REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

JENEBERANG RIVER FLOOD CONTROL PROJECT (PHASE

EXECUTIVE SUMMARY

MARCH 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

P R E F A C E

In response to the request of the Government of the Republic of Indonesia, the Japanese Government decided to conduct a feasibility study on the Jeneberang River Flood Control Project (Phase II) and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Indonesia a study team headed by Mr. Katsuhisa Abe, CTI Engineering Co.,Ltd. from February to August, 1981.

The team exchanged views with the officials concerned of the Government of the Republic of Indonesia and conducted a field survey in the Jeneberang river basin. After the team returned to Japan, further studies were made and the present report has been prepared.

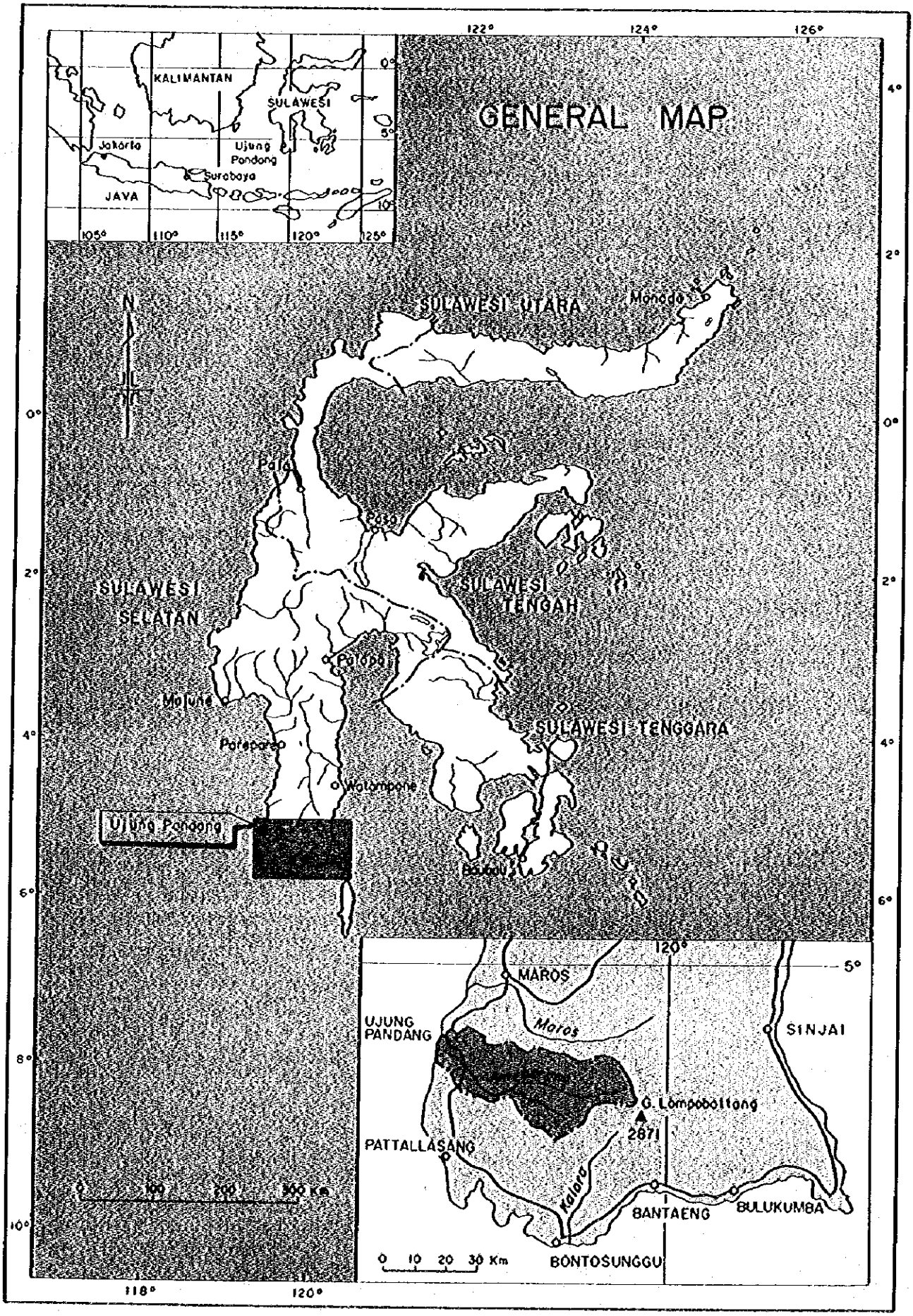
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

March, 1982

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency


GENERAL MAP
KALIMANTAN
SULAWESI
Jakarta
Ujung Pandang
Surabaya
JAVA
105°
110°
115°
120°
125°
122°
124°
126°
SULAWESI UTARA
Manado
Palu
Poso
SULAWESI TENGAH
SULAWESI SELATAN
Palopo
Majene
Parepare
Watampone
SULAWESI TENGGARA
Ujung Pandang
Bau-Bau
MAROS
UJUNG PANDANG
Maros
SINJAI
G. Lompobattang
2871
PATTALLASANG
Kalaro
BANTAENG
BULUKUMBA
BONTOSUNGGU
0 10 20 30 Km
0 100 200 300 Km
N

View of the Bili-Bili Dam and Reservoir

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CHAPTER I CONCLUSION

The Jeneberang River Flood Control Project (Phase II) has been formulated in order to mitigate flood damage and also to develop water resources toward municipal and industrial water, irrigation as well as hydro power generation.

As a result of this detailed study, it has been concluded that the Project is technically feasible and economically viable with 14.8% of the internal rate of return.

CHAPTER II PROJECT DESCRIPTION

2.1 General

Ujung Pandang city, the capital city of the South Sulawesi Province, has a population of over 700,000, and has been developing as a center of East Indonesia.

Ujung Pandang city and its surrounding area suffer from flood damage every year due in part to an insufficient flow capacity of the Jeneberang river and in part to a poor drainage capacity. On the other hand, they are seriously under shortage of municipal and industrial waters, and irrigation water during dry seasons. As for power availability in the project area, its demand is remarkably increasing with the progress of the city development.

To cope with the above-mentioned problems, the project consisting of flood control, municipal and industrial water supply, irrigation water supply and power generation has been formulated in this study.

A multipurpose dam, a core of the project, is planned at the 31 km point (Bili-Bili) away from the Jeneberang river mouth to achieve the desired objectives as mentioned below.

The flooding water will be controlled to protect Ujung Pandang city from flood damage, by the proposed dam and the improved river channel, then safely flown down to the down stream. Municipal and industrial water will be secured by the dam to a satisfactory degree. The proposed dam will also contribute greatly to increment of rice production and power generation.

2.2 Dam and Reservoir

The proposed Bili-Bili dam site is located in the middle reaches of the Jeneberang river. The dam is composed of a main dam and right and left wing dams, all of which are of rock-fill type with a center core.

The Bili-Bili reservoir has a total storage capacity of 362 x $10^6 m^3$ and a total effective capacity of 304 x $10^6 m^3$. A capacity of 46 x $10^6 m^3$ will be allocated for flood control. This capacity is able to regulate 1,300 m^3/s out of 2,400 m^3 at the dam site. The remaining capacity of 258 x $10^6 m^3$ can be utilized as water resources of vested right water supply, municipal/industrial water supply and irrigation water supply.

A spillway having a double free flow section with two regular gates will be constructed between the main dan and the left wing dam. In case the discharge happens to surpass 500 m^3/s, they will be completely opened so that the benefitted area may be free from flooding damages due to misoperation of the gate.

An intake is constructed on the bank of the reservoir. The intake water flows down to the power station for generation. The tail water from the station is divided at the division point for the respective supply purposes; municipal and industrial water, irrigation water and vested right water supplies. For suspention of the power operation, a jet flow gate (1.50 m in diameter) will be installed to supply the water for the benefitted area. In addition, an emergency discharge facilities with gate of 2.00 m in a diamter will be installed in order to lower the reservoir water level for inspection and maintenance in case of emergency.

A land of 1,591 ha shall be acquired and 790 houses shall be evacuated due to implementation of the project.

2.3 Flood Control

The flooding water of the river will be controlled by the proposed impounding reservoir and the river improvement work. By using the proposed flood control capacity of the reservoir, the design discharge of 3,700 m^3/s at Kampili and Sungguminasa sites will be regulated to 2,300 m^3/s, which corresponds to 50-year return period.

