

Table I.3 LIST OF BRIDGE CONSTRUCTION

Name	Location	Bridge Type	Span (m)	Width (m)
BC-1	Citarum River, STA.3.50km	Steel Girder Bridge	30.0 x 3	8.0
BC-2	Citarum River, STA.4.40km	Steel Girder Bridge	30.0 x 3	8.0
BC-3	Citarum River, STA.15.00km	Steel Girder Bridge	28.0 x 3	8.0
BC-4	Cisangkuy River, STA.0.05km	Steel Girder Bridge	16.0 x 2	8.0
BC-5	Cisangkuy River, STA.1.25km	Steel Girder Bridge	16.0 x 2	8.0
BC-6	Cisangkuy River, STA.	Steel Girder Bridge	16.0 x 2	8.0
BC-7	Cisangkuy River, STA.	Steel Girder Bridge	16.0 x 2	8.0

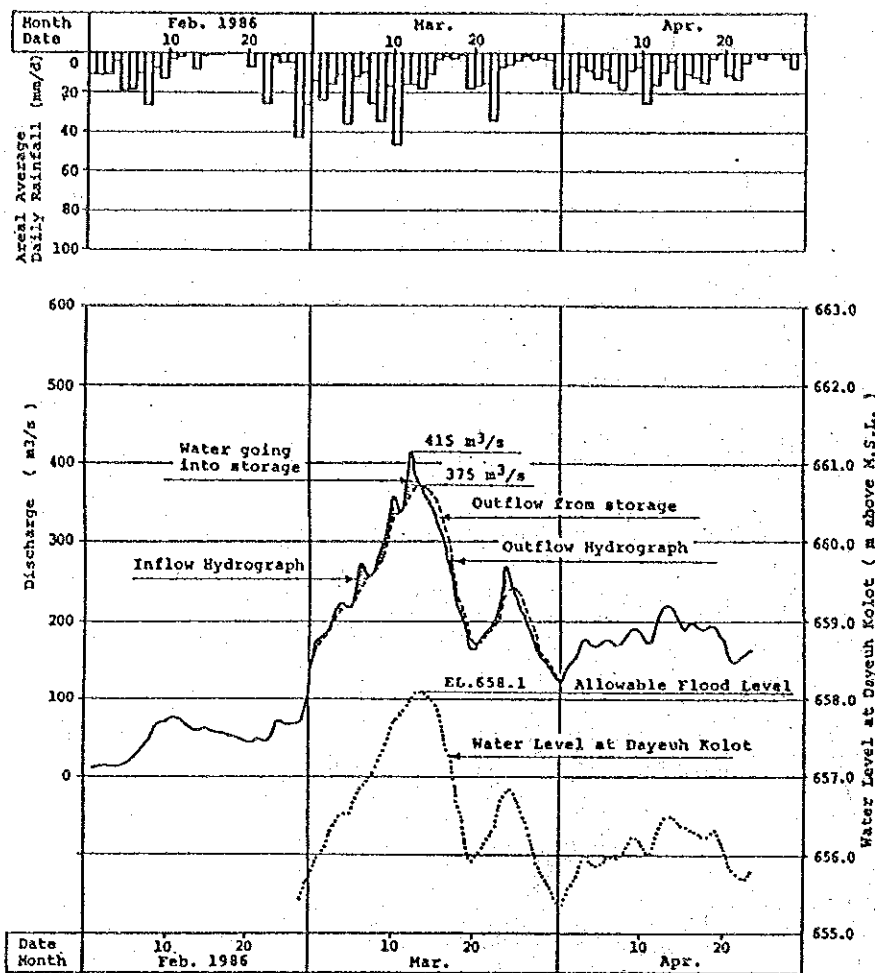
Table I.4 LIST OF BRIDGE STRENGTHENING

Name	Location	Work Item
BS-1	Citarum River, STA	Strengthening for Two piers of Cilampeni road bridge
BS-2	Citarum River, STA	Strengthening for Two piers of Dayeuh Kolot road bridge
BS-3	Citarum River, STA	Strengthening for One piers of Dayeuh Kolot water pipe bridge
BS-4	Citarum River, STA	Strengthening for One piers of Dayeuh Kolot railway bridge

Table I.5 BREAKDOWN OF CONSTRUCTION WORKS

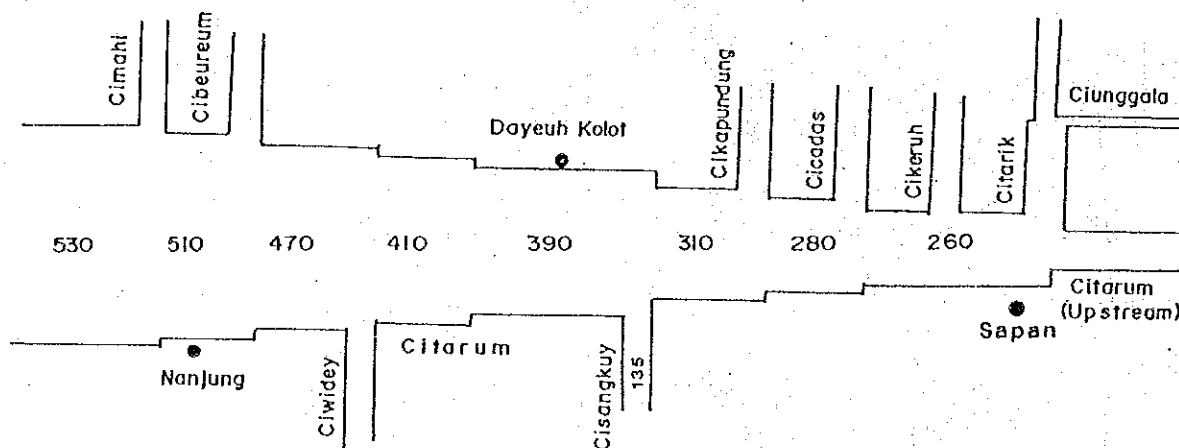
Item	Unit	0.0 - 9.0 (km)	9.0 - 20.0 (km)	20.0 - 31.2 (km)	Citarum Total	Citangkuy	Total
I. Civil Work							
A. Existing River							
(a) Preparatory Work							
(b) Dredging							
(1) Common Soil (i)	x 10 ³ m ³	342	758	1,269	2,369	373	2,742
(2) Stiff Soil (i)	x 10 ³ m ³	210	374	20	674		674
(3) Soft Rock	x 10 ³ m ³	267	668		935		935
(c) Bank Clearing/Grubbing	m ²	118,800			118,800		118,800
(d) Bank Protection	m	1,650	2,450	2,000	6,100		6,100
(e) Bridge Improvement							
Strengthening (Gabion)	place	1		3	4		4
New Bridge construction	m ² (place)		250		250	1024 (4)	1024 (4)
(f) Maintenance/Connection Rd.	m						250
B. Cut-off Channel							
(a) Preparatory Work							
(b) Dredging							
(1) Common Soil							
Common Soil (i)	x 10 ³ m ³		97	654	1,032	77	1,109
Common Soil (ii)	x 10 ³ m ³	281			654	77	731
(2) Stiff Soil							
Stiff Soil (i)	x 10 ³ m ³			32	378		378
Stiff Soil (ii)	x 10 ³ m ³				1,147		1,147
(3) Soft Rock							
New Bridge Construction	x 10 ³ m ³	881	234		32		32
Maintenance/Connection Rd.	x 10 ³ m ³	225	121		1,115		1,115
	m ² (place)	1440 (i)	576		346		346
	m	1,050	1,100		2,016		2,016
C. Total					2,150		2,150
II. Flood Warning System							
III. Land Acquisition/Compensation							
A. Land Acquisition							
(a) Existing River	x 10 ³ m ³	152	293	234	679	71	750
(b) Cut-off Channel	x 10 ³ m ³	145	78	110	333	29	362
B. House Resettlement							
(a) Existing River	house		81	33	114	23	137
(b) Cut-off Channel	house		70	10	80		80

Note: Common soil (i) and Stiff Soil (i): dredged by pump dredger
Common soil (ii) and Stiff Soil (ii): dredged by backhoe and bulldozer



5-Year Frequency

DESIGN DISCHARGE HYDROGRAPH AT DAYEUH KOLOT



DESIGN PEAK DISCHARGE DISTRIBUTION

FIG. I.2

DISCHARGE HYDROGRAPH AT DAYEUH KOLOT AND PEAK DISCHARGE DISTRIBUTION

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARAM BASIN

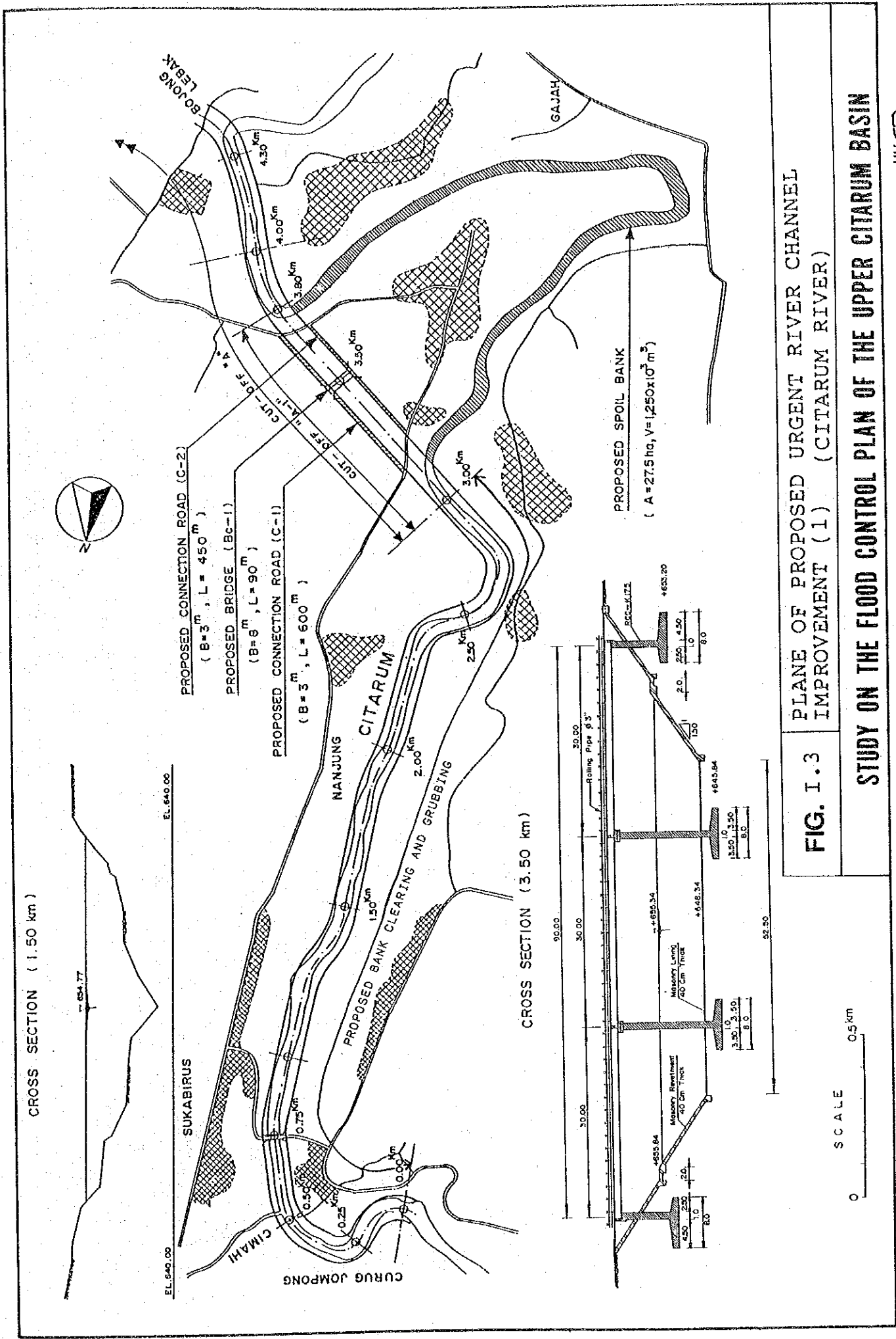
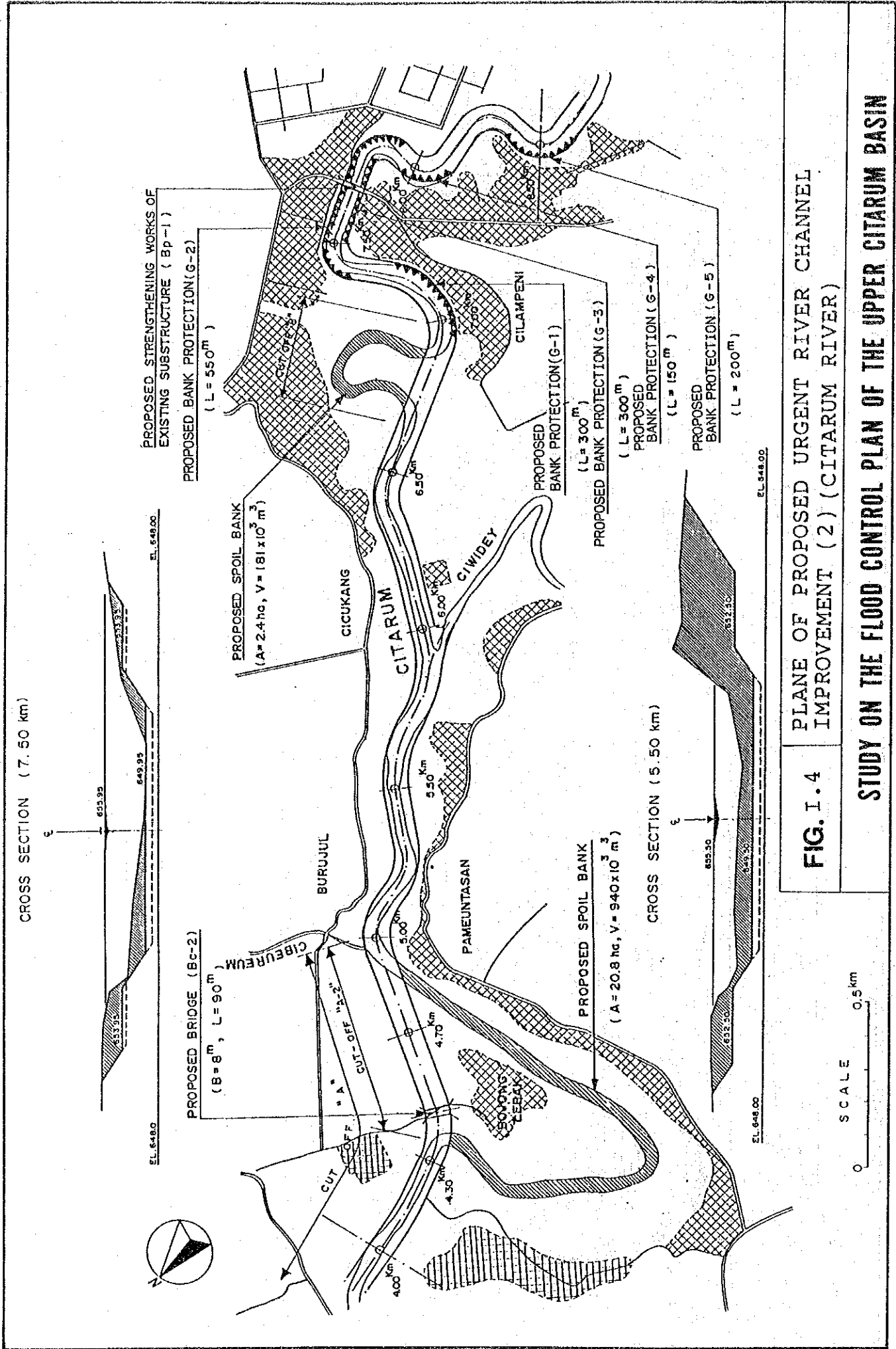


FIG. I.3 PLANE OF PROPOSED URGENT RIVER CHANNEL IMPROVEMENT (1) (CITARUM RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

SCALE 0 0.5 km





PROPOSED STRENGTHENING WORKS OF EXISTING SUBSTRUCTURE (Bp-1)
 PROPOSED BANK PROTECTION (G-2)
 (L = 550m)

PROPOSED SPOIL BANK
 (A = 2.4 ha, V = 181 x 10³ m³)

PROPOSED BANK PROTECTION (G-1)
 (L = 300 m)

PROPOSED BANK PROTECTION (G-3)
 (L = 300 m)

PROPOSED BANK PROTECTION (G-4)
 (L = 150 m)

PROPOSED BANK PROTECTION (G-5)
 (L = 200 m)

CROSS SECTION (7.50 km)

CROSS SECTION (5.50 km)

FIG. I.4

PLANE OF PROPOSED URGENT RIVER CHANNEL IMPROVEMENT (2) (CITARUM RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

SCALE 0 0.5 km



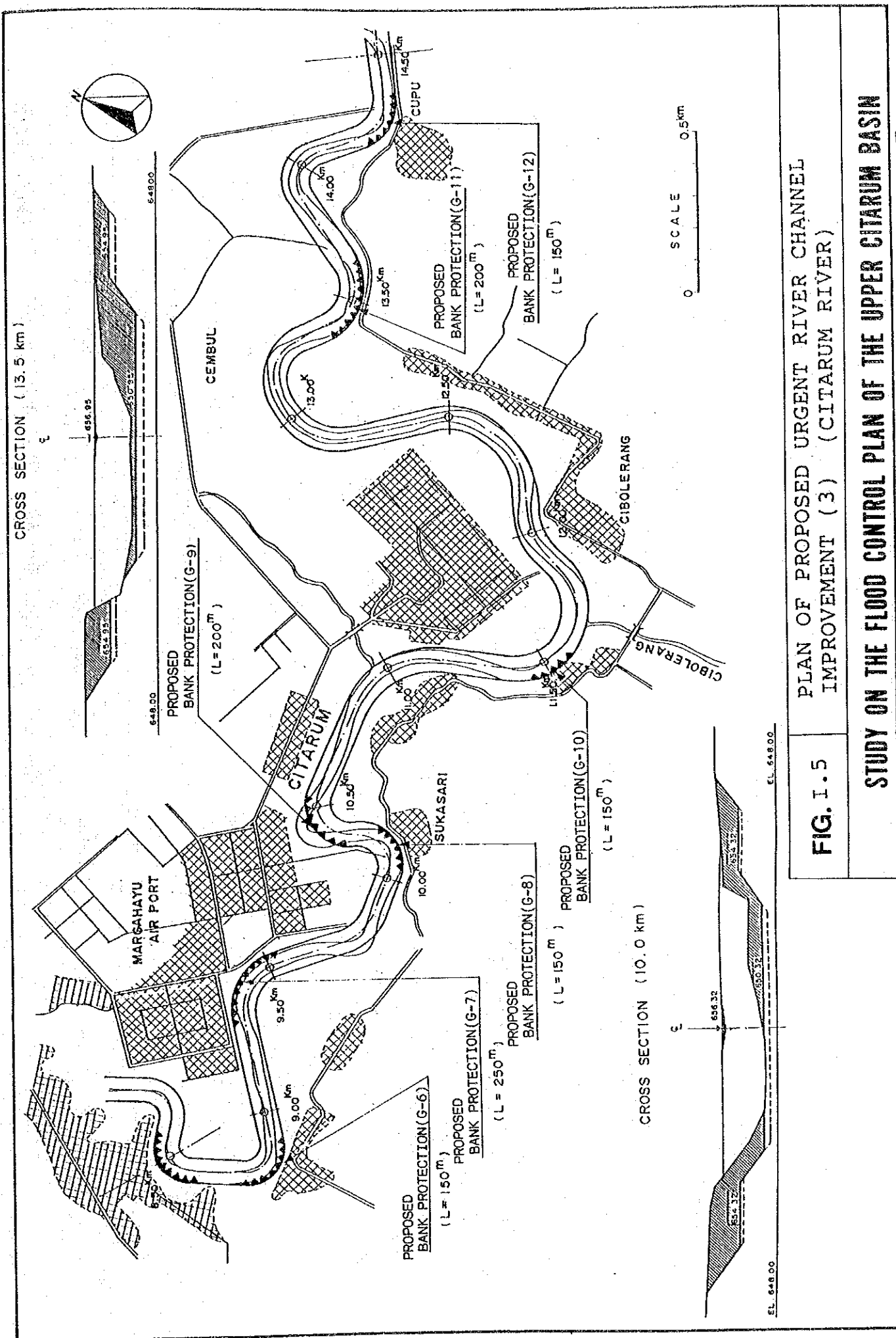


FIG. I.5 PLAN OF PROPOSED URGENT RIVER CHANNEL IMPROVEMENT (3) (CITARUM RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



