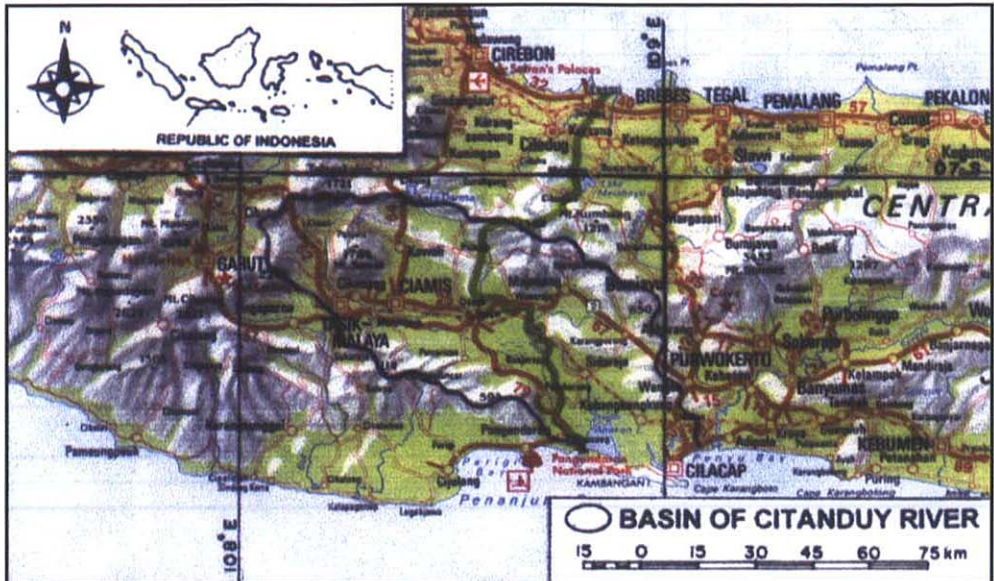


Citanduy

Map of River

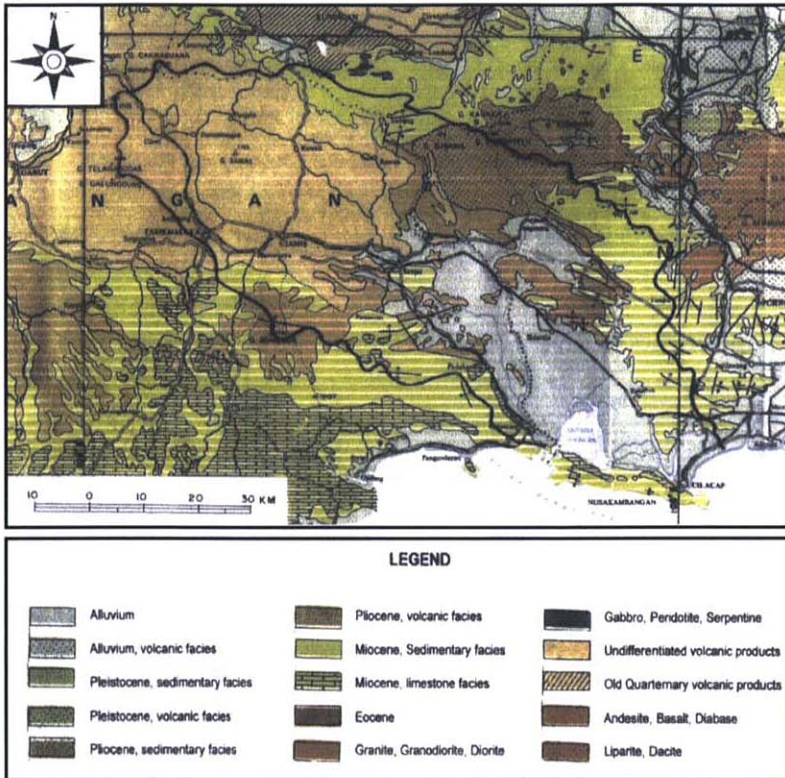


Java & Nusa Tenggara, Nelles Maps, CV Jaya Books, Indonesia

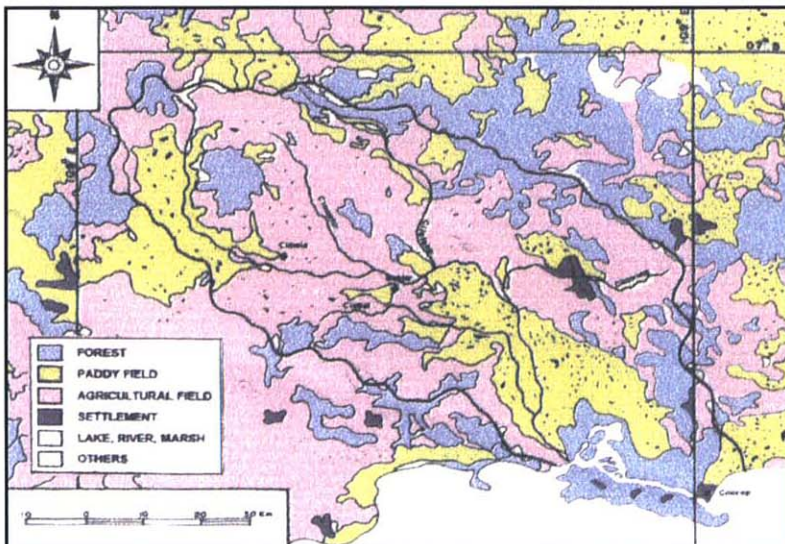
Table of Basic Data

Name: Citanduy		Serial No. : Indonesia-5
Location: Java Island, Indonesia	S 07° 20' - 07° 40'	E 108° 15' - 109° 15'
Area: 4,460 km ²	Length of main stream: 170 km	
Origin: Mt. Cakrabuana (1,750 m)	Highest point : Mt. Sawal (1,764 m.)	
Outlet: Indian Ocean	Lowest point : River Mouth (0 m)	
Main geological features : Holocene, Quarternary, Pleistocene, Pliocene, Miocene.		
Main tributaries: Cimuntur River (600 km ³), Cijolang River (480 km ³), Cikawung River (700 km ³), Ciseel River (980 km ³).		
Main reservoirs: None	Main Marshes : Wanareja	
Mean annual precipitation : 2,900 mm (1970-1984)		
Mean annual runoff : 137 m ³ /s at Pataruman (1,163 km ³) (1970 - 1994)		
Population: 6,909,000 (1993)	Main cities : Banjar, Cianjur, Tasikmalaya, Cilacap	
Land use: Forest (9.32 %), Paddy field (23.64 %), Agricultural field (48.05 %), Settlement (16.56 %), Lake, River, Marsh (0.08 %), Others (2.35 %) (1991)		

2. Geographical Information
2.1 Geological Map



2.2 Land Use Map



1. General Description