The proposed stretch of the river to be improved in this project extends approximately 20 km from the estuary to Kampili. Below Sungguminasa, the improved river channel will be able to confine a discharge of 2,300 m^3/s. Between Sungguminasa and Kanpili, only a low water channel will be provided, and the bankful discharge in this section is estimated at 1,300 m^3/s, which corresponds to a 8-year return period.

The proposed longitudinal profiles are 1/1,200 in the upper reaches of the Sungguminasa bridge and 1/1,900 in its lower reaches.

Compound cross-section is employed for the river improvement works below the Sungguminasa brigde. The cross-section has a low water channel with a flow capacity of 900 m^3/s, which corresponds to 1.5-year return period. River widths above and below Sungguminasa are 162 m and 313 m, respectively.

The low-lying section of Jl. Malino (3 km in distance) in the upper reaches of the Sungguminasa bridge will be raised so as to prevent flood water from flowing into Ujung Pandang city.

The Garassi river which flows into the Jeneberang river at the 0.8 km point will be directly drained to the sea by constructing a diversion channel which runs for about 800 m in parallel to the dike of the Jeneberang.

Riparian structures such as revetments, groynes and groundsills, are proposed in the plan to assure the stability and safety of the proposed river channel.

The land to be acquired and the houses to be evacuated for the river improvement are estimated at 98 ha and 230 nos., respectively.

2.4 Municipal and Industrial Water

Considering the future program of the increasing water demand, the target year of water supply has been fixed in the year of 2000. The water demand in 2000 is estimated at 3,500 l/s, out of which 2,300 l/s has been determined to be secured by the Bili-Bili reservoir.

The municipal and industrial water will be conveyed through a ductile cast-iron pipe with a diameter of 1,500 mm for 25 km from Bili-Bili to the treatment plant. In this stretch, regulating basin and twelve junction wells (at the interval of 1-3 km) will be installed to steadily convey the water.

2.5 Irrigation

The irrigation water developed by the proposed dam will be supplied to the existing irrigation area to achieve the prompt outcome.

In the project area exist two irrigation systems; namely, Bili-Bili system with a benefitted area of 5,000 ha and Kampili system with a benefitted area of 19,000 ha.

The project will enable 19,200 ha out of 24,000 ha to be irrigated even in dry season.

For the purpose of equal distribution of the production output and the resulted wealth, the available irrigation water is distributed to the Kampili and Bili-Bili systems in proportion of its respective area.

Irrigable area, in dry seasons, of the Kampili system is 15,200 ha, while that of the Bili-Bili system is 4,000 ha.

In wet seasons, the irrigation water is steadily be supplied to the benefitted area of 24,000 ha.

In the Kampili system, the narrow section of the main channel of 2,500 m in length, and the secondary and the related facilities are to be improved.

In the Bili-Bili system, a new intake is constructed, and a new connecting channel of 1,500 meters in length will be constructed linking the existing irrigation channel to the intake. The main, secondary and related facilities are also to be improved.

2.6 Hydro Power

The hydro power station is constructed at the immediately down-stream toe of the main dam on the left bank. The generation method is of run-of-river type. The generated output is 11,200 kw in power capacity, and the annual generated energy is 69,600 MWH. Power generating equipment consist 2 units of Kaplan type turbine with the installed capacity of 5,600 kw each, and 2 units of 3-phase vertical shaft type generator of 6,600 KVA each.

The transmission line of 30 KV in capacity links Bili-Bili station to Borongloe sub-station over the distance of 15 km along Jl. Malino on the right bank of the Jeneberang river.

2.7 Construction Schedule

The total construction period required for the execution of the project works is 14 years. The construction work will be started in 1982 and terminated in 1995. Construction schedule of each sector including the detailed design phase is given as below;

Sector	Construction Period
Dam	: April of 1983 - March of 1991
River improvement	: April of 1982 - October of 1995
Water supply	: April of 1986 - March of 1991
Irrigation	: April of 1985 - October of 1990
Hydro power	: April of 1987 - March of 1991

2.8 Project Cost

The total project cost is estimated at US$ 603.56 million, on the contract basis by using mid-1981 prices, of which US$ 298.01 million or 49% is foreign currency, and US$ 305.55 million or 51% is local currency. The project cost is classified by work item given as follows.

(x10^6 US$)

Work Item	Foreign currency	Local currency	Total
Dam and reservior	151.43	158.76	310.19
The urgent flood control plan and overall river improvement	38.77	66.18	104.95
Municipal/industrial water supply	56.91	14.79	71.70
Irrigation water supply	13.93	48.60	62.53
Power generatrion	36.97	17.22	54.19
T o t a l	298.01	305.55	603.56

2.9 Project Evaluation

Economic Cost

The total economic cost is estimated at US$ 276.43 million, which is composed of foreign currency portion of US$ 150.95 million and local currency portion of US$ 125.48 million equivalent. These costs are summarized below.

(x10^6 US$)

Work Item	Foreign currency	Local currency	Total
Dam and reservior	79.54	67.00	146.54
The urgent flood control plan and overall river improvement	17.35	21.81	39.16
Municipal/industrial water supply	28.78	6.68	35.46
Irrigation water supply	7.20	22.71	29.91
Power generatrion	18.08	7.28	25.36
T o t a l	150.95	125.48	276.43

Project Benefit

The total annual benefit of the project is estimated at US$ 47.84 million, which can be classified by sector as follows;

Purpose	Annual benefit (x 10^6 US$)
Flood control	13.0
Irrigation	31.5
Power	3.9
Negative benefit	- 0.56
T o t a l	47.84

Internal Rate of Return

Evaluation of the project was made by means of calculating Internal Rate of Return on the basis of the estimated benefit and economic cost. The Internal Rate of Return of the Jeneberang River Flood Control Project (Phase II) is calculated at 14.8%, assuming a project life of 50 years. This rate shows economic viability of the project.

The Internal Rate of Return has been further calculated for each sector based on cost estimate by purpose, which results in the following percentages.

Sector		IRR (%)
Flood control	:	14.9
Irrigation	:	15.2
Power generation	:	13.3
The Project	:	14.8

ATTACHMENT : FEATURES OF THE PROJECT

1. Dam and Reservoir

Reservoir

Design flood water level (D.F.W.L.)	EL. 102.00 m
Surcharge water level (S.W.L.)	EL. 100.30 m
Normal water level (N.W.L.)	EL. 97.60 m
Low water level (L.W.L.)	El. 74.00 m
Effective water depth (S.W.L.- L.W.L.)	26.30 m
Reservoir surface area at S.W.L.	17.80 km^2
Gross storage capacity	362,000,000 m^3
Effective storage capacity	304,000,000 m^3
Flood control capacity	46,000,000 m^3
Water utilization capacity	258,000,000 m^3
Municipal water capacity	17,000,000 m^3
Irrigation water capacity	241,000,000 m^3
Sediment capacity	58,000,000 m^3

Dam

Main dam	
Height above foundation	66.00 m
Crest length	670.00 m
Crest width	10.00 m
Crest elevation	EL. 105.00 m
Dam volume	3,600,000 m^3
Left wing dam	
Height above foundation	40.00 m
Crest length	752.00 m
Crest width	10.00 m
Crest elevation	EL. 105.00 m
Dam volume	1,350,000 m^3
Right wing dam	
Height above foundation	50.00 m
Crest length	440.00 m
Crest width	10.00 m
Crest elevation	EL. 105.00 m
Dam volume	1,330,000 m^3
Spillway	
Free flow section at N.W.L.	100 m wide EL. 97.60 m
Free flow section at S.W.L.	337 m wide EL. 100.30 m
Roller gate	2 nos x 6.5 m wide x 7.5 m high
Chute way	280.00 m in length
Intake and outflow facilities	
Intake water volume	32 m^3/s, Inclined conduit Roller gate 5.0 m wide x 4.0 m high

Municipal and industrial water	Jet flow gate, 0.5 m in diameter
Irrigation and vested right water	Jet flow gate, 1.5 m in diameter
Emergency discharge	Jet flow gate, 2.0 m in diameter
Division works	Control gates 3.5 wide x 2.0 m high x 2 nos
House evacuation and land acquisition	
House evacuation	790 nos.
Land acquisition	1,591 ha
Relocation	
Road	19,000 m
Pumping station	1 place

