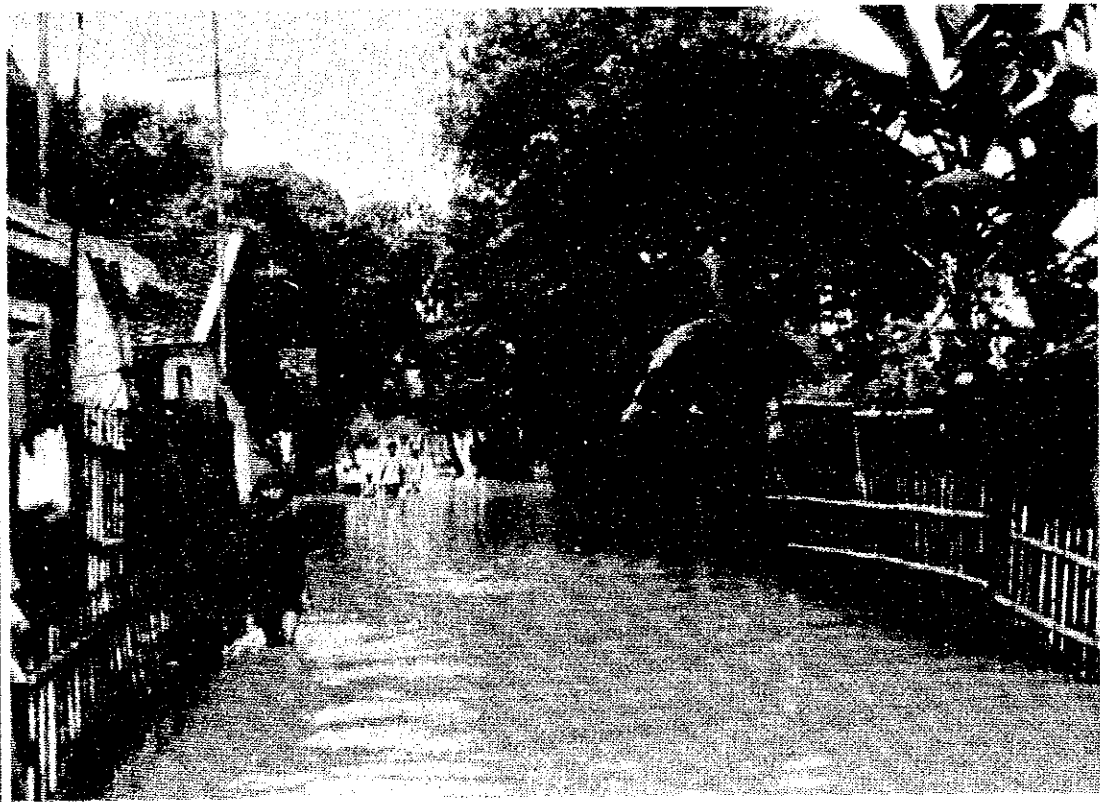


THE GOVERNMENT OF THE REPUBLIC OF INDONESIA

**THE STUDY
ON
THE FLOOD CONTROL PLAN
OF
THE UPPER CITARUM BASIN**

SUPPORTING REPORT



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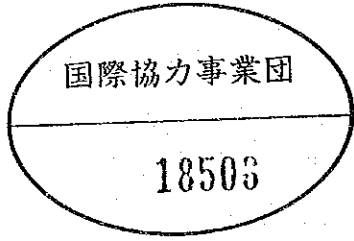
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THE UPPER CITARUM BASIN**

SUPPORTING REPORT

DECEMBER 1988

JAPAN INTERNATIONAL COOPERATION AGENCY



マイクロ
フィルム作成

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ABBREVIATIONS

Administrative districts

Kab.	=	Kabupaten	Regency
Kodya	=	Kotamadya	City
Kec.	=	Kecamatan	Sub-district
		Desa	Sub-district of Kecamatan
Kel.	=	Kelurahan	Village (urban area)
Kp.	=	Kampung	Village (rural area)
Prop.	=	Propinsi	Province

Institutions

ADB	Asian Development Bank
BAPPEDA	Badan Perencanaan Pembangunan Daerah; Provincial Planning Board
Dirjen Bina Marga	Directorate General of Highways
BMG	Badan Meteorology dan Geofisika; Metearological and Geographical Agency
Dirjen Cipta Karya	Directorate General of Human Settlement
DGWRD	Derektorat Jendral Pengairan; Directorate General of Water Resources Development
DOR	Direktorat Sungai; Directorate of Rivers
DEP. PU	Departmen Pekerjaan Umum; Ministry of Public Works
DPUP	Dinas Pekerjaan Umum Propinsi; Provincial Public Works
IHE	Pusat Penelitian dan Pengmebangan Pengairan; Institute of Hydraulic Engineering
JICA	Japan International Cooperation Agency
PLN	Perusahaan Listrik Negara; National Electric Cooperation
PERUMNAS	Perusahaan Umum Perumahan Nasional; National Housing Development Cooperation
SATKORLAK	Satuan Kordinasi Pelaksanaan Unit Coordination Implementation

Others

BUDP	Bandung Urban Development Project
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BUDS	Bandung Urban Development and Sanitation Study 1979
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
KIP	Kampung Improvement Project
REPELITA IV	Rencana Pembangunan Lima Tahun Fourth Five Year Development Plan
WJRDP	West Java River Development Project

Units and Conversion Factors

1) Length	7) Others
mm = millimeter	Kwh = kilowatt hour
cm = centimeter	mkwh = mega kilowatt hour
m = meter	% = per cent
km = kilometer	ppm = parts per million
2) Area	HP = horse power
ha = hectare	°C = degree centigrade
km ² = Square kilometer	10 ³ = thousand
3) Volume	10 ⁶ = million
l, ltr = liter = 1,000 cm ³	10 ⁹ = billion
m ³ = cubic meter	∅ = diameter
mcm = million cubic meter	max = maximum
4) Weight	min = minimum
mg = milligram	m ³ /det = cubic meter/second
g = gram	E = east
kg = kilogram	S = south
t, ton = metric ton = 1,000 kg	N = north
5) Time	W = west
s, sec. = second	Fig. = figure
min = minute	
h, hr = hour	
d = day	
yr = year	
6) Money	
US\$ = united states dollar	
Rp. = rupiah	
ERp. = economic price in rupiah	
¥ = japanese yen	

SUPPORTING REPORT A

GEOLOGICAL CONDITION

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SUPPORTING REPORT A GEOLOGICAL CONDITION

1. Topography and Geology of Study Area

The Study Area is bounded by mountain ridges with an altitude of about 2000 m. The Citarum River flows from the east to the west in the center of the Study Area at an elevation of about 660 m. The flood plain of the Citarum River was a lake during the period between about 6000 and 3000 years ago and almost flat. All of the tributaries have steep slopes because of short stream length and large difference in ground elevation.

The relief of the Upper Citarum Basin is illustrated in Fig. A.1.

Fig. A.2 shows general geology of the Study Area. Bandung is spreading on an alluvial fan. The flat area along the Citarum River consists of lake and alluvial deposit, while the other areas consist mostly of volcanic deposit.

2. Geology of Citarum River

2.1 Available Data

Machine boring test in the Citarum River was conducted by DGWRD at four (4) sites in November 1982 and 20 sites during the period of December 1987 and February 1988.

The JICA Study Team carried out an additional geological investigation: machine boring at 17 sites and seismic exploration at 6 sites, to supplement the geological investigation of DGWRD.

The inventories of the above-mentioned boring tests and seismic exploration are listed in Table A.1 and Table A.2. The locations are shown in Fig. A.3.

2.2 Geological Stratum

2.2.1 Citarum Main River

The geology along the Citarum Main River consists of flood plain deposit layer, lacustrine deposit layer and Pleistocene deposit layer with rock intrusions.

The geological strata of the Citarum Main River is shown in Table A.3.

(1) Flood Plain Deposit Layer

This is a secondary deposit layer consisting mainly of a light brown cohesive soil (laterite). This is distributed overall along the stretches of the Citarum River. The thickness of the layer is 1.0 ~ 4.0 m. The N-value is 1 ~ 13.

(2) Lacustrine Deposit Layer

This is composed of cohesive soil (Ac), humus (Ap) and sandy soil (As). This is widely distributed in the upstream of Dayeuh Kolot (Station 25 km). The thickness of the layer is approximately 50 m.

1) Cohesive Soil Layer (Ac)

This is dark grey soft cohesive soil. It is distributed at an elevation ranging from EL. 626 m to EL. 660 m. The N-value is 2 ~ 8.

Between the layer there is a 3 to 5 m thick bluish gray to greenish gray hard clay layer that is distributed at an elevation of about EL. 650 m. The hard clay layer has the N-value of 19 ~ 36. It is distributed over the 9 km length from Dayeuh Kolot (Station 25 km) to Station 34 km in the upstream direction. The bed of the Citarum River is almost on top of the hard clay layer.

2) Humus Layer (Ap)

This is a black to blackish gray soft humus. It is virtually distributed over the entire stretches of the Citarum River. The layer is distributed at an elevation ranging from EL. 639 m to EL. 660 m. The thickness of the layer is 4 ~ 15 m. The N-value is 0 ~ 3.

3) Sandy Soil Layer (As)

There is a sandy soil layer that exists between the Ac and Ap layers; it is about 3 to 5 m thick. Another sandy soil layer that is about 13 m thick lies beneath the lacustrine layers. This layer is the base of the lacustrine layers and is resting on the diluvial formation. The N-value is 2 ~ 29.

(3) Pleistocene Deposit Layer

This is distributed from Station 0.5 km, near the Nanjung Bridge, through Dayeuh Kolot (Station 25 km). This layer consists of the cohesive soil layer (Dc), the sandy soil layer (Ds), the gravel layer (Dg) and quartz trachyte, a type of intrusive rock. The quartz trachyte is distributed from Curug Jompong (Station 0 km) through Station at 0.5 km.

1) Cohesive Soil Layer (Dc)

This is distributed from Station at 8 km through 25 km and is an alternate stratum to the sandy soil layer. The N-value is generally 7 ~ 60.

However, the hard layer near the river bed has an N-value of 55 ~ 60. In some areas, the layer is in a soft rock condition with a N-value of 80 ~ 100.

2) Sandy Soil Layer (Ds)

This consists mainly of fine sand with a silty soil mixture. It is distributed from Station at 0.5 km through 25 km. Between

Station at 8 km through 25 km, it is an alternate stratum to the cohesive soil layer. The N-value is generally 21 ~ 60.

However, near the river bed where silty soil is mixed with the sandy soil, and where the layer was affected by heat, the N-value exceeds 140. The sandy soil layer near the Nanjung Bridge is in a soft sandy rock condition.

3) Gravel Layer (Dg)

Approximately a 3 m thick gravel layer is partially distributed near Station 17 km.

4) Intrusive Rock

The intrusive rock is quartz trachyte. It is distributed from Curug Jompong through Station at 0.5 km. The intrusive rock contains heat affected entrapped rocks. The rock is very hard.

2.2.2 Cisangkuy Diversion Route

About a 3 km long diversion route is proposed from the 8.5 km upstream site of the Cisangkuy River to Station at 11.7 km of the Citarum River (Refer to Supporting Report H).

The Geology of the diversion consists of the flood plain deposit layer, and the cohesive soil and sandy soil layers of the Pleistocene period. The soils are generally soft and are similar to those in the stretches from Stations 9 km through 16 km of the Citarum River.

The geological strata of the Cisangkuy diversion route is given in Table A.3.

(1) Flood Plain Deposit Layer (Ts)

This is the secondary deposit layer of light brown laterites. It is the top lay in the area and is almost horizontally distributed with the lowest limit being at EL. 656 m to EL. 657.5 m. The thickness of the layer is 3 ~ 6.5 m. The N-value is 3 ~ 16.

(2) Cohesive Soil Layer (Dc1)

This is a darkish gray cohesive soil. It consists of silt, clay, sandy clay and silty clay. The layer is horizontally distributed with the lowest limit being at EL. 653.5 m. The thickness of the layer is 2.5 ~ 6.0 m. The N-value is 3 ~ 23. The proposed diversion channel bed is near the lower limit of the cohesive soil layer distribution.

(3) Cohesive Soil Layer (Dc2)

This consists of sandy clay, silt and clayey silt. It is distributed directly beneath the Dc1 layer. The thickness of the layer is 9.0 ~ 11.0 m. The N-value is 17 ~ 50.

(4) Sandy Soil Layer (Ds)

This is distributed 600 m towards the Cisangkuy River. It is similar to the one distributed near the Station 15 km of the Citarum River. The higher limit of the sandy soil layer distribution is at EL. 650 m. The thickness of the layer is 10 m. The N-value is 17 ~ 43.

2.3 Seismic Wave Velocity

Seismic explorations were conducted for the following five (5) lines of the Citarum Main River and one (1) line of the proposed Cisangkuy diversion route.

A line : Around Station (STA) 0 km, L = 155 m

B line : STA. 0 km + 150 m - STA. 2 km + 150 m, L = 1,800 m

C line : Cut-off channel (STA. 3 km + 100 m - STA. 5 km + 750 m)
L = 630 m

D line : Cut-off channel (STA. 6 km + 350 m - STA. 8 km + 50 m),
L = 550 m

E line : Cut-off channel (STA. 18 km + 100 m - STA. 20 km + 850 m)
L = 830 m

F line : Cisangkuy diversion route, L = 3,060 m

The distribution of the observed velocity strata along the above lines are given in Table A.4.

2.4 River Bed Geology

The geological conditions of the river bed of the Citarum and Citarik Rivers and the proposed Cisangkuy diversion route are summarized in Table A.5.

The geological plane map and profile of the Citarum River are shown in Fig. A.4 ~ Fig. A.8.

The geological profile of the Cisangkuy diversion route is shown in Fig. A.9.

3. Soil Properties of Citarum River

Soil analyses were made on the samples that were obtained by machine borings along the Citarum River.

(1) Gradation

Grain size composition of each soil layer is given in Table A.6.

(2) Consistency

Consistencies of each soil layer are given in Table A.7.

(3) Specific Gravity, Wet Density and Void Ratio

Specific gravity, wet density and void ratio of each soil layer are given in Table A.8.

(4) Mechanical Property

Unconfined compressive strength, cohesion, internal friction angle and permeability of each soil layer are given in Table A.9.

4. Embankment Material

(1) Soil Sampling

Samplings of embankment material were made at the following five (5) riverine sites.

- Bojongrangkas : Citarum River Station No. - 44.5 km
- Sapan Luar : Citarum River Station No. - 38.8 km
- Haurhapit : Citarum River Station No. - 32.5 km
- Cijeruk : Citarum River Station No. - 29.3 km
- Cirebar : Citarum River Station No. - 27.0 km

The locations are shown in Fig. A.10.

Samples obtained were the flood plain deposit material and the upper layer of the lacustrine deposit.

The flood plain deposit material is distributed with a layer thickness of 1.2 to 2.0 m as measured from the ground surface. The deposit material is a secondary layer of brown to darkish brown -- sometimes reddish brown -- volcanic ash cohesive soil. The estimated N-value is 3 ~ 5.

The upper layer of the lacustrine deposit is dark bluish gray to darkish gray highly cohesive inorganic soil. It is distributed below the river-water level during dry seasons. The estimated N-value is 2 ~ 3.

(2) Specific Gravity

The specific gravity of the materials is given below.

	Range	Average
Flood plain deposit	2.66 ~ 2.71	2.68
Upper lacustrine deposit	2.65 ~ 2.72	2.68

(3) Natural Water Content

The natural moisture content of the materials is as follows.

	Range	Average
Flood plain deposit	30.9 ~ 77.2%	58.6%
Upper lacustrine deposit	53.1 ~ 83.0%	64.3%

(4) Gradation

The gradation of the flood plain deposit consists mainly of fine grains mixed with a large variety of grain sizes. On the other hand, the upper layer material of the lacustrine is made up of relatively uniform fine grain soil.

The gradation of the materials is illustrated in Table A.10 and Fig. A.11.

(5) Consistency

The flood plain deposit under natural conditions has high stability but the upper layer of the lacustrine deposit has low stability. Both the flood plain deposit and the upper layer material are very cohesive soils having organic colloids and montmorillonite.

The consistencies of the materials are shown in Table A.11.

The consistency chart is shown in Fig. A.12.

(6) Compaction Test

Compaction test of the materials were made by the Standard Method of ASTM.

The results of the test are summarized in Table A.12.

The compaction curves of the 10 samples: 5 from the flood plain deposit and 5 from the upper layer lacustrine deposit, are shown in Fig. A.13.

(7) Unconfined Compression Test

As a result of compaction tests, test pieces made of soil samples having the maximum dry density of 95% were tested for unconfined compressive strength.

The results of the test are summarized in Table A.13.

(8) Triaxial Compression Test

Test pieces for the triaxial compression test were made of the material samples under the same conditions as for the unconfined compression test.

The results of the test are summarized in Table A.14.

