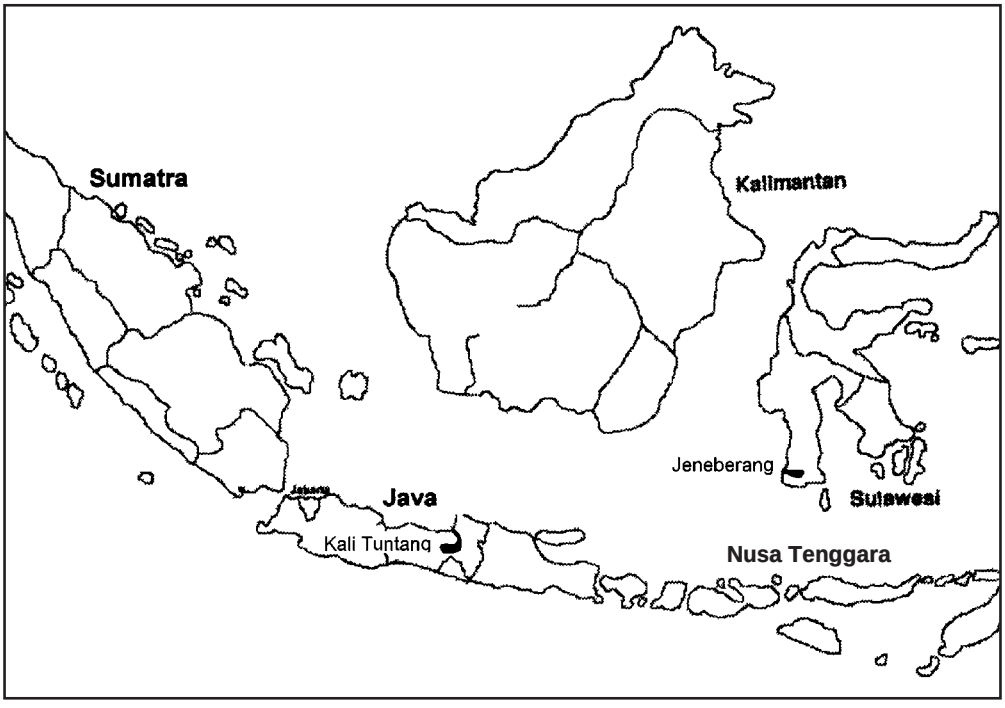
Indonesia

Indonesia-9: Kali Tuntang

Indonesia-10: Jeneberang River



Introduction

The Indonesia archipelago, situated in South-east Asia, consists of five main islands (Sumatra, Kalimantan, Sulawesi, Java and Irian Jaya) and some 13,667 other smaller islands with a total area of 1.9×10^6 km^2. Geographically, Indonesia is located between the latitudes 6° 08' N - 11° 15' S, and longitudes 94° 45' E - 141° 05' E. The total population according to the 1990 census was 179.4 million with the forecast increase at about 1.98 % per year. Population distribution is uneven throughout the country. Java Island has the highest population density whereas the outer islands have very much lower densities.

Politically, Indonesia is divided into 27 provinces, 241 districts, 55 urban municipalities, 3,625 sub-districts and 67,033 villages. Most of the rivers are short, steep and productive in sedimentation. Indonesia is a tropical country affected by tropical monsoon rainfall and has distinct dry and wet seasons. In the wet season, heavy rainfall occurs, ranging from 2,500 up to 6,000 mm/year. The dry season is normally between July and September.

The two rivers catalogued in this volume are the Kali Tuntang located in Java Island, and the Jeneberang River located in Sulawesi Island. They are representative rivers of flood, urban megalopolis conditions, industrial development and agricultural areas.

The Kali Tuntang is located in the Central Java Province, Java Island. The river leaves the lake of Rawa Pening to the northeast, and then changes direction to flow to the northwest before flowing out into the Java Sea on the north coast of Java. The main problem caused by the river is flooding especially downstream of the Glapan Weir. The water of Rawa Pening Lake is used for irrigation, hydropower, fisheries, tourism and water sport, and domestic water supply.

The Jeneberang River is located in the South Sulawesi Province, Sulawesi Island. A major reservoir and a number of small irrigation ponds have been constructed in this basin. It has a long history of flooding and provides water for agricultural and urban needs

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The organizations that have contributed include:

Badan Pertanahan Nasional *(National Board for Land Administration)*.
Badan Perencanaan dan Pembangunan Daerah *(Provincial Development Planning Board)*.
Badan Meteorologi dan Geofisika *(Agency for Meteorology and Geophysics)*.
Direktorat Geologi *(Directorate of Geology)*
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Proyek Induk Pengembangan Wilayah Sungai Jratunseluna *(Jratunseluna River Basin Development Project)*.
Proyek Induk Pengembangan Wilayah Sungai Jeneberang *(Jeneberang River Basin Development Project)*.
Pusat Penelitian dan Pengembangan Sumber Daya Air *(Research Institute for Water Resources)*.

