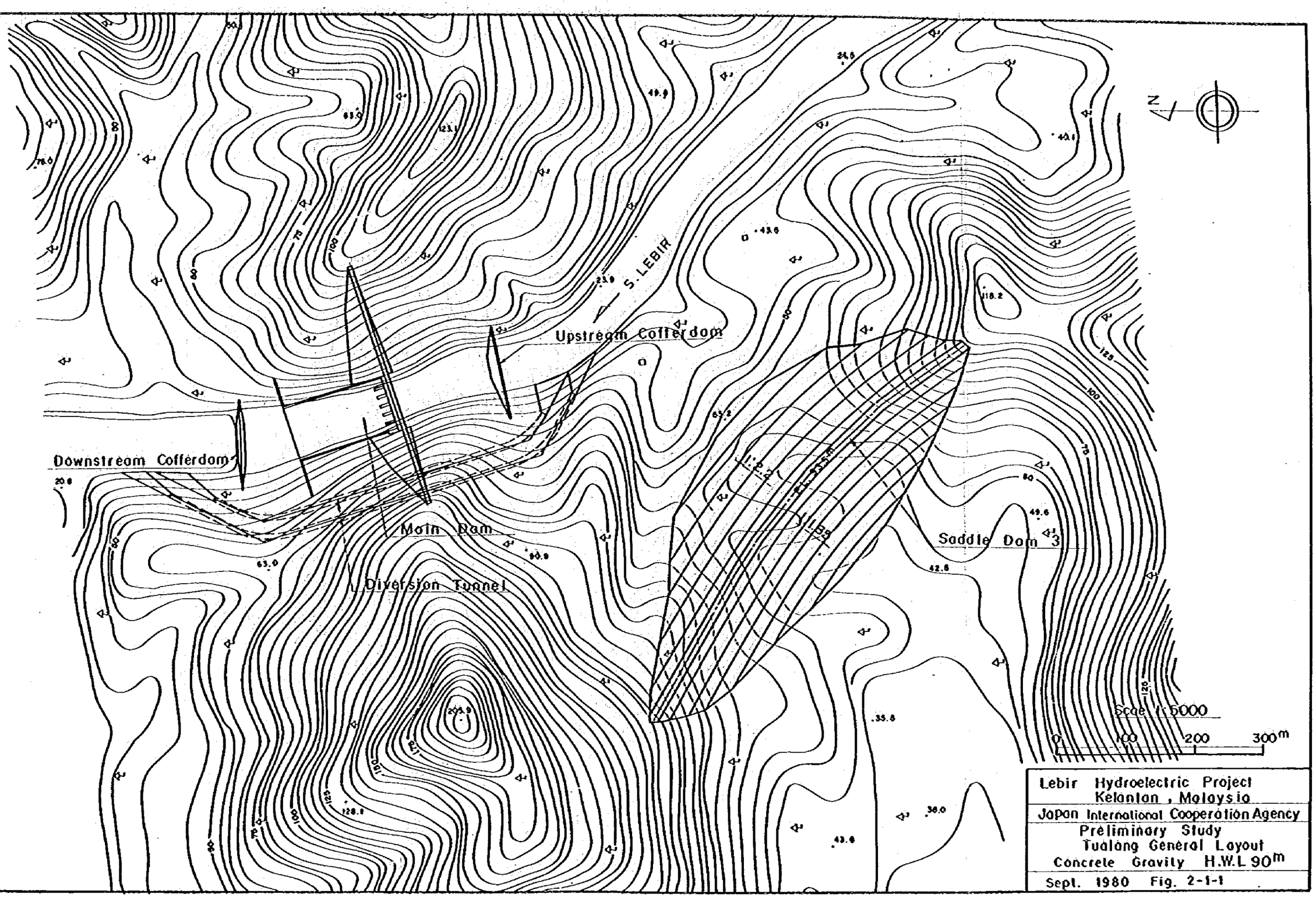
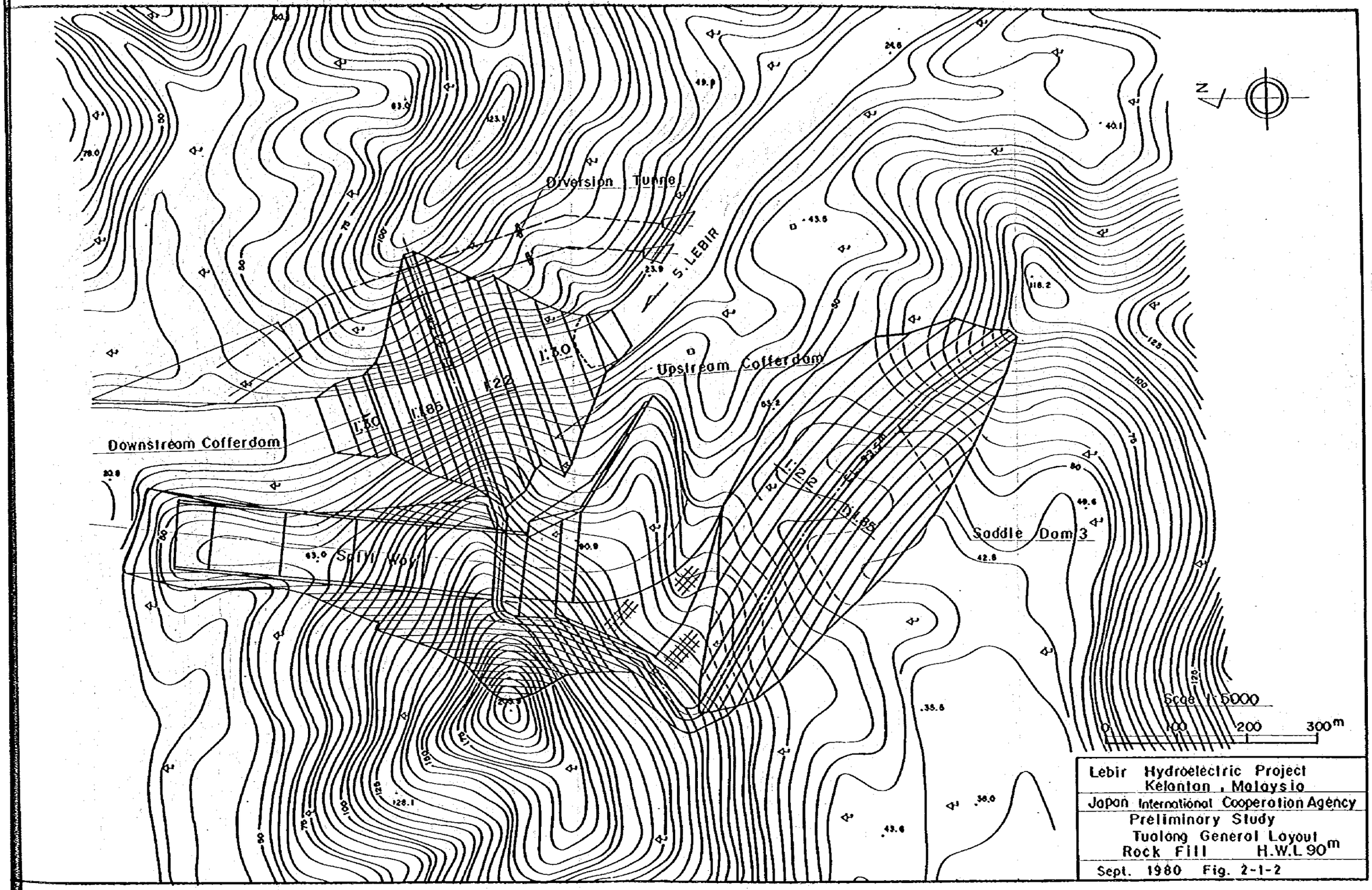