Table A.1 AVAILABLE DATA LIST OF BORING TEST

DGRD (Nov. 1982)		DGRD (Dec. 1987-Feb. 1988)		JICA Team (Jan. 1988-Mar. 1988)			
Boring No.	Location Name	STA. No.	Boring Depth (m)	Boring No.	Location Name	STA. No.	Boring Depth (m)
BIC.I	Bojong Soang		14.5 B.1	MB.88.01	Nanjung Bridge	0K+760m	30.0
BIC.II	Jembul	17K+100m	25.0 B.2	MB.88.02	Curug Jompong	0K+ 0m	10.0
BIC.III	Nanjung	2K+600m	25.0 B.3	MB.88.03	Cisaat	1K+380m	20.0
BIC.IV	Curug Jompong	0K+200m	25.0 B.4	MB.88.04	Kp.Citunggul	6K+ 80m	15.0
Total			B.5	MB.88.05	Cilampeni	8K+790m	15.0
			B.6	MB.88.06	Cikambuy Hilir	13K+620m	15.0
			B.7	MB.88.07	Ranca Manyar	18K+ 80m	15.0
			B.8	MB.88.08	Ranca Manyar	20K+850m	15.0
			B.9	MB.88.09	Parung Halang	22K+570m	15.0
			B.10	MB.88.10	Cibadak	24K+330m	15.0
			B.11	MB.88.11	Dayeuh Kolot	25K+700m	50.45
			B.12	MB.88.12	CiJeruk	29K+ 50m	15.45
			B.13	MB.88.13	Sapan Luar	37K+260m	15.0
			B.14	MB.88.14	Sapan Muara	39K+480m	15.0
		B.15	MB.88.15	Kp.Sukimanah	Citarik River	10.0	
		B.16	MB.88.16	Bojong Rangkas	3K+450m	10.0	
		B.17	MB.88.17	Sapan Bridge	44K+500m	40.0	
		B.18			Citarik River	0K+430m	
		B.19					
		B.20					
		Total	400.0	Total			320.9

Table A.2 AVAILABLE DATA LIST OF SEISMIC EXPLORATION

Exploration Line No.	Location		Explorariion Line Length (m)
	Name	River Staion	
A	Curug Jompong	Around 0.0k	155
B	Nanjung	0k+150m - 2k+150m	1,800
C	Daraulin	3k+100m - 5k+750m Proposed Cut-off channel part	630
D	Bojong Lebak	6k+350m - 8k+ 50m Proposed Cut-off channel part	550
E	Ranca Manyar	18k+100m - 20k+850m Proposed Cut-off channel part	830
F	Cibogo	Cisangkuy R. - Citarum R. Proposed Cisangkuy Diversion	3,060
Total			7,025

Table A.3 GEOLOGICAL STRATA OF CITARUM MAIN RIVER AND CISANGKUY DIVERSION ROUTE

(Citarum Main River)

ERA	STRATUM	SYMBOL
THE QUARTERNARY PERIOD THE HOLOCENE EPOCH LACUSTRINE DEPOSIT LAYER	Flood Plain Deposit Layer	ts
	Cohesive Soil Layer	Ac1
		Ac2
	Humus Layer	Ap
	Sandy Soil Layer	As
THE QUARTERNARY PERIOD THE PLEISTOCENE PERIOD	Cohesive Soil Layer	Dc
	Sandy Soil Layer	Ds
	Grave Layer	Dg
	Quartz Trachyte	Li

(Cisangkuy Diversion Route)

ERA	STARATUM	SYMBOL
THE QUARTERNARY PERIOD THE HOLOCENE PERIOD	Flood Plain Deposit Layer	ts
	Cohesive Soil Layer	Dc1
Dc2		
Ds		
THE QUARTERNARY PERIOD THE PLEISTOCENE PERIOD	Sandy Soil Layer	Ds

Table A.4 DISTRIBUTION OF VELOCITY STRATUM

Velocity Stratum	Exploration Line Name	A-Line	B-Line	C-Line	D-Line	E-Line	F-Line
1st Velocity Stratum	Velocity (km/sec) Thickness (m)	0.3 - 0.4 2.0 - 6.5	0.2 - 0.5 0 - 0.5	0.3 - 0.5 2.0 - 4.0	0.25 - 0.55 0 - 3.5	0.35 - 0.55 1.5 - 8.0	0.4 - 0.8 1.5 - 9.0
2nd Velocity Stratum	Velocity (km/sec) Thickness (m)	0.8 0 - 5.5	0.5 - 0.7 0 - 13.0	0.7 - 1.0 6.0 - 10.0	0.7 - 1.0 8.0 - 16.0	0.6 - 1.2 0 - 17.5	0.7 - 1.3 4.5 - 20.0
3rd Velocity Stratum	Velocity (km/sec) Thickness (m)	1.6 - 2.0 4.5 - 14.0	0.6 - 1.9 0.3 - 55.0	- -	- -	- -	- -
Velocity in Lowest Stratum (km/sec)		4.9	1.2 - 4.9	1.3 - 1.9	1.4 - 2.4	1.5 - 1.8	1.5 - 2.2

Table A.5 GEOLOGICAL CONDITION OF RIVER BED

River Distance	Kind of Soil/Rock	N-value	Velocity of Seismic Wave
(Citarum River)			
0 - 0.5km	Very hard quartz trachyte	-	4,000 - 4,900 m/sec
0.5 - 1.8km	Sand/hard sand	Larger than	1,500 - 4,000 m/sec
		50 - 100	
1.8 - 3.2km	Sand	30 - 50	-
4.0 - 7.0km	Sand/Sandy soil	30 - 150	-
Around 11.0km	Sand/Sandy soil	30 - 60	-
Around 17.0km	Gravel	-	-
18.0 - 21.0km	Hard cohesive soil	61 - 100	-
22.0 - 25.0km	Hard cohesive soil	55 - 80	-
25.0 - 34.0km	Hard cohesive soil	16 - 42	-
34.0 - 38.0km	Sand/Sandy soil	5 - 25	-
38.0 - 45.0km	Cohesive soil/humus soil	1 - 14	-
(Citarik River)			
0 - 4.0km	Sand/cohesive soil	4 - 8	-
(Cisangkuy Diversion)			
0 - 3.0km	Cohesive soil	3 - 23	800-1,200 m/sec

Table A.6 GRAIN SIZE COMPOSITION OF SOIL

Item	Gravel (%)		Sand (%)		Silt Clay (%)		Below No.10 (2.00 mm)		Below No.40 (0.405 mm)		Below No.200 (0.075 mm)	
	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average
Flood plain Deposit Cohesive Soil (Ts)	0.0 - 0.5	0.5	15.0 - 58.0	31.6	37.0 - 85.0	67.9	90.0 - 100.0	99.0	85.0 - 100.0	97.4	37.0 - 85.0	66.9
Lacustrine Deposit Cohesive Soil (Ac)	-	-	26.0 - 79.0	43.7	21.0 - 73.0	99.4	98.0 - 100.0	99.4	79.0 - 97.0	90.6	21.0 - 73.0	55.9
Lacustrine Deposit Humus Soil (Ap)	-	-	16.5 - 54.0	29.4	46.0 - 83.5	99.6	98.0 - 100.0	99.6	87.0 - 98.0	94.6	46.0 - 83.5	70.6
Cohesive Soil (D2)	0.0 - 1.0	0.2	24.0 - 60.0	47.8	40.0 - 68.5	99.2	97.0 - 100.0	99.2	75.0 - 100.0	88.1	40.0 - 76.0	52.2
Sandy Soil (Ds)	0.0 - 14.5	3.9	59.0 - 86.5	76.6	11.0 - 31.0	89.6	81.0 - 96.0	89.6	42.0 - 75.0	60.1	11.0 - 33.0	20.7

Table A.7 CONSISTENCY OF SOIL

Item	Natural Water Content (%)		Liquid Limit (%)		Plastic Limit (%)		Plasticity Index		Activity Ratio of Clay		Below No.200 (0.075mm)	
	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average
Flood plain Deposit Cohesive Soil (Ts)	44.2 - 57.9	50.4	48.9 - 88.5	68.2	23.7 - 40.9	33.9	25.5 - 51.5	34.3	0.81 - 1.96	1.25	37.0 - 85.0	66.9
Lacustrine Deposit Cohesive Soil (Ac)	41.5 - 61.8	45.5	57.3 - 79.7	70.1	30.1 - 37.6	33.9	21.2 - 43.4	36.2	1.21 - 43.4	1.53	21.0 - 73.0	55.9
Lacustrine Deposit Humus Soil (Ap)	173.7 - 289.3	196.5	149.5 - 261.0	187.1	55.1 - 103.0	86.2	71.4 - 158.0	100.9	3.36 - 14.1	6.90	46.0 - 83.5	70.6
Cohesive Soil (D2)	36.9 - 62.2	53.7	33.3 - 99.6	72.9	19.9 - 48.8	39.0	13.4 - 51.1	33.9	0.68 - 5.59	2.87	40.0 - 76.0	52.2
Sandy Soil (Ds)	-	-	-	-	-	-	-	-	-	-	11.0 - 33.0	20.7

Table A.8 SPECIFIC GRAVITY, WET DENSITY AND VOID RATIO OF SOIL

Item	Specific Gravity		Wet Density (t/m ³)		Void Ratio		
	Range	Average	Range	Average	Range	Average	
Alluvial Deposit	Flood plain Deposit Cohesive Soil (Ts)	2.52 - 2.67	2.59	1.60 - 1.75	1.67	1.20 - 1.51	1.33
	Lacustrine Deposit Cohesive Soil (Ac)	2.57 - 2.72	2.62	1.62 - 1.77	1.70	1.08 - 1.32	1.20
	Lacustrine Deposit Humus Soil (Ap)	2.28 - 2.49	2.36	1.35 - 1.70	1.53	3.28 - 4.83	4.05
Diluvial Deposit	Cohesive Soil (Dc)	2.51 - 2.68	2.59	1.61 - 1.80	1.68	1.19 - 1.68	1.38
	Sandy Soil (Ds)	2.65 - 2.75	2.68	-	-	-	-

Table A.9 MECHANICAL PROPERTY OF SOIL

Item	Unconfined Compressive Strength (kg/cm ³)		Cohesion (kg/cm ³)		Internal Friction Angle (degree)		Permeability (cm/s)		
	Range	Average	Range	Average	Range	Average	Range	Average	
Alluvial Deposit	Flood plain Deposit Cohesive Soil (Ts)	0.06 - 0.99	0.38	0.02 - 0.05	0.34	0.0 - 19.3	8.9	1.07x10 ⁻⁵ - 1.77x10 ⁻⁶	5.24 x 10 ⁻⁶
	Lacustrine Deposit Cohesive Soil (Ac)	0.02 - 0.37	0.19	-	0.15	0	0	1.06x10 ⁻⁵ - 1.80x10 ⁻⁸	5.31 x 10 ⁻⁶
	Lacustrine Deposit Humus Soil (Ap)	0.09 - 0.27	0.18	0.05 - 0.12	0.08	0	0	-	-
Diluvial Deposit	Cohesive Soil (Dc)	0.63 - 1.39	1.07	0.15 - 0.35	0.25	12.5 - 29.0	20.8	-	-

Table A.10 GRAIN SIZE DISTRIBUTION

Deposit	Gradation	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
Flood Plain Deposit	Average	-	20.6	60.8	18.6
	Range	-	4.0-42.0	12.0-45.0	8.0-27.0
Upper Layer of Lacustrine Deposit	Average	-	21.4	60.2	18.4
	Range	-	3.0-42	46.0-76.0	10.0-24.0

Table A.11 CONSISTENCY

Consistency Item	Wn (%)	WL	Ip	If	It	Ic	Activity Ratio
Flood Plain Deposit	58.6	76.4	39.2	14.1	3.06	0.52	2.18
	30.9-77.2	57.0-94.0	22.5-54.0	8.0-22.0	1.50-5.23	0.25-1.16	0.94-2.91
Upper Layer of Lacustrine Deposit	64.3	80.8	44.5	16.4	2.97	0.4	4.05
	53.1-83.0	71.0-96.0	31.6-56.0	11.2-23.0	1.69-4.29	0.07-0.70	2.82-7.00

Note : Wn:natural moisture content Wl:liquid limit
 Ip:plasticity index If:flow index
 It:Toughness index Ic:Consistency index

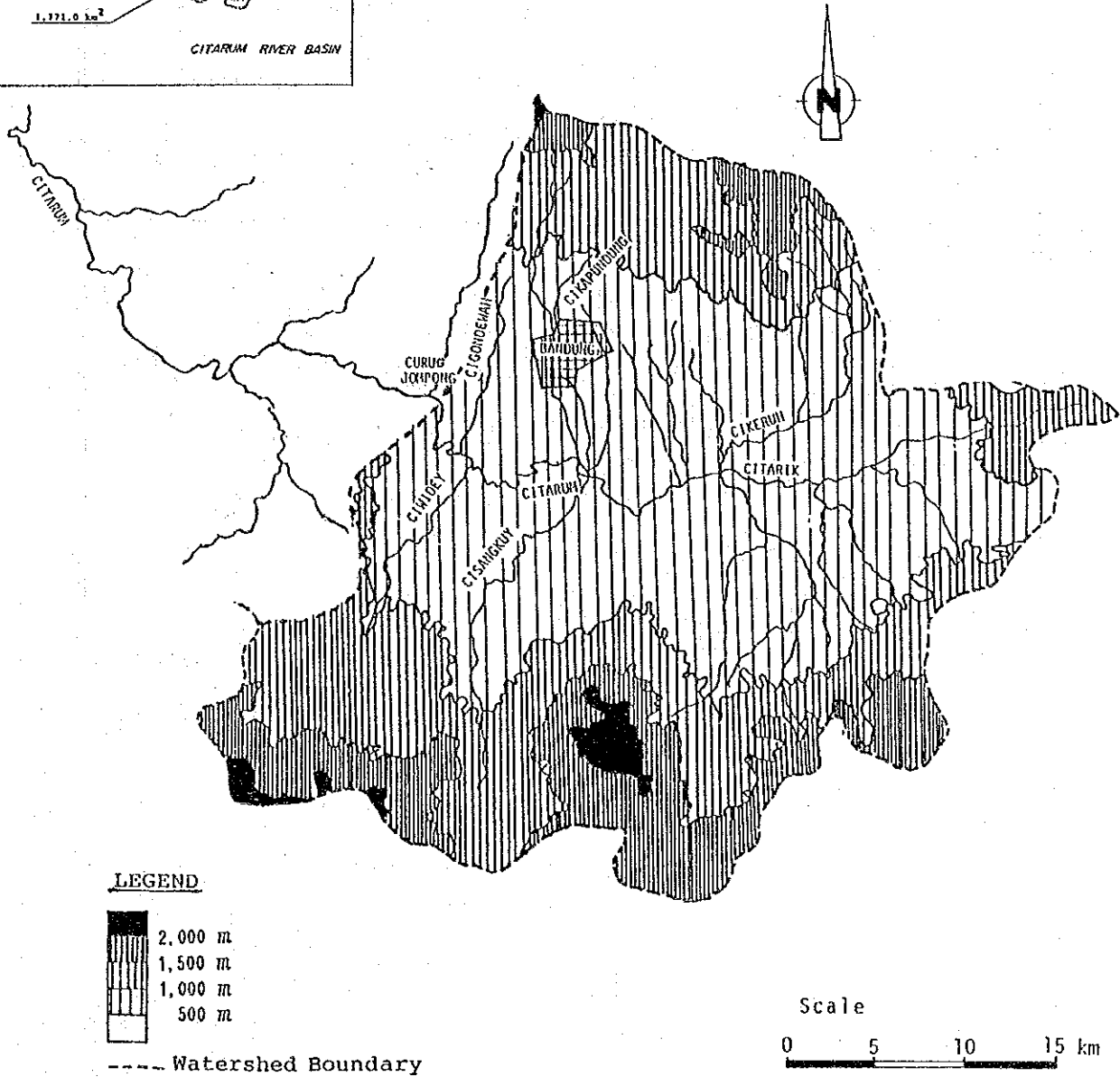
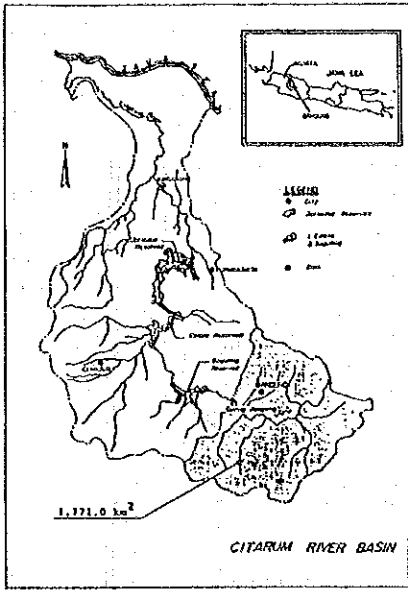
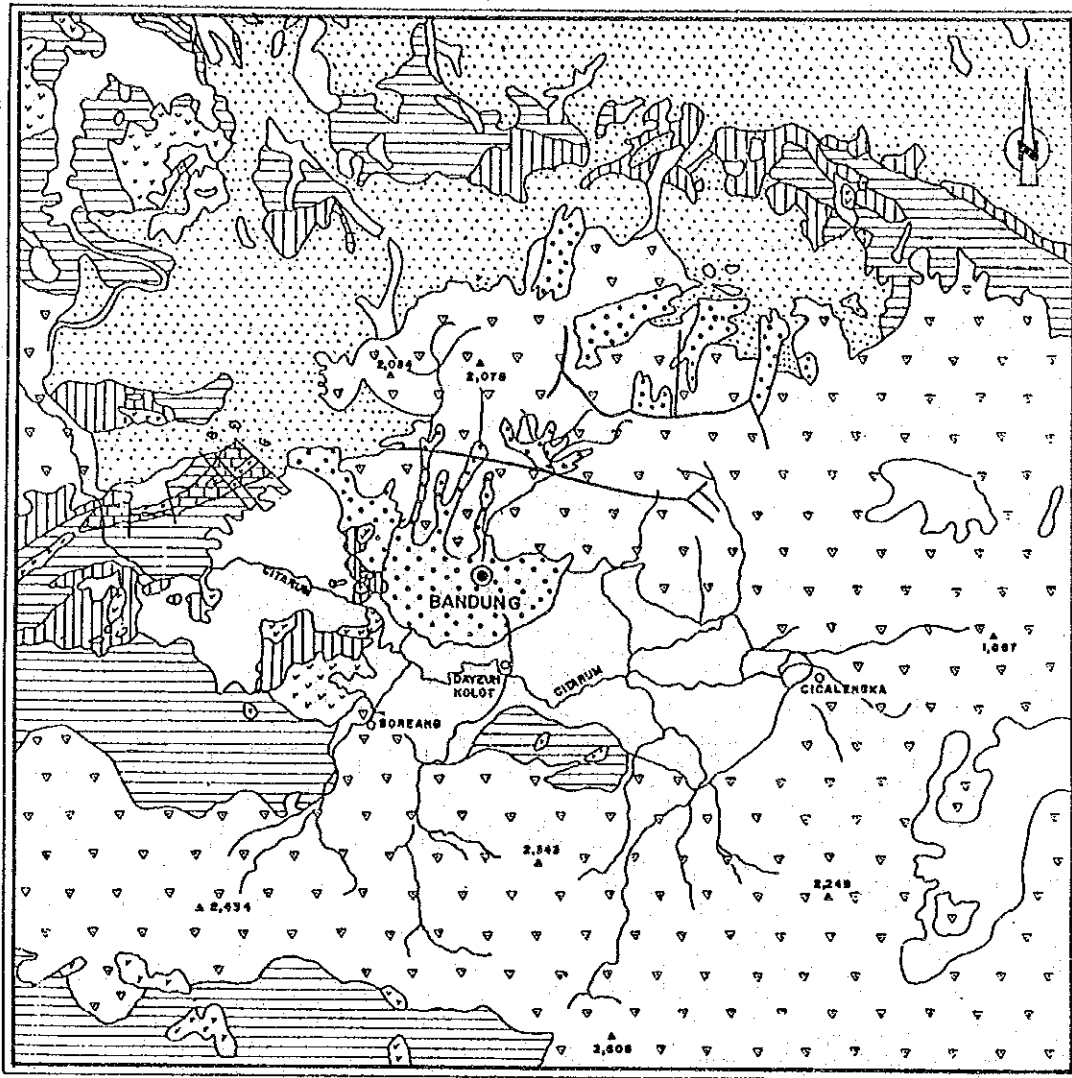