Kali Tuntang

Map of River

Table of Basic Data

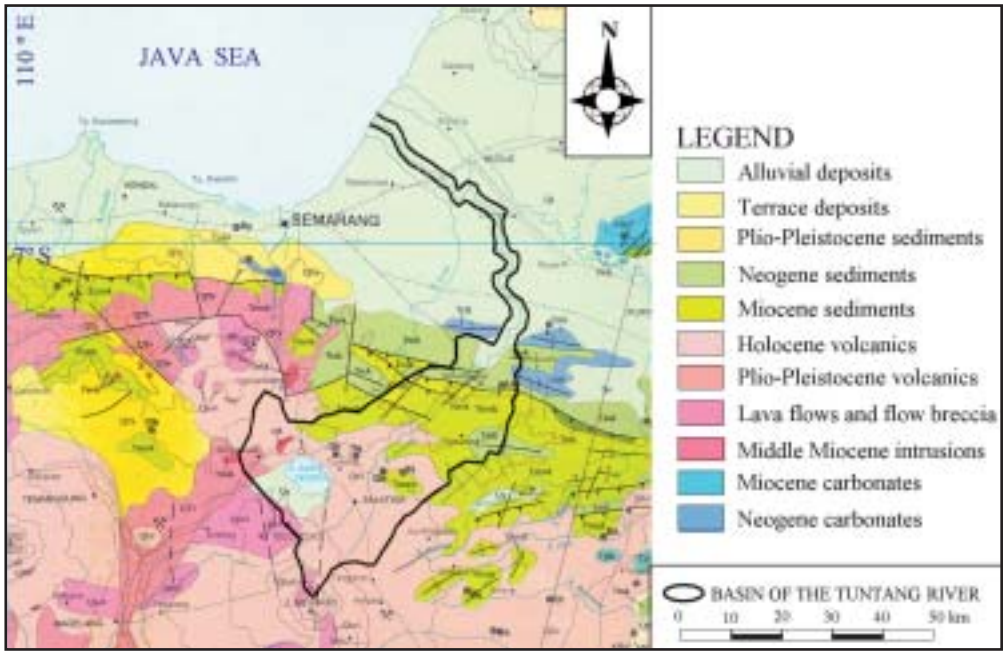
Name(s): Tuntang River		**Serial No. :** Indonesia-9
Location: Java Island, Indonesia	E 110° 15' 50" - 110° 33' 20"	S 06° 51' 25" - 07° 26' 40"
Area: 798 km^2	**Length of the main stream:** 139 km	
Origin: Mt. Merbabu (3,142 m)	**Highest Point:** Mt. Merbabu (3,142 m)	
Outlet: Java sea	**Lowest Point:** River mouth (0 m)	
Main geological features: Alluvial, Miocene sedimentary, Plio-pleistocene sedimentary, Neogene sedimentary, Miocene- sedimentary, Holocene volcanics, Lava flows and flow breccia.		
Main tributaries: Senjoyo River (120 km^2), Bancak River (140 km^2).		
Main lakes: Rawa Pening		
Main reservoirs: -		
Mean annual precipitation: 2,588 mm (1917 - 1989) (basin average)		
Mean annual runoff: 28.43 m^3/s at Glapan (798 km^2) (1953 - 1989)		
Population: 738,000 (1997)	**Main cities:** Salatiga, Ambarawa	
Land use: Forest (21.3%), Paddy Field (30.5%), Agriculture (37.5%), Urban (7.7%), Water surface (3.0%) (1993)		