2. River Improvement

Discharge	
Standard project flood	50-year return period, 2,400 m^3/s at the proposed Bili-Bili dam 3,700 m^3/s at Kampili
Design flood	50-year return period, 1,400 m^3/s at the proposed Bili-Bili dam 2,300 m^3/s at Kampili
Stretch to be improved	20 km from the estuary to the Kampili weir
Flow capacity below Sungguminasa	2,300 m^3/s
Flow capacity above Sungguminasa	1,300 m^3/s in bankful discharge
Diversion Channel of S. Garassi	800 m in total
Road Raising	3,000 m in total
Drainage Ditch	12,000 m in total
Riparian Structures	
Groundsill	2 places at the Sungguminasa bridge, and the intake of the paper mill
Revetment	10,300 m in total

Groyne	93 places, 4,700 m in total
Sluice	8 places
Vested right water	0.5 m^3/s
House Evacuation and Land Acquisition	
House evacuation	230 houses
Land acquisition	98 ha

3. Water Supply

Intake	
Design conveyance volume	2.3 m^3/s
The lowest intake level	EL. 74.0 m
Pipeline Conveyance Facilities	
Sand & regulating basin	1 place
Conveyance pipe	Dia. 1,500 mm Ductile cast-iron pipe, 25,000 m in total

4. Irrigation System Improvement

Bili-Bili System	
Irrigation area	
Wet season	5,000 ha
Dry season	4,000 ha
Connecting channel	
Flow capacity	6.1 m^3/s
Intake gate	2.0 x 2.0 m x 1 gate
Conduit	200 m in length
Open channel	1,300 m in length
Existing channel	8 km in length
Secondary channel and the related facilities	5,000 ha of improvement area
Kampili System	
Irrigation area	
Wet season	19,000 ha
Dry season	15,200 ha
Main channel	23.2 m^3/s in flow capacity, 2,500 m in length
Secondary channel and the related facilities	19,000 ha of improvement area

5. Hydro Power

Power Station

Intake	Inclined conduit
Design intake volume	32 m^3/s
The lowest intake level	EL. 74.0 m
Penstock	1) Dia. 3,500 mm, total length 235 m 2) Dia. 2,400 mm, total length 70 m 3) Dia. 1,800 mm, total length 65 m
Power House	Semi-underground type (floor 38 m x 22 m, 32 m high)

Generating Equipment

Turbine	
Type	Kaplan turbine
Effective head	48.1 m - 24.5 m
Maximum discharge	32 m^3/s
Installed capacity	2 x 5,600 KW
Generator	
Type	3-phase vertical shaft generator
Capacity	2 x 6,600 KVA
Voltage	6 KV
Cycle	50 Hz

Transmission Line

Transmission line	15 km in total
Voltage	30 KV
Conductor	120 mm^2

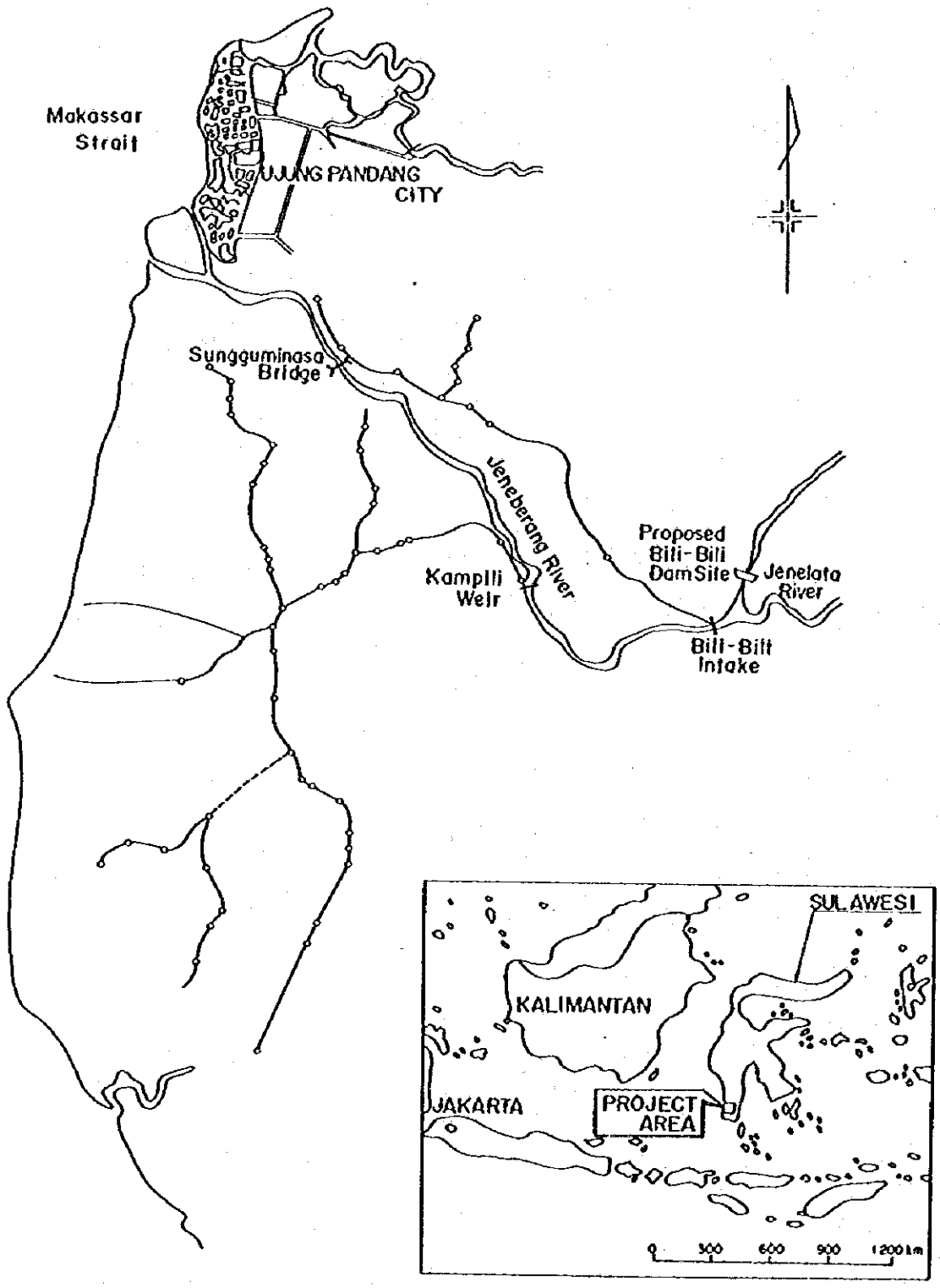
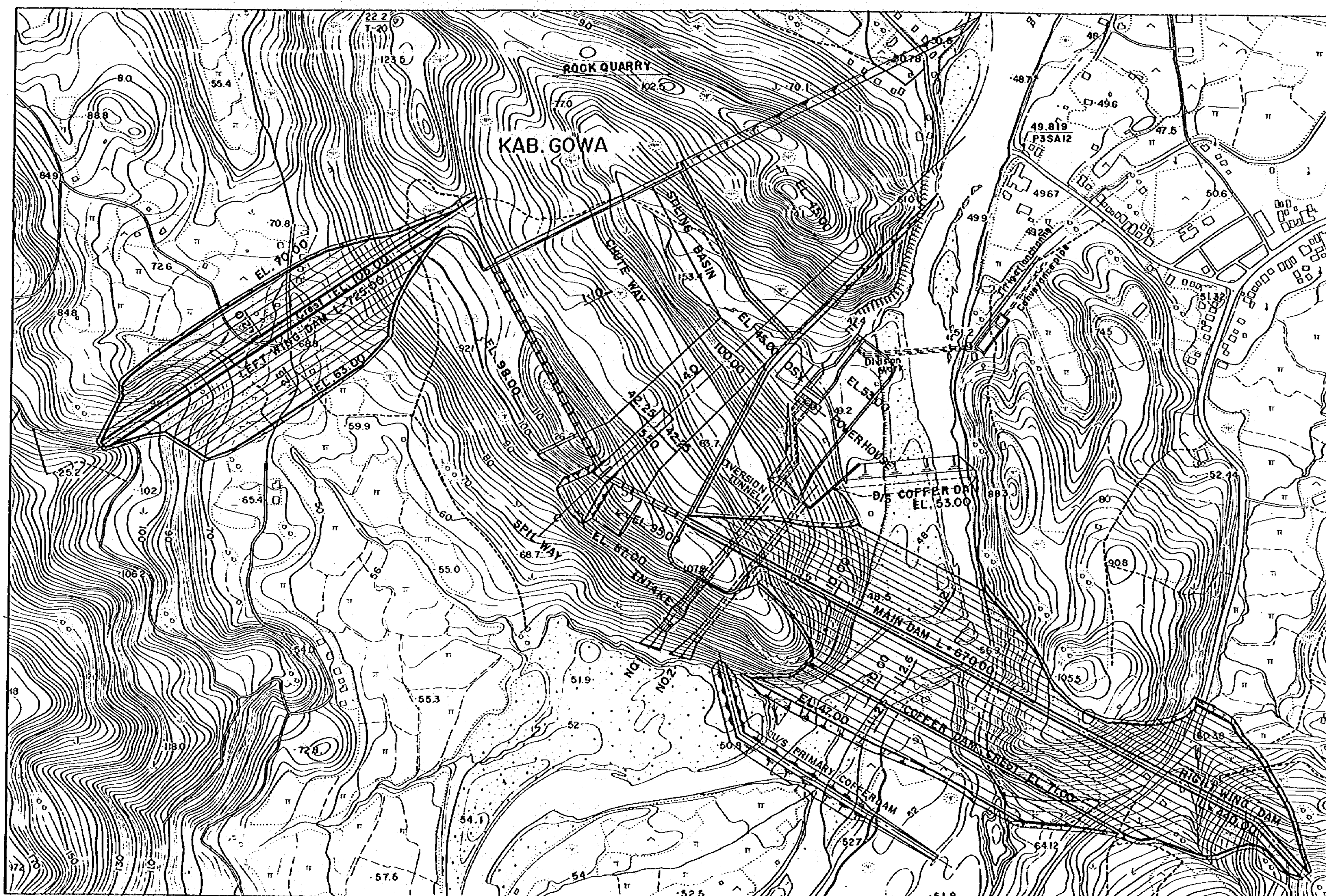