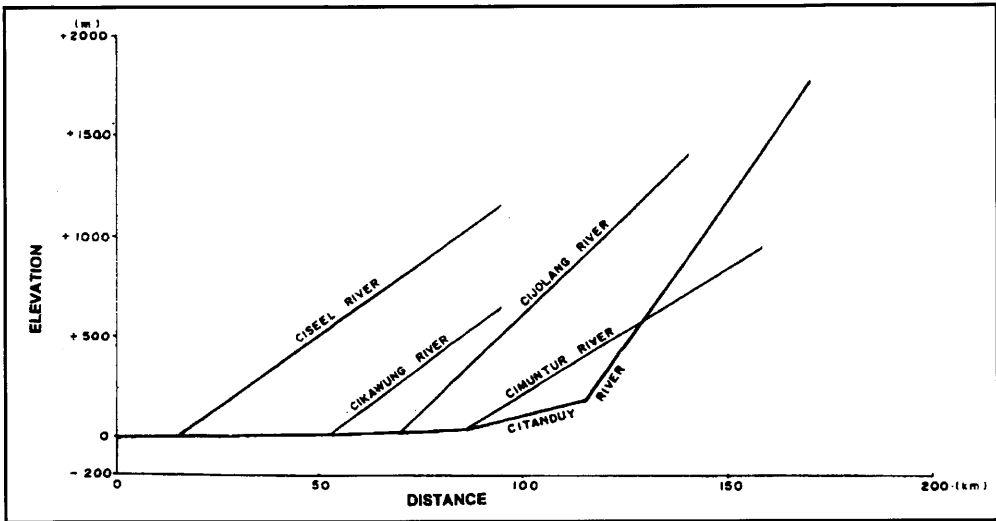
The Citanduy river, 170 km long with 4 main tributaries and draining an area of about 3,500 km², is one of the largest rivers in Java Island. It originates from Mt. Cakrabuana (1,750 m) and flows out into the Indian Ocean through the lagoon of Segara Anakan. The adjacent small rivers with a total catchment area of 960 km² known as Segara Anakan catchment also flow out into the lagoon. The basin average annual precipitation is 3,000 mm and the mean annual discharge at Pataruman (1,163 km²) is 137 m³/s (118 l/s/km²). Tropical monsoon climate is predominant over the basin and is further characterised by two distinct seasons, the wet and dry. The population in the Citanduy basin was 6.909 million in 1993. At Banjar, the point where Citanduy River comes up into its flood plain in a distance of about 90 kilometres, the river drops to about 1,700 m. From Banjar to its outlet into the sea, the Citanduy meanders an additional 80 km, but with a drop in elevation of only 15 m. Therefore from the town of Banjar to the downstream, the main problem in the basin is flooding. At the confluence with Cijolang river up to the river mouth, the stretch of Citanduy river is used as a border between West Java and Central Java provinces.