1. General Description

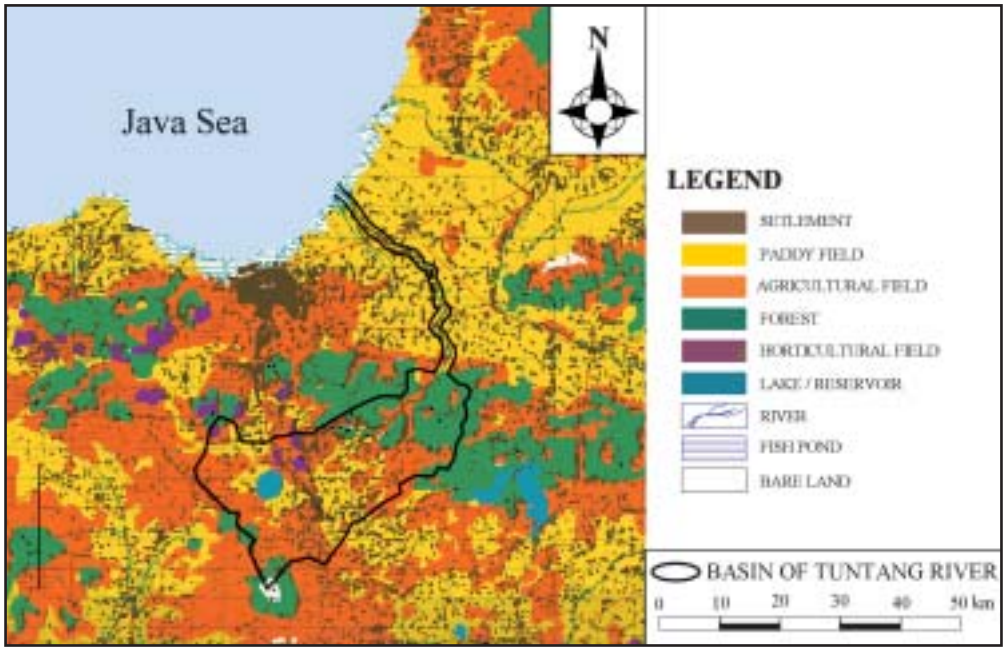
The Tuntang River is one of the major rivers located to the east of Semarang, the capital city of Central Java Province, and to the west of the town of Demak. The river drains the northern part of Mt. Merbabu (3,142 m), the southern part of Mt. Ungaran (2,050 m), the northern and eastern flanks of Mt. Telomoyo (1,994 m), the Rawa Pening, the hills forming the divide between the Rawa Pening and the middle Tuntang, the hills between the Serang and Tuntang rivers and, finally, the hills dividing the Tuntang and Jragung catchments. Mt. Merbabu, Mt. Ungaran, and Mt. Telomoyo are extinct volcanoes. Rawa Pening is a large natural depression fed by rivers draining Mts. Merbabu, Ungaran and Telomoyo, and by a number of springs. The only outlet from the Rawa Pening is the Tuntang river which leaves to the northeast, then changes direction downstream of the Glapan Weir to flow to the northwest before flowing out into the Java Sea. The Glapan Weir was constructed between 1853-1859 at the location where the Tuntang River enters the alluvial coastal plain. It was built for irrigation of both the left and right banks of river. The Tuntang River has a catchment area of 798 km^2 at the Glapan Weir, including 282 km^2 of the upper catchment, which drains directly into Rawa Pening. Below the Glapan Weir there are no additional inflows to the Tuntang River. The length of the river between Mt. Merbabu and the site of the Glapan Weir is approximately 70.5 km and the whole length of the Tuntang River is about 139 km. The average annual rainfall in the basin is 2,588 mm. The basin population was about 738,000 in 1997.

2. Geographical Information

2.1 Geological Map



2.2 Land Use Map

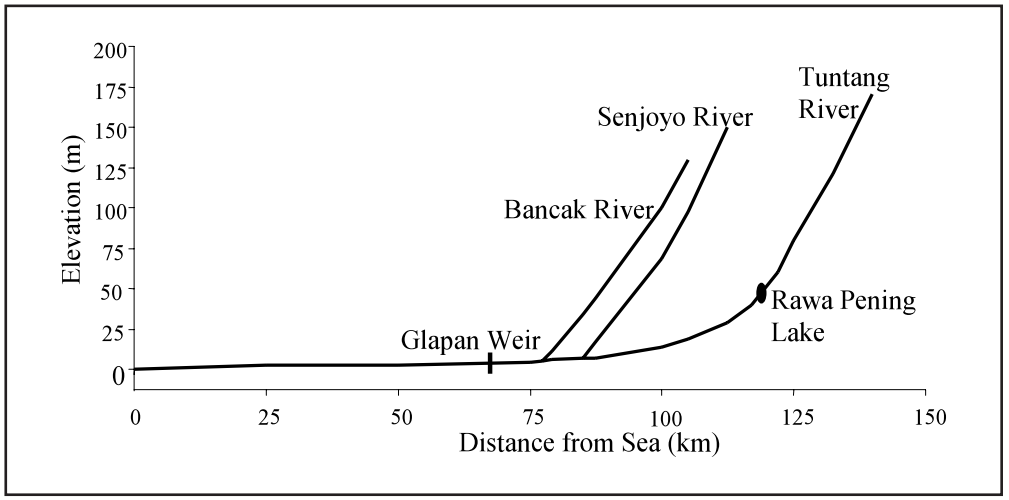


2.3 Characteristics of the River and the Main Tributaries

No.	Names of Rivers	Length [km] Catchment area [km^2]	Highest peak [m] Lowest point [m]	Cities Population (1997)	Land use [%] (1993)
1	**Tuntang River** (Main River)	139 798	Mt. Merbabu, 3,142 River mouth, 0	Ambarawa 42,900	A (37.5) F (21.3) L (3.0) P (30.5) U (7.7)
2	**Senjoyo River** (Tributary)	37 120	Mt. Merbabu, 3,142 Confluence, 75	Salatiga 104,834	
3	**Bancak River** (Tributary)	30 140	------- Confluence, 50		

