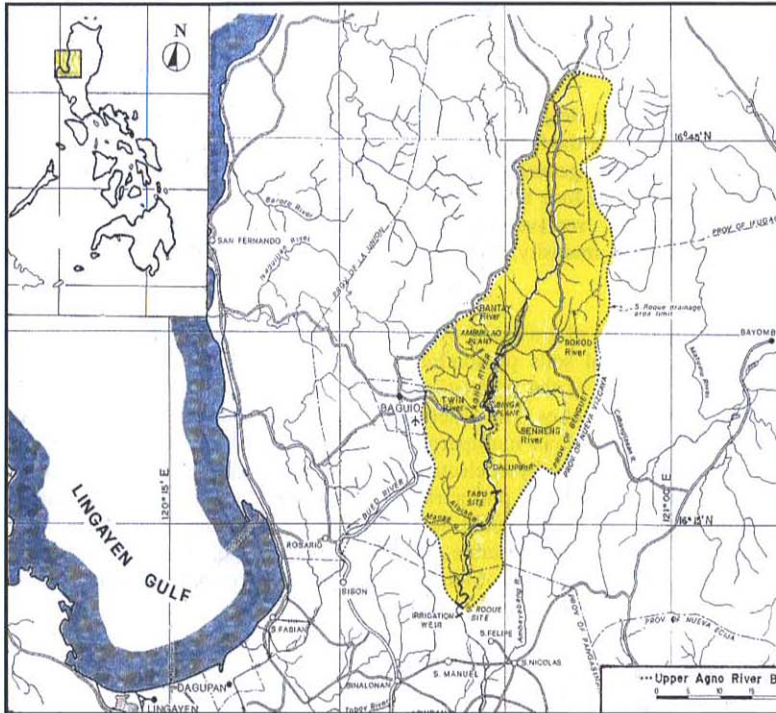


# Ilog Itaas ng Agno

## Map of River



Source: National Power Corporation (1979)

## Table of Basic Data

<b>Name:</b> Upper Agno River		<b>Serial No.:</b> Philippines-3
<b>Location:</b> Central Luzon, Philippines	N 16° 15' ~ 16° 55'	E 120° 35' ~ 120° 55'
<b>Area:</b> 1,250 km <sup>2</sup>	<b>Length of main stream:</b> 110 km	
<b>Origin:</b> Mt. Data (2,300 m)	<b>Highest point:</b> Mt. Pulog (2,922 m)	
<b>Outlet:</b> Lingayen Gulf	<b>Lowest point:</b> San Roque Dam Site (100 m)	
<b>Main geological features:</b> Undifferentiated volcanic rocks, diorite with porphyritic andesite phase, submarine andesite		
<b>Main tributaries:</b> Bengneto River (121 km <sup>3</sup> ), Bokod River (110 km <sup>3</sup> ), Bantay River (47 km <sup>3</sup> ), Twin River (70 km <sup>3</sup> )		
<b>Main lakes:</b> None		
<b>Main reservoirs:</b> Ambuklao Reservoir ( 329x10 <sup>6</sup> m <sup>3</sup> , 1956), Binga Reservoir( 87.4 x10 <sup>6</sup> m <sup>3</sup> , 1960 )		
<b>Mean annual precipitation:</b> 2,800 mm (1950 ~ 1993) (basin average)		
<b>Mean annual runoff:</b> 94.2 m <sup>3</sup> /s (1946 ~ 1965) (basin average)		
<b>Population:</b> 163,949 (1980)	<b>Main cities:</b> None	
<b>Land use:</b>		