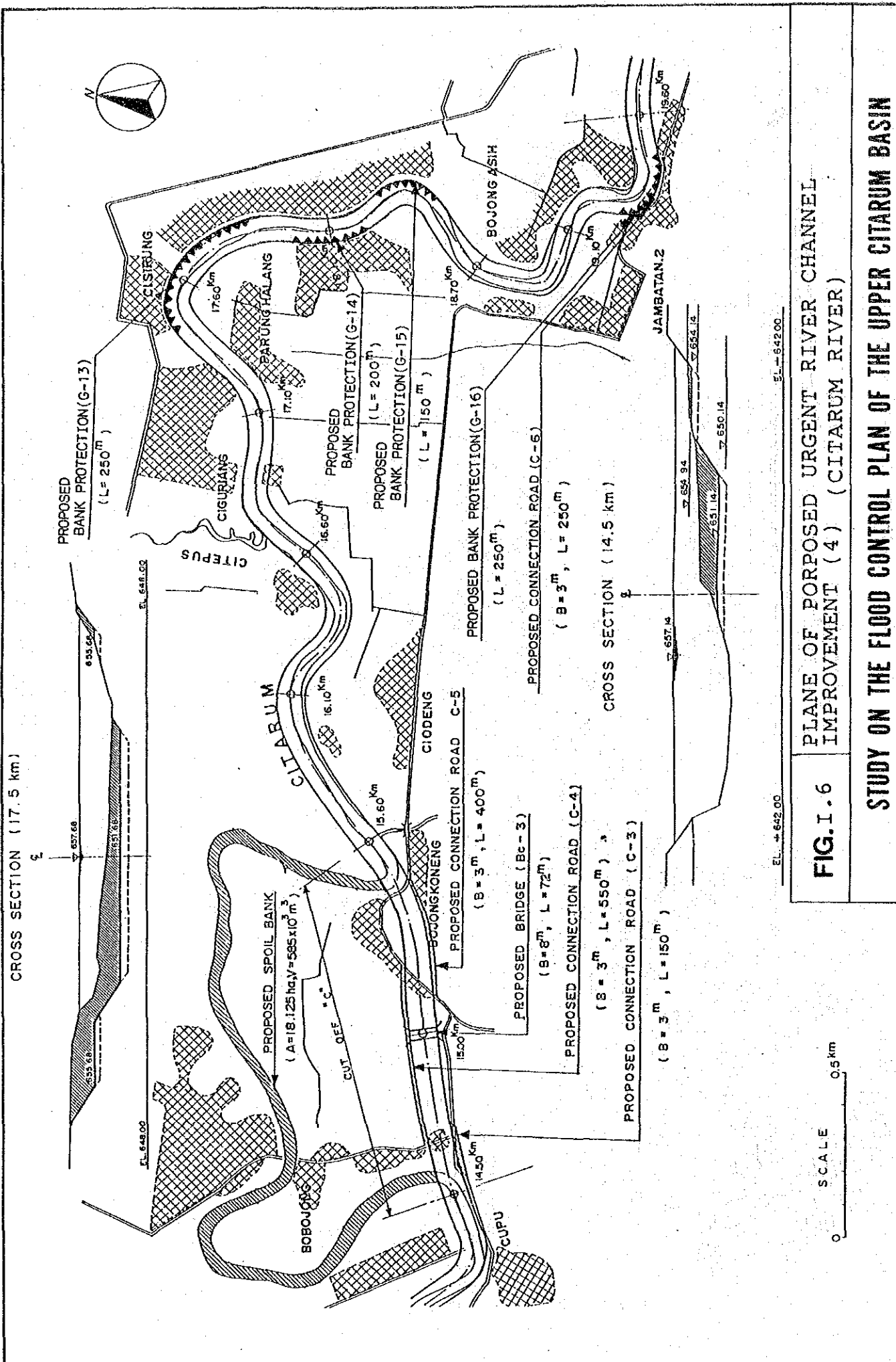


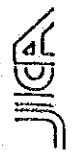
FIG. I. 6

PLANE OF PORPOSED URGENT RIVER CHANNEL IMPROVEMENT (4) (CITARUM RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

SCALE 0 0.5 km

EL. +642.00 5L-64200



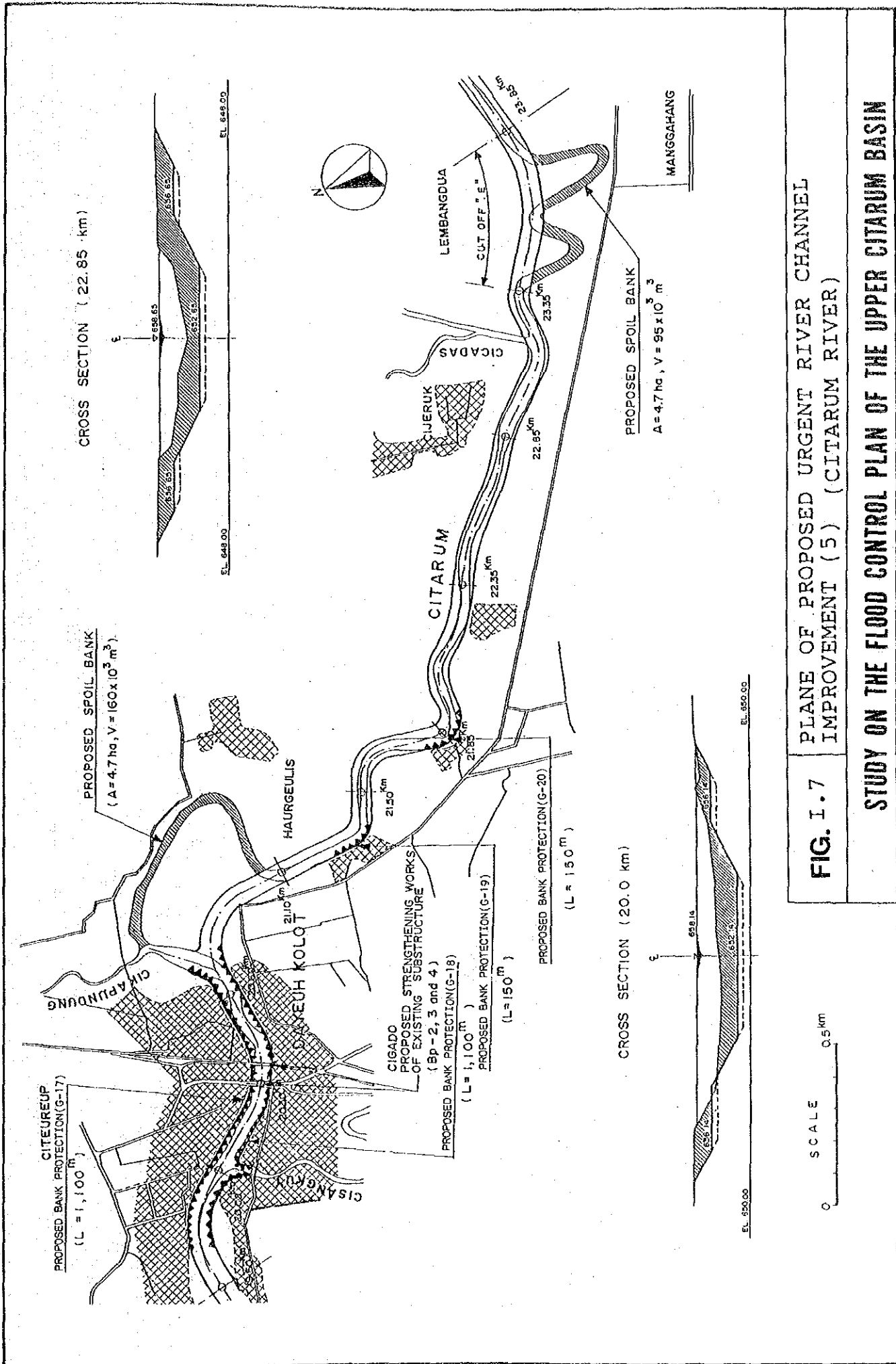


FIG. I. 7

PLANE OF PROPOSED URGENT RIVER CHANNEL IMPROVEMENT (5) (CITARUM RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



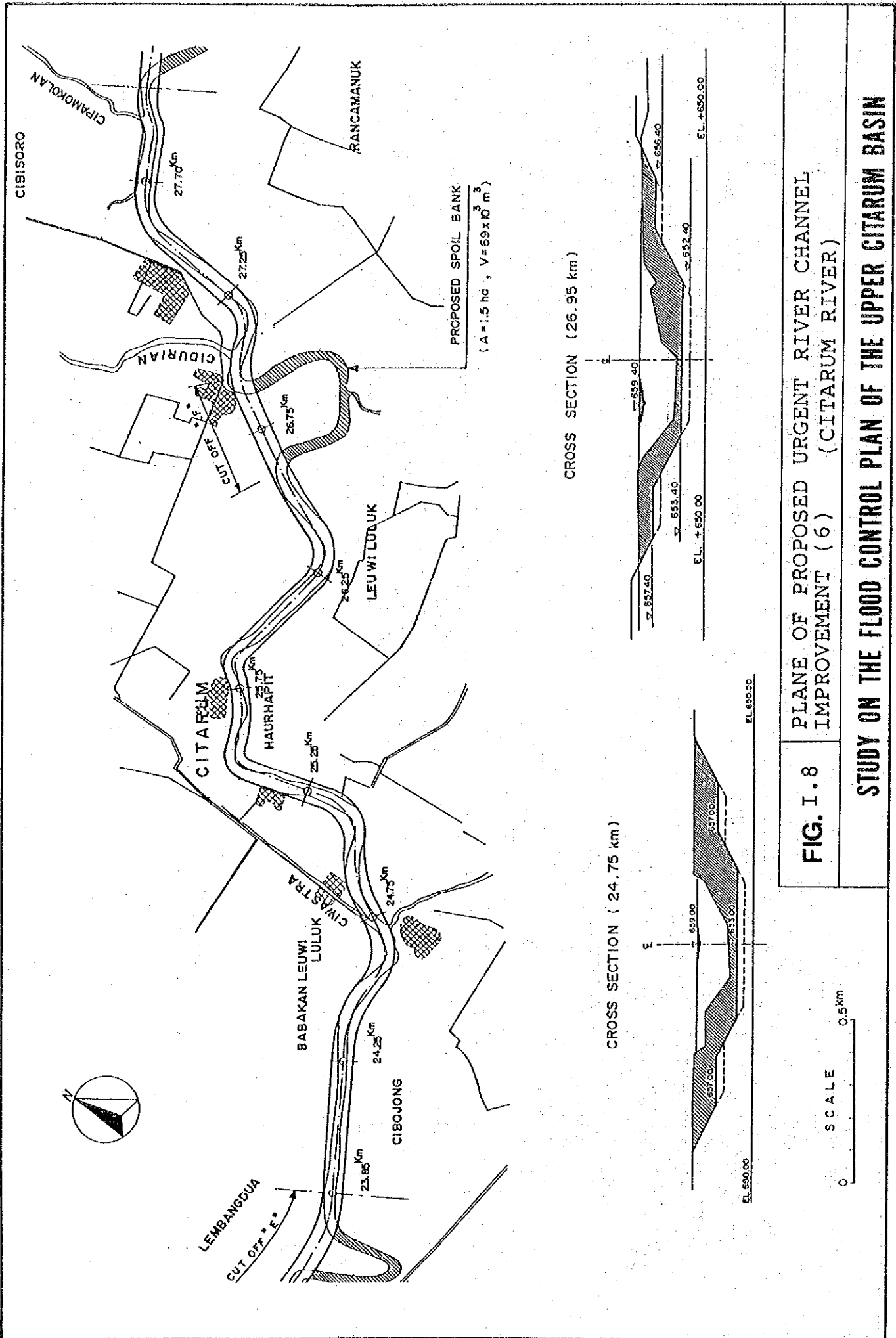
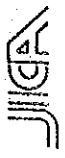


FIG. I. 8 PLANE OF PROPOSED URGENT RIVER CHANNEL IMPROVEMENT (6) (CITARUM RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



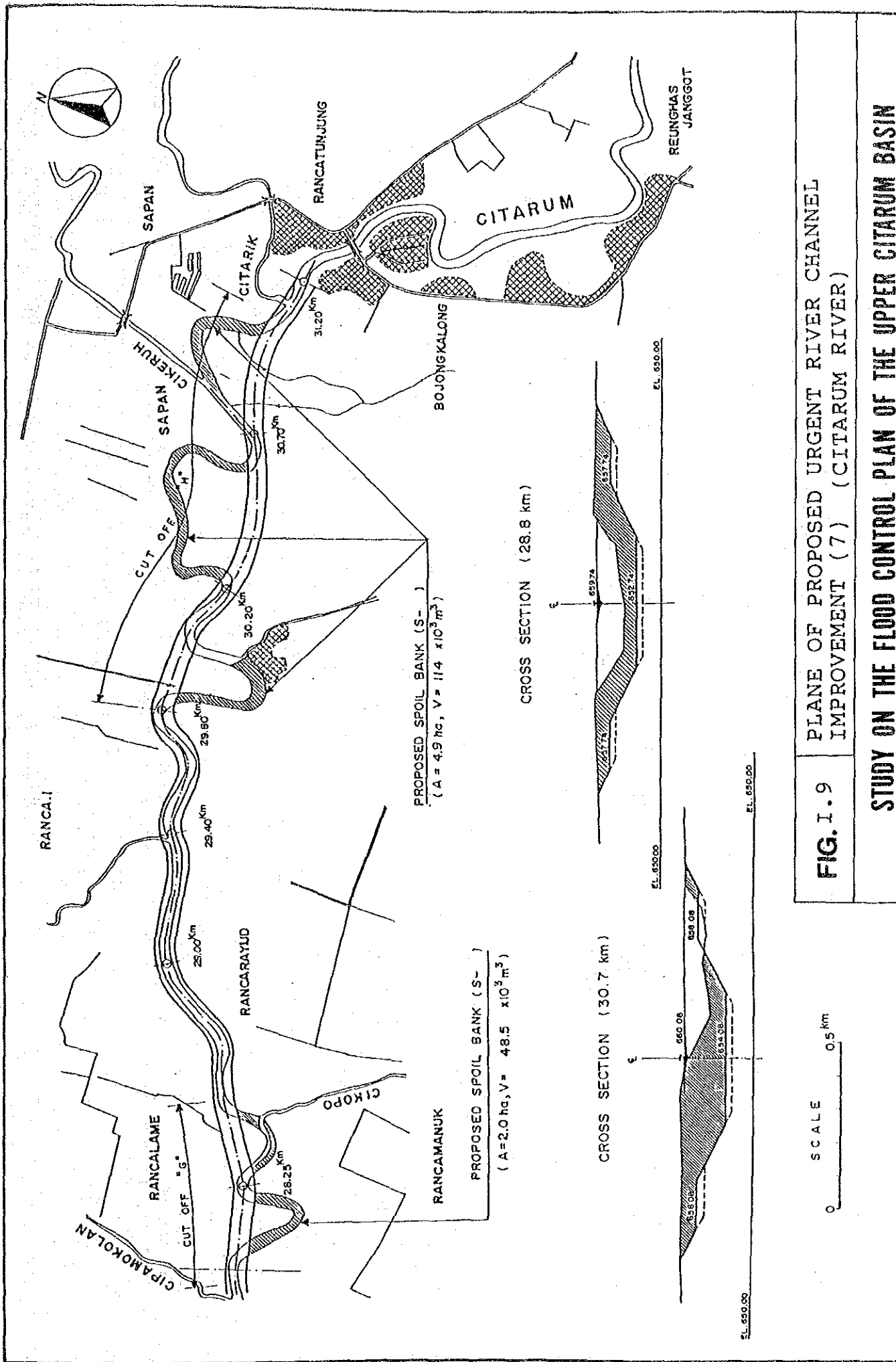
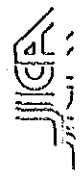
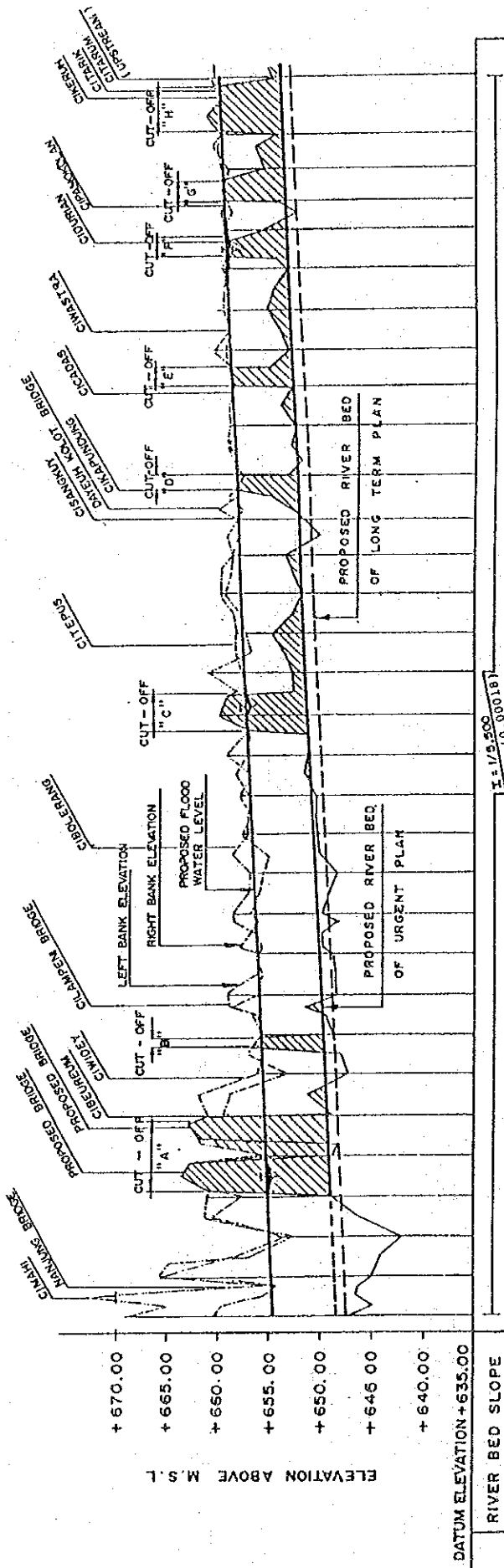


FIG. I. 9

PLANE OF PROPOSED URGENT RIVER CHANNEL IMPROVEMENT (7) (CITARUM RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

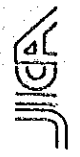


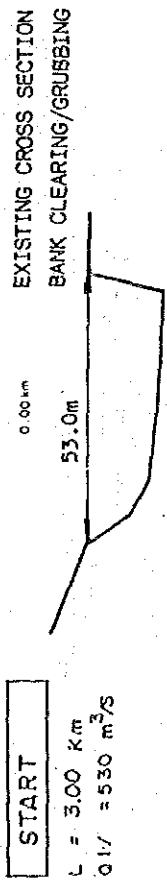


		DATUM ELEVATION +635.00		I = 1/5,500 (1:5,500)	
	PROPOSED	EXISTING		EXISTING	BANK ELEVATION
	SAME AS EXISTING BANK ELEVATION				
RIVER BED SLOPE					
BANK ELEVATION (M)					
FLOOD WATER LEVEL (M)					
RIVER BED ELEVATION (M)					
LEFT BANK ELEVATION (M)					
RIGHT BANK ELEVATION (M)					
RIVER BED ELEVATION (M)					
CUMULATIVE DISTANCE (KM)					
SECTION DISTANCE (KM)					
SECTION NAME					