FIG. A.1

RELIEF MAP OF STUDY AREA

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



LEGEND

	Lake and Alluvial Deposit	} Holocene
	Alluvial Fan	
	Volcanic Deposit	} Pleistocene (the latter period)
	Volcanic Deposit	
	Marine Sediments	} Pleistocene (the first period)
	Marine Sediments	
	Line Stone	} Miocene
	Intrusion (Liparite Dacite Andesite Diabase)	
	Fault	

FIG. A.2

GEOLOGICAL MAP AROUND BANDUNG AREA

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

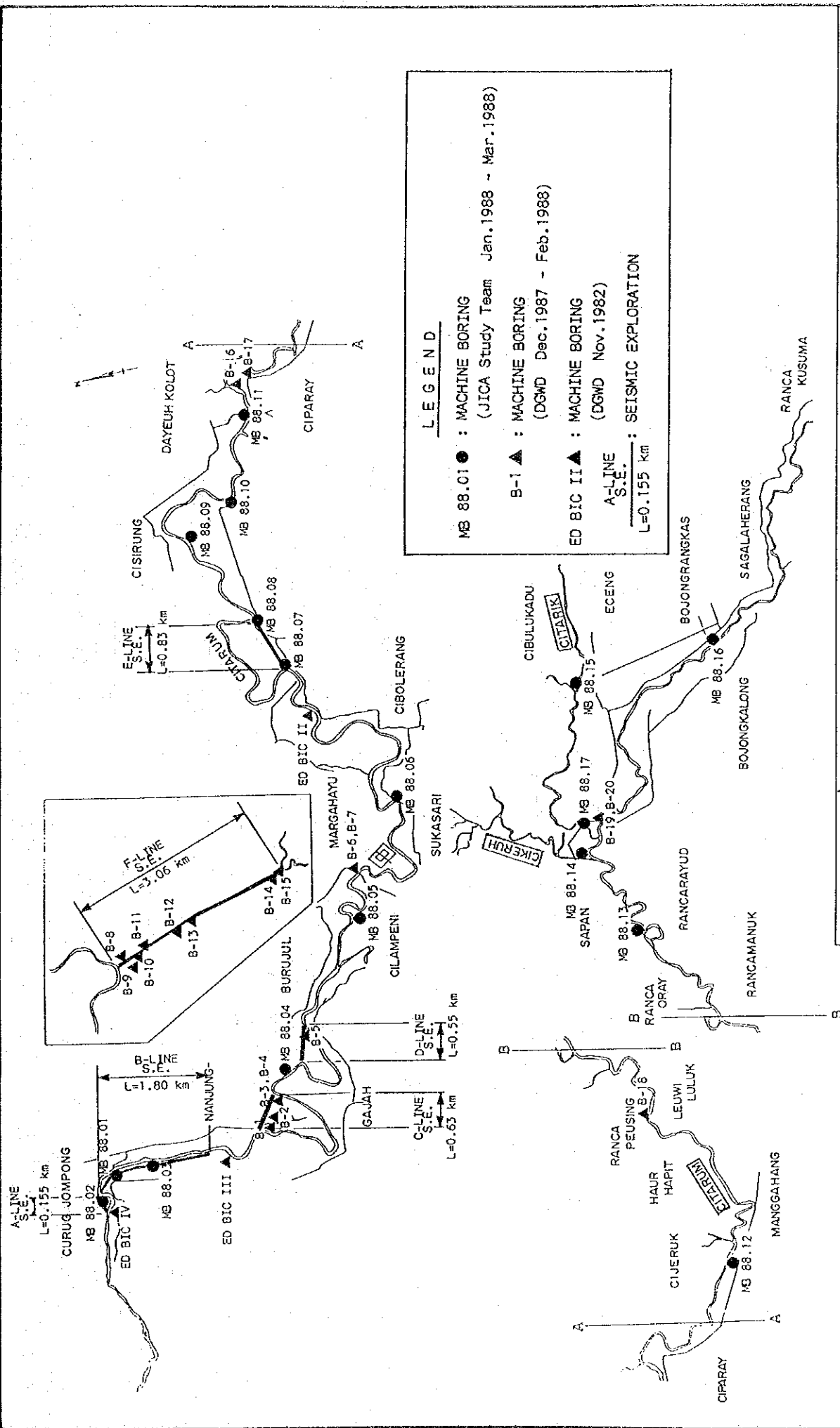


FIG. A.3 LOCATION OF BORING AND SEISMIC EXPLORATION

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



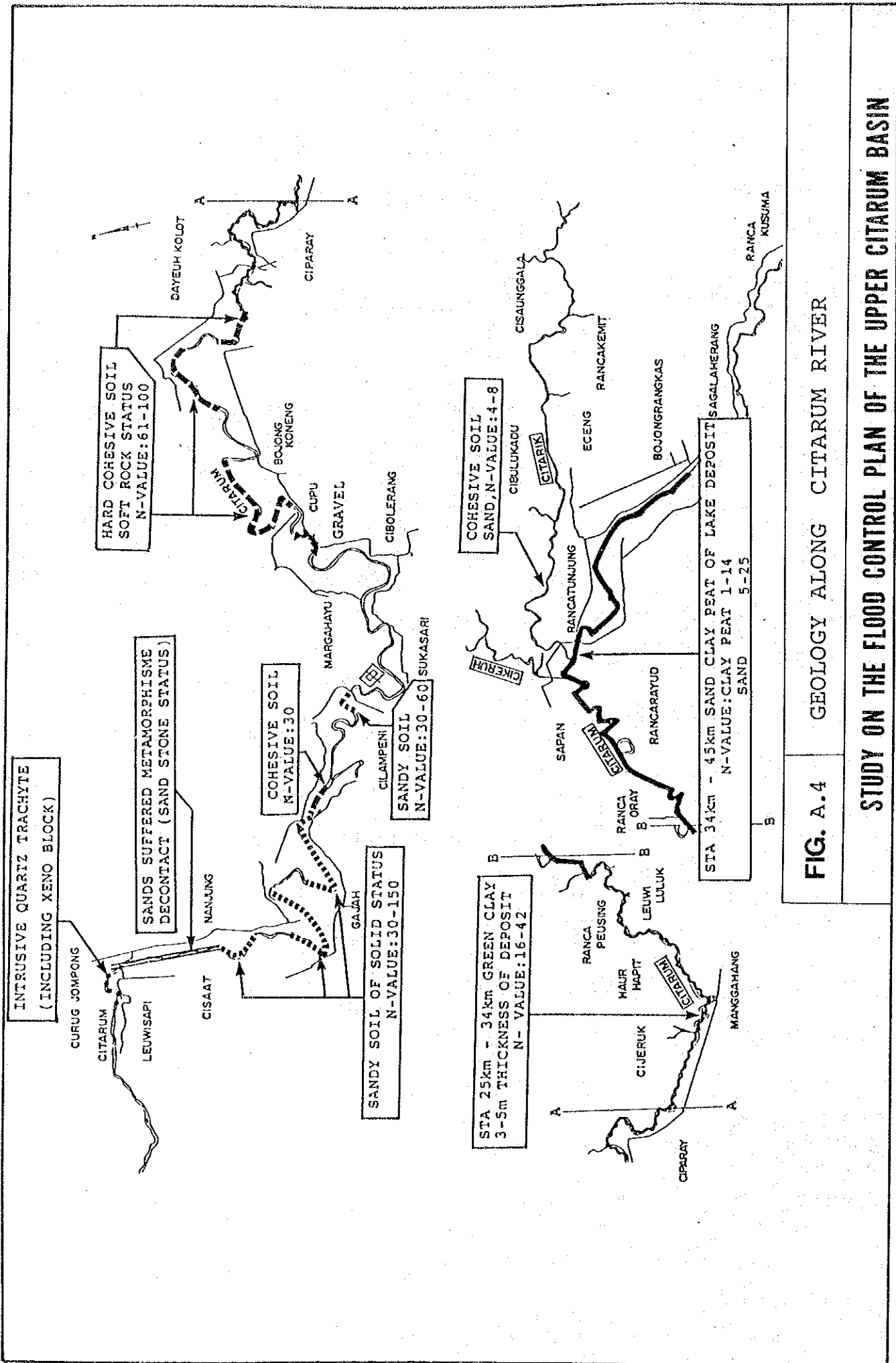


FIG. A.4 GEOLOGY ALONG CITARUM RIVER

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



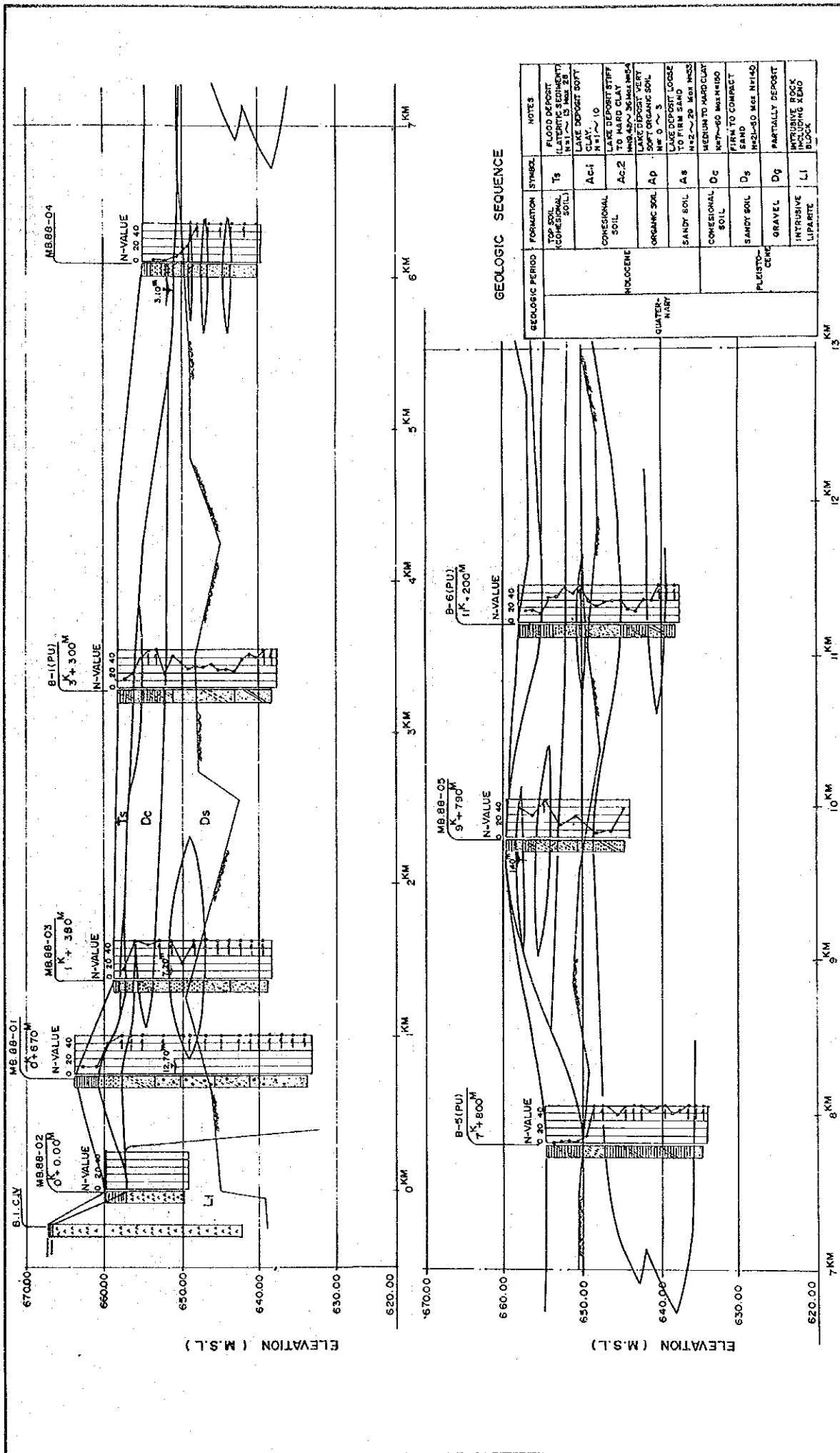


FIG. A.5 GEOLOGICAL PROFILE OF CITARUM RIVER (1)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



