

Kali Brantas

Map of River

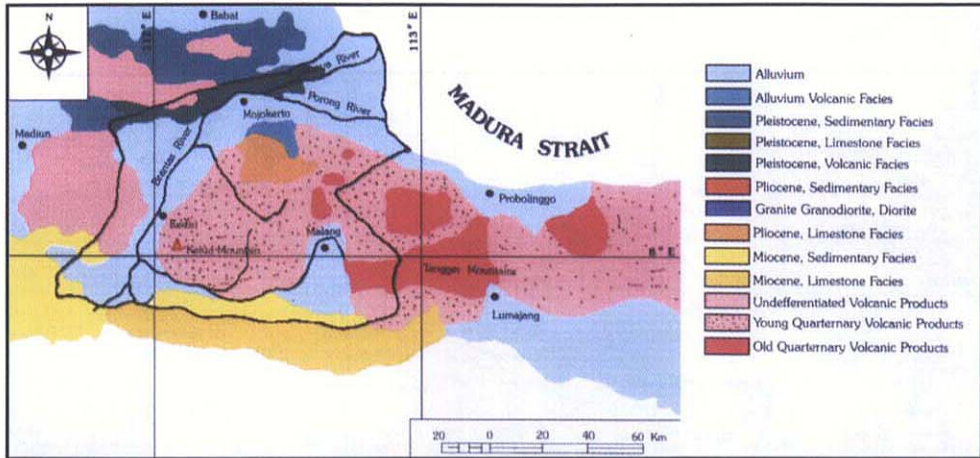


Table of Basic Data

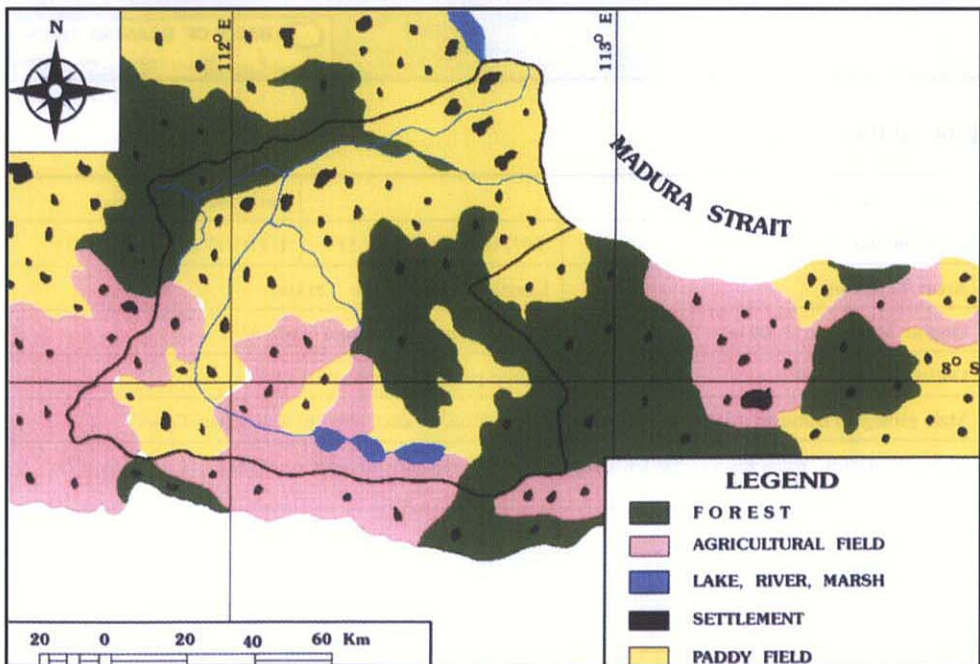
Name: Brantas River		Serial No.: Indonesia-3	
Location: Java Island, Indonesia		S 07° 10' 27" ~ 08° 15' 54"	E 111° 30' 22" ~ 112° 55' 33"
Area: 12 000 km ²		Length of main stream: 320 km	
Origin: Mt. Arjuno (3 399 m)		Highest point: Mt. Semeru (3 676 m)	
Outlet: Madur Strait		Lowest point: River mouth (0 m)	
Main geological features: Alluvium, Young Quaternary Volcanic Product, Miocene Sedimentary Facies			
Main tributaries: Widias River (1 538 km ²), Ngrowo River (1 423 km ²), Konto River (687 km ²), Lesti River (625 km ²)			
Main lakes: None			
Main reservoirs: Sutami reservoir (343 x 10 ⁶ m ³ , 1972), Wlingi reservoir (24.1 x 10 ⁶ m ³ , 1978), Sengguh reservoir (22.4 x 10 ⁶ m ³ , 1988)			
Mean annual precipitation: 2 000 mm			
Mean annual runoff: 194 m ³ /s at Mojokerto (8 650 km ²) (1983~1991)			
Population: 13 250 000 (1990)		Main cities: Surabaya, Malang, Tulungagung, Kediri, Mojokerto	
Land use: Forest (22.1%), Paddy field (29.24%), Other agriculture (19.81%), Urban (28.85%) (1993)			

