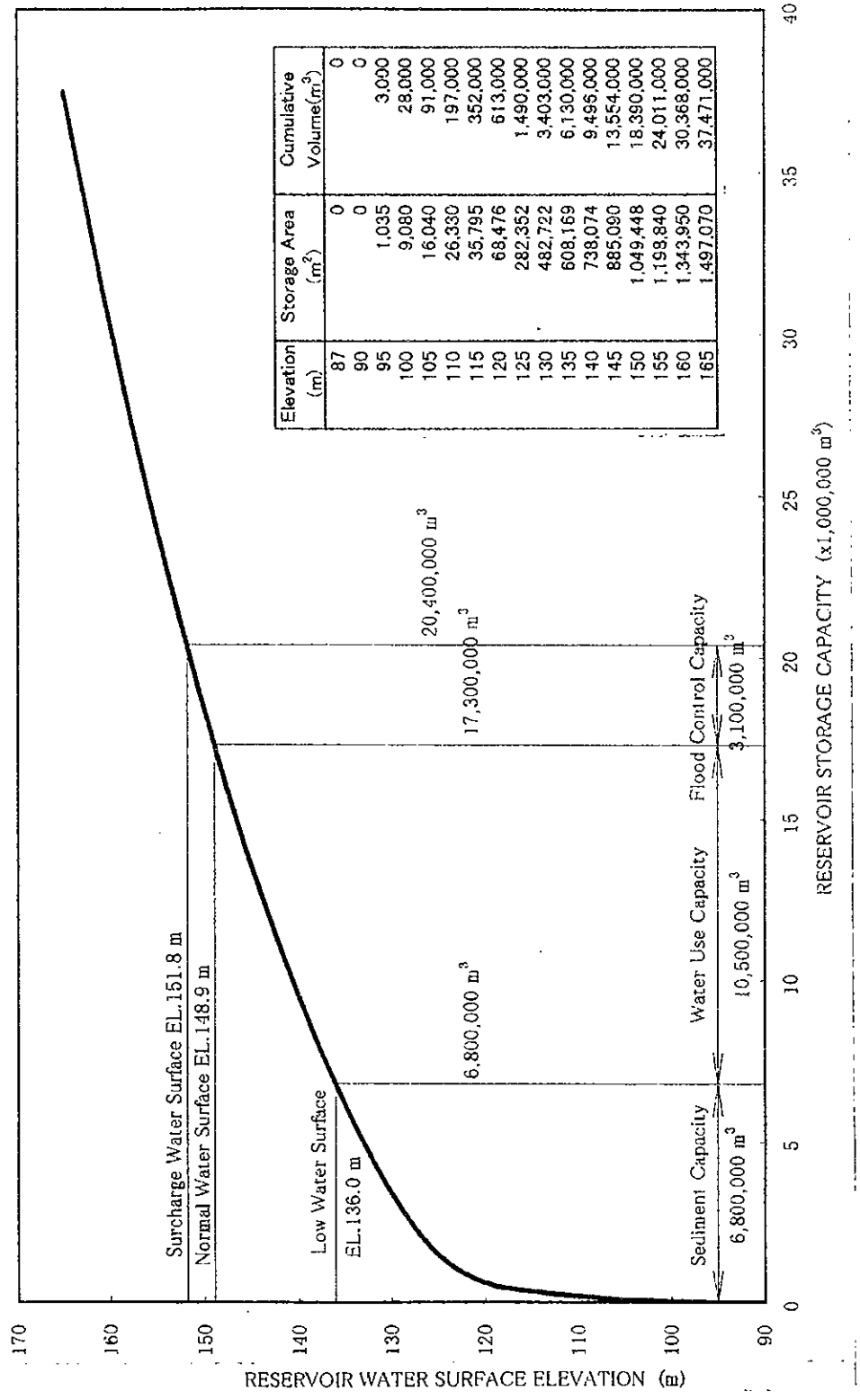
FIGURES

CHAPTER 6

FORMULATION OF DEFINITIVE PLAN

LIST OF FIGURES

Chapter 6

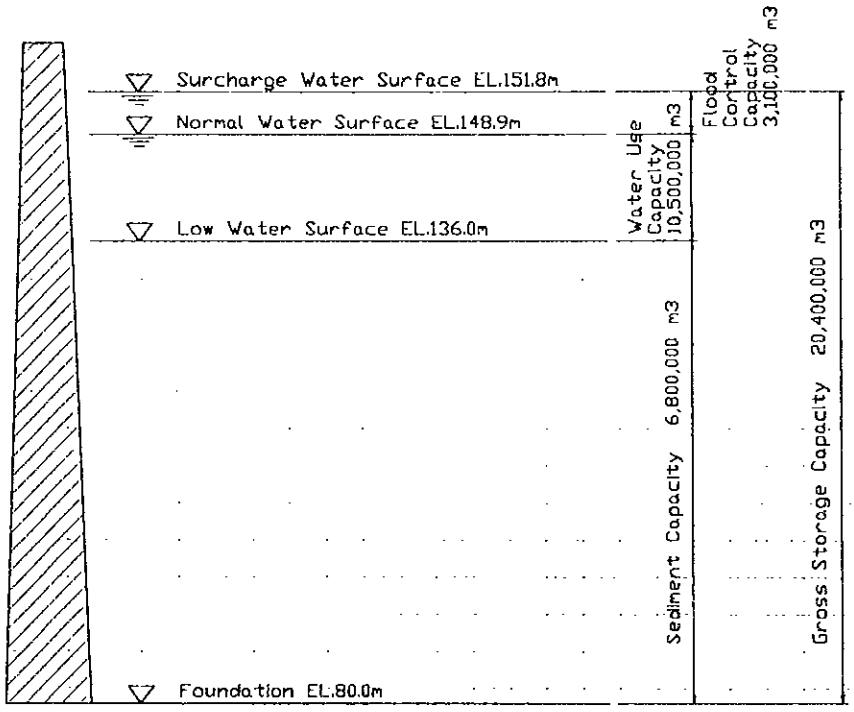


Elevation (m)	Storage Area (m^2)	Cumulative Volume(m^3)
87	0	0
90	0	0
95	1,035	3,000
100	9,080	28,000
105	16,040	91,000
110	26,330	197,000
115	35,795	352,000
120	68,476	613,000
125	282,352	1,490,000
130	482,722	3,403,000
135	608,169	6,130,000
140	738,074	9,496,000
145	885,090	13,554,000
150	1,049,448	18,390,000
155	1,198,840	24,011,000
160	1,343,950	30,368,000
165	1,497,070	37,471,000

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.1
STORAGE-CAPACITY CURVE OF JATIBARANG DAM



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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Fig. 6.2.2
RESERVOIR CAPACITY ALLOCATION OF JATIBARANG DAM

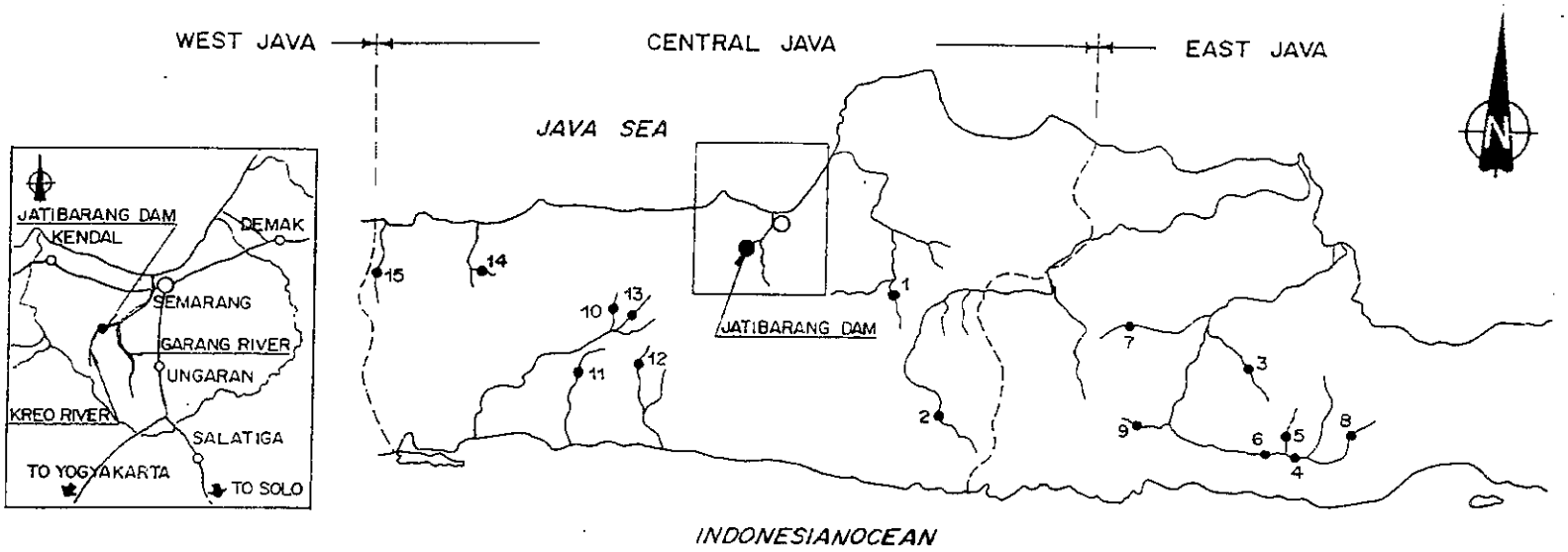
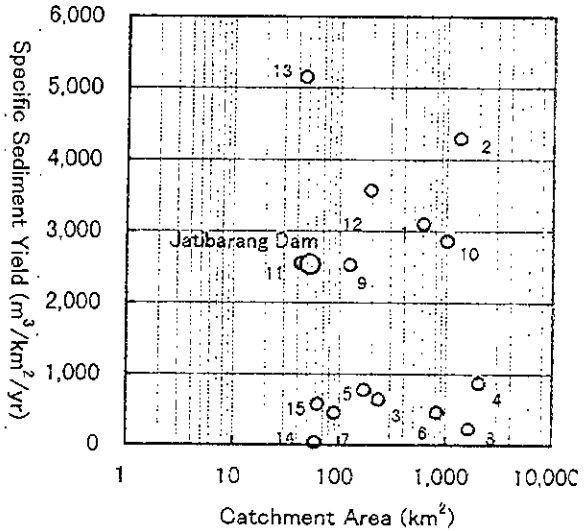
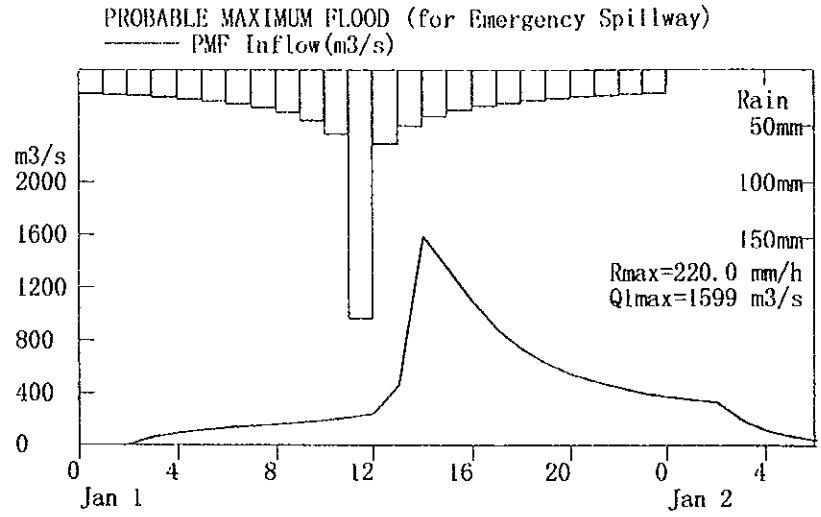


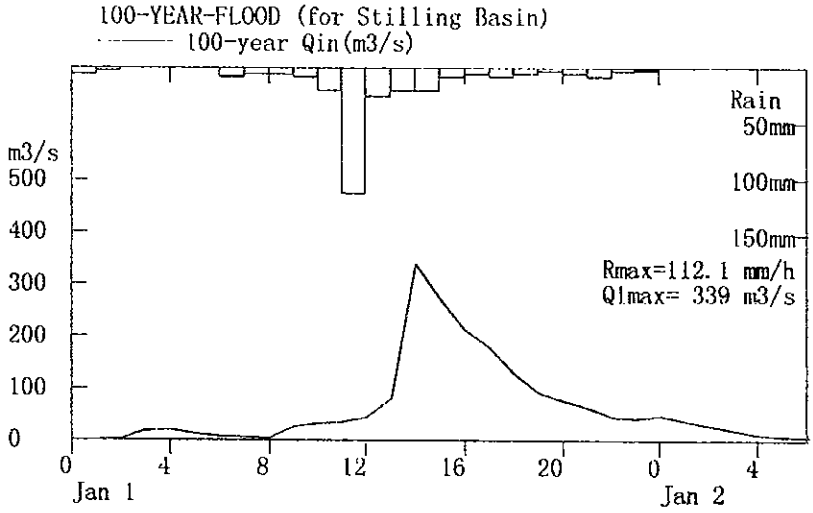
Fig. 6.2.3 SPECIFIC SEDIMENT YIELD ADOPTED IN NEARBY DAM RESERVOIR

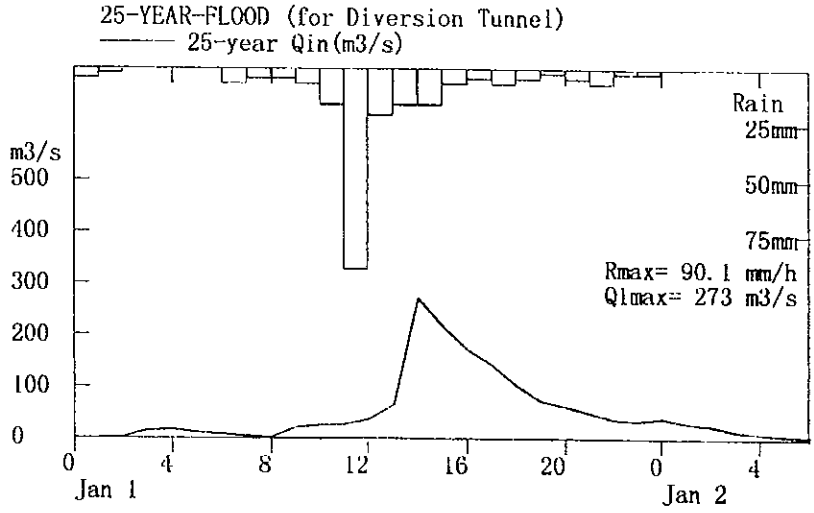
No.	Name of Dam	River	Year of of Completion	Height of Dam (m)	Catchment Area (km^2) (1)	Gross Storage Capacity (m^3)	Sediment Capacity (m^3) (2)	Project Life (year) (3)	Specific Sediment Yield ($m^3/km^2/yr$) (4)=(2)/(1)/(3)
1	Kedung Ombo	Serang	1988	65	614	750,000,000	95,000,000	50	3,094
2	Wonogiri	Solo	1981	42	1,350	730,000,000	290,000,000	50	4,296
3	Kalikonto	Brantas	1972	49	236	62,300,000	7,700,000	50	553
4	Karang Kates	Brantas	1973	100	2,052	343,000,000	90,000,000	50	877
5	Lahor	Lahor in Brantas	1977	74	170	36,110,000	6,680,000	50	786
6	Wlingi	Brantas	1979	47	838	24,000,000	19,800,000	50	473
7	Bening	Bening in Brantas	1984	35	90	28,900,000	2,100,000	50	467
8	Sengguruh	Brantas	1988	33	1,659	21,500,000	19,000,000	50	229
9	Wonorejo	Gondang in Brantas	1999	100	126	122,000,000	16,000,000	50	2,540
10	Mrica	Serayu	1989	110	1,022	193,500,000	146,500,000	50	2,867
11	Sempor	Patahunan in Sempor	1978	58	43	52,000,000	5,500,000	50	2,558
12	Wadaslintang	Lunto Bedegoran	1987	122	196	443,000,000	35,000,000	50	3,571
13	Garung	Klahan in Serayu	1983	36	47	27,000,000	12,100,000	50	5,149
14	Cacaban	Curug Agung	1958	38	59	90,000,000	100,000	50	34
15	Malahayu	Kabuyutan	1940	31	63	39,880,000	1,860,000	50	590

Note : Project life was assumed as 50 years if unknown.