FIG. I. 10 PROPOSED PROFILE OF CITARUM RIVER FOR URGENT PLAN

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN





EXISTING CROSS SECTION
 BANK CLEARING/GRUBBING

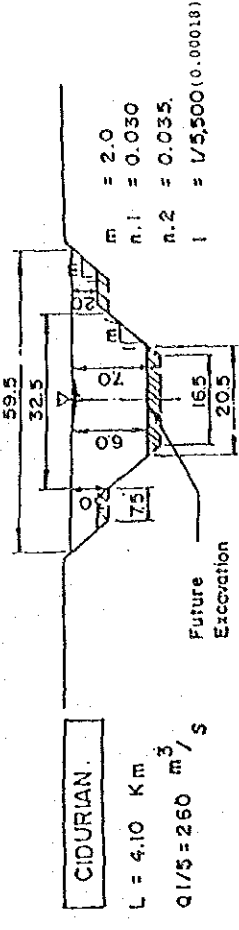
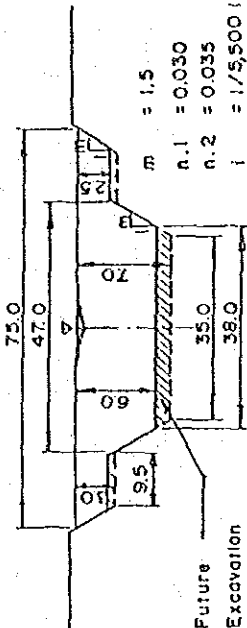
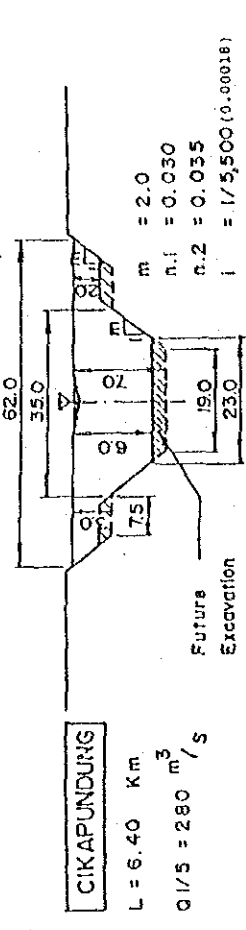
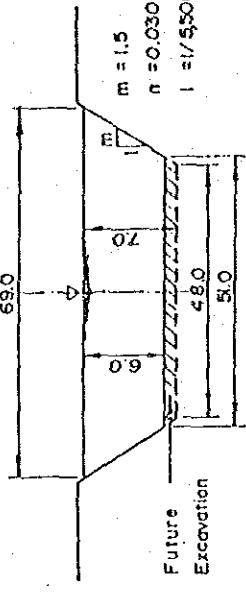
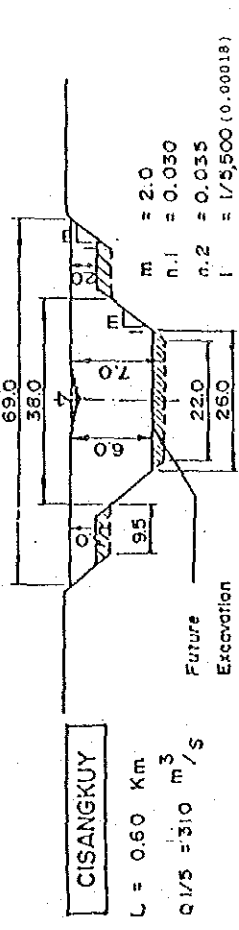
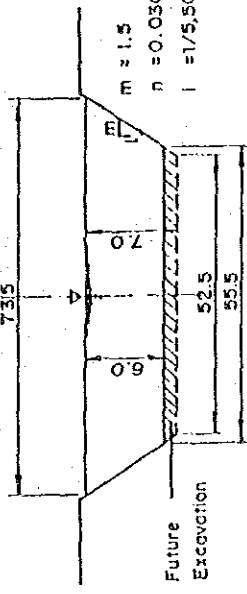
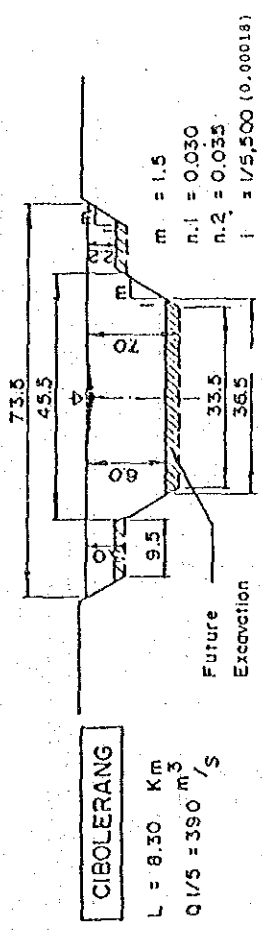


FIG. I.1.1

PROPOSED CROSS SECTIONS OF CITARUM RIVER FOR URGENT PLAN

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



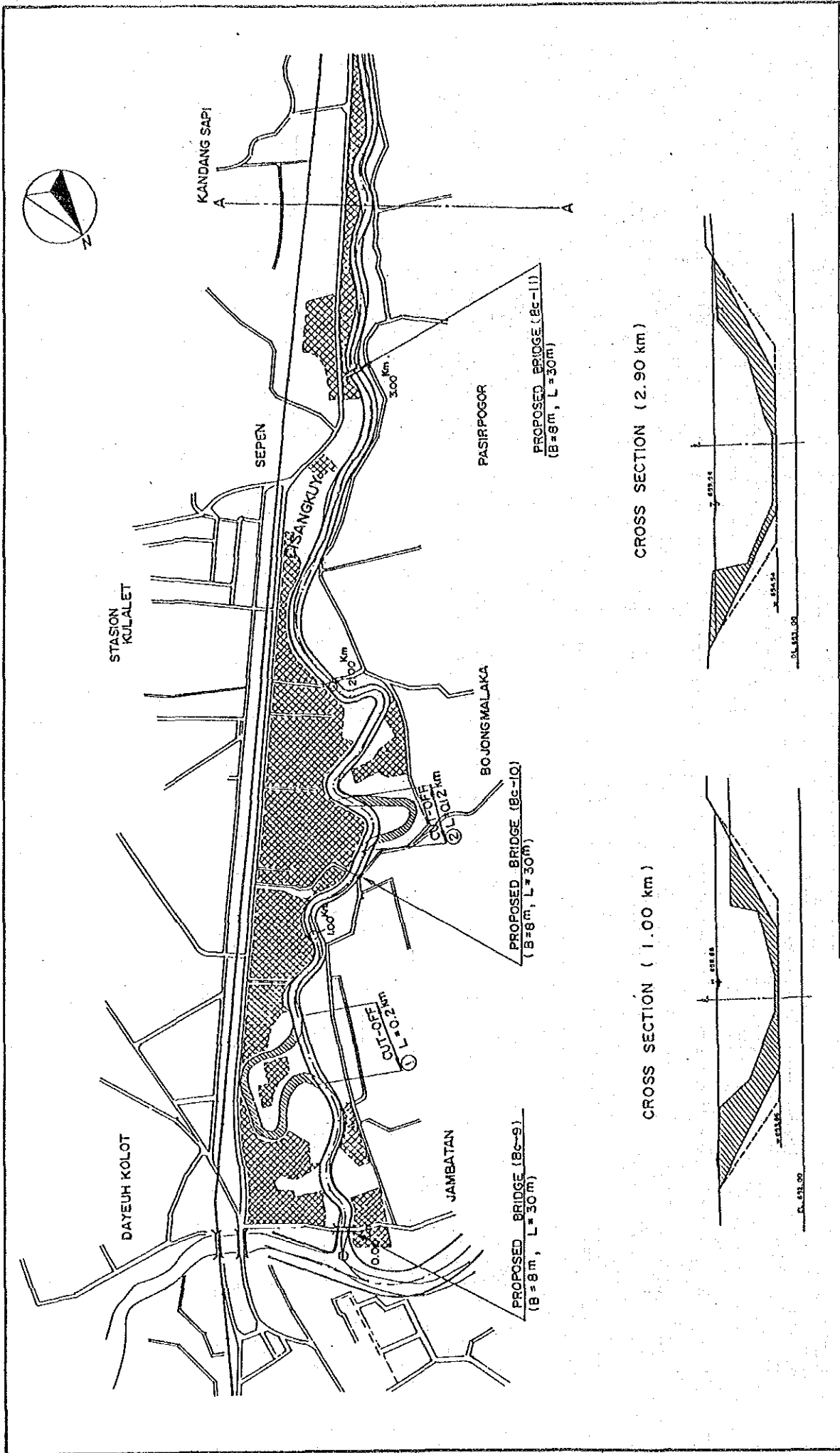


FIG. I. 12 PLANE OF PROPOSED URGENT RIVER CHANNEL IMPROVEMENT (1) (CISANGKUY RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



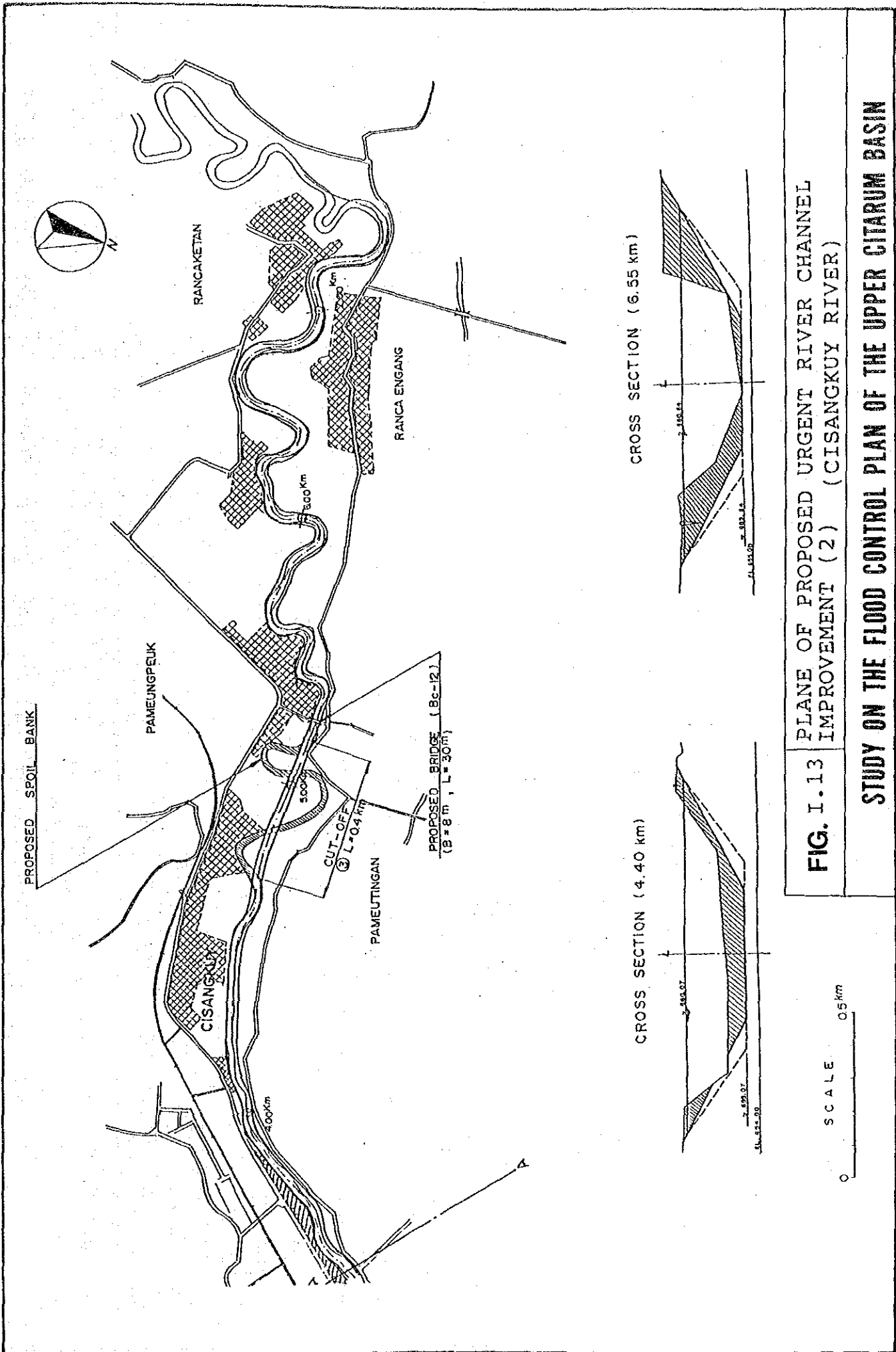
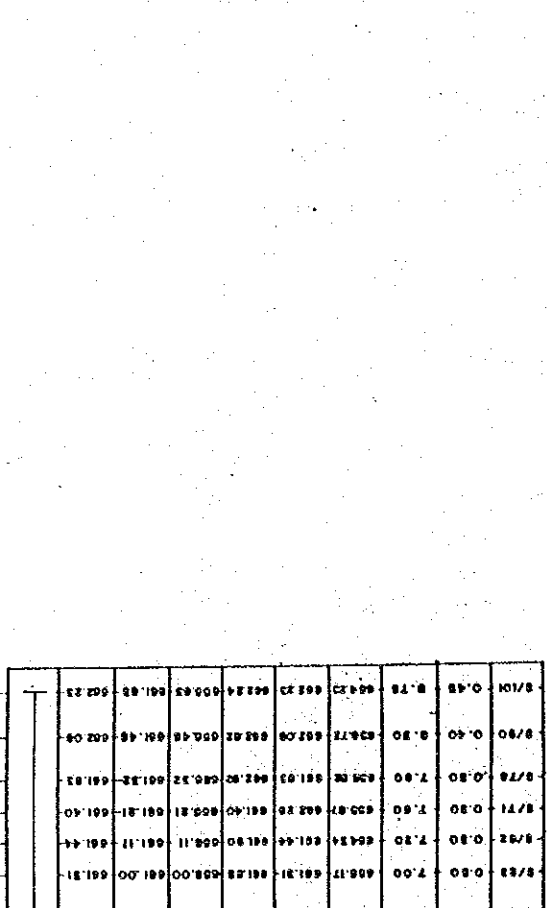
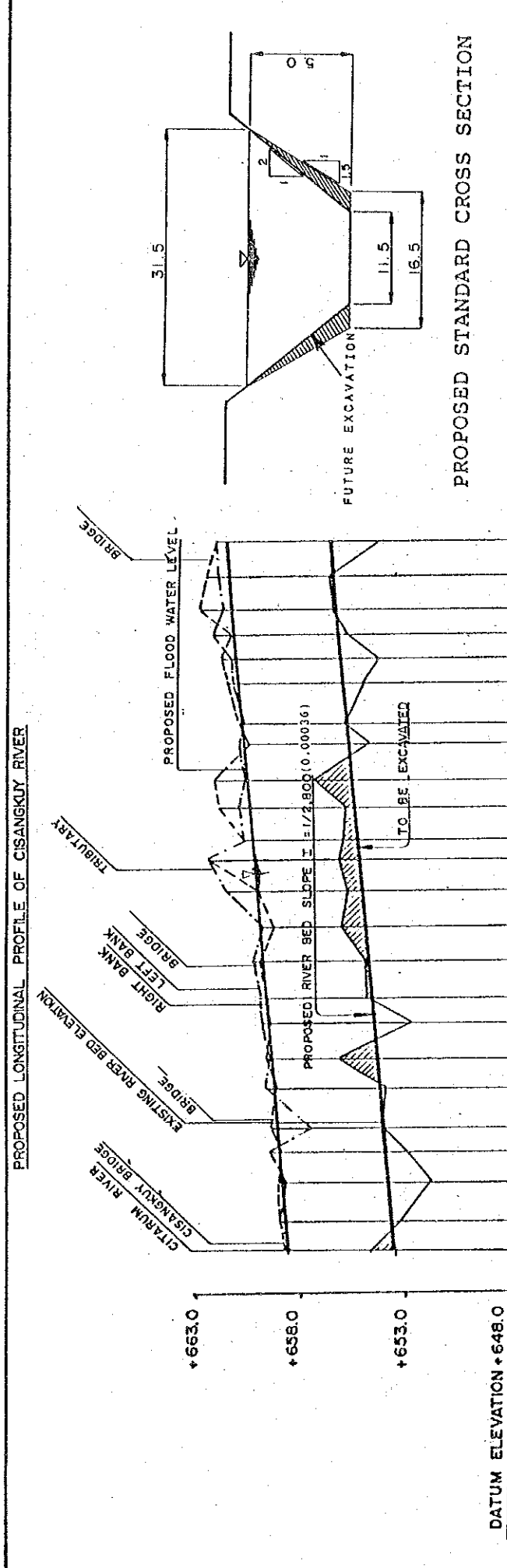


FIG. I. 13

PLANE OF PROPOSED URGENT RIVER CHANNEL IMPROVEMENT (2) (CISANGKUY RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN





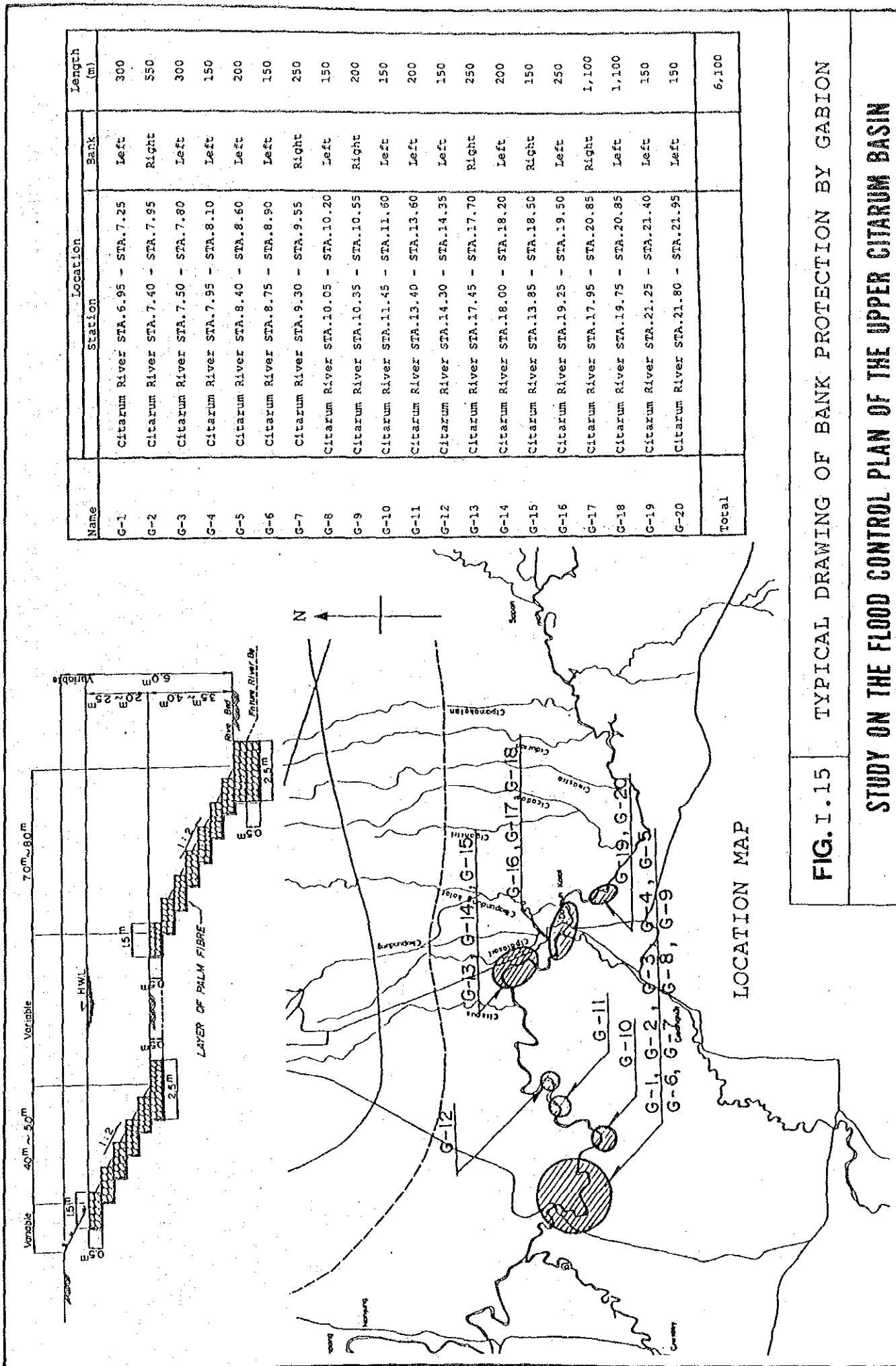
PROPOSED STANDARD CROSS SECTION

PROPOSED		EXISTING		COMULATIVE DISTANCE(KM)		SECTION DISTANCE (KM)		SECTION NAME	
BANK ELEVATION (M)	FLOOD WATER LEVEL (M)	RIVER BED ELEVATION (M)	LEFT BANK ELEVATION (M)	RIGHT BANK ELEVATION (M)	RIVER BED ELEVATION (M)				
652.2	652.2	652.2	652.2	652.2	652.2	0.00	0.00	0.00	0.00
652.3	652.3	652.3	652.3	652.3	652.3	0.00	0.00	0.00	0.00
652.4	652.4	652.4	652.4	652.4	652.4	0.00	0.00	0.00	0.00
652.5	652.5	652.5	652.5	652.5	652.5	0.00	0.00	0.00	0.00
652.6	652.6	652.6	652.6	652.6	652.6	0.00	0.00	0.00	0.00
652.7	652.7	652.7	652.7	652.7	652.7	0.00	0.00	0.00	0.00
652.8	652.8	652.8	652.8	652.8	652.8	0.00	0.00	0.00	0.00
652.9	652.9	652.9	652.9	652.9	652.9	0.00	0.00	0.00	0.00
653.0	653.0	653.0	653.0	653.0	653.0	0.00	0.00	0.00	0.00
653.1	653.1	653.1	653.1	653.1	653.1	0.00	0.00	0.00	0.00
653.2	653.2	653.2	653.2	653.2	653.2	0.00	0.00	0.00	0.00
653.3	653.3	653.3	653.3	653.3	653.3	0.00	0.00	0.00	0.00
653.4	653.4	653.4	653.4	653.4	653.4	0.00	0.00	0.00	0.00
653.5	653.5	653.5	653.5	653.5	653.5	0.00	0.00	0.00	0.00
653.6	653.6	653.6	653.6	653.6	653.6	0.00	0.00	0.00	0.00
653.7	653.7	653.7	653.7	653.7	653.7	0.00	0.00	0.00	0.00
653.8	653.8	653.8	653.8	653.8	653.8	0.00	0.00	0.00	0.00
653.9	653.9	653.9	653.9	653.9	653.9	0.00	0.00	0.00	0.00
654.0	654.0	654.0	654.0	654.0	654.0	0.00	0.00	0.00	0.00
654.1	654.1	654.1	654.1	654.1	654.1	0.00	0.00	0.00	0.00
654.2	654.2	654.2	654.2	654.2	654.2	0.00	0.00	0.00	0.00
654.3	654.3	654.3	654.3	654.3	654.3	0.00	0.00	0.00	0.00
654.4	654.4	654.4	654.4	654.4	654.4	0.00	0.00	0.00	0.00
654.5	654.5	654.5	654.5	654.5	654.5	0.00	0.00	0.00	0.00
654.6	654.6	654.6	654.6	654.6	654.6	0.00	0.00	0.00	0.00
654.7	654.7	654.7	654.7	654.7	654.7	0.00	0.00	0.00	0.00
654.8	654.8	654.8	654.8	654.8	654.8	0.00	0.00	0.00	0.00
654.9	654.9	654.9	654.9	654.9	654.9	0.00	0.00	0.00	0.00
655.0	655.0	655.0	655.0	655.0	655.0	0.00	0.00	0.00	0.00