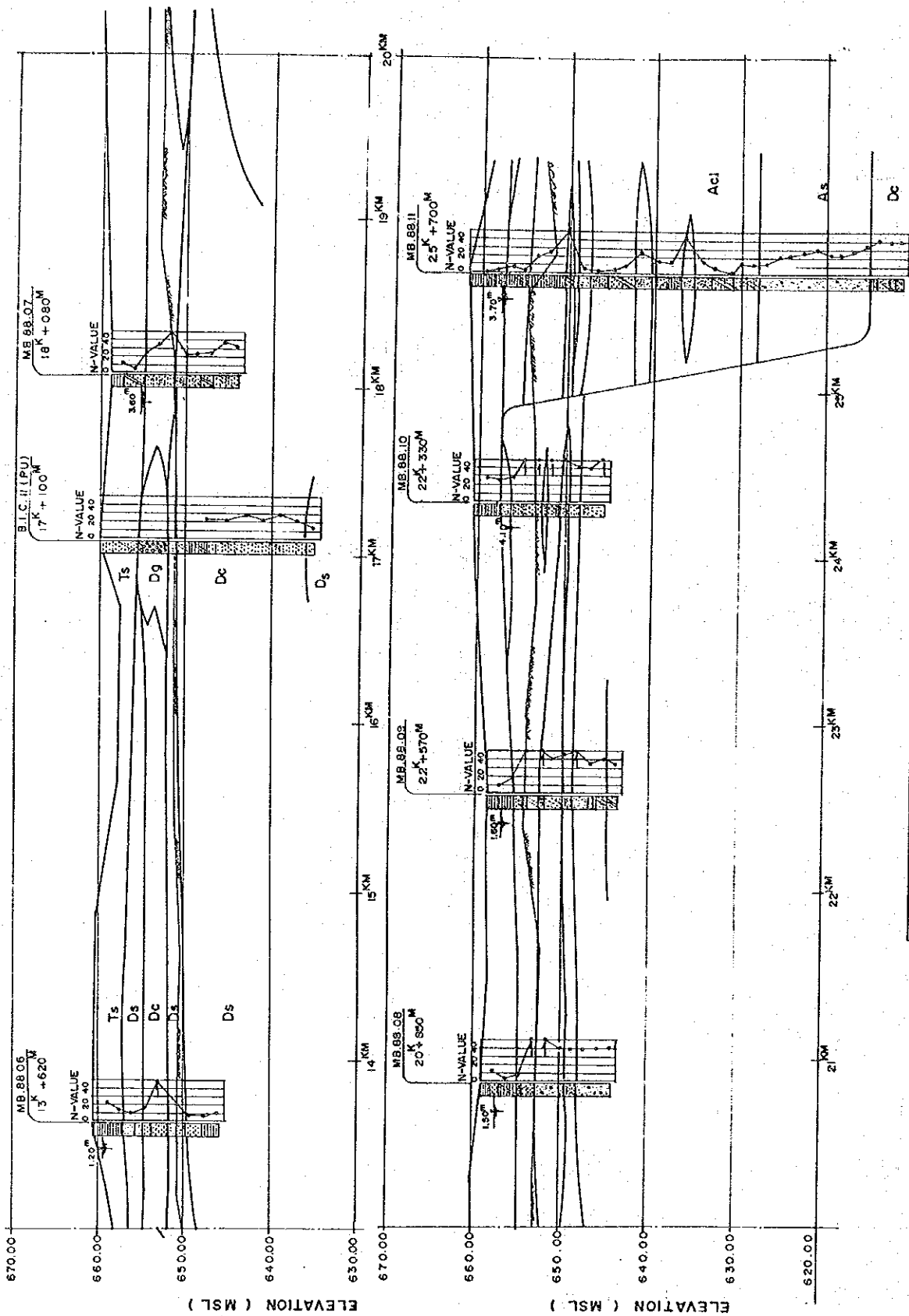


FIG. A.6 GEOLOGICAL PROFILE OF CITARUM RIVER (2)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

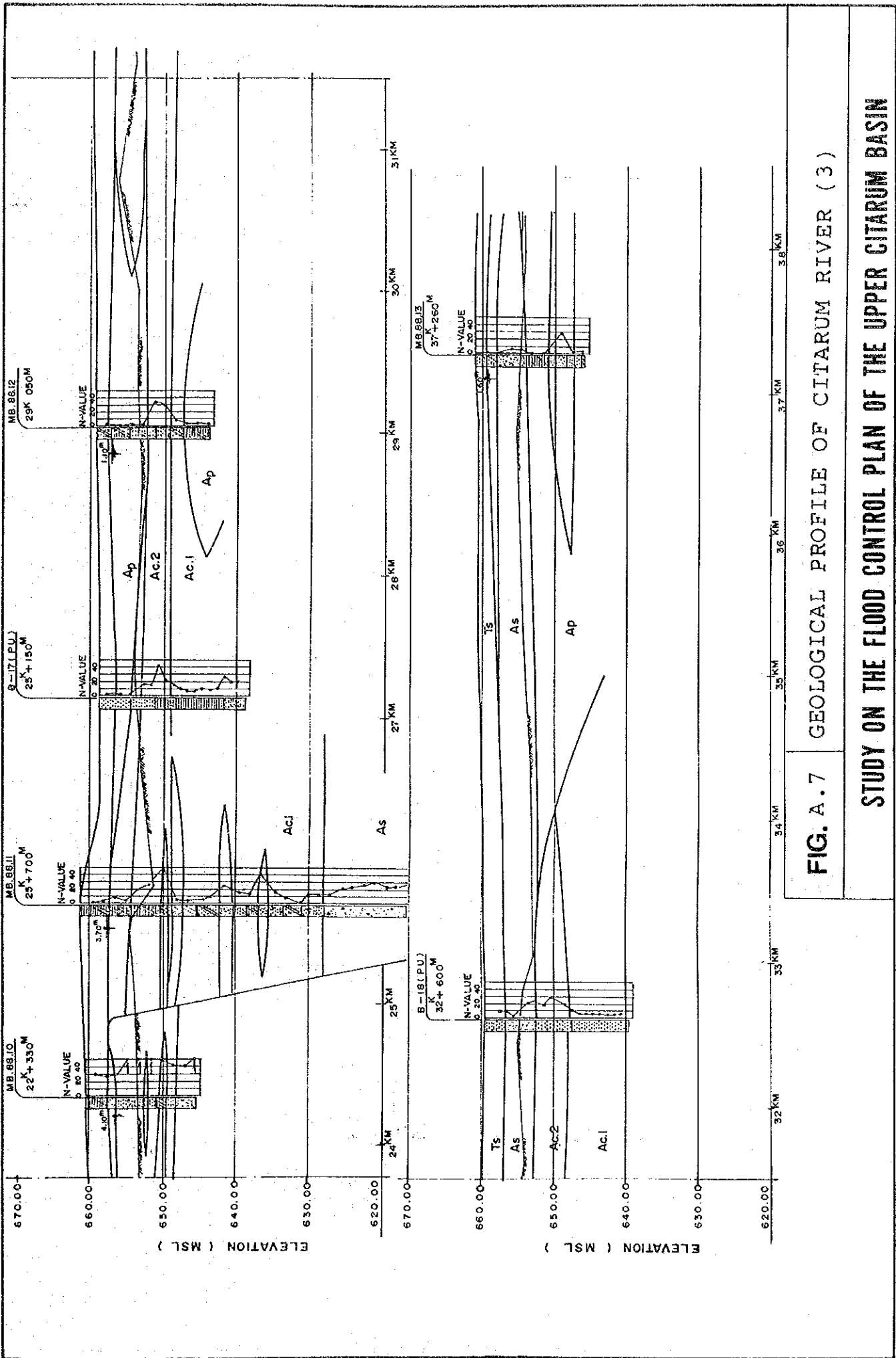


FIG. A.7 GEOLOGICAL PROFILE OF CITARUM RIVER (3)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



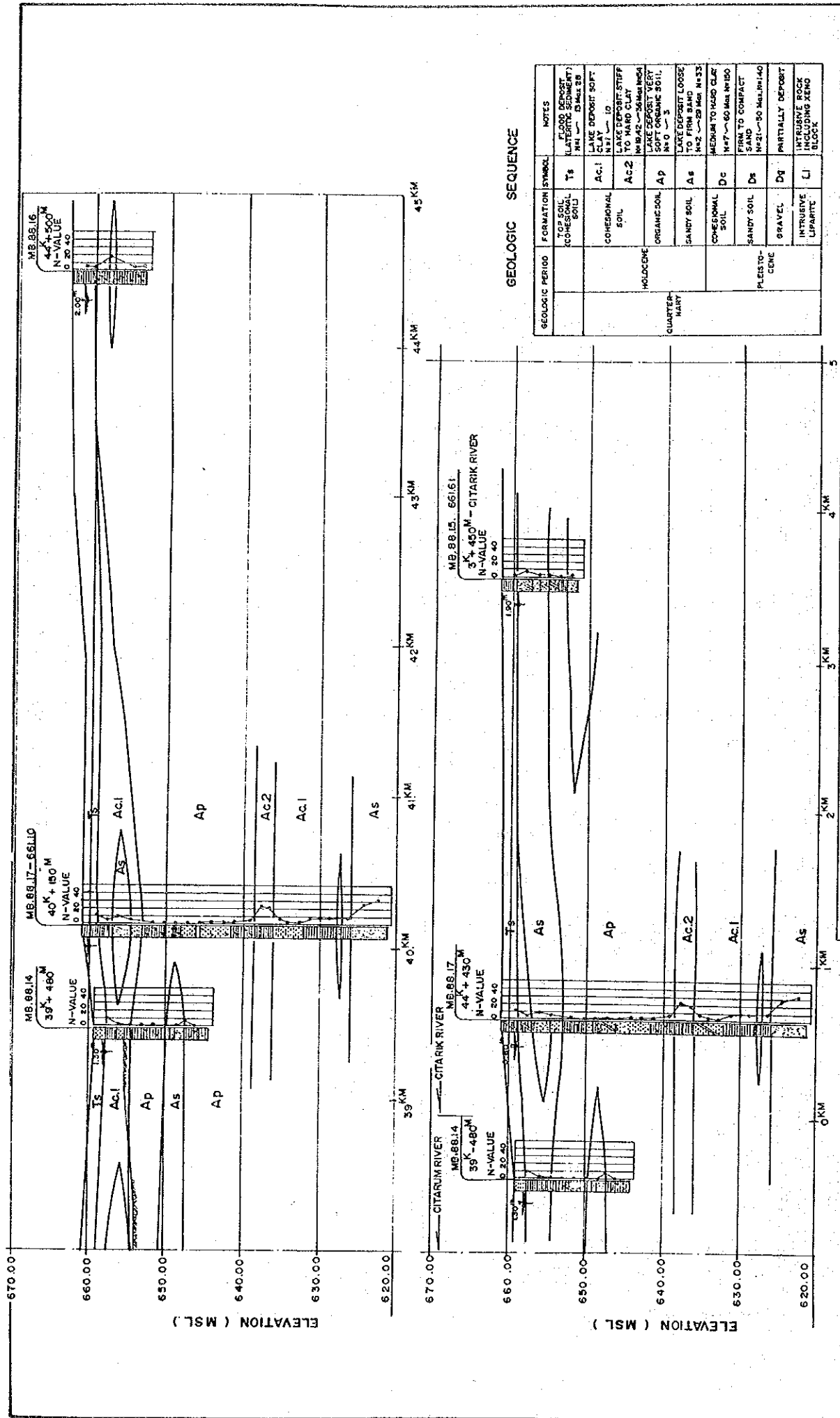


FIG. A.8 GEOLOGICAL PROFILE OF CITARUM RIVER (4)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