2. Geographical Information

2.1 Geological Map



2.2 Land Use Map



1. General Description

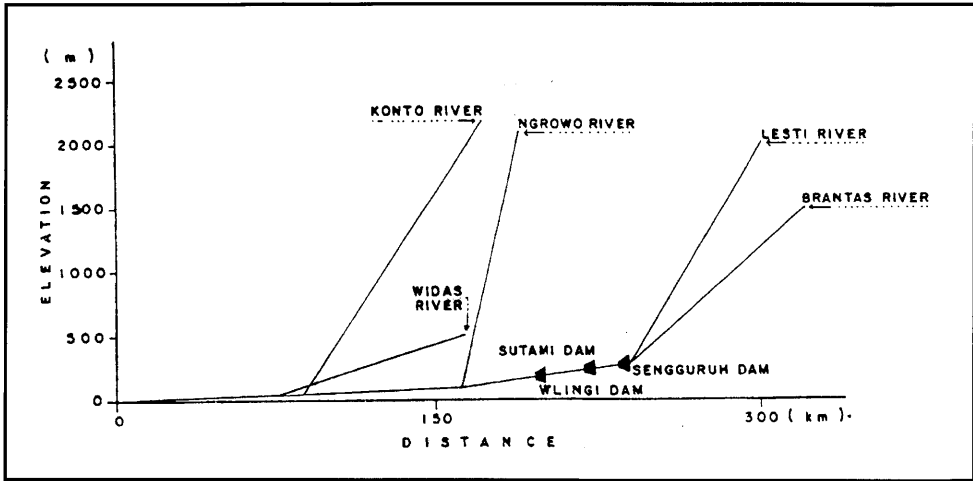
The Brantas River, 320 km long with 39 tributaries and draining an area of about 12 000 km², is the second largest river in Java Island. It originates from the south western slope of Mt. Arjuno and flows out into the Madura Strait. The river is surrounded by the Kelud mountain range in the central part of the basin, the Semeru mountain in the east, the Wilis in the west, and a series of low hills along the northern and southern parts. Mt. Kelud is an active volcano which has a history of eruption once every 15-30 years. When it erupts, hundreds of millions of cubic metres of volcanic material flow down the surrounding slopes and finally end up in the Brantas River. Tropical monsoon climate characterised by distinct wet and dry seasons is predominant in the basin. The average annual rainfall in the basin is 2 000 mm and the annual discharge at Mojokerto (8 650 km²) has been 194 m³/s in 1990. Several dams including the Sutami with a capacity to store 343 x 10⁶ m³ built in 1972, the Wlingi with a capacity of 24.1 x 10⁶ m³ built in 1978 and the Sengguruh with a capacity of 22.4 x 10⁶ m³ built in 1988 exist in the basin. The Kali Brantas is used for irrigation, domestic and industrial water supply, hydropower generation etc. The population in the Kali Brantas basin in 1990 has been 13.25 million.

2.3 Characteristics of River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km ²]	Highest peak [m] Lowest point [m]	Cities Population (1990)	Land use [%] (1993)			
					A	F	P	U
1	Brantas (Main River)	320 12 000	Mt. Arjuno, 3 339 -----	Surabaya 2 270 081 Kediri 231 371 Mojokerto 100 881	19.8	22.1	29.2	28.9
2	Widas (Tributary)	85 1 538	Mt. Wilis, 2 169 -----	Nganjuk 955 354	16.4	29.6	30.6	23.4
3	Konto (Tributary)	85 687	Mt. Anjasmoro, 2 277 -----	Kertosono 51 898	41.6	47.6	5.3	5.5
4	Ngrowo (Tributary)	29 1 423	Mt. Wilis, 2 169 -----	Tulungagung 911 706	21.5	33.9	41.9	2.7
5	Lesti (Tributary)	61 625	Mt. Semeru, 3 676 -----	Turen 93 151	78.3	13.2	2.5	6.0