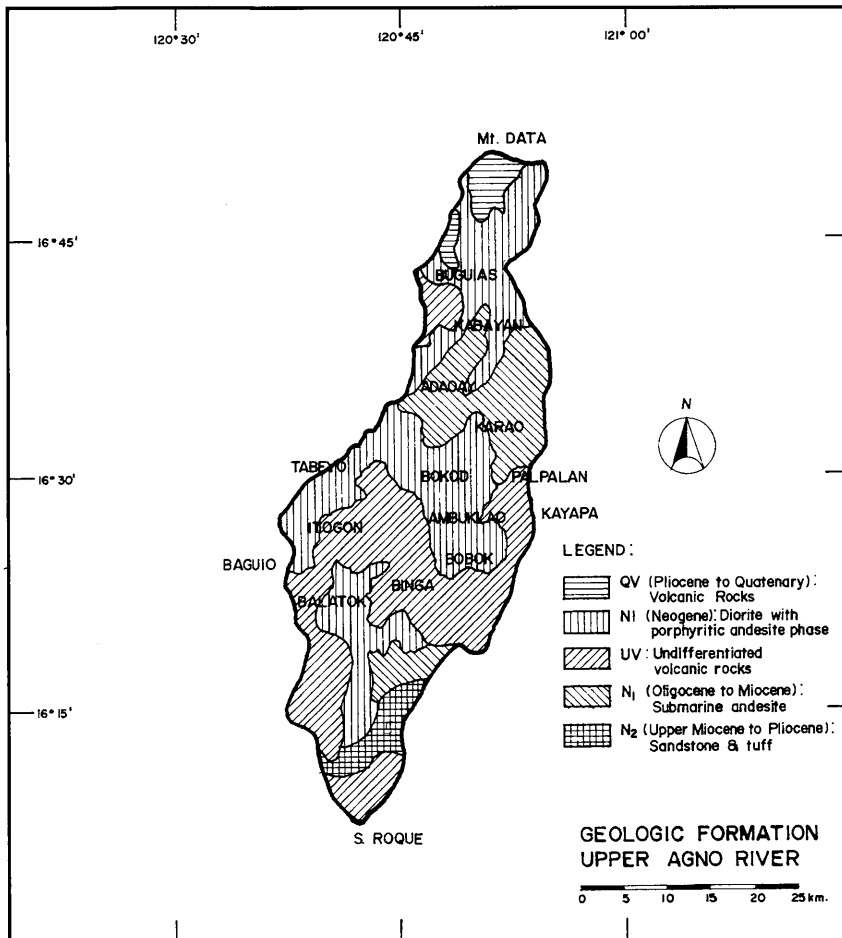
# 1. General Description

The Upper Agno River lies in the west of the central part of Luzon island. Originating in Mt. Data, the river flows through the mountainous region in a southward direction towards San Roque. At about 110 km from its source it enters the Pangasinan plains, turning gradually westward in a long sweep until it discharges its waters at Lingayen Gulf. The highest point of the watershed is at Mt. Pulog at elevation 2,922 m above mean sea level.

The basin has a drainage area of 1,250 km<sup>2</sup> with its tributaries characterised as generally short and steep. Major tributaries of the basin in the east include Benneng River located between Ambuklao and Binga Dams, and Bokod River located upstream of Ambuklao Dam. The major western tributaries are Bantay River located downstream of Ambuklao Dam and Twin River located downstream of Binga Dam. The Agno River basin has a watershed area of around 617 km<sup>2</sup> at Ambuklao Dam, 860 km<sup>2</sup> at Binga Dam, and 1,250 km<sup>2</sup> at San Roque.