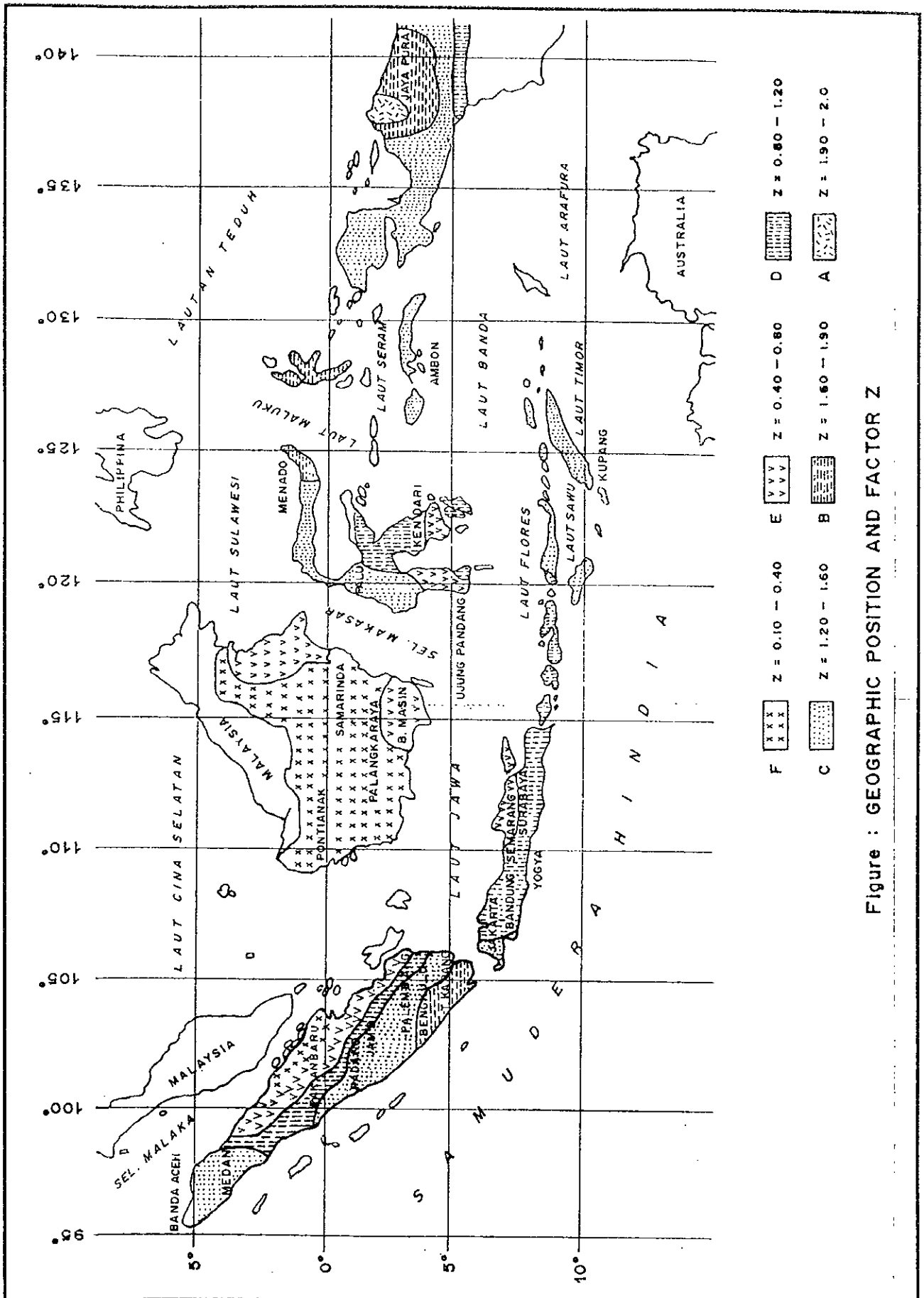




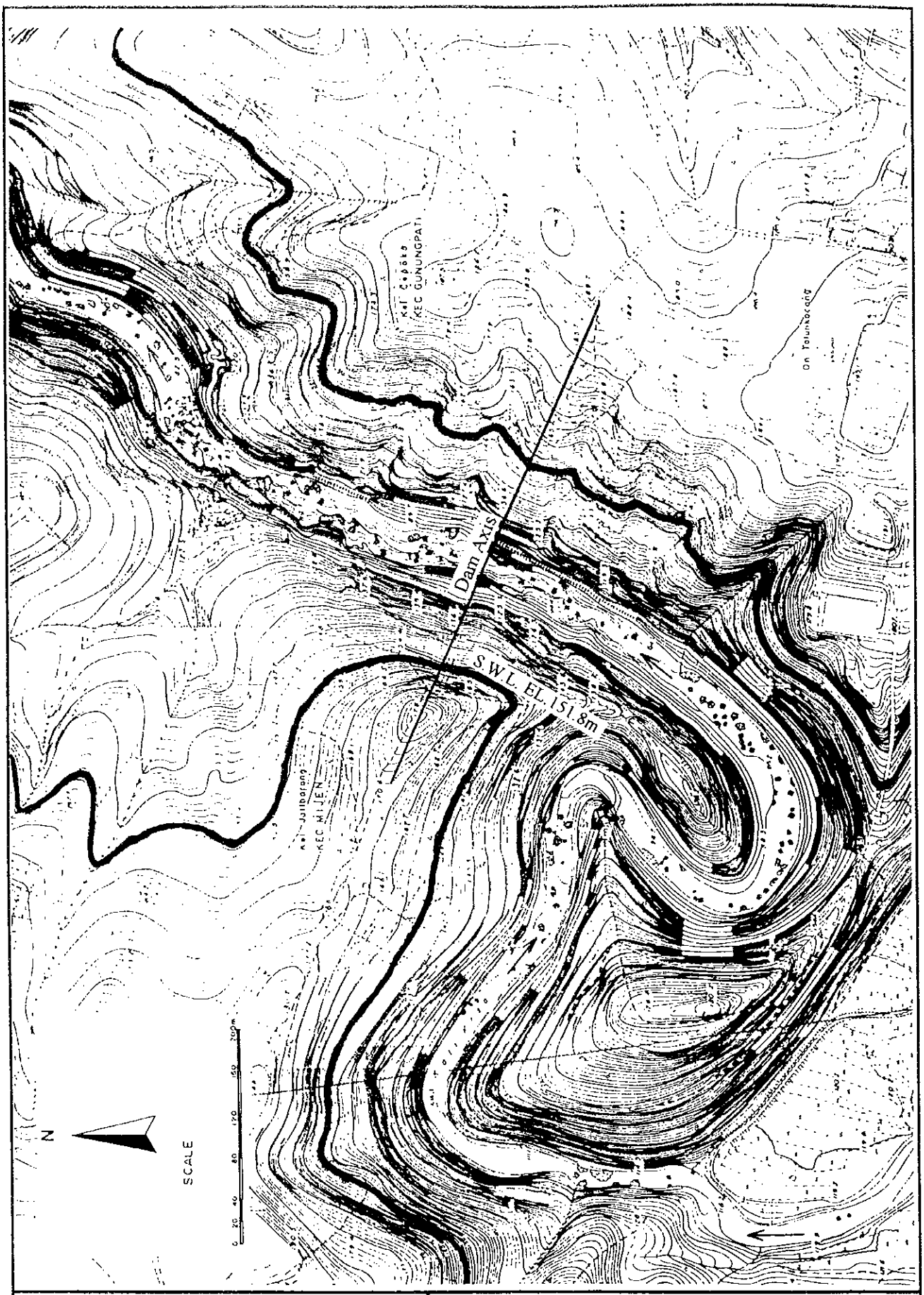




THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.4 DESIGN DISCHARGES FOR FILL TYPE DAM
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.5 EARTHQUAKE ZONE MAP
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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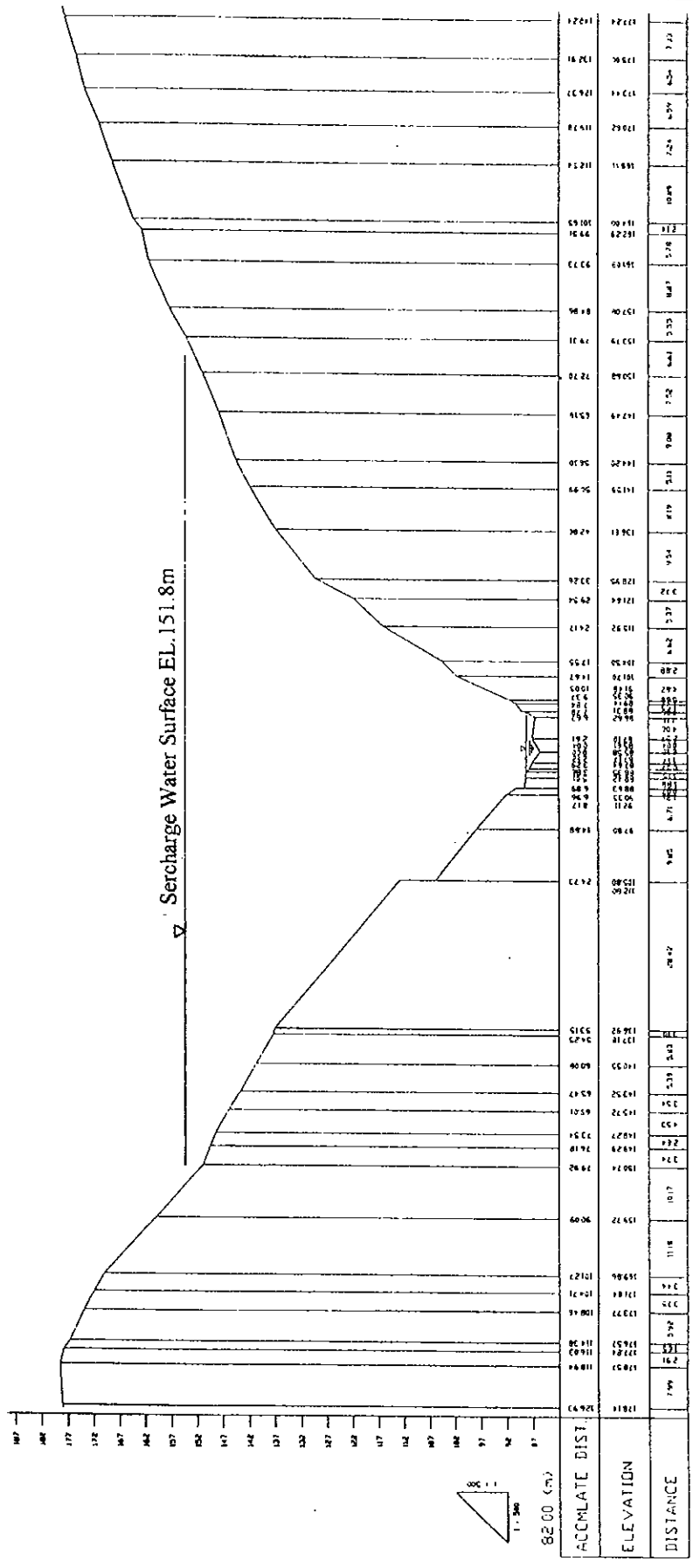
Fig. 6.2.6
AXIS OF JATIBARANG DAM .



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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Fig. 6.2.7
LONGITUDINAL SECTION OF JATIBARANG DAM AXIS

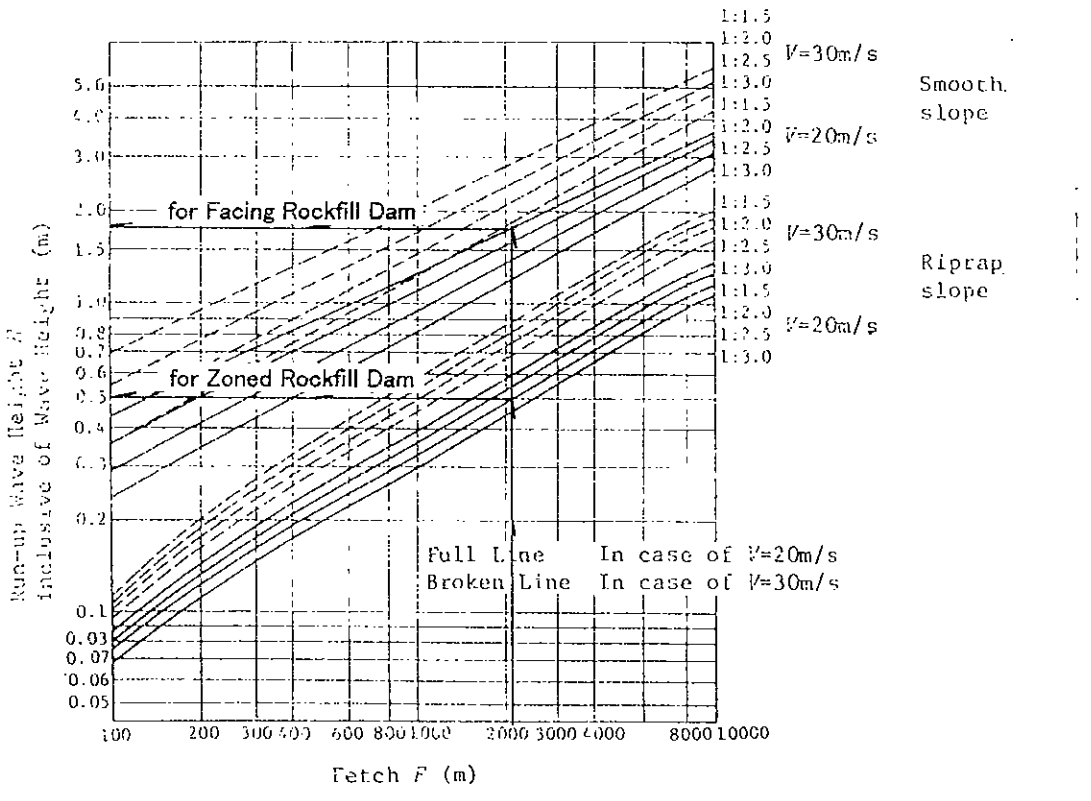
CALCULATION OF WATER WAVE IN RESERVOIR

1. WAVE DUE TO WIND

Dam Type		Symbol	Value	Remarks
Zoned Rockfill	Wind Velocity	V	20 m/s	
	Maximum Fetch	F	2,100 m	
	Upstream Slope		1 : 2.6	Riprap Slope
	Height of Wave by Wind	hw	0.5 m	refer to Diagram shown below
Facing Rockfill	Wind Velocity	V	20 m/s	
	Maximum Fetch	F	2,100 m	
	Upstream Slope		1 : 1.5	Smoothness Slope
	Height of Wave by Wind	hw	1.8 m	refer to Diagram shown below

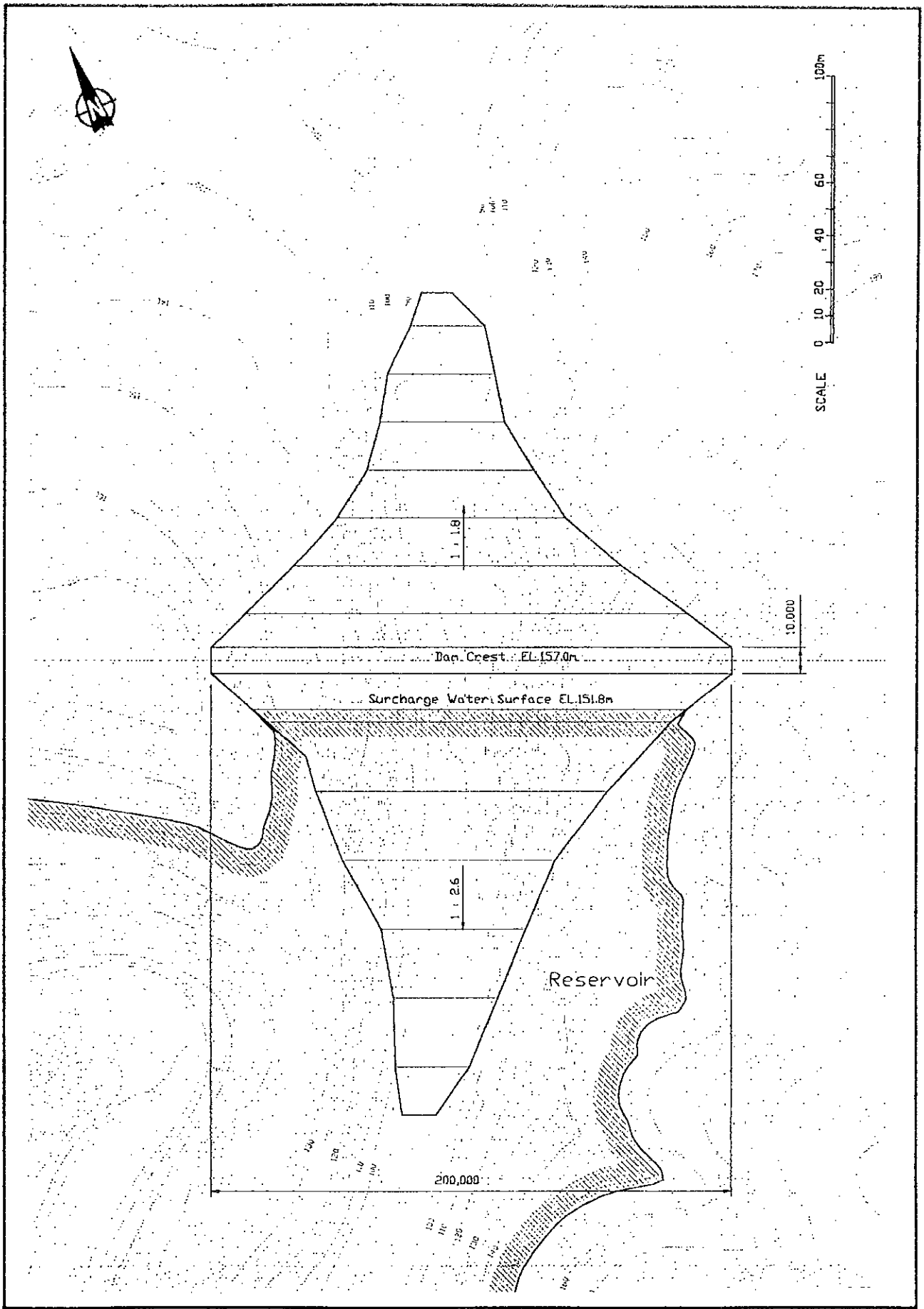
2. WAVE DUE TO SEISMIC MOTION

Dam Type		Symbol	Value	Remarks
Zoned Rockfill Facing Rockfill	Earthquake Coefficient	k	0.18	refer to Table 2.2.3
	Seismic Frequency	t	1 sec	
	Reservoir Depth	Ho	68.9 m	Ho = NWL 148.9 – Base 80.0m
	Height of Wave by Earthquake	he	0. 8 m	he = k*t*(9.8*Ho)$^{0.5}$/2/3.14=0.745m



Run-up Wave Height (inclusive of Wave Height) obtained by a combined use of the S.M.B. Method and Saville's Method

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.8 CALCULATION OF WATER WAVE IN RESERVOIR
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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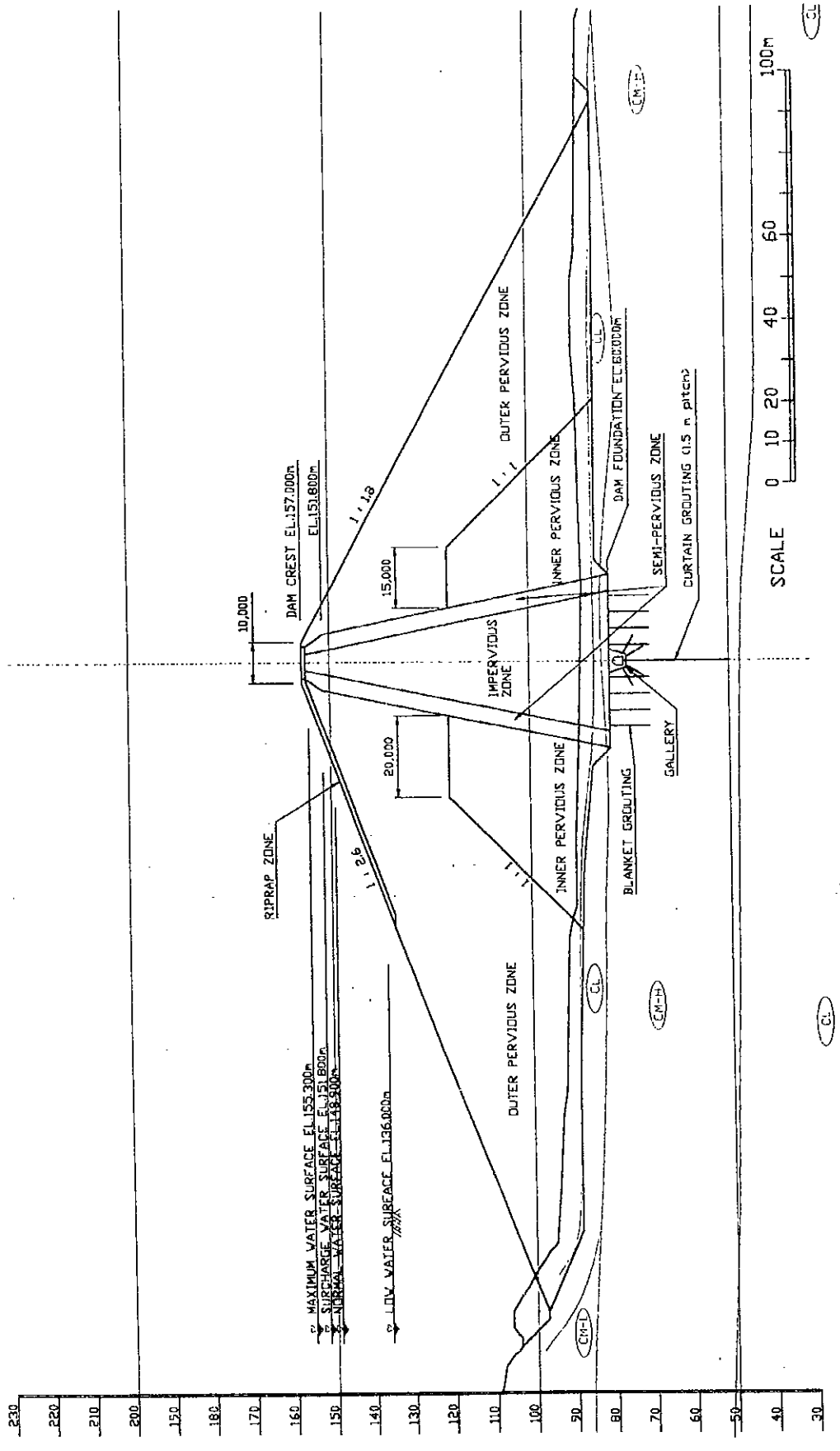
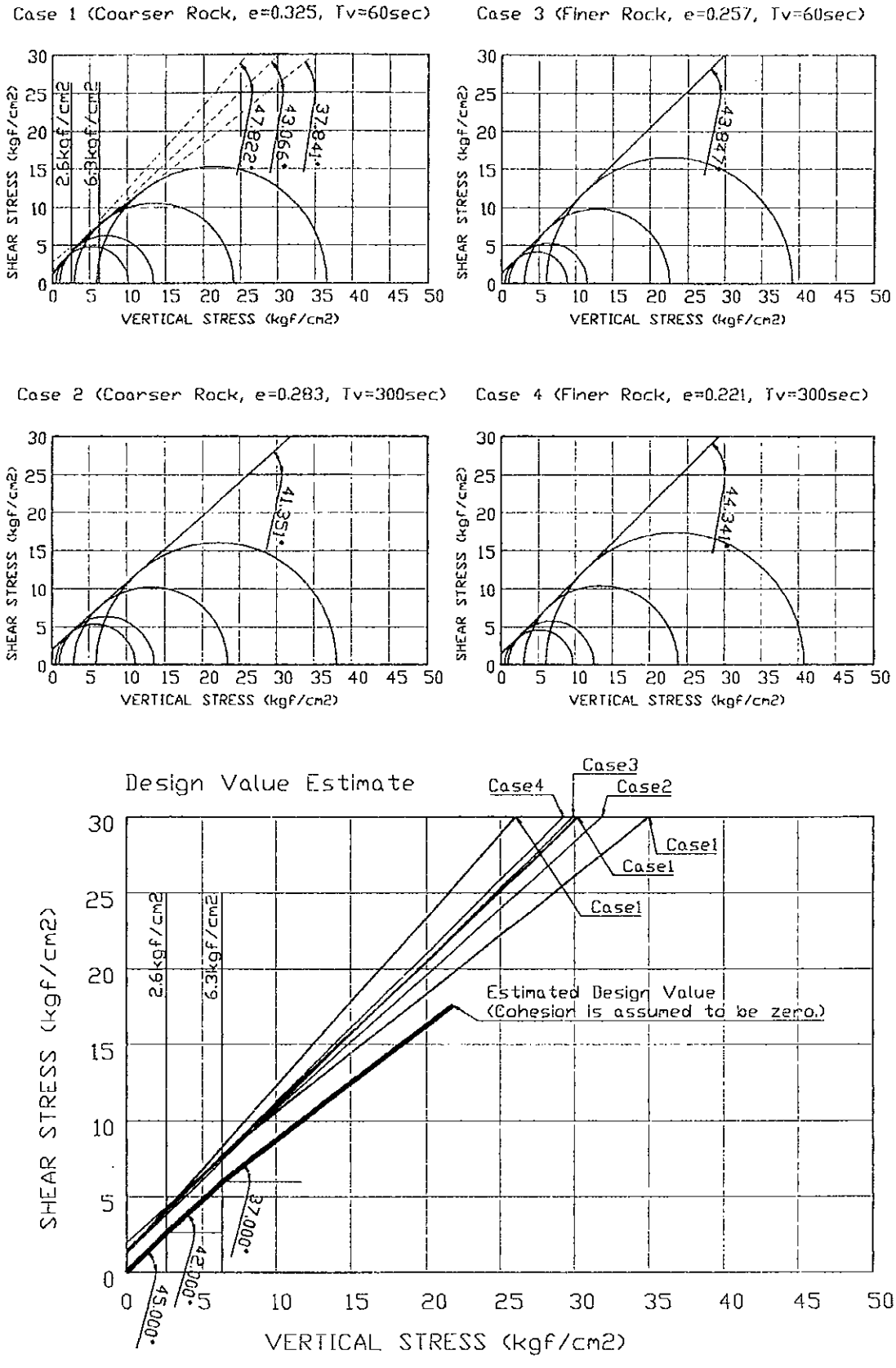
Fig. 6.2.9
PLAN OF CENTER CORE ROCKFILL DAM



