IV. FLOOD RUNOFF ANALYSIS

4.1 General

The flood runoff analysis is conducted to obtain:

a) the probable flood runoff distribution under the present river condition with and without Magat dam in order to grasp present flood phenomenon,

b) the probable flood runoff at damsites to study flood control and to design structures,

c) and the probable flood runoff distribution under the alternative flood control schemes for flood control planning.

The Cagayan river flows in a northerly direction from its headwaters in Nueva Vizcaya province to its mouth in the Babuyan Channel near Aparri with a total length of 522 km. The major tributaries are the Magat river (5,113 km^2), Ilagan river (3,132 km^2), Siffu-Mallig river (2,015 km^2), and Chico river (4,551 km^2). The river bed slope is 1/8,680 between the rivermouth and Tuguegarao in the main river.

The following sections describe the detail estimate of the probable flood runoff in the Cagayan river basin.

4.2 Available Data

4.2.1 Rainfall Data

Daily rainfall records are available at 10 gauges as listed below, which are used for the estimate of basin mean rainfall. The data availability at the selected gauges and the location are shown in Figs. 1.2 and 1.3.

No.	Station No.	Station Name	Basin	Recorded Period	
1	1	Aparri	Lower Cagayan	1951-1984	34 Yrs.
2	7	Tuao	Chico	1956-1985	32 Yrs.
3	8	Tuguegarao	Lower Cagayan	1949-1985	37 Yrs.
4	13	Naneng, Tabuk	Chico	1956-1984	28 Yrs.
5	19	Ilagan	Ilagan	1965-1984	19 Yrs.
6	21	Bontoc	Chico	1963-1985	23 Yrs.
7	29	Nayon, Lamut	Magat	1968-1980	13 Yrs.
8	30	Echague	Upper Cagayan	1976-1985	10 Yrs.
9	38	Consuelo, Santa Fe	Magat	1956-1985	28 Yrs.
10	40	Dakgan	Upper Cagayan	1973-1982	10 Yrs.

Hourly rainfall record series are available at Aparri and Tuguegarao gauges, which are useful for the grasp of hourly distribution pattern. Storm records of which daily rainfall is larger than 100 mm at both gauges are shown in Fig. 4.1.

4.2.2 Flood Runoff Data

Flood hydrographs at Magat damsite are available to establish the flood runoff simulation model as shown in Table 4.1 and Fig. 4.2.

Annual maximum flood water level/runoff are available for the frequency analysis of flood runoff at the following stations:

No.	Station No.	Station Name	Basin Area (km^2)	River Name	Recorded Period	
1	10	Calantac	907	Paret	1958-1969	11 Yrs.
2	18	Larion Alto	655	Tuguegarao	1956-1970	15 Yrs.
3	25	Pasonglao	1,987	Chico	1963-1969	7 Yrs.
4	41	Palattao	6,626	Cagayan	1961-1970	10 Yrs.
5	43	Minanga	1,565	Ilagan	1964-1970	7 Yrs.
6	47	Oscariz	4,150	Magat	1941-1968	25 Yrs.

4.3 Methodology

The flood runoff analysis is made in accordance with the general procedure shown in Fig. 4.3. As seen in this procedure, the flood runoff analysis is performed through three substantial works, they are:

a) construction of river system model,
b) rainfall analysis, and,
c) flood runoff analysis.

The detailed contents of each study item are described below.

4.3.1 River System Model

The river system model is a necessary tool for the flood runoff calculation with the aid of an electronic computer. The model comprises all the elements of flood runoff mechanism such as river basins, channels and dams/reservoirs.

These elements are linked together by the subbase points. The subbase points, at which the flood runoff is calculated, are determined at locations where significant changes in peak flood runoff are expected such as:

a) junctions of main river and major tributaries,

b) reservoir sites, and,
c) points where the channel capacity changes.

Base points, which are selected among the subbase points, are the principal points for estimating the flood runoff and for determining the flood distribution along the river. The base points are located principally at the following points:

a) river mouth,
b) main river at junction of major tributary,
c) major tributary at junction of main river, and,
d) dams/reservoirs.

The Cagayan river basin is divided into subbasins at every base and subbase points. The channels in the model are prepared for the reach where the flood runoff is substantially influenced by the channel storage between the nodes such as subbase and base points. The dams taken into the model include the existing and proposed dams as identified.

4.3.2 Method of Rainfall Analysis

Rainfall analysis aims to estimate the basin mean probable rainfall and its hourly distribution. The results of rainfall analysis are used to the computation of the probable flood runoff.

(1) Design Storm Duration

The design rainfall duration is to be determined from the duration of recorded major storms.

(2) Basin Mean Probable Rainfall

The basin mean rainfall is estimated by either of the following two approaches depending on the number of raingauge and the availability of the recorded data.

a) The basin mean rainfall is estimated directly from recorded rainfall by areal weight of Thiessen polygon method.

b) The basin mean rainfall is estimated by the above areal weight and adjustment factor for basin elevation expressed in the following equation.

$$Rm = \sum_{i} fi\ Ri\ FLi$$

where,

Rm : Basin mean rainfall (mm),

f_i : Areal weight,

Ri : Point rainfall (mm),

FLi: Adjustment factor for elevation of object basin (The relationship of FL-value with the basin average elevation which is studied in the report "Nationwide Flood Control Plan and River Dredging Program (Nov. 1982)" is applied.).

The basin mean probable rainfall is calculated by using a series of estimated annual maximum basin mean rainfall. The frequency analysis is performed by the Pearson Type III method, because the results obtained from this method fit well the rainfall data plotted by the Hazen method. The equations of the Pearson Type III and Hazen methods are described below.

a) Pearson type III method

Probable rainfall (x) at any desired return period (T) is calculated with a series of the annual maximum rainfall (X_i) by the following equations:

$$X = 10^{(\bar{Y} + (\bar{V})^{0.5} k)} \quad (mm)$$

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

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

where,

N : Total number of rainfall

i : Order of the annual maximum rainfalls in magnitude

Y_i : Logarithm of rainfall (X_i)

k : Skew factor corresponding to (T) for the coefficients of variation (C_v) and skewness (C_s)

$\bar{Y}$: Average of Y_i

$$C_v = \frac{(\bar{V})^{0.5}}{\bar{Y}}$$

$$C_s = \frac{N \sum_{i=1}^{N} (Y_i - \bar{Y})^3}{(N-1)\ (N-2)\ \bar{V}^{3/2}} \quad ; \text{ If } C_s \leq 0, \text{ take } C_s = 0$$

b) Hazen method

The annual maximum rainfalls (X_i) are plotted on a probability paper in accordance with the following equation, and probable rainfall (X) is projected corresponding with return period (Y):

$$P(X_i) = \frac{2i - 1}{2N}$$

where,

$P(X_i)$: Plotting position

i : Order of the annual maximum rainfalls in magnitude

N : Total number of rainfall data

(3) Hourly Rainfall Distribution

The hourly rainfall distribution is assumed to have center-concentrated pattern which is commonly applied to the estimation of design flood runoff. This pattern is derived from the rainfall intensity-duration curve using the actual hourly rainfall data of selected stations. To obtain this pattern, the hourly rainfall increments from the intensity curve are distributed in such a way that the maximum hourly rainfall increment is put at the center of total rainfall duration and the succeeding hourly rainfall increments are alternately distributed before and after the central increment so that rainfall intensity of continuous rainfall around the center could accord with the rainfall intensity-duration curve of the station.

The above pattern is adopted for 24 hours in the central portion of design rainfall. For the remaining portion, the hourly rainfalls are generally distributed uniformly using the relationship between 1-day and design rainfall amounts.

4.3.3 Method of Flood Runoff Analysis

Judging from the availability of flood runoff records, the flood runoff analysis is made by applying rainfall data to flood runoff simulation model. Storage function model is applied as the simulation model, which is commonly used and judged to be suitable due to data availability. The flood runoff in a river basin is assumed to be formed by the following different functional elements:

a) Runoff from subbasin

b) River channel flow

c) Flood regulation by reservoir

The estimation results are evaluated by comparing with recorded data to decide the final figures of probable flood runoff.

(1) Flood Runoff from Subbasin

The flood runoff calculation is performed by the storage function method. The basin factors, storage function, runoff coefficient and baseflow are provided by the following methods.

a) Basin factor

The basin factors are prepared using 1/50,000 or 1/250,000 topographic maps, they are catchment area of basin/subbasin (km^2), river length in basin/subbasin (km), and overall slope of the longest watercourse from the point of interest to watershed divide (S).

b) Storage function

The basic equation of the storage function method is described below.

$$r - q_\ell = dS_\ell/dt$$
$$S_\ell = K \quad q_\ell^P$$
$$q_\ell = q(t+T_1)$$
$$Q = 0.2778 \ (f \ q_\ell + (1-f) \ q_{sa}) \ A + Q_B$$

where,

r : Basin average hourly rainfall (mm/hr)

q_ℓ : Runoff depth from a basin (mm/hr)

S_ℓ : Storage (mm)

q : Runoff depth from a basin with lag time, T_1 (mm/hr)

q_{sa} : Runoff depth from a basin after saturation of rainfall, R_{sa} (mm/hr)

Q : Discharge (m^3/s)

f : Runoff coefficient

($r \leq R_{sa}$ $f = f_1$, $r > R_{sa}$ $f = 1.0$)

A : Catchment area (km^2)

Q_B : Baseflow (m^3/s)

K, P: Coefficient

t : Time (hr)

c) Coefficients K and P of storage function and lag time

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

$$K = a*118.84*i^{0.3}$$

$$P = b*0.175*i^{-0.235}$$

$$T = c*0.047*L - 0.56$$

where, i : River bed slope

L : River length (km)

T : Lag time (hrs)

K, P : Coefficient for a function

a,b,c: Constant for K,P,T

d) Primary runoff coefficient and saturated rainfall

Primary runoff coefficient is estimated based on the observed discharge hydrograph and corresponding rainfall records during flood. Saturated rainfall, which is the changing point of runoff coefficient, is determined based on the above hydrological records.

e) Baseflow

The baseflow is estimated averaging the runoff in dry season, which is judged to be representative of the baseflow during rainy season as shown in Fig. 3.3. The baseflows at base point and in subbasin are expressed by the specific discharge derived from the relation between the baseflow and catchment area.

(2) River Channel Flow

The flood runoff from each subbasin is subject to the retardation effect due to channel storage and lag time to reach a point of interest.

a) Flood retardation by channel storage

The computational method of flood retardation is the storage function method. This method is expressed as,

$$S = KQ^P$$

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

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

b) Coefficients K and P

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

c) Lag time of channel flow

Various empirical formulas are proposed for the estimation of the lag time of channel flow. The Kraven formula which is the simplest among them is adopted for the present study.

The Kraven formula gives the following empirical value of the flood velocity depending on the river bed slope.

River Bed Slope	More than 1/100	1/100-1/200	Less than 1/200
Flow Velocity (m/s)	3.5	3.0	2.1

(3) Flood Regulation by Reservoir

In estimating the flood runoff under the present river condition, the flood regulation by the existing Magat reservoir is assumed to be performed by the constant-ratio/constant amount outflow method. The regulation begins when the inflow to the reservoir reaches a certain amount of given discharge which is defined as the control starting discharge (QB). In this regulation method, the outflow becomes diversified at a constant ratio of the inflow, starting from QB until the peak of the inflow hydrograph. After this peak, the outflow is kept at a constant value.

The regulation method is thus, specified by the outflow rate (AA) and control starting discharge (QB). The control starting discharge is determined based on the carrying capacity of the downstream channel. The outflow rate is expressed as:

$$AA = \frac{QO_{max} - QB}{QI_{max} - QB}$$

where,

QI max : Maximum design inflow to reservoir (m^3/s)

QO max : Maximum design outflow from reservoir (m^3/s)

(4) Verification of Estimated Flood Runoff

The probable flood runoff is estimated at strategic points in the basin. This probable flood runoff estimated from probable rainfall is compared with the recorded runoff and evaluated.

(5) Flood Runoff Distribution

The distribution of the flood runoff along the river is examined under the present river condition with and without Magat dam and under the alternative flood control plans.

4.4 River System Model

The 9 points are determined principally as base points at the junctions of main river and major tributaries, Chico, Siffu, Ilagan, Magat rivers. The location of each point and its upstream basin area are tabulated below.

Base Point	Location	Basin Area (km^2)	Distance from Rivermouth (km)
BP - 1	Rivermouth of Cagayan river	27,281	0.0
BP - 2	Cagayan river at junction of Chico river	21,473	51.6
BP - 3	Cagayan river at junction of Siffu river	15,334	198.7
BP - 4	Cagayan river at junction of Ilagan river	11,993	212.3
BP - 5	Cagayan river at junction of Magat river	6,633	232.8
BP - 6	Chico river at junction of Cagayan river	4,551	51.6
BP - 7	Siffu river at junction of Cagayan river	2,015	198.7

BP - 8	Ilagan river at junction of Cagayan river	3,132	212.3
BP - 9	Magat river at junction of Cagayan river	5,113	232.8

The following 15 damsites are also taken as base points.

(1)	Casecnan	(1,150 km^2)	(9)	Ilagan No.1	(1,350 km^2)
(2)	Cagayan No.2	(1,631 km^2)	(10)	Disabungan	(652 km^2)
(3)	Cagayan No.1	(2,364 km^2)	(11)	Siffu No.1 (A)	(656 km^2)
(4)	Diduyon	(477 km^2)	(12)	Mallig No.2	(362 km^2)
(5)	Addalam (A)	(864 km^2)	(13)	Chico No.2	(720 km^2)
(6)	Alimit No.1 (A)	(559 km^2)	(14)	Chico No.4	(1,410 km^2)
(7)	Matuno No.1	(550 km^2)	(15)	Pinukpuk	(856 km^2)
(8)	Magat	(4,143 km^2)			

Subbase points are determined at junctions of tributaries considering the river basin scale. The Cagayan river basin is, then, divided into 50 subbasins at the selected base and subbase points. 30 river channels are prepared as the basin elements, which are regarded to influence the flood runoff substantially.

Finally, the river system model is made assembling the above base and subbase points including the following basin components:

a) 50 subbasins
b) 30 river channels
c) 15 damsites

The basin division is shown including all the basin components in Fig. 4.4. The Cagayan river system model is illustrated in Fig. 4.5.

4.5 Rainfall Analysis

4.5.1 Rainfall Duration Time

The major storms recorded in Aparri and Tuguegarao show that rainfall duration is usually 4-day or less. On the other hand, the lag time of flood runoff is estimated at about 64 hours in the longest watercourse. The rainfall duration for the flood runoff analysis at base point 1 to 9 is therefore decided to be 4 days. While, the duration is determined to be 1 day for runoff analysis at damsites considering lag time.

4.5.2 Basin Mean Probable Rainfall

The Thiessen polygon method is used to estimate the basin mean rainfall from point rainfall as shown in Table 4.2 and Fig. 4.6. Although a deformed polygon appears in Fig. 4.6, basin rainfall is attested to be usable by comparing rainfalls of deformed and uniform polygons. Adjustment factor for basin mean elevation is adopted to estimate the basin mean rainfall at the damsites as shown in Table 4.3 and Fig. 4.7.

The probable basin mean rainfall is calculated from annual maximum basin mean rainfall by Pearson Type III method. The calculated probable rainfall at the base points are shown in Table 4.4 and Fig. 4.8.

4.5.3 Hourly Rainfall Distribution

A 1-day rainfall duration curve is developed using the hourly rainfall data at Aparri and Tuguegarao as given in Fig. 4.9. This 1-day rainfall duration curve is linearly extrapolated for 4 days. In this manner, the 4-day duration curve is developed. A 1-day rainfall amounts to 65% of 4-day amount, in accordance with the rainfall records. The hourly rainfall distribution is assumed from records to be center-concentrated pattern. The hourly rainfall distribution of probable 4-day rainfall is, consequently, estimated as shown in Fig. 4.10.

4.5.4 Areal Rainfall Distribution

There is not enough rainfall data covering the whole basin to examine the areal distribution pattern of storm. Therefore, the areal distribution of the probable rainfall is assumed to give the intensive rainfall to each of the basins of major tributaries. Then, 5 distribution types are introduced as given in Table 4.5.

The distribution type of intensive rainfall in Upper Cagayan basin is adopted to estimate the flood runoff in the main river, because this type induces the biggest runoff. The other distribution types are used for the respective tributaries' runoff estimation.

4.6 Flood Runoff Analysis

4.6.1 Runoff from Subbasin

Flood runoff from subbasin is estimated by applying the storage function of which coefficients are based on the recorded five (5) storms at Magat damsite shown in Table 4.6.

The coefficient of the storage function and lag time for subbasins are estimated by the following formulas, which are well known as Tone River Formulas and applied for many rivers in Japan.

$$K = a \times 118.84 \times i^{0.3}$$
$$P = b \times 0.175 \times i^{-0.235}$$
$$T = c \times 0.047 \times L - 0.56$$

where, i : River bed slope
L : River length (km)
T : Lag time (hrs)
K, P : Coefficient for a function
a,b,c : Constant for K,P,T (a,b,c = 1.0 for Tone River Formula)

The values a, b and c of subbasins are examined through trial and error by comparison of the flood hydrographs recorded at Magat damsite and estimated from rainfall by applying Thiessen Polygon method seen in Fig. 4.11, and determined to be 0.7, 1.0 and 1.0, respectively. Estimated coefficients of storage function K, P and T are listed in Table 4.7.

Primary runoff coefficient (f_1) and saturated rainfall (Rsa) are estimated to be 0.5 and 150 mm based on the selected storms as shown in Fig. 4.12.

The specific baseflow which is estimated using data at 23 stream gauging stations is 0.04 $m^3/sec/km^2$ as shown in Fig. 4.13.

Fig. 4.14 shows the comparison of observed flood hydrograph at Magat damsite and the calculated one with the above values. As seen in this figure, both hydrographs agree with each other. This fact implies that the above storage function is suitable to estimate flood runoff from rainfall.

4.6.2 Channel Flow

The values of the channel storage for each channel calculated under the present river condition are shown in Table 4.8 and 4.9. Under the present river condition, non-uniform flow calculation is applied to channel No. 7, 8, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 26, 27, 28, 29 and 30 while uniform flow calculation is used for the others. The channel storage curves are shown in Fig. 4.15. The lag time of channel flow in each channel estimated by Kraven formula is shown in Table 4.9.

4.6.3 Flood Regulation by Magat Reservoir

The flood operation for Magat reservoir is performed by the constant-ratio/constant amount outflow method which is studied by the project "Flood Forecasting and Warning System for Dam Operation Project (May 1984)". In this project, the control starting point, constant ratio and constant amount outflow are proposed to be 1,600 m^3/s, 0.4 and 3,000 m^3/s, respectively.

4.6.4 Flood Runoff Distribution

(1) Probable Flood Estimated from Recorded Flood Runoff

The following table shows the results of frequency analysis for 100-year flood on the basis of recorded flood at gauges.

Station Name	Basin Area (km^2)	100-Yr Flood (m^3/s)	Specific Runoff ($m^3/s/km^2$)
Calantac	907	4,900	5.40
Larion Alto	655	4,100	6.26
Pasonglao	1,987	7,100	3.57
Palattao	6,626	17,000	2.57
Minanga	1,565	5,800	3.71
Oscariz	4,150	13,200	3.18

(2) Probable Flood Runoff Estimated from Rainfall

The estimated probable flood runoff distribution along the present river and probable flood at damsites are shown in Fig. 4.16. The following table shows the 100-year probable flood peak discharges under the present river condition without Magat dam.

Base Points or Gauging Station	Basin Area (km^2)	100-Yr Flood (m^3/s)	Specific Runoff ($m^3/s/km^2$)
BP-1	27,281	21,400	0.78
BP-2	21,473	21,000	0.98
BP-3	15,334	25,300	1.65
BP-4	11,993	23,500	1.96
BP-5	6,633	14,700	2.22
BP-6	4,551	8,700	1.91
BP-7	2,015	3,300	1.64
BP-8	3,132	9,400	3.00
BP-9	5,113	10,600	2.07

Calantac	907	5,000	5.51
Larion Alto	655	4,000	6.11
Pasonglao	1,987	6,700	3.37
Palattao	6,626	14,700	2.22
Minanga	1,565	8,800	5.62
Oscariz	4,150	13,800	3.33

(3) Comparison and Evaluation

The probable 100-year floods estimated from rainfall and recorded runoff are illustrated in Fig. 4.17 for comparison. As seen in this figure, both values agree with each other. This fact implies that the flood runoff analysis method based on rainfall data is appropriate and applicable to flood control planning.

100-year flood runoff hydrographs at base points are shown in Fig. 4.18. Specific flood peak runoff for 100-year probability is illustrated in Fig. 4.19.

4.6.5 Flood Runoff under Alternative Schemes

The probable flood runoff distribution is estimated under the following flood control schemes.

For Framework Plan (100-year probable flood)

a) Alternative OD (Confining dikes without flood control dam)
b) Alternative 5D (Confining dikes with 5 flood control dams)
c) Alternative 9D (Confining dikes with 9 flood control dams)
d) Alternative ODM (Confining dikes without flood control dam and with improved narrows)
e) Alternative 5DM (Confining dikes with 5 flood control dams and improved narrows)
f) Alternative 9DM (Confining dikes with 9 flood control dams and improved narrows)

For Long Term Plan

a) with confining dikes and 5 flood control dams
b) with confining dikes, 5 flood control dams and improved narrows
c) with 5 flood control dams and improved narrows
d) with Cagayan No. 1 dam
e) with Ilagan No. 1 dam
f) with Siffu No. 1 (A) dam
g) with Mallig No. 2 dam
h) with improved narrows
i) with Magat dam with flood control space of 200 MCM
j) with Magat dam with flood control space of 300 MCM
k) with Magat dam with flood control space of 400 MCM

The above flood control schemes are detailed in the sectoral study of flood control. The estimation results for the above flood control schemes are given in Fig. 4.20 and Fig. 4.21. Table 4.10 and Table 4.11 show the channel storage for confining dike condition.

V. SEDIMENT ANALYSIS

5.1 General

The sediment analysis is carried out to estimate the sediment yield in the upper river basins and the sediment transport capacity in river channels. The study results are used for the reservoir sedimentation and the river improvement plan.

5.2 Data Availability and Methodology

5.2.1 Data and Method for Sediment Yield Estimate

The sediment yield in the upper river basins is usually examined by the following records or formulas:

a) reservoir sedimentation record,
b) empirical formulas,
c) sediment sampling record.

The reservoir sedimentation record does not exist in the Cagayan basin. In Luzon Island, the sediment in the reservoir is measured at Binga Dam and Ambuklao Dam in the Agno river. From this measurement, the annual sediment yield is estimated to be 4.9 mm at Binga Dam and 6.0 mm at Ambuklao Dam. These values are considerably big due to mining operations and are not representative of that in the Cagayan basin.

The empirical formula is usable for obtaining the sediment yield in the upper river basins. Dr. Tanaka and Dr. Ishige developed the following formulas on the basis of dam sedimentation records in Japan.

Tanaka Formula:

$$Y = 13.0X_1 - 6 \pm 189 \ , \ X_1 = R_f \times E_m/10^4$$

Ishige Formula:

$$\log Y = 1.50 \log X_2 - 5.58 \pm 0.65 \sqrt{0.09 + (\log X_2 - 5.41)^2},$$

$$X_2 = R_f \times P$$

where,

Y : Annual sediment yield rate ($m^3/yr/km^2$)

R_f : Mean relief of basin (m); $R_f = \sum (E_{max} - E_{min})/n$

E_m : Mean elevation of basin (m, MSL); $E_m = \sum (E_{max} + E_{min})/2n$

E_{max}, E_{min}: Maximum and minimum elevations read in a square of 4 km x 4 km on topographic maps (scale 1/50,000) (m, MSL)

n : Number of squares which cover the basin

p : Mean annual major rainfall depth (mm/yr)

The suspended sediment records are collected at 25 stations in the Cagayan basin. Among these stations, 3 stations - Pasonglao, Oscariz, Dippadiw - have enough data for deriving the suspended sediment rating curves. The annual sediment yield in the upper river basin is estimated by using these rating curves and daily discharge duration curves and by adding assumed bed load.

5.2.2 Data and Method for Sediment Transport Estimate

The annual sediment transport capacity in river channels is estimated by using the sediment discharge formula and the discharge duration curves. Among 3 sediment discharge formulas, Brown Formula, Einstein-Brown Formula, and Engelund-Hansen Formula, which are commonly used and calculate the total sediment load including the suspended and bed load, one formula is selected to estimate the sediment transport capacity.

The above mentioned formulas are expressed below.

a) Brown Formula

$$Qs = 10 \left(\frac{U^2}{(W_s/W_w - 1)\, gd} \right)^2 \times Ud$$

b) Einstein-Brown Formula

$$Q_s = F_1 \left(g\,(W_s/W_w - 1)\, d^3\right)^{0.5} \times 40 \times \left(\frac{U^2}{(W_s/W_w - 1) gd} \right)^3$$

$$F_1 = \left(\frac{2}{3} + \frac{36\, n_w^2}{gd^3\,(W_s/W_w - 1)}\right)^{0.5} - \left(\frac{36\, n_w^2}{gd^3\,(W_s/W_w - 1)}\right)^{0.5}$$

c) Engelund-Hansen Formula

$$Q_s = 0.05\, V^2 \left(\frac{d}{g\,(W_s/W_w - 1)}\right)^{0.5} \left(\frac{t_o}{(W_s - W_w)\, d}\right)^{1.5}$$

$$V = \sqrt{gR'I} \times (0.6 + 2.5\ \ell n(R'/2.5d))$$

where,

Q_s	:	Sediment discharge ($m^3/s/m$)
U	:	Friction velocity (m/s); $U = (gRI)^{0.5}$
d	:	Grain size of bed materials (m)
W_s, W_w	:	Unit weight of sediment and water ($tons/m^3$)
V	:	Mean velocity (m/s)
t_o	:	Tractive force of flow ($tons/m^2$); $t_o = W_w RI$
R	:	Hydraulic radius (m)
I	:	Energy gradient of flow
n_w	:	Kinematic viscosity of water; $n_w = 8.50 \times 10^{-7}\ m^2/s$ for temperature 27°C
g	:	Acceleration of gravity, $g = 9.8\ m/s^2$

5.3 Sediment Yield

The sediment yield in the upper river basins is estimated by two empirical formulas, Tanaka Formula and Ishige Formula. 6 basins are taken for this estimation, they are Upper Cagayan, Magat, Ilagan, Lower Cagayan, Upper Chico and Lower Chico basin. The mean relief and mean elevation of Basin 1 to Basin 6 are tabulated in Table 5.1, which are based on the

topographical map of 1/50,000. For Ishige Formula, the mean annual major rainfall depth is calculated as the mean of annual sum of the consecutive rainfall over 100 millimeters as shown below.

	Basin 1	Basin 2	Basin 3	Basin 4	Basin 5	Basin 6
Rainfall (mm)	924	945	673	753	1,703	1,146

The estimated yield by formulas is shown below.

			Sediment Yield (mm/year)	
Basin	Basin Name	Downst. Point	Tanaka	Ishige
1	Upper Cagayan	Cagayan No. 1 dam	0.7 - 1.0	0.6 - 3.4
2	Magat	Magat dam	0.7 - 1.1	0.6 - 3.3
3	Ilagan	Ilagan No. 1 dam	0.4 - 0.8	0.4 - 1.3
4	Lower Cagayan	conj. Tuguegarao R.	0.3 - 0.7	0.5 - 1.9
5	Upper Chico	Pasonglao	1.7 - 2.0	1.6 -21.5
6	Lower Chico	Pinukpuk dam	1.1 - 1.4	1.0 - 7.9

The above table shows the wide fluctuation of the yield between 0.3 mm/year and 21.5 mm/year. Then, the probable yield in the upper river basin is difficult to be determined by the empirical formulas.

The sediment yield in the upper river basins is therefore estimated by applying the sediment rating curve. The suspended sediment rating curves are developed at Pasonglao in the Chico river, Oscariz in the Magat river and Dippadiw in the Upper Cagayan river as shown in Fig. 5.1. The suspended sediment yield is estimated at long term and reliable runoff gauges, Ampawilen, Oscariz and Guinalvin, which is shown in Table 5.2. The bedload is assumed to be 20% of the estimated suspended load considering the sediment material and concentration. The estimated sediment yield is summarized below.

Unit: $m^3/km^2/year$

Suspended Sediment Rating Curve	Runoff Gauge	Suspended Load	Bed Load	Total Sediment
Pasonglao (Chico river)	Ampawilen	880	180	1,060
Oscariz (Magat river)	Oscariz	1,270	250	1,520
Dippadiw (Cagayan river)	Guinalvin	1,070	210	1,280

Among the above values, the biggest one of 1,520 $m^3/km^2/year$ or 1.5 mm/year is selected as the sediment yield for the whole basin on the safe side.

5.4 Sediment Transport

The sediment transport capacity of the present river channel is calculated at the selected 26 points on the Cagayan river and the tributaries. Einstein-Brown Formula is applied to the sediment transport capacity estimation, since Brown Formula, Einstein-Brown Formula and Engelund-Hansen Formula lead near results and the Einstein-Brown Formula is simple.

The specific gravity and the mean diameter of the riverbed material are determined to be 2.61 and 0.04 cm on the basis of the investigation result, and are applied to Einstein-Brown Formula. Ten days mean simulated runoff is used for this Einstein-Brown Formula, then the adjustment factor of 2.0 is introduced, which is the ratio between the estimate based on the daily runoff and that based on 10 days mean runoff derived at Palattao. The computed sediment transport capacity in the present river channel is shown in Fig. 5.2.

VI. WATER QUALITY

6.1 Evaluation of Water Quality

Water quality analysis aims to evaluate the appropriateness of river water quality for irrigation, municipal and industrial uses.

The water quality test results are tabulated in Table 6.1 for the Cagayan basin. According to the water quality criteria by NPCC shown in Table 6.2, water in the Cagayan basin is judged to be usable for irrigation, municipal and industrial purposes though Calcium is much contained.

Table 1.1 Preliminary Estimation of Runoff Coefficient at 31 Gauges

	Station	Stream	Drainage area (km^2)	Annual runoff coefficient			Remarks
				Runoff (mm)	Rainfall (mm)	Coeff.	
5	Simay	Zinundungan	189	'65-'71 2,421	2,268	1.07	
7	Calaoagan	Dummon	308	'68-'71 2,019	2,710	0.75	
10	Calantac	Paret	907	'63-'64 3,221	4,110	0.78	
12	Escolta	Matalag	655	'65-'71 1,656	2,430	0.68	
18	Larion Alto	Tuguegarao	655	'65-'71 3,067	4,000	0.77	
19	Pinukpuk	Saltan	856	'65-'71 1,740	2,500	0.70	
24	Abbot	Chico	3,349	'63-'64 3,287	2,770	1.19	
25	Pasonglao	Chico	1,987	'66-'69 2,676	2,960	0.90	
29	Antagan	Tumauini	170	'65-'71 3,405	4,330	0.79	
30	Ampawilen	Chico	751	'65-'71 2,639	3,400	0.78	
34	Taed	Chico	391	'65-'71 2,511	3,300	0.76	
37	Casile	Casile	195	'66-'69 457	1,800	0.25	
38	Maligaya	Mallig	563	'68-'71 1,070	2,260	0.47	
39	Munoz	Siffu	686	'66-'69 1,049	2,220	0.47	
40	Malalam	Ilagan	3,123	'63-'64 2,496	3,170	0.79	
41	Palattao	Cagayan	6,626	'65-'71 1,594	2,370	0.67	
42	Supang	Sabangan	57	'65-'71 2,464	3,200	0.77	
43	Minanga	Ilagan	1,565	'66-'69 1,646	2,580	0.64	
45	Caipilan	Taotao	430	'61-'62 381	1,800	0.21	
46	Dipalin	Disabungan	198	'66-'69 1,640	2,770	0.59	
47	Oscariz	Magat	4,150	'63-'64 1,534	2,250	0.68	
48	Dulao	Alimit	573	'68-'71 2,244	2,900	0.77	
50	Hapid	Ibulao	606	'66-'69 2,672	3,350	0.80	
51	Camandag	Cadaclan	261	'69 1,196	2,400	0.50	
52	Pangal	Cagayan	4,244	'65-'71 2,188	2,750	0.80	
53	Panang	Cagayan	2,392	'61-'62 1,707	2,880	0.59	
54	Guinalvin	Addalam	921	'65-'71 1,676	2,400	0.70	
55	Bante	Matuno	558	'63-'64 2,701	3,200	0.84	
57	Kamamasi	Diduyon	462	'79-'80 846	2,700	0.31	
61	Bato	Magat	1,649	'65-'71 1,377	2,710	0.51	
62	Dippadiw	Cagayan	2,380	'68-'71 2,435	2,850	0.85	

Table 1.2 Mean Monthly Water Level at Aparri

(Daily Mean) Unit; m

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean
1960	0.14	0.16	0.20	0.18	0.16	0.31	0.28	0.36	0.23	0.35	0.29	0.24	0.24
1961	0.03	0.04	0.16	0.16	0.22	0.16	0.37	0.31	0.34	0.34	0.30	0.17	0.22
1962	0.16	0.19	0.19	0.20	0.21	0.28	0.32	0.38	0.39	-	-	0.21	0.25
1963	0.20	0.16	0.18	0.18	0.15	0.29	0.32	0.33	0.25	0.31	0.17	0.26	0.23

Mean= 0.24

(Daily Maximum) Unit; m

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean
1960	0.56	0.56	0.53	0.71	0.54	0.83	0.66	0.94	0.72	0.70	0.74	0.79	0.83
1961	0.50	0.54	0.66	0.66	0.68	0.90	0.72	1.05	0.74	0.72	0.88	0.76	1.05
1962	0.60	0.64	0.62	0.75	0.74	0.80	0.78	0.78	0.88	-	-	0.75	0.88
1963	0.70	0.62	0.74	0.71	0.61	0.90	0.89	0.82	0.79	0.83	0.67	0.64	0.90

Maximum= 1.05

(Daily Minimum) Unit; m

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean
1960	-0.48	-0.52	-0.44	-0.42	-0.42	-0.25	-0.34	-0.38	-0.40	-0.38	-0.34	-0.32	-0.52
1961	-0.44	-0.34	-0.34	-0.42	-0.31	-0.34	-0.28	-0.24	-0.22	-0.26	-0.33	-0.39	-0.44
1962	-0.32	-0.24	-0.28	-0.32	-0.32	-0.28	-0.26	-0.18	-0.28	-	-	-0.36	-0.36
1963	-0.35	-0.42	-0.41	-0.31	-0.41	-0.37	-0.39	-0.39	-0.36	-0.39	-0.39	-0.33	-0.42

Minimum= -0.52

Table 2.1 Summary of Meteorological Record

Rainfall (mm)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Aparri	1951 - 85	134.4	75.2	45.4	35.3	99.4	175.2	183.5	226.5	286.8	345.2	397.6	210.8	2,215.3
Lal-lo	1972 - 84	125.0	56.1	29.5	55.5	162.3	145.9	171.2	275.0	197.7	310.3	349.1	197.2	2,074.8
Bitag Grande	1975 - 80	85.5	21.0	28.9	27.4	212.6	118.3	313.0	199.9	548.7	214.2	286.3	141.2	2,197.0
Tuao	1956 - 85	29.4	24.3	31.2	63.3	171.0	195.4	214.8	232.2	175.1	246.7	230.8	96.9	1,711.1
Tuguegarao	1949 - 85	18.7	14.5	30.2	49.1	113.1	155.2	195.5	234.5	202.2	248.5	276.4	94.7	1,632.6
Pinukpuk	1970 - 81	83.7	26.0	58.4	75.8	203.8	233.6	263.2	322.3	212.7	365.5	364.2	189.2	2,398.4
Naneng	1956 - 85	38.3	28.1	51.4	72.9	208.0	271.8	285.4	337.8	288.7	298.2	299.2	94.9	2,274.7
Guilguila	1963 - 80	122.7	56.1	61.7	77.0	215.4	321.8	329.1	284.7	312.9	318.5	375.9	237.2	2,713.0
Lubuagan	1969 - 78	62.6	32.8	65.2	51.2	147.7	224.6	213.1	236.5	210.8	237.2	275.0	155.4	1,912.1
Basao	1963 - 75	95.6	27.2	70.6	114.8	288.8	422.0	382.0	341.4	314.9	312.6	439.8	271.5	3,081.2
Ilagan	1965 - 84	59.1	20.9	32.3	62.6	155.4	172.8	144.7	186.0	172.2	291.1	315.9	191.1	1,804.1
Banga-an	1963 - 78	27.2	7.6	22.0	78.8	218.7	274.8	302.4	375.6	274.5	148.8	115.3	26.4	1,872.1
Bontoc	1963 - 85	17.9	11.9	46.6	127.6	263.8	294.5	390.5	267.9	302.8	204.8	152.5	54.4	2,135.2
Barlig	1963 - 85	134.4	41.0	92.9	95.2	309.7	402.6	394.7	411.6	372.1	407.8	499.5	326.3	3,487.8
Bauko	1963 - 80	6.5	7.5	43.8	169.1	284.5	304.8	371.0	421.4	313.4	188.7	67.9	54.4	2,233.0
Mt. Polis	1963 - 80	160.4	134.0	110.1	157.7	337.3	457.1	516.8	553.5	453.0	378.1	370.9	246.6	3,875.5
Mt. Data	1950 - 78	27.2	25.0	74.6	187.9	357.0	413.5	619.4	563.3	465.2	296.3	220.4	78.2	3,328.0
Lagawe	1968 - 82	176.0	88.5	65.2	190.1	171.3	265.0	362.0	319.9	341.4	331.6	394.3	146.3	2,851.6
Nayon	1968 - 80	63.4	25.5	69.9	89.5	217.2	200.4	207.8	243.6	220.4	240.2	185.7	99.3	1,862.9
Echague	1976 - 85	17.5	9.1	18.2	91.7	114.5	97.1	148.8	259.9	189.6	272.8	128.0	142.3	1,489.5
Diadi	1968 - 71	54.2	16.3	49.9	54.4	173.0	239.2	275.8	192.4	211.4	399.6	280.0	153.3	2,099.5
Barat	1968 - 80	23.8	10.1	35.8	90.0	226.7	224.8	271.4	323.1	302.7	337.8	156.4	104.9	2,107.5
Consuelo	1956 - 85	33.5	18.0	44.0	70.9	221.5	252.6	380.4	331.0	325.5	263.9	211.8	60.5	2,213.6
Gabong	1973 - 82	38.6	13.0	25.5	33.4	128.5	179.9	251.5	216.7	229.0	230.0	284.9	90.3	1,721.3
Dakgan	1973 - 82	18.4	11.3	29.8	23.1	134.5	158.8	234.2	176.5	216.5	273.1	274.6	68.9	1,619.7
Casiguran	1961 - 84	234.2	113.8	176.5	136.3	242.3	229.4	284.7	251.9	592.5	421.7	628.8	402.9	3,715.0
Wacal	1980 - 85	36.8	19.6	112.2	160.7	174.1	107.5	255.5	201.4	183.2	259.9	141.4	50.4	1,702.7
Banti	1980 - 85	33.7	12.4	17.9	71.4	102.7	86.6	133.0	169.9	224.6	177.9	78.9	34.7	1,143.7
Dippadiw	1980 - 83	185.8	19.7	53.2	27.2	190.1	59.7	245.8	239.2	181.1	249.7	458.1	299.5	2,209.1
San Francisco	1975 - 80	122.8	138.2	47.0	41.8	146.3	82.3	143.1	143.4	153.9	328.3	209.8	171.7	1,728.6
NIA, Cabarroguis	1982 - 85	54.2	7.7	52.0	95.5	170.3	185.8	96.0	187.8	124.2	159.2	121.0	117.5	1,371.2
Hapid	1976 - 85	15.4	21.7	42.8	115.2	222.5	167.9	209.4	173.7	241.4	213.4	109.4	29.9	1,562.7
Baretbet	1977 - 85	21.1	12.5	58.9	128.1	262.7	184.7	231.4	194.9	254.4	250.8	125.1	49.4	1,774.0
Baligatan	1976 - 85	29.4	10.7	37.6	98.7	206.8	177.0	234.2	213.1	231.0	202.9	160.2	50.9	1,652.5
Poblacion Lagawe	1976 - 85	44.9	37.5	62.7	117.9	240.1	183.3	284.8	267.4	230.1	250.7	136.3	64.3	1,920.0
Sto Domingo	1976 - 85	28.6	14.6	29.7	115.3	113.9	161.7	193.5	157.3	232.7	245.3	116.3	44.8	1,453.7
Kasibu	1978 - 85	52.5	44.4	86.0	189.8	260.1	221.3	223.1	234.9	259.6	555.6	398.4	132.1	2,657.8
Kamamasi	1978 - 85	183.1	55.5	111.5	158.7	279.0	187.7	325.4	216.4	401.2	521.3	505.7	306.7	3,252.2
Alayan	1978 - 85	112.1	42.4	60.1	191.4	229.6	170.4	253.8	200.3	375.2	535.9	475.1	268.3	2,914.6
Packet	1979 - 84	45.4	30.5	75.2	126.2	261.3	171.9	259.5	187.3	335.8	231.5	277.7	201.8	2,204.1

(to be continued)

(Continuation)

Mean air temperature (°C)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Aparri	1951 - 85	23.1	23.8	25.3	27.1	28.3	28.5	28.3	27.9	27.6	26.8	25.4	23.8	26.3
Tuguegarao	1951 - 83	23.1	24.1	26.1	28.2	29.0	28.6	28.0	27.7	27.3	26.3	24.8	23.5	26.4
Echague	1981 - 84	21.5	22.7	24.5	26.1	26.9	27.6	26.8	26.6	26.3	25.3	24.2	22.2	25.1

Mean max air temperature (°C)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Aparri	1951 - 85	26.3	27.6	29.6	31.6	33.3	33.5	32.9	32.4	31.6	30.2	28.3	26.8	30.3
Tuguegarao	1951 - 83	29.2	31.2	33.8	35.9	36.8	35.7	34.9	34.2	33.6	32.2	30.1	28.8	33.0
Malasin	1976 - 80	27.2	27.4	30.2	32.8	32.9	31.9	31.5	31.3	30.9	29.0	27.0	26.0	30.0
San Isidro	1976 - 80	27.3	28.2	30.6	33.1	33.0	31.9	31.7	31.6	31.3	29.2	27.3	26.2	30.1
Lagawe	1981 - 84	29.1	29.0	28.9	28.8	29.7	30.2	29.7	29.9	29.7	29.7	29.6	28.4	29.4
Hapid	1981 - 84	23.7	24.6	25.7	27.3	28.5	28.2	27.7	26.8	28.2	26.7	25.5	23.0	26.3
Baretbet	1981 - 84	26.1	28.2	31.2	31.0	30.1	29.9	29.1	28.8	29.8	28.4	27.8	25.9	28.9
Consuelo	1981 - 84	25.5	28.7	30.3	30.9	31.7	31.1	29.2	27.6	28.6	27.4	27.1	24.8	28.6
Sto Domingo	1981 - 84	27.7	29.1	28.9	31.0	32.2	32.7	31.9	30.1	30.0	29.4	30.1	27.2	30.0