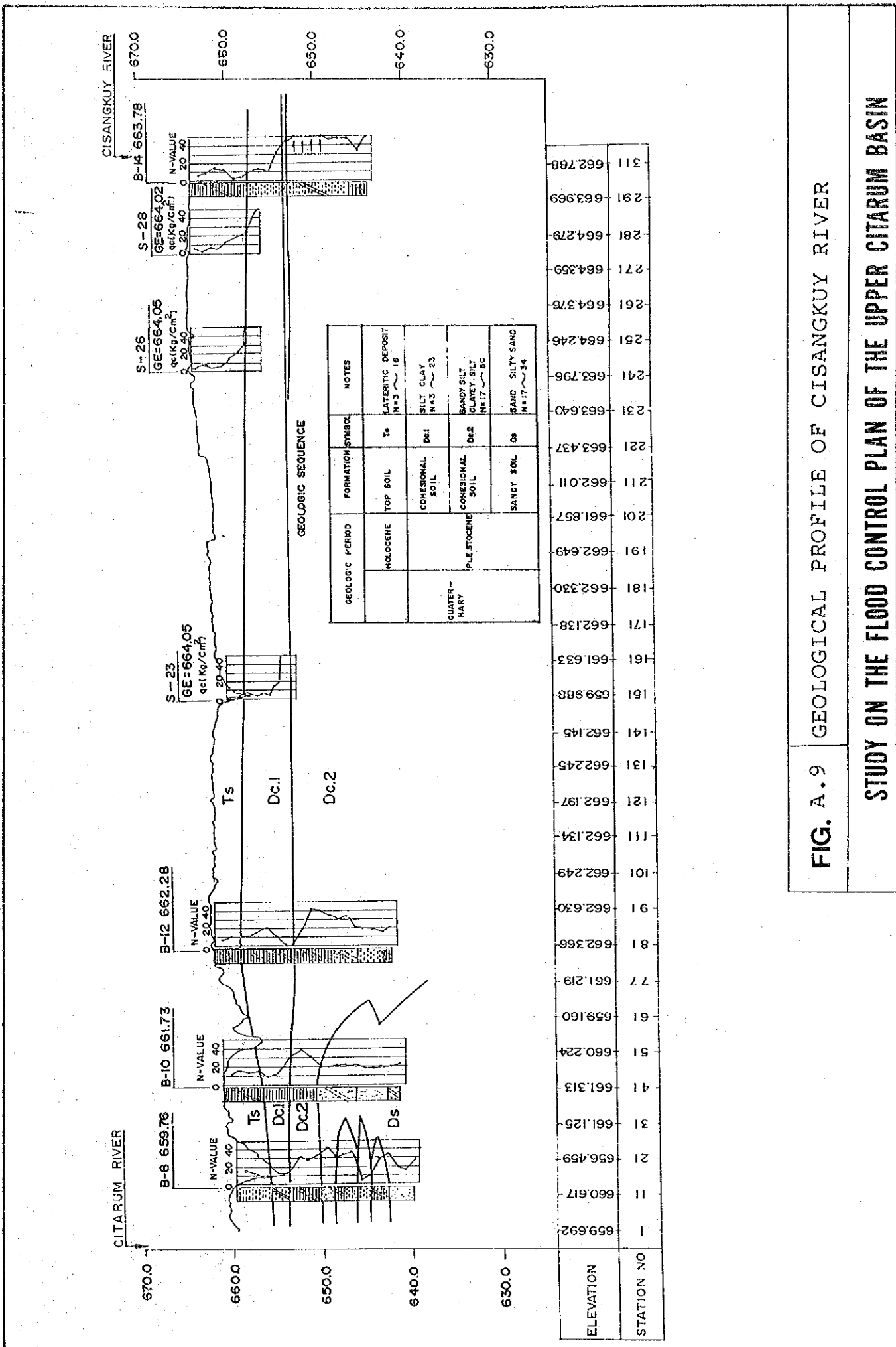


FIG. A.9 GEOLOGICAL PROFILE OF CISANGKUY RIVER
STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



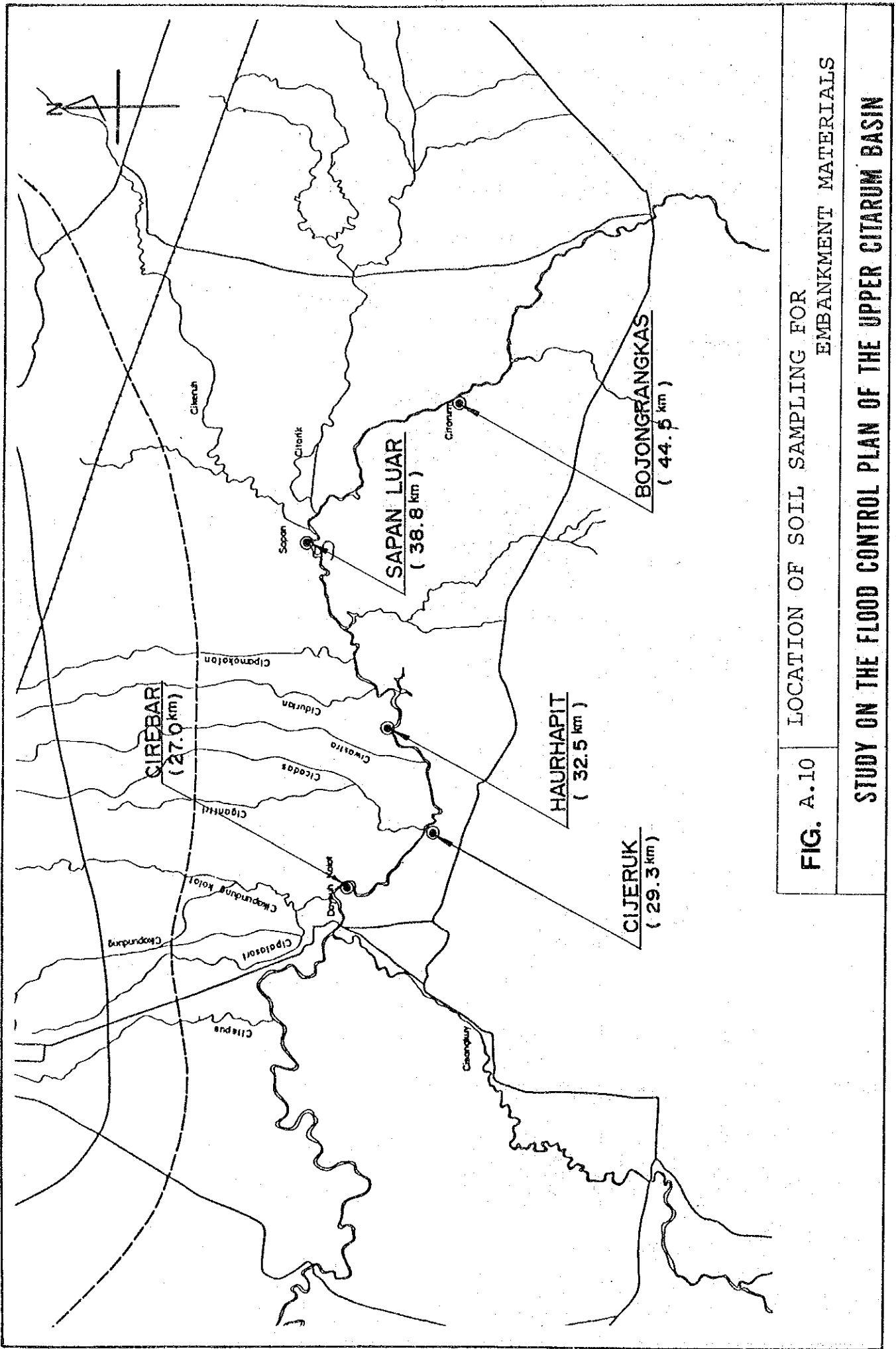
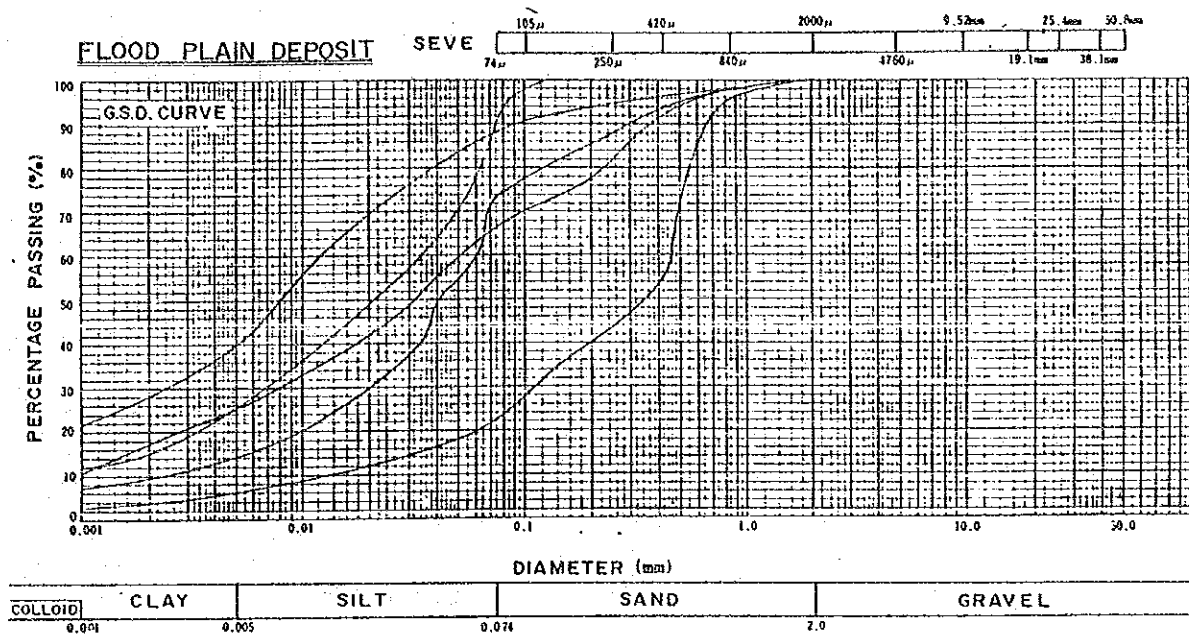
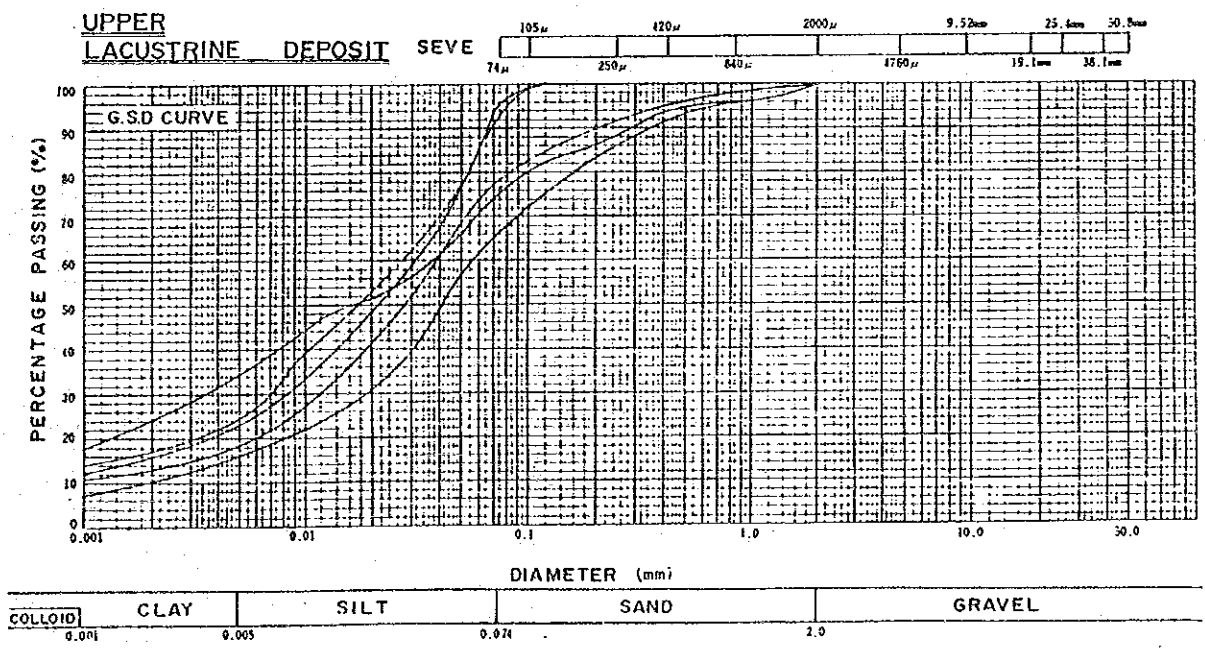


FIG. A.10 LOCATION OF SOIL SAMPLING FOR EMBANKMENT MATERIALS

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



FLOOD PLAIN DEPOSIT



UPPER LACUSTRINE DEPOSIT

FIG. A.11 GRAIN SIZE DISTRIBUTION CURVE

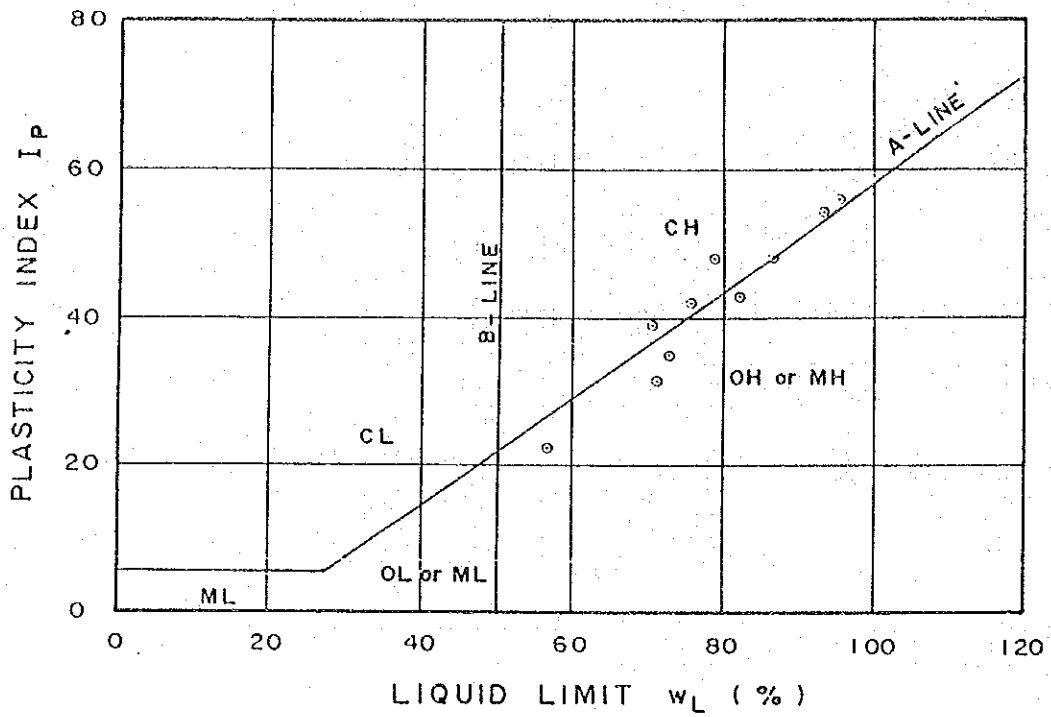


FIG. A.12

CONSISTENCY CHART

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

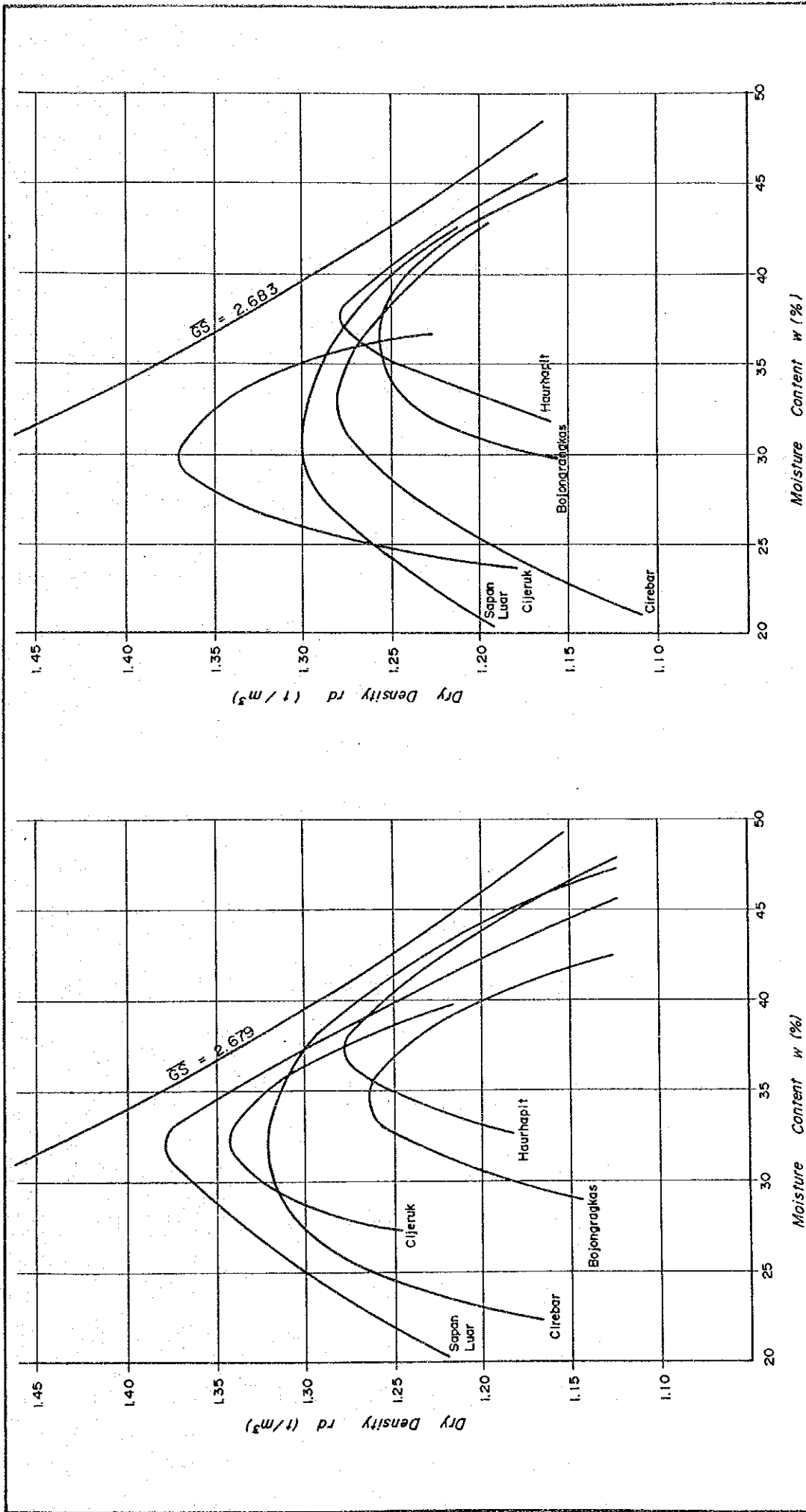


FIG. A.13

COMPACTION CURVE

FLOOD PLAIN DEPOSIT UPPER LACUSTRINE DEPOSIT

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



SUPPORTING REPORT B

SOCIO-ECONOMIC CONDITION

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SUPPORTING REPORT B SOCIO-ECONOMIC CONDITION

1. Project Background

1.1 National Background

Indonesia is located in a tropical zone which extends from 6° north latitude to 11° south latitude and from 95° to 141° east longitude. The total land area of the country is about 1.9 million km² comprising 13,667 islands. Of the numerous islands, Jawa island is the fifth largest island and covers an area of 134,044 km² which occupies approximately 7% of the total area of Indonesia. Administratively, it is divided into five provinces, Jawa Barat (West Java), Jawa Tengah (Central Java), Jawa Timur (East Java) and two special provinces, D.K.I. Jakarta and D.I. Yogyakarta.

Indonesia has a population of 147 million according to the 1980 census, corresponding to a population density of 77 persons/km². The growth in population was about 28 million, as compared with the 1971 census, i.e., the average growth rate was 2.37% per annum during the period from 1971 to 1980. This growth rate is 0.27% higher, as compared with that for the period from 1961 to 1971. The population of Indonesia in the year 2000 is projected to be 223 million, according to the Statistical Yearbook of Indonesia 1985 (Ref. 001). Using the 1961 and 1980 censuses, if the average annual growth rate of 2.23% in the period from 1961 to 1980 is applied to the forecast of population in the future, the population of Indonesia is expected to reach some 230 million by 2000.

As for population, Indonesia is at present ranked as the fifth largest country in the world following China, India, the Soviet Union and the United States, and in 1980 Jawa island has a population of some 91 million corresponding to 62% of the total population of Indonesia. The ratio of the population in Jawa island to the total population of Indonesia has decreased year by year owing to the promotion of transmigration policy by the government. Nevertheless, Jawa island,

with a population density of 690 persons/km² in 1980, is still one of the most densely inhabited areas in the world.

The population of 10 years old and over according to the 1980 census was 105.4 million, about 24 million more than that of the 1971 census. Among them, the labor force is 52.3 million corresponding to 49.6% of the population of 10 years old and over. Comparing these figures with the 1971 figures, though the labor force increased by 10.5 million, the participation rate of the labor force decreased from 51.3% to 49.6%, due to the increase in the population of school attendance.

Percentage of workers employed in the primary sector such as agriculture, forestry, hunting and fishing, in Indonesia was about 55% of the number of the whole workers in 1980 or decreased by about 10%, as compared with the 1971 percentage. Share of the primary sector to the whole industry has a tendency to decrease. On the contrary, there is an observable tendency for increasing shares of manufacturing industry, trade and service sub-sectors. Such a change in industrial structure is also seen in the difference between urban and rural are a growth rate in population, i.e., the average growth rates of population in the urban and rural areas in Indonesia is 2.8% and 1.8% per annum respectively, during the period from 1971 to 1980. In view of the present socio-economic conditions in Indonesia, such a tendency is expected to continue for quite some time.

The Indonesian economy has achieved a remarkable development in the last decade. The per capita GDP in Indonesia in 1985 reached Rp. 588 thousand at current prices as in Table B.6, corresponding to about 50% real increase of that in 1975. Such a growth might be largely due to the expansion of the manufacturing industry, instead of the mining sector including petroleum production. The change in industrial structure is evident from the in share of GDP among industries; the share of agricultural sector to the total GDP decreased from 31.7% to 23.6% between 1975 and 1985, while the share of manufacturing sub-sector increased from 8.9% to 13.5% during the same period, as shown in Table B.8.

In Indonesia, the Fourth Five-Year Development Plan (REPELITA IV 1984/85 to 1988/89) is under execution at present and its major objectives are:

- (1) to raise standard of living, literacy rate and welfare of people, and to strive for equitable distribution of them to the whole nation; and
- (2) to establish a solid foundation for the proceeding development stage.

During the period of REPELITA IV, the Government expects to achieve an average economic growth rate of 5.0% per annum, composing 3.0% in agriculture, 2.4% in mining, 9.5% in manufacturing, 5.0% in construction, 5.2% in transportation and communication and 5.0% in other sectors. In view of the economic growth rate of 5.8% in GDP from 1983 to 1984, the plan is regarded as being on a fair way to success. The Government also expect to keep an inflation rate of less than 8% per annum under control during the period.