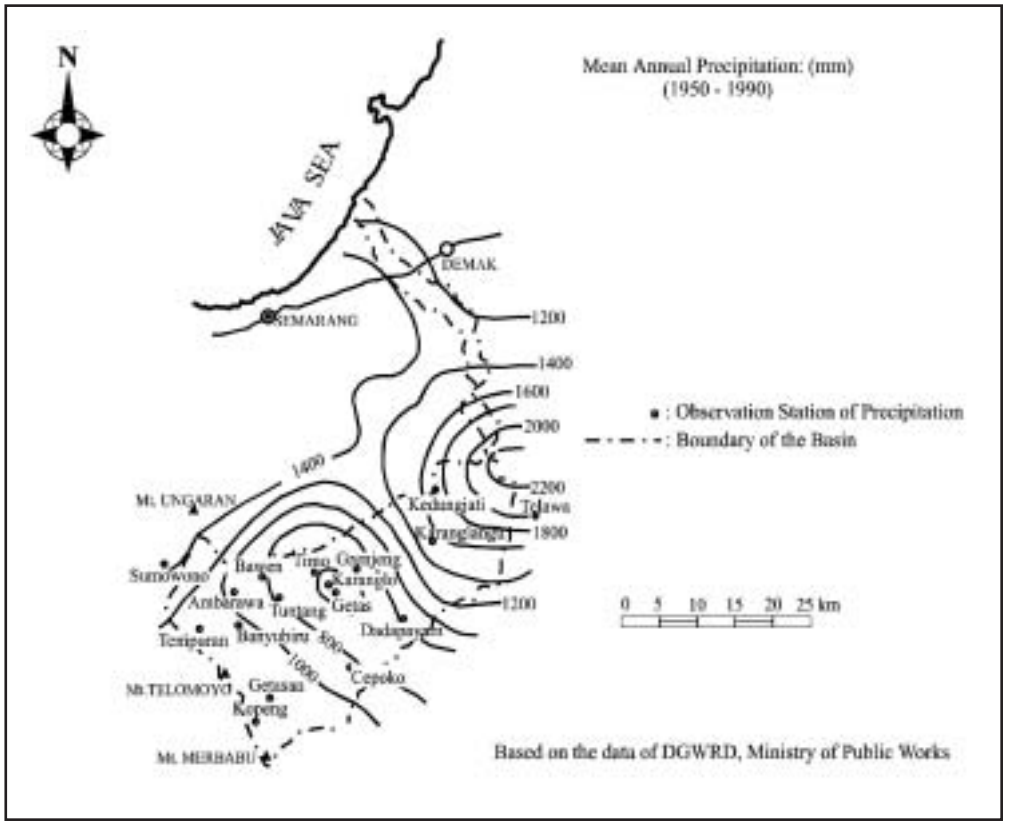
A: Agricultural F: Forest L: Lake, river, marsh P: Paddy Field U: Urban

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



3.2 List of Meteorological Observation Stations

No.	Station	Elevation [m]	Location	Observation Period	Mean annual precipitation [mm]	Mean annual Evaporation [mm]	Observation items
1.	**Semarang**	3	S 06° 59' 09" E 110° 19' 10"	1983 - 1999	2,233	1,607	DS, E, RH, T, WV
2.	**Paras**	23	S 07° 05' 54" E 110° 33' 20"	1984 - 1999	2,643	1,280	DS, E, RH, T, WV
3.	**Getas**	300	S 07° 16' 09" E 110° 26' 00"	1983 - 1999	2,357	1,082	DS, E, T, WV
4.	**Gubug**	24	S 07° 01' 22" E 110° 37' 10"	1983 - 1999	2,208	1,466	DS, E, RH, T, WV

T: Temperature RH: Relative Humidity E: Evaporation WV: Wind Velocity
DS: Duration of Sunshine