Mean min air temperature (°C)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Aparri	1951 - 85	20.4	20.7	22.0	23.6	24.5	24.9	24.8	24.6	24.3	23.8	22.8	21.4	23.2
Tuguegarao	1951 - 83	19.3	19.4	20.9	22.6	23.7	23.8	23.6	23.6	23.3	22.5	21.6	20.3	22.1
Malasin	1976 - 80	21.8	21.9	23.6	24.6	24.8	25.3	25.1	25.3	25.4	24.7	23.2	22.3	24.0
San Isidro	1976 - 80	21.3	21.1	23.0	24.9	25.4	25.7	25.6	25.5	24.6	24.1	22.8	21.6	23.8
Lagawe	1981 - 84	20.5	19.0	22.0	21.7	21.2	22.1	20.6	21.8	21.5	21.8	22.0	21.1	21.3
Hapid	1981 - 84	21.2	20.5	21.1	22.7	23.3	24.1	23.8	23.2	23.0	23.4	22.0	20.5	22.4
Baretbet	1981 - 84	21.7	23.1	23.3	24.3	24.5	24.4	24.2	24.8	25.0	24.0	23.8	22.5	23.8
Consuelo	1981 - 84	20.4	21.5	23.7	24.2	25.4	25.2	24.0	23.4	23.6	22.9	22.0	21.1	23.1
Sto Domingo	1981 - 84	19.6	20.1	19.5	20.2	22.2	22.0	21.2	20.4	20.1	18.7	19.1	18.9	20.2

Relative humidity (%)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Aparri	1951 - 85	85	83	82	81	80	80	81	83	84	84	86	87	83
Tuguegarao	1949 - 85	81	76	72	68	69	73	75	78	79	80	83	83	76
Echague	1981 - 84	88	86	81	79	83	84	84	87	86	85	90	92	85
Malasin	1976 - 80	85	81	78	70	72	80	81	80	85	83	88	86	81
San Isidro	1976 - 80	86	82	78	74	73	80	82	81	83	86	90	88	82

(to be continued)

(Continuation)

Daily evaporation, A-pan (mm)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Tuguegarao	1974 - 85	2.6	4.2	5.2	5.8	5.8	5.2	5.1	4.2	3.3	3.3	2.6	2.0	4.1
Alimanao reservoir	1957 - 67	4.9	5.5	6.6	7.8	7.5	6.4	6.0	5.5	5.8	5.3	4.5	4.4	5.9
Talictic (Baligatan)	1957 - 84	3.7	4.6	6.0	7.3	7.1	6.1	5.6	5.1	5.1	4.6	3.7	3.3	5.2
Bontoc	1969 - 74	3.9	4.4	4.2	4.3	3.0	3.5	2.5	3.1	3.6	3.2	2.9	3.0	3.5
Echague	1977 - 85	3.0	3.9	5.3	5.6	5.4	4.7	4.8	4.2	4.3	3.5	3.2	2.9	4.2
Lagawe	1980 - 83	3.9	3.7	4.3	5.4	5.7	4.8	4.9	5.7	4.9	6.4	5.5	3.9	4.9
Consuelo	1980 - 84	3.5	4.6	5.2	6.0	6.1	5.4	5.1	3.7	4.7	3.3	3.3	3.1	4.5
Sto Domingo	1979 - 84	4.3	5.3	6.3	7.3	6.3	6.4	5.8	5.6	6.0	5.3	4.7	4.7	5.7
Baretbet	1980 - 84	3.4	3.3	5.7	6.2	6.2	5.8	5.6	5.3	5.0	4.3	3.6	3.2	4.8
Wacal	1980 - 84	3.0	4.2	5.2	5.6	5.8	6.6	5.7	5.4	4.8	4.7	3.5	3.0	4.8
Malasin	1976 - 80	3.5	4.4	6.2	8.3	7.5	6.2	6.0	5.5	4.3	3.8	3.1	2.6	5.1
San Isidro	1976 - 80	3.5	4.4	5.8	7.3	7.1	6.4	6.1	5.4	4.9	3.8	3.1	2.6	5.0

Wind speed (km/hr)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Aparri	1951 - 85	12	10	10	10	8	8	9	8	8	11	14	12	10
Tuguegarao	1958 - 85	5	4	5	5	5	5	5	4	4	5	5	5	5

Daily sunshine duration (hr)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Tuguegarao	1978 - 85	4.4	6.5	7.4	8.0	7.5	7.8	6.8	5.2	6.0	4.7	3.6	2.7	5.9
Echague	1981 - 84	2.2	5.6	6.1	6.8	6.7	6.4	5.9	3.9	5.0	3.8	3.3	1.8	4.8

Table 3.1 Selection of Runoff Gauge for Tank Model

Basin	Runoff Gauge /1	Stream	Drainage Area (km^2)	Selection	Reason for Selection
Basin 1 (Upper Cagayan)	Palattao	Cagayan	6,626		.appropriate drainage area .long record period
	Pangal	Cagayan	4,244		
	Panang	Cagayan	2,392		
	Guinalvin	Addalam	921	Selected	
	Dippadiw	Cagayan	2,380		
Basin 2 (Magat)	Oscariz	Magat	4,150		.appropriate drainage area .less missing
	Dulao	Alimit	573	Selected	
	Hapid	Ibulao	606		
	Camandag	Cadaclan	261		
	Bante	Matuno	558		
	Bato	Magat	1,649		
Basin 3 (Ilagan)	Malalam	Ilagan	3,123		.appropriate drainage area
	Minanga	Ilagan	1,565	Selected	
	Dipalin	Disabungan	198		
Basin 4 (Lower Cagayan)	Calaoagan	Dummon	308		.appropriate drainage area .long record period
	Calantac	Paret	907		
	Larion Alto	Tuguegarao	655	Selected	
	Antagan	Tumauini	170		
Basin 5 (Upper Chico)	Ampawilen	Chico	751	Selected	.appropriate drainage area .less missing
	Taed	Chico	391		
	Supang	Sabangan	57		
Basin 6 (Lower Chico)	Escolta	Matalag	655		.less missing
	Pinukpuk	Saltan	856	Selected	

Note; /1: Runoffs at these gauges are examined by double mass curve and runoff coefficient, and judged to be reliable.

Table 3.2

10 - DAY RAINFALL (MM)

* STATION ------ ILAGAN
* DISTRICT ------ ISABELA

* CODE NO. ------ 0552 19
* REGION ------ REGION II

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	0.	27.5	0.	13.2	0.	29.4	180.0	164.4	31.8	42.2	17.5	95.0
	(M)	0.	54.5	7.	18.7	11.9	244.6	67.1	83.9	74.2	77.8	18.7	117.3
	(L)	26.3	31.6	22.8	0.	90.8	169.0	76.9	191.4	124.4	51.8	61.0	24.0
1964	(F)	19.9	14.9	23.8	0.	32.8	79.8	82.1	98.3	71.2	129.2	137.8	42.9
	(M)	7.5	33.1	21.7	26.1	30.0	88.9	69.7	39.7	135.9	34.8	446.1	194.8
	(L)	15.5	63.0	13.8	10.8	156.1	117.0	139.6	50.5	138.5	92.2	171.8	29.1
1965	(F)	3.8	C.	0.	0.	27.6	63.0	143.8	34.8	107.3	0.	126.7	16.5
	(M)	4.3	2.5	G.	21.1	9.4	27.2	167.6	60.8	16.3	109.7	0.	47.8
	(L)	0.	C.	0.	28.4	49.3	110.1	0.	35.1	24.1	0.	48.1	40.4
1966	(F)	0.	2.3	3.8	0.	154.7	62.4	60.1	44.4	19.3	67.5	67.3	93.9
	(M)	1.5	0.	0.	28.4	30.2	95.5	30.5	0.	31.1	53.0	176.2	57.5
	(L)	7.4	8.7	1.5	12.7	98.4	50.8	51.9	48.0	7.4	58.3	382.8	246.1
1967	(F)	16.3	15.0	17.7	67.1	0.	76.7	93.0	66.1	129.5	137.7	101.8	37.2
	(M)	19.3	27.9	8.1	15.2	12.7	35.2	31.8	39.4	10.3	19.2	20.4	5.0
	(L)	20.3	C.	0.	34.0	46.9	111.7	81.9	46.5	31.4	0.	5.0	17.2
1968	(F)	5.0	15.5	8.9	0.	49.5	221.1	34.0	127.2	29.5	14.0	9.9	0.
	(M)	12.4	0.	0.	0.	7.1	66.5	69.2	224.8	79.4	57.9	16.6	80.8
	(L)	1.0	6.3	0.	85.9	16.3	71.4	45.4	21.5	126.3	10.8	67.9	25.0
1969	(F)	23.4	0.0	0.	29.6	7.1	67.8	18.2	121.8	92.5	223.4	5.6	105.9
	(M)	4.8	2.8	54.7	0.	28.2	38.1	1.9	105.8	17.8	43.2	164.1	108.5
	(L)	0.0	0.0	0.	0.	96.6	1.0	4.1	49.0	50.8	7.6	139.9	107.7
1970	(F)	79.2	28.0	25.4	22.9	0.	19.2	38.1	124.5	55.9	182.8	114.4	192.7
	(M)	0.	0.	0.	13.2	12.0	97.9	33.0	83.8	112.6	112.0	98.2	147.0
	(L)	10.7	25.6	14.5	78.8	5.1	66.0	27.9	20.3	33.0	160.4	79.7	17.9
1971	(F)	76.1	C.	12.7	0.	76.0	99.5	86.2	58.4	81.8	313.0	132.1	281.9
	(M)	0.	55.9	181.2	0.	99.6	205.7	199.3	109.2	258.4	210.6	227.7	101.6
	(L)	51.0	C.	0.	0.	38.1	40.6	40.7	116.8	18.4	162.6	373.6	124.8
1972	(F)	111.7	0.	0.	60.9	43.1	25.4	96.3	58.5	48.2	35.5	55.9	35.6
	(M)	0.	15.2	0.	88.9	139.1	5.1	17.8	15.2	15.8	5.1	0.	7.6
	(L)	37.1	0.	20.3	88.6	167.6	106.7	7.6	43.2	40.7	17.7	149.8	0.
1973	(F)	2.5	7.6	0.	0.	0.	240.1	27.9	83.8	15.2	104.1	129.5	127.0
	(M)	0.	0.	15.2	0.	35.5	99.1	25.3	127.0	106.6	264.1	254.0	15.3
	(L)	12.7	C.	7.6	0.	45.7	102.2	101.6	17.7	0.	50.5	357.2	5.1
1974	(F)	5.1	20.3	0.	12.7	38.1	200.6	0.	20.3	58.4	304.8	260.2	53.3
	(M)	0.	0.	0.	5.1	89.8	12.7	96.5	104.1	58.4	279.4	137.2	223.5
	(L)	41.9	2.5	0.	0.	15.2	0.	2.5	0.	63.5	337.8	35.6	71.0
1975	(F)	22.8	2.5	0.	10.2	0.	30.4	35.5	45.6	40.6	5.1	50.8	132.1
	(M)	7.6	2.5	2.5	0.	55.9	45.7	20.3	2.5	71.1	128.8	0.	66.0
	(L)	48.2	0.	2.5	25.4	99.0	73.7	79.4	38.0	7.6	157.5	7.6	101.6
1976	(F)	76.2	14.9	5.1	63.5	48.2	68.5	25.4	200.7	25.4	66.1	149.9	35.5
	(M)	15.2	0.	38.1	25.4	56.2	30.5	0.	12.7	149.6	2.5	213.1	165.1
	(L)	7.6	7.6	0.	0.	177.8	122.3	81.3	5.1	17.8	106.6	266.7	27.9
1977	(F)	17.8	17.7	0.	20.4	2.5	0.	0.	68.6	35.5	20.3	15.2	12.7
	(M)	43.1	5.1	7.6	0.	27.9	2.5	48.2	0.	101.5	20.3	200.6	0.
	(L)	30.5	5.1	0.	0.	152.3	38.1	40.6	40.6	119.4	0.	15.2	12.7
1978	(F)	2.5	0.	0.	7.6	2.5	5.1	15.2	106.6	106.6	63.5	20.2	3.3
	(M)	0.	2.5	0.	0.	45.7	12.7	34.3	40.6	96.5	27.9	185.4	56.0
	(L)	0.	5.0	0.	5.1	104.1	12.7	20.3	139.7	96.5	187.9	33.0	78.8
1979	(F)	3.0	3.4	11.7	14.9	0.	126.3	129.9	25.8	219.4	98.1	90.7	14.7
	(M)	0.	2.0	0.0	15.2	73.8	20.5	173.9	109.6	72.5	17.4	26.2	5.6
	(L)	0.	8.1	0.3	72.2	219.2	67.4	192.1	41.2	19.7	13.9	29.2	19.7
1980	(F)	17.7	2.5	25.4	0.	0.	4.2	44.4	5.0	70.8	68.4	279.0	51.8
	(M)	6.7	10.6	0.	53.4	20.7	0.	66.9	23.0	34.2	7.2	44.0	110.6
	(L)	17.8	5.1	12.7	0.	89.7	4.6	55.9	9.8	10.4	231.0	33.8	18.4
1981	(F)	9.6	1.1	1.6	C.	6.0	123.8	58.0	87.4	40.2	33.4	130.6	30.2
	(M)	27.8	0.7	1.8	3.8	58.6	94.8	133.6	97.2	73.2	36.8	47.8	25.4
	(L)	13.6	1.2	0.	16.0	17.2	32.1	0.	29.4	60.6	172.0	64.0	8.2
1982	(F)	15.0	0.	0.	25.6	13.6	0.	4.2	48.8	128.0	12.2	40.0	70.4
	(M)	0.	10.8	0.	4.0	46.4	84.6	30.0	51.2	84.2	73.0	81.2	42.4
	(L)	6.4	C.	6.6	50.0	51.2	52.4	1.6	86.4	0.	40.2	35.0	12.0
1983	(F)	60.6	0.	13.2	49.4	C.	14.2	0.	32.6	21.8	114.4	55.5	2.4
	(M)	54.8	14.8	0.	C.	78.6	36.6	40.0	20.4	0.	17.2	50.2	15.0
	(L)	0.	C.	0.	C.	66.4	20.2	11.2	63.0	105.2	97.6	7.6	8.4
1984	(F)	5.2	6.2	28.6	0.	111.4	5.2	120.4	89.2	24.8	41.6	3.2	95.0
	(M)	34.4	3.0	51.6	108.8	54.2	36.0	0.	16.0	3.4	102.0	9.8	13.2
	(L)	3.4	6.4	45.2	48.2	128.0	183.4	146.4	110.0	7.6	335.2	4.6	41.8

to be Continued

Continuation

10 - DAY RAINFALL (MM)

* STATION ------ MAYOK
* DISTRICT ------ IFUGAO

* CODE NO. ------ 0552 29
* REGION ------ REGION II

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	0.	24.8	0.	11.9	0.	26.6	162.6	148.7	28.8	38.2	15.8	85.9
	(M)	0.	49.3	6.4	16.9	10.7	221.2	60.6	75.9	67.1	70.4	16.9	106.1
	(L)	23.8	28.6	20.7	0.	82.1	152.9	69.5	173.1	112.5	46.9	55.1	21.7
1964	(F)	18.0	13.4	21.5	0.0	29.7	72.2	74.3	88.9	64.3	116.8	124.6	38.8
	(M)	6.8	29.9	19.7	23.6	27.1	80.4	63.0	42.5	122.9	31.5	403.4	176.2
	(L)	14.0	57.0	12.4	9.7	141.1	105.9	126.2	45.7	125.3	83.4	155.4	26.3
1965	(F)	8.7	20.0	10.5	19.5	42.7	84.9	61.2	31.4	68.4	4.2	41.0	23.7
	(M)	105.9	0.0	3.8	22.4	48.8	58.3	82.6	55.0	31.4	50.5	1.2	30.6
	(L)	69.9	11.7	22.4	45.5	42.2	54.4	162.9	31.8	107.2	5.9	23.0	36.0
1966	(F)	8.5	7.6	29.7	23.5	74.9	56.4	54.4	76.0	3.8	20.2	85.4	77.3
	(M)	5.0	5.2	0.0	8.7	67.7	86.4	27.5	53.5	14.6	14.2	117.5	32.7
	(L)	12.4	34.4	15.0	26.1	146.8	45.9	46.9	102.9	4.2	25.2	258.2	108.4
1967	(F)	50.2	9.8	13.8	41.2	0.0	69.4	50.2	57.2	86.4	141.8	149.9	60.5
	(M)	68.5	20.8	2.2	31.8	43.2	31.8	36.0	81.2	99.8	115.4	20.7	25.1
	(L)	22.4	3.2	0.0	32.8	49.8	101.0	149.8	110.6	69.4	8.4	18.1	32.7
1968	(F)	0.	0.	51.1	0.	87.1	122.3	70.1	165.1	135.6	37.9	18.1	0.
	(M)	0.	0.5	0.	0.	8.4	67.1	21.9	185.1	0.	41.2	14.5	14.7
	(L)	0.	1.5	0.	309.9	47.2	197.1	170.7	108.8	33.9	19.8	16.7	0.
1969	(F)	0.	11.9	0.	21.3	1.3	28.5	24.4	7.9	72.7	86.2	0.8	26.0
	(M)	18.3	0.	35.6	0.	150.1	65.5	0.	11.4	0.	12.2	0.	45.2
	(L)	0.	0.	1.3	6.6	6.9	0.	79.0	95.2	69.9	8.1	93.7	110.3
1970	(F)	184.4	0.	96.2	21.6	25.9	158.2	0.	21.4	33.3	42.9	57.9	179.9
	(M)	24.9	0.	0.	0.	23.6	80.1	54.0	11.2	171.8	268.3	80.5	114.4
	(L)	0.	6.6	24.9	6.1	62.0	0.	103.4	111.0	26.7	109.2	177.3	0.
1971	(F)	78.3	5.3	15.0	0.	107.7	28.7	98.5	16.5	181.1	314.6	66.3	27.8
	(M)	8.4	0.	85.6	3.3	308.1	55.9	164.7	0.	60.5	56.2	34.3	57.1
	(L)	0.	73.4	11.1	0.	22.1	33.6	155.2	134.1	95.6	29.9	215.3	73.6
1972	(F)	63.2	6.1	0.	47.8	42.6	45.2	118.1	118.3	82.5	18.0	96.1	2.6
	(M)	7.9	0.	6.9	35.8	127.6	13.5	104.4	212.2	25.2	0.	10.4	0.5
	(L)	68.6	5.3	10.4	0.	96.5	18.5	55.4	10.4	0.	13.4	29.8	1.0
1973	(F)	0.	42.3	0.	0.	5.1	0.	45.7	48.3	87.6	134.9	29.7	0.
	(M)	0.	0.	0.	0.	101.6	163.1	0.	183.7	9.4	148.2	9.4	14.6
	(L)	2.3	0.	69.2	0.	52.8	68.8	48.8	302.4	59.0	60.5	212.6	0.
1974	(F)	14.3	0.	9.9	0.	0.	69.1	70.6	2.8	77.2	0.	98.4	27.7
	(M)	33.3	5.4	0.	57.7	32.9	161.3	38.6	83.5	0.	177.7	24.9	137.4
	(L)	28.0	0.	10.7	8.7	0.	37.3	21.5	31.3	112.0	225.5	94.7	11.9
1975	(F)	23.2	0.	14.2	0.	48.1	57.7	54.6	34.3	103.4	14.0	73.7	52.1
	(M)	107.2	45.0	5.2	0.	12.9	14.0	50.4	5.8	22.9	85.9	31.3	130.4
	(L)	40.6	4.1	15.9	4.9	64.6	10.5	32.3	49.9	9.7	34.2	13.6	37.0
1976	(F)	0.	6.2	133.7	103.6	133.5	96.5	41.9	117.2	90.5	113.2	25.2	19.1
	(M)	0.	7.6	30.5	1.3	45.2	0.	12.0	94.4	205.1	51.1	41.4	49.3
	(L)	0.	10.2	0.	0.	316.8	144.1	98.8	46.8	95.5	26.9	26.4	8.1
1977	(F)	19.3	12.0	3.3	60.3	25.9	8.6	69.4	162.0	52.4	35.9	39.6	13.8
	(M)	27.1	16.5	13.5	0.3	12.9	75.2	76.2	25.6	109.2	29.5	168.3	2.1
	(L)	38.2	0.	9.9	0.	246.9	40.9	103.9	72.1	26.6	2.0	34.8	0.3
1978	(F)	2.6	3.1	8.4	16.0	6.1	84.0	2.5	20.5	59.5	112.1	112.0	31.1
	(M)	0.	5.3	17.5	30.0	0.	77.3	75.0	19.8	128.9	65.8	7.9	15.3
	(L)	1.3	28.5	5.6	102.6	126.6	23.1	95.3	236.2	126.7	207.4	9.9	53.4
1979	(F)	22.6	0.	19.3	3.6	5.4	214.6	57.7	100.6	75.2	175.0	53.0	17.3
	(M)	2.0	0.	3.6	25.5	153.8	28.7	50.5	61.2	66.1	70.6	69.9	4.6
	(L)	8.7	0.	16.8	120.0	80.6	115.3	105.4	16.0	137.3	13.8	73.2	32.7
1980	(F)	0.	11.7	25.9	0.	5.1	0.0	56.0	94.4	39.9	47.9	241.5	12.4
	(M)	0.	23.2	5.3	89.1	115.4	0.0	116.9	22.3	123.3	65.9	29.0	42.4
	(L)	0.	0.	151.6	2.0	114.7	24.1	74.7	60.1	52.5	255.2	18.3	2.4
1981	(F)	7.0	22.3	0.0	0.0	7.5	129.6	159.4	113.6	158.2	17.1	54.9	6.9
	(M)	4.5	4.1	0.0	48.6	134.7	99.2	243.2	59.6	100.6	30.8	33.6	1.4
	(L)	10.2	16.8	0.0	193.2	296.1	110.2	59.0	8.9	56.0	213.7	87.1	9.5
1982	(F)	4.6	0.0	26.3	71.0	28.7	51.6	57.2	63.0	101.4	4.5	55.7	29.5
	(M)	11.3	0.8	29.6	128.2	46.9	68.7	130.1	12.7	62.8	75.0	23.0	6.4
	(L)	3.7	0.0	144.0	90.8	267.1	55.5	73.4	173.5	38.0	3.0	41.8	15.9
1983	(F)	6.7	0.0	0.0	9.4	2.1	14.5	26.0	61.2	3.5	63.6	1.9	0.0
	(M)	30.2	0.0	0.0	0.0	49.6	54.6	49.4	45.5	27.6	81.5	4.9	7.7
	(L)	8.3	0.0	20.4	0.0	14.8	4.0	29.5	39.0	153.2	165.3	1.4	1.9
1984	(F)	0.0	0.0	20.7	0.0	209.7	53.1	114.5	59.6	0.0	26.8	3.2	59.5
	(M)	2.1	0.0	109.2	91.4	45.6	99.7	97.2	65.2	51.0	82.3	2.6	0.0
	(L)	7.6	2.6	9.1	87.3	112.5	23.1	92.5	110.0	20.1	202.9	12.6	4.0

to be Continued

Continuation

= 10 - DAY RAINFALL (MM) =

* STATION ------ TUGUEGARAO
* DISTRICT ------ CAGAYAN
* CODE NO. ------ 0552 08
* REGION ------ REGION II

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	0.5	0.	0.	0.	1.0	18.1	110.4	20.8	66.1	0.	1.0	139.5
	(M)	6.8	10.1	1.6	1.0	0.8	104.1	148.5	23.5	122.6	10.6	0.	118.6
	(L)	0.	2.3	4.3	0.	6.4	114.5	33.2	10.9	59.5	5.1	14.6	0.8
1964	(F)	4.8	0.	35.5	0.3	18.5	65.9	29.8	323.5	99.0	138.0	155.0	52.4
	(M)	0.	3.3	1.0	4.1	1.3	56.7	75.4	100.9	10.8	41.3	444.4	65.1
	(L)	0.	41.0	0.	2.7	58.6	34.4	81.2	23.2	71.4	54.8	359.4	3.8
1965	(F)	4.6	9.3	1.8	0.8	15.7	12.2	13.4	15.5	139.0	0.	98.7	5.9
	(M)	10.3	0.	0.	0.	3.0	65.6	358.0	67.9	3.9	70.5	4.9	9.7
	(L)	20.7	0.	7.2	9.2	107.7	47.4	57.6	36.0	111.3	3.1	22.4	4.9
1966	(F)	0.	7.9	9.2	4.1	153.3	64.1	24.4	70.9	12.0	7.1	74.4	48.7
	(M)	1.5	0.5	1.3	32.1	56.9	29.2	115.8	117.1	31.3	46.7	117.3	43.2
	(L)	3.6	12.7	41.5	0.	197.7	59.2	66.9	121.1	0.	113.3	422.7	126.9
1967	(F)	2.1	0.	3.9	225.1	0.	62.5	0.	68.2	55.4	287.9	101.9	4.6
	(M)	3.8	2.6	0.	8.1	36.0	0.	0.	147.1	36.1	337.9	24.3	1.5
	(L)	6.4	0.	0.	5.6	38.1	301.0	47.3	226.9	17.7	1.5	7.9	6.3
1968	(F)	7.9	0.	8.9	0.	25.9	82.8	25.2	162.3	32.2	25.7	1.3	0.
	(M)	0.3	1.1	0.	21.4	0.4	64.5	100.3	293.6	2.8	9.9	11.2	0.3
	(L)	0.	0.	0.5	53.9	32.9	56.5	106.8	56.8	290.9	2.9	5.9	0.
1969	(F)	0.8	0.	0.	51.6	0.	138.7	133.5	28.6	73.1	79.1	5.2	30.9
	(M)	0.	0.	1.5	0.	29.4	22.2	30.7	2.6	64.4	3.2	150.4	29.9
	(L)	0.	0.	0.	1.3	54.0	0.	353.3	40.1	65.3	13.2	31.9	7.7
1970	(F)	41.4	0.	11.1	4.1	96.2	71.7	19.5	37.3	38.5	49.9	170.8	70.4
	(M)	2.9	0.	0.	6.5	47.4	17.9	156.8	44.7	49.6	122.4	69.0	113.3
	(L)	3.0	1.8	123.6	24.2	42.1	1.6	9.6	72.7	76.6	261.2	79.3	2.5
1971	(F)	5.5	8.1	0.	0.	39.5	83.6	60.4	28.2	36.6	303.7	179.9	113.8
	(M)	0.8	38.8	9.3	10.0	35.6	53.1	209.8	49.1	114.3	127.3	190.2	70.0
	(L)	0.5	0.	1.0	0.	27.4	9.1	42.3	1.0	91.3	136.4	483.1	36.7
1972	(F)	52.7	4.8	3.1	0.	41.1	79.1	61.2	55.7	86.5	0.	50.7	24.3
	(M)	0.	5.1	28.7	14.5	88.2	14.7	62.1	69.3	5.0	0.	2.5	0.
	(L)	27.4	0.3	4.5	10.7	21.3	77.8	90.3	92.6	59.4	26.2	55.6	9.6
1973	(F)	8.6	7.1	0.	0.	44.2	27.5	25.2	92.7	28.6	147.6	47.8	53.1
	(M)	0.	0.	0.	0.	51.9	101.2	44.2	52.3	35.5	281.4	199.4	2.6
	(L)	6.6	0.3	25.7	0.	12.5	42.7	16.7	131.8	20.1	63.7	538.9	2.2
1974	(F)	0.	1.5	0.	10.1	51.7	108.5	20.5	46.5	16.5	199.1	320.4	19.3
	(M)	0.	0.3	0.	7.1	14.2	12.2	20.5	67.0	100.5	90.8	160.3	98.5
	(L)	3.5	0.	0.	37.3	29.7	29.2	18.3	31.2	139.9	208.0	11.5	38.0
1975	(F)	0.	0.	0.	0.	50.0	33.3	26.5	120.4	41.8	199.1	23.6	13.1
	(M)	0.	0.	7.6	0.	27.2	82.5	2.9	28.8	38.9	90.8	34.4	56.5
	(L)	0.	0.	24.6	0.	68.8	34.8	4.5	118.4	4.6	207.6	1.3	73.1
1976	(F)	12.5	0.5	2.6	48.7	8.1	18.3	7.1	53.6	0.5	42.1	125.8	2.5
	(M)	7.6	0.	4.0	0.	41.4	112.3	0.5	39.8	98.5	19.0	131.8	39.0
	(L)	4.9	0.	35.0	0.	133.8	78.6	93.0	97.1	8.6	153.5	20.3	13.2
1977	(F)	6.1	0.5	0.1	6.5	0.	52.8	37.2	98.4	162.0	38.1	29.4	1.4
	(M)	3.1	1.3	0.2	0.	3.5	44.0	46.6	46.8	303.4	21.2	108.9	4.0
	(L)	9.0	0.	1.0	12.5	70.8	31.8	265.8	42.6	107.2	0.9	10.0	11.8
1978	(F)	0.	1.6	2.2	0.4	0.	51.1	1.8	142.9	58.7	75.4	47.8	32.2
	(M)	0.	4.8	10.0	41.6	6.6	0.	97.6	41.3	122.0	46.0	137.9	57.0
	(L)	2.8	2.1	0.5	31.0	127.4	21.5	75.8	267.2	100.9	158.4	3.7	10.0
1979	(F)	2.2	15.4	4.0	5.0	6.8	18.9	198.3	24.2	53.6	179.4	141.2	1.0
	(M)	1.4	5.9	0.	10.2	85.0	14.6	55.1	49.4	31.0	104.5	45.5	4.7
	(L)	6.0	0.	0.	29.9	65.3	13.2	58.1	5.8	29.4	1.8	17.1	66.3
1980	(F)	0.	2.5	1.0	0.	0.	0.	122.3	35.8	36.4	38.1	180.8	22.9
	(M)	0.	26.5	0.	18.2	134.4	3.8	231.7	80.4	65.0	17.0	57.4	60.6
	(L)	0.	0.	53.3	0.	21.8	12.7	134.9	23.9	10.6	277.9	13.3	9.0
1981	(F)	0.4	1.2	0.4	0.	2.0	112.0	21.4	171.1	6.8	80.0	195.5	4.8
	(M)	3.6	0.8	3.6	1.0	70.6	133.0	11.0	97.2	159.6	66.6	17.0	3.6
	(L)	1.0	1.4	1.0	30.0	127.8	29.6	1.0	22.0	0.	124.2	69.4	3.0
1982	(F)	3.6	0.2	1.4	28.8	10.0	49.2	14.4	69.4	79.2	11.2	34.2	81.2
	(M)	3.8	8.8	0.	45.8	96.8	8.0	14.0	38.3	52.7	173.5	129.0	10.4
	(L)	1.6	0.	0.	9.6	51.4	25.2	30.3	84.0	65.9	0.4	98.2	22.6
1983	(F)	17.2	0.	6.2	7.6	0.	4.6	0.	79.6	156.2	151.8	6.4	1.0
	(M)	46.0	1.4	3.4	0.	34.0	30.4	21.4	22.9	1.4	61.0	7.8	3.0
	(L)	3.2	0.	14.2	0.	26.8	11.8	24.6	12.8	30.2	123.4	41.6	0.2
1984	(F)	0.	0.	6.6	0.	58.1	18.0	90.4	117.5	10.4	14.7	8.4	103.8
	(M)	0.	0.	2.1	46.6	19.3	44.8	29.2	33.4	0.	0.4	53.0	0.
	(L)	0.	0.	0.2	67.2	113.0	117.2	51.4	422.2	6.7	187.6	18.8	0.

to be Continued

Continuation

10 - DAY RAINFALL (MM)

* STATION ------ BONTOC
* DISTRICT ------ MOUNTAIN
* CODE NO. ------ 0551 21
* REGION ------ REGION I

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	0.	0.	0.	0.	0.	142.3	203.4	104.9	79.5	0.	0.	21.5
	(M)	0.	9.6	0.	0.	145.3	68.3	191.8	105.7	62.7	0.	34.3	63.3
	(L)	0.	5.1	14.0	0.	81.7	190.2	111.0	81.3	69.8	0.	73.6	88.9
1964	(F)	0.	0.	2.0	0.	99.4	104.7	70.2	297.2	158.2	206.4	70.0	12.4
	(M)	0.	0.	0.	8.8	48.7	139.6	96.0	147.0	100.8	30.2	111.3	206.1
	(L)	0.	0.	29.5	20.6	134.9	177.5	98.3	58.5	50.8	12.9	205.7	11.7
1965	(F)	0.	0.	0.	59.4	112.1	120.6	64.7	8.9	74.5	8.6	7.3	0.
	(M)	11.4	0.	3.8	24.1	96.7	91.4	195.2	106.9	8.7	7.1	0.	31.7
	(L)	13.2	0.	26.6	139.6	113.2	34.3	296.3	59.5	72.1	73.7	4.3	7.6
1966	(F)	1.0	2.5	12.5	10.2	81.7	114.3	44.5	227.8	74.2	23.1	17.2	129.8
	(M)	0.	9.4	1.0	24.9	145.9	24.5	55.9	104.4	10.2	48.1	56.9	3.8
	(L)	2.8	5.8	16.2	118.9	168.8	53.4	96.8	77.3	0.	86.1	313.8	6.9
1967	(F)	1.8	0.	10.2	7.3	0.	120.9	13.0	157.2	128.6	146.1	301.8	1.3
	(M)	7.1	0.	0.	0.5	107.5	51.4	84.5	144.5	139.1	273.0	0.	0.
	(L)	6.1	0.	0.	70.1	26.7	185.4	453.5	267.3	260.5	0.	0.	0.
1968	(F)	1.3	0.	37.6	3.1	56.9	96.8	72.3	111.1	207.2	67.3	3.8	0.
	(M)	0.	0.	31.3	49.0	197.8	225.1	160.2	219.2	134.4	25.4	0.	0.
	(L)	13.2	0.	62.8	118.3	65.8	231.5	235.5	121.4	404.9	0.	47.3	0.
1969	(F)	2.5	0.	0.	59.1	89.4	189.0	131.8	76.3	69.5	75.2	10.1	15.7
	(M)	9.2	0.	15.2	81.8	111.4	96.3	107.5	76.4	61.2	3.0	11.4	2.6
	(L)	0.	0.	0.	3.0	124.9	35.8	821.1	85.8	62.1	12.6	89.1	15.0
1970	(F)	97.7	0.	12.7	28.7	169.0	162.0	32.2	78.3	95.5	168.0	100.6	41.8
	(M)	0.	0.	0.	0.	140.9	157.8	93.3	189.9	266.7	154.8	72.0	31.2
	(L)	0.	4.8	78.4	138.1	140.3	39.1	93.3	134.3	72.6	175.3	14.5	3.9
1971	(F)	34.7	3.6	0.	22.8	21.0	59.0	81.4	55.1	92.9	303.4	50.0	1.7
	(M)	0.	49.1	11.0	0.	34.0	82.9	225.1	100.8	64.6	53.6	47.9	9.8
	(L)	0.	6.4	49.5	17.7	77.4	44.9	180.6	131.1	186.4	35.4	99.6	29.0
1972	(F)	9.7	0.	1.8	23.8	155.5	189.1	120.6	39.6	24.4	0.7	18.8	22.8
	(M)	0.	0.	4.5	131.4	80.1	57.1	390.6	66.1	21.8	1.6	3.8	1.0
	(L)	13.7		25.1	88.5	175.7	71.6	201.9	60.8	142.8	1.2	4.0	0.
1973	(F)	0.	2.3	0.	32.6	207.5	53.6	93.7	83.2	194.1	247.2	26.9	11.2
	(M)	0.	1.5	2.3	3.8	171.0	33.4	78.4	104.3	73.9	243.1	25.7	1.0
	(L)	0.	0.	6.1	75.2	92.5	78.3	55.6	98.3	67.4	16.3	189.0	5.4
1974	(F)	1.8	0.	0.	82.6	43.9	233.0	47.4	96.5	48.5	65.3	274.3	1.0
	(M)	0.8	5.1	0.	49.6	39.3	10.4	85.4	186.7	27.0	352.0	24.7	92.7
	(L)	20.5	0.	22.3	187.1	106.0	16.2	120.7	166.5	117.6	215.0	30.5	12.7
1975	(F)	0.	0.	25.9	79.4	220.2	119.7	91.1	87.4	187.1	62.4	44.9	24.3
	(M)	0.	4.3	2.5	0.	48.5	94.7	133.4	60.1	95.1	52.8	4.4	20.8
	(L)	13.7	0.	5.1	13.3	77.7	11.7	93.6	129.6	6.1	46.7	2.5	22.6
1976	(F)	7.1	0.	8.6	45.4	42.7	23.1	120.1	39.6	80.6	170.5	21.6	5.4
	(M)	0.	0.	22.0	40.6	33.0	224.9	19.1	26.8	148.1	77.7	65.1	18.8
	(L)	0.	0.	65.4	0.	231.2	278.9	113.3	79.0	88.1	7.6	3.3	0.
1977	(F)	2.5	0.	0.	49.3	0.	70.2	150.5	165.2	66.8	38.8	17.0	0.
	(M)	12.7	0.	0.	77.8	8.6	74.6	122.9	20.0	399.6	18.2	186.2	0.
	(L)	7.8	0.	26.1	0.	93.4	106.5	146.7	78.5	64.1	1.0	0.	0.
1978	(F)	0.	0.	0.	24.6	47.2	31.3	193.5	0.	145.9	0.	0.	0.
	(M)	0.	0.	17.3	73.7	4.5	156.6	60.2	0.	150.5	0.	75.9	21.3
	(L)	0.	0.	41.4	31.7	90.8	39.4	144.3	11.4	240.5	7.1	0.	0.
1979	(F)	5.8	0.6	28.0	0.	67.6	167.5	41.5	54.9	47.6	36.0	25.1	10.2
	(M)	1.0	0.3	0.4	10.6	73.1	19.6	94.9	11.2	25.9	78.8	42.2	25.8
	(L)	11.6	1.4	0.0	159.0	42.2	67.0	78.3	3.6	30.7	27.4	59.3	38.3
1980	(F)	4.1	0.	21.4	0.	49.4	6.9	147.3	45.5	37.2	37.8	171.9	13.2
	(M)	0.	0.	0.	18.8	270.2	3.1	115.3	87.5	97.1	44.4	54.6	5.9
	(L)	27.9	0.	21.0	35.8	150.6	1.3	331.0	101.7	57.2	261.2	12.6	0.
1981	(F)	6.4	0.	0.	0.	43.2	248.9	104.1	53.5	42.9	58.3	185.9	0.
	(M)	2.0	0.	0.	8.4	197.7	146.3	42.3	72.8	176.0	7.1	16.2	0.
	(L)	0.	0.	0.	7.4	133.5	55.3	34.3	70.1	0.	91.2	66.0	5.3
1982	(F)	0.	0.	0.	43.2	56.2	37.9	83.8	91.0	193.0	0.	68.6	53.7
	(M)	0.	3.0	0.	61.3	50.2	124.5	0.	120.9	50.8	94.1	55.9	26.4
	(L)	0.	0.	46.5	0.	50.3	63.5	82.3	18.0	201.5	0.	12.2	18.3
1983	(F)	10.2	0.	15.5	18.3	13.7	33.1	38.1	88.1	35.8	75.4	0.	0.
	(M)	17.0	20.0	0.	0.	25.4	59.5	94.5	83.2	43.8	111.8	23.0	0.
	(L)	0.	0.	0.	0.	128.0	27.4	242.2	70.2	17.8	44.9	1.8	2.5
1984	(F)	0.	0.	0.	0.	55.3	58.2	66.8	111.7	0.	14.0	8.	98.7
	(M)	15.5	0.	110.8	70.5	18.4	39.4	44.5	31.8	64.4	0.4	50.4	0.
	(L)	0.	0.	32.5	82.6	107.5	26.8	54.4	401.5	32.6	178.4	17.9	0.

