

MINUTES OF DISCUSSION
THE BASIC DESIGN STUDY
ON
THE PUMPING STATION PROJECT
FOR
BENGAWAN SOLO LOWER REACHES

In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to conduct a Basic Design Study on the Pumping Station Project for Bengwan Solo Lower Reaches ("the Project") and the Japan International Cooperation Agency ("JICA") sent a study team to the Republic of Indonesia from December 4, 1990 to January 17, 1991.

As a result of the study, JICA prepared a Draft Final Report and dispatched a team from May 1 to 8, 1991, to explain and discuss it.

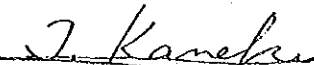
The team held a series of discussions on the Project with the authorities concerned.

As a result of the discussions, both parties confirmed the main items described on the attached document. The team will proceed the works and prepare the Basic Design Study Report on the Project based on the items.

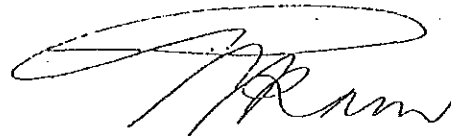
Jakarta, May 7, 1991

On behalf of JICA,

On behalf of the Government of
the Republic of Indonesia,



for Mr. Akira Takahashi
Resident Representative,
Japan International Cooperation
Agency in Indonesia



Ir. Hartono Pramudo, Dipl. NE.
Director of Rivers,
Directorate General of Water
Resources Development,
Ministry of Public Works

ATTACHED DOCUMENT

1. Draft Report

The Government of Indonesia accepted in principle the Draft Final Report prepared by JICA with minor changes. JICA will complete the Final Report considering the items described in Annex I.

2. Budget Allocation

The Government of Indonesia will allocate enough budget to implement the Project.

3. Grant Aid Programme

(1) The Government of Indonesia has understood the system of Japanese Grant Aid Programme explained by the Team.

(2) The Government of Indonesia will take the necessary measures described in Annex II for smooth implementation of the Project on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

4. Submission of the Final Report

JICA will complete the Final Report and send it to the Government of Indonesia by the end of June, 1991.

ANNEX I : The items to be considered to complete the Final Report

1. Solo River Basin Development Project (PBS), Ministry of Public Works will implement the construction works of secondary and tertiary canals. Water Users Association will bear operation and maintenance cost in principle. However, the Government of Indonesia will allocate the needed budget for serious damages.
2. The scope of works of detailed design will be described in the Final Report.
3. The project cost to be undertaken by the Government of Indonesia will be modified based on their budgeting plan.
4. The design standard of the height of water-proof wall of pump house will be described in the Final Report.
5. The Final Report will mention that minimum monthly average flow to be compensated for Sembayat Barrage will be $11.5\text{m}^3/\text{sec}$, which is equivalent to 80% of dependable discharge analyzed by PBS, taking account of the storage effect of Sembayat Barrage.

ANNEX II : Necessary measures to be taken by the Government of
the Republic of Indonesia

1. To provide data and information necessary for implementation of the Project.
2. To secure the land for the Project and to clear the site as needed before commencement of construction.
3. To ensure prompt unloading, tax exemption, customs clearance of the materials and equipments for the Project at the port of disembarkation in Indonesia.
4. To exempt Japanese nationals engaged in the Project from customs duties, internal taxes (including VAT) and other fiscal levies which may be imposed in Indonesia with respect to the supply of the products and services under the verified contracts.
5. To accord Japanese nationals whose services may be required in connection with the Project under the verified contracts such facilities as may be necessary for their entry into Indonesia and stay therein for the duration of their work stay.
6. To provide necessary permissions, licences and other authorization for carrying out the Project.
7. To bear two kinds of commissions to the Japanese foreign exchange bank for the banking services, based upon the "Banking Arrangement", namely, the advising commission of the "Authorization to Pay" and payment commission.
8. To bear all the expenses, other than those to be borne by the Grant Aid.
9. To ensure the necessary budget and personnel for the proper and effective implementation of the Project, including operation and maintenance of the facilities provided under the Grant Aid.

5. カントリー・データ

Items	Year	Unit	Data
1. Basic indicator			
a. Population	mid-1988	mn	174.2
b. Area		'000 km ²	1,905
c. GNP per capita			
1) GNP per capita	1988	US\$	440
2) Average annual growth rate	1965-88	%	4.3
d. Average annual rate of inflation			
	1965-80	%	34.2
	1980-88	%	8.5
e. Life expectancy at birth	1988	years	61
f. Adult illiteracy (Female)	1985	%	35
(Total)	1985	%	26
2. Growth of production			
a. Average annual growth rate			
1) GDP	1965-80	%	8.0
	1980-88	%	5.1
2) Agriculture	1965-80	%	4.3
	1980-88	%	3.1
3) Industry	1965-80	%	11.9
	1980-88	%	5.1
4) (Manufacturing)	1965-80	%	12.0
	1980-88	%	13.1
5) Service, etc.	1965-80	%	7.3
	1980-88	%	6.4
3. Structure of production			
a. GDP			
	1965	mn US\$	3,840
	1988		83,220
b. Distribution of gross domestic product			
1) Agriculture	1965	%	56
	1988	%	24
2) Industry	1965	%	13
	1988	%	36
3) (Manufacturing)	1965	%	8
	1988	%	19
4) Service, etc.	1965	%	31
	1988	%	40
4. Agriculture and food			
a. Value added in agriculture			
	1970	mn current US\$	4,340
	1988		20,055
b. Cereal imports			
	1974	'000 tons	1,919
	1988		1,702
c. Food aid in cereals			
	1974/75	'000 tons	301
	1987/88		319
d. Fertilizer consumption			
	1970/71	100g/ha	133
	1987/88		1,068
e. Average index of food production per capita			
(1979-81=100)	1986-88		117

5. Commercial energy			
a. Average annual energy growth rate			
1) Energy production	1965-80	%	9.9
	1980-88	%	1.0
2) Energy consumption	1965-80	%	8.4
	1980-88	%	4.5
b. Energy consumption per capita	1965	kg of oil eq.	91
	1988	kg of oil eq.	229
c. Energy imports as a percentage of merchandise exports			
	1965	%	3
	1988	%	14
6. Structure of manufacturing			
a. Value added in manufacturing	1970	mn current US\$	994
	1987	mn current US\$	12,876
b. Distribution of manufacturing value added			
1) Food, beverages, and tobacco	1987	%	22
2) Textiles and clothing	1987	%	13
3) Machinery and transport equipment	1987	%	8
4) Chemicals	1987	%	9
5) Others	1987	%	48
7. Manufacturing earnings and output			
a. Earnings per employee			
1) Growth rate	1970-80	%	5.6
	1980-88	%	6.0
2) Index (1980=100)	1985		139
	1986		144
b. Total earnings as a percentage of value added	1970	%	26
	1985	%	19
	1986	%	19
c. Gross output per employee (1980=100)	1970		42
	1985		141
	1986		156
8. Growth of consumption and investment			
a. Average annual growth rate			
1) General government consumption	1965-80	%	11.4
	1980-88	%	2.9
2) Private consumption	1965-80	%	5.9
	1980-88	%	7.2
3) Gross domestic investment	1965-80	%	16.1
	1980-88	%	1.9
9. Structure of demand			
Distribution of gross domestic product			
1) General government consumption	1965	%	5
	1988	%	9
2) Private consumption, etc.	1965	%	87
	1988	%	65
3) Gross domestic investment	1965	%	8
	1988	%	22
4) Gross domestic savings	1965	%	8
	1988	%	25
5) Exports of goods and nonfactor services	1965	%	5
	1988	%	25
6) Resource balance	1965	%	0
	1988	%	4

10. Structure of consumption			
Percentage share of total household consumption			
1) Food		%	
Total		%	48
Cereals and tubers		%	21
2) Clothing and footwear		%	7
3) Gross rents, fuel and power			
Total		%	13
Fuel and power		%	7
4) Medical care		%	2
5) Education		%	4
6) Transport and communication			
Total		%	4
Motor cars		%	0
7) Other consumption			
Total		%	22
Other consumer durables		%	5
11. Central government expenditure			
a. Percentage of total expenditure			
1) Defence	1972	%	18.6
	1988	%	8.3
2) Education	1972	%	7.4
	1988	%	10.0
3) Health	1972	%	1.4
	1988	%	1.8
4) Housing, amenities; social security and welfare	1972	%	0.9
	1988	%	1.7
5) Economic service	1972	%	30.5
	1988	%	-
6) Others	1972	%	41.3
	1988	%	78.2
b. Total expenditure as a percentage of GNP	1972	%	15.1
	1988	%	22.7
c. Overall surplus/deficit as a percentage of GNP	1972	%	-2.5
	1988	%	-3.3
12. Central Government current revenue			
a. Percentage of total current revenue			
1) Tax revenue			
Tax on income, profit, and capital gain	1972	%	45.5
	1988	%	55.9
Social security contributions	1972	%	0.0
	1988	%	0.0
Domestic taxes on goods and services	1972	%	22.8
	1988	%	24.5
Tax on international trade and transactions	1972	%	17.6
	1988	%	5.6
Other taxes	1972	%	3.5
	1988	%	3.0
2) Nontax revenue	1972	%	10.6
	1988	%	11.0
b. Total current revenue as a percentage of GNP	1972	%	13.4
	1988	%	19.2

13. Money and interest rates			
a. Monetary holdings, broadly defined			
1) Average annual nominal growth rate	1965-80	%	54.4
	1980-88	%	23.8
2) Average outstanding as a percentage of GDP	1980	%	13.2
	1988	%	28.5
b. Average annual inflation (GDP deflator)	1980-88	%	8.5
c. Nominal interest rates of banks (average annual percentage)			
1) Deposit rate	1980	%	6.00
	1988	%	17.72
2) Lending rate	1980	%	-
	1988	%	22.10
14. Growth of merchandise trade			
a. Merchandise trade			
1) Exports	1988	mn US\$	19,677
2) Imports	1988	mn US\$	15,732
b. Average annual growth rate			
1) Exports	1965-80	%	9.6
	1980-88	%	2.9
2) Imports	1965-80	%	14.2
	1980-88	%	-2.1
c. Terms of trade (1980=100)			
	1985		94
	1988		70
15. Structure of merchandise imports			
a. Percentage share of merchandise imports			
1) Food	1965	%	6
	1988	%	3
2) Fuels	1965	%	3
	1988	%	18
3) Other primary commodities	1965	%	2
	1988	%	5
4) Machinery and transport equipment	1965	%	39
	1988	%	39
5) Other manufactures	1965	%	50
	1988	%	36
16. Structure of merchandise exports			
a. Percentage share of merchandise exports			
1) Fuels, minerals, and metals	1965	%	43
	1988	%	49
2) Other primary commodities	1965	%	53
	1988	%	22
3) Machinery and transport equipment	1965	%	3
	1988	%	1
4) Other manufactures	1965	%	1
	1988	%	28
5) (Textiles and clothing)	1965	%	0
	1988	%	8

17. Balance of payments and reserves			
a. Current account balance			
1) After official transfers	1970	mn US\$	-310
	1988	mn US\$	-1,189
2) Before official transfers	1970	mn US\$	-376
	1988	mn US\$	-1,500
b. Net worker's remittance	1970	mn US\$	-
	1988	mn US\$	99
c. Net direct private investment	1970	mn US\$	83
	1988	mn US\$	542
d. Gross international reserves	1970	mn US\$	160
	1988	mn US\$	6,322
18. Official development assistance: receipts			
a. Net disbursement of ODA from all sources			
1) Amounts	1982	mn US\$	906
	1983	mn US\$	744
	1984	mn US\$	673
	1985	mn US\$	603
	1986	mn US\$	711
	1987	mn US\$	1,246
	1988	mn US\$	1,632
2) Per capita	1988	US\$	9.3
3) As a percentage of GNP	1988	%	2.1
19. Population growth and projections			
a. Average annual growth of population	1965-80	%	2.4
	1980-88	%	2.1
	1988-2000	%	1.7
b. Population	1988	mn	175
	2000	mn	213
	2025	mn	282
c. Hypothetical size of stationary population		mn	370
d. Age structure of population			
1) 0-14 years	1988	%	37.3
	2025	%	23.3
2) 15-64 years	1988	%	58.9
	2025	%	68.2
20. Demography and fertility			
a. Crude birth rate per thousand population	1965		43
	1988		28
b. Crude death rate per thousand population	1965		20
	1988		9
c. Women of child bearing age as a percentage of population			
	1965	%	47
	1988	%	51
d. Total fertility rate	1965		5.5
	1988		3.4
	2000		2.5
e. Assumed year of reaching net reproduction rate of 1		Year	2005

21. Health and nutrition			
a. Population per physician	1965		31,700
	1984		9,460
b. Population per Nursing person	1965		9,490
	1984		1,260
c. Births attended by health staff	1985	%	43
d. Babies with low birth weight	1985	%	14
e. Infant mortality rate (per thousand live birth)	1965		128
	1988		68
f. Daily calorie supply (per capita)	1965	cal.	1,800
	1986	cal.	2,579
22. Education			
a. Percentage of age group enrolled in education			
1) Primary	1965	%	72
	1987	%	118
2) Secondary	1965	%	12
	1987	%	46
3) Tertiary	1965	%	1
	1987	%	-
23. Income distribution			
a. Percentage share of household income, by percentile group of households			
1) Lowest 20%	1987	%	8.8
2) Second quintile		%	12.4
3) Third quintile		%	16.0
4) Fourth quintile		%	21.5
5) Highest 20%		%	41.3
6) Highest 10%		%	26.5
24. Urbanization			
a. Urban population			
1) As a percentage of total population	1965	%	16
	1988	%	27
2) Average annual growth rate	1965-80	%	4.8
	1980-88	%	4.8
b. Percentage of urban population			
1) In largest city	1960	%	20
	1980	%	23
2) In cities of over 500,000 persons	1960	%	34
	1980	%	50
c. Number of cities of over 500,000 persons			
	1960		3
	1980		9
Source : World Development Report 1990, World Development Indicators. The World Bank			

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表 A - 1 ポンプ場所在地一覧

No.	Name of Station	Sub District (Kecamatan)	District (Kabupaten)
Existing			
1	TAPELAN	NGRAHO	BOJONEGORO
2	SUMBERARUM	NGRAHO	BOJONEGORO
3	TEBON	PADANGAN	BOJONEGORO
4	PERANGI	PADANGAN	BOJONEGORO
5	BANJAREJO	PADANGAN	BOJONEGORO
6	NGRAHO	KALITIDU	BOJONEGORO
7	SUDU	KALITIDU	BOJONEGORO
8	NGRINGINREJO	KALITIDU	BOJONEGORO
9	LERAN	KALITIDU	BOJONEGORO
10	TRUCUK	BOJONEGORO	BOJONEGORO
11	TULUNGREJO	BOJONEGORO	BOJONEGORO
12	MULYOAGUNG	BOJONEGORO	BOJONEGORO
13	KALIREJO	BOJONEGORO	BOJONEGORO
14	SEMANDING	KOTA BOJONEGORO	BOJONEGORO
15	MULYOREJO	BALEN	BOJONEGORO
16	SARIREJO	BALEN	BOJONEGORO
17	PILANGGEDE	BALEN	BOJONEGORO
18	KEDUNGBONDO	BALEN	BOJONEGORO
19	CANGAKAN	KANOR	BOJONEGORO
20	KABALAN	KANOR	BOJONEGORO
Proposed			
21	MOJOREJO	NGRAHO	BOJONEGORO
22	DENGOK	PADANGAN	BOJONEGORO
23	KARANGTINOTO	RENGEL	TUBAN
24	BANDUNGREJO	PLUMPANG	TUBAN
25	KLOTOK	WIDANG	TUBAN
26	TANGGUNGAN	BAURENO	BOJONEGORO
27	KALISARI	BAURENO	BOJONEGORO
28	BANJAR	WIDANG	TUBAN
29	KEDUYUNG	LAREN	LAMONGAN
30	BULUTIGO	LAREN	LAMONGAN
31	PELANGWOT	LAREN	LAMONGAN
32	TAMANPRIJEK	LAREN	LAMONGAN
33	TEJOASRI	LAREN	LAMONGAN

表 A - 2 土地利用区分 (ボジョネゴロ、トゥバン、ラモンガン県)

District (Kabupaten)	(Unit : ha)				
	House Compound & Surroundings	Bareland/ Garden/ Shifting Cultivation	Steppe Pasture	Dike	Water Pond
Bojonegoro	23,185	31,774	8	-	88
Tuban	14,828	61,144	1,862	623	18
Lamongan	12,730	33,326	2	592	-
Total	50,743	126,244	1,872	1,215	106
Ratio	0.139	0.345	0.005	0.003	0.000

District (Kabupaten)	Preliminary Land not Utilized	Land with Grown Wood	Estates	Wet Land	Total
Bojonegoro	116	410	-	61,722	117,303
Tuban	249	83	74	53,027	131,908
Lamongan	70	4	-	70,023	116,747
Total	435	497	74	184,772	365,958
Ratio	0.001	0.001	0.000	0.505	1.000

Source : East Java Figures, 1988. East Java Statistics Office and the Government of East Java

表 A - 3 食用作物の作付面積、単収、生産量
(ボジョネゴロ・レジデンシー)

Crop	Planted Area (ha)	Harvested Area (ha)	Yield (kg/ha)	Production (ton)
Paddy	255,520	247,829	5,662	1,403,275
Maize	218,575	160,083	2,373	379,871
Soybean	53,863	51,217	1,061	54,329
Cassava	17,602	19,205	15,421	296,160
Sweet Poteto	2,441	2,045	8,723	17,838
Peanut	31,478	30,739	967	29,728
Green Pea	15,798	17,710	963	17,059
Sorghum	3,217	3,394	2,911	9,880

*Bojonegoro Residency includes Bojonegoro, Tuban, and Lamongan Districts.
Source: Year Book 1989, Agriculture Office, Bojonegoro

表A-4 主要食用作物の作付面積、単収、生産量
(ボジョネゴロ・レジデンスー、東部ジャワ州、全国、1988年)

Crop Item	Bojonegoro Residency	East Java Province	Indonesia
Paddy			
Paddy in Total			
Harvested Area (ha)	246,653	1,612,530	10,452,179
Production (ton)	1,285,743	8,263,470	44,779,244
Yield (kg/ha)	5,213	5,125	4,284
Wetland Paddy			
Harvested Area (ha)	230,634	1,520,975	9,310,721
Production (ton)	1,239,743	8,023,652	42,417,716
Yield (kg/ha)	5,375	5,275	4,556
Dryland Paddy			
Harvested Area (ha)	16,019	91,555	1,141,998
Production (ton)	46,000	239,818	2,361,528
Yield (kg/ha)	2,872	2,619	2,068
Palawija			
Maize			
Area (ha)	160,083	5,778,091	13,264,680
Production (ton)	379,871	2,528,705	6,212,965
Yield (kg/ha)	2,373	2,285	2,135
Soybean			
Area (ha)	51,217	531,964	1,425,751
Production (ton)	54,329	459,382	1,300,868
Yield (kg/ha)	1,061	1,158	1,096
Cassava			
Area (ha)	19,205	50,399,538	208,511,042
Production (ton)	296,160	4,031,963	17,091,069
Yield (kg/ha)	15,421	12,500	12,200
Sweet Potato			
Area (ha)	2,045	2,454,310	19,775,278
Production (ton)	17,838	245,431	2,126,374
Yield (kg/ha)	8,723	10,000	9,300
Peanut			
Area (ha)	30,739	143,093	618,402
Production (ton)	29,728	142,807	615,325
Yield (kg/ha)	967	1,002	1,005

* Bojonegoro Residency includes Bojonegoro, Tuban, and Lamongan Districts.
Source : Statistical Year Book of Indonesia, 1989. Central Bureau of Statistics.
Year Book, 1989. Agriculture Office, Bojonegoro.

表 A - 5 開発計画時期別の平均年作物生産量
(ボジョネゴロ・レジデンシー)

	(Unit: ton)				
	I 1963-73	II 1974-78	III 1979-83	IV 1984-88	1989
Paddy	341,542	661,389	855,961	1,265,944	1,403,275
Bojonegoro	118,266	180,830	310,352	438,093	
Tuban	91,436	132,265	186,174	261,305	
Lamongan	131,839	348,292	359,435	566,545	
Maize	101,580	137,895	170,281	456,420	379,871
Soybean	15,828	25,670	37,554	53,520	54,329
Cassava	211,487	202,093	198,118	311,574	296,160
Sweet Potato	26,333	23,784	23,872	23,144	17,838
Peanut	13,384	20,515	25,808	28,808	29,728
Sorghum	379	9,523	14,585	8,398	9,880
Green Pea	8,287	14,800	4,890	11,633	

*Bojonegoro Residency includes Bojonegoro, Tuban, and Lamongan Districts.

