^2

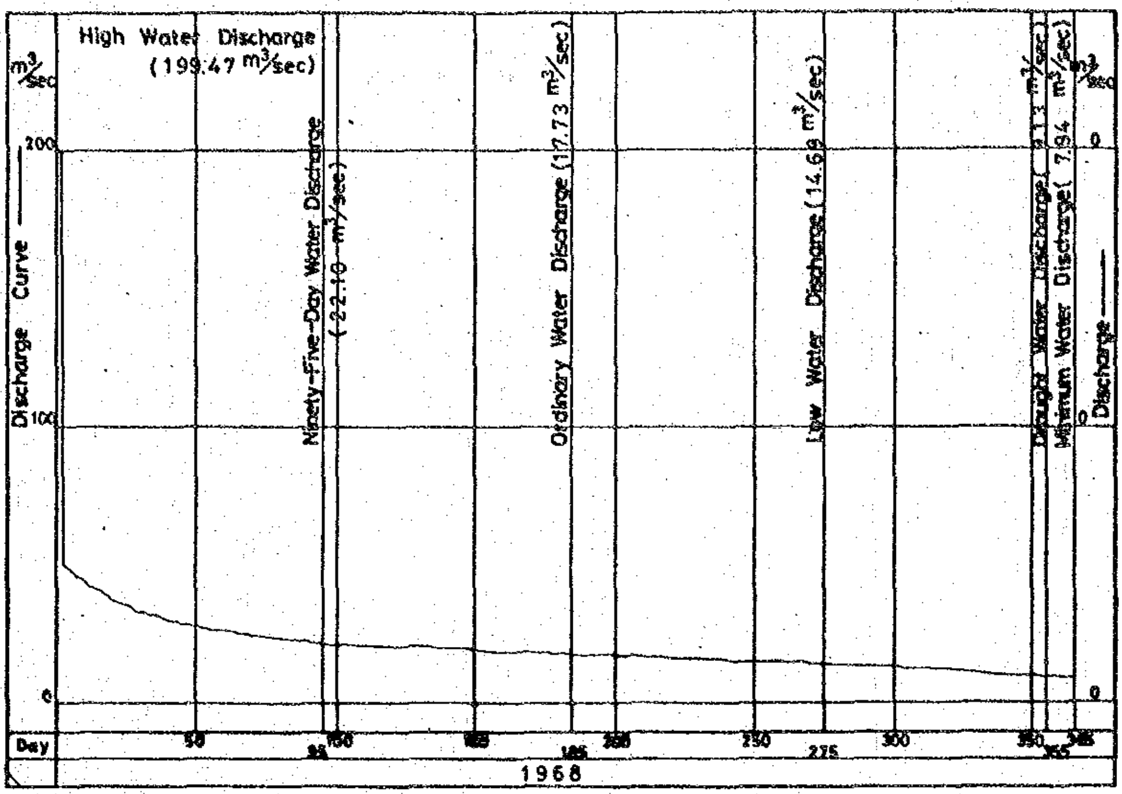


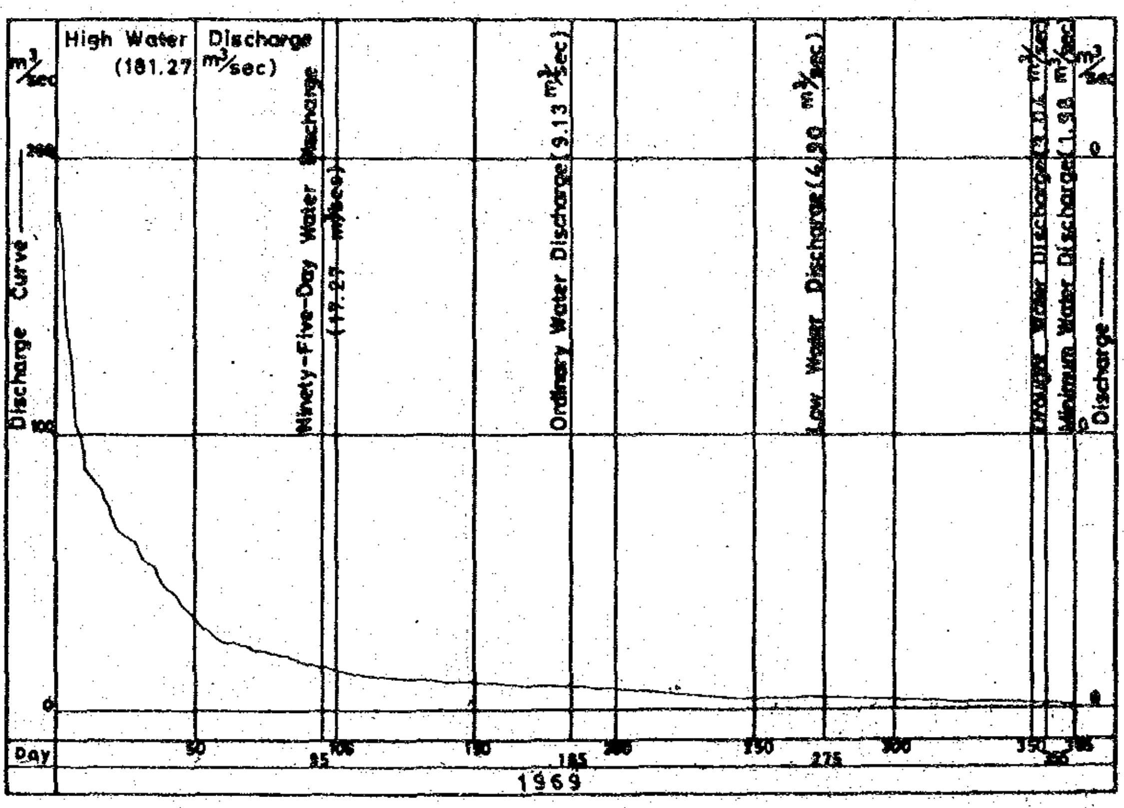


Diduyen Hydroelectric Project Upper Cagayan River Republic of the Philippines	
Japan International Cooperation Agency	
Duration Curve at No.3 Damsite (4)	
October 1980	Fig. 2-4-22 (4)

Duration Curve at No.3 Damsite (5)

