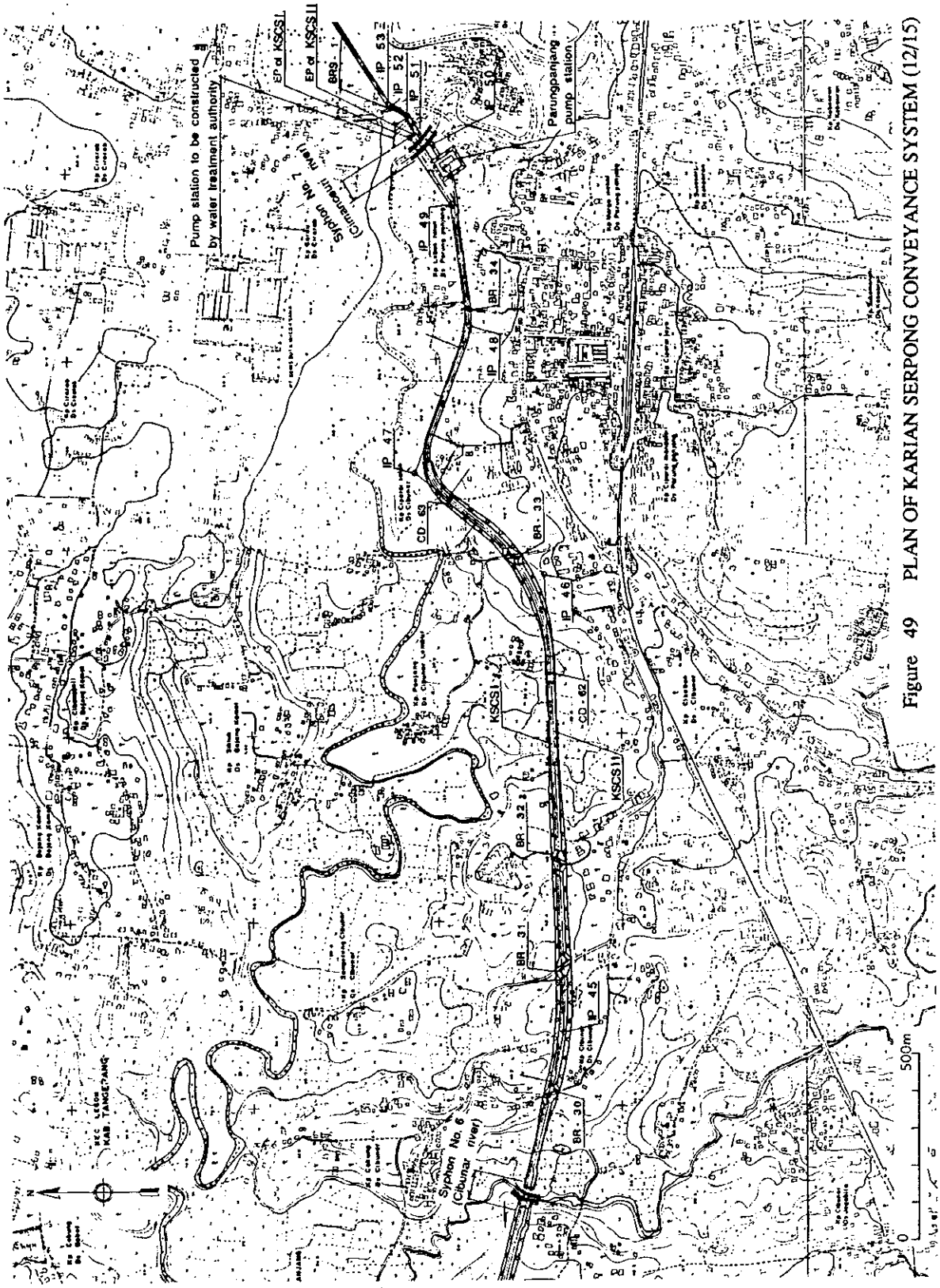


Figure 49 PLAN OF KARIAN SERPONG CONVEYANCE SYSTEM (12/15)

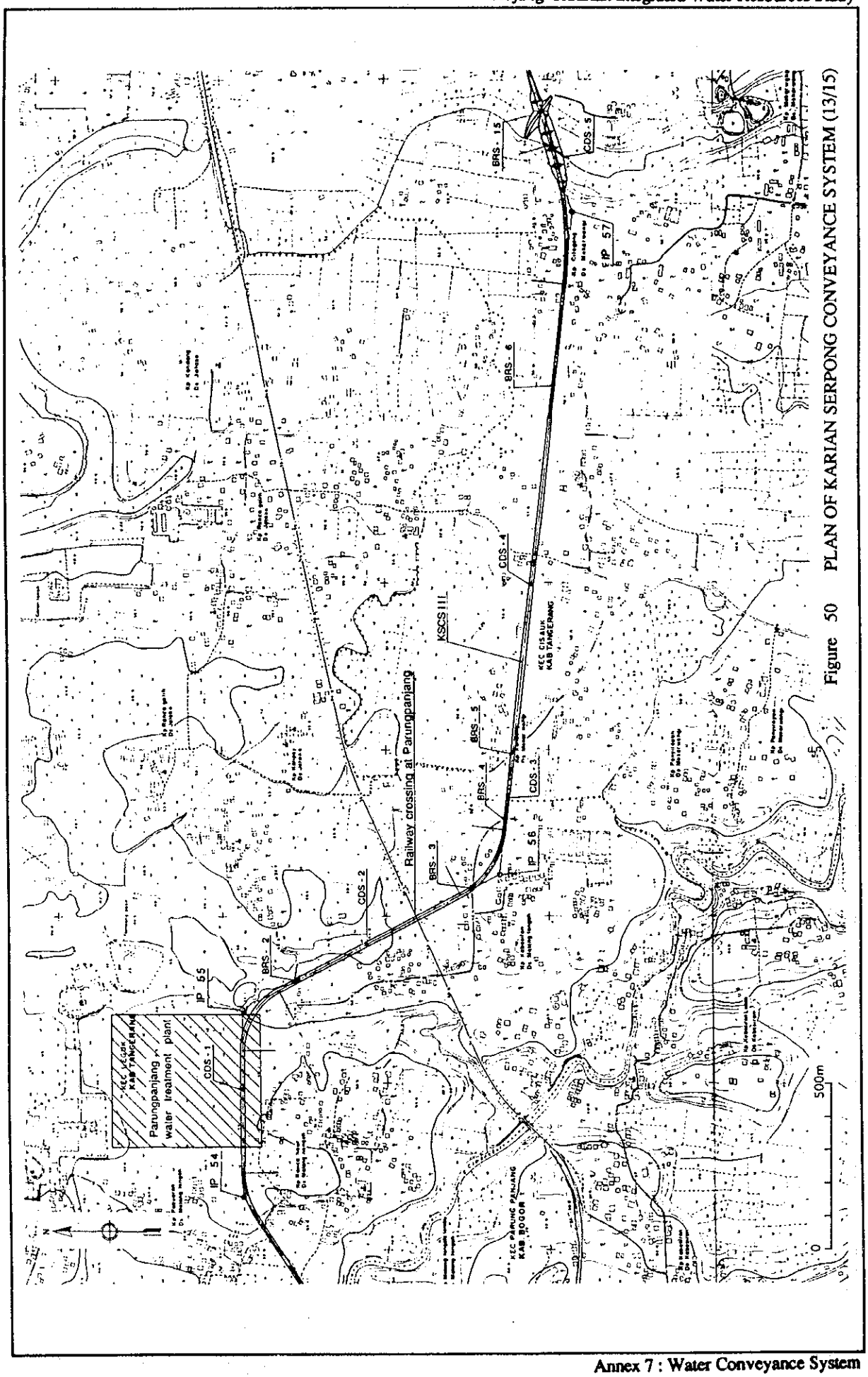


Figure 50 PLAN OF KARIAN SERPONG CONVEYANCE SYSTEM (13/15)

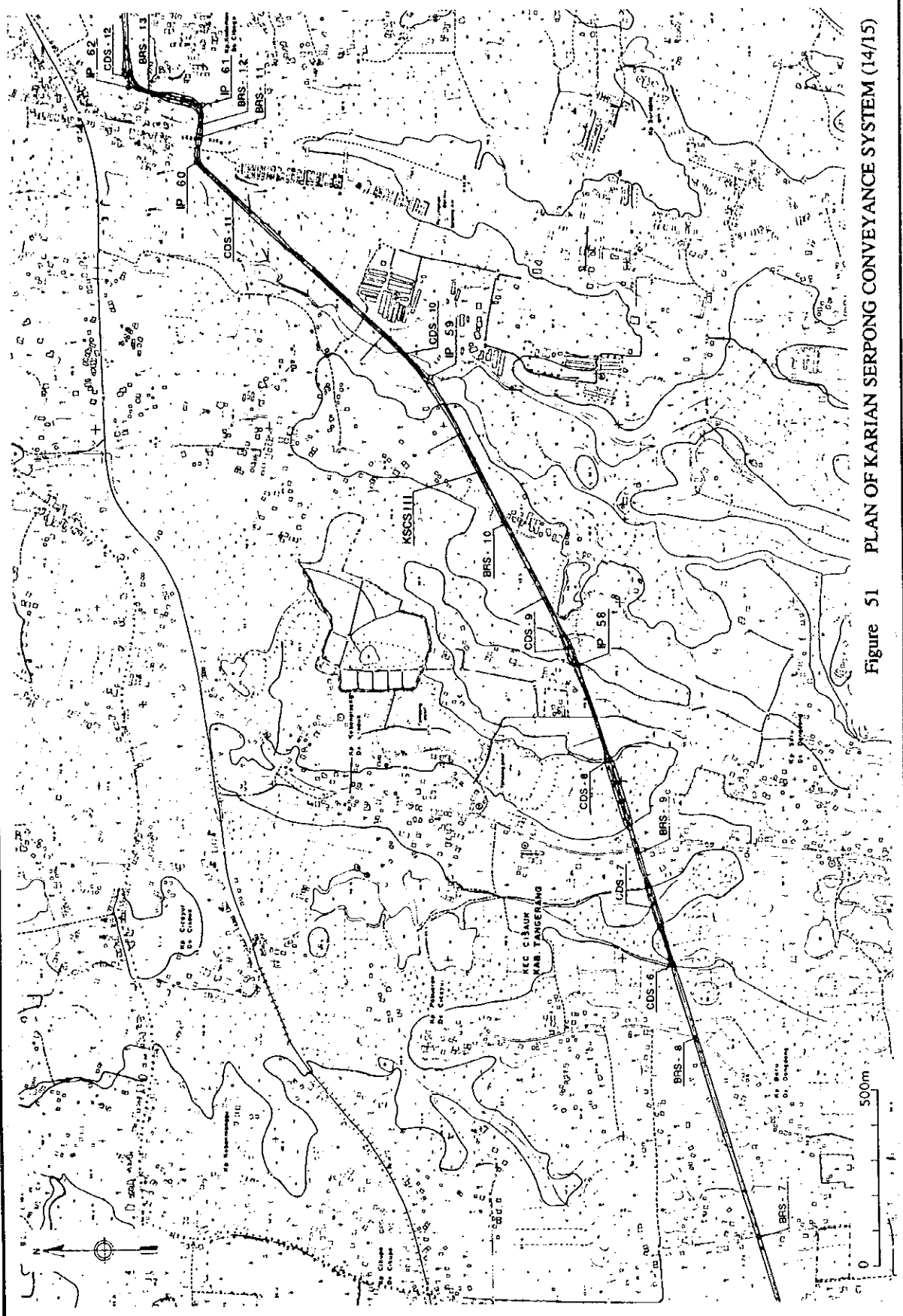


Figure 51 PLAN OF KARIAN SERPONG CONVEYANCE SYSTEM (14/15)

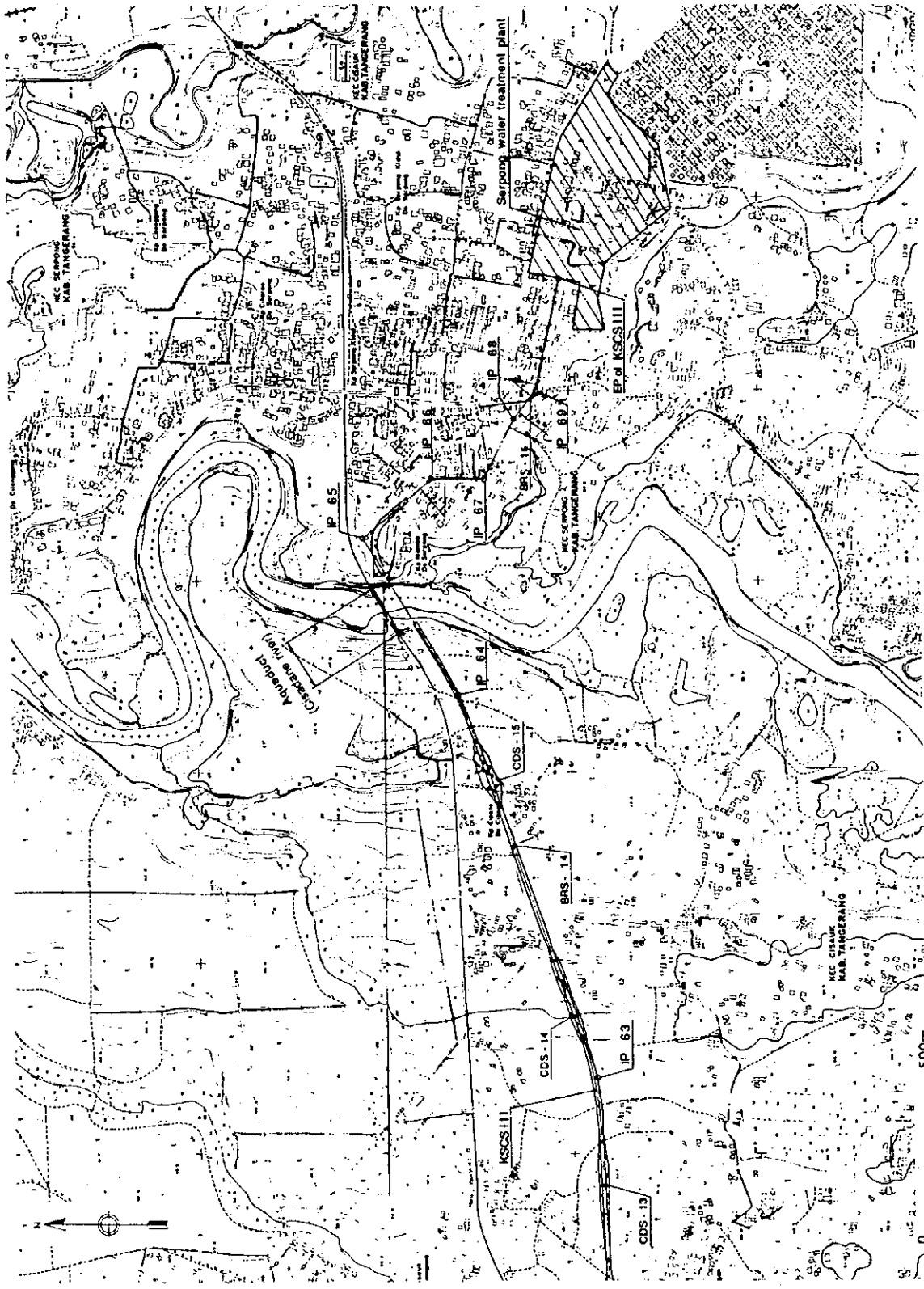


Figure 52 PLAN OF KARIAN SERPONG CONVEYANCE SYSTEM (15/15)

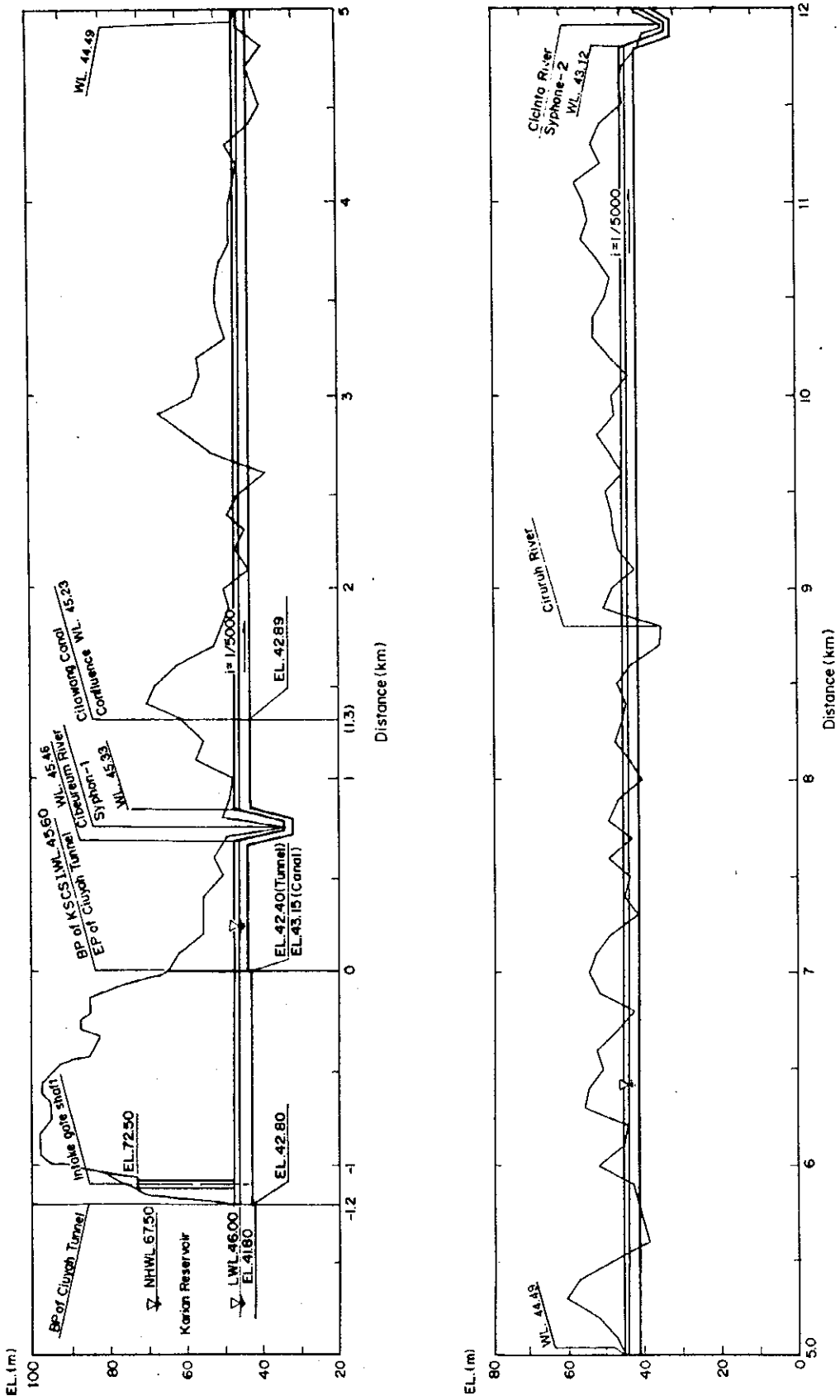


Figure 53 PROFILE OF KARIAN SERPONG CONVEYANCE SYSTEM KSCS I (1/3)

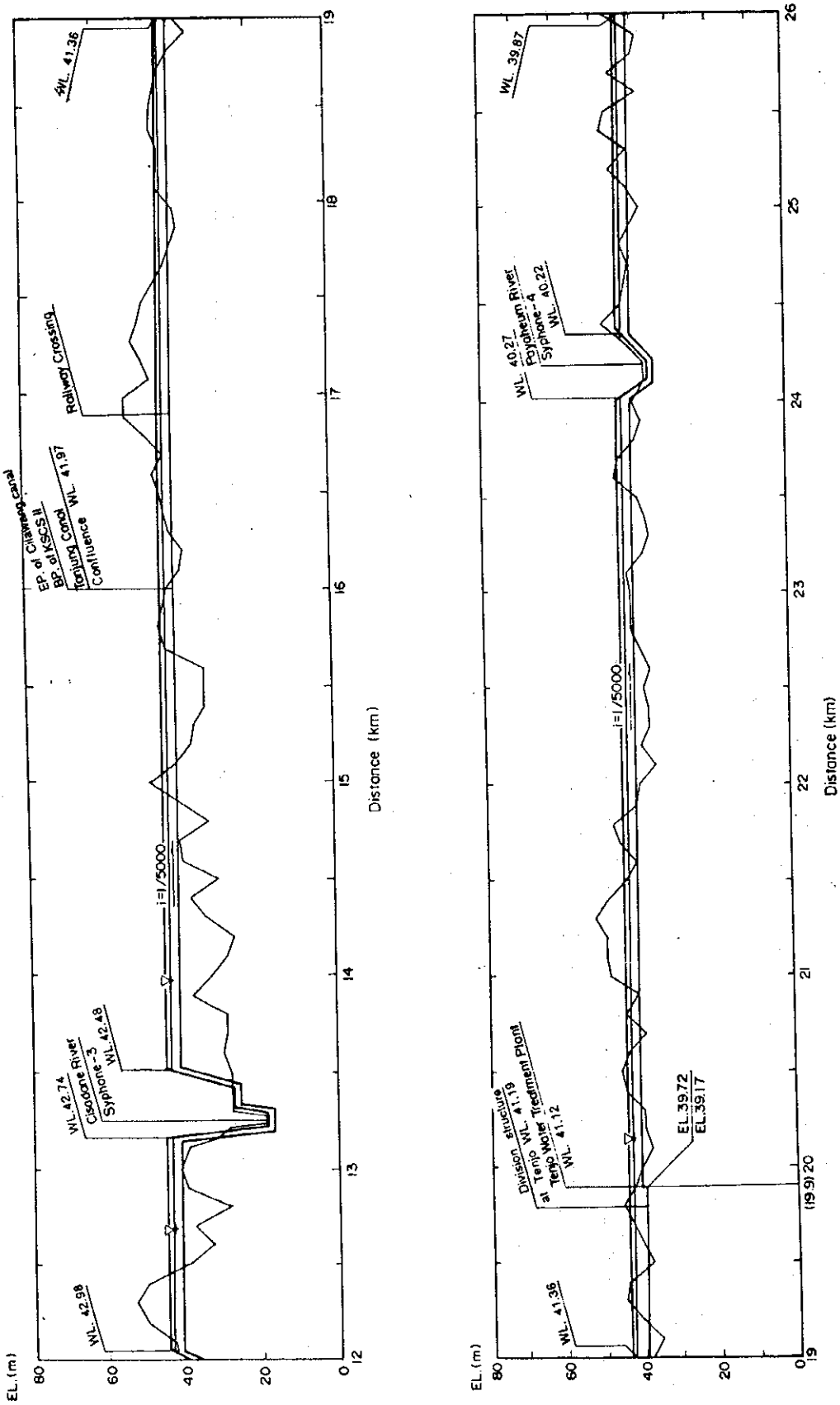
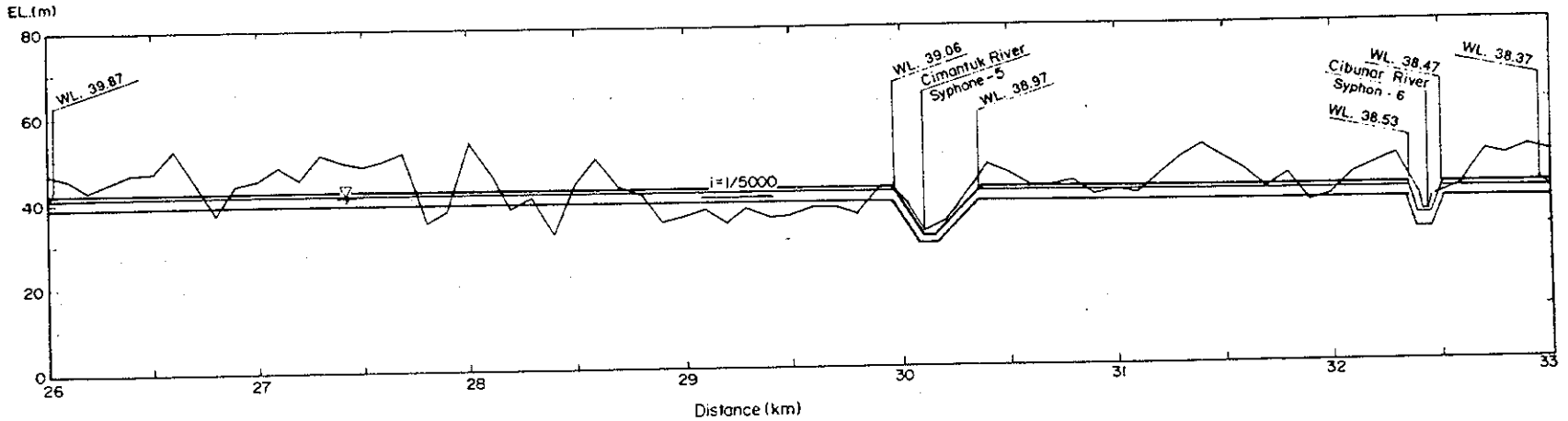


Figure 54 PROFILE OF KARIAN SERPONG CONVEYANCE SYSTEM KSCS I (2/3)



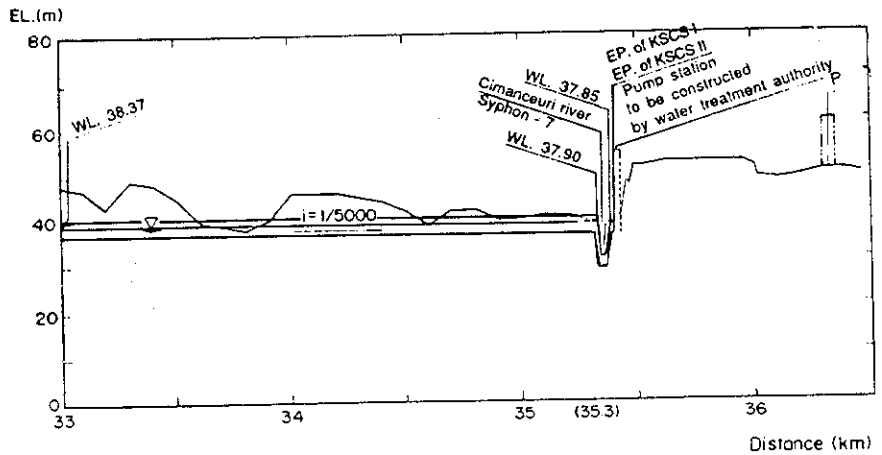
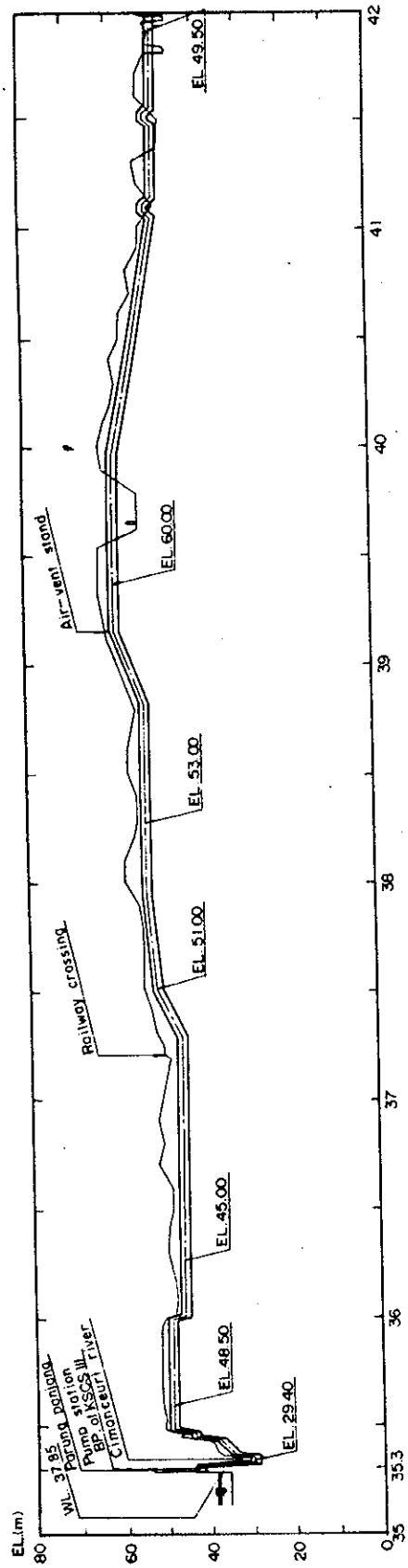


Figure 55 PROFILE OF KARIAN SERPONG CONVEYANCE SYSTEM KSCS I (3/3)



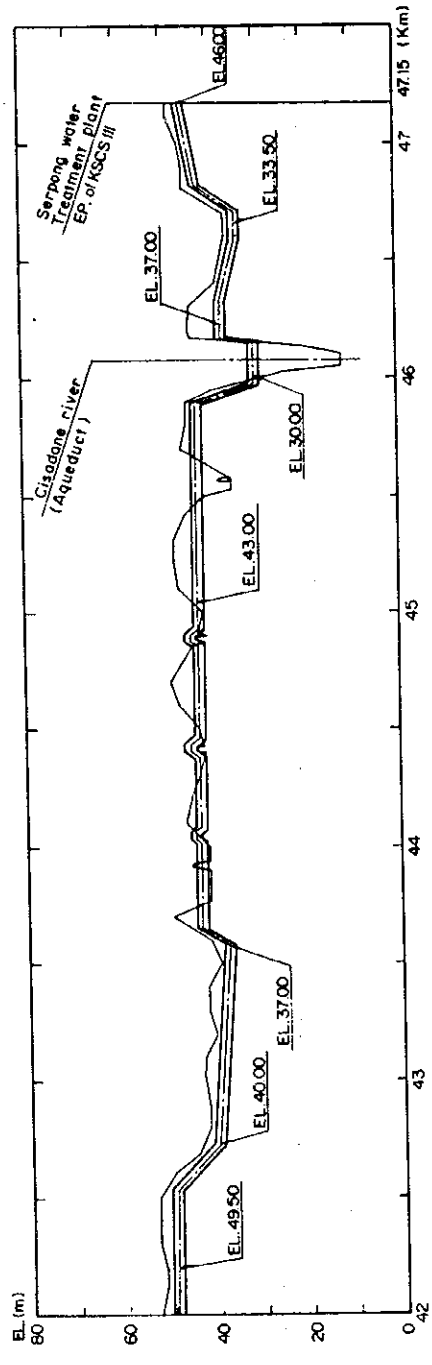
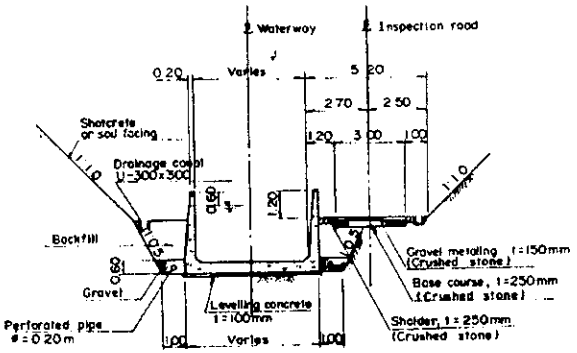
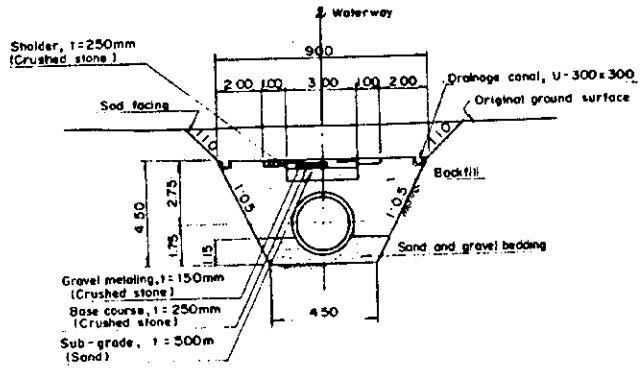


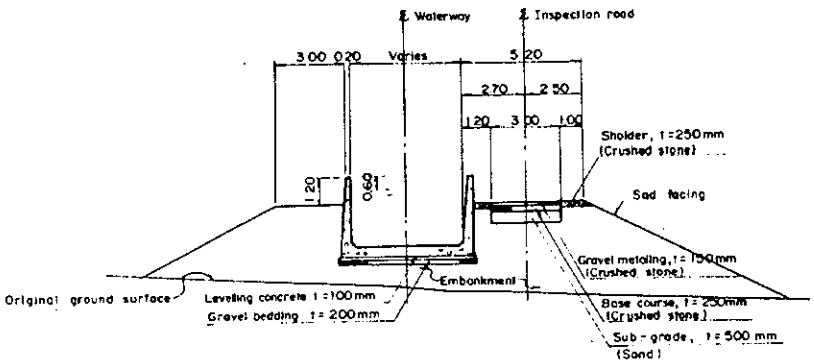
Figure 56 PROFILE OF KARIAN SERPONG CONVEYANCE SYSTEM KSCS III



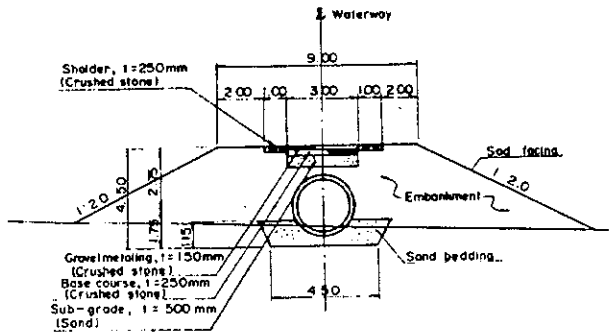
OPEN CHANNEL, EXCAVATION PART
(KSCS I, II Tanjung and Cilanang Canal)



PIPE LINE, EXCAVATION PART
(KSCS III)



OPEN CHANNEL, EMBANKMENT PART
(KSCS I, II Tanjung and Cilanang Canal)



PIPE LINE, EMBANKMENT PART
(KSCS III)

Figure 57 DETAIL TYPICAL CROSS SECTION OF KARIAN SERPONG CONVEYANCE SYSTEM

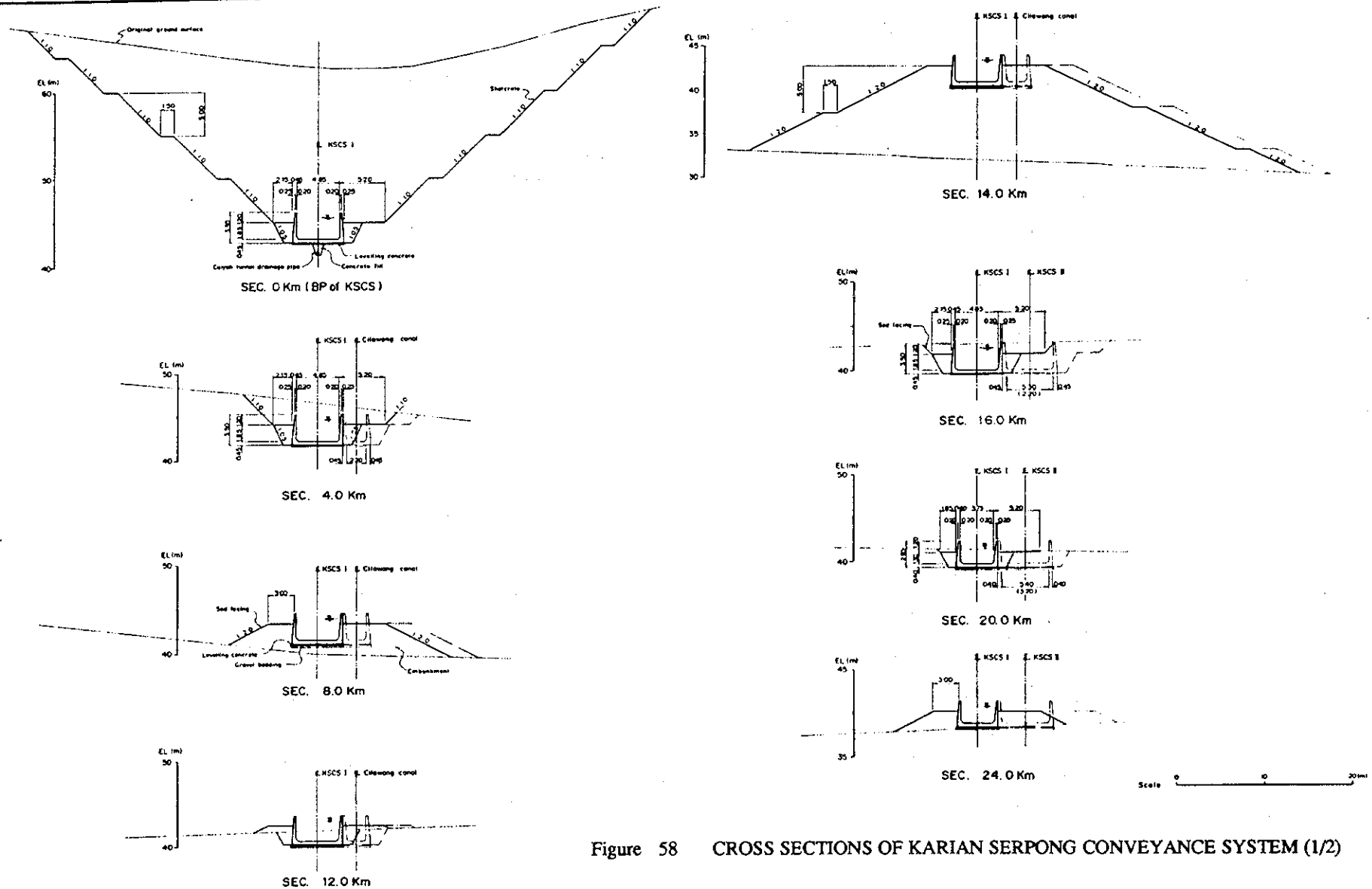


Figure 58 CROSS SECTIONS OF KARIAN SERPONG CONVEYANCE SYSTEM (1/2)

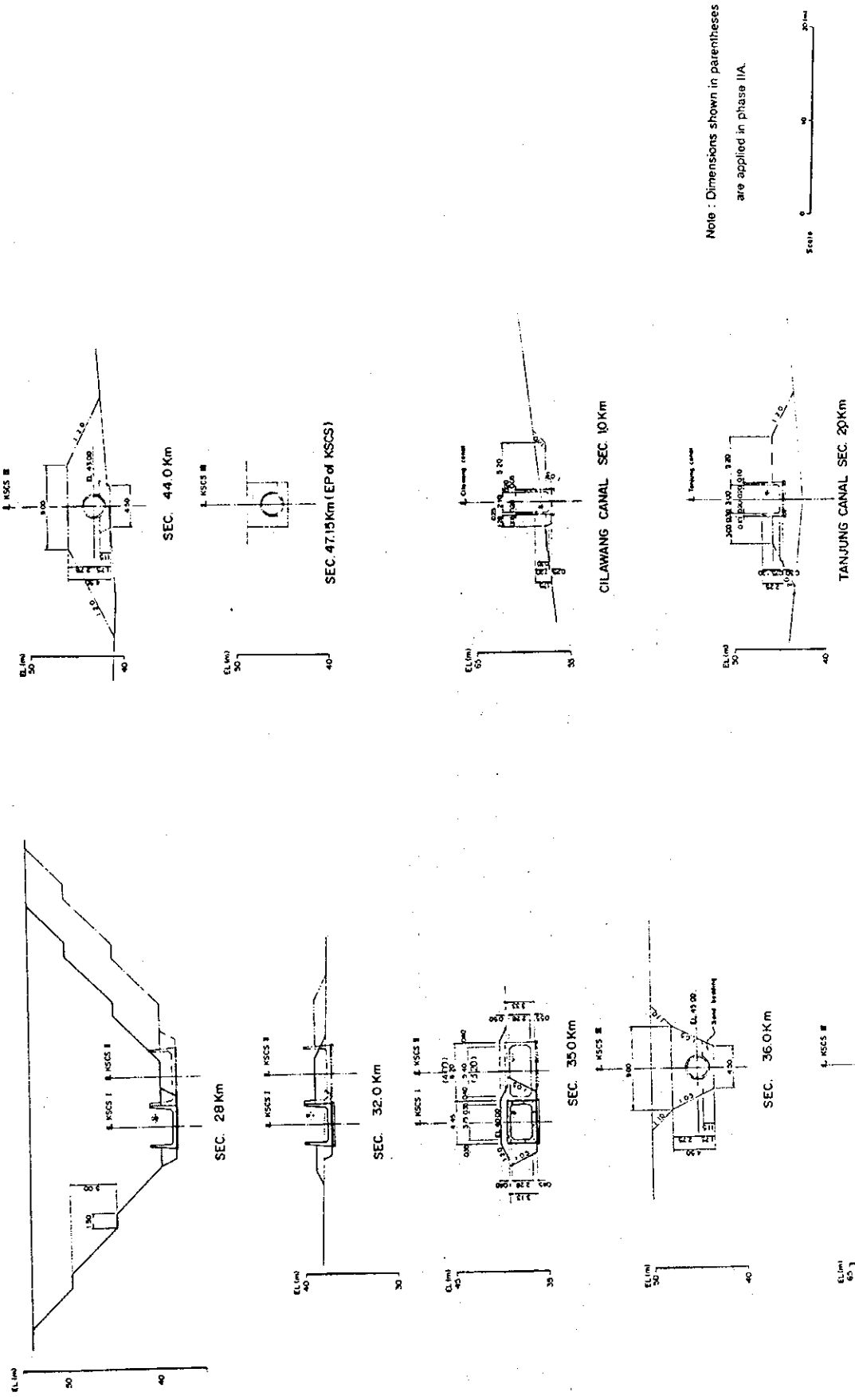


Figure 59 CROSS SECTIONS OF KARIAN SERPONG CONVEYANCE SYSTEM (2/2)

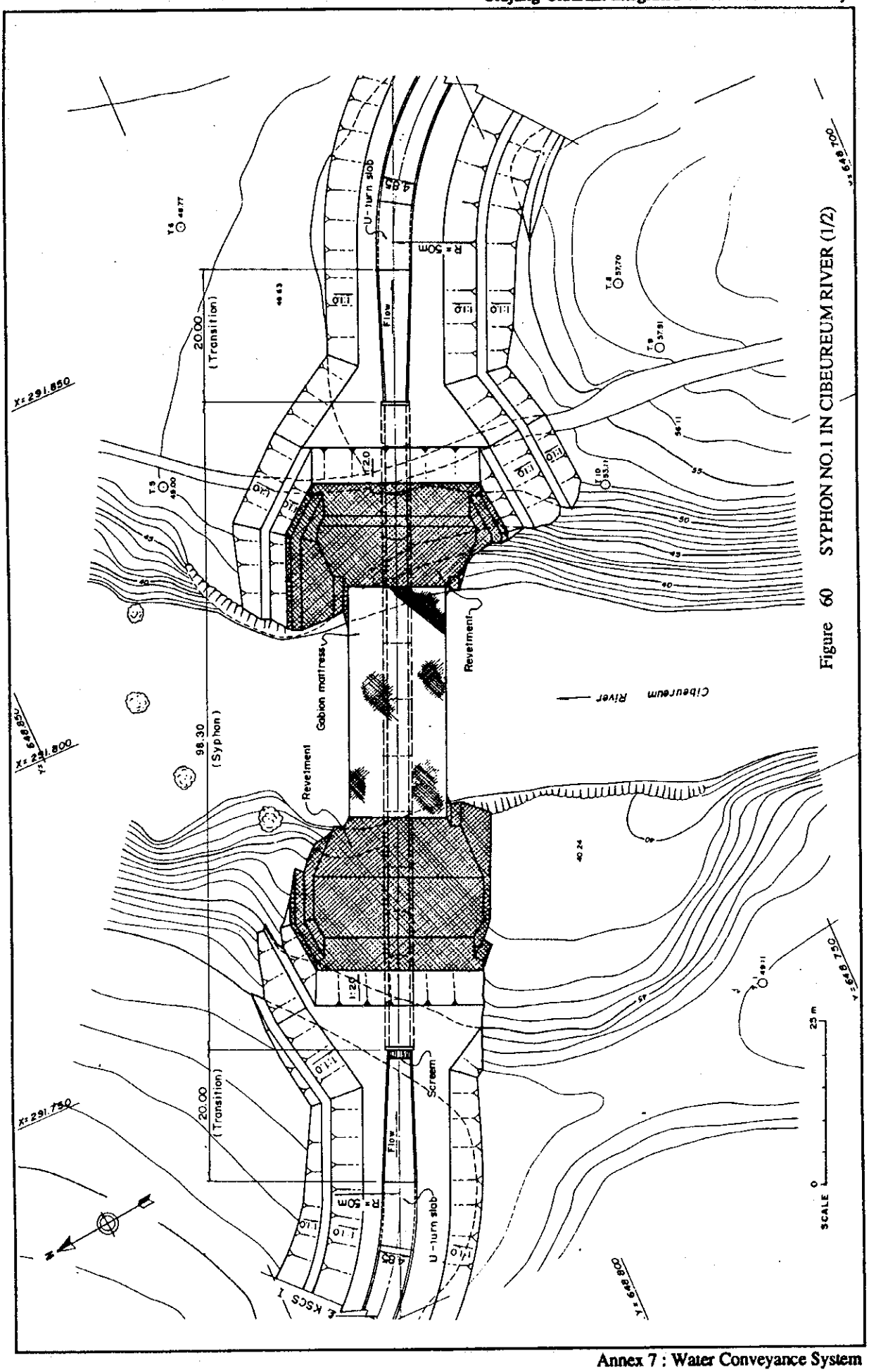


Figure 60 SYPHON NO.1 IN CIBEUREUM RIVER (1/2)

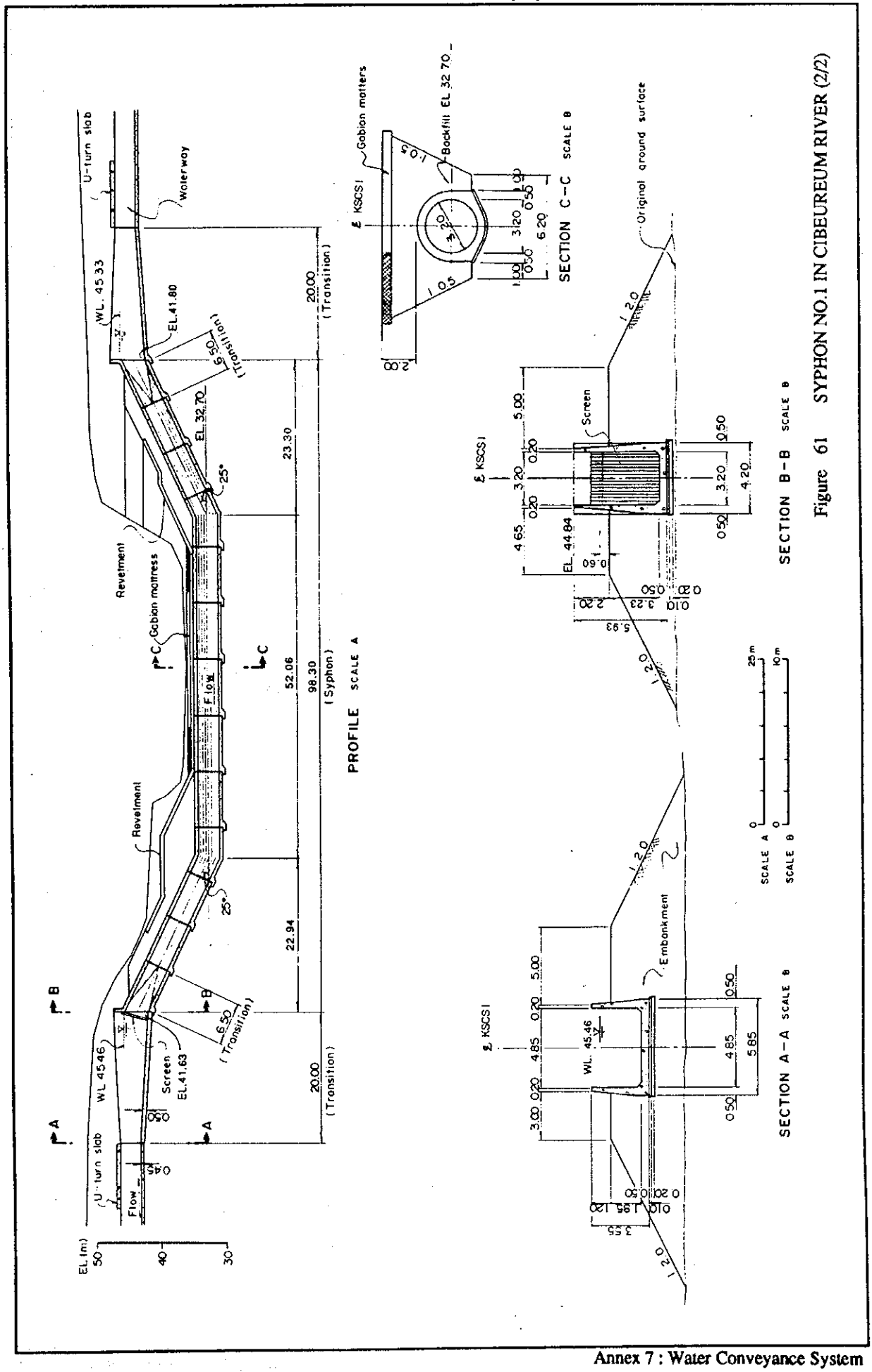


Figure 61 SYPHON NO.1 IN CIBEUREUM RIVER (2/2)

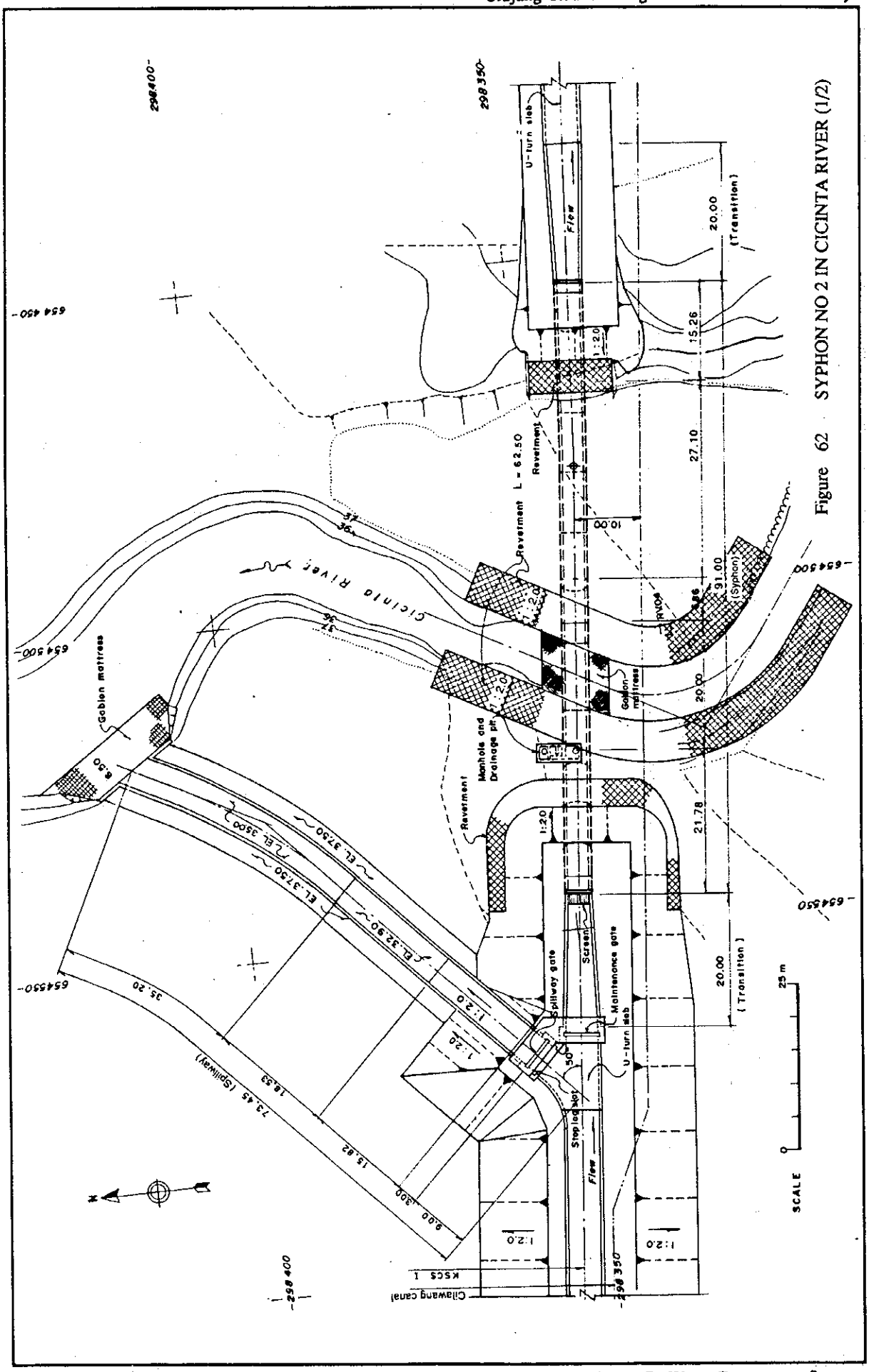


Figure 62 SYPHON NO 2 IN CICINTA RIVER (1/2)

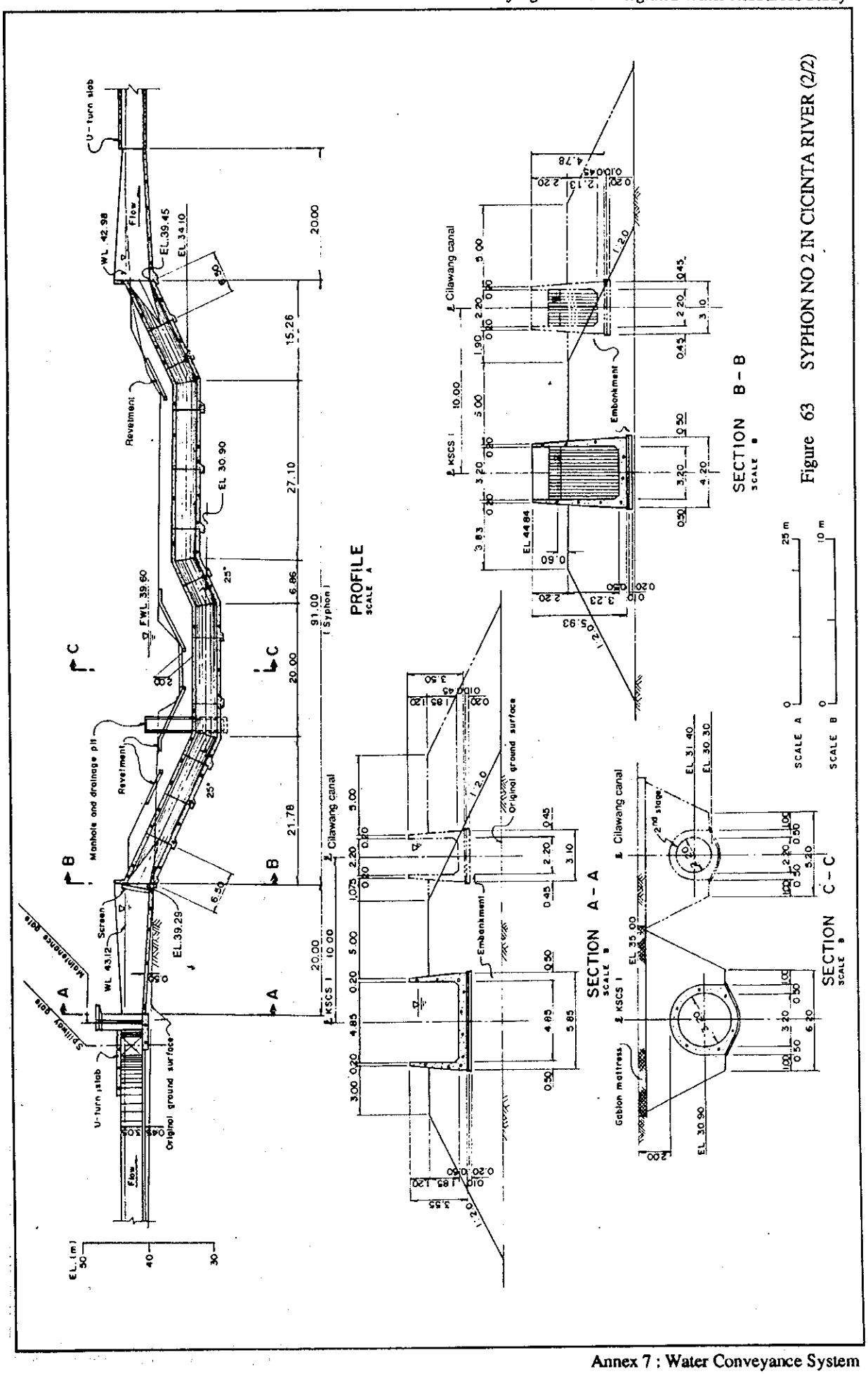


Figure 63 SYPHON NO 2 IN CICINTA RIVER (2/2)

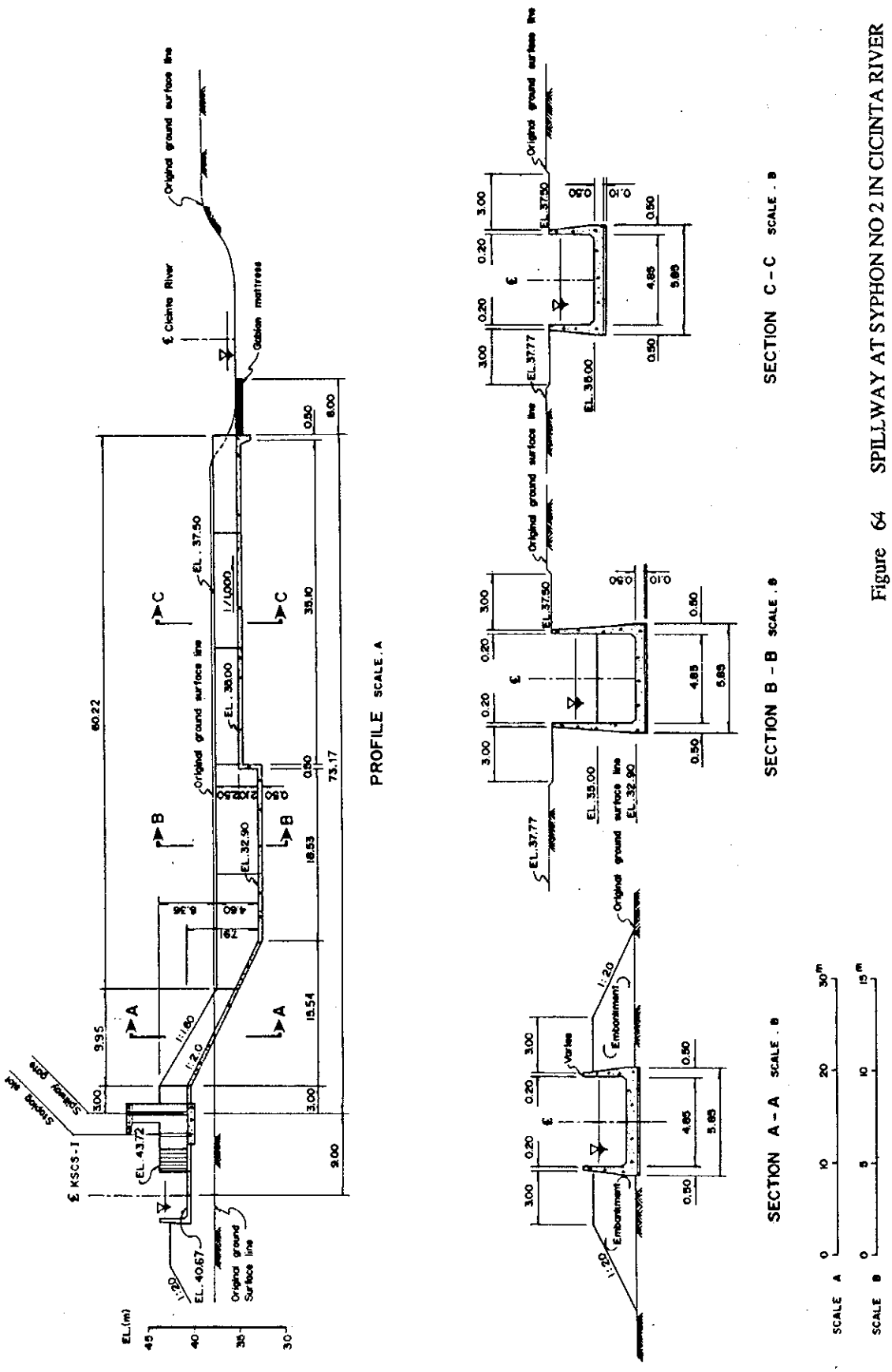


Figure 64 SPILLWAY AT SYPHON NO 2 IN CICINTA RIVER

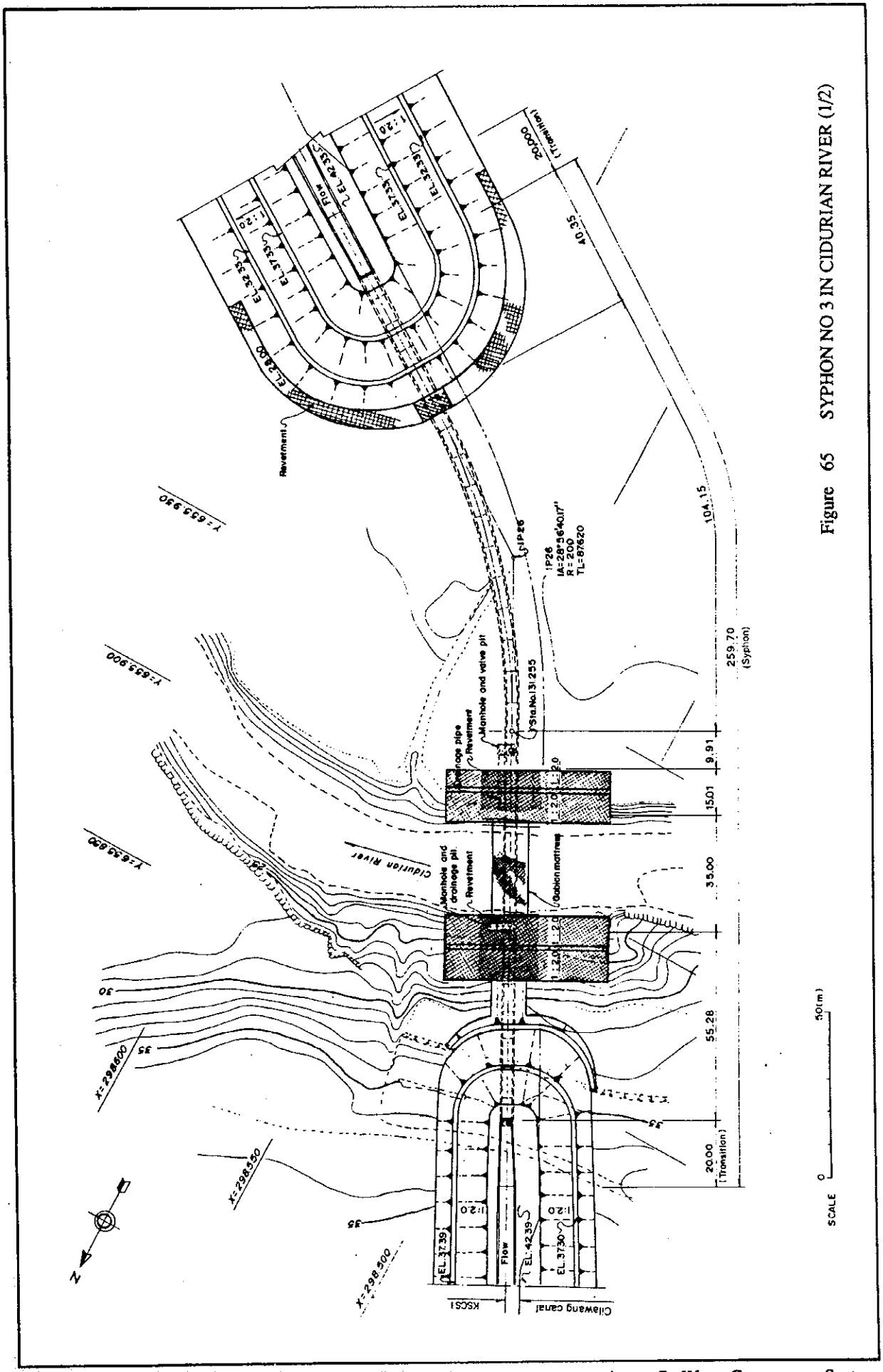


Figure 65 SYPHON NO 3 IN CIDURIAN RIVER (1/2)

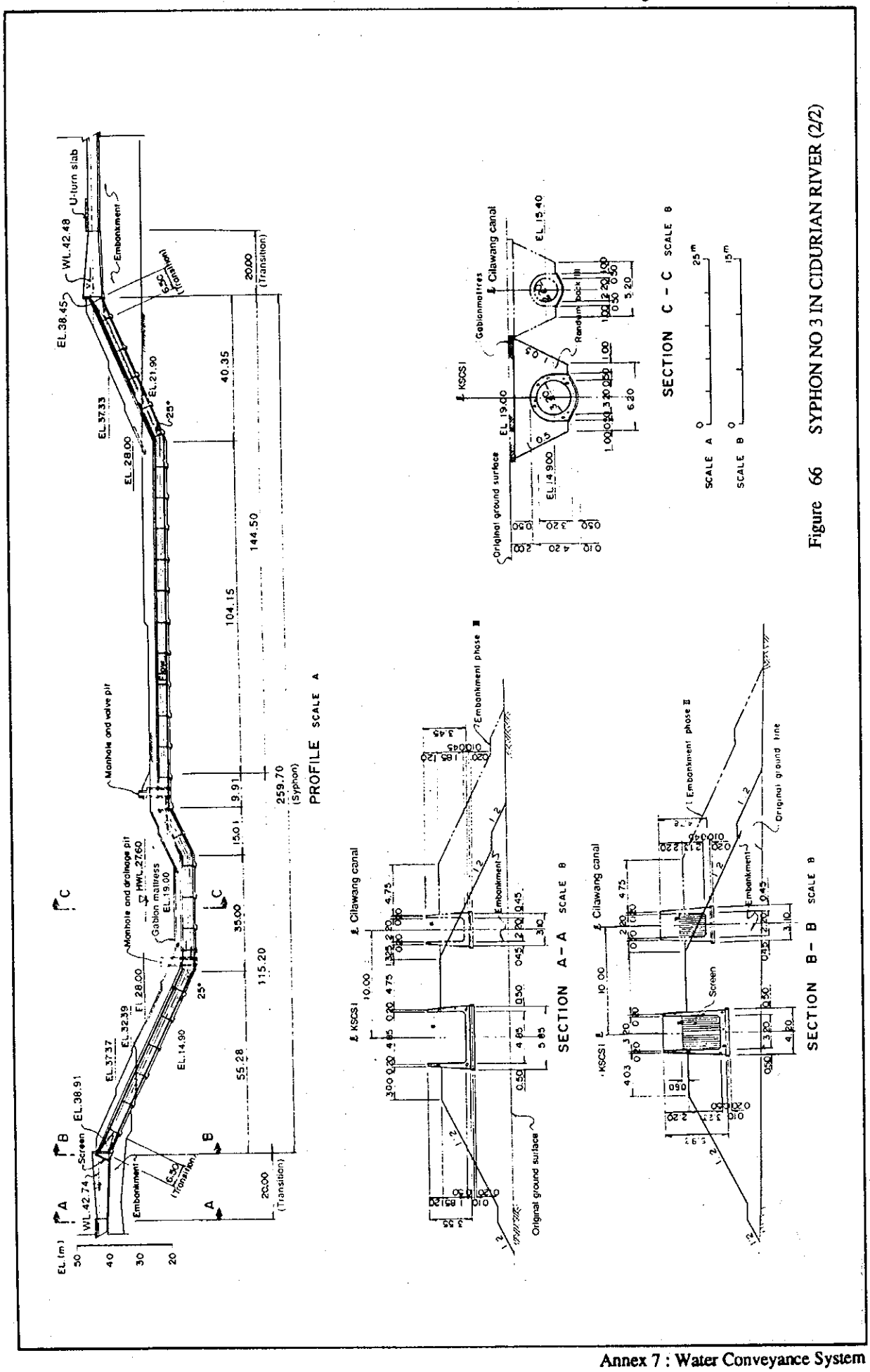


Figure 66 SYPHON NO 3 IN CIDURIAN RIVER (2/2)

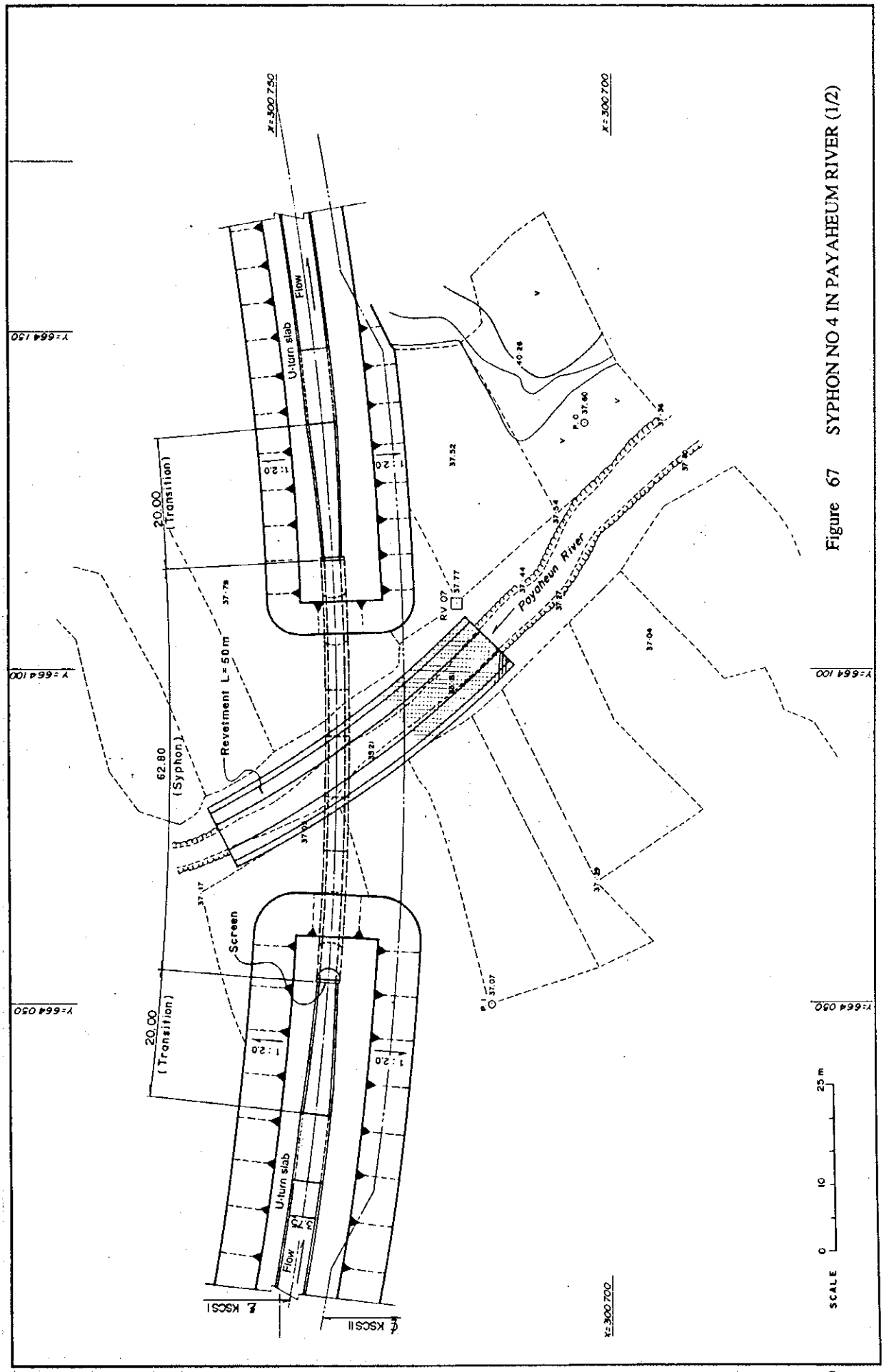


Figure 67 SYPHON NO 4 IN PAYAHEUM RIVER (1/2)

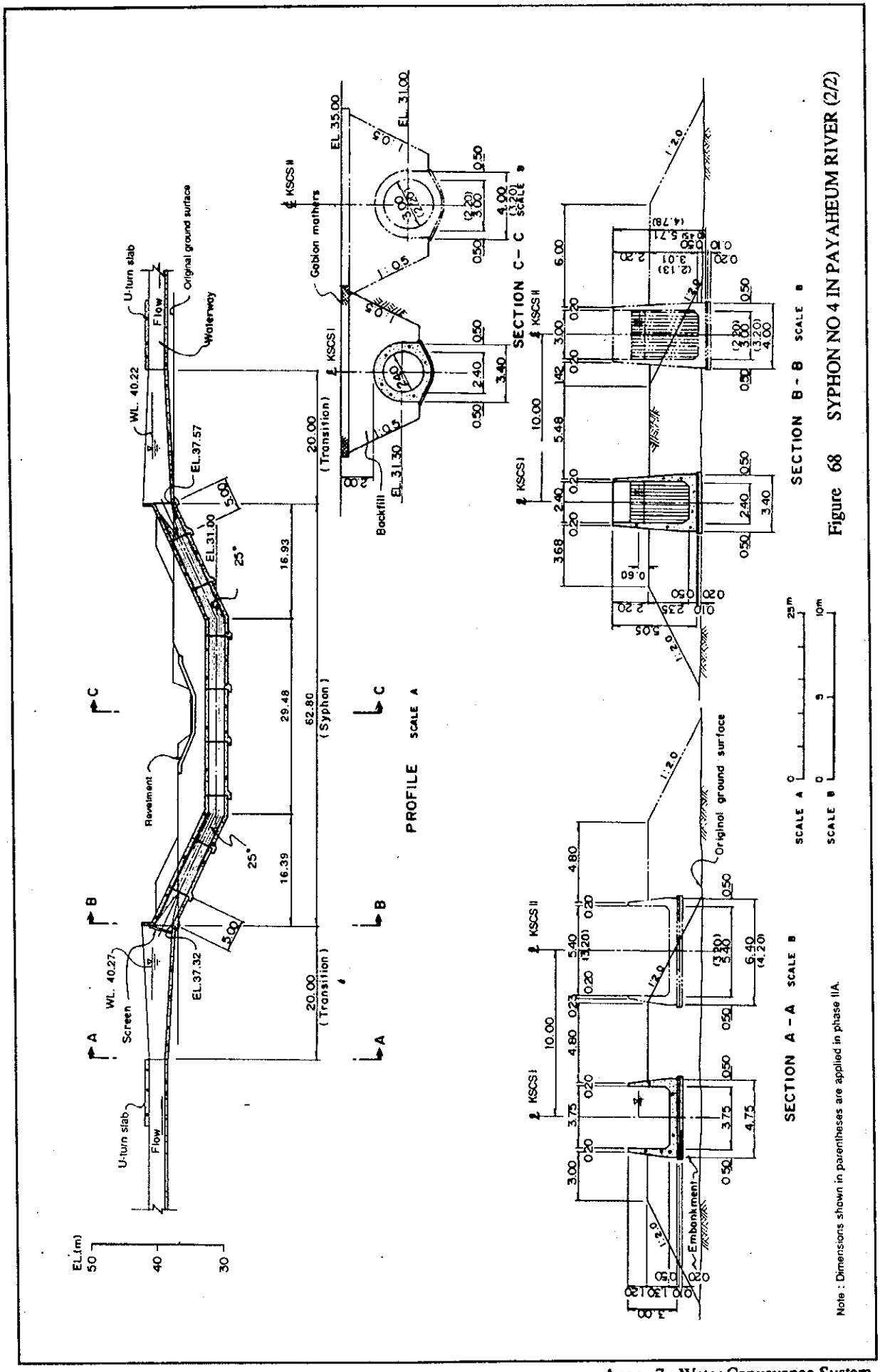


Figure 68 SYPHON NO 4 IN PAYAHEUM RIVER (2/2)

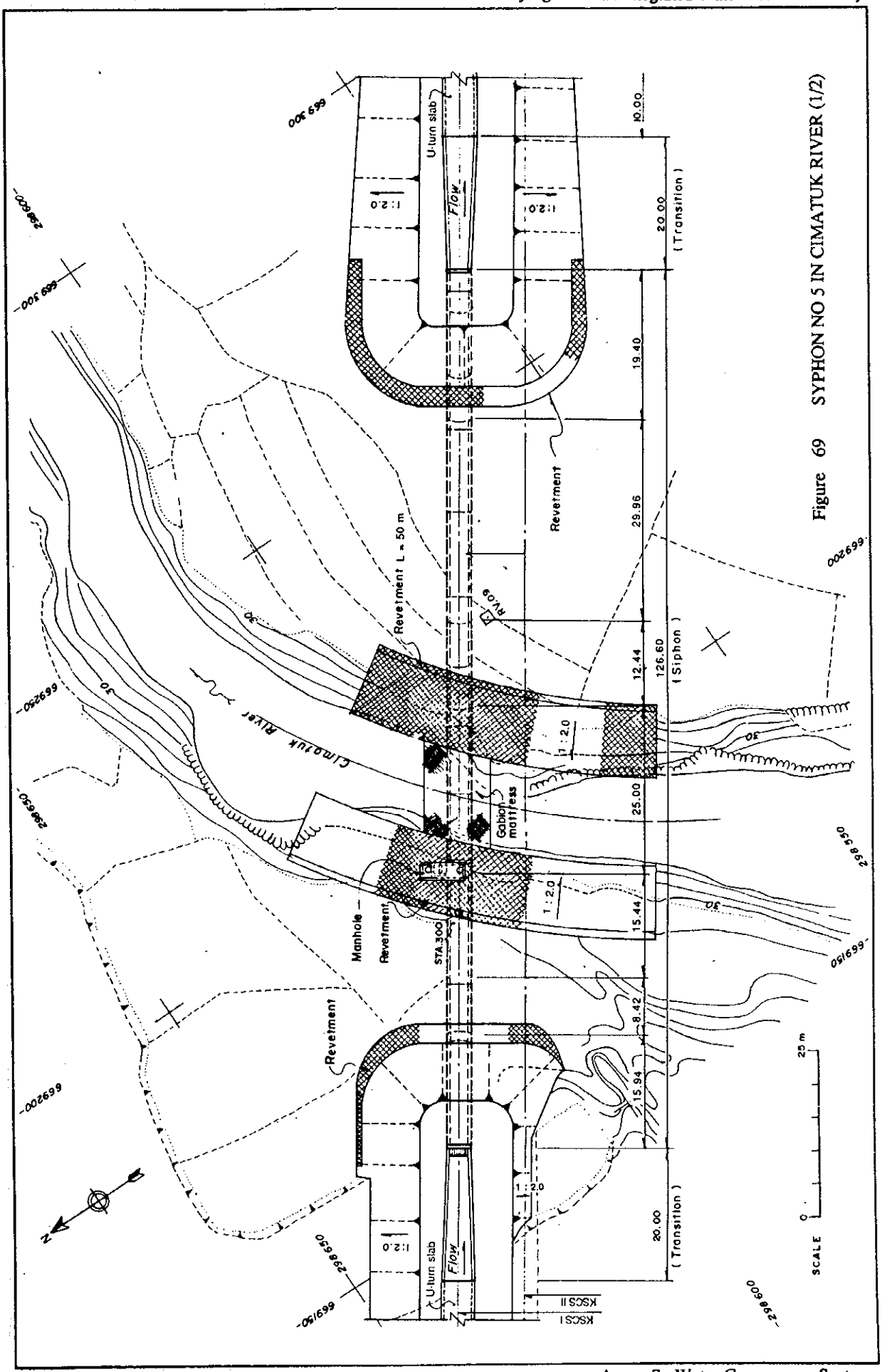


Figure 69 SYPHON NO 5 IN CIMATUK RIVER (1/2)

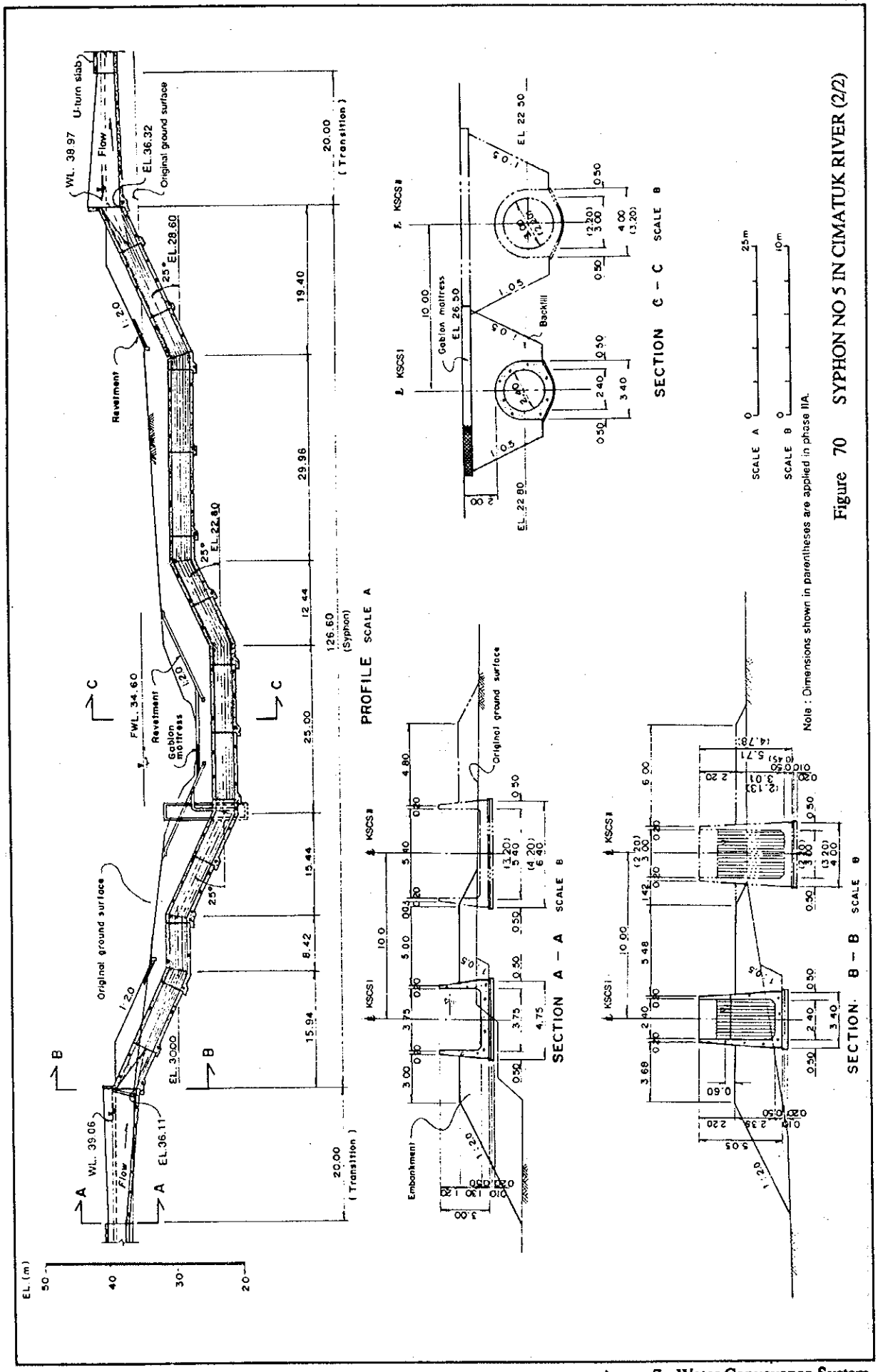


Figure 70 SYPHON NO 5 IN CIMATUK RIVER (2/2)

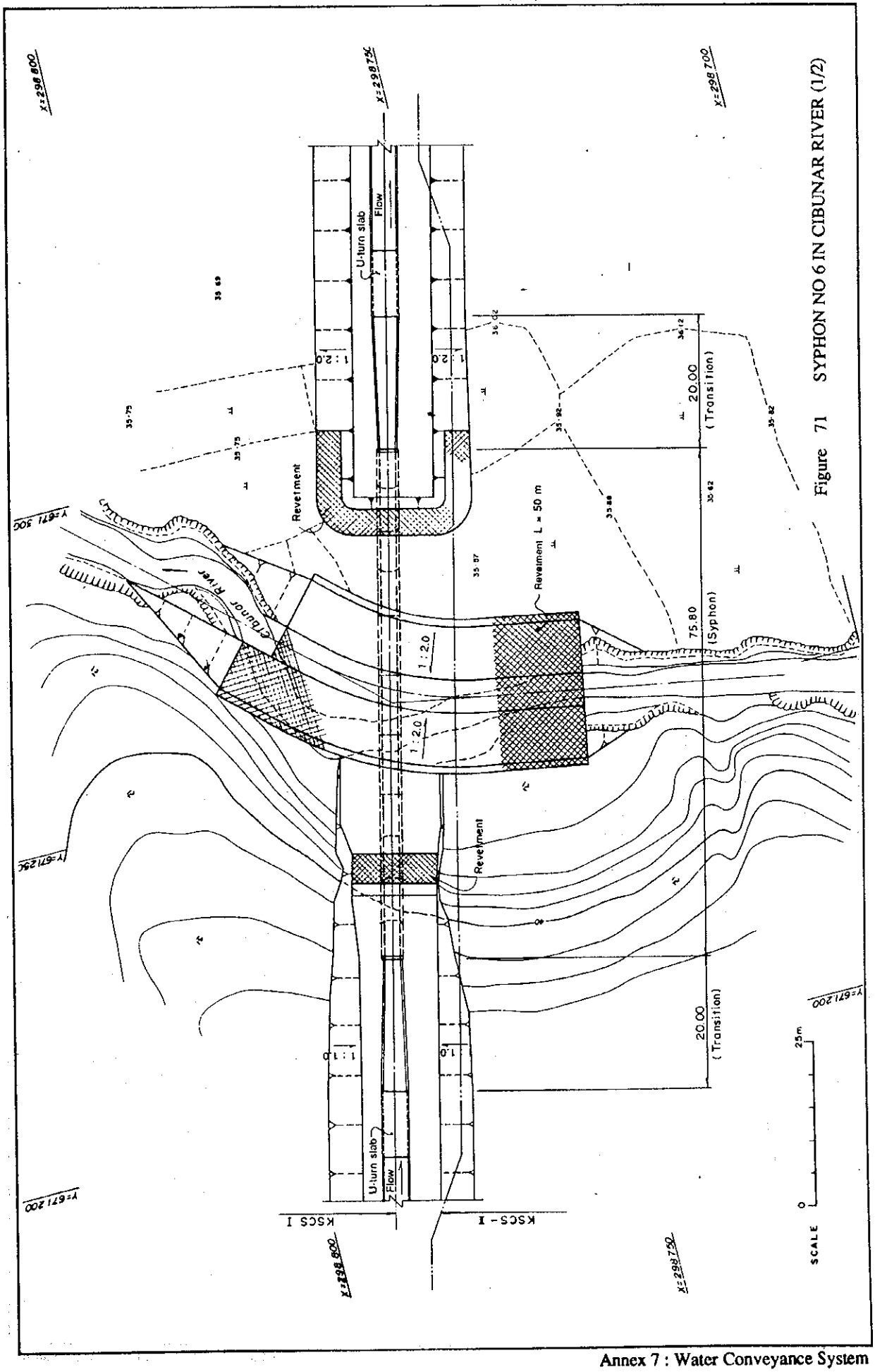


Figure 71 SYPHON NO 6 IN CIBUNAR RIVER (1/2)

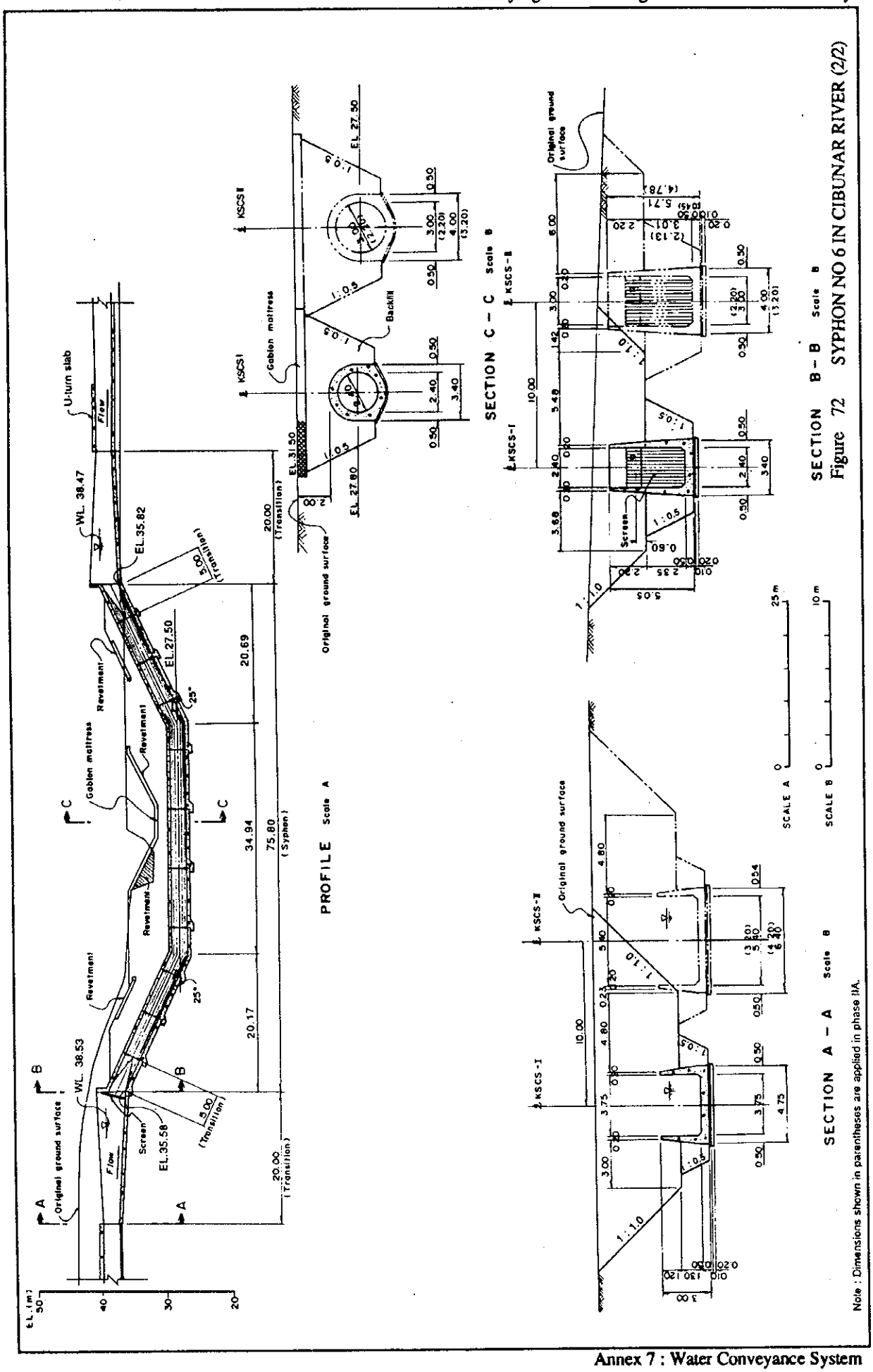


Figure 72 SYPHON NO 6 IN CIBUNAR RIVER (2/2)

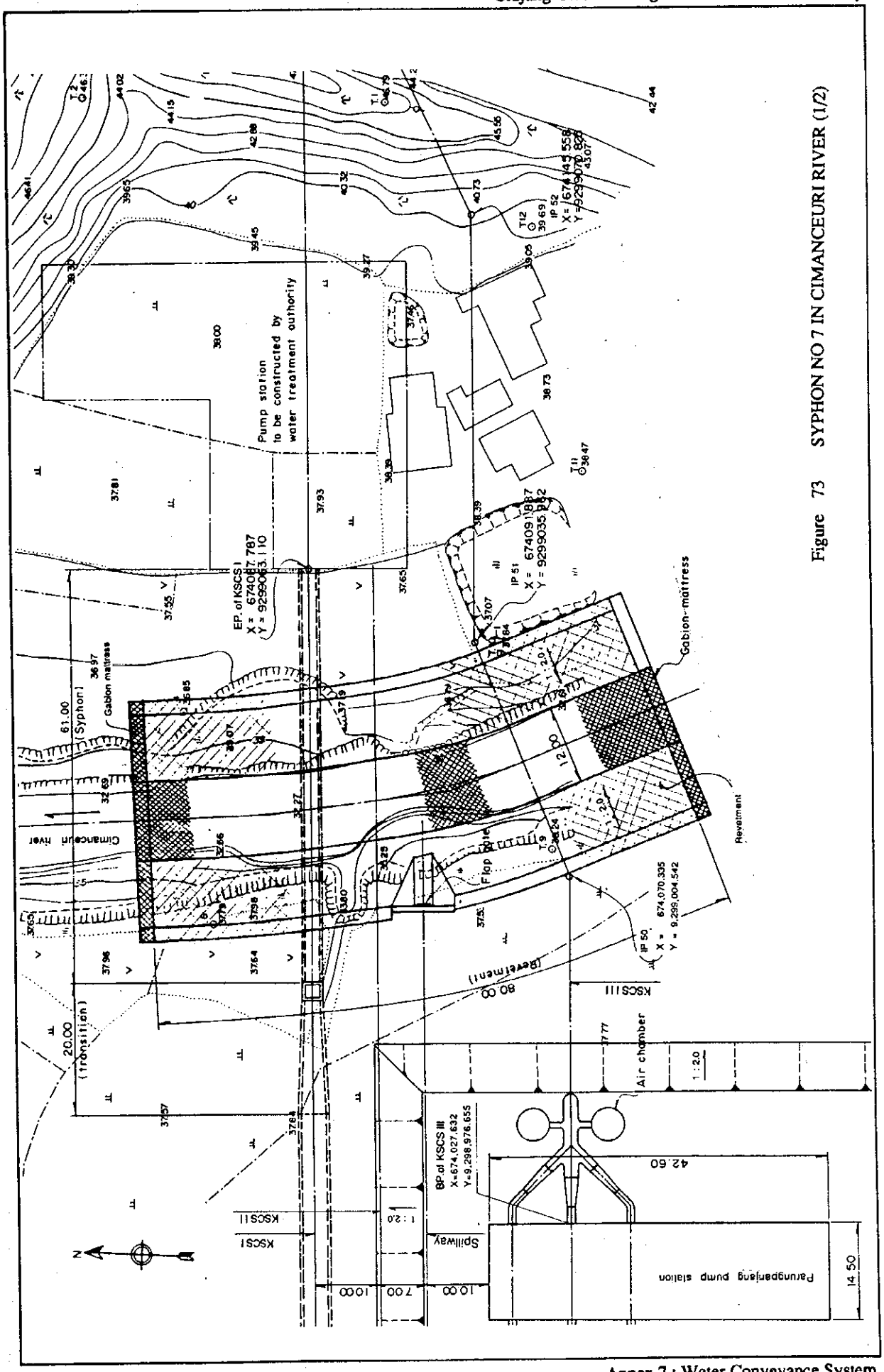


Figure 73 SYPHON NO 7 IN CIMANCEURI RIVER (1/2)

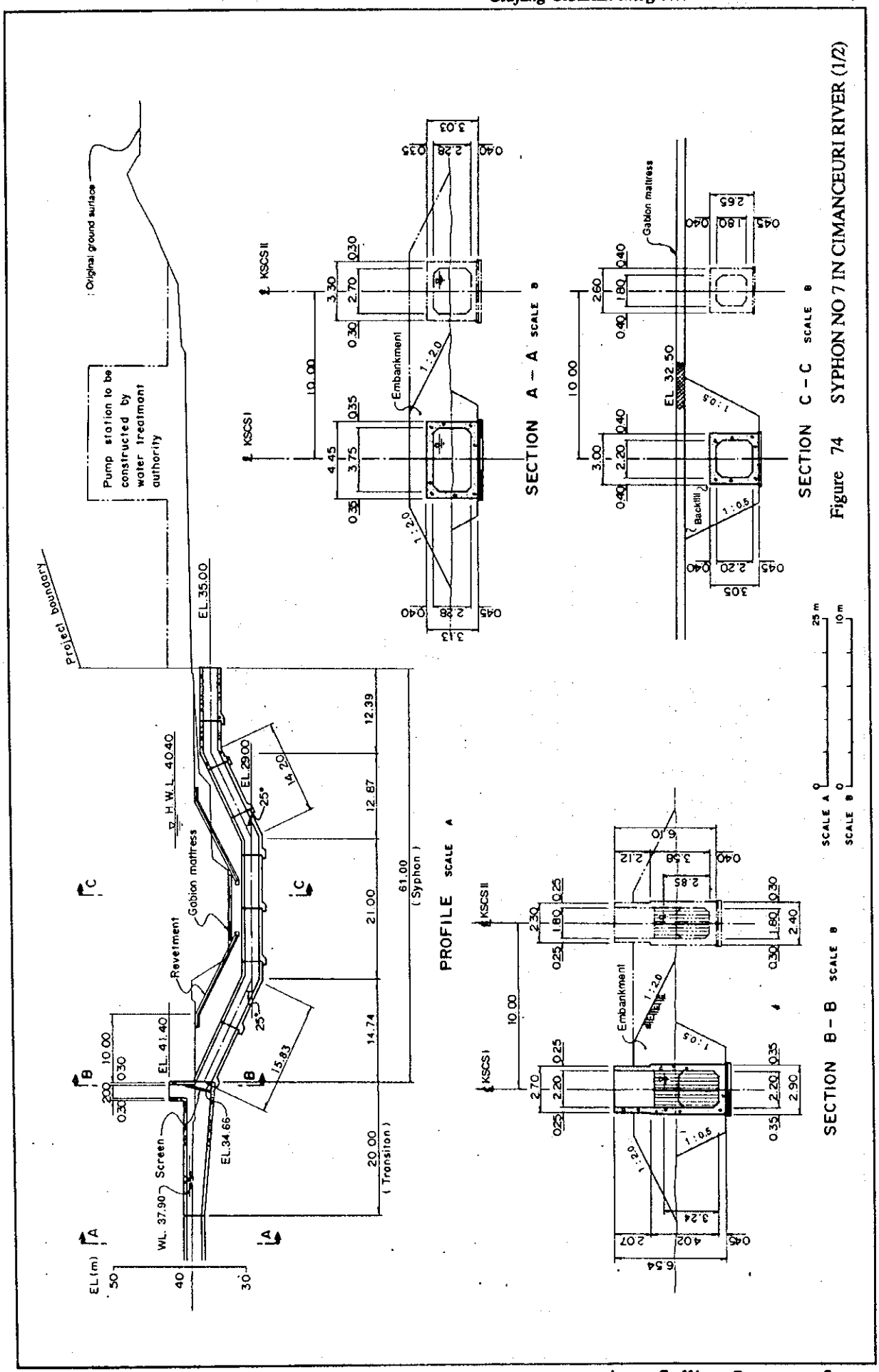


Figure 74 SYPHON NO 7 IN CIMANCEURI RIVER (1/2)

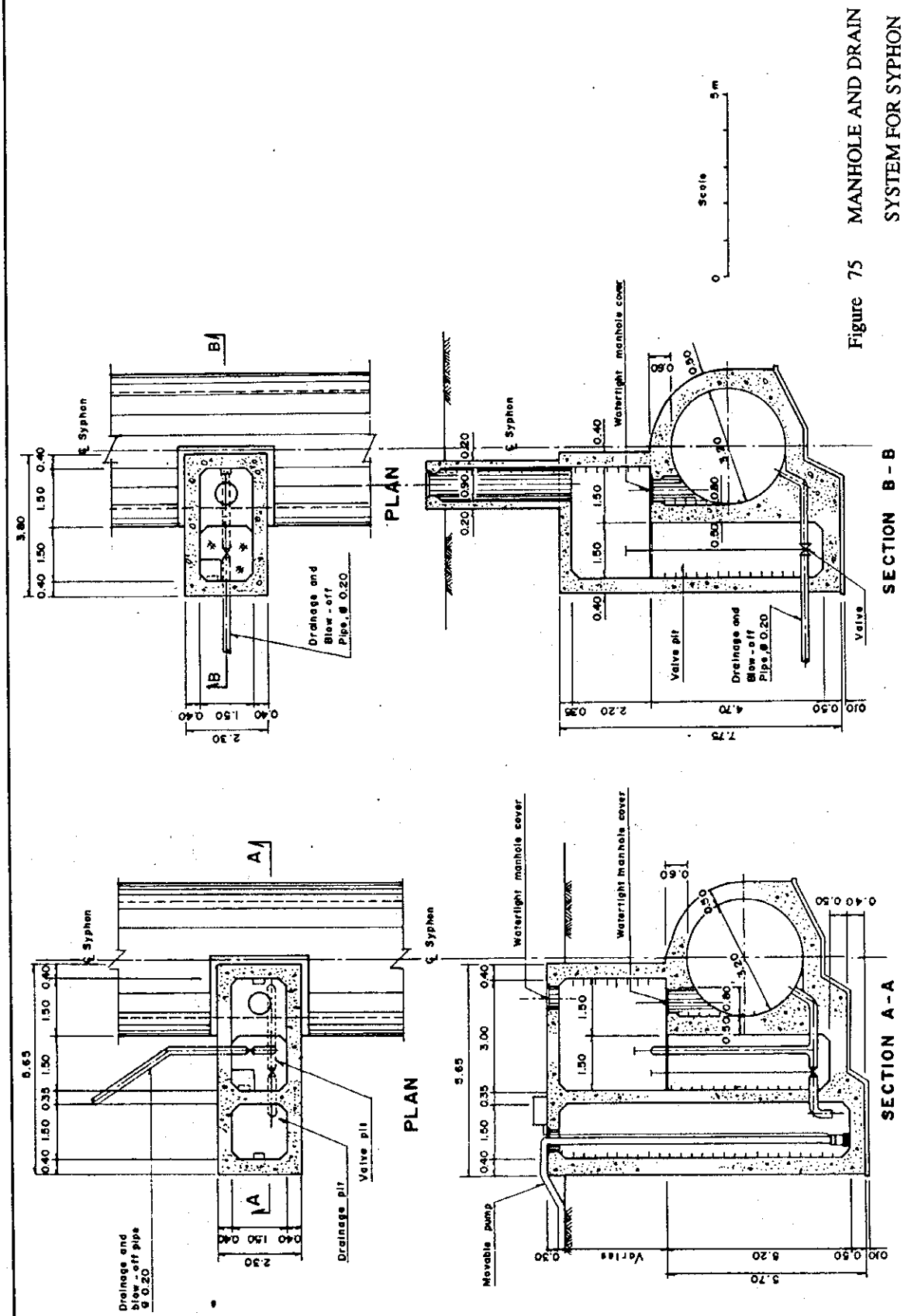


Figure 75 MANHOLE AND DRAIN SYSTEM FOR SYPHON

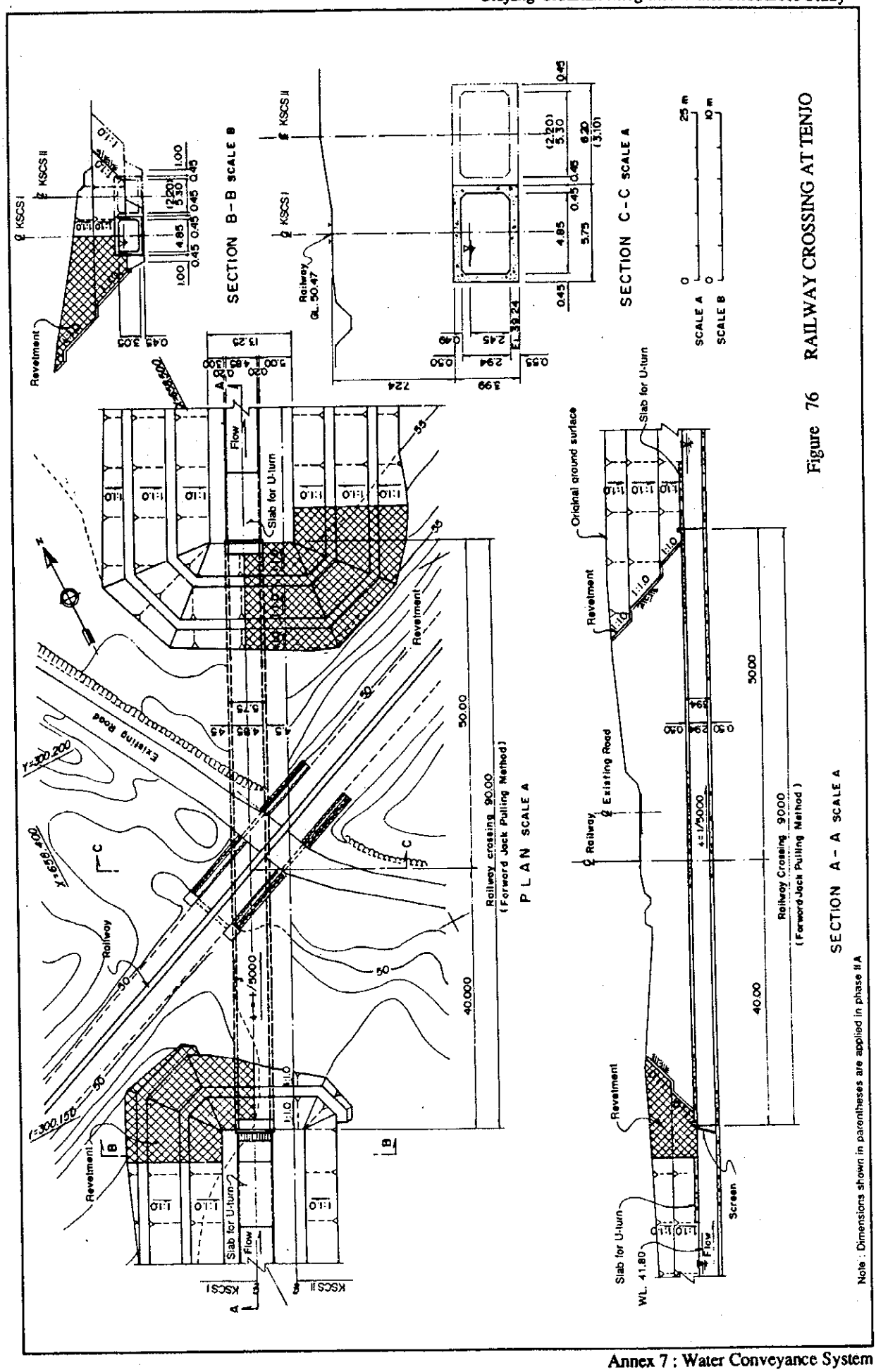


Figure 76 RAILWAY CROSSING AT TENJO

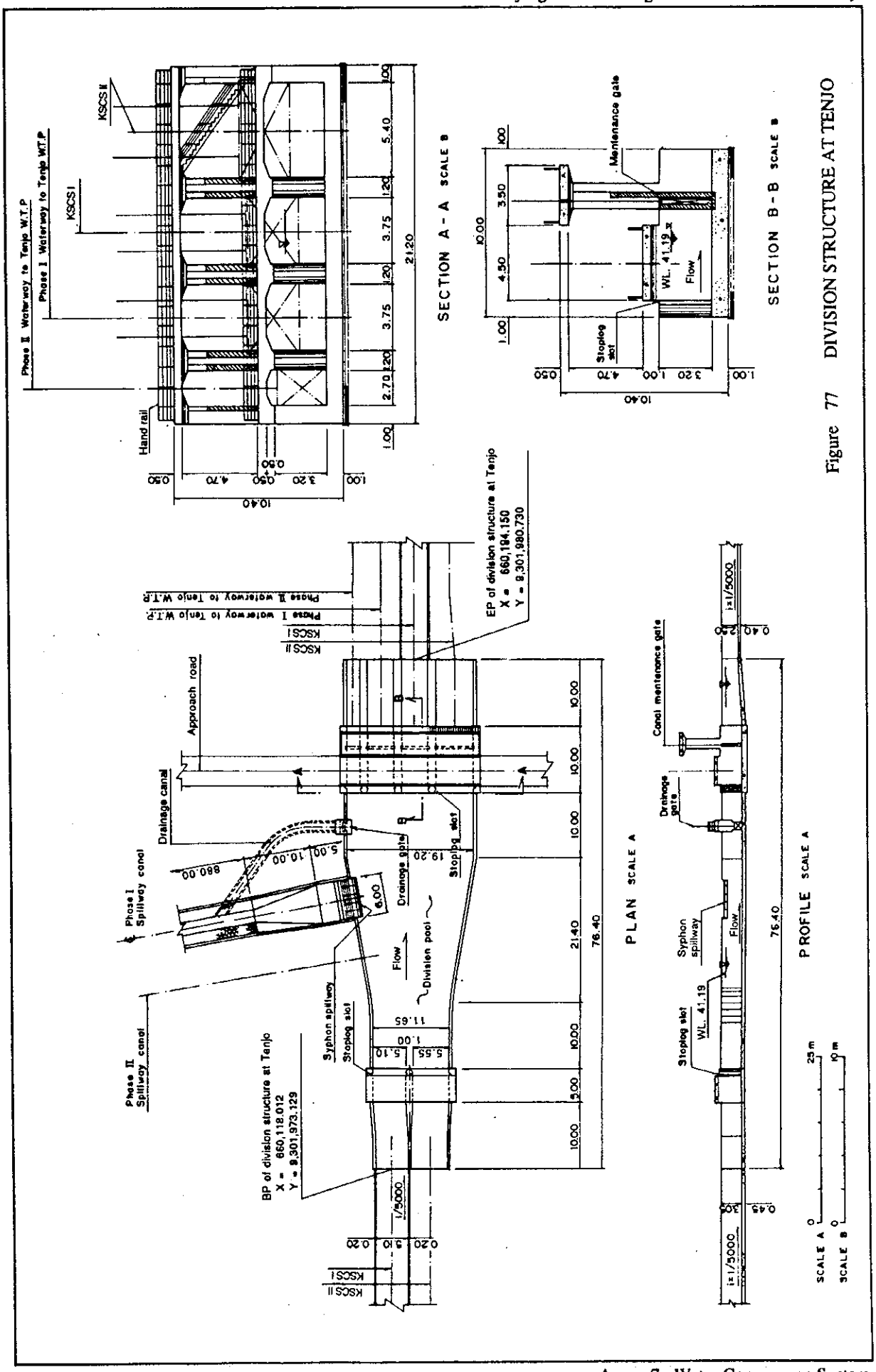


Figure 77 DIVISION STRUCTURE AT TENJO

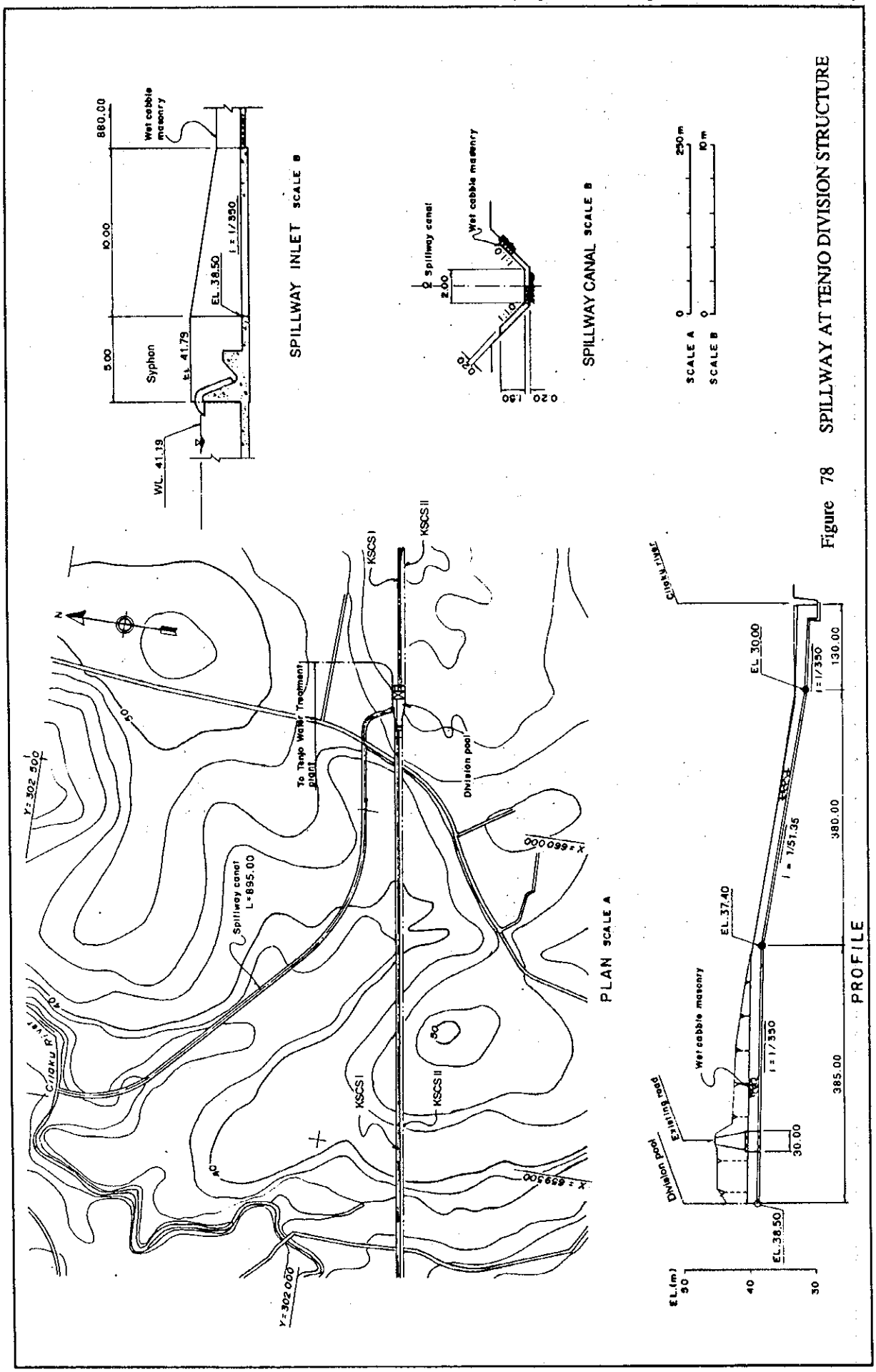


Figure 78 SPILLWAY AT TENJO DIVISION STRUCTURE

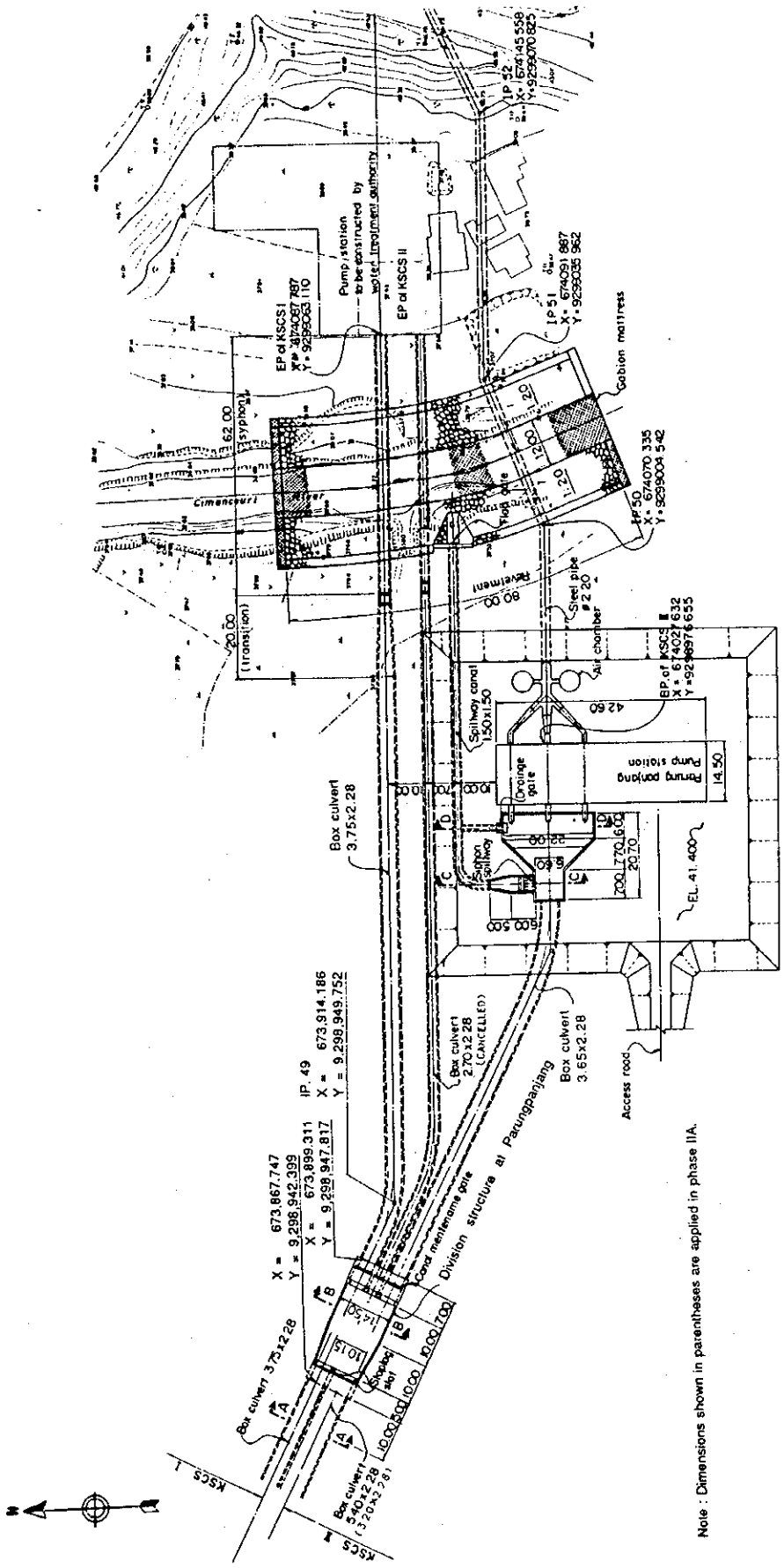


Figure 79 DIVISION STRUCTURE, SPILLWAY AND PUMP STATION AT PARUNGPANJANG (1/3)

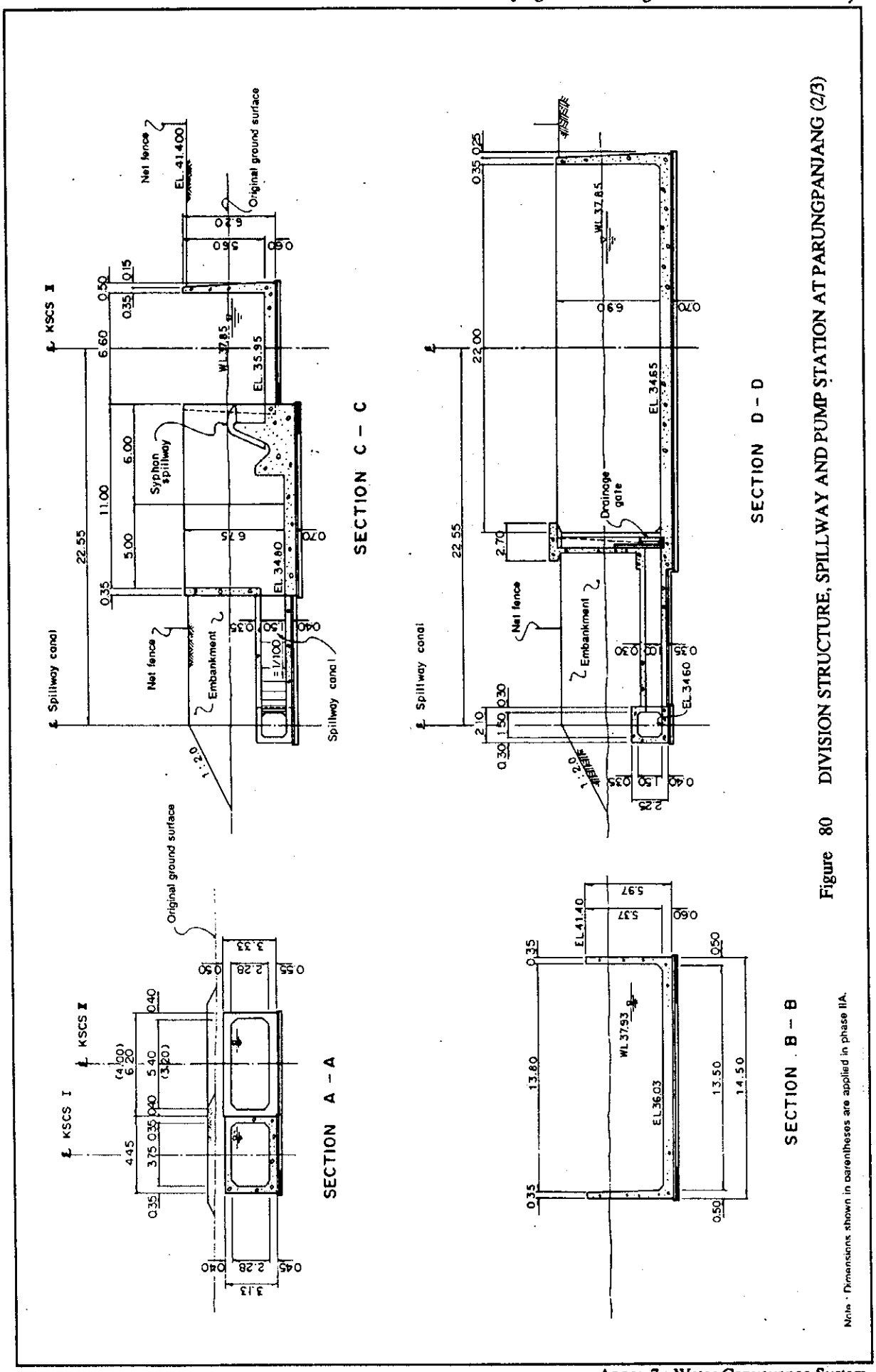


Figure 80 DIVISION STRUCTURE, SPILLWAY AND PUMP STATION AT PARUNGPANJANG (2/3)

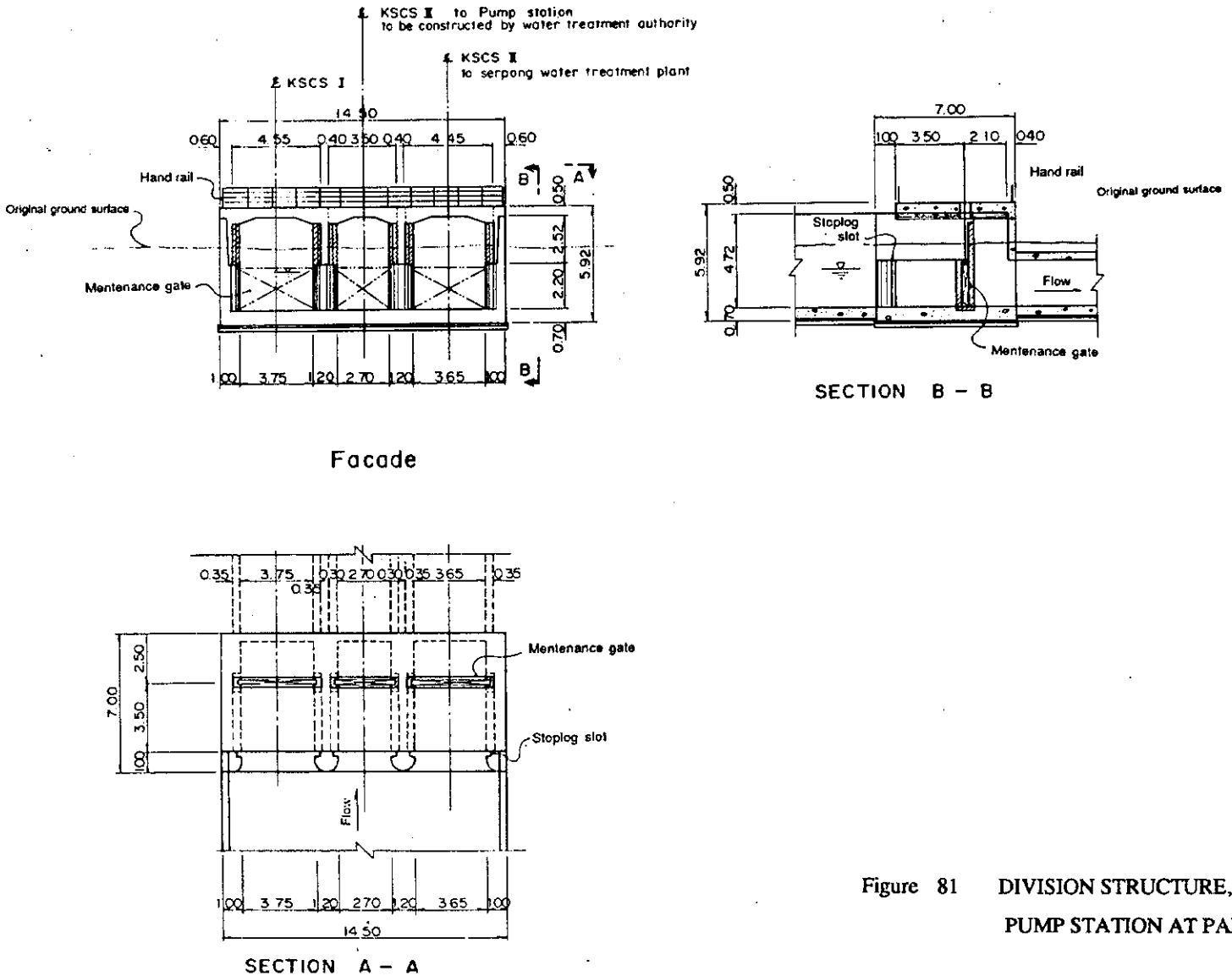
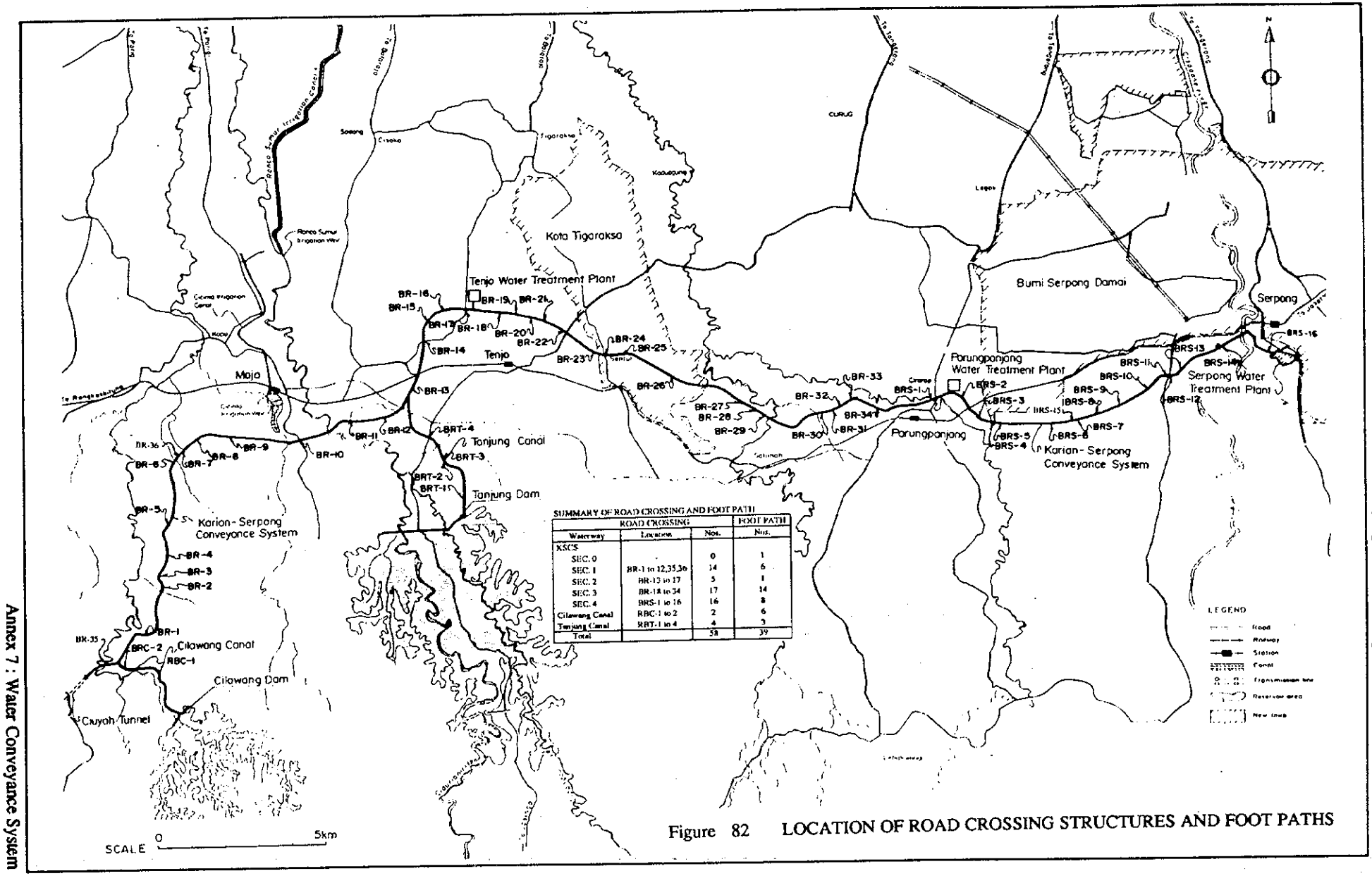


Figure 81 DIVISION STRUCTURE, SPILLWAY AND PUMP STATION AT PARUNGPANJANG (3/3)



SUMMARY OF ROAD CROSSING AND FOOT PATH

Waterway	ROAD CROSSING Location	ROAD CROSSING Nos.	FOOT PATH Nos.
KSCS			
SEC. 0	-	0	1
SEC. 1	BR-1 to 12,35,36	14	6
SEC. 2	BR-13 to 17	5	1
SEC. 3	BR-18 to 34	17	14
SEC. 4	BRS-1 to 16	16	8
Cilawang Canal	RBC-1 to 2	2	6
Tanjung Canal	RBT-1 to 4	4	3
Total		58	39

Figure 82 LOCATION OF ROAD CROSSING STRUCTURES AND FOOT PATHS

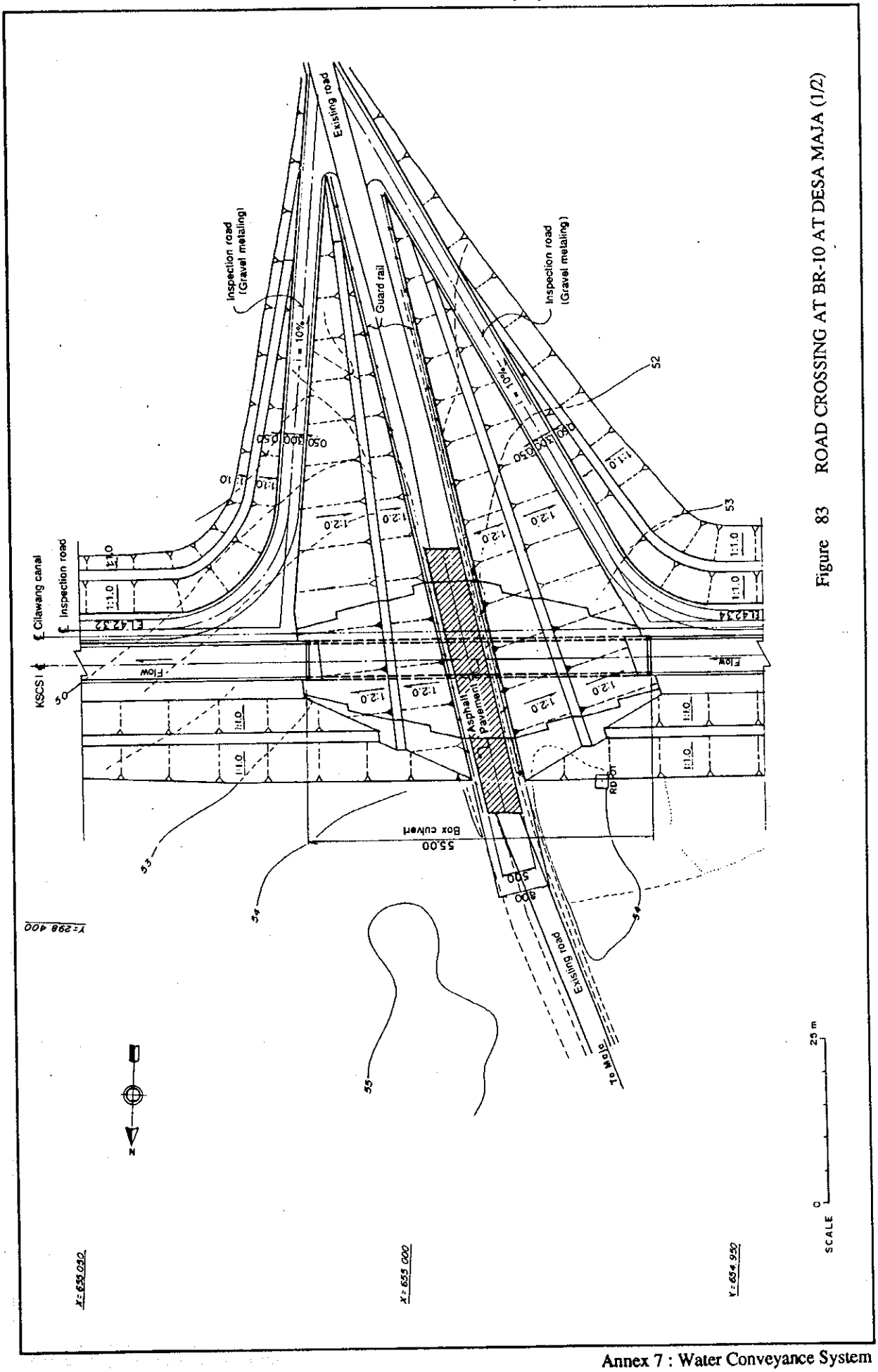


Figure 83 ROAD CROSSING AT BR-10 AT DESA MAJA (1/2)

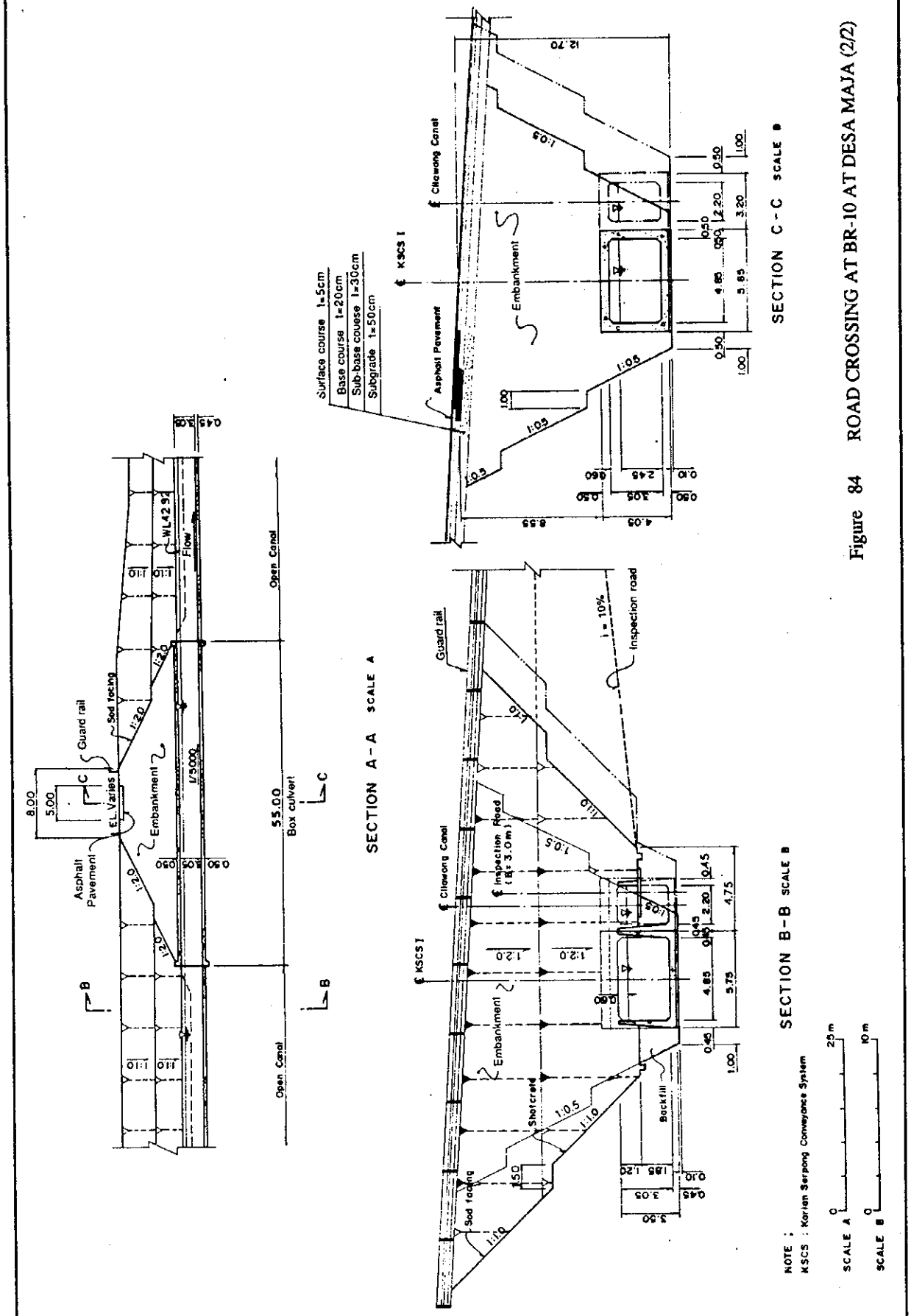


Figure 84 ROAD CROSSING AT BR-10 AT DESA MAJA (2/2)

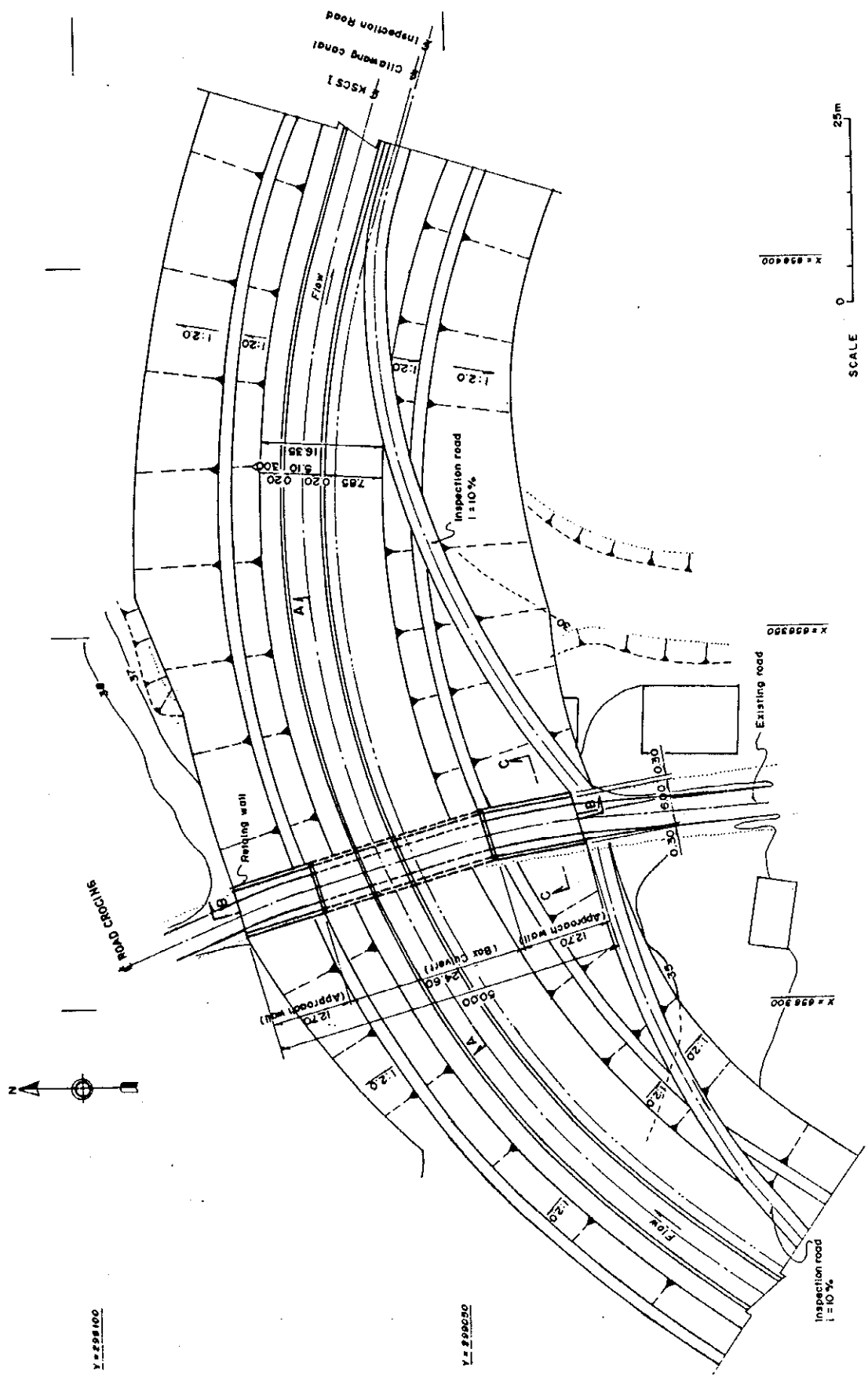


Figure 85 ROAD CROSSING AT BR-11 AT DESA CIKASUNGKA (1/2)

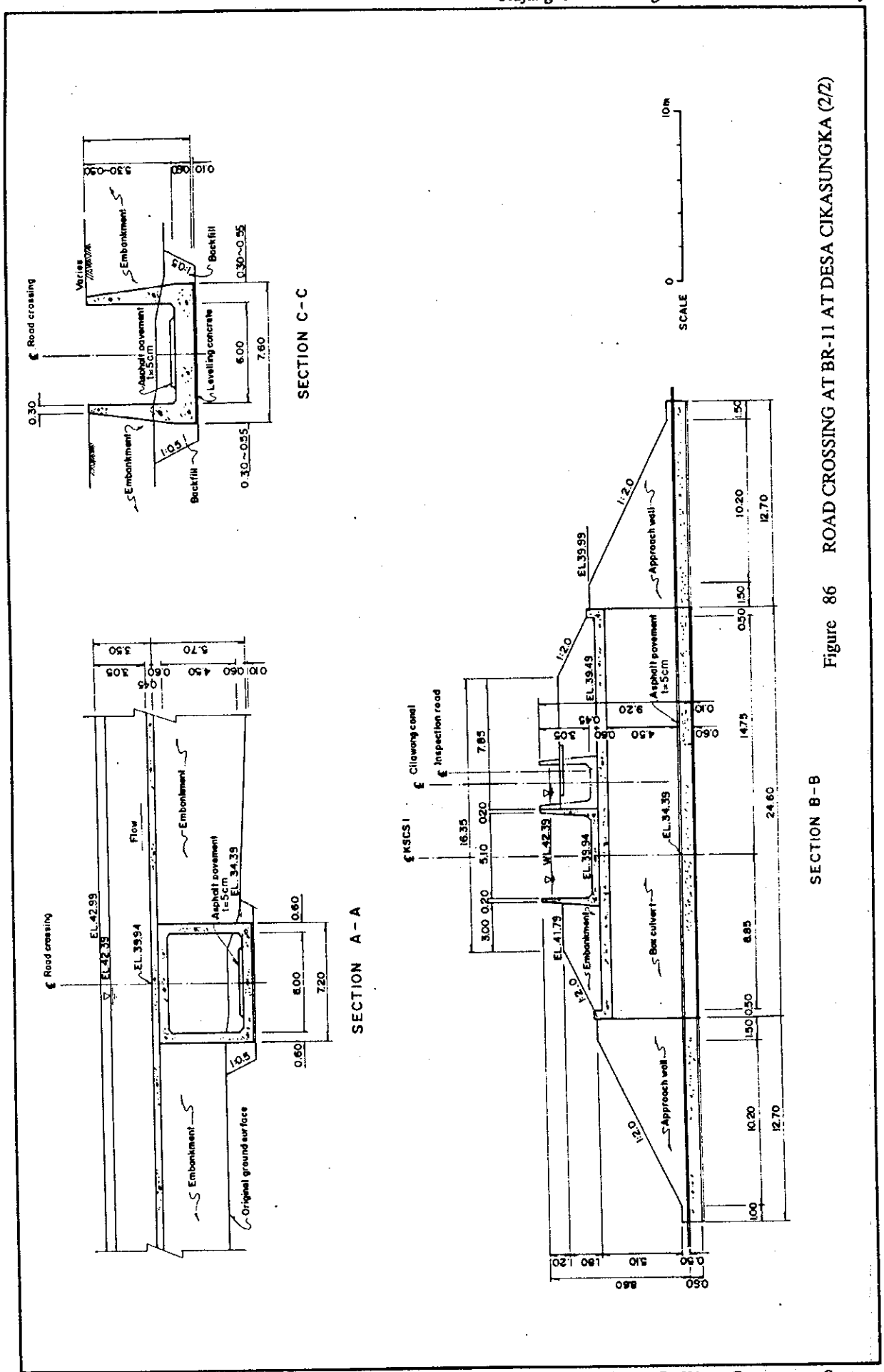


Figure 86 ROAD CROSSING AT BR-11 AT DESA CIKASUNGKA (2/2)

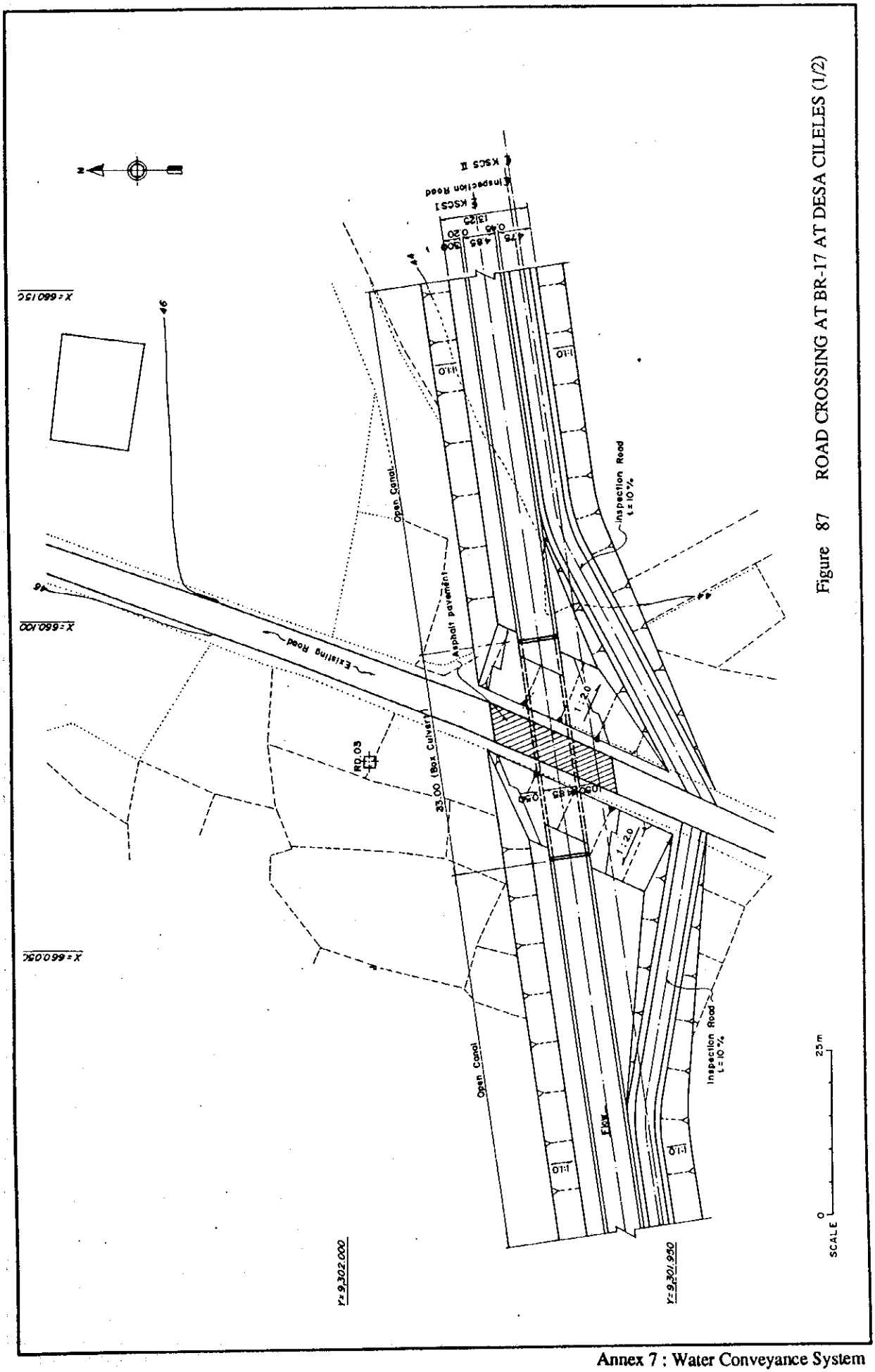
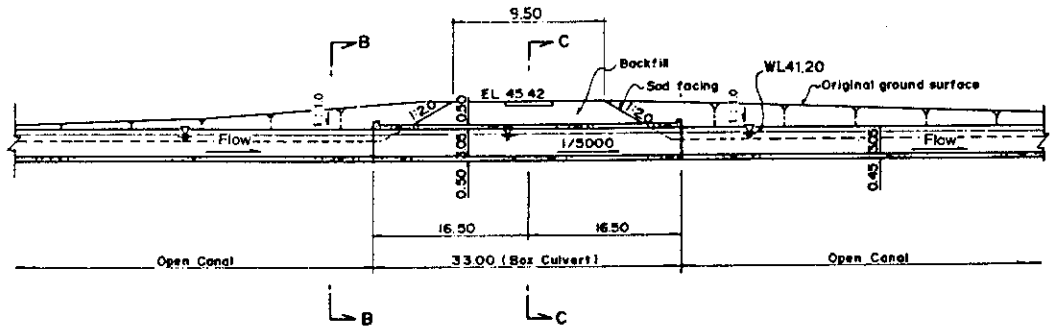
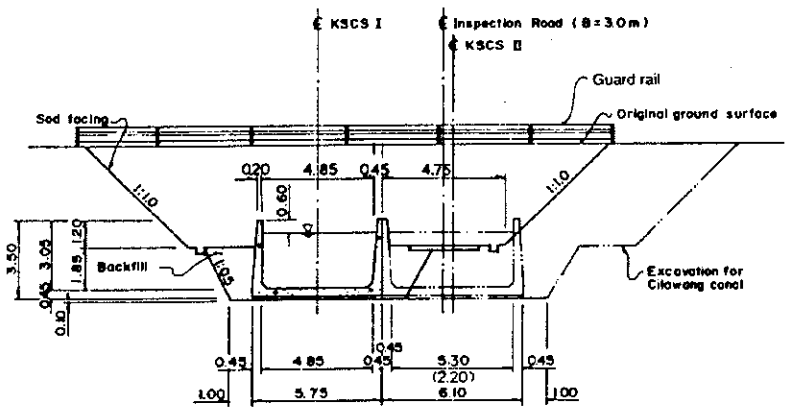


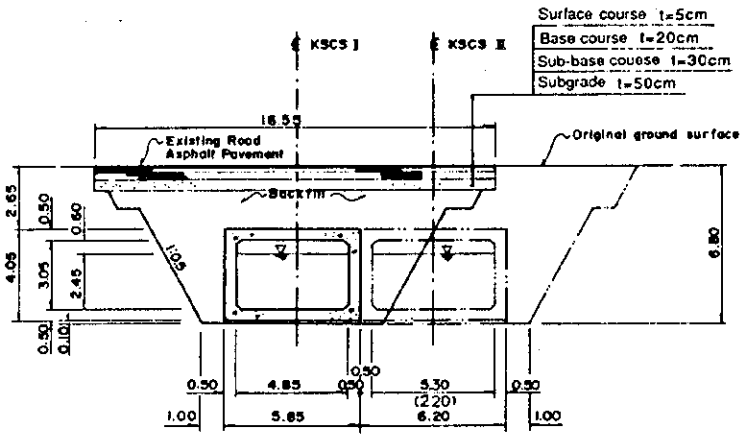
Figure 87 ROAD CROSSING AT BR-17 AT DESA CILELES (1/2)



SECTION A-A SCALE A



SECTION B-B SCALE B



SECTION C-C SCALE B

NOTE ;
KSCS : Karian Serpeng Conveyance System

SCALE A 0 — 25m

SCALE B 0 — 10m

Note : Dimensions shown in parentheses are applied in phase IIA.

Figure 88 ROAD CROSSING AT BR-17 AT DESA CILELES (2/2)

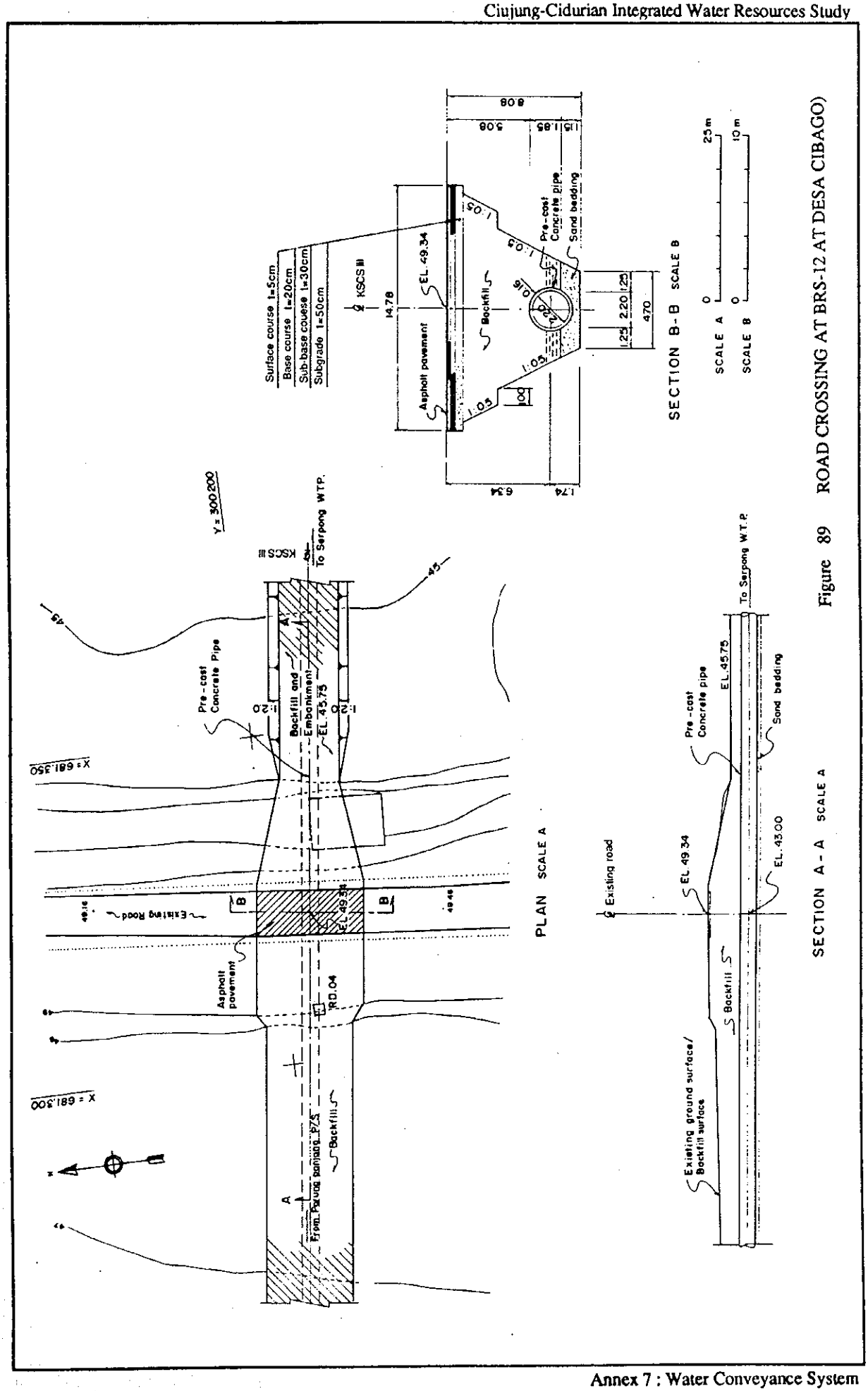


Figure 89 ROAD CROSSING AT BRS-12 AT DESA CIBAGO)

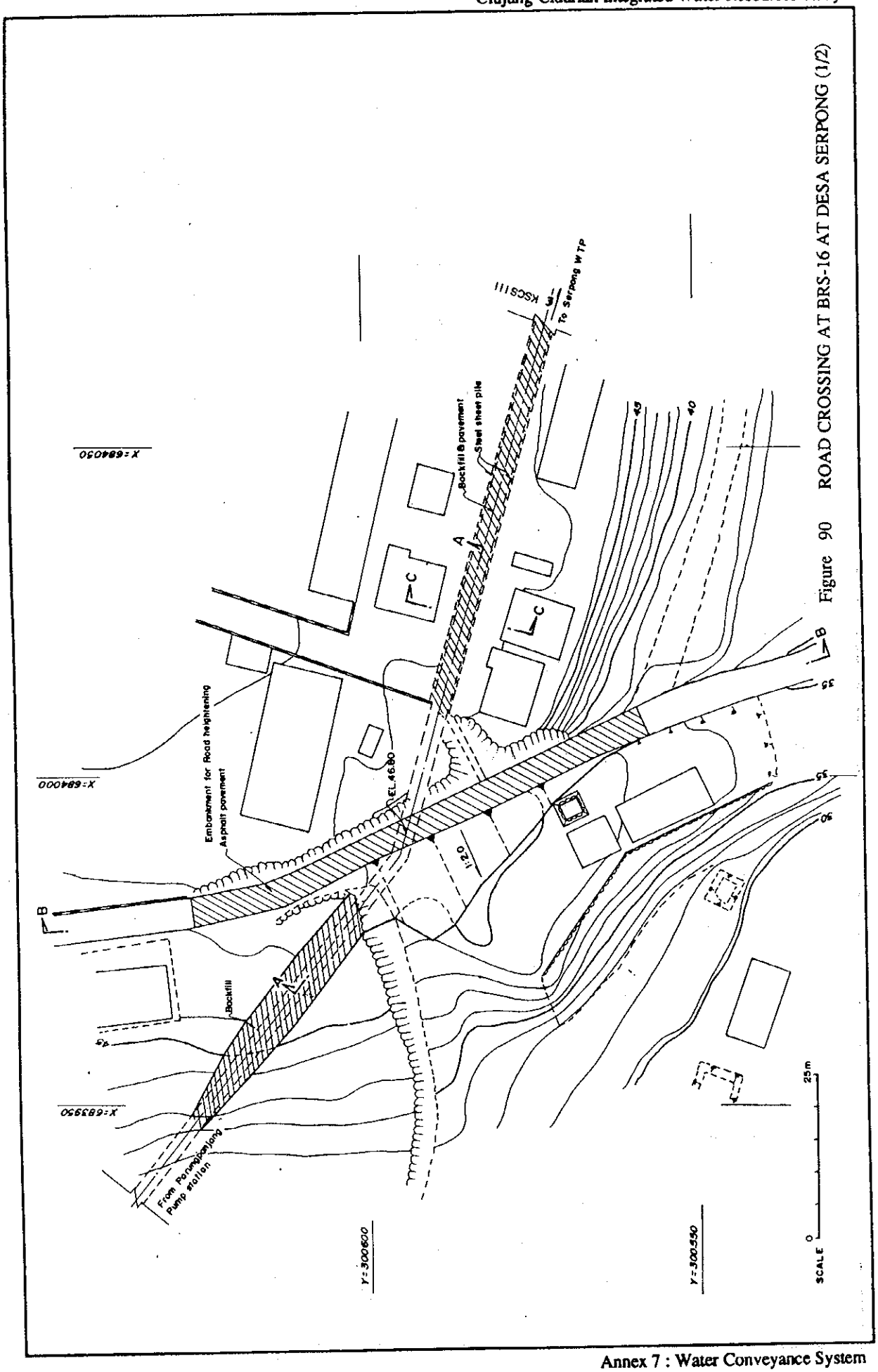


Figure 90 ROAD CROSSING AT BRS-16 AT DESA SERPONG (1/2)

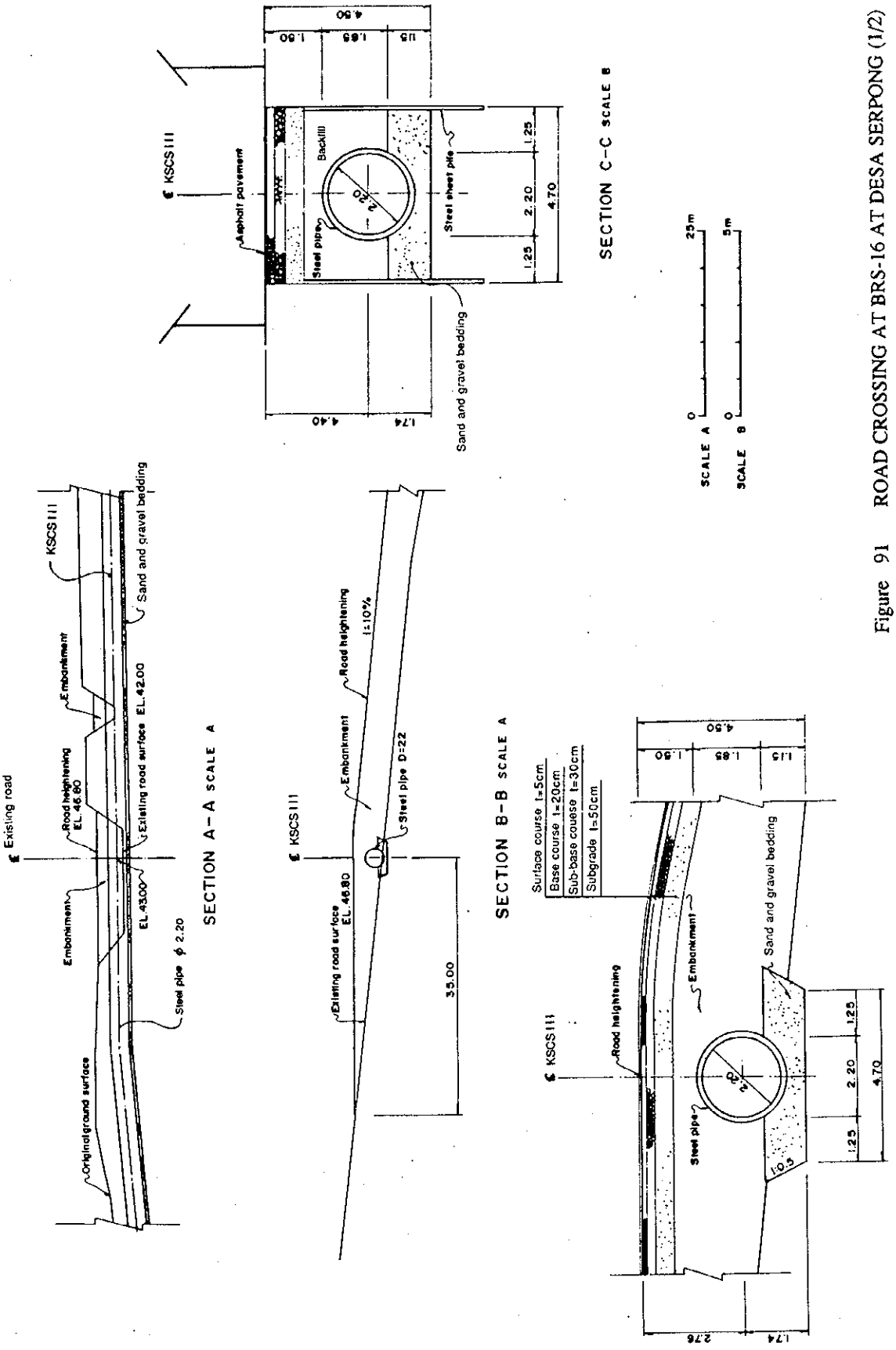
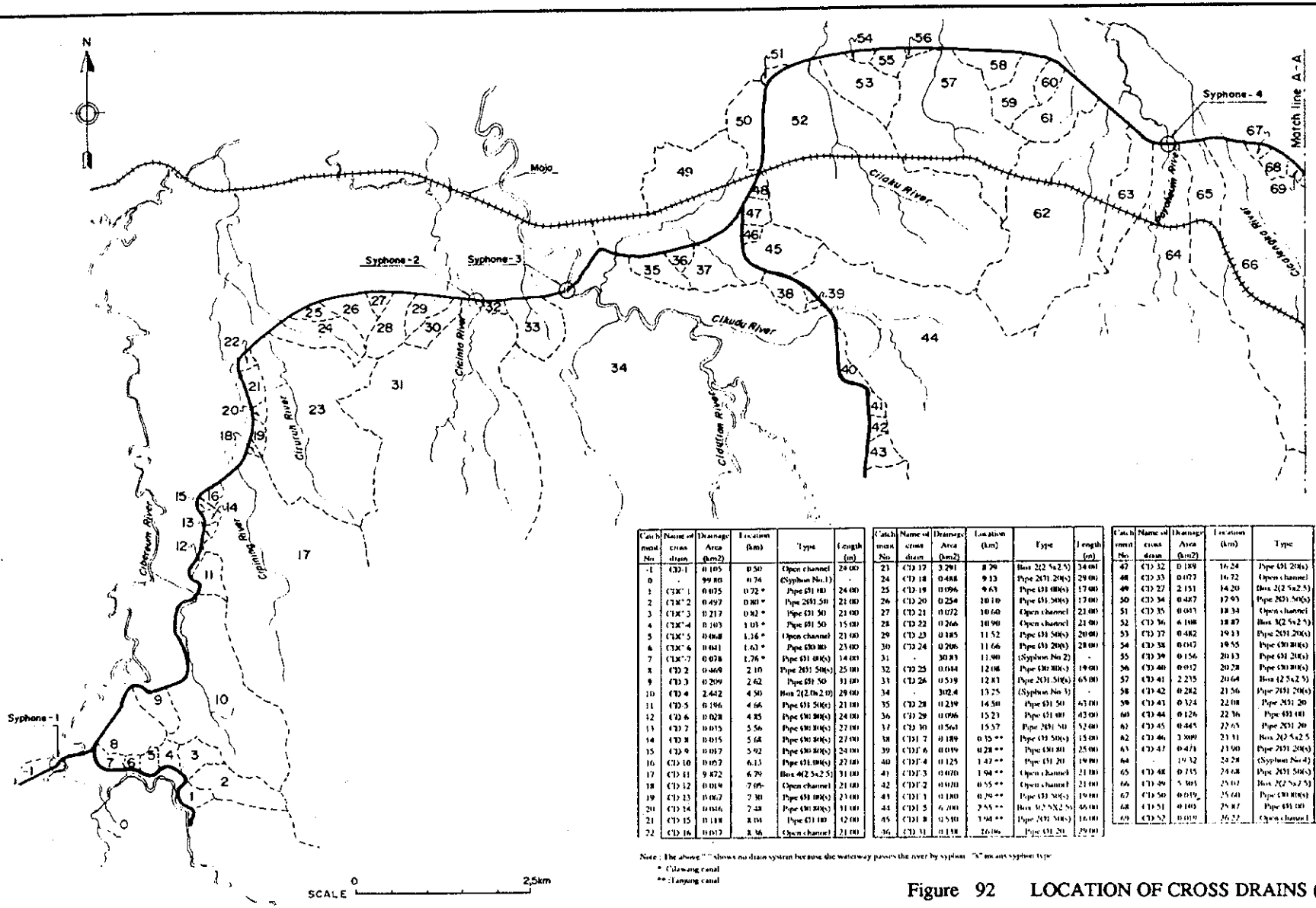


Figure 91 ROAD CROSSING AT BRS-16 AT DESA SERPONG (1/2)



Catchment No.	Name of cross drain	Drainage Area (km2)	Location (km)	Type	Length (m)
-1	CD-1	0.105	0.50	Open channel	24.00
0	-	99.80	0.74	(Syphon No.1)	-
1	CDC 1	0.075	0.72 *	Pipe Ø1.00	24.00
2	CDC 2	0.497	0.80 *	Pipe 2Ø1.50	21.00
3	CDC 3	0.217	0.82 *	Pipe Ø1.50	21.00
4	CDC 4	0.103	1.01 *	Pipe Ø1.50	15.00
5	CDC 5	0.068	1.16 *	Open channel	21.00
6	CDC 6	0.041	1.63 *	Pipe Ø0.80	23.00
7	CDC 7	0.078	1.76 *	Pipe Ø1.00(s)	14.00
8	CD 2	0.460	2.10	Pipe 2Ø1.50(s)	25.00
9	CD 3	0.209	2.62	Pipe Ø1.50	31.00
10	CD 4	2.442	4.50	Box 2(2.0x2.0)	29.00
11	CD 5	0.196	4.66	Pipe Ø1.50(s)	21.00
12	CD 6	0.028	4.85	Pipe Ø0.80(s)	24.00
13	CD 7	0.035	5.56	Pipe Ø0.80(s)	27.00
14	CD 8	0.035	5.68	Pipe Ø0.80(s)	27.00
15	CD 9	0.017	5.92	Pipe Ø0.80(s)	24.00
16	CD 10	0.057	6.13	Pipe Ø1.00(s)	27.00
17	CD 11	9.872	6.79	Box 4(2.5x2.5)	31.00
18	CD 12	0.018	7.05	Open channel	21.00
19	CD 13	0.067	7.30	Pipe Ø1.00(s)	23.00
20	CD 14	0.046	7.48	Pipe Ø0.80(s)	31.00
21	CD 15	0.118	8.04	Pipe Ø1.00	42.00
22	CD 16	0.012	8.36	Open channel	21.00

Catchment No.	Name of cross drain	Drainage Area (km2)	Location (km)	Type	Length (m)
23	CD 17	3.291	8.79	Box 2(2.5x2.5)	34.00
24	CD 18	0.488	9.33	Pipe 2Ø1.20(s)	29.00
25	CD 19	0.096	9.63	Pipe Ø1.00(s)	17.00
26	CD 20	0.254	10.10	Pipe Ø1.50(s)	17.00
27	CD 21	0.072	10.60	Open channel	21.00
28	CD 22	0.266	10.90	Open channel	21.00
29	CD 23	0.185	11.52	Pipe Ø1.50(s)	20.00
30	CD 24	0.206	11.66	Pipe Ø1.20(s)	28.00
31	-	30.83	11.90	(Syphon No.2)	-
32	CD 25	0.044	12.08	Pipe Ø0.80(s)	19.00
33	CD 26	0.539	12.83	Pipe 2Ø1.50(s)	65.00
34	-	302.4	13.25	(Syphon No.3)	-
35	CD 28	0.239	14.50	Pipe Ø1.50	63.00
36	CD 29	0.096	15.23	Pipe Ø1.00	42.00
37	CD 30	0.561	15.57	Pipe 2Ø1.50	52.00
38	CDI 7	0.189	0.35 **	Pipe Ø1.50(s)	15.00
39	CDI 6	0.039	0.28 **	Pipe Ø0.80	25.00
40	CDI 4	0.125	1.47 **	Pipe Ø1.20	19.00
41	CDI 3	0.070	1.94 **	Open channel	21.00
42	CDI 2	0.070	0.55 **	Open channel	21.00
43	CDI 1	0.180	0.29 **	Pipe Ø1.50(s)	19.00
44	CDI 5	6.000	2.55 **	Box 3(2.5X2.5)	46.00
45	CDI 8	0.530	3.98 **	Pipe 3Ø1.50(s)	16.00
46	CD 31	0.138	16.06	Pipe Ø1.20	29.00

Catchment No.	Name of cross drain	Drainage Area (km2)	Location (km)	Type	Length (m)
47	CD 32	0.189	16.24	Pipe Ø1.20(s)	15.00
48	CD 33	0.077	16.72	Open channel	21.00
49	CD 27	2.151	14.20	Box 2(2.5x2.5)	89.00
50	CD 34	0.487	17.93	Pipe 2Ø1.50(s)	54.00
51	CD 35	0.053	18.34	Open channel	21.00
52	CD 36	6.108	18.87	Box 3(2.5x2.5)	33.00
53	CD 37	0.482	19.13	Pipe 2Ø1.20(s)	34.00
54	CD 38	0.047	19.55	Pipe Ø0.80(s)	32.00
55	CD 39	0.156	20.13	Pipe Ø1.20(s)	35.00
56	CD 40	0.012	20.28	Pipe Ø0.80(s)	35.00
57	CD 41	2.235	20.64	Box (2.5x2.5)	20.00
58	CD 42	0.282	21.56	Pipe 2Ø1.20(s)	30.00
59	CD 43	0.324	22.08	Pipe 2Ø1.20	38.00
60	CD 44	0.126	22.36	Pipe Ø1.00	41.00
61	CD 45	0.445	22.65	Pipe 2Ø1.20	14.00
62	CD 46	3.009	23.31	Box 2(2.5x2.5)	28.00
63	CD 47	0.471	23.90	Pipe 2Ø1.20(s)	34.00
64	-	19.32	24.28	(Syphon No.4)	-
65	CD 48	0.735	24.68	Pipe 2Ø1.50(s)	23.00
66	CD 49	5.303	25.02	Box 2(2.5x2.5)	35.00
67	CD 50	0.019	25.60	Pipe Ø0.80(s)	28.00
68	CD 51	0.140	25.87	Pipe Ø1.00	32.00
69	CD 52	0.019	26.22	Open channel	21.00

Note : The above "-" shows no drain system because the waterway passes the river by syphon. "S" means syphon type

* Cilawang canal

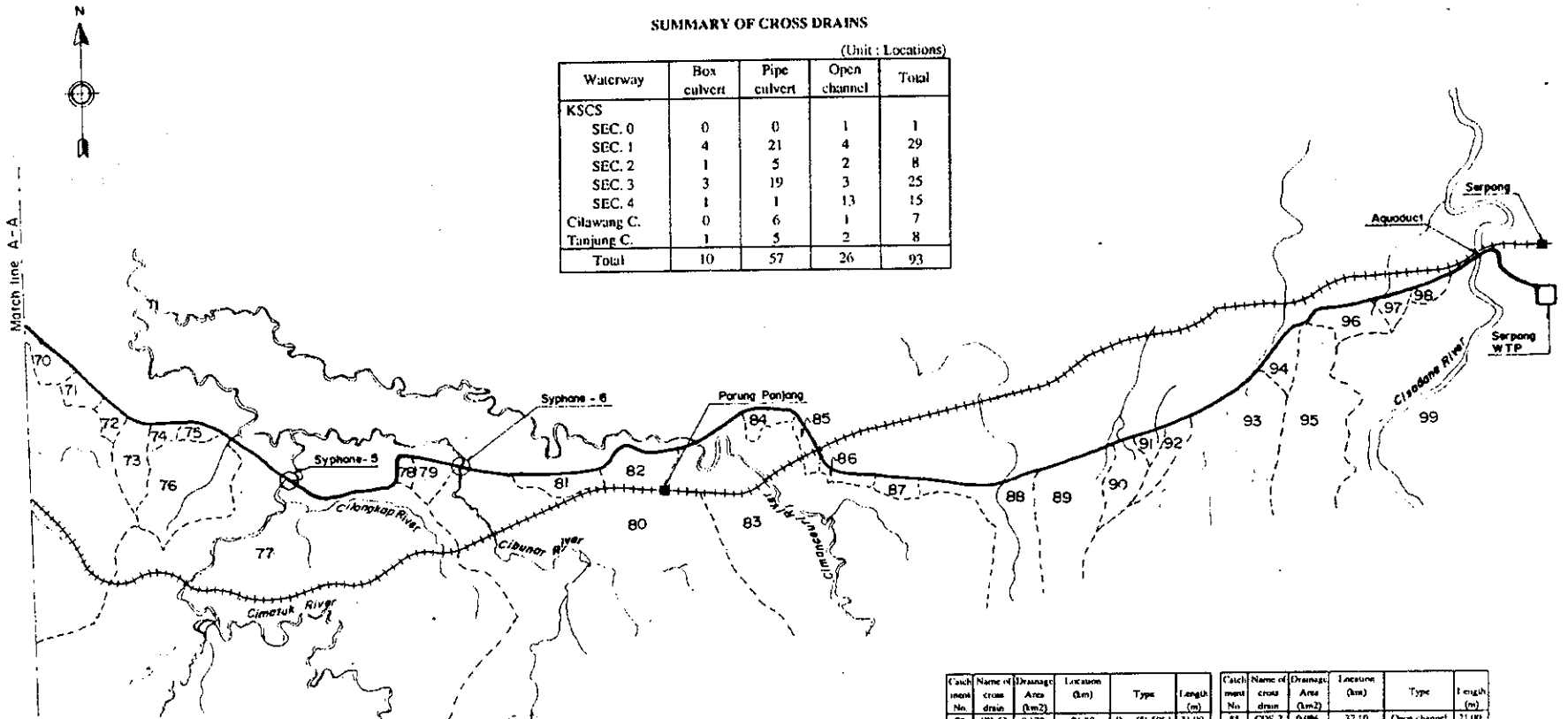
** Tanjung canal

Figure 92 LOCATION OF CROSS DRAINS (1/2)

SUMMARY OF CROSS DRAINS

(Unit : Locations)

Waterway	Box culvert	Pipe culvert	Open channel	Total
KSCS				
SEC. 0	0	0	1	1
SEC. 1	4	21	4	29
SEC. 2	1	5	2	8
SEC. 3	3	19	3	25
SEC. 4	1	1	13	15
Cilawang C.	0	6	1	7
Tanjung C.	1	5	2	8
Total	10	57	26	93



Catchment No.	Name of cross drain	Drainage Area (km2)	Location (km)	Type	Length (m)
70	CD-53	0.172	26.80	Pipe ϕ1.50(s)	31.00
71	CD-54	0.140	27.30	Open channel	21.00
72	CD-55	0.106	27.80	Pipe ϕ1.00(s)	26.00
73	CD-56	0.336	28.20	Pipe 2ϕ1.20	33.00
74	CD-57	0.085	28.40	Pipe ϕ1.00	40.00
75	CD-58	0.086	28.90	Pipe ϕ1.00	34.00
76	CD-59	0.812	29.23	Pipe 2ϕ1.50	37.00
77		88.25	30.12	(Syphon No.5)	-
78	CD-60	0.063	31.68	Pipe ϕ1.00(s)	22.00
79	CD-61	0.179	31.95	Pipe ϕ1.20(s)	29.00
80	-	34.25	32.41	(Syphon No.6)	-
81	CD-62	0.230	33.65	Pipe 2ϕ1.00(s)	20.00
82	CD-63	0.264	34.96	Open channel	21.00
83	-	94.35	35.38	(Syphon No.7)	-
84	CDS-1	0.139	36.30	Open channel	21.00

Catchment No.	Name of cross drain	Drainage Area (km2)	Location (km)	Type	Length (m)
85	CDS-2	0.086	37.10	Open channel	21.00
86	CDS-3	0.084	37.73	Open channel	21.00
87	CDS-4	0.110	38.40	Open channel	21.00
88	CDS-5	1.500	39.68	Box (2.5x2.5)	80.00
89	CDS-6	1.300	40.93	Open channel	21.00
90	CDS-7	0.336	41.11	Open channel	21.00
91	CDS-8	0.070	41.50	Open channel	21.00
92	CDS-9	0.209	41.86	Open channel	21.00
93	CDS-10	10.15	42.83	Open channel	50.00
94	CDS-11	0.204	43.48	Open channel	21.00
95	CDS-12	1.745	43.77	Open channel	21.00
96	CDS-13	0.271	44.50	Open channel	21.00
97	CDS-14	0.097	44.88	Open channel	21.00
98	CDS-15	0.096	45.60	Pipe ϕ1.00(s)	9.00
99	-	104.8	46.08	(Aqueduct)	-

Note : The above "-" shows no drain system because the waterway passes the river by syphon. "s" means syphon type.

SCALE 0 — 2.5km

Figure 93 LOCATION OF CROSS DRAINS (2/2)

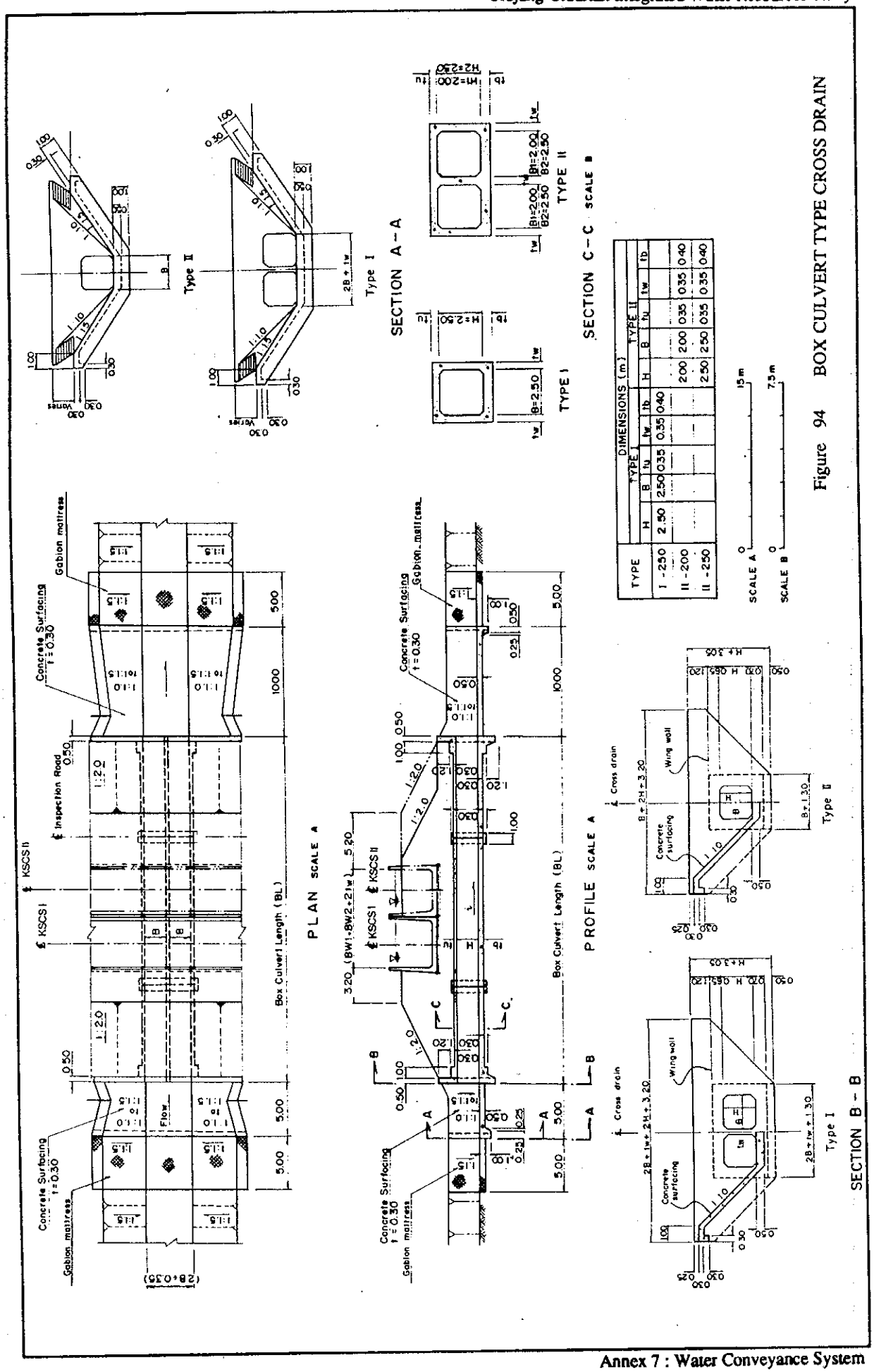
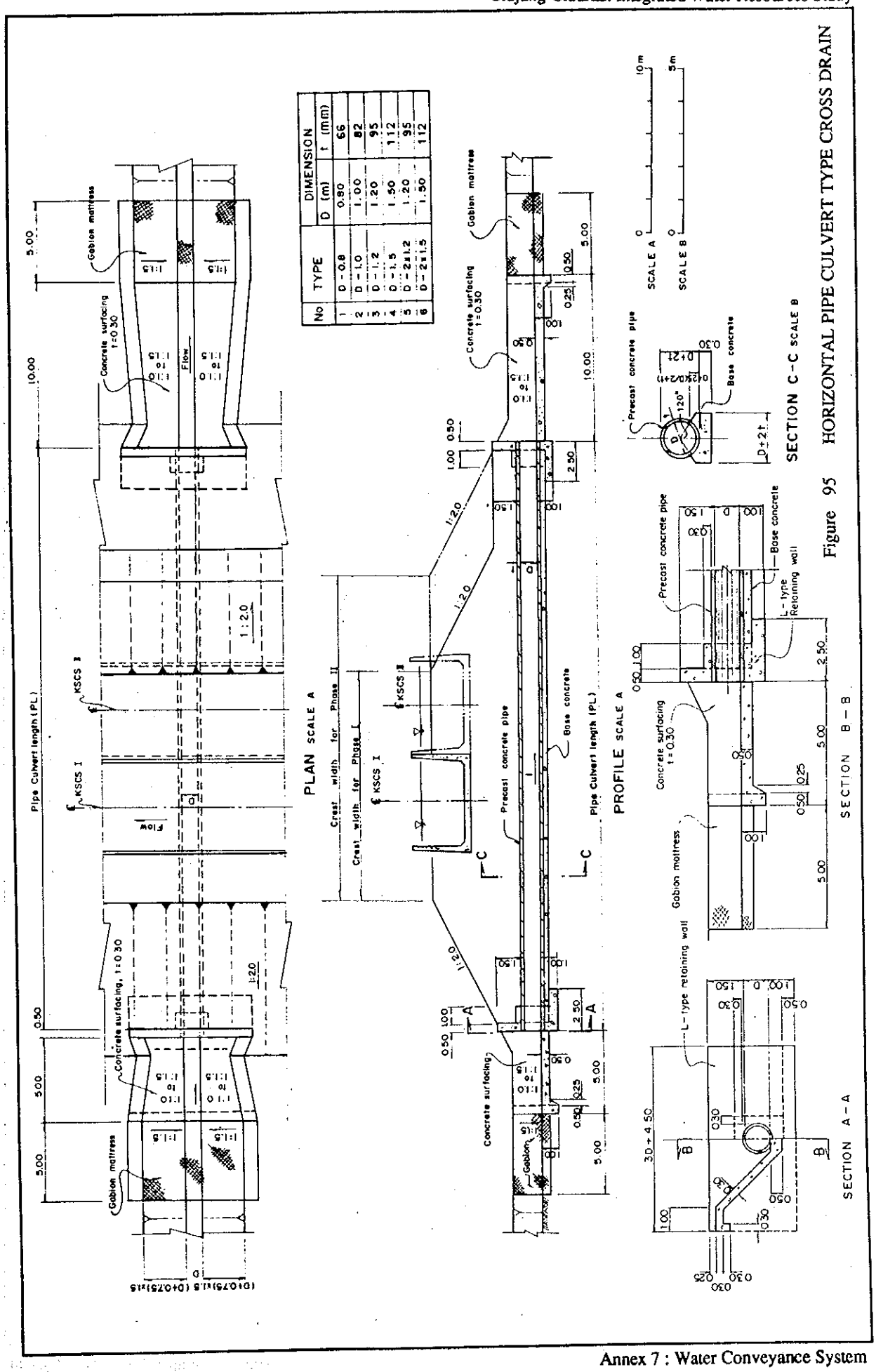
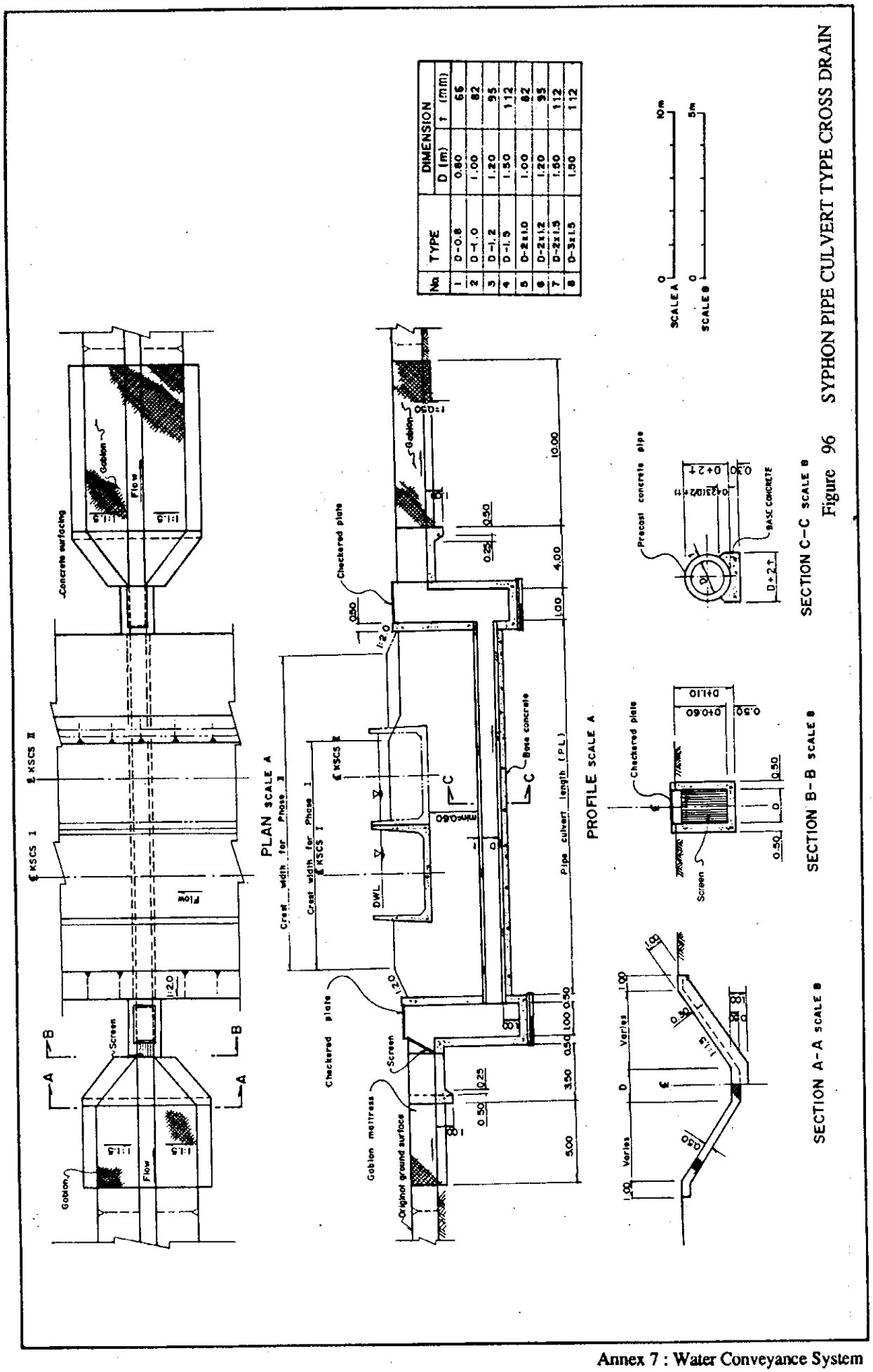


Figure 94 BOX CULVERT TYPE CROSS DRAIN



No	TYPE	DIMENSION D (m)	t (mm)
1	D - 0.8	0.80	66
2	D - 1.0	1.00	82
3	D - 1.2	1.20	95
4	D - 1.5	1.50	112
5	D - 2x1.2	1.20	95
6	D - 2x1.5	1.50	112

Figure 95 HORIZONTAL PIPE CULVERT TYPE CROSS DRAIN



No.	TYPE	DIMENSION D (m)	t (mm)
1	D-0.8	0.80	66
2	D-1.0	1.00	82
3	D-1.2	1.20	95
4	D-1.5	1.50	112
5	D-2x1.0	1.00	82
6	D-2x1.2	1.20	95
7	D-2x1.5	1.50	112
8	D-3x1.5	1.50	112

Figure 96 SYPHON PIPE CULVERT TYPE CROSS DRAIN

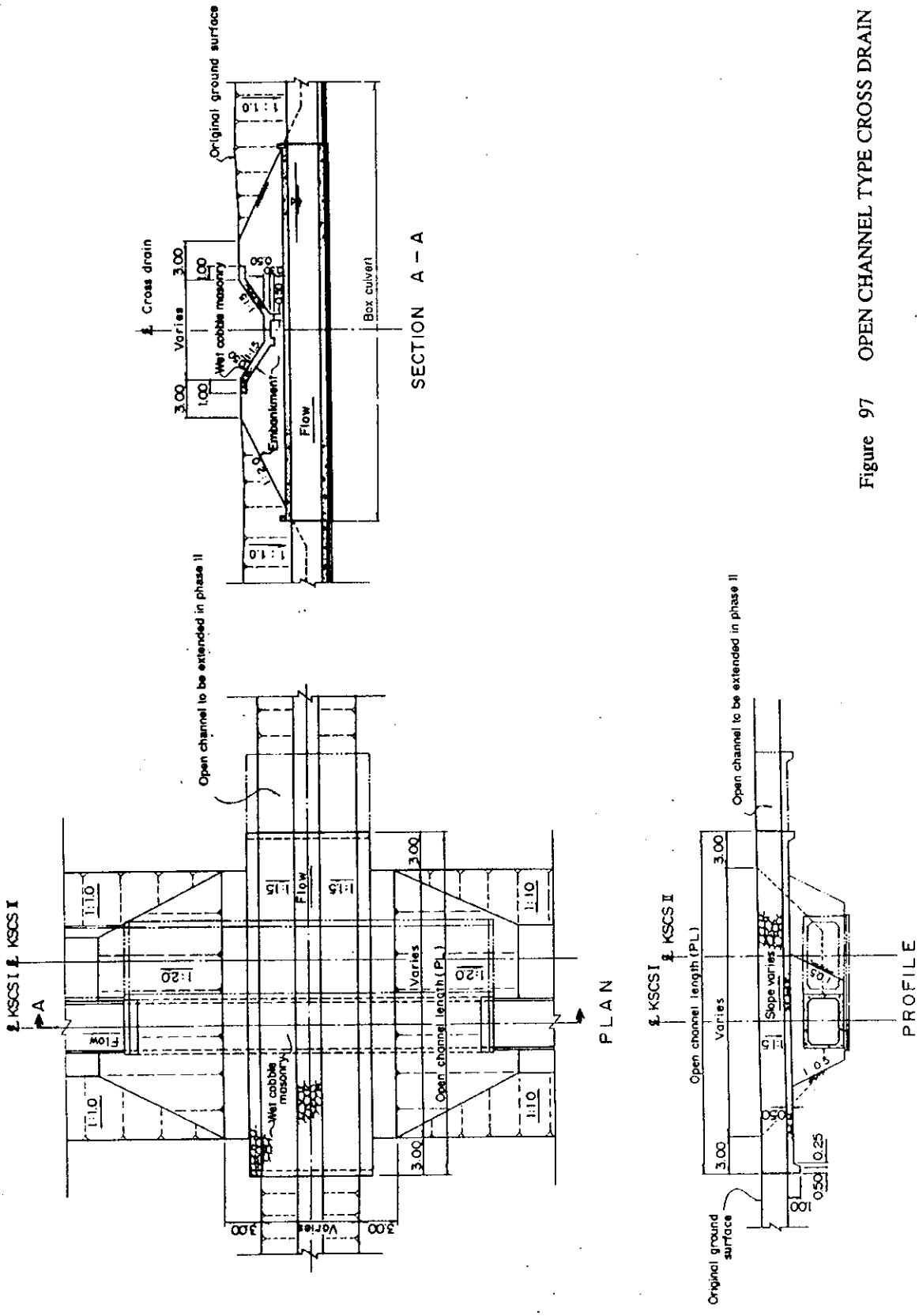


Figure 97 OPEN CHANNEL TYPE CROSS DRAIN

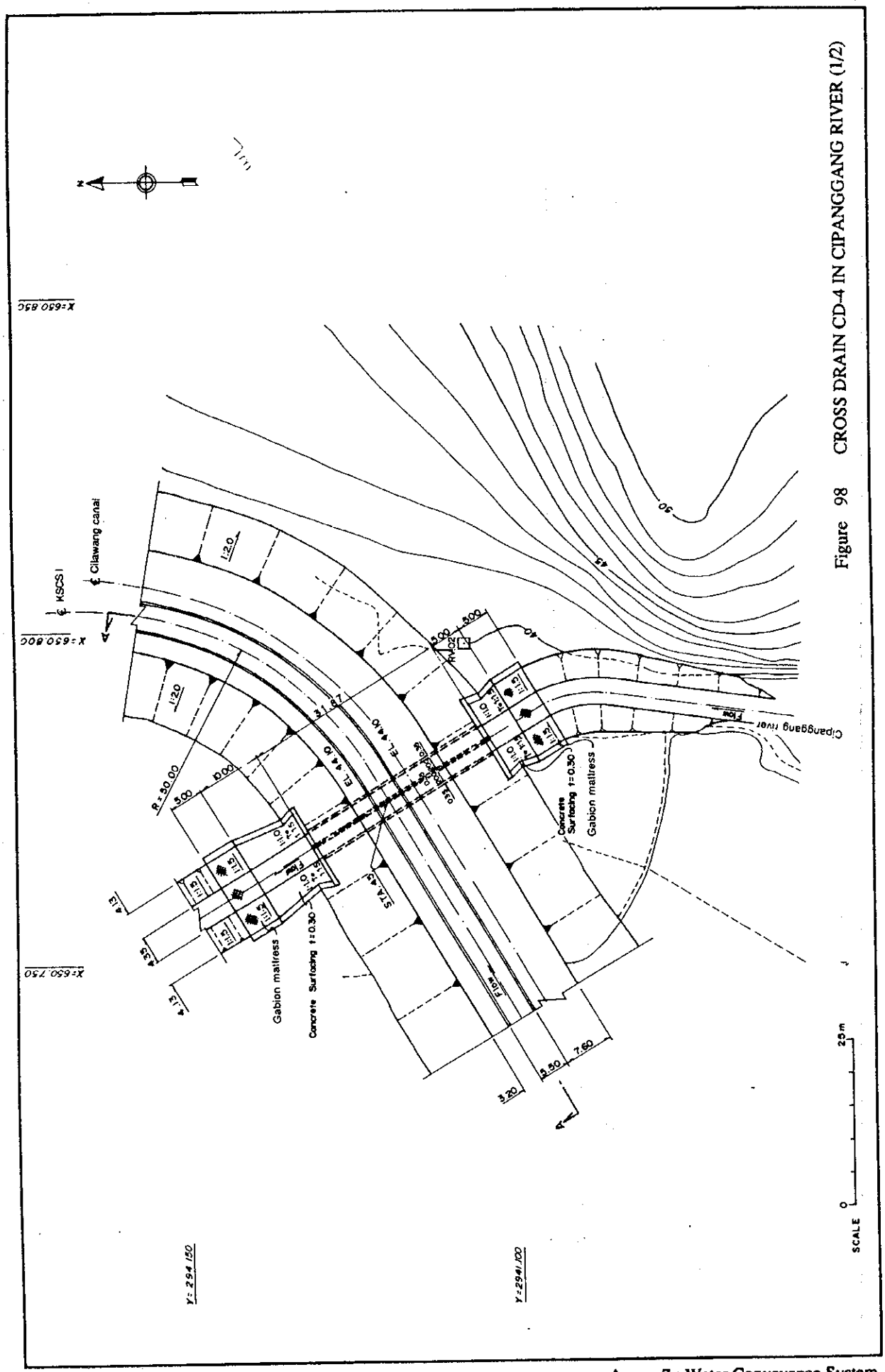


Figure 98 CROSS DRAIN CD-4 IN CIPANGGANG RIVER (1/2)

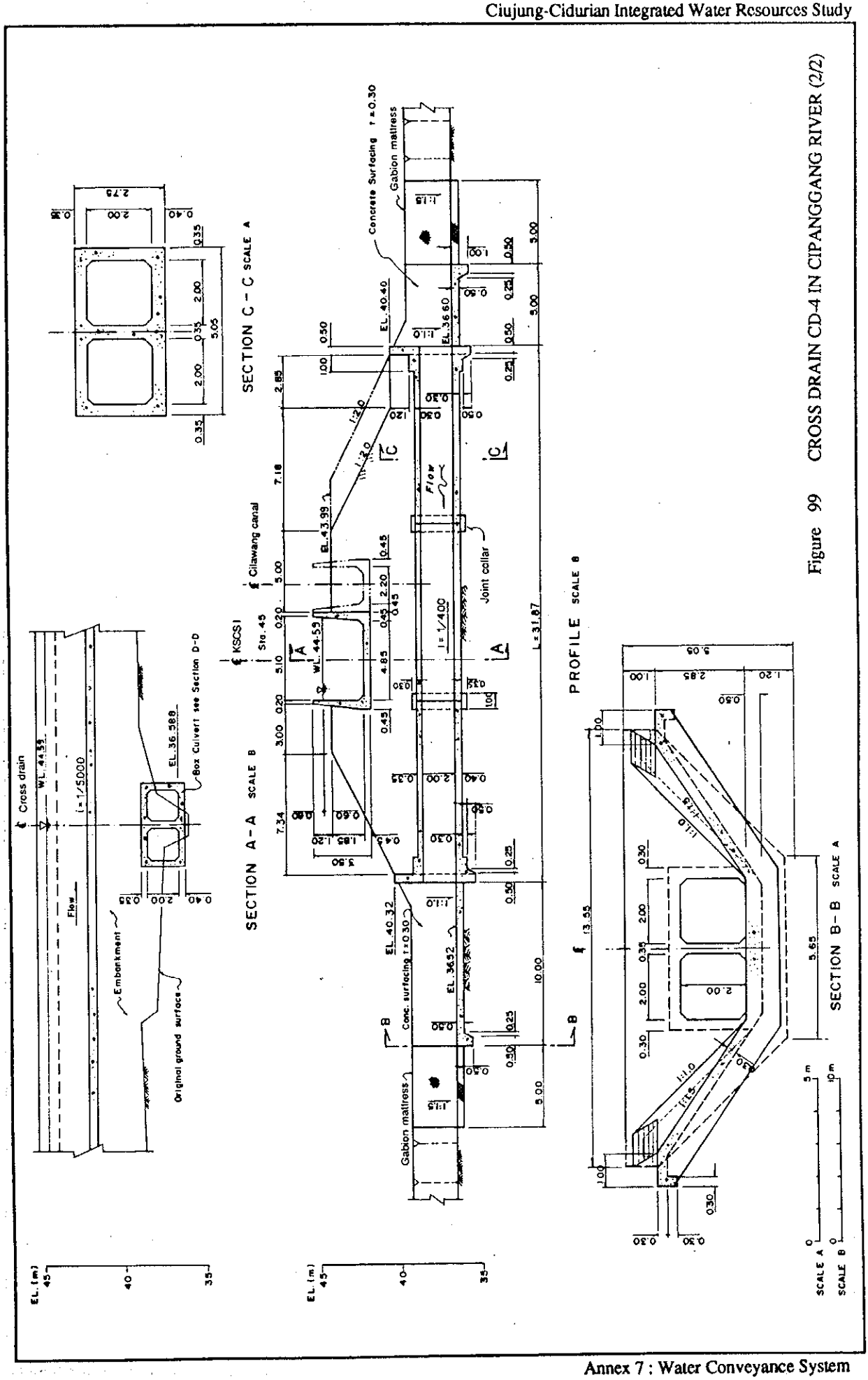


Figure 99 CROSS DRAIN CD-4 IN CIPANGGANG RIVER (2/2)

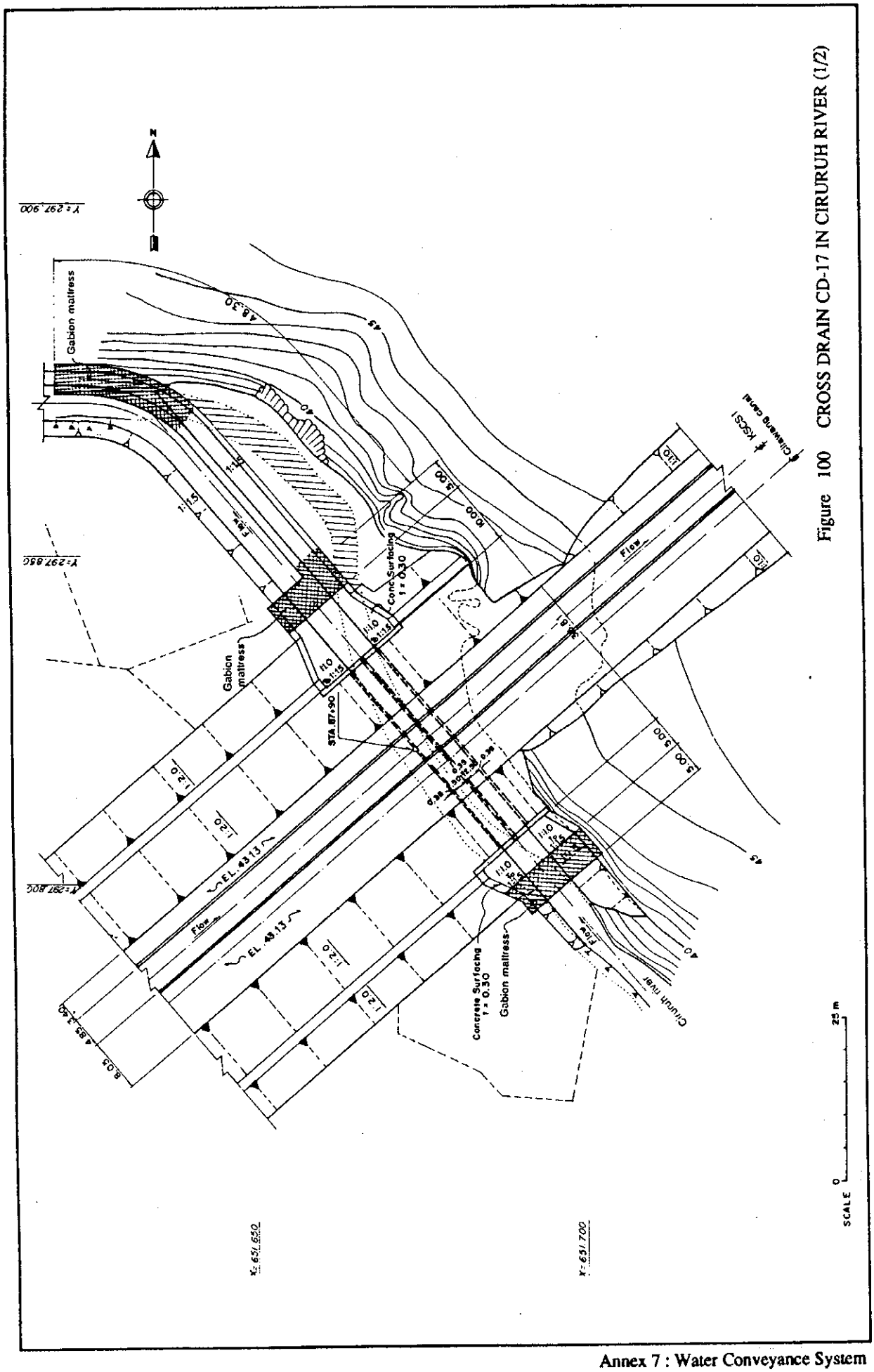


Figure 100 CROSS DRAIN CD-17 IN CIRURUH RIVER (1/2)

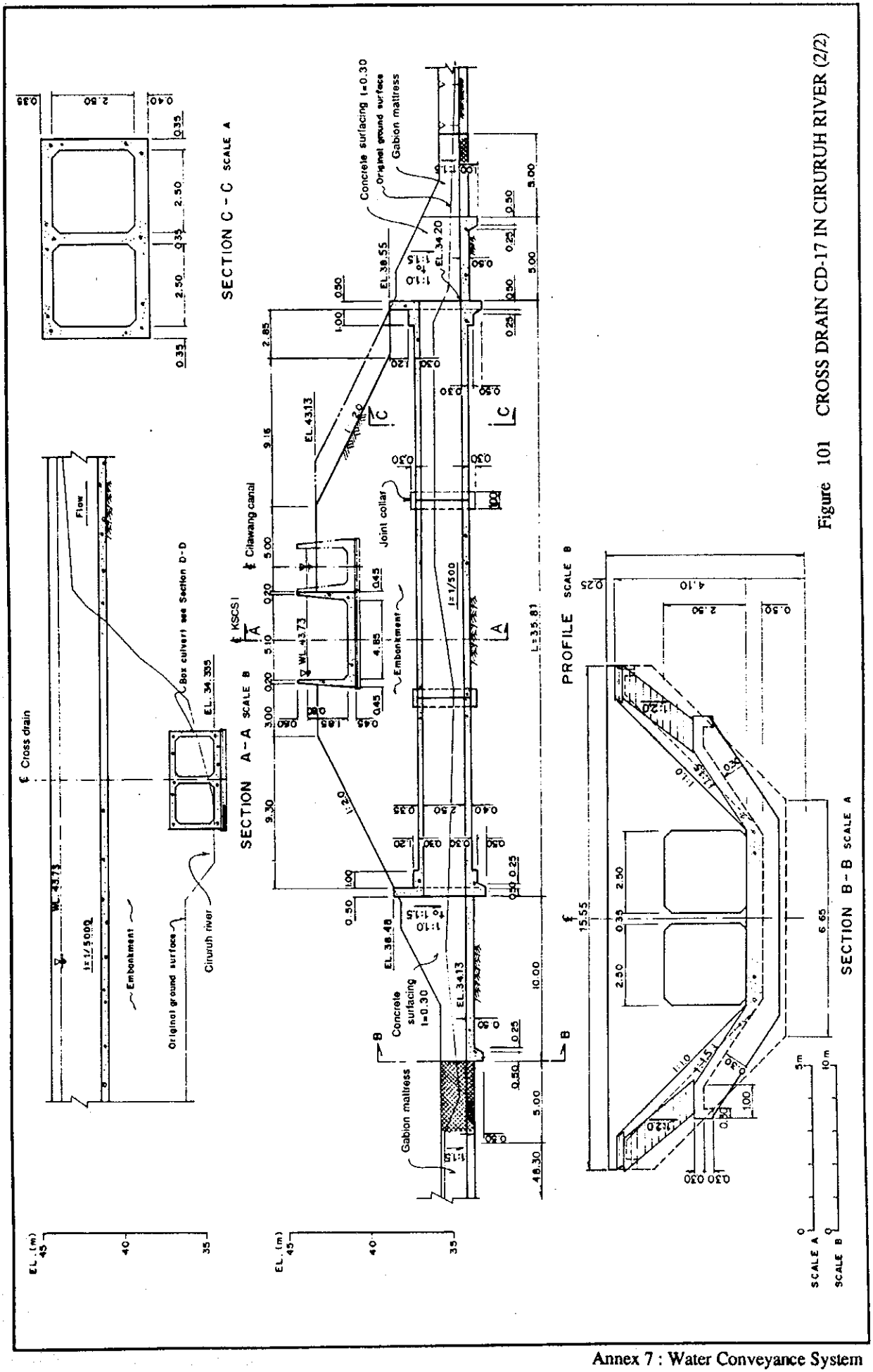


Figure 101 CROSS DRAIN CD-17 IN CIRURUH RIVER (2/2)

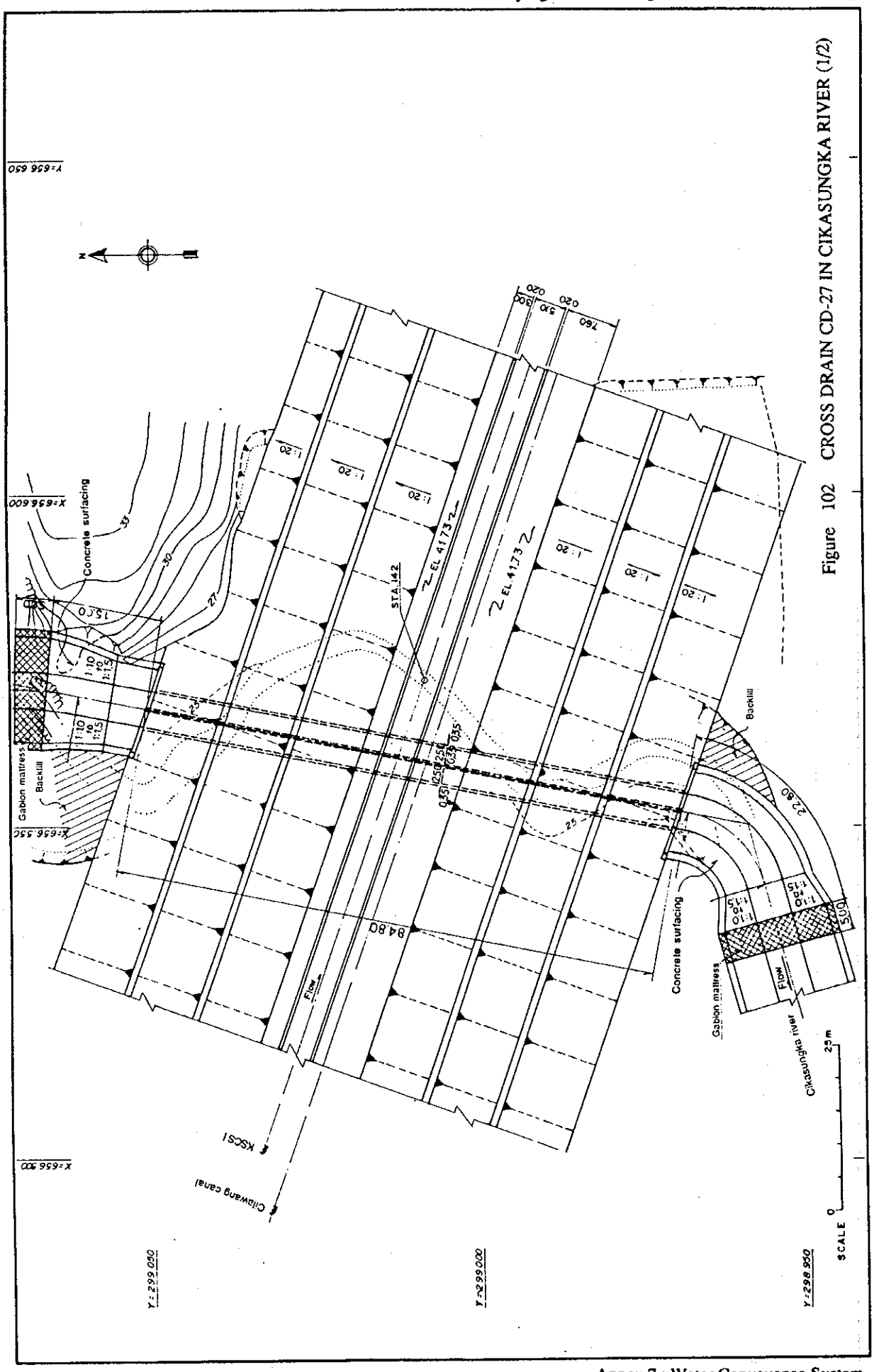


Figure 102 CROSS DRAIN CD-27 IN CIKASUNGKA RIVER (1/2)

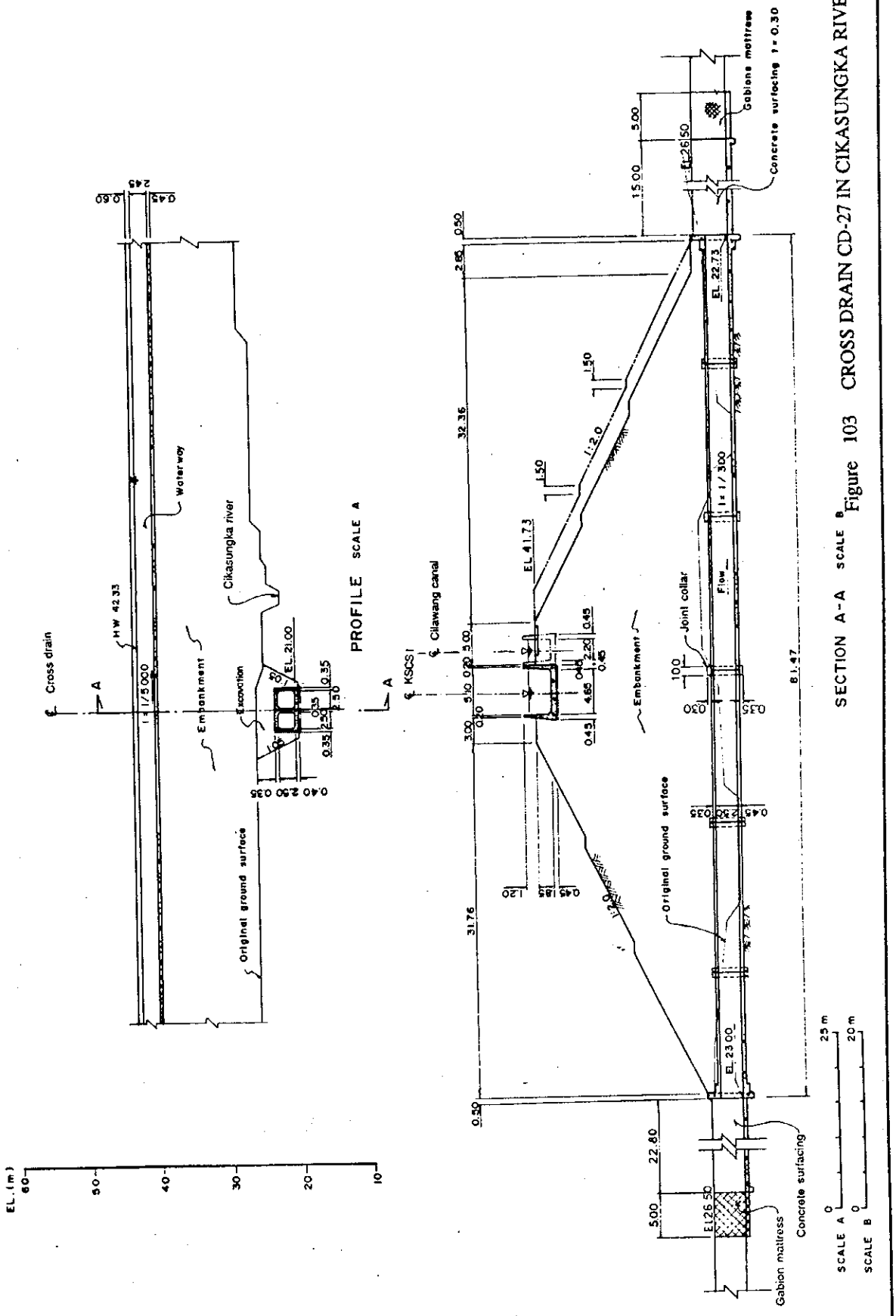
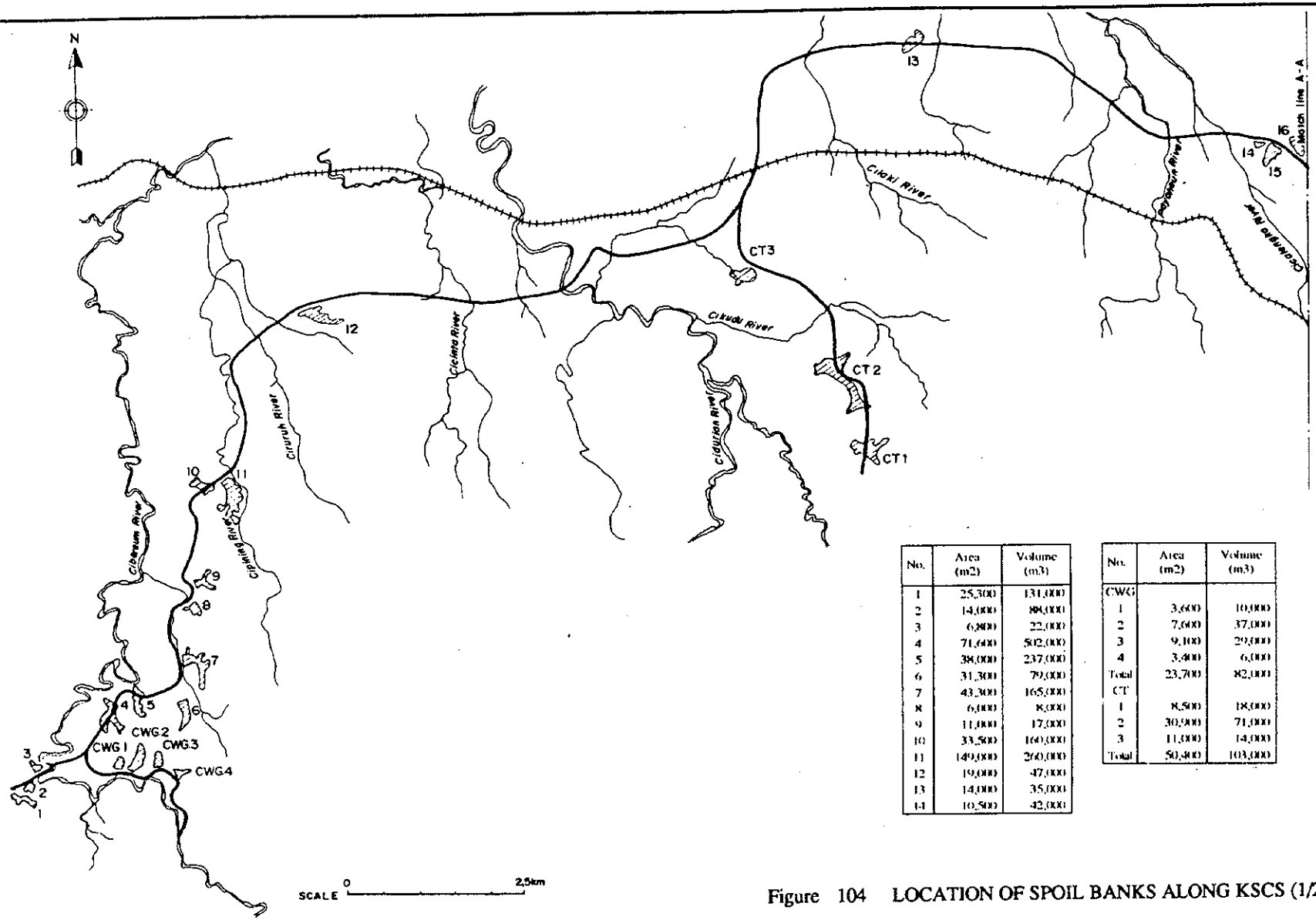


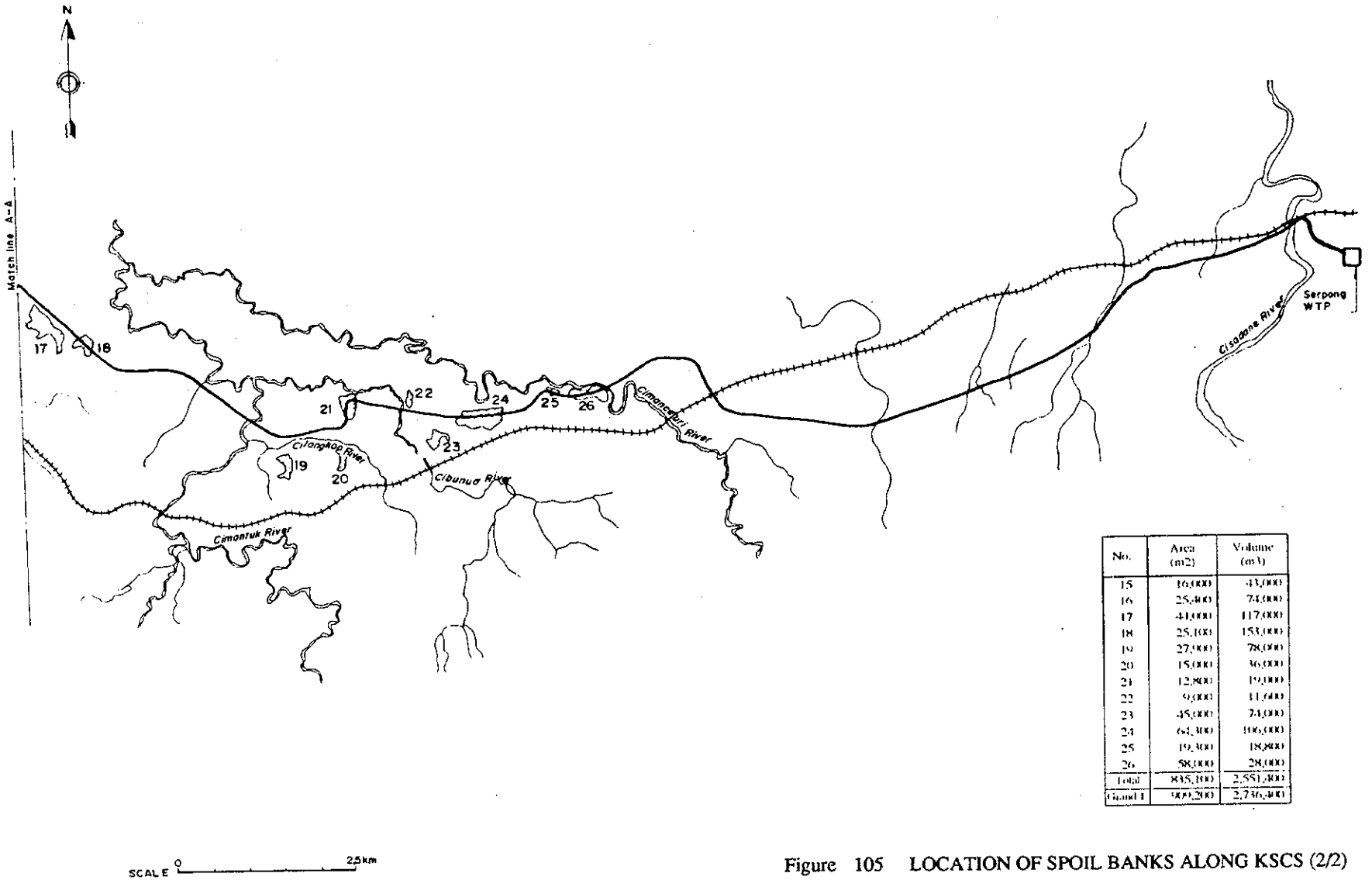
Figure 103 CROSS DRAIN CD-27 IN CIKASUNGKA RIVER (2/2)



No.	Area (m2)	Volume (m3)
1	25,300	131,000
2	14,000	88,000
3	6,800	22,000
4	71,600	502,000
5	38,000	237,000
6	31,300	79,000
7	43,300	165,000
8	6,000	8,000
9	11,000	17,000
10	33,500	160,000
11	149,000	260,000
12	19,000	47,000
13	14,000	35,000
14	10,500	42,000

No.	Area (m2)	Volume (m3)
CWG		
1	3,600	10,000
2	7,000	37,000
3	9,100	29,000
4	3,900	6,000
Total	23,700	82,000
CT		
1	8,500	18,000
2	30,900	71,000
3	11,000	14,000
Total	50,400	103,000

Figure 104 LOCATION OF SPOIL BANKS ALONG KSCS (1/2)



No.	Area (m2)	Volume (m3)
15	16,000	43,000
16	25,400	74,000
17	44,000	117,000
18	25,100	153,000
19	27,900	78,000
20	15,000	36,000
21	12,800	19,000
22	9,000	11,600
23	45,000	74,000
24	63,300	106,000
25	19,300	18,900
26	58,000	28,000
Total	835,300	2,551,300
Grand T	909,200	2,736,400

Figure 105 LOCATION OF SPOIL BANKS ALONG KSCS (2/2)

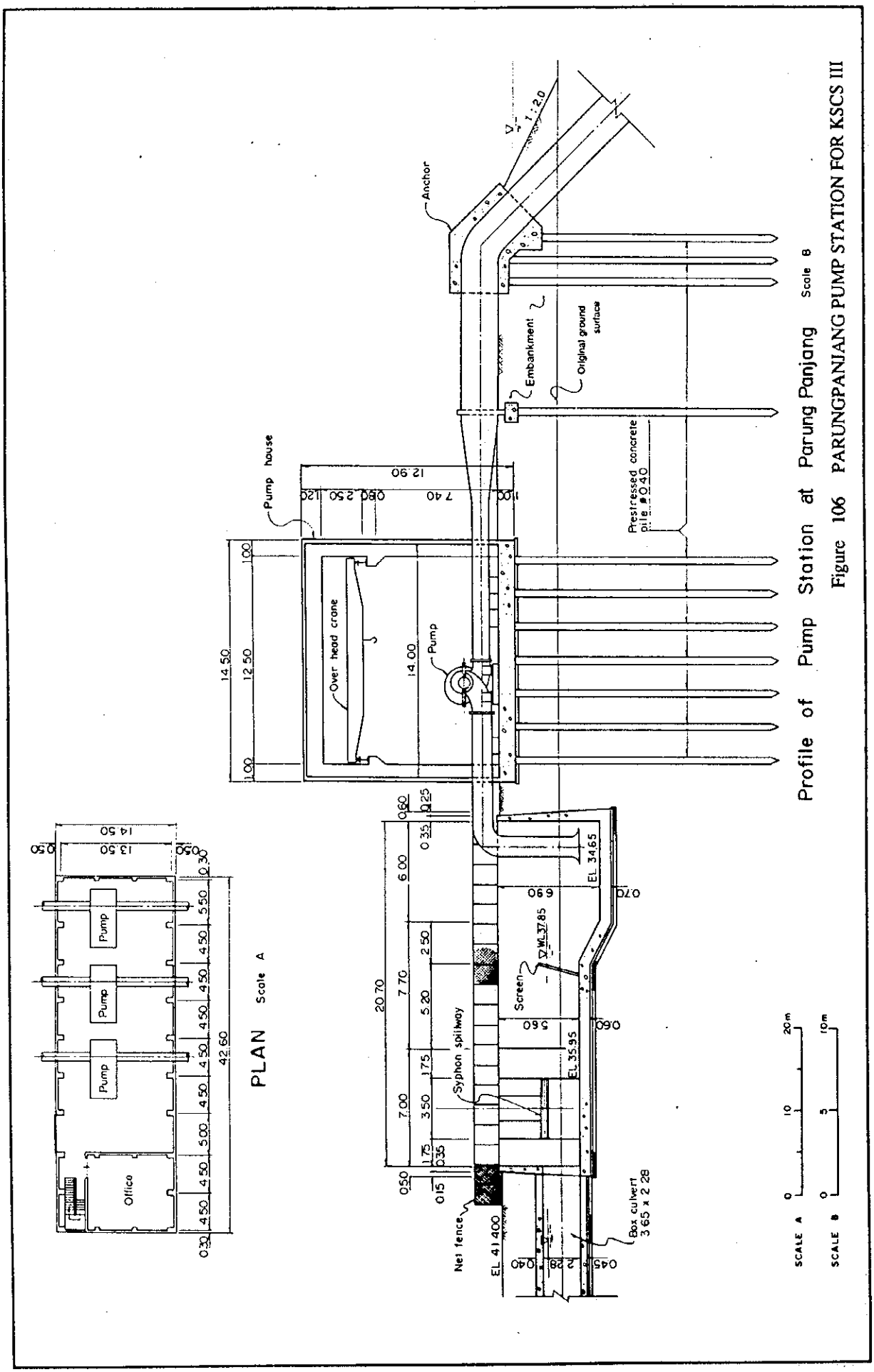


Figure 106 PARUNGPANJANG PUMP STATION FOR KSCS III

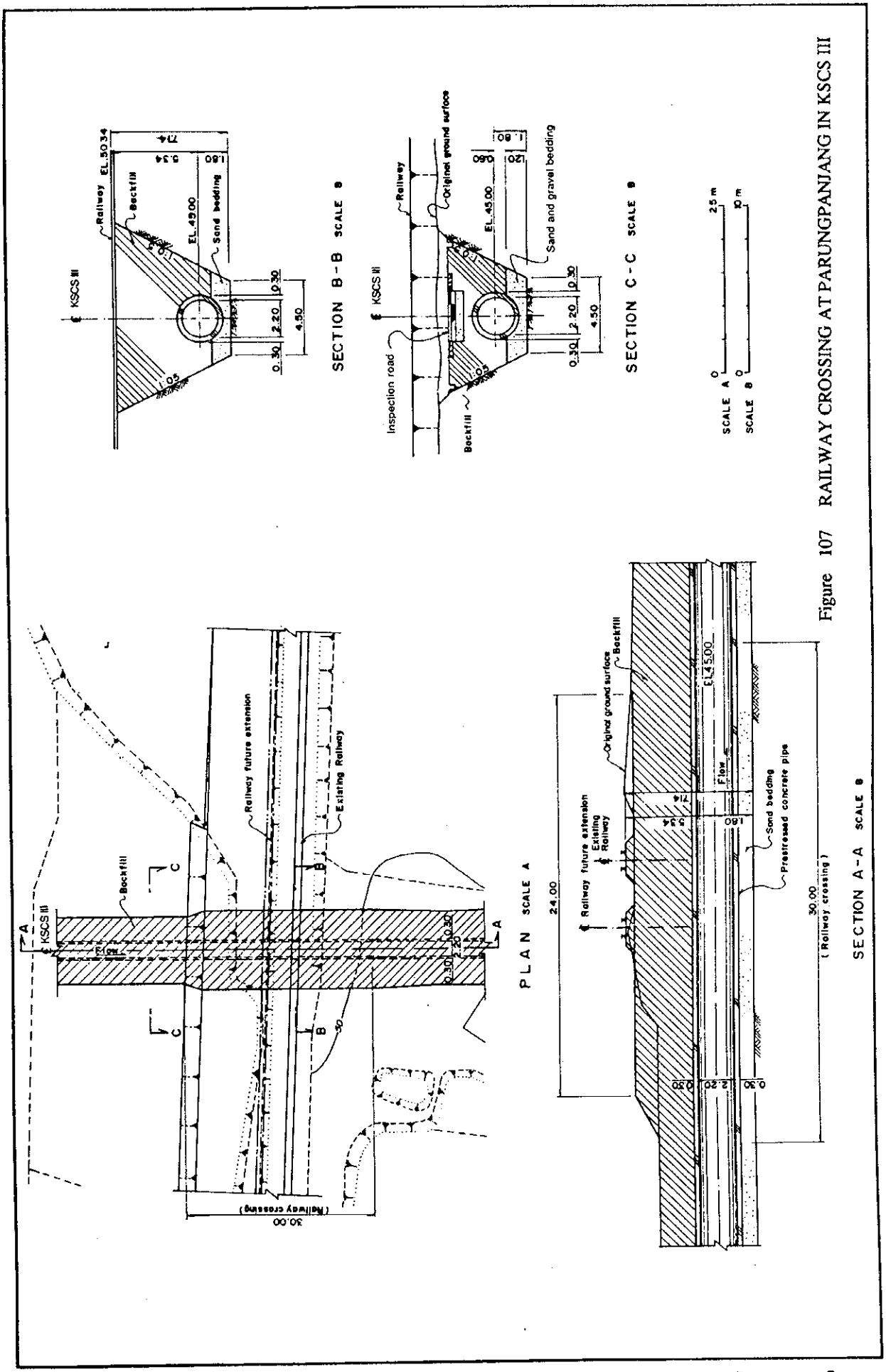


Figure 107 RAILWAY CROSSING AT PARUNGPANJANG IN KSCS III

ANNEX 8

ENVIRONMENTAL IMPACT ANALYSIS

THE STUDY ON CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES

Annex 8 : Environmental Impact Analysis

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1. Introduction

1.1 Project Features

The Ciujung-Cidurian integrated water resources development projects comprises of the Karian, Pasir Kopo, Cilawang and Tanjung dam schemes, Karian-Serpong conveyance system, and the river improvement works along the middle reach of the Ciujung river. The main features of the projects are summarized as follows:

Main Features	Karian Dam	Pasir Kopo Dam A	Pasir Kopo Dam C	Cilawang Dam	Tanjung Dam
I. Dam scheme					
1) Catchment area (km^2)	288	172	172	93	280
2) Dam type	Rockfill	Rockfill	Rockfill	Rockfill	Rockfill
3) Dam crest level (EL. m)	72.5	97.0	106.5	81.0	60.5
4) Flood high water level (EL.m)	69.9	94.2	103.7	78.5	59.5
5) Normal high water level	67.5	90.5	100.5	75.6	56.5
6) Low water level	46.0	80.0	80.0	66.5	50.0
7) Dam height (m)	60.5	52.0	61.5	36.0	35.5
8) Reservoir area (ha)	1,740	640	920	1,056	2,487
9) Effective storage volume (mil. m^3)	219.0	44.5		62.0	120.0
10) Embankment volume of main dam (mil. m^3)	1.23	0.42	0.70	0.42	8.39
11) Design flood discharge (PMF)					
a) Inflow	3,400	3,300	3,300	1,700	3,098
b) Outflow	2,670	1,760	1,430	1,230	727
12) Spillway gate					
a) Type	Radial gate	overflow type	overflow type	Radial gate	overflow type
b) Nos.	2			2	
c) Height	12.5			9.5	
d) Width	12.5			9.0	
13) Side overflow spillway weir (m)	50.0	125.0	125.0	20.0	-
14) Flood control volume against 10-year probable flood (mil. m^3)	33.5	-	-	-	-

Main Features	Description
II. Karian-Serpong conveyance system	
1) Length (km)	
a) Ciuyah tunnel to Parungpanjang	36.5
b) Parungpanjang to Serpong	11.9
c) Cilawang canal	2.4
d) Tanjung canal	4.3
2) Type of conveyance	
a) Ciuyah tunnel to Parungpanjang and other sections	gravity conveyance
b) Parungpanjang to Serpong	pumping-up and pipeline
3) Maximum flow capacities (m^3/s)	
a) Ciuyah tunnel to Parungpanjang	13.8
b) Parungpanjang to Serpong	6.0
c) Cilawang canal	4.1
d) Tanjung canal	9.7

Main Features	Description
III. River improvement works	
1) River length to be improved (km)	18.20
2) Improvement method	Provision of river dredging, short-cut channel (4 km) and flood dyke
3) Design discharge	
a) Design scale	10-year probable flood discharge
b) Design discharge	1,100 m^3/s with retardation of flood peak discharge of 390 m^3/s in the Karian reservoir
4) Earth work volume	
a) Embankment volume (mil. m^3)	0.60
b) Excavation volume (mil. m^3)	1.40
c) Dredging volume (mil. m^3)	0.67

Among the project components, however, the Pasir Kopo dam scheme was not included in the environment impact analysis (ANDAL), since its development scale is recommended to be decided by the review study to be carried out after construction of the Karian dam scheme. In the Study, only preliminary investigation for the Pasir Kopo dam scheme was undertaken and the result is compiled into Annex 4 : Preliminary Design and Environmental Investigation of Pasir Kopo Dam.

1.2 Objectives of Environmental Impact Analysis (ANDAL)

The environment impact analysis (ANDAL) for the aforesaid project components was carried out by a local firm, PT. Indra Karya for about 4 months from the end of June 1994 to the middle of October 1994 under the supervision of the environmentalists of the JICA study team and DGWRD in accordance with the terms of references which was drafted by the JICA study team and officially approved by the Central Committee of the Ministry of the Public Works in November 1993.

The objectives of the ANDAL was to clarify anticipated effects and the problems to be induced in connection with the implementation of the projects and to identify and assess adverse effect or fortunate effect on the natural and social environment.

1.3 Content of ANDAL

The survey area is shown in Figure 1 and investigated items are as follows:

(1) Physical environment such as climate, geology, topography, soil characteristics, hydrological features of water quantity and quality and flooding.

(2) Biological environment such as flora and fauna, important ecological area and conservation area and aquatic biota.

(3) Socio-economical and socio-cultural environment such as population and its density, age distribution, occupation, public health and sanitation, local economic activities such occupation, income level, land use and properties, education, custom, religion, and so on.

(4) Resettlement study for preparing inventory of families and populations required to be relocated from the areas to be affected by the proposed projects, identification of perspectives of the local residents subject to relocation and their desirable relocation areas, locating target areas of relocation, availability and suitability of the area for agricultural use, level of the development of basic infra-structure, available natural resources and other living conditions that the relocated population can use in order to continue their original life style, and estimating total cost for relocating local residents.

(5) Environmental monitoring (RPL) and management (RKL) studies

1.4 Government Regulations

Regulations related to the Environmental Impact Analysis (ANDAL) of the Project are as follows:

a) Government Act of the Republic of Indonesia No.5, 1974, on the Regional Governmental Principles,

b) Government Act of the Republic of Indonesia No.11, 1974 on Supply of Watering/Irrigation Water,

c) Government Act of the Republic of Indonesia No.4, 1982 on the Principles of the Management of Living environment,

d) Government Act of the Republic of Indonesia No.5, 1990 on the Principles of the Conservation of Ecosystem and Natural Resources,

e) Government Act of the Republic of Indonesia No.24, 1992 on the Principles of the Spacing System,

f) Government Act of the Republic of Indonesia No.22, 1982 on the Principles of Water Management,

g) Government Regulation No.29, 1986 of Environmental Impact Analysis (ANDAL),

h) Government Regulation No.20, 1990 of Water Management Act,

i) Government Regulation No.35, 1991 of river Act,

j) Decree of the President of Indonesia, No.55 of 1993 on the Land Established for the Development of Public Interest,

k) Decree of the Ministry of State for the Environment and Population No.Kep-49/MENKLH/6/1987 on Important Determinants of the Environmental Impact (including its attachment),

l) Decree of the Ministry of State for the Living Environment No.Kep-14/MENLH/3/1994, on General Guidance for the Environmental Impact Assessment,

m) Decree of the Ministry of State for the Environment and Population No.Kep-02/MENKLH/6/1988, on Guidance of the Environmental Manner and Custom,

n) Regulation of the Indonesian Ministry of Public Works No.45/PRT/1990, on Manner and Custom/Specification Using Water Resources,

o) Regulation of the Indonesian Ministry of Public Works No.46.PRT/1990, on Technical Guidance on Environmental Impact Assessment for Public Works Project,

p) Decree of the Indonesian Ministry of Public Works No.506/KPTS/1990, on the Guidance of the Method of Determination, which perfects and completes in AMDAL for Public Works Project,

q) Decree of the Ministry of Public Works No.779/KPTS/1990, on Technical Guidance of Environmental Impact Assessment for Public Works Project Concerning the Use of Surface Water,

r) Decree of the Indonesian Ministry of Public Works No.412/ KPTS/1992, on Technical Guidance on Environmental Impact Assessment for Dam Construction Project,

s) Decree of the Ministry of Public Works, NO.63/PRT/1933, on the Boundary of River Limit, Benefit Area of River, River and the Authorized Area of River,

t) Decree of the West Java Governor's Regulation No.38 of 1991, on the Use of Water and the Water Quality Standard of the Water Sources in West Java,

u) Governemnt regulation of Indonesia No. 51-1993, Regarding Environmental Impact Assessment,

v) Other regulations of national, regional and local level relevant to the EIA Study, and

2. PRESENT CONDITIONS IN AFFECTED AREAS

The present situations in the envisaged reservoir areas and along the Karian-Serpong water conveyance system (KSCS) and the middle reach of the Ciujung river are summarized as follows:

2.1 Physical Environment

(1) Topography

The Ciujung and Cidurian rivers, which are the objective rivers of water resources development by the study, are located at the western part of the study area and originate in the southern mountainous area with an altitude of about 2,000 m. The Ciujung river with a total catchment area of 1,850 km^2 and a river length of about 100 km has two (2) major tributaries which are the Cisimeut river with a catchment area of 458 km^2 and the Ciberang river with a catchment area of 305 km^2. The main Ciujung river joins with these tributaries at the just upstream of Rangkasbitung and pass through the existing Pamarayan weir which is an irrigation intake of the Ciujung irrigation scheme. Afterwards, the Ciujung river debauches into the Java Sea. The envisaged Karian dam is located in the Ciberang river.

The Cidurian river has a total catchment area of 865 km^2 and a river length of 95 km. The Cibeureum river with a catchment area of 255 km^2, a major tributary of the Cibeureum river, joins at Parigi. The Tanjung and Cilawang damsites are located in the main Cidurian and the Cibeureum river, respectively.

On the other hand, the water conveyance system route envisaged in the study, which will connect the Karian reservoir with the Serpong treatment plant under construction, lies on the southern hilly area with altitude of 30 m to 60 m along the existing railway line. The water conveyance route is planned to cross the Cibeureum, Cidurian, Cimatuk, Cimanceuri and Cisadane rivers on the way to Serpong.

(2) Geology and soil

Geological features in the study area are generally classified into the alluvial of Holocene, the terrace deposit of Pleistocene, the tuffaceous sedimentary rocks of Pliocene to Miocene, and the southern volcanoes of Miocene. The sedimentary formations of Miocene to Pleistocene is divided into several formations which are superposed monoclonal from south to north and from lower to upper horizons in order. They are mainly composed of fine to coarse tuffaceous sandstone and pumice tuffs with interbedding of lapili tuffs which belong to the Genteng formation of Pliocene in this study area.

The southern volcanic mountains were formed by basalt, volcanic breccia (G. Alung) and andesite (G. Guradog), which were erupted and/or intruded along the faulting zones in Miocene. Tectonic activity in this area is reflected in the presence of a large number of folds

and faults. In general, beddings are dipping in low angles and gently folded, indicating a relatively minor tectonic activity. Most of lineaments and fault lines with NW-SE and NE-SW directions are found out on aerial photographs.

The geological characteristics along the water conveyance route between the Ciuyah tunnel and Serpong water treatment plant is generally divided into the four portions; 1) Genteng formation ; 2) Banten tuff; 3) Bojongmanik formation; 4) Quarternary volcanic; and 5) alluvial plains.

According to the result of soil sampling taken at nine (9) locations in the survey area and analyses for them as given in Table 1, most of the samples indicated that the top soil there was classified into clayey soil and it contained the organic material (Ca and Mg) with high acidity of pH value from 3.7 to 5.8.

(3) Climate

The study area belongs to typically humid tropical zone and the weather patterns are characterized by the monsoons. The wet season is defined as a period from October to March and the dry season from April to September in general. The monthly mean temperatures are rather stable throughout a year ranging between 26° and 27°. The monthly mean relative humidity indicates generally high humidity ranging from about 80% in the dry season to 85% in the wet season throughout a year. The monthly mean wind velocity at Serang ranges between 4 knots and 5 knots or 2.1 m/sec and 2.6 m/sec. The monthly mean sunshine duration at Serang ranges between 5 and 6 hours per day in the dry season and 3 hours to 4 hours per day in the wet season. The annual rainfalls in the Ciujung and Cidurian river basins range from 4,000 mm in the mountainous area, where the envisaged damsites are located, to 1,500 mm in the coastal area.

(4) Flow conditions

According to the daily mean discharge record at Rangkasbitung in the Ciujung river and Kopomaja in the Cidurian river, the flow discharges at the several excess percents in the duration curves thereat are given as follows:

(unit : m^3/s)

Station	River Basin	Period (years)	Catchment Area (km^2)	Max.	25 %	50 %	75 %	97 %	Min.	Mean
Rang-kasbitung	Ciujung	24	1,383	1,010	118	68.5	37.5	10.1	2.3	94.2
Kopomaja	Cidurian	24	304	302	26.6	14.9	7.9	2.0	0.1	21.1

While, the probable drought discharges based on the annual minimum daily mean discharge series for 24 years from 1970 to 1994 were estimated as follows:

(unit : m^3/sec)

Return Period (yeras)	Rangkasbitung	Kopomaja
2	15.5	2.7
5	6.3	1.3
10	3.5	0.9
20	2.5	0.1

(5) Flooding

The river improvement works with the design flood discharge of 1,100 m^3/s were provided for the lower reach of the Ciujung river by PROSIDA and the middle reach is an objective river stretch proposed to be improved by the Karian Multi-purpose Dam project.

In the area along these river reaches of the Ciujung river, the flood in December 1993 caused the severe damages. The inundation with a duration of four (4) days to seven (7) days was caused by the flood along the middle reaches between Pamarayan and upstream of Rangkasbitung and the lower reach downstream of Kragiran bridge, and that the area inundated was 9,316 ha and the damage amount was estimated at Rp.11 billion which was only for restoring the damaged infra-structures such as road system, irrigation facilities and so on.

(6) Water quality

Tables 2 and 3 show the result of the water quality analysis for samples taken from the Ciujung and Cidurian rivers as indicated in Figure 2. Comparing the result with the standard in Indonesia given in Table 4, it is judged that no water pollution is identified in this sampling. However, several harmful heavy metals for human health are detected in both the rivers within an allowance for drinking water and therefore water quality in the rivers is necessary to be monitored by periodical sampling of river water and riverbed deposit and quality analysis.

2.2 Biological Environment

(1) Fauna and flora

The species of fauna and flora existing in the affected areas are given in Tables 5 and 6, which were identified by the field sampling carried out at twelve (12) sites shown in the Figure 3. No plant to be endangered was identified in the envisaged affected areas, comparing to the endangered species specified by the Indonesian government and other international authorities as given in Tables 7 to 9. While, as for fauna, some species of birds to be endangered were identified in the field survey in the forest area in and around the reservoir areas as indicated in the table.

(2) Forest

The forest areas in the envisaged reservoir areas, most of which are classified into productive forest, were identified at 230 ha in the Karian reservoir area, 87 ha in the Tanjung reservoir area, and 18 ha along the river improvement stretch of the Ciujung river.

2.3 Socio-economic Environment

(1) Administration

Table 10 shows the administrative areas predicted to be affected by the implementation of the proposed projects. As indicated in the table, the affected area involves four (4) kabupatens of Serang, Lebak, Tangerang and Bogor in the West Java Province.

(2) Population in the areas affected by the project

The population in the areas based on the result of interview survey for about 10 % of the total households subject to relocation as given in Table 11 were estimated as follows:

Project Components	No. of Kampong to be Affected	No. of Household	No. of Population to be Resettled
Karian	26	2,055	12,124
Cilawang	16	639	3,706
Tanjung	28	2,469	15,060
KSCS	16	117	632
River Improvement	16	98	578
Total	102	5,378	32,100

Distribution of occupation of the residents and formation of families in the areas are shown in Table 12. As shown in the aforesaid tables, the average family size is about 6 persons/family which forms nuclear family. Occupation of the residents in the Karian reservoir area in Lebak and along the river improvement stretch in Serang is mainly farmer but a half of residents in the Cilawang and Tanjung reservoirs and along the KSCS belongs to agriculture and the other part to industrial or commercial sectors.

(3) Economic activities

Gross regional domestic product (GRDP) in West Java and the kabupatens to be affected by the projects are as follows at 1983 constant market prices:

Kabupatens	GRDP (Rp. trillion)		Average Growth Rate (%)	Composition of GRDP in 1991 (%)		
	1986	1990		Agriculture	Industry	Commercial
West Java	13,504	17,803	7.2	18.7	42.1	39.2
Tangerang	866	1,289	10.5	12.9	48.5	38.6
Serang	826	1,062	6.5	11.0	68.1	20.9
Lebak	176	287	13.0	43.8	15.4	40.8
Bogor	871	1,362	11.8	15.5	43.6	40.9

As shown in the above table, West Java province has been developed due to industrialization during the later 1980's. As a result, industrial sector in each kabupaten occupies 40 % to 70 % of GRDP except Lebak where the agricultural activities still dominates the economy in the kabupaten.

On the other hand, the average income of the local residents in the affected areas were investigated as follows:

Affected Areas	Income (Rp.)	
	Monthly	Annual
Karian reservoir	133,000	1,596,000
Cilawang reservoir	138,000	1,656,000
Tanjung reservoir	163,000	1,956,000
KSCS	117,000	1,404,000

(4) Land use

Areas planned to be acquired by the construction of the envisaged projects are fully developed as agricultural land, plantation area for coconut and palm oil trees, and settlement area as shown in Figures 4 to 6. The area by land use is shown as follows:

(unit : ha)

Project Components	Agriculture (Paddy/ Palawija)	Forest Area	Government Estate	Private Estate	Settlement Area	Total
Karian	1,190.0	230.0	-	90.0	230.0	1,740.0
Cilawang	735.0	-	-	298.0	23.0	1,056.0
Tanjung	1,881.0	87.0	-	-	518.0	2,487.0
KSCS	236.5	-	-	-	23.0	259.5
River Improvement	60.0	18.0	-	-	11.0	71.0
Total	4,012.5	317.0	-	388.0	804.0	5,613.5

Its ownership is categorized into four; 1) plantation area of PT. P11 (the Estate Company of the Department of Agriculture); 2) forest area of Perum Perhutani (the General Company of National Forest, the Department of Forestry); 3) private land, mainly rice fields and individually owned former estate as termed "Nucleus Estate of Small Holders"; and 4) land owned by the local government. The following table shows the average land ownership per household interviewed by ANDAL:

(unit : ha)

Land Use	Karian	Cilawang	Tanjung	KSCS	River Improvement
1. Rice Field					
a) Irrigated	0.002	0.067	0.145	0.015	0.016
b) Rainfed	0.473	0.366	0.713	0.122	0.322
2. Up-land Crop	1.002	1.142	1.028	0.075	0.986
3. Housing plot	0.088	0.054	0.213	0.078	0.108
Total	1.565	1.629	2.099	0.29	1.432

As indicated in the aforesaid table, the residents with the main occupation of farmer have agricultural land of 1.2 ha to 1.8 ha but those along the KSCS, where has been industrialized, have narrow area for rice fields of 0.2 ha in average.

(5) Socio-cultural environment

There is no significant cultural, religious and scientifically important area(s) or object(s) directly or indirectly affected by the construction works of the projects in general. However, there are three (3) cemeteries in Kampong Karian and Ngangceng in the Karian reservoir area and Kampong Cokel in the Cilawang reservoir area. These are considered to be important to the villagers. Therefore, replacement of these cemeteries are necessary to be made by the projects with agreement of religious leader in Kampongs.

(6) Road network

There are many roads and footpaths crossing the route of KSCS, which is considered to be important for not only transportation and but also social communication. Number of crossing locations identified are as follows:

- Paved road with an average width of 6.0 m : 54 places
- Footpath with an average width of 3.0 m : 31 places

3. ENVIRONMENTAL IMPACT ANALYSIS

3.1 Identification of Adverse Effect and Fortunate Effect by the Project

The environmental impact analysis (ANDAL) was carried out in order to assess the extent and duration of impacts due to implementation of the projects, to formulate mitigation and control measures and thereby to prepare the environmental management and monitoring plans for which the projects were predicted to cause adverse effects on the environment in the project area. The analysis was made based on the detailed field investigation and survey data on the present environmental conditions as discussed in the aforesaid Chapter.

The EIA approach is carried out in accordance with the following steps :

1) impact prediction and identification,
2) magnitude and duration assessment for predicted impacts,
3) overall assessment for environmental impacts, and
4) selection of important impacts for environmental monitoring and management plans.

Figure 7 shows logic approaches for impact prediction and identification in stages of pre-construction to post-construction. Tables 13 to 17 summarizes the adverse and fortunate effects predicted to be caused by the projects based on the mentioned approaches. As shown in the tables, it was clarified that there are no significant impacts on biological and physical environment through stages from pre-construction to post-construction though some issues are subject to monitoring during implementation period and/or requiring minor countermeasures. But it is predicted that land acquisition and resettlement will affect on socio-economic environment largely.

The major effects are described in the following section.

3.2 Major Adverse and Fortunate Effects

3.2.1 Adverse Effect

Through the ANDAL, no significant adverse effect on physical and natural environment was identified in the affected areas, but socio-economical environment impacts to be induced by the land acquisition and compensation were predicted to dominate the project feasibility as described below:

(1) Land acquisition/compensation and resettlement of local residents

The proposed projects require relocation of about 5,378 households and land acquisition of 5,600 ha as follows:

Project Components	No. of Households to be Relocated	Land to be Acquired (ha)
Karian	2,055	1,740.0
Cilawang	639	1,056.0
Tanjung	2,469	2,487.0
KSCS		
Phase I	89	207.2
Phase II	28	26.1
Cilawang canal	-	7.7
Tanjung canal	-	18.5
Total	117	259.5
River Improvement	98	71.0
Total	5,378	5,613.5

Of all the impacts predicted to be caused by the projects through stages from pre-construction to post-construction, land acquisition/compensation and resettlement of local residents to be affected by the projects are the most important issue dominating the project feasibility.

Resettlement of the inhabitants from the present location to the resettlement area gives the most significant impact as it involves:

1) defragmentation of the present social tie of the local communities;

2) re-establishing new community in the relocation area(s);

3) re-arrangement of the transportation system for moving agricultural and commercial goods necessary for their life style in the resettlement areas; and

4) psychological and financial strain to be derived from resettlement and adapting themselves in the relocation areas of new community.

In order to obtain the detailed information and intention of local residents subject to relocation of their living area due to implementation of the projects, an interview survey was undertaken for about 12 % of total households in the affected areas as follows:

Project Components	No. of Household to be Resettled	No. of Household to be Resettled	Percentage to Total Households (%)
Karian	2,055	253	12.3
Cilawang	639	90	14.1
Tanjung	2,469	155	6.3
KSCS	117	103	88.0
River Improvement	98	24	24.5
Total	5,378	625	11.6

Table 18 shows the summary of the interview survey. As shown in the table, persons more than 80 % agreed on their resettlement on the assumption to move to adjacent places and others may be able to provide acceptable resettlement plan. This result was taken into account for establishing the resettlement and compensation plan described in the Chapter 4.

(2) Land acquisition of forest area

According to the latest Decree of the Department of Forestry, No.164/Kpts-II/94, on the "Guideline to Alter the Forest Area", the status of a portion of forest can be changed to other purposes as request is made according to the procedure based on the government regulations. However, the same quantity of land area should be purchased, in one unit or in separate units, in the adjacent area so as to maintain the current forest area.

In order to meet the above decree, the present forest area may not be available as a resettlement area in case that no proper alternative area is found out. In such case, only lands of governmental and/or private estates are considered to be selected for resettlement area from the potential resettlement areas.

(3) Creating landless farmers

Land-owning farmers whose properties are on the alignment of the KSCS may sell all or a major portion of their land, depending on the scale and location of farmland they own and the alignment of the KSCS. Upon sales of their farmland for the Water Conveyance System, what is left may be a small patch, or patches of land not profitable for agricultural business or not reliable for sustaining food supply for the whole family. In such case, they are forced to sell the rest of land to a farmer owing adjacent land to their land. As a result, upon receipt of compensation money, they may obtain alternative farmland to resume farming, or they may change their occupation by investing the compensation money as well as the money obtained by the sales of the rest of their farmland. Consequently, there will be a number of landless farmers, or semi-landless farmers. Considering the small size of farmland owned by the inhabitants along the KSCS and the river improvement stretch along the Ciujung river, there is a high possibility to induce the above-mentioned impact.

For the aforesaid resettlers who will become landless farmers, special care is necessary to be successfully adapted to new situation and will be studied taking into account the result of ANDAL.

(4) Compensation of spoil bank

There are a number of patches of paddy fields planned to be used as spoil bank with an average filling depth of about 2.5 m and an area of 3 ha per place. These paddy fields are located at lowland areas along the planned waterway. It is necessary to restore land use condition before the construction works. At the time of the restoration, the water supply condition to the paddy fields and soil condition thereat before and after the construction works have to be taken into account since the embankment with the aforesaid average height and material to be disposed may change the present situation related to the mentioned water supply and soil condition.

(5) Adverse effect on flow discharges in the downstream reaches of the rivers

In the downstream river stretch far from the damsites, drastic change of river flow situation is not considered since the dam/reservoir will contribute to stabilize the river flow condition for water use in the downstream areas. But the just downstream area will be largely affected by storing river water in the reservoirs. Especially, no release from the dam will cause no flow situation with significant duration at the just downstream of the damsites, where the inhabitants utilize the river water for their living activities. In order to minimize these adverse effect to the just downstream area, the minimum released discharge from the dam is necessary to be provided to maintain their living activities.

3.2.2 Fortunate Effect

(1) Stable water supply

The projects is planned to supply municipal and industrial water for the area of kabupatens of Tangerang and Serang and DKI Jakarta, where future population at 2025 was estimated at about 25 million and the industrialization is going on with a high growth rate. Also, the projects will contribute to solve the problems related to such groundwater use as land subsidence, intrusion of tidal water, water pollution, and so on by diversification of main water source from groundwater to surface water which is basic concept for water demand projection of the study.

(2) Flood mitigation

Flood control works by the Karian dam and river improvement in the Ciujung river will contribute to mitigate flood damage in the area along the middle and lower reaches of the Ciujung river where housing development and industrialization is going on and flood damage potential is rapidly increasing.

Also, the Tanjung and Cilawang dams to be provided in the Cidurian river basin will mitigate the flood damage in the downstream areas within some extent due to storing river water during the wet season.

(3) Creation of water body in the envisaged reservoirs

The large water body to be created by the reservoirs will provide in-land fresh water fishing area. If well planned and intensively cared for, aqua-culture industry would be of a successful economic activity and it would contribute to enhance the local economy as well as to provide acceptable taste of protein for the local community.

Also, it is high possibility that the reservoirs will be made use of tourism because of relatively easy access to the reservoirs from adjacent urbanized areas.

4. PRELIMINARY RESETTLEMENT AND COMPENSATION PLAN

4.1 Basic Principles for Resettlement and Compensation

4.1.1 Interview survey on public opinions

The projects require 5,378 households and 32,100 persons to move from the envisaged reservoir and construction areas with a total area of 5,521 ha. In order to identify inhabitant reaction and thereby sufficiently reflect it on the resettlement plan, an interview survey on public opinion of local residents subject to resettlement was conducted in the areas to be affected by the projects.

In total, 625 households corresponding to 12 % of the total to be resettled, were interviewed and survey results are shown in Table 18. Findings through the above survey are summarized as follows:

(1) Peoples more than 80 % in the reservoir areas agreed on their resettlement under the assumption to move to the adjacent places and others may agree it by the provision of the acceptable resettlement plan.

(2) The national transmigration program is presently authorized and managed by the Government of Indonesia. In this program, resettlers are supplied with basic requirement including lands, houses, infrastructures, necessary public facilities and so on. However, no inhabitants in the Project are willing to ride on the national transmigration program. In other words, the local residents might consider that the present relationships within their locality are more preferable and important for them.

(3) Peoples more than 90 % wishes to move to near-by villages or within the same kecamatan.

(4) Inhabitants of 5 % to 25 %, living in the areas except the Cilawang reservoir area wishes to move to their own lands, some own places where some of family members and/or relatives, or private land by receiving monetary compensation.

(5) In conclusion, it is very likely that inhabitants presently living in the affected areas shall be cooperative to the resettlement program provided that:

a) public hearings shall be held on necessary occasions for dissemination of full information on the projects,

b) the displaced inhabitants who intend to resettle near-by villages shall be arranged with the resettlement areas in their surrounding areas providing such a basic infrastructure as village road, water supply, electric supply, etc., and

c) the national transmigration program shall be on voluntary effort but not by force.

4.1.2 Potential resettlement and land compensation areas

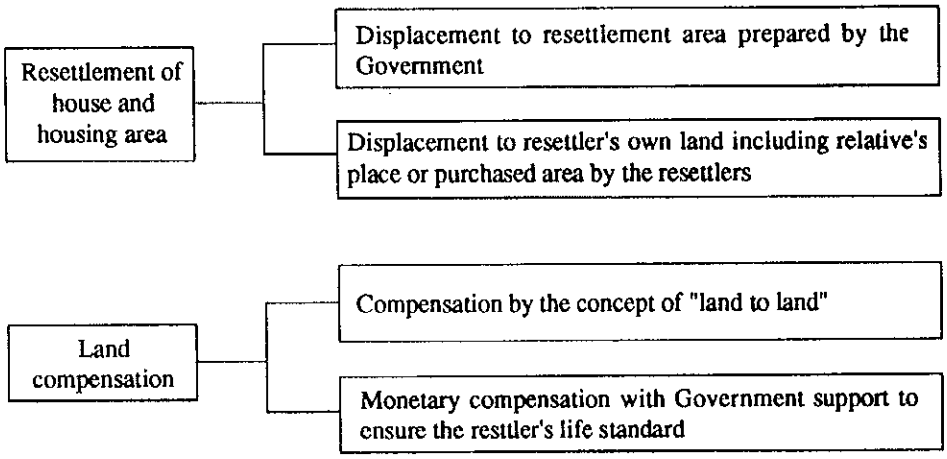
The ANDAL identified potential areas for resettlement at the government forest or private estates neighbouring the affected area shown in Figures 8 and 9. The total potential area for resettlement are about 4,200 ha in Lebak and 6,600 ha in Bogor as listed in Table 19.

As indicated in the table, among the above potential area, an area of about 2,600 ha in the kabupatens Lebak is available for resettlement since a part of the potential area is planned to be protection area by the local government of Lebak. On the other hand, all the potential area in Bogor is located in the hilly area not adequate for paddy production, which is main crop in the Tanjung reservoir area. This result means that the concept of "land to land" is not applicable for land compensation for the Cilawang and Tanjung dam schemes.

While, since resettlement operation for the local residents on the route of the KSCS and proposed dyke and short-cut channel for the river improvement works along the Ciujung river will not be a large scale and there is no area available in the kabpatens of Tangerang and Serang for mass relocation of the local residents, individual arrangement for relocation is necessary.

4.1.3 Types of resettlement and land compensation

Considering the current socio-economic conditions of the displaced people and the results of interview survey on public opinion thereof, the following manners were applied for establishing the resettlement and land compensation plan:



The preliminary resettlement plan shall be established in accordance with the basic principles as enumerated as follows:

(1) Resettlement of houses

Based on the intention of the local residents regarding to resettlement area in Table 18, the following local residents were assumed to relocate their houses to their own land and relative's places, or to find out proper land to other places in the near-by area, and other inhabitants were considered to follow the Government arrangement:

Affected Area	Total households subject to relocation	Resettlement to resettlers' own land		Resettlement to the land to be prepared by GOI	
	(nos.)	(%)	nos.	(%)	nos.
Karian	2,055	23.3 %	479	76.7 %	1,576
Cilawang	639	0.0 %	-	100.0 %	639
Tanjung	2,469	11.6 %	286	88.4 %	2,183
KSCS	117	4.8 %	6	95.2 %	111
River improvement	98	6.1 %	6	93.9 %	92

In principle, all the houses shall be compensated by money, and resettles to resettlement area to be prepared by the GOI shall construct their houses in resettlement area in accordance with their present life standard after receiving monetary compensation.

While, housing plot in the resettlement area shall be acquired and prepared by the GOI.

(2) Land compensation

Currently, areas for land compensation was identified to be available only for the Karian dam among the proposed schemes investigated by the ANDAL as stated in the foregoing section and therefore the mentioned two (2) manners for land compensation were applied for this scheme. But, as for other schemes, the monetary compensation is only a manner applicable for land compensation.

However, the area near the Tanjung reservoir area has been rapidly urbanized and industrialized. Taking into account the implementation period of the Cilawang and Tanjung dam schemes between 2005 and 2025, there is a high possibility that life style, living standard, and income level of the local residents will be changed from the present situation at the implementation stage and that this socio-economic change may need other resettlement concept in future.

Considering above socio-economic situation, employment and occupation in the above areas will be different from the present situation. In fact, the interview survey indicated that residents, who clearly replied to wish to be farmer in agricultural sector, was only 10 % to 20 % against the total households.

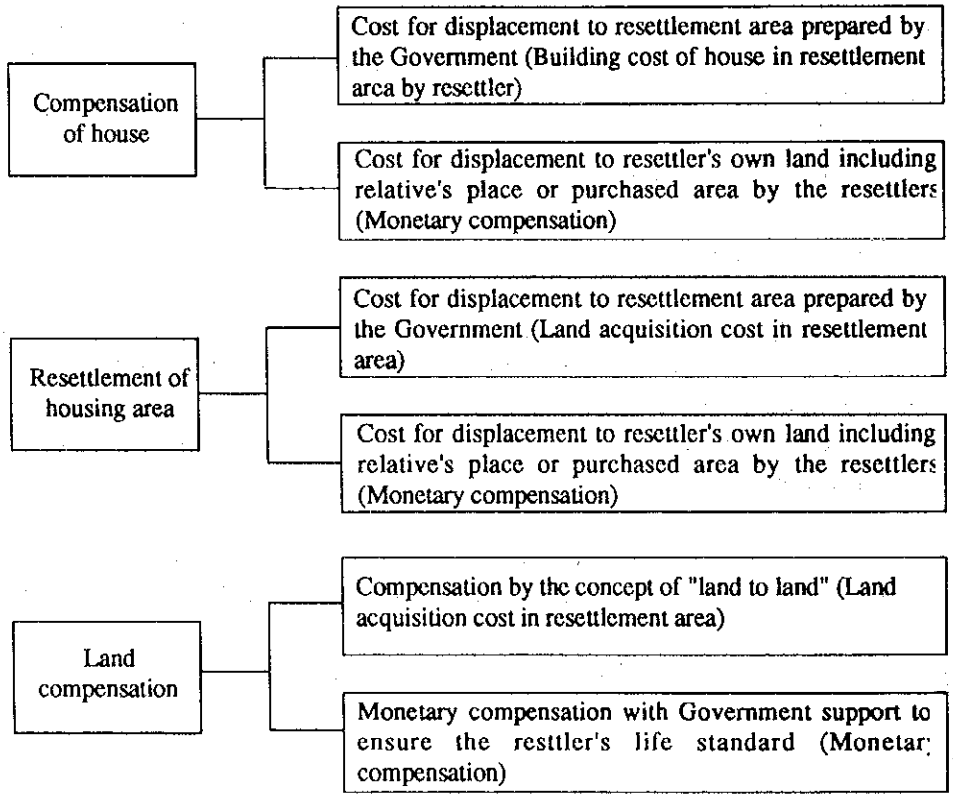
Therefore, in order to successfully carry out resettlement in the above reservoirs, other concept instead of the current one " land to land" may be required to be established by monitoring socio-economic situation and requirement of local residents subject to resettlement.

(3) Infra-structure

In the resettlement area for the envisaged dam schemes, the public facilities and infra-structures such as governmental administration office, education facility, religious facility, supply system of electricity and domestic water, road, and so on shall be made with the same conditions as those in the present residential areas in order to maintain current living standard of displaced people. Also, irrigation system in agricultural land in resettlement area for the Karian dam scheme is required to be provided.

4.2 Cost Estimate for Resettlement and Land Compensation

The total land acquisition and compensation cost consist of the following costs:



4.2.1 Conditions and assumptions for cost estimate

(1) House compensation

The number of households and population involved in the monetary compensation or resettlement to the areas to be prepared were estimated as follows:

Affected Area	Total		Monetary compensation			Resettlement		
	House-holds	Popu-lation	Propor-tion (%)	House-holds	Popu-lation	Propor-tion (%)	House-holds	Popu-lation
Karian	2,055	12,124	23.3	479	2,825	76.7	1,576	9,299
Cilawang	639	3,706	0.0	0	0	100.0	639	3,706
Tanjung	2,469	15,060	11.6	286	1,747	88.4	2,183	13,313
KSCS	117	632	4.8	6	30	95.2	111	602
River improvement	98	578	6.1	6	35	93.9	92	543

The houses to be compensated were counted by using the following average floor area and house types in the affected area:

Affected Area	Total Households	Average Floor Area (m^2)	Number of Houses by Type		
			Permanent	Semi-permanent	Non-permanent
Karian		76	594	284	1,178
Cilawang	639	89	270	92	277
Tanjung	2,469	103	1,321	415	733
KSCS	117	73	64	19	35
River improvement	98	74	48	13	37

In the above table, house type is defined as follows:

a) permanent type : whole houses is made of brick wall, mortar floor and roofing tile,

b) semi-permanent type : a part of house is made of brick wall, mortar floor or roofing tile, and

c) non-permanent : house is made of bamboo mat wall, earth flood and other material locally obtained and/or not durable for a period as long as the material used for permanent house.

Based on the above conditions, houses to be compensated were estimated as follows:

Affected Area	Floor Area (m^2)	Number of Houses by Type			Compensation Area (m^2)		
		Perma-nent	Semi-permanent	Non-permanent	Perma-nent	Semi-permanent	Non-permanent
Karian	76	594	284	1,178	45,144	21,584	89,528
Cilawang	89	270	92	277	24,030	8,188	24,653
Tanjung	103	1,321	415	733	136,063	42,745	75,499
KSCS	73	64	19	35	4,672	1,387	2,555
River improvement	74	48	13	37	3,552	962	2,738

The above houses were divided into two types of monetary compensation and resettlement as follows:

Affected Area	Monetary Compensation (m^2)			Houses to be Built by Resettlers in Resettlement Area (m^2)		
	Perma-nent	Semi-permanent	Non-permanent	Perma-nent	Semi-permanent	Non-permanent
Karian	10,488	5,016	20,824	34,656	16,568	68,628
Cilawang	0	0	0	24,030	8,188	24,653
Tanjung	15,759	4,944	8,755	120,304	37,801	66,744
KSCS	219	73	146	4,380	1,314	2,409
River improvement	222	74	148	3,330	888	2,590

(2) Compensation of housing area

Housing area was estimated by dividing into two types of monetary compensation and land preparation in the resettlement area using the average housing area of households in the affected area, which was estimated by dividing the settlement area with total households in the affected areas:

Affected Area	Average of Housing Plot (m^2)	Monetary Compensation		Land Preparation for House Construction in Resettlement Area	
		Nos. of HHs	Area (m2)	Nos. of HHs	Area (m2)
Karian	1,119	478	534,988	1,577	1,765,012
Cilawang	360	0	0	639	2,300,000
Tanjung	2,098	286	600,032	2,183	4,579,968
KSCS	1,966	6	11,795	111	218,205
River improvement	1,112	6	6,735	92	103,265

(3) Land compensation

Land compensation cost for agricultural land, forest area, government estate and private estate were estimated based on the following conditions:

a) Land compensation cost for Karian dam scheme was estimated by dividing into two types of monetary compensation and land acquisition cost for agricultural activities. As for other schemes, since the concept of "land to land" for land compensation is not applicable because of insufficient space near the affected areas, the monetary compensation was adopted for cost estimation.

b) Productivity of the resettlement area for the Karian dam scheme was assumed to be same as the present agricultural land through the preliminary investigation by the ANDAL. Therefore, the cost was calculated under the assumption that the same area of the present agricultural land per household was planned to be provided in the resettlement area.

c) No provision of spoil banks for the dam schemes was planned because of effective use of excavated material. The Karian-Serpong conveyance system (KSCS),

however, will produce the excavated material of 2.7 million along the route with a total length of about 50 km and therefore spoil banks are required at 24 locations with the total area of 91.5 ha. Since the spoil bank was planned to be acquired for use in both the first and second phases, the land for spoil bank was planned to be compensated by money.

The area to be compensated on the basis of the above conditions are given in Table 20 and summarized below:

Affected Area	Monetary Compensation		Land Preparation for Agricultural Use in Resettlement Area	
	Nos. of HHs	Area (m2)	Nos. of HHs	Area (m2)
Karian	478	5,276,963	1,577	9,823,037
Cilawang	639	10,330,000	-	-
Tanjung	2,469	19,690,000	-	-
KSCS	117	2,365,000	-	-
River improvement	98	600,000	-	-

(4) Preparation of resettlement area

As well as land acquisition cost for house and housing area and agricultural land in the resettlement area for the dam schemes, the following public facilities and infra-structures were also planned to be provided in order to maintain living standard and life style in accordance with "Standard of Settlement Program, Town and City Planning, Ministry of Public Works, 1962":

a) Public facilities :
- a) administration office with area of 250 m^2 for building and 1,650 m^2 for land area,
- b) primary school with area of 700 m^2 for building and 5,000 m^2 for land area,
- c) junior high school with area of 1,000 m^2 for building and 8,000 m^2 for land area,
- d) public park with area of 1,200 m^2,
- e) clinic with area of 252 m^2 for building and 1,200 m^2 for land area,
- f) mosque with area of 100 m^2 for building and 250 m^2 for land area,
- g) market place with area of 600 m^2 for building and 1,000 m^2 for land area,

b) Infra-structures :
- a) transportation system,
- b) electric supply system,
- c) water supply system,
- d) drainage system, and
- e) irrigation system.

While, as for the Karian-Serpong conveyance system and the river improvement works, resettlement area will be scattered by selecting proper land near the residence of resettlers due to small number of households located along the conveyance route and river course with a length of about 50 km and 20 km respectively. Therefore, the currently utilized public facilities and infra-structures are available for them and further provision is considered not to be necessary.

4.2.2 Cost estimate

Based on the result of ANDAL, unit prices for house and land compensation was established as shown in Table 21 through data collection and analysis on land cost and housing cost collected in regional government (PEMDA) and regional development agency (BAPPEDA) in Tangerang, Bogor and Lebak. In the table, cost per unit for public facilities was estimated by using land and housing cost and area described in the previous section, and it for infra-structure was assumed on the lump-sum basis referring to the similar project in Indonesia.

Required cost for land acquisition and compensation was estimated as given in Tables 22 to 26 and summarized as follows:

(unit : Rp. million)

Items	Karian	Cilawang	Tanjung	KSCS	River Improve-ment
A. House compensation					
I. Houses					
a) Monetary compensation	4,530	-	4,523	67	63
b) Housing cost to be handled to resettlers	14,951	8,046	34,529	1,263	960
II. Housing plot					
a) Monetary compensation	1,599	-	5,064	121	20
b) Land cost for resettlement area	2,277	1,762	10,351	973	133
B. Land compensation					
I. Monetary compensation	4,265	12,752	21,259	5,288	634
II. Land cost for resettlement area	12,672	-	-	-	-
C. Preparation of resettlement area					
I. Construction of public facilities	5,202	2,396	8,177	-	-
II. Infra-structures	13,105	230	5,180	230	110
D. Trees	111	40	163	7	5
Total	58,714	25,226	89,246	7,949	1,926

4.3 Preliminary Resettlement and Land Compensation Plan

(1) General procedure for implementation of resettlement and land compensation

The projects require resettlement of about 5,378 households in the affected area. As mentioned earlier, all of inhabitants are proposed to be resettled either by moving them to

their own lands or to resettlement areas to be prepared by the Government. It is currently estimated that more than 90 % of inhabitants shall be moved to resettlement areas.

Proposed resettlement areas are, in principle, located in the same kecamatan or kabupaten. The resettlement shall be systematically and efficiently executed in such a manner that inhabitants subject to resettlement gradually move to the designated resettlement areas in timely sequence of construction of resettlement areas during construction of the projects. The entire resettlement shall therefore be finished at the completion of construction works of the projects. Of particular importance is how to systematically and efficiently manage the resettlement program without causing any chaos or panic among resettlers in the designated construction period.

(2) Basic strategy for resettlement and land compensation program

In due consideration of the general procedure for implementing the resettlement and land compensation plan peculiar to the projects as mentioned above, the following strategies are basically applied for formulation of resettlement and land compensation plan:

a) To maintain the current living standard of the displaced people and to provide the opportunities for them to achieve a higher standard of living after resettlement as much as possible,

b) To minimize the socio-cultural and mental damages on the displaced people, and to provide adequate assistance of both the social and economic aspects,

c) To involve the displaced people and concerned officials in planning and implementation of resettlement program,

d) To take enough time for persuasion of displaced people through close consultations, not by force,

e) To establish a satisfactory compensation standard in terms of monetary value taking into account at least equivalent current value of land, location, house and comparable quality,

f) To have adequate institutional arrangements to ensure effective and timely implementation and proper montoring/evaluation of resettlement program,

g) To advise, counsel and support the displaced people for successful settling down in resettlement areas up to self-sustainable level, and

h) To compensate houses and housing land principally based on the President Decree No. 55/1993 of Land Arrangement for Implementation of Construction for Public Utility.

(3) Organizational set-up for implementation of resettlement and land compensation

The DGWRD shall be the responsible agency for dealing with resettlement and land compensation matters after the official commitment on implementation of the projects. Taking the importance of impacts on socio-economic environment into account, it is to be prerequisite to provide a detailed resettlement and land compensation program for the projects in advance. In view of the above, a Task Force formed by concerned agencies shall be established to specially deal with various matters and associated issues on resettlement and land compensation in the project.

The proposed Task Force is recommended to consist of appropriate members from the DGWRD, Local Government, National Land Affairs and other relevant agencies. The Task Force is to be the official organization in charge for resettlement and land compensation plan of the projects, and has the initiative to deal with discussions and negotiations with the displaced people.

5. ENVIRONMENTAL MANAGEMENT AND MONITORING PLANS

5.1 General

Prediction of impacts in connection with the implementation of the projects and their overall evaluation in view of the magnitude and duration was conducted through the environmental impacts analysis (ANDAL). When adverse impacts are predicted, mitigation measures or control methods are also studied as definitely as possible in the AMDAL. Besides, unexpected environmental problems may be occurred during and after implementation of the projects. In this sense, it is very important to monitor and thereby manage the effectiveness and efficiency of the proposed mitigation measures and control methods. Thus, the Environmental Management and Monitoring Plan (EMMP) is required to cope with these matters. The EMMP, in other words, aims at ensuring the sustainability of the projects under the environmentally sound conditions.

5.2 Environmental Items for EMMP

The resettlement of local inhabitants to be relocated is assessed to be the most significant impact in connection with the implementation of the projects. This might presumably cause some crucial problems to the displaced people from both the socio-economical and socio-cultural aspects unless the well-considered and attractive resettlement and land compensation program is prepared for a successful implementation and control of the Project. Along this line, the resettlement and land compensation program is formulated focusing on the mitigation and control of the said impact as discussed in the Chapter 4. Thus, this program should be managed and monitored by integrated ways.

As for other several impacts identified, water use and flow discharges downstream of the damsites after completion of the projects are recommended to be monitored for EMMP since storing dam may change the flow situation and affect water use, especially drought situation and water distribution in the downstream. The monitoring operation should be made in line with the obligated operation and maintenance works by the executing agency of the projects.

Also, in the natural environment, some species of birds to be endangered were identified in the forest area in and around the envisaged reservoir areas. The project may reduce a habitat of these birds though the forest area surrounds the reservoirs and the forest area to be inundated is planned to be compensated to adjacent area. Monitoring on these species of birds is proposed in order to confirm a habitat of the birds, to forecast the degree of impact for them and to identify the countermeasures if required.

5.3 Environmental Management and Monitoring Plan

The environmental management and monitoring program for resettlement is prepared in accordance with the Ministerial Decree of Living Environment No. KEP-14/MENLH/3/1994 and presented as follows:

(1) Organizational set-up for EMMP

A new unit for EMMP is proposed to be established in the DGWRD. This unit will handle environmental issues during and after the implementation of the projects as well as overall management of EMMP for resettlement and land compensation plan.

The principal functions are to;

a) manage all environmental aspects related to the Project
b) organize implementation of EMMP
c) coordinate institutional matters related to EMMP
d) cope with unexpected environmental issues
e) supervise the actual resettlement and land compensation plan
f) evaluate the actual performance of resettlement and land compensation plan and to modify the program if necessary
g) monitor change of requirement of resettlers, and
h) establish the appropriate concept and manner for resettlement to successfully execute the projects.

Since the activities of a unit for EMMP may include institutional matters, authorized right or power should be given to this unit for not only effective execution of expected activities but also appropriate collaboration with concerned agencies. The professional staff and assistant staff together with equipment as many as required should also be mobilized.

(2) Items to be managed

The following items shall be managed:

a) Involvement and cooperation of the displaced people to the resettlement plan
b) Dissemination of necessary and correct information to the displaced people on timely occasions
c) Consultation with the displaced people
d) Payment of compensation amount to the displaced people
e) Full supporting to the displaced people for settling down to self-sustainable level in the resettlement sites
f) Coordination of necessary arrangement between related agencies and the displaced people

(3) Items to be monitored

The following items shall be monitored until the displaced people attain self-sustainable level:

a) Actual progress of the resettlement and land compensation plan

b) Socio-economic and socio-cultural conditions of the displaced people
c) Requirements of the displaced people related to the resettlement

The information obtained through monitoring should be used for the purpose of evaluating the actual performance of the plan. It will also be the basis of modifying the features of facilities in the resettlement sites if any or its operating regime as needed to overcome degradation of the environment.

(4) Management and monitoring area

The area of EMMP should include all the resettlement sites for local migration of the displaced people. The data and information related to the national transmigration should be given from the regional office of the Department of Transmigration in charge.

(5) Monitoring period and frequency

The monitoring period is broadly divided into the three (3) phases as given below.

a) From the initiation of the resettlement program to the completion time of payment of compensation amount to the displaced people, frequent opportunities as many as required for discussion and negotiation with them should be held and then monitored.

b) Up to the completion time of relocation of the displaced people to the resettlement sites, frequent occasions as many as necessary but regularly should be monitored for evaluating the actual performance of the resettlement plan.

c) Up to the time of setting down in the resettlement sites, periodic monitoring and evaluation shall be made at least once a year for the period more than three years.

TABLES

Table 1 RESULT OF PHYSICAL AND CHEMICAL ANALYSIS FOR SOIL SAMPLES

Soil Characteristics		Sample No.	1	2	3	4	5	6	7	8	9
		Location	Hajere	Berkat	Karian	Paja	Kembang-kuning	Neglasari	Tenjo	Cirangrang	Bungaok
		Stratigraphic Unit	Bojong-manik	Bojong-manik	Genteng	Genteng	Genteng	Banten Tuff	Genteng	Bojong-manik	Genteng
(1)	pH (Kcl)		3.7	4.1	3.8	3.7	4.0	3.8	3.9	4.2	4.8
(2)	C-org	%	0.82	0.82	0.30	0.19	0.50	0.97	0.63	0.46	0.28
(3)	N-total	ppm	0.09	0.09	0.04	0.03	0.06	0.07	0.06	0.04	0.04
(4)	P	ppm	-	0.4	0.4	-	-	-	-	-	-
(5)	Ca	me/100 mg	11.94	23.17	28.77	31.22	3.08	4.76	2.49	3.12	6.16
(6)	Mg	me/100 mg	3.32	5.35	10.78	5.35	0.78	3.71	1.81	2.24	1.03
(7)	K	me/100 mg	0.01	0.08	0.09	0.03	0.05	0.08	0.05	0.04	0.03
(8)	Na	me/100 mg	0.02	0.17	0.13	0.07	0.09	0.13	0.09	0.04	0.04
	Total	me/100 mg	15.29	28.77	39.77	36.67	4.00	8.68	4.44	5.44	7.26
(9)	CEC	me/100 mg	30.80	33.40	46.50	57.90	27.50	46.50	27.50	28.80	21.90
(10)	BS	%	49.60	86.10	85.50	63.30	14.50	18.70	16.10	18.90	33.10
(11)	Al	me/100 mg	5.54	-	7.48	14.96	16.43	24.70	12.56	17.63	-
(12)	H	me/100 mg	0.71	0.36	0.68	1.28	1.39	3.03	0.93	1.15	0.19
	Composition of Soil										
(13)	Sand	%	24.71	14.82	6.81	7.09	20.21	6.12	16.32	19.27	4.90
(14)	Silt	%	25.31	56.82	40.93	29.69	38.88	33.99	18.04	24.52	18.18
(15)	Clay	%	49.98	28.36	52.26	63.22	40.91	59.89	65.64	26.21	76.92
(16)	Porosity	%	43.40	53.58	36.98	42.26	38.11	66.42	52.45	50.19	50.94

Table 2 RESULT OF WATER QUALITY ANALYSIS MADE BY JICA STUDY TEAM IN 1993

	Works	Tanjung			Tanjung			-		
	River	Cidurian			Cipangaur			Cicinta		
	Location	A			B			C		
	Date	07/09/1993			07/09/1993			08/09/1993		
	Time	10:30	14:35	15:55	10:00	14:15	15:50	8:30	12:00	15:30
Parameter	Unit									
Air Temperature	oC	27.70	31.00	29.30	28.00	31.20	29.50	25.70	29.60	27.30
Water Temperature	oC	26.90	28.00	26.00	27.50	28.10	27.00	25.00	26.40	26.00
pH	-	6.70	6.90	6.80	6.80	6.90	6.70	6.90	7.00	7.10
BOD	mg/l	1.70	1.90	2.00	2.40	2.60	2.80	1.50	1.50	1.20
Suspended Solid	mg/l	80.00	74.00	88.00	110.00	116.00	124.00	120.00	112.00	92.00
Dissolved Oxygen	mg/l	6.90	6.90	7.00	6.70	6.80	6.90	7.20	7.40	7.30
Colon Bacillus	MPN/100ml	36.000	25.000	19.000	25.000	17.000	18.000	15.000	17.000	10.000
Cadmium (Cd)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Organic Phosphorus	mg/l	0.013	0.019	0.180	0.063	0.045	0.050	0.038	0.038	0.044
Ortho (PO4)	mg/l	0.004	0.004	0.003	0.004	-	0.006	0.003	-	0.003
Plumbum (Pb)	mg/l	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cyanogen (Cn)	mg/l	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium (Cr+6)	mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Arsenic (As)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Alkyl Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Date	18/09/1993			18/09/1993			19/09/1993		
	Time	8:30	13:30	15:00	8:00	13:00	16:35	8:15	12:15	15:15
Parameter	Unit									
PCB	ng/l	-	-	3.85	-	-	-	-	-	6.2

	Works	Cilawang			Cilawang			Karian		
	River	Cibeureum			Cibeureum			Ciberang		
	Location	D			E			F		
	Date	09/09/1993			09/09/1993			09/09/1993		
	Time	6:30	13:30	16:30	6:30	13:30	16:30	9:15	12:00	17:15
Parameter	Unit									
Air Temperature	oC	25.40	30.10	29.40	27.30	29.00	28.60	26.40	32.00	29.00
Water Temperature	oC	24.80	28.00	28.60	25.30	26.40	25.70	25.20	27.30	26.50
pH	-	6.90	7.00	6.90	7.00	7.20	7.00	6.90	7.10	6.90
BOD	mg/l	1.80	2.20	2.00	1.20	1.60	1.30	1.60	1.30	1.30
Suspended Solid	mg/l	106.00	88.00	78.00	102.00	116.00	124.00	82.00	78.00	80.00
Dissolved Oxygen	mg/l	6.80	7.00	7.10	7.30	7.40	7.50	7.10	7.10	7.20
Colon Bacillus	MPN/100ml	20.000	22.000	17.000	21.000	25.000	15.000	23.000	15.000	15.000
Cadmium (Cd)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Organic Phosphorus	mg/l	0.031	0.021	0.025	0.044	0.056	0.060	0.023	0.016	0.013
Ortho (PO4)	mg/l	-	-	-	0.008	0.004	0.005	-	0.003	-
Plumbum (Pb)	mg/l	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cyanogen (Cn)	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium (Cr+6)	mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Arsenic (As)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Alkyl Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Date	20/09/1993			20/09/1993			20/09/1993		
	Time	6:00	12:50	16:45	8:00	13:15	16:10	9:00	11:50	17:30
Parameter	Unit									
PCB	ng/l	-	-	-	-	-	-	-	12.915	-

Table 3 RESULT OF WATER QUALITY ANALYSIS MADE BY ANDAL

	Works	Tanjung Dam				Karian Dam	Cilawang Dam		Tanjung Dam	
	River	Cipanggaur	Cidurian	Cipanggaur	Cidurian	Ciberang	Cibeureum	Cibeureum	Cipanggaur	Cidurian
	Location	1	2	3	4	5	6	7	8	9
	Date	28/07/1994	28/07/1994	28/07/1994	28/07/1994	29/07/1994	29/07/1994	29/07/1994	30/07/1994	30/07/1994
Parameter	Unit									
Odour		-	-	-	-	-	-	-	-	-
Colour	Pt. Co	19	11	9	2	41	40	nil	nil	2
Turbidity	FTU	23	13	12	9	35	15	nil	nil	4
Taste		-	-	-	-	-	-	-	-	-
pH		7.70	7.30	7.10	6.86	6.96	6.68	6.55	6.40	6.58
Total Iron	mg/l	0.440	0.440	< 0.040	< 0.040	0.160	1.050	0.120	0.160	0.320
manganese	mg/l	0.110	0.080	< 0.020	< 0.020	< 0.020	0.400	< 0.020	0.040	0.040
Zinc	mg/l	0.073	0.054	< 0.008	< 0.008	< 0.008	0.019	< 0.008	< 0.008	0.032
Chloride	mg/l	4.04	nil	4.60	nil	nil	8.78	3.130	nil	3.110
Floride	mg/l	nil	0.11	0.11	< 0.02	< 0.02	0.15	0.020	0.090	0.080
Nitrate (NO4)	mg/l	< 0.110	< 0.110	< 0.110	0.200	< 0.110	0.400	< 0.110	0.200	< 0.110
Nitrate (NO3)	mg/l	< 0.030	< 0.030	0.046	< 0.030	< 0.030	0.192	< 0.030	0.050	< 0.030
Sulphate	mg/l	7.550	7.320	8.400	7.090	5.740	4.610	4.190	6.000	6.470
Arsenic	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide	mg/l	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Crrom 6+	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead	mg/l	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Mercury	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Selenium	mg/l	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Organic Matter	mg/l	14.070	8.440	11.400	6.510	5.140	30.110	4.230	5.600	4.750
Surfactans Anionic	mg/l	0.220	< 0.050	0.310	0.200	0.050	1.320	< 0.050	< 0.050	< 0.050
Dissolved Solid	mg/l	120.00	96.00	130.00	96.00	68.00	176.00	64.00	110.00	96.00
Total Hardness	mg/l CaCO3	58.49	40.41	62.65	47.54	30.23	74.21	28.11	50.46	44.65
COD	mg/l	14.63	11.38	21.13	17.88	11.38	24.38	11.38	13.00	9.75
BOD	mg/l	5.93	4.64	8.49	7.21	4.64	9.73	4.64	5.28	4.00
SS	mg/l	16.00	11.00	11.00	8.00	22.00	13.00	4.00	5.00	9.00
Coliform	per 100 ml	nil	nil	nil	nil	4	nil	nil	nil	nil

	Works	Tanjung	Karian Dam				-	-	-	-
	River	Cidurian	Ciberang	Ciberang	Ciberang	Ciberang	Ciujung	Ciujung	Ciujung	Cidurian
	Location	10	11	12	13	14	15	16	17	18
	Date	30/07/1994	31/07/1994	31/07/1994	31/07/1994	31/07/1994	31/07/1994	31/07/1994	31/07/1994	01/08/1994
Parameter	Unit									
Odour		-	-	-	-	-	+	-	+	+
Colour	Pt. Co	23	5	nil	6	7	95	22	4	39
Turbidity	FTU	9	7	nil	4	4	35	18	12	21
Taste		-	-	-	-	-	-	-	-	-
pH		6.77	6.50	6.60	6.70	6.56	8.80	7.56	7.30	7.40
Total Iron	mg/l	0.250	0.560	0.140	0.370	0.320	0.320	0.860	0.330	0.250
manganese	mg/l	0.060	0.040	< 0.020	0.060	0.030	0.120	0.380	0.660	< 0.430
Zinc	mg/l	0.032	0.022	< 0.008	0.016	0.038	< 0.008	0.016	< 0.008	< 0.008
Chloride	mg/l	5.190	3.060	3.480	3.970	3.210	5,268.24	12.150	2,220.42	11,150.72
Floride	mg/l	0.070	0.050	0.010	0.080	nil	0.750	0.070	0.430	1.090
Nitrate (NO4)	mg/l	0.200	< 0.110	< 0.110	0.300	< 0.110	0.200	0.200	< 0.110	0.300
Nitrate (NO3)	mg/l	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030
Sulphate	mg/l	4.330	3.790	4.400	3.360	4.470	142.710	10.650	126.470	75.800
Arsenic	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide	mg/l	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Crrom 6+	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead	mg/l	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Mercury	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Selenium	mg/l	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Organic Matter	mg/l	13.480	3.380	2.700	6.790	4.350	35.270	16.290	19.420	16.630
Surfactans Anionic	mg/l	0.290	< 0.050	< 0.050	0.250	0.420	0.015	0.130	0.050	0.250
Dissolved Solid	mg/l	78.00	60.00	94.00	98.00	72.00	8,950.00	165.00	3,860.00	18,100.00
Total Hardness	mg/l CaCO3	28.80	26.66	47.12	45.23	32.97	1,394.18	71.28	760.66	7,402.64
COD	mg/l	16.26	8.13	11.38	27.64	22.76	52.02	11.38	35.76	37.39
BOD	mg/l	6.57	3.35	4.64	11.00	9.10	20.55	4.64	14.20	14.81
SS	mg/l	7.00	9.00	3.00	7.00	7.00	21.00	17.00	12.00	17.00
Coliform	per 100 ml	nil	nil	nil	nil	2	nil	nil	nil	nil

Table 4 WATER QUALITY STANDARD IN WEST JAVA PROVINCE

Parameter	Unit	Rank			
		A	B	C	D
Odour		-	-	-	-
Colour	TCU	15	-	-	-
Taste		-	-	-	-
Turbidity	NTU	-	-	-	-
pH		6.5 - 8.5	5 - 9	6 - 9	5 - 9
Total Iron	mg/l	0.3	5.0	-	-
Manganese	mg/l	0.1	0.5	-	2.0
Zinc	mg/l	5.0	5.0	0.02	2.0
Chloride	mg/l	250	600	-	-
Floride	mg/l	0.5	1.5	1.5	1.0
Nitrate (NO4)	mg/l	10	10	-	-
Nitrate (NO3)	mg/l	1.00	1.00	0.06	-
Sulphate	mg/l	400	400	-	-
Arsenic	mg/l	0.05	0.05	1.0	1.0
Cadmium	mg/l	0.005	0.01	0.01	0.01
Cyanide	mg/l	0.10	0.10	0.02	-
Crrom 6+	mg/l	0.05	0.05	0.05	1.0
Lead	mg/l	0.05	0.10	0.03	1.0
Mercury	mg/l	0.001	0.001	0.002	0.005
Selenium	mg/l	0.01	0.01	0.05	0.05
Organic Matte	mg/l	10	-	-	-
Total Solid	mg/l	1000	1000	1000	1000
Hardness	mg/l CaCO3	500	-	-	-
COD *	mg/l	-	10	-	-
BOD *	mg/l	-	6	-	-
Coliform	per 100 ml	3	10000	-	-

Remarks:

A: Raw water suitable for drinking without treatment.

B: Raw water Suitable for drinking with treatment.

C: Suitable for Fishery and livestock use.

D: Suitable to use for agriculture, industry and power generation.

Table 5 LIST OF THE SPECIES OF FAUNA IDENTIFIED IN THE SURVEY AREA

(1) Bird

No.	English Name	Latin Name	Indinesian Name	Existence						
				Karian		Cilawang		Tanjung		KSCS
				Res.	Sur.	Res.	Sur.	Res.	Sur.	
1.	Red Junglefowl	Gallus gallus	Ayam hutan	-	+	-	+	-	+	-
2.	Whistling Thrushes	Myophoneus sp.	Berkencet	+	+	-	+	-	-	+
3.	Pigmy Wren Babbler	Pnoepyga poecilla	Tikus	x	-	-	-	-	-	-
4.	Blue Shortwing	Brychypterix montana	Cing coang	x	x	x	x	x	x	x
5.	Whitecrowned Forktail	Enicurus leschnaulti	Meninting	x	x	x	x	x	x	x
6.	Leafbird	Chloropsis sp.	Daun	x	x	x	-	-	-	-
7.	Fairy Bluebird	Irena puela	Sekar gadung	-	x	-	-	-	-	-
8.	Kite	Elanus sp.	Alap-alap	x	x	x	x	x	-	-
9.	Small Wren Babbler	Napothera epilepidota	Berencet	+	+	+	+	-	-	-
10.	Common Coucal	Centropus sinensis	Bubut	x	x	x	x	x	-	x
11.	Little Spiderhunter *	Arachnotera longinostra	Jantung	x	x	-	x	-	-	-
12.	Chestnut-capped Babbler	Timalia pileata	Kaso	+	x	+	-	-	+	-
13.	Pied Fantail *	Rhipidura javanica	Kipas	x	x	x	x	-	-	-
14.	Banded Pitta	Pitta guajana	Paok	-	-	-	-	-	+	-
15.	Dove	Macropygia sp.	Uncal	+	-	+	-	-	-	-
16.	Long-tailed Nightjar	Caprimulgus macrurus	Mailng	x	-	-	-	-	-	-
17.	Scarlet-backed Flowerpecker	Dicaeum trochileum	Cabe	x	x	x	x	-	x	-
18.	Common Flowerpecker	D.Sanguinolentum	Cabe Gunung	x	x	x	-	-	-	-
19.	Fantailed Warbler	Cisticola juncindis	Cica padi	+	-	-	-	-	-	-
20.	-----	irthitumus sutirius	Cinenen	+	x	-	-	-	x	-
21.	Common Iora	Aegithina tiphia	Cipoh	x	x	x	x	-	-	-
22.	Shrike Babbler	Ptruthius aenobarbus	Ciu kecil	-	-	-	-	+	x	-
23.	-----	Cirvus enka	Gagak	+	+	+	-	x	-	+
24.	Java Sparrow	Padda orizifora	Gelatik padi	x	x	x	x	x	x	x
25.	Chickadee	Parus major	Gelatik batu	x	x	x	x	-	+	-
26.	Tree Sparrow	Passer montanus	Geraja	x	x	x	x	x	x	x
27.	Starling	Sturnus melanopterus	Jalak putih	+	-	-	-	-	-	-
28.	Fly-catcher Shrike	Hemipus sp.	Jeunjing teureup	-	-	-	-	-	-	-
29.	Yellow-vented Bulbul	Pycnonotus goiavier	Jog jog	x	x	x	x	x	x	x
30.	Black-capped Bubbler	Pellomeum capistratum	Kancilan	x	x	x	x	x	x	-
31.	White-breasted Wood Swallow	Arthamus leuchorincus	Kekep	x	x	x	x	-	-	x
32.	House Swift	Apus afinis	Kepinis	x	x	x	x	x	x	x
33.	Oriole	Oriolus chinensis	Kepodang	x	x	x	-	-	-	-
34.	Java Myna	Acridotheras javanicus	Kerak	+	-	x	-	-	-	-
35.	-----	Callocalia esculenta	Kesapi	x	x	x	x	-	x	x
36.	White-eared Bulbul	Pycnonotus aurigaster	Ketilang	x	x	x	x	x	x	x
37.	White Awl	Tyto alba	Kukuk beluk	-	-	-	-	-	-	-
38.	Robin	Copsychus saularis	Kucica	x	x	x	-	-	x	-
39.	Koel	Eudynamis sp.	Kulik	+	-	+	-	-	-	-
40.	Brown-throated Sunbird *	Anthreptes malacensis	Madu kelapa	x	x	x	x	-	-	-
41.	Black-headed Bulbul	Pycnonotus aticeps	Kuricang	x	x	x	x	-	x	x
42.	Sunbird	Aethropyga sp.	Madu gunung	x	x	x	x	x	x	-
43.	Sunbird	Nectarinia sp.	Madu gunung hitam	x	x	x	x	x	x	x
44.	Blue-eared Kingfisher	Alcedo mininting	Meninting	x	x	x	x	-	-	-
45.	Yellow Bulbul	Pycnonotus melanictreus	Pacampeor	x	x	x	x	x	x	x
46.	Spice Finch	Lonchura punctulata	Peking	x	x	x	x	x	x	x
47.	Three-toed Woodpecker	Picoides macei	Pelatuk	x	-	-	-	-	-	-
48.	Tawny Prinia	Prinia subiava	Perinjak	x	x	x	x	x	x	x
49.	Tawny Prinia	Prinia sublava	Perinjak wayu	x	x	x	x	-	-	-
50.	Zebra Dove	Geopelia striata	Perkutut	x	x	x	x	-	-	x
51.	Java Munia	Lonchura leucogastroides	Pipit	x	x	x	x	x	x	x
52.	Parrot-Finch	Erythyra sp.	Pipit dada merah	-	x	x	-	x	x	-
53.	Hill Partridge	Arborophila sp.	Puyu gonggong	x	x	x	x	-	-	-
54.	White-collared Kingfisher *	Halcyon chloris	Raja udang	x	x	x	x	-	x	-
55.	Olive-backed Sunbird *	Nectarinia jungularis	Sriganti	x	x	x	x	x	x	x
56.	Black Drongo	Dicrurus macrocercus	Srigunting	x	-	x	-	-	-	-
57.	White Eye	Laphosostrerop sp.	Senangka gunung	-	x	-	-	-	-	-
58.	Spotted Dove	Streptopelia chinensis	Tekukur	x	x	x	x	x	x	x
59.	Black-headed Shrike	Lanius schach	Toed	x	-	x	x	-	-	-
60.	Cuckoo	Cuculus sepulchralis	Uncuing	x	x	x	x	x	-	-

Note : Res.: Reservoir Area Sur.: Surrounding Area +: Reported to exist x: Observed on site - : Not existing

Remarks : Birds with symbol of "*" indicate species to be endangered.

(2) Mammals

No.	English Name	Latin Name	Indinesian Name	Exsistence
1.	Longtail Macaque	Macaca fascisularis	Kera ekor panjang	+
2.	Rat	Rattus norwegicus	Tikus sawah	x
3.	Tree Shrews	Tupaia tupaia	Kekes	x
4.	Pig	Sus sp.	Babi hutan	+
5.	Dog	Cannis sp.	Anjing	x
6.	Goat	Capra sp.	Kambing	x
7.	Water Buffalo	Bubalus bubalis	Kerbau	x
8.	Tree Squirrel	Callisciurus nitatus	Bajing	x
9.	Fruit Bat	Cynopterus sp.	Codot	x
10.	Common Bat	Pteropus sp.	Kelelawar	x
11.	Begnal Cat	Felis bengalensis	Kucing hutan	+
12.	Malay Cat	Paradoxurus hermaphroditu	Musang	+
13.	Clawless Otter	Amblonyx cierea	Sero	+
14.	Weasel	Mydaus brachyura	Teledu	+
15.	------		Garangan	x

Note : + : Reported to exist x : Observed during the field survey

(3) Reptilia

No.	English Name	Latin Name	Indinesian Name	Exsistence
1.	Small Monitor Lizard	Varanus salvator	Biawak kecil	+
2.	Mud Turtle	Trionix sp.	Bulus	x
3.	Chameleon	Calotes jubatus	Bunglon	x
4.	House Lizard	Hemidactylus frenatus	Cicak	x
5.	House Gecko	Cosymbatus sp.	Cicak Hitam	x
6.	Flying Lizard	Draco volans	Hap-hap	x
7.	Common Mabouya	Mabouya multigasciata	kadal	x
8.	Mole	Trachydromus sp.	Orong-orong	+
9.	Gecko	Gecko gecko	Tikek	+
10.	Water Snake	Himalopsis sp	Ular air	+
11.	-----	Gymosoma sp	Ular Bungka	+
12.	Striped Coral Snake	Maticora intestinalis	Ular cabe	+
13.	Blunt-headed Tree Snake	Boiga dendrophila	Ular cincin mas	+
14.	-----	Angkistrodon rhodostoma	Ular gibug	+
15.	Banded Snake	Elaphe sp	Ular hijau	x
16.	Wart Snake	Acrochordus granulatus	Ular kadut	+
17.	-----	Achaetulla formosus	Ular kacang	+
18.	Blinded Snake	Typholops sp	Ular kawat	+
19.	Grass Snake	Natrix vitata	Ular kisi	x
20.	Taiwanese Cobra	Naja naja	Ular cobra	+
21.	-----	Ptyas corros	Ular koros	x
22.	Ring Snake	Natrix subminiata	Ular pincung	+
23.	Python	Phyton sp.	Ular sanca	+
24.	Banded Snake	Elaphe radiata	Ular tikus	+
25.	Worm Snake	Calamaria linnei	Ular surapari	+
26.	-----	Pseudopistocalamus sp.	Ular tengkuk kuning	+
27.	Banded Krait	Bungarus fasciatus	Ular welang	+
28.	Blunt-headed Snake	Boiga sp	Ular tali wangsa	+

Note: + : Reported to exist x : Observed during the field survey

(4) Amphibia

No.	English Name	Latin Name	indinesian Name	Exsistence
1.	Frog	Hyla sp.	Katak daun	x
2.	Frog	Rana cancrivora	katak sawah	x
3.	Frog	Rachophorus sp.	Katak daun besar	x
4.	Toad	Bufo melanosticus	Kodok	x

Nite: x - Observed during the field survey

(5) Fish

No.	English Name	Latin Name	Indinesian Name	Existence				
				A	B	C	D	E
1.	Towes	Puntis bromoides	Lalawak	x	x	x	-	-
2.	-----	Mystacoleucus marginatus	Genggehek	-	x	x	-	-
3.	Towes	Puntius bonatatus	Beunteur	-	x	x	x	-
4.	Rasbora	Rasbora sp.	Paray/Lunjar	x	x	x	x	-
5.	-----	Lais hexanema	Lais	-	x	x	-	-
6.	-----	Homalotera sp.	Salusur	x	x	x	-	x
7.	-----	Akysis sp	Kekel	x	x	x	x	x
8.	-----	Glyptostermum platypogon	Sengal	x	x	x	x	-
9.	-----	Bogarius sp.	Lika	-	-	x	-	-
10.	-----	Macrones nigripes	Kebiogerang	-	-	x	-	x
11.	-----	Hampala sp.	Palung	x	x	-	-	-
12.	-----	Ostechilus sp	Nilem	x	x	-	-	-
13.	Towes	Puntius sp.	Lempon	x	x	x	-	x
14.	-----	Tor sp	Tambira	x	-	x	-	x
15.	-----	Mystus sp.	Singgal	x	x	-	x	x
16.	Eel	Anguilla sp.	Pelus	x	x	x	x	-
17.	-----	Phiocephalus sp.	Deleg	-	-	x	-	-
18.	-----	Acentogobius sp.	Nyoho	-	-	x	-	x
19.	Rainbow Guppy	Lebistes sp.	Seribu	x	x	x	x	x
20.	Blue Goulammy	Trichogaster sp	Sepat siem	x	x	x	x	x
21.	-----	Fluta sp.	Belut	x	x	x	x	x
22.	-----	Mastocembelus maculatus	Berod	-	-	x	-	-
23.	Striated Murrel	Ophiocephalus gachua	Bogo	-	-	x	-	-
24.	-----	Hypostamus plecastomus	Sapu	-	x	x	x	x
25.	-----	Labeobarbus douorensis	Kancra	-	x	x	-	-
26.	Tawes	Puntius javanicus	Tawes	-	x	x	-	x

Note: A : Ciberang B : Cibeureum C : Cipangaur
D : Cidurian E : Cisadane
x : Observed during the field survey

Table 6 LIST OF THE MAJOR SPECIES OF FLORA IDENTIFIED IN THE SURVEY AREA

(1) Karian Dam

No.	English Name	Latin Name	Indoneasian Name	Existence		
				Wet Area	Dry Area	Area along Ciberang
1.	Coconut	Cocos nucifera	Kelapa	x	x	x
2.	Rubber	Hevea braciliensis	Karet	x	x	-
3.	Rambutan	Nephelium lappaceum	Rambutan	x	-	x
4.	Jackfruit	Artoculpus heterophylia	Nangka	x	-	-
5.	Bamboo	Bambusa sp.	Bambu	x	x	-
6.	Banana	Musa paradisica	Pisang	x	x	x
7.	- - - - - - -	Dendracalamus apus	Bambu tali	x	-	x
8.	- - - - - - -	Genta renghas	Reunghas	x	-	-
9.	Gumihan	Artocarpus elasticus	Teureup	x	x	-
10.	Hibiscus	Hibiscus	Waru	x	-	-
11.	- - - - - - -	Erythrina variegata	Dadap	x	-	-
12.	- - - - - - -	Cyca rumphii	Pakis haji	x	-	-
13.	- - - - - - -	Schima walichi	Puspa	x	x	-
14.	Brunei	Albizia falcataria	Albisia	-	x	-
15.	Guava	Psidium guajava	Jambu batu	-	x	-
16.	Mahogany	Swietema mahagoni	Mahoni	-	x	-
17.	Mango	Mangifera indica	Mangga	-	x	x
18.	Durian	Durio sibetinus	Durian	-	-	x
19.	Silk-Cotton Tree	Ceiba petandra	Randu	-	-	x
20.	Walnut	Albizia lebeckoides	Kitoke	-	-	x

(2) Cilawang Dam

No.	English Name	Latin Name	Indoneasian Name	Existence		
				Wet Area	Dry Area	Area along Ciberang
1.	Coconut	Cocos nucifera	Kelapa	x	x	-
2.	Rubber	Hevea braciliensis	Karet	-	x	x
3.	Rambutan	Nephelium lappaceum	Rambutan	-	-	x
4.	Jackfruit	Artoculpus heterophylia	Nangka	-	x	x
5.	Bamboo	Bambusa sp.	Bambu	x	x	x
6.	Banana	Musa paradisica	Pisang	x	-	-
7.	- - - - - - -	Genta renghas	Reunghas	x	-	-
8.	Gumihan	Artocarpus elasticus	Teureup	x	-	-
9.	Hibiscus	Hibiscus	Waru	x	-	-
10.	Brunei	Albizia falcatoria	Albisia	-	-	x
11.	Guava	Psidium guajava	Jambu batu	x	-	-
12.	Mango	Mangifera indica	Mangga	-	-	x
13.	Durian	Durio sibetinus	Durian	-	-	x
14.	Silk-cotton Tree	Ceiba petandra	Randu	x	-	-
15.	Blady Grass	Imperata cylindrica	Alang-alang	x	x	-
16.	Cocoa	Theofroma cacao	Kakao	-	x	-
17.	Coffee	Coffea canephora	Kopi	-	x	-
18.	Malay Apple	Syzigium malacenensis	Jambu bol	-	x	-
19.	Pineapple	Ananas comosus	Nanas	-	x	-
20.	Papaya	Carica papaya	Pepaya	-	x	-
21.	- - - - - - -	Zingeber officinole	Jahe	-	x	-
22.	- - - - - - -	Marihot utilisina	Ubi kayu	-	x	-
23.	Crove	Syzigium aromaticum	Cengkeh	-	-	x
24.	- - - - - - -	Parkia speciosa	Petai	-	-	x
25.	Tamarind	Pithecellobium dulce	Jengkol	-	-	x

(3) Tanjung Dam

No.	English Name	Latin Name	Indoneasian Name	Existence		
				Wet Area	Dry Area	Area along Ciberang
1.	Coconut	Cocos nucifera	Kelapa	x	x	x
2.	Rubber	Hevea braciliensis	Karet	-	x	-
3.	Rambutan	Nephelium lappaceum	Rambutan	x	-	-
4.	Jackfruit	Artoculpus heterophylia	Nangka	x	x	-
5.	Bamboo	Bambusa sp.	Bambu	x	x	-
6.	Banana	Musa paradisica	Pisang	x	-	x
7.	Gumihan	Artocarpus elasticus	Teureup	-	x	x
8.	Guava	Psidium guajava	Jambu batu	x	-	x
9.	Hibiscus	Hibiscus	Waru	-	-	x
10.	Balady Grass	Imperata cylindrica	Alang-alang	-	x	x
11.	- - - - - - -	Marihot utilisina	Ubi kayu	x	-	-
12.	- - - - - - -	Achras zapota	Sawo	x	-	-
13.	Macang	Mangifera faltida	Mangga limus	x	-	-
14.	Mango	Mangifera indica	Mangga	-	x	-
15.	Mahogany	Swietema mahagoni	Mahoni	x	-	-
16.	- - - - - - -	Schima walichi	Puspa	x	x	-
17.	- - - - - - -	Oriza sativa	Padi	x	-	-
18.	- - - - - - -	Ipomoea batatas	Ubi jalar	x	-	-
19.	- - - - - - -	Pleomela augustifolia	Suji	x	-	-
20.	Vitex	Vitex pubescens	Laban	x	-	-
21.	- - - - - - -	Oethosipan spicatus	Kmis kucing	x	-	-
22.	Indian Rosewood	Dalbergia latifolia	Sawo keling	-	x	-
23.	Walnut	Albizia lebeckoides	Kitoke	-	-	x
24.	- - - - - - -	Dendrocalamus apus	Bambu dali	-	-	x
25.	- - - - - - -	Ageratum canyxoides	Babadtan	-	-	x
26.	Mempisang	Anona muricata	Sirsak	-	-	x

(4) Karian-Serpong Conveyance System

No.	English Name	Latin Name	Indoneasian Name	Existence		
				Wet Area	Dry Area	Area along Ciberang
1.	Coconut	Cocos nucifera	Kelapa			
2.	Rubber	Hevea braciliensis	Karet			
3.	Jackfruit	Artoculpus heterophylia	Nangka			
4.	Bamboo	Bambusa sp.	Bambu			
5.	Gumihan	Artocarpus elasticus	Teureup			
6.		Syzigium aqueum	Jambu air			
7.	Papaya	Carica papaya	Pepaya			
8.	Maize	Zea mays	Jagung			
9.	- - - - - - -	Marihot utilisina	Ubi kayu			
10.	- - - - - - -	Achras zapota	Sawo			
11.	- - - - - - -	Albizia procera	Kihiang			
12.	Mango	Mangifera indica	Mangga			
13.	Mahogany	Swietema mahagoni	Mahoni			
14.	- - - - - - -	Schima walichi	Puspa			
15.	- - - - - - -	Oriza sativa	Padi			
16.	- - - - - - -	Ipomoea batatas	Ubi jalar			
17.	Brunei	Albizia falcotoria	Jengjen			
18.	Pineapple	Ananas comosus	Nanas			
19.	Durian	Durio sibetinus	Durian			
20.	- - - - - - -	Casia siamea	Johar			
21.	- - - - - - -	Artocarpus ahampeden	Cempedak			

Note : x : observed in the field survey