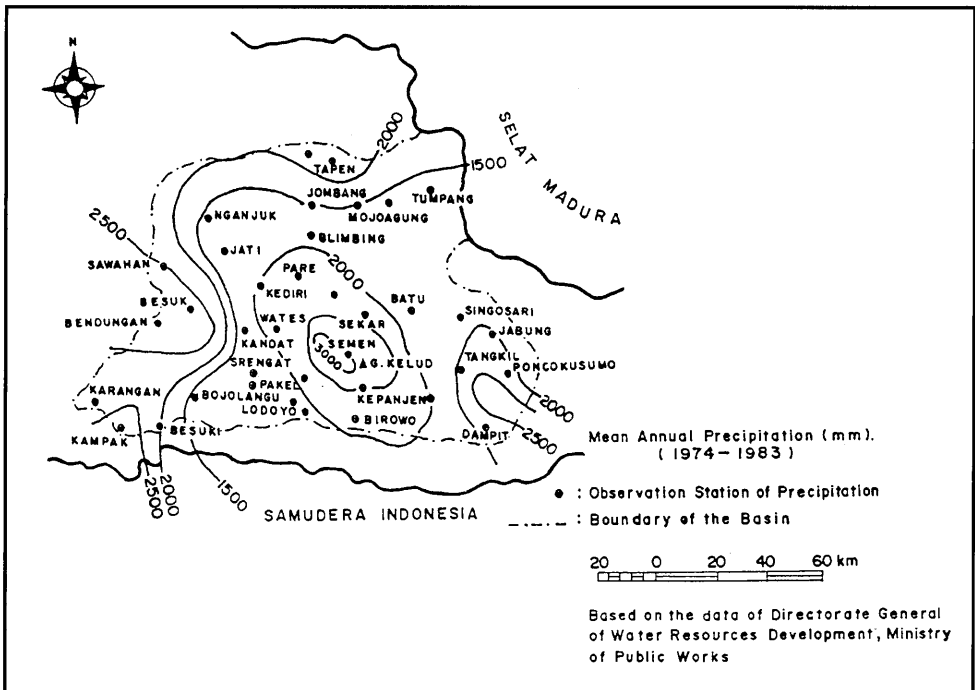
A: Other agricultural field F: Forest P: Paddy field U: Urban

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⁾
021	Malang	505	S 07° 58' 11" E 112° 37' 52"	1978~1989	2 008	766.5	E, RH, T, WV
123	Karangates	222.2	S 08° 09' 51" E 112° 27' 21"	1972~1989	1 883	730	E, RH, T, WV
122	Wlingi	178.8	S 08° 08' 36" E 112° 21' 00"	1974~1989	1 785	868.5	E, RH, T, WV
215	Mrican	60.0	S 07° 47' 40" E 112° 00' 53"	1975~1984	1 348	1 642.5	E, RH, T, WV
118	Selorejo	637	S 07° 53' 20" E 112° 21' 14"	1973~1983	2 064	1 602	E, RH, T, WV
314	Bening	107.8	S 07° 32' 00" E 111° 46' 00"	1973~1983	1 561	-	RH, T, WV
211	Mojoagung	28.0	S 07° 34' 17" E 112° 20' 24"	1973~1983	1 099	739.5	E, RH, T, WV
510	Porong	10.5	S 07° 16' 00" E 112° 42' 00"	1973~1988	551	985.5	E, RH, T, WV