Station Name : No.3 Damsite
Catchment Area : 477 km²

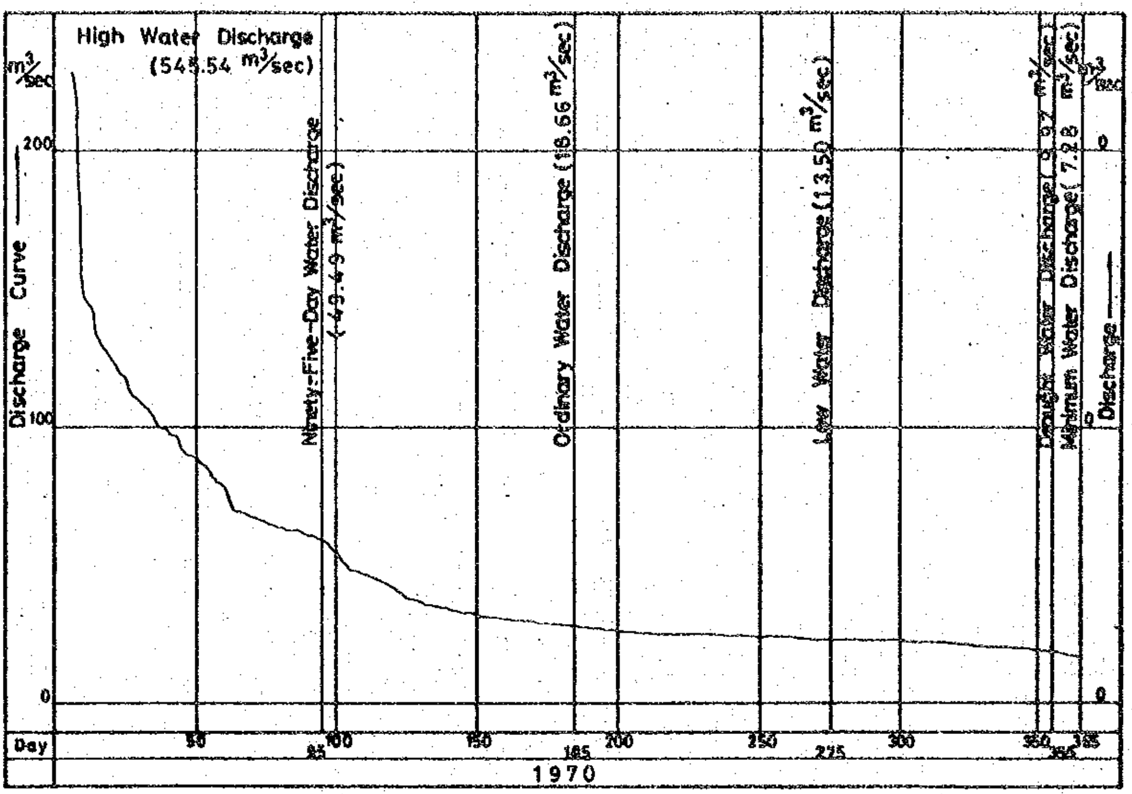


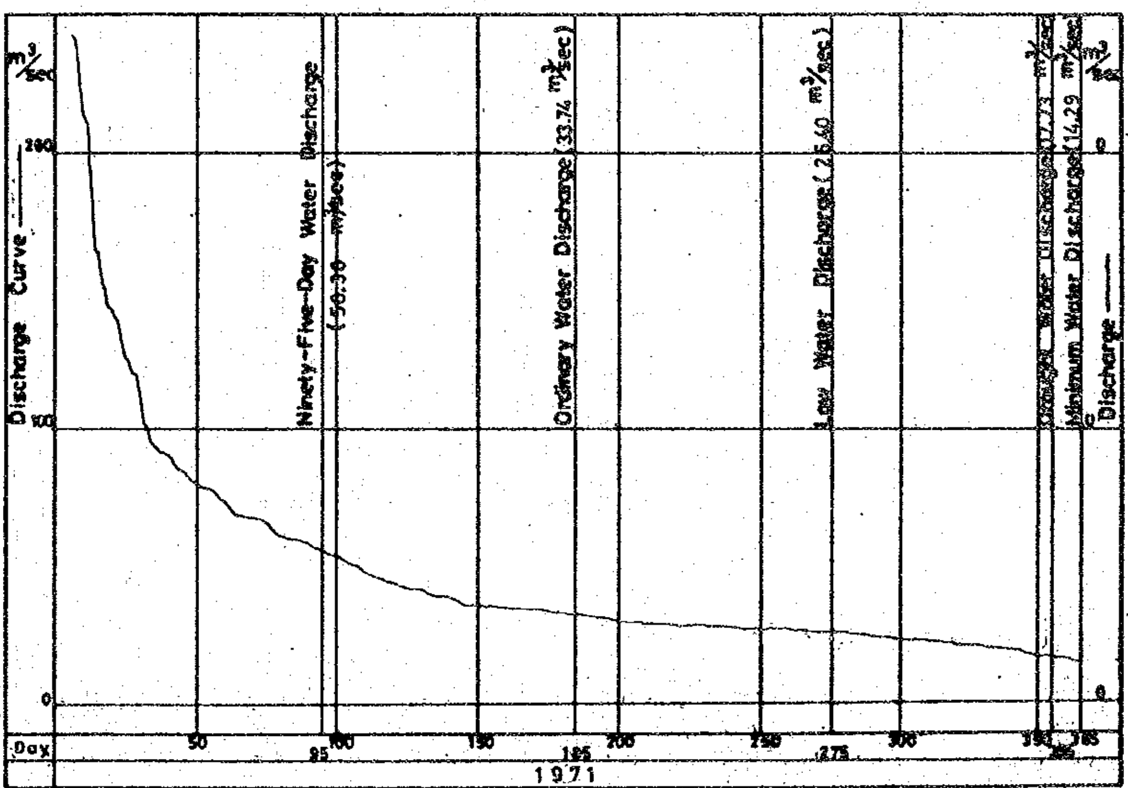


Diduyon Hydroelectric Project Upper Cagayan River Republic of the Philippines	
Japan International Cooperation Agency	
Duration Curve at No.3 Damsite (5)	
October 1980	Fig. 2-4-22 (5)

Duration Curve at No.3 Damsite (6)