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.10 TYPICAL CROSS SECTION OF CENTER CORE ROCKFILL DAM
JAPAN INTERNATIONAL COOPERATION AGENCY	



NOTE : e=Void Ratio, Tv=Time of Vibrating Compaction

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.11 INTERNAL FRICTION ANGLE OF ROCK IN PERVIOUS ZONE
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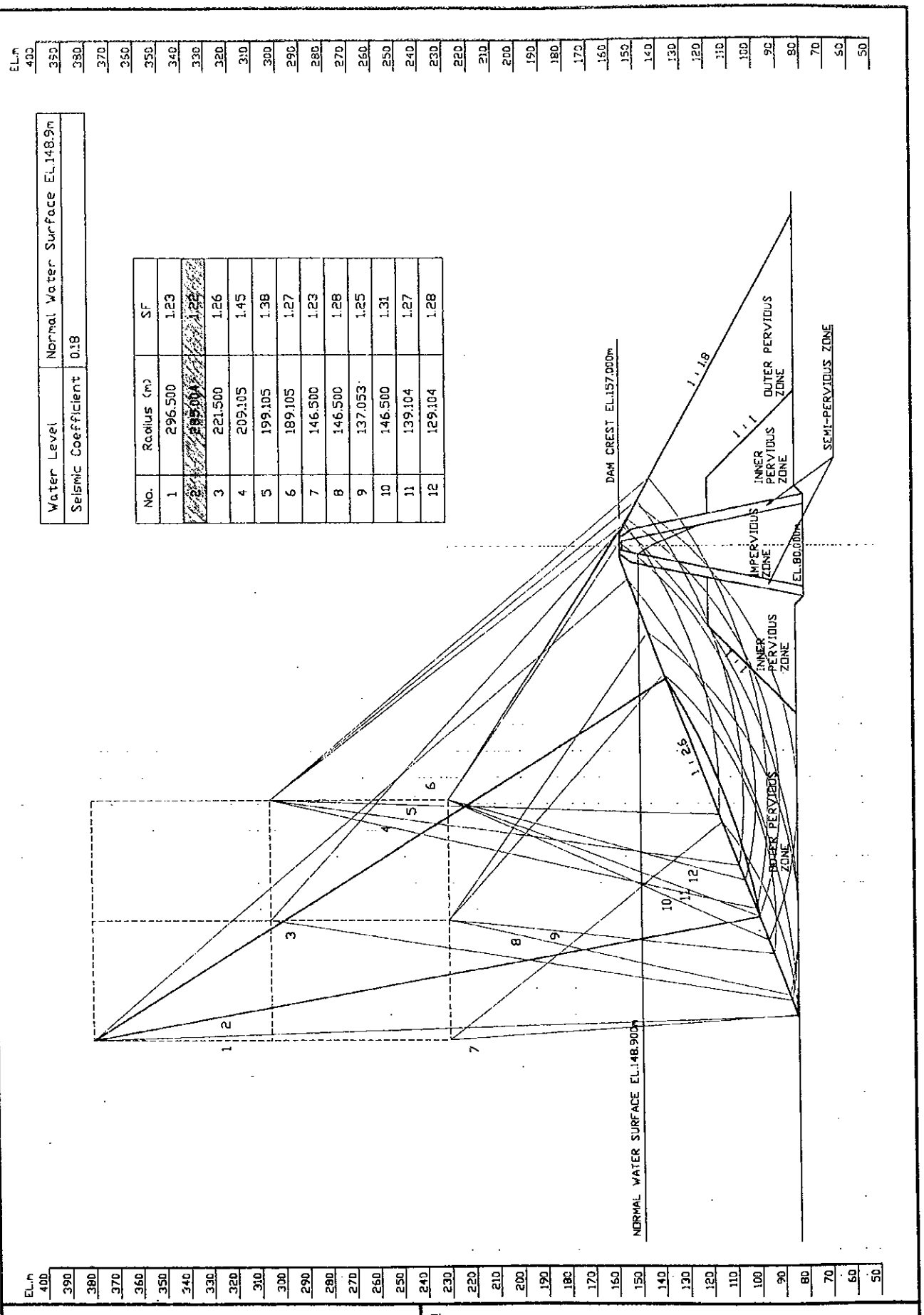

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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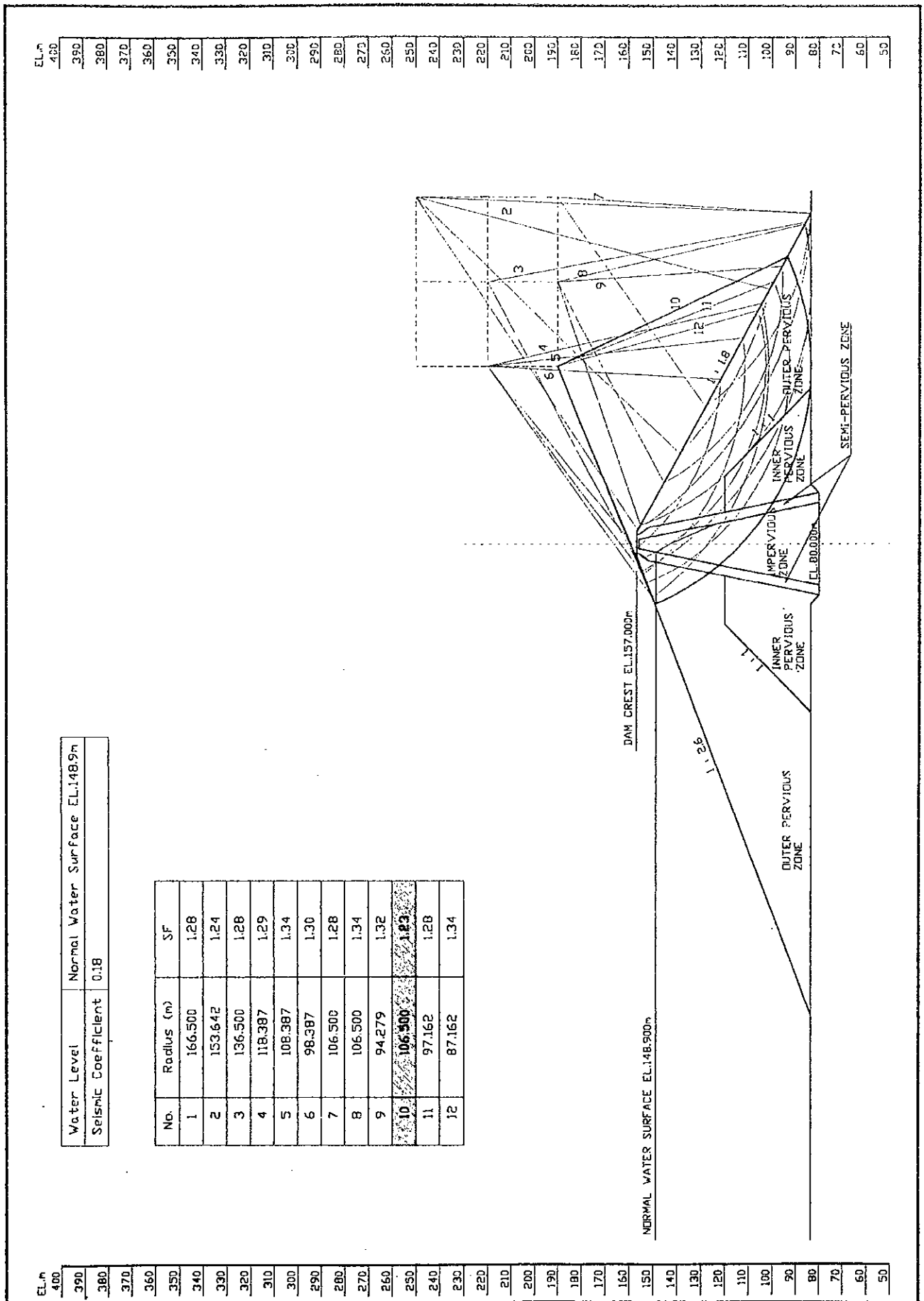
Fig. 6.2.12
UPSTREAM SLOPE STABILITY ANALYSIS OF CENTER CORE ROCKFILL DAM



Water Level	Normal Water Surface EL.148.9m
Seismic Coefficient	0.18

No.	Radius (m)	SF
1	166.500	1.28
2	153.642	1.24
3	136.500	1.28
4	118.387	1.29
5	108.387	1.34
6	98.387	1.30
7	106.500	1.28
8	106.500	1.34
9	94.279	1.32
10	106.500	1.23
11	97.162	1.28
12	87.162	1.34

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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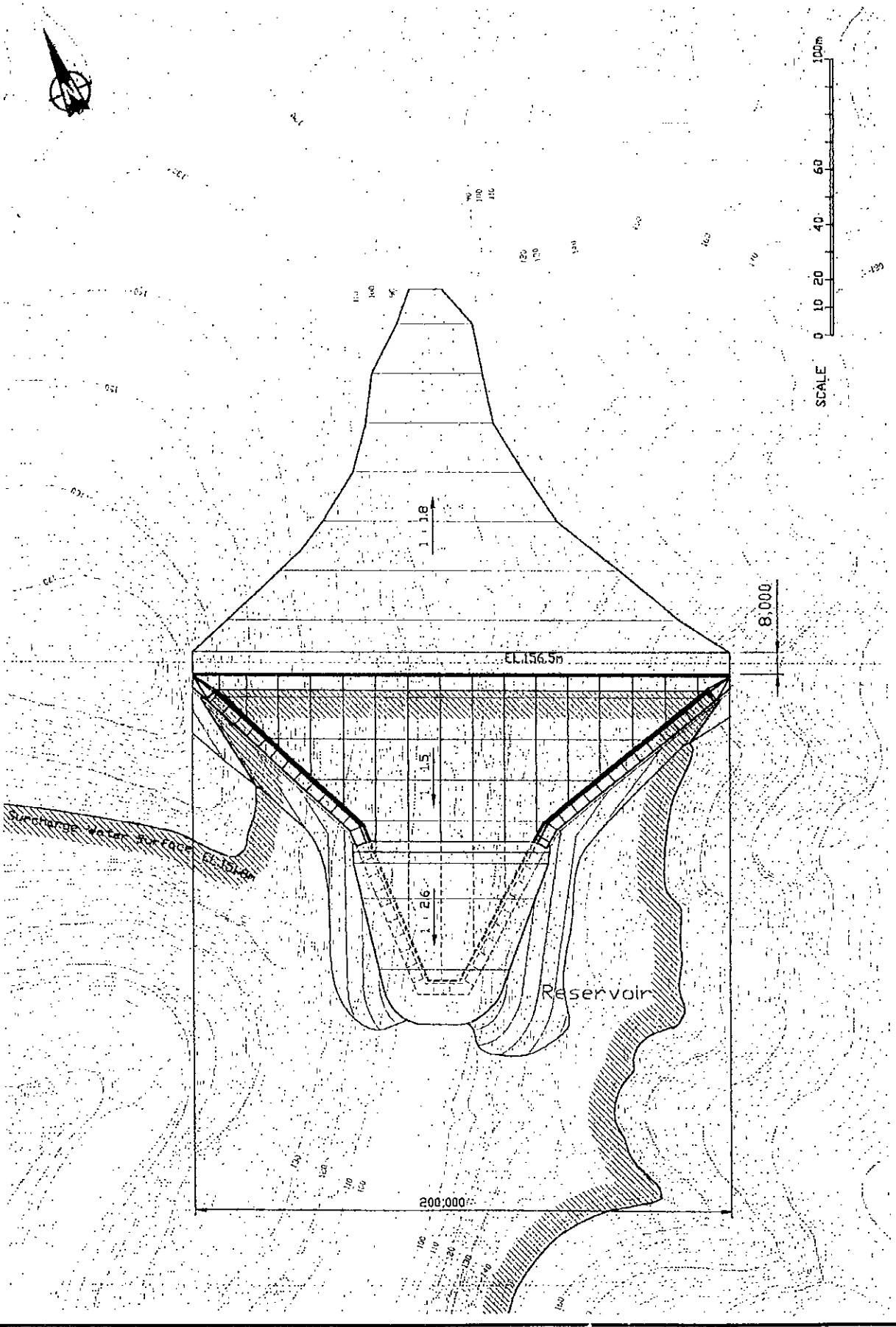
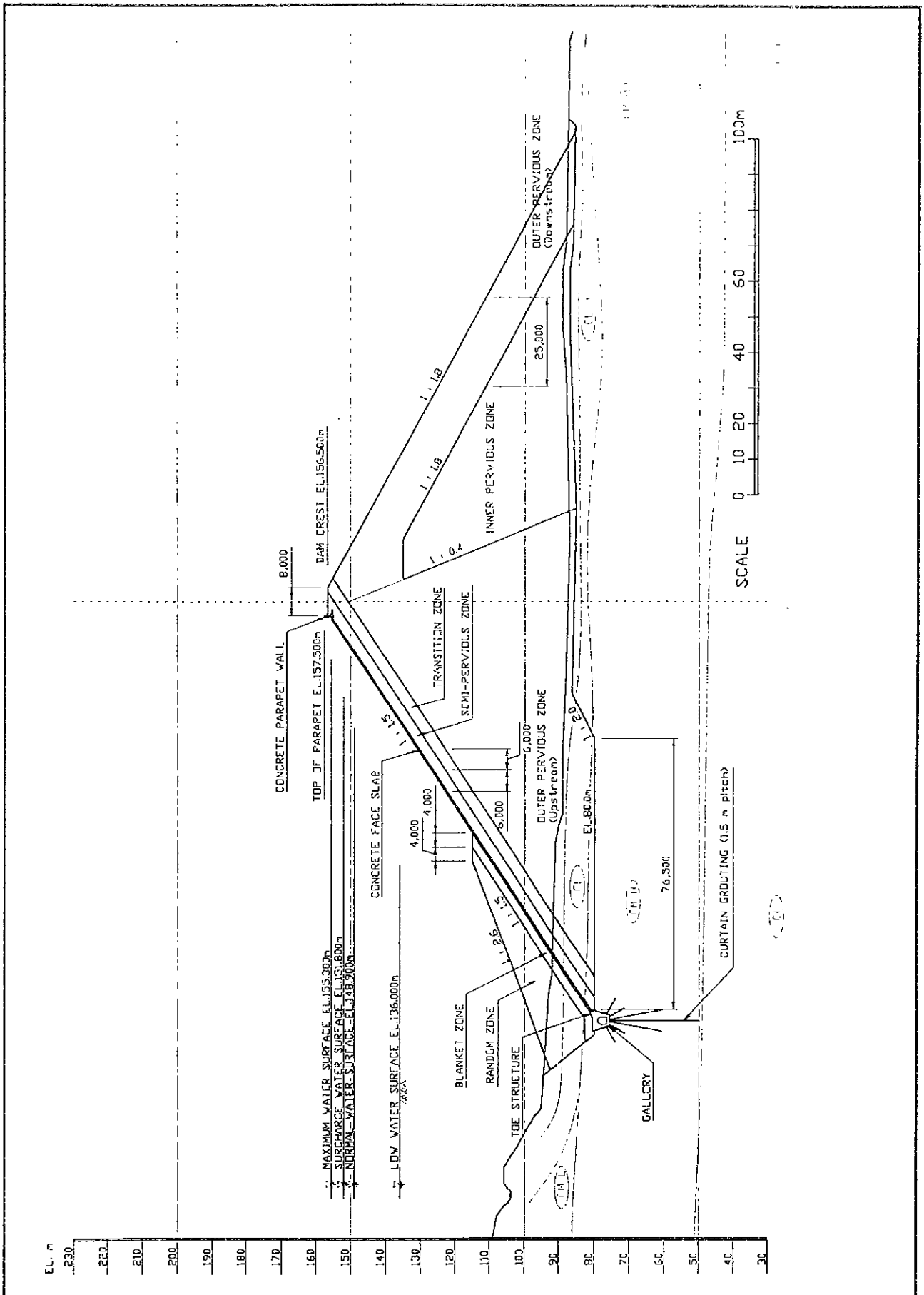
Fig. 6.2.13
DOWNSTREAM SLOPE STABILITY ANALYSIS OF CENTER CORE ROCKFILL DAM



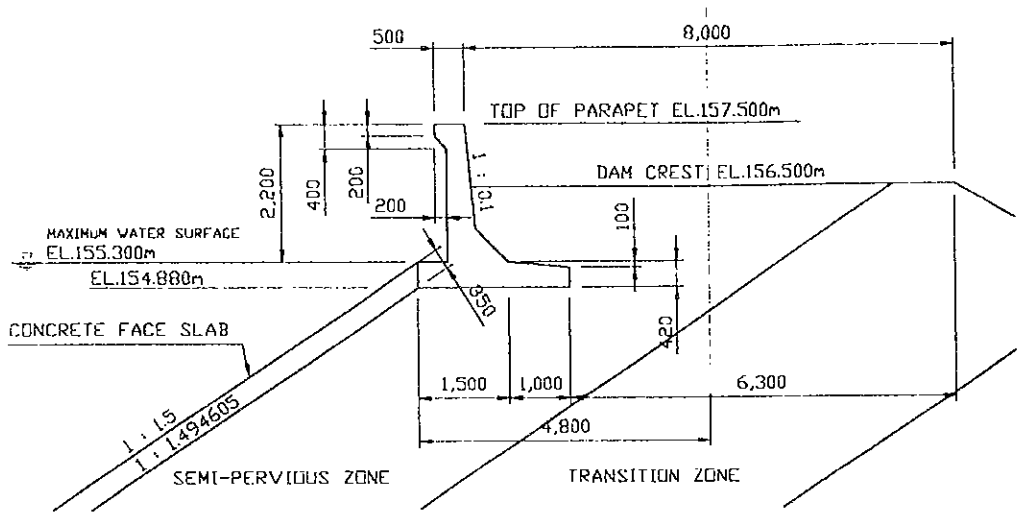
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.14 PLAN OF CONCRETE FACE ROCKFILL DAM
JAPAN INTERNATIONAL COOPERATION AGENCY	