2.3 Characteristics of River and Main Tributaries

No.	Name of river	Length [m] Catchment area [km ²]	Highest peak [m] Lowest point [m]	Cities Population [year]	Land use [%]
1	Citanduy (Main river)	170 4,460	Mt. Cakrabuana, 1,750 0.00	Tasikmalaya 187,609 (1995) Ciamis 145,406 (1995) Banjar 130,197 (1995)	F (9.32 %), P (23.64 %), A (48.05 %), U (16.56 %), L (0.08 %), O (2.35 %)
2	Cimuntur (Tributary)	72 600	Mt. Pasirloji, 938 30.51	Cisaga 61,614 (1995)	F (11.4 %), P (21.76 %), A (47.87 %), U (15.42 %), L (0.10 %), O (3.45 %)
3	Cijolang (Tributary)	70 480	Mt. Cijolang, 1,400 15.21	Dayeuhluhur 44,432 (1995)	F (12.28 %), P (21.25 %), A (47.03 %), U (17.05 %), L (0 %), O (2.39 %)
4	Cikawung (Tributary)	43 700	Mt. Kendeng, 640 9.27	Majenang 113,246 (1995)	F (10.73 %), P (22.35 %), A (47.19 %), U (17.21 %), L (0 %), O (2.52 %)
5	Ciseel (Tributary)	70 980	Mt. Bongkok, 1,150 - 1.08	Banjarsari 87,531 (1995)	F (7.61 %), P (21.22 %), A (54.78 %), U (13.07 %), L (0.47 %), O (2.85 %)

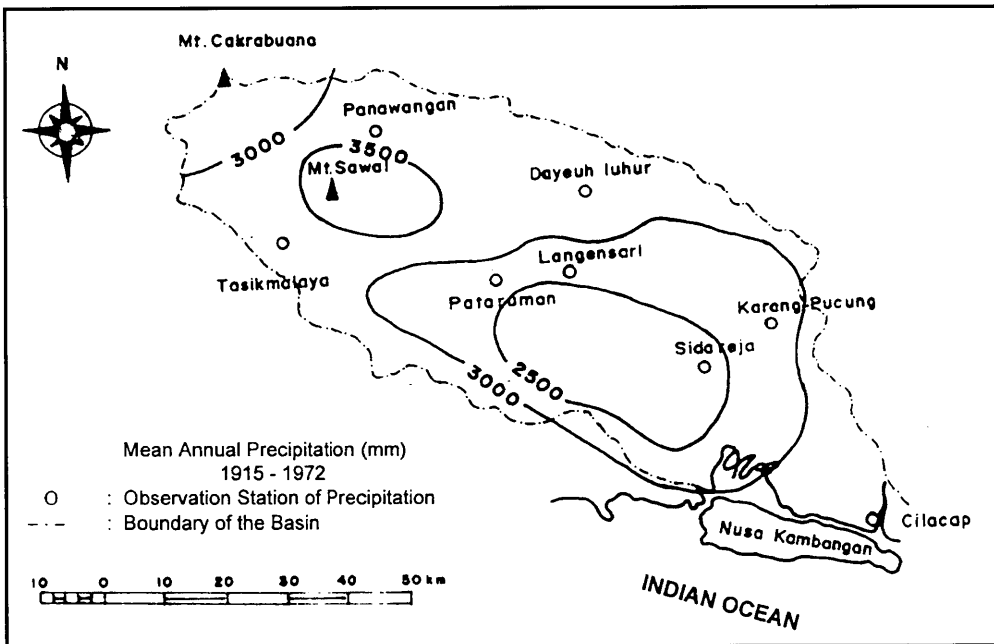
A: Agricultural field (vegetable field, grass field), F: Forest, L: Lake, River, Marsh, O: Others, P: Paddy Field, U: Urban.