表 A - 6 水利組合の組織数

District	Number of Village	Number of Water Users Association			
		Total	Less Developed	Medium Developed	Well Developed
Bojonegoro	430	237	78	117	42
Tuban	319	217	103	86	28
Lamongan	425	355	214	119	22
Total	1,174	809	395	322	92

Source : Year Book, 1989. Agriculture Office, Bojonegoro

表 A - 7 水田及び畑作等の区分
(ボジョネゴロ・レジデンシー、1989年)

(Unit:ha)				
Distribution	Bojonegoro	Tuban	Lamongan	Total
I. Paddy Field	73,305	55,708	82,943	211,956 (100%)
Irrigated/Technical	16,351	8,067	6,846	31,264 (15%)
Irrigated/Semi-Tech.	5,178	6,434	13,866	25,478 (12%)
Irrigated/Non-Tech./Public	785	1,982	17,207	19,974 (9%)
Irrigated/Non-Tech./Private	4,356	2,430	8,050	14,836 (7%)
Rainfed	46,635	36,770	36,380	119,785 (57%)
Others	0	25	594	619 (0%)
II. Dryland	151,653	128,285	83,948	363,886 (100%)
Yard	25,229	14,969	12,463	52,661 (14%)
Upland Paddy	33,574	58,922	33,678	126,174 (35%)
Upland Field	6	3,197	521	3,724 (1%)
Grass Land	8	1,355	2	1,365 (0%)
State Forest	86,136	44,496	29,669	160,301 (44%)
Others	6,700	5,346	7,615	19,661 (5%)

*Bojonegoro Residency includes Bojonegoro, Tuban, and Lamongan Districts.
Source: Year Book 1989, Agriculture Office, Bojonegoro

表A-8 プロジェクト地域一覧

(Unit: ha)

No.	Name of Station	Potential Area	Existing Irrigated Area	Project Area		
				Total Area	Non-Inundated Area	Inundated Area
1	TAPELAN	59	25	60	32	28
2	SUMBERARUM	141	40	150	150	0
3	TEBON	50	40	50	43	7
4	PERANGI	80	35	80	55	25
5	BANJAREJO	87	0	90	36	54
6	NGRAHO	160	25	160	127	33
7	SUDU	382	40	200	169	31
8	NGRINGINREJO	217	55	200	165	35
9	LERAN	83	20	90	69	21
10	TRUCUK	126	40	130	111	19
11	TULUNGREJO	109	25	110	0	110
12	MULYOAGUNG	173	80	180	180	0
13	KALIREJO	270	40	160	160	0
14	SEMANDING	171	25	180	180	0
15	MULYOREJO	235	120	200	90	110
16	SARIREJO	290	70	200	40	160
17	PILANGGEDE	81	43	90	40	50
18	KEDUNGBONDO	145	50	100	100	0
19	CANGAKAN	207	35	140	75	65
20	KABALAN	162	30	170	80	90
21	MOJOREJO	150	24	150	130	20
22	DENGOK	200	11	200	200	0
23	KARANGTINOTO	200	30	200	140	60
24	BANDUNGREJO	240	70	200	190	10
25	KLOTOK	296	0	200	170	30
26	TANGGUNGAN	116	9	120	50	70
27	KALISARI	78	0	80	0	80
28	BANJAR	190	0	190	0	190
29	KEDUYUNG	290	75	200	10	190
30	BULUTIGO	300	75	200	20	180
31	PELANGWOT	255	150	200	20	180
32	TAMANPRIJEK	184	100	120	20	100
33	TEJOASRI	250	75	200	125	75
TOTAL		5,977	1,457	5,000	2,977	2,023

表 A - 9 灌溉状态別作物单位収量

Crop	Area	(Unit : ton/ha)			Sub District (Kecamatan)
		Irrigated Area		Non-Irrigated Area	
		Technical	Non-Tech.		
Paddy	A1	8.5	6.5	4.5	Kapas, Balen, Sumberrejo
	A2	6.2	5.3	4.0	Baureno, Kepohbaru, Kalitidu, Padangan
	A3	5.4	4.5	3.5	Ngraho, Tambakrejo, Sugihwaras
Maize	A1	4.5	3.2	1.0	Bojonegoro
	A2	2.8	1.6	0.5	Kepohbaru, Kedungadem, Padangan, Purwosari
Soybean	A1	2.6	1.9	1.0	Balen, Kapas, Bojonegoro
	A2	1.8	1.2	0.4	Baureno, Padangan, Dander

Source : Agriculture Office, Bojonegoro

表A-10 プロジェクト地域における作物生産量

Crops	Area (ha)	Yield (t/ha)	Production (ton)
With Project Condition			
Non-Inundated Area			
Paddy (Wet Season)	2,977	6.0	17,862.0
Paddy (Dry Season 1)	2,977	6.5	19,350.5
Maize	2,382	3.0	7,146.0
Soybean	595	2.0	1,190.0
Inundated Area			
Paddy (Dry Season 1)	2,023	6.5	13,149.5
Paddy (Dry Season 2)	2,023	6.5	13,149.5
Total			
Paddy	10,000		63,511.5
Maize	2,382		7,146.0
Soybean	595		1,190.0
Without Project Condition			
Existing Irrigated Area			
Non-Inundated Area			
Paddy (Wet Season)	413	6.0	2,478.0
Paddy (Dry Season 1)	124	6.5	806.0
Maize (Dry Season 1)	231	3.0	693.0
Soybean (Dry Season 1)	58	2.0	116.0
Maize (Dry Season 2)	330	3.0	990.0
Soybean (Dry Season 2)	83	2.0	166.0
Inundated Area			
Paddy (Dry Season 1)	1,044	6.5	6,786.0
Maize (Dry Season 2)	835	3.0	2,505.0
Soybean (Dry Season 2)	209	2.0	418.0
Total			
Paddy	1,581		10,070.0
Maize	1,396		4,188.0
Soybean	350		700.0
Rainfed Area			
Non-Inundated Area			
Paddy (Wet Season)	2,564	4.0	10,256.0
Paddy (Dry Season 1)	769	4.0	3,076.0
Maize (Dry Season 1)	1,436	1.0	1,436.0
Soybean (Dry Season 1)	359	0.8	287.2
Maize (Dry Season 2)	2,051	1.0	2,051.0
Soybean (Dry Season 2)	513	0.8	410.4
Inundated Area			
Paddy (Dry Season 1)	979	4.0	3,916.0
Maize (Dry Season 2)	783	1.0	783.0
Soybean (Dry Season 2)	196	0.8	156.8
Total			
Paddy	4,312		17,248.0
Maize	4,270		4,270.0
Soybean	1,068		854.4
Grand Total			
Paddy	5,893		27,318.0
Maize	5,666		8,458.0
Soybean	1,418		1,554.4
Increment (With-Without)			
Paddy	4,107		36,193.5
Maize	-3,284		-1,312.0
Soybean	-823		-364.4

表A-11 プロジェクト地域における作物生産高

Crops	Cropped Area (ha)	Prod'n (ton)	Price (Rp/kg)	Gross Value (million Rp)
With Project Condition				
Paddy	10,000	63,512	250	15,878
Palawija				2,227
Maize	2,382	7,146	250	1,787
Soybean	595	1,190	370	440
Total	12,977			18,105
Without Project Condition				
Existing Irrigated Area				
Paddy	1,581	10,070	250	2,518
Palawija				1,306
Maize	1,396	4,188	250	1,047
Soybean	350	700	370	259
Total	3,327			3,824
Rainfed Area				
Paddy	4,312	17,248	250	4,312
Palawija				1,383
Maize	4,270	4,270	250	1,068
Soybean	1,068	854	370	316
Total	9,650			5,695
Whole Area				
Paddy	5,893	27,318		6,830
Palawija				2,689
Maize	5,666	8,458		2,115
Soybean	1,418	1,554		575
Total	12,977			9,519
Increment (With-Without)				8,586

表 A - 1 2 單位灌溉用水量 (1)

Month	OCT			NOV			DEC			JAN			FEB			MAR			APR			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
LP (1st)	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
Re	12.4	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9
Net	137.6	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1	110.1
Area Ratio	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
WR	23.4	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
LP (2nd)																						
Re																						
Net																						
Area Ratio																						
WR																						
ETo				5.4	4.8	4.6	4.8	4.8	4.6	4.6	4.5	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.8
Average Kc				1.20	1.20	1.21	1.23	1.23	1.21	1.21	1.27	1.24	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.15
ETCrop				6.5	5.8	5.6	5.5	5.6	5.6	5.7	5.7	5.5	5.7	5.8	5.7	5.8	5.7	5.8	5.7	5.8	5.6	5.5
P&S				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ETCrop,P&S				84.8	77.6	75.7	75.7	75.7	75.7	75.7	77.2	74.6	76.7	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	75.2
Re				39.9	55.1	55.1	55.1	55.1	55.1	55.1	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8	52.5
Net				44.9	22.5	20.6	27.8	27.8	20.6	27.8	4.8	4.8	6.9	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	41.6
Area Ratio				0.08	0.25	0.42	0.58	0.58	0.42	0.58	0.75	0.75	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.88
WR				3.6	5.6	8.6	16.1	16.1	8.6	16.1	3.6	3.6	6.4	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	7.8
Net Farm																						
Req. (mm)	23.4	28.4	28.4	24.0	24.0	24.8	24.8	24.8	24.8	24.8	16.1	3.6	6.4	15.1	21.6	28.6	28.6	28.6	28.6	28.6	28.6	3.2
Overall																						
Effl.				0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Diversions																						
Req. (mm)	27.5	24.0	24.0	20.3	25.6	29.2	19.0	19.0	29.2	19.0	4.2	4.2	7.5	17.3	25.4	24.3	24.3	24.3	24.3	24.3	24.3	3.9
Diversions																						
Req. (l/s/ha)	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0

Note: LP; Land Preparation Requirement.
 Re; Effective Rainfall; 70% of monthly rainfall (one in five year low) at Hojonegoro.
 P&S; Percolation and Lateral Seepage Requirement.
 ETo; Reference Crop Evapotranspiration.
 Kc; Crop Coefficient.
 ETCrop; Crop Evapotranspiration; = ETo x Kc.
 Net; Net Crop Water Requirement; = Water Requirement - Effective Rainfall.
 Diversion Req. (l/s/ha); Unit Irrigation Diversion Requirement in l/s/ha; this requirement is computed considering "Area Expansion Factor", which is applied to the standard irrigation diversion requirement as a reduced demand of 80%.

Source: Study Team's estimate using the following data:
 - Canadian International Development Agency, LOWER SOLO RIVER DEVELOPMENT PROJECT, Appendix F Agriculture, Part 6 Crop Water Requirement, 1986.
 - Hydrometeorological data collected from PBS, Ministry of Public Works.
 - Farm survey conducted by the Study Team.

表 A - 1 2 單位灌溉用水量 (2)

- PROPOSED PADDY 2 -

Month	MAR		APR		MAY		JUN		JUL		AUG		SEP	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Decade	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
LP(1st)	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
Re	52.5	52.5	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Net	97.5	97.5	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4
Area Ratio	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17
WR	16.6	16.6	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8
LP(2nd)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re														
Net														
Area Ratio														
WR														
ETO	4.7	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Average Kc	1.20	1.20	1.21	1.21	1.23	1.23	1.23	1.23	1.27	1.27	1.27	1.27	1.27	1.27
ETcrop	5.6	5.6	5.8	5.8	5.8	5.8	5.8	5.8	5.5	5.5	5.5	5.5	5.5	5.5
P&S	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ETcrop,P&S	84.0	77.6	78.1	78.0	78.3	78.3	78.3	78.3	74.6	74.6	74.6	74.6	74.6	74.6
Se	52.5	33.6	33.6	33.6	33.6	33.6	33.6	33.6	8.6	8.6	8.6	8.6	8.6	8.6
Net	31.5	44.0	44.5	44.5	45.4	45.4	45.4	45.4	66.1	66.1	66.1	66.1	66.1	66.1
Area Ratio	0.88	0.25	0.42	0.42	0.58	0.58	0.58	0.58	1.80	1.80	1.80	1.80	1.80	1.80
WR	2.5	11.8	18.7	18.7	26.4	26.4	26.4	26.4	52.2	52.2	52.2	52.2	52.2	52.2
Net Farm														
Req. (mm)	16.6	16.6	19.1	30.8	38.5	46.1	52.2	59.9	68.1	72.0	72.0	72.0	72.0	72.0
Overall														
Effi.	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Diversión														
Req. (mm)	19.5	19.5	22.5	36.2	45.3	54.2	61.5	70.5	80.1	84.8	84.8	84.8	84.8	84.8
Diversión														
Req. (l/s/ha)	0.2	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7

Note: LP: Land Preparation Requirement.

Re: Effective Rainfall; 70% of monthly rainfall (one in five year low) at Bojonegoro.

P&S: Percolation and Lateral Seepage Requirement.

ETo: Reference Crop Evapotranspiration.

Kc: Crop Coefficient.

ETcrop: Crop Evapotranspiration; = ETo x Kc.

Net: Net Crop Water Requirement; = Water Requirement - Effective Rainfall.

Diversión Req. (l/s/ha): Unit Irrigation Diversión Requirement in l/s/ha; this requirement is computed considering "Area Expansion Factor", which is applied to the standard irrigation diversión requirement as a reduced demand of 80%.

Source: Study Team's estimate using the following data:

- Canadian International Development Agency, LOWER SOLO RIVER DEVELOPMENT PROJECT, Appendix F Agriculture, Part 5 Crop Water Requirement, 1986.

- Hydrometeorological data collected from P&S, Ministry of Public Works.

- Farm survey conducted by the Study Team.

表 A-12 单位灌溉用水量 (4)

Month	JUN			JUL			AUG			SEP			OCT			NOV			DEC				
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
Decade																							
LP(1st)																							
Re	35.8	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	
Net	6.5	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	
Area Ratio	28.5	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	
WR	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
LP(2nd)																							
Re																							
Net																							
Area Ratio																							
WR																							
ETo																							
Average Kc																							
ETcrop																							
P&S																							
ETcrop,P&S																							
Re																							
Net																							
Area Ratio																							
WR																							
Net Farm																							
Req. (mm)	4.8	7.8	9.7	15.0	21.8	30.3	38.7	43.0	52.2	58.6	58.5	42.4	36.4	5.7	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	
Overall																							
Effi.																							
Diversion																							
Req. (mm)	7.4	12.0	14.9	23.8	33.6	46.7	59.5	66.2	80.3	90.2	77.7	65.2	56.0	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Diversion																							
Req. (l/s/ha)	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.7	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Note: LP: Land Preparation Requirement.
 Re: Effective Rainfall; 78% of monthly rainfall (one in five year low) at Bojonegoro.
 ETo: Reference Crop Evapotranspiration.
 Kc: Crop Coefficient.
 ETcrop: Crop Evapotranspiration; = ETo x Kc.
 Net: Net Crop Water Requirement; = Water Requirement - Effective Rainfall.
 Diversion Req. (l/s/ha): Unit Irrigation Diversion Requirement in l/s/ha; this requirement is computed considering "Area Expansion Factor", which is applied to the standard irrigation diversion requirement as a reduced demand of 80%.

Source: Study Team's estimate using the following data:
 - Canadian International Development Agency, LOWER SOLO RIVER DEVELOPMENT PROJECT, Appendix F Agriculture, Part 6 Crop Water Requirement, 1986.
 - Hydrometeorological data collected from PBS, Ministry of Public Works.
 - Farm survey conducted by the Study Team.

表 A-12 單位灌溉用水量 (5)

- EXISTING PALAWIJA -

Month	MAY			JUN			JUL			AUG			SEP			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
Decade																
LP(1st)	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Re	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5
Net	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Area Ratio	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
WR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LP(2nd)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Re	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5
Net	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Area Ratio	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
WR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ETg	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Average Kc	0.58	0.60	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
ETcrop	2.7	2.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
PS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ETcrop.P&S	30.0	29.8	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
Re	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5
Net	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Area Ratio	0.08	0.25	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
WR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Farm Req. (mm)	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Overall Effi.	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Diversions Req. (mm)	0.0	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Diversions Req. (l/s/ha)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes: LP; Land Preparation Requirement.
 Re; Effective Rainfall; 70% of monthly rainfall (one in five year low) at Bojonegoro.
 ETg; Reference Crop Evapotranspiration.
 Kc; Crop Coefficient.
 ETcrop; Crop Evapotranspiration; = ETg x Kc.
 Net; Net Crop Water Requirement; = Water Requirement - Effective Rainfall.
 Diversion Req. (l/s/ha); Unit Irrigation Diversion Requirement in l/s/ha; this requirement is computed considering "Area Expansion Factor", which is applied to the standard irrigation diversion requirement as a reduced demand of 80%.

Source: Study Team's estimate using the following data:
 - Canadian International Development Agency, LOWER-SOLO RIVER DEVELOPMENT PROJECT, Appendix F Agriculture, Part 5 Crop Water Requirement, 1986.
 - Hydrometeorological data collected from PBS, Ministry of Public Works.
 - Farm Survey conducted by the Study Team.

表 A - 13 計畫灌溉用水量

Item	Area (ha)	JAN			FEB			MAR			APR			MAY			JUN			
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
(Unit Irrig. Req.)																				
NON-INUNDATED AREA																				
Paddy 1	0.0	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.1	0.0									
Paddy 2																				
Palawija																				
Total (l/s/ha)	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.4	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.6
INUNDATED AREA																				
Paddy 2																				
Paddy 3																				
Total (l/s/ha)																				
(Diversion Req.)																				
EXISTING PUMP STA.																				
Non-Inundated	1,982	0.00	0.19	0.19	0.38	0.38	0.19	0.76	0.57	0.57	0.57	0.76	0.95	1.14	1.33	1.33	1.33	1.33	1.33	1.14
Inundated	838	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.17	0.17	0.25	0.34	0.42	0.50	0.59	0.59	0.59	0.59	0.59	0.57
Sub-total (m3/s)	2,740	0.00	0.19	0.19	0.38	0.38	0.19	0.93	0.74	0.74	0.82	1.10	1.37	1.64	1.92	1.92	1.92	1.92	1.92	1.81
PROPOSED PUMP STA.																				
Non-Inundated	1,075	0.00	0.11	0.11	0.22	0.22	0.11	0.43	0.32	0.32	0.32	0.43	0.54	0.65	0.75	0.75	0.75	0.75	0.75	0.65
Inundated	1,185	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.24	0.24	0.36	0.47	0.59	0.71	0.83	0.83	0.83	0.83	0.83	0.95
Sub-total (m3/s)	2,260	0.00	0.11	0.11	0.22	0.22	0.11	0.67	0.56	0.56	0.68	0.90	1.13	1.36	1.58	1.58	1.58	1.58	1.58	1.59
GRAND TOTAL (m3/s)	5,000	0.00	0.30	0.30	0.60	0.60	0.30	1.60	1.30	1.30	1.50	2.00	2.50	3.00	3.50	3.50	3.50	3.50	3.50	3.40

Item	Area (ha)	JUL			AUG			SEP			OCT			NOV			DEC			
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
(Unit Irrig. Req.)																				
NON-INUNDATED AREA																				
Paddy 1	0.5	0.3	0.2	0.1																
Paddy 2																				
Palawija																				
Total (l/s/ha)	0.5	0.4	0.4	0.4	0.5	0.6	0.7	0.8	0.7	0.8	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.6
INUNDATED AREA																				
Paddy 2	0.5	0.3	0.2	0.1																
Paddy 3																				
Total (l/s/ha)	0.5	0.3	0.2	0.1	0.3	0.7	0.9	1.0	1.0	0.9	0.7	0.5	0.7	0.5	0.2	0.1	0.0			
(Diversion Req.)																				
EXISTING PUMP STA.																				
Non-Inundated	1,982	1.14	0.76	0.76	0.76	0.76	0.95	1.14	1.33	1.52	1.33	1.14	1.33	0.57	0.38	0.57	0.38	0.57	0.38	0.38
Inundated	838	0.67	0.50	0.59	0.59	0.67	0.59	0.75	0.84	0.84	0.75	0.59	0.42	0.17	0.08	0.00	0.00	0.00	0.00	0.00
Sub-total (m3/s)	2,740	1.81	1.26	1.35	1.35	1.33	1.54	1.90	2.17	2.36	2.09	1.73	1.75	0.74	0.46	0.57	0.38	0.57	0.38	0.38
PROPOSED PUMP STA.																				
Non-Inundated	1,075	0.65	0.43	0.43	0.43	0.43	0.54	0.65	0.75	0.86	0.75	0.65	0.75	0.32	0.22	0.32	0.22	0.32	0.22	0.22
Inundated	1,185	0.95	0.71	0.83	0.83	0.95	0.82	1.07	1.19	1.19	1.07	0.83	0.59	0.24	0.12	0.00	0.00	0.00	0.00	0.00
Sub-total (m3/s)	2,260	1.59	1.14	1.26	1.26	1.38	1.37	1.71	1.94	2.05	1.82	1.47	1.35	0.56	0.33	0.32	0.22	0.32	0.22	0.22
GRAND TOTAL (m3/s)	5,000	3.40	2.40	2.61	2.61	2.81	2.90	3.61	4.11	4.40	3.90	3.20	3.10	1.30	0.80	0.89	0.89	0.89	0.89	0.89

Source : Computed by the Study Team.
 Note : EXISTING PUMP STA.: Pump stations (No.1 to No.20) to be rehabilitated.
 PROPOSED PUMP STA.: Pump stations (No.21 to No.33) to be constructed newly.

表 A-14 現況灌漑用水量 (1)

Item	Area (ha)			JAN			FEB			MAR			APR			MAY			JUN			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
(Unit Irrig. Req.)																						
NON-INUNDATED AREA																						
Paddy 1	0.0	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.0											
Paddy 2 (38 %)				0.2	0.2	0.3	0.2	0.2	0.3	0.4	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.5
Palawija 1 (70 %)				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4
Palawija 2																						0.1
Total (l/s/ha)	0.0	0.1	0.1	0.2	0.2	0.1	0.3	0.2	0.2	0.2	0.1	0.1	0.2	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5
INUNDATED AREA																						
Paddy							0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.5
Palawija																						0.1
Total (l/s/ha)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6
(Diversion Req.)																						
PRESENT IRRIG. AREA																						
Non-Inundated	413	0.08	0.04	0.04	0.08	0.04	0.11	0.07	0.07	0.04	0.05	0.06	0.16	0.28	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.32
Inundated	1,044	0.00	0.00	0.00	0.00	0.00	0.21	0.21	0.21	0.31	0.42	0.52	0.63	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.63
Total (m ³ /s)	1,457	0.08	0.04	0.04	0.08	0.04	0.32	0.27	0.27	0.35	0.47	0.58	0.79	0.93	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.85

Source : Computed by the Study Team.

Note : In the estimation of present unit irrigation requirement except for Palawija 1,

proposed figures are adopted.

PRESENT IRRIG. AREA: Total present irrigation area concerning to the pump stations included in the Project.

表 A-15 灌漑用水量の増加 (1)

Item	Area (ha)			JAN			FEB			MAR			APR			MAY			JUN			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
(Diversion Req.)																						
Proposed	5,800	0.0	0.3	0.6	0.6	0.3	1.6	1.3	1.3	1.5	2.0	2.5	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4
Present	1,457	0.2	0.0	0.0	0.1	0.0	0.3	0.3	0.3	0.4	0.5	0.6	0.8	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.8
Increase (m ³ /s)	3,543	0.0	0.3	0.5	0.5	0.3	1.3	1.0	1.0	1.1	1.5	1.9	2.2	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.6
Monthly Ave			0.2			0.4			1.1		1.5			2.4								2.5

表 A-14 現況灌漑用水量 (2)

Item (Unit Irrig. Req.)	JUL			AUG			SEP			OCT			NOV			DEC		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
NON-INUNDATED AREA																		
Paddy 1	0.5	0.3	0.2	0.1										0.2	0.2	0.2	0.3	0.2
Paddy 2 (30 %)	0.4	0.3	0.2	0.1	0.0													
Palawija 1 (70 %)	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.7	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0
Palawija 2	0.5	0.4	0.4	0.4	0.4	0.5	0.6	0.7	0.8	0.7	0.6	0.7	0.3	0.2	0.3	0.2	0.3	0.2
Total (l/s/ha)																		
INUNDATED AREA																		
Paddy	0.5	0.3	0.2	0.1														
Palawija	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.7	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0
Total (l/s/ha)	0.6	0.4	0.4	0.4	0.4	0.5	0.6	0.7	0.8	0.7	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0
(Diversion Req.)																		
PRESENT IRRIG. AREA																		
Non-Inundated	413	0.22	0.17	0.17	0.17	0.21	0.25	0.29	0.33	0.29	0.25	0.29	0.12	0.08	0.12	0.08	0.12	0.08
Inundated	1,044	0.63	0.42	0.42	0.42	0.52	0.63	0.73	0.84	0.73	0.62	0.52	0.18	0.08	0.08	0.08	0.08	0.08
Total (m ³ /s)	1,457	0.85	0.58	0.58	0.58	0.73	0.87	1.02	1.17	1.02	0.87	0.81	0.23	0.08	0.12	0.08	0.12	0.08

Source : Computed by the Study Team.

Note : In the estimation of present unit irrigation requirement except for Palawija 1,

proposed figures are adopted.

PRESENT IRRIG. AREA; Total present irrigation area concerning to the pump stations included in the Project.

表 A-15 灌漑用水量の増加 (2)

Item (Diversion Req.)	JUL			AUG			SEP			OCT			NOV			DEC		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Proposed	5,000	3.4	2.4	2.6	2.8	2.9	3.6	4.1	4.4	3.9	3.2	3.1	1.3	0.8	0.9	0.6	0.9	0.6
Present	1,457	0.8	0.6	0.6	0.6	0.7	0.9	1.0	1.2	1.0	0.9	0.8	0.2	0.1	0.1	0.1	0.1	0.1
Increase (m ³ /s)	3,543	2.6	1.8	2.0	2.2	2.2	2.7	3.1	3.2	2.9	2.3	2.3	1.1	0.7	0.8	0.5	0.8	0.5
Monthly Ave				2.1		2.1		3.0		3.0		2.5		0.9		0.5		0.6

表A-16 ババット地域におけるソロ河の月平均観測流量
(プロジェクトが実施されなかった場合)

(Unit: m³/s)

Year	Annual												Annual Ave		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
1955	1,001.0	976.2	851.6	460.3	398.7	184.8	47.4	0.4	3.8	2.5	37.1	531.8	1,001.0	8.4	384.6
1960	513.0	888.3	316.8	733.4	567.5	49.8	11.3	0.5	0.5	1.5	272.6	288.3	838.3	0.5	353.0
1961	522.0	594.0	666.2	365.7	308.5	34.3	0.5	1.2	3.1	4.6	26.4	120.3	656.2	0.5	219.9
1962	786.6	702.7	653.1	945.0	304.5	56.6	40.7	16.8	0.7	5.0	135.3	333.5	945.0	0.7	326.7
1963	727.7	856.3	1,084.4	528.3	71.9	43.5	1.7	0.8	0.1	7.4	116.5	1,064.4	1,064.4	0.1	285.9
1964	184.1	239.7	530.6	519.4	264.3	153.9	21.9	10.8	12.2	271.6	322.9	180.8	530.6	18.8	236.5
1965	497.8	734.6	621.0	417.9	49.8	23.2	13.0	8.0	7.7	7.8	8.3	221.9	734.6	7.7	222.6
1966	546.3	539.8	1,492.6		770.9	513.0	416.7	45.4	48.5	42.5	230.4	519.3	1,492.6	48.6	
1967	881.5	723.1	584.8	373.1	59.2	27.9	13.0	8.6	7.8	7.7	21.3	277.8	881.5	7.7	258.5
1968	422.1	606.3	927.5	601.0	548.4		509.9	225.2	2.8	3.0	327.0	744.7	927.5	2.8	
1969	536.5	542.8	857.2	347.0	75.1	7.1	2.2	1.4	0.2	2.4	83.7	394.9	942.0	0.2	328.8
1970	425.7	872.3	989.7	470.5	431.8	155.9	41.3	6.5	37.9	56.4	198.7	559.7	989.7	6.5	251.4
1971	1,376.1	1,208.4	916.0	635.7	460.5	293.7	54.8	26.0	7.8	139.9	655.8	850.7	1,376.1	7.8	552.1
1972	551.7	480.3	842.5	445.8	376.8	41.5	21.8	16.5	13.5	12.1	52.2		842.5	12.1	
1973	1,405.3	1,072.9	916.3	1,134.5	359.3	243.6	118.9	130.7	113.6	113.6	404.7	326.2	1,134.5	113.9	
1974	493.8	892.2	1,043.4	923.8	518.4	112.6	111.5	165.9	238.0	435.9	678.8	805.4	1,043.4	111.5	517.7
1975	751.1	1,202.0		1,330.0	949.5	279.1	264.8	180.5	243.8	599.3	772.2	819.2	1,330.0	180.5	
1976	1,836.8	550.6	795.7	496.8	243.3	141.7	36.9	14.5	7.3	75.0	267.0	224.9	1,836.8	7.3	324.2
1977	526.2	743.7	868.4	822.3	241.8	324.4	92.8	37.0	11.5	7.3	22.2	289.5	868.4	7.3	317.3
1978	1,117.9	968.8	894.5	356.4	412.8	485.6	557.7	206.8	173.6	69.6	236.8	741.6	1,117.9	69.6	518.5
1979	1,001.7	823.4	807.1	1,126.9	883.7	325.2	54.8	28.7	18.7	49.4	221.8	378.0	1,126.9	18.7	476.5
1980	581.9	783.1	623.1	787.1	203.8	55.8	35.8	51.1	12.5	32.1	305.8	499.7	787.1	12.5	331.3
1981	845.6	742.8	387.9	270.0	335.5	199.7	288.4	101.7	116.7	132.5	352.4	622.1	742.8	101.7	349.5
1982	1,689.8	1,378.6	1,105.6	721.5	122.4	67.9	34.4	36.4	29.2	25.1	34.6	353.2	1,689.8	25.1	459.9
(59-82)															
Max	1,809.8	1,378.6	1,492.6	1,330.8	1,134.5	513.0	557.7	225.2	243.8	599.3	772.2	850.7	1,689.8	188.5	552.1
Min	184.1	239.7	387.9	270.0	49.8	7.1	0.5	0.4	0.2	0.1	7.4	116.5	530.6	0.1	219.9
Ave	745.8	828.9	844.2	647.6	406.9	179.9	122.1	54.3	48.9	87.4	236.5	465.3	1,084.1	31.0	357.8
1983	987.8	831.6	747.1	694.1	844.7	225.8	79.0	62.8	54.7	122.9	517.0	498.2	844.7	54.7	457.1
1984	1,166.1	1,651.6	1,044.7	648.9	288.8	111.4	102.0	69.0	233.9	212.2	138.3	721.9	1,651.6	69.0	535.0
1985	861.6	1,026.2	1,143.2	716.8	227.1	242.8	69.2	49.2	43.1	86.8	172.0	428.7	1,143.2	43.1	422.2
1986	1,899.3	1,484.2	1,578.4	1,361.8	152.2	317.8	135.2	52.4	103.9	103.5	377.0	289.7	1,578.4	52.4	586.3
1987	1,383.5	1,798.3	1,075.1	209.3	109.9	119.4	45.0	29.4	24.9	22.0	73.4	675.0	1,798.3	22.0	463.9
1988	663.8	820.1	731.0	553.9	323.2	128.5	39.4	31.4	21.2	47.8	357.7	447.6	820.1	21.2	385.4
1989	789.3	943.6	789.0	558.1	379.7	625.6	387.3	84.2	35.2	50.1	221.6	412.5	943.6	35.2	435.0
1990	832.4	738.2	586.5	332.5	218.8	93.9	77.3	31.5	27.1	20.7			332.5	20.7	
(83-90)															
Max	1,383.5	1,798.3	1,578.4	1,361.8	844.7	629.6	287.3	84.2	233.9	212.2	517.0	721.9	1,798.3	69.0	586.3
Min	663.8	788.2	586.5	289.3	109.9	39.4	29.4	21.2	20.7	73.4	265.4	447.6	844.7	20.7	385.4
Ave	957.9	1,175.5	951.9	689.5	318.1	233.7	104.3	51.2	68.0	83.3	265.4	497.7	1,216.6	39.8	468.7

Source : Discharge data collected from PSS, Ministry of Public Works.
Note : Construction of the Monofiri Dam had been completed in the year 1982.

表A-17 ババット地域におけるソロ河の月平均推定流量
(プロジェクトが実施された場合)
(Unit:m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual		Annual
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Ave
I.I.D.P.	0.2	0.4	1.1	1.5	2.4	2.5	2.1	2.1	3.0	2.5	0.9	0.6	3.0	0.2	1.6
1983	807.6	831.2	746.0	692.6	842.3	223.3	76.9	50.7	51.7	120.4	516.1	497.6	842.3	51.7	455.5
1984	1,165.9	1,651.2	1,043.6	647.4	286.4	108.9	99.9	66.9	230.9	209.7	138.4	751.3	1,651.2	66.9	533.4
1985	861.4	1,025.8	1,142.1	715.3	224.7	240.3	67.1	47.1	40.1	64.3	171.1	428.1	1,142.1	40.1	420.6
1986	1,099.1	1,423.8	1,577.3	1,360.3	149.8	315.3	133.1	50.3	100.9	101.0	376.1	269.1	1,577.3	50.3	504.7
1987	1,333.3	1,798.4	1,074.0	208.3	107.5	116.9	42.9	27.3	21.9	19.5	72.5	674.4	1,798.4	19.5	462.2
1988	563.1	879.7	729.9	352.4	320.8	126.0	37.3	29.3	18.2	45.3	356.8	447.0	879.7	18.2	333.0
1989	789.1	943.2	787.9	556.6	377.3	627.1	235.2	82.1	32.2	47.6	220.7	411.9	943.2	32.2	423.4
1990	892.2	787.8	585.4	331.8	216.4	91.4	75.2	29.4	24.1	18.2			892.2	18.2	
(83-90)															
Max	1,333.3	1,798.4	1,577.3	1,360.3	842.3	627.1	285.2	82.1	230.9	209.7	516.1	751.3	1,798.4	66.9	504.7
Min	653.1	787.8	585.4	208.3	107.5	91.4	37.3	27.3	18.2	18.2	72.5	269.1	842.3	18.2	333.8
Ave	957.7	1,175.1	950.8	608.0	315.7	231.2	102.2	49.1	65.0	30.8	264.5	497.1	1,215.8	37.1	459.1

Source: Computed by the Study Team.

Note: Above figures are calculated by subtracting the incremental irrigation diversion requirement (I.I.D.R.) from the observed flow data after the construction of the Wonogiri Dam.

表 A-18 各ポンプ場地点におけるソロ河の水位

No.	Name of Station	Distance (m)	Section Interval (m)	LLWL (m)	LWL (m)	HWL (m)	HHWL (m)
	(NAPEL Gstn*)	0	0	31.02	31.63	36.11	38.68
21	MOJOREJO	35,714	35,714	22.21	22.73	26.81	29.38
1	TAPELAN	38,571	2,857	21.50	22.02	26.07	28.64
2	SUMBERARUM	41,429	2,858	20.88	21.31	25.32	27.89
3	TEBON	45,714	4,285	19.74	20.24	24.21	26.78
4	PERANGI	47,143	1,429	19.39	19.88	23.88	26.41
22	DENGOK	51,429	4,286	18.32	18.82	22.72	25.29
	(CEPU Gstn)	52,857	1,428	17.96	18.46	22.35	24.92
5	BANJAREJO	58,571	5,714	16.94	17.43	21.34	23.90
6	NGRAHO	62,143	3,572	16.29	16.79	20.71	23.27
7	SUDU	66,071	3,928	15.57	16.08	20.02	22.57
8	NGRINGINREJO	90,000	23,929	11.20	11.76	15.81	18.32
9	LERAN	96,428	6,428	10.03	10.60	14.67	17.17
10	TRUCUK	100,000	3,572	9.39	9.96	14.04	16.54
11	TULUNGREJO	101,428	1,428	9.12	9.70	13.79	16.28
	(BOJONEGORO Gstn)	110,000	8,572	7.55	8.15	12.28	14.85
12	MULYOAGUNG	111,071	1,071	7.39	7.99	12.15	14.62
13	KALIREJO	114,286	3,215	6.90	7.51	11.77	14.21
14	SEMANDING	117,143	2,857	6.46	7.09	11.43	13.84
15	MULYOREJO	120,000	2,857	6.03	6.66	11.09	13.47
16	SARIREJO	123,571	3,571	5.48	6.13	10.67	13.01
17	PILANGGEDE	126,071	2,500	5.10	5.76	10.37	12.68
18	KEDUNGBONDO	127,143	1,072	4.94	5.60	10.24	12.55
19	CANGAKAN	130,000	2,857	4.51	5.18	9.90	12.18
20	KABALAN	131,428	1,428	4.29	4.96	9.73	11.99
23	KARANGTINOTO	139,285	7,857	3.09	3.80	8.80	10.98
24	BANDUNGREJO	151,785	12,500	1.19	1.94	7.31	9.36
25	KLOTOK	153,928	2,143	0.86	1.62	7.06	9.09
26	TANGGUNGAN	158,571	4,643	0.16	0.93	6.50	8.49
27	KALISARI	159,285	714	0.05	0.82	6.42	8.39
	(BABAT Gstn)	160,714	1,429	0.00	0.61	6.25	8.21
28	BANJAR	164,643	3,929	0.00	0.58	5.98	7.86
29	KEDUYUNG	176,071	11,428	0.00	0.51	5.21	6.84
30	BULUTIGO	178,571	2,500	0.00	0.49	5.04	6.62
31	PELANGWOT	182,500	3,929	0.00	0.46	4.77	6.27
32	TAMANPRIJEK	186,428	3,928	0.00	1.44	4.50	5.92
33	TEJOASRI	198,571	12,143	0.00	0.39	4.02	5.28
	(RIVERMOUTH)	252,851	54,280	0.00	0.00	0.00	0.00

Source : Water Level Records, 1983-1990. PBS

*Gstn : Gauging Station

HHWL : Highest water level at 10-year return period.

It is not higher than highest water level at 25-year return period plus 0.25 m.

HWL : Highest monthly average water level during 8 years.

LWL : Lowest monthly average water level during 8 years.

LLWL : Lowest water level during 8 years.

表 A - 1 9 月別降雨量と降雨日数

Measuring Station : Bojonegoro

Month	Jan.		Feb.		Mar.		Apr.		May		Jun.		Jul.		Aug.		Sep.		Oct.		Nov.		Dec.		Annual Rainfall mm
	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	RF mm	RD days	
1979	305	14	228	12	225	14	269	11	222	10	103	6	11	1	33	1	70	5	109	7	195	10	269	14	2,039
1980	299	17	238	11	228	12	197	10	13	2	28	2	93	5	74	4	15	2	96	17	262	14	208	15	1,751
1981	277	16	336	16	244	14	144	10	182	10	129	8	152	6	38	4	122	8	66	6	331	13	332	15	2,353
1982	338	18	420	17	413	15	335	14	73	4	29	2	6	1	0	0	31	2	23	2	91	6	248	14	2,007
1983	320	16	285	14	229	15	239	13	233	12	37	2	9	2	0	0	6	1	179	10	297	13	388	13	2,222
1984	371	18	341	16	205	12	127	10	91	7	19	2	19	2	88	3	124	8	123	8	217	10	267	14	1,992
1985	312	14	306	13	299	14	150	8	56	4	90	4	77	5	25	2	54	4	173	6	188	11	276	13	2,006
1986	373	16	278	13	332	13	264	10	37	6	279	11	14	4	48	3	102	7	107	8	250	13	236	11	2,320
1987	399	19	283	15	227	12	80	7	84	5	65	3	11	1	4	1	19	2	53	3	171	8	301	13	1,697
Average	333	16	302	14	267	13	201	10	110	7	87	4	44	3	34	2	60	4	103	7	222	11	281	14	2,043
Average Rainfall a Rain Day mm/day	21		22		21		20		16		22		15		17		15		15		20		20		19

*RF : Rainfall

**RD : Rain Days

表 A - 2 0 平均規模のポンプ場の年間運営維持管理費用の推定

Item	Cost
A. Operation Cost	<u>14,709,000</u>
A-1. Fuel and Oil	10,621,000
Engine Power : 38 ps	
Unit Fuel Consumption : 0.2 l/ps*hr	
Operation Hour Per Year : 4,300 hr	
Unit Price of Fuel : 250 Rp./l	
Oil and Others : 30 % of Fuel	
$38*0.2*4300*250*1.30$	
A-2. Operator	4,088,000
Working Hour : 12 hr/day, 365 days	
Number of Operators : 2 persons	
Wage Rate for Normal Time : 400 Rp./hr	
Wage Rate for Overtime : 600 Rp./hr	
$(400*8+600*4)*365*2$	
B. Maintenance Cost	<u>8,240,000</u>
B-1. Spare Parts and Repair	2,240,000
10 % of Pump and Engine Price	
B-2. Civil Works	3,000,000
Civil Worker : 100 persons, 10 days	
Wage Rate : 3,000 Rp./day	
$100*10*3000$	
B-3. Communication Cost	3,000,000
C. Depreciation	<u>2,240,000</u>
Life Years of Pump and Engine : 10 years	
D. Total O & M Cost Per Year	<u>25,189,000</u>

表 A-2 1 平均規模のプロジェクト地域における年間粗生産高の推定

(Unit : '000 Rp.)

Item	Gross Output by Season			Year
	Wet	Dry 1	Dry 2	
Non-Inundated Area (90.2 ha)	Paddy	Paddy	Palawija	Total
Gross Output Per ha	1,500	1,625	748	3,873
Gross Output in Total				349,345
Inundated Area (61.3 ha)	Fallow	Paddy	Paddy	Total
Gross Output Per ha	0	1,625	1,625	3,250
Gross Output in Total				199,225
Total Gross Output Per Year (151.5 ha)				548,570

Description of Gross Output Per ha	Production	Unit Price	Output
	kg	Rp./kg	Rp.
Paddy (Wet)	6,000	250	1,500,000
Paddy (Dry)	6,500	250	1,625,000
Palawija			748,000
Palawija (Maize : 80 %)	3,000	250	750,000
Palawija (Soybean : 20 %)	2,000	370	740,000

表 A - 2 2 現況作物生産費及び収入

Items	(Unit : Rp./ha)		
	Paddy	Maize	Soybean
Labor	596,000	340,000	328,000
Hired	450,000	265,000	240,000
Family	146,000	75,000	88,000
Inputs	141,100	161,300	111,600
Seed	20,000	62,000	40,000
Fertilizer	88,500	73,000	44,000
Insecticide	17,600	8,800	17,600
Others	15,000	17,500	10,000
Land Cost	200,000	150,000	150,000
Land Tax	10,000	5,000	5,000
Production Cost			
Economic	947,100	656,300	594,600
Real	601,100	431,300	356,600
Gross Income	1,439,375	975,000	918,750
Net Income			
Economic	492,275	318,700	324,150
Real	838,275	543,700	562,150
Net Income / Gross Income			
Economic	0.34	0.33	0.35
Real	0.58	0.56	0.61

Source : Year Book 1989. Agriculture Office, Bojonegoro

図リスト

- 図A-1 行政区分図
- 図A-2 郡別平均洪水面積
- 図A-3 土壌概要図
- 図A-4 地形及び地質系列図
- 図A-5 地形概要図
- 図A-6 土地利用概要図

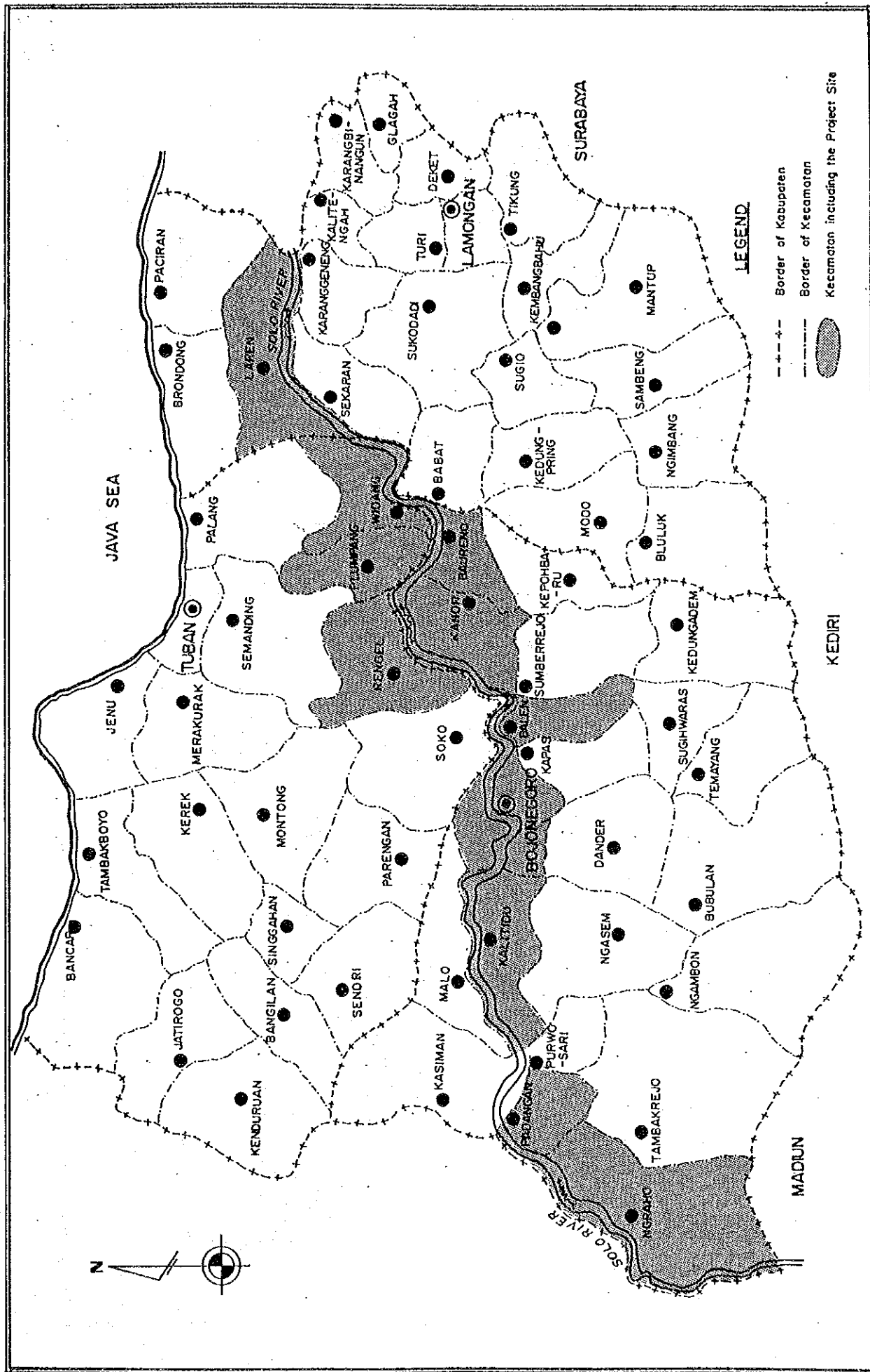
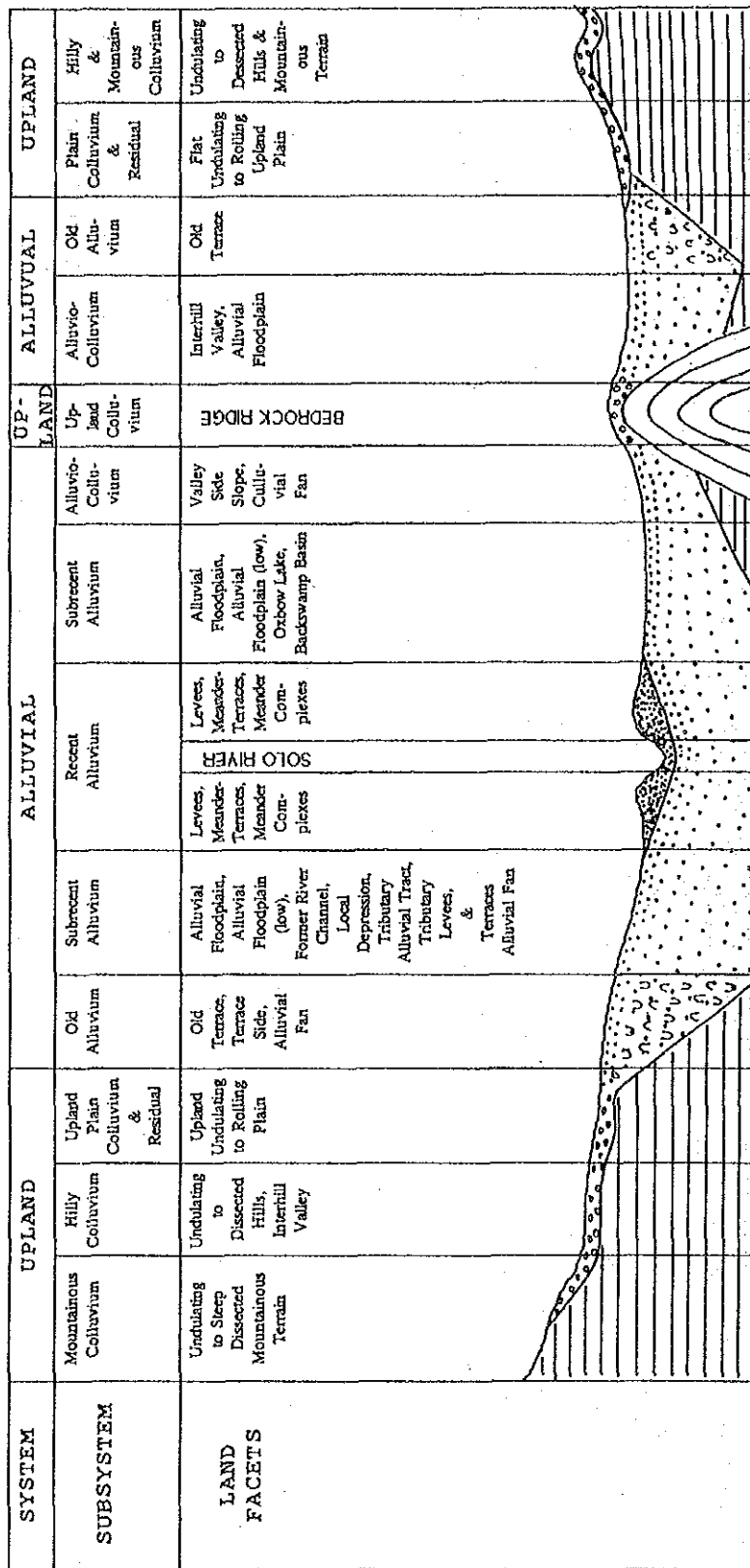


图 A-1 行政区划图

NORTH ←

→ SOUTH



UPLAND AND SOLO RIVER
TRIBUTARIES SYSTEMS

SOLO RIVER FLOODPLAIN SYSTEM

UPLAND AND SOLO RIVER
TRIBUTARIES SYSTEMS

SOLO RIVER BASIN

LEGEND






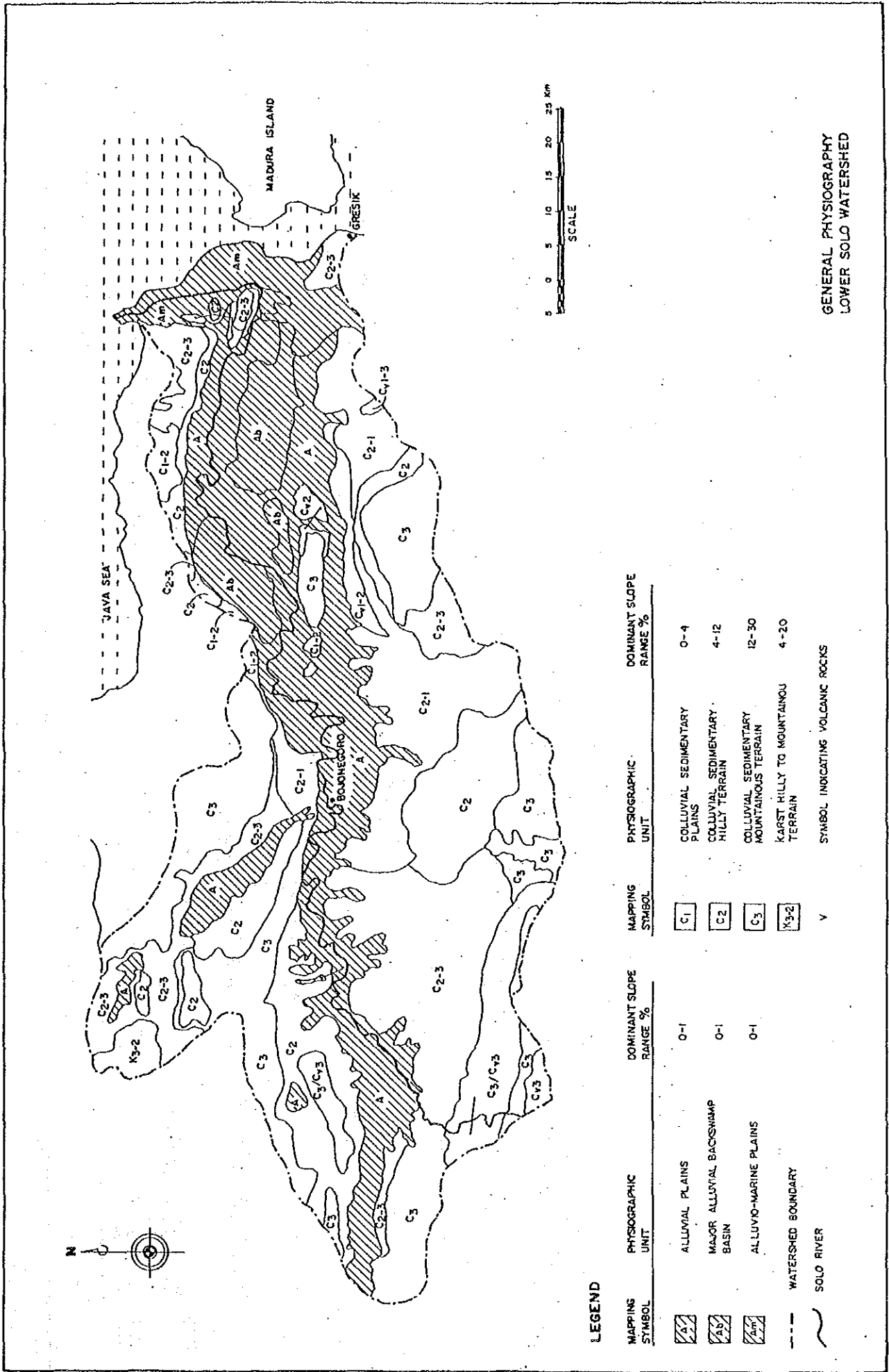
-  RECENT ALLUVIUM ... HOLOCENE
-  SUBRECENT ALLUVIUM ... HOLOCENE
-  OLD ALLUVIUM ... PLEISTOCENE
-  COLLUVIUM & RESIDUAL MATERIAL ... PLEISTOCENE
-  BEDROCK ... PLEISTOCENE TO MIOCENE

図 A - 4 地形及び地質系列図

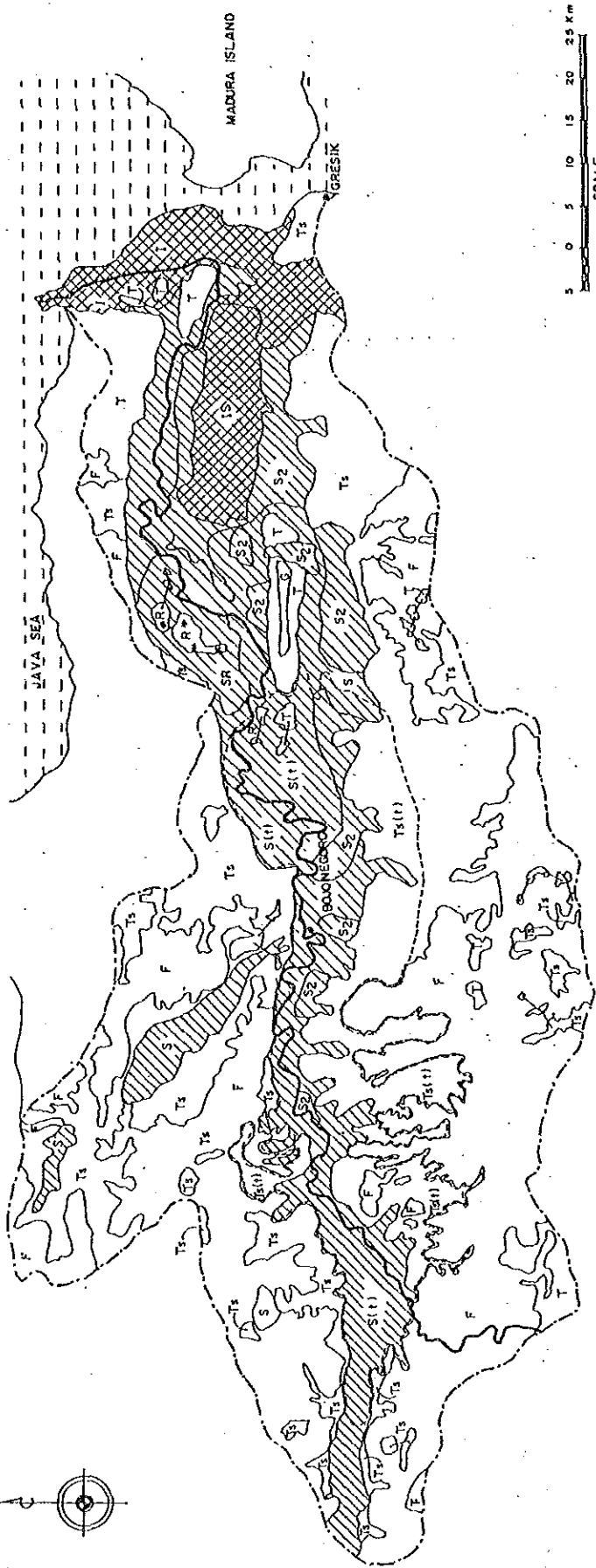
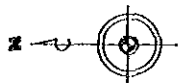


GENERAL PHYSIOGRAPHY
LOWER SOLO WATERSHED

LEGEND

MAPPING SYMBOL	PHYSIOGRAPHIC UNIT	DOMINANT SLOPE RANGE %	MAPPING SYMBOL	PHYSIOGRAPHIC UNIT	DOMINANT SLOPE RANGE %
	ALLUVIAL PLAINS	0-1	C1	COLLUVIAL SEDIMENTARY PLAINS	0-4
	MAJOR ALLUVIAL BACKSWAMP BASIN	0-1	C2	COLLUVIAL SEDIMENTARY HILLY TERRAIN	4-12
	ALLUVIO-MARINE PLAINS	0-1	C3	COLLUVIAL SEDIMENTARY MOUNTAINOUS TERRAIN	12-30
	WATERSHED BOUNDARY		K3-2	KARST HILLY TO MOUNTAINOU TERRAIN	4-20
	SOLO RIVER		V	SYMBOL INDICATING VOLCANIC ROCKS	

图 A-5 地形概要图



LEGEND

- F** FOREST LAND
- S** WETLAND RICE (SAWAH) PREDOMINANTLY ONE RICE CROPS/YEAR
- S2** WETLAND RICE (SAWAH) PREDOMINANTLY TWO RICE CROPS/YEAR
- T** PREDOMINANTLY DRYLAND AGRICULTURE (TEGAL)
- T1** MAJOR TOBACCO PRODUCING AREAS
- T2** WATERSHED BOUNDARY
- T3** APPROXIMATE BOUNDARY
- T4** TOBACCO PRODUCING AREAS
- G** GRASSLAND
- R** PERMANENT SWAMP (RAWA)
- SOLO RIVER
- FISH AND WETLAND RICE PRODUCTION (KAN & SAWAH)
- AREAS PRODUCING FISH ONLY

**GENERAL LAND USE
LOWER SOLO WATERSHED**

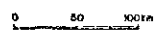
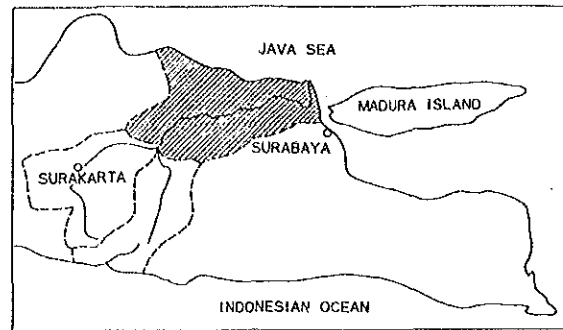
図 A - 6 土地利用概要図

圖 面 集

図面リスト

PLATE No	図 面 名 称
1	LOCATION ON THE PUMPING STATION
2	GENERAL PLAN OF PUMPING STATION (1)
3	GENERAL PLAN OF PUMPING STATION (2)
4	GENERAL PLAN OF PUMPING STATION (3)
5	GENERAL PLAN OF PUMPING STATION (4)
6	GENERAL PLAN OF OUTLET, MAINTENANCE BOX AND PIPELINE
7	LOCATION MAP OF EXISTING PUMP NO. 1 (TAPELAN)
8	LOCATION MAP OF EXISTING PUMP NO. 2 (SUMBERARUM)
9	LOCATION MAP OF EXISTING PUMP NO. 3 (TEBON) PUMP NO. 4 (PRANGI)
1 0	LOCATION MAP OF EXISTING PUMP NO. 5 (BANJARREJO)
1 1	LOCATION MAP OF EXISTING PUMP NO. 6 (NGRAHO)
1 2	LOCATION MAP OF EXISTING PUMP NO. 7 (SUDU)
1 3	LOCATION MAP OF EXISTING PUMP NO. 8 (NGRINGINREJO)
1 4	LOCATION MAP OF EXISTING PUMP NO. 9 (LERAN)
1 5	LOCATION MAP OF EXISTING PUMP NO. 10 (TRUCUK) PUMP NO. 11 (TULUNGREJO)
1 6	LOCATION MAP OF EXISTING PUMP NO. 12 (MULYOAGUNG)
1 7	LOCATION MAP OF EXISTING PUMP NO. 13 (KALIREJO)
1 8	LOCATION MAP OF EXISTING PUMP NO. 14 (SEMANDING)
1 9	LOCATION MAP OF EXISTING PUMP NO. 15 (MULYOREJO)
2 0	LOCATION MAP OF EXISTING PUMP NO. 16 (SARIREJO)
2 1	LOCATION MAP OF EXISTING PUMP NO. 17 (PILANGGEDE)
2 2	LOCATION MAP OF EXISTING PUMP NO. 18 (KEDUNGBONDO)
2 3	LOCATION MAP OF EXISTING PUMP NO. 19 (CANGAKAN)
2 4	LOCATION MAP OF EXISTING PUMP NO. 20 (KABALAN)
2 5	LOCATION MAP OF PROPOSED PUMP NO. 21 (MOJOREJO)
2 6	LOCATION MAP OF PROPOSED PUMP NO. 22 (DENGOK)
2 7	LOCATION MAP OF PROPOSED PUMP NO. 23 (KARANGTINOTO)
2 8	LOCATION MAP OF PROPOSED PUMP NO. 24 (BANDUNGREJO)
2 9	LOCATION MAP OF PROPOSED PUMP NO. 25 (KLOTOK)
3 0	LOCATION MAP OF PROPOSED PUMP NO. 26 (TANGGUNGAN)
3 1	LOCATION MAP OF PROPOSED PUMP NO. 27 (KALISARI)
3 2	LOCATION MAP OF PROPOSED PUMP NO. 28 (BANJAR)
3 3	LOCATION MAP OF PROPOSED PUMP NO. 29 (KEDUYUNG)

PLATE No	图 面 名 称
3 4	LOCATION MAP OF PROPOSED PUMP NO. 30 (BULUTIGO)
3 5	LOCATION MAP OF PROPOSED PUMP NO. 31 (PELANGWOT)
3 6	LOCATION MAP OF PROPOSED PUMP NO. 32 (TAMAN PRIJED)
3 7	LOCATION MAP OF PROPOSED PUMP NO. 33 (TEJOASRI)

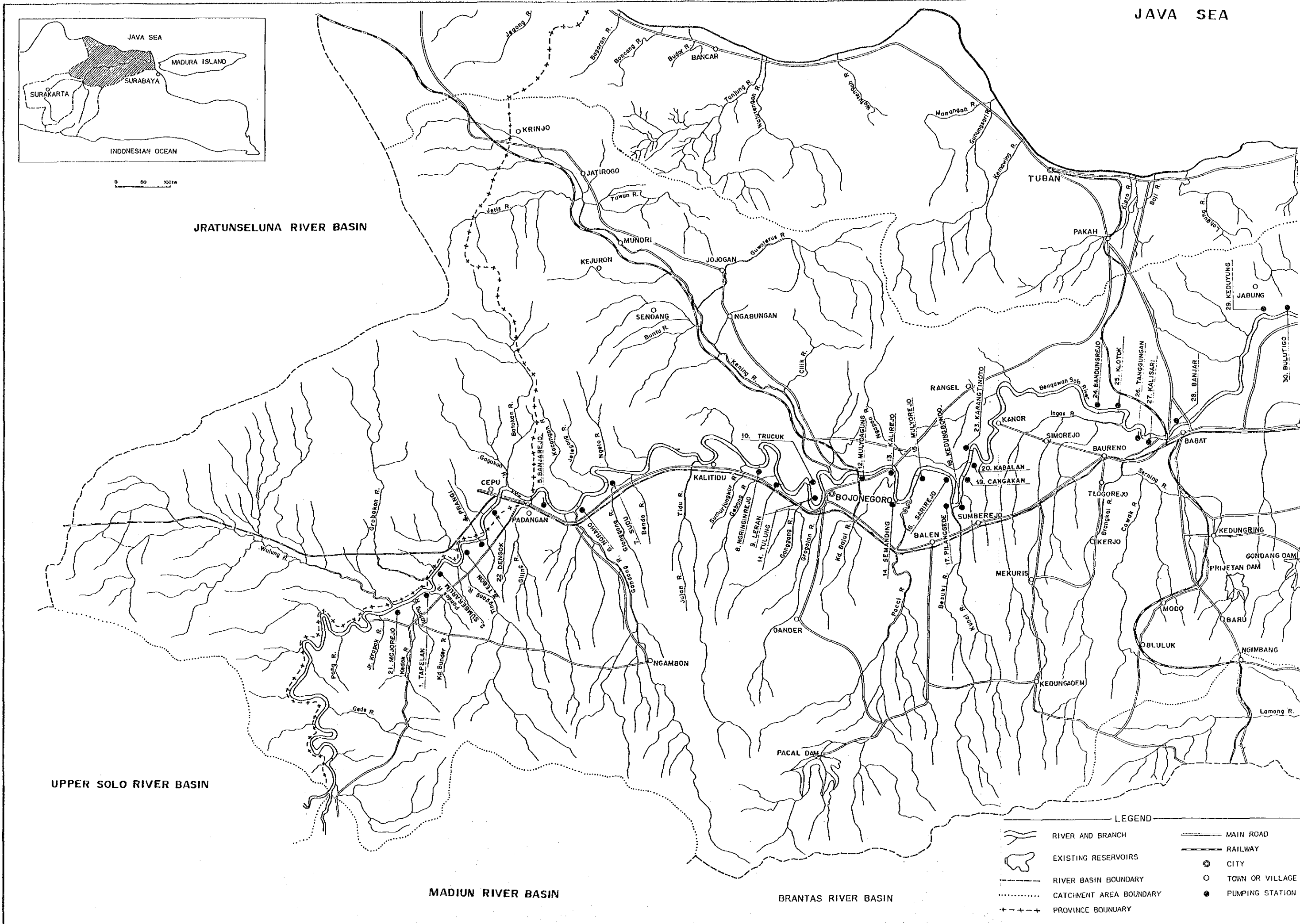


JRATUNSELUNA RIVER BASIN

UPPER SOLO RIVER BASIN

MADIUN RIVER BASIN

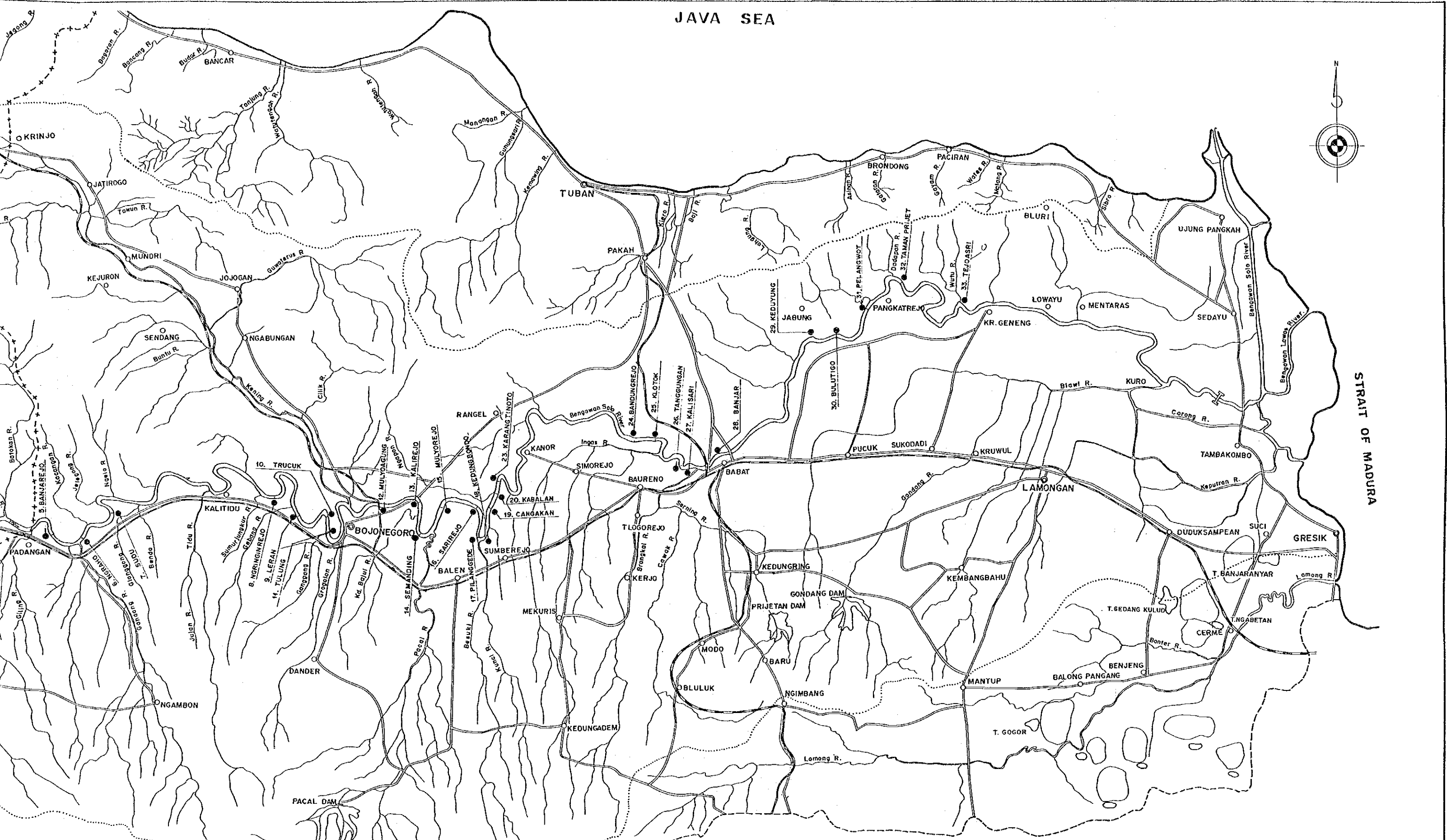
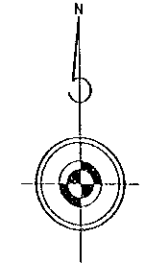
BRANTAS RIVER BASIN



LEGEND

- RIVER AND BRANCH
- EXISTING RESERVOIRS
- RIVER BASIN BOUNDARY
- CATCHMENT AREA BOUNDARY
- PROVINCE BOUNDARY
- MAIN ROAD
- RAILWAY
- CITY
- TOWN OR VILLAGE
- PUMPING STATION

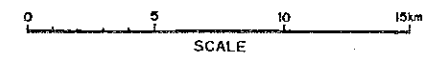
JAVA SEA



STRAIT OF MADURA

LEGEND

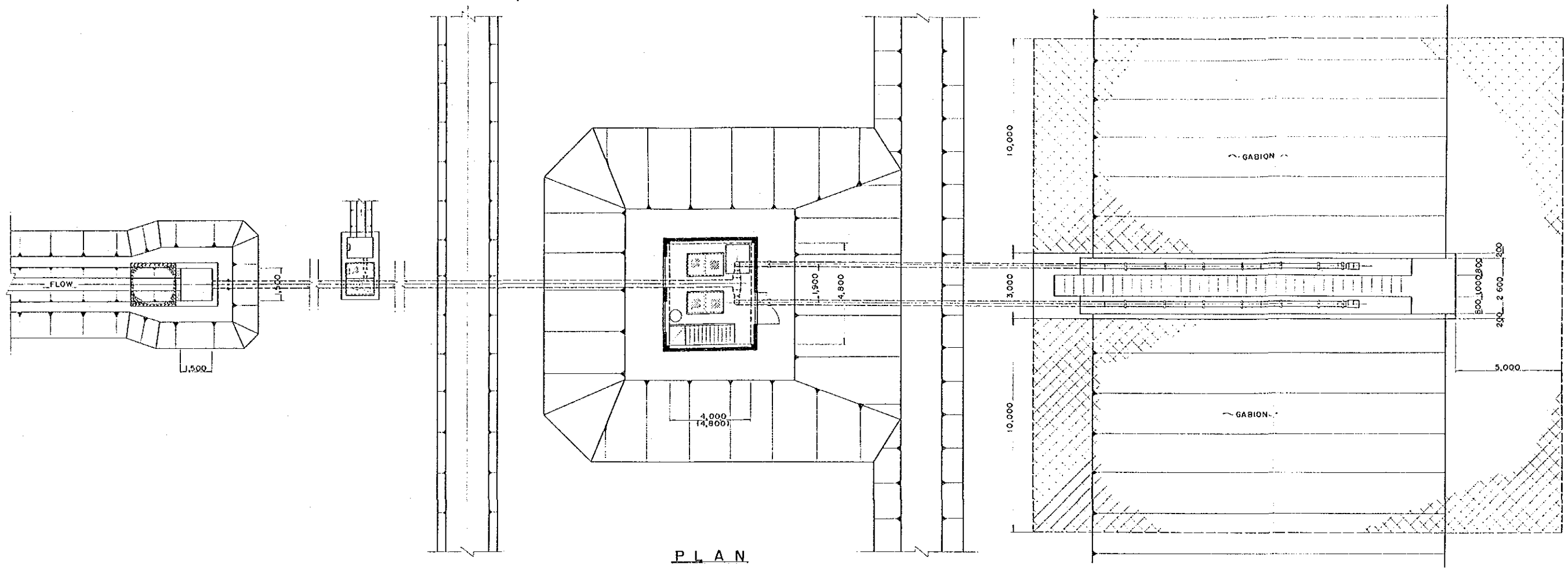
	RIVER AND BRANCH		MAIN ROAD
	EXISTING RESERVOIRS		RAILWAY
	RIVER BASIN BOUNDARY		CITY
	CATCHMENT AREA BOUNDARY		TOWN OR VILLAGE
	PROVINCE BOUNDARY		PUMPING STATION



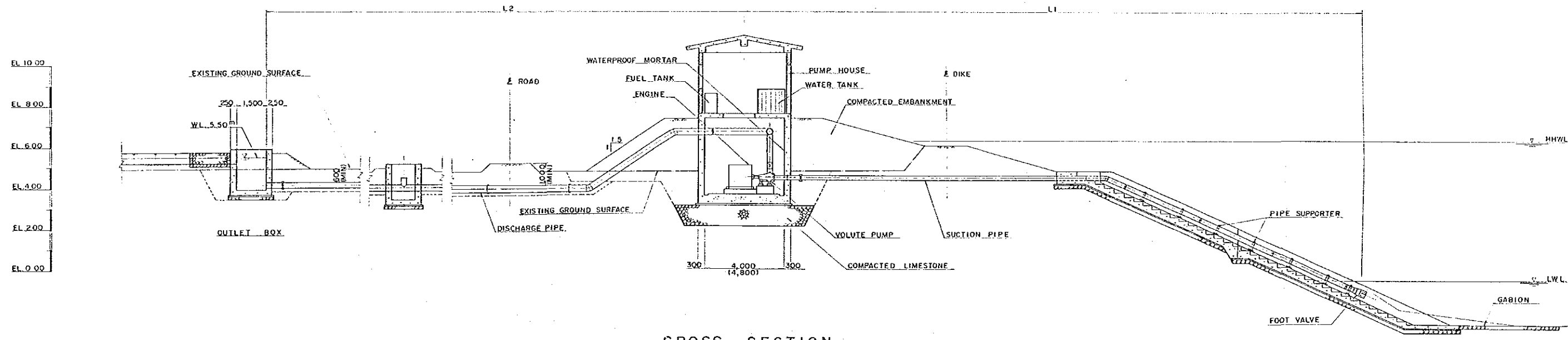
GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLO LOWER REACHES	
TITLE OF DRAWING LOCATION ON THE PUMPING STATION	PLATE No. 1
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

ER BASIN

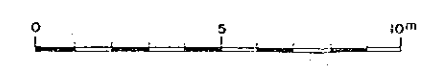
BRANTAS RIVER BASIN



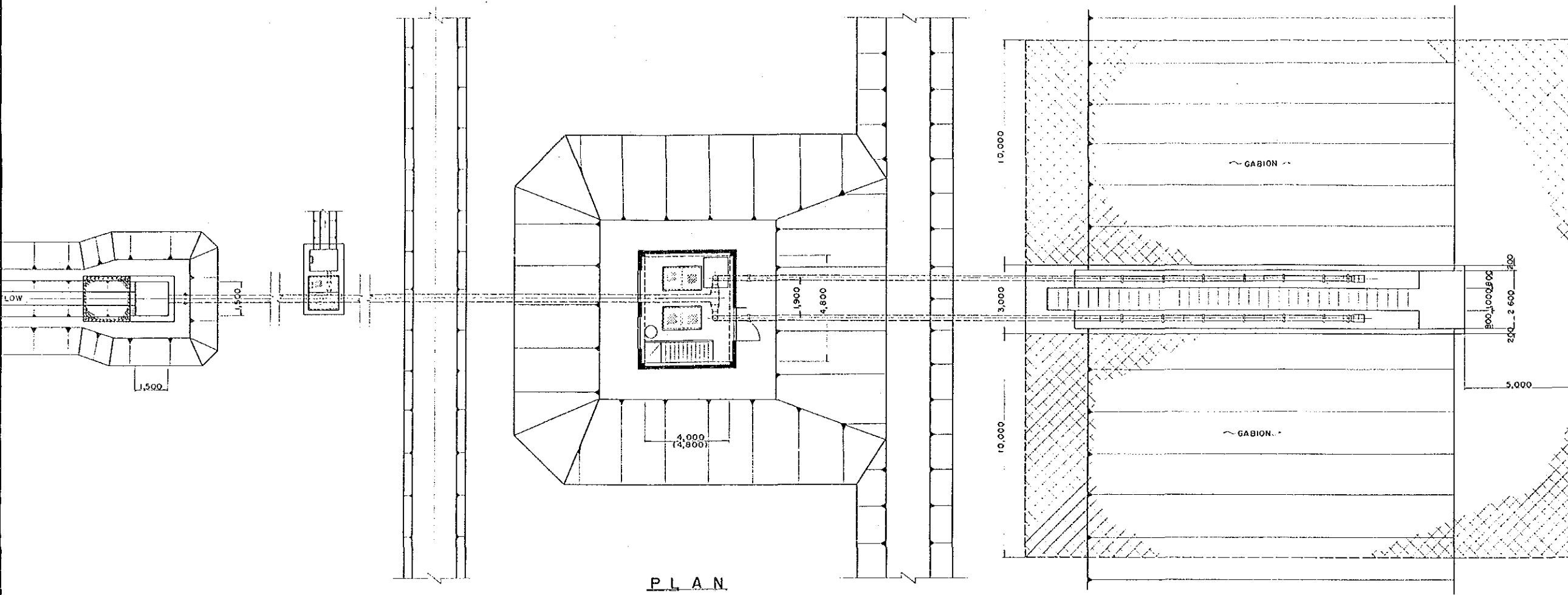
P L A N



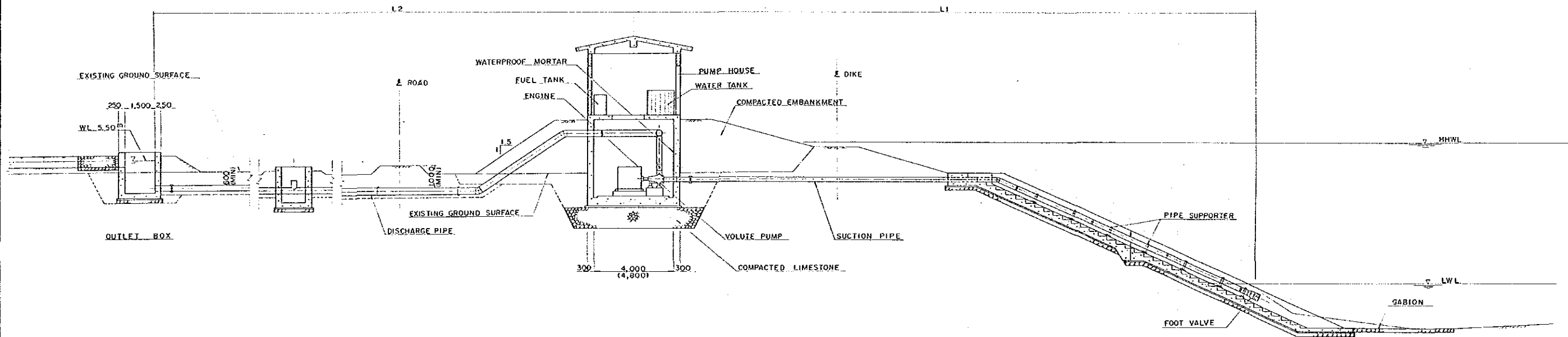
C R O S S S E C T I O N



GOVERNMENT OF THE REPUBLIC OF INDONESIA
 MINISTRY OF PUBLIC WORKS AND INFRASTRUCTURE
 DIRECTORATE GENERAL OF WATER RESOURCES AND CONSTRUCTION
 PUMPING STATION PROJECT FOR BENGLI
 TITLE OF DRAWING :
 GENERAL PLAN OF PUMPING STATION
 JAPAN INTERNATIONAL COOPERATION AGENCY



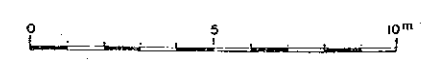
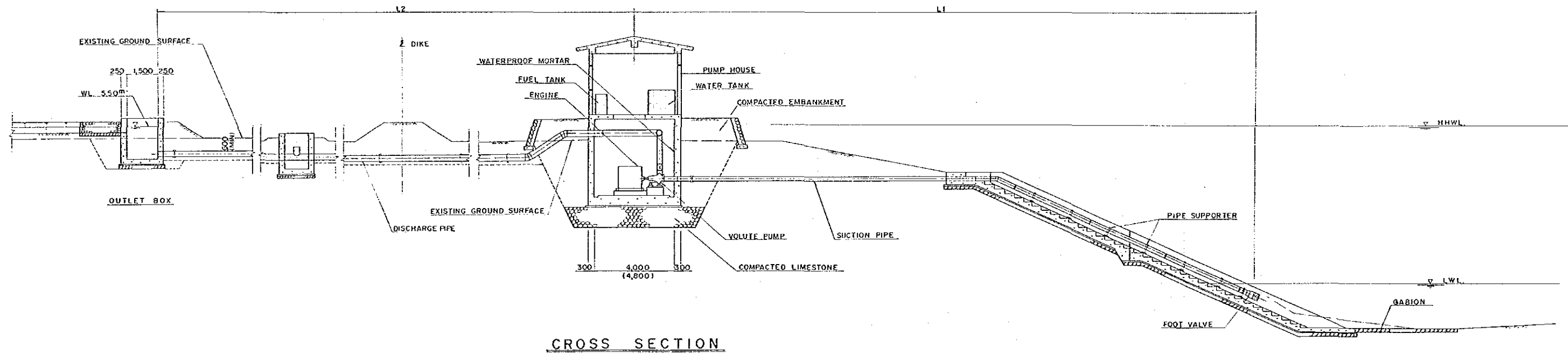
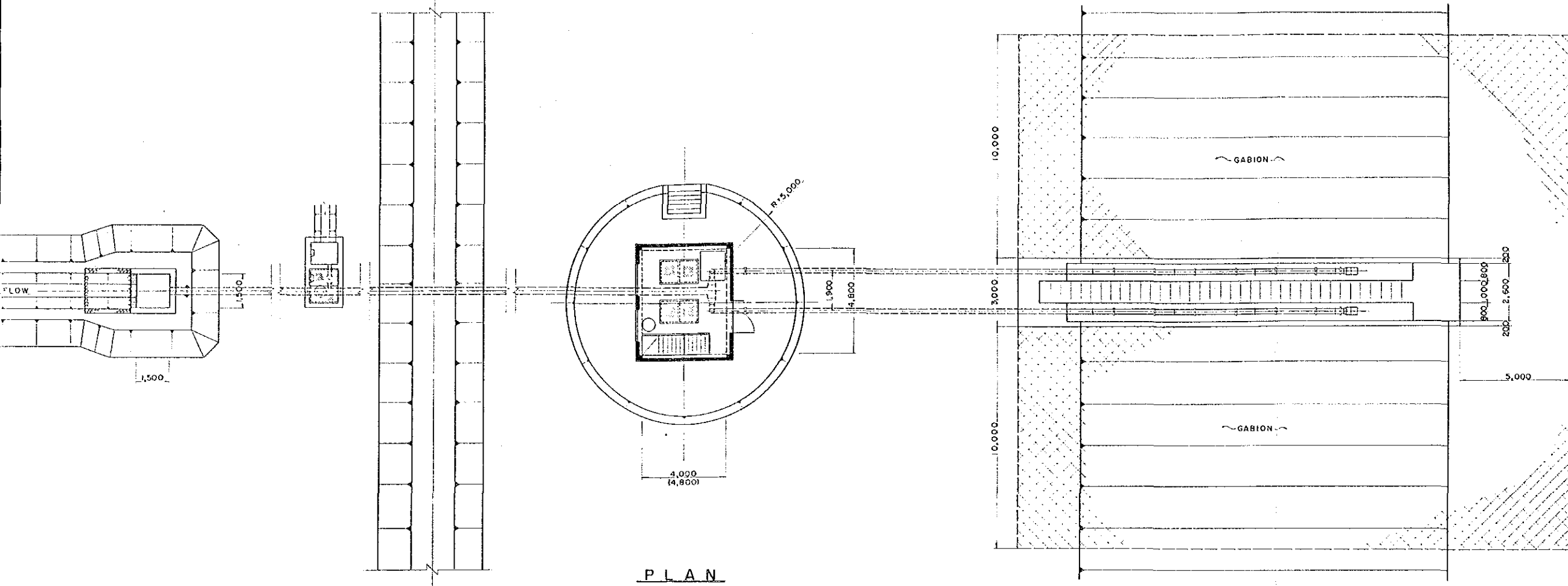
PLAN



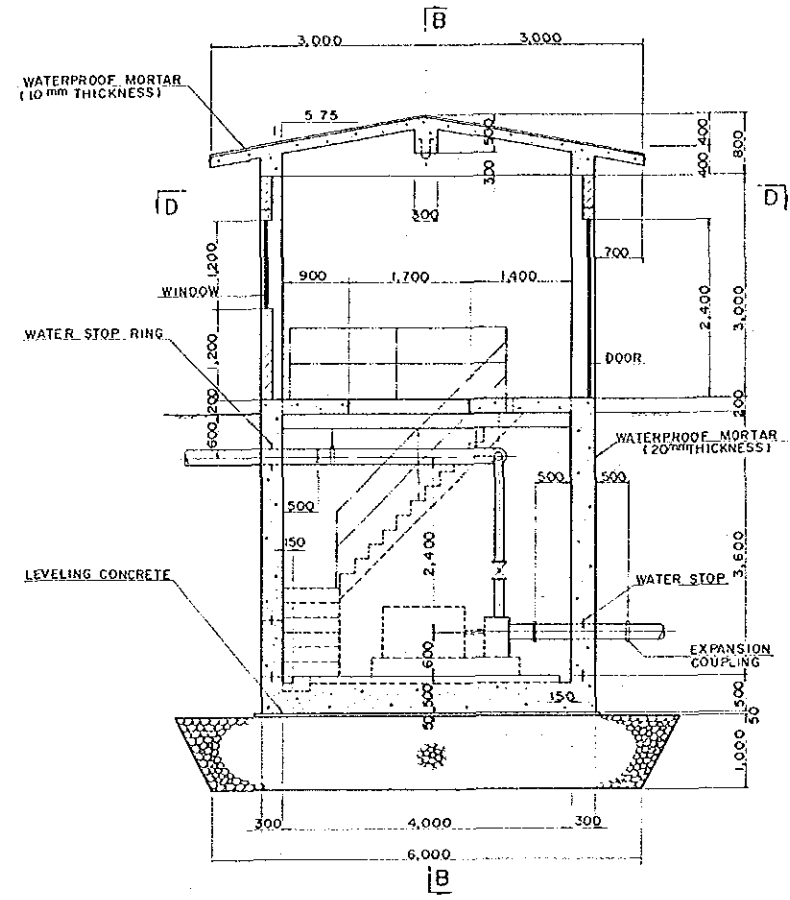
CROSS SECTION



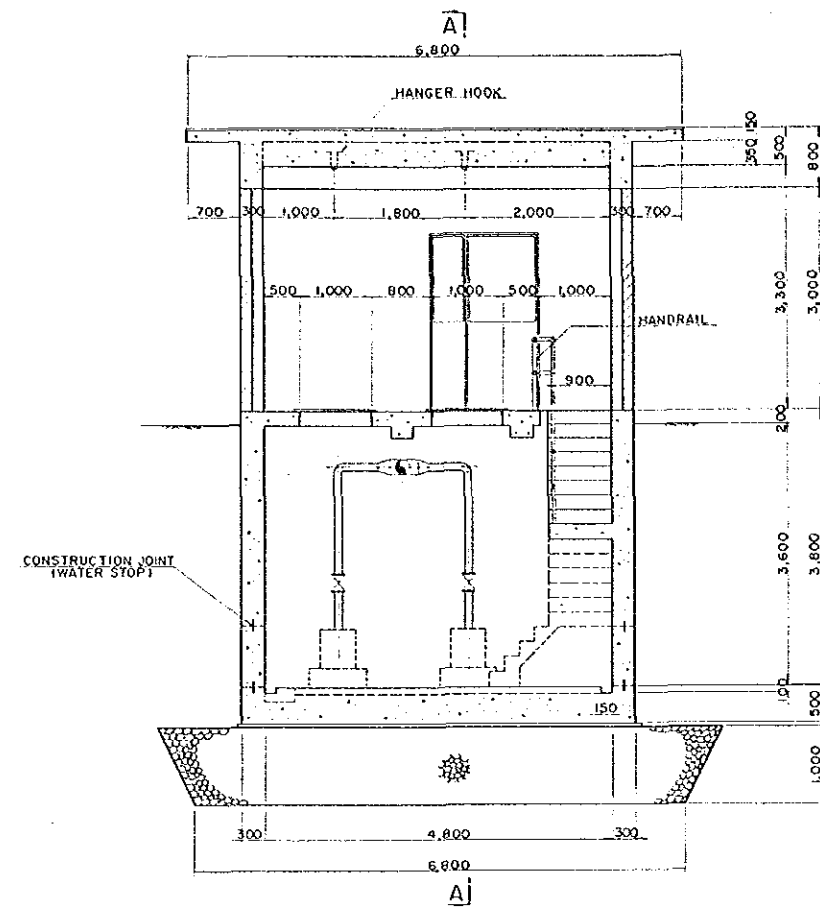
GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLO LOWER REACHES	
TITLE OF DRAWING: GENERAL PLAN OF PUMPING STATION (1)	PLATE NO. 2
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	



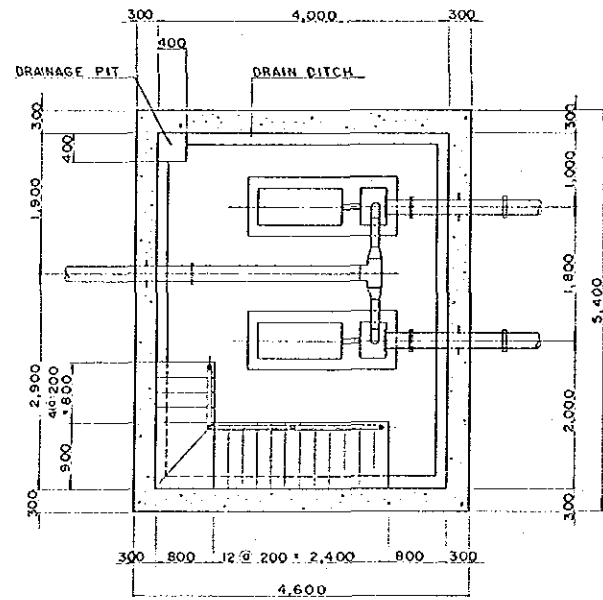
GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLO LOWER REACHES	
TITLE OF DRAWING : GENERAL PLAN OF PUMPING STATION (2)	PLATE NO. 3
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	



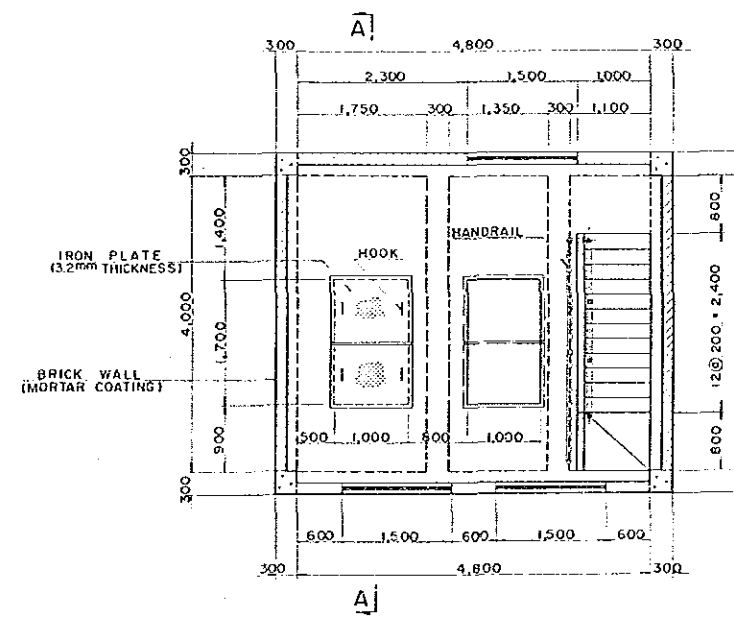
CROSS SECTION OF PUMP STATION (A - A)



CROSS SECTION OF PUMP STATION (B - B)



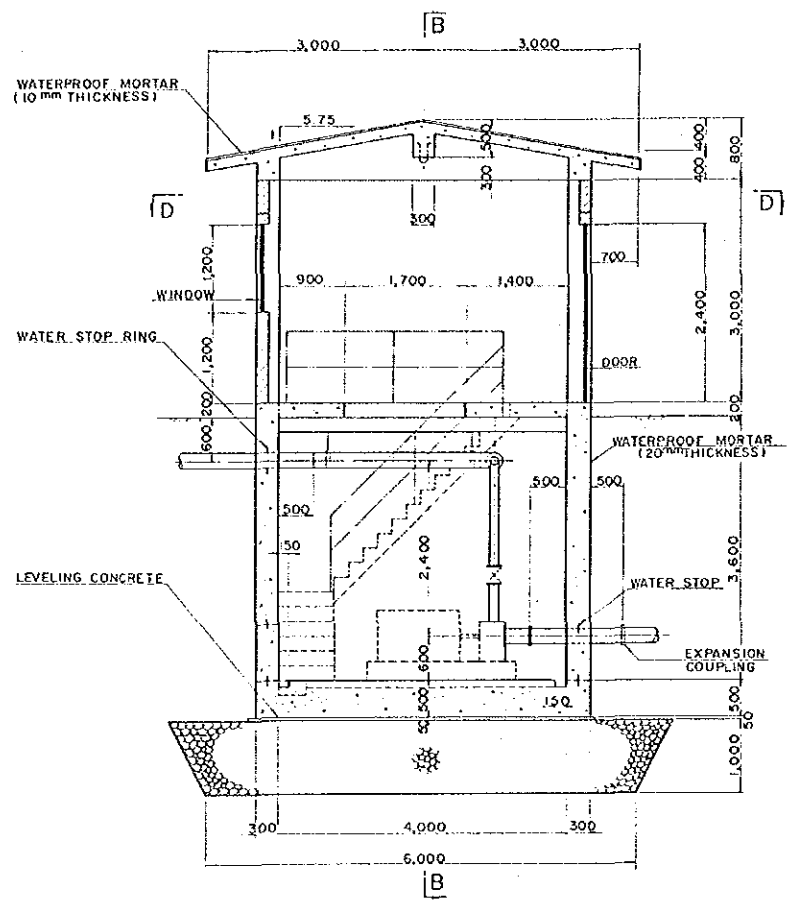
SECTION C - C



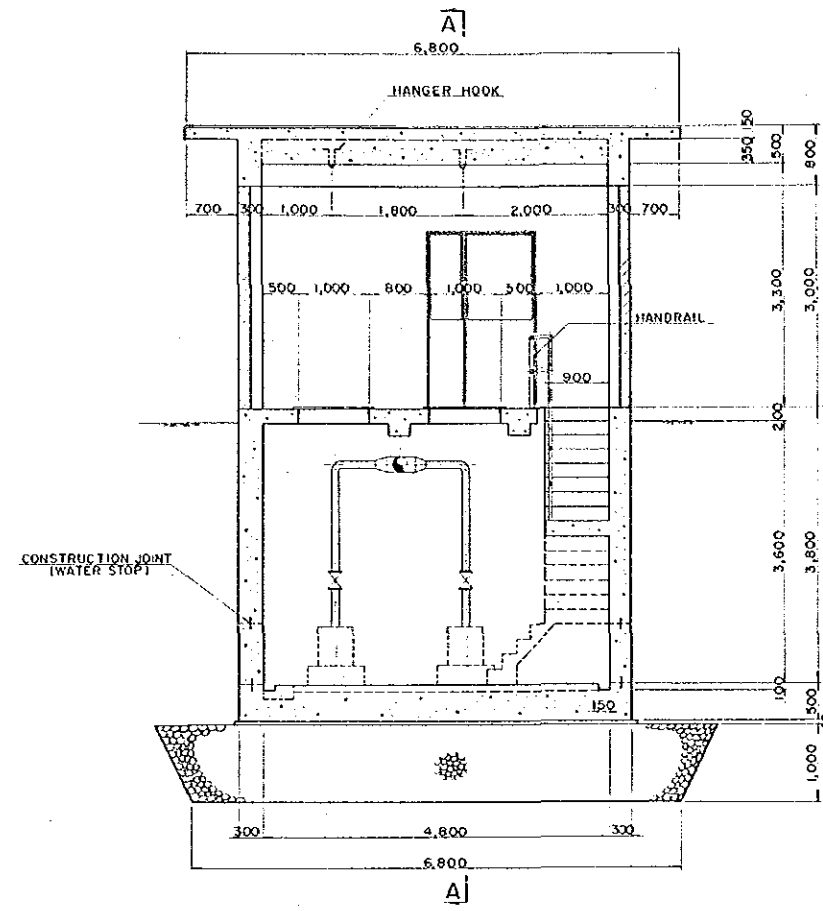
SECTION D - D



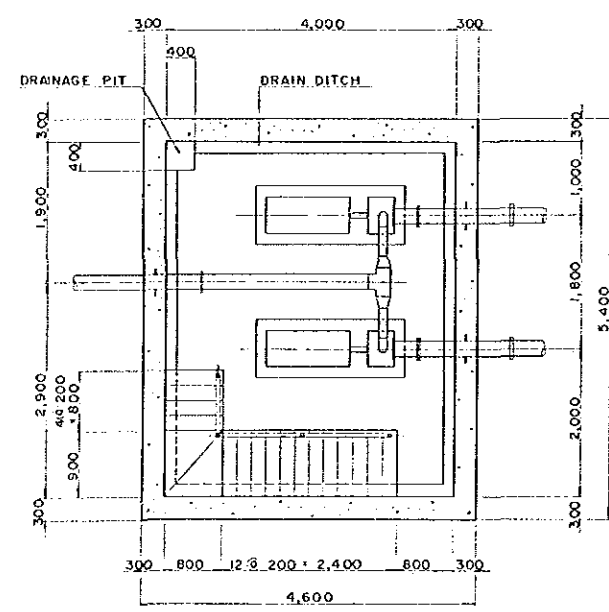
GOVERNMENT OF THE REP
 MINISTRY OF PUBL
 DIRECTORATE GENERAL OF WATE
 PUMPING STATION PROJECT FOR BE
 TITLE OF DRAWING :
 GENERAL PLAN OF PUMPING
 JAPAN INTERNATIONAL COOPER



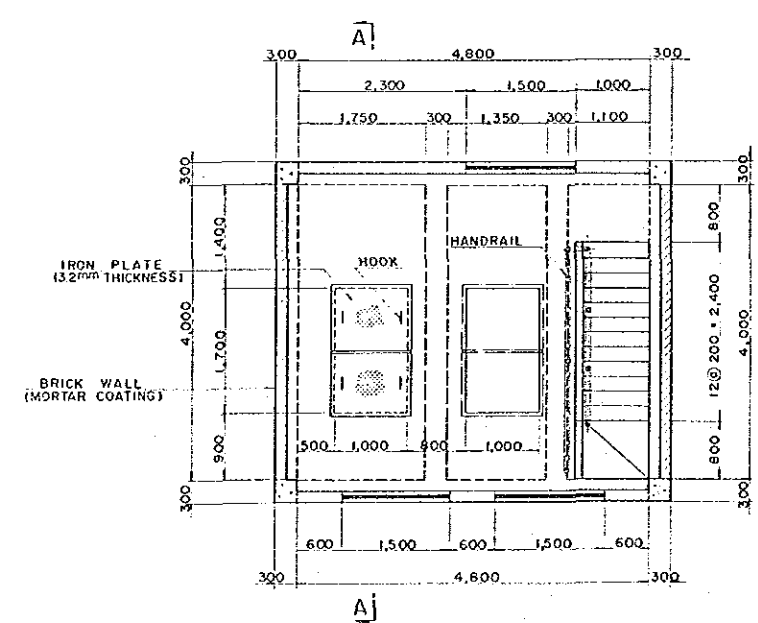
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CROSS SECTION OF PUMP STATION (B - B)



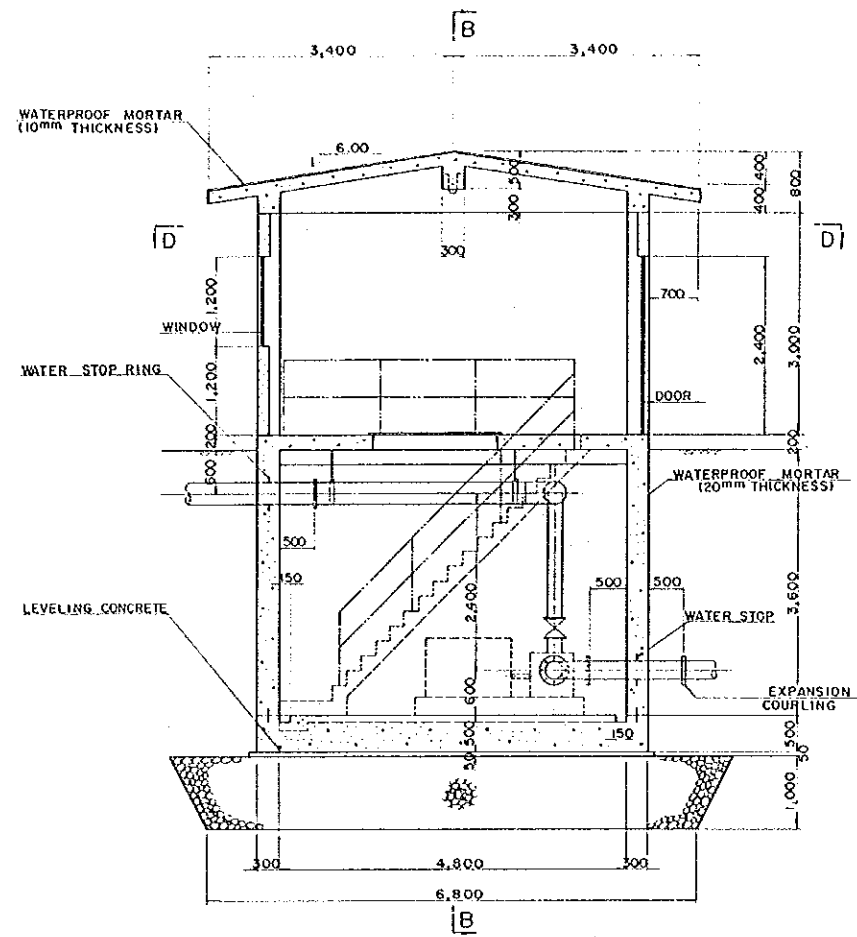
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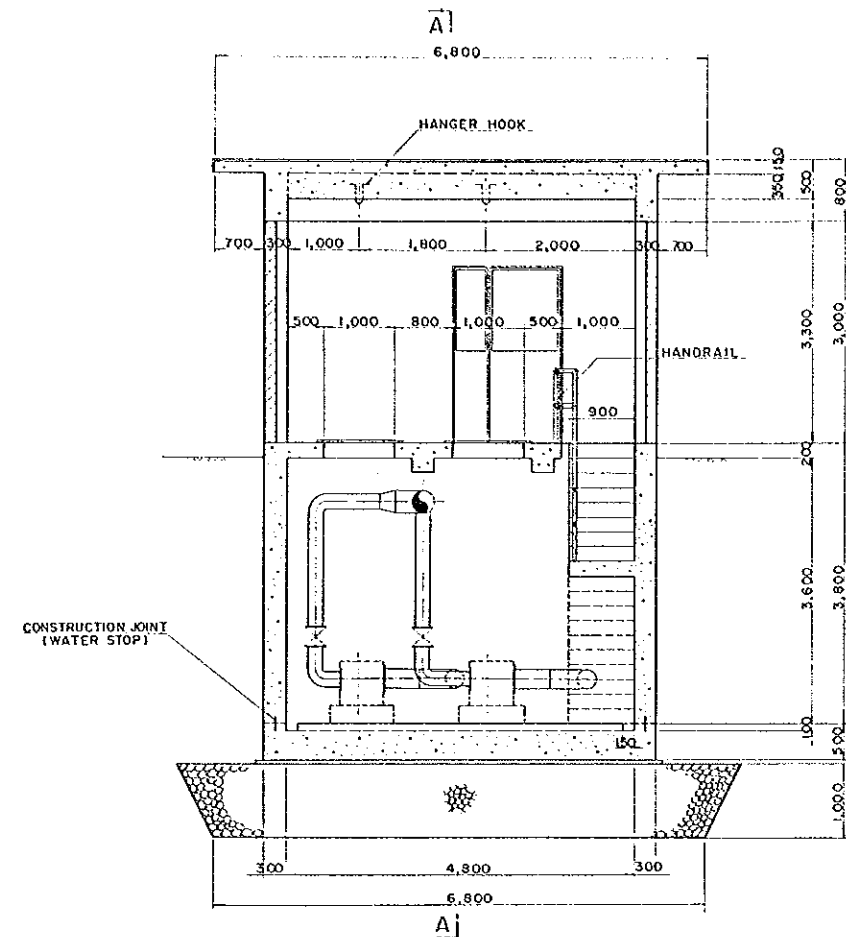
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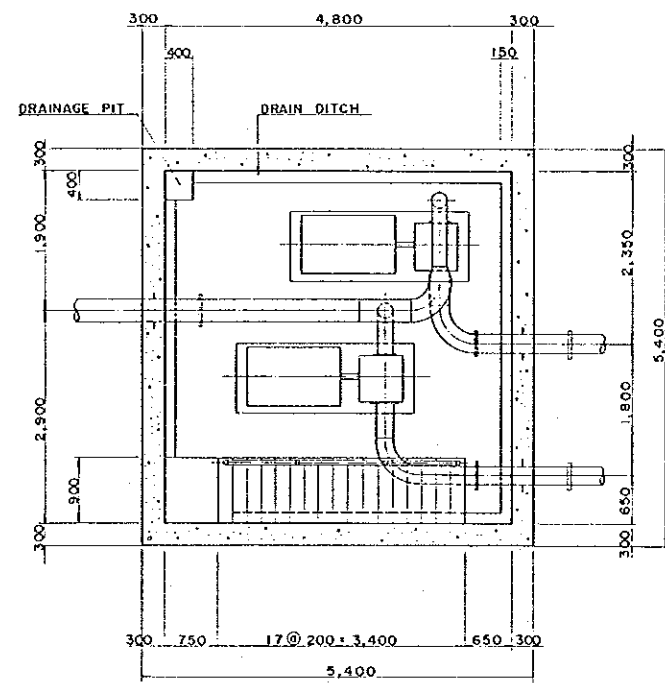
GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLO LOWER REACHES	
TITLE OF DRAWING: GENERAL PLAN OF PUMPING STATION (3)	PLATE NO. 4
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	



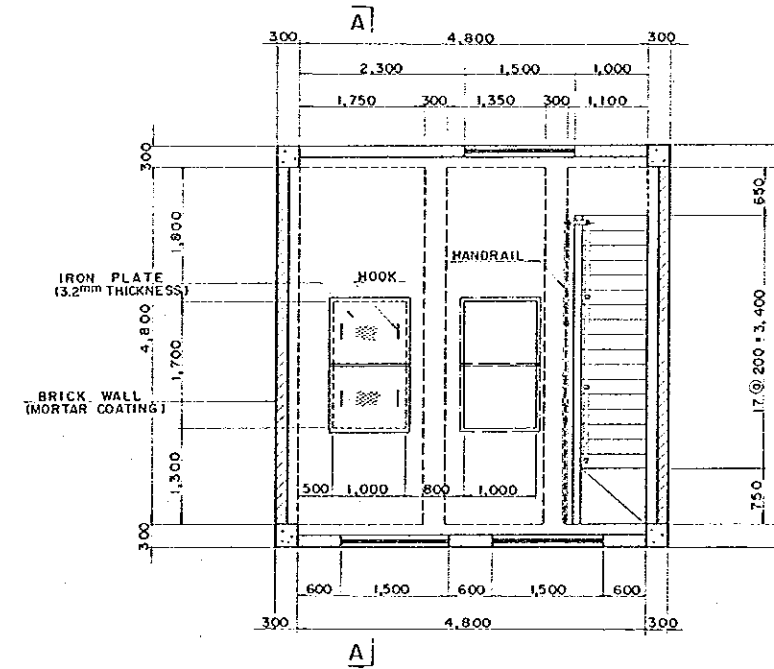
CROSS SECTION OF PUMP STATION (A - A)



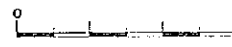
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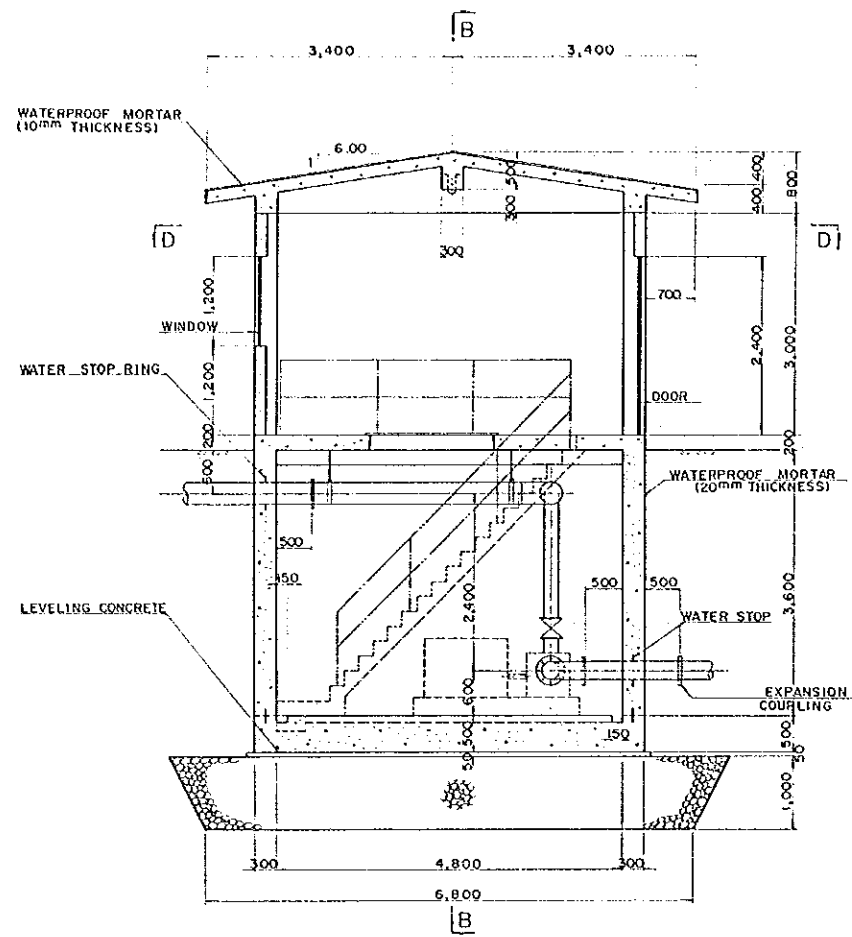
SECTION C - C



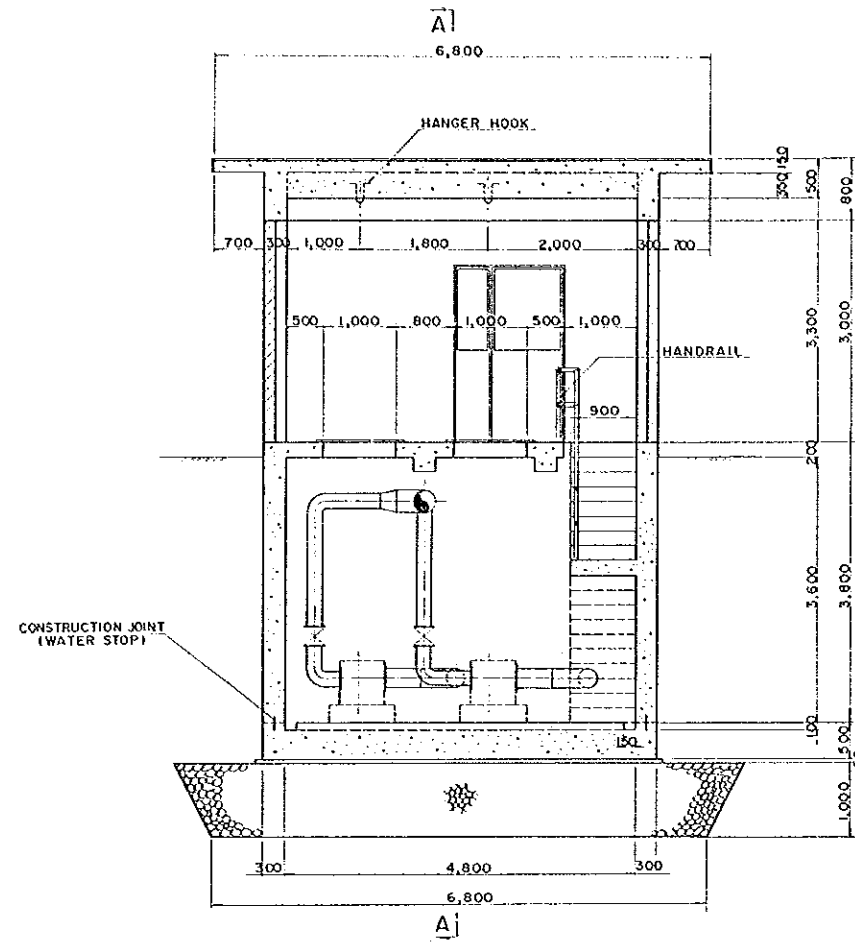
SECTION D - D



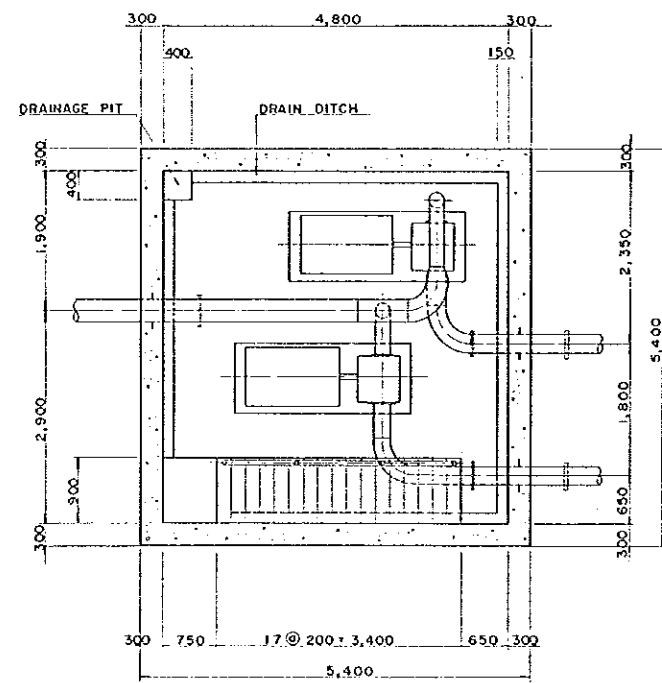
GOVERNMENT OF THE REPUBLIC OF JAPAN
 MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER SUPPLY AND SEWERAGE
 PUMPING STATION PROJECT FOR BEIJING
 TITLE OF DRAWING :
 GENERAL PLAN OF PUMPING STATION
 JAPAN INTERNATIONAL COOPERATION AGENCY



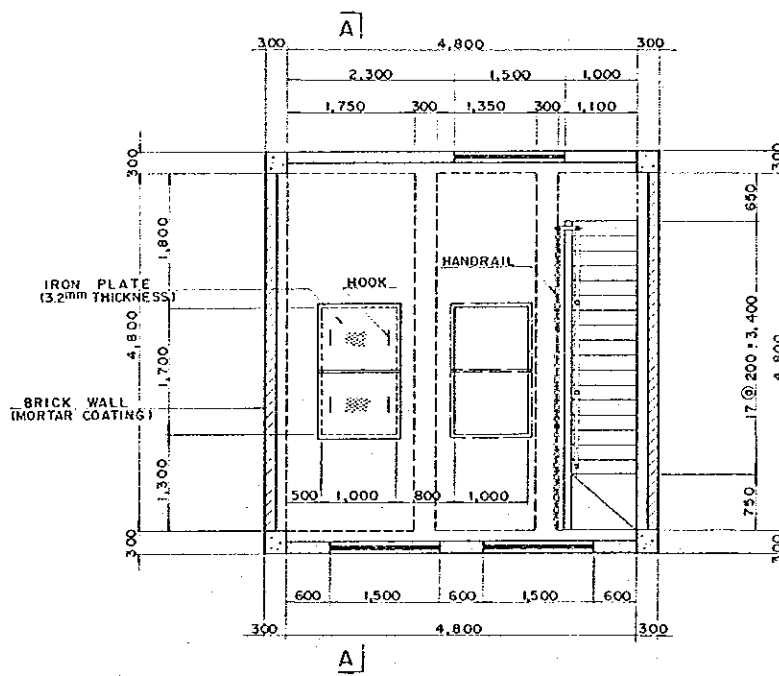
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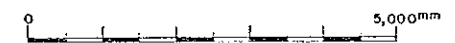
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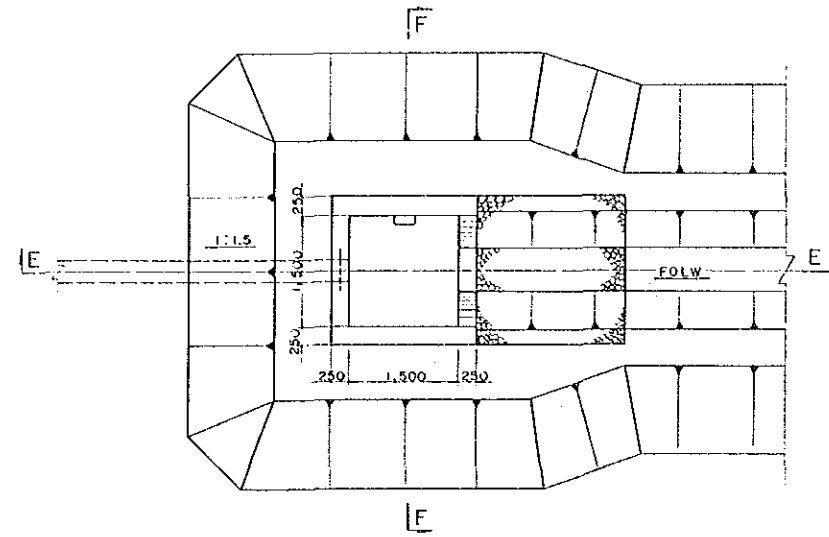
SECTION C - C



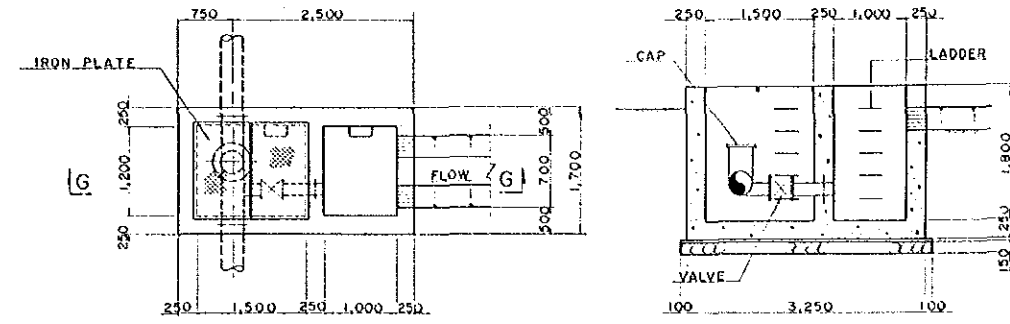
SECTION D - D



GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLO LOWER REACHES	
TITLE OF DRAWING : GENERAL PLAN OF PUMPING STATION (4)	PLATE NO. 5
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	

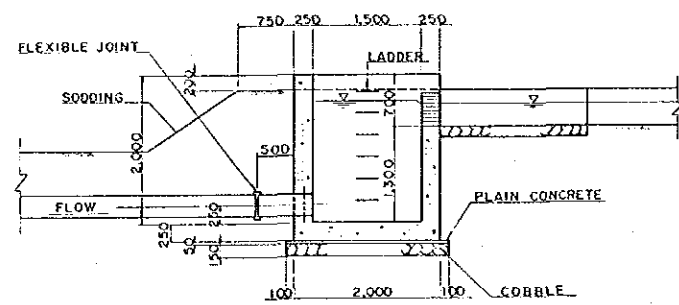


OUTLET BOX

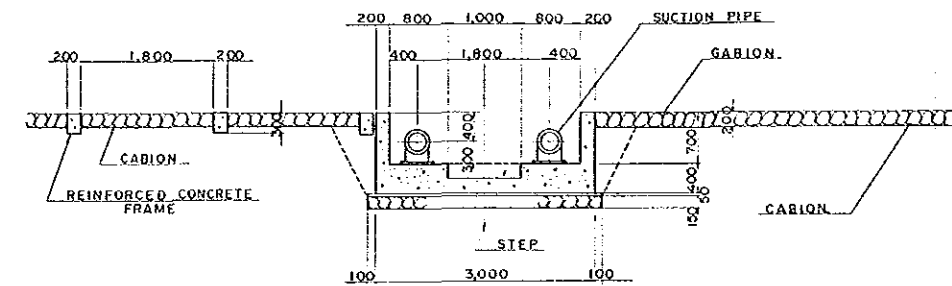


MAINTENANCE BOX

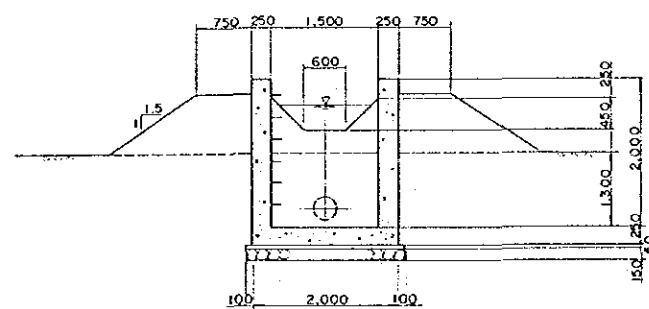
SECTION G-G



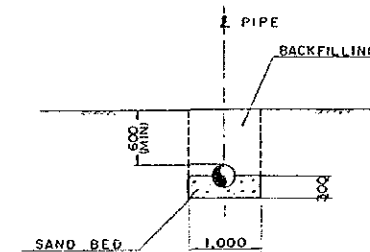
SECTION E-E



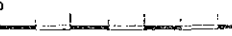
TYPICAL SECTION OF INTAKE STRUCTURE



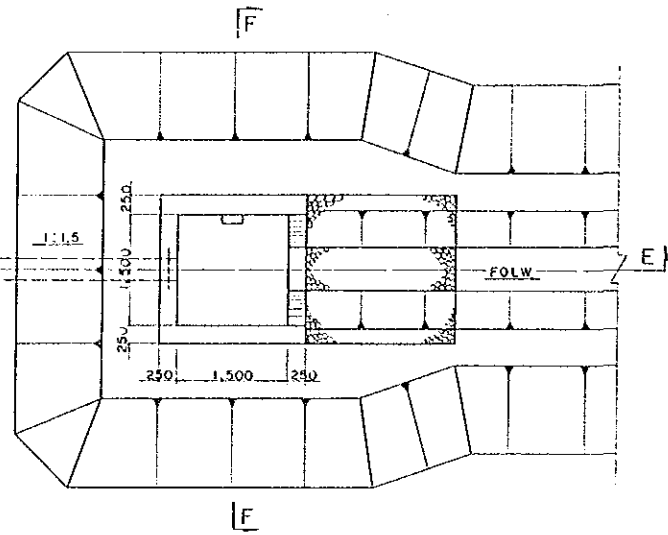
SECTION F-F



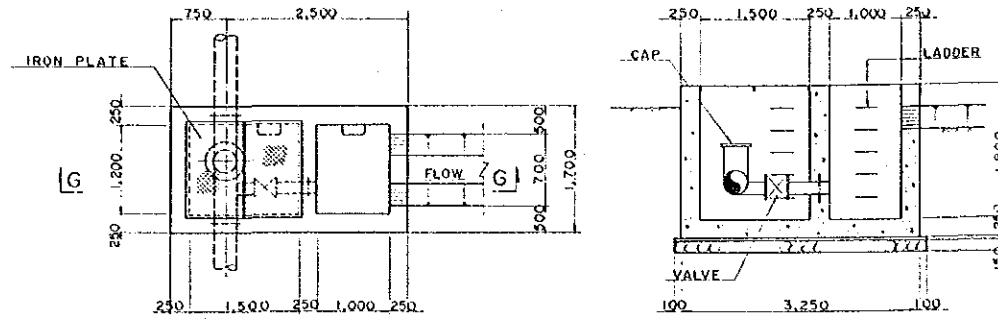
TYPICAL SECTION OF PIPELINE



GOVERNMENT OF THE REPUBLIC OF BENIN
 MINISTRY OF PUBLIC WORKS AND INFRASTRUCTURE
 DIRECTORATE GENERAL OF WATER RESOURCES
 PUMPING STATION PROJECT FOR BENIN
 TITLE OF DRAWING:
 GENERAL PLAN OF OUTLET, MAINTENANCE BOX AND PIPELINE
 JAPAN INTERNATIONAL COOPERATION AGENCY

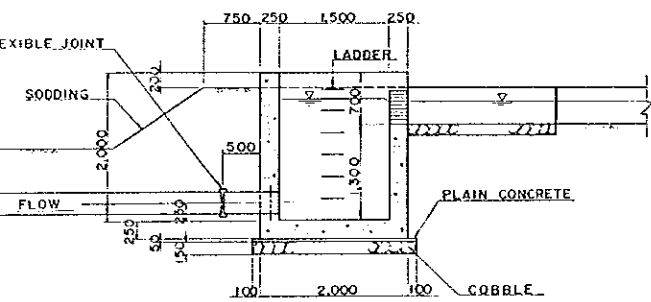


OUTLET BOX

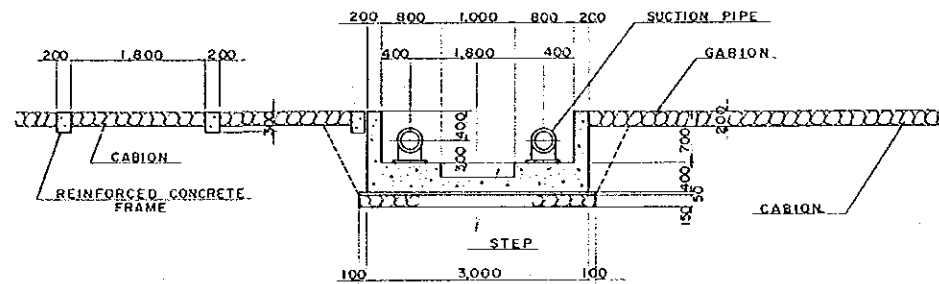


MAINTENANCE BOX

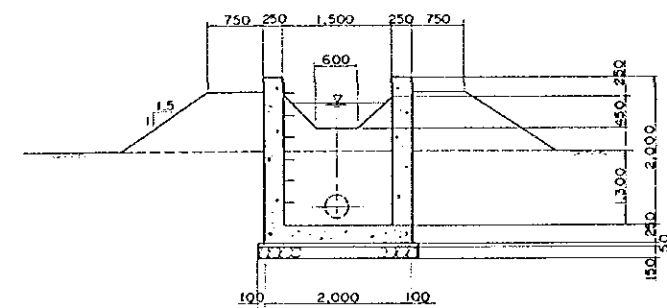
SECTION G-G



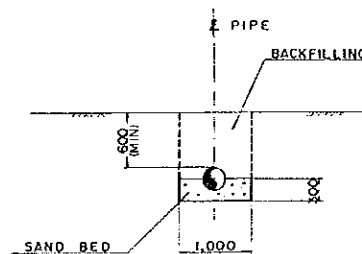
SECTION E-E



TYPICAL SECTION OF INTAKE STRUCTURE



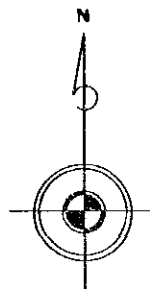
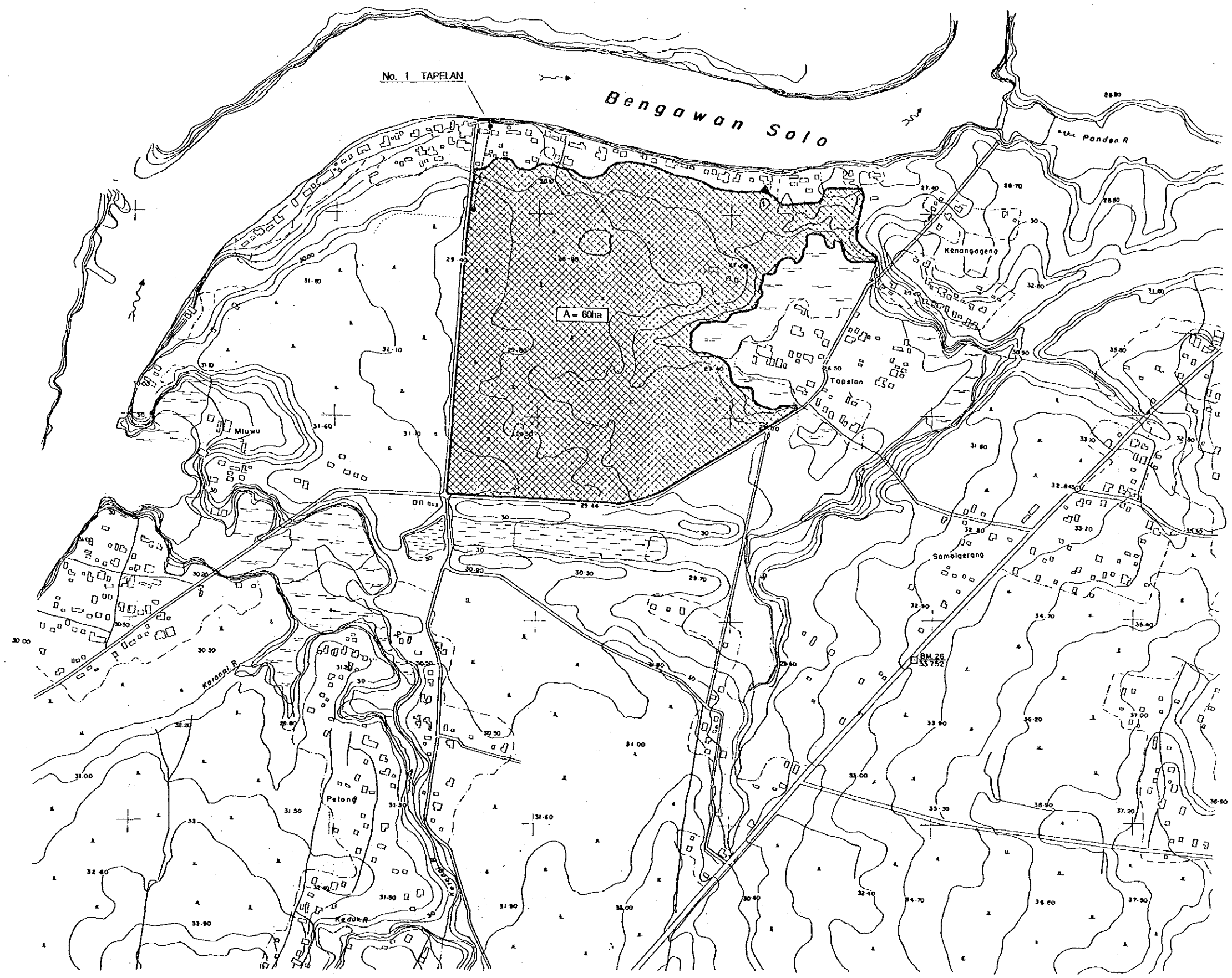
SECTION F-F



TYPICAL SECTION OF PIPELINE

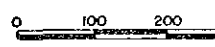


GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLO LOWER REACHES	
TITLE OF DRAWING: GENERAL PLAN OF OUTLET, MAINTENANCE BOX AND PIPELINE	PLATE NO. 6
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	



LEGEND

- : Control P
- : Bench M
- : Road (L)
- : Path (L)
- - - : Foot Path
- - - : Rice Field
- ~ : Swamp
- ~ : Canal
- ~ : River
- ~ : Branch R.
- ▨ : Village
- ▨ : Rice Field
- v v : Plantation
- 6 : Trees
- : House

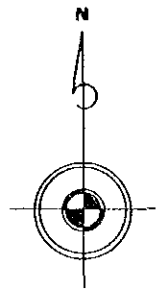
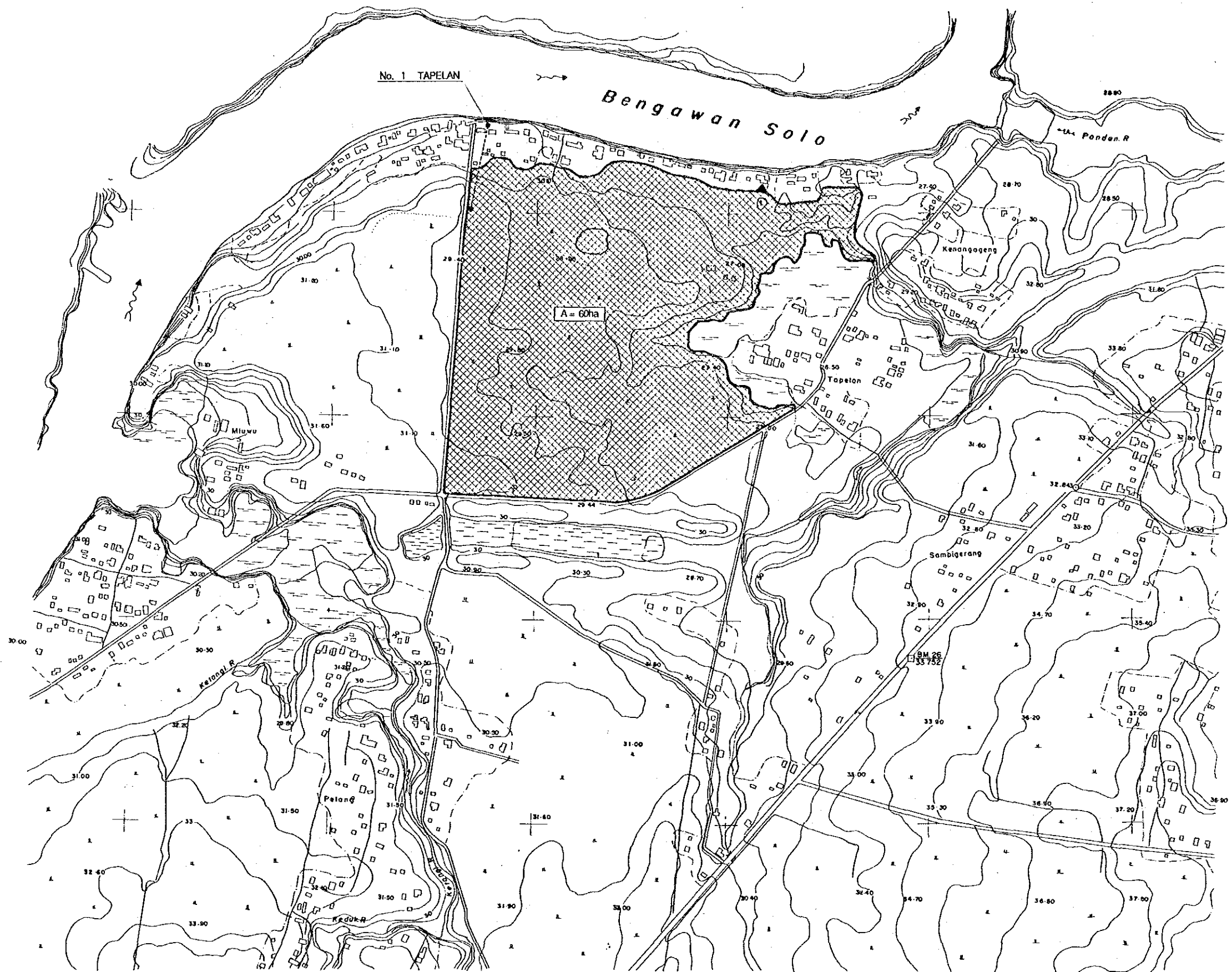


GOVERNMENT OF THE REPUBLIC OF INDONESIA
 MINISTRY OF PUBLIC WORKS AND INFRASTRUCTURE
 DIRECTORATE GENERAL OF WATER RESOURCES

PUMPING STATION PROJECT FOR BEN

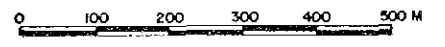
TITLE OF DRAWING :
 LOCATION MAP OF EXISTING
 (TAPELAN)

JAPAN INTERNATIONAL COOPERATION AGENCY

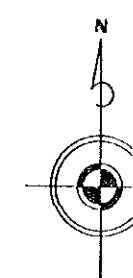


LEGEND

- : Control Point (CP)
- : Bench Mark (BM)
- : Road (2m)
- - - : Path (1-2m)
- - - : Foot Path
- - - : Rice Field Boundary (Raised path)
- ~ : Swamp
- ~ : Canal
- ~ : River
- ~ : Branch River
- ▨ : Village
- ▨ : Rice Field
- V V : Plantation
- ⊕ : Trees
- : House



GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLO LOWER REACHES	
TITLE OF DRAWING : LOCATION MAP OF EXISTING PUMP NO.1 (TAPELAN)	PLATE NO. 7
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	



LEGEND

- Control Poi
- Banch Ma
- Road 12m
- - - Path 11-2
- - - Foot Path
- - - Rice Field
- ~ Swamp
- ~ Canal
- ~ River
- ~ Branch Riv
- ▨ Village
- ▨▨ Rice Field
- ▽▽ Plantation
- ♣ Trees
- House

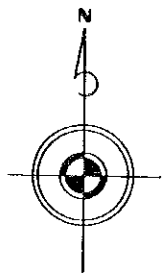
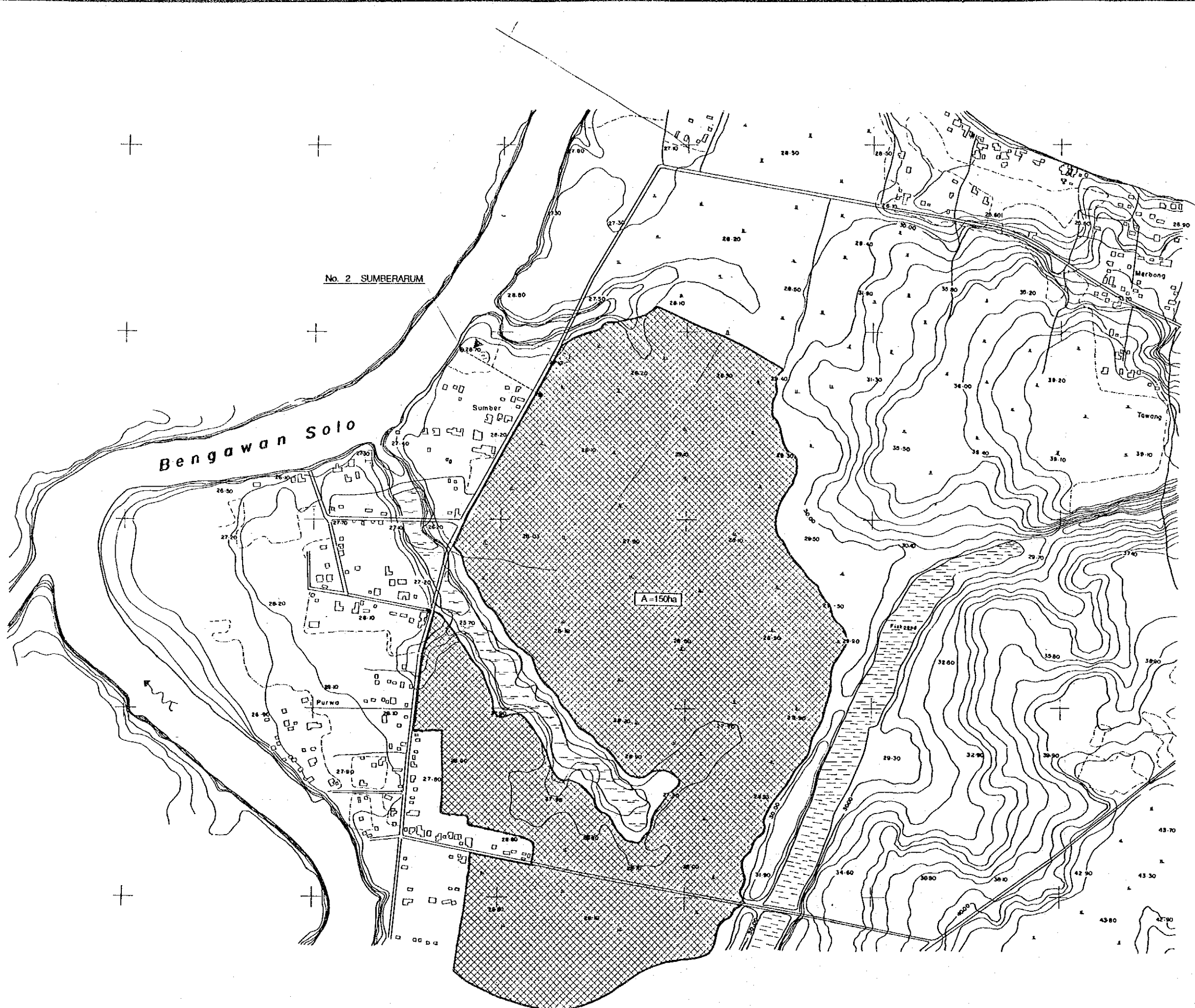


GOVERNMENT OF THE REPUBLIC
 MINISTRY OF PUBLIC
 DIRECTORATE GENERAL OF WATER

PUMPING STATION PROJECT FOR BENG

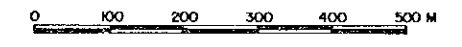
TITLE OF DRAWING :
 LOCATION MAP OF EXISTING
 (SUMBERARUM)

JAPAN INTERNATIONAL COOPERAT

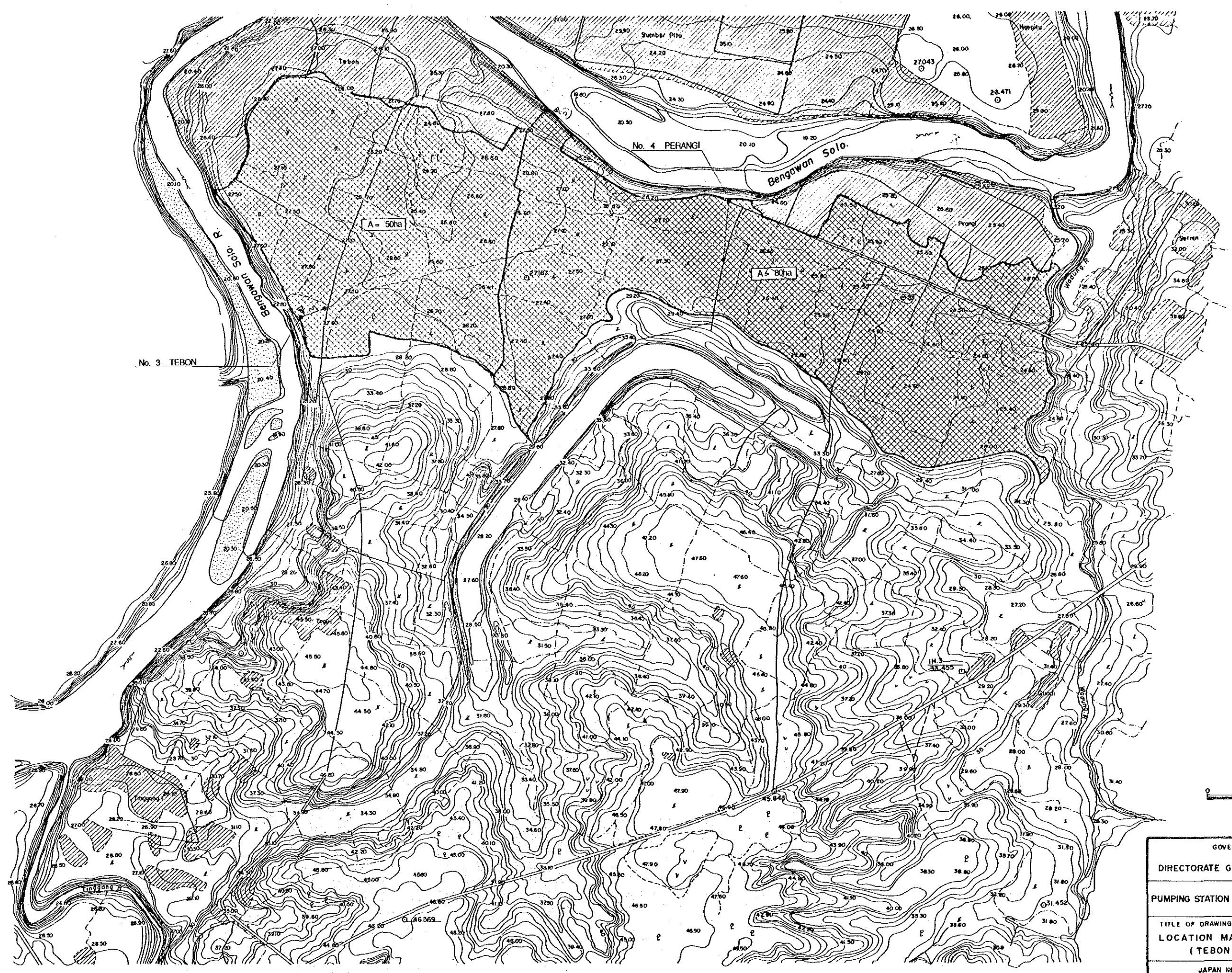


LEGEND

- Control Point (CP)
- Bench Mark (BM)
- Road (2m)
- Path (1-2m)
- - - Foot Path
- - - Rice Field Boundary (Raised path)
- ▨ Swamp
- Canal
- River
- Branch River
- ▨ Village
- ▨ Rice Field
- ∇ Plantation
- ♣ Trees
- House



GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLD LOWER REACHES	
TITLE OF DRAWING : LOCATION MAP OF EXISTING PUMP NO.2 (SUMBERARUM)	PLATE NO 8
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	



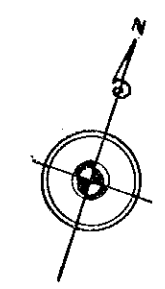
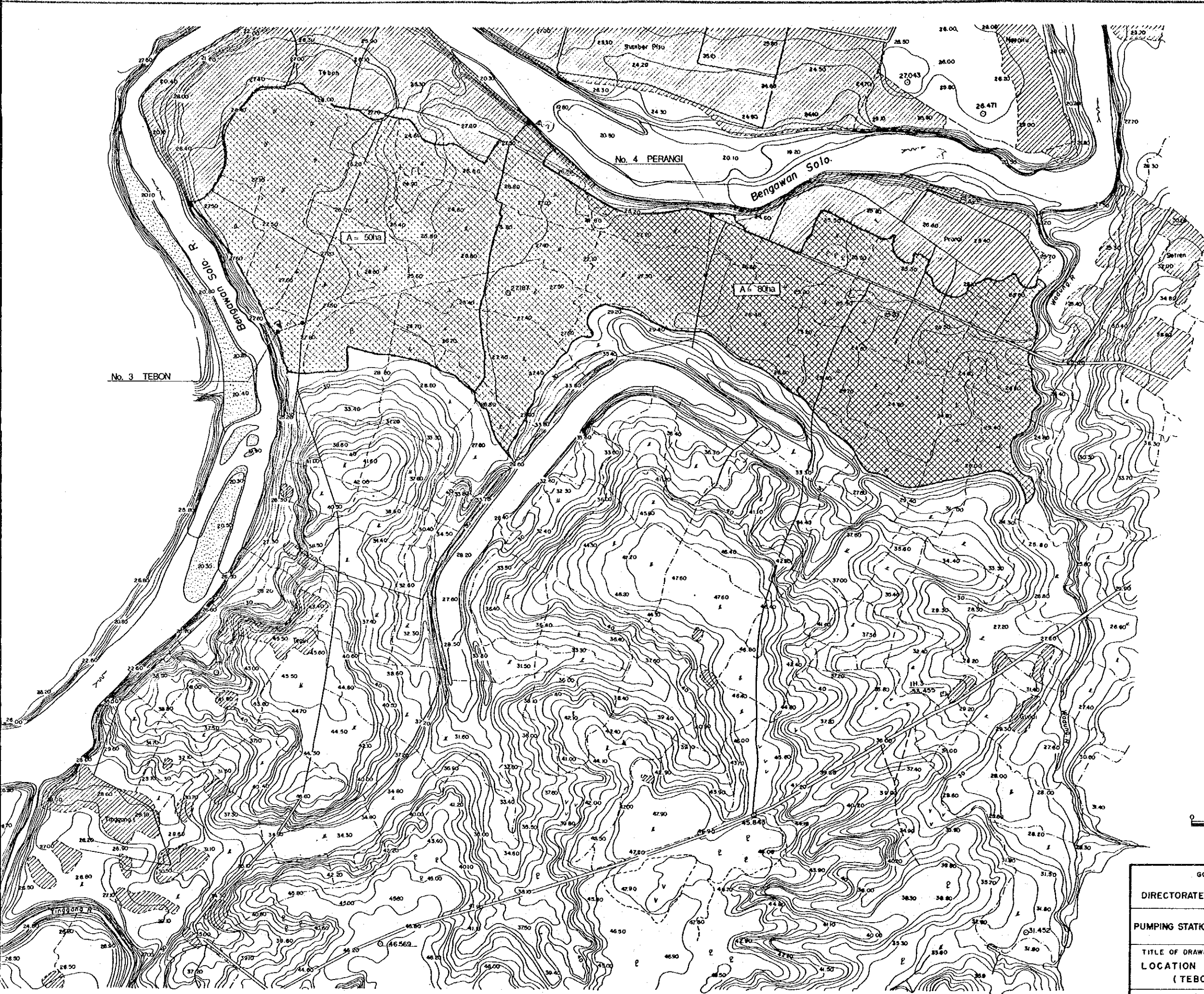
- LEGE**
- : Cc
 - : Bo
 - : Re
 - : Pa
 - - - : Fo
 - - - : Ri
 - - - : S
 - - - : Cc
 - - - : Ri
 - - - : Bra
 - ▨ : Vill
 - ▨ : Ric
 - V V : Pla
 - : Tre
 - : Mo

GOVERNMENT OF THE REPUBLIC
 MINISTRY OF PUBLIC
 DIRECTORATE GENERAL OF WATER

PUMPING STATION PROJECT FOR BENG

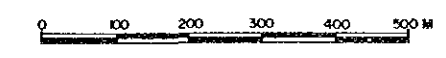
TITLE OF DRAWING :
 LOCATION MAP OF EXISTING
 (TEBON) PUMP NO.4 (I

JAPAN INTERNATIONAL COOPERAT



LEGEND

- : Control Point (CP)
- : Bench Mark (BM)
- : Road (2m)
- - - : Path (1-2m)
- - - : Foot Path
- - - : Rice Field Boundary (Raised path)
- ~ : Swamp
- ~ : Canal
- ~ : River
- ~ : Branch River
- ▨ : Village
- ▨ : Rice Field
- V V : Plantation
- ♂ : Trees
- : House



GOVERNMENT OF THE REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT	
PUMPING STATION PROJECT FOR BENGAWAN SOLO LOWER REACHES	
TITLE OF DRAWING : LOCATION MAP OF EXISTING PUMP NO.3 (TEBON) PUMP NO.4 (PRANGI)	PLATE NO. 9
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	