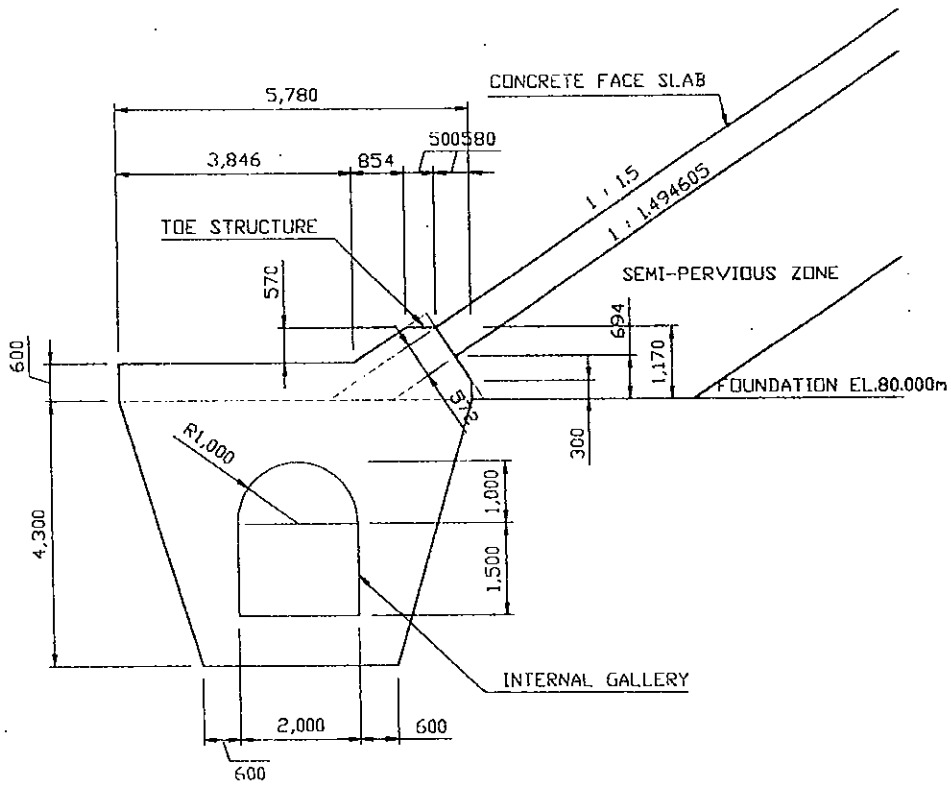
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.15
TYPICAL CROSS SECTION OF CONCRETE FACE ROCKFILL DAM



PARAPET WALL



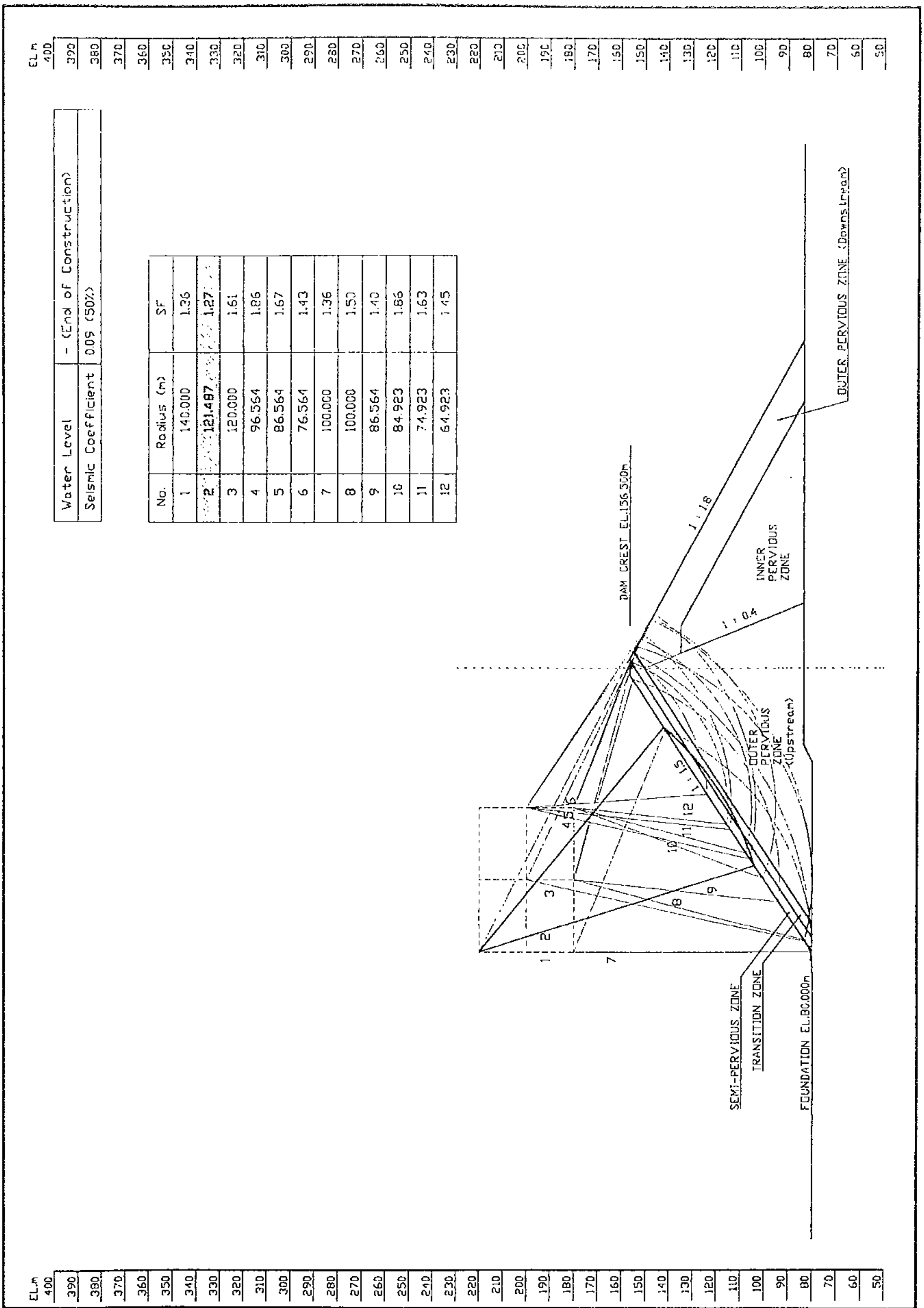
TOE STRUCTURE AND GALLERY

0 1 2 3 4 5 6m

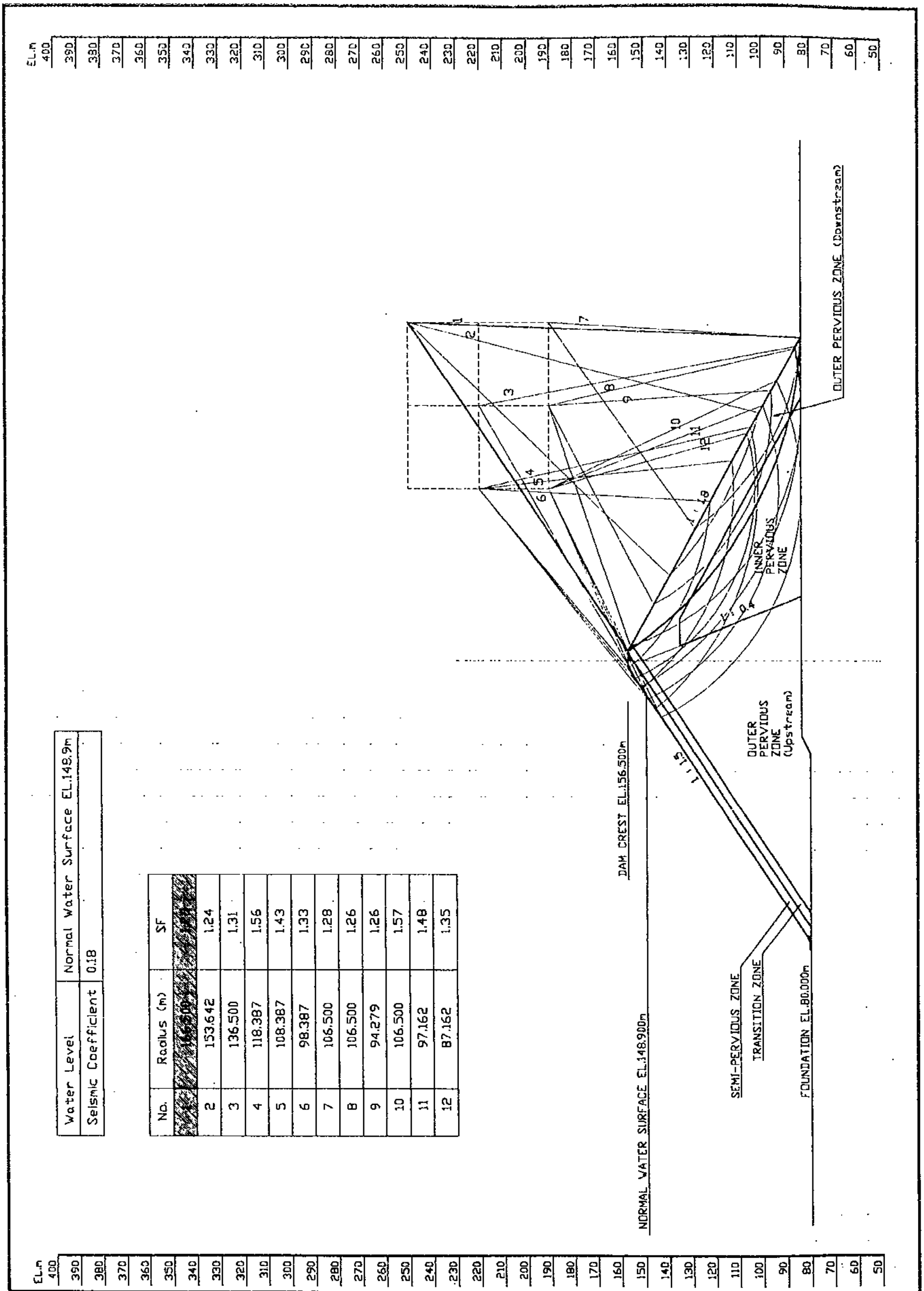
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.16 TYPICAL CROSS SECTION OF PARAPET WALL AND TOE SLAB
JAPAN INTERNATIONAL COOPERATION AGENCY	

Water Level	- (End of Construction)
Seismic Coefficient	0.09 (50%)

No.	Radius (m)	SF
1	140.000	1.36
2	121.487	1.27
3	120.000	1.61
4	96.564	1.86
5	86.564	1.67
6	76.564	1.43
7	100.000	1.36
8	100.000	1.50
9	86.564	1.40
10	84.923	1.66
11	74.923	1.63
12	64.923	1.45



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.17 UPSTREAM SLOPE STABILITY ANALYSIS OF CONCRETE FACE ROCKFILL DAM
JAPAN INTERNATIONAL COOPERATION AGENCY	



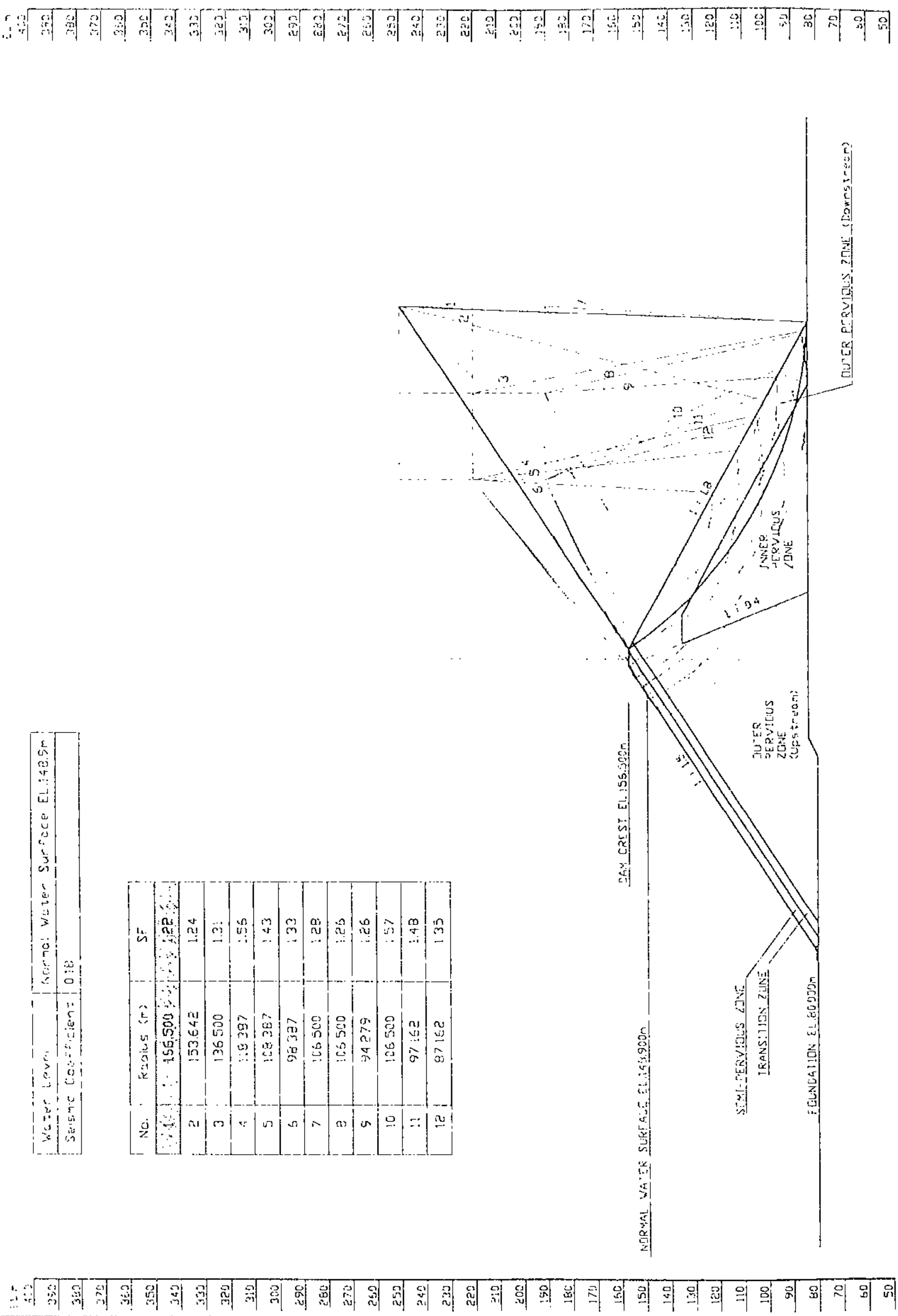
Water Level	Normal Water Surface EL.148.9m
Seismic Coefficient	0.18

No.	Radius (m)	SF
1	166.500	[illegible]
2	153.642	1.24
3	136.500	1.31
4	118.387	1.56
5	108.387	1.43
6	98.387	1.33
7	106.500	1.28
8	106.500	1.26
9	94.279	1.26
10	106.500	1.57
11	97.162	1.48
12	87.162	1.35

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.18
DOWNSTREAM SLOPE STABILITY ANALYSIS OF CONCRETE FACE ROCKFILL DAM



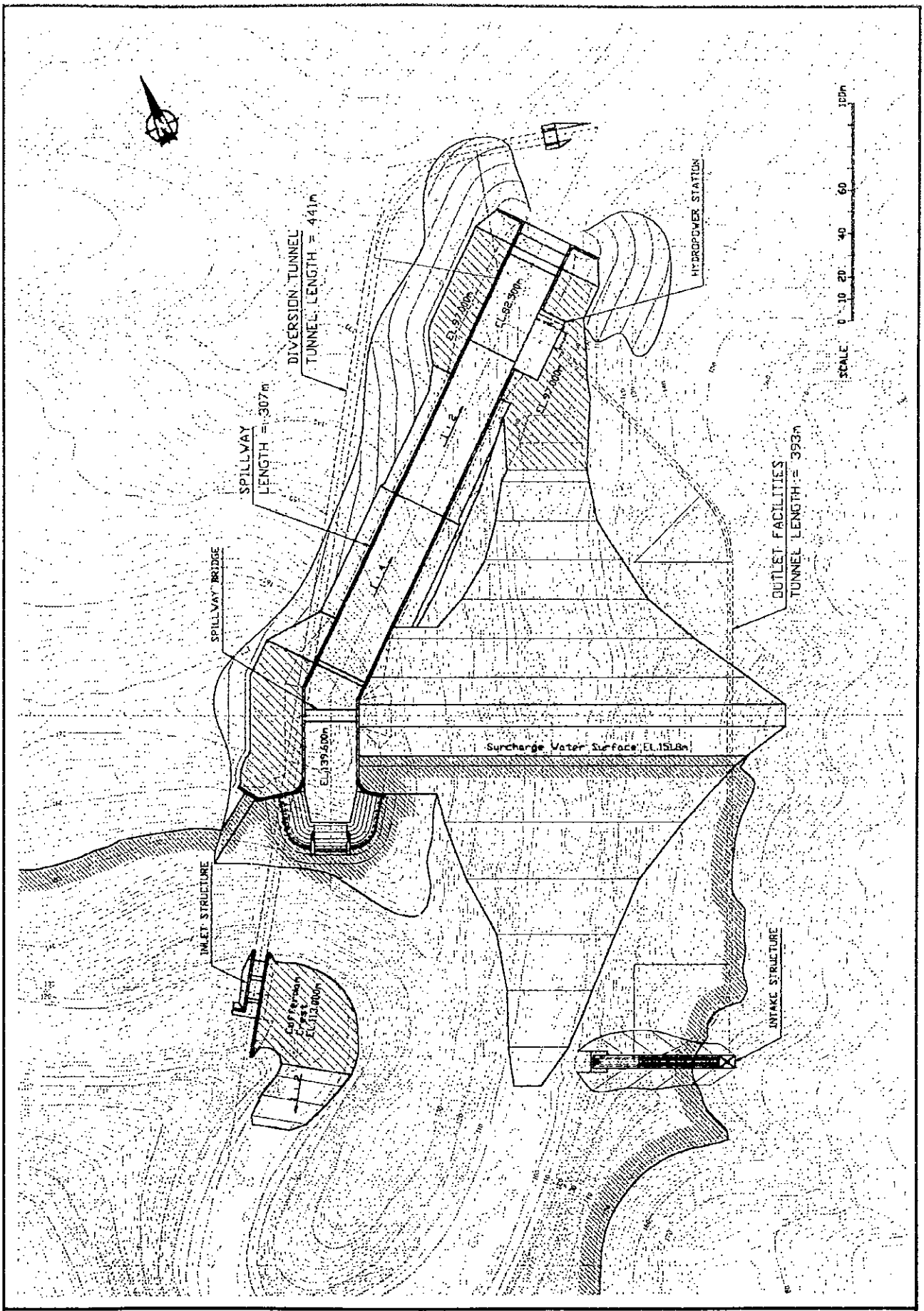
Water Level	Normal Water Surface EL.148.5m
Seismic Coefficient	0.18

No.	Radius (r)	SF
1	156.500	1.22
2	153.642	1.24
3	136.500	1.31
4	119.397	1.55
5	108.387	1.43
6	98.387	1.33
7	106.500	1.28
8	106.500	1.25
9	94.279	1.26
10	106.500	1.57
11	97.162	1.48
12	87.162	1.35

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.18
DOWNSTREAM SLOPE STABILITY ANALYSIS OF CONCRETE FACE ROCKFILL DAM