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	Langensari	16.00	S 07° 24' E 108° 31'	1977 ~ 1983	2,490	1,940	E, P, SR, DS, RH, T, WV
2	Dayeuhluhur	205.00	S 07° 16' E 108° 36'	1980 ~ 1983	2,933	1,250	E, P, SR, DS, RH, T, WV
3	Karang Pucung	127.00	S 07° 25' E 108° 54'	1915 ~ 1983	2,210	2,123	E, P, SR, DS, RH, T, WV
4	Sidareja	10.00	S 07° 29' E 108° 47'	1980 ~ 1983	2,090	1,485	E, P, SR, DS, RH, T, WV
5	Panawangan	700.00	S 07° 07' E 108° 23'	1978 ~ 1983	2,254	1,408	E, P, SR, DS, RH, T, WV
6	Pataruman	22.00	S 07° 23' E 108° 33'	1975 ~ 1983	2,525	1,565	E, P, SR, DS, RH, T, WV
7	Tasikmalaya	350.00	S 07° 29' E 108° 15'	1975 ~ 1993	3,229		P, SR, DS, RH, T, WV
8	Ciamis		S 07° 20' E 108° 21'	1970 ~ 1994	3,277		P, SR, DS, RH, T, WV
9	Cilacap	6.00	S 07° 44' E 109° 01'	1980 ~ 1993	3,560		P, SR, DS, RH, T, WV

DS : Duration of Sunshine, E: Evaporation, P : Precipitation, RH: Relative Humidity, SR : Solar Radiation, T: Temperature, WV: Wind Velocity

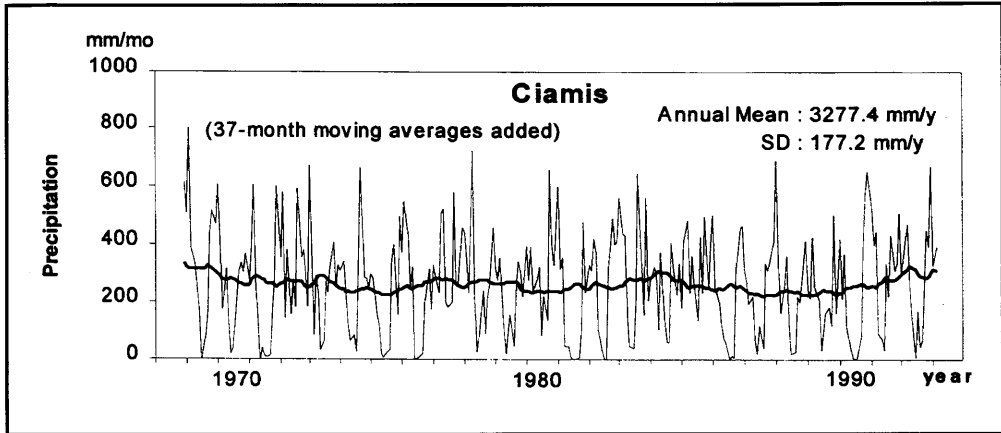
3.3 Monthly Climate Data

Station : Panawangan

Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [C°]	24.5	24.8	24.6	25.0	24.8	23.3	23.2	23.3	22.9	23.2	23.7	23.9	23.9	1978-1983
Precipitation [mm]	330	318	403	329	221	123	113	59	116	222	319	363	2,916	1978-1983
Evaporation* [mm]	121.	112.	130.2	141.	120.9	93.0	86.8	112	129.	133.	126.	102.	1,406.9	1978-1983
Solar Radiation [MJ/m ² /d]	3.58	4.76	4.15	3.95	3.39	3.40	3.11	3.08	4.05	4.51	4.23	3.97	3.84	1978-1983
Duration of ** sunshine [hr]	357	329	386	453	438	468	409	372	367	394	338	379	4,690	1970-1992