FIG. I. 14 PROPOSED PROFILE AND CROSS SECTION OF CISANGKUY RIVER FOR URGENT PLAN

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARAM BASIN



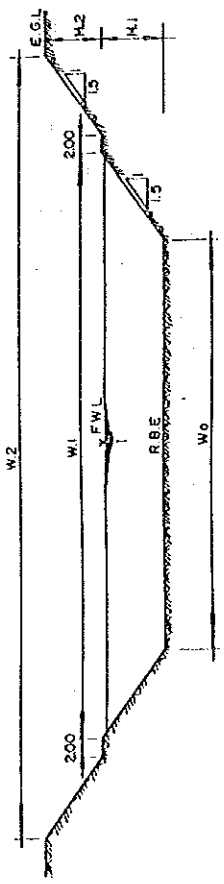
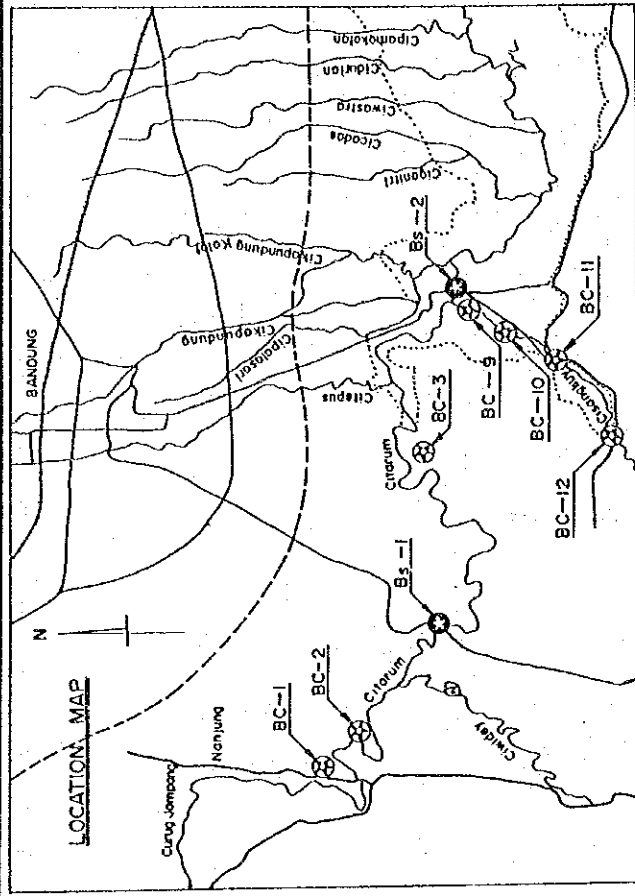


Name	Location		Length (m)
	Station	Bank	
G-1	Citarum River STA.6.95 - STA.7.25	Left	300
G-2	Citarum River STA.7.40 - STA.7.95	Right	550
G-3	Citarum River STA.7.50 - STA.7.80	Left	300
G-4	Citarum River STA.7.95 - STA.8.10	Left	150
G-5	Citarum River STA.8.40 - STA.8.60	Left	200
G-6	Citarum River STA.8.75 - STA.8.90	Left	150
G-7	Citarum River STA.9.30 - STA.9.55	Right	250
G-8	Citarum River STA.10.05 - STA.10.20	Left	150
G-9	Citarum River STA.10.35 - STA.10.55	Right	200
G-10	Citarum River STA.11.45 - STA.11.60	Left	150
G-11	Citarum River STA.13.40 - STA.13.60	Left	200
G-12	Citarum River STA.14.30 - STA.14.35	Left	150
G-13	Citarum River STA.17.45 - STA.17.70	Right	250
G-14	Citarum River STA.18.00 - STA.18.20	Left	200
G-15	Citarum River STA.13.85 - STA.18.50	Right	150
G-16	Citarum River STA.19.25 - STA.19.50	Left	250
G-17	Citarum River STA.17.95 - STA.20.85	Right	1,100
G-18	Citarum River STA.19.75 - STA.20.85	Left	1,100
G-19	Citarum River STA.21.25 - STA.21.40	Left	150
G-20	Citarum River STA.21.80 - STA.21.95	Left	150
Total			6,100

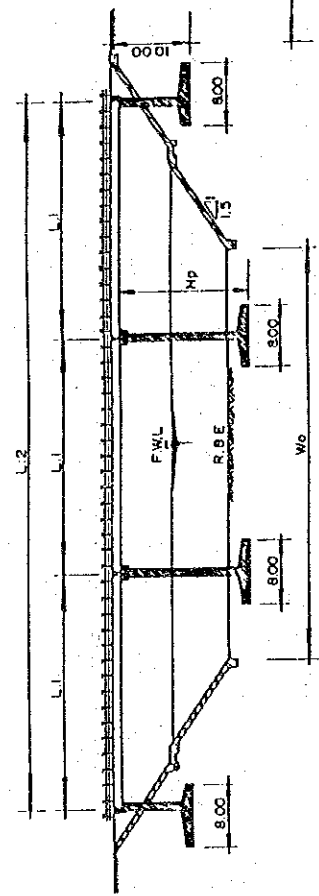
FIG. I.15 TYPICAL DRAWING OF BANK PROTECTION BY GABION

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

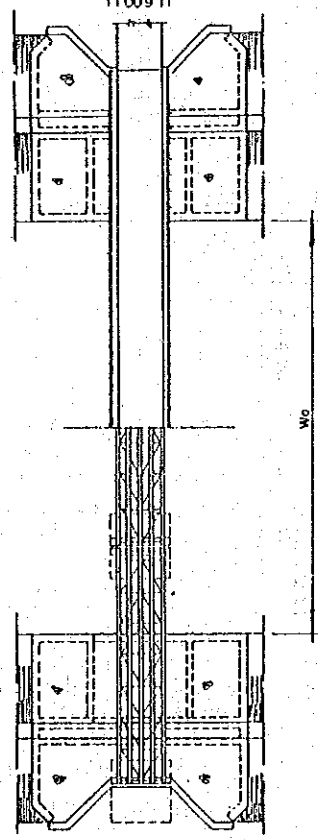
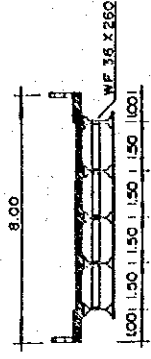




SECTION OF RIVER



SECTION OF BRIDGE



PLAN

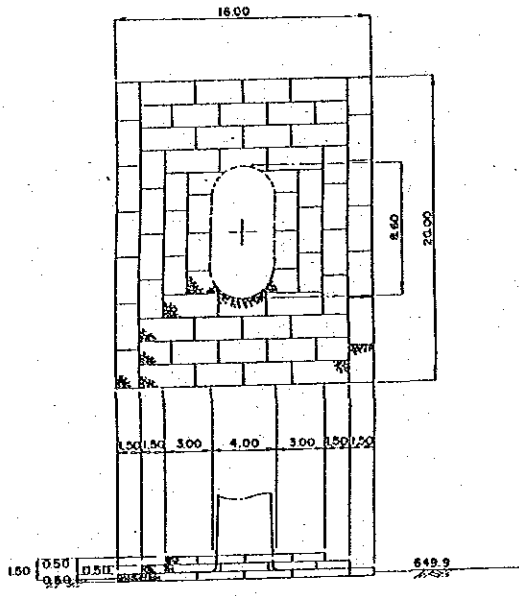
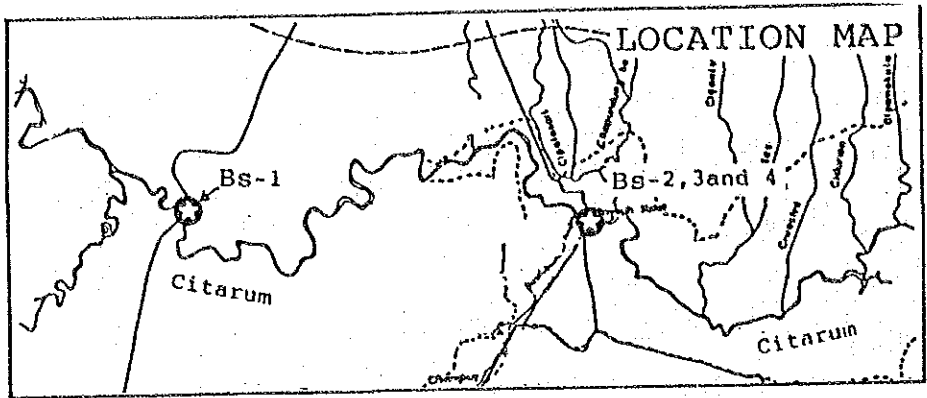
TABLE OF SECTION

NAME OF SECTION	SECTION OF RIVER						SECTION OF BRIDGE						REMARK
	R.B.E (m)	FWL (m)	E.G.L (m)	W0 (m)	W1 (m)	W2 (m)	H1 (m)	H2 (m)	W0 (m)	L1 (m)	L2 (m)	Hp (m)	
BC.1	648.13	655.13	661.50	52.50	75.00	96.61	7.50	5.87	8.00	30.00	90.00	90.00	CITARUM RIVER
BC.2	649.34	655.34	662.50	52.50	75.00	100.00	7.50	7.06	8.00	30.00	90.00	17.06	CITARUM RIVER
BC.3	650.23	657.23	660.99	33.50	44.50	88.54	4.00	6.76	8.00	28.00	84.00	13.56	CITARUM RIVER

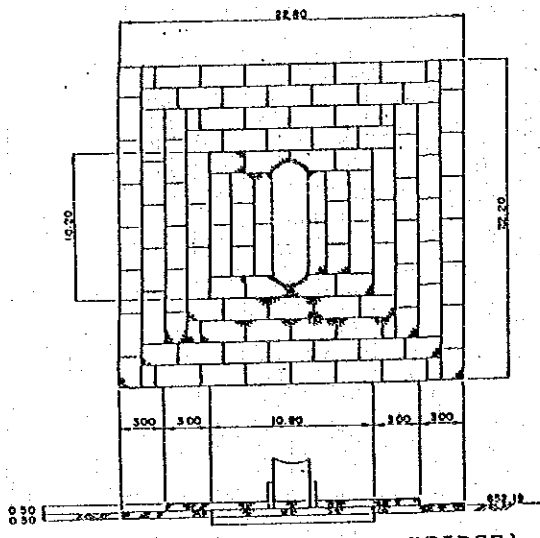
TYPICAL DRAWING OF PROPOSED BRIDGE (CITARUM RIVER)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

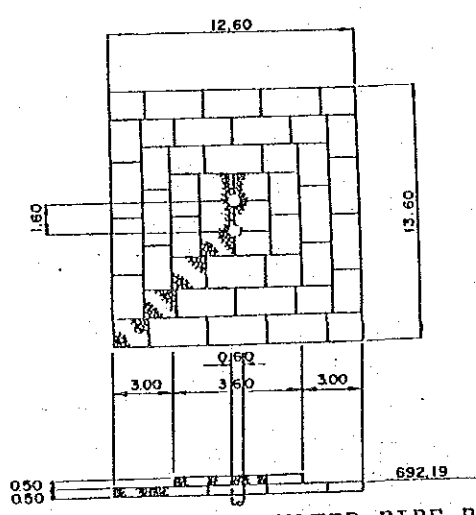




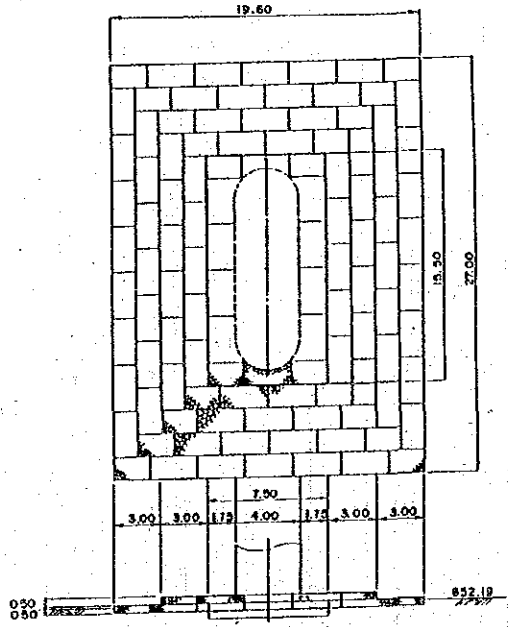
BS-1 (CIRANPENI ROAD BRIDGE)



BS-2 (DAYEUH KOLOT ROAD BRIDGE)



BS-3 (DAYEUH KOLOT WATER PIPE BRIDGE)



BS-4 (DAYEUH KOLOT RAILWAY BRIDGE)

FIG. I. 18

TYPICAL BRIDGE STRENGTHENING (GABION)