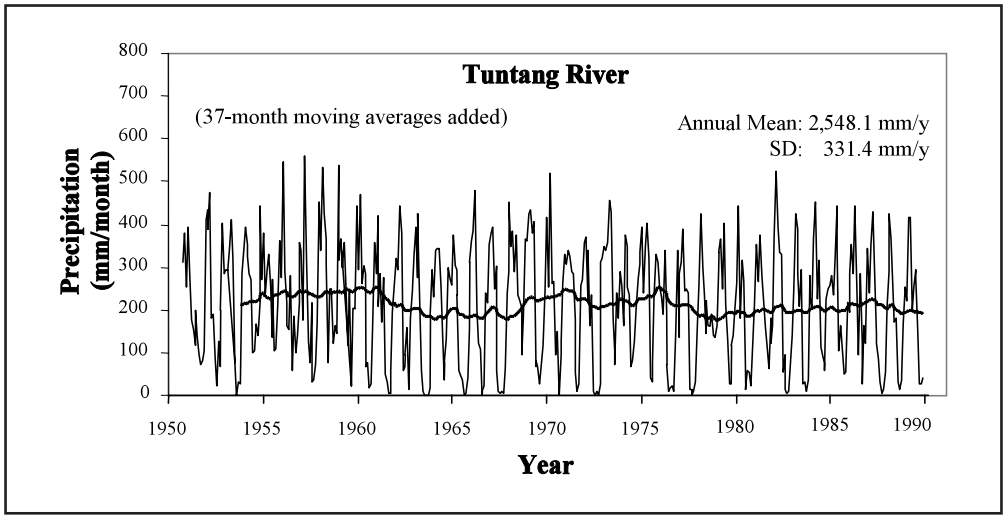
3.3 Monthly Climate Data

Station: Gubug

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	25.2	25.6	26.2	26.3	26.7	26.1	26.1	26.5	26.8	26.7	26.1	25.6	26.1	1983-1999
Evaporation* [mm]	91.8	92.2	106.3	108.4	122.8	107.6	119.1	154.8	159.5	159.7	122.1	100	1,466	1983-1999
Relative Humidity [%]	84.5	84.9	83.9	83.8	83.0	83.1	81.9	80.6	78.4	80.3	81.5	82.8	82.2	1983-1999
Duration of sunshine [hr]	167	188	199	238	269	271	285	296	298	274	224	189	2,905	1983-1999

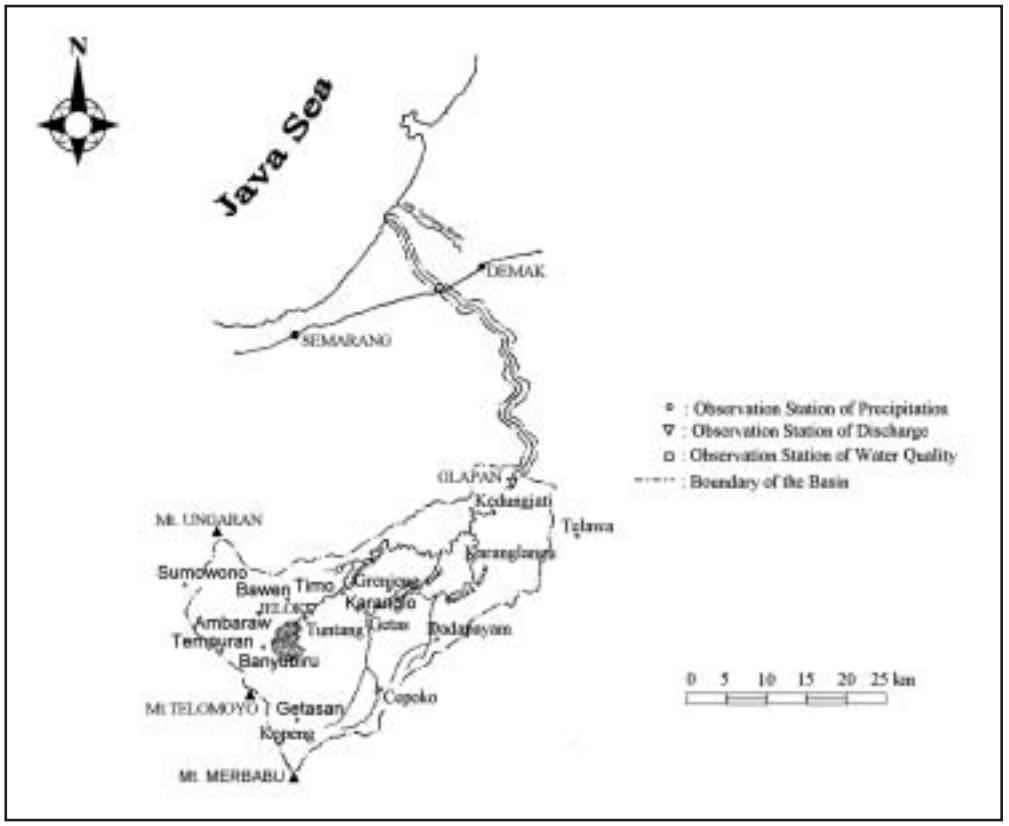
* Average using Class A Pan

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



4.2 List of Hydrological Observation Stations

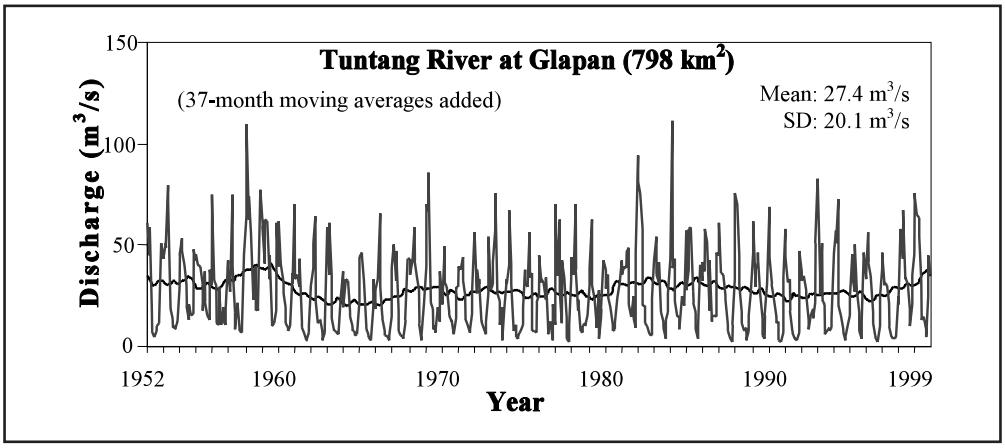
No.	Station	Location	Catchment area [km^2]	Observation period	Observation items[1)] (frequency)
1	Glapan	E 110° 04' 40" S 07° 07' 11"	798	1952 - 1999	Q

[1] Q: discharge

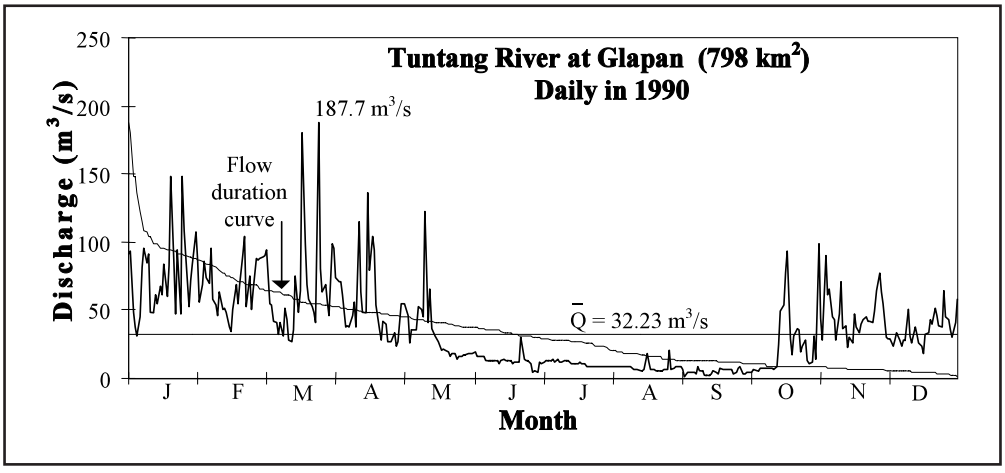
No.	$\overline{Q}$[a)] [m^3/s]	Qmax[b)] [m^3/s]	$\overline{Q}$max[c)] [m^3/s]	$\overline{Q}$min[d)] [m^3/s]	$\overline{Q}$/A [m^3/s/100km^2]	Qmax/A [m^3/s/km^2]	Period of statistics
1	27.7	1,088.	500.	4.50	3.48	1.37	1952 - 1999

[b] mean annual discharge [c] maximum discharge [d] mean annual maximum discharge
[e] mean annual minimum discharge measured over half months

4.3 Long-term Variation of Monthly Discharge



4.4 Annual Pattern of Discharge



4.5 Unique Hydrological Features

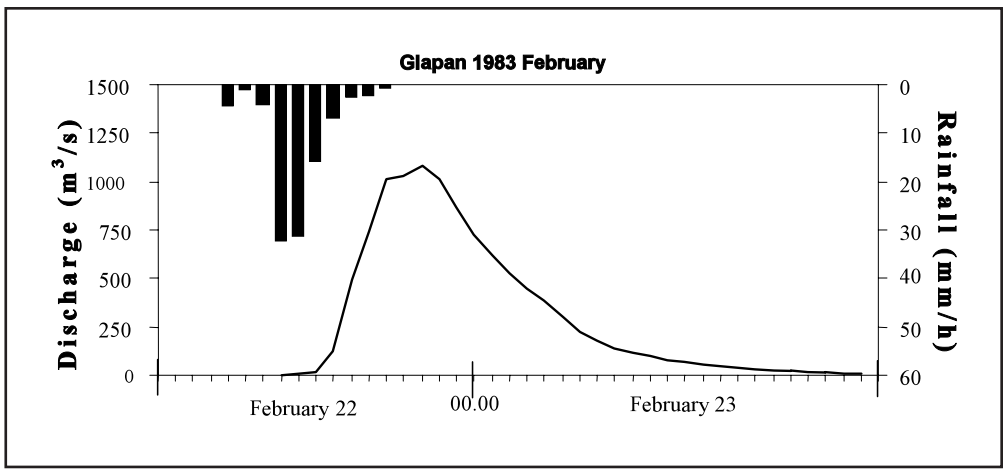
Where the Tuntang River enters the alluvial coastal plain, the Glapan Weir was constructed during 1853-1859 for irrigation of both the left and right banks of the downstream area. Below the Glapan Weir, the channel of the Tuntang River is enclosed between levees that were constructed in the period of 1886-1890 to protect the surrounding area that had just been brought under irrigation. Due to accretion of the channel the levees have had to be raised repeatedly over time, so that now the riverbed is higher than the surrounding area. From the Glapan Weir to the river mouth there are no additional inflows to the river and this brings about the unusual shape of the catchment. Below the Glapan Weir the lower the elevation of the river, the lower is the maximum discharge. Originally, the Tuntang River used to run through the town of Demak. To prevent the recurrent inundations of Demak, a short cut was made from Wonosalam to the sea at the time the levees were built. This cut, which bears the name Kali Kontrak, is the present lower course of the Tuntang River. Originally a gated structure at Wonosalam permitted release of some water to the old Tuntang River (Kali Tuntang Lama). The remains of this structure can still be seen, although it has been closed and is partially buried under fill.

4.6 Annual Maximum and Minimum Discharges at Glapan (798 km^2)

Year	Maximum*)		Minimum*)		Year	Maximum*)		Minimum*)	
	Date	[m^3/s]	Date	[m^3/s]		Date	[m^3/s]	Date	[m^3/s]
1955	11.20	414	10	7.6	**1974**	3.05	468	9	2.2
1958	3.13	363	10	12.3	**1975**	5.25	437	10	6.5
1959	7.02	425	9	7.5	**1976**	3.19	635	10	2.5
1960	5.29	348	9	7.7	**1977**	11.30	428	10	2.5
1961	5.03	477	10	2.5	**1978**	1.19	325	7	6.2
1962	1.21	287	10	2.5	**1979**	1.16	462	9	2.5
1963	1.10	635	9	6.4	**1980**	1.22	1,088	1	4.9
1964	2.01	308	10	4.8	**1981**	4.21	582	11	7.4
1965	4.09	442	9	3.2	**1982**	2.06	718	11	3.1
1966	2.18	356	10	3.3	**1983**	2.22	1,084	9	3.3
1967	1.02	323	9	3.8	**1984**	2.01	652	8	8.0
1968	1.02	486	10	3	**1985**	2.22	489	9	2.6
1969	2.18	406	11	0.2	**1986**	6.04	556	9	7.3
1970	4.05	287	10	2.4	**1987**	2.25	519	10	1.0
1971	4.11	384	9	6.9	**1988**	2.10	477	9	2.5
1972	12.18	420	9	6.9	**1989**	2.13	847	10	2.2
1973	5.29	522	10	2.7	**1990**	2.25	335	10	0.7