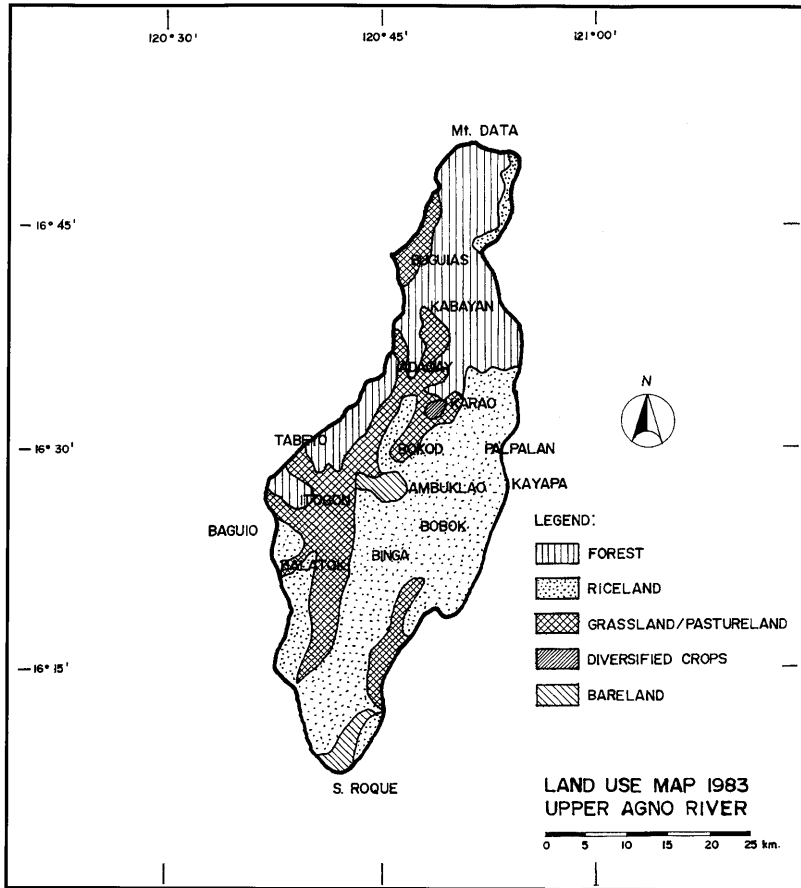
# 2. Geographical Information

## 2.1 Geological Map



Source: National Water Resources Board (1983)

2.2 Land Use Map



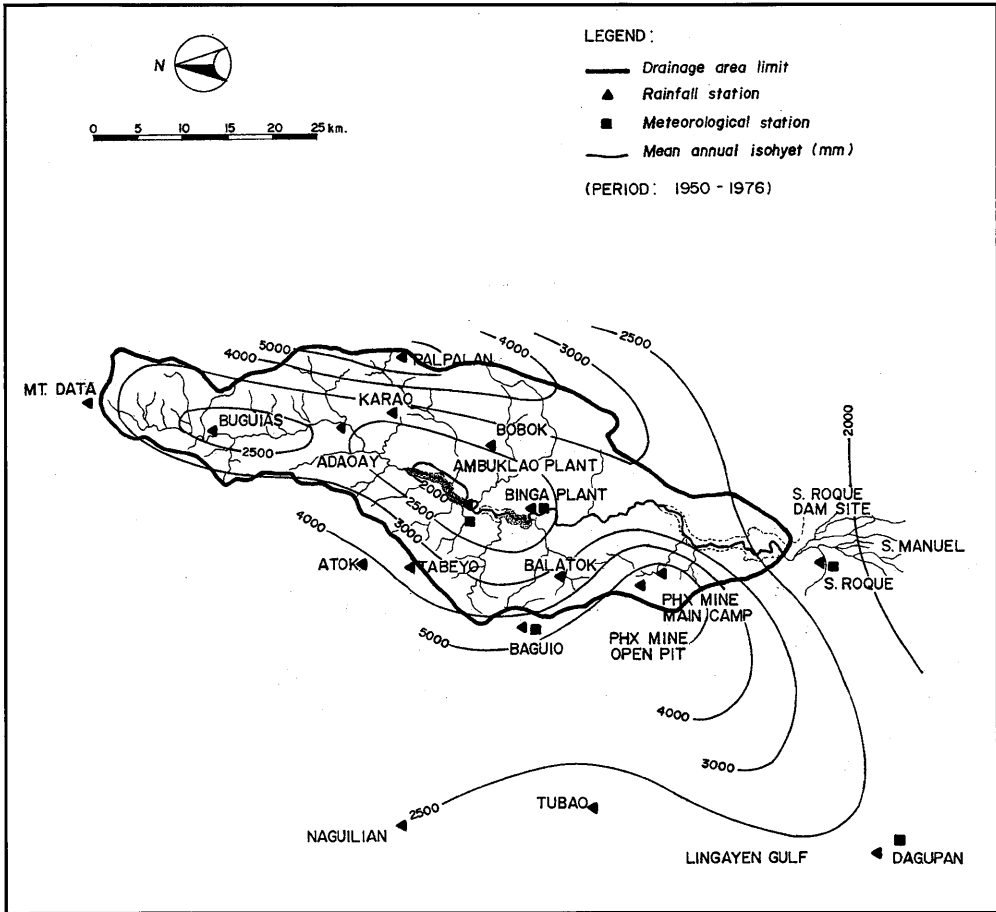
Source: National Water Resources Board (1983)

2.3 Characteristics of the River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km <sup>2</sup> ]	Highest peak [m] Lowest point [m]	Cities population	Land use [%]
1	Agno (Main river)	110 1,250	2,922 100		
2	Bokod (Tributary)	----- 110			
3	Benneng (Tributary)	----- 121			
4	Bantay (Tributary)	----- 47			
5	Twin (Tributary)	----- 70			