to be Continued

Continuation

= 10 - DAY RAINFALL (MM) =

* STATION ------ TUAO
* DISTRICT ------ CAGAYAN
* CODE NO. ------ 0552 07
* REGION ------ REGION II

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	1.1	12.8	0.	0.5	0.5	65.8	166.8	43.4	58.2	19.2	3.8	101.7
	(M)	11.5	34.8	0.	11.7	41.1	155.9	112.6	22.2	20.3	14.7	0.	135.0
	(L)	0.8	8.1	7.6	0.	20.3	162.8	1.3	41.4	32.8	12.0	9.7	3.6
1964	(F)	9.9	1.0	89.4	4.6	5.1	89.6	2.6	180.4	68.0	115.5	191.1	32.2
	(M)	0.	3.6	1.3	11.2	2.6	82.0	34.2	80.3	84.7	47.4	437.5	71.8
	(L)	0.	8.0	0.	0.3	75.9	52.1	82.8	78.5	107.4	73.9	250.1	52.9
1965	(F)	0.3	17.8	4.2	0.	195.0	78.3	28.2	30.7	207.7	0.	72.4	11.8
	(M)	26.9	0.	0.3	10.9	0.8	97.6	198.9	52.4	14.0	51.1	1.3	10.0
	(L)	12.6	5.1	5.9	117.7	96.4	24.7	185.2	87.2	35.0	3.1	39.9	17.3
1966	(F)	1.0	1.3	20.6	5.9	80.3	50.9	56.0	15.5	22.2	28.0	87.5	17.0
	(M)	0.	5.7	0.	117.9	108.1	32.1	79.4	105.6	55.3	59.2	113.4	30.0
	(L)	0.6	2.0	1.3	128.7	210.2	55.1	111.1	110.7	13.3	89.2	340.9	85.0
1967	(F)	3.3	0.8	0.9	124.8	0.	124.0	48.8	78.7	50.4	238.2	104.0	30.7
	(M)	3.7	4.3	2.8	0.8	53.9	0.6	6.2	126.7	82.9	225.4	27.2	3.1
	(L)	4.6	1.0	0.	46.1	51.6	224.9	106.6	99.9	62.8	2.3	24.1	9.1
1968	(F)	31.5	5.6	4.1	0.	17.3	68.9	54.0	181.4	44.1	1.5	0.	0.
	(M)	1.3	2.8	0.	23.9	18.3	55.4	23.1	291.9	2.0	31.0	1.3	0.5
	(L)	0.	0.	1.3	59.3	71.1	37.4	46.7	40.7	219.8	13.1	4.3	0.2
1969	(F)	2.8	1.5	0.	22.9	1.0	106.1	136.1	21.8	102.8	113.1	14.7	41.2
	(M)	7.1	0.	3.0	0.	68.4	32.5	31.3	0.	72.5	24.9	61.4	22.7
	(L)	0.	0.	0.	1.5	30.7	0.	360.1	11.9	53.6	11.6	72.7	19.0
1970	(F)	48.9	4.5	3.3	17.3	44.4	60.2	13.5	112.2	52.9	74.6	134.8	43.4
	(M)	2.6	0.	0.	2.8	174.5	20.7	50.8	49.2	73.4	113.2	139.8	89.6
	(L)	2.3	0.	35.7	21.3	92.4	2.8	38.4	125.0	41.5	173.0	64.5	21.1
1971	(F)	29.7	11.2	3.8	0.	61.0	140.0	52.2	13.3	84.9	294.8	106.0	76.3
	(M)	6.4	39.8	31.8	0.	34.2	31.4	174.4	73.8	60.0	98.8	63.2	82.5
	(L)	1.5	4.3	2.5	0.	17.7	29.3	39.6	3.3	45.1	55.6	309.0	29.5
1972	(F)	47.0	1.5	6.6	5.6	64.3	42.4	93.8	82.9	30.4	6.9	54.9	38.0
	(M)	0.	2.0	34.1	60.8	71.7	24.6	102.7	140.2	14.8	0.2	0.	1.5
	(L)	11.8	4.4	14.5	20.8	70.7	44.3	96.0	37.1	32.9	13.6	54.8	3.3
1973	(F)	13.0	11.4	0.	1.0	0.	96.9	72.2	107.5	98.5	199.2	59.4	56.0
	(M)	12.7	0.	0.	0.	34.5	181.2	43.4	63.8	40.6	317.2	109.2	9.8
	(L)	4.8	1.8	26.4	3.6	22.3	37.6	53.7	216.0	39.3	40.9	399.5	14.7
1974	(F)	6.9	3.8	0.5	7.8	94.1	64.2	3.3	61.9	1.6	183.8	247.9	26.1
	(M)	0.8	0.5	2.0	11.2	41.1	6.9	31.8	138.3	89.7	78.0	134.1	122.6
	(L)	14.2	2.3	0.	75.0	90.8	15.2	7.1	29.6	137.4	212.2	17.0	34.4
1975	(F)	10.3	0.	0.	43.6	115.6	93.4	98.3	88.5	5.0	28.4	15.2	15.2
	(M)	6.8	2.6	3.7	0.	43.5	169.4	55.9	32.0	36.3	73.5	22.5	43.2
	(L)	29.0	1.0	20.0	3.0	92.2	24.0	1.0	214.9	0.	293.8	8.6	78.0
1976	(F)	30.7	1.0	24.6	11.9	14.7	52.5	71.3	50.6	12.2	96.2	95.5	50.1
	(M)	12.1	0.5	15.2	0.	54.3	82.8	0.	56.1	72.9	3.6	132.7	17.0
	(L)	12.0	1.3	26.6	0.	168.0	119.6	130.8	134.1	19.9	92.0	73.8	9.6
1977	(F)	14.2	3.1	1.5	9.6	0.	44.9	13.4	161.4	70.8	1.2	27.6	0.8
	(M)	21.7	10.0	1.5	2.2	14.7	103.9	36.1	9.5	135.5	7.6	92.7	1.8
	(L)	12.9	3.4	10.0	0.	93.0	87.1	200.0	34.5	99.6	5.9	13.1	12.4
1978	(F)	9.4	0.8	3.3	0.	19.6	52.0	4.3	87.7	112.3	195.5	18.1	36.0
	(M)	3.0	2.0	23.4	15.5	47.7	58.9	168.9	102.0	63.2	59.9	63.7	52.8
	(L)	0.2	2.0	2.3	21.6	100.4	27.5	56.1	282.8	87.0	129.7	6.6	15.1
1979	(F)	1.5	35.1	3.0	11.9	6.9	7.6	104.0	30.4	96.5	114.0	117.1	5.7
	(M)	0.8	0.4	0.	16.3	86.6	4.9	66.0	8.9	41.8	105.5	70.7	19.5
	(L)	0.2	0.	0.	26.7	66.6	29.7	93.2	4.3	14.1	3.1	28.7	83.2
1980	(F)	5.1	1.4	15.6	0.	5.4	29.0	118.8	2.2	83.6	25.2	166.2	12.0
	(M)	5.2	10.2	0.7	25.8	249.6	0.	93.8	37.2	40.4	18.2	51.4	59.4
	(L)	17.1	0.	25.2	0.8	39.4	58.2	104.0	108.8	12.6	378.9	9.0	9.4
1981	(F)	6.4	6.1	0.	0.	0.8	234.4	35.4	61.4	12.1	102.6	169.2	3.4
	(M)	10.9	0.2	19.3	2.1	99.9	81.8	124.7	166.0	150.1	40.9	31.2	1.5
	(L)	5.2	0.5	0.	42.0	105.8	10.2	6.9	3.5	13.2	112.2	49.8	7.1
1982	(F)	11.9	0.5	0.	42.9	10.7	88.2	81.8	25.9	120.7	8.9	10.2	47.9
	(M)	2.7	11.9	0.	18.8	111.1	1.3	44.0	30.7	50.3	186.0	104.9	39.9
	(L)	0.7	0.	0.	84.3	164.1	79.9	19.0	131.6	34.7	1.0	109.9	40.7
1983	(F)	3.0	0.	1.0	6.1	0.	23.8	0.	107.8	87.0	115.4	28.7	115.8
	(M)	59.5	2.0	4.6	0.	43.4	61.4	37.6	44.3	68.3	43.1	7.4	43.1
	(L)	6.8	0.	33.3	0.	8.4	14.2	115.5	38.1	35.8	106.4	48.1	106.4
1984	(F)	5.6	0.	9.2	5.1	114.4	32.3	77.1	84.7	0.	18.5	35.6	86.2
	(M)	0.2	0.	0.3	108.1	16.0	126.5	45.5	6.9	2.3	36.8	71.0	0.
	(L)	4.3	5.7	1.3	84.9	142.0	176.8	35.4	321.8	18.8	160.2	29.7	3.6

to be Continued

Continuation

= 10 - DAY RAINFALL (MM) =

* STATION ------ APARRI
* DISTRICT ------ CAGAYAN
* CODE NO. ------ 0552 01
* REGION ------ REGION II

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	46.0	14.0	0.	49.3	1.3	51.6	81.6	23.2	185.4	19.4	0.	73.4
	(M)	68.3	88.9	0.8	0.	0.	212.6	87.5	8.2	19.5	56.1	0.	184.4
	(L)	74.0	5.6	0.	0.	0.	47.8	0.3	28.9	29.1	60.0	0.	54.3
1964	(F)	7.2	36.4	4.0	0.	0.	36.3	1.5	111.6	227.8	212.0	426.2	85.8
	(M)	0.	13.8	0.5	0.	8.3	34.6	11.7	88.5	27.2	79.5	286.8	278.1
	(L)	7.3	7.4	1.2	0.	128.5	9.5	6.9	90.4	139.5	113.2	314.9	28.0
1965	(F)	139.2	9.1	0.4	0.	42.2	138.7	36.8	53.7	227.3	3.8	89.2	17.9
	(M)	177.3	0.	18.0	0.	0.	95.6	108.6	44.4	33.3	143.9	1.8	46.6
	(L)	102.0	0.6	0.5	6.7	71.9	42.0	87.1	14.8	10.5	0.	67.6	78.5
1966	(F)	6.7	7.4	0.	0.	126.0	52.1	1.3	32.4	17.3	18.1	174.8	62.2
	(M)	0.	11.2	0.1	50.8	35.6	1.8	64.2	7.9	205.6	119.3	149.3	95.7
	(L)	6.7	22.6	33.4	0.	108.0	12.4	24.8	29.8	49.9	200.6	375.4	124.5
1967	(F)	37.5	35.8	31.5	84.6	0.	123.4	36.5	121.2	65.8	235.1	143.9	123.9
	(M)	54.9	23.5	1.3	0.	3.6	52.8	1.8	239.4	151.3	296.8	15.9	91.5
	(L)	1.0	7.6	2.0	0.	7.1	244.2	43.6	203.6	139.6	2.8	32.8	87.4
1968	(F)	37.3	14.0	51.5	0.	6.9	48.5	124.0	205.7	44.9	4.0	4.5	0.
	(M)	7.3	16.8	0.	0.	0.	40.9	74.5	182.1	44.3	74.9	3.3	30.4
	(L)	18.2	14.5	0.	65.1	33.3	76.3	247.0	20.1	354.6	4.3	25.7	3.5
1969	(F)	16.7	23.5	0.	5.2	0.	67.1	79.5	15.9	249.0	295.4	26.2	97.8
	(M)	28.1	0.	33.4	0.	17.8	62.5	1.1	1.1	94.5	22.1	91.1	89.5
	(L)	0.	0.1	0.3	0.	28.1	0.	204.7	0.5	50.1	12.0	181.1	30.9
1970	(F)	61.5	26.2	2.3	0.2	18.5	68.7	20.3	64.4	30.8	42.2	692.0	80.5
	(M)	186.9	0.9	0.	0.7	65.3	98.1	39.9	56.5	17.5	105.1	139.4	112.6
	(L)	20.5	10.9	140.6	40.6	13.8	0.	15.7	97.9	77.4	247.3	100.6	3.6
1971	(F)	108.8	45.6	12.3	21.5	13.1	28.9	23.7	91.9	10.2	205.5	90.2	49.1
	(M)	0.	57.1	109.4	5.0	0.2	38.3	376.7	66.6	58.4	165.9	132.8	117.1
	(L)	153.7	0.	0.	0.	2.5	49.9	16.3	0.	74.9	241.4	385.2	117.3
1972	(F)	77.7	47.3	58.2	20.1	17.9	31.8	6.7	116.3	17.0	37.6	56.6	26.0
	(M)	53.6	25.0	0.2	11.1	106.8	5.1	91.0	22.3	37.4	0.5	13.9	5.7
	(L)	4.5	108.1	48.5	0.2	56.7	26.6	45.1	65.9	116.1	137.6	112.0	8.2
1973	(F)	61.5	4.3	0.	0.1	0.	27.0	19.3	67.7	202.1	292.3	196.7	51.7
	(M)	26.8	0.2	0.	0.	16.8	197.5	38.3	7.8	3.3	229.7	580.3	13.4
	(L)	22.7	0.	36.7	0.	0.	21.3	36.0	159.4	3.0	173.0	565.3	75.2
1974	(F)	33.2	37.0	0.	1.6	1.1	25.6	23.3	30.2	14.2	151.4	248.1	41.1
	(M)	46.4	4.4	0.9	0.6	2.5	1.6	16.2	175.2	47.9	89.5	215.3	79.5
	(L)	66.0	25.9	0.	8.0	4.3	0.2	1.1	11.9	178.4	228.4	65.5	54.5
1975	(F)	24.9	36.8	3.0	33.0	1.1	43.2	55.6	53.4	2.7	31.5	15.6	59.7
	(M)	119.3	13.3	4.4	0.	49.5	61.6	18.9	57.6	34.8	148.4	25.0	79.2
	(L)	63.0	9.5	10.2	0.5	53.3	19.7	21.6	105.8	3.1	147.7	57.9	34.6
1976	(F)	5.4	0.4	2.7	3.4	12.8	27.8	14.7	110.8	2.1	185.4	197.0	31.8
	(M)	10.5	0.	0.5	1.3	27.6	7.7	27.1	34.3	74.2	16.5	57.5	4.1
	(L)	1.6	1.6	1.1	0.	93.3	115.8	8.3	100.1	110.6	102.0	53.3	54.6
1977	(F)	21.6	17.3	2.0	0.8	0.	44.5	6.5	26.5	58.7	34.7	71.0	7.6
	(M)	87.9	45.3	0.	6.3	0.	46.7	9.8	16.0	159.4	75.7	184.5	0.
	(L)	41.3	0.	0.1	0.	36.2	18.9	255.0	12.2	143.9	22.8	54.9	9.5
1978	(F)	21.3	2.5	25.8	6.6	0.	2.0	0.	102.5	146.0	138.5	50.5	26.5
	(M)	12.6	67.8	20.1	0.	64.7	23.0	7.0	103.0	67.0	62.0	145.5	64.0
	(L)	0.	21.2	0.6	1.1	95.8	78.5	45.1	157.5	132.7	301.7	44.0	34.7
1979	(F)	0.	72.5	0.	9.5	1.0	11.5	99.5	125.0	28.0	150.0	110.2	1.5
	(M)	1.2	33.7	0.	3.0	188.7	5.0	25.0	284.4	4.5	182.5	141.4	3.0
	(L)	1.0	0.	0.	4.0	34.8	1.5	126.5	0.	44.0	49.5	215.7	61.5
1980	(F)	2.0	5.0	0.	0.	0.	0.	204.5	0.	68.0	83.5	65.0	197.5
	(M)	30.5	3.8	0.	12.6	160.5	0.	160.5	13.2	153.5	3.5	332.0	126.2
	(L)	48.5	1.1	38.2	0.	10.0	3.5	44.0	24.0	39.0	319.5	52.5	32.0
1981	(F)	42.0	11.0	31.0	0.3	1.5	89.0	28.5	108.0	0.	33.7	63.0	57.0
	(M)	13.5	0.	3.0	32.5	446.0	212.5	59.0	110.8	573.0	12.0	11.0	64.6
	(L)	12.0	0.	2.5	5.0	23.5	13.2	0.5	9.0	7.0	76.5	108.5	30.1
1982	(F)	32.1	0.	0.	77.9	0.	6.5	97.7	29.5	44.5	45.2	36.0	113.5
	(M)	39.5	15.0	0.	4.0	4.0	31.3	27.0	48.0	22.5	99.5	84.5	228.8
	(L)	3.0	0.	1.7	5.5	9.2	157.5	79.1	36.5	18.0	0.	60.0	85.8
1983	(F)	20.0	0.	10.5	3.5	0.	29.5	0.	0.	221.0	130.1	106.6	21.5
	(M)	227.2	43.5	35.5	0.	2.0	23.0	2.0	68.0	0.	38.8	95.3	67.9
	(L)	117.1	0.	5.0	0.	4.0	37.0	10.0	2.2	59.9	301.1	199.2	180.6
1984	(F)	62.5	7.5	136.7	0.	122.0	91.0	127.5	50.5	0.1	50.0	34.0	249.0
	(M)	0.	1.5	0.	6.0	4.0	239.0	16.0	25.2	7.5	44.8	176.2	0.
	(L)	54.0	31.2	4.5	129.5	90.0	67.5	67.0	166.5	44.0	150.0	225.8	123.6

to be Continued

Continuation

10 - DAY RAINFALL (MM)

* STATION ------ NANENG
* DISTRICT ------ KALING-APAYAO
* CODE NO. ------ 0552 13
* REGION ------ REGION II

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	3.8	27.6	0.	10.1	1.0	61.0	194.7	118.9	44.6	14.7	24.9	116.6
	(M)	3.8	25.2	1.5	0.	27.1	86.4	85.5	47.6	79.8	36.0	0.3	72.9
	(L)	7.7	10.6	6.5	0.	58.1	149.0	51.9	253.0	164.5	26.6	68.8	4.3
1964	(F)	21.4	0.8	31.9	4.1	74.2	83.2	77.8	141.6	59.5	115.7	172.1	19.8
	(M)	0.5	9.7	24.7	17.3	11.0	191.8	115.9	77.8	193.0	96.1	262.2	308.4
	(L)	6.1	1.8	0.5	0.	217.9	98.3	111.7	111.2	162.9	67.7	265.8	10.7
1965	(F)	9.1	34.0	17.8	21.6	73.4	57.2	67.5	98.0	133.1	47.3	40.9	7.9
	(M)	55.3	0.5	0.5	44.4	6.9	84.9	309.4	129.9	30.9	50.4	4.9	31.0
	(L)	34.6	28.7	31.8	95.1	82.3	18.1	217.5	90.5	174.3	37.9	22.6	43.7
1966	(F)	3.6	18.1	11.2	17.8	182.6	163.4	101.4	237.9	50.6	14.7	85.5	114.6
	(M)	46.0	5.4	0.	7.4	222.8	39.4	176.9	26.7	57.7	71.3	105.9	48.5
	(L)	22.1	29.8	68.4	42.2	309.6	143.6	147.4	131.5	24.3	92.5	329.5	160.9
1967	(F)	74.5	14.5	20.5	61.2	0.0	102.9	74.4	84.8	128.2	210.3	222.3	89.8
	(M)	101.5	30.8	3.2	47.2	64.1	47.2	53.4	120.4	148.1	171.2	30.7	37.2
	(L)	33.2	4.7	0.0	48.6	73.8	150.0	222.2	164.0	103.0	12.5	26.9	48.5
1968	(F)	9.4	0.	56.0	0.	59.9	101.4	61.4	178.6	131.8	35.9	7.2	0.3
	(M)	6.4	0.	0.8	67.1	57.7	152.1	81.1	298.6	112.3	38.7	12.1	33.2
	(L)	9.3	0.	38.7	85.1	152.6	73.6	95.3	130.5	131.7	9.0	41.3	0.8
1969	(F)	13.8	1.4	0.	115.8	22.3	258.9	120.2	81.5	78.7	211.7	16.6	47.4
	(M)	1.2	0.	25.6	0.	74.0	60.3	101.0	115.1	96.6	83.9	14.4	21.5
	(L)	0.	0.	0.5	1.8	160.2	64.0	223.1	76.3	55.4	98.4	104.8	20.6
1970	(F)	37.2	8.3	27.9	33.6	63.1	68.8	44.3	70.4	42.5	87.3	139.5	95.3
	(M)	14.0	0.3	7.9	0.8	260.5	101.1	59.6	0.	173.8	208.9	104.9	97.5
	(L)	0.	1.1	139.3	5.4	80.7	2.6	68.6	0.	60.1	223.4	137.4	16.8
1971	(F)	83.0	39.5	2.3	0.	43.2	187.1	85.9	71.2	167.3	258.2	32.4	72.4
	(M)	5.8	54.3	45.1	0.3	115.2	156.4	229.3	85.7	61.6	114.9	152.9	61.1
	(L)	7.1	0.	1.3	20.3	58.4	75.0	72.9	29.7	97.6	74.4	223.4	38.9
1972	(F)	22.2	7.3	4.0	20.9	43.1	128.8	88.6	27.8	32.7	0.3	64.3	56.0
	(M)	0.3	0.	9.0	66.8	164.8	38.1	128.2	158.0	39.7	11.7	18.3	1.7
	(L)	20.5	2.6	20.7	109.5	236.6	54.7	57.3	96.9	140.6	45.8	6.5	0.
1973	(F)	7.1	4.9	0.	18.6	32.0	186.3	78.9	93.1	96.1	114.5	84.4	20.0
	(M)	0.	0.	15.3	47.0	13.2	178.0	44.6	106.5	140.6	235.5	41.7	17.7
	(L)	0.6	0.	52.4	0.	15.5	143.8	58.2	166.8	134.9	42.2	199.7	10.5
1974	(F)	2.0	8.6	5.5	52.9	8.4	148.6	79.3	113.6	2.0	146.1	183.2	20.1
	(M)	1.6	1.8	9.7	38.9	40.2	4.3	87.2	214.3	138.7	136.5	77.4	93.0
	(L)	98.7	0.8	0.	38.9	43.9	30.9	75.2	41.4	140.8	206.1	115.4	55.6
1975	(F)	55.5	0.3	0.8	44.5	53.7	113.0	194.0	82.3	140.3	139.0	60.9	111.4
	(M)	28.0	1.4	0.5	0.	77.4	292.8	218.3	34.7	54.6	66.6	21.3	7.5
	(L)	59.5	0.	19.3	42.6	151.1	55.7	83.9	156.5	0.8	79.8	2.5	46.8
1976	(F)	18.2	0.8	97.9	0.3	60.4	59.5	12.2	62.1	9.7	67.9	20.5	41.1
	(M)	46.8	0.	8.1	0.	26.5	139.8	114.0	107.2	200.5	10.7	63.6	39.6
	(L)	16.6	0.	0.	0.	159.4	204.3	162.2	170.3	58.9	72.7	56.5	4.9
1977	(F)	10.0	1.1	0.5	36.8	6.9	110.5	100.3	153.5	14.2	5.9	46.5	0.6
	(M)	2.1	28.5	0.	26.2	72.5	54.7	39.0	1.3	85.7	6.6	75.8	11.2
	(L)	18.8	1.0	41.0	0.	110.7	134.2	77.7	106.6	41.4	0.	4.4	4.9
1978	(F)	3.8	0.	11.7	0.	6.9	22.1	88.7	167.8	117.5	218.2	6.4	23.8
	(M)	0.	1.3	0.3	49.1	39.9	70.3	69.1	190.2	202.8	32.2	11.1	7.4
	(L)	0.	2.1	0.	15.9	99.8	9.2	149.0	190.0	130.6	133.3	2.4	3.3
1979	(F)	7.5	0.8	36.3	8.7	3.5	83.1	53.9	62.7	22.2	118.0	107.1	14.8
	(M)	1.3	0.	0.5	5.7	48.0	58.2	123.3	49.9	13.6	48.8	138.8	35.9
	(L)	15.0	1.8	0.	8.9	2.1	75.6	101.7	27.4	2.0	7.9	75.0	70.8
1980	(F)	7.2	6.2	12.3	2.5	0.	74.7	28.5	50.3	17.0	36.3	53.7	21.4
	(M)	5.7	9.0	11.8	0.9	36.8	53.8	120.4	15.2	23.4	130.0	217.0	37.6
	(L)	8.0	18.2	0.	0.	156.2	79.8	99.8	52.2	34.5	197.6	269.2	18.0
1981	(F)	3.2	1.6	8.7	2.1	16.5	70.1	62.5	35.7	36.8	138.8	134.1	26.9
	(M)	17.0	0.8	0.	3.8	72.7	24.4	99.4	87.8	68.1	138.1	368.0	29.9
	(L)	8.4	0.6	9.4	0.	100.3	148.4	177.2	144.0	19.8	47.4	571.0	2.8
1982	(F)	2.9	0.	0.	70.7	48.5	85.8	133.3	193.8	393.0	0.	180.4	47.3
	(M)	21.1	6.9	1.5	90.3	59.0	95.3	13.2	103.4	95.8	791.0	9.7	5.6
	(L)	4.6	3.5	0.	33.0	175.5	241.0	27.4	697.9	394.8	236.2	206.3	0.
1983	(F)	5.9	0.3	4.5	19.1	0.	85.9	10.9	49.6	380.4	267.7	25.4	0.
	(M)	11.9	1.8	0.	0.	31.5	22.4	66.0	218.2	13.7	115.3	222.0	1.3
	(L)	3.5	0.3	35.1	0.	63.5	0.	91.7	19.8	136.2	92.5	519.9	2.5
1984	(F)	0.	0.	21.1	0.	32.8	0.	15.1	30.0	0.	21.6	41.5	100.4
	(M)	2.8	0.	7.9	20.0	14.3	39.8	35.9	19.1	3.3	42.9	82.7	0.0
	(L)	1.3	2.1	13.2	3.6	137.1	70.0	27.2	45.3	6.1	186.6	34.6	4.2

to be Continued

Continuation

10 - DAY RAINFALL (MM)

* STATION ------ CONSUELO * CODE NO. ------ 0552 38
* DISTRICT ------ NUEVA VIZCAYA * REGION ------ REGION II

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	11.7	20.0	0.	0.	3.8	382.5	24.7	33.1	197.1	11.2	9.6	10.4
	(M)	9.4	17.7	0.	14.0	104.9	73.6	83.8	99.6	113.1	4.9	9.9	138.4
	(L)	9.2	5.6	5.3	2.5	58.5	172.5	39.7	52.5	122.2	9.7	21.6	2.5
1964	(F)	1.2	0.0	13.8	10.3	63.7	127.9	31.9	201.1	148.6	146.2	84.8	6.5
	(M)	10.6	0.0	10.3	69.1	67.6	76.7	59.6	155.8	69.1	29.2	159.4	120.5
	(L)	0.7	7.6	21.1	27.2	85.4	160.7	64.2	94.0	65.6	39.5	59.6	19.3
1965	(F)	0.0	0.0	4.9	7.9	62.7	54.8	77.1	17.9	59.2	34.4	50.8	9.6
	(M)	8.7	0.0	0.0	33.0	53.0	78.0	162.3	69.9	121.5	27.4	5.0	3.1
	(L)	13.8	4.5	41.5	90.0	123.0	49.1	63.4	42.0	19.0	18.2	5.5	1.9
1966	(F)	4.1	10.4	44.9	23.4	85.0	17.3	65.0	88.8	178.1	8.6	70.4	23.8
	(M)	15.5	0.	0.	5.6	339.7	48.3	72.0	114.6	103.6	40.4	204.4	24.2
	(L)	10.7	10.6	30.8	3.8	233.4	79.8	54.6	65.2	33.0	15.3	165.9	42.4
1967	(F)	0.9	1.7	2.7	28.4	0.	15.7	58.3	181.8	98.7	145.3	329.5	17.8
	(M)	4.8	6.4	1.4	16.2	48.3	0.5	71.1	144.2	200.6	168.6	4.6	1.3
	(L)	1.6	1.9	0.	36.3	1.9	7.6	152.4	96.0	124.8	0.3	5.6	12.0
1968	(F)	8.0	0.	25.5	1.5	29.0	39.4	39.1	89.9	175.3	11.5	1.5	0.
	(M)	5.1	0.	0.	9.7	108.9	43.9	76.1	97.1	185.1	20.3	11.0	1.2
	(L)	16.5	0.8	0.8	51.2	40.4	19.6	272.2	287.0	204.5	1.6	103.3	1.5
1969	(F)	1.8	4.8	0.	30.8	13.7	49.0	65.5	179.4	252.5	73.7	0.	16.0
	(M)	2.0	0.	0.	0.	113.2	47.3	72.2	51.3	71.3	89.2	45.4	3.6
	(L)	0.	0.	0.	8.6	56.3	41.0	361.1	92.3	10.4	36.6	71.9	31.3
1970	(F)	93.3	1.7	18.1	31.3	12.9	160.0	31.6	88.8	99.0	99.2	68.5	49.6
	(M)	3.5	0.	0.	0.	86.3	182.7	83.7	83.8	274.3	182.8	86.2	55.8
	(L)	0.	2.5	28.1	113.5	60.7	66.0	104.0	94.0	106.7	129.5	45.7	0.
1971	(F)	2.5	0.	0.	12.7	114.2	32.1	167.5	74.7	50.7	346.8	61.0	29.2
	(M)	0.	15.2	12.7	10.2	114.2	177.7	233.7	60.9	41.9	123.2	33.0	30.4
	(L)	0.	15.2	12.7	30.4	96.4	71.4	139.6	106.6	196.8	67.2	148.5	92.7
1972	(F)	30.4	5.1	2.5	8.9	46.9	101.7	581.5	132.6	31.5	0.	124.5	24.0
	(M)	2.5	2.5	22.3	12.7	81.3	19.1	649.0	253.1	219.2	0.	5.0	15.2
	(L)	38.1	0.	28.0	26.6	80.0	93.9	816.7	69.0	37.8	0.	3.8	0.
1973	(F)	22.9	14.0	0.	0.	17.8	33.1	89.1	82.5	76.2	339.1	50.7	16.6
	(M)	0.	0.	0.	2.5	77.5	139.7	60.8	31.9	180.7	235.0	58.4	14.0
	(L)	3.9	3.8	22.9	71.1	39.4	38.1	35.5	79.9	123.1	23.0	92.7	8.9
1974	(F)	8.9	1.3	57.1	0.	30.4	220.8	33.1	0.	71.2	48.2	302.3	22.8
	(M)	2.5	0.	19.0	0.	59.7	77.4	238.6	0.	38.1	475.5	113.2	123.2
	(L)	19.0	3.8	8.9	0.	88.8	22.9	40.7	0.	96.6	458.6	134.7	53.4
1975	(F)	7.7	0.	1.3	25.4	24.3	52.1	26.7	116.9	134.7	33.1	19.0	31.8
	(M)	30.5	0.	6.4	0.	125.8	43.3	39.3	104.2	124.6	152.4	19.2	69.8
	(L)	66.0	0.	21.6	2.5	113.1	40.6	71.1	63.5	48.4	68.5	3.8	45.7
1976	(F)	59.6	6.4	1.3	63.0	34.3	25.4	38.3	46.6	62.6	71.1	2.3	2.0
	(M)	16.5	1.3	36.9	21.5	44.4	116.9	92.8	51.5	159.4	27.9	38.3	0.
	(L)	19.2	1.3	5.0	0.	1232.3	742.2	139.3	194.4	68.0	111.4	4.0	13.8
1977	(F)	1.5	0.	0.	1.5	7.1	62.3	48.3	57.9	32.8	16.3	18.9	0.
	(M)	2.0	7.1	7.6	0.	74.7	37.4	140.2	112.1	245.5	31.2	255.4	2.5
	(L)	3.0	0.	40.7	0.	102.3	59.0	75.7	90.2	97.3	0.	1.0	0.
1978	(F)	2.0	1.5	14.7	0.5	7.6	80.4	26.2	111.6	65.9	185.9	111.3	32.7
	(M)	0.	0.	8.4	0.	1.5	43.2	118.3	60.8	140.7	83.0	13.2	54.1
	(L)	0.	1.5	3.6	35.2	88.3	29.9	101.4	471.5	253.4	291.6	6.6	10.6
1979	(F)	4.3	0.	1.5	0.5	23.1	157.7	148.2	117.5	49.2	239.2	22.2	17.2
	(M)	0.	0.	0.	9.2	58.8	120.1	44.1	57.5	108.5	26.6	32.6	2.0
	(L)	0.	0.	44.2	73.4	59.4	81.8	48.6	46.7	114.0	11.6	3.0	16.8
1980	(F)	5.0	0.	0.	0.	47.0	81.0	94.4	8.6	214.2	20.7	982.9	25.1
	(M)	14.0	11.6	1.0	90.4	63.6	37.2	209.3	29.3	168.5	22.0	29.2	29.2
	(L)	3.5	0.	29.5	0.	93.1	34.0	471.1	126.5	144.8	96.1	25.1	0.5
1981	(F)	24.5	8.6	0.	0.	45.2	51.5	451.0	122.7	139.8	40.2	20.3	13.2
	(M)	6.6	10.7	0.	5.1	71.4	274.4	174.2	187.3	165.8	30.7	41.9	15.7
	(L)	5.5	3.5	0.	80.4	50.1	92.7	14.7	48.9	125.5	140.1	223.5	5.1
1982	(F)	1.5	0.	5.1	36.4	4.5	14.8	202.1	107.8	96.3	20.9	65.0	9.0
	(M)	2.5	8.9	0.	33.5	7.5	21.6	149.9	21.3	31.2	124.0	16.3	16.8
	(L)	2.5	0.	64.0	0.	73.3	67.4	93.8	181.1	46.7	21.2	25.6	20.9
1983	(F)	36.3	0.	6.1	1.0	6.4	13.0	99.6	61.4	46.4	104.4	6.9	0.
	(M)	30.4	0.5	0.	0.	0.	37.6	150.4	264.4	39.5	108.9	67.8	0.
	(L)	5.2	5.3	5.1	0.8	35.0	4.0	123.7	29.7	70.7	125.3	0.	0.
1984	(F)	0.	8.9	22.9	0.	68.6	50.4	62.2	25.4	65.1	155.7	13.2	7.3
	(M)	0.	0.	64.8	141.1	205.6	53.1	4.8	175.3	57.0	64.5	17.7	0.
	(L)	10.4	2.5	23.1	41.4	74.2	66.5	67.1	343.8	58.2	317.3	3.6	0.

Table 3.3 Conditions and Results of Tank Coefficient Calibration

	Basin 1 (Upper Cagayan)	Basin 2 (Magat)	Basin 3 (Ilagan)
Runoff Gauge	Guinalvin	Dulao	Minanga
Raingauge	Ilagan	Nayon	Ilagan
Drainage Area (km2)	921	573	1,565
Calibration Period	1965 71,74	1968 70	1966, 68 69
Rainfall Ratio /1	1.35	1.60	1.20
Evaporation Ratio /2	0.7	0.7	0.7
Rainfall (mm)	2,808	2,845	2,153
Loss (mm)	1,255	1,221	1,152
Estimated Runoff (mm)	1,553	1,624	1,001
Observed Runoff (mm)	1,686	1,497	915

	Basin 4 (Lower Cagayan)	Basin 5 (Upper Chico)	Basin 6 (Lower Chico)
Runoff Gauge	Larion Alto	Ampawilen	Pinukpuk
Raingauge	Tuguegarao	Bontoc	Tuao
Drainage Area (km2)	655	751	856
Calibration Period	1957 73	1963 76	1968 71
Rainfall Ratio /1	2.20	1.40	1.70
Evaporation Ratio /2	0.7	0.6	0.7
Rainfall(mm)	3,707	3,379	2,913
Loss (mm)	1,244	1,037	1,143
Estimated Runoff (mm)	2,463	2,342	1,770
Observed Runoff (mm)	2,427	2,383	1,890

Notes;

/1 ;Ratio of basin rainfall to rainfall at applied gauge.

/2 ;Ratio of evapotranspiration to evaporation by A-pan.

Table 3.4 SIMULATED 10-DAY MEAN RUNOFF

STATION : GUINALVIN
DRAINAGE AREA : 921. (SQ.KM) UNIT : CMS

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	31.0	21.0	17.1	11.7	8.0	11.3	143.7	122.0	53.7	51.3	30.5	73.4
	(M)	25.3	24.7	15.6	10.7	7.9	146.9	71.4	21.6	62.0	64.9	26.5	97.5
	(L)	20.7	29.9	11.9	8.9	22.3	133.6	55.3	132.3	97.8	43.6	37.7	35.3
1964	(F)	28.6	18.4	19.7	12.7	10.4	53.3	63.1	82.7	51.2	113.2	113.3	91.3
	(M)	23.8	18.0	16.8	12.0	10.1	57.4	52.1	40.4	99.0	49.7	336.2	169.9
	(L)	19.2	39.9	13.1	10.6	65.1	79.2	87.7	33.0	112.9	66.5	204.1	66.0
1965	(F)	44.1	25.2	17.4	11.8	10.4	18.0	96.0	23.5	67.7	16.4	73.6	20.7
	(M)	37.4	21.0	15.5	11.9	10.3	12.6	124.5	32.6	24.0	55.8	21.0	27.6
	(L)	28.0	24.3	12.4	10.6	10.1	54.2	22.8	21.6	20.8	16.0	25.0	25.8
1966	(F)	17.7	11.9	9.1	8.8	71.4	37.5	36.4	24.3	14.2	22.1	45.0	133.2
	(M)	16.5	10.6	9.0	8.7	16.5	58.6	21.3	15.7	14.0	28.9	123.7	76.6
	(L)	11.8	12.5	8.1	8.6	45.0	33.7	20.8	15.5	11.4	30.3	286.9	175.1
1967	(F)	62.0	28.8	16.5	17.5	11.3	26.0	62.3	44.9	84.9	86.2	54.9	20.1
	(M)	39.4	26.0	15.7	13.3	10.2	14.6	22.5	26.8	23.7	26.4	23.8	16.4
	(L)	30.7	27.0	12.7	12.6	9.6	59.7	42.3	23.5	21.8	17.7	18.5	13.7
1968	(F)	12.6	10.5	8.2	8.0	16.6	118.2	21.0	81.4	26.0	28.8	19.6	16.7
	(M)	12.1	9.2	8.1	7.9	8.5	54.2	38.0	162.9	51.4	39.6	17.4	43.0
	(L)	10.1	10.6	7.3	22.4	7.1	45.4	22.3	39.0	91.5	20.7	29.8	19.9
1969	(F)	19.8	11.3	7.6	7.5	7.3	31.9	7.8	51.4	56.8	147.9	17.7	96.7
	(M)	15.9	10.1	10.5	7.4	7.2	14.7	6.8	66.6	18.0	55.1	96.1	96.7
	(L)	11.4	11.3	8.9	7.4	25.2	8.8	6.1	28.6	22.0	19.8	112.3	87.5
1970	(F)	77.1	22.2	15.1	10.5	8.9	7.1	15.2	63.9	25.7	123.0	110.2	154.3
	(M)	29.5	17.5	12.6	9.2	7.9	32.4	13.6	57.6	70.8	98.0	93.9	141.7
	(L)	22.5	20.4	10.3	18.9	6.5	31.8	10.4	16.7	27.3	127.4	78.1	45.9
1971	(F)	69.0	26.1	16.4	16.6	20.7	56.1	61.3	47.8	74.1	231.0	141.4	288.0
	(M)	32.5	28.5	102.7	14.0	53.3	139.8	142.7	81.2	192.2	203.0	202.4	161.0
	(L)	31.1	27.9	20.5	12.0	17.3	48.0	47.4	84.2	56.3	150.5	318.5	133.7
1972	(F)	133.1	44.3	20.7	24.5	28.5	40.1	74.4	28.4	26.6	23.6	22.5	41.5
	(M)	58.6	38.7	24.0	49.0	91.2	28.2	31.1	23.4	22.0	19.4	17.4	23.2
	(L)	49.1	41.1	20.4	45.1	112.9	59.3	22.9	22.2	23.3	16.0	87.8	17.5
1973	(F)	16.4	13.7	11.9	11.5	11.1	140.2	27.7	62.2	23.5	60.0	108.4	169.4
	(M)	15.4	12.4	11.7	11.4	11.0	84.7	23.4	94.1	61.3	190.3	202.8	65.6
	(L)	13.3	15.0	10.6	11.2	10.6	77.3	51.6	26.5	22.6	68.0	298.8	41.0
1974	(F)	38.4	27.9	18.3	13.2	11.1	112.1	11.8	11.9	18.1	209.1	253.9	70.2
	(M)	31.9	23.2	16.3	11.6	21.9	21.8	38.5	45.6	30.3	235.1	166.6	183.4
	(L)	28.9	25.1	13.1	11.2	10.6	15.3	11.6	12.3	38.1	260.0	78.1	94.1
1975	(F)	51.8	33.3	20.2	14.8	11.2	17.0	20.2	27.1	17.3	13.2	55.2	77.3
	(M)	40.9	27.6	18.3	12.9	13.5	18.1	16.4	16.0	35.2	66.3	22.1	59.8
	(L)	37.5	29.0	14.9	12.3	39.6	37.4	30.9	14.3	15.9	101.7	18.9	73.1
1976	(F)	68.5	20.1	13.0	14.5	11.1	53.7	23.9	133.8	18.7	42.2	111.4	82.2
	(M)	28.6	15.6	13.0	11.4	14.0	21.4	17.0	30.2	83.7	19.9	169.3	140.6
	(L)	20.9	17.8	10.5	10.0	92.1	73.0	28.2	18.9	24.8	52.5	223.0	53.4
1977	(F)	38.4	28.9	16.9	12.6	9.6	11.9	9.0	27.4	11.9	21.6	11.7	19.2
	(M)	38.7	24.1	15.5	10.8	9.5	9.6	10.9	10.0	50.4	18.1	116.5	15.2
	(L)	31.2	25.6	12.3	9.7	62.2	9.7	10.3	9.8	79.4	12.0	28.8	12.0
1978	(F)	11.0	7.9	7.6	7.4	7.1	8.4	6.7	40.8	77.3	52.2	38.5	26.3
	(M)	10.1	7.8	7.5	7.3	8.0	7.2	6.6	18.8	71.6	25.0	133.3	35.4
	(L)	8.1	9.6	6.8	7.2	35.3	6.8	6.0	74.2	71.9	113.7	51.3	54.1
1979	(F)	23.7	12.2	9.1	6.8	6.6	98.0	84.7	47.0	155.6	71.2	54.2	22.4
	(M)	18.9	11.1	7.6	6.7	14.2	22.5	127.4	81.7	82.3	31.0	28.3	19.0
	(L)	13.2	12.8	6.2	12.1	116.8	36.4	136.6	36.8	33.9	22.8	26.2	15.8
1980	(F)	16.0	11.9	9.6	7.6	7.3	7.5	6.3	8.7	17.5	21.2	213.5	44.0
	(M)	13.7	11.0	6.2	9.3	7.3	7.0	19.8	8.0	11.7	9.2	75.0	85.1
	(L)	11.9	12.6	7.0	7.4	21.1	7.0	19.5	6.4	7.8	122.6	38.6	27.4
1981	(F)	23.4	14.3	9.0	6.6	6.3	50.0	26.5	40.9	21.4	22.7	109.7	32.0
	(M)	22.1	11.5	7.6	6.5	9.1	55.2	81.8	63.3	42.9	21.7	54.6	26.2
	(L)	16.9	13.2	6.0	6.4	5.7	16.5	14.4	20.0	40.0	101.6	53.8	18.7
1982	(F)	18.4	10.8	7.2	6.5	6.2	6.0	7.4	8.1	80.4	12.5	21.6	47.4
	(M)	14.4	9.9	6.6	6.4	7.2	22.5	7.0	12.2	61.4	26.4	50.7	33.5
	(L)	11.0	10.9	5.9	7.6	8.0	19.1	5.3	37.7	15.0	17.6	26.3	16.3
1983	(F)	31.3	11.6	7.9	6.8	5.4	7.4	5.2	5.0	6.7	70.1	39.3	11.5
	(M)	36.8	9.9	6.4	5.5	16.1	7.9	5.9	4.9	4.8	14.7	33.4	10.0
	(L)	14.2	11.1	5.1	5.5	20.5	6.4	4.5	8.3	38.6	48.6	14.8	7.1
1984	(F)	6.9	5.6	4.5	4.4	56.6	14.3	91.6	69.5	24.2	14.7	50.4	52.6
	(M)	8.1	4.6	4.8	34.4	28.1	13.4	19.7	23.3	12.6	54.8	25.7	22.7
	(L)	5.9	5.7	7.0	15.1	65.0	103.2	75.0	59.0	13.4	209.6	20.6	22.4