1) E: Evaporation RH: Relative humidity T: Temperature WV: Wind velocity

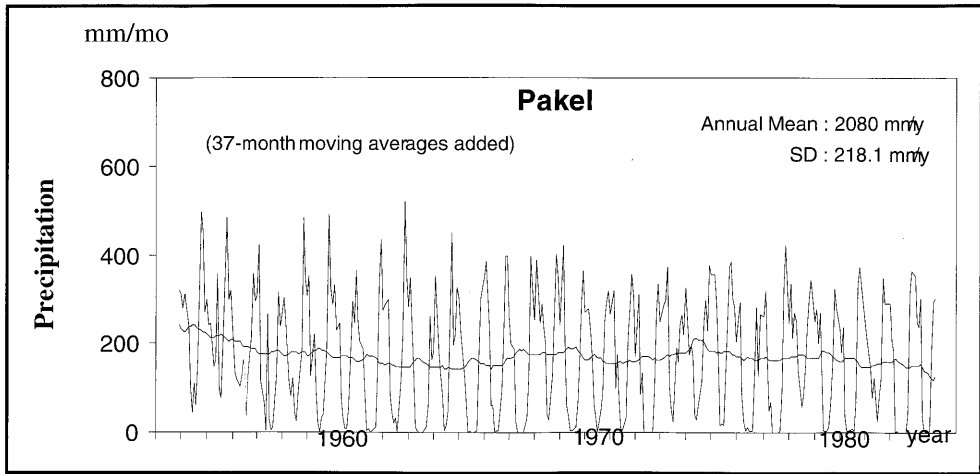
3.3 Monthly Climate Data

Station: Malang

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	24.0	24.1	24.3	24.4	24.3	23.6	23.0	23.4	23.9	24.8	24.8	24.2	24.1	1973~1983
Precipitation [mm]	338	258	240	200	163	78	48	13	34	91	229	316	2 008	1973~1983
Evaporation* [mm]	55.8	44.8	57.2	54.0	62.0	69.0	73.4	86.8	78.0	93.0	54.0	52.7	776.24	1973~1983

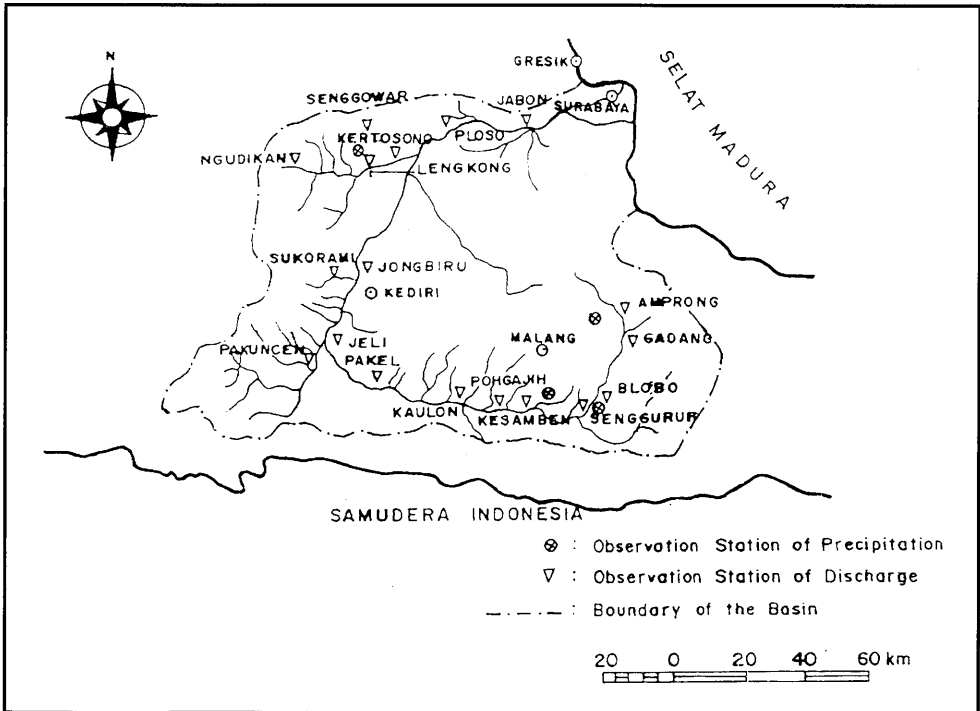
* Average using Class A Pan

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

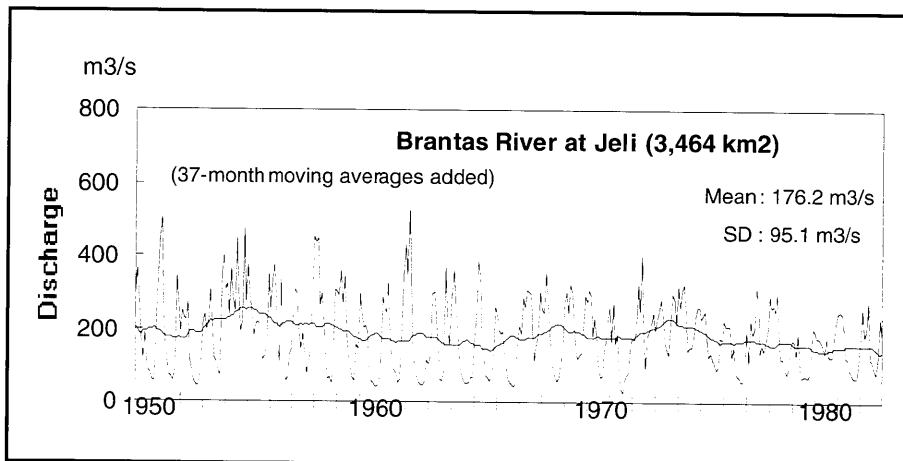
No.	Station	Location	Catchment area (A) [km ²]	Observation period	Observation items ¹⁾ (frequency)
1	Pakel	S 08° 04' 00" E 111° 58' 00"	3 410	1951~1993	Q(d), Q(m)
2	Jeli	S 08° 00' 00" E 111° 55' 00"	3 464	1951~1993	Q(d), Q(m)
3	Jong biru	S 07° 47' 00" E 112° 00' 00"	4 546	1951~1990	Q(m)
4	Kertosono	S 07° 36' 00" E 112° 06' 00"	5 106	1951~1990	Q(m)
5	Jabon	S 07° 24' 00" E 112° 29' 00"	8 650	1951~1990	Q(m)