At present, the agricultural sector is the second lowest of all industrial sectors in terms of the economic growth rate and the per capita income. To realize the equitable distribution of the fruits of economic growth, which is one of the major objectives of REPELITA IV, further economic growth is desired in the primary sector in which majority of the Indonesia people are engaged. Accordingly, the flood control project for the upper Citarum River Basin is an effective factor to increase agricultural production.

1.2 Regional Background

The Province of Jawa Barat (West Java) covers an area of 46,300 km² occupying 35% of the total area of the Jawa island and its administrative units consist of 20 Kabupatens (regencies) and four Kotamadyas (municipalities) which are further divided into 439 kecamatans (sub-districts) as of 1985.

According to the 1980 census, the Province has a population of 27.5 million corresponding to one third of the total population of Jawa island

and its population density is 593 persons/km². The population increased by 5.8 million between 1971 and 1980 with an average annual growth rate of 2.66%. This growth rate is higher than that for the period from 1961 to 1971.

The population of 10 years old and over in the Province was 19.1 million in 1980 comprising 9.5 million of male and 9.6 million of female which corresponds to 70% of the total population. This total population increased by 4.8 million as compared with that in 1971. The labor force was 8.7 million in 1980, corresponding to 45.5% of the population of 10 years old and over. The percentage of employed persons in the Province was 97.8% of the total labor force in 1980, and the percentage of persons employed in the agricultural sector to those in all industrial sectors decreased from 58.0% in 1971 to 47.8% in 1980. It seems that such a decrease in the share of agricultural sector is faster than the Indonesian average.

The gross regional domestic product (GRDP) for the Province of Jawa Barat increased from Rp. 2,261 billion in 1978 to Rp. 3,654 billion in 1984 at 1975 constant prices. This showed an average real growth rate of 8.3% per annum. The shares in GRDP by main sectors in 1984, were 25.9% for agriculture, 7.0% for mining and quarrying, 10.8% for manufacturing industries, 9.8% for construction, 5.6% for transportation and communication and 22.0% for trade, financing and other services. The share of agricultural sector reduced by 4.5% during the period from 1978 to 1984.

The per capita income for the Province in 1984 was Rp. 388,000 at current prices and Rp. 122,000 at the 1975 constant prices. The average real growth rate of the per capita income was 5.8% per annum, during the period from 1978 to 1984.

2. Socio-Economic Condition

2.1 Administration

The study area, the upper Citarum Basin area, is situated almost at the center of the Province of Jawa Barat. The study area consists of three administrative autonomies: Kotamadya Bandung; about a half of Kabupaten Bandung; and a small portion of Kabupaten Sumedang. It covers about 1,771.0 km² or 4.0% of the gross area of the Province, comprising 20 Kabupatens. Kotamadya Bandung is not only the center of the study area but also the capital city of the Province. The study area, therefore, functions as an administrative center of the Province, as well. Although the catchment area of the upper Citarum River includes a small part of Kabupaten Sumedang, the study area for socio-economy is limited to Kotamadya Bandung and Kabupaten Bandung, judging from objectives of the socio-economic study in the present master plan.

1,525.9 km² or 85.0% of the upper Citarum Basin is covered by Kabupaten Bandung comprising 36 Kecamatans, and consists of 26 Kecamatans of the total 36 Kecamatans. 81.0 km² or 4.5% of the basin is the whole area of Kotamadya Bandung, and comprises 16 Kecamatans. The rest 164.1 km² of the study area belongs to Kabupaten Sumedang, as shown in Table B.1.

The intermediate administrative unit between Kecamatan and Kotamadya is called Kota Administratif (Kotif.). In the study area, Kotif Cimahi is situated neighboring Kotamadya Bandung, which consists of three Kecamatans of Cimahi Utara, Cimahi Tengah and Cimahi Selatan.

Each Kecamatan has several Desas (villages) as a terminal administrative district. The number of Desas related to aforesaid Kecamatan is 467 in total comprising 327 in Kabupaten Bandung, 91 in Kotamadya Bandung and 49 in Kabupaten Sumedang. Most of the study area is covered by rural areas, although the rural areas surrounding Kotamadya Bandung, i.e., outskirts of Kotamadya Bandung, are gradually urbanized by the sprawl of the city. Fig. B.1 shows this administrative structures of the study area.

2.2 Population

Population censuses in Indonesia were taken in the years 1961, 1971 and 1980 since independence. Population figures for these years for the whole Indonesia, Jawa, the Province of Jawa Barat and the study area are given in Table B.2. According to the 1980 census, the study area has a population of 3.633 million, comprising a 1.461 million in Kotamadya Bandung, 2.023 million in Kabupaten Bandung and 148,000 in Kabupaten Sumedang. The population in the study area was about 13% of that in the Province.

Population in the study area is considerably dense, i.e., in Kotamadya Bandung and its outskirts, and relatively sparse in the surroundings of the center. The population density for the study area was 16.1 persons/ha in 1980, as shown in Table B.2. This figure is higher than those for the Province and the whole country. According to the table, the population density in the study area is broken down in 1980 as follows: 180.5 persons/ha in Kotamadya Bandung, 10.1 persons/ha in Kabupaten Bandung and 9.1 persons/ha in Kabupaten Sumedang. Incidentally, the population density of the whole Kabupaten Bandung is 8.7 persons/ha, so the portion of Kabupaten Bandung within the basin is somewhat denser than the whole area of the basin.

Besides 1980 census, annual statistics of population are available, compiled by the local government on the basis of registered population. Referring to these registered population data, population in the study area is estimated as 3.966 million in 1985. The population distribution by Kecamatan related to the study area is given in Table B.3. According to this estimation, in spite of the fact that the population of Kotamadya Bandung has scarcely increased at the small rate of 0.7% per annum, population in the study area has increased at 1.8% annually. In particular, the adjacent Kecamatans, such as Cisarua, Lembang, Cicadas, Buah Batu and Marga Asih, have grown at a quite high rate. On the other hands, some other adjacent Kecamatans such as Cimahi Tengah, Cimahi Utara and Dayeuh Kolot seem to be matured by urbanization of Kotamadya expansion. It means that Kotamadya Bandung already has an overflowing population and that the increment of urban population toward Kotamadya Bandung is absorbed in the outskirts of the Kotamadya.

The future population in the year 2005, target year of this project, is estimated, referring to the following two plans: (a) Structure plan for Kotamadya Bandung 2005; and (b) Master plan for Metropolitan Bandung 2001. The future population in the Bandung region is projected as 6.440 million, with a break-down of 4.735 million in Kabupaten Bandung and 1.705 million in Kotamadya Bandung, as shown in Table B.4. Comparing these projection with the population in 1985, increment of population during 20 years between 1985 and 2005 is 1.737 million in Kabupaten and 191,000 in Kotamadya. Thus, 90% of incremental population will be absorbed in the Kabupaten area.

2.3 Labor Force and Employment

In Bandung region, the population of 10 years old and over in 1980 was over 2.932 million corresponding to 71% of the total population. According to the 1980 census, the labor force participation rate in the Province of Jawa Barat was 45.4% of the total population of 10 years old and over. In the present study, the number of labor force in Bandung region is estimated using the labor force participation rate of the Province, because of data availability on rates for the study area. The number of labor force in the Bandung region is estimated around 1.311 million. This number corresponds to 32% of the total population. In the same way, since the population of 10 years old and over in the flood area was 79,578 as shown in Table B.5, the number of labor force is estimated at 36,128 or 32% of the total population.

In the Province, more than 47.8% of the population in 1980 is employed in the agricultural sector though the share of agricultural sector is decreasing as a recent trend. This sector in the Province still has high share in the whole industries as to the occupation. On the other hand, the shares of both industrial and services' sectors are increasing and their shares reached to 17.6% and 34.6% in 1980, respectively.

2.4 Gross Regional Domestic Product

Table B.6 provides GRDP growth for Kabupaten in comparison with GRDP for the Province of Jawa Barat and GDP for Indonesia from 1975 to 1985. GRDP for Kabupaten Bandung is Rp. 832 billion in 1985 at current price. GRDP per capita is Rp. 243,000 in 1984, which is equivalent to 46.3% of national GDP per capita and to 74.2% of provincial GRDP per capita. On the other hand, in 1975 GRDP per capita for Kabupaten Bandung occupies 67.2% of the whole nation and 94.0% of the Province. These percentage of share have gradually decreased year by year. This implies that the productivity of Kabupaten Bandung has deteriorated as compared with not only the national average but also the provincial average.

Table B.7 shows GDP at 1973 constant prices and GRDP at 1975 constant prices from 1975 to 1984. During the period, GDP and per capita GDP grew at annual growth rates of 6.6% and 4.3%, respectively. Though the growth rates have slightly reduced in recent years, they seem to remain stable except in 1982. GRDP and per capita GRDP for Kabupaten Bandung grew at rates of 8.4% and 5.2%, respectively. They are higher than the national ones but a little lower than the provincial ones. The progressive growth of GRDP of Kabupaten Bandung is not stable as compared with the progress of both the nation and the Province.

The regional economic structure of Kabupaten Bandung in 1985 is as follows: the agricultural sector is Rp. 222 billion or 26.6% of GRDP; the industrial sector, Rp. 244 billion or 29.3%; and the services' sector, Rp. 367 billion or 44.1%. Per capita GRDP is Rp. 272,000 in 1985, which is only 46.3% of the national value of Rp. 588,000. The percentage share of agricultural sector to GRDP in Kabupaten Bandung decreased from 35.2% in 1975 to 26.6% in 1985 as shown in Table B.8, in spite of the fact that the sector grew at a high rate of 5.8% per annum during almost the same period. This is because other economic sectors has grown at a higher rate than the agricultural sector. For instance, (a) electricity, gas and water-supply sub-sector, (b) construction sub-sector, and (c) transportation and communication sub-sector have grown at considerably high speed as shown in the table. This growth might be kept up by investment in large-scale projects such as Saguling dam

project. Although the manufacturing sub-sector in Kabupaten Bandung has a comparatively large share both with respect to the nation and to the Province in 1985, it did not attain a remarkable growth. According to Table B.9, the sub-sector represents a large share in the regional economy, but its growth is the lowest among all sub-sectors during the past ten years.

Per capita GRDP of Kabupaten Bandung in the year 2005 is estimated to be Rp. 464,000 at 1985 constant prices on the following assumptions as shown in Table B.10: (a) the national economy will grow at a rate of 5.0% per annum, the same rate as REPELITA IV, up to the year 2000; (b) after 2000, its growth rate will decrease to 4.0%; and (c) the regional share of GRDP per capita to the national one will be the same as 1985 condition of 46.3%. Then, GRDP in Kabupaten Bandung is expected to be Rp. 2,198 billion at 1985 constant prices.

3. Land-use

3.1 Present Land-use

The land-use composition of the upper Citarum Basin is dominantly occupied by natural utilization such as forest with an area of 23.7% of the basin area (1,771.0 km²). Agricultural land-use accounts for 68.7% of the basin, broken down as follows: lowland paddy field with 39.2%; upland dry field and plantation with 29.5%. Built-up area occupies only 7.1% of the total basin area. Fig. B.2 shows the present land-use conditions in the study area.

Built-up areas in the basin are being expanded into surroundings of Kotamadya Bandung. A basic frame-work of Kotamadya Bandung was formed in the 1950's. Afterwards, the urban area has expanded along the trunk lines year by year. Fig. B.3 shows the progress of urbanization in Kotamadya Bandung. Urbanized area grew from 3,650 ha in 1968 to 6,003 ha in 1981. Then, agricultural areas in Kotamadya decreased from 3,341 ha to 1,020 ha in the same period, into which urbanization has sprawled out continuously. Although southern parts of Kotamadya is backward in development, completion of Jl. Soekarno-

Hatta by-pass line facilitates urbanization of these parts. Expansion of urban area exceeded the Kotamadya boundary and reached adjacent Kecamatans such as Dayeuh Kolot and Ujung Berung. It is forming a conurbation with these surrounding Kecamatans.

3.2 Land-use Plan

The future land-use pattern of the study area should be provided taking into consideration of existing plans published by concerned public agencies. The basic development policies based on the existing plans are to develop the Bandung metropolitan area including the surrounding areas of Kotamadya Bandung and to promote the balanced development in order to prevent the disordered urban expansion and the excessive centralization of population. On the basis of the above basic policies, the following development directions is assumed to provide the future land-use pattern of the study area:

- (a) The Kotamadya Bandung area is inadequate for the future urban development, so further urban growth will extend toward the outskirts of the Kotamadya such as Kecamatans of Cicadas, Buah Batu, Dayeuh Kolot and Kotif. Cimahi, which have good transportation accessibility to the central area;
- (b) The northern part of the Kotamadya including Kecamatan Lembang in the upper reaches of tributaries of the Citarum river, hence careful control measures for environmental pollution are required, and further development in this part should be discouraged in the future;
- (c) Several medium and small towns in the Kabupaten Bandung such as Kecamatans of Padalarang, Ranca Ekek, Ciparay, Majalaya, Pameungpeuk, Banjaran and Soreang are expected to function as satellite cities in the metropolitan areas;
- (d) In the southern part of the Kotamadya to Kecamatan Dayeuh Kolot, the ribbon development along the existing arterial road should be controlled because of flooding problems of the Citarum river;

- (e) New urban development in the area to the west of Cimahi and Banjaran will be restricted, because these areas are situated around the reservoir of Saguling Dam and will be preserved with natural environment;
- (f) Further urbanization to the southern part should be implemented in the planned sub-center area, which is reasonably far from the Citarum river. The flood area will be reserved for agricultural field or green belt and be kept with low population density; and
- (g) Highland areas located in the northern and southern part of the upper Citarum river basin utilized for forest and plantation should be restricted from further development. These areas are quite important for flood control from the point of view of overall watershed management in the catchment area.

The future land-use pattern for the study area is demarcated on the basis of these development and planning policies, as shown in Fig. B.4. Accordingly built-up area will increase from 125 km² to 284 km².

References and Data Books

No.	Title	Issued on	Issued by
001	STATISTIK INDONESIA 1985	Nov.1986	BPS
002	PENDUDUK JAWA-BARAT HASIL REGISTRASI PENDUDUK AKHIR TAHUN 1985	Oct.1986	BPS Kantor Statistik Propinsi Jawa Barat
003	PENDUDUK JAWA BARAT, SERI SUPAS NO.15 HASIL SURVEI PENDUDUK ANTAR SENSUS 1985	Jan.1986	BPS
004	PENDUDUK KABUPATEN DT.II BAUDUNG PER DESA HASIL REGISTRASI PENDUDUK TAHUN 1986	Aug.1987	Kantor Statistik Kab. Bandung
005	PENDUDUK KABUPATEN DT.II BAUDUNG PER DESA HASIL REGISTRASI PENDUDUK TAHUN 1985	May 1986	Kantor Statistik Kab. Bandung
006	PENDUDUK KABUPATEN DT.II BAUDUNG PER DESA HASIL REGISTRASI PENDUDUK TAHUN 1974-1981	Apr.1983	Kantor Statistik Kab. Bandung
007	STATISTIK KABUPATEN DT.II BANDUNG TAHUN 1978-1981	Jan.1983	Kantor Statistik Kab. Bandung BAPPEDA Kab. Bandung
008	KABUPATEN BANDUNG DALAM ANGKA 1984	Mar.1987	Kantor Statistik Kab. Bandung
009	STATISTIK DOTAMADYA DAERAH TK.II BANDUNG 1985	Sep.1986	BAPPEDA Kot. Bandung Kantor Statistik Kot. Bandung
010	SENSUS EKONOMI 1986 KECAMATAN DI KABUPATEN BAUNDUNG	Aug.1987	Kantor Statistik Kab. Bandung
011	PENDUDUK PROPINSI JAWA BARAT 1980 HASIL PENCACAHAN LENGKAP	Mar.1981	BPS Kantor Statistik Propinsi Jawa Barat
012	INDONESIA, SENSUS PENDUDUK 1971 PENDUDUK DIPERINTJI MEMURUT KETJAMATAN DI DJAWA-MADURA	May 1972	BPS

References and Data Books

No.	Title	Issued on	Issued by
001	STATISTIK INDONESIA 1985	Nov.1986	BPS
002	PENDUDUK JAWA-BARAT HASIL REGISTRASI PENDUDUK AKHIR TAHUN 1985	Oct.1986	BPS Kantor Statistik Propinsi Jawa Barat
003	PENDUDUK JAWA BARAT, SERI SUPAS NO.15 HASIL SURVEI PENDUDUK ANTAR SENSUS 1985	Jan.1986	BPS
004	PENDUDUK KABUPATEN DT.II BAUDUNG PER DESA HASIL REGISTRASI PENDUDUK TAHUN 1986	Aug.1987	Kantor Statistik Kab. Bandung
005	PENDUDUK KABUPATEN DT.II BAUDUNG PER DESA HASIL REGISTRASI PENDUDUK TAHUN 1985	May 1986	Kantor Statistik Kab. Bandung
006	PENDUDUK KABUPATEN DT.II BAUDUNG PER DESA HASIL REGISTRASI PENDUDUK TAHUN 1974-1981	Apr.1983	Kantor Statistik Kab. Bandung
007	STATISTIK KABUPATEN DT.II BANDUNG TAHUN 1978-1981	Jan.1983	Kantor Statistik Kab. Bandung BAPPEDA Kab. Bandung
008	KABUPATEN BANDUNG DALAM ANGKA 1984	Mar.1987	Kantor Statistik Kab. Bandung
009	STATISTIK DOTAMADYA DAERAH TK.II BANDUNG 1985	Sep.1986	BAPPEDA Kot. Bandung Kantor Statistik Kot. Bandung
010	SENSUS EKONOMI 1986 KECAMATAN DI KABUPATEN BAUNDUNG	Aug.1987	Kantor Statistik Kab. Bandung
011	PENDUDUK PROPINSI JAWA BARAT 1980 HASIL PENCAHAHAN LENGKAP	Mar.1981	BPS Kantor Statistik Propinsi Jawa Barat
012	INDONESIA, SENSUS PENDUDUK 1971 PENDUDUK DIPERINTJI MEMURUT KETJAMATAN DI DJAWA-MADURA	May 1972	BPS