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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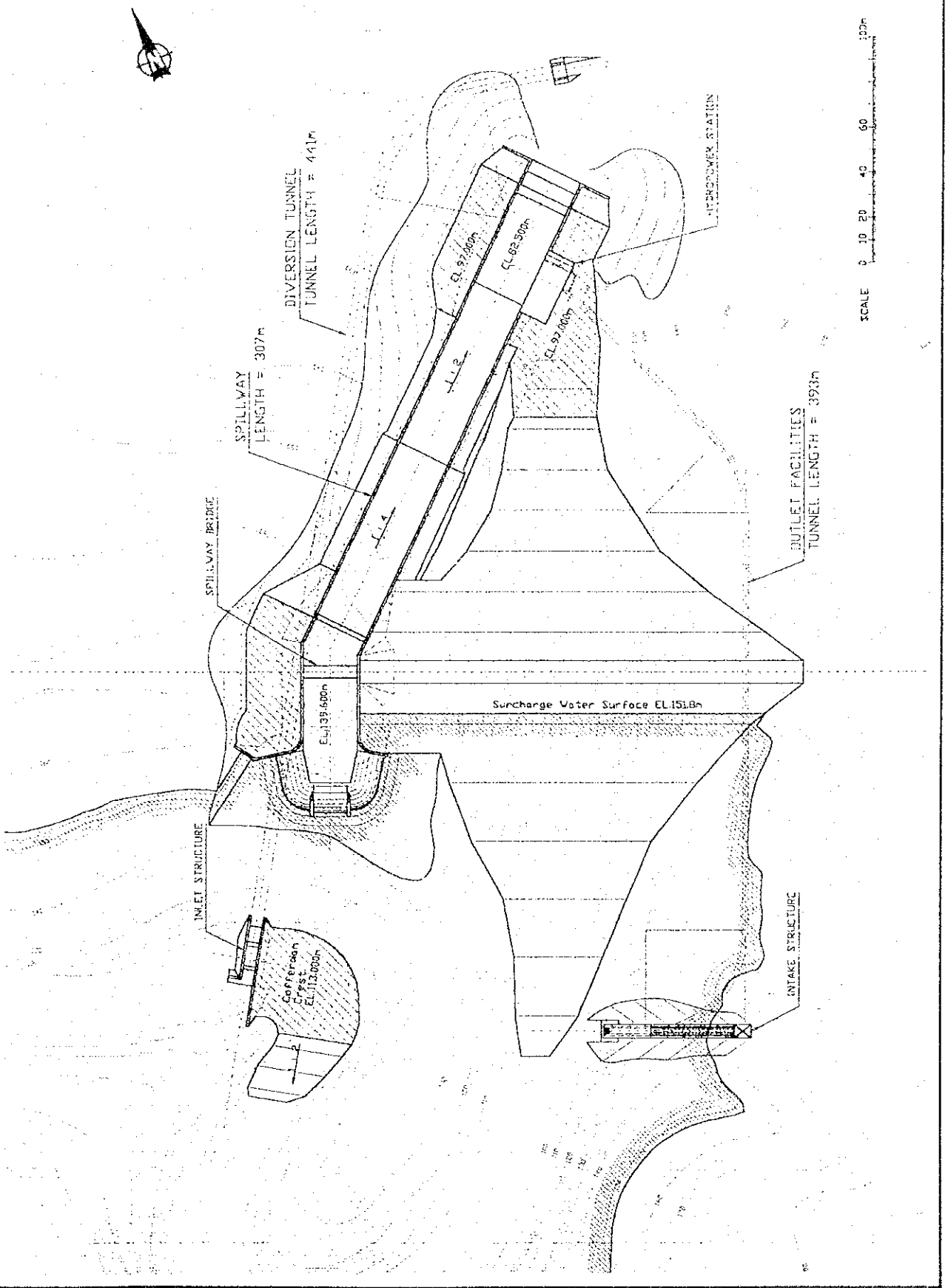
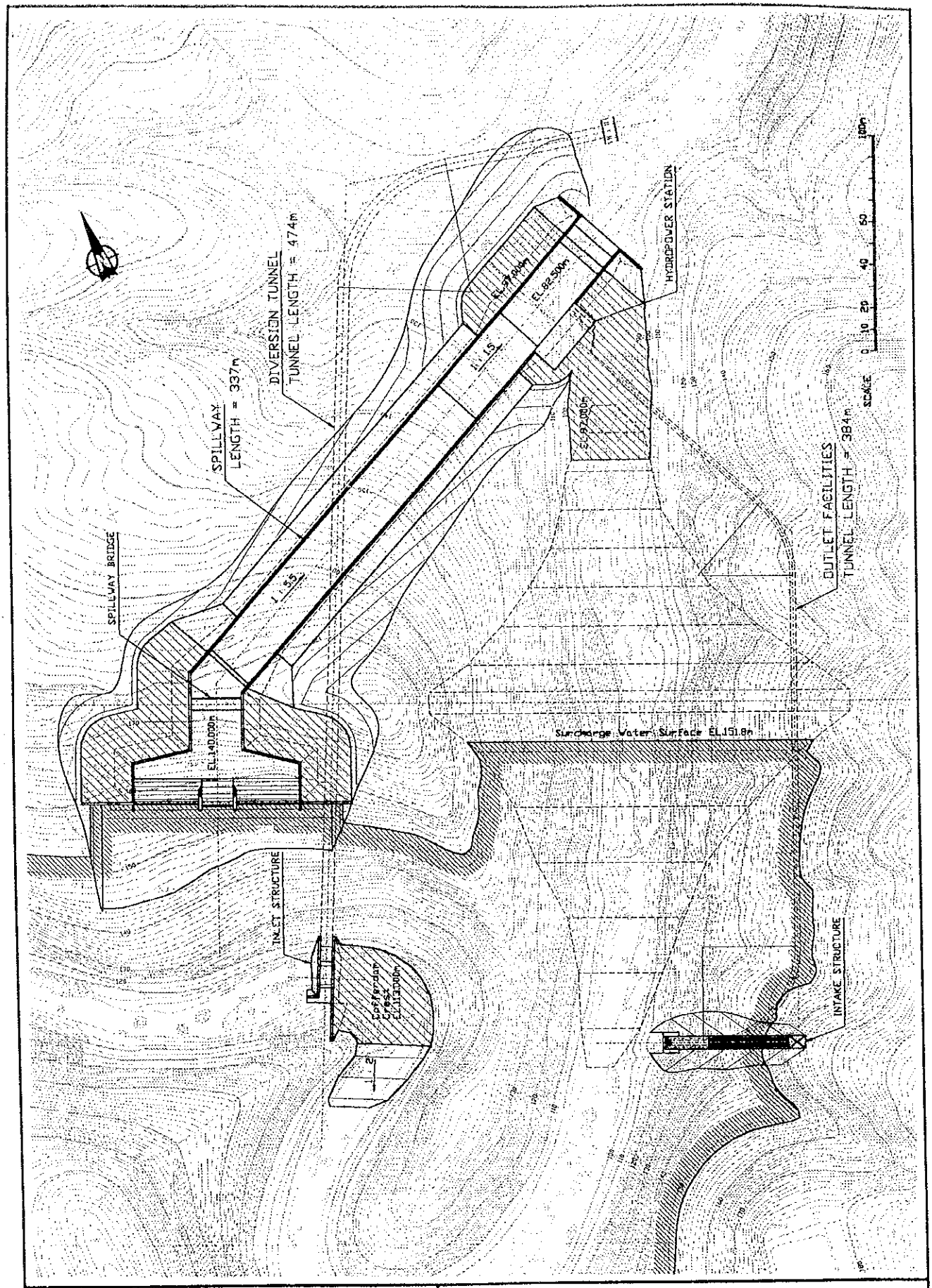
Fig. 6.2.19
LAYOUT OF APPURTENANT STRUCTURES IN ALTERNATIVE L 1



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.19 LAYOUT OF APPURTENANT STRUCTURES IN ALTERNATIVE L1
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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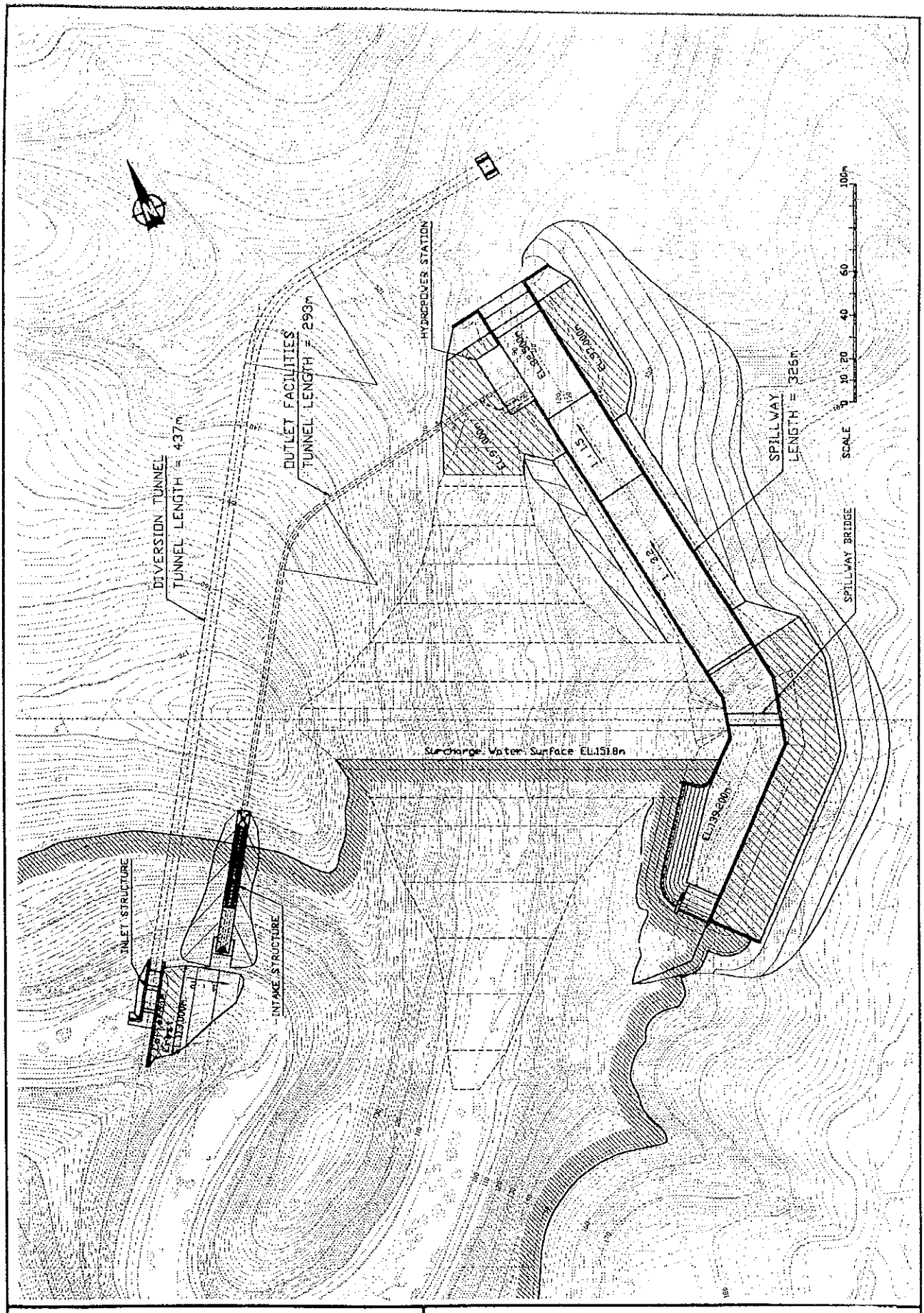
Fig. 6.2.20
LAYOUT OF APPURTENANT STRUCTURES IN ALTERNATIVE L 2



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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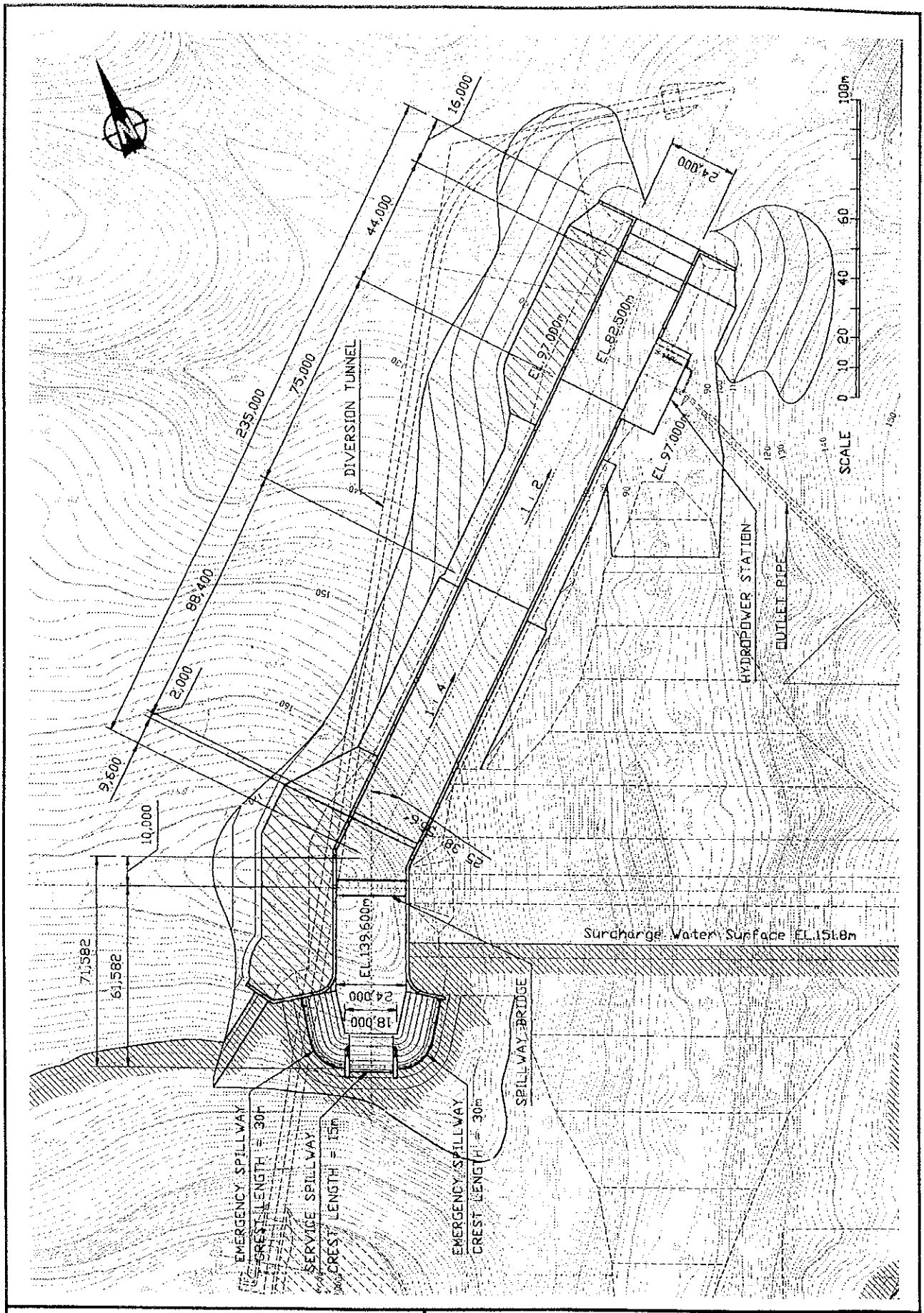
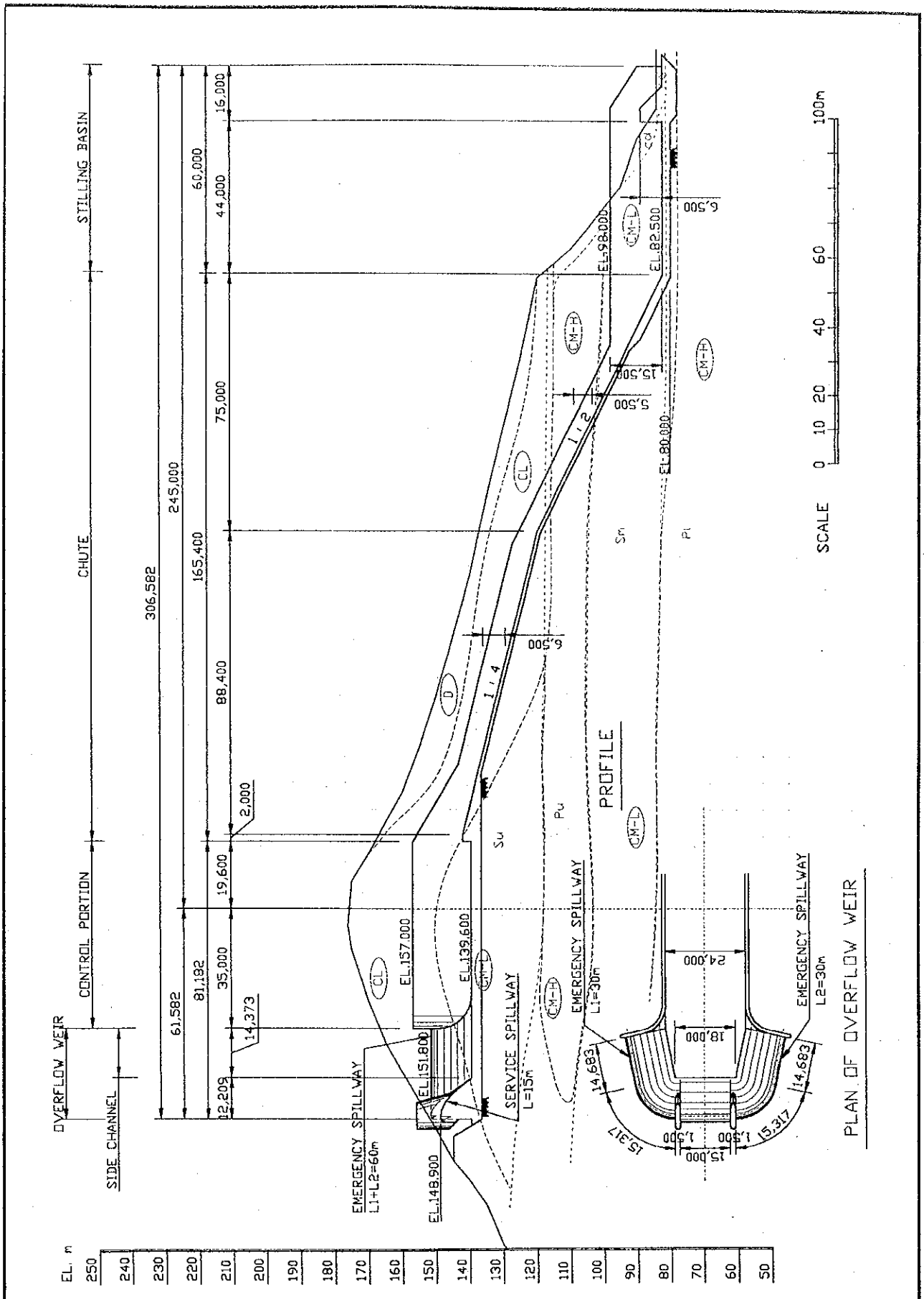
Fig. 6.2.21
LAYOUT OF APPURTENANT STRUCTURES IN ALTERNATIVE R 1



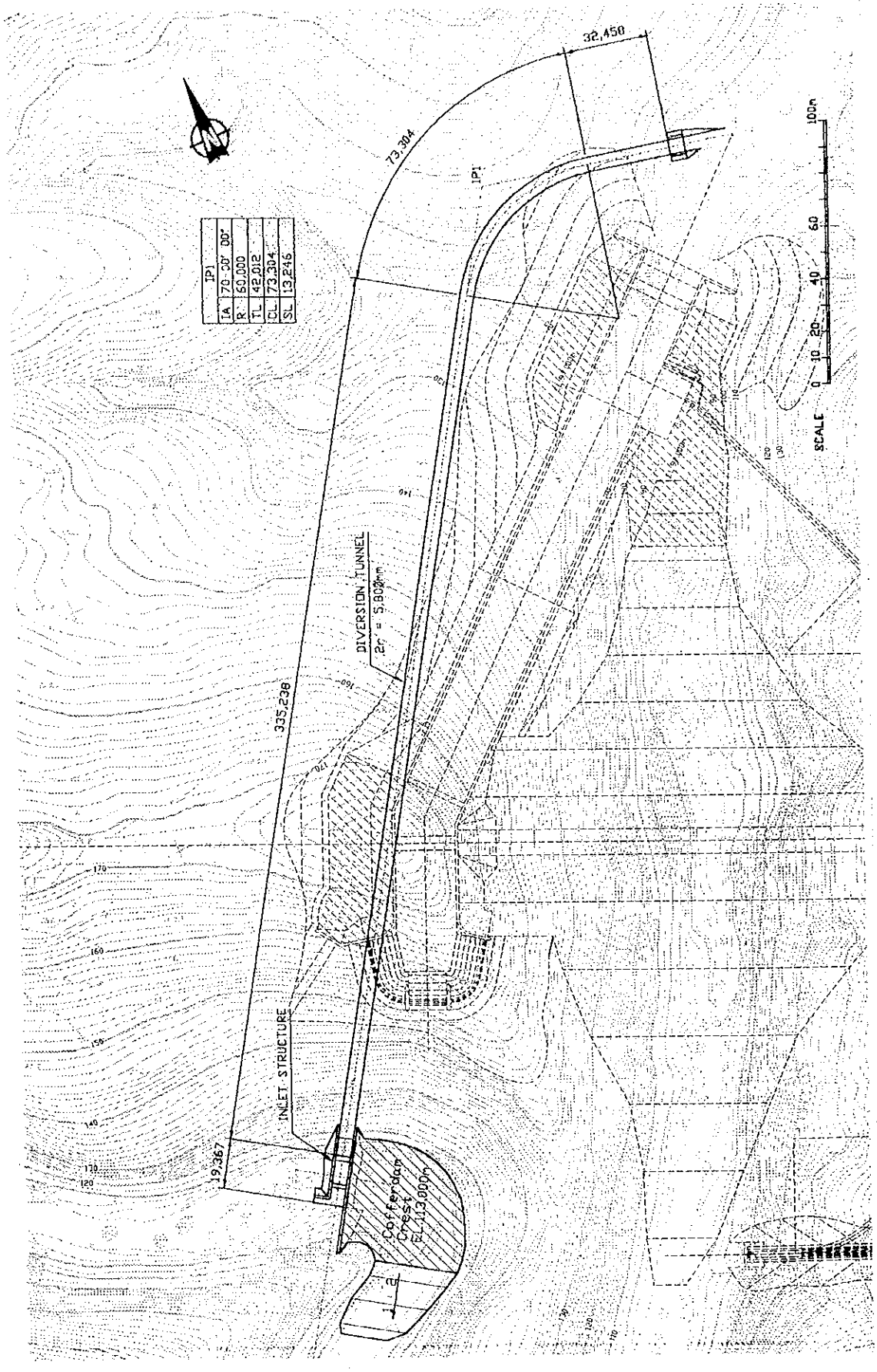
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.22 PLAN OF SPILLWAY
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.23
PROFILE OF SPILLWAY



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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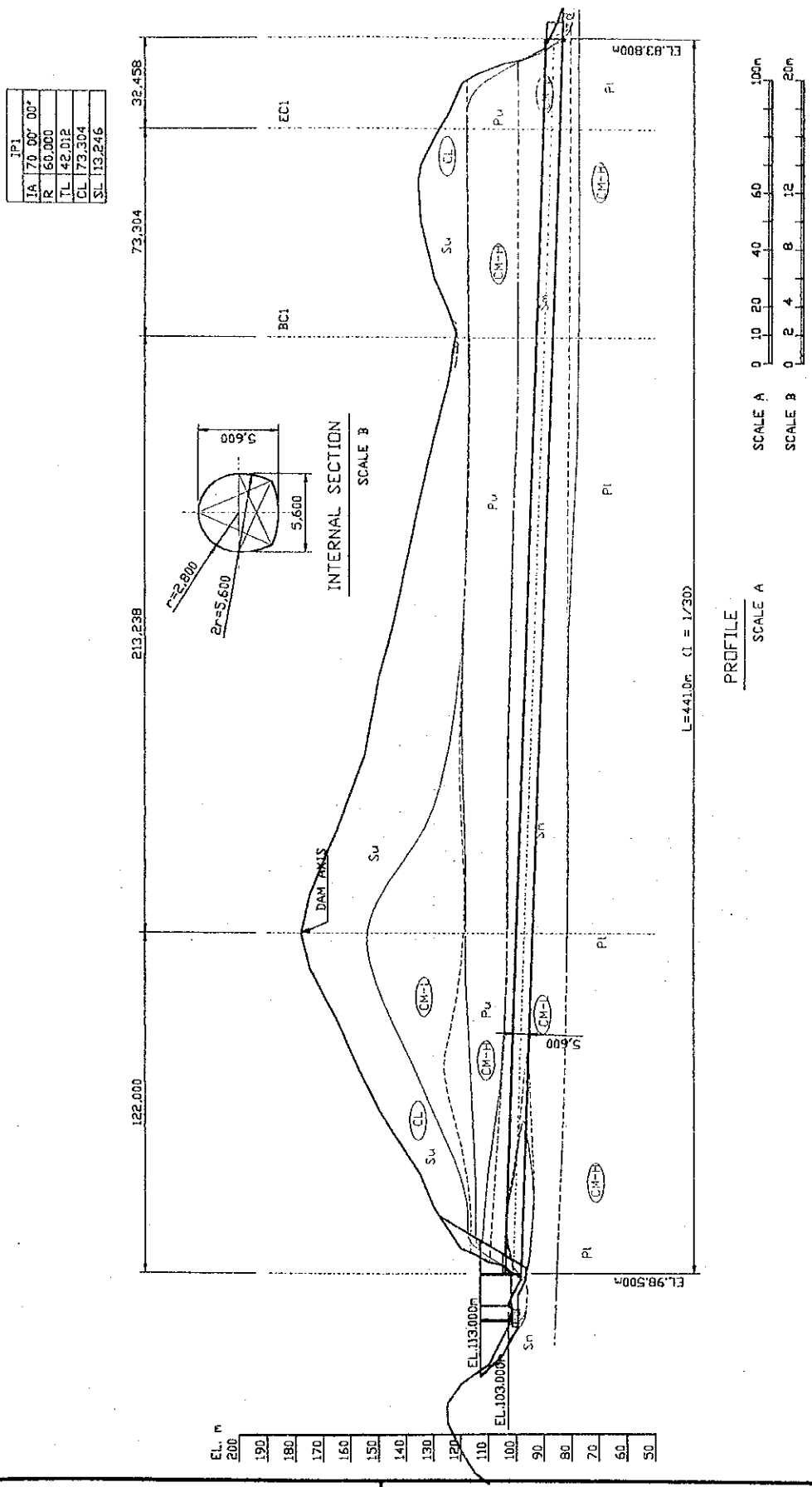
Fig. 6.2.24
PLAN OF DIVERSION TUNNEL



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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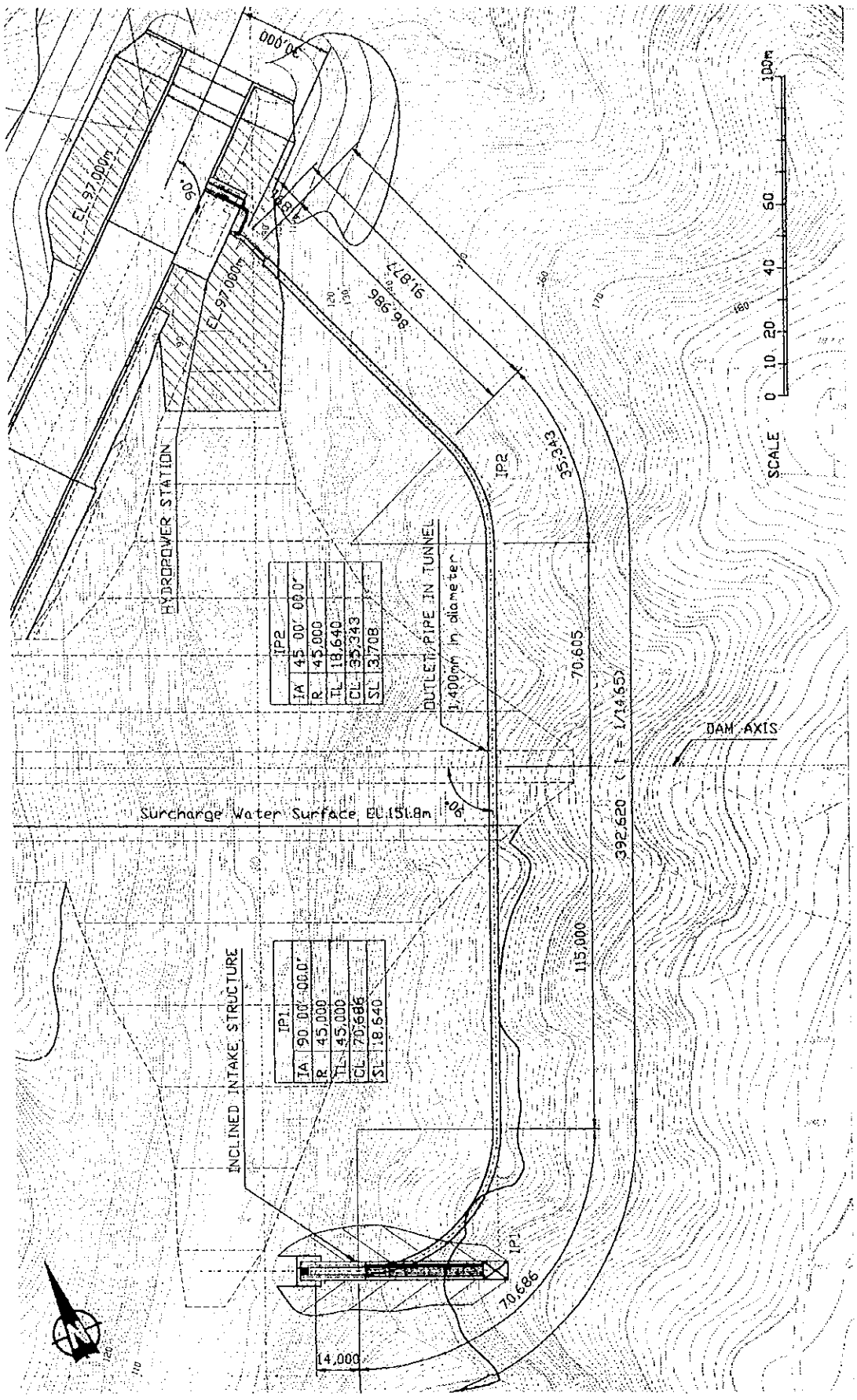
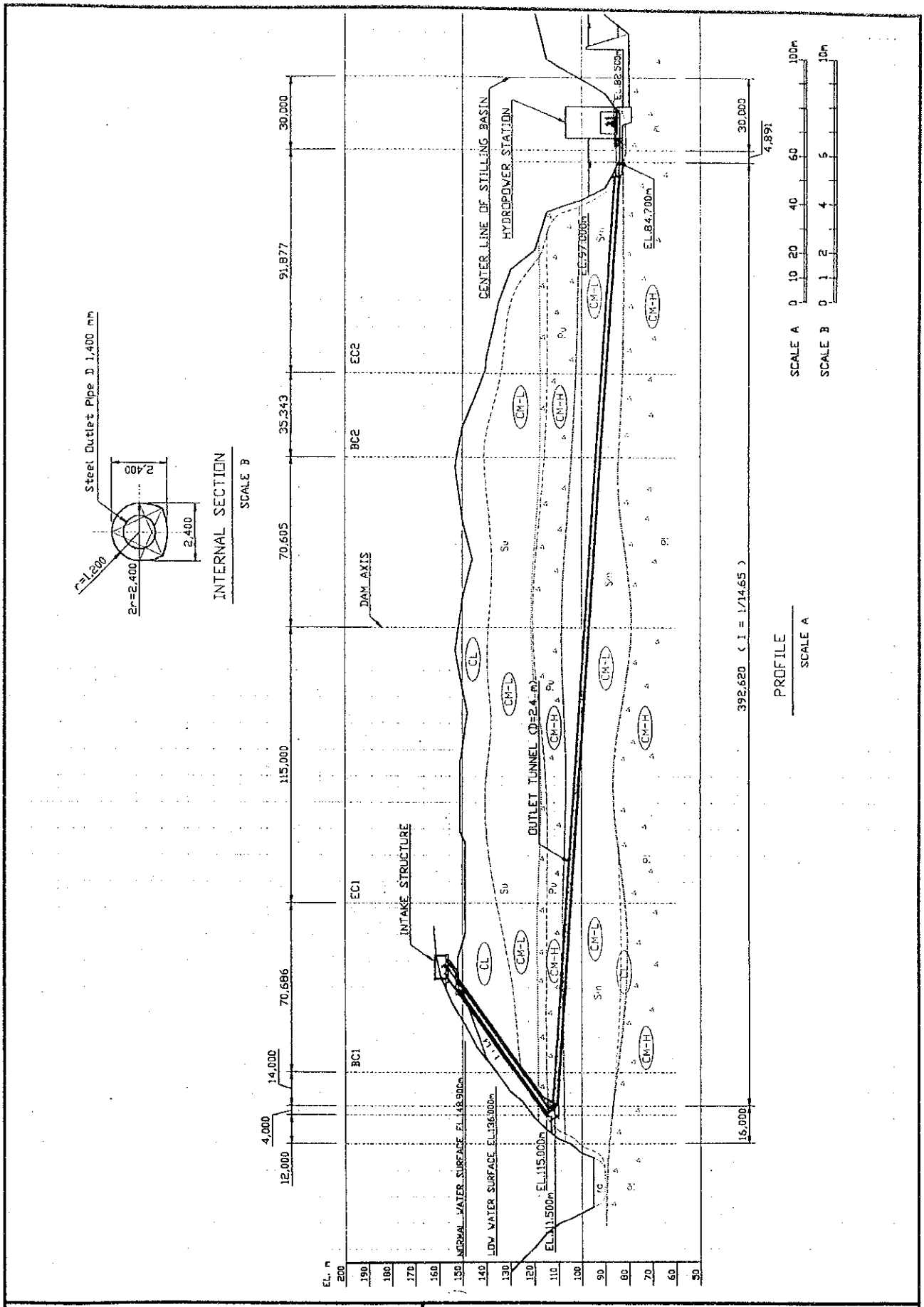
Fig. 6.2.25
PROFILE OF DIVERSION TUNNEL



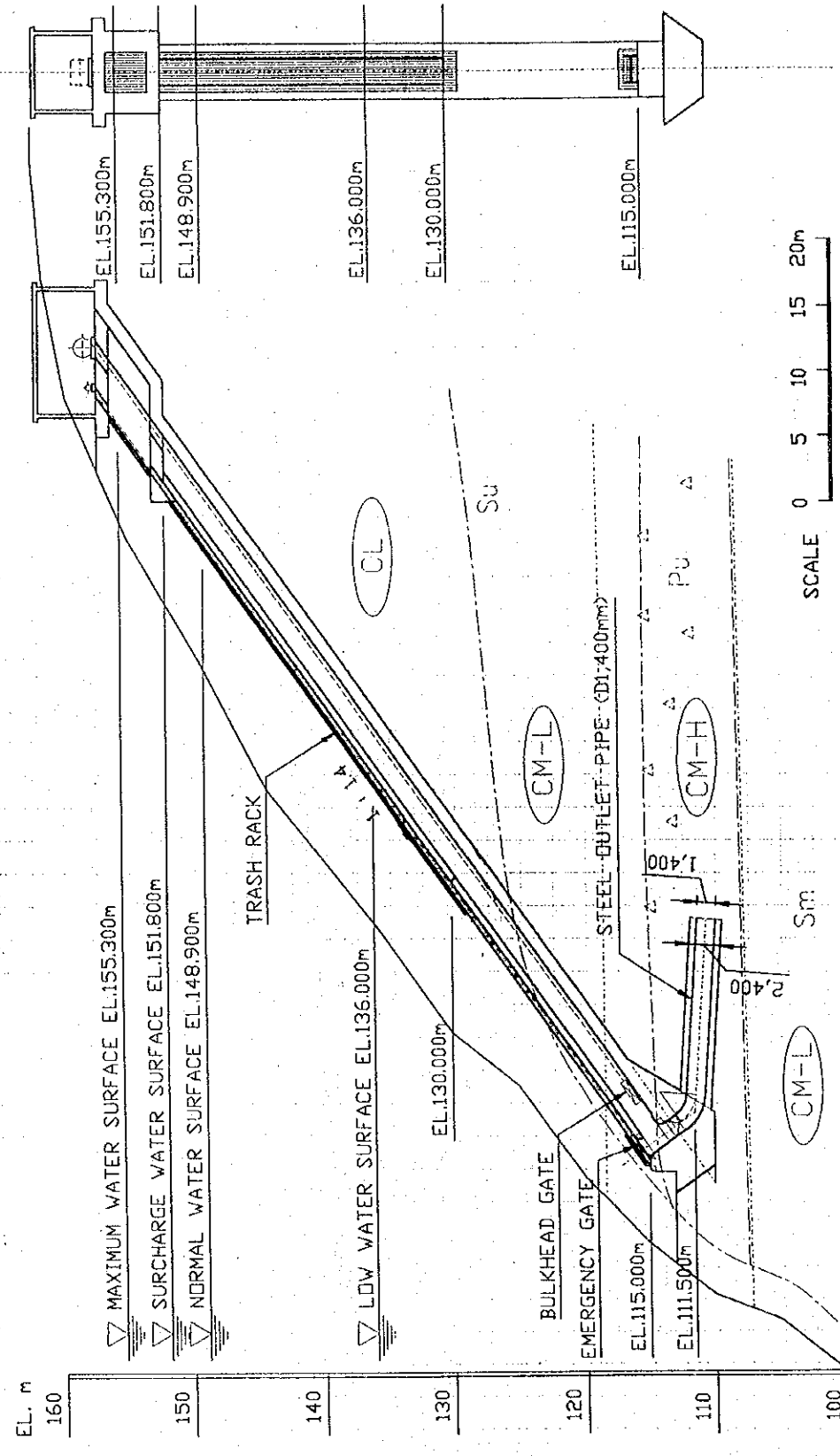
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.26 PLAN OF OUTLET FACILITIES
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

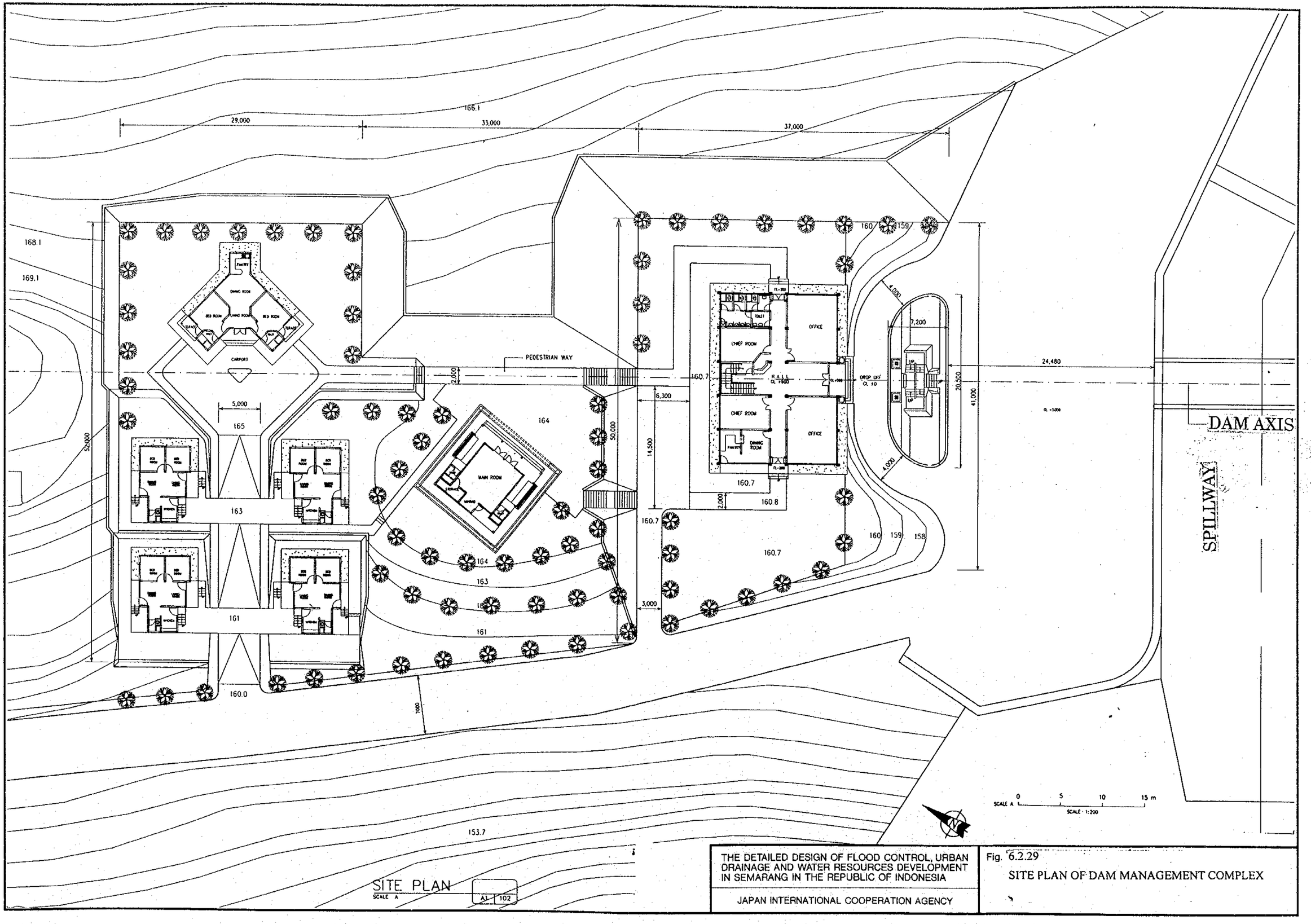
Fig. 6.2.27
PROFILE OF OUTLET FACILITIES



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.28
PROFILE OF INCLINED INTAKE STRUCTURE

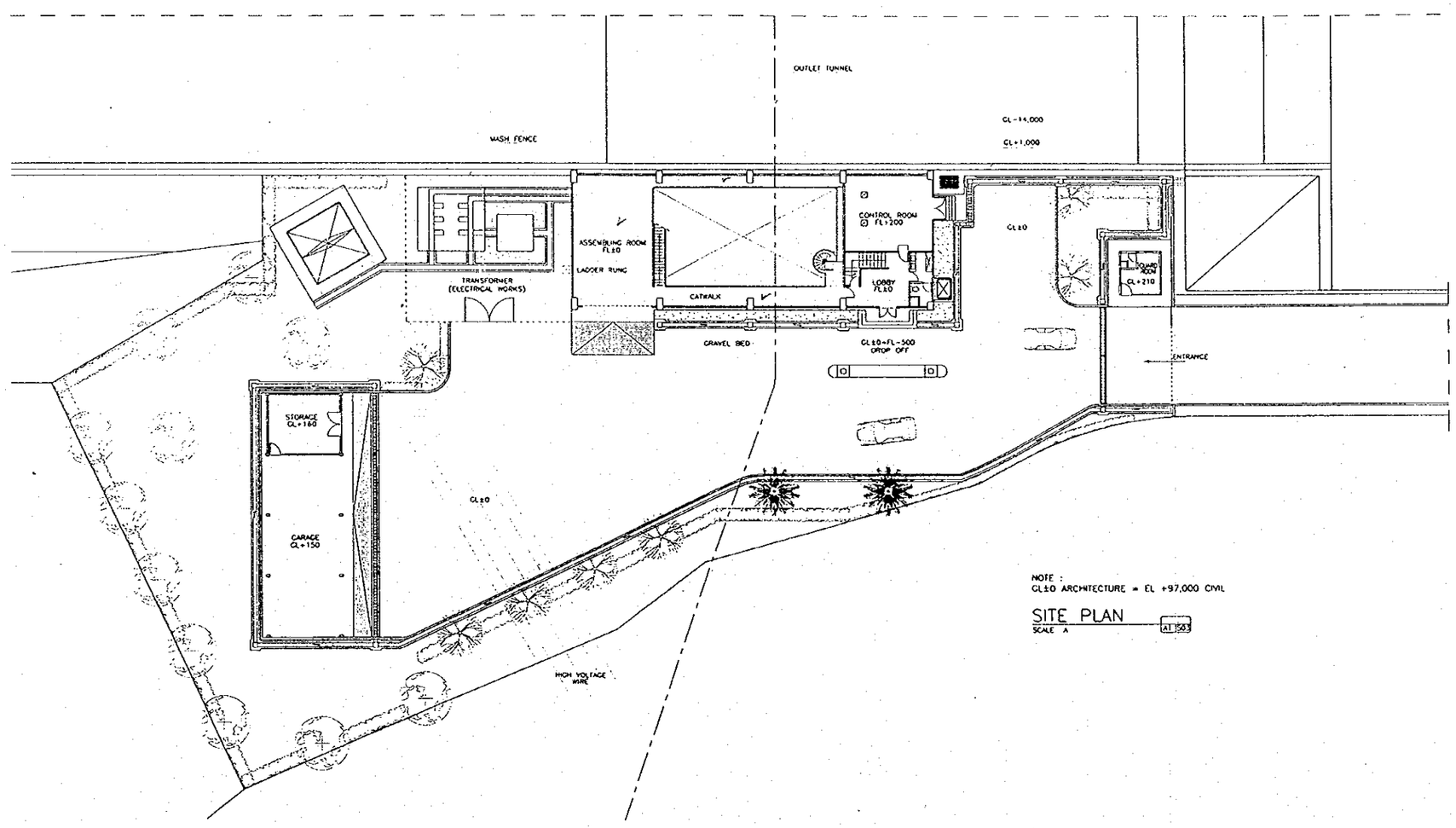


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

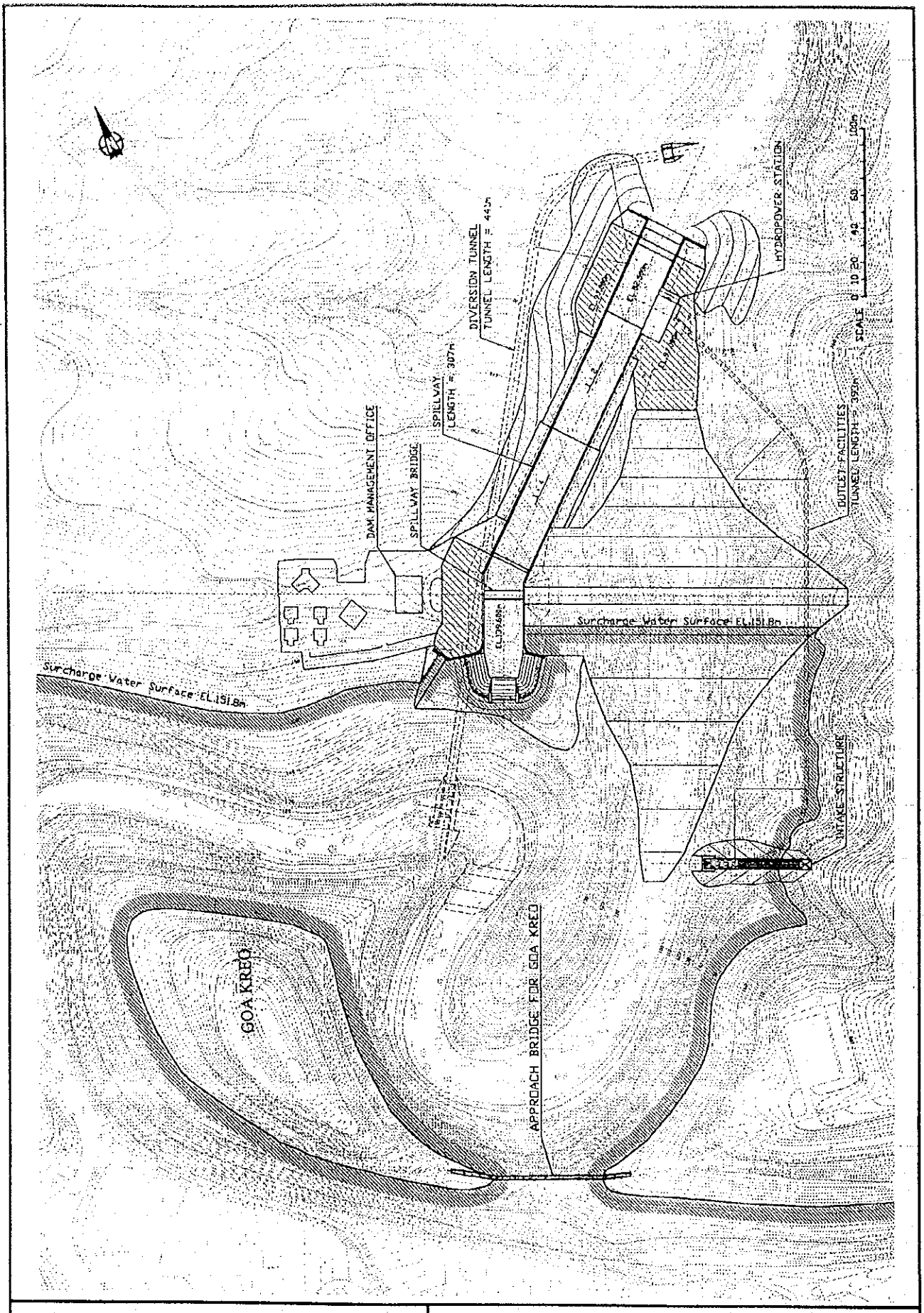
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.29

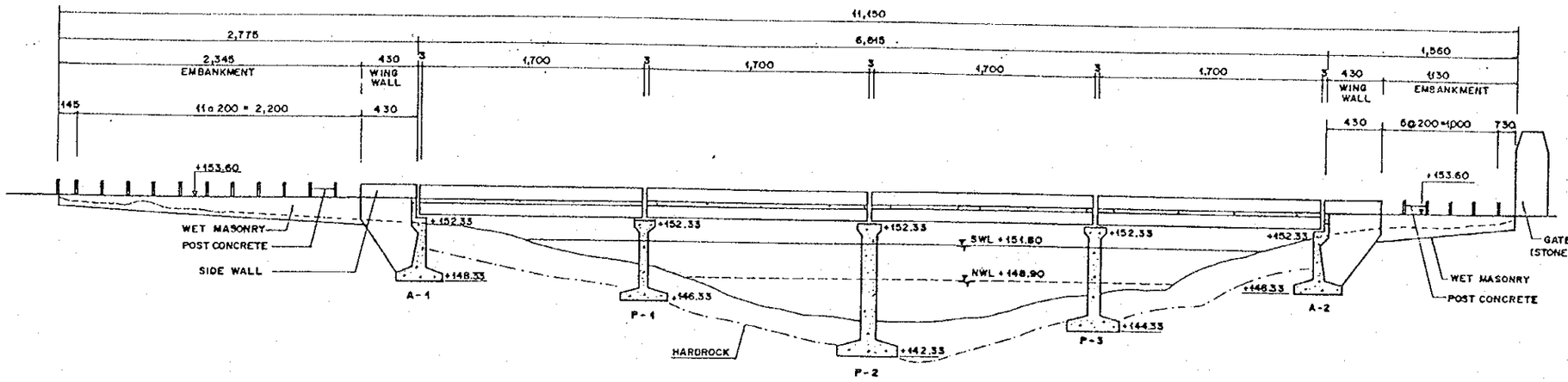
SITE PLAN OF DAM MANAGEMENT COMPLEX



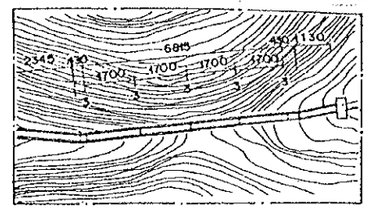
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.30 SITE PLAN OF HIDRO POWER STATION COMPLEX
JAPAN INTERNATIONAL COOPERATION AGENCY	



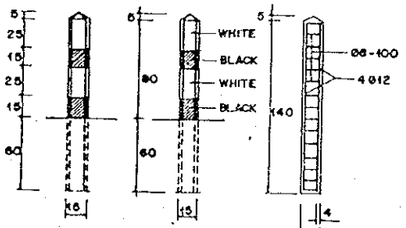
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.31 LOCATION OF APPROACH BRIDGE TO GOA KREO
JAPAN INTERNATIONAL COOPERATION AGENCY	



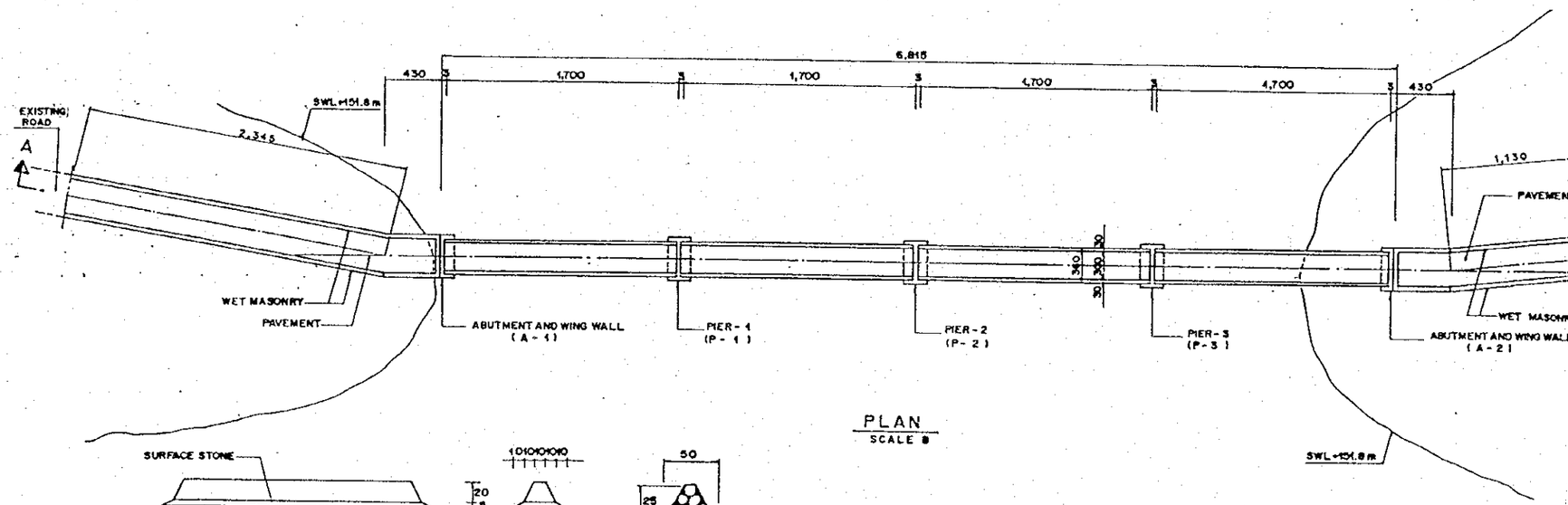
SECTION A - A
SCALE B



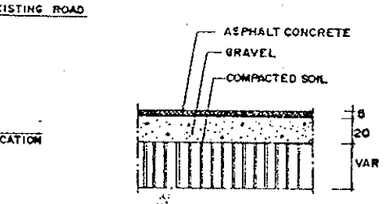
KEY MAP



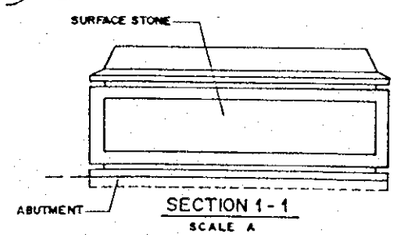
DETAIL OF POST CONCRETE
SCALE A



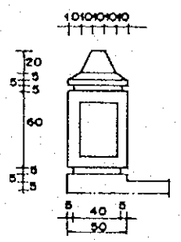
PLAN
SCALE B



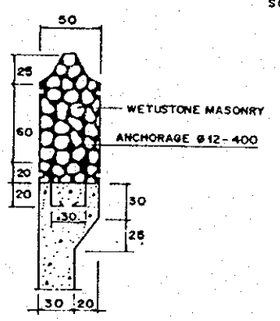
DETAIL OF PAVEMENT
SCALE A



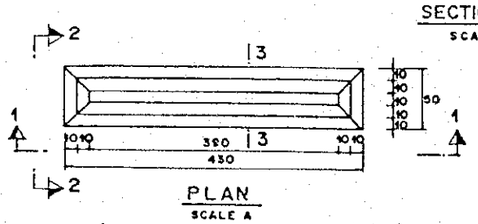
SECTION 1-1
SCALE A



SECTION 2-2
SCALE A



SECTION 3-3
SCALE A

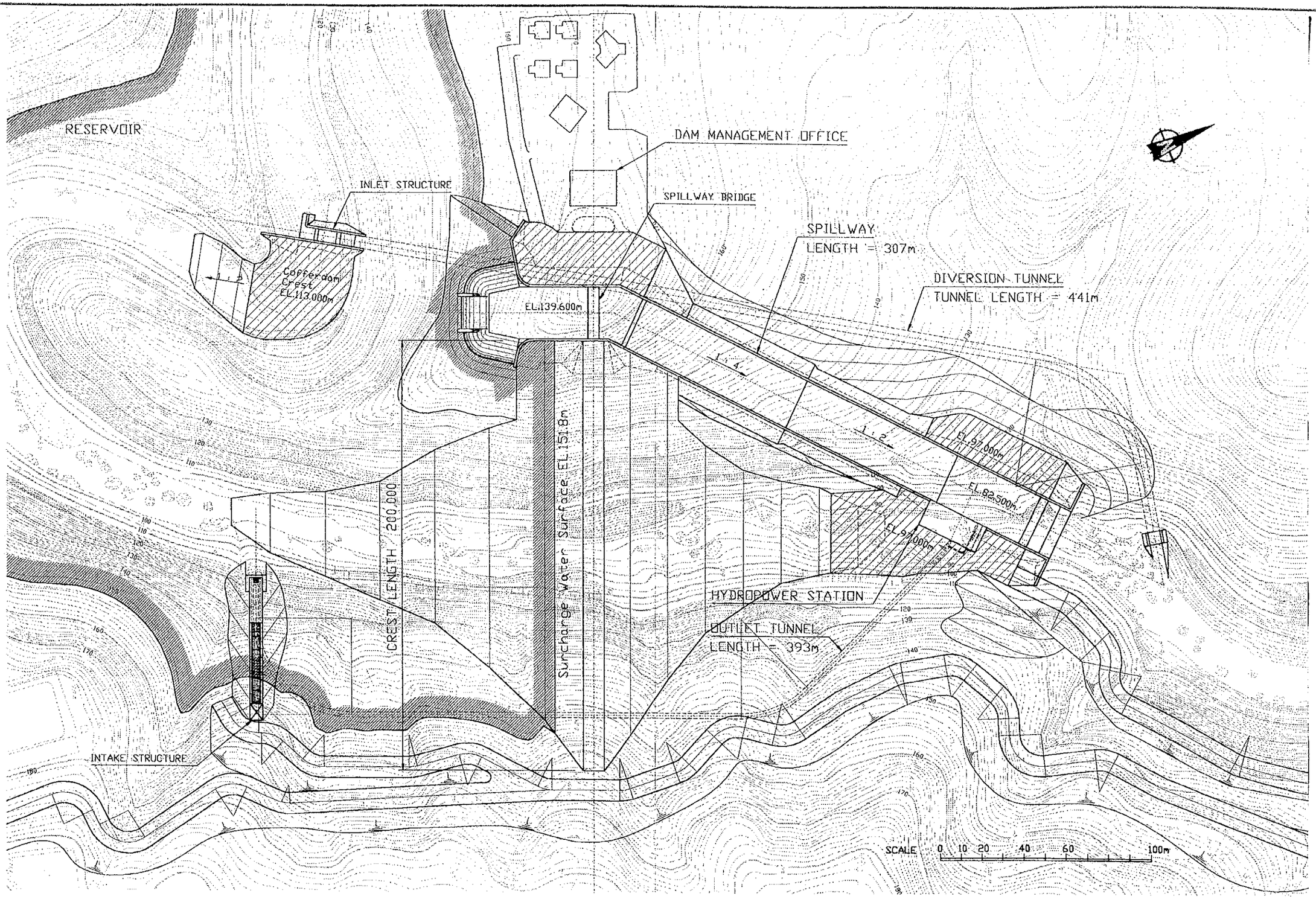


PLAN
SCALE A

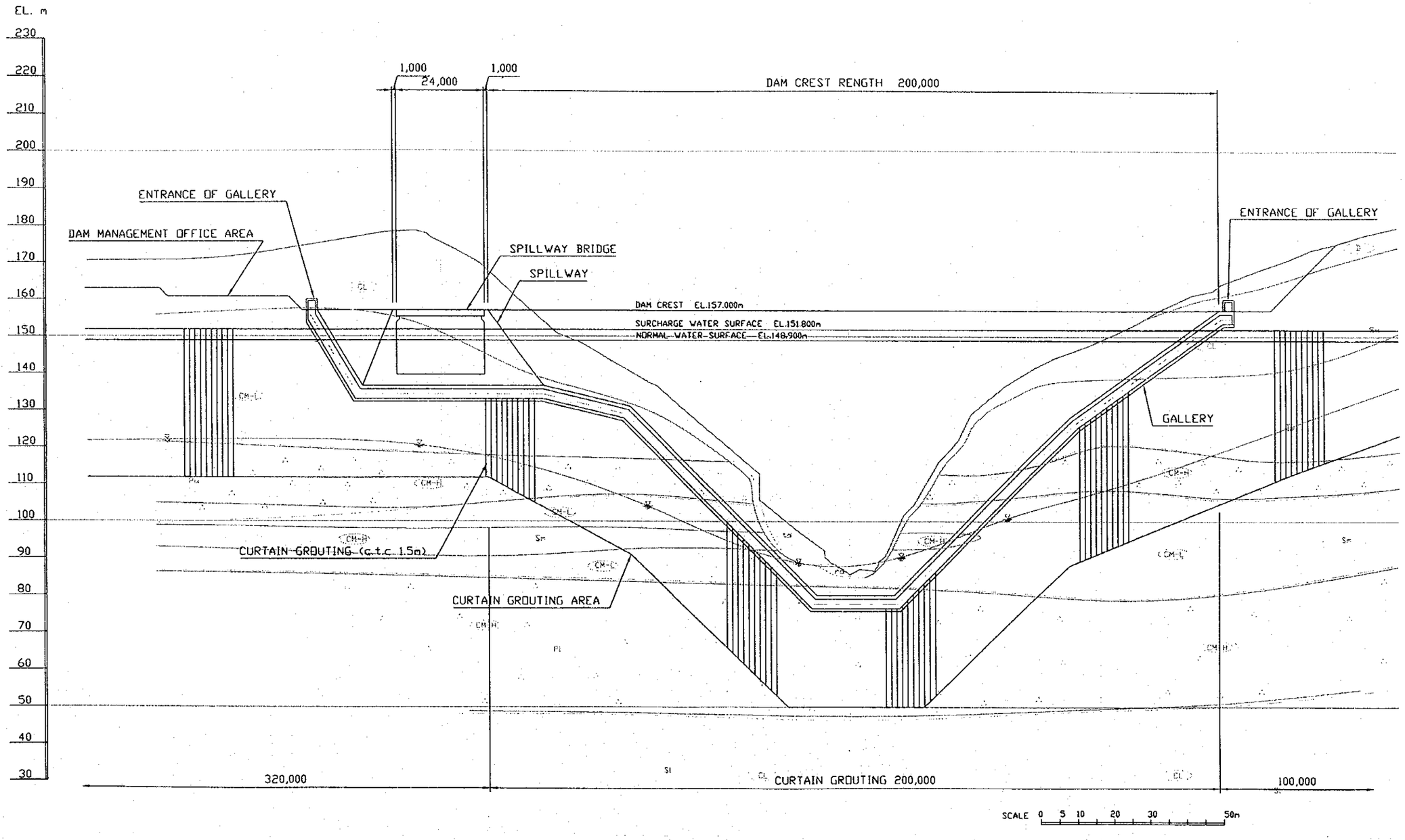
NOTE
1 UNIT IN CENTIMETER
2 CONCRETE QUALITY K.225
3 STEEL QUALITY U.24
4 CONCRETE COVER MINIMUM 100mm
5 MAXIMUM AGREGATE 40mm