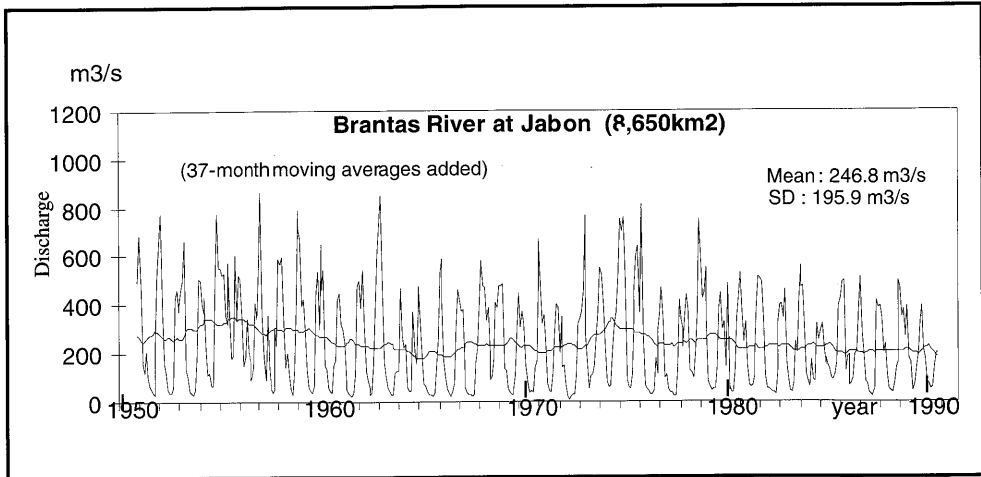
No.	\bar{Q} ²⁾ [m ³ /s]	Q max ³⁾ [m ³ /s]	\bar{Q} max ⁴⁾ [m ³ /s]	\bar{Q} min ⁵⁾ [m ³ /s]	\bar{Q} / A [m ³ /s/100km ²]	Q max / A [m ³ /s/100km ²]	Period of statistics
1	133.8	303.2	226.1	61.17	3.92	8.89	1951~1993
2	188.0	522.5	318.5	75.88	5.43	15.08	1951~1993
3	193.0	459.7	348.3	82.98	4.25	10.11	1951~1990
4	221.5	676.7	403.4	85.25	4.34	13.25	1951~1990
5	258.7	866.1	565.3	46.56	2.99	10.01	1951~1990

1): Q: Discharge
d: Daily
m: Monthly

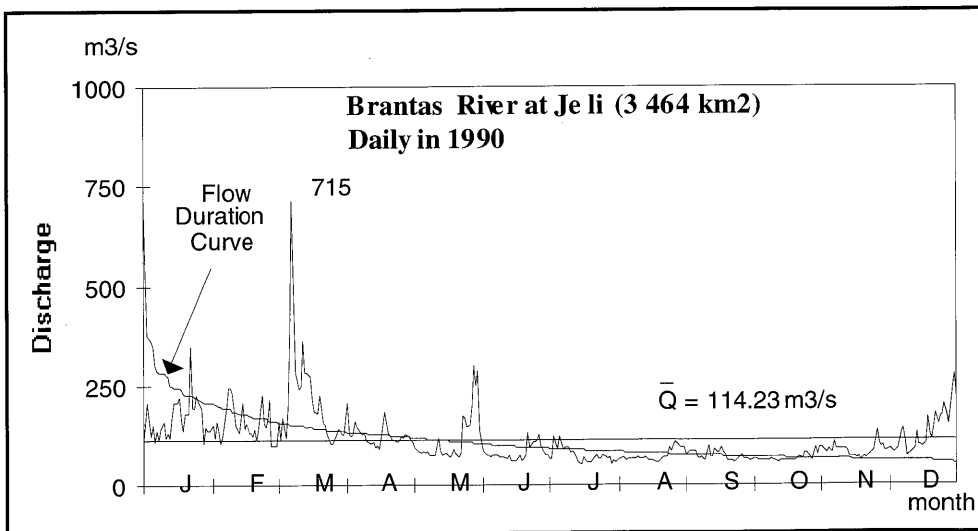
2) Mean annual discharge
3) Maximum monthly discharge
4) Mean maximum monthly discharge
5) Mean minimum monthly discharge

4.3 Long-term Variation of Monthly Discharge

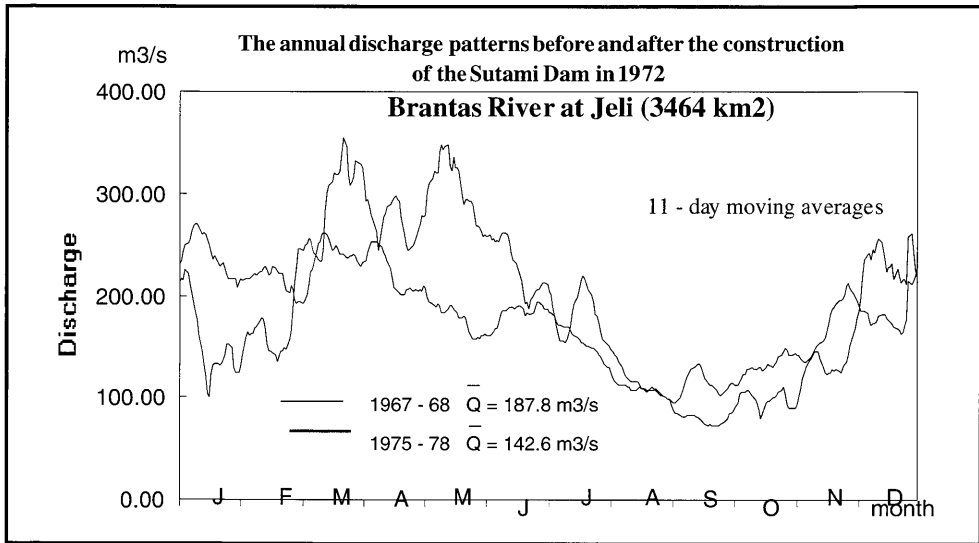




4.4 Annual Pattern of Discharge



4.5 Unique Hydrological Features



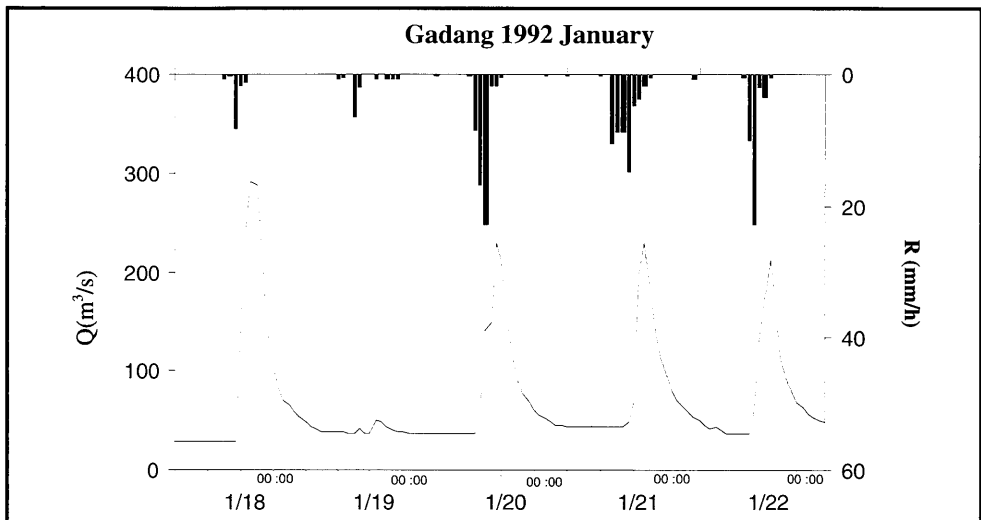
4.6 Annual Maximum and Minimum Discharges

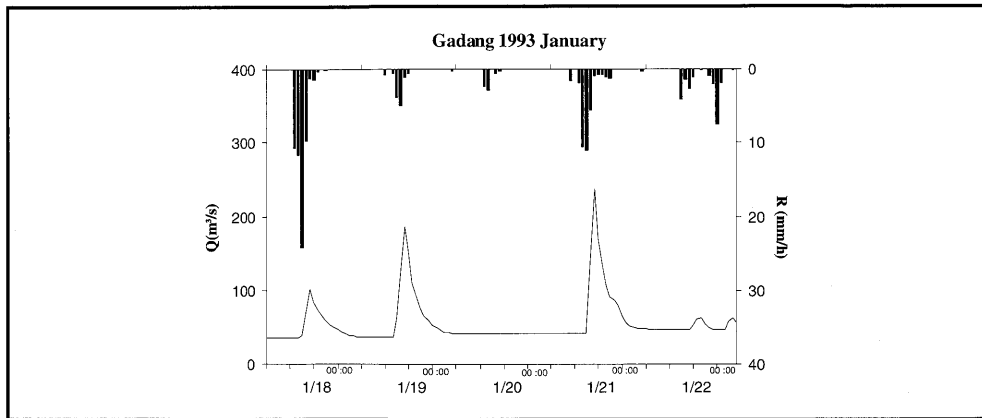
At Pakel [3 410 km²]

Year	Maximum ¹⁾		Minimum ²⁾		Year	Maximum ¹⁾		Minimum ²⁾	
	Date	[m ³ /s]	Month	[m ³ /s]		Date	[m ³ /s]	Month	[m ³ /s]
1973	4.25	448	8	79.9	1978	3.07	466	7	87.3
1974	1.26	311	7	76.8	1979	1.24	485	10	64
1975	1.09	525	7	103	1981	12.14	700	7	68.8
1976	3.07	513	-	-	1982	1.06	716	11	55.1

1), 2) Instantaneous observation by recording chart

4.7 Hyetographs and Hydrographs of Major Floods

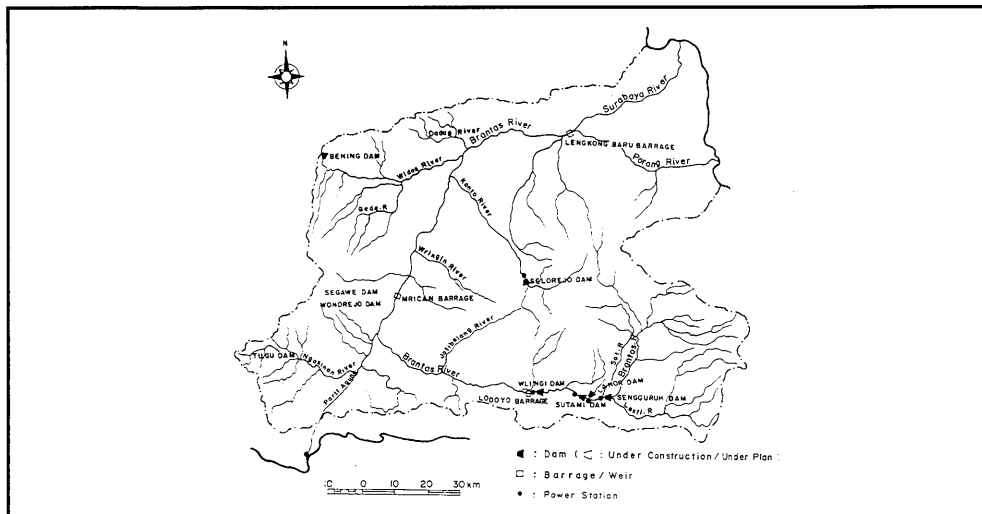




5. Water Resources
5.1 General Description

The Brantas River has about 12 000 km^2 of catchment area or about 9.17% of the extent of Java Island (130 777 km^2). The lower reach bifurcates into the two rivers Surabaya and Porong in Mojokerto. Both these rivers flow out into the Madura Strait. Land and water resource development has a long history in this basin. In 1961, an overall development plan was formulated which has subsequently been reviewed in 1973 and 1985. Based on the plan, several hydraulic structures have been built. In the Brantas catchment area, there are 6 large dams (Sutami, Selorejo, Bening, Lahor, Wlingi and Sengguruh), 3 barrages (Lodoyo, Mrican, and Lengkong Baru) and several weirs. Among the existing dams, the Sutami dam provides for irrigation, hydropower and flood control. In order to reduce the inundation in Tulungagung and its surrounding that occur almost every year, the downstream reach of Ngrowo River course is changed to direct the waters into the Indonesian Ocean by the Tulungagung drainage channel (1986) at the confluence of the Ngrowo and Brantas Rivers. The Parit Agung (24.2 km) has been built in 1986 to divert all Ngrowo floods (486 m^3/s) to the Indonesian Ocean. After the construction of the dams and the Parit Agung, the flooding in Brantas river have been substantially reduced.

5.2 Map of Water Resorces Systems



5.3 List of Major Water Resources Facilities

Major Reservoirs

Name of river	Name of dam	Catchment area [km ²]	Gross capacity [10 ⁶ m ³]	Effective capacity [10 ⁶ m ³]	Purpose ¹⁾	Year of completion
Brantas	Sutami	2 050	343	243	A, F, P	1972
Konto	Selorejo	236	62.3	50.1	A, F, P	1971
Widas	Bening	89.5	37.5	33.0	A, F, P	1981
Lahor	Lahor	2.6	36.1	29.4	A, F, P	1977
Brantas	Lodoyo	3 017	5.9	5.8	A, F, P	1980
Brantas	Wlingi	2 890	24.1	4.40	A, F, P	1977
Brantas	Sengguruh	1 659	22.4	2.5	N, P	1988

Floodways

Name of transfer line	Names of rivers and places connected		Length [km]	Maximum capacity [m ³ /s]	Purpose ¹⁾	Year of completion
	From	To				
Parit Agung	Ngrowo	Tulungagung Tunnel	24.2	486	F, N	1986
Parit Raya	Ngasinan	Parit Agung	17.5	340	F, N	1963
Tulungagung Tunnel	Parit Agung	Indonesian Ocean	1.2	636	F, N, P	1986

Others

Name of river	Facility	Purpose ¹⁾	Capacity	Year of completion
Brantas	Mrican Barrage	A	264.9 km ²	1991
Brantas	New Lengkong Barrage	A, F, N	401.56 km ²	1973
Brantas	Jatimlerek Rubber Dam	A, EC	15.82 km ²	1992
Brantas	Menturus Rubber Dam	A, EC	29.67 km ²	1993
Konto	Mendalan Sabo Dam	EC, SC	0.5 x 10 ⁶ m ³	1973
Konto	Tokol Sabo Dam	A, SC	0.6 x 10 ⁶ m ³ ; 3 km ²	1975

1)A: Agricultural use EC: Erosion control F: Flood control N: Maintenance of normal flows
P: Hydropower SC: Sand control

5.5 Water Quality

River Water Quality at Jagir¹⁾ in 1993

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH	7.3	7.1	6.5	6.6	7.1	7.3	7.1	6.9	7.4	7.1	7.1	6.7
DO [mg/l]	4.3	4.7	4.1	4.4	4.3	3.4	2.5	2.1	2.2	1.4	2.0	3.2
COD [mg/l]	19.5	14.8	14.3	16.4	14.5	22.9	18.5	14.8	14.5	21.1	26.9	44.5
SS [mg/l]	436.9	476.6	284.2	333.3	117.7	123.5	89.4	89.8	67.4	67.4	174.4	690.5
Discharge [m ³ /sec] ²⁾	106.4	80.8	61.5	82.6	61.2	42.7	24.0	12.8	12.2	19.2	30.7	62.3

1) Located at Jagir gate, Wonokromo, Surabaya, East Java.

2) Mean discharge

5.6 Other Notable Water Resources Features

Water Uses at Major Reservoirs

Name of dam	Hydropower capacity [MW]	Agricultural use [km ²]	Industrial use [10 ⁶ m ³]	Fisheries use [10 ⁶ m ³]	Municipal water supply [10 ⁶ m ³]
Sutami	3 x 35	340	48	-	45
Selorejo	4.5	57	-	-	-
Bening	0.65	91.2	-	-	-
Lahor	-	11	-	-	-
Lodoyo	4.5	-	-	-	-
Wlingi	2 x 27	150	-	-	-
Sengguruh	2 x 14.5	-	-	-	-

6. Socio-cultural Characteristics

Fossils of ancient humans have been found in several locations of the Kali Brantas valley, particularly in Mojokerto and Tulungagung. The fossils of *Pithecanthropus Mojokertoensis* was found in 1936 at Perring village near Mojokerto and *Meganthropus Palaeo Javanicus* was found in 1941 on another location, whereas *Homo Wajakensis* which was found in Wajak village near Tulungagung included the *Homo Sapiens*. In the period between 12-15th centuries, the Hindu Kingdoms of Singosari and Mojopahit that existed in the Kali Brantas catchment area had authority over most of Indonesia. Ruins of the culture that flourished at that time are protected by the government and have become subjects of interest to tourists as well as historians. The cemetery of the first President of Indonesia Ir. Soekarno is in Blitar which is in the Brantas basin.

7. References, Databooks and Bibliography

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