No.	Title	Issued on	Issued by
013	LAPORAN TAHUNAN 1986	Mar.1986	Pemerintah Kab. Bandung Dinas Pertanian Tanaman Pangan
014	LAPORAN TAHUNAN, DINAS PERERNAKAN KABUPATEN BANDUNG TAHUN 1985-1986	Apr.1986	Pemerintah Kab. Bandung
015	LAPORAN TAHUNAN KANTOR DEPARTEMEN / CABANG DINAS PERINDUSTRIAN KABUPATEN DAERAH TINGKAT II BANDUNG TAHUN 1986	Jan.1987	Kantor Wilayah Dinas Perindustrian
016	STATISTIK JAWA BARAT TAHUN 1980	Dec.1981	Kantor Statistik Propinsi Jawa Barat
017	STATISTIK JAWA BARAT TAHUN 1982	Dec.1983	Kantor Statistik Propinsi Jawa Barat
018	STATISTIK JAWA BARAT TAHUN 1983	Dec.1984	Kantor Statistik Propinsi Jawa Barat
019	STATISTIK JAWA BARAT TAHUN 1984	Dec.1985	Kantor Statistik Propinsi Jawa Barat
020	STATISTIK JAWA BARAT TAHUN 1985	Dec.1986	Kantor Statistik Propinsi Jawa Barat
021	STATISTIK KABUPATEN BANDUNG TAHUN 1977	Sep.1978	Kantor Sensus & Statistik Kab. Bandung
022	STATISTIK KABUPATEN BANDUNG TAHUN 1976	Sep.1977	Kantor Sensus & Statistik Kab. Bandung
023	PENELITIAN TENTANG KEBUTUHAN TRAINING PENGUSAHA BATA METAH DAN BATAKO DI KABUPATEN BANDUNG	May 1986	Konrad Adenauer Stiftung & Lembaga Manajemen Fakultas Ekonomi Universitas Padjadjaran
024	PRODUK DOMESTIK REGIONAL BRUTO KABUPATEN BANDUNG 1975 - 1982		- Kantor Statistik Kab. Bandung - BAPPEDA Kab. Bandung

No.	Title	Issued on	Issued by
025	PRODUK DOMESTIK REGIONAL BRUTO KABUPATEN BANDUNG 1983 - 1986	1987	BAPPEDA Tk. II Kab. Bandung
026	PRODUK DOMESTIK REGIONAL BRUTO MENURUT WILAYAH PEMBANGUNAN PROPINSI DT.I. JAWA BARAT 1979-1983		- Kantor Statistik Propinsi Jawa Barat - Badan Perencanaan Pembangunan Daerah Propinsi Jawa Barat
027	PRODUK DOMESTIK REGIONAL BRUTO MENURUT WILAYAH PEMBANGUNAN PROPINSI DT.I. JAWA BARAT 1980-1984		- Kantor Statistik Propinsi Jawa Barat - Badan Perencanaan Pembangunan Daerah Propinsi Jawa Barat
028	PRODUK DOMESTIK REGIONAL BRUTO MENURUT WILAYAH PEMBANGUNAN PROPINSI DT.I. JAWA BARAT 1983-1985		- Kantor Statistik Propinsi Jawa Barat - Badan Perencanaan Pembangunan Daerah Propinsi Jawa Barat
029	STATISTIK INDONESIA 1986	Jan.1987	BPS
030	STATISTIK INDONESIA 1977-1978		BPS
031	STATISTIK JAWA BARAT TAHUN 1981		Kantor Statistik Propinsi Jawa Barat

Table B.1 OUTLINE OF THE STUDY AREA

Kabupaten Kotamadya	Area (km ²)	Share to Total Area (%)	Rate to Whole Sub-district (%)	Number of Kecamatan	Number of Desas
Kabupaten Bandung	1525.9	86.2	50.2	26	327
Kabupaten Sumedang	164.1	9.3	11.5	2	49
Kotamadya Bandung	81.0	4.6	100.0	16	91
Total (Study Area)	1771.9	100.0	-	44	467

Table B.2 POPULATION IN THE STUDY AREA, JAWA BARAT AND INDONESIA IN 1961, 1971 AND 1980

Item	Area (km ²)	Population Census (10 ³)			Average Annual Population Growth Rate (%)		Population Density per km ² (1980)
		Oct. 1961	Sep. 1971	Oct. 1980	'60-'71	'71-'80	
Indonesia	1,919,443	97,086	119,208	147,490	2.10	2.37	77
Jawa Barat	46,300	17,615	21,624	27,454	2.09	2.66	593
Kabupaten Bandung	3,041	1,596	1,974	2,669	2.15	3.41	872
Kotamadya Bandung	81	980	1,202	1,461	2.05	2.20	18,047
Bandung Region	3,122	2,576	3,176	4,130	2.12	2.96	1,354
Study Area	2,256.41	-	2,776	3,633	-	3.13	1,610
- Kabupaten Bandung	2,012.41	-	1,452	2,023	-	3.75	1,006
- Kabupaten Sumedang	163.41	-	122	148	-	2.18	908
- Kotamadya Bandung	81	-	1,202	1,461	-	2.20	18,047

Note : /1 Since the administrative areas are applied, it is different from the physically demarcated basin area mentioned in Table B.1.

Sources : 001, 002 & 004.

Table B.3 POPULATION DISTRIBUTION IN THE STUDY AREA

Kabupaten Kotamadya Kecamatan ¹	Census Population (1980)	Estimated Population (1985)	Average Annual Growth Rate (%)	Area (ha)	Density in 1985 (Persons/ha)
<u>Kabupaten Bandung</u>	2,023,462	2,295,019	2.55	201,231	11.4
Ciwidey	75,981	82,287	1.61	15,570	5.3
Pasirjambu	44,484	55,412	4.49	10,676	5.2
Pangalengan	100,230	106,899	1.30	47,720	2.2
Pacet	51,987	60,629	3.12	5,479	11.1
Paseh	59,141	63,098	1.30	5,369	11.8
Cicalengka	74,030	92,175	4.48	8,557	10.8
Ranca Ekek	58,673	64,039	1.77	4,604	13.9
Majalaya	122,754	127,889	0.82	4,625	27.7
Ciparay	121,457	142,526	3.25	9,432	15.1
Banjaran	101,049	111,419	1.97	9,552	11.7
Pemeungpeuk	86,607	92,629	1.35	5,821	15.9
Soreang	76,749	84,335	1.90	6,644	12.7
Dayeuh Kolot	131,616	139,343	1.15	2,532	55.0
Buah Batu	97,189	118,032	3.96	6,226	19.0
Ujung Berung	115,210	141,237	4.16	8,324	17.0
Cicadas	87,346	112,748	5.24	5,374	21.0
Lembang	86,482	103,532	3.66	10,349	10.0
Cisarua	75,945	97,692	5.17	5,236	18.7
Ibun	40,627	47,261	3.07	6,145	7.7
Katapan	43,655	51,066	3.19	2,041	25.0
Cikancung	33,756	42,883	4.90	4,156	10.3
Marga Asih	46,407	54,338	3.21	2,096	25.9
Kertasari	45,848	51,056	2.18	10,762	4.7
Cimahi Selatan	81,478	95,045	3.13	1,708	55.6
Cimahi Tengah	106,907	93,730	-2.60	911	102.9
Cimahi Utara	57,854	63,719	1.95	1,322	48.2
<u>Kabupaten Sumedang</u>	147,697	156,776	1.20	16,270	9.6
Cikeruh	72,551	78,398	1.56	8,212	9.5
Tanjungsari	75,146	78,378	0.85	8,058	9.7
<u>Kotamadya Bandung</u>	1,461,407	1,514,300	0.71	8,098	187.0
Study Area	3,632,566	3,966,095	1.77	225,599 ²	17.6
Bandung region	4,130,599	4,512,900	1.79	312,208	14.5

Note : /1 Kecamatan related to the study area.

/2 Since the administrative district is applied, it is different from the the physically demarcated basin area shown in Table B.1.

Source : 004

Table B.4 POPULATION FRAMEWORK IN BANDUNG REGION : 2005

Item	Area (km ²)	Population (10 ³)			Average Annual Population Growth Rate(%)		Population Density (1985)
		1980 ¹	1985 ²	2005	'80-'85	1985-2005	
Indonesia	1,919,443	147,490	164,047	244,734	2.15	2.02	85
Kabupaten Bandung	3,041	2,669	2,999	4,735	2.35	2.31	986
Kotamadya Bandung	81	1,461	1,514	1,705	0.71	0.60	18,700
Bandung Region	3,122	4,130	4,513	6,440	1.79	1.79	1,445
Study Area	2,256 ³	3,632	3,966	5,527	1.78	1.67	1,758
- Kabupaten Bandung	2,012 ⁴	2,023	2,295	3,623	2.55	2.31	1,140
- Kabupaten Sumedang	163 ⁴	148	157	199	1.20	1.20	960
- Kotamadya Bandung	81	1,161	1,514	1,705	0.71	0.60	18,700

- Note :
1. Population Census.
 2. Estimated Population by the study team.
 3. Projection in Ref. 029.
 4. Estimated by a growth rate of 1.9%, the same rate as the projected rate between 1995 and 2005 in Ref. 029.
 5. Estimated population based on the Master Plan for Metropolitan Bandung, 2001.
 6. Structure Plan for Kotamadya Bandung, 2005.
 7. Since the administrative areas are applied, it is different from the physically demarcated basin area mentioned in Table B.1.

Table B.5 POPULATION DISTRIBUTION BY SEX AND BY AGE IN THE FLOOD AREA : 1986

Zone	Sex		Age (Year)		Total		Zone Area (ha)	Density (p./ha)
	Male	Female	0 - 9	10 & Over	Number	Percent(%)		
Zone A	19,951	21,478	12,512	28,917	41,429	36.9	606	68.4
Zone B	13,742	12,228	7,397	18,573	25,970	23.1	1,454	17.9
Zone C	11,525	9,168	6,117	14,576	20,693	18.4	2,295	9.0
Zone D	5,399	5,460	2,951	7,908	10,859	9.7	1,108	9.8
Zone E	7,128	6,173	3,697	9,604	13,301	11.4	1,786	7.4
Total	56,683	55,559	32,674	79,578	112,252	100.0	7,249	15.5
Percentage Distribution(%)	50.5	49.5	29.1	70.9	100.0	-	-	-

Source : Potensi Desa

Table B.6 GDP AND GRDP AT CURRENT PRICES

Year	Indonesia		Jawa Barat		Kabupaten Bandung		Rate to the Nation		Rate to the Province	
	GDP (Rp.10 ⁹)	GDP per Capita (Rp.10 ³)	GDP (Rp.10 ⁹)	GRDP per Capita (Rp.10 ³)	GRDP (Rp.10 ⁹)	GRDP per Capita (Rp.10 ³)	GRDP (%)	GRDP per Capita (%)	GRDP (%)	GRDP per Capita (%)
1975	12,642.5	96.8	1,726.5	71.3	150.2	67.0	1.19	69.2	8.70	94.0
1976	15,466.7	115.7	2,135.7	86.1	198.9	85.8	1.29	74.2	9.31	99.7
1977	19,010.7	139.0	2,419.7	95.3	204.1	85.3	1.07	61.4	8.85	89.5
1978	22,746.0	162.7	3,015.0	115.9	269.3	108.9	1.18	66.9	8.93	94.0
1979	32,025.4	223.9	4,003.6	150.3	383.0	149.9	1.20	66.9	9.57	99.7
1980	45,445.7	310.5	5,651.5	171.9	442.9	167.8	0.97	54.0	7.84	97.6
1981	54,027.0	361.0	6,938.5	211.9	527.3	193.3	0.98	53.5	7.60	91.2
1982	59,632.6	389.8	7,757.8	231.7	590.8	209.7	0.99	53.8	7.62	90.5
1983	73,697.6	471.3	9,185.9	264.9	635.7	220.5	0.86	46.8	6.92	83.2
1984	87,535.5	547.7	11,592.5	327.3	721.6	242.9	0.82	44.3	6.22	74.2
1985	97,066.4	588.0	-	-	832.2	272.1	0.86	46.3	-	-

Sources : 024, 025, 026, 027 and Statistik Indonesia 1980 - 1986

Table B.7 GDP AND GRDP AT CONSTANT PRICES

Year	Indonesia:1				Java Barat:2				Kabupaten Bandung:2			
	GDP		GDP per capita		GRDP		GRDP per capita		GRDP		GRDP per capita	
	Value (Rp.10 ⁹)	Growth Rate (%)	Value (Rp.10 ³)	Growth Rate (%)	Value (Rp.10 ⁹)	Growth Rate (%)	Value (Rp.10 ³)	Growth Rate (%)	Value (Rp.10 ⁹)	Growth Rate (%)	Value (Rp.10 ³)	Growth Rate (%)
1975	7,631.8	-	58.4	-	1,726.5	-	71.3	-	150.2	-	67.0	-
1976	8,156.3	6.9	61.0	4.4	1,913.1	10.8	77.2	8.2	167.7	11.6	72.3	8.1
1977	8,870.4	8.8	64.8	6.3	2,010.8	5.1	79.2	2.6	157.3	-6.2	65.7	-9.2
1978	9,586.5	7.8	68.4	5.5	2,261.2	12.5	86.9	9.8	191.1	21.5	77.3	17.6
1979	10,164.9	6.3	71.1	3.8	2,324.2	2.8	87.3	0.4	213.2	11.5	83.4	7.9
1980	11,169.2	9.9	76.3	7.4	2,633.9	13.3	87.8	0.7	233.2	9.5	88.3	5.9
1981	12,054.6	7.9	80.5	5.5	2,933.9	11.4	96.7	10.1	262.7	12.6	96.3	9.0
1982	12,325.4	2.2	80.6	0.0	3,109.1	6.0	99.9	3.3	264.1	0.6	93.8	-2.7
1983	12,842.2	4.2	82.1	1.9	3,265.2	5.0	102.5	2.6	282.7	7.0	98.1	4.6
1984	13,591.4	5.8	85.0	3.5	3,654.3	11.9	113.9	11.1	310.0	9.7	104.4	6.4
Annual Average	-	6.6	-	4.3	-	8.7	-	5.3	-	8.4	-	5.1

Note : 1 At 1973 constant prices
2 At 1975 constant prices

Sources : 024, 025, 026, 027 and Statistic Indonesia 1980 - 1986

Table B.8 GDP AND GRDP BY INDUSTRIAL ORIGIN AT CURRENT PRICES : 1975 AND 1985

Industrial Type	Indonesia						Java Barat						Kabupaten Bandung					
	GDP (Rp.10 ⁹)		Distri- bution (%)		Average Annual Growth (%)		GRDP (Rp.10 ⁹)		Distri- bution (%)		Average Annual Growth (%)		GRDP (Rp.10 ⁹)		Distri- bution (%)		Average Annual Growth (%)	
	1975	1985	1975	1985	1975	1985	1975	1985	1975	1985	1975	1985	1975	1985	1975	1985	1975	1985
1. Agricultural	4,003	22,650	31.7	23.6	3.9	597	2,988	34.6	20.8	5.2	52.8	221.7	35.2	26.6	5.8	1.0	7.4	
2. Industry	4,268	34,480	33.8	35.9	8.6	387	5,848	22.4	40.6	12.6	37.1	243.7	24.7	29.3	9.3	0.7	5.6	
- Mining & quarrying	2,485	15,609	19.7	16.3	1.8	183	2,249	10.6	15.6	4.7	0.4	5.1	0.2	0.6	13.3	0.0	0.3	
- Manufacturing	1,123	12,983	8.9	13.5	12.2	138	2,468	8.0	17.2	12.4	31.2	136.9	20.8	16.5	4.1	1.1	10.3	
- Electricity, Gas & Water-supply	70	781	0.5	0.8	14.4	9	189	0.5	1.3	13.4	0.3	6.1	0.2	0.6	13.3	0.8	2.8	
- Construction	590	5,107	4.7	5.3	11.0	57	942	3.3	6.5	26.9	5.2	95.6	3.5	11.5	25.0	1.9	10.2	
3. Service	4,371	38,973	34.5	40.5	8.8	742	5,555	43.0	38.6	9.1	60.3	356.8	40.1	44.1	9.8	0.9	6.6	
- Trade, hotel & Restaurant	2,104	14,815	16.6	15.4	7.6	397	2,913	23.0	20.2	7.7	36.9	188.7	24.5	22.7	8.6	1.3	6.5	
- Transportation & Communication	521	6,279	4.1	6.5	13.1	73	704	4.2	4.9	11.8	4.5	72.5	3.0	8.7	22.4	1.2	10.4	
- Other services	1,746	17,843	13.8	18.6	8.9	272	1,938	15.8	13.5	10.2	18.9	105.6	12.6	12.7	8.0	0.6	5.5	
4. Total	12,642	96,067	100.0	100.0	7.1	1,727	14,391	100.0	100.0	8.8	150.2	832.2	100.0	100.0	8.4	0.9	6.5	
5. Per Capita G(R)DP (Rp.1000)	97	588	-	-	4.7	71	467	-	-	4.9	67	272	-	-	4.9	46.3	64.8	

Note : Average annual growth rate between 1975 and 1982, because of availability of constant values.