Station Name : No.3 Damsite
Catchment Area : 477 km^2

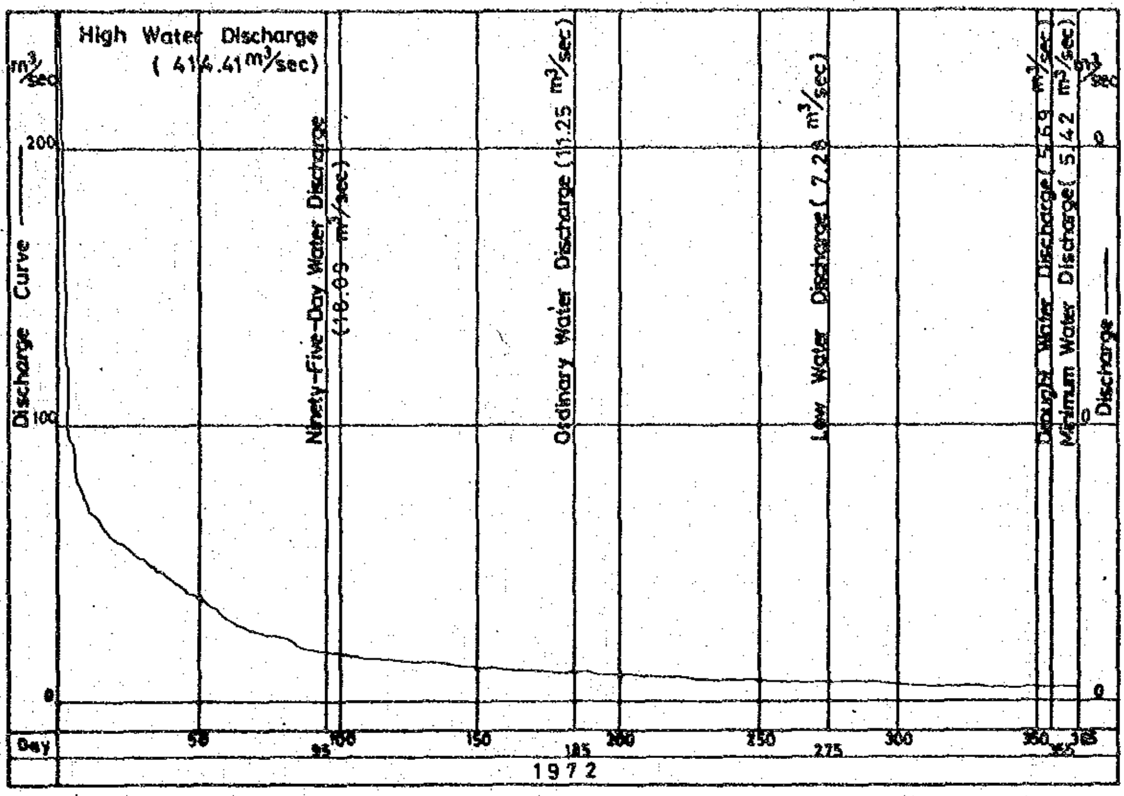


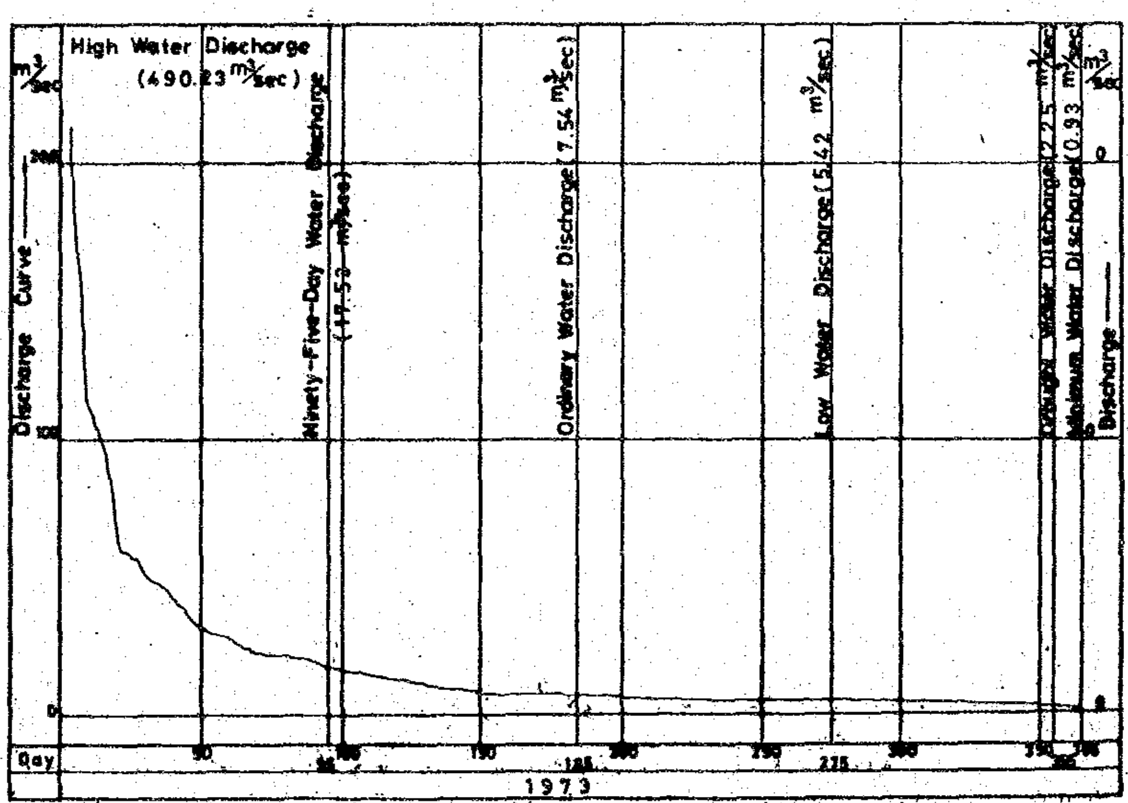


Diduyon Hydroelectric Project Upper Cagayan River Republic of the Philippines
Japan International Cooperation Agency
Duration Curve at No.3 Damsite (6)
October 1980 Fig. 2-4-22 (6)

Duration Curve at No.3 Damsite (7)

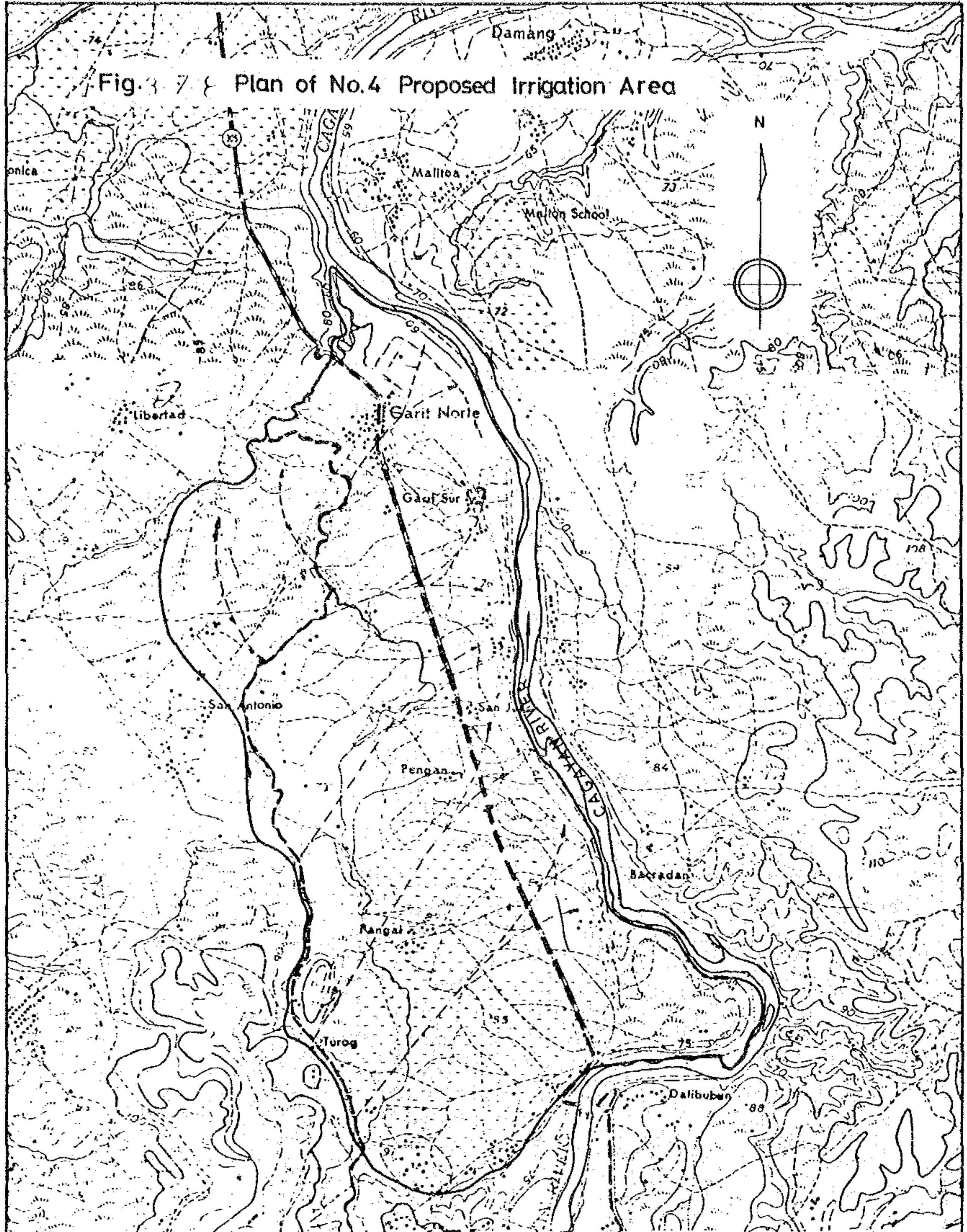
Station Name : No.3 Damsite
Catchment Area : 477 km²





Diduyan Hydroelectric Project Upper Cagayan River Republic of the Philippines	
Japan International Cooperation Agency	
Duration Curve at No.3 Damsite (7)	
October 1980	Fig. 2-4-22 (7)

Fig. 3-7-8 Plan of No.4 Proposed Irrigation Area



Note:

(1) Elevation difference between three pump stations and palay field is 10 ∿ 15 m.

(2) Elevation difference between water level of Cagayan River and pump stations is assumed to be about 35 m.

(3) Main canal is approximately 15 km long.

(4) Canal gradient is designed at 1/1,000.

(5) Water discharge of main canal is $3.6 m^3/sec$.

Scale

0 1 2 (km)

Diduyon Hydroelectric Project
Upper Cagayan River
Republic of the Philippines

Japan International Cooperation Agency

Plan of No.4 Proposed Irrigation Area

October 1980 Fig. 3-7-8