to be Continued

SIMULATED 10-DAY MEAN RUNOFF

Continuation

STATION : DULAO
DRAINAGE AREA : 573. (SQ.KM)
UNIT : CMS

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	13.7	11.2	10.4	7.7	5.3	7.7	101.1	81.5	44.6	39.7	20.5	49.9
	(M)	11.9	12.6	8.9	7.0	5.2	94.2	56.8	59.9	44.9	45.9	18.6	67.1
	(L)	10.3	17.8	7.6	5.8	13.4	94.1	41.5	89.1	66.4	32.6	27.8	29.8
1964	(F)	19.7	14.0	14.6	9.3	7.6	39.3	46.7	59.4	36.1	80.0	76.6	75.2
	(M)	16.9	13.6	14.9	8.9	7.4	41.9	39.0	35.9	66.4	40.9	217.5	115.1
	(L)	13.8	26.5	10.2	7.9	41.1	55.5	59.5	26.0	78.2	46.7	150.2	52.2
1965	(F)	29.4	31.7	16.7	13.3	13.6	37.6	33.0	40.0	36.8	19.1	17.7	14.3
	(M)	64.6	23.0	16.0	12.3	16.0	32.9	44.4	36.2	24.0	27.6	16.6	15.0
	(L)	53.2	26.3	15.4	12.8	13.9	29.8	77.8	20.8	55.4	15.0	14.3	15.7
1966	(F)	13.6	9.8	9.9	7.3	13.7	39.0	28.4	36.4	16.1	11.1	29.1	82.6
	(M)	11.9	9.2	8.4	6.4	24.4	45.2	15.7	31.2	13.9	10.2	60.8	43.7
	(L)	10.0	12.5	7.0	6.3	58.9	28.8	17.7	47.9	11.8	8.8	138.9	60.0
1967	(F)	46.1	18.4	13.1	9.7	7.9	23.8	29.7	44.0	57.6	82.2	81.4	37.4
	(M)	48.2	16.9	10.8	9.4	8.5	13.0	19.1	47.7	62.8	61.0	38.0	25.6
	(L)	24.0	18.6	8.6	9.2	8.8	42.4	62.3	56.6	50.7	27.0	22.2	22.0
1968	(F)	17.6	10.4	10.4	5.9	71.8	55.8	61.9	103.4	94.8	27.9	19.3	14.3
	(M)	14.8	9.8	8.4	5.6	18.7	42.9	26.7	120.4	32.7	29.0	17.5	13.4
	(L)	11.5	11.2	8.5	123.3	16.5	100.6	76.5	82.1	27.4	19.1	16.1	10.5
1969	(F)	10.4	8.6	5.8	5.6	5.4	8.4	7.0	7.2	34.3	41.7	8.5	16.9
	(M)	10.0	7.6	6.2	5.5	48.1	19.2	5.8	6.1	9.4	13.5	6.9	22.3
	(L)	8.4	8.5	5.1	5.5	7.9	7.3	14.7	23.6	23.3	9.2	28.8	49.5
1970	(F)	101.0	12.3	26.0	8.1	5.5	63.6	7.8	15.4	22.2	27.1	59.1	122.0
	(M)	42.6	10.0	9.7	6.9	5.2	48.5	9.9	9.9	81.6	140.9	58.0	98.4
	(L)	13.7	11.0	8.0	5.7	6.7	10.4	36.2	37.4	34.0	86.7	103.6	33.0
1971	(F)	52.0	17.5	15.6	12.0	31.0	23.7	46.9	37.8	102.7	170.4	49.6	56.5
	(M)	24.1	14.9	35.4	9.8	145.5	27.8	88.0	18.1	61.4	85.6	35.8	50.3
	(L)	18.1	33.5	15.9	8.6	45.1	18.6	88.4	53.6	64.4	40.4	116.3	50.0
1972	(F)	51.4	21.9	13.9	12.0	10.4	30.4	45.1	64.2	50.6	16.0	35.2	12.9
	(M)	24.5	18.6	12.2	11.9	46.8	13.7	57.9	117.9	26.8	13.9	15.2	11.3
	(L)	37.9	20.8	10.4	9.9	45.8	12.0	35.1	37.1	17.4	11.4	15.4	8.9
1973	(F)	9.2	8.7	5.9	5.8	5.6	6.7	27.7	18.0	93.4	74.8	35.2	37.5
	(M)	8.3	7.1	5.9	5.7	25.3	60.0	10.6	85.7	33.6	94.2	21.0	22.1
	(L)	6.8	8.1	10.0	5.6	18.0	42.8	11.0	149.8	37.0	53.8	105.0	16.7
1974	(F)	16.6	14.1	9.8	6.4	5.4	11.1	34.4	9.1	33.9	12.8	88.1	33.5
	(M)	17.2	12.2	8.5	8.2	5.4	68.1	21.3	23.6	11.2	80.1	40.9	77.0
	(L)	15.4	13.1	7.0	6.2	4.8	30.0	10.5	12.8	44.4	116.5	58.2	29.1
1975	(F)	21.9	18.0	14.2	9.0	7.6	18.2	9.0	10.5	42.8	8.8	35.9	22.9
	(M)	57.8	19.5	14.0	7.6	6.2	8.1	15.2	8.0	17.5	28.2	22.2	65.9
	(L)	34.4	20.1	9.5	6.5	7.9	6.6	9.2	9.2	10.1	16.6	12.5	33.0
1976	(F)	14.0	8.1	43.4	30.4	42.3	87.2	38.5	65.9	52.9	60.8	23.1	19.4
	(M)	11.5	7.2	19.1	9.0	24.4	23.2	17.4	63.1	112.0	51.8	27.9	28.4
	(L)	8.7	8.7	7.3	6.8	132.8	69.8	39.7	35.5	81.1	27.0	22.0	16.0
1977	(F)	16.4	14.6	9.7	10.2	6.2	24.9	32.0	88.8	34.4	23.9	15.5	19.7
	(M)	16.2	13.2	9.2	7.7	5.6	34.3	39.0	37.1	59.1	19.0	79.6	15.1
	(L)	15.8	14.4	7.5	6.4	84.4	21.7	46.9	37.3	28.7	12.9	41.2	11.8
1978	(F)	11.2	7.8	6.5	5.0	6.2	40.1	8.3	16.1	57.1	78.1	93.7	21.7
	(M)	9.5	7.0	6.1	4.9	4.9	39.3	20.2	11.4	75.0	65.1	37.1	19.7
	(L)	7.8	9.2	4.7	29.1	32.1	14.1	38.0	94.4	81.8	107.1	22.2	26.0
1979	(F)	19.8	12.1	8.8	5.9	7.6	107.5	42.3	62.0	38.0	106.0	35.0	26.2
	(M)	16.1	10.1	7.7	5.6	58.5	42.0	35.5	46.0	40.3	68.1	45.0	18.5
	(L)	13.2	11.7	6.4	33.5	41.2	61.6	50.3	17.1	74.9	25.6	49.9	16.9
1980	(F)	15.4	16.2	8.8	10.5	8.0	12.6	11.4	52.5	23.1	32.6	157.3	22.4
	(M)	13.5	9.3	8.0	30.9	35.0	9.6	49.1	22.3	60.6	38.6	68.1	27.5
	(L)	10.4	11.5	46.9	9.9	49.3	9.0	38.9	26.4	40.3	117.8	33.6	17.3
1981	(F)	16.8	12.6	9.3	9.5	17.2	104.4	97.0	79.5	81.3	27.0	64.6	25.5
	(M)	14.9	11.0	8.0	6.7	58.5	76.3	145.5	55.6	75.1	24.4	40.1	20.6
	(L)	12.2	13.0	8.1	74.9	134.9	73.5	68.2	22.6	52.2	98.7	56.9	16.8
1982	(F)	16.6	11.6	9.3	40.3	24.5	61.3	36.5	46.0	74.8	20.4	26.9	22.5
	(M)	15.1	10.6	9.1	64.2	22.8	48.7	70.3	20.9	53.8	36.4	19.5	16.7
	(L)	12.1	12.0	46.9	55.5	113.7	38.4	49.2	76.9	35.1	17.2	25.4	14.1
1983	(F)	13.9	10.7	7.8	6.2	6.0	5.8	5.7	17.7	8.0	43.7	31.0	11.0
	(M)	14.1	9.9	8.7	6.2	7.4	7.8	7.7	18.2	8.2	47.4	15.4	9.9
	(L)	11.4	11.2	5.8	6.1	5.4	5.7	6.7	13.4	60.1	88.6	12.8	7.6
1984	(F)	7.5	5.4	4.8	4.9	98.9	36.6	55.1	43.2	18.7	16.3	35.5	25.2
	(M)	6.9	4.9	29.6	19.7	64.5	52.0	58.6	41.4	25.6	38.2	17.6	15.0
	(L)	5.8	6.1	6.3	34.6	52.1	21.3	51.8	55.5	17.1	94.9	15.6	11.9

to be Continued

SIMULATED 10-DAY MEAN RUNOFF

Continuation

STATION : MINANGA
DRAINAGE AREA : 1565. (SQ.KM)
UNIT : CMS

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	38.3	31.1	26.9	19.3	15.4	15.9	182.0	150.7	83.3	76.5	50.7	95.1
	(M)	34.9	32.0	23.2	17.2	15.1	165.6	100.7	110.5	85.5	68.8	46.6	127.8
	(L)	29.9	39.2	19.9	15.6	19.6	166.4	74.2	166.1	126.2	63.3	51.0	57.6
1964	(F)	48.4	36.9	34.0	24.9	19.5	65.1	81.1	107.5	65.8	149.3	146.1	146.7
	(M)	43.9	35.1	32.3	23.1	18.6	70.6	67.8	58.7	123.0	77.0	410.5	224.9
	(L)	37.0	49.9	25.7	20.2	70.0	96.7	107.3	45.1	145.1	88.9	283.6	106.6
1965	(F)	74.3	53.6	36.5	25.0	21.2	23.0	113.5	36.0	80.6	31.0	88.4	33.0
	(M)	68.6	47.4	33.1	23.1	20.9	20.6	153.7	41.7	37.8	64.7	34.5	37.5
	(L)	55.3	52.6	26.3	21.9	18.7	57.1	35.2	33.1	34.6	28.8	38.0	34.6
1966	(F)	31.8	23.0	17.5	16.7	76.2	44.9	44.5	32.0	24.6	25.0	53.7	189.1
	(M)	28.4	20.4	17.2	16.4	24.0	69.4	30.8	26.7	23.5	30.7	147.1	113.5
	(L)	22.9	23.7	15.4	16.2	50.1	42.9	29.0	23.6	20.3	34.9	346.2	218.0
1967	(F)	99.4	50.6	37.3	27.6	20.9	23.3	74.1	54.6	98.8	101.3	63.5	31.1
	(M)	61.5	47.1	32.2	25.4	18.5	20.0	31.3	35.2	35.5	40.3	36.8	29.4
	(L)	49.5	52.2	24.9	24.3	16.4	64.1	49.0	31.2	32.3	30.1	32.1	25.0
1968	(F)	24.1	19.0	15.1	14.4	18.9	129.1	28.9	93.5	41.1	44.3	34.7	30.1
	(M)	22.1	16.4	14.9	14.2	14.4	69.2	42.7	195.3	63.5	52.6	31.8	50.3
	(L)	18.7	19.2	15.3	19.4	12.3	56.3	28.1	60.9	112.1	34.0	36.3	30.9
1969	(F)	30.4	20.8	14.2	13.6	13.0	33.1	13.1	51.5	66.1	169.7	29.3	127.0
	(M)	28.2	18.8	14.0	13.4	12.8	19.4	13.8	76.3	24.7	76.9	109.2	127.3
	(L)	21.8	20.6	12.5	13.2	21.6	14.5	10.6	35.5	27.3	28.7	139.5	115.5
1970	(F)	105.3	39.8	29.8	20.0	16.4	13.1	20.5	66.6	29.5	145.1	146.5	194.0
	(M)	46.9	34.4	24.1	17.3	14.0	30.2	17.9	68.0	81.7	126.1	126.6	188.0
	(L)	38.8	40.3	19.9	20.6	12.1	34.1	15.4	23.3	36.6	159.5	106.8	76.0
1971	(F)	95.9	48.0	37.2	34.2	27.1	65.0	79.8	66.5	101.3	265.5	198.4	389.1
	(M)	54.3	47.0	121.9	27.7	60.0	166.8	174.2	103.5	237.7	269.6	266.7	243.8
	(L)	50.6	53.0	35.6	24.5	26.7	70.8	71.0	109.1	93.0	207.8	408.5	195.7
1972	(F)	194.9	85.0	61.3	47.4	50.9	68.7	99.6	48.2	43.9	39.2	36.5	59.7
	(M)	101.9	77.6	56.7	65.3	115.2	51.7	53.6	45.0	41.1	36.9	33.2	38.1
	(L)	86.7	87.2	44.5	65.2	145.6	78.0	44.0	39.6	40.0	31.1	102.3	32.7
1973	(F)	32.3	26.6	25.6	22.8	21.8	155.1	41.7	78.5	39.6	74.5	143.2	242.7
	(M)	29.8	24.5	25.5	22.4	21.4	109.5	35.2	117.7	74.9	230.2	255.0	115.1
	(L)	26.1	30.2	21.0	22.1	19.2	100.1	61.5	41.5	39.0	101.4	378.1	67.2
1974	(F)	68.3	54.0	36.9	26.6	21.9	126.1	22.5	22.2	26.6	245.9	336.5	104.8
	(M)	60.9	48.1	33.7	23.3	31.3	33.4	41.7	49.5	32.6	295.9	235.6	233.4
	(L)	52.3	53.9	26.9	22.2	19.9	27.0	21.5	21.8	45.1	330.9	124.6	138.9
1975	(F)	88.0	62.7	42.8	30.4	22.4	25.8	29.8	33.6	26.3	24.1	77.0	89.7
	(M)	71.2	55.7	37.4	26.4	22.0	26.5	26.5	27.5	36.7	73.9	34.7	78.4
	(L)	63.9	62.0	30.9	24.7	41.3	40.5	32.7	24.2	26.8	122.6	32.8	93.7
1976	(F)	91.8	36.4	24.7	20.9	17.5	67.0	34.0	155.0	31.4	52.6	136.0	128.0
	(M)	45.1	31.2	23.9	20.4	16.2	29.9	27.7	47.8	95.5	33.2	210.9	183.8
	(L)	35.7	35.1	19.3	17.8	98.9	84.1	30.1	30.3	37.8	62.2	282.3	83.8
1977	(F)	61.2	50.3	34.4	24.4	18.2	20.0	16.7	23.9	16.9	30.6	20.5	28.1
	(M)	60.5	45.5	30.1	20.6	17.9	17.8	16.5	16.8	50.1	24.9	130.6	25.8
	(L)	50.5	50.9	24.4	18.5	66.5	17.6	14.9	15.2	91.7	20.3	42.8	21.4
1978	(F)	20.1	13.9	13.2	12.6	12.1	12.7	11.1	38.4	93.1	66.9	57.0	40.1
	(M)	17.9	13.6	13.0	12.5	11.9	11.6	10.9	19.0	88.3	35.1	161.3	47.6
	(L)	14.6	16.8	11.7	12.3	30.8	11.3	9.8	82.8	88.9	133.0	75.3	68.5
1979	(F)	37.9	24.8	17.4	12.1	11.6	120.5	99.0	72.9	188.0	92.8	68.3	38.4
	(M)	34.5	21.0	14.2	11.9	14.4	32.9	154.2	103.9	115.0	49.6	46.0	35.6
	(L)	26.6	24.6	11.2	14.0	127.5	43.2	170.3	52.3	53.1	39.8	42.4	30.1
1980	(F)	30.7	22.6	17.7	14.4	13.8	13.6	12.6	13.9	16.3	18.3	256.9	57.3
	(M)	27.2	20.8	14.9	14.2	13.6	13.0	17.3	13.2	14.4	13.8	110.0	104.5
	(L)	22.8	23.5	13.3	14.0	17.5	12.8	17.7	11.1	12.7	135.2	57.2	41.3
1981	(F)	37.0	27.7	17.4	11.9	11.4	48.8	27.3	46.7	29.7	32.5	137.9	45.7
	(M)	35.0	23.0	14.4	11.8	11.3	62.5	92.4	74.4	47.8	30.9	77.4	40.0
	(L)	29.7	24.9	11.0	11.6	10.1	21.6	20.4	28.2	46.0	116.6	71.9	31.8
1982	(F)	32.6	20.4	13.5	11.9	11.4	10.9	12.0	10.1	90.4	19.6	25.4	56.5
	(M)	27.9	19.0	12.3	11.8	11.2	17.7	11.6	12.8	74.6	25.5	56.5	42.5
	(L)	22.0	20.8	11.0	11.6	10.1	17.7	9.3	35.3	21.0	22.2	32.8	23.6
1983	(F)	36.7	22.0	14.8	10.0	9.5	10.8	8.8	8.4	6.4	78.0	46.7	18.8
	(M)	44.7	19.3	11.7	9.8	13.5	10.8	6.7	8.3	7.9	19.1	39.6	17.0
	(L)	23.5	20.2	9.2	9.6	16.5	10.0	7.8	8.9	35.0	53.9	20.5	13.2
1984	(F)	12.0	9.5	7.4	7.1	59.1	18.6	111.6	87.5	35.9	23.9	84.0	63.0
	(M)	11.8	7.7	7.4	29.1	31.0	18.0	26.0	34.0	29.7	59.9	39.6	36.0
	(L)	9.9	9.4	6.9	14.0	72.3	114.0	88.7	70.5	25.1	246.6	34.9	33.7

to be Continued

SIMULATED 10-DAY MEAN RUNOFF

Continuation

STATION : LARION ALTO
DRAINAGE AREA : 655. (SQ.KM)
UNIT : CMS

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	24.8	12.9	8.8	5.3	5.1	5.0	100.2	36.4	46.8	27.4	15.0	92.2
	(M)	21.2	11.3	7.4	5.2	5.1	52.6	134.6	28.2	101.1	23.1	11.5	114.4
	(L)	15.3	12.6	5.6	5.2	4.5	87.7	59.4	19.5	75.6	17.3	10.8	35.8
1964	(F)	22.1	10.0	20.6	5.7	4.5	39.5	21.9	249.9	100.8	127.9	142.4	198.5
	(M)	17.7	8.4	9.2	4.6	4.5	42.0	52.9	157.0	46.8	78.5	375.8	142.0
	(L)	12.4	20.4	6.6	4.6	15.7	28.1	61.1	66.3	71.3	64.5	400.8	69.7
1965	(F)	57.5	38.7	21.4	12.7	8.8	16.5	16.8	56.3	119.8	38.1	83.3	25.1
	(M)	49.6	32.1	16.5	10.7	7.4	42.8	255.1	71.0	46.7	67.7	35.9	22.1
	(L)	41.0	33.4	13.3	9.4	50.0	39.4	113.2	46.8	99.0	27.8	32.1	17.4
1966	(F)	15.4	10.1	7.6	6.2	87.5	91.4	34.9	77.4	55.4	24.2	86.6	166.0
	(M)	12.4	8.9	6.4	7.4	58.2	48.9	92.9	111.4	45.4	33.1	117.0	104.3
	(L)	9.8	10.7	6.5	5.5	136.6	56.5	69.9	114.4	28.2	83.2	348.6	129.6
1967	(F)	65.6	31.2	17.0	144.4	15.1	44.4	68.6	61.7	115.3	229.2	136.3	43.7
	(M)	44.5	25.8	15.5	46.3	16.7	16.0	28.2	126.4	72.7	330.3	82.5	37.4
	(L)	34.4	26.5	10.8	20.1	18.7	208.9	34.8	187.5	44.7	116.6	51.7	29.4
1968	(F)	28.3	15.4	11.6	6.8	11.2	46.0	27.8	146.7	77.7	105.5	32.2	20.1
	(M)	23.5	14.2	10.0	6.7	6.9	51.4	75.1	261.3	40.6	54.4	28.4	16.6
	(L)	17.5	15.9	7.6	17.3	7.3	49.0	87.0	122.0	226.9	34.7	24.3	12.2
1969	(F)	12.0	8.3	6.0	14.6	5.7	93.8	86.0	110.4	70.7	85.5	24.1	48.4
	(M)	10.9	7.1	6.0	5.8	6.5	37.7	44.8	43.5	22.5	35.3	109.9	42.5
	(L)	8.8	7.8	5.4	5.7	17.9	13.1	238.8	41.8	73.8	26.0	63.0	24.2
1970	(F)	38.7	14.9	9.6	14.5	53.8	55.6	14.2	35.2	45.9	59.2	206.4	103.9
	(M)	23.0	11.2	8.0	10.5	42.1	25.1	102.6	40.5	49.0	108.3	131.2	130.7
	(L)	17.4	12.8	66.6	9.9	30.9	15.6	31.9	55.9	69.6	264.7	114.8	54.2
1971	(F)	41.0	24.1	16.3	9.8	9.5	52.1	39.5	46.2	27.0	251.7	200.5	258.2
	(M)	34.3	27.4	15.6	8.7	14.0	45.9	157.1	50.3	89.1	182.9	220.7	169.2
	(L)	25.6	26.1	10.7	7.0	9.9	15.8	71.4	21.2	94.4	153.9	440.8	103.4
1972	(F)	103.6	47.5	26.4	17.2	17.1	59.7	60.9	68.4	96.0	29.5	41.2	34.0
	(M)	61.9	40.8	27.4	16.0	59.4	25.6	62.8	74.0	39.7	24.1	22.2	20.5
	(L)	53.2	43.0	20.5	14.8	23.8	59.8	75.6	83.6	59.4	21.3	43.9	16.6
1973	(F)	16.7	10.8	7.3	6.5	10.7	10.5	25.2	65.3	55.5	115.4	89.6	216.4
	(M)	13.4	9.8	6.7	6.5	27.0	61.2	33.4	54.8	43.5	242.4	184.0	101.7
	(L)	10.6	10.9	6.3	6.4	8.5	42.5	15.8	98.5	28.3	120.7	461.8	56.4
1974	(F)	51.8	30.3	15.9	11.0	26.3	70.5	17.5	27.0	19.4	184.4	308.9	72.4
	(M)	43.4	24.8	14.2	9.6	12.0	24.4	16.3	51.2	73.6	131.6	236.5	114.4
	(L)	33.3	25.7	11.1	11.3	11.6	21.9	13.2	30.3	121.8	161.5	109.1	75.3
1975	(F)	46.9	26.5	14.5	11.2	15.8	27.5	25.5	73.8	58.3	145.5	89.6	31.7
	(M)	39.2	21.5	14.4	9.4	12.0	59.5	15.0	39.6	45.8	115.5	64.4	53.5
	(L)	29.5	22.2	11.8	7.7	36.3	37.2	10.4	84.1	22.3	173.4	35.7	68.7
1976	(F)	39.4	18.8	10.8	22.8	6.7	31.3	26.9	54.0	25.9	40.8	132.3	35.6
	(M)	27.8	14.7	9.4	9.0	9.5	82.6	17.8	43.7	77.9	27.0	144.1	46.6
	(L)	21.4	14.9	10.0	7.7	76.2	77.4	52.1	73.3	31.3	107.0	70.5	28.5
1977	(F)	26.2	15.1	9.0	5.5	5.4	34.1	25.6	133.2	138.1	99.8	38.7	31.9
	(M)	22.2	11.7	7.5	5.5	5.3	31.6	33.6	79.5	268.2	61.8	98.8	27.4
	(L)	17.5	13.2	5.5	5.4	24.1	23.1	175.7	53.0	176.1	36.4	48.2	22.1
1978	(F)	19.9	11.4	8.0	5.3	5.3	47.4	7.9	117.0	115.1	103.6	94.1	55.9
	(M)	16.1	10.4	7.2	8.1	5.1	11.9	53.2	65.2	131.0	76.5	141.5	70.2
	(L)	11.9	11.7	5.6	9.1	60.9	11.3	56.4	191.4	122.6	133.3	61.8	36.0
1979	(F)	30.7	19.2	11.4	6.6	5.3	18.0	128.5	35.6	38.3	136.0	120.1	28.4
	(M)	25.9	16.0	9.7	5.8	38.2	11.6	76.2	44.9	31.8	120.8	78.2	24.3
	(L)	20.0	16.0	7.2	6.5	40.8	9.5	56.2	19.1	28.4	39.5	44.4	44.9
1980	(F)	23.6	11.7	8.8	7.0	4.8	9.1	68.2	76.3	43.1	38.0	204.0	48.0
	(M)	19.2	12.9	7.3	6.7	73.1	6.0	179.3	84.6	61.9	25.5	119.2	69.2
	(L)	13.7	12.7	10.3	5.3	23.5	5.3	137.1	42.0	28.9	187.9	60.6	34.2
1981	(F)	28.9	15.8	9.4	5.0	4.8	98.8	32.2	114.1	25.2	72.6	184.3	42.5
	(M)	24.7	12.3	8.0	4.9	27.3	121.3	21.6	105.0	118.9	74.0	82.4	32.2
	(L)	18.1	13.5	5.9	5.6	77.6	57.5	14.7	44.6	40.2	104.9	86.6	24.7
1982	(F)	22.7	11.5	8.1	5.7	5.0	37.7	11.0	41.2	72.5	28.2	42.1	101.5
	(M)	19.0	10.6	6.7	13.6	47.1	13.2	9.6	33.2	58.1	132.8	108.9	48.8
	(L)	13.8	12.1	4.7	5.6	34.8	13.1	9.9	57.5	63.8	40.5	110.4	35.1
1983	(F)	30.1	20.2	10.0	6.9	4.5	4.4	4.2	41.0	102.3	112.6	44.9	21.6
	(M)	48.0	15.9	8.9	5.3	6.1	5.7	4.2	19.3	28.2	79.0	26.0	18.0
	(L)	23.1	15.6	7.4	4.6	5.6	4.4	4.5	8.3	25.1	103.0	37.9	12.8
1984	(F)	10.6	5.8	5.8	3.7	39.4	27.9	88.4	98.0	121.0	31.3	55.3	92.2
	(M)	7.9	4.7	5.6	9.0	14.5	32.9	46.7	55.6	49.4	25.5	61.2	36.2
	(L)	6.4	4.9	5.4	35.0	65.9	87.0	43.6	291.1	36.0	122.1	38.4	22.8

to be Continued

SIMULATED 10-DAY MEAN RUNOFF

Continuation

STATION : AMRAWILEN
DRAINAGE AREA : 751. (SQ.KM)
UNIT : CMS

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	19.7	12.5	6.1	6.0	5.8	86.1	150.4	95.7	71.7	28.0	16.2	21.0
	(M)	16.5	11.2	6.4	5.9	54.7	55.2	155.1	92.6	60.1	23.9	16.0	41.4
	(L)	12.6	12.5	5.5	5.9	43.4	120.0	99.4	69.3	60.6	17.8	36.4	56.6
1964	(F)	20.2	10.7	6.6	5.5	27.1	70.3	72.7	196.9	120.4	146.1	54.4	60.0
	(M)	16.2	9.7	5.6	5.4	20.4	93.0	73.8	146.4	99.0	66.6	86.9	147.9
	(L)	12.4	10.4	5.0	5.4	63.0	124.3	68.0	72.0	63.1	31.2	153.0	52.8
1965	(F)	32.1	21.6	12.7	12.5	72.7	86.9	44.8	68.9	64.2	26.9	22.5	13.8
	(M)	28.0	17.7	10.8	10.2	67.9	74.0	125.1	85.9	30.2	22.8	19.1	13.8
	(L)	23.2	18.5	9.3	62.9	69.1	36.8	190.7	55.8	48.4	32.5	16.5	11.4
1966	(F)	11.0	7.4	5.8	5.6	43.8	92.1	30.2	148.8	65.5	20.5	23.7	138.7
	(M)	10.1	6.6	5.8	5.6	85.3	34.3	35.6	103.7	27.9	22.6	39.0	48.1
	(L)	7.9	7.4	5.2	38.0	101.5	34.6	54.8	67.5	22.5	46.4	197.1	25.7
1967	(F)	23.8	14.6	9.3	5.4	5.4	59.3	31.4	174.6	142.8	157.6	216.9	38.0
	(M)	21.1	11.7	7.4	5.4	33.4	35.5	51.4	139.7	132.2	221.1	79.3	33.2
	(L)	16.4	13.3	5.1	9.5	9.7	109.3	252.0	184.5	202.1	70.5	44.1	25.8
1968	(F)	24.2	15.2	11.3	10.4	37.6	69.3	95.9	123.9	170.1	141.4	38.5	28.1
	(M)	20.5	13.7	11.4	12.0	117.6	148.7	124.8	173.2	139.7	71.7	33.1	24.8
	(L)	16.7	14.9	17.4	54.2	57.4	178.4	161.8	117.9	292.9	39.5	33.3	19.2
1969	(F)	18.1	12.7	7.7	9.3	30.5	126.3	86.1	205.0	79.5	71.6	28.0	27.3
	(M)	16.2	10.9	7.1	30.5	61.4	82.6	85.7	117.1	68.7	35.9	25.2	22.2
	(L)	13.1	11.9	6.2	7.8	71.3	41.3	465.2	86.5	64.8	28.0	46.4	18.6
1970	(F)	52.7	15.3	10.8	11.6	103.1	121.4	35.0	66.9	94.5	138.1	116.6	48.6
	(M)	21.9	12.8	8.9	8.5	103.4	126.0	63.9	132.5	190.0	140.9	88.6	42.0
	(L)	16.8	15.0	16.9	53.1	94.3	58.1	64.7	108.2	104.6	139.8	45.4	28.6
1971	(F)	31.5	19.3	14.8	12.4	9.4	27.8	47.4	72.4	84.8	223.0	54.4	33.5
	(M)	26.2	21.0	13.3	11.2	9.1	45.4	139.7	79.8	64.1	104.4	51.2	28.8
	(L)	20.7	21.9	15.0	10.1	17.8	28.9	128.9	90.4	130.7	52.5	80.2	25.5
1972	(F)	24.0	15.8	10.3	7.9	95.0	139.8	90.9	88.7	37.4	32.8	21.1	14.9
	(M)	21.4	13.4	8.7	42.7	64.9	71.2	258.5	71.9	32.8	26.7	18.3	13.2
	(L)	17.5	15.3	7.6	51.7	102.5	60.2	180.3	56.0	92.6	20.9	15.7	10.9
1973	(F)	10.7	6.7	6.4	6.2	111.2	47.3	63.3	58.5	136.4	168.5	45.4	51.9
	(M)	9.3	6.6	6.4	6.1	121.5	26.3	59.7	75.7	84.1	193.7	35.3	30.6
	(L)	7.2	8.1	5.7	13.0	71.6	46.8	40.1	69.7	65.3	67.0	128.3	24.2
1974	(F)	23.2	15.0	9.7	18.5	43.7	147.1	24.5	77.5	70.0	76.6	233.5	38.4
	(M)	19.6	12.9	7.8	18.6	24.8	43.3	52.1	131.4	37.7	234.8	96.4	69.9
	(L)	16.5	14.7	6.7	101.6	52.5	22.1	73.0	123.5	81.5	183.9	58.9	33.8
1975	(F)	30.3	19.9	13.5	19.2	102.6	75.8	53.3	71.7	137.1	49.0	40.9	19.7
	(M)	26.8	16.8	12.1	9.7	46.6	70.7	89.4	54.6	97.9	47.2	24.5	18.8
	(L)	21.8	17.9	9.3	9.1	42.7	22.2	69.2	81.8	33.8	37.7	21.2	16.6
1976	(F)	16.2	10.3	6.3	11.5	7.5	36.5	127.5	46.7	62.1	127.8	29.6	22.1
	(M)	13.8	8.7	6.2	11.4	8.0	134.7	47.9	29.3	105.3	86.9	46.9	20.4
	(L)	10.5	9.3	9.0	7.1	105.0	198.6	71.8	47.9	83.3	29.7	25.6	16.4
1977	(F)	15.2	10.7	6.0	6.7	5.5	32.9	97.6	126.1	54.6	61.7	24.6	23.8
	(M)	13.8	9.0	5.8	23.1	5.4	40.0	93.6	46.9	252.7	33.8	107.0	21.0
	(L)	10.8	9.7	5.2	6.2	20.1	62.2	97.3	51.9	115.1	24.6	33.7	15.9
1978	(F)	14.5	9.0	5.3	5.2	12.0	12.8	116.6	24.3	69.1	50.2	17.5	14.9
	(M)	11.9	7.5	5.3	15.0	6.8	83.8	62.8	18.4	104.4	24.3	31.5	13.8
	(L)	9.8	7.8	4.9	9.1	23.7	36.7	87.9	14.5	170.3	19.2	16.9	10.6
1979	(F)	9.9	6.8	4.7	4.5	41.9	94.0	27.3	42.2	16.3	16.2	17.5	17.1
	(M)	8.8	5.4	4.6	4.5	40.9	29.0	56.0	18.8	15.2	42.4	23.8	16.9
	(L)	7.5	6.0	4.2	60.8	19.6	38.4	49.0	13.7	15.1	19.1	37.2	18.6
1980	(F)	13.7	9.1	6.1	4.1	6.2	27.7	63.9	85.9	44.3	37.5	153.5	28.9
	(M)	11.7	7.4	4.4	4.0	140.3	13.5	77.6	75.2	69.2	36.4	82.3	24.2
	(L)	10.0	8.1	3.8	4.0	104.9	10.7	191.5	72.4	52.9	149.1	36.3	19.3
1981	(F)	18.2	10.3	5.6	4.4	4.6	163.2	76.5	36.1	36.7	41.9	124.8	23.8
	(M)	15.2	8.6	4.5	4.3	92.1	122.1	43.7	49.8	111.8	22.0	46.9	19.9
	(L)	11.0	9.3	4.6	4.3	81.6	64.4	25.1	46.4	30.2	46.3	53.6	15.8
1982	(F)	14.2	8.3	4.5	6.9	8.4	13.1	52.7	56.3	117.0	38.9	42.6	36.0
	(M)	11.4	6.9	4.4	15.8	12.5	64.4	14.4	81.1	60.5	66.6	45.3	26.0
	(L)	8.7	7.1	4.8	5.1	14.6	44.5	32.3	24.5	134.3	22.1	23.4	19.2
1983	(F)	17.5	10.6	6.0	4.3	4.1	16.0	12.3	88.1	33.4	42.1	19.6	12.9
	(M)	15.8	9.9	6.1	4.2	4.1	25.2	46.8	69.8	31.2	74.8	18.5	10.4
	(L)	12.5	10.7	4.0	4.2	37.4	11.4	132.3	51.0	20.2	40.2	15.6	7.8
1984	(F)	7.7	4.5	5.9	5.1	28.0	35.9	30.5	66.1	68.1	23.3	30.7	62.8
	(M)	7.3	3.9	34.0	11.0	10.9	22.2	25.2	30.6	56.5	19.2	37.7	21.8
	(L)	5.4	4.9	11.2	35.4	41.9	14.6	25.8	218.2	33.9	63.6	22.5	15.7

to be Continued

SIMULATED 10-DAY MEAN RUNOFF

Continuation STATION : PIHUKPUK
DRAINAGE AREA : 856. (SQ.KM) UNIT : CMS

YEAR		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1963	(F)	23.4	12.7	10.8	9.3	8.9	23.3	166.3	45.8	49.0	22.5	12.2	56.9
	(M)	19.3	14.5	9.6	9.2	10.4	108.0	136.9	31.3	27.0	18.6	10.9	113.0
	(L)	12.6	15.4	8.6	9.0	7.9	145.4	40.5	30.1	26.3	14.1	10.2	33.7
1964	(F)	21.9	9.8	39.0	7.9	7.6	57.9	17.5	140.9	76.2	120.8	170.6	156.7
	(M)	16.1	8.6	9.9	7.8	7.5	65.9	17.6	101.0	85.2	76.7	386.9	125.8
	(L)	10.1	10.5	7.3	7.7	22.3	48.4	45.3	78.6	105.4	72.5	330.2	88.7
1965	(F)	50.9	30.5	16.1	11.0	149.8	75.4	30.6	86.6	134.0	32.8	51.5	23.8
	(M)	44.6	23.0	14.0	10.8	41.0	91.1	151.5	69.7	76.0	39.5	25.4	20.2
	(L)	33.0	22.9	11.2	59.3	66.9	43.5	167.0	79.2	54.2	23.8	30.0	17.1
1966	(F)	15.2	11.5	10.6	10.3	81.0	95.0	56.5	43.9	52.6	29.1	90.8	123.3
	(M)	13.8	11.1	10.6	59.0	97.3	53.4	73.7	90.4	57.4	48.3	115.7	75.5
	(L)	11.3	13.7	9.5	99.2	162.2	55.0	92.3	99.1	31.4	70.9	294.6	88.3
1967	(F)	43.5	19.5	15.8	65.5	12.4	88.5	86.1	82.5	75.5	203.6	118.1	45.9
	(M)	33.7	16.6	12.2	15.9	17.0	23.4	32.6	119.1	87.0	241.1	69.4	32.3
	(L)	24.5	19.1	10.7	19.0	24.5	162.1	74.0	101.6	75.9	83.1	48.7	24.7
1968	(F)	27.0	15.7	12.1	11.6	12.5	46.2	41.0	136.5	75.7	61.4	24.6	13.9
	(M)	21.6	14.2	11.9	11.4	11.3	44.5	23.0	257.9	37.0	46.1	18.2	12.6
	(L)	15.4	16.1	10.7	17.6	22.5	31.5	27.5	107.1	168.6	29.1	15.2	10.4
1969	(F)	10.6	10.2	9.7	9.3	8.9	66.1	81.7	106.5	72.6	102.5	24.4	52.3
	(M)	10.5	10.0	9.6	9.1	22.4	33.3	40.8	38.5	74.3	52.1	43.8	34.1
	(L)	9.4	12.3	8.6	9.0	11.9	14.5	245.3	26.4	61.3	26.5	65.9	23.5
1970	(F)	40.5	12.7	9.3	8.9	10.7	64.7	13.8	79.5	68.2	69.3	157.6	78.0
	(M)	21.4	11.3	9.2	8.8	110.1	28.0	18.1	54.7	72.7	104.4	162.6	100.0
	(L)	14.8	12.6	9.0	8.6	81.4	18.4	16.8	92.7	50.9	146.2	110.1	50.1
1971	(F)	44.6	18.9	13.7	10.1	18.1	84.0	36.5	28.9	57.2	230.3	116.4	158.1
	(M)	30.6	21.1	13.8	9.9	14.5	39.5	131.7	57.2	57.5	152.6	91.9	127.5
	(L)	21.3	20.9	10.9	9.8	9.8	23.7	59.5	21.4	47.0	86.9	265.5	69.2
1972	(F)	69.3	23.8	14.6	11.9	30.3	39.2	70.0	89.9	45.5	22.5	26.2	34.1
	(M)	38.6	17.7	15.0	19.1	48.9	23.3	91.9	131.8	30.6	16.3	14.5	17.8
	(L)	26.7	20.2	12.4	13.5	49.0	28.8	85.9	63.6	29.0	13.0	30.0	13.0
1973	(F)	13.0	10.7	9.7	9.2	8.8	44.7	66.5	88.8	132.5	166.7	101.8	176.3
	(M)	12.4	10.0	9.5	9.1	9.2	134.5	47.1	72.0	75.9	294.5	124.9	84.7
	(L)	10.4	12.3	8.5	9.0	7.8	62.6	42.2	162.1	55.0	125.2	347.6	49.0
1974	(F)	42.5	21.2	14.1	11.5	63.6	60.1	12.9	24.4	19.7	171.8	258.1	64.0
	(M)	33.2	17.6	12.4	11.3	38.4	23.4	13.4	99.1	57.1	116.8	198.8	122.6
	(L)	25.4	20.1	10.6	28.5	59.8	18.9	10.6	41.4	114.0	179.9	93.5	68.8
1975	(F)	42.2	23.9	14.2	13.7	59.0	81.0	89.6	63.2	59.4	25.3	93.4	29.2
	(M)	33.4	17.9	12.6	11.3	37.6	144.4	68.2	40.9	45.9	52.5	53.1	36.6
	(L)	28.6	20.3	10.9	11.2	59.6	61.3	26.2	151.9	27.3	209.8	34.1	63.5
1976	(F)	46.3	17.5	13.0	11.0	10.5	64.7	83.0	65.8	46.0	80.9	95.1	77.1
	(M)	28.2	14.6	12.2	10.8	14.5	73.5	29.6	60.3	67.1	30.8	131.5	43.7
	(L)	21.2	16.7	10.9	10.7	100.2	105.1	86.1	104.3	34.7	66.2	102.3	28.5
1977	(F)	26.5	15.8	11.7	10.5	10.1	31.9	28.1	165.1	64.8	40.5	21.6	20.3
	(M)	24.5	14.3	10.9	10.4	9.9	74.4	27.6	62.1	119.5	29.5	65.6	16.1
	(L)	18.8	16.8	9.7	10.2	35.6	78.4	133.7	39.8	113.0	20.6	29.0	12.8
1978	(F)	13.0	9.8	9.4	9.0	8.6	42.6	14.8	80.9	164.9	184.3	68.6	41.9
	(M)	12.0	9.7	9.3	8.9	11.3	44.9	102.0	97.3	106.4	113.0	76.8	56.2
	(L)	9.7	11.9	8.3	8.7	49.8	23.3	60.9	215.4	103.8	126.5	38.8	29.3
1979	(F)	24.6	16.5	10.8	10.0	9.5	14.9	57.3	40.6	54.1	80.4	95.0	27.5
	(M)	18.8	13.7	10.3	9.9	35.9	10.3	56.2	21.0	40.2	99.8	83.5	24.6
	(L)	13.5	15.5	9.2	9.7	39.2	10.3	69.1	13.3	20.3	28.2	49.3	57.0
1980	(F)	25.4	12.6	9.6	8.5	8.1	33.7	85.7	30.7	85.1	25.0	219.2	39.1
	(M)	19.5	11.5	8.8	8.4	155.5	17.7	89.5	32.2	54.5	21.2	120.2	58.2
	(L)	15.6	13.0	7.9	8.3	60.3	24.9	89.5	76.0	27.8	249.5	55.3	29.6
1981	(F)	25.5	13.7	9.6	9.2	8.8	186.8	35.6	51.2	28.1	68.6	160.5	34.6
	(M)	21.8	12.3	9.5	9.0	45.0	116.7	98.4	135.2	110.1	58.7	81.4	26.9
	(L)	15.0	13.8	8.5	10.5	68.3	42.1	28.9	39.9	43.7	90.9	68.3	19.5
1982	(F)	18.1	11.4	9.7	11.0	12.0	99.2	73.8	24.0	115.1	27.2	28.8	74.7
	(M)	14.4	10.7	9.6	9.2	63.6	29.5	51.2	22.9	72.6	138.0	81.6	57.6
	(L)	11.8	12.3	8.6	35.1	115.5	59.4	24.5	84.7	47.1	40.8	108.5	46.3
1983	(F)	27.7	18.3	10.7	9.5	9.1	8.7	8.3	90.1	69.1	95.3	53.0	97.8
	(M)	46.3	13.8	9.8	9.4	11.0	19.0	9.9	54.2	67.0	60.7	27.8	65.3
	(L)	22.7	15.6	9.2	9.2	8.0	10.1	59.6	33.5	43.0	86.2	38.8	91.5
1984	(F)	38.8	13.1	9.3	8.3	91.2	49.5	108.0	75.1	82.5	25.6	166.5	81.6
	(M)	24.8	11.5	8.6	49.7	30.5	101.9	68.4	31.1	37.1	26.3	75.3	31.5
	(L)	17.4	13.1	7.7	62.1	92.3	158.5	40.9	218.5	30.4	108.9	47.9	22.0

Table 3.5 Rainfall Data for Streamflow Analysis

Sub-basin	Basin /1	Drainage area (km^2)	Basin /2 rainfall (mm)
1	1	1,150	3,300
2	1	481	3,600
3	1	733	3,400
4	1	298	2,900
5	1	351	2,800
6	1	142	2,300
7	1	477	2,750
8	1	387	2,650
9	1	193	2,500
10	1	264	2,150
11	1	1,106	2,080
12	1	1,051	2,060
13	2	620	2,500
14	2	292	3,100
15	2	550	3,500
16	2	1,228	2,500
17	2	628	4,000
18	2	559	3,000

Sub-basin	Basin /1	Drainage area (km^2)	Basin /2 rainfall (mm)
19	2	266	2,070
20	2	970	1,910
21	3	247	2,100
22	3	876	2,500
23	3	474	2,300
24	3	215	2,400
25	3	652	3,800
26	3	915	3,900
27	4	209	2,960
28	2	656	2,850
29	2	408	1,820
30	2	362	2,500
31	2	589	1,820
32	4	225	3,530
33	4	739	2,180
34	4	327	3,690
35	4	92	2,250
36	4	657	3,880

Sub-basin	Basin /1	Drainage area (km^2)	Basin /2 rainfall (mm)
37	6	1,042	2,000
38	4	969	3,100
39	6	73	2,100
40	5	386	3,100
41	5	334	3,500
42	5	157	2,950
43	5	533	2,950
44	5	372	3,340
45	5	612	2,200
46	6	856	3,090
47	6	366	1,900
48	6	775	2,900
49	6	160	1,900
50	6	169	2,080
51	4	417	2,000
52	6	393	2,500
53	6	278	2,300

Notes: /1 ; 1 = Upper Cagayan, 2 = Magat,
3 = Ilagan, 4 = Lower Cagayan
5 = Upper Chico, 6 = Lower Chico

/2 ; Basin rainfall is assumed on the basis of the isohyetal map for the period from 1963 to 1978.

Basin	Runoff gauge	Drainage area (km^2)	Basin rainfall (mm)	Basin	Runoff gauge	Drainage area (km^2)	Basin rainfall (mm)
1. Upper Cagayan	Guinalvin	921	2,700	4. Lower Cagayan	Larion Alto	655	3,880
2. Magat	Dulao	573	3,000	5. Upper Chico	Ampawilen	751	3,270
3. Ilagan	Minanga	1,565	2,400	6. Lower Chico	Pinukpuk	856	3,090

Table 3.6 Runoff Estimation

(Unit: $\times 10^8 m^3$)

Year	Upper Cagayan Jan. → May	Upper Cagayan June → Dec.	Upper Cagayan Annual	Magat Jan. → May	Magat June → Dec.	Magat Annual	Ilagan Jan. → May	Ilagan June → Dec.	Ilagan Annual
1963	16.6	100.2	116.8	10.5	80.0	90.5	8.5	48.0	56.5
1964	20.3	128.4	148.7	16.1	102.8	118.9	11.9	61.2	73.1
1965	18.2	50.7	68.9	25.5	44.8	70.3	13.1	24.2	37.3
1966	16.8	78.3	95.2	15.1	55.8	71.0	9.1	36.2	45.4
1967	21.0	46.4	67.4	18.3	66.6	84.8	13.3	21.6	34.8
1968	10.1	62.7	72.7	24.3	71.4	95.7	5.9	29.0	34.9
1969	10.6	66.7	77.3	10.5	26.3	36.9	6.1	30.0	36.1
1970	18.1	85.6	103.7	19.4	79.4	98.8	10.8	39.2	50.1
1971	30.8	182.0	212.8	33.7	92.4	126.2	16.9	87.4	104.3
1972	50.2	42.5	92.8	25.1	46.4	71.5	29.5	24.4	53.9
1973	11.8	120.3	132.0	9.7	74.8	84.5	8.3	57.2	65.5
1974	19.6	122.6	142.2	10.6	60.9	71.6	13.1	58.1	71.3
1975	23.9	48.6	72.5	17.9	29.5	47.3	15.5	22.9	38.4
1976	23.3	90.1	113.4	27.4	70.2	97.6	12.4	42.2	54.6
1977	22.0	32.0	54.0	17.3	51.9	69.2	13.1	15.2	28.3
1978	9.5	59.6	69.1	10.6	70.1	80.7	5.2	27.0	32.2
1979	18.1	78.7	96.8	18.5	72.0	90.5	9.4	38.0	47.4
1980	10.3	49.1	59.4	20.3	62.9	83.2	6.4	22.3	28.7
1981	10.3	58.3	68.6	29.2	93.7	122.9	6.5	26.1	32.6
1982	8.6	34.0	42.6	33.8	58.3	92.2	5.6	14.4	20.0
1983	12.3	22.7	35.0	9.1	31.3	40.4	6.2	10.2	16.3
1984	16.7	64.9	81.5	23.8	54.2	78.1	6.9	30.0	36.9
Average	18.1	73.8	91.9	19.4	63.4	82.8	10.6	34.8	45.4
Sub-basin	▽1 ~ ▽12			▽13 ~ ▽20			▽22 ~ ▽26		
Drainage Area (km^2)	6,633			5,113			3,132		

(Unit: $\times 10^8 m^3$)

Year	Siffu-Mallig Jan. → May	Siffu-Mallig June → Dec.	Siffu-Mallig Annual	Chico Jan. → May	Chico June → Dec.	Chico Annual	Whole Basin Jan. → May	Whole Basin June → Dec.	Whole Basin Annual
1963	3.4	26.1	29.6	9.2	56.2	65.4	56.7	369.4	426.1
1964	5.3	33.6	38.9	9.5	95.8	105.3	72.7	552.4	625.1
1965	8.3	14.6	23.0	23.1	54.5	77.6	111.9	257.1	369.0
1966	4.9	18.2	23.2	20.9	66.0	87.0	91.0	353.1	444.1
1967	6.0	21.8	27.7	11.5	97.0	108.5	95.1	358.1	453.1
1968	7.9	23.3	31.3	15.4	79.6	95.0	74.6	342.2	416.7
1969	3.4	8.6	12.1	11.0	71.5	82.6	49.0	275.1	324.1
1970	6.3	26.0	32.3	20.9	79.5	100.4	94.9	395.8	490.7
1971	11.0	30.2	41.2	11.4	77.8	89.1	118.6	601.8	720.4
1972	8.2	15.2	23.4	20.7	52.0	72.7	162.4	232.8	395.3
1973	3.2	24.4	27.6	12.8	85.9	98.7	54.1	479.2	533.3
1974	3.5	19.9	23.4	17.6	82.6	100.2	83.1	443.1	526.2
1975	5.8	9.6	15.5	17.6	57.3	74.9	98.9	238.0	336.8
1976	8.9	22.9	31.9	12.9	63.7	76.7	101.8	358.2	460.0
1977	5.7	17.0	22.6	8.4	58.7	67.1	77.1	253.6	330.7
1978	3.5	22.9	26.4	7.4	60.4	67.8	46.6	330.9	377.5
1979	6.0	23.5	29.6	10.5	34.2	44.8	76.2	304.1	380.3
1980	6.6	20.6	27.2	15.9	63.4	79.3	74.4	297.9	372.2
1981	9.6	30.6	40.2	12.6	60.1	72.6	82.4	347.4	429.9
1982	11.0	19.1	30.1	10.3	50.8	61.1	82.9	235.4	318.4
1983	3.0	10.2	13.2	8.3	41.2	49.5	50.1	158.0	208.2
1984	7.8	17.7	25.5	14.8	53.5	68.3	85.4	298.5	383.9
Average	6.3	20.7	27.0	13.8	65.5	79.3	83.6	340.1	423.7
Sub-basin	▽28 ~ ▽31			▽40 ~ ▽49					
Drainage Area (km^2)	2,015			4,551			27,281		

Table 3.7 Mean Monthly Runoff

(Unit: m^3/s)

POINT	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL MEAN
1	42.5	28.2	20.1	18.3	36.4	63.3	58.4	64.1	68.7	103.2	134.4	96.3	61.3
2	19.4	12.9	9.2	8.4	16.6	28.9	26.6	29.2	31.4	47.1	61.3	43.9	28.0
3	27.9	18.5	13.2	12.0	23.9	41.6	38.3	42.1	45.1	67.8	88.2	63.2	40.3
4	9.7	6.4	4.6	4.2	8.3	14.4	13.3	14.6	15.7	23.5	30.6	21.9	14.0
5	11.0	7.3	5.2	4.7	9.4	16.4	15.1	16.6	17.8	26.7	34.8	24.9	15.9
6	3.7	2.4	1.7	1.6	3.1	5.4	5.0	5.5	5.9	8.9	11.6	8.3	5.3
7	14.7	9.8	7.0	6.3	12.6	21.9	20.2	22.2	23.8	35.7	46.4	33.3	21.2
8	11.5	7.6	5.4	5.0	9.8	17.1	15.8	17.3	18.6	27.9	36.3	26.0	16.6
9	5.4	3.6	2.6	2.3	4.6	8.1	7.4	8.1	8.7	13.1	17.1	12.2	7.8
10	6.4	4.2	3.0	2.7	5.4	9.5	8.7	9.6	10.3	15.4	20.1	14.4	9.2
11	25.8	17.1	12.2	11.1	22.1	38.4	35.4	38.9	41.7	62.5	81.5	58.3	37.2
12	24.3	16.1	11.5	10.5	20.8	36.1	33.3	36.6	39.2	58.9	76.7	54.9	35.0
13	18.4	11.9	10.8	13.1	27.2	34.0	35.5	40.2	41.6	43.6	41.6	28.7	29.0
14	10.8	6.9	6.3	7.6	15.9	19.9	20.7	23.5	24.3	25.5	24.3	16.8	16.9
15	22.9	14.8	13.4	16.2	33.8	42.2	44.1	50.0	51.6	54.2	51.7	35.7	36.0
16	36.5	23.5	21.4	25.9	53.9	67.3	70.3	79.7	82.3	86.4	82.4	56.9	57.4
17	29.9	19.3	17.5	21.2	44.1	55.1	57.5	65.2	67.3	70.7	67.4	46.5	47.0
18	19.9	12.9	11.7	14.1	29.5	36.8	38.4	43.5	45.0	47.2	45.0	31.1	31.4
19	6.5	4.2	3.8	4.6	9.7	12.1	12.6	14.3	14.8	15.5	14.8	10.2	10.3
20	22.0	14.2	12.9	15.6	32.6	40.6	42.4	48.1	49.7	52.2	49.7	34.3	34.6
21	6.3	4.8	3.4	2.8	4.2	7.0	6.8	7.4	8.1	11.9	15.9	12.2	7.6
22	26.6	20.2	14.2	11.8	17.6	29.7	28.8	31.4	34.0	50.3	67.3	51.6	32.0
23	13.3	10.1	7.0	5.9	8.8	14.8	14.3	15.6	16.9	25.0	33.5	25.7	15.9
24	6.3	4.8	3.3	2.8	4.1	7.0	6.8	7.4	8.0	11.9	15.9	12.2	7.5
25	30.1	22.9	16.0	13.4	19.9	33.6	32.5	35.5	38.5	56.9	76.1	58.4	36.2
26	43.4	32.9	23.1	19.3	28.7	48.3	46.8	51.2	55.4	82.0	109.7	84.1	52.2
27	6.6	4.2	2.7	2.8	6.1	10.1	14.4	19.0	17.4	23.0	27.8	15.2	12.5
28	22.2	14.3	13.0	15.8	32.8	41.0	42.8	48.5	50.1	52.6	50.2	34.6	34.9
29	8.8	5.7	5.2	6.3	13.0	16.3	17.0	19.3	19.9	20.9	19.9	13.8	13.9
30	10.8	6.9	6.3	7.6	15.9	19.9	20.7	23.5	24.3	25.5	24.3	16.8	16.9
31	12.8	8.2	7.5	9.0	18.8	23.5	24.5	27.8	28.7	30.2	28.8	19.9	20.0
32	8.5	5.4	3.5	3.6	7.8	13.0	18.4	24.4	22.4	29.5	35.7	19.5	16.0
33	17.3	11.0	7.0	7.3	15.9	26.3	37.4	49.6	45.4	59.9	72.5	39.6	32.5
34	13.0	8.2	5.3	5.5	11.9	19.7	28.0	37.1	34.0	44.9	54.3	29.7	24.4
35	2.2	1.4	0.9	0.9	2.0	3.4	4.8	6.4	5.8	7.7	9.3	5.1	4.2
36	27.4	17.4	11.1	11.5	25.1	41.6	59.1	78.4	71.9	94.8	114.7	62.6	51.5
37	19.2	11.9	8.7	12.7	31.8	46.4	50.0	62.3	53.1	67.4	75.5	44.1	40.4
38	32.3	20.5	13.1	13.6	29.6	49.0	69.7	92.4	84.7	111.7	135.2	73.8	60.7
39	1.4	0.9	0.6	0.9	2.3	3.4	3.7	4.6	3.9	5.0	5.6	3.2	3.0
40	8.1	5.6	3.9	7.5	23.6	32.5	43.1	41.0	41.1	33.3	26.3	14.5	23.5
41	7.9	5.4	3.8	7.3	23.1	31.7	42.1	40.1	40.1	32.6	25.7	14.1	22.9
42	3.1	2.2	1.5	2.9	9.1	12.6	16.7	15.9	15.9	12.9	10.2	5.6	9.1
43	10.6	7.3	5.1	9.8	31.1	42.7	56.6	53.9	54.0	43.8	34.6	19.0	30.8
44	8.4	5.8	4.0	7.8	24.5	33.7	44.7	42.6	42.7	34.6	27.3	15.0	24.4
45	9.1	6.3	4.4	8.4	26.6	36.5	48.5	46.2	46.2	37.5	29.6	16.3	25.4

(to be continued)

(Continuation)

(Unit: m^3/s)

POINT	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL MEAN
46	24.3	15.1	11.0	16.1	40.4	58.9	63.5	79.0	67.4	85.5	95.9	56.0	51.3
47	6.4	4.0	2.9	4.2	10.6	15.5	16.7	20.8	17.7	22.5	25.2	14.7	13.5
48	20.7	12.9	9.3	13.7	34.3	50.0	53.9	67.1	57.2	72.7	81.5	47.6	43.6
49	2.8	1.7	1.3	1.8	4.6	6.8	7.3	9.1	7.7	9.8	11.0	6.4	5.9
50	3.2	2.0	1.5	2.1	5.4	7.8	8.4	10.5	9.0	11.4	12.7	7.4	6.8
51	9.0	5.7	3.6	3.8	8.2	13.6	19.3	25.7	23.5	31.0	37.5	20.5	16.8
52	9.0	5.6	4.1	6.0	15.0	21.9	23.6	29.4	25.0	31.8	35.6	20.8	19.1
53	5.9	3.7	2.7	3.9	9.8	14.2	15.3	19.1	16.3	20.7	23.2	13.5	12.4
101	61.9	41.1	29.3	26.7	53.0	92.2	85.0	93.4	100.1	150.2	195.7	140.2	89.3
102	89.9	59.6	42.5	38.7	76.9	133.8	123.3	135.4	145.2	218.0	283.9	203.4	129.6
103	110.6	73.4	52.3	47.6	94.6	164.6	151.7	166.6	178.7	268.2	349.3	250.2	159.4
104	26.2	17.4	12.4	11.3	22.4	39.0	35.9	39.5	42.3	63.5	82.8	59.3	37.8
105	31.6	21.0	15.0	13.6	27.0	47.1	43.4	47.6	51.1	76.7	99.8	71.5	45.6
106	145.8	96.8	69.0	62.8	124.7	217.1	200.1	219.8	235.7	353.8	460.7	330.0	210.2
107	177.9	118.1	84.2	76.7	152.2	265.0	244.2	268.2	287.6	431.7	562.3	402.8	256.6
108	29.2	18.8	17.1	20.7	43.1	53.9	56.2	63.7	65.8	69.1	65.9	45.5	45.9
109	52.1	33.6	30.5	37.0	77.0	96.1	100.3	113.7	117.4	123.3	117.6	81.1	81.9
110	118.5	76.4	69.5	84.0	175.0	218.5	228.1	258.7	267.1	280.5	267.4	184.5	186.3
111	138.4	89.2	81.2	98.2	204.5	255.3	266.5	302.2	312.1	327.7	312.4	215.6	217.7
112	145.0	93.4	85.0	102.8	214.2	267.4	279.1	316.5	326.8	343.3	327.2	225.8	228.0
113	167.0	107.6	97.9	118.5	246.7	308.0	321.5	364.6	376.5	395.4	376.9	260.1	262.6
114	369.2	241.9	193.6	205.6	419.7	609.2	599.0	669.4	703.3	886.0	1,015.9	717.8	556.8
115	39.9	30.3	21.2	17.7	26.4	44.4	43.1	47.0	51.0	75.3	100.8	77.3	47.9
116	76.3	57.9	40.5	33.9	50.4	85.0	82.4	89.9	97.5	144.1	192.8	147.9	91.7
117	119.7	90.8	63.6	53.2	79.1	133.4	129.2	141.1	152.9	226.1	302.4	232.1	143.9
118	495.3	337.4	260.6	261.6	502.9	749.5	735.0	817.9	864.3	1,124.0	1,334.2	962.2	705.7
119	31.1	20.0	18.2	22.0	45.9	57.3	59.8	67.8	70.0	73.6	70.1	48.4	48.8
120	23.5	15.2	13.8	16.7	34.7	43.4	45.3	51.3	53.0	55.7	53.1	36.6	37.0
121	54.6	35.2	32.0	38.7	80.6	100.7	105.1	119.2	123.0	129.2	123.2	85.0	85.8
122	556.5	376.8	295.3	303.1	589.7	860.3	854.4	956.1	1,004.8	1,276.2	1,485.3	1,062.4	804.0
123	565.0	382.3	298.8	306.7	597.5	873.3	872.9	980.6	1,027.2	1,305.8	1,521.0	1,081.9	820.1
124	595.3	401.5	311.1	319.4	625.3	919.2	938.2	1,067.3	1,106.6	1,410.6	1,647.8	1,151.1	877.0
125	624.9	420.3	323.1	331.9	652.5	964.2	1,002.2	1,152.1	1,184.3	1,513.1	1,771.8	1,218.9	932.7
126	676.4	452.8	344.9	358.2	713.9	1,059.6	1,121.9	1,306.7	1,322.1	1,692.2	1,982.5	1,336.8	1,033.8
127	16.0	11.0	7.7	14.8	46.7	64.2	85.2	81.1	81.2	65.9	52.1	28.6	46.4
128	19.1	13.1	9.2	17.7	55.9	76.7	101.9	97.0	97.1	78.8	62.2	34.2	55.5
129	29.7	20.4	14.3	27.5	86.9	119.4	158.5	150.9	151.1	122.6	96.8	53.2	86.3
130	38.1	26.2	18.4	35.2	111.5	153.1	203.2	193.5	193.8	157.2	124.2	68.2	110.7
131	71.5	47.6	33.7	59.7	178.4	248.5	315.2	318.7	307.4	280.2	249.7	140.4	188.4
132	98.6	64.4	46.0	77.6	223.4	314.0	385.8	406.6	382.4	375.4	356.3	202.8	245.5
133	101.4	66.2	47.3	79.5	228.0	320.7	393.1	415.7	390.1	385.2	367.4	209.2	251.4
134	779.2	519.8	392.8	438.6	944.3	1,383.8	1,518.6	1,727.0	1,716.1	2,082.3	2,355.5	1,549.3	1,288.1
135	791.4	527.5	397.9	444.5	957.8	1,405.2	1,546.4	1,763.2	1,748.6	2,124.7	2,405.7	1,577.2	1,311.8
136	800.4	533.1	401.9	450.5	972.8	1,427.1	1,570.0	1,792.5	1,773.6	2,156.5	2,441.3	1,598.0	1,330.8
137	806.3	536.8	404.6	454.3	982.6	1,441.3	1,585.3	1,811.6	1,789.9	2,177.2	2,464.5	1,611.6	1,343.2

Table 3.8 Comparison of Calculated Monthly Runoff with Observed or Studied One (Unit: m^3/s)

Basin 1 at Palattao (6626 km^2) 1963-1967, 1969-71

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	223	155	124	83	144	353	370	367	394	554	784	675	353
Observed :	211	154	162	83	206	224	331	341	430	690	1095	732	389

Basin 1 at Casecnan Damsite (1150 km^2) 1963-79

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	48	32	23	20	39	72	64	72	77	110	149	111	68
Studied :	67	36	32	26	33	44	62	65	89	125	136	113	69

Basin 2 at Hapid (606 km^2) 1965-66 , 1968-69

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	27	21	14	20	31	61	59	71	56	40	69	58	44
Observed :	25	18	14	11	32	43	77	90	78	47	63	34	45

Basin 2 at Magat Damsite (4143 km^2) 1963-84

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	145	93	85	103	214	267	279	317	327	343	327	226	228
Studied :	134	122	78	81	175	210	305	338	399	408	329	200	232

Basin 2 at Siffu Diversion Damsite (627 km^2) 1963-72

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	28	16	12	13	26	38	45	50	47	45	53	44	35
Studied :	22	14	13	15	24	40	57	54	62	61	62	38	38

Basin 2 at Matuno Damsite (550 km^2) 1963-76

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	28	17	14	13	28	41	41	52	51	52	54	44	36
Studied :	30	19	16	15	27	39	52	55	58	61	52	37	38

Basin 3 at Dipalin (198 km^2) 1966-68

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	8	6	4	4	6	12	8	12	10	9	17	16	9
Observed :	9	7	6	6	7	7	6	7	9	12	17	20	10

Basin 4 at Calaoagan (308 km^2) 1965-70

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	7	4	3	5	8	13	19	23	18	22	23	14	13
Observed	7	5	3	6	4	10	19	29	13	34	22	10	14

Basin 4 at Calantac (907 km^2) 1963-66

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	27	19	12	8	37	51	93	95	77	56	153	102	61
Observed :	60	31	12	8	46	21	72	30	72	114	77	194	62

Basin 4 at Antagan (170 km^2) 1965-71

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	7	5	3	4	7	12	19	21	18	25	29	17	14
Observed	18	9	9	5	8	10	12	16	9	26	37	36	16

Basin 5 at Chico 4 Damsite (1410 km^2) 1963-84

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	30	20	14	28	87	119	159	151	151	123	97	53	86
Studied :	34	21	16	26	83	129	168	154	131	106	113	57	86

Basin 6 at Escolta (655 km^2) 1965-72

	J	F	M	A	M	J	J	A	S	O	N	D	Ave.
Calculated:	20	12	8	16	34	38	53	62	49	57	60	37	37
Observed :	25	19	15	17	25	28	48	41	42	65	57	45	36

Table 4.1 Storm Records in the Cagayan River Basin

Tropical Cyclone			Flood Hydrograph		Hourly Rainfall	Remarks
Code	Name	Period	Availability	Peak (m^3/s)	Availability	
(1) Magat damsite (C.A. = 4,143 km^2)						
T6718	Welming	Nov. 1 - 5 '67	x	8,281	x	
T6811	Nitang	Sep. 24 - 29 '68	x	1,790	x	
T6905	Elang	Jul. 24 - 27 '69	x	1,242	x	
T7013	Pitang	Sep. 8 - 12 '70	x	9,540	x	
T7311	Narsing	Oct. 12 - 16 '73	x	6,128	x	
T7416	Tering	Oct. 14 - 17 '74	x	5,658	x	
T7604	Didang	May 15 - 26 '76	x	4,900	x	
T7717	Uding	Nov. 10 - 17 '77	o	1,449	o	
T7810	MIDING	Aug. 23 - 26 '78	o	3,060	o	
T7818	WELING	Sep. 26 - 30 '78	o	3,100	o	
T7822	Kading	Oct. 25 - 27 '78	o	7,906	o	
TS7922	Krising	Dec. 21 - 24 '79	x	2,537	x	
T8011	Nitang	Jul. 18 - 22 '80	o	3,101	o	
T8012	Osang	Jul. 22 - 27 '80	x	1,650	x	
TS8019	Yoning	Oct. 28 - 30 '80	o	3,297	o	
T8020	Aring	Nov. 1 - 7 '80	o	7,637	o	
TS8105	Elang	Jul. 3 - 5 '81	o	3,996	o	
T8120	Anding	Nov. 21 - 27 '81	o	5,440	o	
TS8410	Maring	Aug. 28 - Sep. 5 '84	o	2,140	o	
TD8415	Seniang	Oct. 28 - Nov. 3 '84	o	4,440	o	
TS8510	Miling	Sep. 2 - 11 '85	o	3,192	o	
T8516	Tasing	Oct. 18 - 26 '85	o	6,300	o	
(2) Matuno damsite (C.A. = 550 km^2)						
T8011	Nitang	Jul. 18 - 22 '80	o	852	o	2 hrs. rainfall
(3) Palattao G/S (C.A. = 6,626 km^2)						
		Nov. 22 - 23 '61	o	5,978	x	
		Nov. 6 - 7 '62	o	4,786	x	
		Jun. 27 - 28 '63	o	3,290	x	
(4) Cabulay G/S (C.A. = 196 km^2)						
		Sep. 18 - 19 '65	o	105	x	
(5) Ibulao G/S (C.A. = 606 km^2)						
		Sep. 23 '71	o	445	x	
(6) Gabong G/S (C.A. = 586 km^2)						
		Jul. 19 - 25 '80	o	441	x	

Table 4.2 Thiessen Weight for Base Point Basin

Case 1 (Period 1956 - 1963)

Basin	Rainfall Gauging Station									
	Aparri	Tuao	Tuguegarao	Naneng	Ilagan	Bontoc	Nayon	Echague	Consuelo	Dakgan
Casecnan	-	-	-	-	-	-	-	-	1.00	-
Cagayan No.2	-	-	-	-	-	-	-	-	1.00	-
Cagayan No.1	-	-	-	-	-	-	-	-	1.00	-
Diduyon	-	-	-	-	-	-	-	-	1.00	-
Addaism (A)	-	-	-	-	-	-	-	-	1.00	-
Matuno No.1	-	-	-	-	-	-	-	-	1.00	-
Alimit No.1 (A)	-	-	-	1.00	-	-	-	-	-	-
Magat	-	-	-	0.27	-	-	-	-	0.73	-
Ilagan No.1	-	-	0.64	-	-	-	-	-	0.36	-
Disabungan	-	-	1.00	-	-	-	-	-	-	-
Siffu No.1 (A)	-	-	-	1.00	-	-	-	-	-	-
Mallig No.2	-	-	-	1.00	-	-	-	-	-	-
Chico No.2	-	-	-	1.00	-	-	-	-	-	-
Chico No.4	-	-	-	1.00	-	-	-	-	-	-
Pinukpuk	-	0.23	-	0.77	-	-	-	-	-	-
Base Point No.1	0.04	0.09	0.29	0.28	-	-	-	-	0.30	-
" 2	-	0.02	0.36	0.22	-	-	-	-	0.40	-
" 3	-	-	0.23	0.21	-	-	-	-	0.56	-
" 4	-	-	0.06	0.27	-	-	-	-	0.67	-
" 5	-	-	0.09	0.16	-	-	-	-	0.75	-
" 6	-	0.36	0.02	0.62	-	-	-	-	-	-
" 7	-	-	0.23	0.77	-	-	-	-	-	-
" 8	-	-	0.85	-	-	-	-	-	0.15	-
" 9	-	-	0.02	0.38	-	-	-	-	0.60	-

Case 2 (Period 1964 - 1967)

Basin	Rainfall Gauging Station									
	Aparri	Tuao	Tuguegarao	Naneng	Ilagan	Bontoc	Nayon	Echague	Consuelo	Dakgan
Casecnan	-	-	-	-	-	1.00	-	-	-	-
Cagayan No.2	-	-	-	-	-	1.00	-	-	-	-
Cagayan No.1	-	-	-	-	-	1.00	-	-	-	-
Diduyon	-	-	-	-	-	1.00	-	-	-	-
Addalam (A)	-	-	-	-	-	1.00	-	-	-	-
Matuno No.1	-	-	-	-	-	1.00	-	-	-	-
Alimit No.1 (A)	-	-	-	-	-	1.00	-	-	-	-
Magat	-	-	-	-	-	1.00	-	-	-	-
Ilagan No.1	-	-	0.78	-	-	0.22	-	-	-	-
Disabungan	-	-	1.00	-	-	-	-	-	-	-
Siffu No.1 (A)	-	-	-	0.72	-	0.28	-	-	-	-
Mallig No.2	-	-	-	1.00	-	-	-	-	-	-
Chico No.2	-	-	-	-	-	1.00	-	-	-	-
Chico No.4	-	-	-	0.31	-	0.69	-	-	-	-
Pinukpuk	-	0.23	-	-	0.77	-	-	-	-	-
Base Point No.1	0.04	0.09	0.30	0.14	-	0.43	-	-	-	-
" 2	-	0.02	0.38	0.10	-	0.50	-	-	-	-
" 3	-	-	0.26	0.05	-	0.69	-	-	-	-
" 4	-	-	0.08	0.07	-	0.85	-	-	-	-
" 5	-	-	0.09	0.06	-	0.85	-	-	-	-
" 6	-	0.36	0.01	0.38	-	0.25	-	-	-	-
" 7	-	-	0.23	0.68	-	0.09	-	-	-	-
" 8	-	-	0.91	-	-	0.09	-	-	-	-
" 9	-	-	0.02	0.09	-	0.89	-	-	-	-

to be Continued

Continuation

Case 3 (Period 1968 - 1976)

Basin	Rainfall Gauging Station									
	Aparri	Tuao	Tuguegarao	Naneng	Ilagan	Bontoc	Nayon	Echague	Consuelo	Dakgan
Casecnan	-	-	-	-	-	-	-	-	1.00	-
Cagayan No.2	-	-	-	-	-	-	-	-	1.00	-
Cagayan No.1	-	-	-	-	-	-	0.23	-	0.77	-
Diduyon	-	-	-	-	-	-	0.21	-	0.79	-
Addalam (A)	-	-	-	-	-	-	0.51	-	0.49	-
Matuno No.1	-	-	-	-	-	-	0.83	-	0.17	-
Alimit No.1 (A)	-	-	-	-	-	0.28	0.72	-	-	-
Magat	-	-	-	-	-	0.07	0.66	-	0.27	-
Ilagan No.1	-	-	-	-	1.00	-	-	-	-	-
Disabungan	-	-	-	-	1.00	-	-	-	-	-
Siffu No.1 (A)	-	-	-	0.66	0.06	0.25	0.03	-	-	-
Mallig No.2	-	-	-	1.00	-	-	-	-	-	-
Chico No.2	-	-	-	-	-	1.00	-	-	-	-
Chico No.4	-	-	-	0.31	-	0.69	-	-	-	-
Pinukpuk	-	0.23	-	0.77	-	-	-	-	-	-
Base Point No.1	0.03	0.09	0.12	0.10	0.26	0.06	0.22	-	0.12	-
" 2	-	0.01	0.15	0.04	0.34	0.02	0.28	-	0.16	-
" 3	-	-	-	-	0.37	0.02	0.39	-	0.22	-
" 4	-	-	-	-	0.20	0.03	0.49	-	0.28	-
" 5	-	-	-	-	0.26	-	0.40	-	0.34	-
" 6	-	0.36	0.02	0.38	-	0.24	-	-	-	-
" 7	-	-	0.02	0.47	0.42	0.08	0.01	-	-	-
" 8	-	-	-	-	1.00	-	-	-	-	-
" 9	-	-	-	0.01	0.08	0.06	0.63	-	0.22	-

Case 4 (Period 1977 - 1984)

Basin	Rainfall Gauging Station									
	Aparri	Tuao	Tuguegarao	Naneng	Ilagan	Bontoc	Nayon	Echague	Consuelo	Dakgan
Casecnan	-	-	-	-	-	-	-	-	0.19	0.81
Cagayan No.2	-	-	-	-	-	-	-	-	0.13	0.87
Cagayan No.1	-	-	-	-	-	-	-	0.01	0.09	0.90
Diduyon	-	-	-	-	-	-	0.04	-	0.12	0.84
Addalam (A)	-		-	-	-	-	0.01	0.12	0.07	0.79
Matuno No.1	-	-	-	-	-	-	0.83	-	0.17	-
Alimit No.1 (A)	-	-	-	-	-	0.28	0.72	-	-	-
Magat	-	-	-	-	-	0.07	0.65	-	0.27	0.01
Ilagan No.1	-	-	-	-	0.05	-	-	0.95	-	-
Disabungan	-	-	-	-	1.00	-	-	-	-	-
Siffu No.1 (A)	-	-	-	0.66	0.06	0.25	0.03	-	-	-
Mallig No.2	-	-	-	1.00	-	-	-	-	-	-
Chico No.2	-	-	-	-	-	1.00	-	-	-	-
Chico No.4	-	-	-	0.31	-	0.69	-	-	-	-
Pinukpuk	-	0.23	-	0.77	-	-	-	-	-	-
Base Point No.1	0.03	0.09	0.12	0.10	0.15	0.06	0.11	0.18	0.05	0.11
" 2	-	0.02	0.14	0.04	0.20	0.02	0.14	0.23	0.07	0.14
" 3	-	-	-	-	0.18	0.02	0.20	0.32	0.09	0.19
" 4	-	-	-	-	0.06	0.02	0.25	0.30	0.12	0.25
" 5	-	-	-	-	0.04	-	0.02	0.46	0.04	0.44
" 6	-	0.35	0.02	0.38	-	0.25	-	-	-	-
" 7	-	-	0.02	0.47	0.41	0.07	0.01	-	-	-
" 8	-	-	-	0.59	-	-	0.41	-	-	-
" 9	-	-	0.01	0.04	0.06	0.58	0.09	0.22	-	-

Table 4.3 Adjustment Factor for Basin Mean Elevation

Dam Basin	Rainfall Gauging Station									
	Aparri	Tuao	Tugue-garao	Naneng	Ilagan	Bontoc	Nayon	Echague	Con-suelo	Dakgan
Casecnan	1.52	1.48	1.50	1.15	1.47	0.85	1.22	1.45	1.00	1.14
Cagayan No.2	1.47	1.44	1.45	1.11	1.42	0.82	1.18	1.41	0.96	1.11
Cagayan No.1	1.44	1.41	1.42	1.09	1.40	0.81	1.16	1.38	0.94	1.08
Diduyon	1.55	1.52	1.53	1.17	1.50	0.87	1.25	1.48	1.10	1.27
Addalam (A)	1.27	1.25	1.26	0.96	1.24	0.72	1.03	1.22	0.91	1.04
Matuno No.1	1.50	1.46	1.48	1.13	1.45	0.84	1.21	1.43	1.07	1.22
Alimit No.1 (A)	1.27	1.25	1.26	0.96	1.24	0.72	1.03	1.22	0.91	1.04
Magat	1.22	1.20	1.21	0.92	1.19	0.69	0.99	1.17	0.87	1.00
Ilagan No.1	1.25	1.22	1.23	0.94	1.21	0.70	1.01	1.20	0.89	1.02
Disabungan	1.17	1.14	1.15	0.88	1.13	0.66	0.94	1.12	0.83	0.95
Siffu No.1 (A)	1.17	1.15	1.16	0.89	1.14	0.66	0.95	1.12	0.84	0.96
Mallig No.2	1.18	1.16	1.17	0.89	1.15	0.66	0.95	1.13	0.84	0.97
Chico No.2	1.81	1.77	1.79	1.37	1.76	1.02	1.46	1.73	1.29	1.48
Chico No.4	1.52	1.49	1.51	1.15	1.48	0.86	1.23	1.46	1.09	1.25
Pinukpuk	1.29	1.26	1.28	0.97	1.25	0.73	1.04	1.24	0.92	1.06

Table 4.4 Probable Rainfall in the Base Point Basin

Unit: mm

	Basin	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/1,000	1/10,000 /1
1-Day Rainfall	Casecnan	155	248	328	400	480	560	650	900	1,250
	Cagayan No.2	150	241	321	390	470	550	640	890	1,250
	Cagayan No.1	138	223	298	360	440	510	620	840	1,200
	Diduyon	149	239	316	420	510	600	700	980	1,400
	Addalam (A)	115	183	236	315	382	457	539	768	1,209
	Matuno No.1	117	153	176	205	226	247	267	316	386
	Alimit No.1 (A)	83	114	137	168	193	219	247	319	443
	Magat	91	123	144	169	188	207	227	272	339
	Ilagan No.1	135	201	247	310	358	408	461	591	804
	Disabungan	135	201	251	321	377	439	505	681	998
	Siffu No.1 (A)	68	103	128	161	187	214	242	312	426
	Mallig No.2	76	111	136	169	194	221	248	316	427
	Chico No.2	124	171	202	242	271	301	331	403	511
	Chico No.4	97	144	177	220	253	287	323	410	549
	Pinukpuk	88	127	153	188	215	242	270	337	444
4-Day Rainfall	Base Point No.1	168	217	248	286	314	341	-	-	-
	" No.2	170	229	267	315	351	386	-	-	-
	" No.3	178	244	288	344	385	427	-	-	-
	" No.4	188	261	310	372	419	466	-	-	-
	" No.5	204	285	340	409	462	515	-	-	-
	" No.6	169	233	276	330	371	412	-	-	-
	" No.7	165	220	256	301	335	367	-	-	-
	" No.8	191	264	313	375	421	468	-	-	-
	" No.9	177	241	283	336	376	416	-	-	-

Note: /1; Probability

Table 4.5 Areal Rainfall Distribution

Distribution Type	Area	Return Period (year) 2	5	10	25	50	100
		Area Rainfall (mm)					
Intensive rainfall in Upper Cagayan basin	U/*	204	285	340	409	462	515
	BP-4/**	168	231	273	326	366	405
	BP-3/***	142	183	209	244	263	287
	BP-2	150	192	215	243	266	284
	BP-1	161	173	178	179	180	181
Intensive rainfall in Magat basin	M	177	241	283	336	376	416
	BP-4	196	276	330	399	451	503
	BP-3	142	183	209	244	263	287
	BP-2	150	192	215	243	266	284
	BP-1	161	173	178	179	180	181
Intensive rainfall in Ilagan basin	I	191	264	313	375	421	468
	BP-3	175	239	282	336	376	417
	BP-2	150	192	215	243	266	284
	BP-1	161	173	178	179	180	181
Intensive rainfall in Siffu basin	S	165	220	256	301	335	367
	BP-2	171	230	268	316	353	388
	BP-1	161	173	178	179	180	181
Intensive rainfall in Chico basin	C	169	233	276	330	371	412
	BP-1	168	214	242	277	303	327

Remarks: /*; U = Upper Cagayan basin, M = Magat basin,
I = Ilagan basin, S = Siffu basin,
C = Chico basin

/**; BP-4 means the area upstream BP-4 except U.

/***; BP-3 means the area between BP-3 and BP-4.

Table 4.6 Runoff Coefficient of the Selected Storms at Magat Damsite

No.	Storm	Rainfall			Runoff			Coefficient		
		1-hr Max (mm)	24-hr Max (mm)	Total (3-day) (mm)	1-hr Max (m^3/s)	Total (3-day) (mm)	Direct Runoff (mm)	Peak	Total	Direct
* 1.	T7717 Uding	38.0	81.0	125.1	1,440	52.7	43.3	0.03	0.42	0.35
* 2.	T7810 Miding	32.9	96.5	135.3	3,060	87.7	78.3	0.08	0.65	0.58
3.	T7818 Weling	26.1	66.2	89.1	3,100	100.1	90.7	0.10	1.12	1.02
* 4.	T7822 Kading	95.2	193.8	203.9	7,906	125.3	115.9	0.07	0.61	0.57
5.	T8011 Nitang	42.0	55.0	55.5	3,101	69.0	59.6	0.06	1.24	1.07
* 6.	T8019 Yoning	55.7	87.8	141.8	3,297	64.5	55.1	0.05	0.45	0.39
7.	T8020 Aring	83.0	244.2	284.9	7,637	220.9	211.5	0.08	0.78	0.74
8.	TS8105 Elang	73.4	130.1	132.9	3,996	73.3	63.9	0.05	0.55	0.48
9.	T8120 Anding	45.2	101.5	114.4	5,440	110.1	100.7	0.10	0.96	0.88
*10.	TS8410 Maring	23.1	62.7	115.6	2,140	56.3	46.9	0.08	0.49	0.41
11.	TD8415 Seniang	28.3	67.7	102.9	4,440	100.3	90.4	0.14	0.97	0.88
12.	TS8510 Miling	24.8	52.1	86.0	3,192	58.0	48.6	0.11	0.67	0.57
13.	T8516 Tasing	38.8	86.4	113.5	6,300	113.1	103.7	0.14	1.00	0.91

Note: * Storm selected for simulation study.
The others are not selected due to unreliability of runoff coefficient value and unreliable response between hourly rainfall and runoff data.

Table 4.7 Storage Function of Subbasin

Basin No.	A (km2)	L (km)	I	K	P	Tl (hr)
1	1,150	92.1	1/20	27.5	0.416	3.8
2	481	25.0	1/90	21.6	0.504	0.6
3	733	37.5	1/50	25.7	0.439	1.2
4	298	35.0	1/260	15.7	0.646	1.1
5	351	62.5	1/330	14.6	0.684	2.4
6	142	30.0	1/740	11.5	0.827	0.9
7	477	42.5	1/200	17.0	0.608	1.4
8	387	56.0	1/40	27.5	0.416	2.1
9	193	22.5	1/560	12.5	0.774	0.5
10	264	45.0	1/1,730	8.9	1.009	1.6
11	1,106	65.0	1/1,040	10.4	0.895	2.5
12	1,051	55.0	1/1,000	10.5	0.887	2.0
13	620	26.0	1/190	17.2	0.601	0.7
14	292	44.0	1/80	22.3	0.490	1.5
15	550	41.0	1/90	21.6	0.504	1.4
16	1,228	45.0	1/390	13.9	0.711	1.6
17	628	53.0	1/80	22.3	0.490	1.9
18	559	57.0	1/240	16.1	0.634	2.1
19	266	42.5	1/480	13.1	0.747	1.4
20	970	112.0	1/560	12.5	0.774	4.7
21	247	30.0	1/390	13.9	0.711	0.9
22	876	82.0	1/190	17.2	0.601	3.3
23	474	50.0	1/220	16.5	0.622	1.8
24	215	38.0	1/680	11.8	0.810	1.2
25	652	48.0	1/120	19.8	0.539	1.7
26	915	63.0	1/120	19.8	0.539	2.4
27	209	35.0	1/150	18.5	0.568	1.1
28	656	48.0	1/150	18.5	0.568	1.7
29	408	88.0	1/1,910	8.6	1.033	3.6
30	362	51.0	1/150	18.5	0.568	1.8
31	589	82.0	1/1,390	9.5	0.959	3.3
32	964	55.0	1/220	16.5	0.622	2.0
33	327	39.0	1/120	19.8	0.539	1.3
34	92	19.0	1/3,940	6.9	1.225	0.3
35	657	74.0	1/70	23.3	0.475	3.0
36	1,042	76.5	1/5,000	6.5	1.295	3.0
37	969	70.0	1/140	18.9	0.559	2.7
38	73	13.5	1/5,000	6.5	1.295	0.1
39	386	26.0	1/70	23.3	0.475	0.7
40	334	42.5	1/90	21.6	0.504	1.4
41	157	25.0	1/30	30.0	0.389	0.6
42	533	36.0	1/40	27.5	0.416	1.1
43	372	44.0	1/70	23.3	0.475	1.5
44	612	53.5	1/230	16.3	0.628	2.0
45	856	58.0	1/60	24.4	0.458	2.2
46	1,301	70.0	1/120	19.8	0.539	2.7
47	169	30.0	1/240	16.1	0.634	0.9
48	417	19.0	1/350	14.4	0.693	0.3
49	393	69.0	1/480	13.1	0.747	2.7
50	278	29.5	1/5,670	6.2	1.334	0.8

Notes;

A; Catchment Area (km2)
L; River Length (km)
I; Basin Slope
K, P; Storage Function
Tl; Lag Time (hr)

Table 4.8 Relationship of Discharge and Channel Storage
(Present River Condition)

No.	Channel-1 Cagayan S	Q	Channel-2 Cagayan S	Q	Channel-3 Cagayan S	Q	Channel-4 Cagayan S	Q	Channel-5 Addalam S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	6.0	228	5.8	204	21.7	1,265	19.3	1,265	3.3	200
2	12.0	719	11.5	645	43.4	3,990	38.5	3,990	13.6	636
3	18.0	1,404	17.3	1,262	65.1	7,788	57.8	7,788	20.4	1,250
4	24.0	2,252	23.0	2,026					27.3	2,019
5	30.0	3,249	28.8	2,929					34.1	2,929
6	42.0	5,622	40.3	5,066						
7	60.0	10,004	57.5	9,041						
8										
9										
10										
11										
12										
13										

No.	Channel-6 Addalam S	Q	Channel-7 Cagayan S	Q	Channel-8 Cagayan S	Q	Channel-9 Hagat S	Q	Channel-10 Hagat S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	1.3	200	19.7	580	46.2	580			12.0	331
2	5.6	636	29.2	1,160	70.5	1,160	14.3	681	24.0	1,048
3	8.4	1,250	38.5	1,740	91.4	1,740	21.4	1,331	36.0	2,053
4	11.1	2,019	53.5	2,900	128.7	2,900	28.5	2,136	48.0	3,299
5	13.9	2,929	68.9	4,060	166.0	4,060	35.6	3,082	60.0	4,765
6			88.6	5,800	228.7	5,800	49.9	5,325	84.0	8,281
7			121.2	8,700	352.6	8,700				
8			163.1	11,600	489.5	11,600				
9			210.0	14,500						
10			256.3	17,400						
11			359.4	23,200						
12			482.2	29,000						
13										

No.	Channel-11 Hagat S	Q	Channel-12 Cagayan S	Q	Channel-13 Ilagan S	Q	Channel-14 Ilagan S	Q	Channel-15 Ilagan S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	14.1	300	20.0	490					10.9	300
2	21.4	500	28.3	980			13.3	400	14.8	500
3	38.5	1,000	43.8	1,960	5.8	800	15.9	800	23.0	1,000
4	72.6	2,000	61.7	2,940	8.5	1,700	23.2	1,700	36.4	2,000
5	108.8	3,000	91.8	4,900	10.6	2,500	28.9	2,500	48.1	3,000
6	144.7	4,000	119.7	6,860	14.5	4,200	39.6	4,200	58.7	4,000
7	181.4	5,000	163.0	9,800	17.4	5,400	47.4	5,400	69.9	5,000
8	252.9	7,000	229.5	14,700					92.8	7,000
9	354.9	10,000	312.3	19,600					133.8	10,000
10			391.5	24,500						
11			474.2	29,400						
12										
13										

to be Continued

Continuation

No.	Channel-16 Cagayan S	Q	Channel-17 Siffu S	Q	Channel-18 Hallig S	Q	Channel-19 Cagayan S	Q	Channel-20 Cagayan S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	16.0	1,000	11.1	300	9.0	300	26.4	500	17.6	500
2	25.2	2,000	19.5	500	11.8	500	41.3	1,000	28.9	1,000
3	33.7	3,000	79.9	1,000	58.9	1,000	65.2	2,000	48.2	2,000
4	49.8	5,000	211.2	2,000	110.5	2,000	87.8	3,000	65.4	3,000
5	62.7	7,000	325.2	3,000	382.4	3,000	180.0	5,000	123.0	5,000
6	91.1	10,000					262.1	7,000	167.5	7,000
7	155.9	15,000					406.5	10,000	247.1	10,000
8	224.8	20,000							380.5	15,000
9	285.2	25,000							527.9	20,000
10	342.5	30,000								
11	467.7	40,000								
12										
13										

No.	Channel-21 Cagayan S	Q	Channel-22 Cagayan S	Q	Channel-23 Chico S	Q	Channel-24 Chico S	Q	Channel-25 Chico S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	49.9	500	40.2	2,000						
2	78.8	1,000	48.1	3,000	5.4	740				
3	129.7	2,000	60.8	5,000	7.2	1,180			6.8	940
4	175.0	3,000	74.0	7,000	9.0	1,710			9.6	1,650
5	360.8	5,000	98.8	10,000	10.8	2,300	6.1	1,530	11.1	2,060
6	557.7	7,000	137.0	15,000	12.7	2,950	7.5	2,080	14.1	2,990
7			175.8	20,000	16.3	4,430	9.8	3,050	17.2	4,050
8			212.8	25,000	20.0	6,110	12.3	4,190	20.4	5,230
9			245.5	30,000	23.8	7,980	15.8	5,960	22.1	5,880
10			305.2	40,000	27.5	10,010	18.7	7,500	27.1	7,980
11			359.5	50,000						
12										
13										

No.	Channel-26 Chico S	Q	Channel-27 Chico S	Q	Channel-28 Cagayan S	Q	Channel-29 Cagayan S	Q	Channel-30 Cagayan S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	7.0	300	25.2	300	19.6	1,000	39.0	2,000	121.3	2,000
2	10.5	500	34.7	500	30.2	2,000	45.3	3,000	134.0	3,000
3	18.0	1,000	58.1	1,000	39.0	3,000	57.0	5,000	161.4	5,000
4	33.0	2,000	97.5	2,000	58.4	5,000	74.0	7,000	209.6	7,000
5	41.0	3,000	144.3	3,000	73.6	7,000	101.4	10,000	274.2	10,000
6	79.8	5,000	183.2	4,000	99.1	10,000	148.4	15,000	378.5	15,000
7			217.9	5,000	147.2	15,000	193.4	20,000	500.0	20,000
8			282.2	7,000	199.6	20,000	239.2	25,000		
9			372.9	10,000	245.3	25,000	279.6	30,000		
10					286.1	30,000	352.3	40,000		
11					357.4	40,000	415.3	50,000		
12					419.3	50,000				
13										

Table 4.9 Storage Function of Channel
(Present River Condition)

Channel No.	L (km)	I	K	P	Tl (hr)
1	25.0	1/330	68.9	0.593	3.3
2	31.0	1/560	69.2	0.595	4.1
3	19.3	1/790	65.8	0.629	2.6
4	17.2	1/980	68.4	0.610	2.3
5	56.0	1/40	50.9	0.648	4.4
6	22.5	1/560	3.6	0.894	3.0
7	45.0	1/1,730	22.6	0.824	6.0
8	58.0	1/2,900	82.7	0.774	7.7
9	45.0	1/390	66.6	0.623	6.0
10	42.5	1/480	145.4	0.557	5.6
11	63.5	1/870	15.7	0.948	8.4
12	20.5	1/6,410	28.3	0.810	2.7
13	14.0	1/260	59.4	0.502	1.9
14	38.0	1/680	178.1	0.492	5.0
15	40.0	1/2,470	27.5	0.780	5.3
16	18.5	1/3,850	5.0	0.946	2.4
17	88.0	1/1,910	0.6	1.499	11.6
18	82.0	1/1,390	0.1	1.685	10.8
19	35.5	1/3,940	16.3	0.944	4.7
20	19.0	1/19,000	12.9	0.930	2.5
21	76.5	1/5,000	33.1	0.938	10.1
22	13.5	1/5,000	47.3	0.701	1.8
23	20.0	1/110	22.9	0.631	1.9
24	20.0	1/120	11.4	0.683	1.9
25	25.5	1/120	25.8	0.629	2.4
26	53.5	1/230	16.3	0.834	7.1
27	61.0	1/1,030	73.2	0.787	8.1
28	10.0	1/50,000	17.8	0.809	1.3
29	11.5	1/19,170	24.8	0.775	1.5
30	29.5	1/5,670	250.0	0.626	3.9

Notes;
L; River Length (km)
I; River Slope
K,P; Storage Function
Tl; Lag Time (hr)

Table 4.10 Relationship of Discharge and Channel Storage

(Confining dike condition)

No.	Channel-7 Cagayan		Channel-8 Cagayan		Channel-11 Magat		Channel-12 Cagayan		Channel-15 Ilagan	
	S	Q	S	Q	S	Q	S	Q	S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	0.5	10	2.3	10	0.9	10	0.9	10	1.0	10
2	17.6	580	47.5	580	13.8	300	19.3	500	10.8	300
3	26.2	1,160	71.6	1,160	20.7	500	27.5	1,000	14.8	500
4	34.4	1,740	92.3	1,740	36.2	1,000	43.1	2,000	23.0	1,000
5	48.0	2,900	130.0	2,900	61.5	2,000	61.2	3,000	36.4	2,000
6	62.0	4,060	168.5	4,060	89.3	3,000	93.4	5,000	47.4	3,000
7	78.0	5,800	226.7	5,800	109.2	4,000	124.6	7,000	56.6	4,000
8	106.6	8,700	329.9	8,700	130.9	5,000	163.5	10,000	66.6	5,000
9	143.5	11,600	431.5	11,600	166.7	7,000	216.6	15,000	87.5	7,000
10	181.5	14,500			214.9	10,000	269.4	20,000	115.1	10,000
11	222.1	17,400					321.3	25,000		
12	306.4	23,200					368.8	30,000		
13	413.4	29,000								
14										

No.	Channel-16 Cagayan		Channel-19 Cagayan		Channel-20 Cagayan		Channel-21 Cagayan		Channel-22 Cagayan	
	S	Q	S	Q	S	Q	S	Q	S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	0.8	10	1.5	10	0.8	10	3.6	10	2.0	10
2	16.9	500	31.3	500	17.9	500	58.5	500	25.0	500
3	21.9	1,000	48.2	1,000	28.7	1,000	83.7	1,000	31.8	1,000
4	32.3	2,000	77.1	2,000	47.7	2,000	131.3	2,000	41.4	2,000
5	41.8	3,000	104.8	3,000	65.3	3,000	172.6	3,000	49.7	3,000
6	59.6	5,000	159.6	5,000	99.7	5,000	261.4	5,000	63.2	5,000
7	74.0	7,000	205.5	7,000	132.8	7,000	360.9	7,000	74.8	7,000
8	86.7	10,000	275.9	10,000	183.0	10,000			90.1	10,000
9	134.6	15,000	384.6	15,000	260.2	15,000			116.7	15,000
10	171.5	20,000	479.2	20,000	323.2	20,000			143.1	20,000
11	209.3	25,000							167.9	25,000
12	245.3	30,000							190.1	30,000
13	314.3	40,000							229.1	40,000
14	380.9	50,000							264.0	50,000

No.	Channel-28 Cagayan		Channel-29 Cagayan		Channel-30 Cagayan	
	S	Q	S	Q	S	Q
	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)	($\times 10^6 m^3$)	(m^3/s)
1	0.7	10	1.1	10	13.0	10
2	17.2	500	29.0	500	118.1	500
3	21.8	1,000	30.6	1,000	120.9	1,000
4	31.4	2,000	35.2	2,000	129.5	2,000
5	39.6	3,000	39.8	3,000	140.1	3,000
6	54.5	5,000	49.1	5,000	164.3	5,000
7	67.9	7,000	59.1	7,000	189.7	7,000
8	93.2	10,000	75.4	10,000	227.6	10,000
9	136.5	15,000	101.7	15,000	286.4	15,000
10	173.7	20,000	125.3	20,000	337.7	20,000
11	206.8	25,000	146.0	25,000	383.6	25,000
12	235.2	30,000	164.8	30,000	427.7	30,000
13	285.4	40,000	195.5	40,000		
14	329.4	50,000	226.0	50,000		

Table 4.11 Storage Function of Channel
(Confining dike condition)

Channel No.	L (km)	I	K	P	Tl (hr)	Channel No.	L (km)	I	K	P	Tl (hr)
1	25.0	1/330	68.9	0.593	3.3	16	18.5	1/3,850	42.5	0.711	2.4
2	31.0	1/560	69.2	0.595	4.1	17	88.0	1/1,910	0.6	1.499	11.6
3	19.3	1/790	65.8	0.629	2.6	18	82.0	1/1,390	0.1	1,685	10.8
4	17.2	1/980	68.4	0.610	2.3	19	35.5	1/3,940	73.9	0.753	4.7
5	56.0	1/40	50.9	0.648	4.4	20	19.0	1/19,000	33.3	0.794	2.5
6	22.5	1/560	3.6	0.894	3.0	21	76.5	1/5,000	205.1	0.690	10.1
7	45.0	1/1,730	21.1	0.817	6.0	22	13.5	1/5,000	173.1	0.552	1.8
8	58.0	1/2,900	118.1	0.728	7.7	23	20.0	1/110	22.9	0.631	1.9
9	45.0	1/390	66.6	0.623	6.0	24	20.0	1/120	11.4	0.683	1.9
10	42.5	1/480	145.4	0.557	5.6	25	25.5	1/120	25.8	0.629	2.4
11	63.5	1/870	40.5	0.797	8.4	26	53.5	1/230	16.3	0.834	7.1
12	20.5	1/6,410	44.4	0.750	2.7	27	61.0	1/1,030	73.2	0.787	8.1
13	14.0	1/260	59.4	0.502	1.9	28	10.0	1/50,000	41.7	0.709	1.3
14	38.0	1/680	178.1	0.492	5.0	29	11.5	1/19,170	109.3	0.586	1.5
15	40.0	1/2,470	59.6	0.677	5.3	30	29.5	1/5,670	-	0.402	3.9

Note: L; River Length (km)
I; River Slope
K,P; Storage Function
Tl; Lag Time (hr)

Table 5.1 Mean Relief and Elevation of Basin

Mean Relief, Rf' (100 m)

EL.(m)	Xi (100m)	Basin 1 f_i	Basin 1 Xi·f_i	Basin 2 f_i	Basin 2 Xi·f_i	Basin 3 f_i	Basin 3 Xi·f_i	Basin 4 f_i	Basin 4 Xi·f_i	Basin 5 f_i	Basin 5 Xi·f_i	Basin 6 f_i	Basin 6 Xi·f_i
0~ 99	1	2	2	7	7	0	0	1	1	1	1	0	0
100~ 199	2	2	4	13	26	6	12	4	8	0	0	1	2
200~ 299	3	3	9	18	54	6	18	2	6	2	6	1	3
300~ 399	4	9	36	19	76	5	20	7	28	1	4	4	16
400~ 499	5	16	80	33	165	13	65	3	15	0	0	1	5
500~ 599	6	20	120	25	150	15	90	2	12	3	18	5	30
600~ 699	7	25	175	23	161	14	98	3	21	9	63	4	28
700~ 799	8	27	216	26	208	12	96	2	16	22	176	3	24
800~ 899	9	21	189	33	297	8	72	5	45	20	180	10	90
900~ 999	10	13	130	25	250	5	50	2	20	14	140	5	50
1000~1099	11	13	143	18	198	2	22	5	55	19	209	7	77
1100~1199	12	5	60	14	168	1	12	4	48	21	252	6	72
1200~1299	13	2	26	8	104			1	13	7	91	5	65
1300~1399	14			1	14					5	70	2	28
1400~1499	15			4	60					5	75	1	15
1500~1599	16			1	16								
Total		158	1,190	268	1,954	87	555	41	288	129	1,285	55	505
R'_f = Xi·f_i/f_i			7.53		7.29		6.38		7.02		9.96		9.18

Mean Elevation, Em' (100 m)

EL.(m)	Xi (100m)	Basin 1 f_i	Basin 1 Xi·f_i	Basin 2 f_i	Basin 2 Xi·f_i	Basin 3 f_i	Basin 3 Xi·f_i	Basin 4 f_i	Basin 4 Xi·f_i	Basin 5 f_i	Basin 5 Xi·f_i	Basin 6 f_i	Basin 6 Xi·f_i
0~ 99	1	0	0	0	0	0	0	3	3	0	0	0	0
100~ 199	2	2	4	0	0	3	6	5	10	0	0	1	2
200~ 299	3	4	6	16	48	8	24	8	24	1	3	4	12
300~ 399	4	7	28	22	88	7	28	1	4	1	4	3	12
400~ 499	5	12	60	23	115	8	40	6	30	2	10	4	20
500~ 599	6	13	78	32	192	8	48	3	18	3	18	3	18
600~ 699	7	12	84	22	154	11	77	2	14	4	28	2	14
700~ 799	8	20	160	20	160	17	136	3	24	6	48	3	24
800~ 899	9	25	225	19	171	19	81	3	27	4	36	3	27
900~ 999	10	17	170	22	220	6	60	3	30	5	50	2	20
1000~1099	11	14	264	24	264	6	66	3	33	6	66	6	66
1100~1199	12	10	120	11	132	3	36	1	12	9	108	2	24
1200~1299	13	9	117	8	104	0	0			6	78	5	65
1300~1399	14	2	28	9	126	1	14			15	210	3	42
1400~1499	15	1	15	14	210					9	135	4	60
1500~1599	16			4	64					13	208	4	64
1600~1699	17			7	119					11	187	4	68
1700~1799	18			3	54					9	162	2	36
1800~1899	19			6	114					8	152		
1900~1999	20			2	40					10	200		
2000~2099	21			3	63					4	84		
2100~2199	22			0	0					3	66		
2200~2299	23			0	0								
2300~2399	24			1	24								
Total		158	1,359	268	2,462	87	616	41	229	129	1,853	55	574
Em' = Xi·f_i/f_i			8.60		9.19		7.08		5.59		14.36		10.44

f_i : frequency

Table 5.2 Suspended Sediment Estimation

Basin	Basin 1	Basin 2	Basin 5
Runoff gauge	Guinalvin	Oscariz	Ampawilen
Runoff record	1965 - 1971	1958 - 1964	1963 - 1976
Drainage area	921 km²	4,150 km²	751 km²
Rating curve	Dippadiw	Oscariz	Pasonglao

Limits (%)	Interval (%)	Water discharge (m³/s)	Sediment discharge (tons/day)	Water discharge (m³/s)	Sediment discharge (tons/day)	Water discharge (m³/s)	Sediment discharge (tons/day)
0.0 ~ 0.1	0.1	925.3	1,263,259	3,601.5	3,550,901	1,045.4	538,468
0.1 ~ 0.5	0.4	627.8	352,578	2,278.8	1,256,361	653.2	147,051
0.5 ~ 1.5	1.0	354.7	53,885	1,363.1	391,290	490.3	66,622
1.5 ~ 5.0	3.5	172.1	4,990	663.0	76,200	227.8	8,031
5.0 ~ 10.0	5.0	114.2	1,295	433.0	28,970	155.3	2,790
10.0 ~ 20.0	10.0	77.2	357	285.0	11,210	103.6	913
20.0 ~ 30.0	10.0	52.0	97	204.0	5,248	69.7	306
30.0 ~ 40.0	10.0	40.8	44	147.5	2,514	51.8	135
40.0 ~ 50.0	10.0	33.3	22	108.0	1,239	35.7	48
50.0 ~ 60.0	10.0	28.2	13	76.0	558	26.9	22
60.0 ~ 70.0	10.0	23.9	8	54.0	257	20.5	10
70.0 ~ 80.0	10.0	20.0	4	44.0	161	13.7	3
80.0 ~ 90.0	10.0	16.8	2	32.9	83	7.6	1
90.0 ~ 95.0	5.0	13.2	1	25.2	46	4.7	0
95.0 ~ 98.5	3.5	7.4	0	11.8	8	3.4	0
98.5 ~ 99.5	1.0	5.4	0	4.5	1	2.0	0
99.5 ~ 99.9	0.4	3.4	0	1.3	0	1.6	0
99.9 ~ 100.0	0.1	3.0	0	0.3	0	1.6	0
	(1)	(2)	(3)	(2)	(3)	(2)	(3)
Annual suspended sediment, (1)x(3)		3,506 tons/day 1,070 m³/km²/year		18,734 tons/day 1,270 m³/km²/year		2,357 tons/day 880 m³/km²/year	

Table 6.1 Water Quality in Cagayan River

LOCATION	TURBIDITY	COLOR	pH	EC	HARDNESS			Cl	ALKALINITY		
				μmhos /cm	Ca ppm	Mg ppm	Total ppm	ppm	Bicarb ppm	Carb ppm	CaCo3 ppm
Larion Alto, Tuguegarao	nil	nil	7.20	157	65	15.79	130	70	134.2	0	110
	nil	5	7.70	191	130	15.80	145	120	164.7	0	135
Casile, Mallig	11	55	6.92	190	80	0	100	70	94.5	0	77.5
	107	1,000	7.29	201	110	4.86	100	115	122	0	100
Malalam (Alinguigan)	nil	nil	6.94	85	60	0	70	70	97.6	0	80
	7	30	7.15	115	100	8.50	135	115	134.3	0	110
Palattao, Naguilian	nil	nil	6.92	128	65	7.29	100	80	88.45	0	72.5
	9	120	7.45	201	90	8.51	120	100	195.2	0	160
Cabulay, Santiago	nil	nil	6.93	280	100	21.87	210	80	207.4	0	170
	140	530	7.47	302	160	26.73	250	135	269.4	0	220
Hapid, Lamut (Tupaya)	nil	nil	7.12	178	60	4.86	80	70	97.6	0	80
	nil	5	7.58	240	80	4.86	100	150	122	0	100
Dabubu, Pequino	nil	nil	7.05	108	60	2.43	100	70	97.6	0	80
	nil	10	7.38	128	110	4.86	120	100	231.8	0	190
Dippadiw, Madella	nil	nil	7.07	154	70	7.29	120	80	76.25	0	62.5
	nil	75	7.59	197	100	12.15	130	110	195.2	0	160
Pingkian, Kayapa	nil	0	6.81	260	85	0	160	70	173.85	0	142.5
	34	900	7.94	280	160	32.81	220	110	183	0	150
Bangag	nil	nil	6.83	150	70	9.11	100	70	134.2	0	110
	4	260	7.67	172	120	2.43	107.5	275	183	0	150
Baybayog	10.5	10	7.22	240	130	12.75	182.5	65	183	0	150
	12	280	7.86	350	180	17.01	200	125	256.2	0	210
Rosario	nil	nil	7.40	310	120	0	160	75	256.2	0	210
	nil	5	7.94	320	180	14.58	230	90	280.6	0	230
Tungngod	nil	nil	7.16	250	60	9.75	140	50	158.6	0	130
	nil	10	7.50	300	140	14.58	200	80	244	0	200
Careb	nil	nil	7.33	250	140	24.3	240	60	256.2	0	210
	nil	7	7.68	380	190	27.95	280	70	292.8	0	240
Balilling	nil	nil	6.91	200	130	0	140	60	170.8	0	140
	nil	65	7.87	290	200	21.87	290	120	256.2	0	210
Beti	nil	nil	6.77	112	60	2.43	70	65	146.4	0	120
	1	10	7.70	280	105	8.51	140	100	231.8	0	190
Ilut	nil	nil	7.10	220	70	2.43	120	70	183	0	150
	nil	10	7.30	250	110	9.72	150	100	250.1	0	205
Aurora East	nil	nil	7.59	260	100	12.15	210	70	219.6	0	180
	nil	15	7.83	310	160	36.45	280	100	256.2	0	210
Gamis	nil	nil	6.64	340	130	18.22	250	70	195.2	0	160
	nil	15	7.58	420	180	29.16	300	90	451.1	0	370
Jones	nil	0	6.74	132	60	0	70	60	97.6	0	80
	5	50	7.30	195	160	2.43	160	75	146.4	0	120

Observed in June to August, 1985 by NWRC

Table 6.2 Water Quality Criteria for Fresh Surface Water by NPCC (1978)

	Quality Parameter	Criteria	Unit	CLASS					
				AA	A	B	C	D	E
1.	Color	not less	units	-	75	50	50	-	-
2.	Temperature	not exceed	°C	-	30	30	3(e)	3(e)	-
3.	Transparency	-	-	-	-	(c)	(c)	(c)	-
4.	Dissolved Oxygen	not less	mg/l	-	5	5	5	3	2
5.	5-day BOD at 20°C	not exceed	mg/l	-	10	15	20	-	-
6.	Total Dis. Solids	not exceed	mg/l	-	-	-	1000	1000	-
7.	Total Solids	not exceed	mg/l	500(a)	500(a)	-	2000	2000	-
8.	PH	within	-	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	5.0-9.0
9.	Coliform	not exceed	MPN/100 ml	50	5000	1000	5000	-	-
10.	Phenolic Subs.	not exceed	mg/l	0.001	0.001	0.002	0.02	-	-
11.	Radioactive Subs.:								
	Gross Alpha	not exceed	pCi/l	3	3	-	-	-	-
	Gross Beta	not exceed	pCi/l	30	30	-	-	-	-
12.	Trace Elements								
	Aluminum	not exceed	mg/l	-	-	-	-	5	-
	Arsenic	not exceed	mg/l	0.05	0.05	0.05	0.05	0.1	-
	Barium	not exceed	mg/l	1.0	1.0	-	0.5	-	-
	Beryllium	not exceed	mg/l	-	-	-	-	0.1	-
	Boron	not exceed	mg/l	-	-	-	-	0.75	-
	Cadmium	not exceed	mg/l	0.01	0.01	0.01	0.01	0.01	-
	Chromium	not exceed	mg/l	0.05	0.05	0.05	0.05	0.10	-
	Cobalt	not exceed	mg/l	-	-	-	-	0.05	-
	Copper	not exceed	mg/l	1.0	1.0	-	0.02	0.02	-
	Cyanide	not exceed	mg/l	0.05	0.05	0.05	0.05	-	-
	Flouride	not exceed	mg/l	0.6	0.6	-	-	1	-
	Iron	not exceed	mg/l	1.0(a)	1.0(a)	-	-	5	-
	Lead	not exceed	mg/l	0.05	0.05	0.05	0.05	5	-
	Lithium	not exceed	mg/l	-	-	-	-	2.5(d)	-
	Manganese	not exceed	mg/l	0.5	0.5	-	-	0.2	-
	Mercury	not exceed	mg/l	0.002	0.002	0.002	0.002	-	-
	Melyboenum	not exceed	mg/l	-	-	-	-	0.01	-
	Nickel	not exceed	mg/l	-	-	-	-	0.2	-
	Selenium	not exceed	mg/l	0.05	0.05	0.05	0.05	0.2	-
	Silver	not exceed	mg/l	0.05	0.05	0.05	0.05	-	-
	Venadium	not exceed	mg/l	-	-	-	-	0.1	-
	Zinc	not exceed	mg/l	5(S)	5(S)	-	2	2	-
13.	Sodium Absorption Ratio	within	(SAR)	-	-	-	-	8-18	-
14.	Organic Chemicals Synthetic								
	Detergents	not exceed	mg/l	NIL	0.5	0.5	0.5	-	-
	Oil & Grease	not exceed	mg/l	NIL	2	2	5	5	10
15.	Persistent Pesticides								
	Aldrin	not exceed	mg/l	0.001	0.001	0.001	0.01	-	-
	DDT	not exceed	mg/l	0.05	0.05	0.05	0.02	-	-
	Dieldrin	not exceed	mg/l	0.001	0.001	0.001	0.005	-	-
	Chlordane	not exceed	mg/l	0.003	0.003	0.003	0.04	-	-
	Endrin	not exceed	mg/l	0.0002	0.0002	0.0002	0.002	-	-
	Heptachlor	not exceed	mg/l	0.0001	0.0001	0.0001	0.01	-	-
	Lindane	not exceed	mg/l	0.004	0.004	0.004	0.02	-	-
	Toxaphane	not exceed	mg/l	0.005	0.005	0.005	0.01	-	-
	Methexychlor	not exceed	mg/l	0.1	0.1	0.1	0.005	-	-
	2, 4 - D	not exceed	mg/l	0.1	0.1	0.1	4.0	-	-
	2, 4, 5 - TP	not exceed	mg/l	0.01	0.01	0.01	-	-	-
	PCB	not exceed	mg/l	NIL	0.001	0.001	-	-	-
16.	Other Chemicals								
	Ammonia	not exceed	mg/l	-	0.01	-	-	-	-
	Calcium	not exceed	mg/l	75	75	-	-	-	-
	Chloride	not exceed	mg/l	200(a)	200(a)	-	-	-	-
	Magnesium	not exceed	mg/l	50(a)	50(a)	-	-	-	-
	Nitrate	not exceed	mg/l	30	30	-	-	-	-
	Sulfate	not exceed	mg/l	200(a)	200(a)	-	-	-	-
17.	Nutrients	not exceed	-	-	(b)	(b)	(b)	(b)	-

NOTES: (a) Secondary Standards; compliance with the standard analysis are not obligatory.
(b) Shall not be present in concentrations to cause deleterious or abnormal biotic growth.
(c) Secchi disk shall be visible at a min. depth of 1 M.
(d) Recommended max. concentration for irrigating is .075 mg/l.
(e) The maximum rise above natural temperature

Fig. 1.1 LIST OF CLIMATOLOGICAL STATION

No.	Station	Item	Location		Elevation (m)
			Latitude	Longitude	
1	Aparri	Rainfall	18°22'	121°38'	3
		Air Temperature			
		Relative Humidity			
		Wind			
2	Tuguegarao	Rainfall	17°39'	121°45'	62
		Air Temperature			
		Relative Humidity			
		Wind			
		Sunshine Hours			
		Evaporation			
3	Echague	Air Temperature	16°42'	121°40'	66
		Relative Humidity			
		Evaporation			
		Sunshine Hours			
4	Santo Domingo	Air Temperature	16°25'	121°06'	320
		Evaporation			
5	Baretbet, Bagabag	Air Temperature	16°35'	121°16'	230
		Evaporation			
6	Alimanao R., Tuguegarao	Evaporation			
7	Consuelo, Santa Fe	Air Temperature	16°10'	120°57'	600
		Evaporation			
8	Baligatan (Talictic)	Evaporation	16°48'	121°27'	200
9	Lagawe	Air Temperature	16°48'	121°07'	400
		Evaporation			
10	Wacal	Evaporation			
		Sunshine Hours			
11	Bontoc	Evaporation			
12	NIA-PIO, Bayombong	Sunshine Hours			
13	Hapid	Air Temperature	16°42'	121°15'	280
14	Malasin	Air Temperature			
		Relative Humidity			
		Evaporation			
15	San Isidro	Air Temperature			
		Relative Humidity			
		Evaporation			

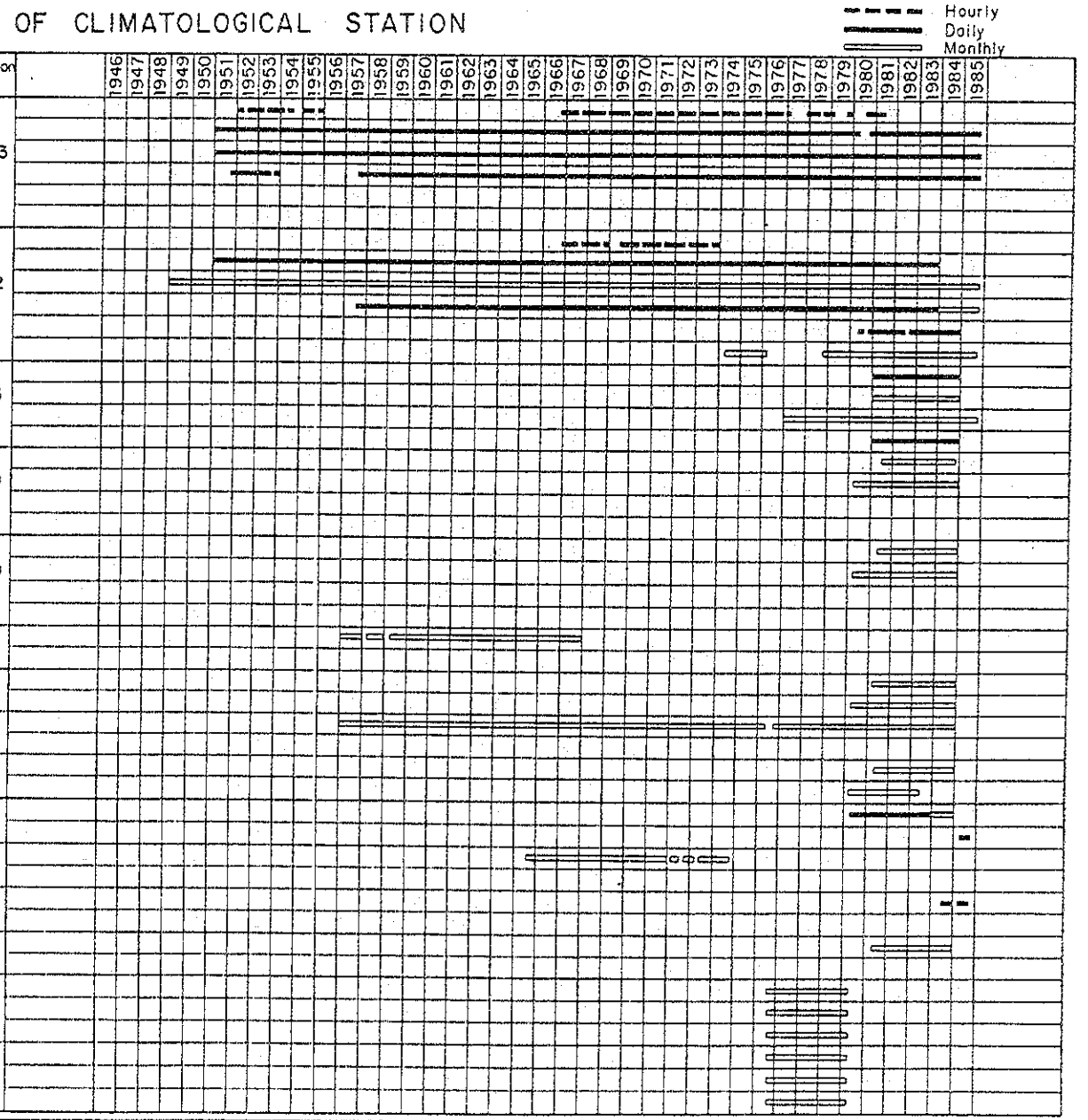
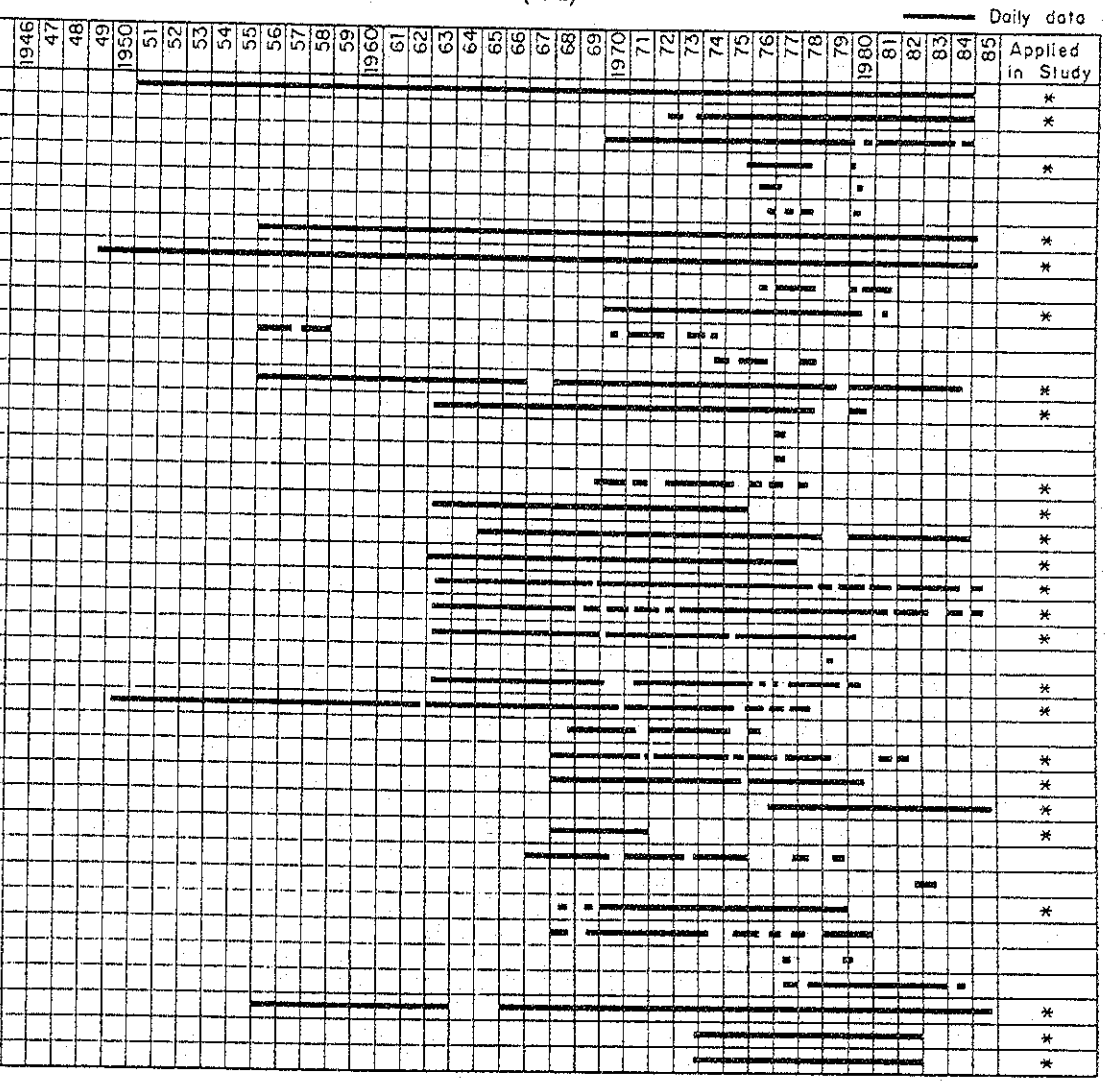


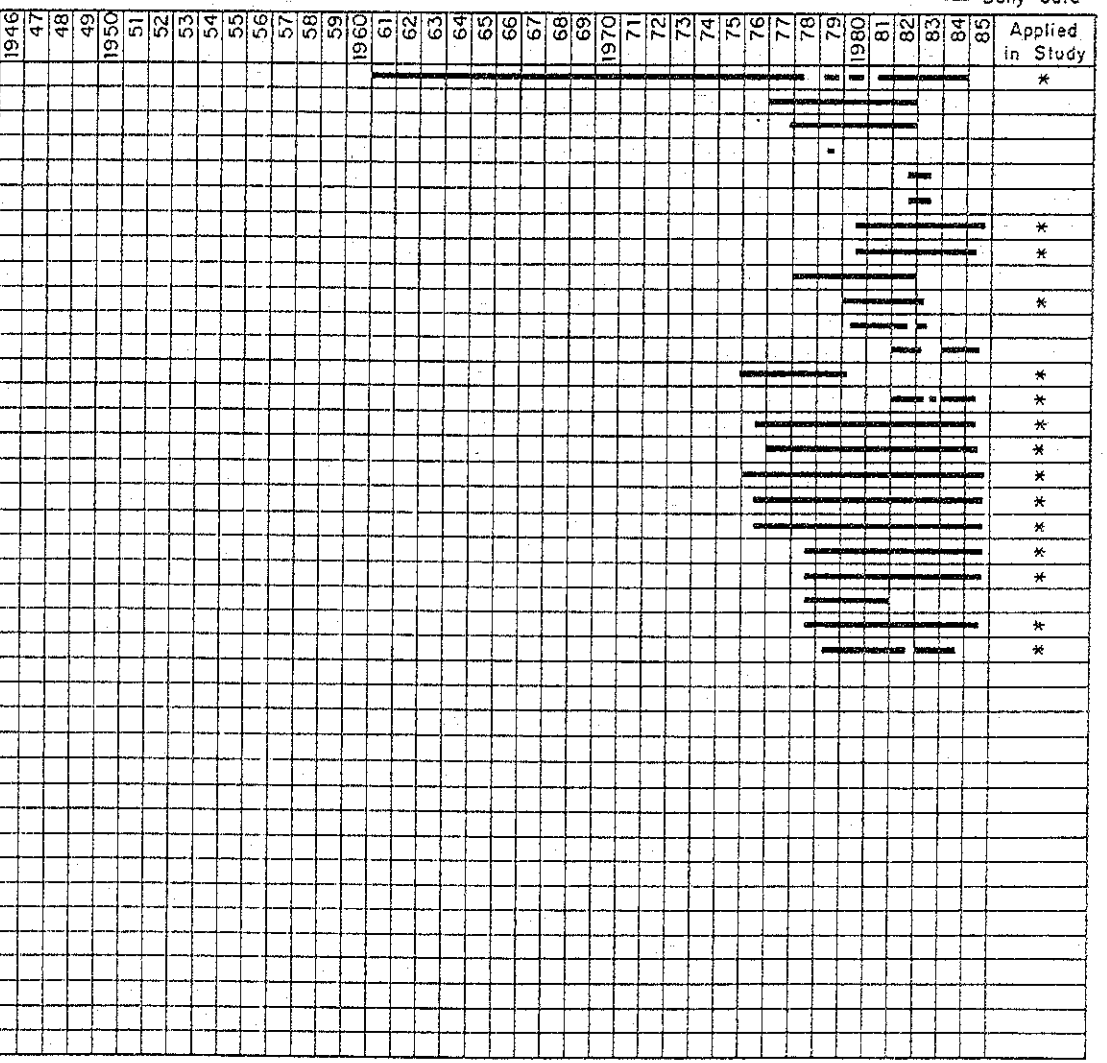
Fig. 1.2 LIST OF RAINFALL GAUGING STATION (1/2)



No.	Station	Location Latitude	Location Longitude	Elevation (m)	Applied in Study
1	Aparri	18°21'	121°39'	2	*
2	Lal-Lo	18°12'	121°40'	8	*
3	Aggunetan, Gattaran	18°04'	121°38'	10	
4	Bitag Grande	17°54'	121°51'		*
5	Imurung	17°55'	121°56'		
6	Bauan, Peñablanca	17°50'	121°43'	10	
7	Tuao	17°45'	121°28'	35	*
8	Tuguegarao	17°37'	121°44'	19	*
9	Bagabba, Peñablanca	17°37'	121°47'	20	
10	Pinukpuk	17°35'	121°22'	120	*
11	Salegseg, Balbalan	17°31'	121°06'	1,120	
12	Tomiangan, Tabuk	17°26'	121°26'	380	
13	Naneng, Tabuk	17°24'	121°14'	418	*
14	Guilguila, Tanudan	17°18'	121°14'	500	*
15	Tumauini	17°17'	121°49'	30	
16	Cabagan	17°26'	121°46'		
17	Lubuagan	17°22'	121°07'		*
18	Basao, Tinglayan	17°14'	121°07'	600	*
19	Ilagan	17°09'	121°53'	47	*
20	Banga-An	17°07'	120°54'	1,600	*
21	Bontoc	17°05'	120°58'	855	*
22	Bartig	17°03'	121°06'	1,500	*
23	Bauko	16°59'	120°52'	1,200	*
24	Reina Mercedes	16°59'	121°50'	34	
25	Mt. Polis, Banaue	16°58'	121°02'	1,900	*
26	Mt. Data, Benguet	16°51'	120°52'	1,500	*
27	Namulditon, Lagawe	16°51'	121°05'	900	
28	Lagawe	16°48'	121°04'	480	*
29	Nayon, Lamut	16°43'	121°10'	320	*
30	Echague	16°42'	121°40'	66	*
31	Diadi	16°40'	121°22'	168	*
32	Solano	16°31'	121°11'	255	
33	Bayombong	16°29'	121°09'	278	
34	Barat, Bambang	16°23'	121°06'	610	*
35	Dupax	16°17'	121°05'	390	
36	Malico	16°11'	120°51'	1,250	
37	Imugan, Santa Fe	16°10'	120°55'	800	
38	Consuelo, Santa Fe	16°10'	120°57'	506	*
39	Gabong	16°01'	121°21'		*
40	Dakgan	16°05'	121°30'		*

Fig. 1.2 LIST OF RAINFALL GAUGING STATION (2/2)

No.	Station	Location		Elevation (m)	Applied in Study
		Latitude	Longitude		
41	Casiguran	16°17'	122°07'	3	*
42	Taan				
43	Upper Casecnan				
44	Aurora				
45	Aritao				
46	Kayapa				
47	Wacal				*
48	Banti				*
49	Conwap				
50	Dippadiw				*
51	Tabayong				
52	Lias, Barlig	17°05'	121°08'		
53	San Francisco	18°10'	121°39'		*
54	NIA- PIO, Cabarroguis	16°30'	121°32'	129	*
55	Hapid, Lamut	16°42'	121°15'	280	*
56	Baretbet, Bagabag	16°35'	121°16'	230	*
57	Baligatan	16°48'	121°27'	200	*
58	Poblacion Lagawe	16°48'	121°07'	400	*
59	Sto Domingo	16°25'	121°06'	320	*
60	Kasibu	16°19'	121°18'	701	*
61	Kamamasi	16°16'	121°25'	639	*
62	Biyoy	16°15'	121°24'	623	
63	Alayan	16°19'	121°24'	653	*
64	Packet	16°17'	121°20'	640	*



Climatological Station

No.	Station Name	No.	Station Name
1	Aparri	10	Wacal
2	Tuguegarao	11	Bontoc
3	Echague	12	Bayombong
4	Santo Domingo	13	Hapid
5	Baretbet	14	Malasin
6	Alimanao R.	15	San Isidro
7	Consuelo		
8	Baligatan		
9	Lagawe		

Rainfall Gauging Station

No.	Station Name
1	Aparri
2	Lal-lo
3	Agguneton
4	Bitag Grande
5	Imurung
6	Bauan
7	Tuao
8	Tuguegarao
9	Bagabba
10	Pinukpuk
11	Salegseg
12	Tomiangan
13	Naneng
14	Guilguila
15	Tumauini
16	Cabagan
17	Lubuagan
18	Basao
19	Ilagan
20	Banga-an
21	Bontoc
22	Barlig
23	Bauko
24	Reina Mercedes
25	Mt. Potis
26	Mt. Data
27	Namulditan
28	Lagawe
29	Nayon
30	Echague
31	Diadi
32	Solano
33	Bayombong
34	Barat
35	Dupax
36	Malico
37	Imugan
38	Consuelo
39	Gabong
40	Dakgan
41	Casiguran
42	Taan
43	Upper Casecnan
44	Aurora
45	Aritao
46	Kayapa
47	Wacal
48	Banti
49	Conwap
50	Dippadiw
51	Tabayong
52	Lias
53	San Francisco
54	Cabarroguis
55	Hapid, Lamut
56	Baretbet
57	Baligatan
58	Poblacion Lagawe
59	Sto Domingo
60	Kasibu
61	Kamamasi
62	Biyoy
63	Alayan
64	Packet

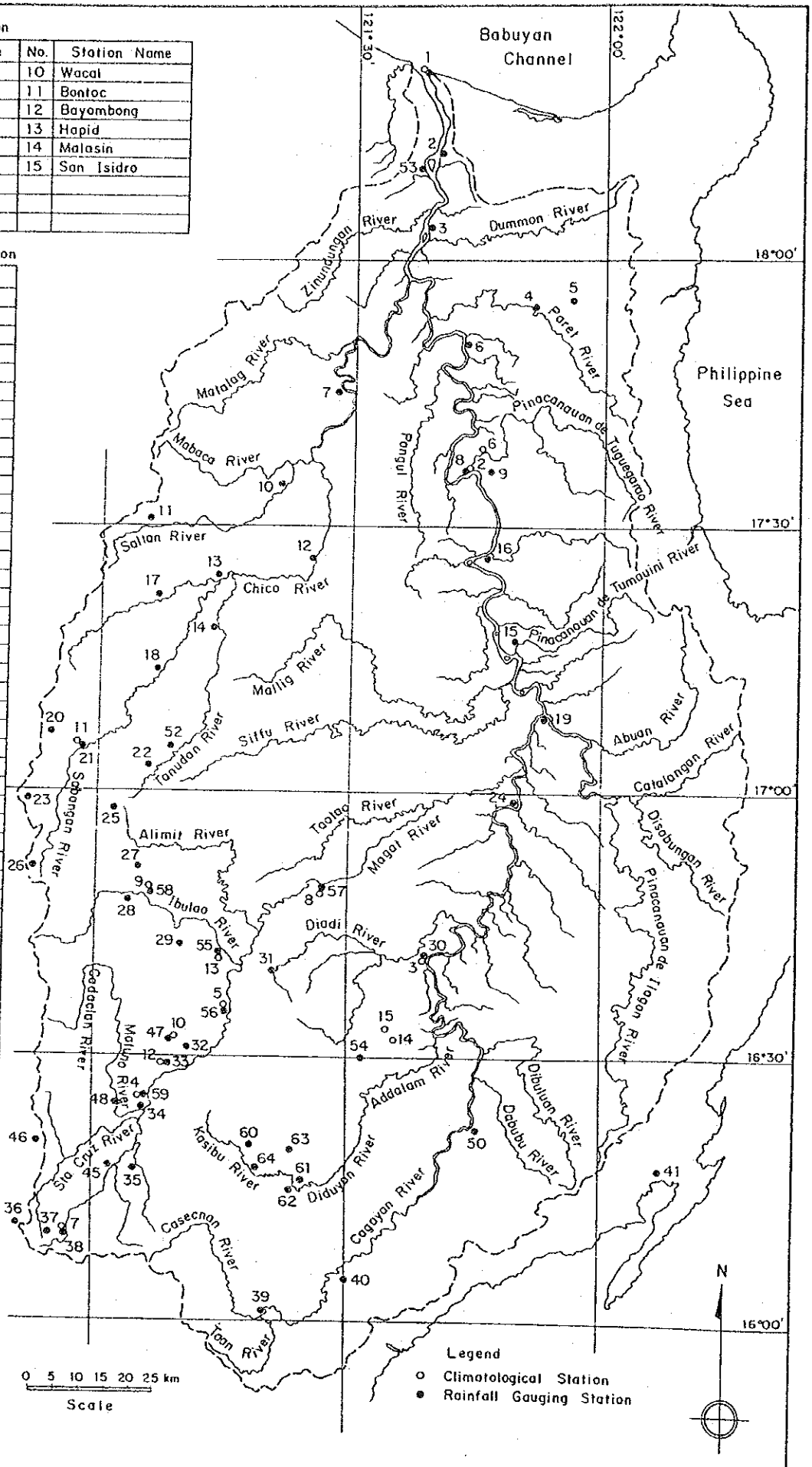


Fig. 1.3 LOCATION OF METEOROLOGICAL STATIONS

Fig. 1.4 LIST OF STREAMFLOW GAUGING STATION (1/2)

Daily Gauge Height
Daily Discharge

No.	Station	River	Location Latitude	Location Longitude	Drainage Area (km²)	Discharge Measurement Record	Zero of Gauge EL. (m)
1	Aparri	Cagayan	18°22'	121°37'	27,281		0.0
2	Maddalero, Buguey	Banurbor	18°16'	121°50'	112	Available	-0.574
3	Catayauan, Lal-lo	Cagayan	18°18'	121°39'	27,081		0.0
4	Centro, Camalaniugan	Cagayan	18°17'	121°41'	27,230		0.0
5	Simay (Alannay), Lasam	Zinundungan	18°04'	121°35'	189	Available	
6	Poblacion, Gattaran	Cagayan	18°04'	121°38'	26,615		0.0
7	Calaoagan, Dacquel	Dummon	18°03'	121°43'	308	Available	
8	Nassiping, Gattaran	Cagayan	17°58'	121°37'	21,473		0.0
9	Tupang, Alcala	Cagayan	17°57'	121°38'	21,436		0.0
10	Calantac, Alcala	Paret	17°55'	121°41'	907	Available	3.341
11	Asassi, Baggao	Paret	17°55'	121°47'	730		
12	Escalta, Rizal	Matalag	17°50'	121°25'	655	Available	
13	Anguiray, Amulong	Cagayan	17°49'	121°43'	20,213		0.0
14	Centro, Iguig	Cagayan	17°45'	121°44'	19,683		0.0
15	Bayo, Iguig	Cagayan	17°42'	121°44'	19,625		0.0
16	Pangul, Solana	Pangul	17°40'	121°38'	312	Available	20.399
17	Centro, Solana	Cagayan	17°39'	121°41'	19,545		0.0
18	Larion Alto, Tuguegarao	Pina de Tuguegarao	17°38'	121°46'	655	Available	18.184
19	Pinukpuk	Saltan	17°37'	121°24'	856	Available	
20	Cataggaman, Tuguegarao	Cagayan	17°35'	121°40'	19,494		0.0
21	Namabbalan, Tuguegarao	Cagayan	17°32'	121°47'	18,685		0.0
22	Liglig Gawaan, Balbalan	Saltan	17°31'	121°12'	255		
23	Naneng, Tabuk	Chico				Available	
24	Abbot, Pinukpuk	Chico	17°42'	121°26'	3,349		43.497
25	Pasongtao, Tabuk	Chico	17°24'	121°25'	1,987	Available	
26	Baba-Alan, Tabuk	Tanudan	17°23'	121°16'	365	Available	
27	Poloc, Babaalan	Tanudan					
28	Abut, Quezon	Casile Creek	17°20'	121°35'	29		113.719
29	Antagan, Tumauini	Pina de Tumauini	17°17'	121°56'	170	Available	
30	Ampawilen	Chico			751	Available	
31	Anabel	Chico			605	Available	
32	Tomiangan	Chico	17°24'	121°14'	1,408	Available	
33	Pattacan, Tomiangan	Chico					
34	Taed	Chico	17°05'	120°59'	391	Available	
35	Basao	Chico	17°14'	121°08'	891	Available	
36	Ambato, Tinglayan	Chico	17°16'	121°09'	1,087	Available	
37	Casile, Mallig	Casile Creek	17°13'	121°36'	195	Available	49.119
38	Maligaya, Mallig	Mallig	17°11'	121°36'	563	Available	41.716
39	Muñoz, Roxas	Siffu	17°09'	121°34'	686	Available	50.520
40	Malalam (Alinguigan)	Pina de Ilagan	17°08'	121°54'	3,123	Available	26.143 (1955~1977)

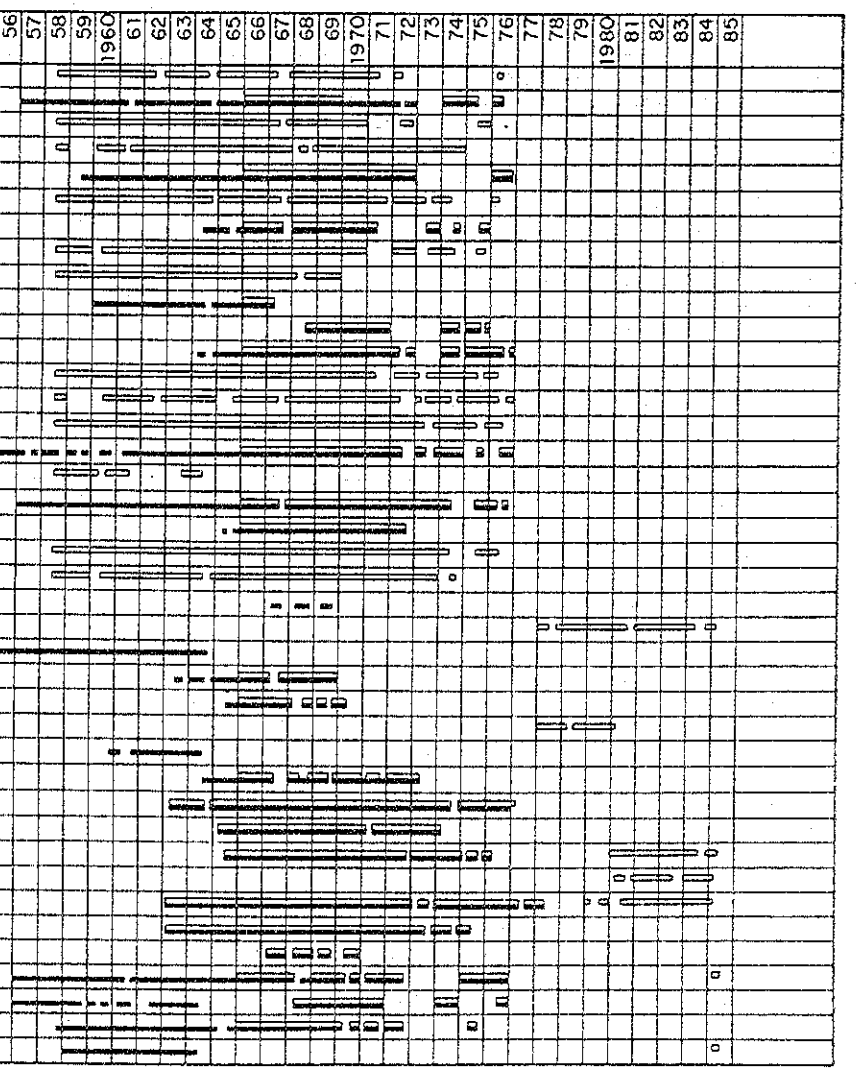


Fig. 1.4 LIST OF STREAMFLOW GAUGING STATION (2/2)

No.	Station	River	Location Latitude	Location Longitude	Drainage Area (km²)	Discharge Measurement Record	Zero of Gauge EL. (m)
41	Palattoo, Naguilian	Cagayan	17°01'	121°50'	6,626	Available	27.227 (83-330)
42	Supang, Sabangan	Sabangan	17°00'	120°54'	57	Available	
43	Minanga, SN Mariano	Pina de Ilagan	17°00'	122°01'	1,565	Available	
44	Disulap, SN Mariano	Disulap	16°58'	122°05'	146	Available	
45	Caipilan, Aurora	Taotao	16°57'	121°33'	430		62.416
46	Dipalin, Binatog	Disabungan	16°57'	122°04'	198	Available	
47	Oscariz (Maris Dam)	Magat	16°47'	121°30'	4,150		89.747
48	Dutao, Lagawe	Alimit	16°44'	121°20'	573	Available	
49	Cabulay, Santiago	Diadi	16°44'	121°29'	196	Available	79.487 (83-84 654)
50	Hapid, Lamut (Tupaya)	Ibulao	16°43'	121°15'	606	Available	
51	Camandag, Kiangan	Cadaclan	16°36'	121°03'	261	Available	
52	Pangal, Echague	Cagayan	16°36'	121°41'	4,244		
53	Panang, SN Agustin	Cagayan	16°25'	121°45'	2,392		
54	Guinatvin, Aglipay	Addatam	16°29'	121°39'	921	Available	
55	Bante, Bambang	Matuno	16°27'	121°04'	558	Available	
56	Manamtam, Bambang	Matuno					
57	Kamamasi, Kasibu	Diduyon	16°16'	121°27'	462	Available	
58	Minuri, Jones	Dibuluan			272	Available	
59	Dabubu, Peguiño	Dabubu	16°27'	121°47'	162	Available	
60	NPC Lamut	Magat					
61	Bato, Bayombong	Magat	16°26'	121°07'	1,649	Available	294.057
62	Dippadiw, Madella	Cagayan	16°23'	121°44'	2,380	Available	
63	Pingkian, Kayapo	Sta. Cruz	16°19'	120°57'	162	Available	
64	Taan	Taan					
65	Ponggo, Maddela	Casecnan					
66	Bangag	Cagayan	18°07'	121°41'		Available	-1.52
67	Baybayog	Paret	17°54'	121°41'	966	Available	1.98
68	Rosario	Rosario	16°39'	121°18'		Available	225.37
69	Tungngod	Burnay	16°48'	121°07'	95	Available	
70	Careb	Lanog	16°34'	121°12'		Available	
71	Baliling	Sta. Fe	16°14'	120°58'	96	Available	487.32
72	Beti	Marang	16°15'	121°03'		Available	
73	Ilut	Ilut	16°40'	121°26'		Available	145.489
74	Aurora East	Ganano				Available	
75	Gamis	Dumatata	16°40'	121°32'		Available	
76	Jones	Cagayan	16°33'	121°42'		Available	
77	Tuguegarao	Cagayan					
78	Tumauini	Cagayan					

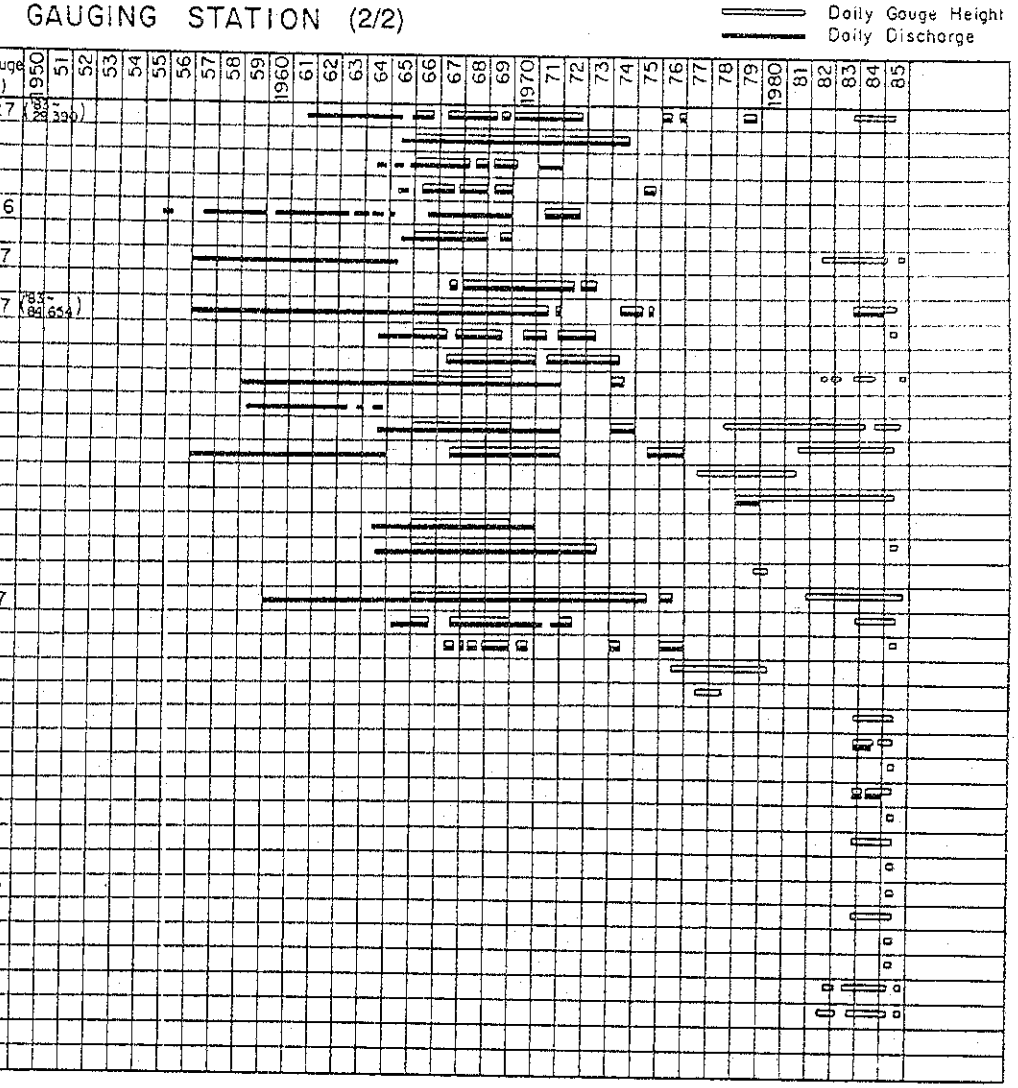
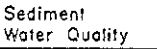


Fig. 1.5 LIST OF SEDIMENT AND WATER QUALITY RECORD



No.	Station	River	Location	
			Latitude	Longitude
1	Calaoagan, Dacquel	Dummon	18°03'	121°43'
2	Asassi, Baggao	Paret	17°55'	121°47'
3	Escolta, Rizal	Matalag	17°50'	121°25'
4	Larion Alto, Tuguegarao	Tuguegarao	17°38'	121°46'
5	Liglig Gawaan, Balbalan	Saltan	17°31'	121°12'
6	Pasonglao, Tabuk	Chico	17°24'	121°25'
7	Antagan, Tumauini	Tumauini	17°17'	121°56'
8	Casile, Mallig	Casile	17°13'	121°36'
9	Muñoz, Roxas	Siffu	17°09'	121°34'
10	Malalam (Alinguigan)	Ilagan	17°08'	121°54'
11	Palattao, Naguilian	Cagayan	17°01'	121°50'
12	Minanga, Sn Mariano	Ilagan	17°00'	122°01'
13	Oscariz, Sn Mateo	Magat	16°47'	121°30'
14	Magat Damsite	Magat		
15	Dulao, Lagawe	Alimit	16°44'	121°20'
16	Cabulay, Santiago	Diadi	16°44'	121°29'
17	Lamut	Lamut		
18	Hapid, Lamut (Tupaya)	Ibulao	16°43'	121°15'
19	Camandag, Kiangan	Cadaclan	16°36'	121°03'
20	Guinalvin, Aglipay	Addalam	16°29'	121°39'
21	Bante, Bambang	Matuno	16°27'	121°04'
22	Minuri, Jones	Dibuluan		
23	Dabubu, Peguiño	Dabubu	16°27'	121°47'
24	Bato, Bayombong	Magat	16°26'	121°07'
25	Dippadiw, Madella	Cagayan	16°23'	121°44'
26	Pingkian, Kayapa	Sta. Cruz	16°19'	120°57'
27	Bangag	Cagayan	18°07'	121°41'
28	Baybayog	Paret	17°54'	121°41'
29	Rosario	Rosario	16°39'	121°18'
30	Tungngod	Burnay	16°48'	121°07'
31	Careb	Lanog	16°34'	121°12'
32	Balliling	Sta. Fe	16°14'	120°58'
33	Beti	Marang	16°15'	121°03'
34	Ilut	Ilut	16°40'	121°26'
35	Aurora East	Ganano		
36	Gamis	Dumatata	16°40'	121°32'
37	Jones	Cagayan	16°33'	121°42'
38	Maddela, Quirino	Tabayong		
39	Conwap	Cagayan		
40	Gabong	Casecnan		
41	Dakgan	Casecnan		
42	Bagabag	Magat		

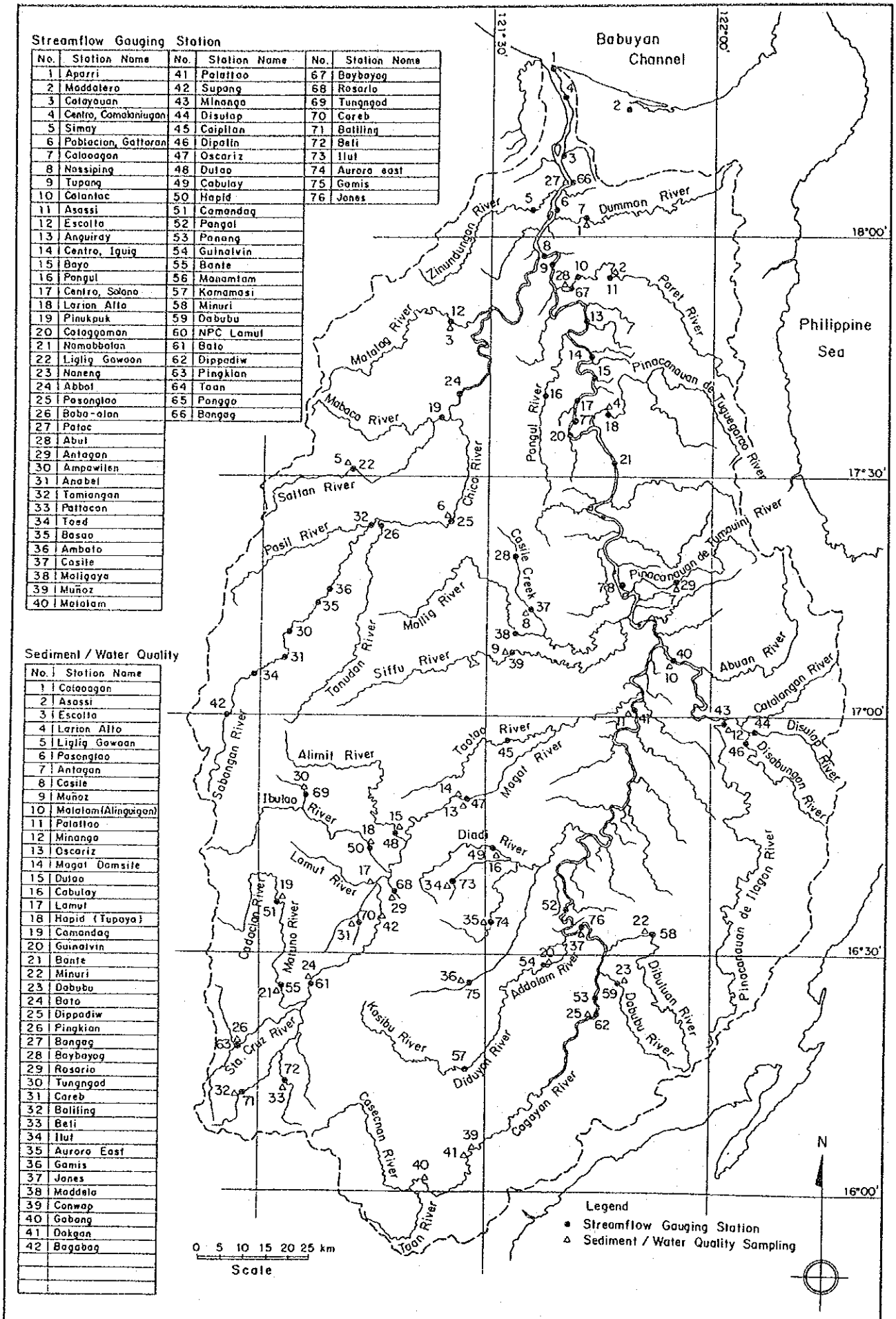
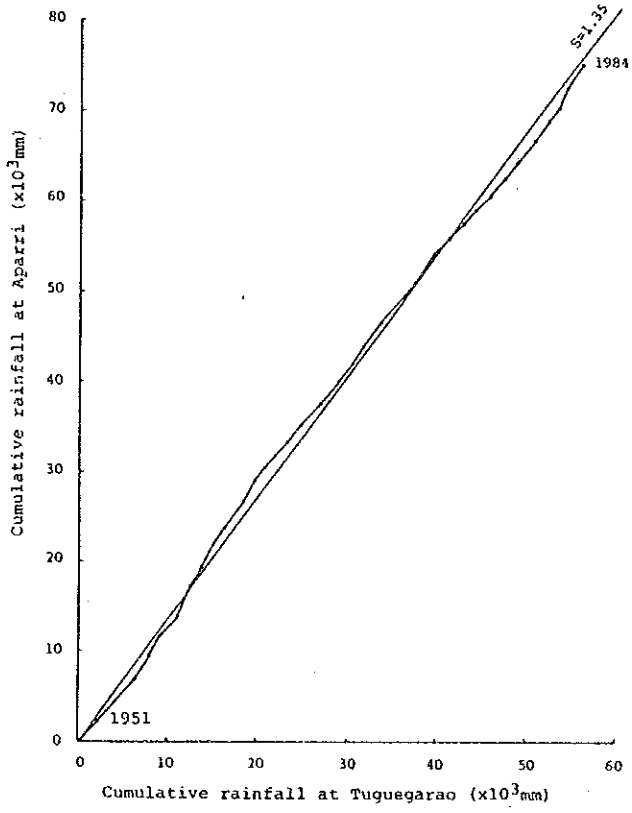
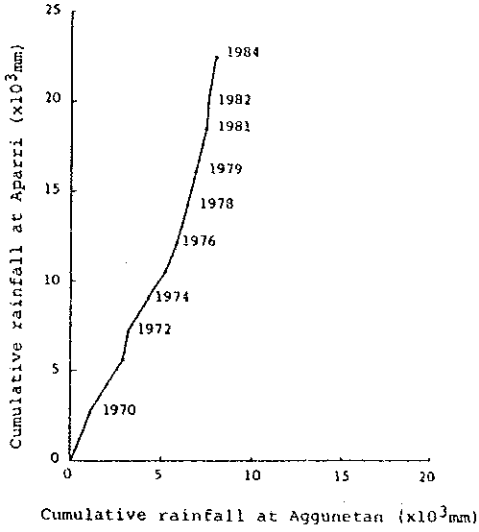
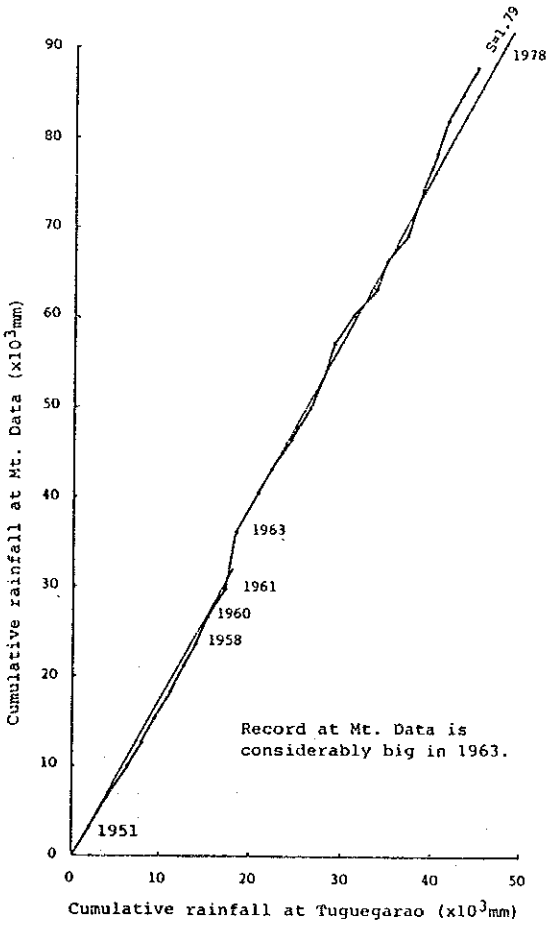
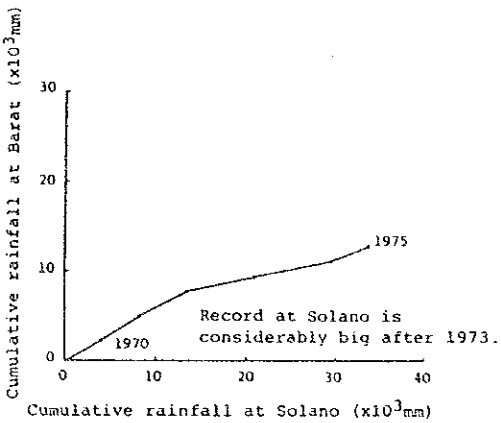


Fig. 1.6 LOCATION OF HYDROLOGICAL STATIONS









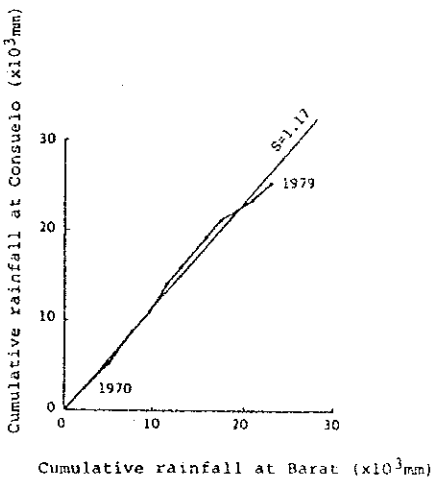
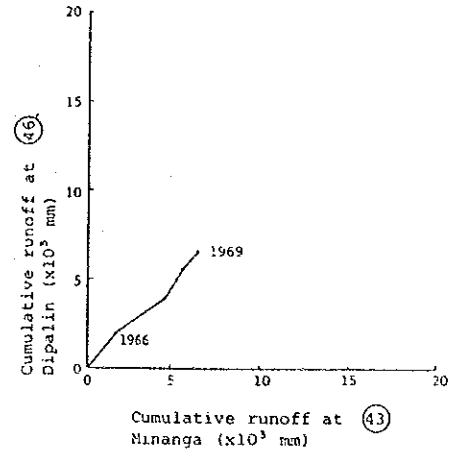
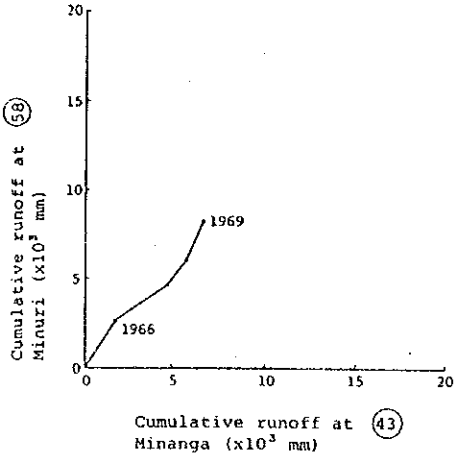
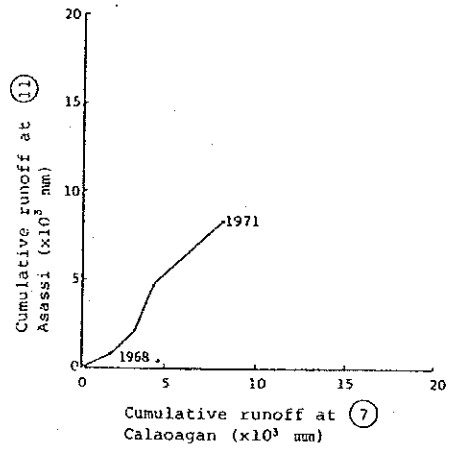
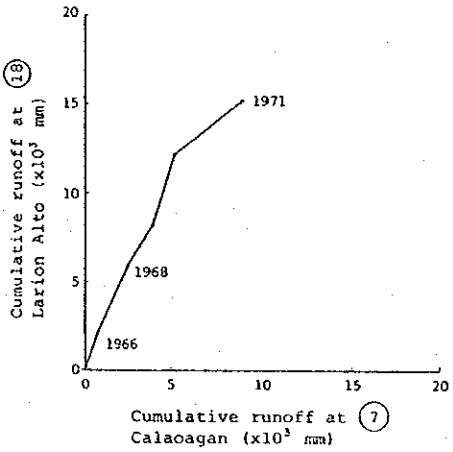


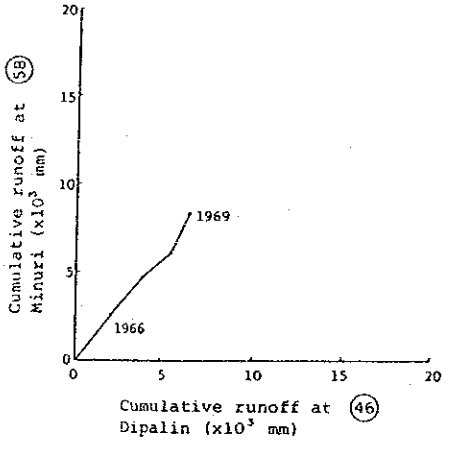
Fig. 1.7 DOUBLE MASS CURVE OF RAINFALL RECORD

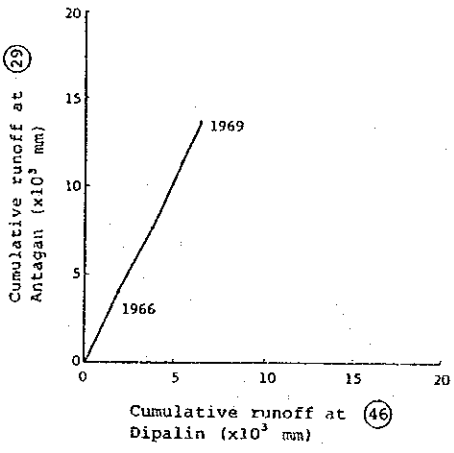


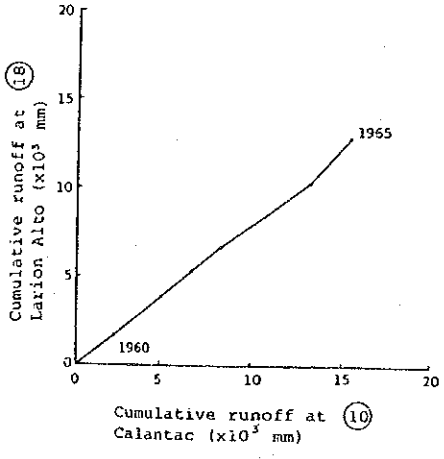












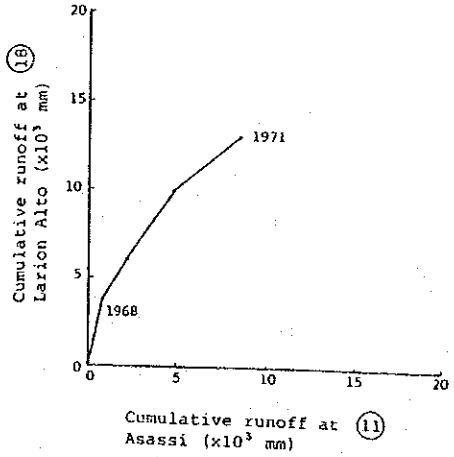
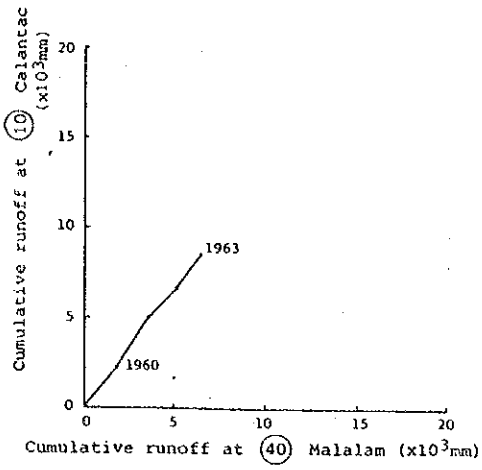
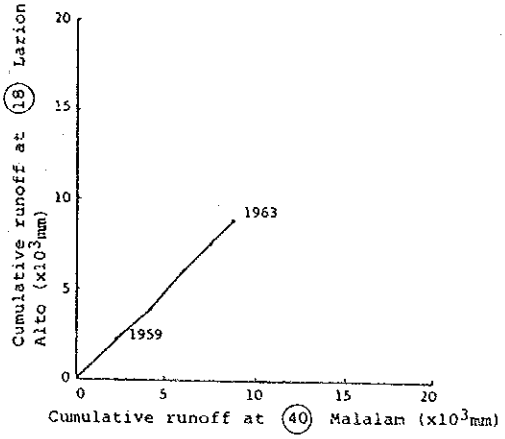
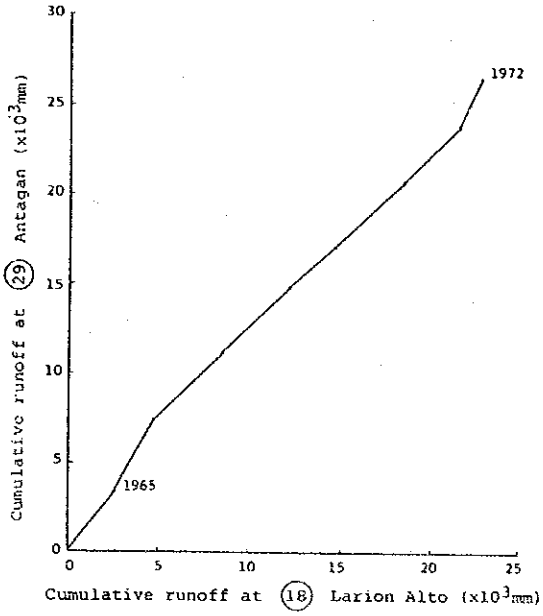
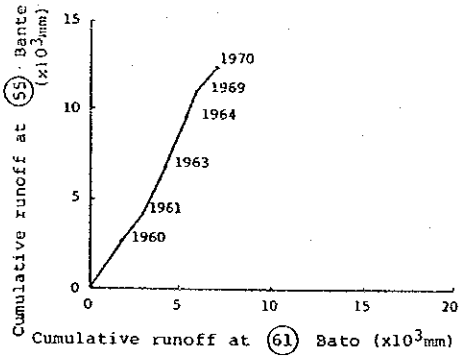


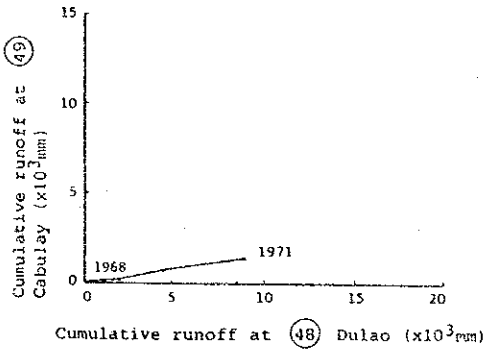
Fig. 1.8 DOUBLE MASS CURVE OF STREAMFLOW RECORD (1/7)

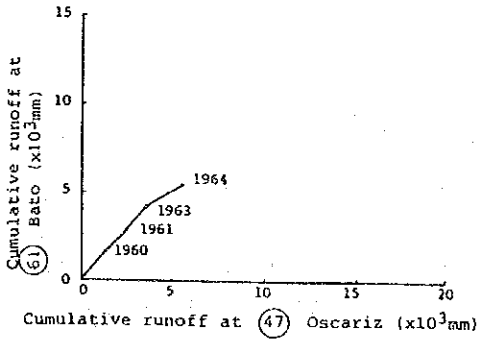












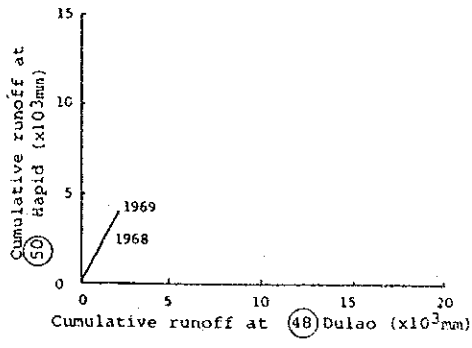


Fig. 1.8 DOUBLE MASS CURVE OF STREAMFLOW RECORD (2/7)

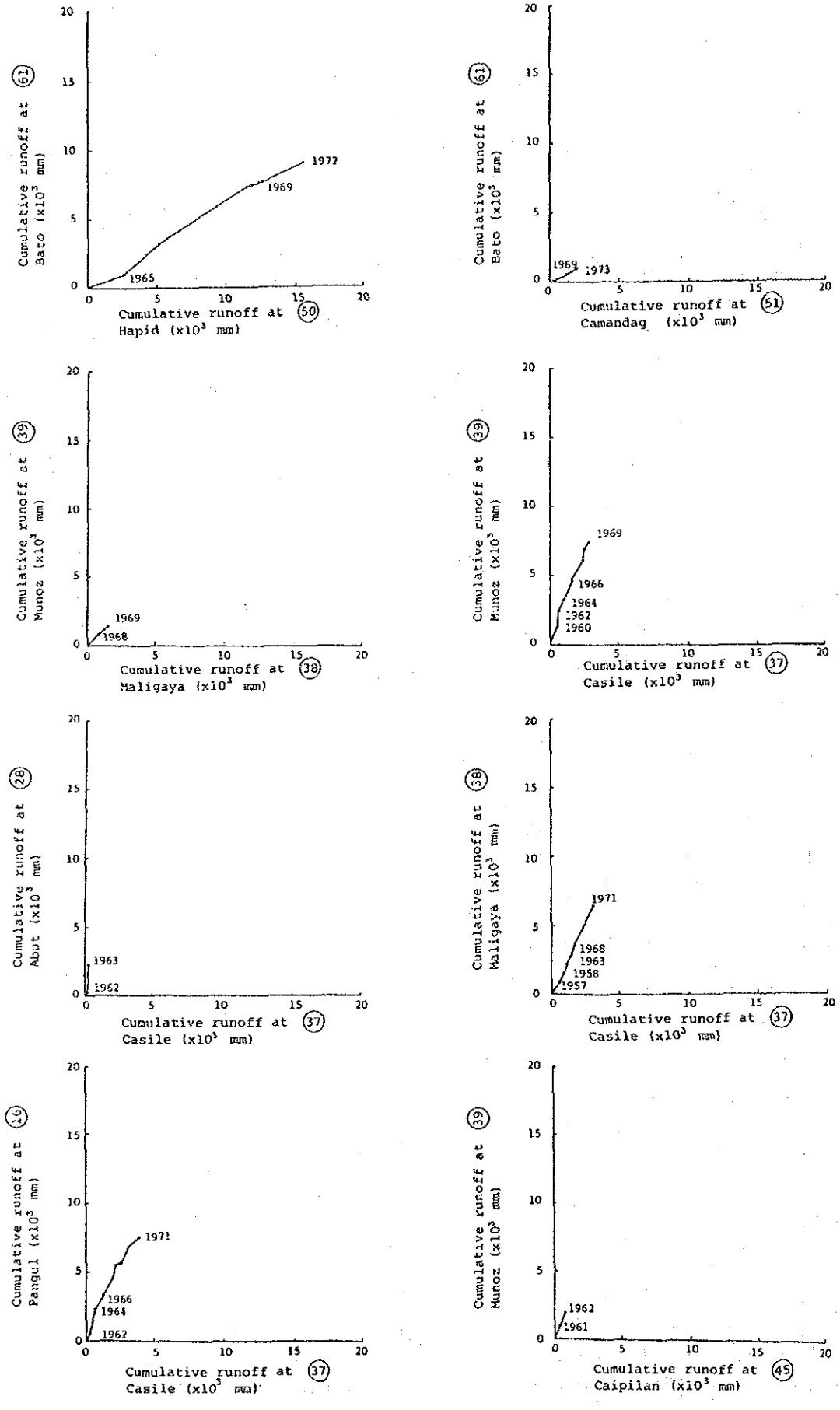
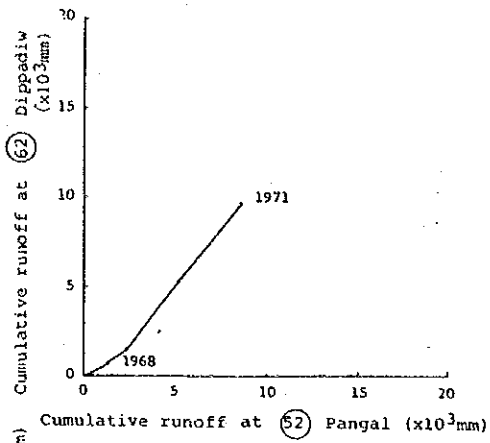
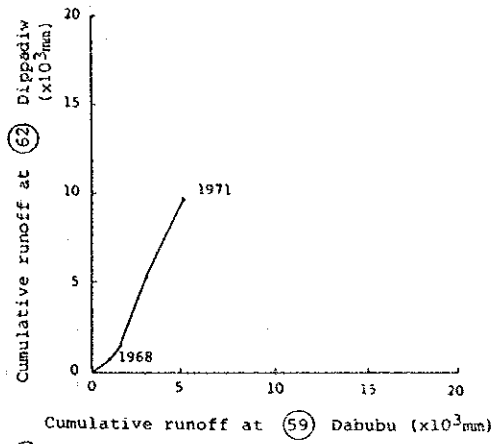
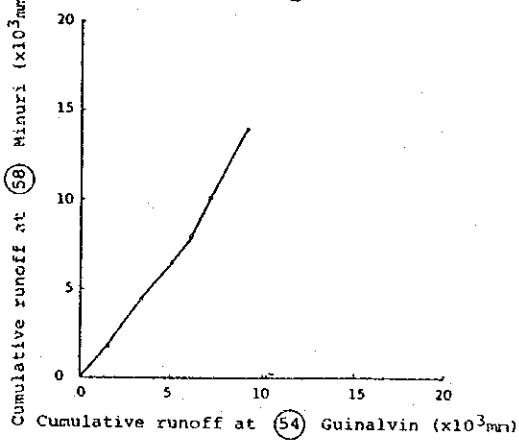
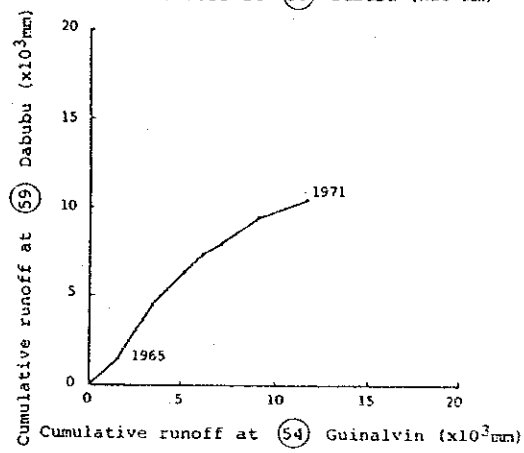


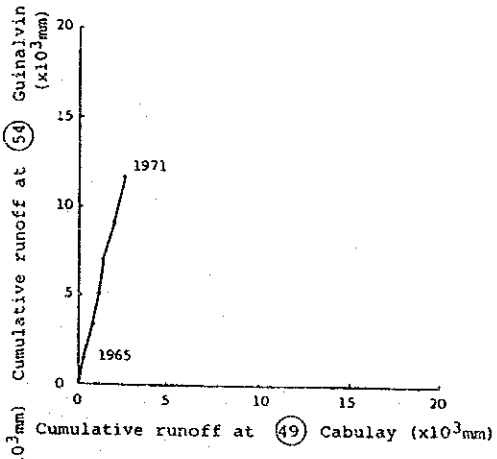
Fig. 1.8 DOUBLE MASS CURVE OF STREAMFLOW RECORD (3/7)

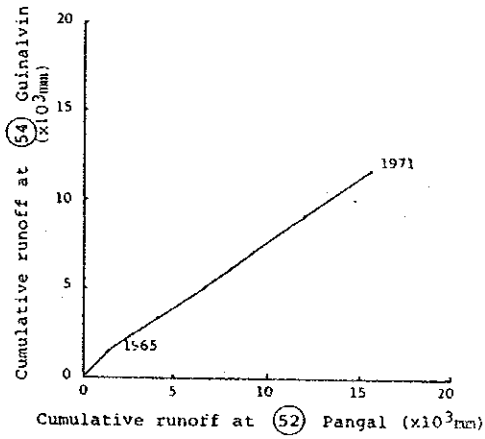












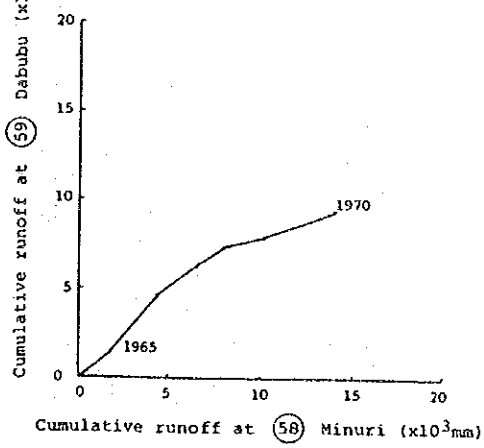


Fig. 1.8 DOUBLE MASS CURVE OF STREAMFLOW RECORD (4/7)

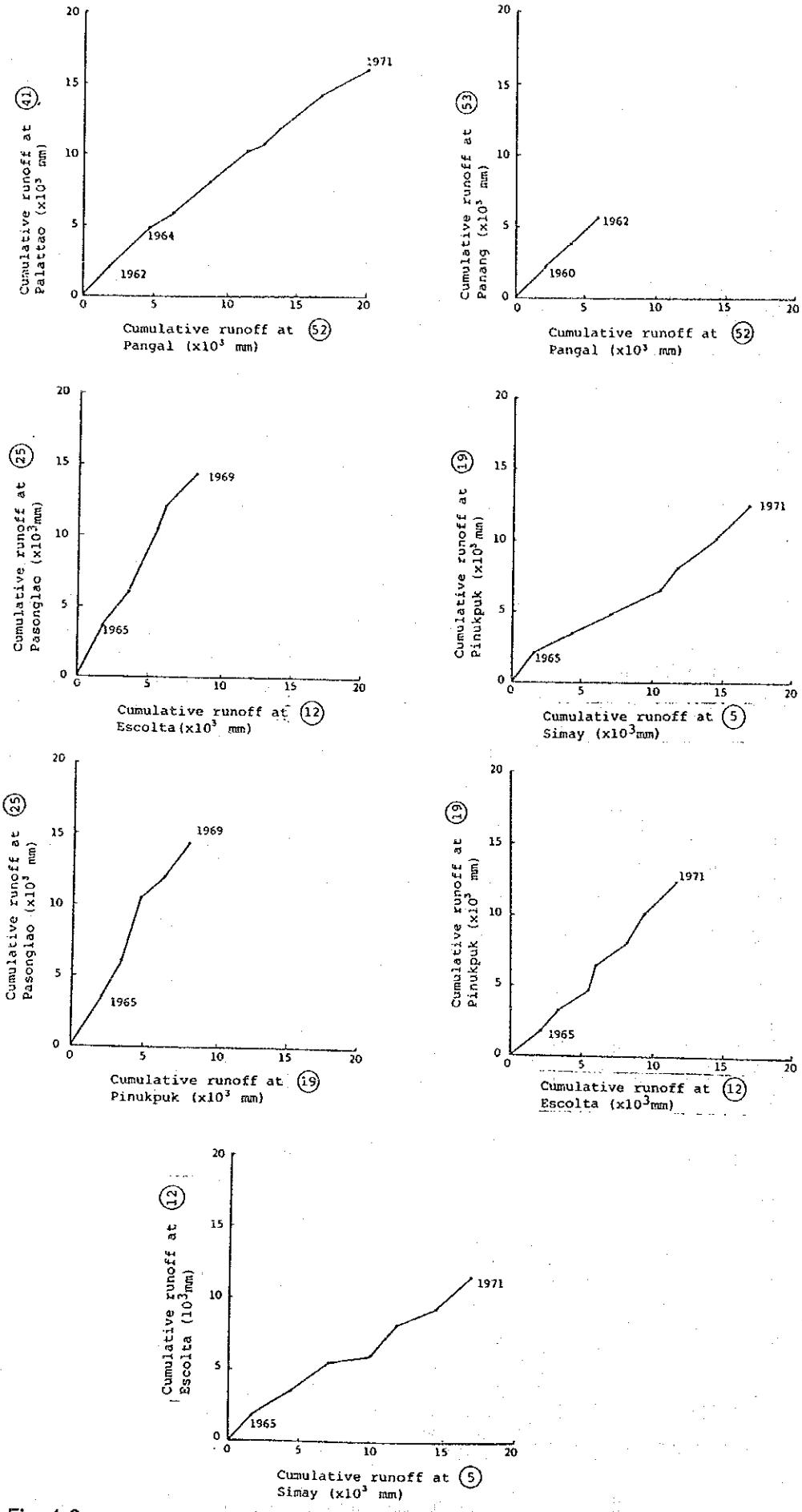
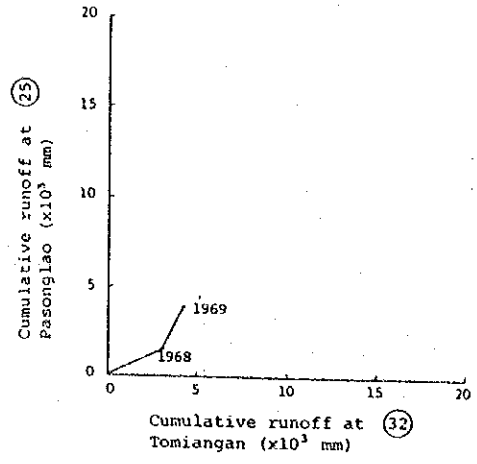
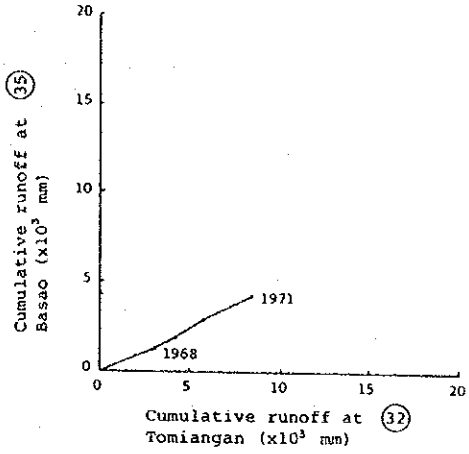
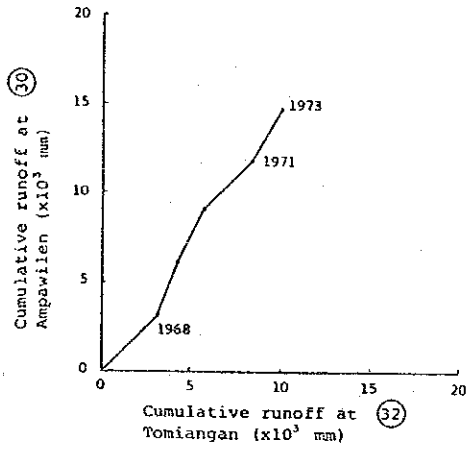
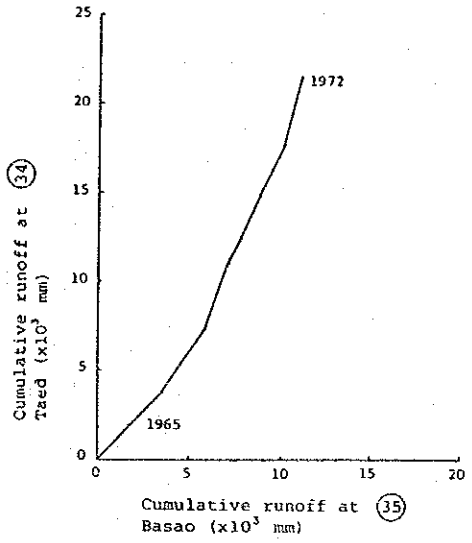


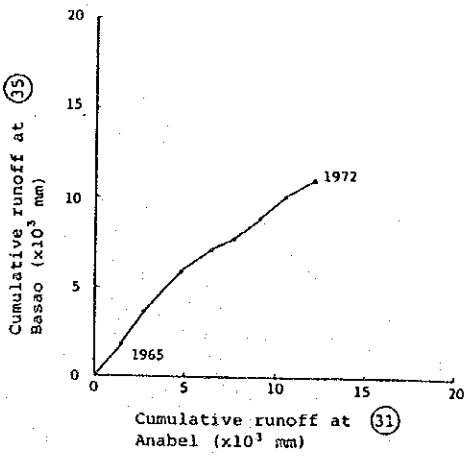
Fig. 1.8 DOUBLE MASS CURVE OF STREAMFLOW RECORD (5/7)











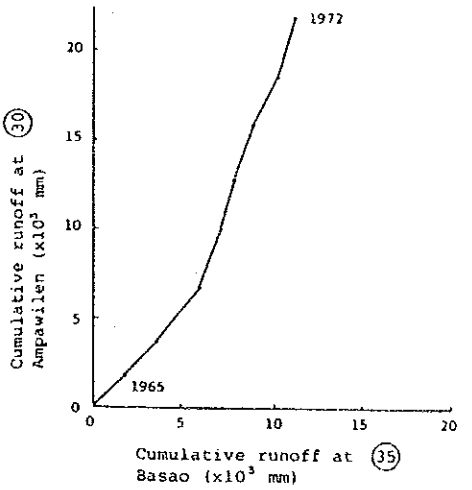
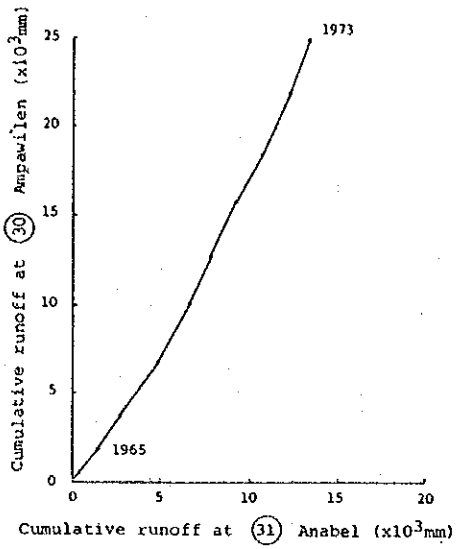
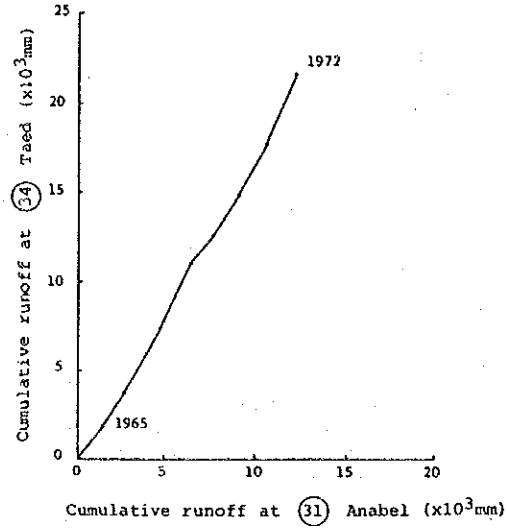
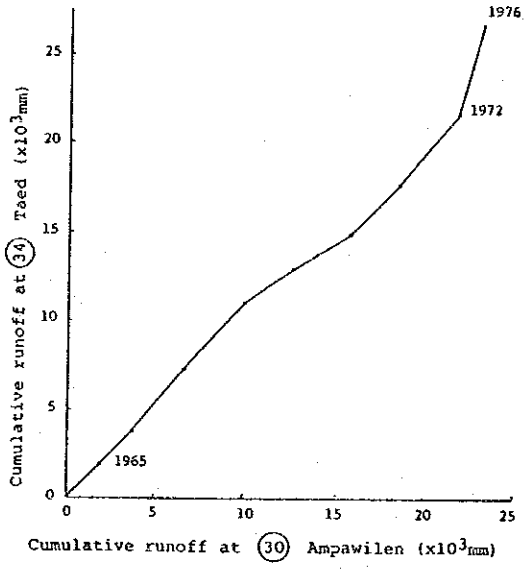
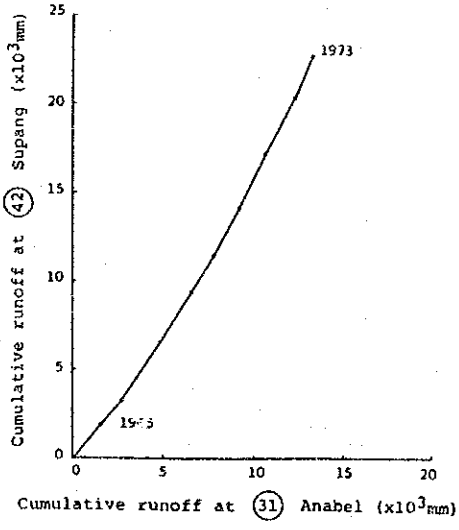


Fig. 1.8 DOUBLE MASS CURVE OF STREAMFLOW RECORD (6/7)









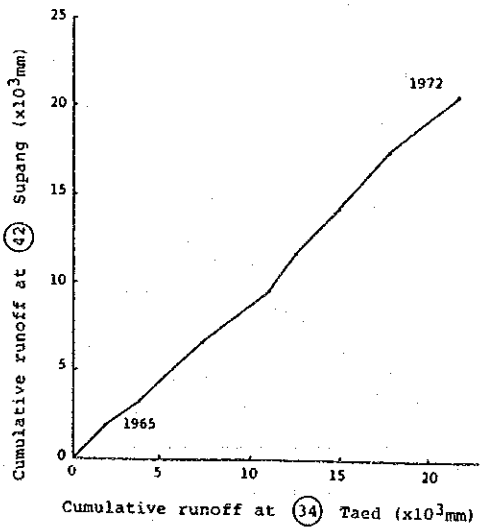
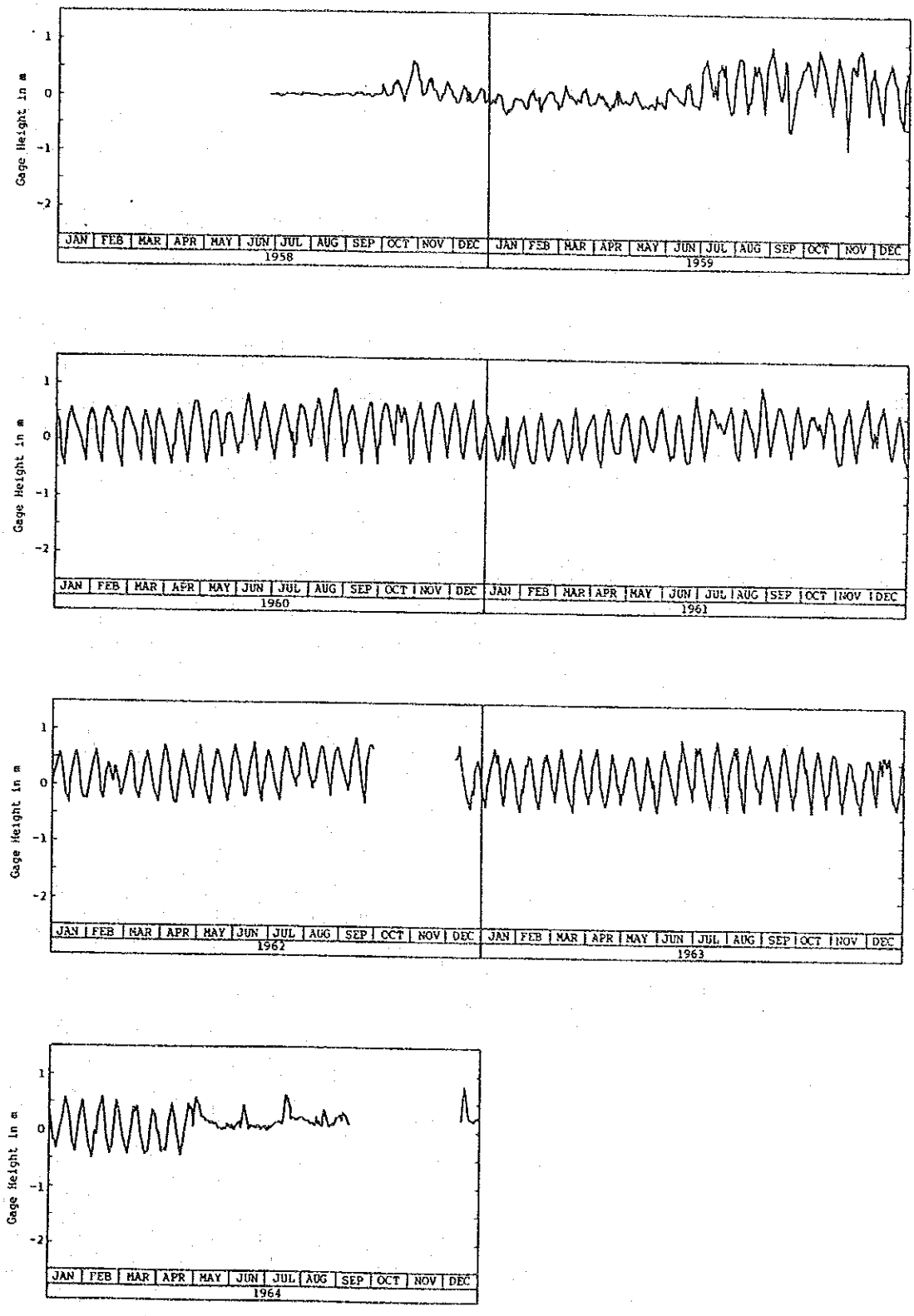


Fig. 1.8 DOUBLE MASS CURVE OF STREAMFLOW RECORD (7/7)



Note; Zero of gage is mean sea level.
Asterisk (*) breaks in recording.

Fig. 1.9 DAILY WATER LEVEL AT APARRI

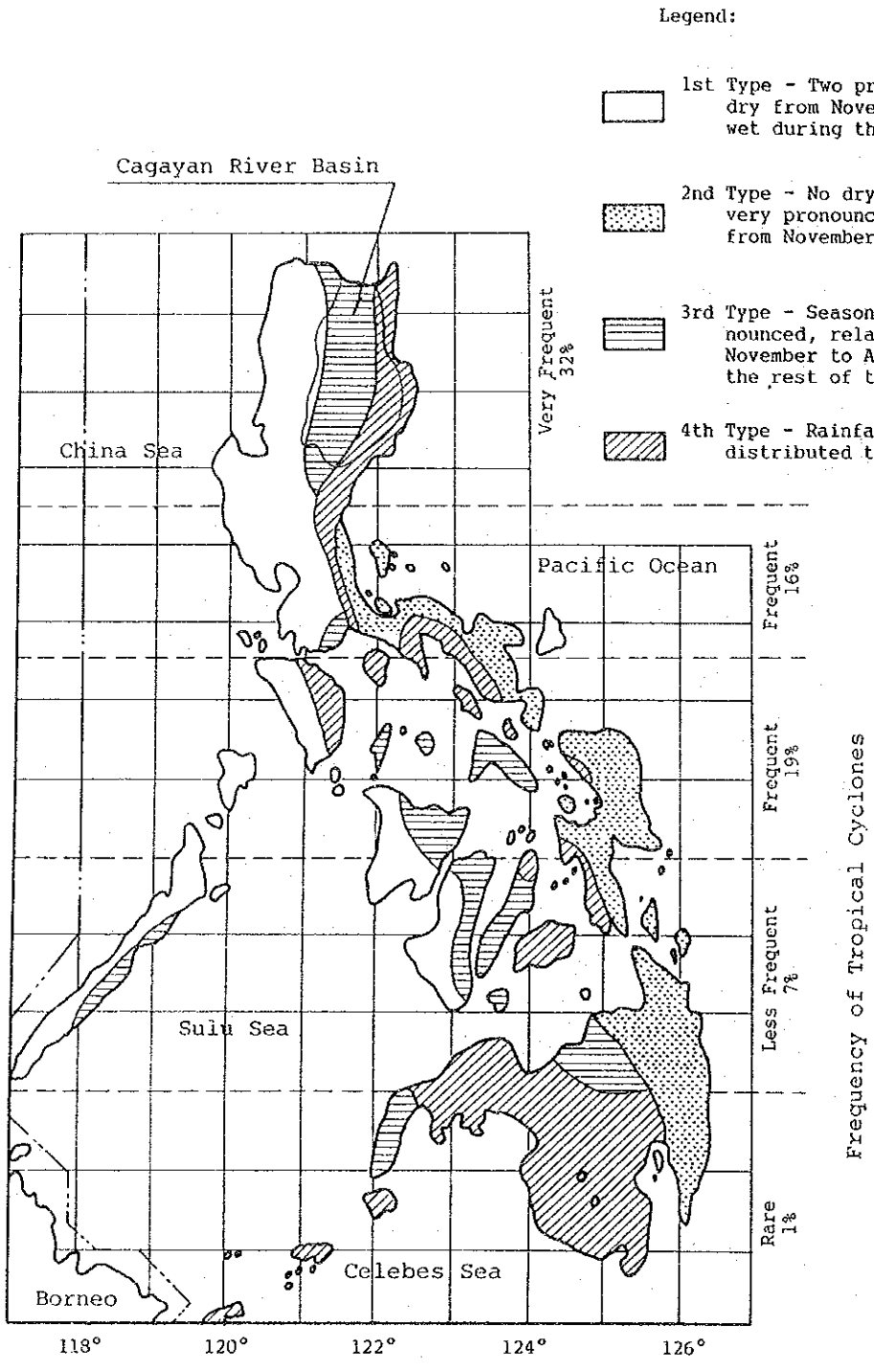


Fig. 2.1 CLIMATE IN THE PHILIPPINES

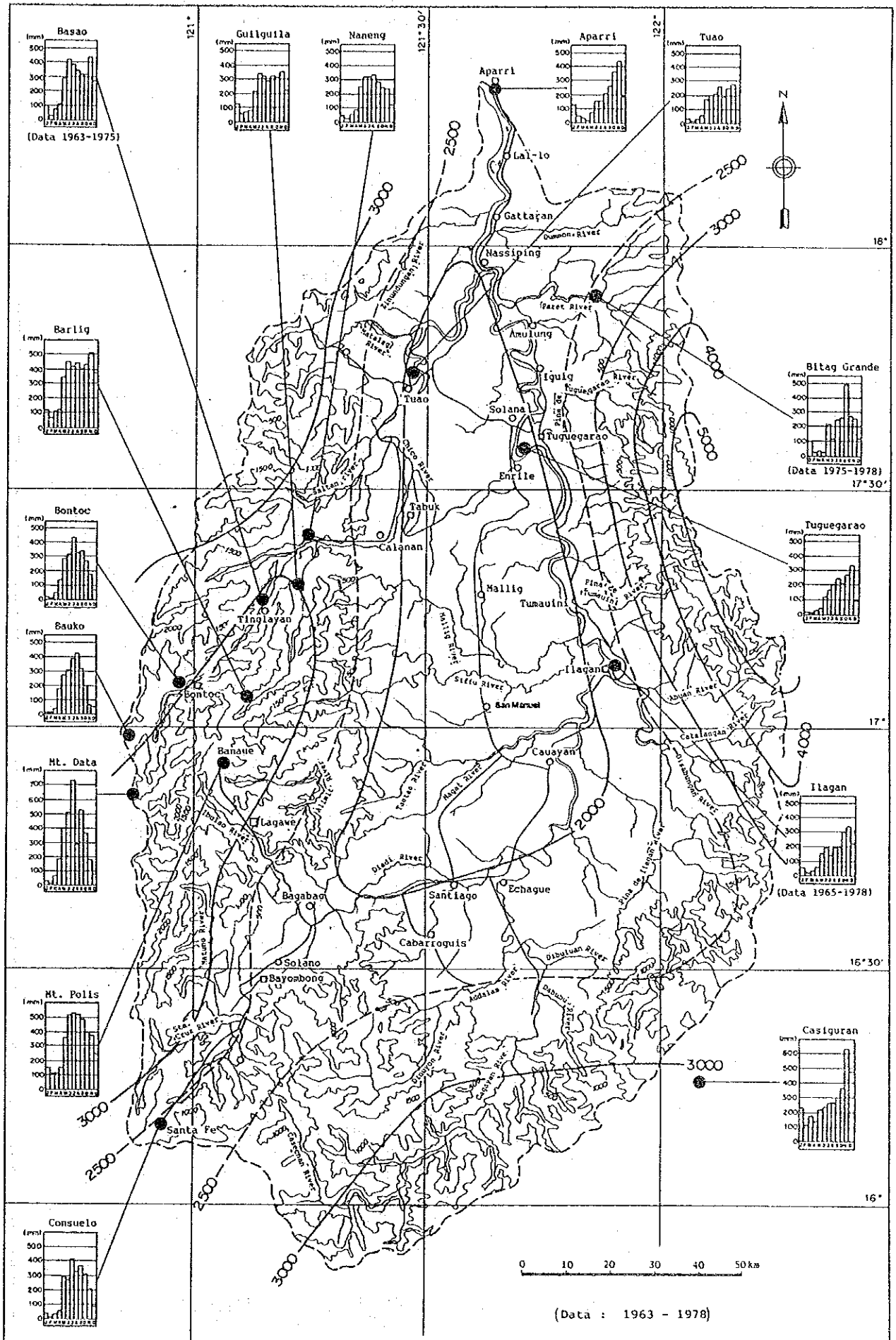


Fig. 2.2 ISOHYETAL MAP IN CAGAYAN BASIN

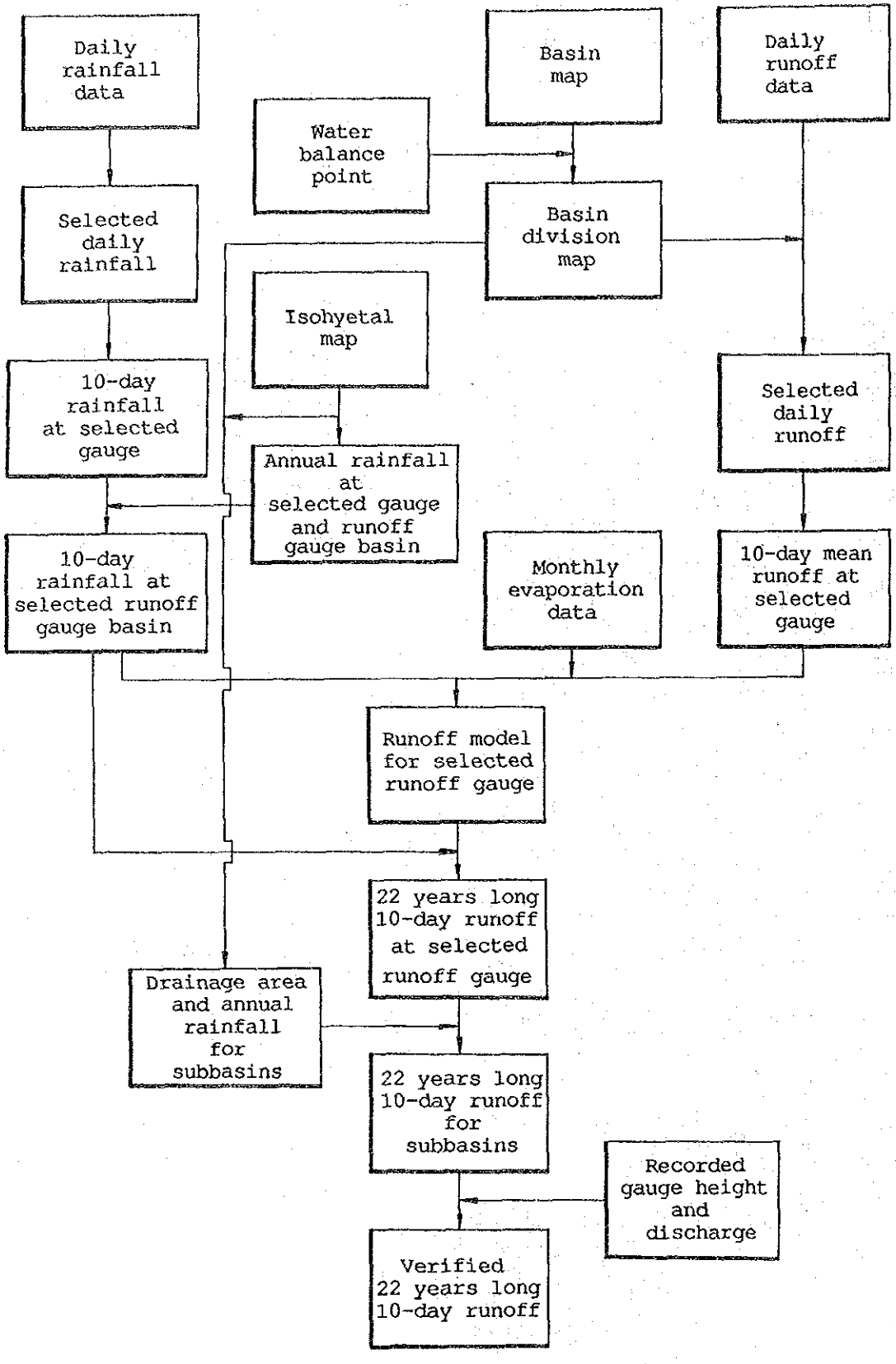


Fig. 3.1 WORK FLOW OF STREAMFLOW ANALYSIS

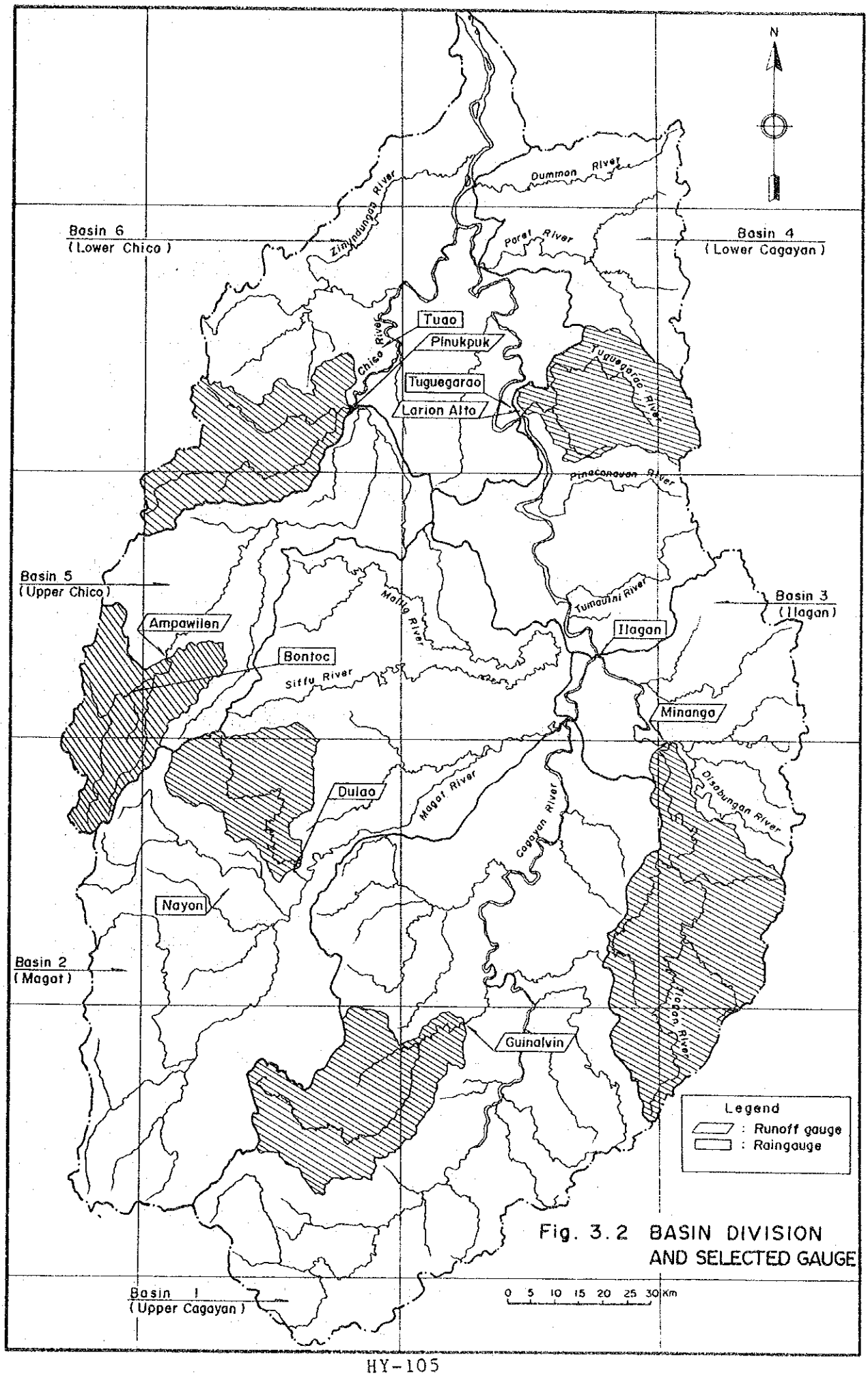


Fig. 3.2 BASIN DIVISION AND SELECTED GAUGE