Sources : 024, 025, 027, 029, 030, and 031

Table B.9 GDP OF KABUPATEN BANDUNG BY INDUSTRIAL ORIGIN AT 1975 CONSTANT PRICES : 1975, 1980 AND 1985

Industrial Type	GDP (Rp.10 ⁶)				Percentage Distribution (%)			Average Annual Growth Rate (%)	
	1975	1980	1985	1975	1980	1985	'75 - '80	'80 - '85	
1. Agriculture	52,849	82,324	104,903	35.2	35.3	31.3	9.3	5.0	
2. Industry	37,089	55,744	92,962	24.7	23.9	27.7	8.5	10.8	
- Mining & Quarrying	371	1,220	1,992	0.2	0.5	0.6	26.9	10.3	
- Manufacturing	31,248	38,087	47,886	20.8	16.3	14.3	4.0	4.7	
- Electricity, Gas & Water-supply	268	1,099	3,974	0.2	0.5	1.2	32.6	29.3	
- Construction	5,202	15,338	39,110	3.5	6.6	11.7	24.1	20.6	
3. Services	60,273	95,136	137,546	40.1	40.8	41.0	9.6	7.7	
- Trade, Hotel & Restaurant	36,870	59,458	78,951	24.5	25.5	23.5	10.0	5.8	
- Transportation & Communication	4,473	9,279	21,453	3.0	4.0	6.4	15.7	18.2	
- Other Services	18,930	26,399	37,142	12.6	11.3	11.1	6.9	7.1	
4. Total	150,211	233,204	335,411	100.0	100.0	100.0	9.2	7.5	
5. Per Capita GDP (Rp.10 ³)	67.0	88.3	109.7	-	-	-	5.7	4.4	

Sources : 024 and 025

Table B.10 GDP PROJECTION AT 1985 CONSTANT PRICES

Item	Projection	
	1985	2005
I. Indonesia		
1. Population (Thousand)	165,154.1	222,753.1
2. GDP		
- GDP (Rp.10 ⁹)	97,066	201,794
- GDP per Capita (Rp.10 ³)	588	906
3. Average Annual Growth Rate		
- GDP (%)	4.073	5.374
- GDP per Capita (%)	2.873	2.9
		4.073
		2.1
II. Kabupaten Bandung		
1. Population (Thousand)	2,998	4,230
2. GRDP		
- GRDP (Rp.10 ⁹)	832	1,773
- GRDP per Capita (Rp.10 ³)	272	419
3. Share to GDP		
- GRDP (%)	0.86	0.88
- GRDP per Capita (%)	46.3	46.375
3. Average Annual Growth Rate		
- GRDP (%)	8.973	5.2
- GRDP per Capita (%)	5.873	2.9
		4.4
		2.1

Note : /1 Statistik Indonesia 1986

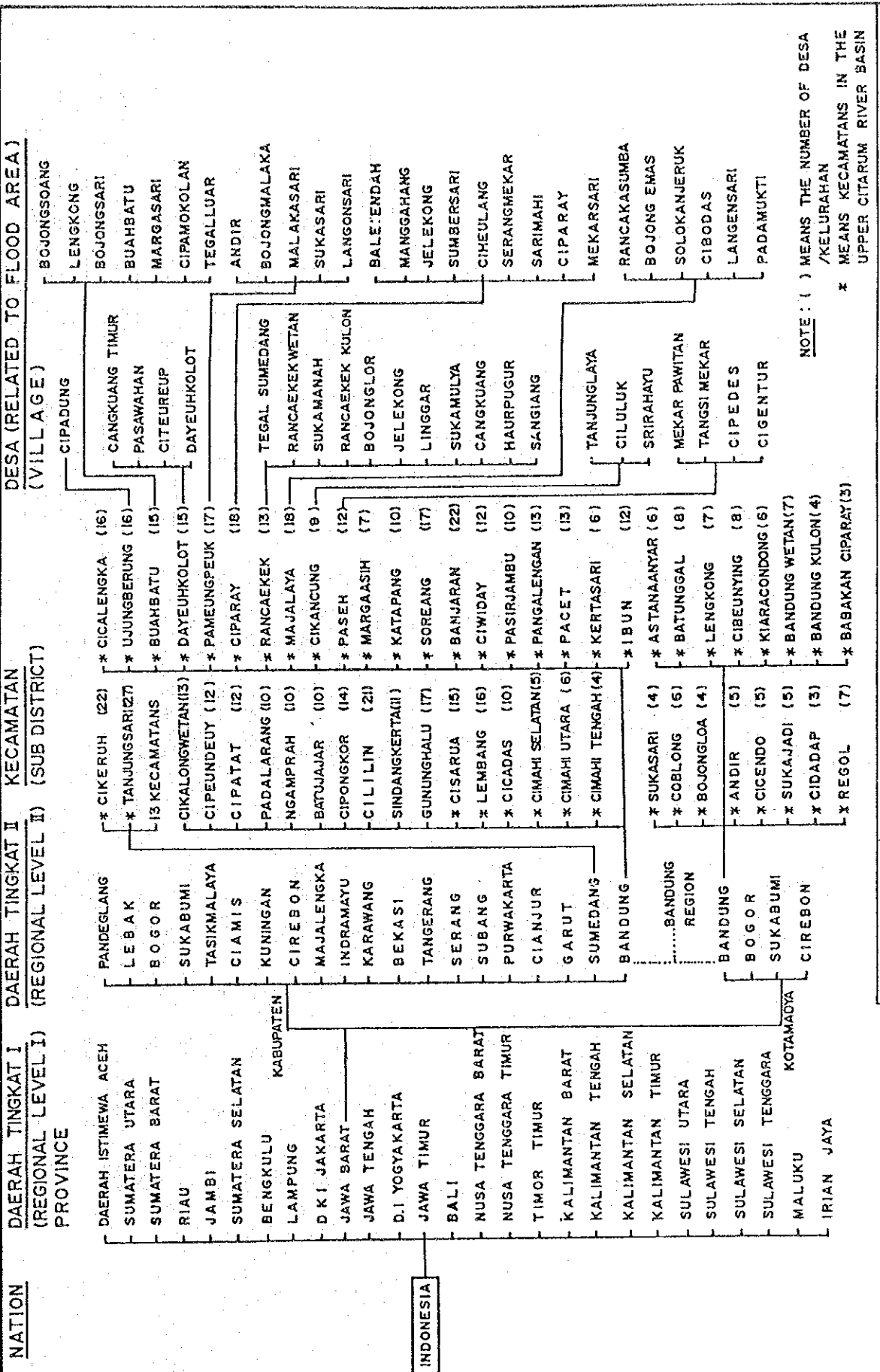
/2 Estimated by a growth rate of 1.9% which is the same rate as the one between 1988 and 2000.

/3 Average during two years between 1983 and 1985.

/4 The same rate as REPELITA IV (1985 - 1989). After 2000, the growth rate is assumed to go down to 4.0%.

/5 Shares are assumed to be the same as the 1985 condition.

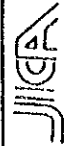
Sources : 025 and 029



NOTE: () MEANS THE NUMBER OF DESA /KELURAHAN
 * MEANS KECAMATAN IN THE UPPER CITARUM RIVER BASIN

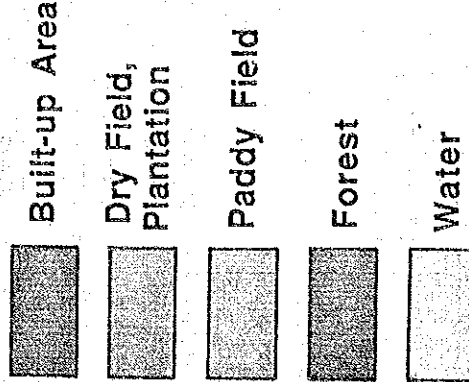
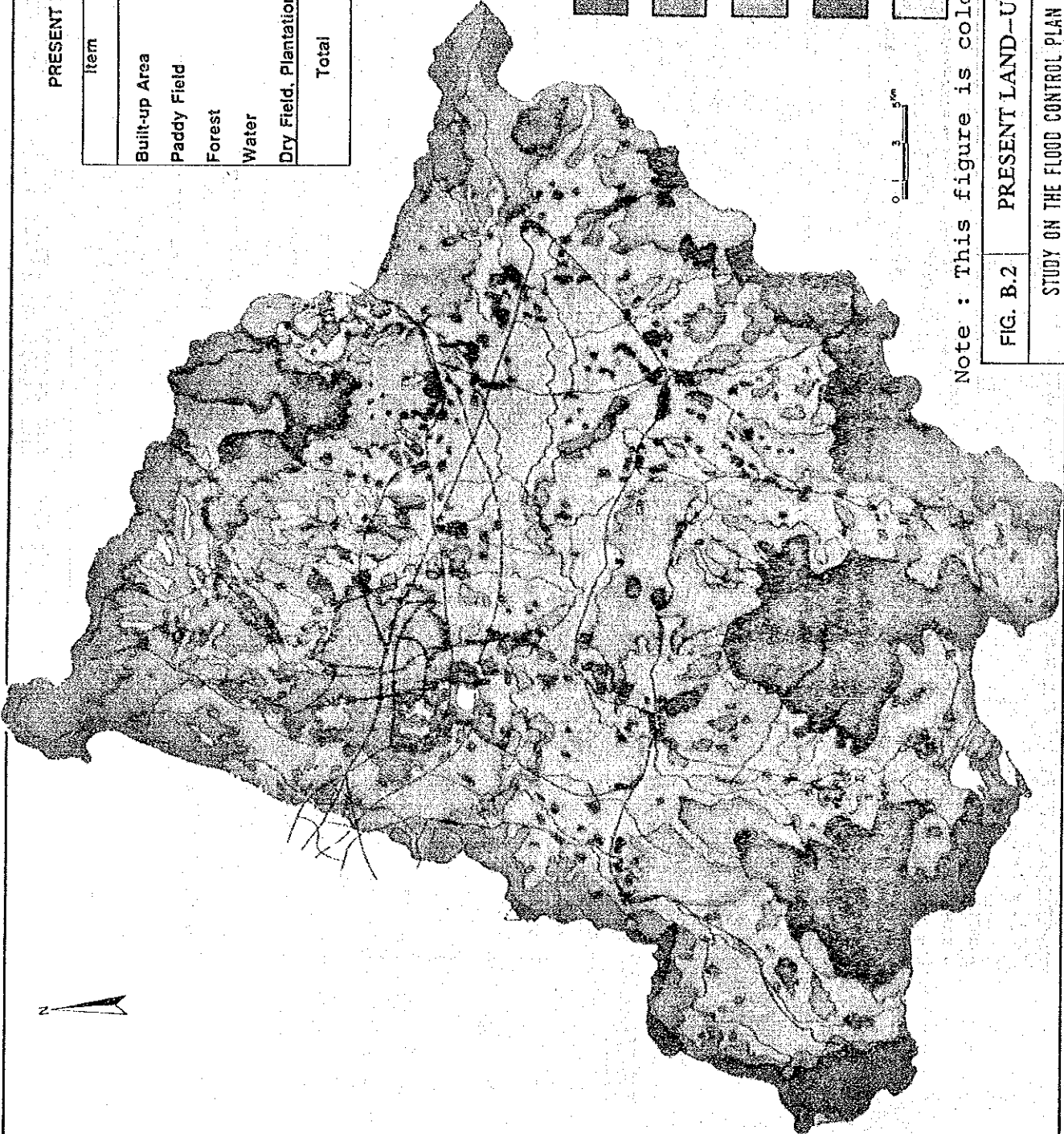
FIG. B.1 ADMINISTRATIVE DISTRICT

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



PRESENT LAND USE IN STUDY AREA

Item	Area (km ²)	Percentage Distribution (%)
Built-up Area	125.4	7.1
Paddy Field	694.9	39.2
Forest	419.6	23.7
Water	8.1	0.5
Dry Field, Plantation, etc	523.0	29.5
Total	1,771.0	100.0



Note : This figure is colored in Main Report.

FIG. B.2 PRESENT LAND-USE IN STUDY AREA.

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITRUM BASIN



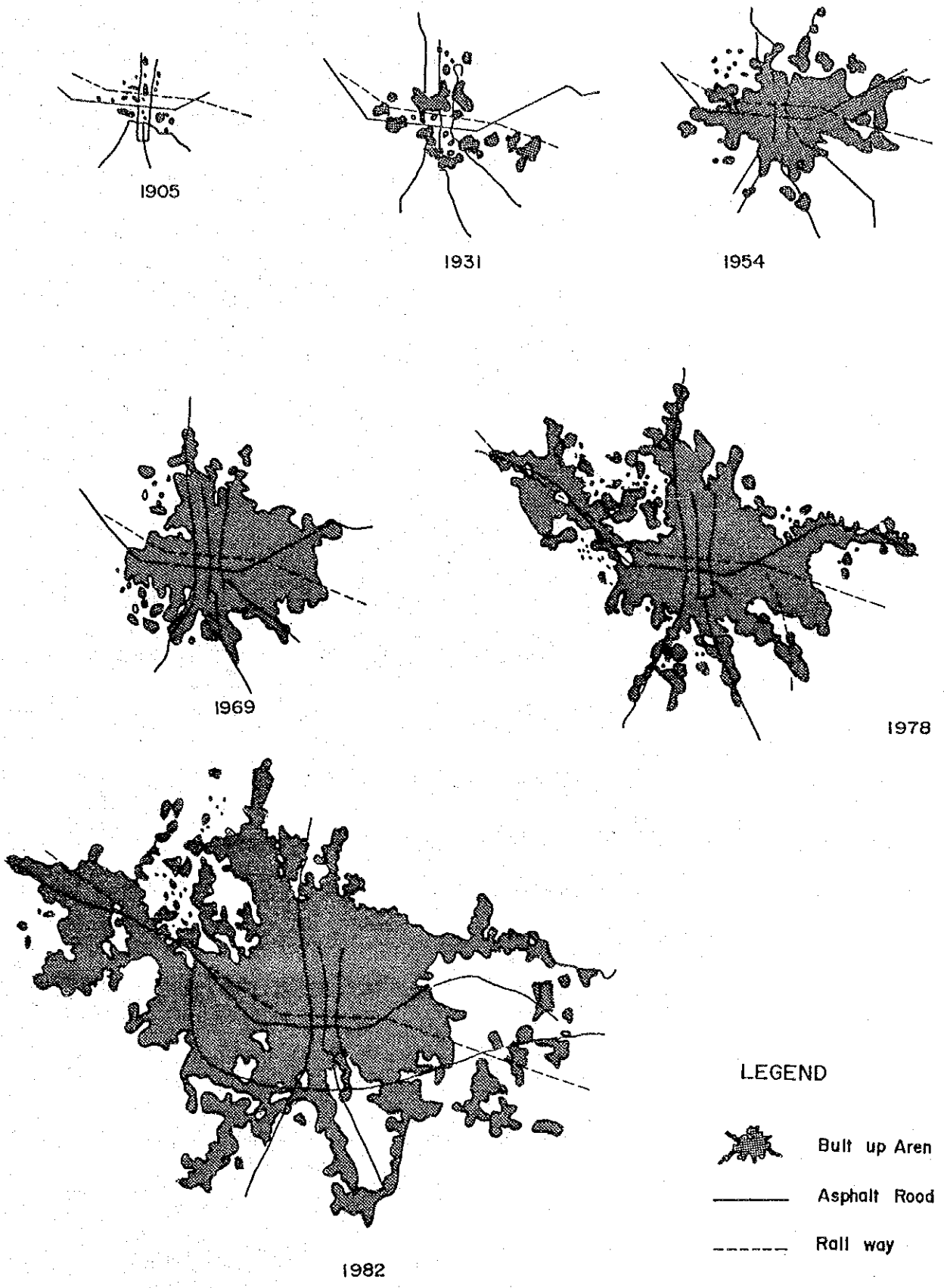


FIG. B.3

EXPANSION OF KOTAMADYA BANDUNG

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN