

7. PROJECT IMPLEMENTATION

7.1 Implementation Method and Time Schedule

7.1.1 Executing System

The organization for project implementation is expected to be the Directorate General of Water Resources Development (DGWRD), Ministry of Public Works (MPW). Actual project execution is to be entrusted to the Project Office for Flood Control in Medan and Vicinity (Bagian Proyek Pengendalian Banjir Medan dan Sekitarnya) under the North Sumatra Water Resources and Flood Control Project Office (Proyek Pengendalian Sumber Air dan Pengendalian Banjir Sumatera Utara, PPSAPB-SU). The organization chart of PPSAPB-SU is shown in Fig. 7.1.

7.1.2 Implementation Schedule

The implementation schedule is prepared to achieve prompt construction of the Project so as to release properties from flood damage and improve the environmental conditions in and around Medan City. Necessary undertakings and activities are incorporated in the schedule, as shown in Fig. 7.2.

The implementation period of major work items is estimated, as shown below:

Major Work Items		Period
I.	Detailed Design	
I-1	Basic Study/Design	Apr. 1995 to Aug. 1995
I-2	Detailed Design including Tender Documents	Nov. 1995 to Sep. 1996
I-3	Approval on ANDAL and RKL/RPL	Jun. 1995 to Jan. 1996
I-4	Inventory Survey for Compensation Works	Sep. 1995 to Mar. 1996
II.	Required Administration Works	
II-1	Fund Requirement (APBN and APBD)	Sep. 1996 to Nov. 1996
II-2	Land Acquisition and Compensation	Dec. 1996 to Feb. 1998
III.	Loan (OECE) Acquisition	
III-1	Request for Loan	Nov. 1996 to Jan. 1997
III-2	Loan Appraisal	Mar. 1997 to Apr. 1997
III-3	Pledge/Loan Agreement	Aug./Nov. 1997
IV.	Construction of the Project	
IV-1	Selection and Contract of Consultant	Aug. 1997 to Dec. 1997
IV-2	P/Q, Tendering and Contract for Construction	Aug. 1997 to Feb. 1998
IV-3	Construction	Apr. 1998 to Mar. 2001
	(3-1) Percut River Improvement Works	Apr. 1998 to Mar. 2001
	(3-2) Medan Floodway	Apr. 1998 to Mar. 2001

7.2 Fund Requirement

7.2.1 Project Cost and Loan Amount

The total project cost is estimated to be Rp. 263,118 million, excluding value added tax, as presented below:

Item	Amount (million Rp.)
1. Construction Base Cost	176,913
2. Compensation Cost	38,160
3. Administration Cost	11,383
4. Engineering Services Cost	12,743
5. Physical Contingencies (10% of 1 to 4)	23,919
6. Total	263,118
7. Value Added Tax	26,312
8. Grand Total	289,430

From the table above, the ratio of eligible cost (construction base cost and engineering services cost) is estimated to be Rp. 208,622 million corresponding to 72.1% of the total project cost. Therefore, the total loan amount including physical contingencies is estimated to be Rp. 208,622 million.

7.2.2 Disbursement Schedule

The disbursement schedule is prepared as discussed below.

(1) Annual Disbursement Schedule

The annual disbursement schedule for the Project is prepared in accordance with the implementation schedule, as presented in Table 7.1.

(2) Operation, Maintenance and Replacement Cost

Operation, maintenance and replacement cost is estimated at 1% of the total amount of construction cost. It covers ordinary operation and maintenance works and replacement of spare parts of rubber-made dam, weirs, fences and other appurtenant facilities.

7.3 Works Required for Project Implementation

7.3.1 Environmental Impact Assessment (ANDAL)

Based on Government Regulation No. 51/1993 on ANDAL, the meeting on ANDAL for Medan Flood Control Project was held by the Technical Team on August 29, 1995, and ANDAL, RKL and RPL documents have been modified as suggested and advised in the

meeting. Under these circumstances, the meeting of KOMPUS was held on November 3, 1995 in the presence of a representative of KOMDA. Final approval was issued on January 10, 1996.

7.3.2 Compensation Works

Land acquisition is the most significant element to provide an easy access to project implementation. For the Medan Flood Control Project, the PPSAPB-SU informed the Governor, on December 15, 1995, the necessity of land acquisition at the minimum scale possible for project execution. The Mayor or Bupati was also appraised on this matter after the project was approved by the Governor on January 30, 1996. Since no objection was received in this process, the Mayor organized a Land Acquisition Committee (Panitia Pembebasan Tanah) composed of the following nine members from different agencies and institutions concerned:

- (1) Mayor or Bupati as Chairman
- (2) Chief of National Land Agency (Badan Pertanahaan Nasional)
- (3) Chief of Taxation Office for Land and Building
- (4) Chief of Local Government Office responsible for public works
- (5) Chief of Local Government Office responsible for agriculture
- (6) Chief of Subdistrict (Kecamatan) affected by the Project
- (7) Chief of Village (Desa) affected by the Project
- (8) Section Chief of Mayor or Bupati's Secretariat as Secretary I
- (9) Section Chief of National Land Agency as Secretary II

Public hearings took place under the direction of the Camat (Chief of Subdistrict) and the Kepala Desa (Chief of Village) to explain the significant impacts of the project and to ask the people's understanding and cooperation. The Project Office also requested the National Land Agency to conduct an inventory survey in the project site, which shall include cadastral survey, land ownership, land use, etc.

As of the end of June 1996, the inventory survey and succeeding detailed land survey were completed and the negotiation with land owner was started.

TABLES

Table 2.1 CLIMATOLOGICAL DATA AT SAMPALI STATION (PMG) IN MEDAN

Item	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Average
Monthly Rainfall	mm	78	61	81	121	174	102	145	148	198	271	208	190	1,777
Mean Temperature	°C	25	26	26	27	27	27	26	26	26	26	26	26	26
Mean Max. Temp.	°C	31	32	33	33	33	33	32	32	31	31	31	31	32
Mean Min. Temp.	°C	21	21	21	22	23	22	22	22	22	22	22	22	22
Relative Humidity	%	85	84	84	84	85	84	83	84	86	87	87	86	85
Rainy Days	dys	8	8	8	11	13	9	13	14	18	19	18	15	154
Sunshine Duration	%	49	54	59	57	57	60	59	58	49	45	43	47	53
Wind Velocity	m/s	1.3	0.81	0.85	0.85	0.73	0.74	0.81	0.76	0.75	0.75	0.75	0.85	1
Pan Evaporation	mm/d	3.8	4.5	4.5	4.7	4.6	4.7	4.5	4.8	4.1	4	3.9	3.4	1,566

Note : Data except evaporation are the average of 1974 - 1984 (by PMG)

Evaporation data is the average of 1980 - 1989

Table 2.2 MEAN MONTHLY RAINFALL OF BASIN

River Basin	(unit : mm/month)												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Deli	126	100	125	153	225	170	171	215	274	310	255	213	2,337
Percut	132	114	131	158	234	168	195	211	284	315	252	208	2,402

Note : Average of 1954 - 1994 using several rainfall station

Table 2.3 ANNUAL MAXIMUM FLOOD DISCHARGE

Station	Simeme			Helvetia			Tembung			
	Date	Water Level (m)	Discharge (m ³ /s)	Date	Water Level (m)	Discharge (m ³ /s)	Date	Water Level (m)	Discharge (m ³ /s)	
C.A.		158 km ²			341 km ²			171 km ²		
River		Deli			Deli			Percut		
Year	Date	Water Level (m)	Discharge (m ³ /s)	Date	Water Level (m)	Discharge (m ³ /s)	Date	Water Level (m)	Discharge (m ³ /s)	
1980	30 Oct	2.43	160	6 Dec	3.90	158	X	X	X	
1981	16 Dec	2.42	158	29 Oct	3.58	136	X	X	X	
1982	29 Dec	2.49	168	X	X	X	X	X	X	
1983	30 Sep	2.53	174	X	X	X	X	X	X	
1984	X	X	X	27 Jul	4.35	199	30 Oct	3.06	83	
1985	6 Oct	2.90	235	6 Nov	4.60	224	21 May	3.49	105	
1986	6 Dec	3.01	253	3 Feb	4.75	240	7 Dec	4.67	178	
1987	16 Sep	2.43	160	X	X	X	10 Dec	4.45	163	
1988	19 Sep	2.48	166	X	X	X	1 Apr	2.97	79	
1989	24 Sep	2.12	119	24 Nov	4.55	219	19 Dec	4.24	149	
1990	26 Nov	2.93	240	X	X	X	26 Nov	4.91	195	
1991	11 Oct	2.35	149	13 Oct	2.95	101	26 Mar	3.17	89	
1992	23 Dec	2.41	157	2 Oct	3.16	112	23 Dec	4.77	185	
1993	1 Jul	1.93	96	18 Sep	2.99	103	5 Nov	3.62	112	

Table 2.4 FLOW REGIME AT SIMEME (DELI RIVER)

(unit : m³/s)

Year	Frequency							Average
	Max	25%	50%	80%	95%	99%	Min	
1984	x	x	x	x	x	x	x	x
1985	38.40	10.30	6.71	4.31	3.93	3.51	2.57	8.38
1986	27.20	8.35	4.76	3.65	2.81	2.33	2.23	6.66
1987	30.90	9.26	6.59	4.94	4.06	3.70	3.48	8.53
1988	25.90	9.85	8.08	4.97	5.16	6.13	4.43	9.08
1989	25.10	8.34	5.45	4.53	4.10	4.21	4.25	6.79
1990	34.60	9.55	6.50	4.70	3.60	3.20	2.80	7.58
1991	28.30	9.80	6.30	3.70	3.00	2.72	2.48	7.47
1992	43.20	9.85	7.12	4.74	3.56	2.98	2.94	8.01
1993	20.60	8.54	5.88	4.53	3.76	3.29	3.04	7.06
Average	30.47	9.32	6.38	4.45	3.78	3.56	3.14	7.73
Specific Discharge (m ³ /s/km ²)	0.193	0.059	0.040	0.028	0.024	0.023	0.020	0.049

Table 2.5 FLOW REGIME OBSERVED AT HELVETIA (DELI RIVER)

(unit : m³/s)

Year	Frequency							Average
	Max	25%	50%	80%	95%	99%	Min	
1984	75.90	22.00	16.40	11.80	10.20	9.60	9.30	18.42
1985	81.50	20.40	13.90	8.85	5.52	4.69	4.58	16.13
1986	74.00	21.00	14.90	9.45	6.60	6.12	6.12	17.23
1987	42.90	17.70	12.10	7.50	8.85	9.90	10.40	14.28
1988	70.90	24.40	17.90	16.00	9.90	9.00	8.40	21.47
1989	85.00	23.80	17.90	12.10	9.90	8.85	8.40	20.84
1990	x	x	x	x	x	x	x	x
1991	54.80	22.00	13.90	9.00	7.35	6.60	5.88	17.28
1992	66.90	20.20	14.00	9.70	7.50	6.60	5.76	16.64
1993	48.00	19.60	13.70	9.60	7.20	5.88	4.69	15.92
Average Q	66.66	21.23	14.97	10.44	8.11	7.47	7.06	17.58
Specific Discharge (m ³ /s/km ²)	0.195	0.062	0.044	0.031	0.024	0.022	0.021	0.052

Table 2.6 FLOW REGIME OBSERVED AT TEMBUNG

(unit : m³/s)

Year	Frequency							Average
	Max	25%	50%	80%	95%	99%	Min	
1990	79.60	10.10	6.97	4.21	2.68	1.69	1.55	8.47
1991	41.90	11.00	8.28	5.90	3.49	2.80	2.54	9.27
1992	56.40	9.39	7.40	5.72	4.54	3.60	2.01	8.50
1993	42.60	11.90	8.81	6.62	5.18	4.52	3.86	10.16
Average Q	55.13	10.60	7.87	5.61	3.97	3.15	2.49	9.10
Specific Discharge (m ³ /s/km ²)	0.322	0.062	0.046	0.033	0.023	0.018	0.015	0.053

Table 2.7 AREA, CENSUS POPULATION, GROWTH RATE, POPULATION DENSITY, NUMBER OF HOUSEHOLD AND HOUSEHOLD SIZE OF INDONESIA, NORTH SUMATRA, PROVINCE AND THE STUDY AREA

Administration	Area (km ²)	Population			Population Density (person/km ²)		Number of Households			Average Size of Household (person/household)	
		1930	1990	Annual Growth Rate (%)	1930	1990	1930	1990	Annual Growth Rate (%)	1930	1990
I Indonesia(1000pop)	1,919,317	147,490	179,379	1.93	76	92	30,372	39,772	2.73	4.86	4.51
II North Sumatra Prov.(1000)	70,789	8,361	10,256	2.06	117	143	1,548	2,023	2.71	5.40	5.07
III Study Area	905.95	1,618,141	2,128,975	2.73	1,786	2,350	278,135	401,288	3.73	5.82	5.31
(1) Kodya Medan	265.10	1,373,737	1,730,052	2.33	5,182	6,526	232,864	324,034	3.36	5.90	5.34
Kecamatan											
1 Medan Tuntungan	14.90	11,743	48,539	15.25	788	3,258	2,322	10,095	15.83	5.06	4.81
2 Medan Johor	15.00	36,096	71,296	7.04	2,406	4,753	6,216	13,321	7.92	5.81	5.35
3 Medan Amplas	14.74	55,550	86,634	4.54	3,769	5,877	9,539	15,700	5.11	5.82	5.52
4 Medan Denai	7.96	63,736	106,946	5.31	8,007	13,435	11,520	19,194	5.24	5.53	5.57
5 Medan Tembung	6.80	92,115	117,904	2.50	13,546	17,339	16,360	21,918	2.97	5.63	5.38
6 Medan Kota	5.50	95,225	93,043	-0.23	17,314	16,917	15,578	16,977	0.86	6.11	5.48
7 Medan Area	3.80	118,373	116,779	-0.14	31,151	30,731	18,970	21,298	1.16	6.24	5.48
8 Medan Baru	4.94	52,016	49,499	-0.49	10,530	10,020	8,107	9,760	1.87	6.42	5.07
9 Medan Polonia	8.28	42,977	53,605	2.23	5,190	6,474	7,366	10,162	3.27	5.83	5.28
10 Medan Maimun	3.98	46,484	49,148	0.56	11,679	12,349	8,119	9,426	1.50	5.73	5.21
11 Medan Selayang	19.80	31,120	54,801	5.82	1,572	2,768	5,561	10,517	6.58	5.60	5.21
12 Medan Sunggal	15.70	64,620	91,675	3.56	4,116	5,839	11,015	16,953	4.41	5.87	5.41
13 Medan Helvetia	11.60	75,756	110,903	3.88	6,531	9,561	12,600	20,773	5.13	6.01	5.34
14 Medan Petisah	4.50	80,693	79,575	-0.14	17,932	17,683	13,721	15,141	0.99	5.88	5.26
15 Medan Barat	6.60	74,274	87,489	1.65	11,254	13,256	12,082	16,302	3.04	6.15	5.37
16 Medan Timur	7.60	98,797	109,433	1.03	13,000	14,399	16,345	20,993	2.53	6.04	5.21
17 Medan Deli	21.00	72,491	100,109	3.28	3,452	4,767	12,442	18,809	4.22	5.83	5.32
18 Medan Labuhan	46.00	38,815	55,624	3.66	844	1,209	7,018	10,258	3.87	5.53	5.42
19 Medan Belawan	10.00	81,165	83,666	0.30	8,117	8,367	14,120	15,033	0.63	5.75	5.57
20 Medan Perjuangan	4.40	101,561	104,458	0.28	23,082	23,740	16,723	20,097	1.85	6.07	5.20
21 Medan Marelan	32.00	40,130	58,928	3.92	1,254	1,842	7,140	11,357	4.75	5.62	5.19
(2) Kab. Deli Serdang	640.85	244,404	398,923	5.02	381	622	45,271	77,204	5.48	5.40	5.17
Kecamatan											
1 Pancur Batu	122.53	35,957	47,961	2.92	293	391	6,861	9,793	3.62	5.24	4.90
2 Namu Rambe	62.30	12,660	17,444	3.26	203	280	2,573	3,577	3.35	4.92	4.88
3 Patumbak	46.79	21,186	34,522	5.00	453	738	3,901	6,612	5.42	5.43	5.22
4 Deli Tua	9.36	21,325	32,806	4.40	2,278	3,505	4,047	6,499	4.85	5.27	5.05
5 Labuhan Deli	127.23	23,581	36,774	4.54	185	289	4,322	7,198	5.23	5.46	5.11
6 Percut Sei Tuan	190.79	105,894	197,192	6.41	555	1,034	19,092	37,304	6.93	5.55	5.29
7 Pantai Labu	81.85	23,801	32,224	3.08	291	394	4,475	6,221	3.35	5.32	5.18

Source : Sensus Penduduk 1980 dan 1990

Table 3.1 PROPOSED DIMENSION OF BRIDGE TYPE

Perout River

No.	Bridge No.	Name of Bridge	Station Number (P.E.m)	Length of Bridge and Span (m)			Height of Beam (m)			Width of Roadway (m)			Elevation (EL. m)			Remarks	
				Left	Center	Right	Total	Left	Center	Right	Left	Center	Right	Left	Riverbed		DHWL
1	Br.P1	Titi Besi	057 + 0.5	23.6	31.6	25.6	82.8	1.25	1.60	1.25	7.0	5	5	5	-0.258	5.442	reconstructed
2	Br.P2	Perkebunan	084 + 28	31.6	40.8	31.6	104.0	1.60	1.70	1.60	7.0	5	6	5	2.006	7.706	reconstructed
3	Br.P3	Titi Gantung	115 + 05	16.6	-	40.8	57.4	0.90	1.70	-	7.0	5	6	6	4.876	10.576	reconstructed
4	Br.P5	Payung	137 + 45	-	40.8	-	40.8	-	1.70	-	7.0	6	6	6	7.562	13.672	reconstructed
5	Br.P6	Pedestrian	147 + 58	-	40.8	-	40.8	-	1.70	-	2.0	1	1	1	8.889	14.999	reconstructed
6	Br.P7	Medan-Tembung	169 + 59	-	40.8	-	40.8	-	1.70	-	9.0	7	7	7	11.461	17.571	reconstructed
7	Br.P9	Medan-Damai	200 + 25	-	40.8	-	40.8	-	1.70	-	16.0	12	12	12	15.206	21.316	reconstructed
8	Br.P11	Binjai	222 + 00	-	40.8	-	40.8	-	1.70	-	16.0	12	12	12	17.847	23.957	reconstructed
9	Br.P13	Amplas	246 + 57.5	-	40.8	-	40.8	-	1.70	-	16.0	12	12	12	20.828	26.938	reconstructed
10	WBr.1	Water Pipe 1	255 + 10	-	-	-	-	-	-	-	-	-	-	-	-	dia. 600 (2 pcs)	

Medan Floodway

No.	Bridge No.	Name of Bridge	Station Number (F.V.m)	Length of Bridge and Span (m)			Height of Beam (m)			Width of Roadway (m)			Elevation (EL. m)			Remarks	
				Left	Center	Right	Total	Left	Center	Right	Left	Center	Right	Left	Riverbed		DHWL
11	Br.F1	Jalan Bajak	006 + 90	-	31.6	-	31.6	-	1.60	-	7.0	6	6	6	25.106	30.906	new
12	Br.F2	PTP IX	020 + 45	-	31.6	-	31.6	-	1.60	-	9.0	6	6	6	25.682	31.482	new
13	WBr.2	Water Pipe Br	020 + 55	-	-	-	-	-	-	-	-	-	-	-	-	dia. 300 (1 pcs)	
14	WBr.3	Water Pipe Br	024 + 90	-	-	-	-	-	-	-	-	-	-	-	-	dia. 300 (1 pcs)	
15	Br.F3	JLSTM Ujung	028 + 22	-	31.6	-	31.6	-	1.60	-	9.0	6	6	6	26.018	32.618	new
16	Br.F4	Kelurga/Railway	032 + 00	-	31.6	-	31.6	-	1.60	-	7.0	2	2	2	26.180	31.980	new
17	WBr.4	Water Pipe Br	032 + 10	-	-	-	-	-	-	-	16.0	10	10	10	26.250	32.050	dia. 600 & 800
18	Br.F5	JL Deil Tua	033 + 65	-	31.6	-	31.6	-	1.60	-	3.0	1	1	1	26.420	33.220	new
19	Br.F6	Pedestrian Br w/ Water Pipe	037 + 60	-	-	-	-	-	-	-	-	-	-	-	-	dia. 300 (2 pcs)	
20	Br.F7	JL SMA - 12	38 + 78	-	16.6	-	16.6	-	0.90	-	4.5	3	3	3	26.470	32.270	new
21	Br.F8	Gg. Salsama	019 + 00*	13.6	31.6	13.6	58.8	0.90	1.60	0.90	2.0	1	1	1	25.289	34.080	reconstructed

Table 3.2 ECONOMIC EVALUATION OF MEDAN FLOOD CONTROL PROJECT

I. Immediate Plan (Return Period : 25 Years)

(Unit : Rp Million)

Year	Economic Cost			Economic Benefit (B)	(B)-(C)
	Construction	OM	Total (C)		
1 1998	15,270	0	15,270	0	-15,270
2 1999	52,980	0	52,980	0	-52,980
3 2000	65,948	474	66,422	7,119	-59,303
4 2001	44,193	948	45,141	14,737	-30,404
5 2002		1,319	1,319	22,897	21,578
6 2003		1,319	1,319	23,584	22,265
7 2004		1,319	1,319	24,291	22,972
8 2005		1,319	1,319	25,020	23,701
9 2006		1,319	1,319	25,771	24,452
10 2007		1,319	1,319	26,544	25,225
11 2008		1,319	1,319	27,340	26,021
12 2009		1,319	1,319	28,160	26,841
13 2010		1,319	1,319	29,005	27,686
14 2011		1,319	1,319	29,875	28,556
15 2012		1,319	1,319	30,772	29,453
16 2013		1,319	1,319	31,695	30,376
17 2014		1,319	1,319	32,646	31,327
18 2015		1,319	1,319	33,625	32,306
19 2016		1,319	1,319	34,634	33,315
20 2017		1,319	1,319	35,673	34,354
21 2018		1,319	1,319	36,743	35,424
22 2019		1,319	1,319	37,845	36,526
23 2020		1,319	1,319	38,981	37,662
24 2021		1,319	1,319	40,150	38,831
25 2022		1,319	1,319	41,355	40,036
26 2023		1,319	1,319	42,595	41,276
27 2024		1,319	1,319	43,873	42,554
28 2025		1,319	1,319	45,189	43,870
29 2026		1,319	1,319	46,545	45,226
30 2027		1,319	1,319	47,941	46,622
31 2028		1,319	1,319	49,379	48,060
32 2029		1,319	1,319	50,861	49,542
33 2030		1,319	1,319	52,387	51,068
34 2031		1,319	1,319	53,958	52,639
35 2032		1,319	1,319	55,577	54,258
36 2033		1,319	1,319	57,244	55,925
37 2034		1,319	1,319	58,962	57,643
38 2035		1,319	1,319	60,731	59,412
39 2036		1,319	1,319	62,552	61,233
40 2037		1,319	1,319	64,429	63,110
41 2038		1,319	1,319	66,362	65,043
42 2039		1,319	1,319	68,353	67,034
43 2040		1,319	1,319	70,403	69,084
44 2041		1,319	1,319	72,515	71,196
45 2042		1,319	1,319	74,691	73,372
46 2043		1,319	1,319	76,932	75,613
47 2044		1,319	1,319	79,240	77,921
48 2045		1,319	1,319	81,617	80,298
49 2046		1,319	1,319	84,065	82,746
50 2047		1,319	1,319	86,587	85,268
51 2048		1,319	1,319	89,185	87,866
52 2049		1,319	1,319	91,860	90,541
53 2050		1,319	1,319	94,616	93,297
54 2051		1,319	1,319	97,455	96,136
55 2052		1,319	1,319	100,378	99,059
56 2053		1,319	1,319	103,390	102,071
Total	178,391	70,010	248,401	2,808,334	2,559,933

II. Urgent Plan (Return Period : 40 Years)

(Unit : Rp Million)

Year	Economic Cost			Economic Benefit (B)	(B)-(C)
	Construction	OM	Total (C)		
1 1998	15,270	0	15,270	0	-15,270
2 1999	53,223	0	53,223	0	-53,223
3 2000	72,410	595	73,005	9,407	-63,598
4 2001	47,541	1,268	48,809	20,751	-28,058
5 2002		1,497	1,497	4,845	25,351
6 2003	3,348	1,532	4,880	26,726	21,846
7 2004		1,566	1,566	28,140	26,574
8 2005		1,566	1,566	28,984	27,418
9 2006		1,566	1,566	29,854	28,288
10 2007		1,566	1,566	30,749	29,183
11 2008		1,566	1,566	31,672	30,106
12 2009		1,566	1,566	32,622	31,056
13 2010		1,566	1,566	33,601	32,035
14 2011		1,566	1,566	34,609	33,043
15 2012		1,566	1,566	35,647	34,081
16 2013		1,566	1,566	36,716	35,150
17 2014		1,566	1,566	37,818	36,252
18 2015		1,566	1,566	38,952	37,386
19 2016		1,566	1,566	40,121	38,555
20 2017		1,566	1,566	41,325	39,759
21 2018		1,566	1,566	42,564	40,998
22 2019		1,566	1,566	43,841	42,275
23 2020		1,566	1,566	45,156	43,590
24 2021		1,566	1,566	46,511	44,945
25 2022		1,566	1,566	47,906	46,340
26 2023		1,566	1,566	49,344	47,778
27 2024		1,566	1,566	50,824	49,258
28 2025		1,566	1,566	52,349	50,783
29 2026		1,566	1,566	53,919	52,353
30 2027		1,566	1,566	55,537	53,971
31 2028		1,566	1,566	57,203	55,637
32 2029		1,566	1,566	58,919	57,353
33 2030		1,566	1,566	60,686	59,120
34 2031		1,566	1,566	62,507	60,941
35 2032		1,566	1,566	64,382	62,816
36 2033		1,566	1,566	66,314	64,748
37 2034		1,566	1,566	68,303	66,737
38 2035		1,566	1,566	70,352	68,786
39 2036		1,566	1,566	72,463	70,897
40 2037		1,566	1,566	74,637	73,071
41 2038		1,566	1,566	76,876	75,310
42 2039		1,566	1,566	79,182	77,616
43 2040		1,566	1,566	81,558	79,992
44 2041		1,566	1,566	84,004	82,438
45 2042		1,566	1,566	86,524	84,958
46 2043		1,566	1,566	89,120	87,554
47 2044		1,566	1,566	91,794	90,228
48 2045		1,566	1,566	94,548	92,982
49 2046		1,566	1,566	97,384	95,818
50 2047		1,566	1,566	100,306	98,740
51 2048		1,566	1,566	103,315	101,749
52 2049		1,566	1,566	106,414	104,848
53 2050		1,566	1,566	109,607	108,041
54 2051		1,566	1,566	112,895	111,329
55 2052		1,566	1,566	116,282	114,716
56 2053		1,566	1,566	119,770	118,204
Total	195,140	83,192	278,332	3,256,339	2,978,007

EIRR (%) 14.42

Discount Rate (%)	B/C	PV (Rp. Million)		NPV (Rp Million)
		Cost	Benefit	
15	0.95	27,846	121,848	-5,998
12	1.25	38,801	174,041	35,240
10	1.57	47,348	231,513	84,164

EIRR (%) 15.43

Discount Rate (%)	B/C	PV (Rp. Million)		NPV (Rp Million)
		Cost	Benefit	
15	1.03	138,459	143,179	4,720
12	1.35	150,856	203,812	52,956
10	1.68	160,582	270,512	109,930

**Table 3.3 ENVIRONMENTAL MANAGEMENT PLAN FOR
MEDAN FLOOD CONTROL PROJECT**

Impact Managed	Source of Impact	Measuring Standard of Impact	Managing Approach	Management Location	Managing Agency Concerned
(Pre-Construction) -Social unrest	-Land acquisition -House evacuation	-Compensation -Public protest/ demonstration & project disturb	-Negotiation -Resettlement plan -Presidential decree No. 55/1993	All project affected villages	-Land acquisition committee -Project office -DGWRD -Cipta Karya
(Construction Stage) -Noise	Operation of heavy equipment	Noise level : 60 dBA	-Control of number or speed of vehicles/ equipment -Working hour -Equipment operators	Housing area	Project office
-Air pollution and traffic congestion	-Mobilization of equipment -Earth works	Quality standard KLH decree No. 02/ MENLH/1988 -Traffic congestion frequency/duration	-Covering materials with sheet -Watering road -Selection of spoil site	Villages close to the project site Bridge construction site	Project office
-Water quality of the river	All civil works relating to the project	Water quality standard according to Gov. regulation No.20/1990	-Dredging work from downstream -Effort to minimize spilt soil into the river -Protective net at downstream direction	Percut River Weir and bridge construction sites	-Project office -Government of North Sumatra Province
-Sedimentation	Dredging in the Percut river	Soil suspended level 100 to 250 mg/l	Sediment dredging at the river mouth	River mouth at Percut village	Project office
-Groundwater level	Construction of floodway	-Depth of groundwater. -Public complaint about decline of groundwater level	-Compensation for affected wells -Extension of water supply service by PDAM	Titi Kuning, Suka Maju, Harjo Sari	Project office
-Disturbance for Irrigation and fishpond	Dredging in the Percut river	-Unit water requirement for paddy : 1.1 l/sec/ha -Soil suspended level 100 to 250 mg/l -Standard water quality	-Control of turbidity level -Dredging of main irrigation canal in case of high sedimentation	Saentis, Cinta Rakyat, Cinta Damal and Percut villages	-Project office -PU branch office Deli Serdang
-Mud pollution by toxic materials	River dredging work	Contents of Cu, Cr, Pb and Cd in mud Sediment	-No use of such materials for embankment -Proper method of disposal in dumping site	Harjo Sari, Sitirejo, Denal, Medan Tembung, Medan Tenggara, Sidorejo	-Project office -Government of North Sumatra Province
-Disturbance for the use of river water	River dredging work	Public perception, reaction of people to bathing/washing	-Effort to minimize degradation of water quality -Advising people of filtering water	All villages existing along Percut River	Project office
-Aquatic biology	-Weir construction -Percut river improvement work	-Diversity index of plankton and benthos -Mangrove trees	-Effort to minimize degradation of water quality -Release of Benthos from dredged material -Preservation of natural ecology	-Percut river and river mouth -Submergible area by the weir	Project office
(Post-Construction) -Illegal use of land on river and floodway borders	-Land acquisition -Dependence on river water	-No. of squatters -Illegal land use	-Effort to gain public comprehension -Control of illegal land use	Villages along Percut River and Floodway	Project office
-Sedimentation and aquatic weed development	Erosion in upstream the rives	Soil suspended level 100 mg/l -Massive growth of weed	-Dredging Sediment -Weed control	Submergible area by the weir Percut River, Floodway	Project office
-Groundwater level	Construction of floodway	-Depth of groundwater -Public complaint about decline of groundwater level	-Compensation for affected wells -Extension of water supply service by PDAM	Titi Kuning, Suka Maju, Harjo Sari	Project office
-Solid waste and refuse	People's conception of river channel	-Amount of waste -Riverine landscape	-Establishing waste collecting system -Educating people	All project affected villages	-Project office -Municipality/Deli Serdang Regency -Public Sanitary Corp.

Table 3.4 ENVIRONMENTAL MONITORING PLAN FOR MEDAN FLOOD CONTROL PROJECT

Monitoring Item	Monitoring Method	Location	Monitoring Frequency	Duration	Monitoring Agency Concerned
(Pre-Construction) -Land issue and social unrest	Interview and field confirmation	All project affected villages	Once every 6 months	As long as problems exist	-Land acquisition committee -Project office -DGWRD -Cipta Karya
(Construction Stage) -Noise	Measured by noise level meter	Dense populated area	Once every 3 months	Construction period	Project office
-Dust and traffic congestion	Field observation	-Villages close to project site -Bridge construction site	Once every 3 months	Construction period	Project office
-Water quality of the river	Test and analysis of sample waters in laboratory	11 locations selected in ANDAL study	Once every 3 months	Construction period	-Project office -Government of North Sumatra Province
-Sedimentation	Field observation	River mouth at Percut village	Once every 6 months	Construction period	Project office
-Groundwater level	Field observation and measurement	14 locations selected in ANDAL study	Once every 6 months	Construction period	Project office
-Disturbance for irrigation and fishpond	-Field observation -Sample water analysis in laboratory	Saentis, Cinta Rakyat, Cinta Damai and Percut villages	Once every 6 months	Construction period + min. 1 year	-Project office -PU Branch office Deli Serdang
-Mud pollution by toxic materials	Mud sample analysis in laboratory	Harjo Sari, Sitirejo, Denal, Medan Tembung Medan Tenggara, Sidorejo	Once every 6 months	Construction period	-Project office -Government of North Sumatra Province
-Disturbance for the use of river water	Field observation and interview	All villages existing along the Deli and Percut	Once every 6 months	Construction period + min. 1 year	Project office
-Aquatic biology	-Field observation and interview -Sample analysis	-Percut river and river mouth -Submergible area by the weir	Once every 6 months	Construction period	Project office
(Post-Construction) -Illegal use of land on river and floodway borders	Field observation	Along the Percut river and floodway border	Once every 3 months	Min. 2 years	Project office
-Sedimentation and aquatic weed development	Field observation and measurement	Along the Percut, Deli and floodway	Once every 6 months	Min. 1 years	Project office
-Groundwater level	Observation and measurement	14 sites selected in ANDAL study	Once every 6 months	Min. 1 years	Project office
-Solid waste and refuse	Field observation	Along the Percut, Deli and floodway	Once every 3 months	Min. 2 years	-Project office -Municipality/Deli Serdang Regency -Public Sanitary Corp.
-Water quality of the river	Sample analysis in laboratory	11 sites selected in ANDAL study	Once every 6 months	Min. 2 years	-Project office -Government of North Sumatra Province
-Project effect and evaluation	Observation and analysis	Whole project area	Once a year	No limit defined	Project office

Table 3.5 LAND USE AND BUILDINGS IN THE PROJECT AREA

REQUIRED AREA FOR LAND EXPROPRIATION

(Unit : m²)

Classification	Floodway	Percut I (Downstream)	Percut II (Upstream)	Upper Deli	Total
Residential Area	32,310	7,720	109,100	46,270	195,400
Dryland/Wasteland	37,770	278,140	67,700	52,860	436,470
Cultivated Land	5,755	335,400	82,150	23,043	446,348
Paddy Field	12,405	67,700	0	0	80,105
Plantation/Woods	94,348	81,700	159,800	0	335,848
Wetland	9,020	283,500	69,670	0	362,190
Factory	3,725	0	12,180	730	16,635
Cemetery	160	0	12,800	0	12,960
Total	195,493	1,054,160	513,400	122,903	1,885,956

NUMBER OF PROJECT-AFFECTED HOUSES AND FACILITIES

Item	Floodway	Percut I (Downstream)	Percut II (Upstream)	Upper Deli	Total
House	171	377	396	26	970
- Type A	105	276	150	24	555
- Type B	33	14	112	1	160
- Type C	33	21	109	1	164
School	2	0	2	1	5
Mosque	0	2	2	1	5
Factory	1	0	3	3	7
Cemetery	1	0	1	0	2
Church	0	0	1	0	1
Total	175	379	405	31	990

FLOOR SPACE OF PROJECT-AFFECTED HOUSES AND FACILITIES

Item	Floodway	Percut I (Downstream)	Percut II (Upstream)	Upper Deli	Total
House	16,492	17,042	22,945	4,112	60,591
- Type A	11,922	16,006	10,355	3,912	42,195
- Type B	3,565	879	9,088	182	13,714
- Type C	1,005	157	3,502	18	4,682
School	600	0	34	960	1,594
Mosque	221	117	204	158	700
Factory	0	0	2,025	760	2,785
Church	0	0	304	0	304
Total	17,313	17,159	25,512	5,990	65,974

Note : house is classified into the following tree types in accordance with floor space directly

Table 3.6 MATRIX OF SOCIAL IMPACT PREDICTION AND EVALUATION

Social Impact	Project Activity Component	Pre-Construction		Construction						Post Construction		
		Land Acquisition	Equipment and Material Mobilization	Land Clearing	Excavation for Floodway	Weir Construction	Percut River Excavation	Percut River Embankment	River Structure Construction	Operation	Maintenance	
1. Social Conflict/Social Unrest		INI										
2. Traffic Congestion			INI		INI					INI		
3. Disturbance to Utilization of Percut River Water							INI			INI		
4. Declining of Water Stage in Wells					SNI					SNI		
5. Disturbance to Irrigation												
6. Declining of Agricultural Yield												
7. Disturbance to Development Plans in the Project Area		SNI										
8. Disturbance to Use of Infrastructures					INI					INI		
9. Disturbance to the Industrial Activities				SNI						SNI		
10. Illegal Utilization of Rapanan Area along Percut River and Floodway												INI

Table 3.7 (1/2) MATRIX FOR SOCIAL IMPACT MANAGEMENT PLAN

Item No.	Type of Social Impact to be Managed	The Objective of Management	Management Efforts	Location of Social Impact Management	Institutional Coordination System
(1)	(2)	(3)	(4)	(5)	(6)
I PRE-CONSTRUCTION					
1	Social conflict and social unrest	To prevent social apprehension and social conflict between the project initiator and the people.	<ol style="list-style-type: none"> 1. Extension to the people affected by the project, namely 165 households in proposed floodway and 1,400 households in Percut riverbank (see Appendix 7.1) 2. To provide land acquisition according to negotiation between project and landowners (Presidential Decree No. 55/1993) 3. To provide building compensation according to the estimation of Public Works Services 4. To provide building compensation according to the estimation of Agricultural Services 5. To provide building compensation for land and building remnant which are not feasible to support people living 6. To prepare resettlement area for the people when the rate of house compensation is not sufficient to pay a new residence (see Appendix 7.2) 7. To relocate people's houses which are crossed by river normalization (see Appendix 7.2) 8. To carry out special approach to Muslim religious leaders, priests, land donation official ("nazir") and foundation leader to support acquisition for social facilities 9. To be responsible for all administration costs of land certificate change related to this project 10. To provide a chance for people who have no land certificate to take the statement letter from Kepala Desa known by Camat 	All villages affected by the project	Project-LPC-People affected
II CONSTRUCTION STAGE					
1	Traffic Congestion and Disturbance to People Mobility	To prevent traffic congestion on busy roads and to reduce disturbance to people mobility	<ol style="list-style-type: none"> 1. To construct temporary bridges in locations where traffic is chronically heavy and where there are many mobility disturbances. The temporary bridges will be utilized up to the construction of the permanent bridges and new roads are finished. 	All bridge locations such as: Jl. Seksuma Ujung, Pasar Merah Ujung, Jl. Panglima Denal, Jl. Taplan Nauli, Jl. SMA 12, Gang Anai, Gg. Salak, Gg. Kelapa Kuning, Jl. Suka Cerdas, Jl. Tuba 3, Jl. Tanggul Kanan Denal, Jl. Tanggul Kanan Bandar Khalipah, Jl. Benteng, Jl. Perhungan, Jl. Tenusan, Jl. Bandar Setia-Tambak Bayan, Jl. Kebun Ceklat PTP DK, Jl. Cinda Damai, Jl. Todak, Jl. Bagan Percut	Project-PU Bina Marga
2	Disturbance to the use of Percut River Water	To prevent social unrest due to disturbance of Percut river water which is needed for bathing and washing	<ol style="list-style-type: none"> 1. Percut river dredging should be started from the downstream 2. Dredging equipment should be operated from the edges of the river 3. Dredging system should be conducted according to the river flow 4. To extend to local people the use of healthy methods of water utilization and to advise water treatment by simple filtration. 5. To provide public facilities for water supply such as public pump wells 	All villages along Percut river improvement	Project
3	Decline of ground water level of public wells	To reduce ground water level decline in public wells	<ol style="list-style-type: none"> 1. To extend water supply network to areas affected by the project 2. To build public facilities for water supply such as public pump wells 3. To suggest digging of wells to local residents in case of significant decline of ground water level and to provide compensation for digging 	Especially in all villages along the proposed floodway (Titi Kuning, Sukamaju, Harjosari II, Marindal I, Patumbak Kampung)	Project-PDAM (Water Supply Enterprise)
					Project-PU Cipta Karya
					Project

Table 3.7 (2/2) MATRIX FOR SOCIAL IMPACT MANAGEMENT PLAN

Item No.	Type of Social Impact to be Managed	The Objective of Management	Management Efforts	Location of Social Impact Management	Institutional Coordination System
(1)	(2)	(3)	(4)	(5)	(6)
4	Disturbance to Irrigation	To prevent social apprehension due to water discharge reduction and water quality of irrigation water for paddy fields.	1. To maintain the turbidity level of the Percut river water as low as possible by efforts such as: <ul style="list-style-type: none"> a. Starting dredging work from downstream b. Operating dredging equipment from the edges of river 	Cinta Rafyat, Cinta Damai, Sampati, Femalang Lalang and Percut Village	Project-PU Irigasi
			2. To close the Bandar Sidoras intake gate during the dredging period in the area	Bandar Sidoras Intake	Project-PU Irigasi
			3. River dredging in the Bandar Sidoras weir area should be conducted in March-July and September-October when the requirement of irrigation water in the paddy fields is relatively low.	Cinta Rafyat, Cinta Damai, Sampati, Femalang Lalang and Percut Village	Project-PU Irigasi
5	Decline of Agricultural Yield	To reduce declining of agricultural production	1. Land clearing should be conducted after harvest time	All villages in the project area	Project
			2. To provide seedlings of fruit or plantation crops to the affected people (around 5 seedlings per household)	All villages in the project area	Project-Agricultural Services-Plantation Services
			3. Reforestation for embankments of inundation area, proposed floodway and Percut River using mixed fruit trees (duku, rambutan, mangga, etc.) or plantation crops (coconut, cocoa, etc.)	All villages in the project area	Project-Agricultural Services-Plantation Services
6	Disturbance of Development Plan in the Area	To reduce and to prevent conflict between the project plan and the other plans	1. To inform the development company or the people the objective of the Medan Flood Control Project	Titi Kuning and Tembung Village	Project
			2. To provide land and building compensation if the plan is implemented	Titi Kuning and Tembung Village	Project
7	Disturbance of Infrastructure Use	To reduce disturbance on the use of infrastructures	1. To extend information to related institutions regarding the objectives of Medan Flood Control Project	All villages where there are infrastructures affected	Project-PLN-PDAM-Telkom-PU-Kanwil Perhubungan
			2. To suggest to related institutions the submission of report on disturbance intensity and budget proposal for the project	All villages where there are infrastructures affected	Project-Related Institution
			3. To provide compensation for installations affected by the project	All villages where there are infrastructures affected	Project-Related Institution
			4. To provide a chance for related institutions to relocate and arrange their installations before land clearing works	All villages where there are infrastructures affected	Project-Related Institution
			5. To flow out all sewerages and drainage channels to the floodway and Percut River supported by sluice gate	All villages affected by the project	Project-PU Irigasi
8	Disturbance to Industrial Activities	To reduce disturbance to industrial activities	1. To inform the company the objectives of the Medan Flood Control Project	Titi Kuning, Bandar Khalipah and Laut Dendang Village	Project
			2. To provide compensation for land, buildings and installations	Titi Kuning, Bandar Khalipah and Laut Dendang Village	Project-LPU
			3. To provide a chance for industrial companies to relocate their installations up to normal activities	Kimsari Paper Industry in Titi Kuning and sawmill in Bandar Khalipah	Project
			4. To provide a chance for industrial companies to get a new location up to normal activities	Trass Industry in Titi Kuning and Chinese cake Industry in Laut Dendang	Project
III	POST CONSTRUCTION STAGE				
1	Illegal utilization of land along Percut River and Floodway Border	To prevent illegal utilization of land along Percut River, floodway borders and inundation area	1. Extension program for people regarding river conservation	Villages along Percut River, proposed floodway and inundation area	Project-PU Irigasi
			2. To put up signs informing that land is forbidden for use		
			3. To control and maintain the riverbank continuously		

Note : LPC = Land Provision Committee
 BPN = National Land Board
 PLN = Electricity Enterprise
 PDAM = Water Supply Enterprise
 Telkom = Telecommunication Enterprise
 Kanwil Perhubungan = Representative Office for Transportation
 PU Irigasi = Irrigation-PU

Table 4.1 PROPOSED DRAINAGE OUTLET ALONG PERCUT RIVER AND FLOODWAY

Drainage Outlet No.	Location	Type	Gate	Bottom Elevation (E.L. m)	Ground Height (E.L. m)	Design Riverbed (E.L. m)	HWL (E.L. m)	Date Crest (E.L. m)	Catchment Area (ha.)	Assumed Discharge (m ³ /s)	Note
Right Bank											
SR1	PE. 166 + 80	Pipe Culvert D=800mmx2		14.800	17.300	11.145	17.255	18.055	37.890	2.508	
SR2	PE. 176 + 83	Pipe Culvert D=800mmx2		16.100	18.600	12.365	18.475	19.275	50.868	2.758	Railway Br.
SR3	PE. 200 + 10	Open Ditch B=600mm		20.000	21.700	15.185	21.298	22.098	0.990	0.093	Denai Br.
SR4	PE. 200 + 25	Pipe Culvert D=1000mm		20.800	21.800	15.206	21.316	22.116	11.040	0.806	Denai Br.
SR5	PE. 216 + 0	Open Ditch B=600mm		23.800	24.300	17.052	23.162	23.962	0.540	0.088	
SR6	PE. 218 + 40	Pipe Culvert D=600mm		23.000	24.700	17.393	23.503	24.303	10.180	0.749	
SR7	PE. 234 + 20	Pipe Culvert D=800mm		24.000	26.000	19.326	25.436	26.236	15.500	0.970	
SR8	PE. 246 + 30	Pipe Culvert D=800mm		27.500	27.100	20.794	26.904	27.704	15.010	1.394	Amplas Br.
SR9	PE. 255 + 20	Pipe Culvert D=600mm		24.300	28.300	21.862	27.972	28.772	6.390	0.583	
SR10	PE. 259 + 0	Box Culvert 2.0x2.0x2		24.300	28.700	22.310	28.420	29.220	498.490	22.293	River
SR11	PE. 271 + 40	Pipe Culvert D=800mm		28.000	30.400	24.016	30.126	30.926	11.850	1.144	
SR12	PE. 272 + 83	Pipe Culvert D=1000mm		29.500	30.200	24.186	30.296	31.096	14.500	2.376	
SL	PE. 85 + 0	Pipe Culvert D=600mm	1 Flip Gate	4.000	5.500	2.066	7.766	8.566	17.740	0.709	Perkeruban Br.=100m
SL2	PE. 95 + 35	Box Culvert 2.0x1.5x1	2 Slide Gates	5.000	7.040	2.925	9.425	10.225	559.020	14.882	
SL3	PE. 138 + 55	Box Culvert 1.5x1.5x1	1 Slide Gate	11.000	12.800	7.694	13.804	14.604	109.230	6.074	Paving Br.=110m
SL4	PE. 155 + 90	Box Culvert 2.0x1.5x1	1 Slide Gate	13.000	15.400	9.855	15.965	16.765	119.250	7.474	Under Construction
SL5	PE. 176 + 55	Box Culvert 1.5x1.5x1		16.000	18.500	12.329	18.439	19.239	54.600	5.553	Railway Br.
SL6	PE. 176 + 85	Box Culvert 2.0x1.5x1		16.000	18.600	12.365	18.475	19.275	62.000	8.030	Railway Br.
SL7	PE. 189 + 40	Pipe Culvert D=800mm		18.000	20.500	13.901	20.011	20.811	9.000	1.258	
SL8	PE. 198 + 35	Pipe Culvert D=1000mmx2		21.000	21.500	14.955	21.065	21.865	35.200	3.781	
SL9	PE. 200 + 25	Pipe Culvert D=600mm		21.000	22.000	15.206	21.316	22.116	2.500	0.290	Denai Br.
SL10	PE. 200 + 40	Pipe Culvert D=600mm		20.500	21.700	15.224	21.334	22.134	7.750	0.573	Denai Br.
SL11	PE. 206 + 0	Pipe Culvert D=600mm		20.500	22.100	15.862	21.972	22.772	0.360	0.053	Tollway Br.
SL12	PE. 208 + 55	Open Ditch B=1000mm		23.000	22.500	15.929	22.039	22.839	23.000	1.716	Tollway Br.
SL13	PE. 212 + 0	Box Culvert 1.5x1.5x1		21.000	23.200	16.604	22.714	23.514	181.600	12.564	JL. omo
SL14	PE. 222 + 0	Box Culvert 2.1x2.4x2		21.500	24.400	17.847	23.957	24.757	345.760	23.880	Binali Br.
SL15	PE. 222 + 15	Pipe Culvert D=1000mm		21.500	25.100	17.865	23.975	24.775	32.600	2.350	JL. Timur
SL16	PE. 246 + 40	Box Culvert 2.0x2.0x1		23.500	27.500	20.806	26.916	27.716	108.420	10.908	Amplas Br.
SL17	PE. 250 + 90	Pipe Culvert D=600mm		26.000	27.500	21.369	27.479	28.279	14.350	0.849	
SL18	PE. 255 + 13	Pipe Culvert D=800mm		26.500	28.000	21.856	27.966	28.766	20.960	1.736	Pipe Bridge
SL19	PE. 258 + 25	Pipe Culvert D=600mm		27.500	28.700	22.219	28.329	29.129	10.170	0.748	
SL20	PE. 259 + 60	Pipe Culvert D=600mm		28.000	29.000	22.383	28.493	29.293	3.780	0.272	
SL21	PE. 262 + 80	Pipe Culvert D=1000mmx2		26.000	29.803	22.764	28.874	29.674	55.090	3.439	
SL22	PE. 264 + 90	Pipe Culvert D=600mm		26.896	29.400	22.995	29.105	29.905	4.770	0.405	
SL23	PE. 269 + 50	Open Ditch B=600mm		30.398	30.000	23.687	29.797	30.597	4.090	0.507	National Road Br.
SL24	PE. 269 + 80	Open Ditch B=600mm		29.719	33.100	23.723	29.833	30.633	9.230	0.611	National Road Br.
SL25	PE. 274 + 55	Pipe Culvert D=800mm		32.000	33.000	24.322	30.432	31.232	17.740	0.888	
SF1	FW. 6 + 50	Pipe Culvert D=1000mm		32.000	33.477	25.088	30.888	31.688	20.200	0.890	
SF2	FW. 9 + 81	Box Culvert 2.0x2.0x1		33.000	35.484	25.229	31.029	31.829	150.150	7.003	
SF3	FW. 13 + 0	Pipe Culvert D=1000mm		35.667	36.167	25.365	31.165	31.965	9.000	0.721	
SF4	FW. 16 + 0	Pipe Culvert D=1000mm		0.000	35.147	25.493	31.293	32.093	40.500	1.971	
SF5	FW. 25 + 24	Box Culvert 2.0x2.0x2		32.500	34.035	25.888	31.688	32.488	422.110	16.900	Buluan River
SF6	FW. 30 + 0	Pipe Culvert D=1000mm		0.000	37.938	26.694	31.894	32.694	9.375	0.477	
SF7	FW. 38 + 50	Pipe Culvert D=1000mm		34.300	34.800	26.457	32.257	33.057	11.250	1.889	
Floodway											

Table 5.1 BALANCE OF SOIL VOLUME FOR EACH WORK PORTION (FOR EMBANKMENT)

(UNIT : m³)

WORK ITEM	MFC-1	MFC-2	MFC-3	MFC-4	MFC-5	MFC-6	MFC-7	TOTAL
1. Excavation (Common)	139,600	340,900	626,300	342,900	654,000	290,200	189,300	2,543,000
2. Excavation (Riverbed)	164,600	166,200	161,900	99,500	0	0	13,000	608,000
I. Volume can be used for Embankment	72,300	340,050	596,050	328,510	588,600	261,180	172,970	2,359,660
3. Embankment	263,800	338,000	95,200	59,200	15,800	4,600	267,800	912,000
II. Remained Volume after Embankment	231,900	167,050	503,550	383,200	638,200	190,770	29,330	2,144,000
4. Dredging	82,600	0	0	0	0	0	0	84,000
5. Clearing and Grubbing (m ²)	273,700	528,000	332,400	228,700	159,100	63,200	143,700	1,764,000
6. Stripping	32,500	61,100	16,300	8,700	4,200	2,300	21,900	148,000
Total of Remained Volume (II. + 4. +6.)	347,000	228,150	519,850	391,900	642,400	193,070	51,230	2,373,600

Note : Clearing and Grubbing Volume will is not counted in the remained volume.

Table 5.2 BALANCE OF SOIL VOLUME FOR EACH WORK PORTION (FOR SOIL AREA)

(UNIT : m³)

WORK ITEM	MFC-1	MFC-2	MFC-3	MFC-4	MFC-5	MFC-6	MFC-7	TOTAL
1. Excavation (Common)	Right	105,100	153,100	345,900	159,000	654,000	170,900	1,878,200
	Left	34,500	187,800	280,400	183,900	0	18,400	705,000
	Sub-Total	139,600	340,900	626,300	342,900	654,000	290,200	2,583,200
Satisfied Volume for Embankment	Right	42,040	137,790	311,310	143,100	588,600	153,810	1,637,830
	Left	13,800	169,020	252,360	165,510	0	16,560	617,250
	Sub-Total	55,840	306,810	563,670	308,610	588,600	170,370	2,255,080
2. Excavation (Riverbed)	Right	129,100	63,400	91,800	43,400	0	8,200	335,900
	Left	35,500	102,800	70,100	56,100	0	4,800	269,300
	Sub-Total	164,600	166,200	161,900	99,500	0	13,000	605,200
Satisfied Volume for Embankment	Right	12,910	12,680	18,360	8,680	0	1,640	54,270
	Left	3,550	20,560	14,020	11,220	0	960	50,310
	Sub-Total	16,460	33,240	32,380	19,900	0	2,600	104,580
3. Embankment	Right	179,500	184,400	45,000	30,800	15,800	161,700	621,800
	Left	84,300	153,600	50,200	28,400	0	106,100	422,600
	Sub-Total	263,800	338,000	95,200	59,200	15,800	267,800	1,044,400
Volume Balance after Embankment	Right	-124,550	-33,930	284,670	120,980	572,800	-6,250	1,070,300
	Left	-66,950	35,980	216,180	148,330	0	-88,580	244,960
	Sub-Total	-191,500	2,050	500,850	269,310	572,800	256,580	1,315,260
Remained Volume	0	0	311,400	269,310	572,800	161,750	0	1,315,260
Embankment Material from other Package	MFC-1	0	2,050	189,450	0	0	0	0
	MFC-2	-2,050	0	0	0	0	0	0
	MFC-3	-189,450	0	0	0	0	0	0
	MFC-4	0	0	0	0	0	0	0
	MFC-5	0	0	0	0	0	0	0
	MFC-6	0	0	0	0	0	0	0
	MFC-7	0	0	0	0	0	94,830	0
Legend :								
- minus get from other Package								
- plus produce to other Package								

Table 6.1 ITEMS FOR INSPECTION WORKS

Works of Inspection	Item of Inspection	Frequency of Inspection
1. River/Floodway	<ul style="list-style-type: none"> - Sedimentation or scouring condition of bed - Flow condition - River mouth condition - Illegal occupation - Waste disposal and water quality 	Weekly
2. Dike/Bank	<ul style="list-style-type: none"> - Weed and crack - Seepage and erosion - Illegal occupation 	Weekly
3. Revetment	<ul style="list-style-type: none"> - Crack on slope and foot - Foundation 	Weekly
4. Diversion Weir	<ul style="list-style-type: none"> - Obstacles (tree, grass and solid waste) - Sedimentation - Local seepage and scouring - Crack in apron and retaining wall 	Weekly
5. Intake Weir	<ul style="list-style-type: none"> - Sedimentation and obstacles - Sliding condition of gates - Painting 	Weekly
6. Groundsill	<ul style="list-style-type: none"> - Obstacles (tree, grass and solid waste) - Sedimentation - Local seepage and scouring - Crack in apron and retaining wall 	Weekly
7. Groin	<ul style="list-style-type: none"> - Crack and destruction - Foot protection 	Weekly
8. Drainage Outlet	<ul style="list-style-type: none"> - Sedimentation and obstacles - Crack on concrete 	Weekly

Table 7.1 ANNUAL DISBURSEMENT SCHEDULE

(Unit : Million Rp.)

Description	Amount		1997/1998		1998/1999		1999/2000		2000/2001		
	F.C.	L.C.	Total	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
				0	0	21,564	20,403	35,630	43,240	23,764	32,120
1. Construction Base Cost	81,147	96,766	178,913	0	0	0	0	0	0	0	0
1.1 MFC-1	5,471	6,511	11,982	0	0	4,122	4,196	1,349	2,313	0	0
1.2 MFC-2	14,346	11,260	25,606	0	0	10,217	7,026	4,129	4,234	0	0
1.3 MFC-3	14,000	12,948	26,948	0	0	384	564	6,167	4,555	7,460	7,828
1.4 MFC-4	9,707	9,125	18,832	0	0	369	578	4,864	3,622	4,453	4,925
1.5 MFC-5	11,278	11,374	22,652	0	0	4,417	4,078	6,861	7,296	0	0
1.6 MFC-6	9,701	11,722	21,423	0	0	311	407	4,542	5,335	4,848	5,980
1.7 MFC-7	9,716	12,488	22,205	0	0	477	642	4,877	6,970	4,362	4,877
Sub-total	74,219	75,429	149,648	0	0	20,316	17,493	32,789	34,325	21,114	23,611
1.5 Price Escalation	6,928	20,337	27,265	0	0	1,237	2,911	3,040	8,915	2,650	8,512
2. Compensation Cost	0	38,160	38,160	0	18,346	0	19,814	0	0	0	0
2.1 Land Acquisition	0	29,302	29,302	0	14,651	0	14,651	0	0	0	0
2.2 House Evacuation	0	4,672	4,672	0	2,336	0	2,336	0	0	0	0
Sub-total	0	33,974	33,974	0	16,987	0	16,987	0	0	0	0
2.3 Price Escalation	0	4,186	4,186	0	1,359	0	2,827	0	0	0	0
3. Administration Cost	0	11,383	11,383	0	917	0	3,196	0	4,227	0	3,042
3.1 Administration (5% of 1+2)	0	9,181	9,181	849	849	2,740	2,740	3,356	3,356	2,236	2,236
3.2 Price Escalation	0	2,202	2,202	0	68	0	456	0	872	0	806
4. Engineering Services	8,846	3,697	12,743	419	169	2,838	1,199	3,172	1,406	2,416	1,123
4.1 Construction Supervision	8,132	3,126	11,258	407	156	2,676	1,028	2,903	1,116	2,147	825
4.2 Price Escalation	714	771	1,485	12	13	163	171	269	290	269	297
5. Physical Contingency (10% of 1+2+3+4)	8,959	14,970	23,919	42	1,943	2,439	4,461	3,900	4,887	2,618	3,629
6. Total (1+2+3+4+5)	98,992	164,128	263,118	461	21,375	26,831	49,074	42,902	53,760	28,798	39,917
7. Value Added Tax (10% of 6.)	0	26,912	26,912	0	4,821	0	9,198	0	8,256	0	3,992
8. Grand Total	98,992	190,433	289,430	461	26,196	26,831	58,271	42,902	62,016	28,798	43,908

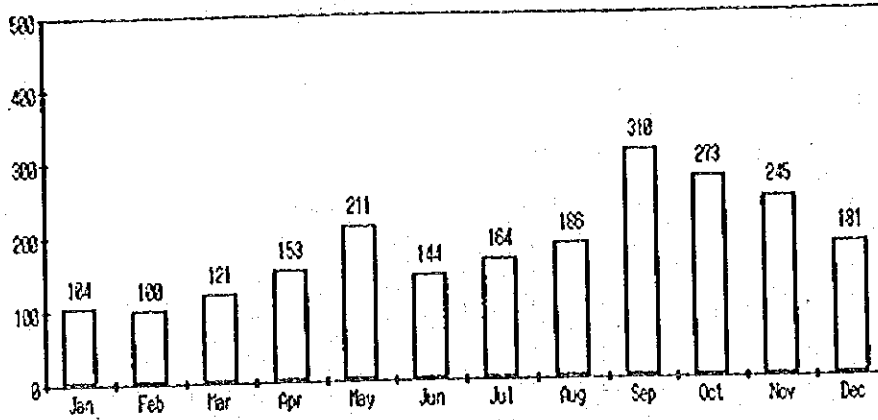
Note : *1 Price level is in November 1995.

*2 Conversion rate US\$1.00 = Rp.2,285 = Yen 103.6

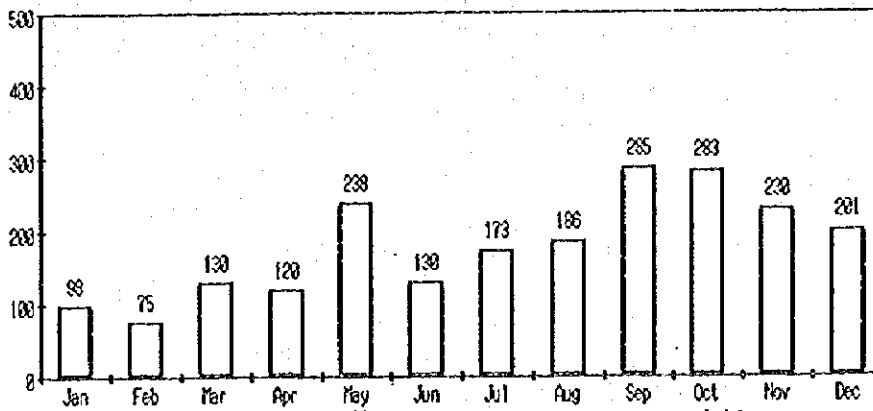
*3 Price escalation rate F.C. = 3%, L.C. = 8%

FIGURES

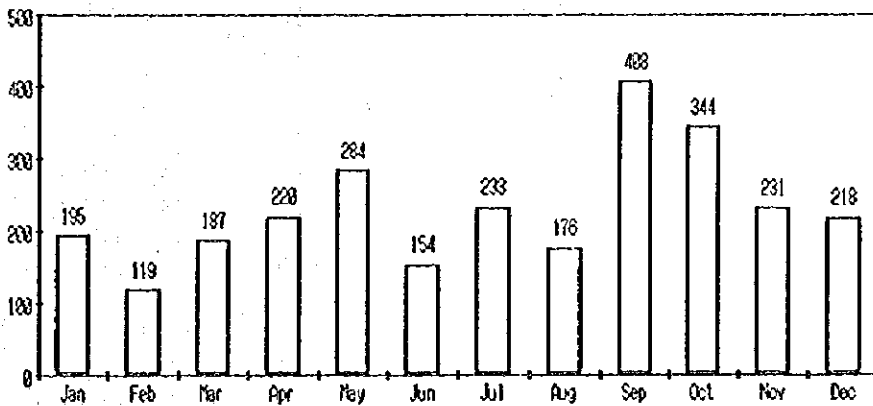
Monthly Rainfall (mm) at No 1.01
Average from 1984 to 1993 (2,192mm/yr)



Monthly Rainfall (mm) at No 3.03
Average from 1984 to 1993 (2,149mm/yr)



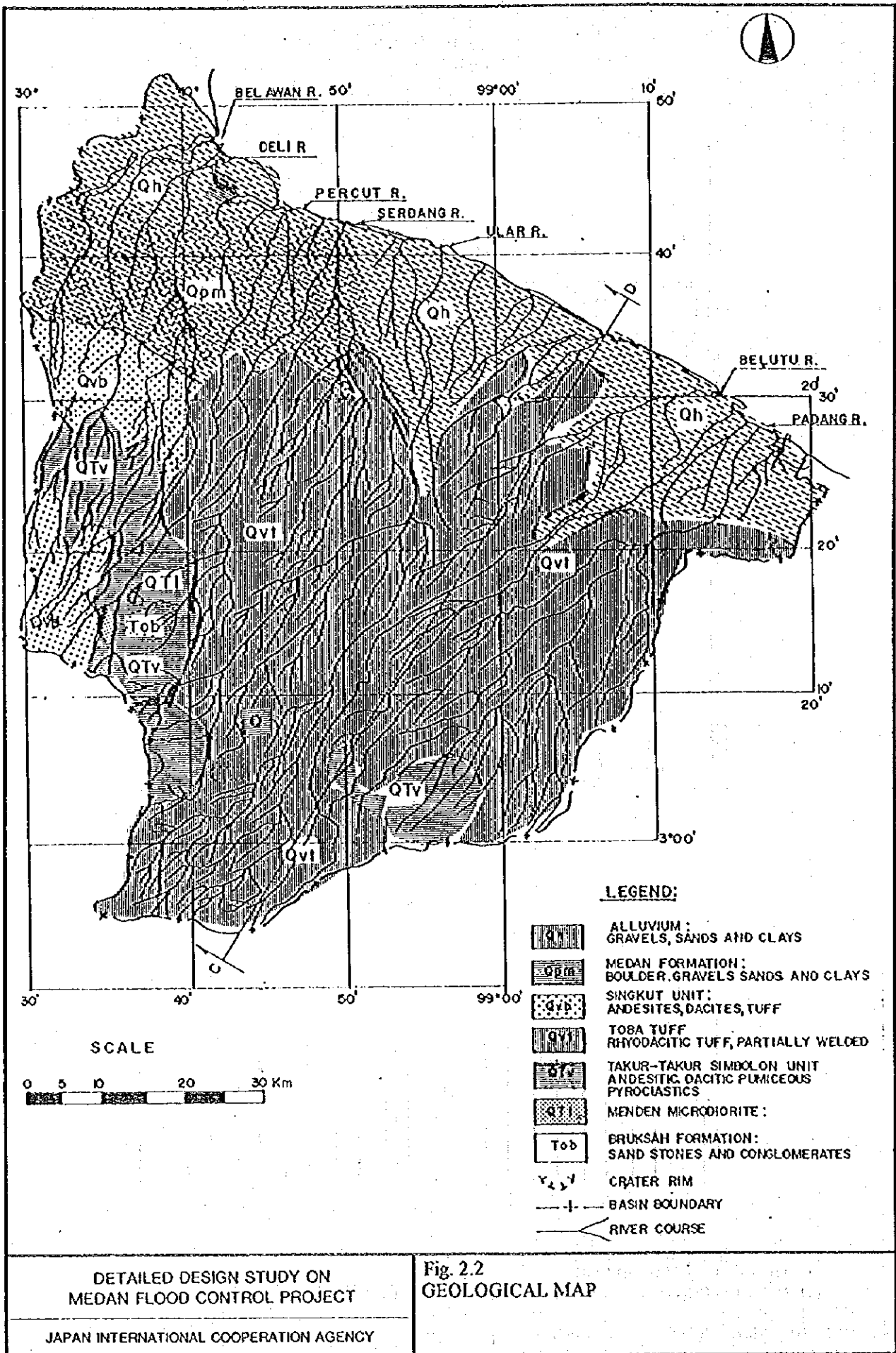
Monthly Rainfall (mm) at No 3.32
Average from 1984 to 1993 (2,768mm/yr)



DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

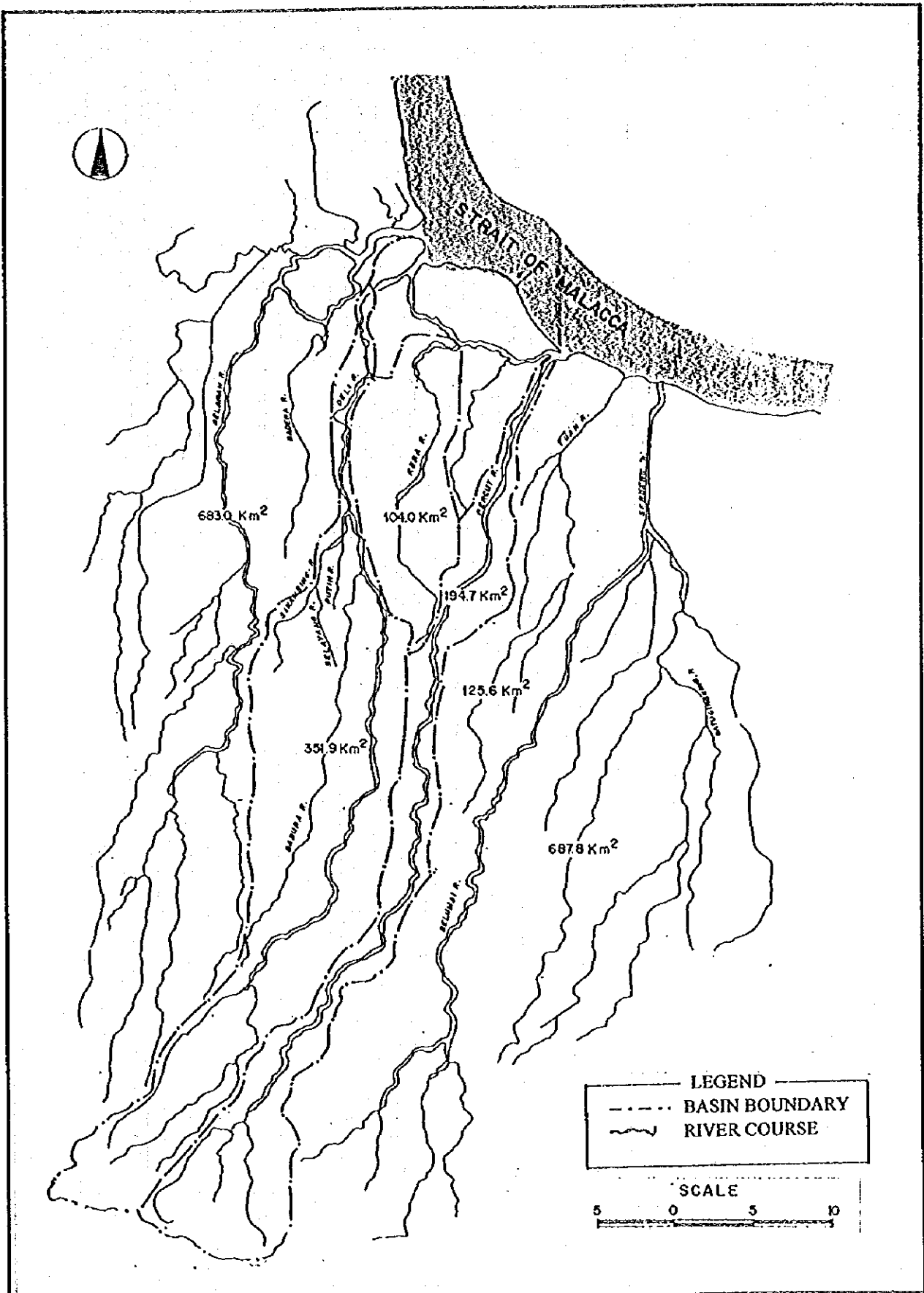
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 2.1
MONTHLY RAINFALL PATTERNS



DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

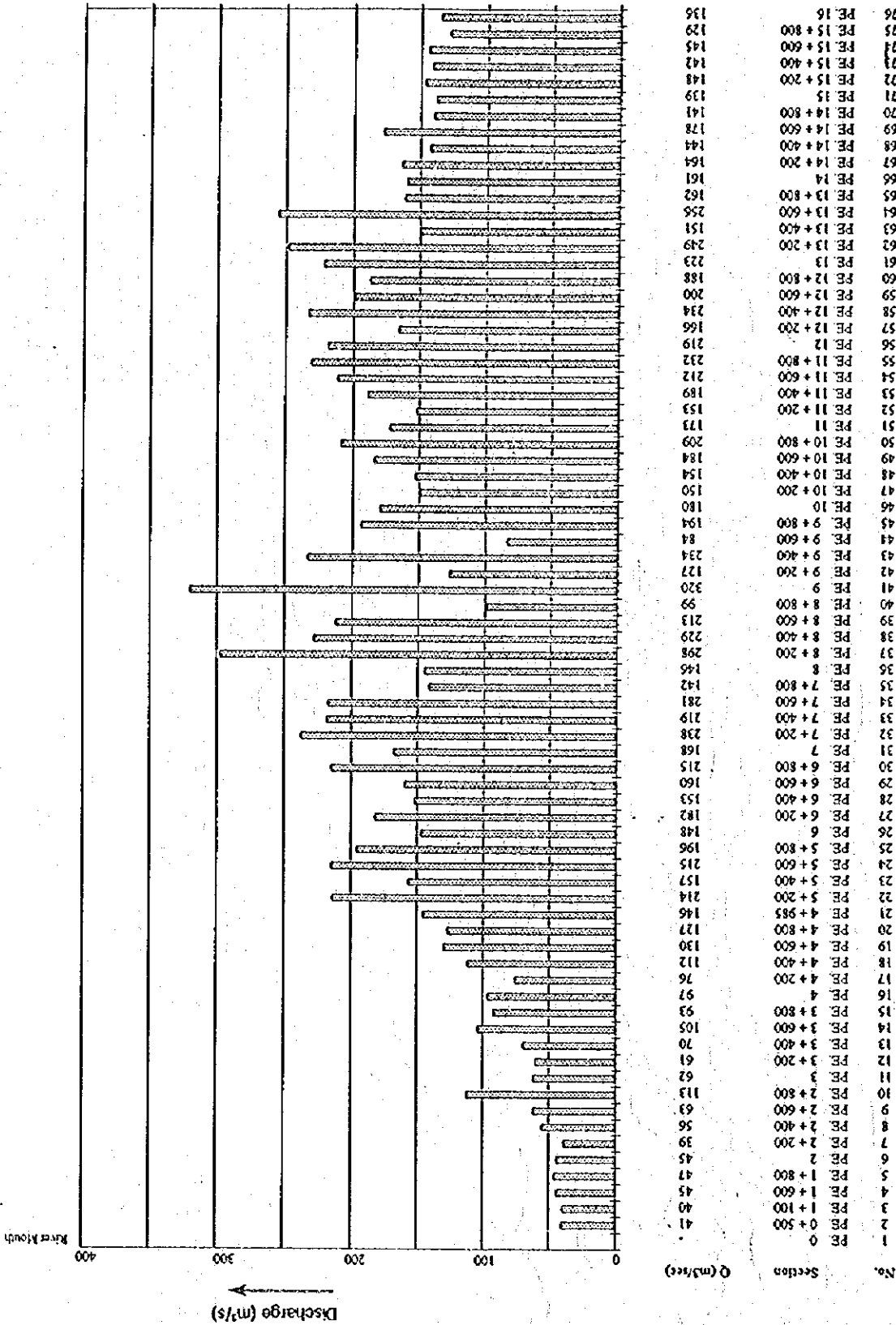
JAPAN INTERNATIONAL COOPERATION AGENCY



DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

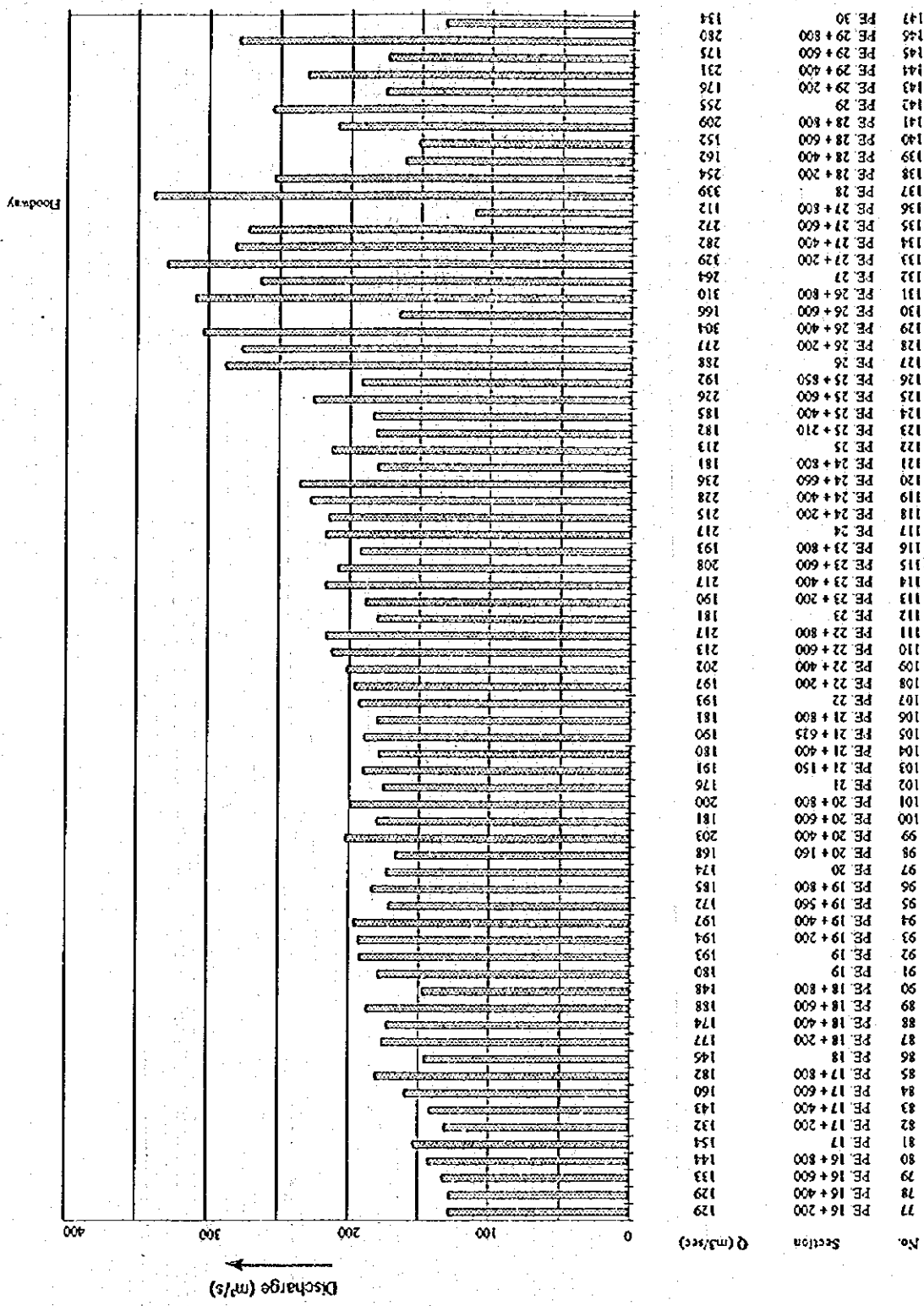
Fig. 2.3
MAJOR RIVER SYSTEM AND CATCHMENT
BASIN



DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

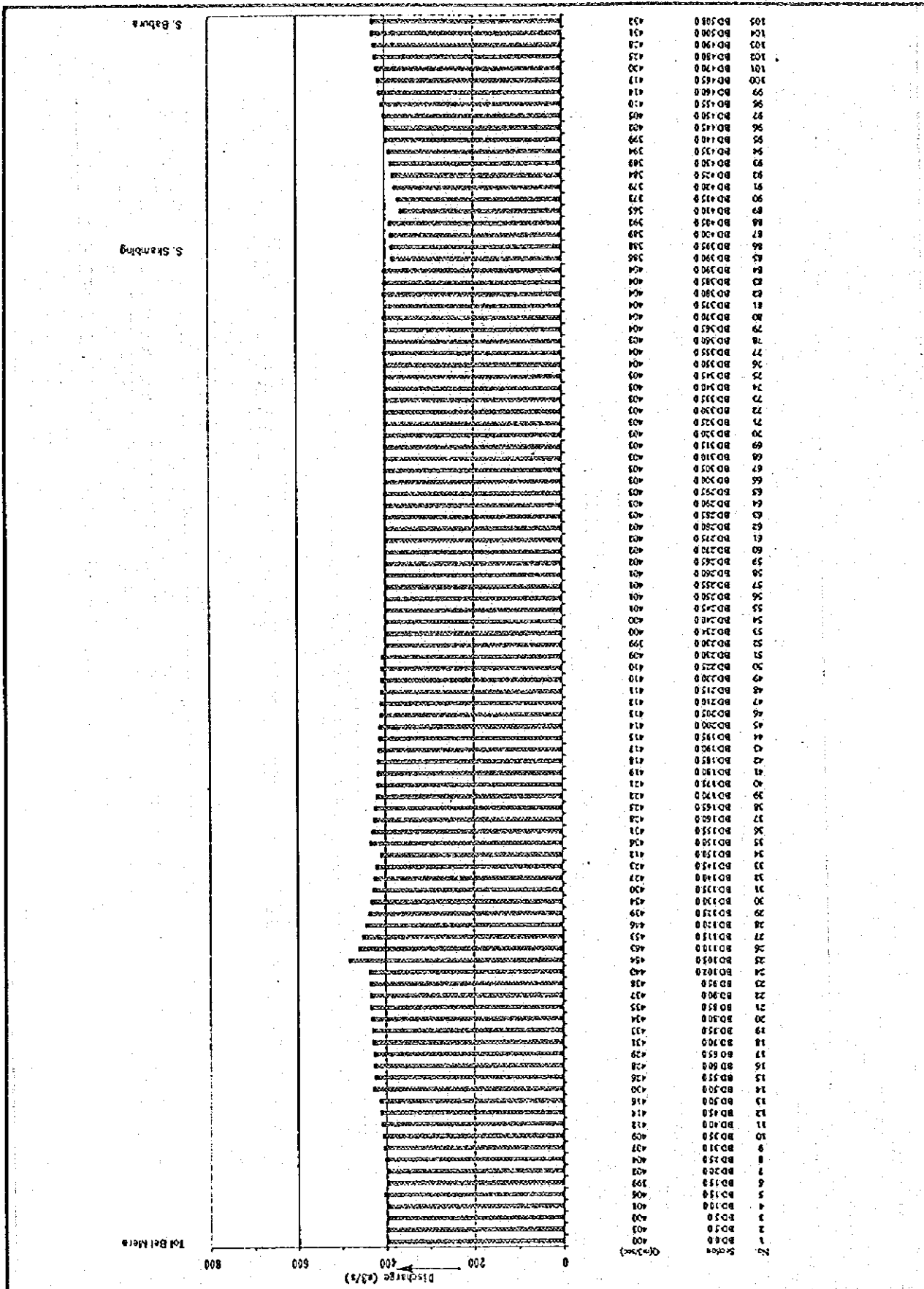
Fig. 2.4(1/2)
FLOW CAPACITY OF PERCUT RIVER



DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

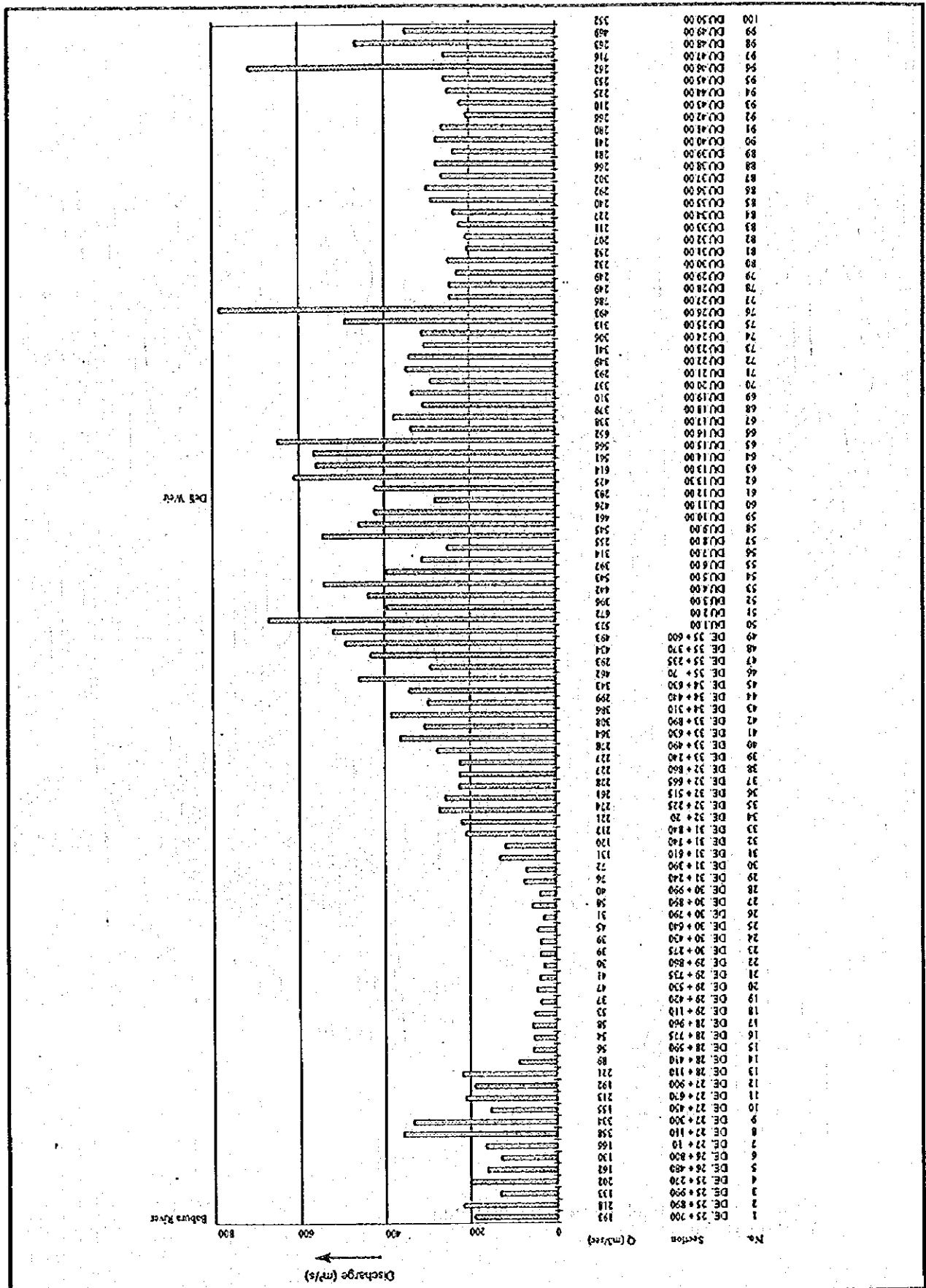
Fig. 2.4(2/2)
FLOW CAPACITY OF PERCUT RIVER



DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

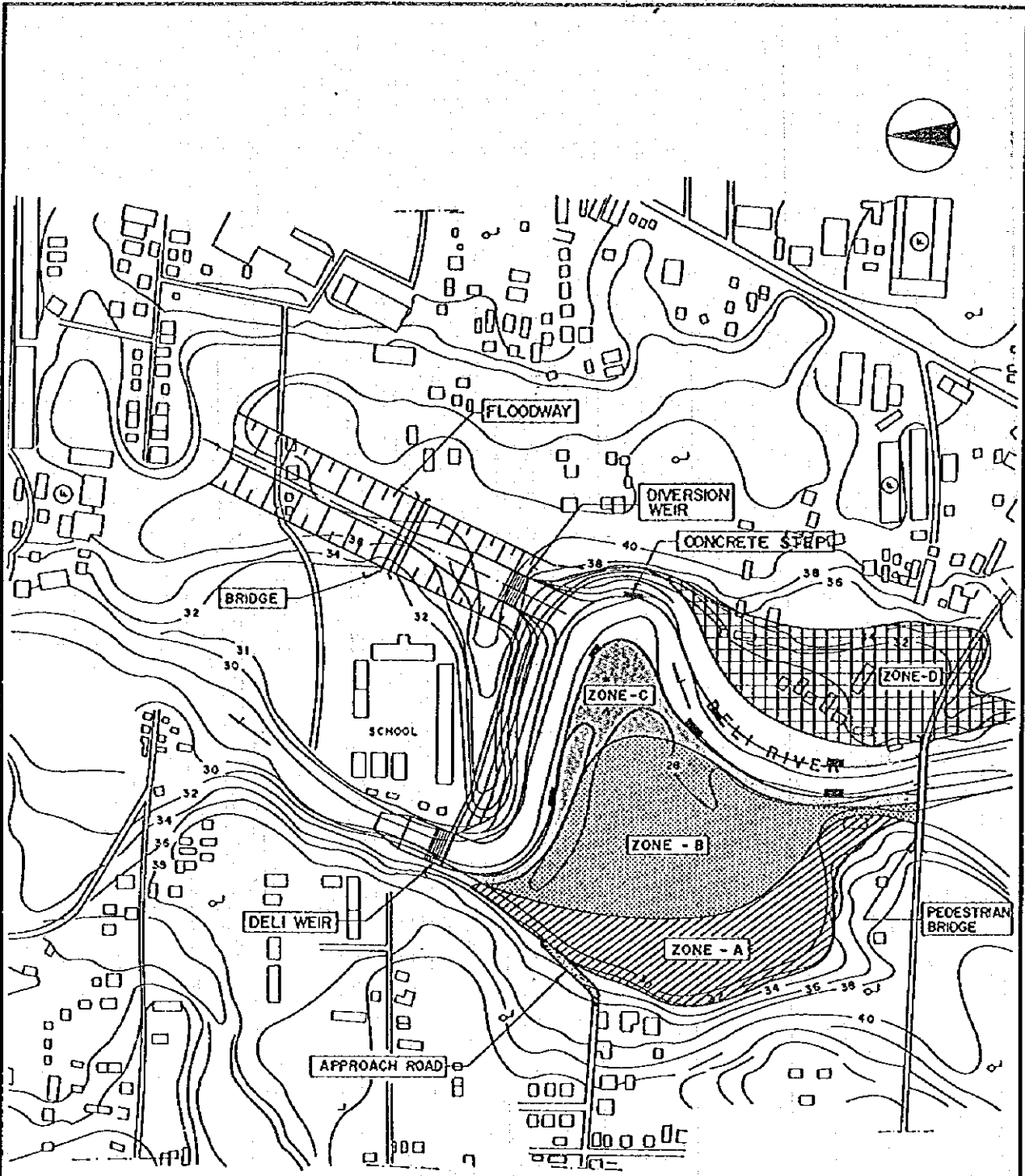
Fig. 2.5(1/2)
FLOW CAPACITY OF DELI RIVER
(LOWER STRETCH)



DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

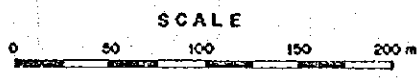
Fig. 2.5(2/2)
FLOW CAPACITY OF DELI RIVER
(UPPER STRETCH)

JAPAN INTERNATIONAL COOPERATION AGENCY



ZONE - A	PARK AND SPORTS ZONE	A = 1.20 ha.
ZONE - B	FREE OPEN SPACE	A = 1.75 ha.
ZONE - C	WATERFRONT AREA	A = 0.78 ha.
ZONE - D	RESIDENTIAL AREA	A = 1.36 ha.

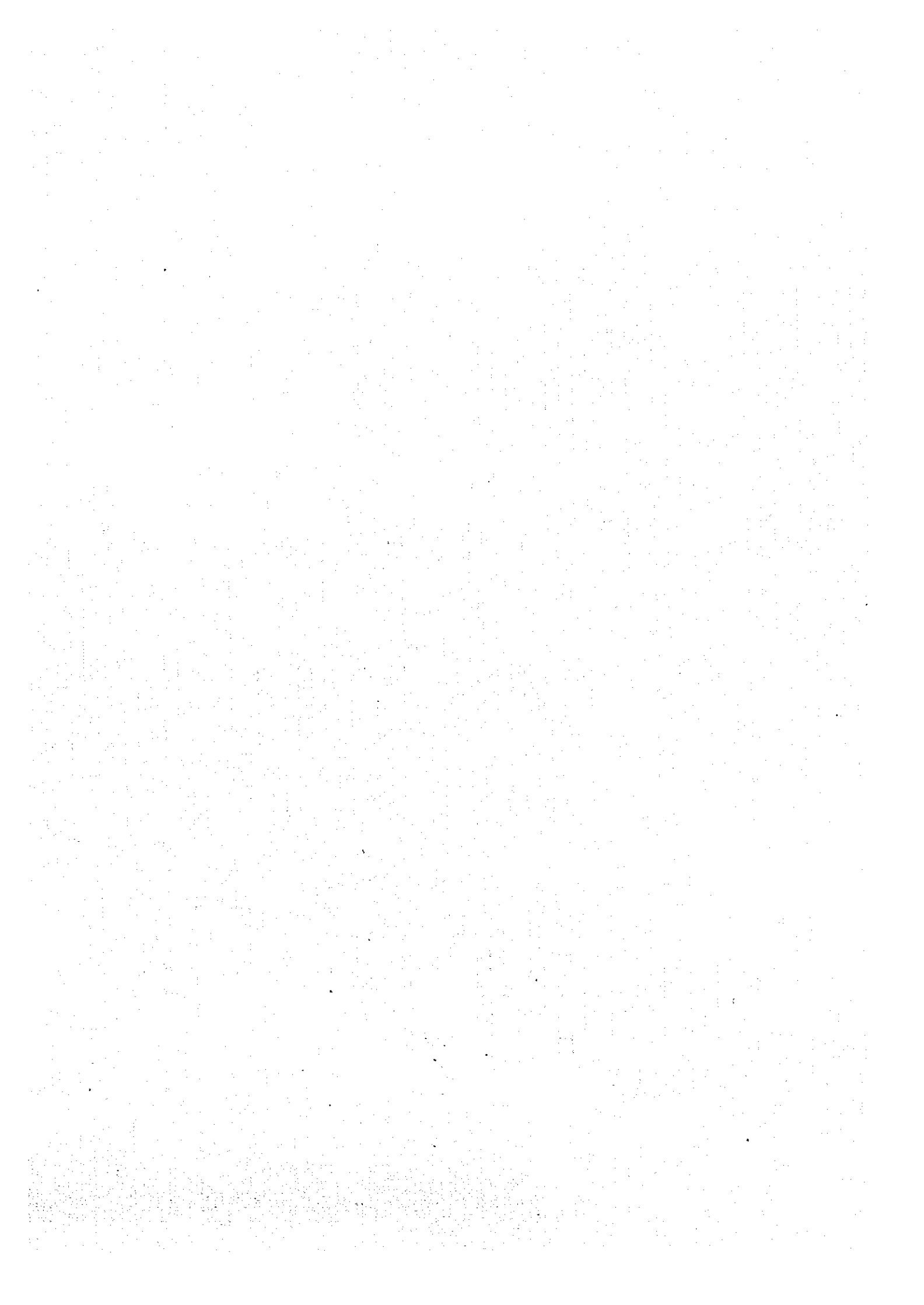
LAND USE ZONING OF RETARDING CHANNEL OF DELI RIVER

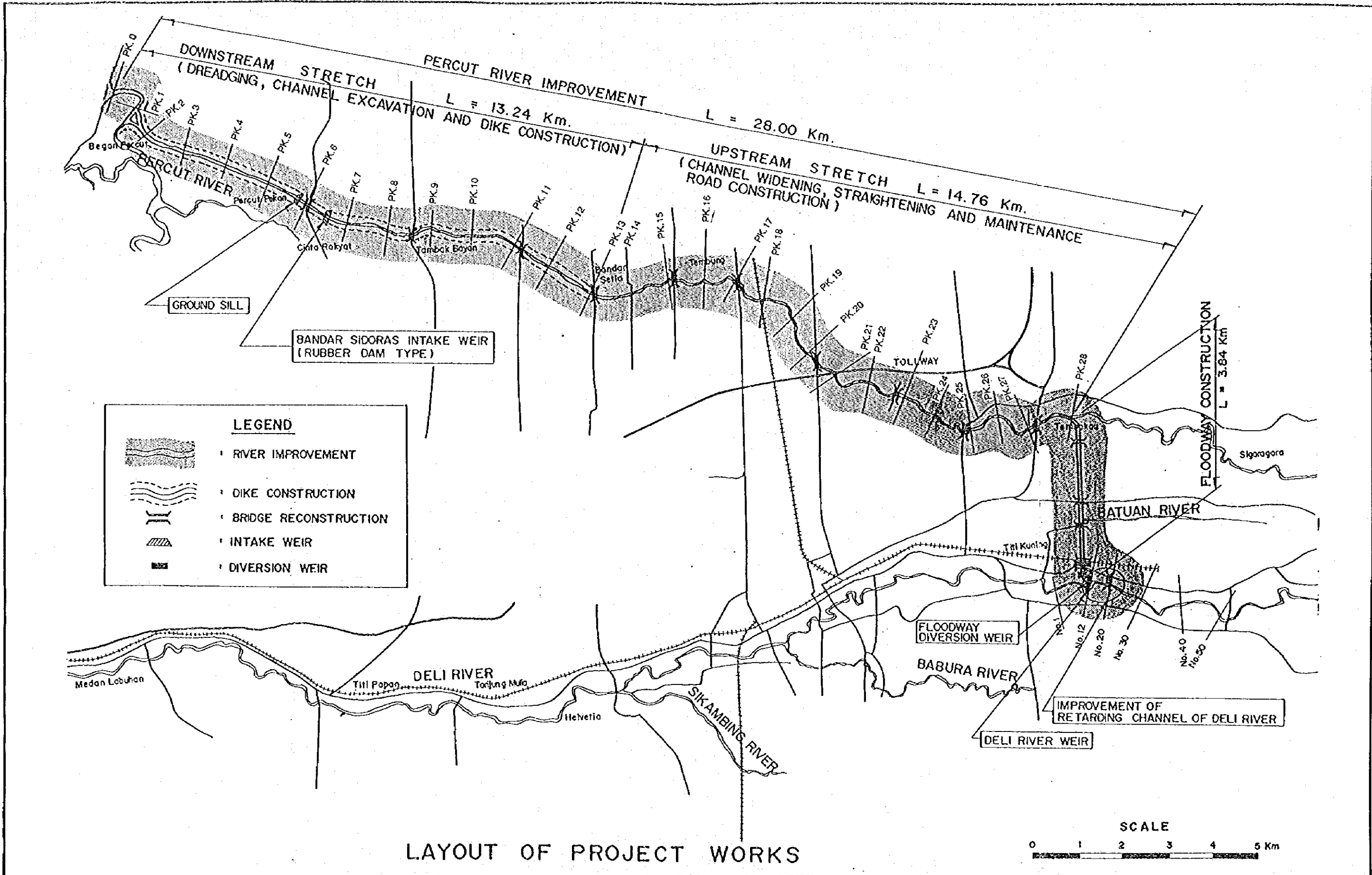


DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.1
LAND USE ZONING IN RETARDING CHANNEL OF
DELI RIVER



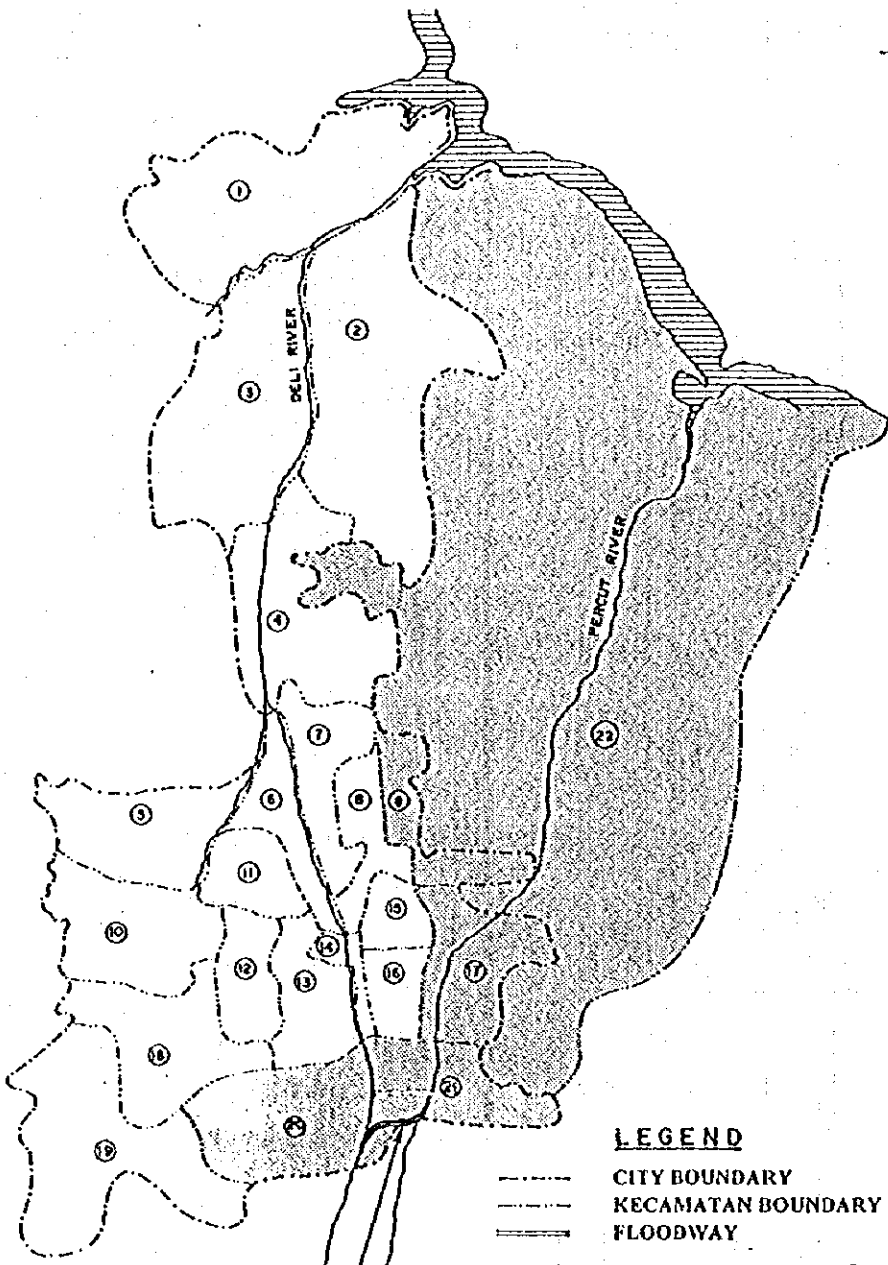


LAYOUT OF PROJECT WORKS

DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.2
LAYOUT OF PROJECT WORKS



MEDAN FLOODWAY

LEGEND

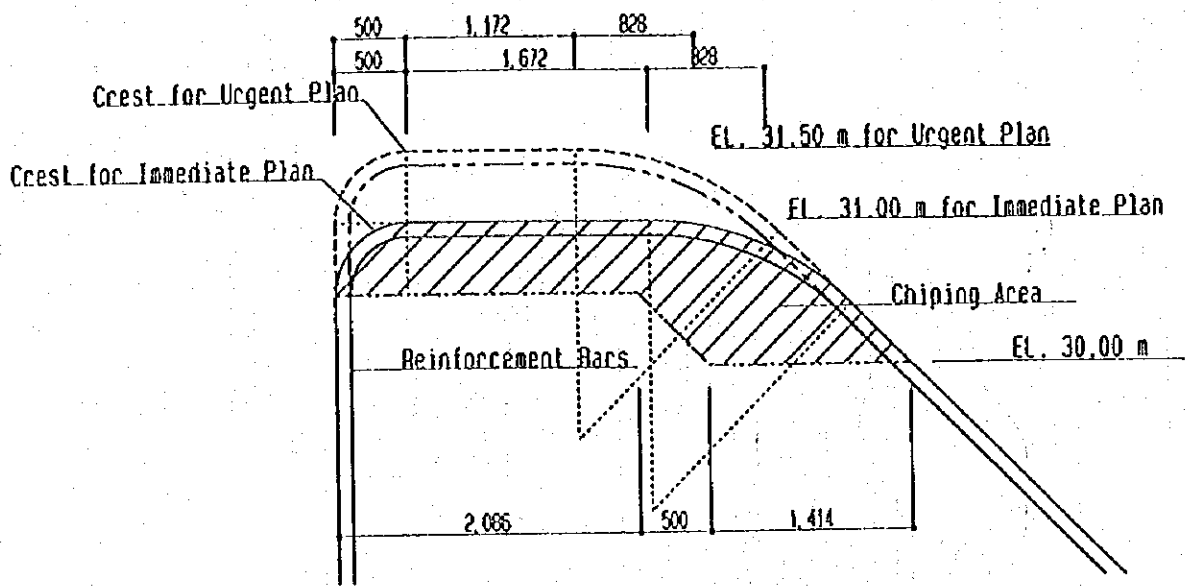
- CITY BOUNDARY
- KECAMATAN BOUNDARY
- ==== FLOODWAY

- | | |
|--------------------|-------------------|
| ① MEDAN BELAWAN | ⑬ MEDAN POLONIA |
| ② MEDAN LABUAN | ⑭ MEDAN MAIMUN |
| ③ MEDAN MARELAN | ⑮ MEDAN AREA |
| ④ MEDAN MARELAN | ⑯ MEDAN KOTA |
| ⑤ MEDAN DELI | ⑰ MEDAN DENAI |
| ⑥ MEDAN HELVETIA | ⑱ MEDAN SELAYAN |
| ⑦ MEDAN BARAT | ⑲ MEDAN TUNTINGAN |
| ⑧ MEDAN TIMUR | ⑳ MEDAN JOHOR |
| ⑨ MEDAN PERJUANGAN | ㉑ MEDAN AMPLAS |
| ⑩ MEDAN TEMBUNG | ㉒ PERCUT SEI TUAN |
| ⑪ MEDAN SUNGGAL | ㉓ PATUMBAK |
| ⑫ MEDAN PETISAH | |

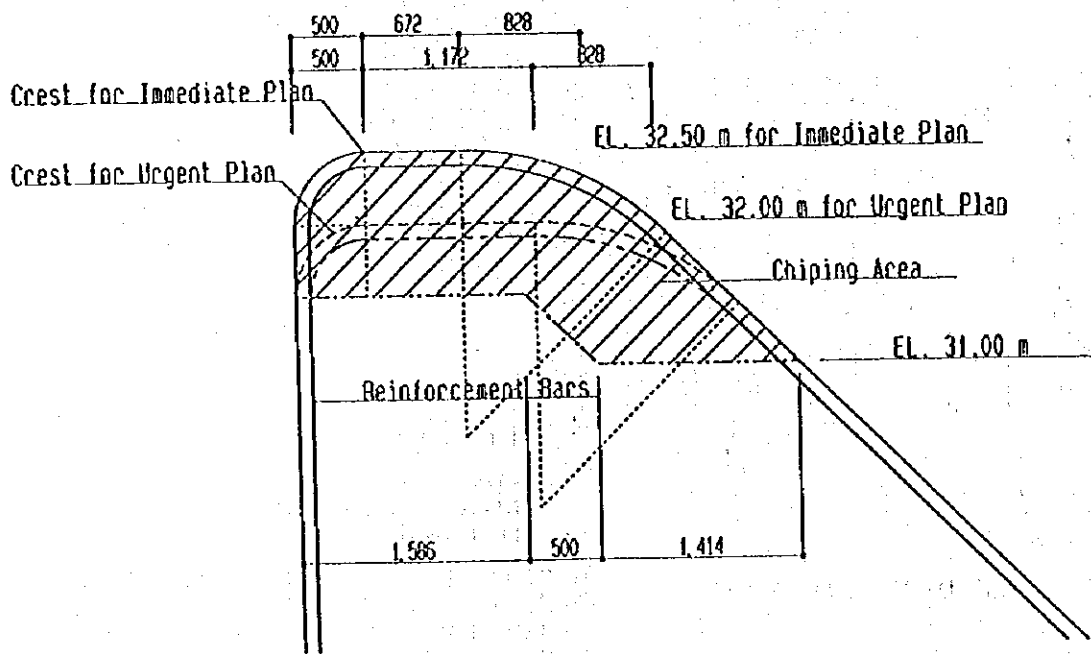
DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.3
CONCERNED SUB-DISTRICTS FOR SOCIAL
STUDY



Deli River Weir

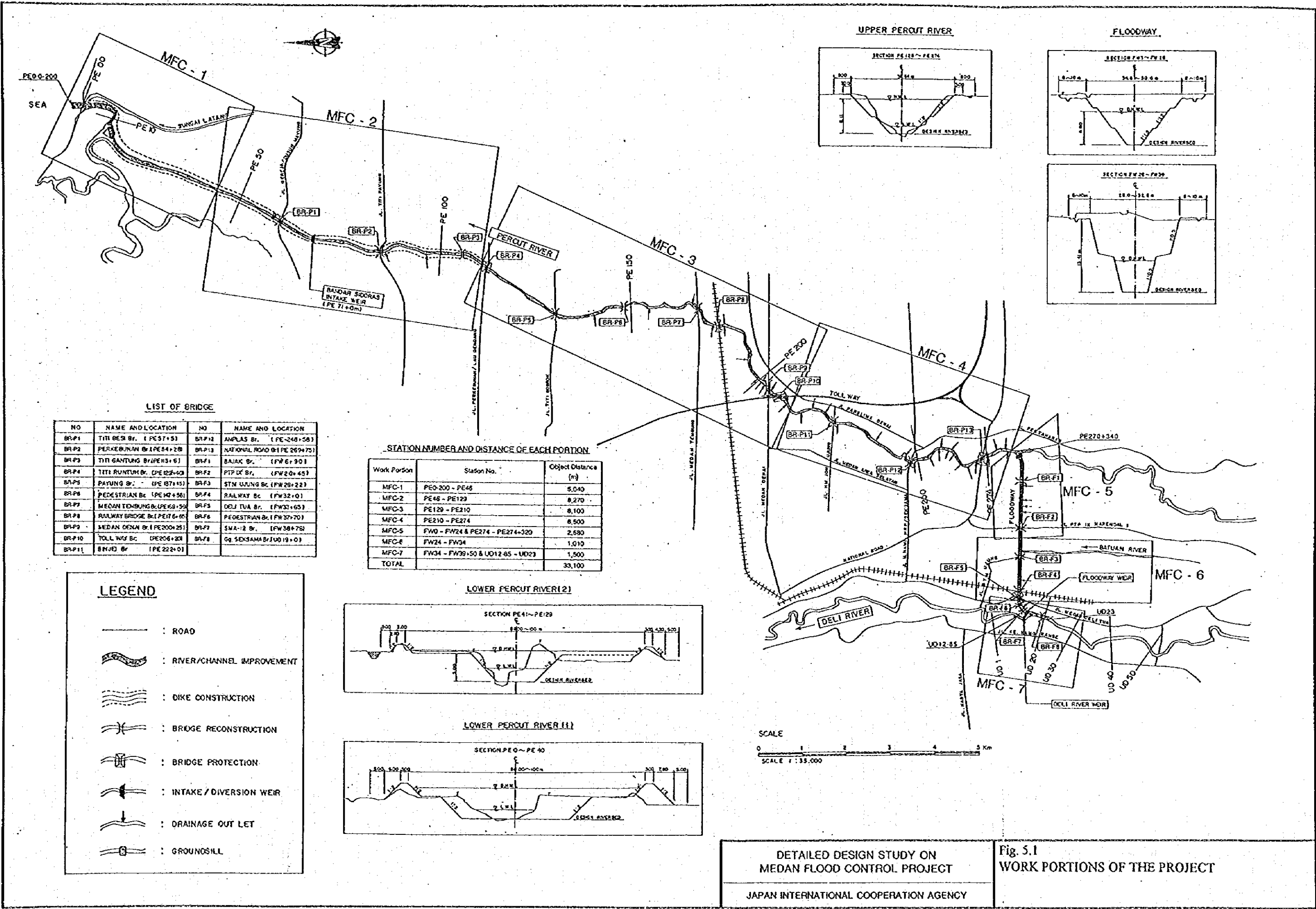


Floodway Weir

DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.1:
MODIFICATION METHOD OF CREST OF
DIVERSION WEIRS



LIST OF BRIDGE

NO	NAME AND LOCATION	NO	NAME AND LOCATION
BR-P1	TITI DESI Br. (PE 57+53)	BR-F12	ANPLAS Br. (FE 240+58)
BR-P2	PERKEMBUN Br. (PE 84+20)	BR-F13	NATIONAL ROAD Br. (PE 269+75)
BR-P3	TITI GANTUNG Br. (PE 113+6)	BR-F1	BAJAK Br. (FW 6+30)
BR-P4	TITI RUNTUH Br. (PE 128+40)	BR-F2	PTP IX Br. (FW 20+45)
BR-P5	PAYUNG Br. (PE 137+15)	BR-F3	STN WAUNG Br. (FW 29+22)
BR-P6	PEDESTRIAN Br. (PE 142+58)	BR-F4	RAILWAY Br. (FW 32+0)
BR-P7	MECAN TOMBUNG Br. (PE 159+50)	BR-F5	DELJ TUA Br. (FW 33+65)
BR-P8	RAILWAY BRIDGE Br. (PE 176+00)	BR-F6	PEDESTRIAN Br. (FW 37+70)
BR-P9	MEDAN DENA Br. (PE 200+25)	BR-F7	SMA-12 Br. (FW 38+75)
BR-P10	TOLL WAY Br. (PE 206+20)	BR-F8	Qg SEKSAAMA Br. (UD 19+0)
BR-P11	BRJED Br. (PE 222+0)		

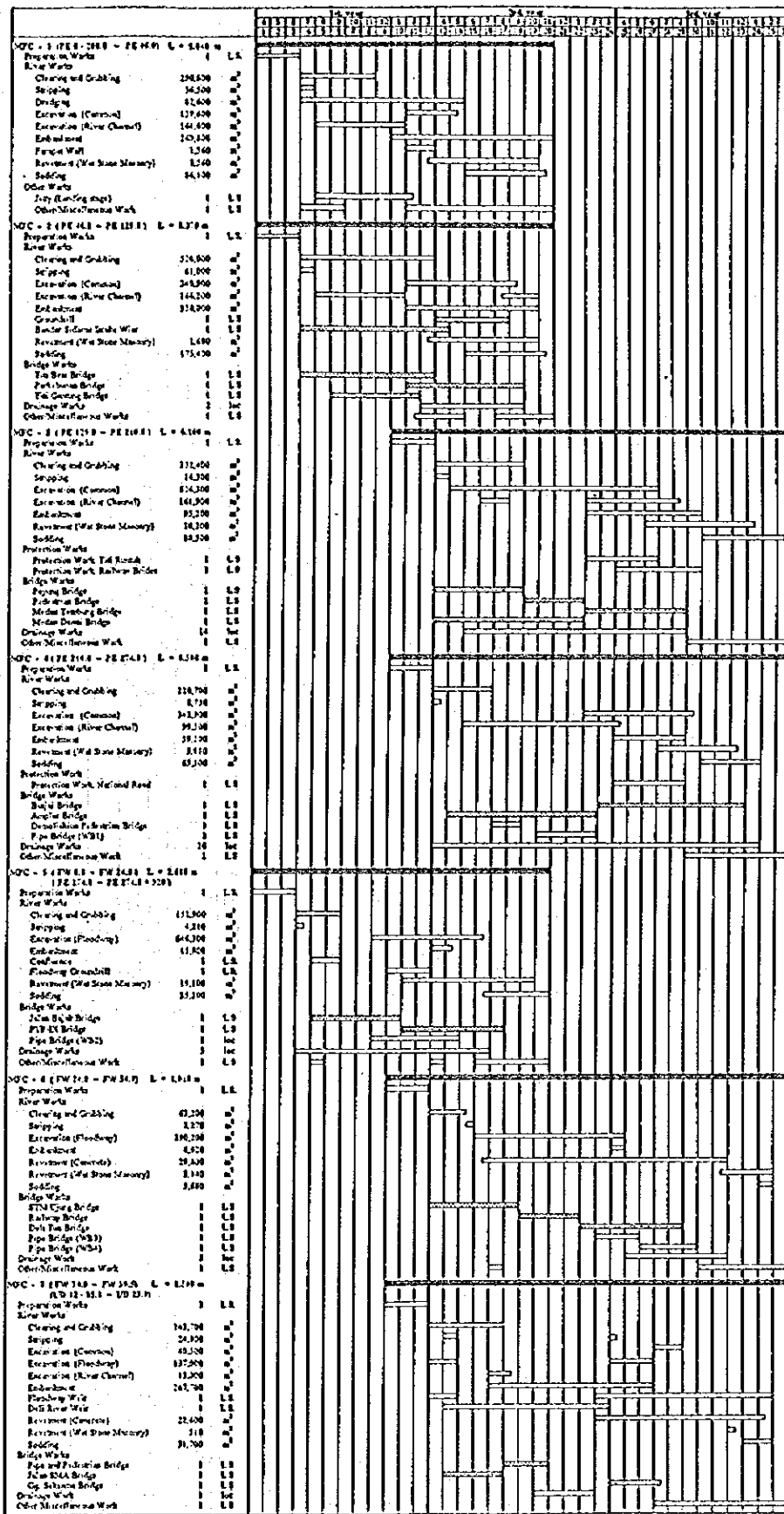
STATION NUMBER AND DISTANCE OF EACH PORTION

Work Portion	Stasion No.	Object Distance (m)
MFC-1	PE0-200 - PE46	5,040
MFC-2	PE46 - PE129	8,270
MFC-3	PE129 - PE210	8,100
MFC-4	PE210 - PE274	6,500
MFC-5	FW0 - FW24 & PE274 - PE274+320	2,680
MFC-6	FW24 - FW34	1,010
MFC-7	FW34 - FW39+50 & UD12-85 - UD23	1,500
TOTAL		33,100

LEGEND

- : ROAD
- : RIVER/CHANNEL IMPROVEMENT
- : DIKE CONSTRUCTION
- : BRIDGE RECONSTRUCTION
- : BRIDGE PROTECTION
- : INTAKE / DIVERSION WEIR
- : DRAINAGE OUT LET
- : GROUNDSILL

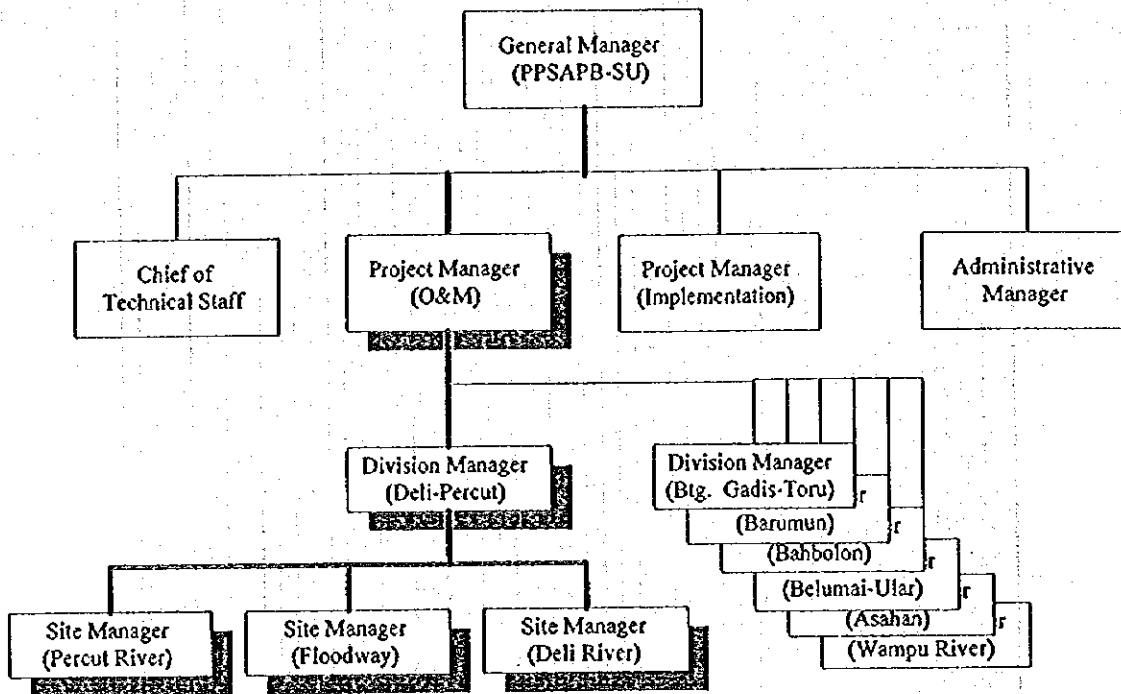
DETAILED DESIGN STUDY ON MEDAN FLOOD CONTROL PROJECT
 JAPAN INTERNATIONAL COOPERATION AGENCY
 Fig. 5.1 WORK PORTIONS OF THE PROJECT



DETAILED DESIGN STUDY ON MEDAN FLOOD CONTROL PROJECT

Fig. 5.2 OVERALL SCHEDULE FOR MEDAN FLOOD CONTROL PROJECT

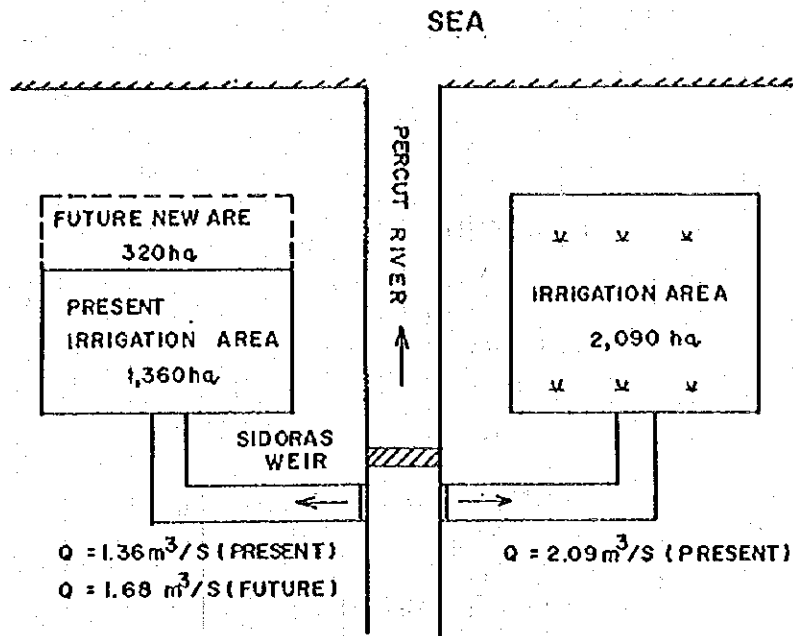
JAPAN INTERNATIONAL COOPERATION AGENCY



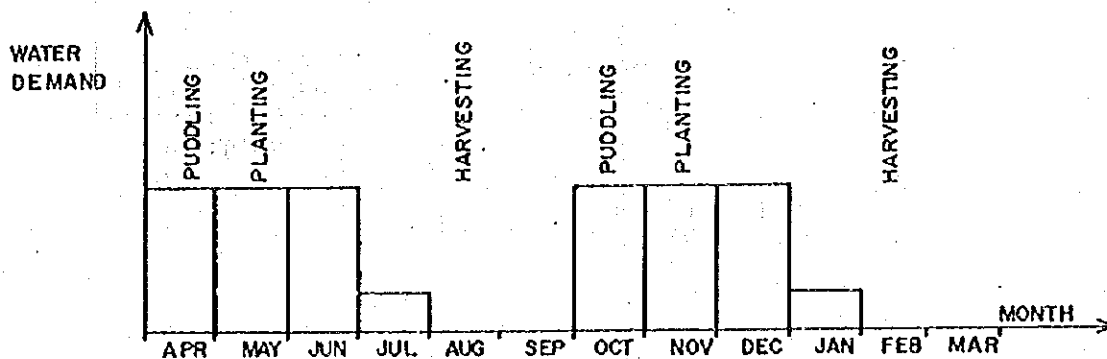
DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.1:
PROPOSED ORGANIZATIONAL STRUCTURE FOR
O&M



IRRIGATION AREA AND INTAKE DISCHARGE

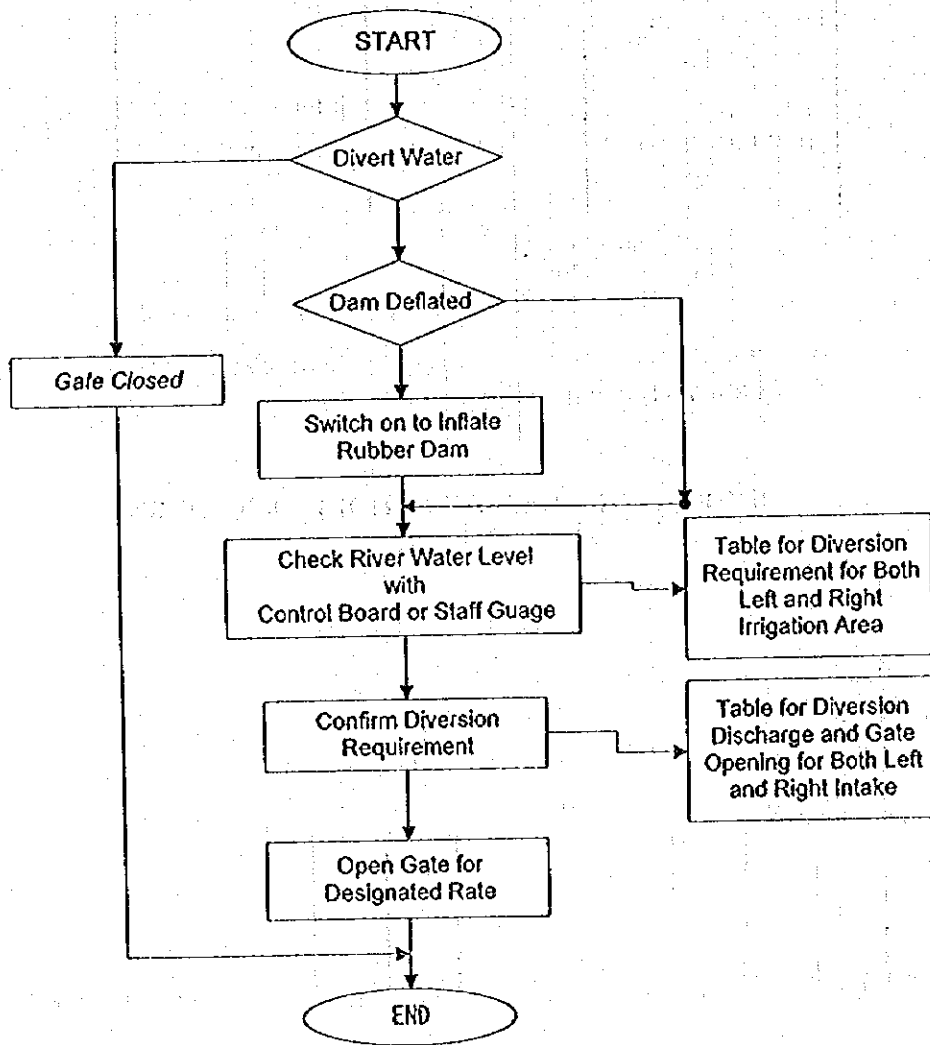


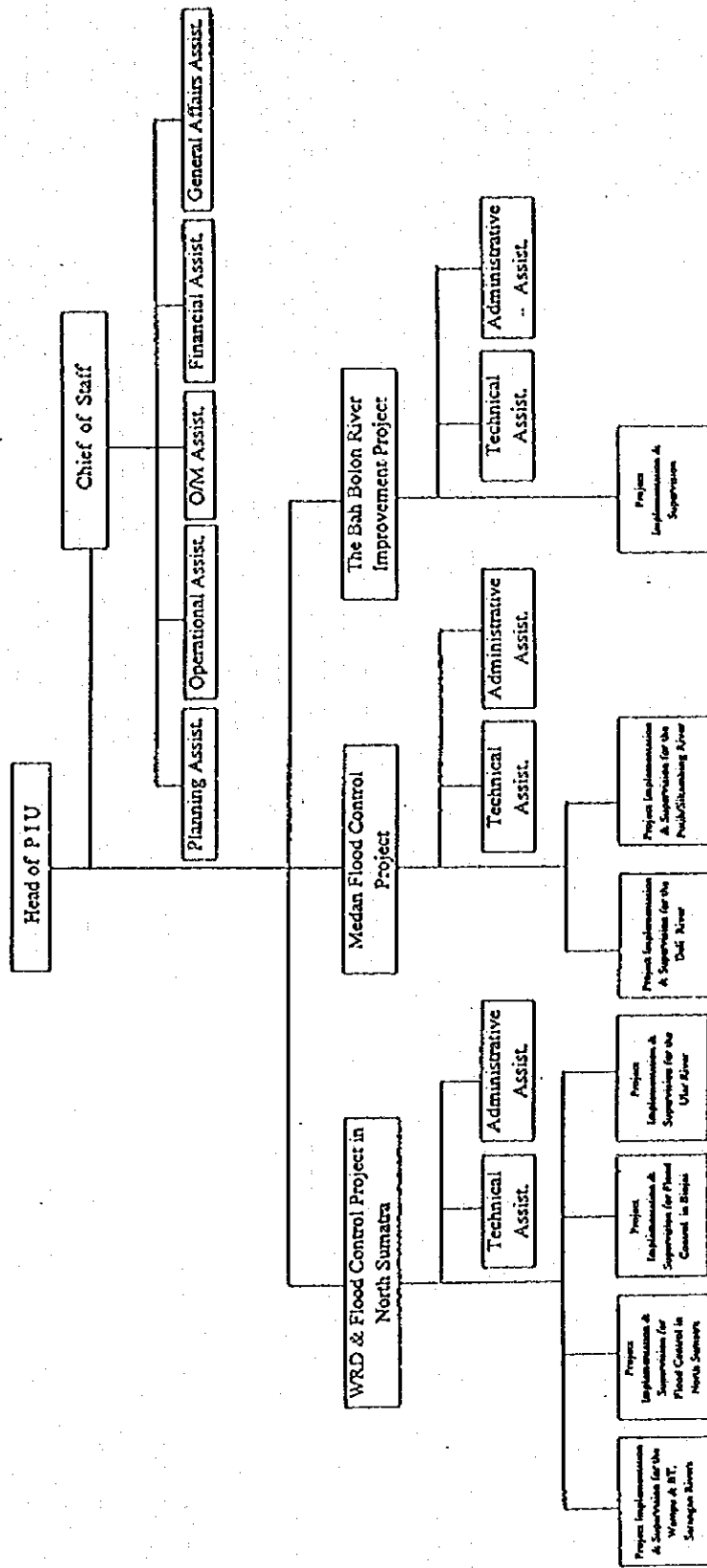
CROPPING AND WATER DEMAND PATTERN

DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2
PRESENT CONDITION OF WATER USE AT
BANDAR SIDORAS WEIR

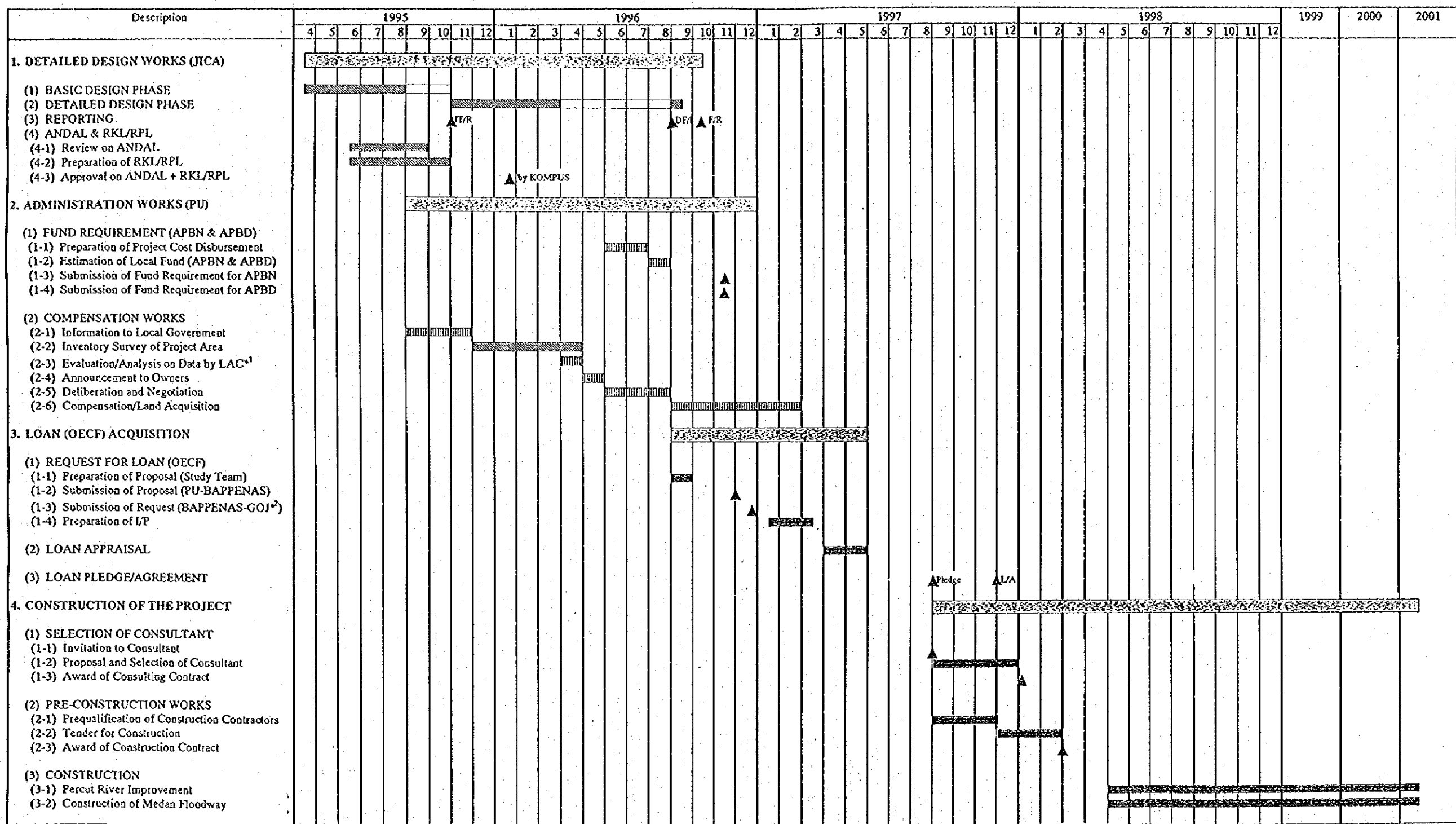




DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.1
ORGANIZATIONAL STRUCTURE OF PPSAPB-SU



Legend : ¹ LAC = Land Acquisition Committee
² GOJ = Government of Japan

IT/R = Interim Report,

DF/R = Draft Final Report,

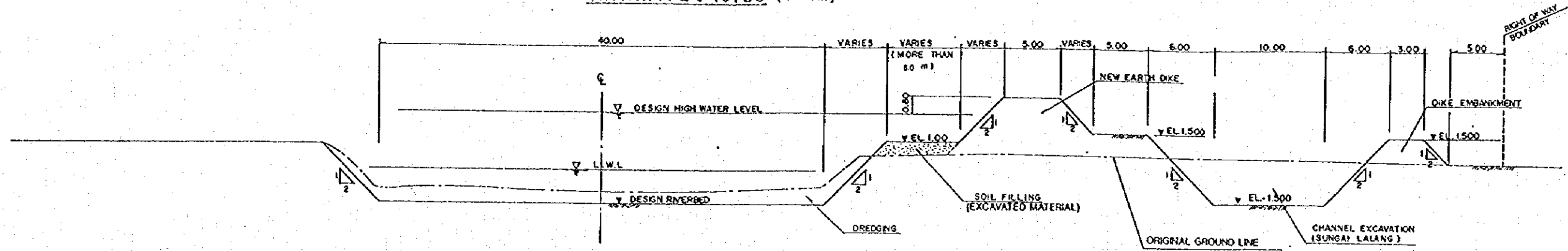
F/R = Final Report

DETAILED DESIGN STUDY ON
 MEDAN FLOOD CONTROL PROJECT
 JAPAN INTERNATIONAL COOPERATION AGENCY

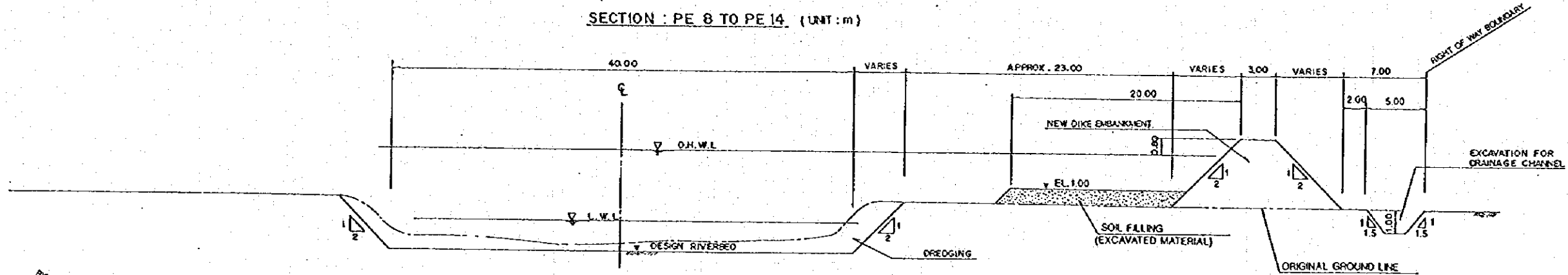
Fig. 7.2
 IMPLEMENTATION SCHEDULE OF
 MEDAN FLOOD CONTROL PROJECT

DRAWINGS

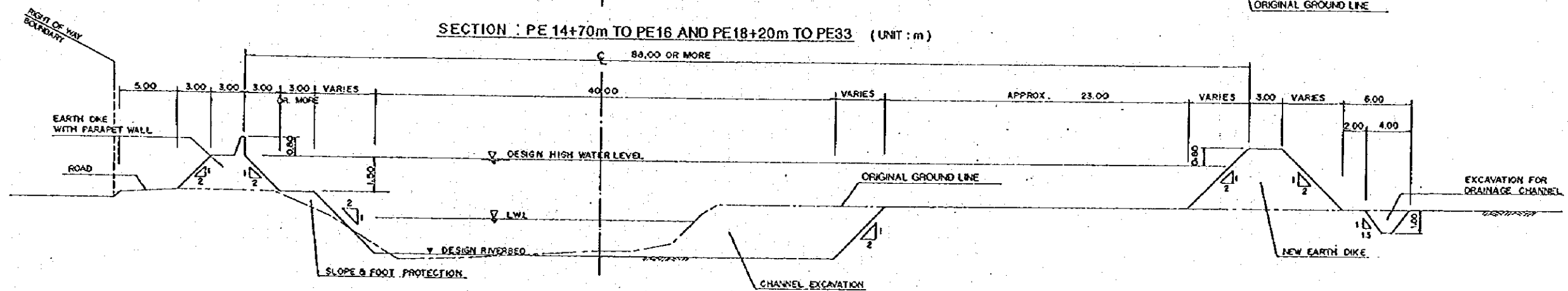
SECTION : PE 0 TO PE 8 (UNIT : m)



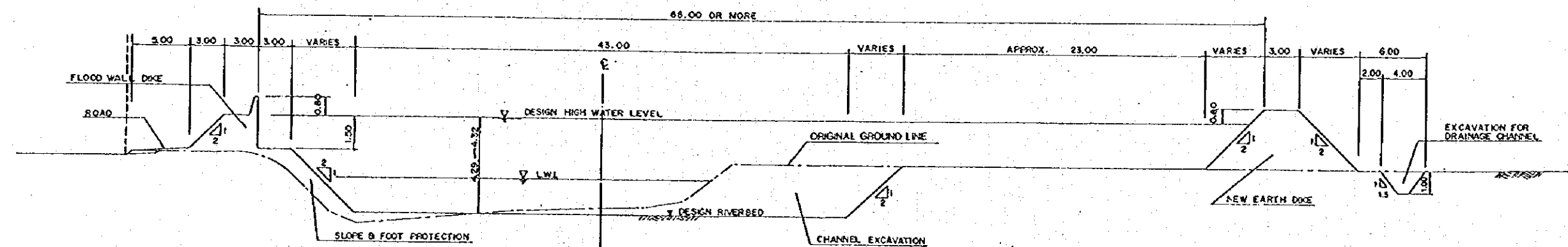
SECTION : PE 8 TO PE 14 (UNIT : m)



SECTION : PE 14+70m TO PE16 AND PE18+20m TO PE33 (UNIT : m)



SECTION : PE 17-65m TO PE 18+20m (L=120,00) (UNIT : m)



SCALES

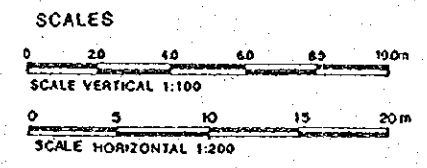
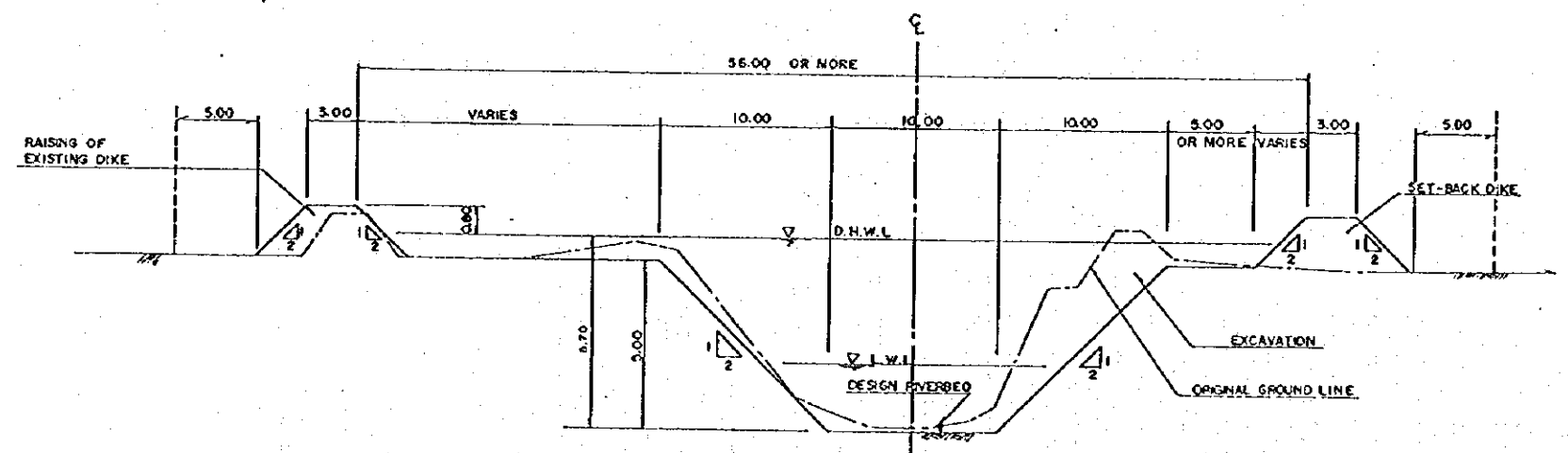
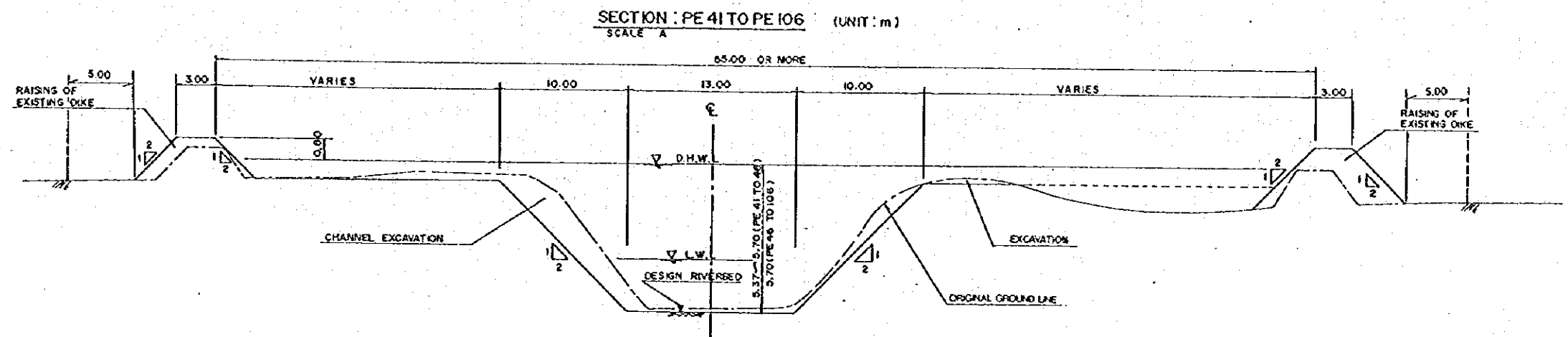
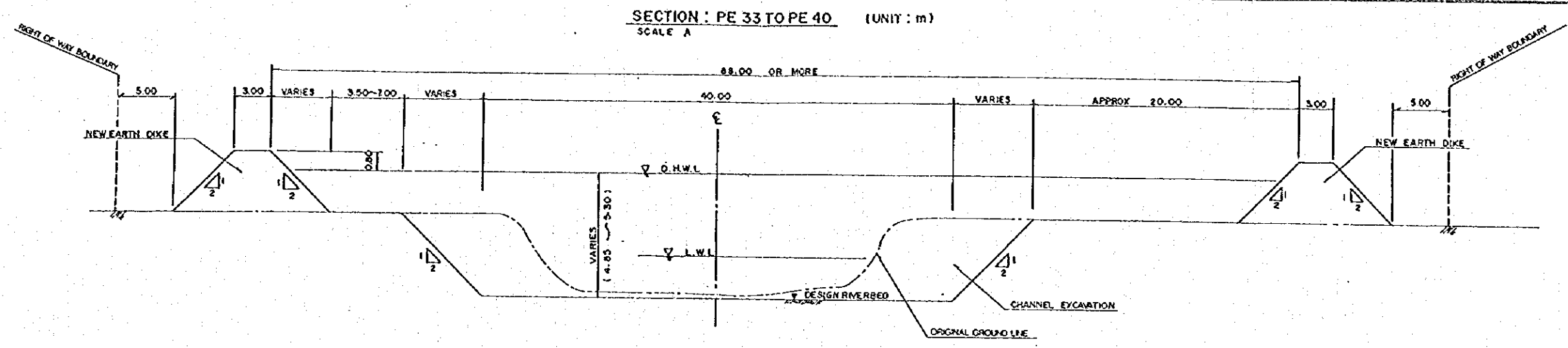
0 20 40 60 80 100m
SCALE VERTICAL 1:100

0 5 10 15 20m
SCALE HORIZONTAL 1:200

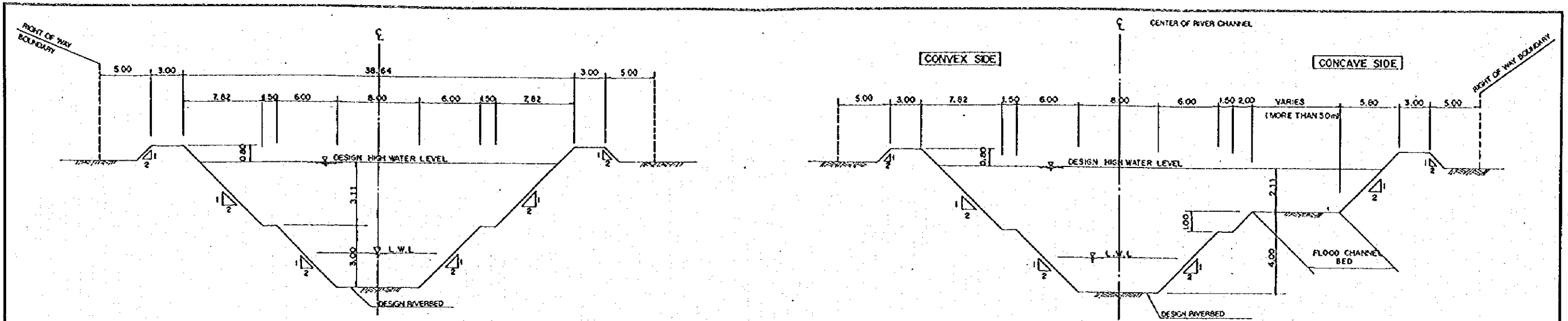
DETAILED DESIGN STUDY ON
MEDAN FLOOD CONTROL PROJECT

DWG. 4.1 (1/3)
STANDARD CROSS SECTION OF PERCUT RIVER

JAPAN INTERNATIONAL COOPERATION AGENCY

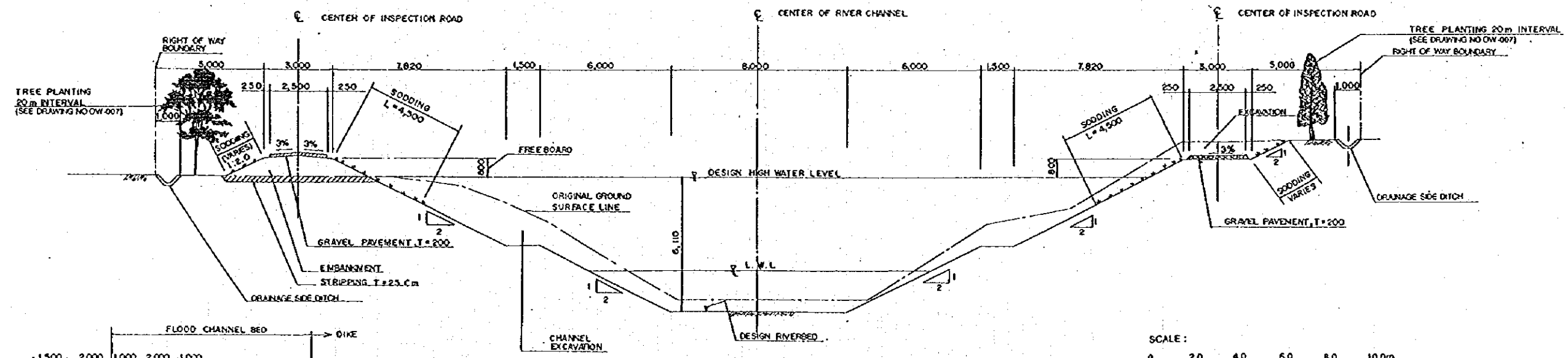


DETAILED DESIGN STUDY ON MEDAN FLOOD CONTROL PROJECT	DWG. 4.1 (2/3) STANDARD CROSS SECTION OF PERCUT RIVER
JAPAN INTERNATIONAL COOPERATION AGENCY	

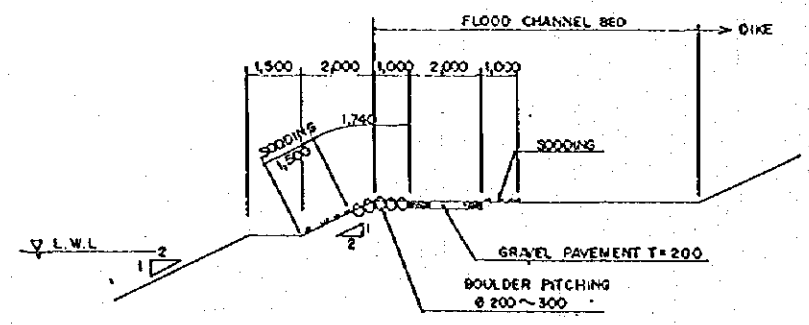
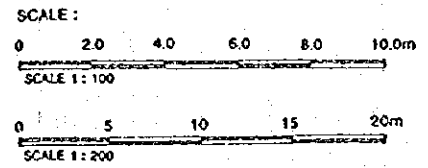


STANDARD CROSS SECTION OF PERCUT RIVER (PE 129+43m TO PE 247+0m) (UNIT : m)
 SCALE VERTICAL 1 : 100
 HORIZONTAL 1 : 200

STANDARD CROSS SECTION AT BEND (UNIT : m)
 SCALE VERTICAL 1 : 100
 HORIZONTAL 1 : 200

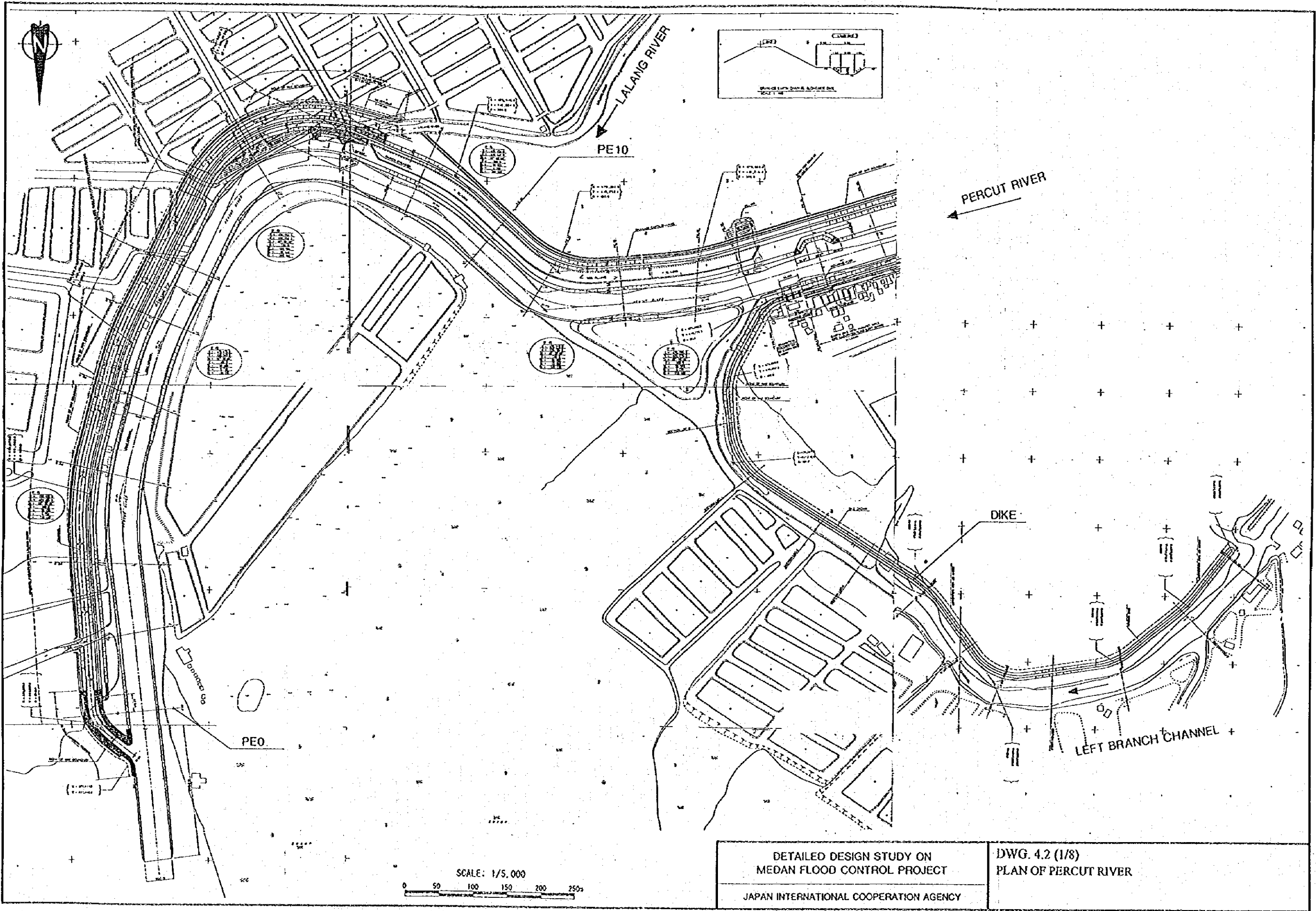


TYPICAL CROSS SECTION OF RIVER CHANNEL AND INSPECTION ROAD (UNIT : m)
 SCALE 1 : 100



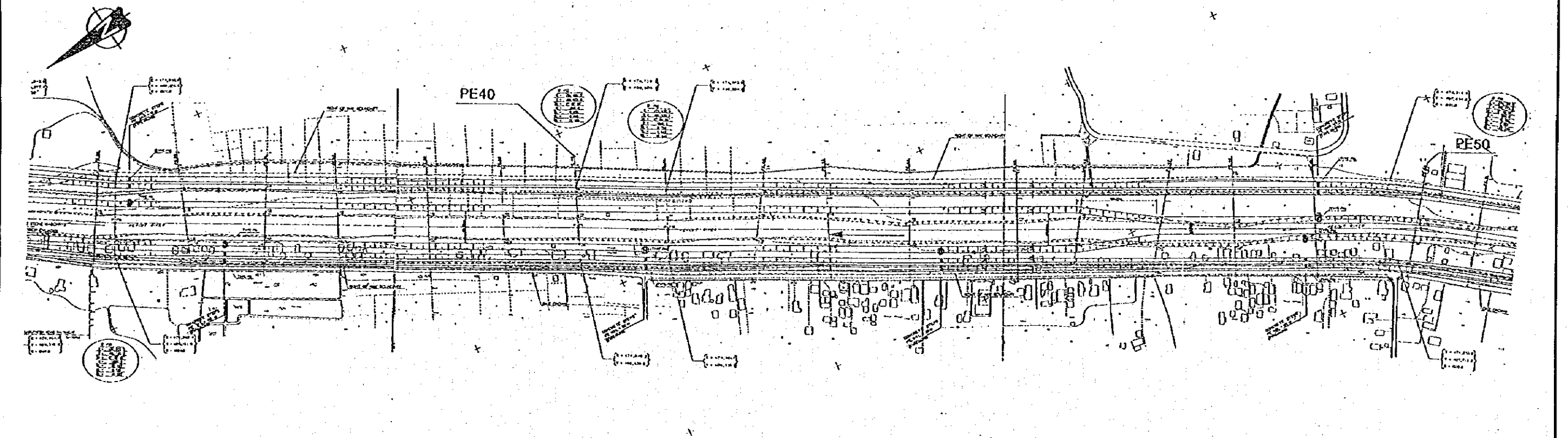
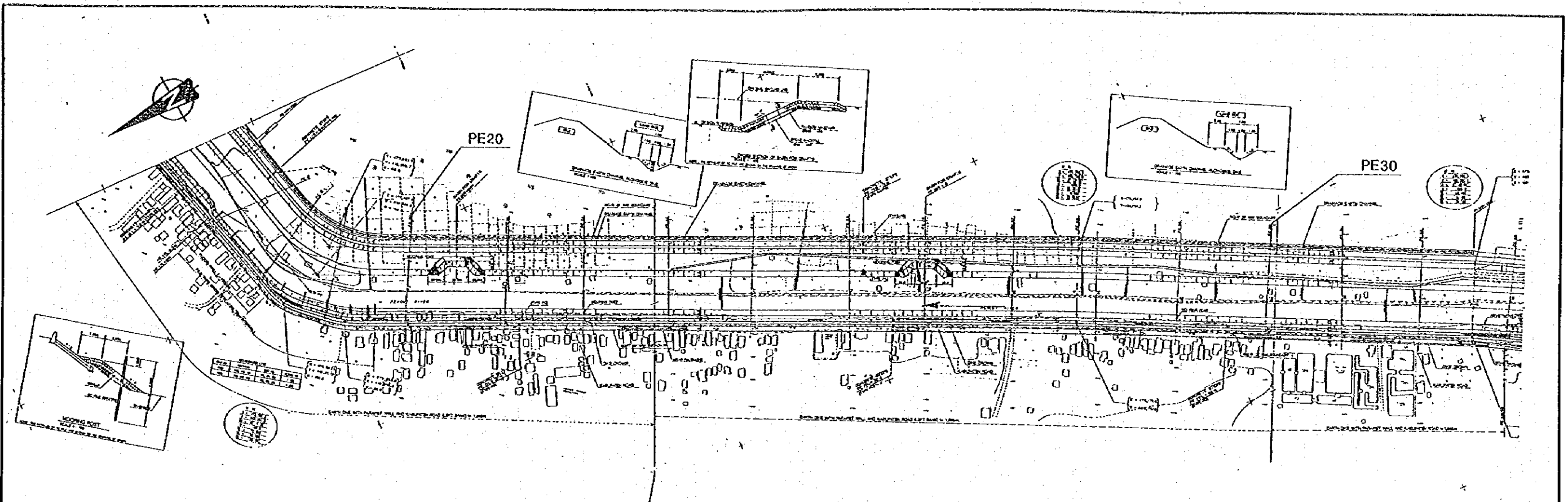
DETAIL OF WALKWAY ON FLOOD CHANNEL BED
 SCALE 1 : 100

DETAILED DESIGN STUDY ON MEDAN FLOOD CONTROL PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	DWG. 4.1 (3/3) STANDARD CROSS SECTION OF PERCUT RIVER
---	--



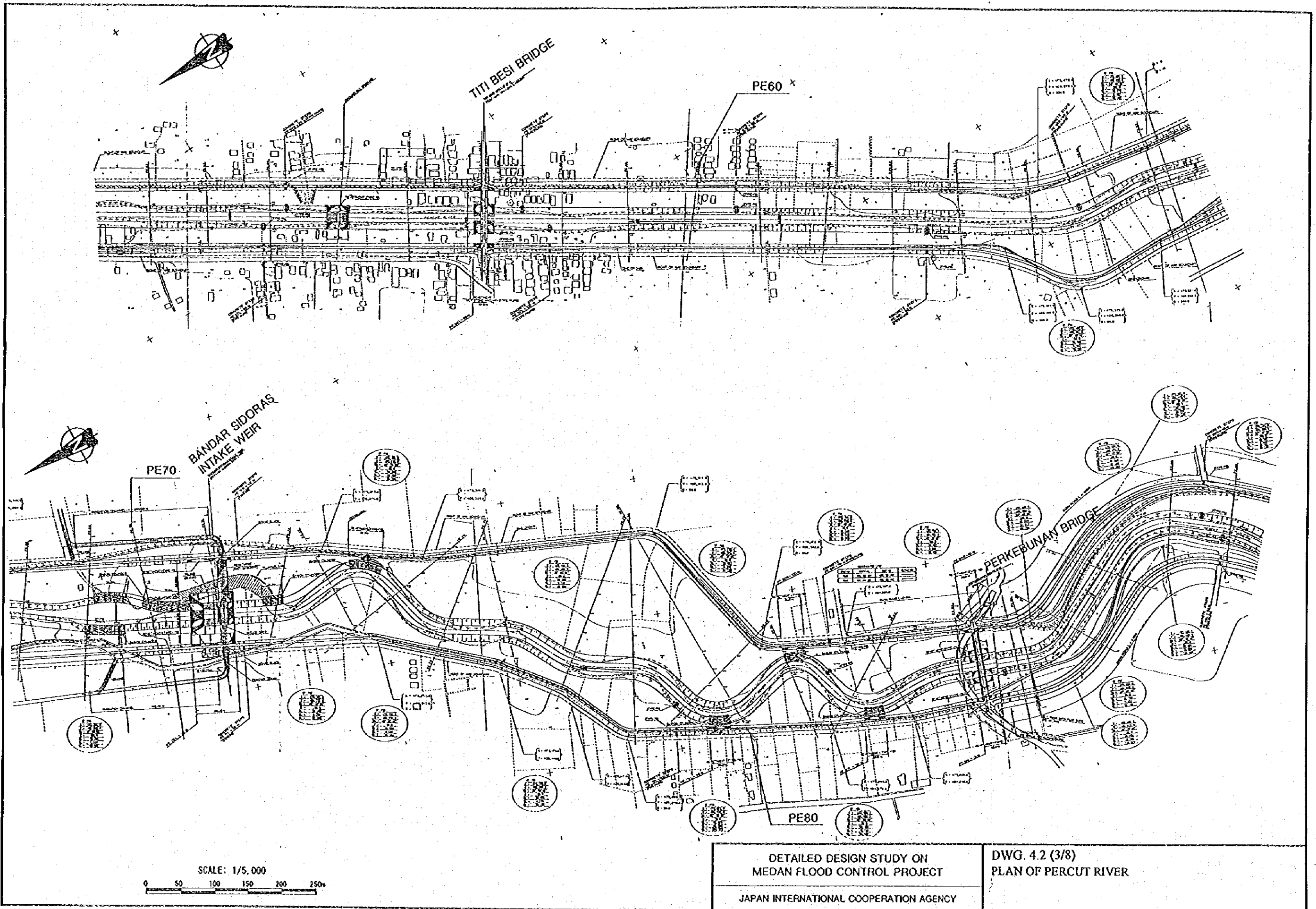
DETAILED DESIGN STUDY ON
 MEDAN FLOOD CONTROL PROJECT
 JAPAN INTERNATIONAL COOPERATION AGENCY

DWG. 4.2 (1/8)
 PLAN OF PERCUT RIVER



SCALE: 1/5,000
 0 50 100 150 200 250m

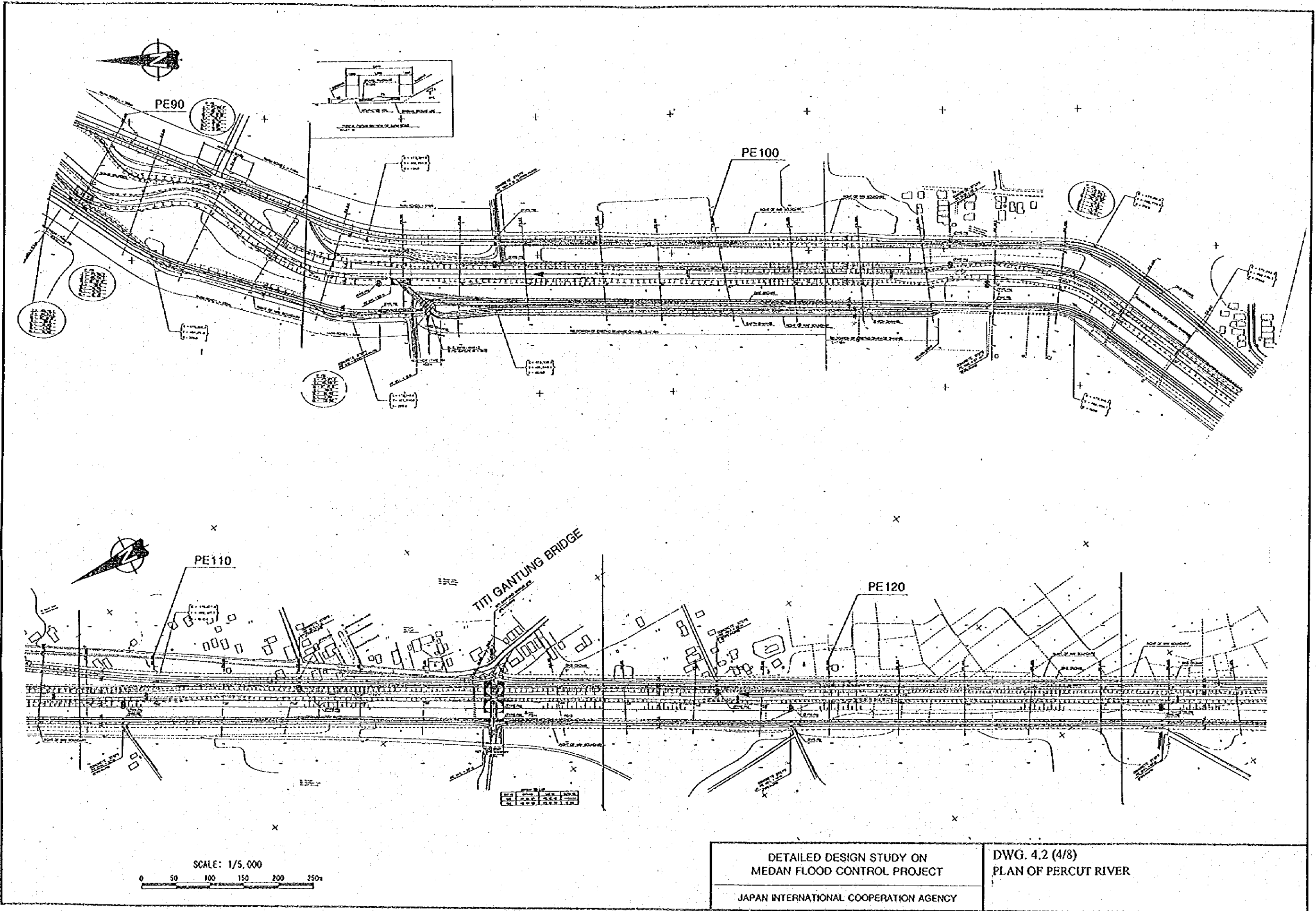
<p>DETAILED DESIGN STUDY ON MEDAN FLOOD CONTROL PROJECT</p>	<p>DWG. 4.2 (2/8) PLAN OF PERCUT RIVER</p>
<p>JAPAN INTERNATIONAL COOPERATION AGENCY</p>	

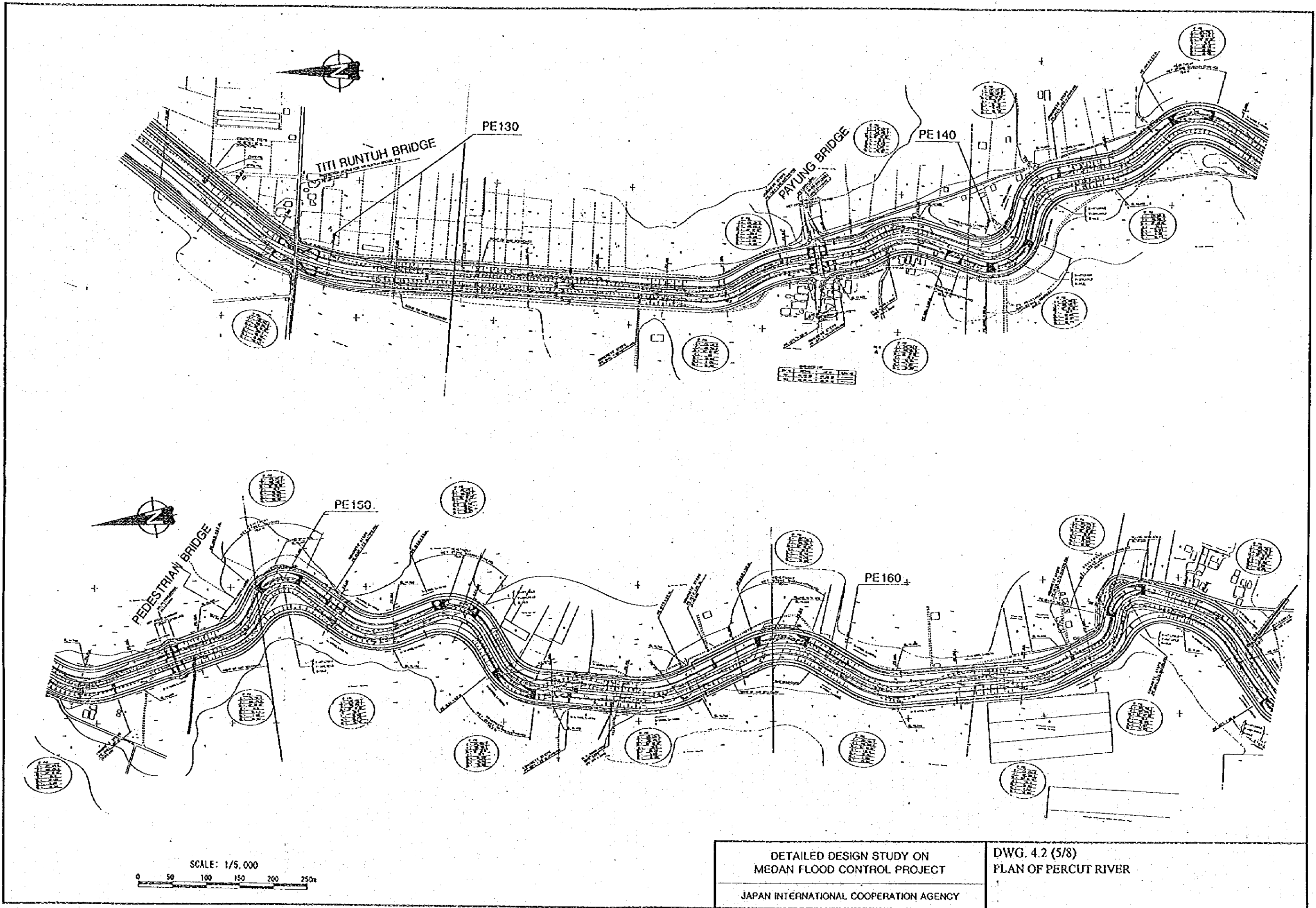


SCALE: 1/5,000
 0 50 100 150 200 250m

DETAILED DESIGN STUDY ON
 MEDAN FLOOD CONTROL PROJECT
 JAPAN INTERNATIONAL COOPERATION AGENCY

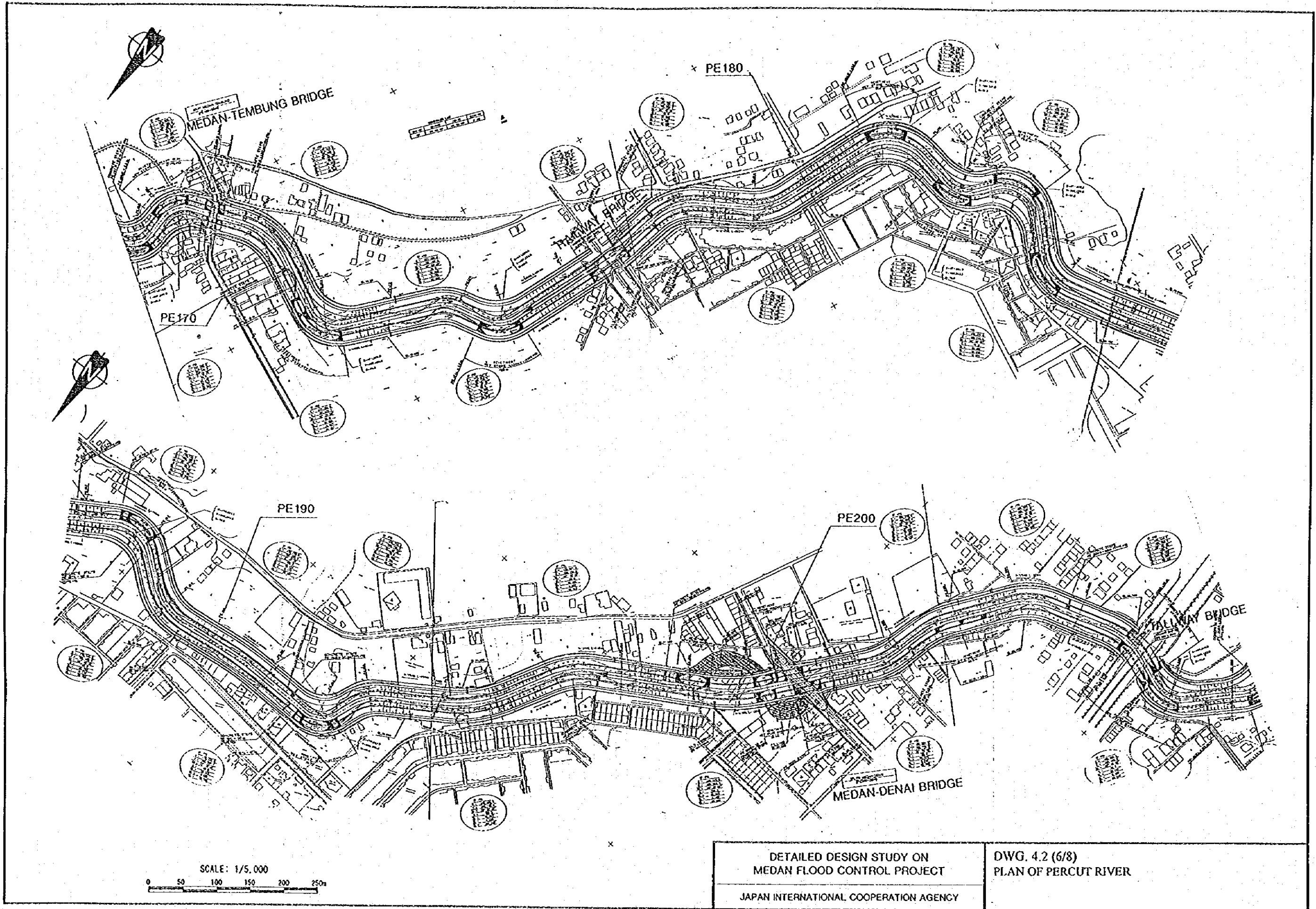
DWG. 4.2 (3/8)
 PLAN OF PERCUT RIVER





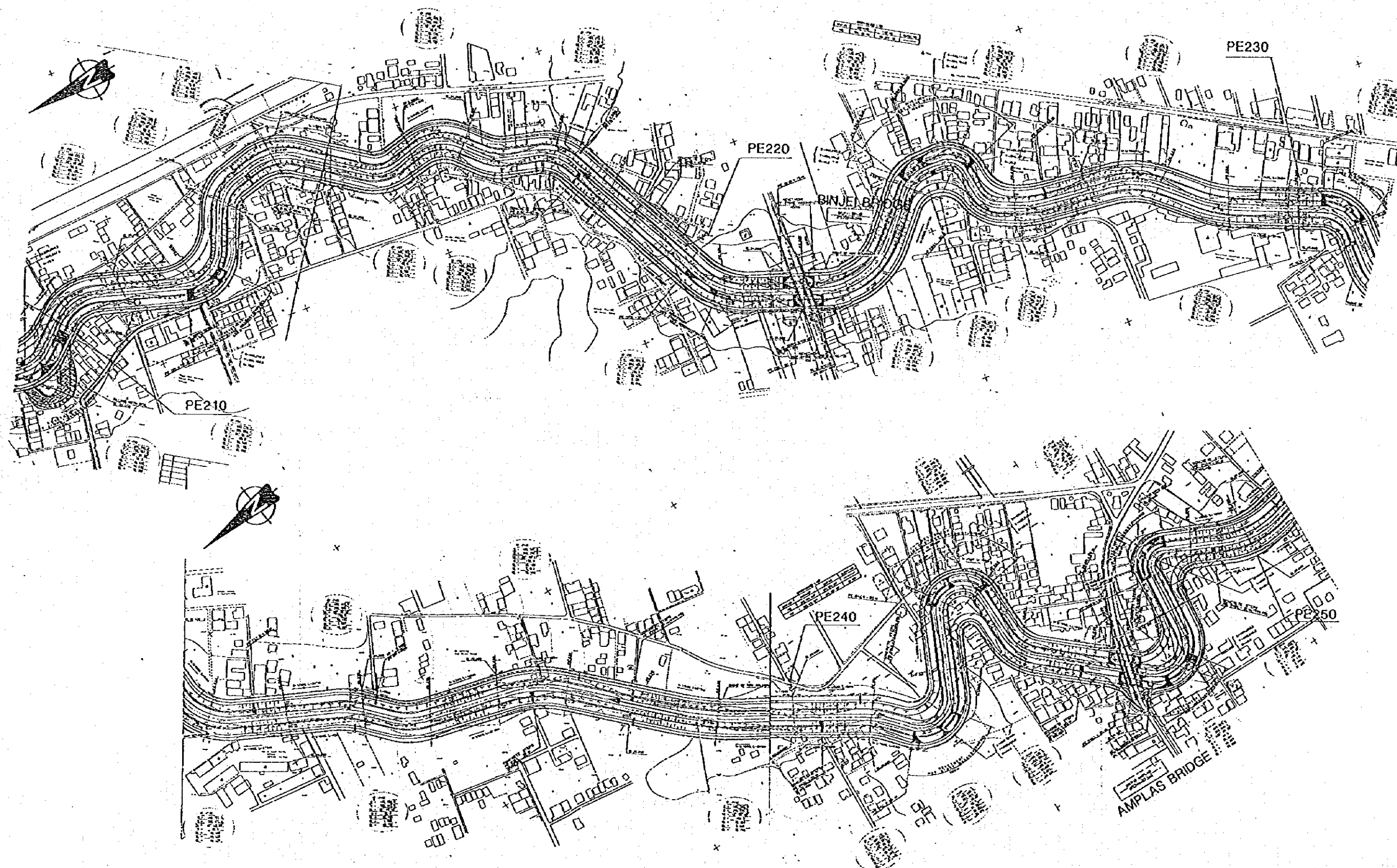
DETAILED DESIGN STUDY ON
 MEDAN FLOOD CONTROL PROJECT
 JAPAN INTERNATIONAL COOPERATION AGENCY

DWG. 4.2 (5/8)
 PLAN OF PERCUT RIVER



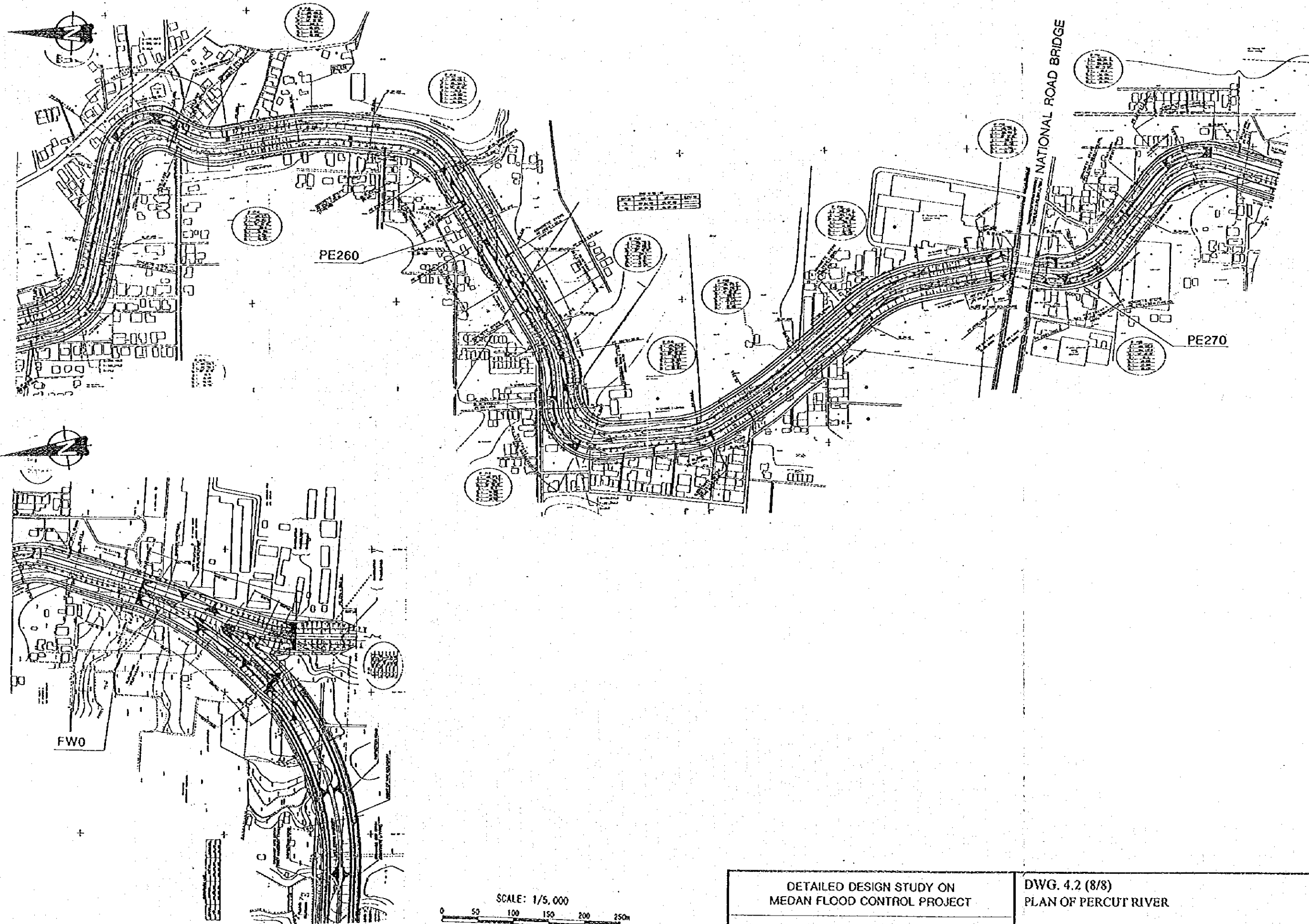
DETAILED DESIGN STUDY ON
 MEDAN FLOOD CONTROL PROJECT
 JAPAN INTERNATIONAL COOPERATION AGENCY

DWG. 4.2 (6/8)
 PLAN OF PERCUT RIVER



SCALE: 1/5,000
 0 50 100 150 200 250m

<p>DETAILED DESIGN STUDY ON MEDAN FLOOD CONTROL PROJECT</p>	<p>DWG. 4.2 (7/8) PLAN OF PERCUT RIVER</p>
<p>JAPAN INTERNATIONAL COOPERATION AGENCY</p>	



DETAILED DESIGN STUDY ON
 MEDAN FLOOD CONTROL PROJECT
 JAPAN INTERNATIONAL COOPERATION AGENCY

DWG. 4.2 (8/8)
 PLAN OF PERCUT RIVER