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



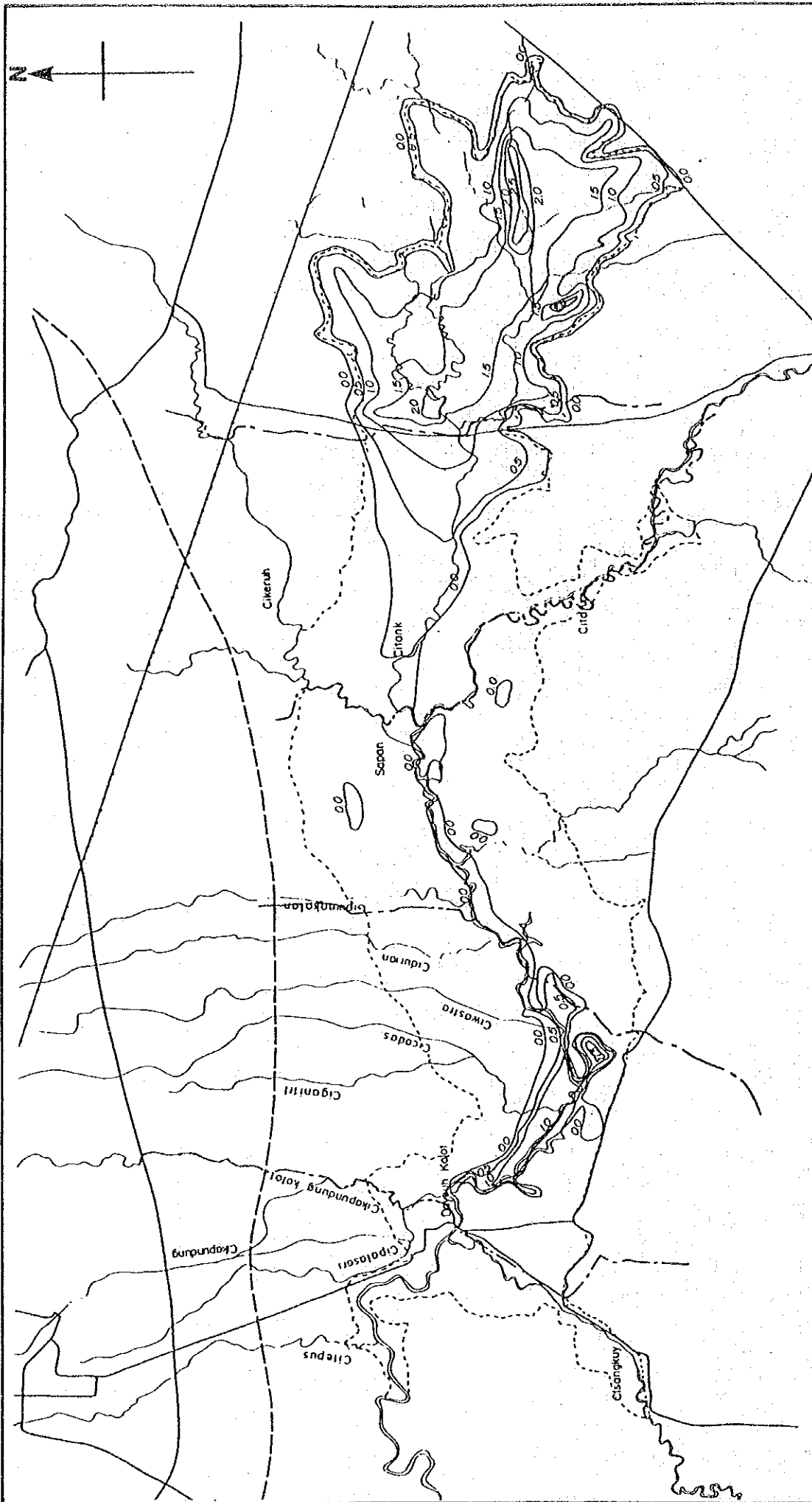


FIG. I. 20 FLOOD RISK MAP BY 5-YEAR FLOOD AFTER COMPLETION OF URGENT PLAN

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



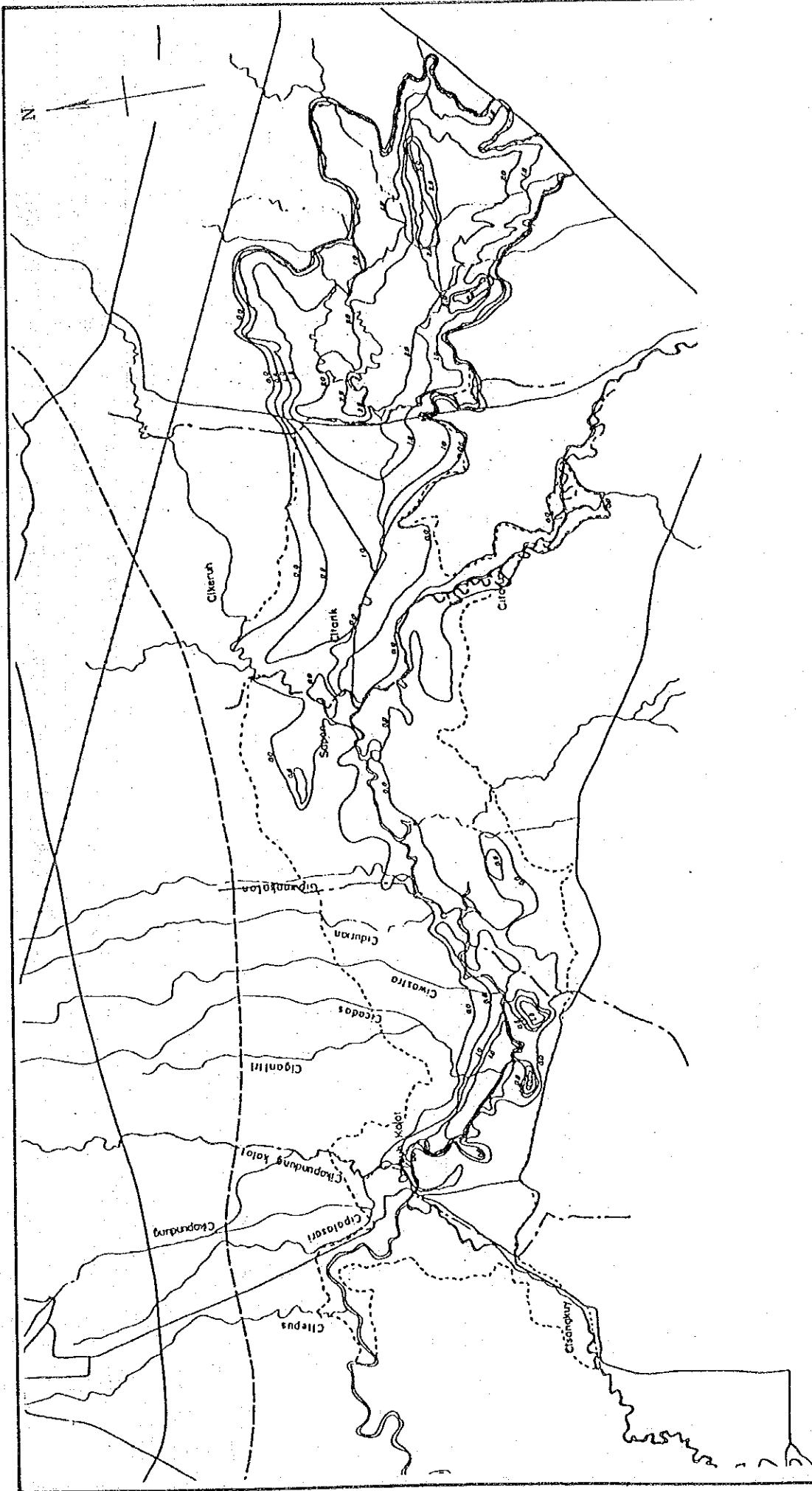


FIG. I.21 FLOOD RISK MAP BY 20-YEAR FLOOD AFTER COMPLETION OF URGENT PLAN

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



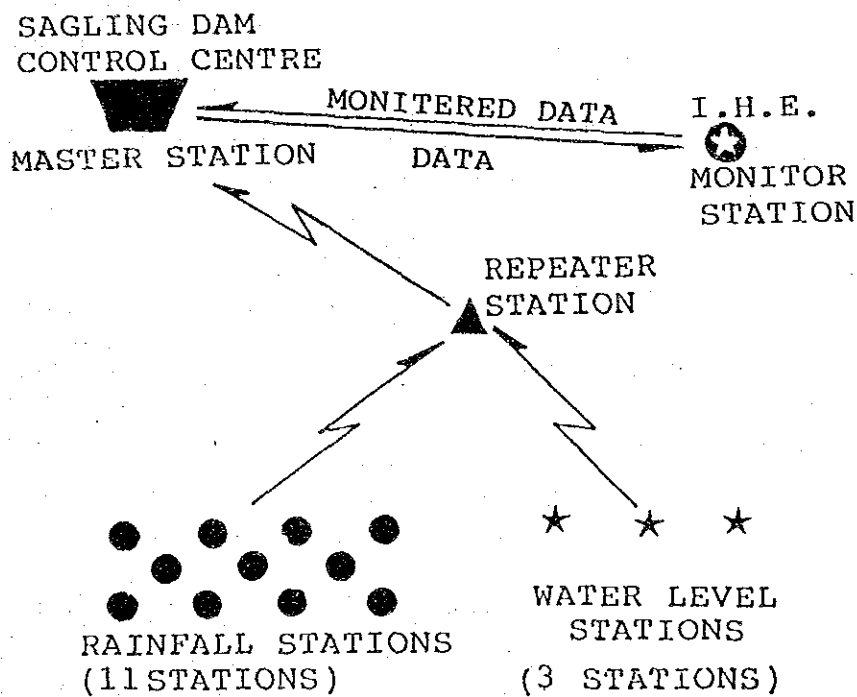
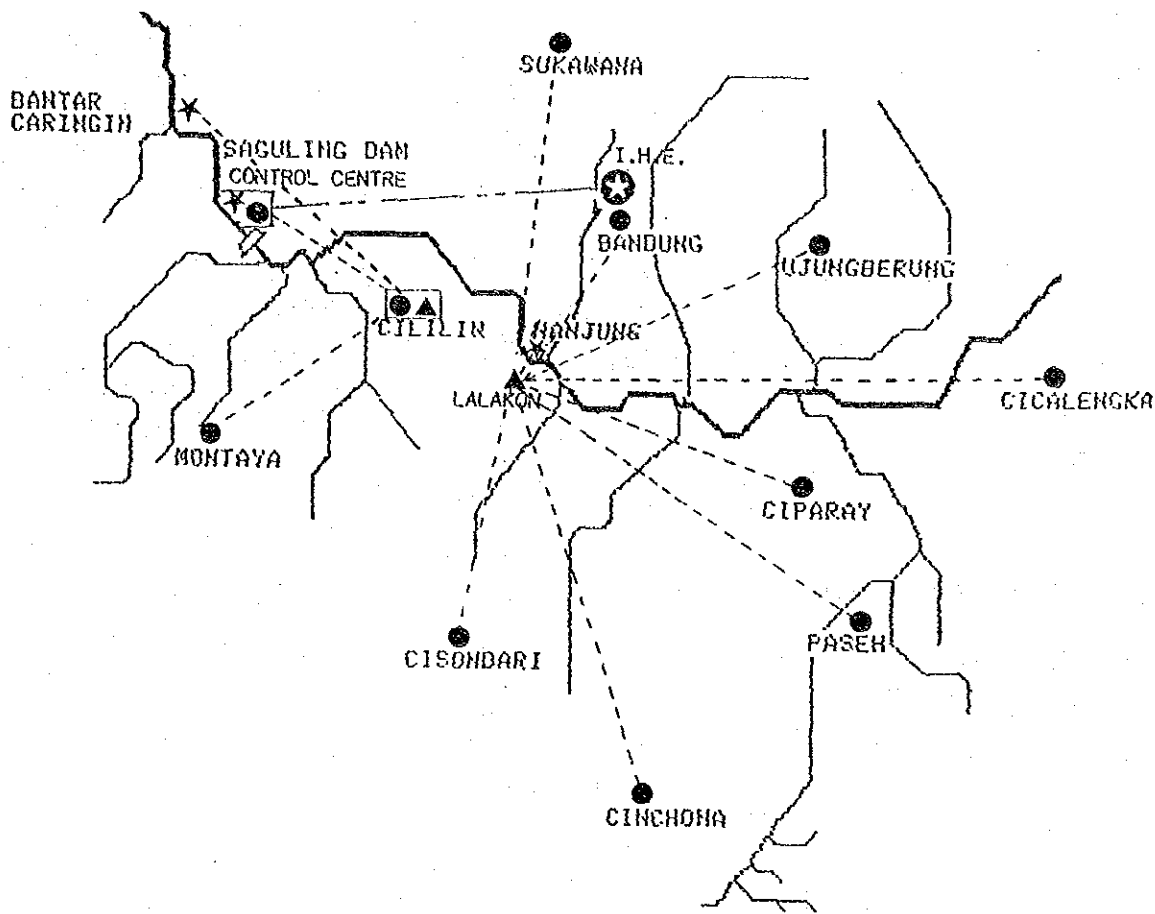


FIG. I. 23

SAGULING HYDROPOWER PROJECT HYDROLOGICAL TELEMETERING SYSTEM

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

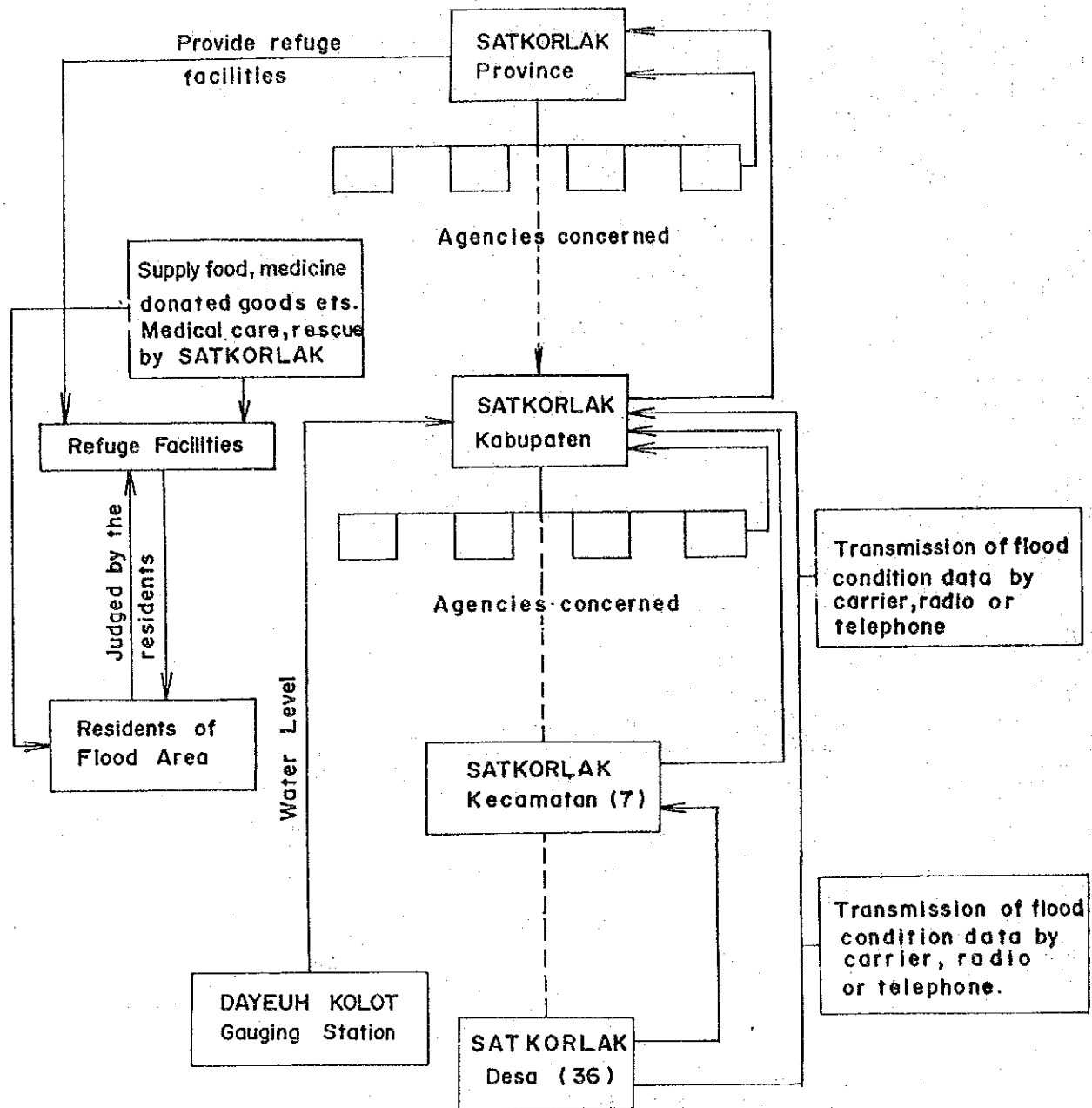


FIG. I.24 EXISTING FLOOD INFORMATION AND EVACUATION SYSTEM

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

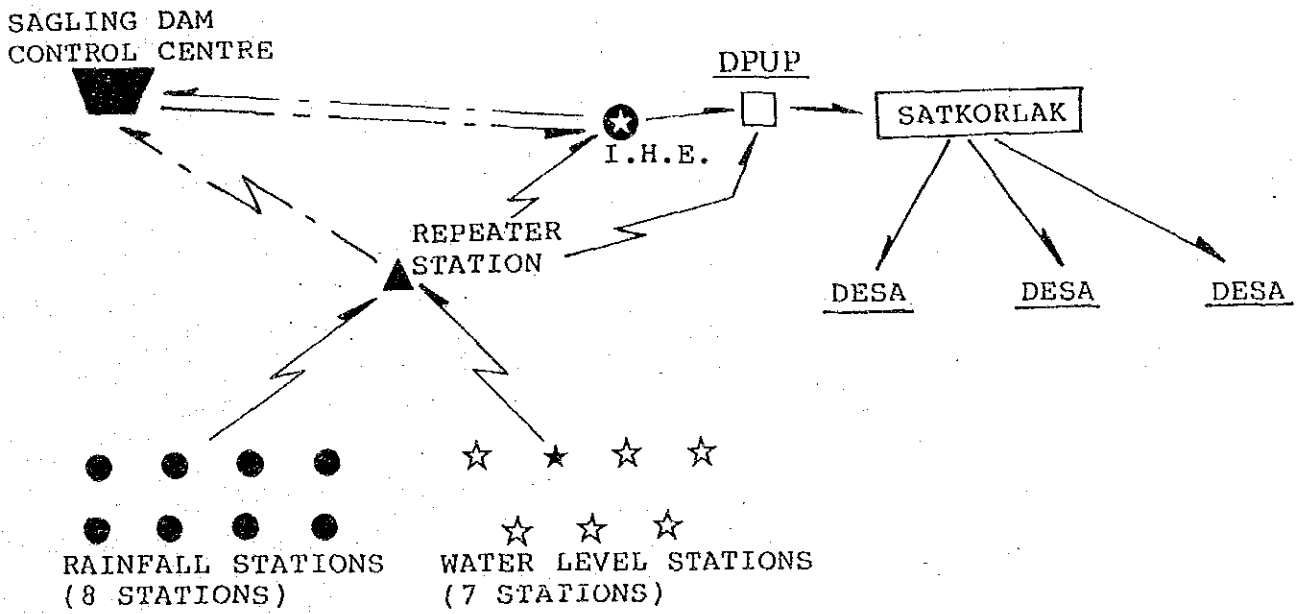
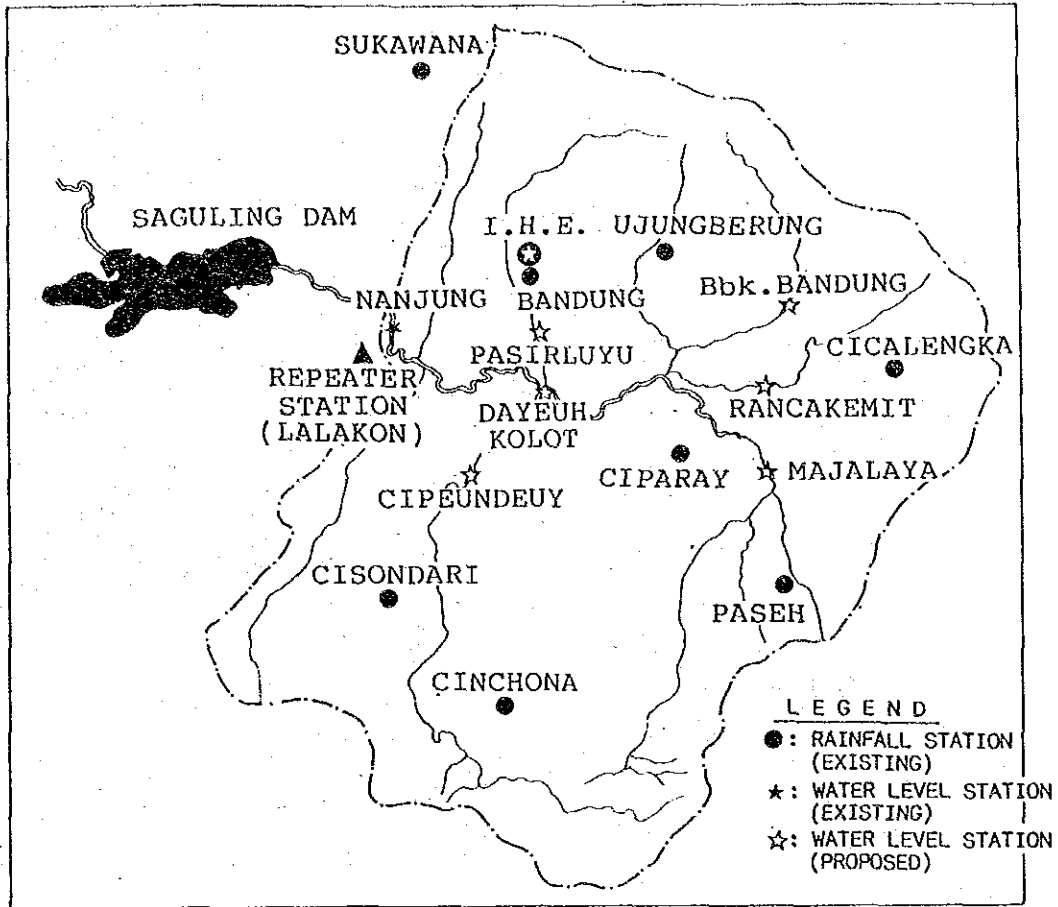
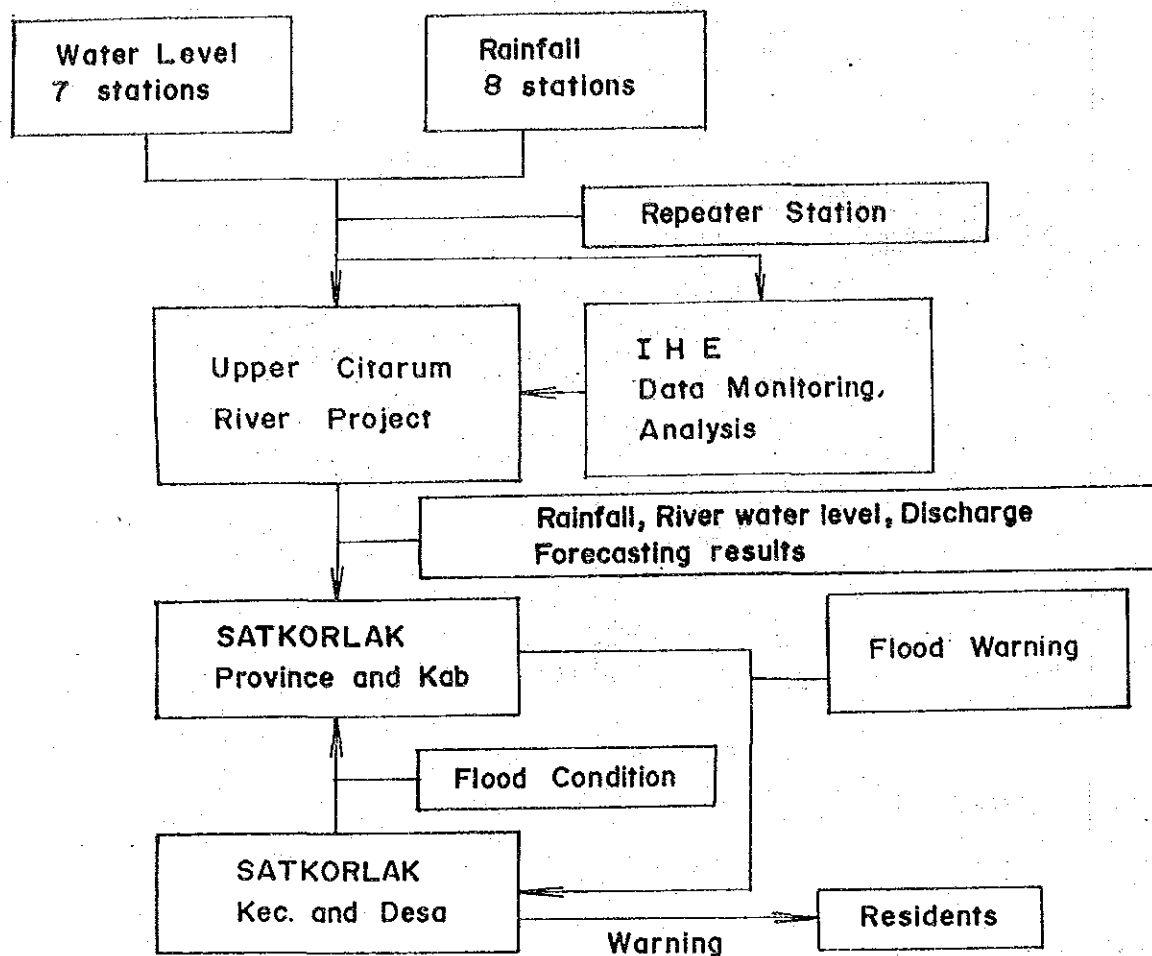


FIG. I.25 PROPOSED FLOOD FORECASTING AND WARNING SYSTEM

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



Water Level
 Nanjung
 Dayeuh Kolor, Citarik
 Cipeundeuy, Cikapundung
 Bbk. Bandung, Majalaya

Rainfall
 Cisondari, Cinchona, Paseh
 Ciparay, Cicalengka
 Bandung, Ujungberung
 Sukawana

FIG. I.26

PROPOSED FLOW CHRT OF FLOOD FORECASTING AND WARNING SYSTEM

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

SUPPORTING REPORT J

**CONSTRUCTION PLAN AND COST ESTIMATE
FOR URGENT FLOOD CONTROL PLAN**

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SUPPORTING REPORT J
CONSTRUCTION PLAN AND COST ESTIMATE
FOR URGENT FLOOD CONTROL PLAN

1. General

The construction works for urgent flood control plan consist mainly of river dredging including cut-off channels, bank protection by gabion, construction of new bridge and strengthening the sub-structures of existing bridge. Reaches to be improved are the Citarum River of 31.2 km long between Curug Jompong and Sapan, and its tributary Cisangkuy River of 7.4 km long.

In this Report, the construction plan, cost estimate and implementation schedule for the proposed urgent flood control plan are described.

2. Construction Plan

2.1 Basic Condition of Construction Plan

(1) Workable Days and Working Hours

Execution of earth work, which is a major component of work in the proposed urgent plan, is affected by rainfall. Workable days within a year are assumed based on the rainfall records during the past five (5) years, 1981 to 1985, at four rainfall stations (Cimahi, Cihampelas, Cisondari and Arjasari) in the Study Area. As shown in Table J.1, total workable days in a year is assumed to be 235 days which is almost the same as the average number of no rainfall days in a year during the past five (5) years.

Daily working hours and operation hours of construction equipment are assumed to be eight (8) and five (5) hours, in net respectively.

(2) Existing Available Equipment

According to the data collected from agency concerned, existing available main equipment in Bandung area are listed in Table J.2.

(3) Topographical and Geological Conditions

Topographical and geological conditions along the improvement stretch are described in Supporting Report A and L. In this section, soil classification for the preparation of the construction plan and cost estimate are described.

According to the geological survey, geological strata along Citarum River (main) and Cisangkuy River are classified into nine (9) and four (4) strata respectively, as shown in Table A.3 and Fig. A.5 to Fig. A.9 of Supporting Report A.

For the preparation of construction plan and cost estimate, soil classification is to be simplified based mainly on the results of the standard penetration test. The simplified soil classification are as follows.

Simplified Soil Classification

Classification of Stratum	Symbol	Note
Common Soil	A	$N < 10$
Stiff Soil	B	$10 < N < 50$
Soft Rock	C	$N > 50$
Hard Rock	D	Intrusive Rock

Geological profiles based on the simplified soil classification are shown in Fig. J.1 and Fig. J.2.

(4) Execution System and Construction Method

A complete contracting system is adopted as the execution system for the urgent project.

2.2 Preparatory Works

(1) Transportation Road and Access Road

At the present time, there are two asphalt-paved roads run from Bandung to the project area. One links Bandung with Dayeuh Kolot, and the other Bandung with Cilampeni. These are useful as main trunk roads for the project site. Branching from the main roads, access roads for each river are also available. It is required, however, that some existing roads be partially improved and some new access roads to be constructed to facilitate in transportation.

(2) Office and Quarters

The project office to be provided for designing and supervision of construction works, along with quarters for project personnel in the vicinity of the project office. Also temporary site offices are required at several places for supervision of execution works.

Communication facilities, exclusively for the project, should be provided during the period of project implementation.

(3) Topographic and Geological Survey

It is required to carry out the topographic and geological survey before the commencement of the construction works.

(4) Other Works

Clearing and grubbing works should be executed at the site of river dredging and some other temporary works also will be required.

2.3 Construction Plan

(1) Division of Construction Section for Citarum River

The improvement stretches of the Citarum River (main) of 31.2 km long was divided into the following three (3) construction sections for the study on construction plan.

- First section : STA. 0 km - STA. 9.0 km, L= 9.0 km
- Second section : STA. 9 km - STA. 20.0 km, L= 11.0 km
- Third section : STA. 20.0 km - STA. 31.2 km, L= 11.2 km

(2) Required Construction Works

Required construction works for the urgent flood control plan are described in the Supporting Report I.

(3) Land Acquisition and Compensation

Land acquisition and house resettlement compensation are required prior to the execution of the construction works, and are to be carried out by DPUP, West Java Province. The required total quantity is given in Supporting Report I.

(4) Construction Plan

The construction method in combination with mechanical and manual powers is applied to the construction work mentioned above. Construction method for major works is described below and the percentages of mechanical and manual powers for such works are given in Table J.3.

1) Dredging of Existing River Channel

Dredging of existing river channels are planned to be carried out by pump dredger with a capacity of 250 m³/hr and of an engine capacity of D600 P.S. Materials dredged are to be used for reclamation of low-lying area near the river course or to spoil-

bank area. The existing river courses that remain after the construction of cut-off channels are also potential areas of spoil-bank.

2) Dredging of Cut-off Channel

The Citarum River (main) and Cisangkuy River are planned to be provided with, respectively, eight (8) and three (3) cut-off channels to shorten the river course.

Among these cut-off channels, the three (3) cut-off channels at downstream stretches of the Citarum River from Dayeuh Kolot are planned to be dredged by using back-hoe (0.6 m³, 1.2 m³ with Ripper) and bulldozer (32 ton with Ripper) because of their geological conditions having stiff soil and soft rocks.

Dredging works for other cut-off channels are planned to be carried out by the pump dredger because of their common soil condition.

It is confirmed that dredged materials can be used for reclamation of low-lying areas near the river course.

3) Loading and Transportation of Dredged Materials

Loading and transportation of materials dredged by bulldozer are planned to be carried out by combination of backhoe and dump truck to low-lying area of reclamation and spoil bank.

4) Bank Protection

A bank protection of 6.1 km by gabion is planned for erosion control at meanders. The bank protection measures are planned to be implemented by manual labor. Working in the low-water channel areas require coffer-dams using sand bags.

5) Bridge Improvement

Bridge improvement works consist of constructing new bridges at seven (7) places and strengthening the sub-structure of existing bridges at four (4) places.

The construction of new bridge is divided into two (2) items of sub-structure and super-structure.

The construction of sub-structure consisting of coffering, pile driving for foundation to be used for four (4) bridges of the Cisangkuy River, along with concrete works. The piles are of reinforced concrete type and to be driven by diesel pile drivers. The three (3) bridges of the Citarum River (main) are to be provided with spread foundation because of their stiff soil or soft rock condition.

The steel plate girder for super-structure is to be fabricated in the factory. This steel plate girder has to be ordered for fabrication ahead of the commencement of execution works.

The strengthening of foundation of existing bridge pier is planned to be carried out by replacing the river bed materials around foundation by gabion.

2.4 Construction Schedule

The urgent flood control project will be completed within five (5) years after the signing of loan agreement according to the following staged construction plan.

- (1) Loan agreement will be contracted until the end of September 1989. Then, it takes almost six (6) months for selection of consultants.
- (2) Detailed design will be commenced in April 1990 and completed by September 1991 within a period of 18 months.

- (3) In March 1991, tendering procedure will be commenced, and will be completed by September 1992 within a period of seven (7) months.
- (4) Main civil work will be commenced in October 1992 and be completed by September 1995 within construction period of 3 years.
- (5) Land acquisition will be commenced at least one year prior to the implementation of civil works.

Summary of the proposed sequence of the river improvement works are as follows:

- (1) Construction works of Citarum River (main) is divided into three sections. Construction schedule of each section will be as follows:

Construction Section	River Length (km)	Construction		
		Commencement	Completion	Period (month)
First	9.0	Oct. 1992	Sep. 1994	24
Second	11.0	Aug. 1993	Oct. 1994	15
Third	11.2	Nov. 1994	Sep. 1995	11

Preparatory works on flood forecasting and warning system will be included in the Third Section.

- (2) Construction works on Cisangkuy River improvements will be commenced in October 1992 and be completed by July 1993 within a period of 10 months.

Proposed construction schedule is shown in Fig. J.3.

3. Cost Estimate

Cost estimate is carried out for the assessment of economic and financial viability, and for the preparation of a fund allocation schedule by the Government. The costs are estimated based on the current prices of construction materials, equipment, and labour rate prevailing in Bandung.

3.1 Basis of Cost Estimates

The estimation of the construction cost, consisting of

- direct cost: (1) civil work cost
- (2) flood warning system cost
- indirect cost: (3) land acquisition and house resettlement compensation cost
- (4) administration cost
- (5) engineering service cost
- contingency: (6) physical contingency
- (7) price escalation

was made based on the following consideration;

- (1) The estimates are made on the assumption that all construction works will be contracted to general contractors through international tendering.
- (2) All base costs are expressed under the economic conditions that prevailed in November, 1987.
- (3) The exchange rate of currencies are considered as follows:

$$\text{US\$1.00} = \text{Rp. 1,655} = \text{¥135}$$

- (4) The cost is classified into foreign currency and local currency portions, based on the following:

The foreign currency portions include the costs of:

- Imported equipment, materials, and supplies,

- Domestic materials for which the country is a net importer,
- Wages of expatriate personnel, and
- Overhead and profit of foreign firms.

The local currency portions contain the costs of:

- Domestic materials and supplies for which the country is a net exporter,
- Wages of local personnel,
- Land acquisition and house resettlement compensation,
- Overhead and profit of local firms, and
- Taxes.

- (5) Civil works consist of preparatory works of construction, main civil works and other miscellaneous works. The cost of main civil works is estimated by multiplying the quantity of work by unit cost. The cost for preparatory works is assumed to be 8% of the total cost of main civil works. The cost of miscellaneous works is assumed to be 5% of the total cost of both the preparatory and main civil works.
- (6) Administration cost is assumed at 5% of the total cost of civil works, flood warning system, and land acquisition and house resettlement compensation.
- (7) Engineering service cost is assumed at 11% of the total cost of civil works, flood warning system, and land acquisition and house resettlement compensation.
- (8) A physical contingency allowance which is an amount added to a "risk-free" base cost is established at 10% of the total construction costs.
- (9) Annual price escalation is considered to be 3% for foreign currency (F/C) and 8% for local currency (L/C).

3.2 Unit Construction Cost

3.2.1 Unit Price

The unit prices of labor, materials and equipment are determined based on the data collected from DPUP, West Java Province and other agencies concerned. The unit prices of the construction materials are divided into two (2) components of foreign and local currencies based on the current data applied to similar projects in Indonesia. The unit prices of labor and construction materials are shown in Table J.4.

Operation cost of the construction equipment are estimated based on the cost of fuel, maintenance and repair depreciation, and cost for labour and supervision. For estimating the depreciation, repair and maintenance costs of major construction equipment, two (2) estimation methods are applied. One is straight method which is applied to the special construction equipment imported for this project. The other one is the declining balance method which is applied to the equipment used commonly in Indonesia.

The hourly operation costs estimated using both the straight and declining balance methods are given in Table J.6 and Table J.7 respectively. Table J.5 provides the estimated operation cost per day of the construction equipment. Rental cost of the equipment and its factor in Indonesia are given in Table J.8 to Table J.10.

The costs of land acquisition and house resettlement compensation are respectively 5,000 Rp./m² and 5.0 million Rp./house as provided by the DPUP, West Java Province.

3.2.2 Unit Construction Cost

The unit construction cost is estimated by applying the unit prices of labor, construction materials and equipment, and based on the aforementioned construction plan.

In estimating the unit construction cost, contract prices including site expenses, contractor's overhead and profit including tax are assumed as follows:

- (1) Site expenses : 20% of direct construction cost
- (2) Contractor's overhead, profit and tax : 20% of direct construction cost and site expenses

The estimated unit construction costs are given in Table J.11 and Table J.12.

3.3 Estimated Project Cost

The total project cost, consisting of direct cost, indirect cost, and physical contingency, amounts to Rp. 81,465.2 million at November 1987 prices as given below (Rp. 101,742.3 million, including price escalation).

Cost Item	L/C (10 ⁶ Rp)	F/C (10 ³ US\$)	Equiv.Total (10 ⁶ Rp)
A. Direct Cost	9,381.3	28,784.2	57,019.2
(1) Civil Work	(9,128.9)	(28,172.2)	(55,754.0)
(2) Flood Warning System	(252.4)	(612.0)	(1,265.2)
B. Indirect Cost	10,970.7	3,667.3	17,040.1
(1) Land Acquisition/Compensation	(6,645.0)	(-)	(6,645.0)
(2) Administration	(3,183.2)	(-)	(3,183.2)
(3) Engineering Service	(1,142.5)	(3,667.3)	(7,211.9)
C. Physical Contingency	2,035.2	3,245.2	7,405.9
Total (1)	22,387.2 (27.5%)	35,696.7 (72.5%)	81,465.2 (100%)
D. Price Escalation	10,324.1	6,014.0	20,277.1
Total (2)	32,711.3 (32.2%)	41,710.7 (67.8%)	101,742.3 (100%)

The break-down of the estimated project cost are given in Table J.13 to Table J.20.

Based on the construction schedule as shown in Fig. J.3, the annual disbursement schedule is prepared as given in Table J.21.

3.4 Operation and Maintenance Cost

The operation and maintenance cost at full operation stage of the facilities, after completion of the project, is assumed to be annually 0.5% (285 million Rp./year) of the total construction cost of civil works and warning system equipment at the November 1987 price.

Table J.1 RECORD OF NO RAINFALL DAYS AT FOUR RAINFALL STATION
(Average Days for Five Year, from 1981 to 1985)

Month Station	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Cimahi	13.4	15.0	15.8	15.4	19.4	25.4	25.2	28.6	27.4	17.0	18.6	14.4	235.6
Cihampelas	14.8	13.6	13.4	13.6	19.8	24.0	25.0	26.4	23.4	18.4	18.6	18.2	229.2
Cisondari	16.0	16.2	16.2	14.6	23.8	25.2	25.4	28.4	23.4	22.4	20.8	19.2	251.6
Arjasari	12.0	16.9	18.0	15.3	20.3	26.5	26.7	25.3	25.3	21.0	17.5	13.7	238.5
average	14.4	15.4	15.9	14.7	20.8	25.3	25.6	27.2	24.9	19.7	18.9	16.4	239.2

On account of the above record, total workable days within a year is assumed to be 235 days.

Table J.2 AVAILABLE EXISTING CONSTRUCTION EQUIPMENT

Equipment	Capacity	Engine Power
Bulldozer	11 Ton	100 HP
Bulldozer	15 Ton	150 HP
Bulldozer	21 Ton	200 HP
Moter Grader	2.8 ~ 3.1 m	100 HP
Moter Grader	3.7 m	150 HP
Excavator (Back Hoe)	1.0 m ³	190 HP
Excavator (Back Hoe)	0.6 m ³	120 HP
Vibration Roller	1 Ton	7 HP
Vibration Roller	2.5 Ton	23 HP
Vibration Roller	4 ~ 6 Ton	27 ~ 71 HP
Vibration Roller	10 Ton	120 HP
Dump Truck	3 ~ 3.5 Ton	100 HP
Dump Truck	5 Ton	160 HP
Dump Truck	8 Ton	240 HP
Crane on Truck	15 Ton	230 HP
Crane on Truck	25 Ton	280 HP
Cutter Dredger	100 m ³ /Hour	D250 p.s
Cutter Dredger	250 m ³ /Hour	D600 p.s
Cutter Dredger	500 m ³ /Hour	D1350 p.s

Table J.3 PERCENTAGE OF MECHANICAL AND MAN POWER FOR MAJOR WORKS

Works	Percentage (%)		Composition of Equipment
	Man Power	Equipment	
1. Excavation (for major bed)	0	100	BD (21 t)
2. Loading and Transportation	0	100	BH (0.6 m3) DT (8 t)
3. Dredging	0	100	Dredger (class 250 m3)
4. Embankment	0	100	BD (21 t)
5. Gravel Metaling (for inspection road)	0	100	BD (21 t)
6. Concrete Work	0	100	Concrete mixer (1.0 m3, 0.3 m3) Concrete Vibrator (ø 30m/m)
7. Pilling Work (for R.C. Pile)	0	100	Diesel Pile driver
8. Gabion (for bank protection)	100	0	
9. Setting Gabion (for protection of bridge pier)	0	100	Crawler crane 15 T

Note: BD: Bulldozer DT: Dump truck BH: Backhoe

Table J.4 UNIT PRICES OF LABOR AND CONSTRUCTION MATERIALS
(US\$1=Rp.1,655=¥135) November, 1987

Item	Unit	Basic Unit Price (Rp.)	Unit Price		Ratio of F.C. (*) (%)
			L.C. (Rp.)	F.C. (US\$)	
I. Labor Wages					
1) Chief operator dredger	day (8hrs)	12,000	12,000	---	0
2) Operator dredger	day (8hrs)	10,000	10,000	---	0
3) Common dredger crew	day (8hrs)	3,000	3,000	---	0
4) Common crew	day (8hrs)	2,500	2,500	---	0
5) Fore man	day (8hrs)	5,000	5,000	---	0
6) Skilled labor	day (8hrs)	3,000 ~ 4,000	3,000 ~ 4,000	---	0
7) Skilled rock excavation labor	day (8hrs)	10,000	10,000	---	0
8) Common labor	day (8hrs)	2,500	2,500	---	0
9) Concrete worker	day (8hrs)	3,500	3,500	---	0
10) Carpenter	day (8hrs)	3,500	3,500	---	0
11) Steel bar bender	day (8hrs)	3,500	3,500	---	0
12) Mason	day (8hrs)	3,500	3,500	---	0
13) Operator (Machine)	day (8hrs)	10,000	10,000	---	0
14) Assistant operator	day (8hrs)	4,000	4,000	---	0
15) Electrician	day (8hrs)	4,000	4,000	---	0
16) Driver (**)	day (8hrs)	3,500	3,500	---	0
17) Mechanic (**)	day (8hrs)	5,000	5,000	---	0
II. Fuel and Materials					
1) Gasoline	Lit	385	193	0.12	50
2) Diesel oil	Lit	200	100	0.06	50
3) Sand for concrete	m3	11,000	517	3.59	53
4) Sand for others	m3	6,500 ~ 7,000	3,055 ~ 3,270	2.12 ~ 2.28	53
5) Cravel for concrete	m3	11,000 ~ 12,000	5,170 ~ 5,674	3.59 ~ 3.91	53
6) Unscreened gravel	m3	7,000	3,290	2.28	53
7) Stone for masonry	m3	7,000	3,290	2.28	53
8) Cobble stone	m3	7,000	3,290	2.28	53
9) Cement (Portland)	m3	92.5	32.4	0.04	65
10) Reinforcement bar	kg	565	113	0.40	80
11) Steel plate (***)	kg	1,170	---	0.72	100
12) Shape steel (***)	kg	1,330	---	0.82	100
13) Steel sheet pile (***)	kg	1,770	---	1.09	100
14) H section steel	kg	1,120	---	0.69	100
15) Bolt and nut	kg	850	---	0.52	100
16) Wire rope 18 mm (***)	kg	5,560	---	3.42	100
17) Zinc wire 0.8 mm (***)	kg	3,060	---	1.88	100
18) Nail	kg	750 ~ 1,600	---	0.46 ~ 0.98	100
19) Wooden plate for form	m3	200,000	188,000	7.38	6
20) Wooden beam	m3	175,000	164,500	6.46	6
21) Wooden log (****)					
- ø 150mm	m3	55,000	51,700	2.03	6
- ø 120mm	m3	45,000	42,300	1.66	6
22) Paint					
-Masonry paint	Gallon	6,500 ~ 27,000	3,250 ~ 13,500	2.00 ~ 8.31	50
-Wooden Paint	kg	3,500 ~ 4,000	1,750 ~ 2,000	1.08 ~ 1.23	50
23) Bamboo net	m2	1,700	1,700	---	0
24) Tuff	m2	270	240	0.02	10
25) Polythylene sheet (t=0.25mm)	m2	4,780	---	2.89	100
26) Polythylene sheet (t=0.71mm)	m2	23,000	---	13.90	100
27) Sand bag 40cm x 62 cm	sheet	740	44	0.42	6
28) Fastening Wire (# 10 x 700 mm - 200 pcs)	1 Box	26,970	---	16.30	100

Note: (*): Ratio of F.C. in unit Price is Estimated based on the data prepared by West Jakarta Flood Control Project, April, 1983
(**): Wages of electrician and Mechanic are adjusted based on the data prepared by Padang Area Flood Control Project, January 1988
(***): Prices of steel plate, shape steel pile and H section steel are adjusted based on the data prepared by Japanese journal on construction labor wages and material prices, April 1988
(****): Price of wooden log is adjusted based on the data prepared by Krueng Aceh Irrigation Project, June 1986.

Table J.5 ESTIMATED OPERATION COST OF EQUIPMENT PER DAY

Equipment	Capacity	Local Currency (Rp.)			Forecin Currence (U.S \$)			TOTAL (Rp.)
		Fuel	Labor	Total	Owing and Repair	Fuel	Total	
Bulldozer	11 t	9,240	17,360	26,600	92.76	5.58	98.34	189,352
Bulldozer	15 t	15,120	17,360	32,480	115.02	9.14	124.16	237,965
Bulldozer	21 t	21,840	17,360	39,200	179.37	13.20	192.57	357,903
* Bulldozer	32 t	32,760	139,608	172,368	483.98	19.81	503.79	1,006,140
* 32ton Ripper Bulldozer	With Two Ripper	36,960	173,530	210,490	536.55	22.33	558.88	1,345,926
* Swamp Bulldozer	13 t	10,920	63,014	73,934	179.27	6.58	185.85	381,515
* Swamp Bulldozer	16 t							
* Swamp Backhoe	0.35 m3	8,400	55,839	64,239	157.71	5.11	162.82	333,706
Backhoe	0.6 m3	7,140	17,360	24,500	120.53	4.31	124.84	231,110
* 1.2m3 Backhoe Ripper	1.2 m3 with Ripper	57,400	293,300	350,700	93016.00	34.72	964.88	1,947,576
Crawler Tractor Shovel	1.8 m3	13,440	15,680	29,120	122.89	8.12	130.71	245,445
Crawler Crane	16 t	3,600	16,450	20,050	171.01	2.18	173.19	306,679
Dump Truck	2 t	2,160	4,030	6,190	11.40	1.31	12.45	26,794
Dump Truck	8 t	7,812	3,430	11,242	41.62	4.72	46.34	88,398
Sand Pump Dredger	D600 P.S	210,000	117,000	327,000	2051.67	126.89	2178.56	3,932,520
Self moving Anchor Boat	5T.D90 P.S	1,440	15,000	16,440	131.17	0.87	132.04	224,960
Transportation Boat	3GTD10 P.S	960	5,000	5,960	5.38	0.58	5.96	15,830
Tug Boat	W10T	2,210	12,500	14,710	14.37	1.34	15.71	40,710
Dredger Tender	3TD10P.S	1,200	9,000	10,200	14.21	0.72	14.93	34,909
Sand Pipe on the Water	ø410mm, L=120m	-	-	-	213.34	-	213.34	353,080
Landing Stage	100T	-	6,000	6,000	46.63	-	46.63	83,173
* Landing stage (ship)	120 t	-	43,974	43,974	210.56	-	210.56	348,476
Compressor	5 m3/min	4,444	10,400	14,844	21.07	2.69	23.76	54,166

Note: Operation cost of equipment marked in * is estimated by straight method.
Another one is estimated by declining balance method.