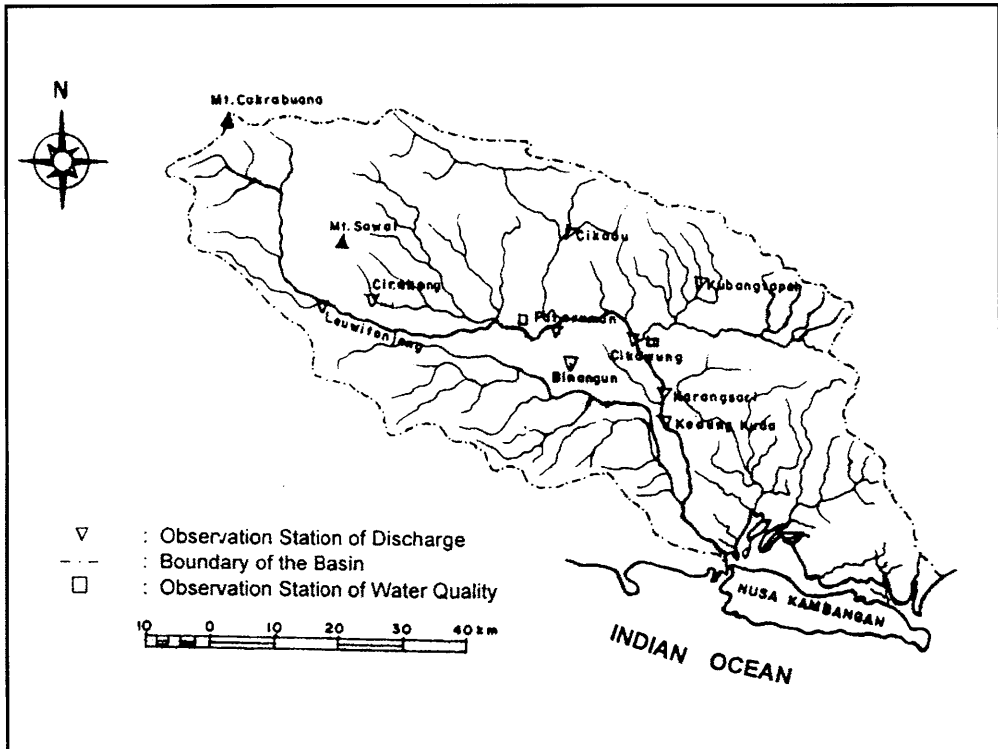
* Average Class A Pan, ** at Tasikmalaya Station

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



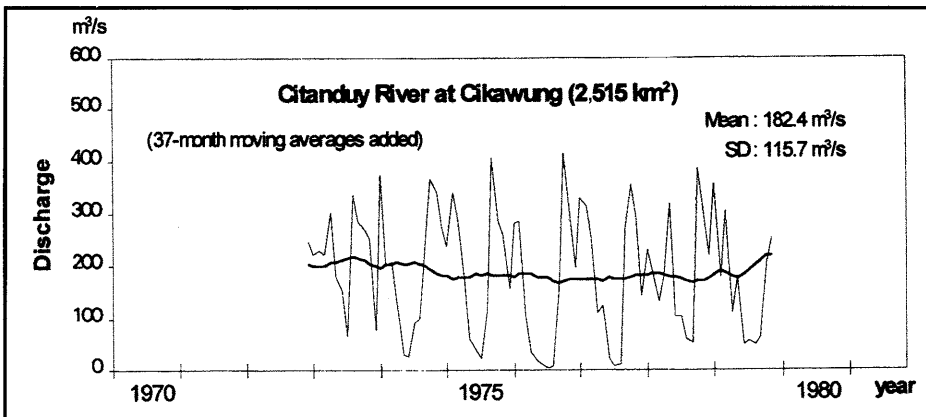
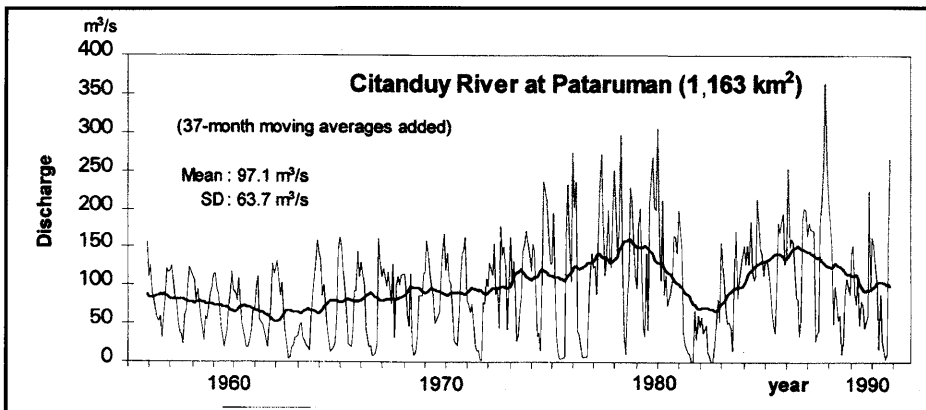
4.2 List of Hydrological Observation Stations