*) Instantaneous observation from a recording chart

4.7 Hyetographs and Hydrographs of Major Floods

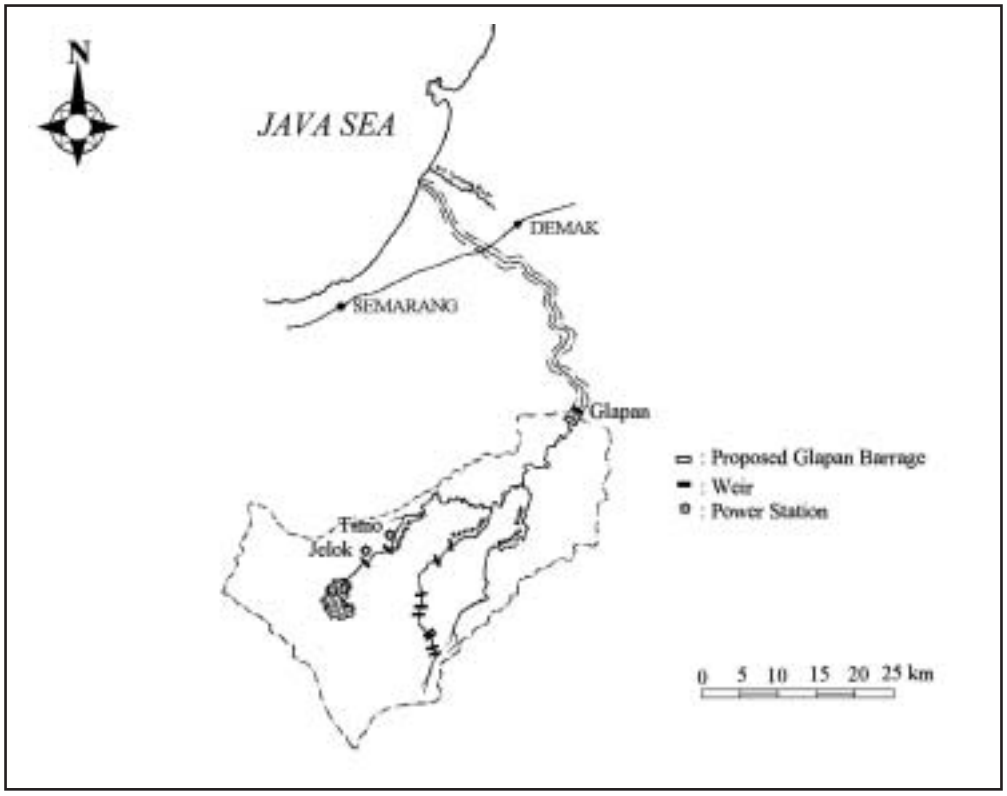


5. Water Resources

5.1 General Description

The 798 km^2 catchment of the Tuntang River is 2.45 % of the land area of Central Java Province (32,544 km^2). The Rawa Pening Lake has a maximum storage capacity of 65 x 10^6 m^3 fed by 9 small rivers and 4 springs, the most important of which are the so called Muncul springs which have a firm yield of approximately 2 m^3/s. The Rawa Pening Lake is used for irrigation, hydropower, fisheries, tourism and water sport, and domestic water supply especially for the Demak District. The Jelok Weir at the outlet of Rawa Pening acts as the intake structure for the Jelok and Timo power stations. From the Jelok Weir, the water is diverted nearly 3 km to the Jelok power station via a 15 m^3/s waterway (mostly in tunnels). The 21 MW Jelok power station was built in 1938, while the 12 MW Timo power station was built in 1963. The Glapan Weir (approximately 60 km downstream of the Jelok Weir) was constructed for irrigation of 20,508 ha of paddy fields. In the tributaries, especially in the Senjoyo River, many small weirs have been built. A barrage is proposed approximately 500 m upstream of the Glapan Weir.

5.2 Map of Water Resources System



5.3 List of Major Water Resources Facilities

Major Lakes

Name of river	Name of lake	Catchment Area [km^2]	Maximum capacity [$10^6 m^3$]	Minimum capacity [$10^6 m^3$]	Purpose[1)]	Year of completion
Tuntang	Rawa Pening	282	65	25	A, P	Natural lake

Others

Name of River	Facilities	Purpose[1)]	Capacity	Year of completion
Tuntang	**Glapan Weir**	A	20,508 ha	1859
Tuntang	**Jelok Weir**	A	279 ha	1938
Tuntang	**Jelok Power Station**	P	2,098 MW	1938
Tuntang	**Timo Power Station**	P	1,200 MW	1963
Senjoyo	**Senjoyo Weir**	A	2,356 ha	
Senjoyo	**Grenjeng Weir**	A	750 ha	
Senjoyo	**Cepoko Weir**	A	621 ha	
Senjoyo	**Sucen Weir**	A	595 ha	
Senjoyo	**Belon Weir**	A	319 ha	
Senjoyo	**Gendor Weir**	A	138 ha	
Senjoyo	**Aji Getas Weir**	A	119 ha	
Bancak	**Sicangkring Weir**	A	273 ha	

1) A: Agricultural use, P: Hydro-power.

5.5 Water Quality

River Water Quality at Pantura Bridge

Date	November 10, 1998
pH	7.6
DO [mg/l]	5.4
COD [mg/l]	6.2
Suspended Solid [mg/l]	420
Fecal coli x $10^{4*)}$	5.5

*) Membrane Filter Methods, colonies/100ml

6. Socio-Cultural Characteristics

Many people in the catchment area still conduct a traditional ceremony called “Selamatan” (meal-ceremony) connected with agricultural activities, in which they ask God’s blessing. In the non-irrigated area, all of the villagers still conduct this kind of selamatan, while in the irrigated area approximately 50% of the inhabitants no longer conduct the ceremony. It seems that villagers in the irrigated area are more rational than in the non-irrigated area. The religious life of the community is dominated by Islam, and spread by the famous “Wali Songo” (Nine Moslems Saint). With the influence of Islam, the traditional ceremony has taken on a Moslem tinge and now is connected with Islam. There is a legend of Rawa Pening Lake in which a poor ugly boy namely Baru Klinting won a contest to pull out a palm leaf rib that was embedded in the earth. As soon as the boy pulled out the rib, water spurted from the earth and created the lake of Rawa Pening. The legend is still famous, especially in the Java Island.

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