SCALE A 1:25 — 0 0.50 1.00 1.50 2.00 2.50m
SCALE B 1:200 — 0 10.00 20.00m

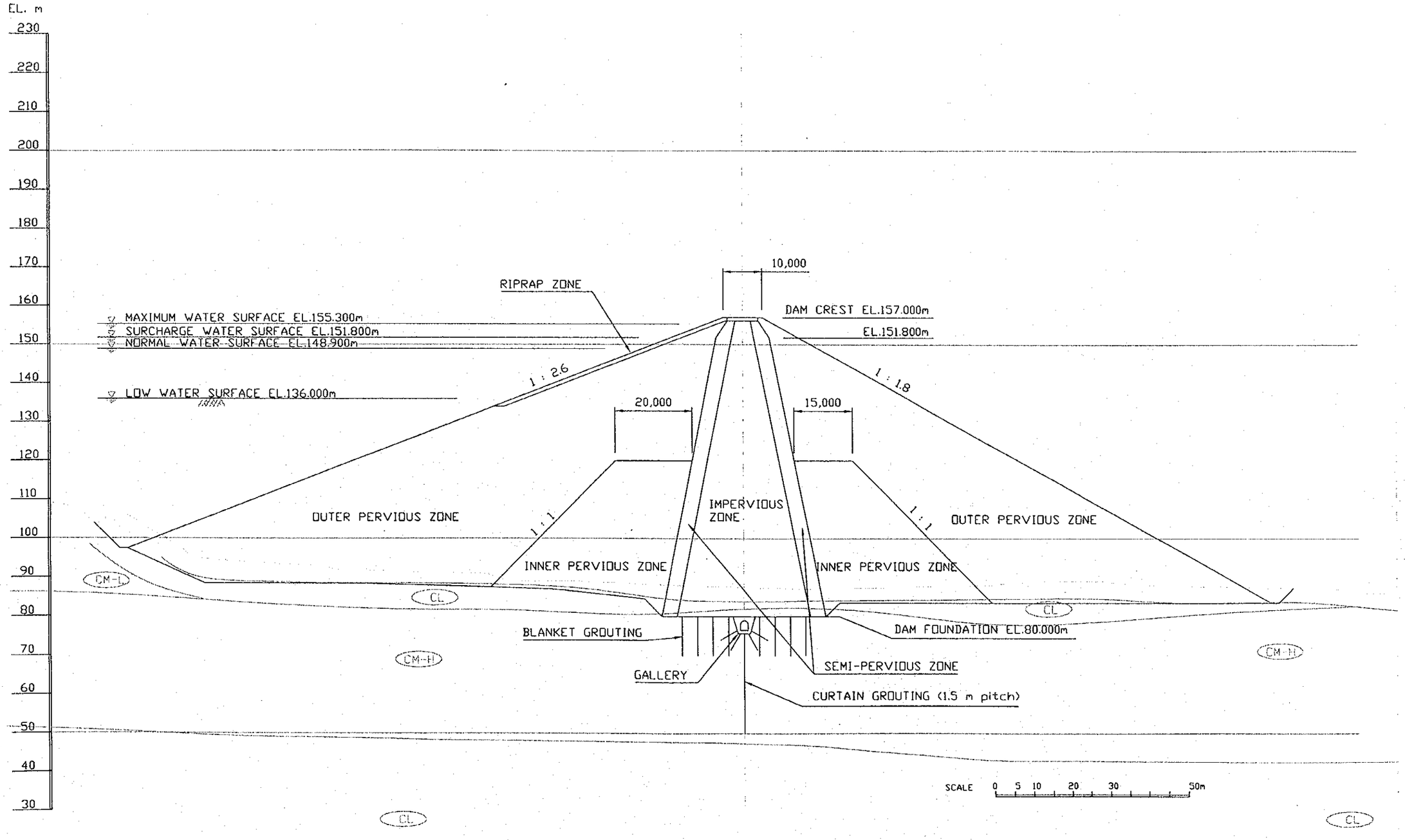
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.32 STRUCTURAL FEATURES OF APPROACH BRIDGE TO GOA KREO
JAPAN INTERNATIONAL COOPERATION AGENCY	



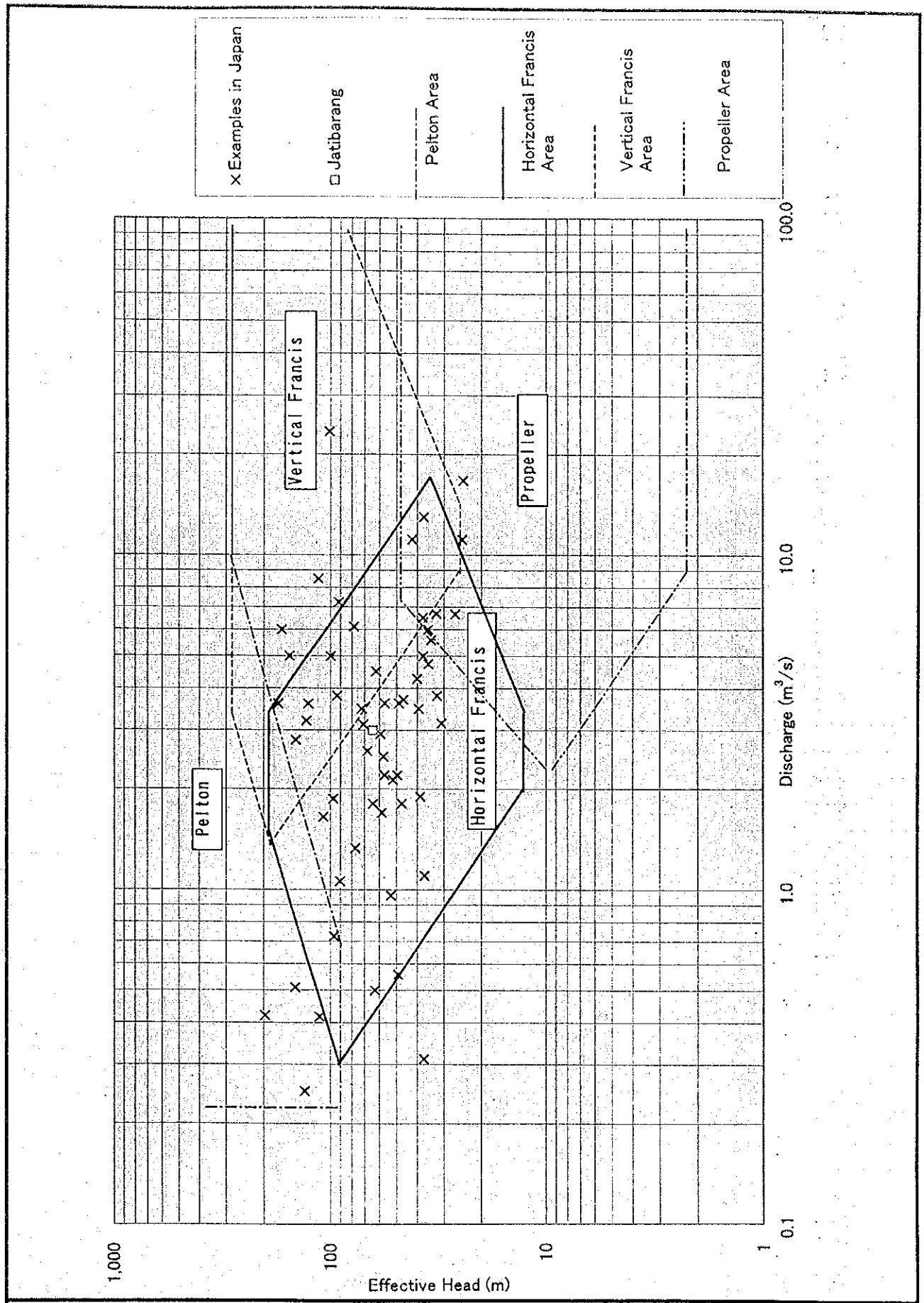
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.33 PLAN OF JATIBARANG MULTIPURPOSE DAM
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.34 LONGITUDINAL PROFILE OF JATIBARANG MULTIPURPOSE DAM
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.2.35 TYPICAL CROSS SECTION OF JATIBARANG MULTIPURPOSE DAM
JAPAN INTERNATIONAL COOPERATION AGENCY	



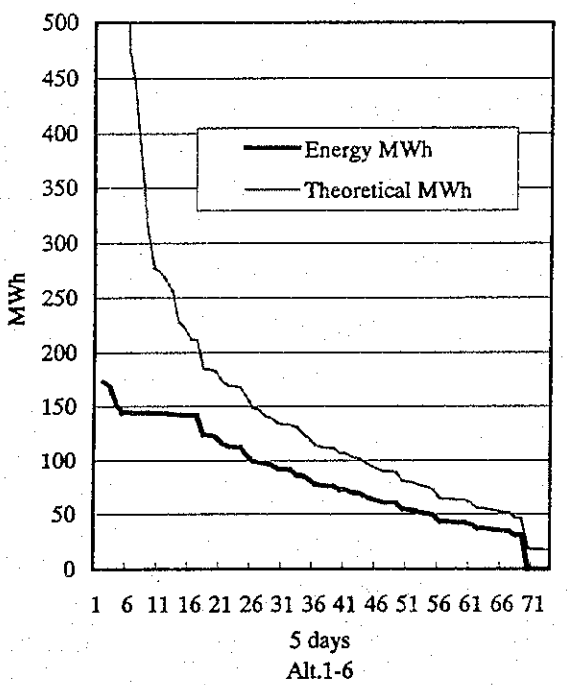
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

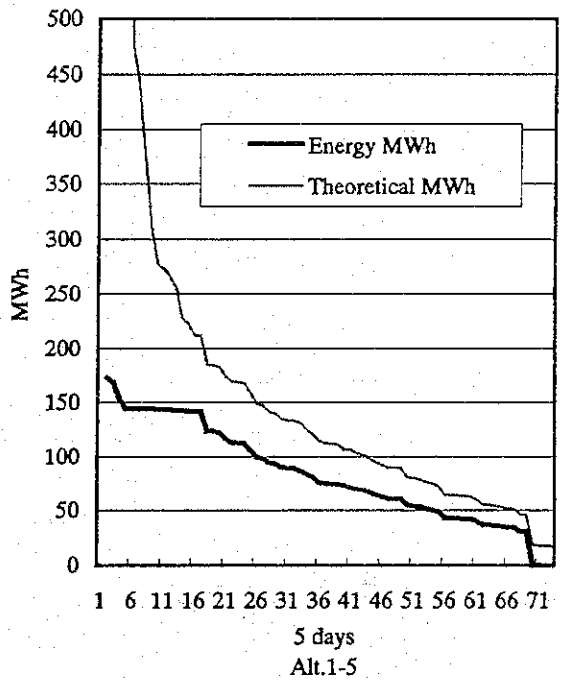
JAPAN INTERNATIONAL COOPERATION AGENCY

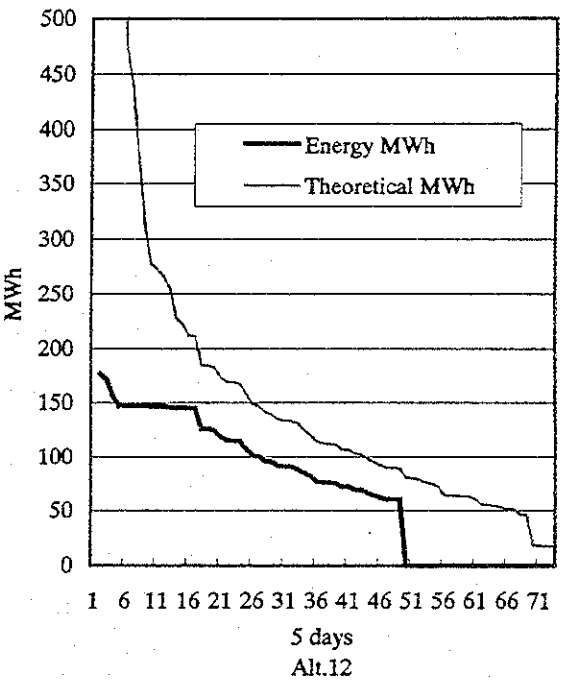
Fig. 6.3.1
TURBINE TYPE SELECTION DIAGRAM

Energy Production and Allocation of Turbine Discharge for Two Units

	Discharge(m^3/s)			Power(kW)			Output(MWh)	
	Unit #1	Unit #2	Total	Unit #1	Unit #2	Total	Energy (Present Stage)	Energy (Future Stage)
Alt.1-6	2.0	1.0	3.0	948	463	1,411	6,437	8,212
Alt.1-5	1.5	1.5	3.0	705	705	1,410	6,408	8,183
Alt.12	3.0	0	3.0	1,438	0	1,438	5,790	8,307

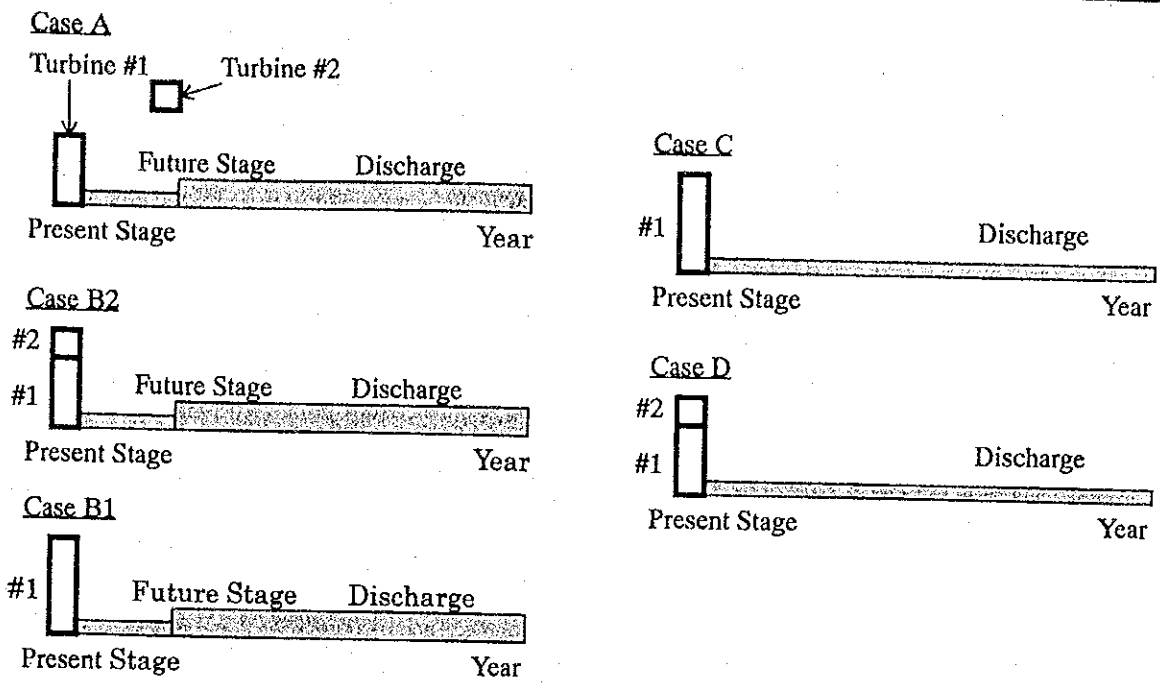




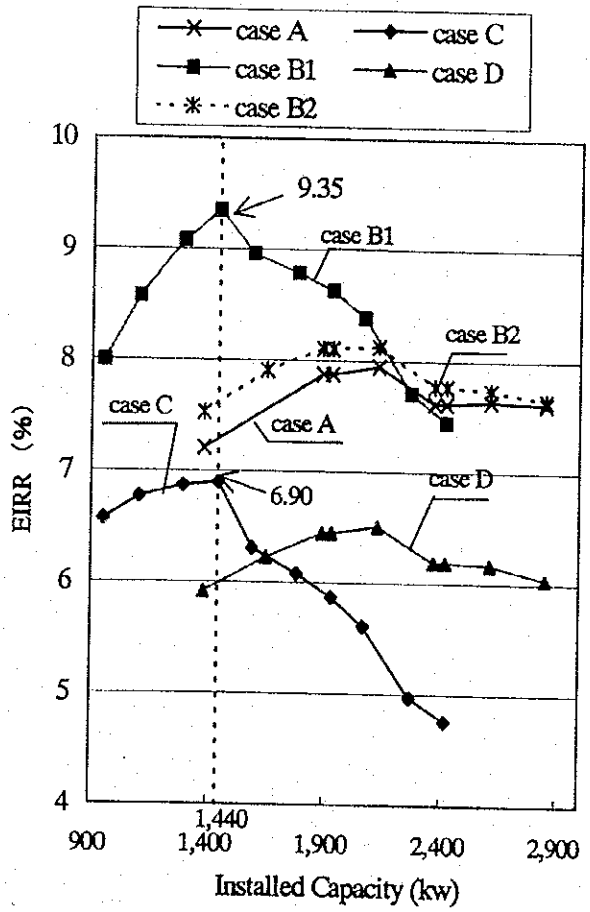


Note : Theoretical MWh = $9.8Q_{out}\ H_{max} \times 5 \times 24/1000$

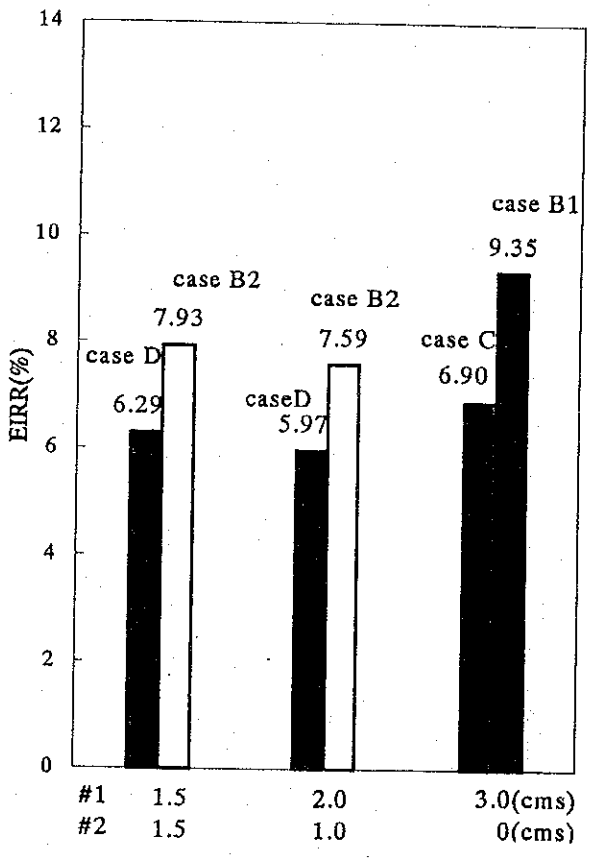
Fig. 6.3.2 ANNUAL DURATION CURVE OF MWH ON FUTURES STAGE OF 1990'S DATA



(a) Stage Development and Turbine Number



(b) Relation between Installed Capacity and EIRR



(c) Variation of EIRR with Changes in Turbine Discharge Allocation

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 6.3.3 SELECTION OF OPTIMUM SCALE
JAPAN INTERNATIONAL COOPERATION AGENCY	