No.	Station	Location	Catchment area(A) [km ²]	Observation period	Observation items ¹⁾ (frequency)
2-092-01-06	Pataruman	S 07° 23' E 108° 33'	1,163	1957~1991	Q(d)
2-092-03-01	Cikawung	S 07° 24' E 108° 42'	2,515	1969~1984	Q(d)

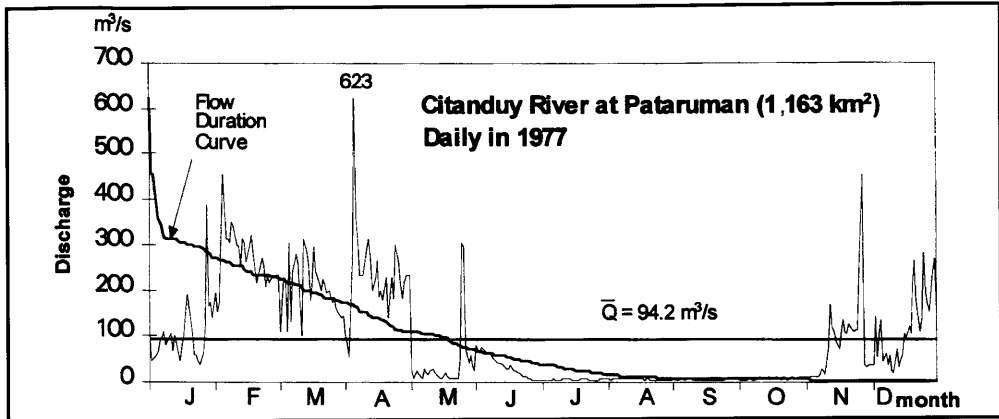
No.	\bar{Q} ²⁾ [m ³ /s]	Q max ³⁾ [m ³ /s]	\bar{Q} max ⁴⁾ [m ³ /s]	\bar{Q} min ⁵⁾ [m ³ /s]	\bar{Q} / A [m ³ /s/100 km ²]	Qmax / A [m ³ /s/100 km ²]	Period of statistics
2-092-01-06	103.7	842	480.8	13.76	8.92	72.39	1957~1991
2-092-03-01	204.0	987	710.6	16.27	8.11	39.24	1969~1984

- 1) Q(d) : daily discharge
- 2) Mean annual discharge
- 3) Maximum discharge
- 4) Mean maximum discharge
- 5) Mean minimum discharge

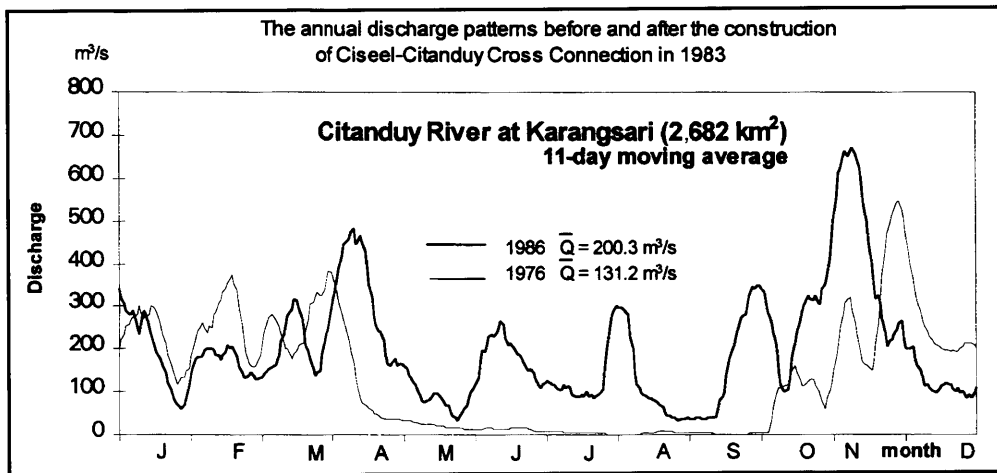
4.3 Long-term Variation of Monthly Discharge