### 3. Climatological Information

#### 3.1 Annual Isohyetal Map and Observation Stations

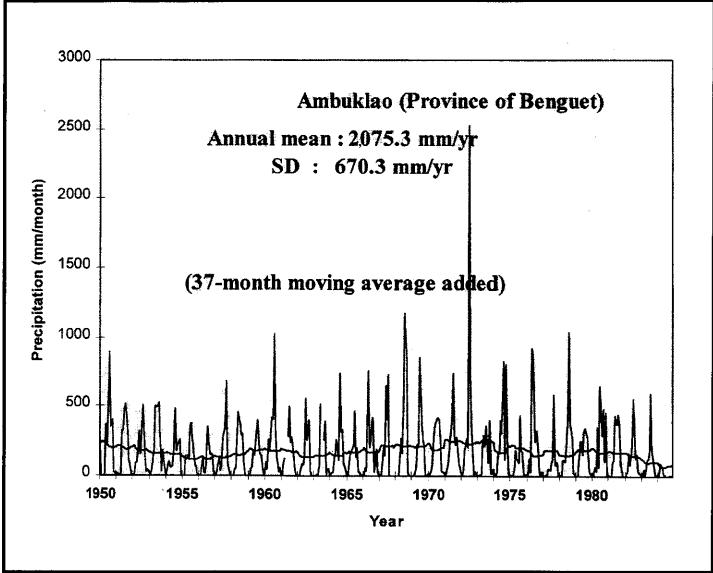


Source: National Power Corporation (1979)

#### 3.3 Monthly Climate Data

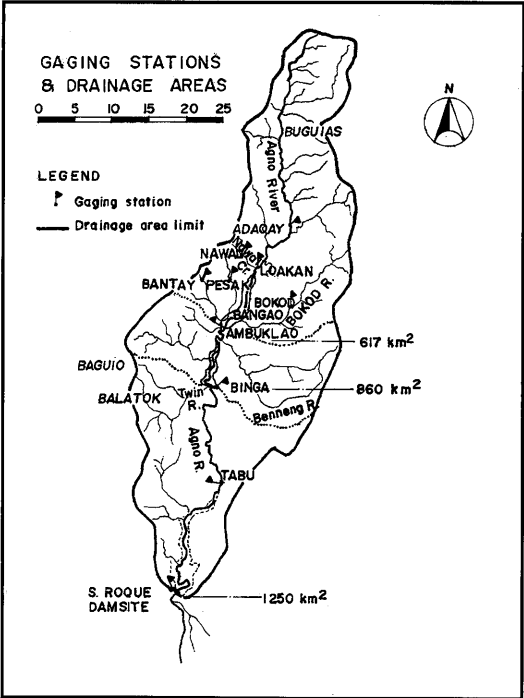
Observation item	Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	Dagupan	25.8	26.5	28.0	29.6	29.5	28.7	28.1	27.7	27.9	27.9	27.3	26.2	27.8	1961 - 1995
Precipitation [mm]	Ambuklao	13.6	8.1	40.8	93.8	213.4	259.7	421.1	475.9	310.8	160.6	70.6	16.3	2,078.3	1950 - 1989
Evaporation [mm]	San Roque	184.5	203.4	250.2	259.0	230.1	146.9	139.0	134.3	118.8	142.2	139.5	159.1	2,107	1958 - 1970