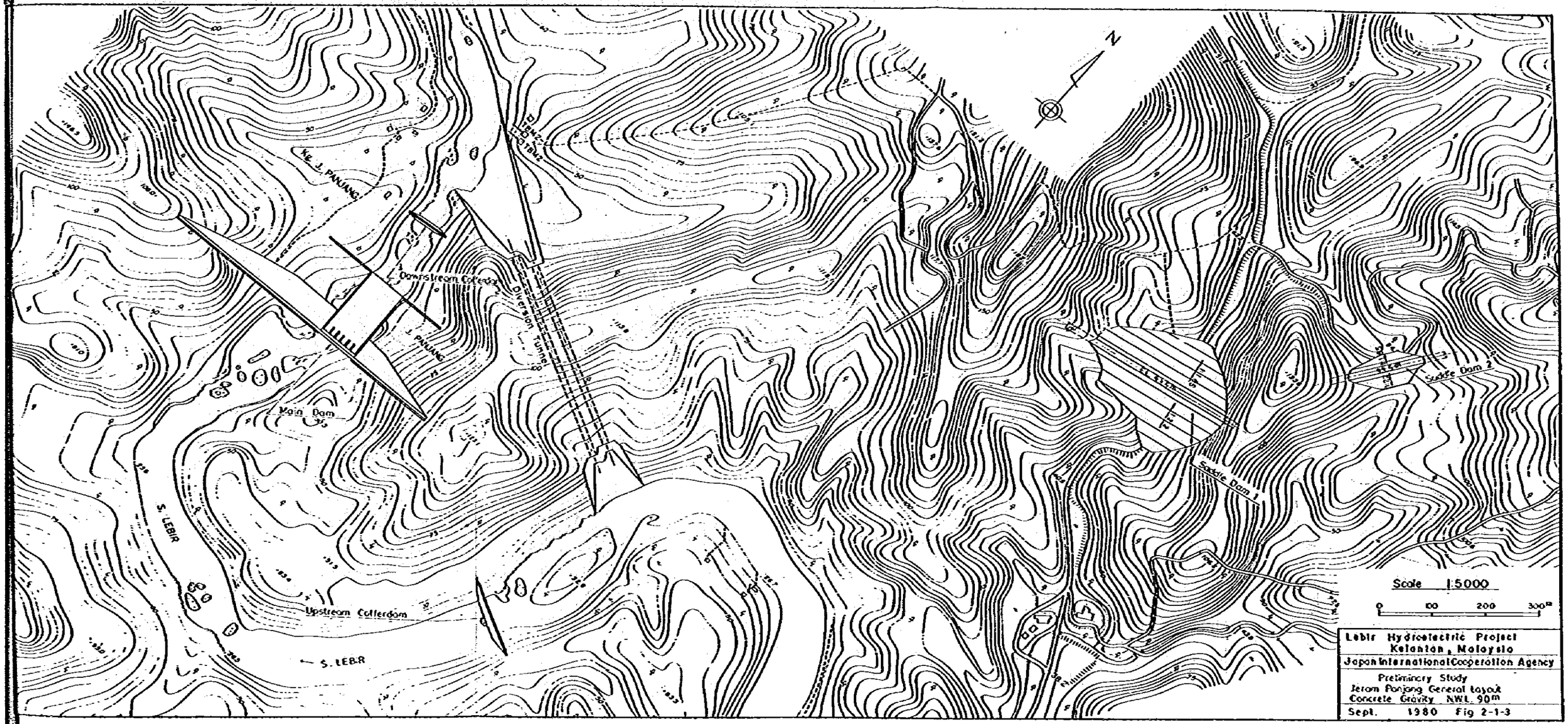
Appendix