4.4 Annual Pattern of Discharge



4.5 Unique Hydrological Features

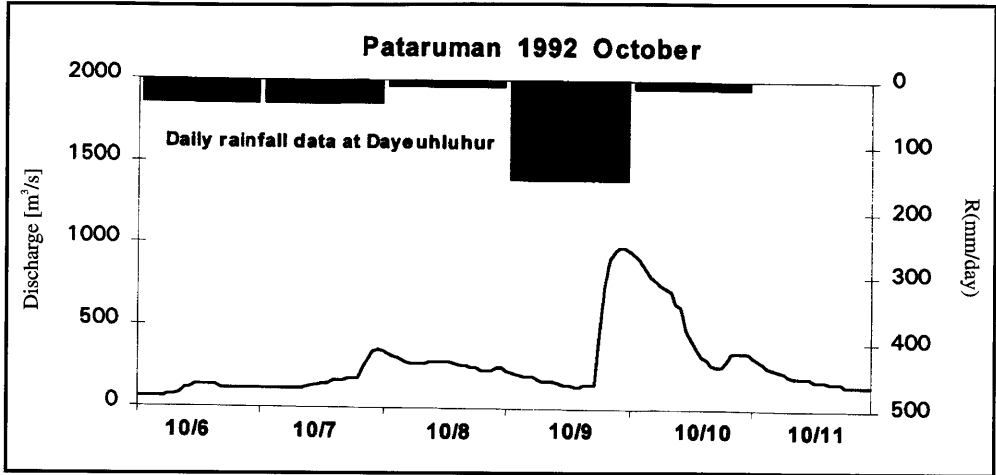


4.6 Annual Maximum and Minimum Discharges At Pataruman [1,163 km²]

Year	Maximum ¹⁾		Minimum ²⁾		Year	Maximum ¹⁾		Minimum ²⁾	
	Date	Discharge [m ³ /s]	Month	Discharge [m ³ /s]		Date	Discharge [m ³ /s]	Month	Discharge [m ³ /s]
1970	1.26	340	8	49.5	1976	10.5	693	8	3.3
1971	1.12	428	8	20.4	1977	2.5	648	6	5.9
1972	11.28	840	10	2.2	1978	5.24	945	4	87.4
1973	9.23	1,050	8	43.1	1979	5.21	912	8	10.9
1974	10.5	1,110	6	27.7	1980	3.29	626	7	34.4
1975	10.3	1,251	8	15.4	1981	11.24	1,079	8	73.3

1), 2) Instantaneous Observation by Recording Chart

4.7 Hyetographs and Hydrographs of Major floods

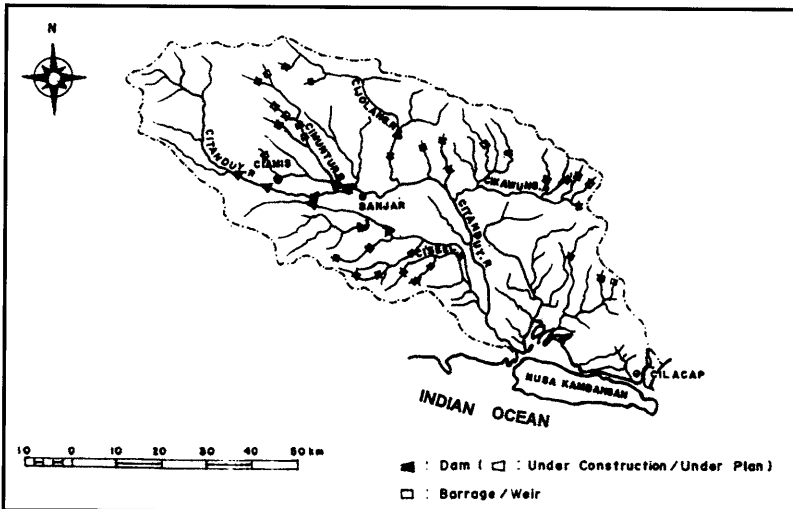


5. Water Resources

5.1 General Description

The Citanduy River and Segara Anakan have about 4,460 km² of catchment area or 3.41% of the area of Java Island (130,777 km²). In order to protect the agricultural lands and other property against flooding in the lower part of the basin, the Citanduy River Basin Development Project was established on April 1, 1969. The long-term objective of the project is to carry out physical construction within the framework to develop the basin of Citanduy River. In order to achieve this objective an overall development plan was formulated in 1975. Based on the plan, implementation of the project up to 1994 included flood control aspects such as upgrading the existing levee system to provide protection against 25-year frequency floods, providing cross connection between the Citanduy and the Ciseel Rivers, and using the Wanareja marshes as a retarding basin. Implementation on the irrigation works included rehabilitation of irrigation areas and utilities for 19,995 hectares, and the construction of Manganti Barrage (completed in 1986) for developing new irrigation area of 24, 600 hectares. The Pataruman Weir has been built before the establishment of the Citanduy Project.

5.2 Map of Water Resources System



5.3 List of Major Water Resources Facilities

Major Reservoirs

Major Reservoirs

Name of river	Name of dam (reservoir)	Catchment area [km ²]	Gross capacity [10 ⁶ m ³]	Effective capacity [10 ⁶ m ³]	Purpose ¹⁾	Year of completion
Citanduy	Banjar	1,300			F	Under plan
Citanduy	Ciamis	650			F, A, P	Under plan
Citanduy	Manonjaya	600			F, A, P	Under plan
Ciseel	Binangun 1	190				Under plan
Cijolang	Matenggeng	407	1,075	945	F, A, P	Under plan
Ciseel	Binangun 2	340				Under plan

Floodways

Name of transfer line	Name of rivers connected		Length [km]	Maximum capacity [m ³ /s]	Purpose ¹⁾	Year of completion
	From	To				
Nusawuluh Diversion	Citanduy River	Cikujang River	13	600	F	
Ciseel-Citanduy Cross Connection	Ciseel River	Citanduy River	1.85	730	F	1983

Retarding Basins

Name of river	Name of retarding basin	Area [km ²]	Volume [10 ⁶ m ³]	Purpose ¹⁾
Citanduy, Cikawung	Wanareja	13	43	F

1) A: Agricultural use F: Flood control, P: Hydro-power
2) Under construction

Others

Name of river	Facility	Purpose ¹⁾	Capacity [km ²]	Year of completion
Citanduy	Pataruman Weir	A		
Citanduy	Manganti Barrage	A	246	1986

1) A : Agricultureuse

5.4 Major Floods and Droughts

Major Floods at Pataruman [Catchment area 1,163 km²]

Date	Peak discharge [m ³ /s]	Rainfall [mm] Duration	Meteorological cause	Dead and missing	Major damage (Districts affected)
1992.10.8 - 10.9	1,159	107	Storm	0	Cihaur irrigation area, Kawunganten, Sidareja Gandrungmangu, Padaherang, Kalipucang
1995.11.26	967	100	Storm	0	Sidareja, Kedungreja, Kawunganten, Padaherang, kalipucang
1989.01.08	1,545	122	Storm	0	Banjar

5.5 Groundwater and Water Quality

River Water Quality at Cikawung¹⁾, 1992-1993

Date	Nov, 28 10.00	Dec, 22 15.30	Jan, 28 16.20	Feb, 18 16.25
pH	7.6	6.9	7.1	7.4
DO [mg/l]	6.1	6.4	7.0	7.1
COD [mg/l]	24	9.0	17	17
SS [mg/l]	546	226	406	474
E. Coli (x 10 ³)*	7,000	45,000	54,000	480,000
Discharge [m ³ /s]**	228	124	204	136

1) Located at Cikawung

*) Membrane filter method, colonies/100 ml ***) Discharge on the observation date

6. Socio-Cultural Characteristics

The legend of Ciung Wanara is related to the Citanduy River. Ciung Wanara was floated away in the Citanduy River by his parents when he was a baby, but later on he became a king of the Galih Pakuan Kingdom (about 900 years ago). The grave of Ciung Wanara is located in the area just upstream of the confluence of Cimuntur and Citanduy River. This is a good location for a reservoir to be built (Banjar Reservoir) which many people needed. The older generation however was against the idea and they suggested to take care of the Ciung Wanara's grave. This fact was taken into consideration in the planning study of Banjar Reservoir. Since the Citanduy River is used as a border between West and Central Java Provinces, there were many conflicts of interest between the two provinces especially before the establishment of the Citanduy River Basin Development Project. The Citanduy River flows out into the Indian Ocean through the lagoon of Segara Anakan, which is separated from the ocean by Nusakambangan Island. The island is used as a high security prison for convicts who have committed serious crimes.

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