### 3.4 Long-term Variation of Monthly Precipitation



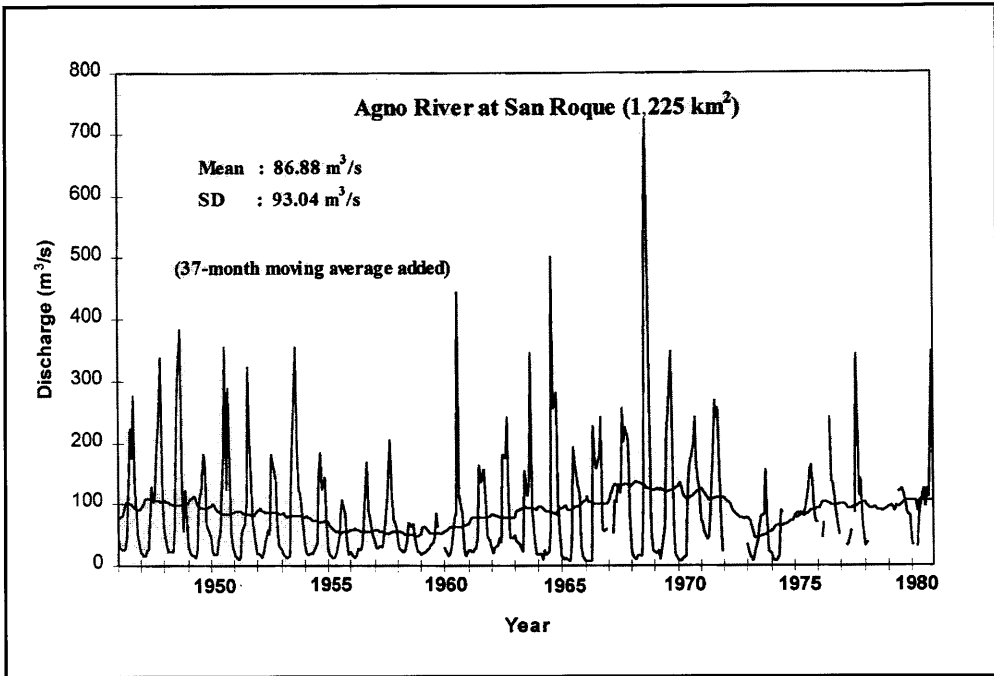
## 4. Hydrological Information

### 4.1 Map of Streamflow Observation Stations



Source: National Power Corporation (1979)

### 4.3 Long-term Variation of Monthly Discharge



### 4.6 Annual Maximum and Minimum Discharges

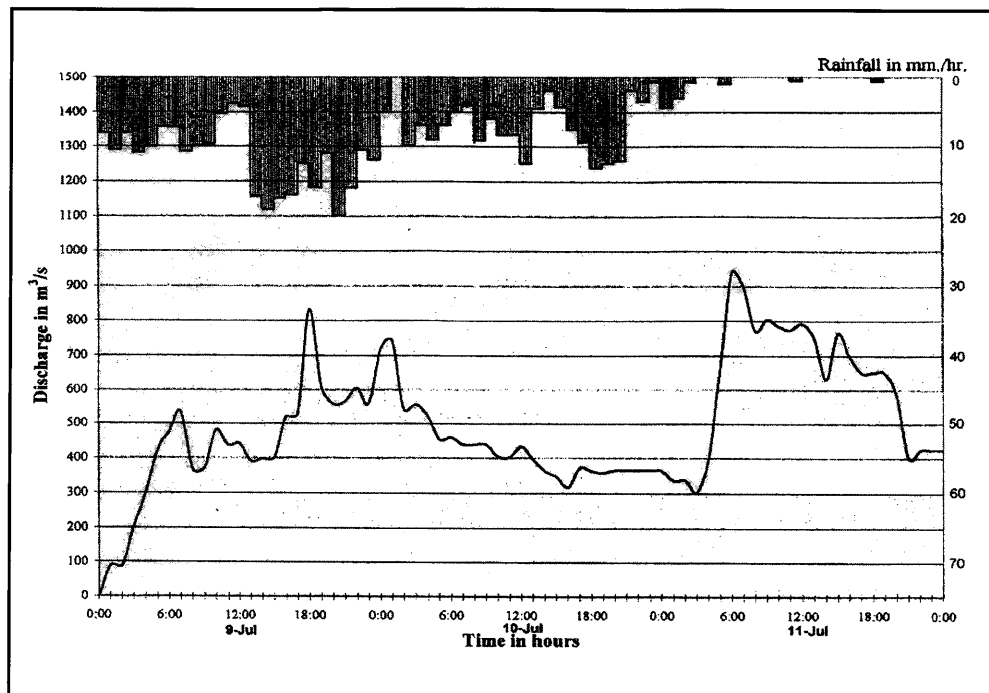
At San Roque (Town of San Manuel in the Province of Pangasinan) [ 1,225 km<sup>2</sup>]

Year	Maximum <sup>1)</sup>		Minimum <sup>2)</sup>		Year	Maximum <sup>1)</sup>		Minimum <sup>2)</sup>	
	Date	[m <sup>3</sup> /s]	Month	[m <sup>3</sup> /s]		Date	[m <sup>3</sup> /s]	Month	[m <sup>3</sup> /s]
1946	07.17	1,110	4	14.20	1964	08.07	2,046	6	4.20
1947	10.06	2,373	3	11.28	1965	07.15	870	3	3.10
1948	08.24	1,142	5	16.60	1966	05.20	3,694	2	4.40
1949	10.03	736	5	10.10	1967	10.18	1,182	3	7.00
1950	08.08	1,040	3	14.06	1968	09.29	4,350	6	4.20
1951	07.31	717	3	8.02	1969	07.29	2,158	4	3.10
1952	10.28	473	3	11.71	1970	10.15	550	5	3.40
1953	08.21	1,036	3	11.28	1971	08.14	863	12	4.80
1954	11.08	1,404	3	15.42	1972				
1955	09.24	583	4	8.40	1973	10.08	462	4	3.68
1956	09.25	314	4	9.95	1974	07.23	321	4	0.41
1957	09.18	515			1975	10.21	210	11	52.00
1958	06.12	444			1976	05.25	705	3	14.40
1959	09.06	137			1977	09.23	1,341	8	21.90
1960	08.23	1,093	3	8.44	1978	02.11	309	3	20.50
1961	07.14	758	4	5.40	1979	09.25	381	12	31.70
1962	07.22	900	4	7.40	1980	10.06	3,944	4	9.60
1963	09.12	1,214	12	7.53					

## 4.7 Hyetographs and Hydrographs of Major Floods

### Binga (860 km<sup>2</sup>) 1986 July

[Discharge and Precipitation at Binga Powerplant]



## 5. Water Resources

### 5.1 General Description

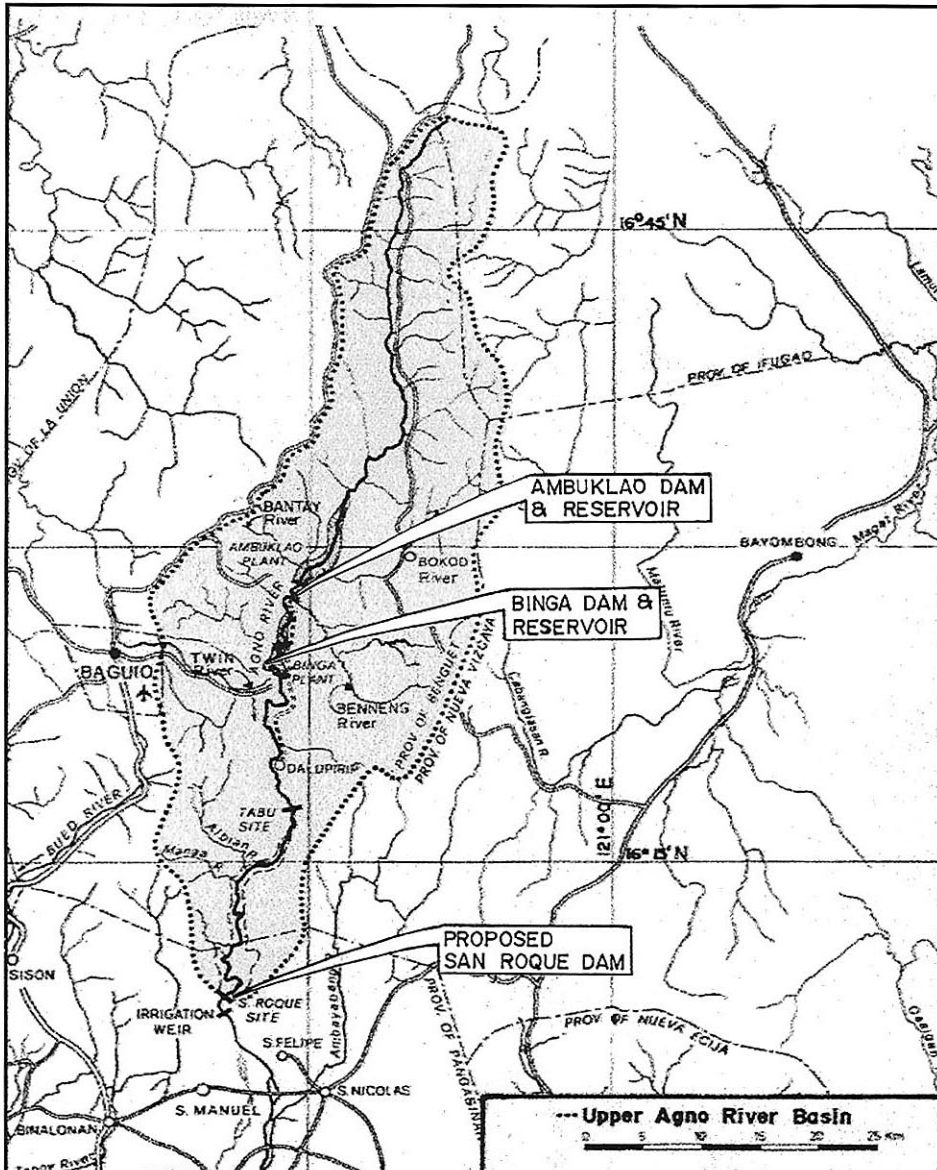
The water resources of the Agno river basin include significant quantities of surface water and groundwater originating from the high intensity of rainfall in the watershed. Heavy precipitation generally occurs in June through October during the south-west monsoon with August usually the month of heaviest rainfall. The watershed receives approximately an annual average of 2,800 mm of rainfall. The average annual runoff is 94 m<sup>3</sup>/s varying throughout the basin. At Ambuklao, with a drainage area of 617 km<sup>2</sup>, the annual runoff is 46.0 m<sup>3</sup>/s. From Ambuklao to Binga, with a drainage area of 263 km<sup>2</sup>, the annual runoff is 14 m<sup>3</sup>/s and downstream of Binga to San Roque, it is 34 m<sup>3</sup>/s.

Because of the predominantly fertile alluvial soils in the plains, large and small water impounding reservoirs used for irrigation and power supply are abundant within the basin. The basin has an immense potential for multipurpose projects. Two multipurpose reservoirs are already existing, at Ambuklao and Binga dams, and there are proposals for a dam and a reservoir at San Roque. The Ambuklao Dam, constructed in 1956, is rockfill type, 129 m high with a reservoir capacity of 329x10<sup>6</sup> m<sup>3</sup>. The hydro-power station at Ambuklao which has a maximum output of 75 MW is one of the main sources of power for the Luzon island. It has been in operation since 1956, but has ceased operating in 1990 because of the damages it suffered from the major Luzon earthquake that year. The earthquake effects and the high rate of sediment inflow into the reservoir, caused serious problems to the operation of the hydroelectric plant.

The Binga dam, located downstream of Ambuklao, is another 107 m high rockfill dam. It has a storage capacity of 87x10<sup>6</sup> m<sup>3</sup>. The Binga hydroelectric plant was put into commercial operation in 1960. The power plant which operates at a maximum capacity of 100 MW together with that at Ambuklao provides for the peak demand from the Manila area of the Luzon Grid. Due to the increasing power demand of the Luzon Grid and the stoppage in the

operations of Ambuklao plant, the construction of the 345 MW San Roque hydroelectric plant, downstream of Binga, in San Manuel Pangasinan will start soon. The expected completion of the San Roque Multipurpose reservoir in the year 2004 will prevent the yearly flooding in the 16 towns of Pangasinan and provide irrigation facilities to farmlands of Pangasinan, Nueva Ecija and Tarlac. Manila area of the Luzon Grid. Due to the increasing power demand of the Luzon Grid and the stoppage in the operations of Ambuklao plant, the construction of the 345 MW San Roque hydroelectric plant, downstream of Binga, in San Manuel Pangasinan will start soon. The expected completion of the San Roque Multipurpose reservoir in the year 2004 will prevent the yearly flooding in the 16 towns of Pangasinan and provide irrigation facilities to farmlands of Pangasinan, Nueva Ecija and Tarlac.

5.2 Map of Water Resource Systems





## 7. References, Databooks and Bibliography

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- JICA Report (1988) : *Draft Report on Study of Binga Dam Rehabilitation Project* December 1988. (4.7, 5.1)
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- National Power Corporation (1979) : *Feasibility Study Report on San Roque Multipurpose Project*, March 1979. (3.1, 4.1, 5.1, 5.2)