Table J.6 HOURLY OPERATION COST OF EQUIPMENT (STRAIGHT METHOD)

(US\$1=Rp.1,655=K135) November, 1987

Name of Equipment (or Tool)	Initial Cost (1000 U.S.\$)	Useful Life		Maintenance Rate %	Currency	Depreci- ation	Invest- ment cost	Operation Cost		Tire Pipe Cost	Maintenance and Sparepart Cost	TOTAL	
		Year	Hour					Operator	Fuel			in U.S.\$	in Rp.
Swamp Back Hoe 0.35 m3 (D 80 P.S)	104.00	5	10,000	100	L (Rp.) F (\$)	- 9.36	- 6.24	2,240 -	1,200 0.73	- 0.00	5,737 6.93	- 23.26	9,177 38,495
Swamp Bulldozer 13 t (D112 P.S)	118.22	5	10,000	100	L (Rp.) F (\$)	- 10.64	- 7.09	2,480 -	1,560 0.94	- 0.00	6,522 7.88	- 26.55	10,562 43,940
Swamp Bulldozer 16 t (D153 P.S)	143.11	5	10,000	100	L (Rp.) F (\$)	- 12.88	8.59	2,480 -	2,160 1.31	- 0.00	7,895 9.54	32.32	12,535 53,490
32 ton Bulldozer (ripper)	353.78	5	10,000	100	L (Rp.) F (\$)	- 31.84	21.23	2,340 -	5,280 3.19	- 0.00	19,510 23.58	79.84	27,130 132,140
1.2 m3 Back Hoe (204)	306.67	5	10,000	100	L (Rp.) F (\$)	- 27.60	18.40	4,030 -	4,100 2.48	- 0.00	16,920 20.44	68.92	25,050 114,063
Landing Stage (120 t)	115.71	10	20,000	90	L (Rp.) F (\$)	- 5.21	6.36	270 -	- -	- 0.00	2,871 3.47	15.04	13,141 24,899
32 ton Bulldozer	319.11	5	10,000	100	L (Rp.) F (\$)	- 28.72	19.15	2,340 0.00	4,680 2.83	- 0.00	17,604 21.27	71.97	24,624 119,110

Table J.7 HOURLY OPERATION COST OF EQUIPMENT (DECLINING BALANCE METHOD)

(Exchange Rate: US\$ 1.00 = Rp 1655 = ¥135, in Nov.1987)

Name of Equipment	Fuel Quantity (lit.) Cost	Consumption & Cost	Higher Crew or operator Person Cost	Common Crew or Assistant Person Cost		Foreman Person Cost	Rental in a basis Cost	Total Cost (Rp.)	Currency		Description
				Person Cost	Person Cost				L/C (Rp.)	F/C (US\$)	
D600 P.S Dredger	120 lit. 24,000	25 % 6,000	0.45 4,500	1.56 3,900	-	-	242,537	280,937	23,400	155.61	Operating hour: 14 hrs/day
STD90 P.S Anchor Boat	16 3,200	60 1,920	0.20 2,000	0.40 1,000	-	-	43,415	51,535	5,560	27.78	Operating hour: 5 hrs/day
Transportation Boat	2 400	20 80	-	0.50 1,250	-	-	2,227	3,957	1,490	1.49	Operating hour: 4 hrs/day
0.6 m3 Back Hoe	8.5 1,700	20 340	0.20 2,000	0.07 280	0.04 200	-	28,497	32,737	3,500	17.67	
11 ton Bulldozer	11 2,200	20 440	0.20 2,000	0.07 280	0.04 200	-	21,978	27,098	3,800	14.08	
15 ton Bulldozer	18 3,600	20 720	0.20 2,000	0.07 280	0.04 200	-	27,194	33,994	4,640	17.74	
21 ton Bulldozer	26 5,200	20 1,040	0.20 2,000	0.07 280	0.04 200	-	42,408	51,128	5,600	27.51	
2 ton Dump Truck	3 600	20 120	0.19 670	-	-	-	3,074	4,464	1,030	2.07	
8 ton Dump Truck	9.3 1,860	20 372	0.14 490	-	-	-	9,839	12,561	1,606	6.62	
1.8 m3 Tractor Shovel	16 3,200	20 640	0.18 1,800	0.06 240	0.04 200	-	29,054	35,134	4,160	18.72	
16 ton Crawler Crane	4.2 840	20 168	0.20 2,000	0.06 240	0.03 150	-	39,857	43,255	2,894	24.39	
5 m3/min Compressor	4.63 926	20 185	0.13 1,300	-	-	-	4,359	6,770	1,855	2.97	

Table J.8 RENTAL COST PER HOUR IN INDONESIA

Exchange Rate: U.S\$ 1.00 = Rp.1655 = ¥135 (in Nov.1987)

Equipment		Engine Power (P.S)	Useful Year		Basic Price		[2] Hauling Expenses (X Rp.10^6)	[3] Initial Cost [1]+[2] (X Rp.10^6)	Maintenance Rate (%)	[4] The Middle of Life Line Factor	[5] Rental Cost [3]X[4] (Rp.)
Name	Description		Year	Hour	Japanese (X ¥1,000)	Indonesia (X Rp.10^6)					
Sand Pump Dredger	D 600 P.S	600	15	30,000	283,000	3,469.40	208.20	3,677.60	90	65.95	242,537
Self Moving Anchor Boat	1T; D30P.S	30	10	20,000	8,130	99.70	6.00	105.70	90	86.33	9,125
Self Moving Anchor Boat	3T; D60P.S	60	10	20,000	23,400	286.90	17.20	304.10	90	86.33	26,253
Self Moving Anchor Boat	3T; D90P.S	90	10	20,000	38,700	474.40	28.50	502.90	90	86.33	43,415
Transport Boat	3GT; D10P.S	10	10	20,000	1,980	24.30	1.50	25.80	90	86.33	2,227
Sand Pipe (for D600 P.S)	lit.=6.0m ø 410 m/m	-	5	10,000	84	1.03	0.06	1.09	90	143.33	156
Floater (for ø 410 m/m)	lit.=4.5m ø 90 cm	-	5	10,000	424	5.20	0.31	5.51	90	143.33	790
Gum Joint (for ø 410 m/m)	lit.=0.4m ø 90 cm	-	5	10,000	161	1.97	0.12	2.09	90	143.33	300
Dredger Tender	3T D10 P.S	10	10	20,000	4,190	51.37	3.08	54.45	90	86.33	4,701
Landing Stage	(Ship) 100T	-	10	20,000	8,600	105.43	6.33	111.76	90	86.33	9,648
Dump Truck 2T	D 96 P.S	96	5	10,000	1,750	21.45	-	21.45	90	143.33	3,074
Crawler Crane	16 T	96	5	10,000	21,400	262.35	15.74	278.09	65	143.33	39,857
Compressor	5 m3/min	50	5	10,000	2,340	28.69	1.72	30.41	90	143.33	4,359

(Continued)

Exchange Rate: U.S\$ 1.00 = Rp.1655 = ¥135 (in Nov.1987)

Equipment		Engine Power (P.S)	Useful Year		Basic Price		[2] Hauling Expenses (domestic) (X Rp.10^6)	[3] Initial Cost [1]+[2] (X Rp.10^6)	[4] The Middle of Life Line Factor	[5] Rental Cost [3]X[4] (Rp.)
			Year	Hour	Japanese (X ¥1,000)	Indonesia (X Rp.10^6)				
Name	Description									
Tug Boat	W 10 T	40	10	20,000	10,600	129.95	7.80	137.75	86.33	11,892
Bulldozer	11 ton	108	5	10,000	11,800	144.66	8.68	153.34	143.33	21,978
Bulldozer	15 ton	150	5	10,000	14,600	178.99	10.74	189.73	143.33	27,194
Bulldozer	21 ton	211	5	10,000	23,000	281.46	16.92	298.88	143.33	42,408
0.6 m3 Back hoe	18.8 ton	119	5	10,000	15,300	187.57	11.25	198.82	143.33	28,497
8 ton Dum Truck	7 ton	240	5	10,000	5,600	68.65	-	68.65	143.33	9,839
1.8 m3 Tractor Shovel	17.9 ton	159	5	10,000	15,600	191.24	11.47	202.71	143.33	29,054

Table J.9 RENTAL COST FACTOR PER HOUR (DECLINING BALANCE METHOD) (1)

Item	Maintenance Rate	Useful Year Factor														
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
15 Year (15 X 2000 Hour)	90%	123.05	112.22	101.91	92.14	82.99	74.18	65.95	58.28	51.13	44.50	38.39	32.81	27.76	23.24	19.23
	60%	122.75	111.67	101.09	91.05	81.52	72.51	64.84	56.09	45.66	41.76	35.29	29.53	24.20	19.40	15.13
10 Year (10 X 2000 Hour)	90%	151.03	133.16	126.90	100.39	86.33	73.01	60.84	49.41	35.94	39.73					
	60%	150.47	131.96	174.51	95.41	83.31	69.43	56.66	45.05	34.58	25.24					
10 Year (10 X 1500 Hour)	90%	214.14	188.99	165.38	143.31	122.76	103.73	36.22	70.26	55.81	42.33					
	60%	213.34	187.40	162.99	140.13	129.28	98.96	30.63	64.89	43.55	34.93					
10 Year (10 X 1000 Hour)	90%	302.11	266.31	232.81	201.69	172.67	146.06	121.21	99.66	59.91	62.11					
	60%	300.89	263.93	229.23	189.47	166.71	138.89	113.35	90.11	69.16	50.49					
8 Year (8 X 2000 Hour)	90%	171.29	147.44	125.35	105.-	86.45	59.56	53.47	41.13							
	60%	170.37	145.61	122.61	101.56	81.55	64.09	45.09	33.84							
6 Year (6 X 2000 Hour)	90%	203.63	168.75	136.87	107.99	82.13	59.25									
	60%	202.06	163.63	132.18	101.75	74.32	49.38									
5 Year (5 X 2000 Hour)	90%	228.38	183.75	143.33	107.10	75.03										
	60%	226.19	179.37	336.76	98.35	64.13										
4 Year (4 X 2000 Hour)	90%	263.81	203.18	148.84	100.50											
	60%	260.54	196.61	139.-	87.68											
4 Year (4 X 1000 Hour)	90%	527.63	406.39	293.68	201.60											
	60%	521.06	393.23	288.99	175.35											
3 Year (3 X 2000 Hour)	90%	318.94	228.38	148.31												
	60%	313.47	217.43	131.90												
2 Year (2 X 2000 Hour)	90%	417.38	257.25													
	60%	406.43	235.38													
2 Year (2 X 100 Hour)	90%	729.75	514.50													
	60%	707.85	470.75													

Table J.10 RENTAL COST FACTOR PER HOUR (DECLINING BALANCE METHOD) (2)

No. Unit	Item	Usefull Life		Maintenance & Repair Rate (%)
		year	hour	
1	Bulldozer	5	10,000	90
2	Grader	5	10,000	90
3	Loader	5	10,000	90
4	Excavator	5	10,000	90
5	Towed Scraper	6	12,000	65
6	Self propelled scraper	5	10,000	90
7	Crawler tractor	5	10,000	90
8	Wheel tractor	5	10,000	90
9	Crane	5	10,000	65
10	Piye Hammer (lenglap dengan mesin)	4	4,000	90
11	Non Vibrating Rollers			
	- Self Propelled	5	10,000	65
	- Towed (excl. tractor)	6	12,000	65
12	Vibrating Rollers:			
	- Self propelled s/d 2 ton	3	6,000	90
	- Self propelled di atas 2 ton	4	8,000	90
	- Towed (exl. tractor)	4	8,000	90
13	Tamper:			
	- mechanical/pneumatic	4	4,000	65
	- vibrating plate tamper	4	4,000	65
14	Dump truck s/d 8 ton	5	10,000	90
15	Dump truck di atas 8 s/d 20 ton	8	16,000	90
16	Cargo truck	5	10,000	90
17	Tank truck	5	10,000	90
18	Trailer with tractor	10	10,000	90
19	Asphalt distributor	5	10,000	90
20	Asphalt Sprayer	5	10,000	65
21	Asphalt finisher	6	12,000	90
22	Asphalt Mixing Plant	10	15,000	90
23	Batching Mixing Plant	15	30,000	90
24	Chip spreader	4	4,000	65
25	Soil stabilizer	4	4,000	65
26	Soil Mixing Plant	5	10,000	65
27	Stone crusher	5	10,000	90
28	Harrow	4	4,000	65
29	Plow	4	4,000	65
30	Chain saw	2	2,000	65
31	Compressor	5	10,000	90
32	Concrete Mixer s/d 250 liter	2	4,000	65
33	Water Pump s/d 4"	2	4,000	65
34	Water Pump di atas 4"	3	6,000	65
35	Generator Set 30 KVA keatas	5	10,000	65
36	CDR	15	30,000	90
37	Floating Her	10	20,000	90
38	Tug Boat	10	20,000	90
39	Fuel Barge	15	30,000	65
40	House Boat	10	20,000	65
41	Dredge Tender	10	20,000	65
42	Fuel Boat	10	20,000	90
43	Landing Ship	10	20,000	90
44	Survey Ship	15	30,000	90
45	Floating Pump	10	20,000	65
46	Inspection Boat	4	8,000	65

Tsble J.11 ESTIMATED UNIT CONSTRUCTION COST (CITARUM RIVER)

Works	Unit	Unit Cost		
		Local C. (Rp.)	Forein C. (US\$)	Eq. Total (Rp.)
Dredging				
I. Common Soil				
Common Soil (i)	10^3 m3	422	1.87	3,516.9
Common Soil (ii)	10^3 m3	768	1.73	3,631.2
II. Stiff Soil				
Stiff Soil (i)	10^3 m3	754	3.68	6,844.4
Stiff Soil (ii)	10^3 m3	829	1.87	3,923.9
III. Soft Rock				
(1) Existing River	10^3 m3	1,480	9.21	16,722.6
(2) Cut-off Channel	10^3 m3	1,464	3.84	4,819.2
Bank Clearing/Gruffing	m2	135	0.17	416.4
Gabion	m	340,680	263.90	777,434.5
New Bridge Construction	m2	303,415	550.00	1,213,665.0
Bridge Improvement Strengthening (Gabion)	Place	1,468,376	5,593.25	10,725,204.8
Maintenance/Connection Rd.	m	7,752	6.72	18,873.6

Table J.12 ESTIMATED UNIT CONSTRUCTION COST (CISANGKUY RIVER)

Works	Unit	Unit Cost		
		Local C. (Rp.)	Forein C. (US\$)	Eq. Total (Rp.)
Dredging	10^3 m3	422	1.87	3,516.9
New Bridge Construction	m2	225,552	377.51	850,331.1

able J.13 BREAKDOWN OF CONSTRUCTION COST OF URGENT PROJECT

		(1987 Price)		
Item	L/C 10 ⁶ Rp	F/C 10 ³ US\$	Equiv. Total 10 ⁶ Rp	
I	Civil Work			
A	Existing River			
	(a) Preparatory Work	428.0	1,449.3	2,826.5
	(b) Dredging			
	(1) Common Soil (i)	1,124.6	4,983.5	9,372.4
	(2) Stiff Soil (i)	508.2	2,480.3	4,613.1
	(3) Soft Rock	1,383.8	8,611.4	15,635.7
	(c) Bank Clearing/Grubbing	16.0	20.2	49.4
	(d) Bank Protection	2,078.2	1,609.8	4,742.4
	(e) Bridge Improvement			
	Strengthening (Gabion)	5.9	22.4	43.0
	New Construction	231.0	386.6	870.8
	(f) Maintenance/Connection Rd.	1.9	1.7	4.7
	(f) Miscellaneous	308.1	1,029.0	2,011.2
	Sub-total	6,085.7	20,594.2	40,169.2
B	Cut-off Channel			
	(a) Preparatory Work	214.6	534.0	1,098.4
	(b) Dredging			
	(1) Common Soil			
	Common Soil (i)	308.5	1,367.0	2,570.9
	Common Soil (ii)	290.3	653.9	1,372.5
	(2) Stiff Soil			
	Stiff Soil (i)	24.1	117.8	219.1
	Stiff Soil (ii)	924.3	2,085.1	4,375.1
	(3) Soft Rock	506.5	1,328.6	2,705.3
	(c) New Bridge Construction	611.7	1,108.8	2,446.8
	(d) Maintenance/Connection Rd.	16.6	14.5	40.6
	(e) Miscellaneous	146.6	368.3	756.1
	Sub-total	3,043.2	7,578.0	15,584.8
C	Total	9,128.9	28,172.2	55,754.0
II	Flood Warning System	252.4	612.0	1,265.2
III	Land Acquisition/Compensation			
A	Land Acquisition			
	(a) Existing River	3,750.0	-	3,750.0
	(b) Cut-off Channel	1,810.0	-	1,810.0
B	House Resettlement			
	(a) Existing River	685.0	-	685.0
	(b) Cut-off Channel	400.0	-	400.0
C	Total	6,645.0	-	6,645.0
IV	Total 1	16,026.3	28,784.2	63,664.2
V	Administration	3,183.2	-	3,183.2
VI	Engineering Services	1,142.5	3,667.3	7,211.9
VII	Physical Contingency	2,035.2	3,245.2	7,405.9
VIII	Total 2	22,387.2	35,696.7	81,465.2
IX	Price Escalation	10,324.1	6,014.0	20,277.1
X	Grand Total	32,711.3	41,710.7	101,742.3

Note: Common soil (i) and Stiff soil (i): dredged by pump dredger
 Common soil (ii) and Stiff soil (ii): dredged by backhoe and bulldozer

Table J.14 BREAKDOWN OF CIVIL WORK COST FOR CITARUM RIVER OF URGENT PROJECT

Item	Quantity		Local Currency (Rp.)		Foreign Currency (US\$)		Equivalent Total (Rp. 10^6)
	Unit	Amount	Unit Cost	Amount (10^6)	Unit Cost	Amount (10^3)	
A Existing River							
(a) Preparatory Work							
(b) Dredging							
(1) Common Soil (i)	10^3 m3	2,369	422	399.5	1.87	1,374.1	2,673.6
(2) Stiff (i)	10^3 m3	674	754	999.7	1.87	4,430.0	8,331.4
(3) Soft Rock	10^3 m3	935	1,480	508.2	3.68	2,480.3	4,613.1
(c) Bank Clearing/Grubbing	m2	118,800	135	16.0	0.17	20.2	49.4
(d) Bank Protection	m	6,100	340,680	2,078.2	263.90	1,609.8	4,742.4
(e) Bridge Improvement							
Strengthening (Gabion)	place	4	1,468,378	5.9	5,593.25	22.4	43.0
(f) Maintenance/Connection Rd.	m	250	7,752	1.9	6.72	1.7	4.7
(g) Miscellaneous	L.s.			269.7		927.5	1,804.7
Sub-total				5,662.9		19,477.4	37,898.0
B Cut-off Channel							
(a) Preparatory Work							
(b) Dredging							
(1) Common Soil	10^3 m3	1,032		212.0		522.5	1,076.7
Common Soil (i)	10^3 m3	654	422	276.0	1.87	1,223.0	2,300.1
Common Soil (ii)	10^3 m3	378	768	290.3	1.73	653.9	1,372.5
(2) Stiff Soil	10^3 m3	1,147	754	24.1	3.68	117.8	219.1
Stiff Soil (i)	10^3 m3	32	829	924.3	1.87	2,085.1	4,375.1
Stiff Soil (ii)	10^3 m3	1,115	1,464	506.5	3.84	1,328.6	2,705.3
(3) Soft Rock	10^3 m3	346	1,464	611.7	550.00	1,108.8	2,446.8
(c) New Bridge Construction	m2 (place)	2,016	303,415	16.6	6.72	14.5	40.6
(d) Maintenance/Connection Rd.	m	2,150	7,752	143.1		352.7	726.8
(e) Miscellaneous	L.s.						
Sub-total				3,004.6		7,406.9	15,263.0
C Total				8,667.5		26,884.3	53,161.0

Note: Common soil (i) and Stiff soil (i): dredged by pump dredger
Common soil (ii) and Stiff soil (ii): dredged by backhoe and bulldozer

Table J.15 BREAKDOWN OF CIVIL WORK COST OF URGENT PLAN
(CITARM RIVER 0.0 km - 9.0 km)

Item	Quantity		Local Currency (Rp.)		Foreign Currency (US\$)		Equivalent Total (Rp. 10 ⁶)
	Unit	Amount	Unit Cost	Amount (10 ⁶)	Unit Cost	Amount (10 ³)	
A Existing River							
(a) Preparatory Work							
(b) Dredging							
(1) Common Soil	10 ³ m ³	342	422	144.3	1.87	346.6	675.8
(2) Stiff Soil	10 ³ m ³	210	754	158.3	3.68	639.5	1,202.7
(3) Soft Rock	10 ³ m ³	267	1,480	395.2	9.21	772.8	1,437.3
(c) Bank Clearing/Grubbing	m ²	118,800	135	16.0	0.17	2,459.1	4,465.0
(d) Bank Protection	m	1,650	340,680	562.1	263.90	20.2	49.4
(e) Bridge Improvement							1,282.7
(f) Strengthening (Gabion)	place	1	1,468,378	1.5	5,593.25	5.6	10.8
(f) Miscellaneous	I.s.			690.0		234.0	456.2
Sub-total				1,448.6		4,913.2	9,579.9
B Cut-off Channel							
(a) Preparatory Work							
(b) Dredging							
(1) Common Soil	10 ³ m ³	281	768	215.8	1.73	486.1	1,020.3
(2) Stiff Soil	10 ³ m ³	881	829	730.3	1.87	1,647.5	3,456.9
(3) Soft Rock	10 ³ m ³	225	1,464	329.4	3.84	864.0	1,759.3
(c) New Bridge Construction	m ² (place)	1,440 (1)	303,415	436.9	550.00	792.0	1,747.7
(d) Maintenance/Connection Rd.	m	1,050	7,752	8.1	6.72	7.1	19.9
(e) Miscellaneous	I.s.			92.9		205.0	432.2
Sub-total				1,951.0		4,305.4	9,076.6
C Total				3,399.6		9,218.6	18,656.5

Table J.16 BREAKDOWN OF CIVIL WORK COST OF URGENT PLAN
(CITARM RIVER 9.0 km - 20.0 km)

Item	Quantity		Local Currency (Rp.)		Foreign Currency (US\$)		Equivalent Total (Rp. 10^6)
	Unit	Amount	Unit Cost	Amount (10^6)	Unit Cost	Amount (10^3)	
A Existing River				194.2		767.6	1,464.5
(a) Preparatory Work							
(b) Dredging		758	422	319.9	1.87	1,417.5	2,665.9
(1) Common Soil	10^3 m3	374	754	282.0	3.68	1,376.3	2,559.8
(2) Stiff Soil	10^3 m3	668	1,480	988.6	9.21	6,152.3	11,170.7
(3) Soft Rock	10^3 m3	2,450	340,680	834.7	263.90	646.6	1,904.8
(c) Bank Protection	m	250	7,752	1.9	6.72	1.7	4.7
(d) Maintenance/Connection Rd.	m			131.1		518.1	988.5
(e) Miscellaneous	L.s.						
Sub-total				2,752.4		10,880.1	20,758.9
B Cut-off Channel							
(a) Preparatory Work							
(b) Dredging				50.3		111.5	234.9
(1) Common Soil	10^3 m3	97	768	74.5	1.73	167.8	352.2
(2) Stiff Soil	10^3 m3	234	829	194.0	1.87	437.6	918.2
(3) Soft Rock	10^3 m3	121	1,464	177.1	3.84	464.6	946.0
(c) New Bridge Construction	m2 (place)	576	303,415	174.8	550.00	316.8	699.1
(d) Maintenance/Connection Rd.	m	1,100	7,752	8.5	6.72	7.4	20.7
(e) Miscellaneous	L.s.			34.0		75.3	158.6
Sub-total				713.2		1,581.0	3,329.7
C Total				3,465.6		12,461.1	24,088.6

Table J.17 BREAKDOWN OF CIVIL WORK COST OF URGENT PLAN
(CITARM RIVER 20.0 km - 31.2 km)

Item	Quantity		Local Currency (Rp.)		Foreign Currency (US\$)		Equivalent Total (Rp. 10 ⁶)
	Unit	Amount	Unit Cost	Amount (10 ⁶)	Unit Cost	Amount (10 ³)	
A Existing River							
(a) Preparatory Work							
(b) Dredging							
(1) Common Soil	10 ³ m3	1,269	422	535.5	1.87	2,373.0	4,462.8
(2) Stiff Soil	10 ³ m3	90	754	67.9	3.68	331.2	616.0
(c) Bank Protection	m	2,000	340,680	681.4	263.90	527.8	1,554.9
(d) Bridge Improvement							
(e) Strengthening (Gabion)	place	3	1,468,378	4.4	5,593.25	16.8	32.2
(e) Miscellaneous	L.s.			69.6		175.4	360.0
Sub-total				1,461.9		3,684.1	7,559.2
B Cut-off Channel							
(a) Preparatory Work							
(b) Dredging							
(1) Common Soil	10 ³ m3	654	422	276.0	1.87	1,223.0	2,300.1
(2) Stiff Soil	10 ³ m3	32	754	24.1	3.68	117.8	219.1
(c) Miscellaneous	L.s.			16.2		72.4	136.0
Sub-total				340.4		1,520.5	2,856.7
C Total				1,802.3		5,204.6	10,415.9

Table J.18 BREAKDOWN OF CIVIL WORK COST FOR CISANGKUY RIVER OF URGENT PROJECT

Item	Quantity		Local Currency (Rp.)		Foreign Currency (US\$)		(1987 Price) Equivalent Total (Rp. 10 ⁶)
	Unit	Amount	Amount (10 ⁶)		Amount (10 ³)		
			Unit Cost	Amount	Unit Cost	Amount	
A Existing River							
(a) Preparatory Work				28.5		75.2	152.9
(b) Dredging	10 ³ m3	373	422	124.9	1.87	553.5	1,041.0
(c) New Bridge Construction	m2 (place)	1,024 (4)	225,552	231.0	377.51	386.6	870.8
(d) Miscellaneous	I.s.			38.4		101.5	206.5
Sub-total				422.8		1,116.8	2,271.2
B Cut-off Channel							
(a) Preparatory Work				2.6		11.5	21.7
(b) Dredging	10 ³ m3	77	422	32.5	1.87	144.0	270.8
(c) Miscellaneous				3.5		15.6	29.3
Sub-total				38.6		171.1	321.8
C Total				461.4		1,287.9	2,593.0

Table J.19 BREAKDOWN OF COST FOR FLOOD FORECASTING AND WARNING SYSTEM OF URGENT PROJECT

No.	Description	Q'ty	Local Currency (Rp.) * 10 ⁶		Foreign Currency (US\$) * 10 ³		(1987 Price) Equivalent Total (Million Rp.)
			Unit Price	Price	Unit Price	Price	
1	Hydrological Radio Telemetering System						
	Equipment for Master Station	1		62.9		150.0	311.2
	Water-level Gauging Station	6	24.8	149.0	35.00	210.0	496.6
	10KVA Uninterruptible Power Supply Equipment	1		9.9		120.0	208.5
	Sub-total			221.8		480.0	1,016.2
2	Radio Telecommunication System						
	Equipment for Master Station	2	0.8	1.7	12.00	24.0	41.4
	Equipment for Monitoring Station	1		0.8		14.0	24.0
	Sub-total			2.5		38.0	65.4
3	Training And Test	L.S		3.3		34.0	59.5
4	Spare Parts			24.8		60.0	124.1
5	Total	L.S		252.4		612.0	1,265.2

Table J.20 BREAKDOWN OF LAND ACQUISITION/COMPENSATION OF URGENT PLAN

Item	Quantity		Local Currency (Rp.)		Foreign Currency (US\$)		(1987 Price) Equivalent Total (Rp. 10 ⁶)
	Unit	Amount	Unit Cost	Amount (10 ⁶)	Unit Cost	Amount (10 ³)	
I. Citarum River							
A Land Acquisition							
(a) Existing River							
(1) 0.0 km - 9.0 km	10 ³ m2	679	5,000	3,395.0			3,395.0
(2) 9.0 km - 20.0 km	10 ³ m2	152	5,000	760.0			760.0
(3) 20.0 km - 31.2 km	10 ³ m2	293	5,000	1,465.0			1,465.0
(b) Cut-off Channel							
(1) 0.0 km - 9.0 km	10 ³ m2	333	5,000	1,665.0			1,665.0
(2) 9.0 km - 20.0 km	10 ³ m2	145	5,000	725.0			725.0
(3) 20.0 km - 31.2 km	10 ³ m2	78	5,000	390.0			390.0
(c) Sub-total	10 ³ m2	1,012	5,000	550.0			550.0
B House Resettlement Compensation							
(a) Existing River							
(1) 0.0 km - 9.0 km	house	114	5,000,000	570.0			570.0
(2) 9.0 km - 20.0 km	house	-	5,000,000	-			-
(3) 20.0 km - 31.2 km	house	81	5,000,000	405.0			405.0
(b) Cut-off Channel							
(1) 0.0 km - 9.0 km	house	33	5,000,000	165.0			165.0
(2) 9.0 km - 20.0 km	house	80	5,000,000	400.0			400.0
(3) 20.0 km - 31.2 km	house	-	5,000,000	-			-
(c) Sub-total	house	194	5,000,000	970.0			970.0
C Total							
				6,030.0			6,030.0

(Continued)

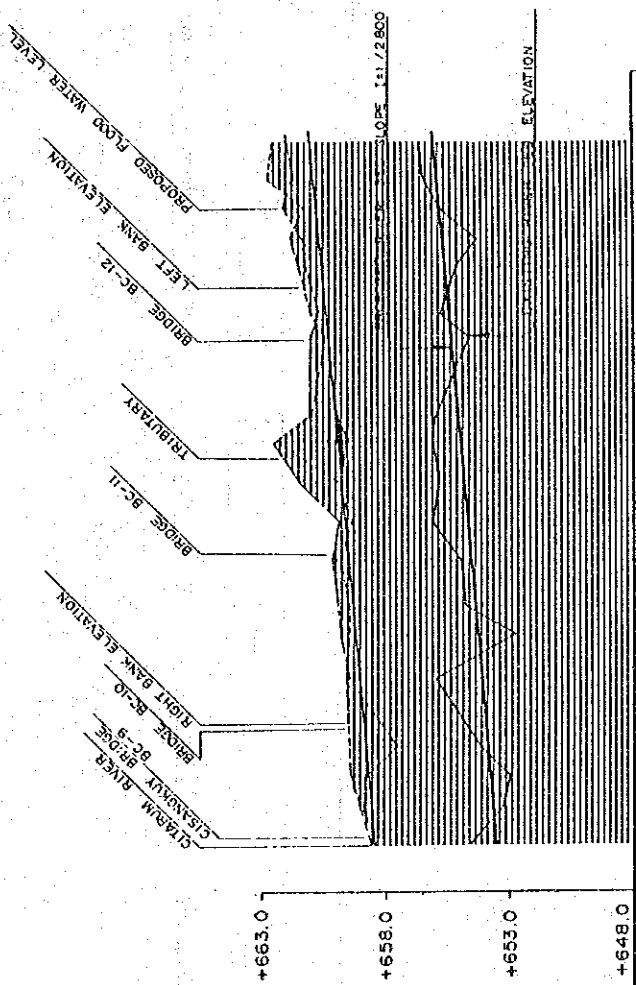
Item	Quantity		Local Currency (Rp.)		Foreign Currency (US\$)		Equivalent Total (Rp. 10^6)
	Unit	Amount	Unit Cost	Amount (10^6)	Unit Cost	Amount (10^3)	
II. Cisingkuy River							
A. Land Acquisition							
(a) Existing River	10^3 m2	94	5,000	470.0		470.0	
(b) Cut-off Channel	10^3 m2	71	5,000	355.0		355.0	
	10^3 m2	23	5,000	115.0		115.0	
B. House Resettlement Compensation							
(a) Existing River	house	29	5,000,000	145.0		145.0	
(b) Cut-off Channel	house	29	5,000,000	145.0		145.0	
	house	-	5,000,000	-		-	
C. Total				615.0		615.0	
III Grand Total				6,645.0		6,645.0	

Table J.21 ANNUAL DISBURSEMENT SCHEDULE

								(1987 price)					
Item	Currency	90/91	91/92	92/93	93/94	94/95	Total Cost						
							L/C (x10 ⁶ Rp)	F/C (x10 ³ US\$)	Equivalent Total (x10 ⁶ Rp)				
Civil Work	Citarum River	0-9km	Existing River	L/C		869.2	579.4						
			F/C			2,947.9	1,965.3			1,448.6	4,913.2	9,579.9	
			E/T			5,747.9	3,832.0						
		Cut-off Channel	L/C		487.8	975.5	487.7						
		F/C			1,076.4	2,152.7	1,076.3			1,951.0	4,305.4	9,076.6	
		E/T			2,269.2	4,538.3	2,269.1						
	9-20km	Existing River	L/C			1,467.9	1,284.5						
		F/C				5,802.7	5,077.4			2,752.4	10,880.1	20,758.9	
		E/T				11,071.4	9,687.5						
	Cut-off Channel	L/C			380.4	332.8							
	F/C				843.2	737.8			713.2	1,581.0	3,329.7		
	E/T				1,775.8	1,553.9							
	20-31.2km	Existing River	L/C				664.5	797.4					
		F/C					1,674.6	2,009.5	1,461.9	3,684.1	7,559.2		
		E/T					3,436.0	4,123.2					
	Cut-off Channel	L/C				154.7	185.7						
	F/C					691.2	829.3	340.4	1,520.5	2,856.7			
	E/T					1,298.5	1,558.2						
	Sub-total	L/T		1,357.0	3,403.2	2,924.2	983.1						
	F/C			4,024.3	10,763.9	9,257.3	2,838.8			8,667.5	26,884.3	53,161.0	
	E/T			8,017.1	21,217.5	18,245.0	5,681.4						
	Cisangkuy River	L/C		292.5	168.9								
		F/C		785.9	502.0					461.4	1,287.9	2,593.0	
		E/T		1,593.3	999.7								
Sub-Total	L/C		1,649.5	3,572.1	2,924.2	983.1							
F/C			4,810.2	11,265.9	9,257.3	2,838.8			9,128.9	28,172.2	55,754.0		
E/T			9,610.4	22,217.2	18,245.0	5,681.4							
Warning System	L/C					252.4							
	F/C					612.0			252.4	612.0	1,265.2		
	E/T					1,265.2							
Sub-Total	L/C		1,649.5	3,572.1	2,924.2	1,235.5							
F/C			4,810.2	11,265.9	9,257.3	3,450.8			9,381.3	28,784.2	57,019.2		
E/T			9,610.4	22,217.2	18,245.0	6,946.6							
Land Acquisition & House Compensation	L/C	1,107.0	2,215.0	2,215.0	1,108.0	-							
	F/C	-	-	-	-	-			6,645.0	-	6,645.0		
	E/T	1,107.0	2,215.0	2,215.0	1,108.0	-							
Administration	L/C	707.4	707.4	707.4	707.4	353.6							
	F/C	-	-	-	-	-			3,183.2	-	3,183.2		
	E/T	707.4	707.4	707.4	707.4	353.6							
Engineering Services	Detailed Design	L/C	688.3	75.4									
		F/C	1,131.9	125.9						763.7	1,257.8	2,845.3	
		E/T	2,561.0	284.3									
	Construction Supervision	L/C		63.1	126.3	126.3	63.1						
		F/C		402.0	803.0	803.0	401.5			378.8	2,409.5	4,366.6	
		E/T		727.9	1,455.5	1,455.4	727.8						
Sub-Total	L/C	688.3	138.5	126.3	126.3	63.1							
F/C	1,131.9	527.9	803.0	803.0	401.5			1,142.5	3,667.3	7,211.9			
E/T	2,561.0	1,012.2	1,455.5	1,455.4	727.8								
Physical Contingency	L/C	250.3	471.0	662.1	486.6	165.2							
	F/C	113.2	533.8	1,206.9	1,006.0	385.3			2,035.2	3,245.2	7,405.9		
	E/T	437.5	1,354.5	2,659.5	2,151.6	802.8							
Total (1)	L/C	2,753.0	5,181.4	7,282.9	5,352.5	1,817.4							
	F/C	1,245.1	5,871.9	13,275.8	11,066.3	4,237.6			22,387.2	35,696.7	81,465.2		
	E/T	4,812.9	14,899.5	29,254.6	23,667.4	8,830.8							
Price Contingency	L/C	715.0	1,867.9	3,417.9	3,141.4	1,181.9							
	F/C	115.6	737.0	2,114.8	2,148.1	898.5			10,324.1	6,014.0	20,277.1		
	E/T	906.2	3,087.7	6,917.8	6,696.5	2,668.9							
Total (2)	L/C	3,468.0	7,049.3	10,700.8	8,493.9	2,999.3							
	F/C	1,360.7	6,608.9	15,390.6	13,214.4	5,136.1			32,711.3	41,710.7	101,742.3		
	E/T	5,719.1	17,987.2	36,172.4	30,363.9	11,499.7							

Note : 1. Unit of L/C and equivalent total is x10⁶ Rp
 2. Unit of F/C is x10³ US\$

L/C : Local Currency
 F/C : Foreign Currency
 E/T : Equivalent Total



SYMBOL	CLASSIFICATION OF STRATUM	NOTE
	COMMON SOIL	N<10
	STIFF SOIL	10<N<50
	SOFT ROCK	N>50
	HARD ROCK	INTRUSIVE ROCK

SECTION NAME	SECTION DISTANCE (KM)	COMULATIVE DISTANCE (KM)	EXISTING		PROPOSED	
			RIVER BED ELEVATION (M)	LEFT BANK ELEVATION (M)	RIVER BED ELEVATION (M)	FLOOD WATER LEVEL (M)
0.00	0.00	0.00	628.47	628.47	628.50	628.47
17	0.25	0.25	628.63	628.99	630.63	628.91
36	0.70	0.70	628.68	628.87	631.76	628.87
32	0.50	1.00	628.53	628.45	631.66	628.61
50	0.25	1.25	629.11	629.69	631.55	629.52
59	0.45	1.70	629.66	629.82	631.84	629.82
65	0.50	2.20	629.59	629.56	632.36	629.58
73	0.46	2.80	629.26	629.84	632.54	629.84
82	0.40	3.30	629.81	629.38	632.54	629.38
88	0.45	3.75	629.56	629.84	632.94	629.84
95	0.40	4.15	629.27	629.96	632.96	629.96
100	0.25	4.40	629.01	629.84	632.96	629.84
108	0.30	4.70	629.18	629.18	632.96	629.18
132	0.10	4.80	629.32	629.32	632.96	629.32
140	0.20	5.00	629.43	629.43	632.96	629.43
150	0.30	5.25	629.51	629.51	632.96	629.51
170	0.20	5.45	629.63	629.63	632.96	629.63
178	0.30	5.75	629.73	629.73	632.96	629.73
188	0.30	6.05	629.84	629.84	632.96	629.84
198	0.30	6.35	629.94	629.94	632.96	629.94
208	0.30	6.65	629.94	629.94	632.96	629.94
218	0.30	6.95	629.94	629.94	632.96	629.94
228	0.30	7.25	629.94	629.94	632.96	629.94
240	0.10	7.45	629.94	629.94	632.96	629.94
250	0.10	7.55	629.94	629.94	632.96	629.94

FIG. J. 2 GEOLOGICAL PROFILE OF CISANGKUY RIVER
STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



Description	1989/1990	1990/1991	1991/1992	1992/1993	1993/1994	1994/1995	Remarks
1. Loan Process	■■■■■■■■■■						
2. Civil Work							
A. Citarum River			OCT	(36)		SEP	
(a) 0km - 9.0kms			OCT	(24)	SEP		
Existing River (Dredging)			OCT (10)	JUL			
Cut-off channel (Land work)			OCT	(24)	SEP		
(b) 9.0kms - 20.0kms				AUG (15)	OCT		
Existing River (Dredging)				AUG (15)	OCT		
Cut-off channel (Land work)				AUG (15)	OCT		
(c) 20.0kms - 31.2kms					NOV (11)	SEP	
Existing River (Dredging)					NOV (11)	SEP	
Cut-off channel (Dredging)					NOV (11)	SEP	
B. Cisangkuy River			OCT (10)	JUL			
3. Flood Warning System						APR (6)	SEP
4. Land Acquisition and House Compensation		OCT	(36)	SEP			
5. Administration	■■■■■■■■■■	OCT	(54)	SEP			
6. Engineering Services							
(a) Detailed Design		APR (18)	SEP				
(b) Assistance of Tendering and Supervision		■■■■■■■■■■	OCT	(36)	SEP		

FIG. J.3 CONSTRUCTION SCHEDULE OF URGENT PROJECT

STUDY ON THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN



SUPPORTING REPORT K

**PROJECT EVALUATION FOR
URGENT FLOOD CONTROL PLAN**

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**SUPPORTING REPORT K
PROJECT EVALUATION FOR
URGENT FLOOD CONTROL PLAN**

1. Economic Evaluation Methodology

An evaluation analysis is carried out to ascertain the economic viability of alternative development schemes proposed by this study and to make priority ranking for these schemes from the economic point of view. The economic viability is evaluated by factors of investment efficiency such as Net Present Value (NPV), Benefit-Cost ratio (B/C) and Economic Internal Rate of Return (EIRR).

To estimate economic cost and benefit, which are basic figures for calculation of evaluation factors, the economic price is assumed as follows:

- (1) Foreign exchange rate is set at US\$1.00 = Rp. 1,655, based on the medium exchange rate of the Bank Indonesia in November 1987.
- (2) Economic price of unskilled labor is estimated to be 60% of the actual market wage with reference to the studies of similar projects.
- (3) Transfer payments such as tax and duty are assumed as follows: the goods and services procured locally would include a transfer payment of 10% of their prices while those imported from abroad would not include any transfer payments.
- (4) The opportunity cost of capital is assumed to be 10% for the standard analysis case; and
- (5) The economic life of the project is considered as 50 years after completion of the project.

Economic cost for construction works is estimated by altering the aforesaid economic price to the financial cost estimated on the basis of

the proposed alternative physical design. Economic cost of annual operation and maintenance are estimated to be 0.5% of the civil works of the proposed scheme.

Economic benefit is accrued from two phases: (1) economic effects of reduction in damage caused by inundation and (2) derivative economic effect owing to this implementation of flood control project. The economic benefit is given by a following formula on the basis of tangible economic benefit, which is conceptually illustrated as shown below:

Item		Without Project	With Project
Damage caused by inundation		D_0	D_i
Derivative effect owing to the project implementation	Advantage	-	E_p
	Disadvantage	-	E_n

$$B = B_r + B_n = (D_0 - D_i) + (E_p - E_n)$$

where:

- B : Economic benefit owing to the project
- B_r : Reduction of flood damage
- B_n : Net benefit owing to the project implementation
- D_0 : Flood damage at the present condition
- D_i : Flood damage remaining even after the implementation of the proposed project
- E_p : Advantageous effects derived from the project implementation
- E_n : Disadvantageous effects derived from the project implementation, so called negative benefit