Fig. 1

PROJECT ARFA


KAB. GOWA
ROCK QUARRY
LEFT WING DAM L-725.00
Crest EL 100.00
EL. 70.00
EL. 53.00
EL. 98.00
CHUTE WAY
STILLING BASIN
SPILL WAY
INTAKE
DIVERSION TUNNEL
POWER HOUSE
D/S COFFER DAM
EL. 53.00
MAIN DAM L-670.00
COFFER DAM
U/S PRIMARY COFFER DAM
RIGHT WING DAM
EL 47.00
EL 87.00
EL 95.00
Diversion Work
Irrigation channel
Conveyance pipe

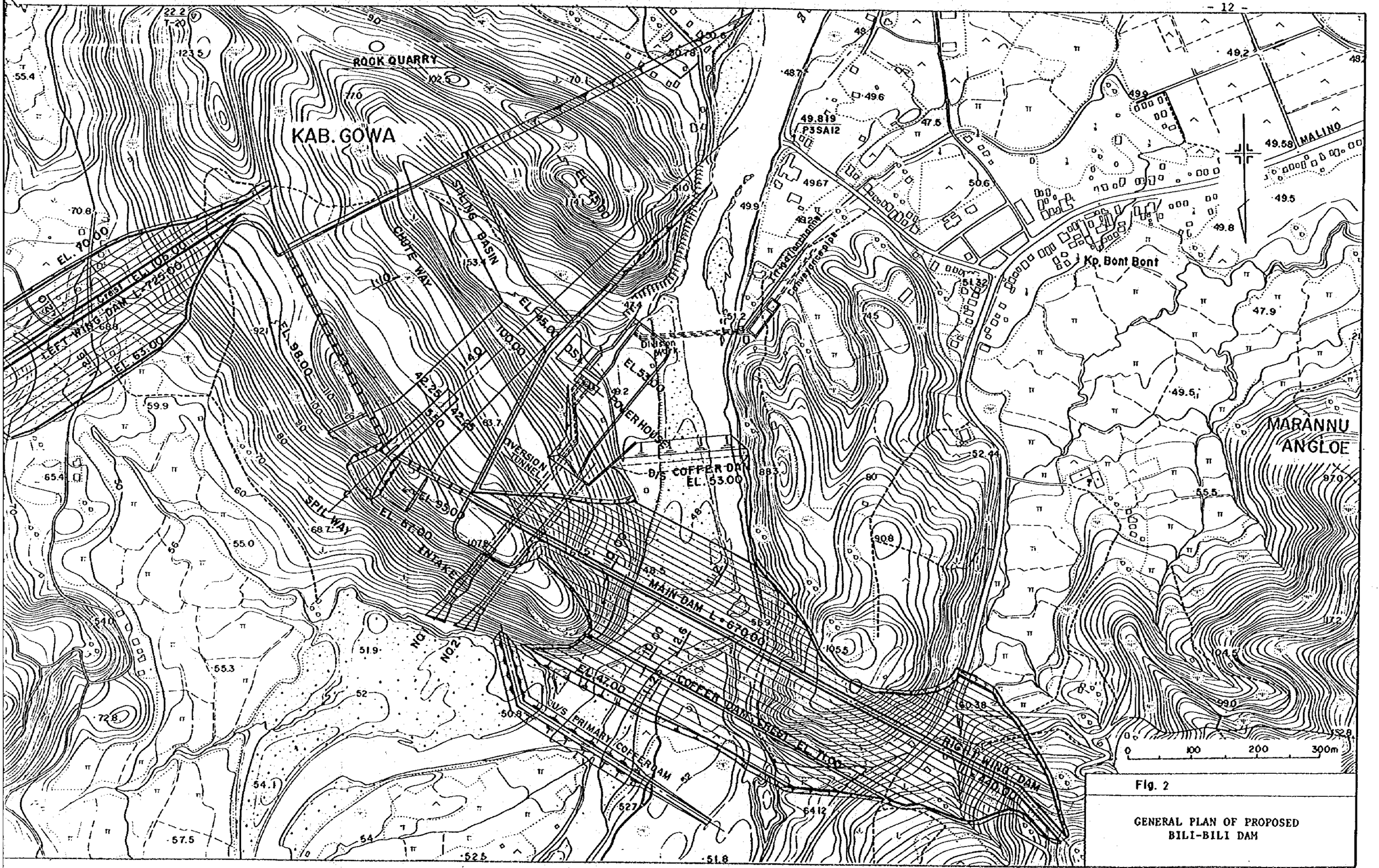
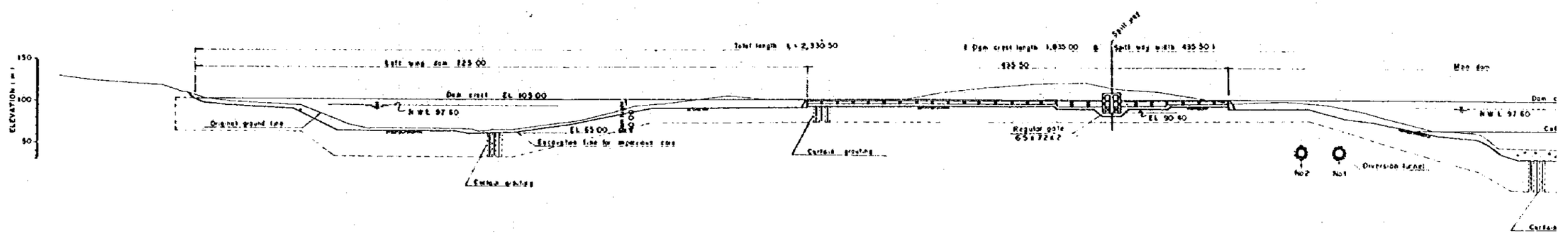


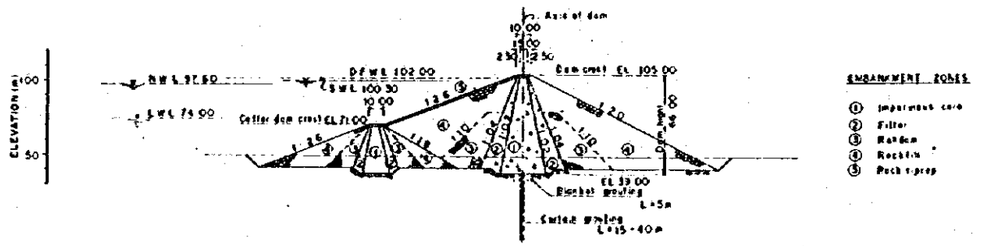
Fig. 2

GENERAL PLAN OF PROPOSED
BILI-BILI DAM

PROFILE ALONG AXIS OF DAM



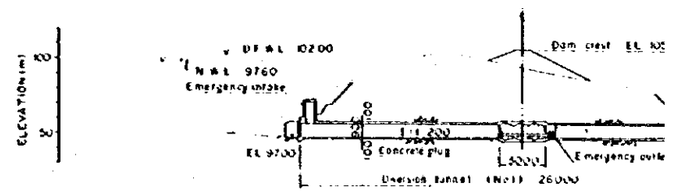
TYPICAL CROSS SECTION OF DAM



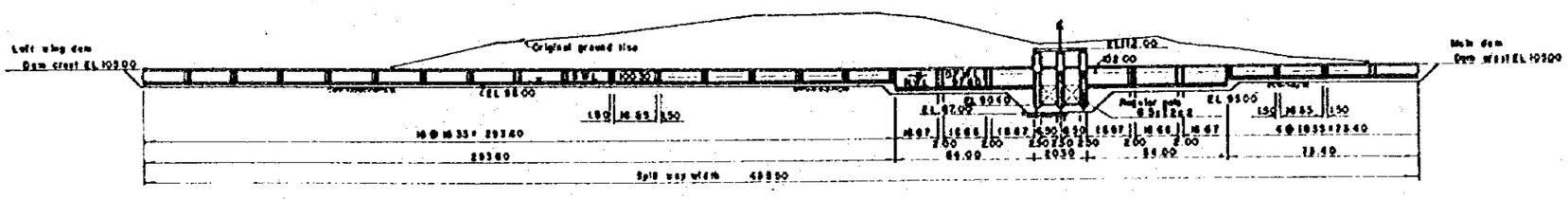
EMBANKMENT ZONES

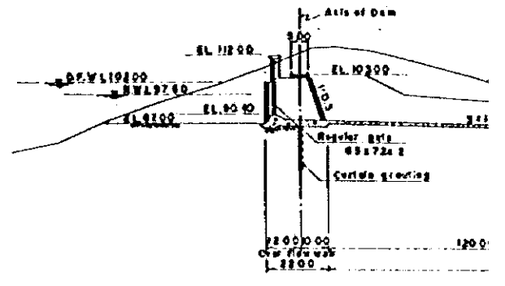
① Impervious core
② Filter
③ Random
④ Rockfill
⑤ Rock riprap

PROFILE OF DIVERSION TUNNEL



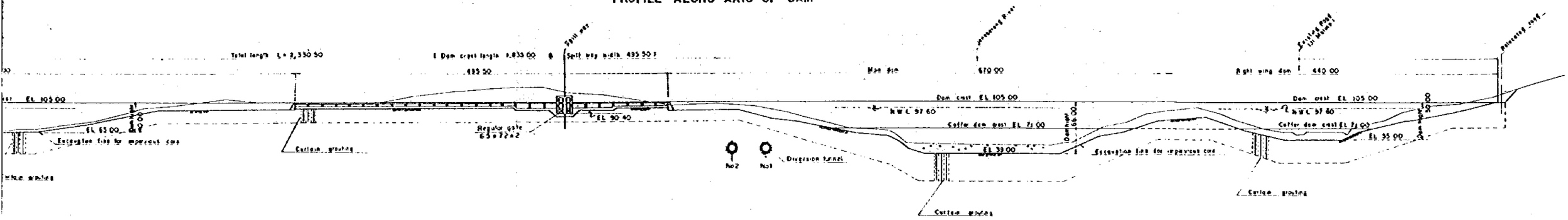
OVERFLOW WEIR - FRONT VIEW

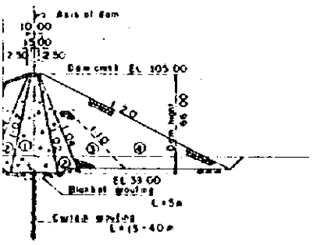




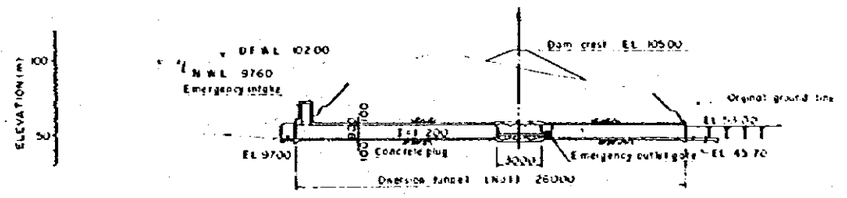
OVER FLOW WEIR-FRONT VIEW OF SPILLWAY

PROFILE ALONG AXIS OF DAM



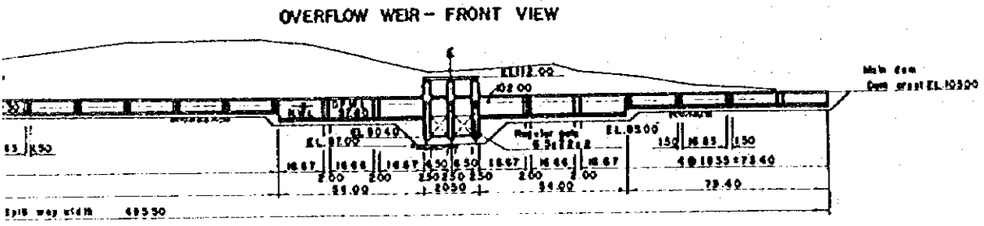


CROSS SECTION OF DAM

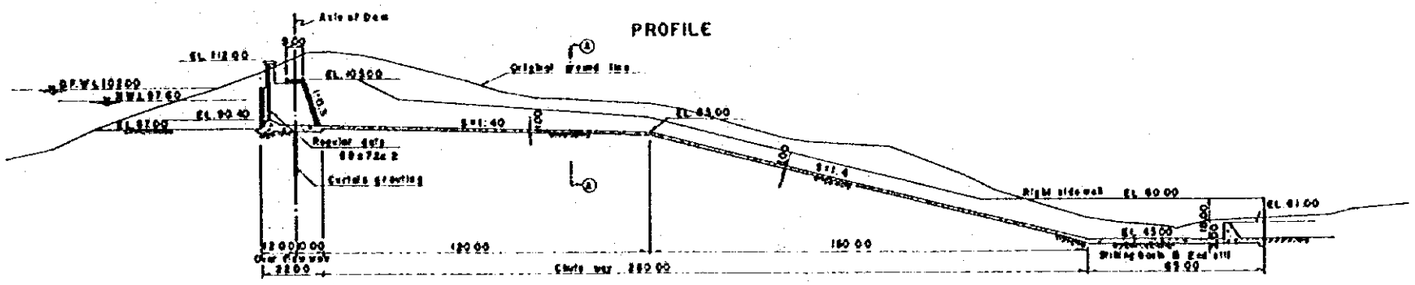


PROFILE OF DIVERSION TUNNEL

OVERFLOW WEIR - FRONT VIEW



OVER FLOW WEIR - FRONT VIEW OF SPILLWAY



PROFILE OF SPILLWAY

Fig. 3

DAM AND SPILLWAY PROFILE
AND CROSS-SECTION

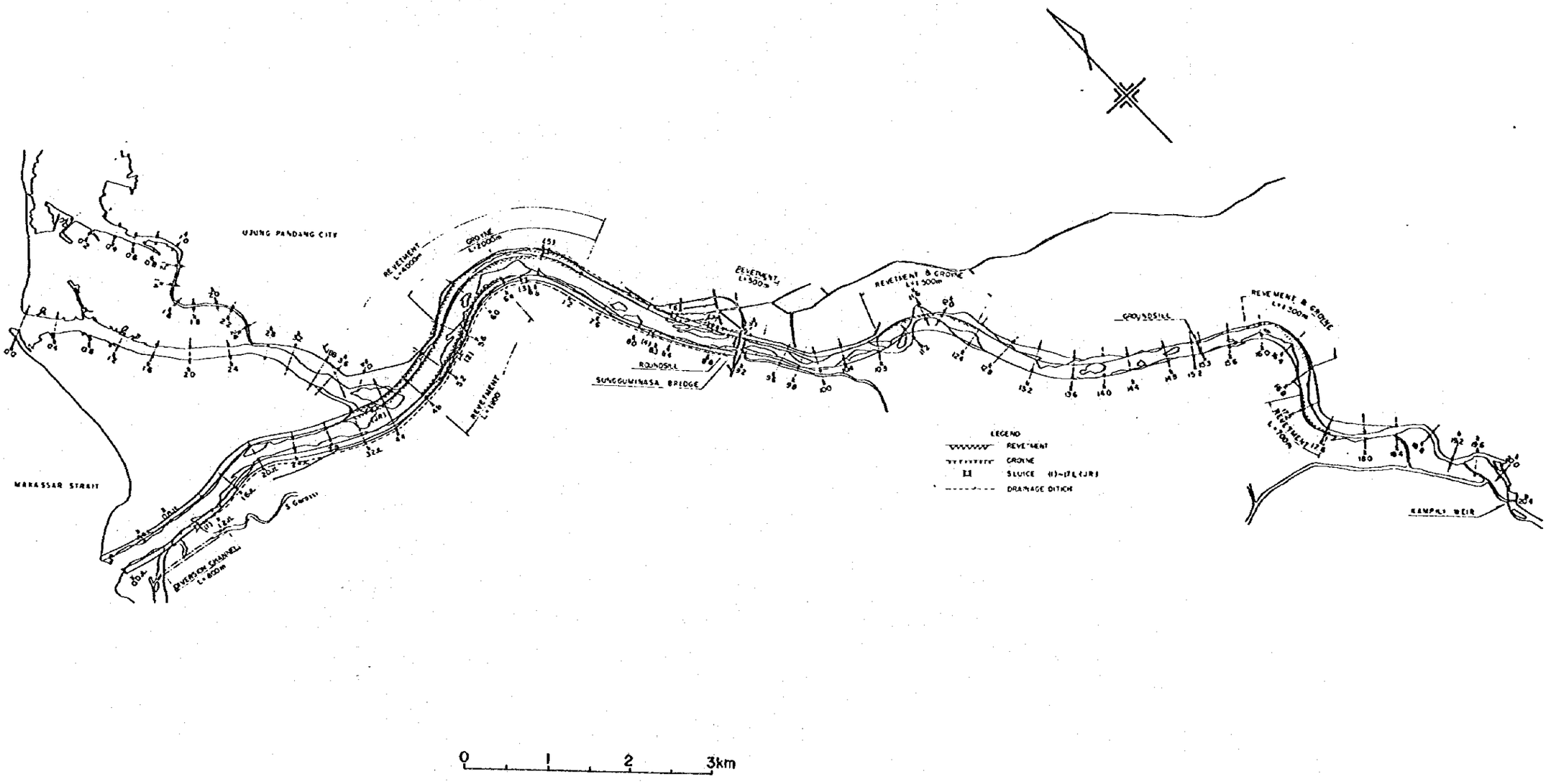


Fig. 4

PROPOSED ALIGMENT OF
THE JENEBERANG RIVER

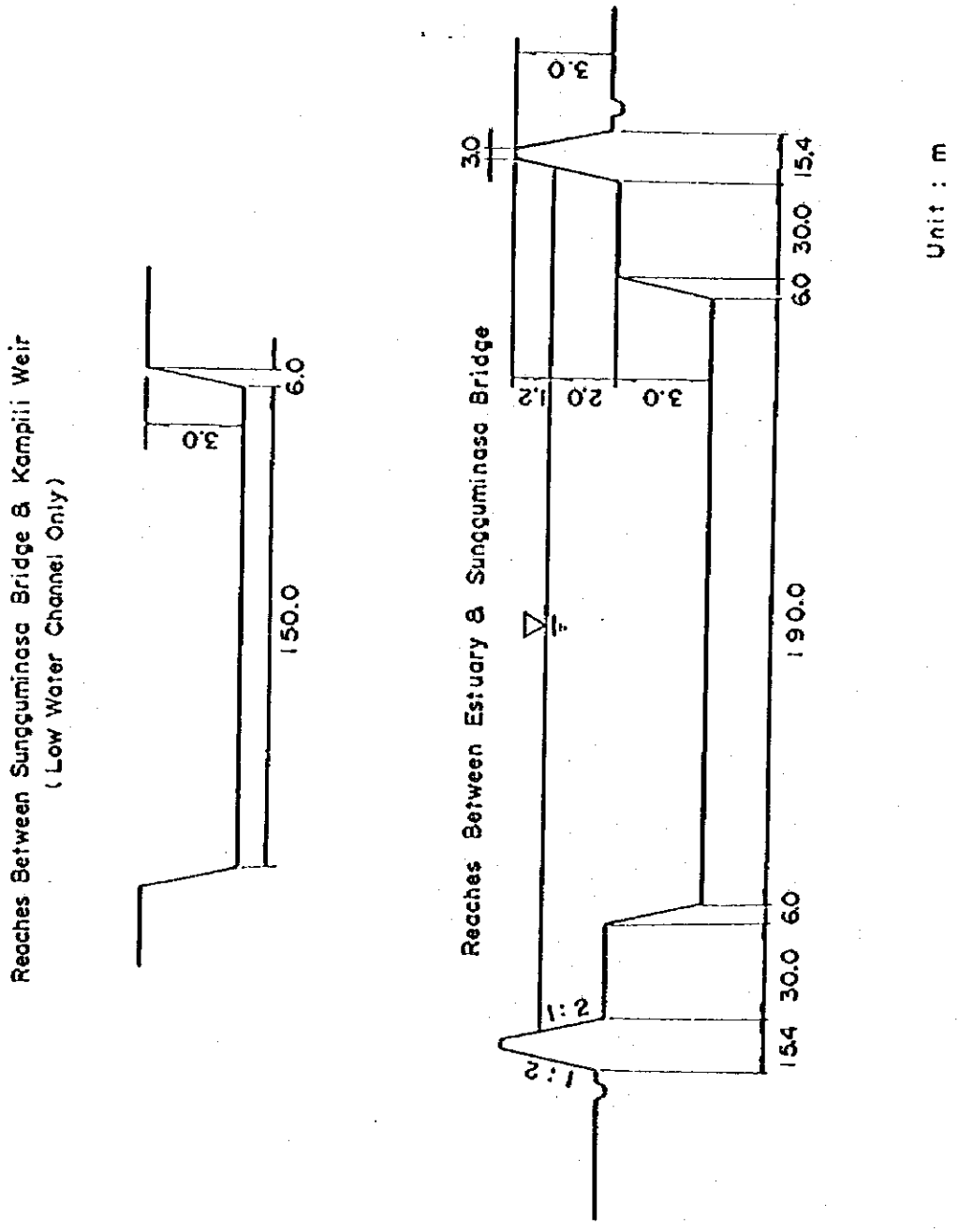


Fig. 5

STANDARD CROSS-SECTION
OF RIVER INPROVEMENT

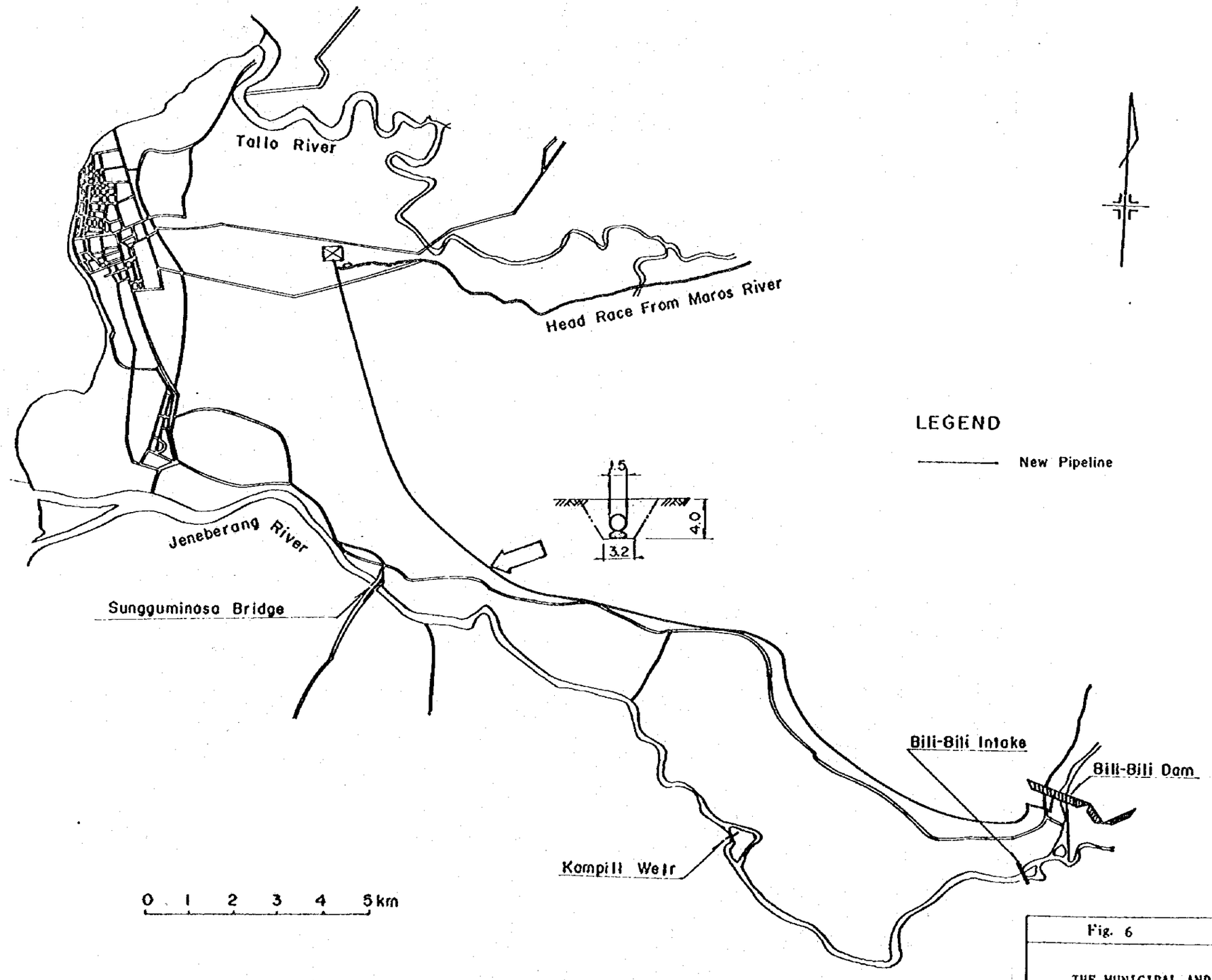


Fig. 6

THE MUNICIPAL AND INDUSTRIAL WATER HEADRACE ROUTE

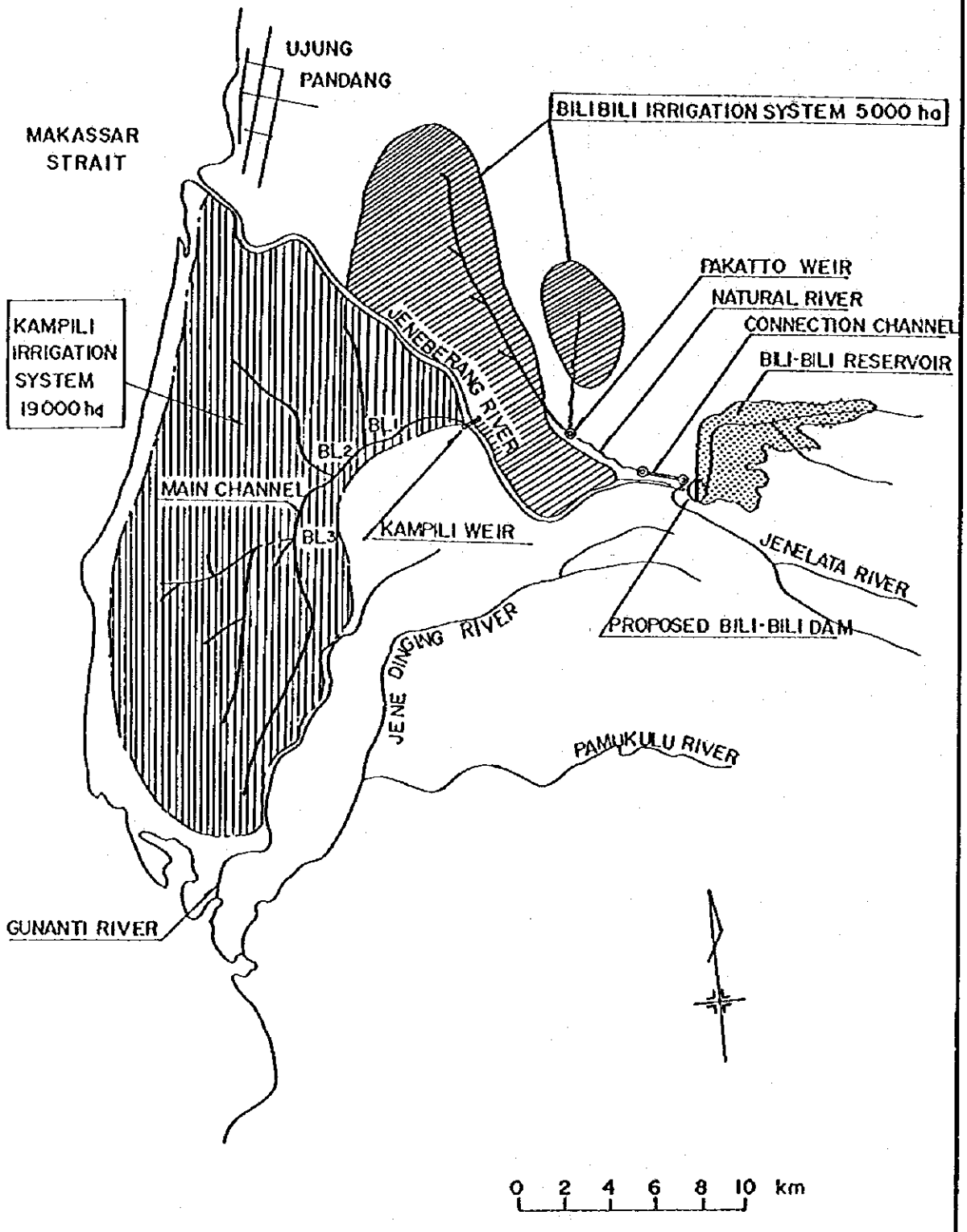
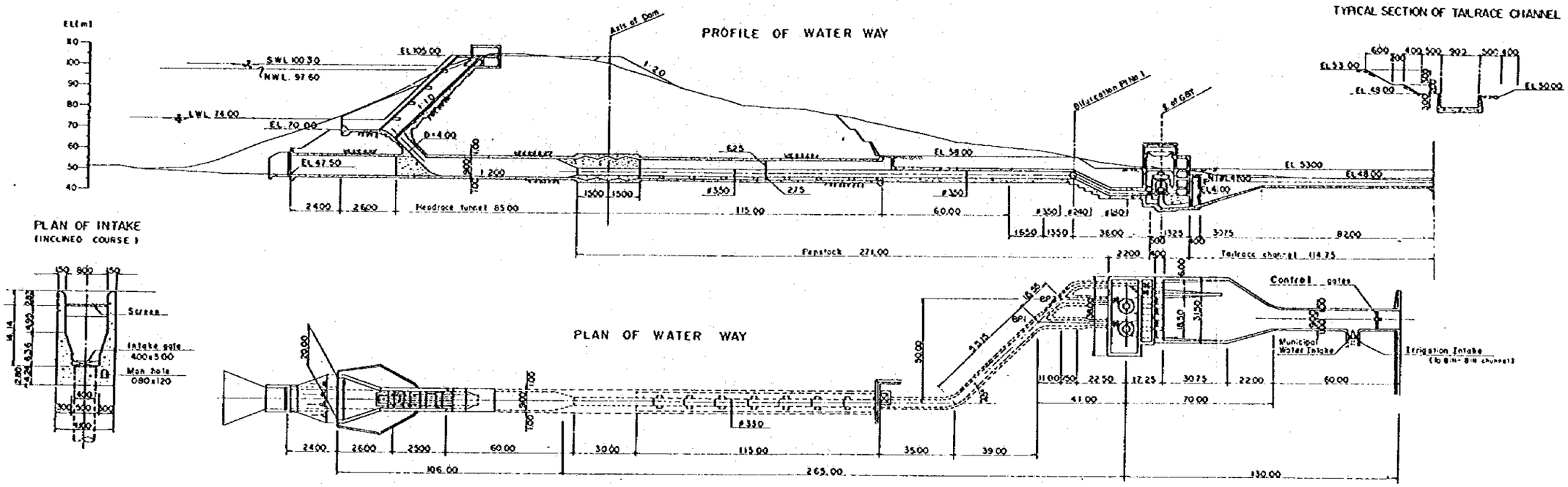
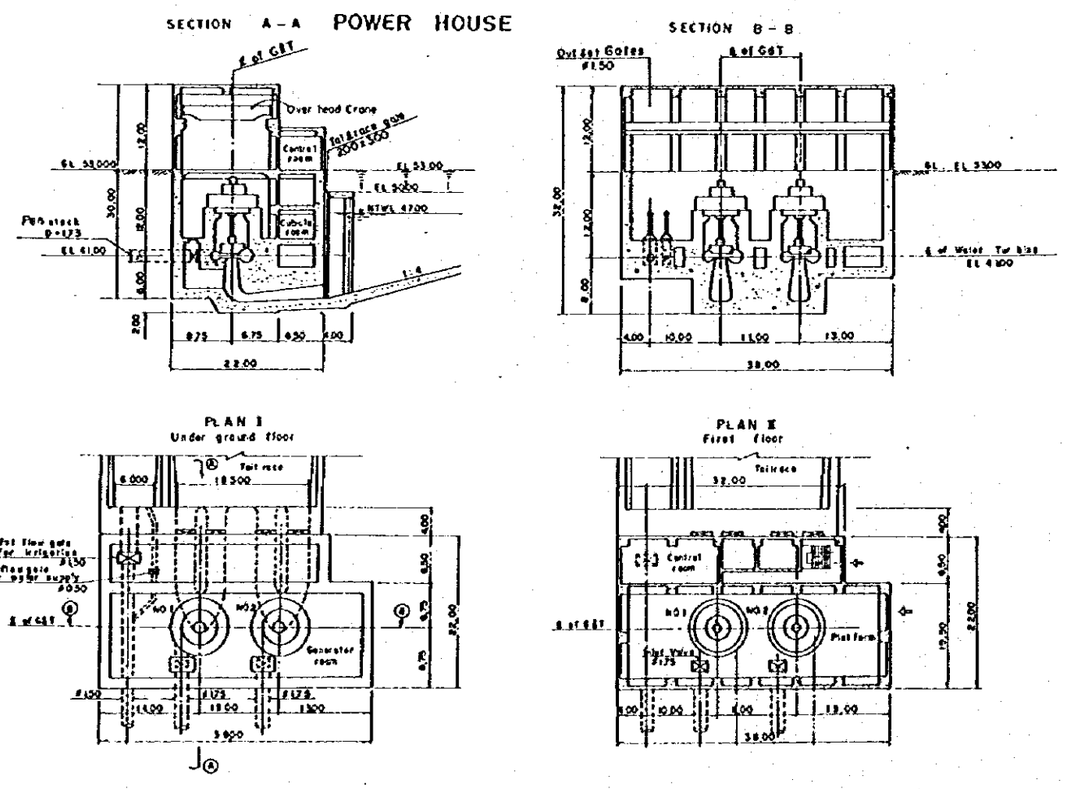
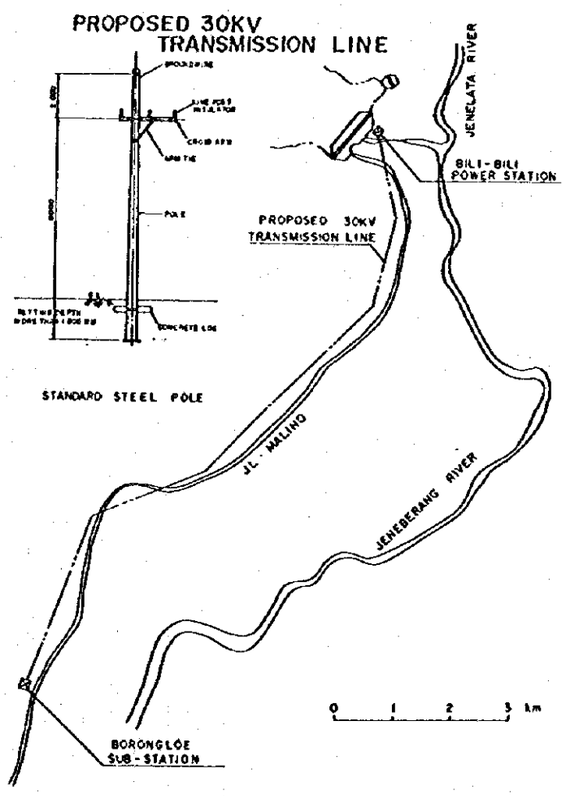


Fig. 7

IRRIGATION AREA







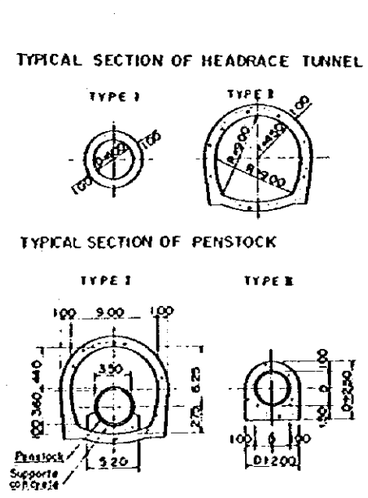


Fig. 8

PLAN OF HYDRO POWER FACILITIES

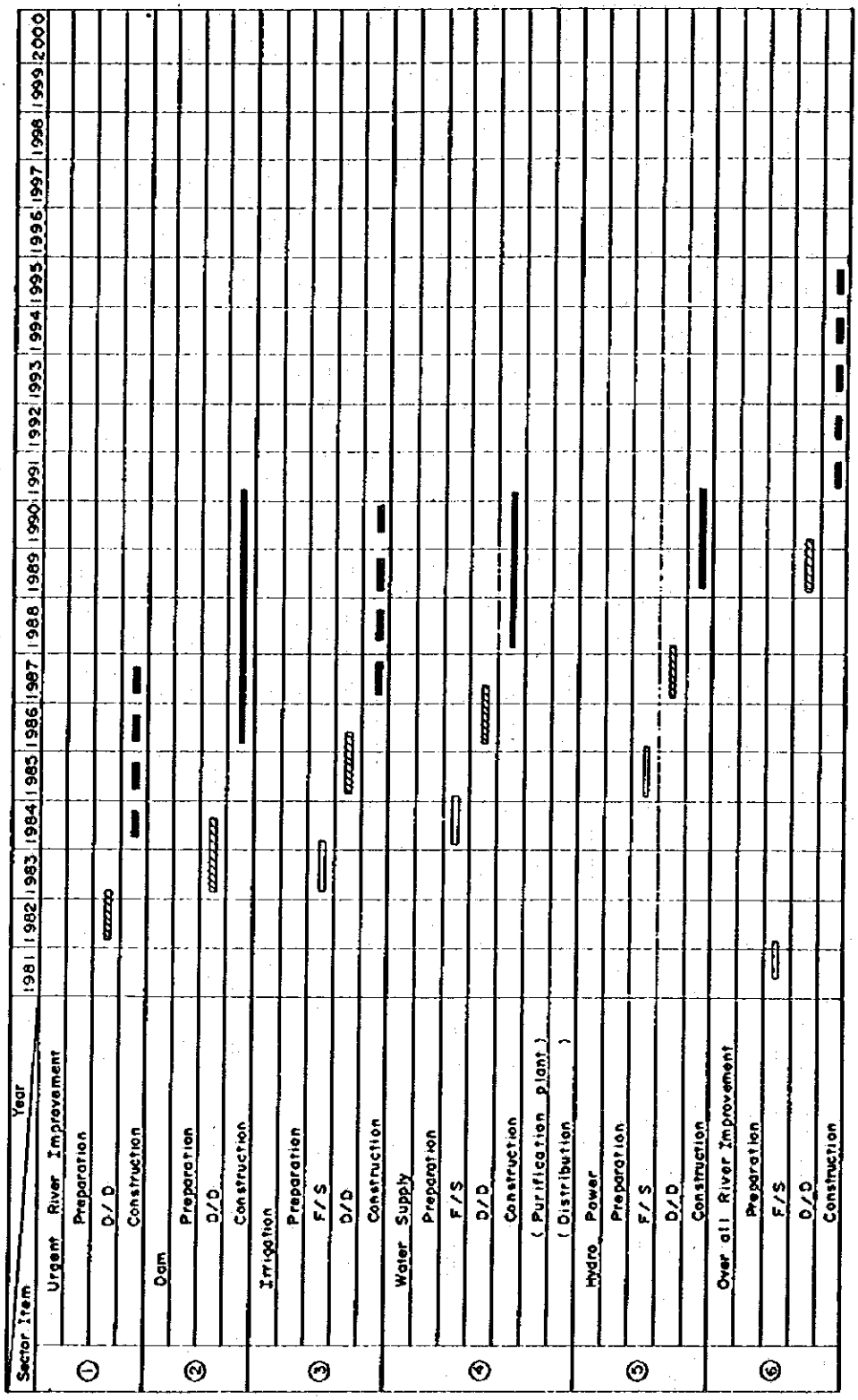


Fig. 9

CONSTRUCTION SCHEDULE