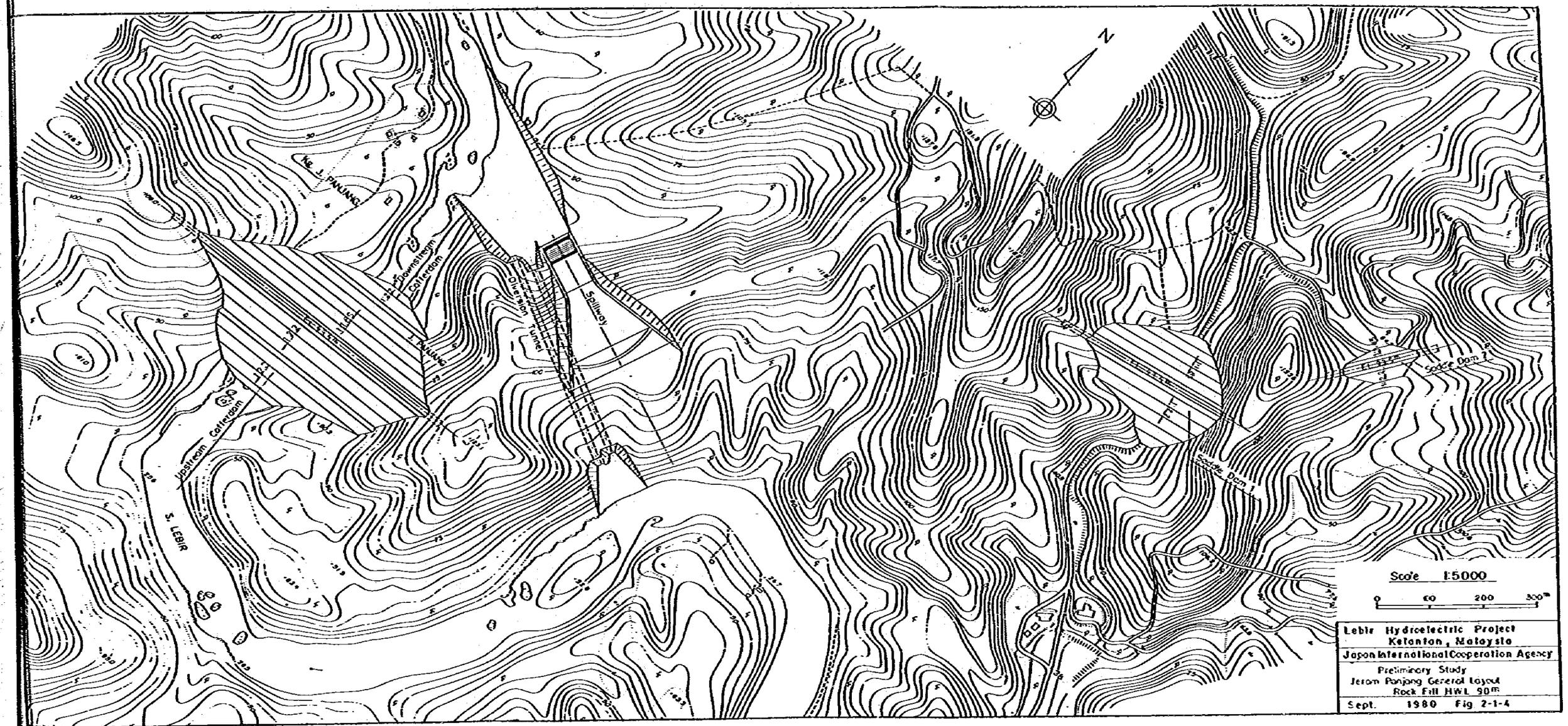
Figures and Tables

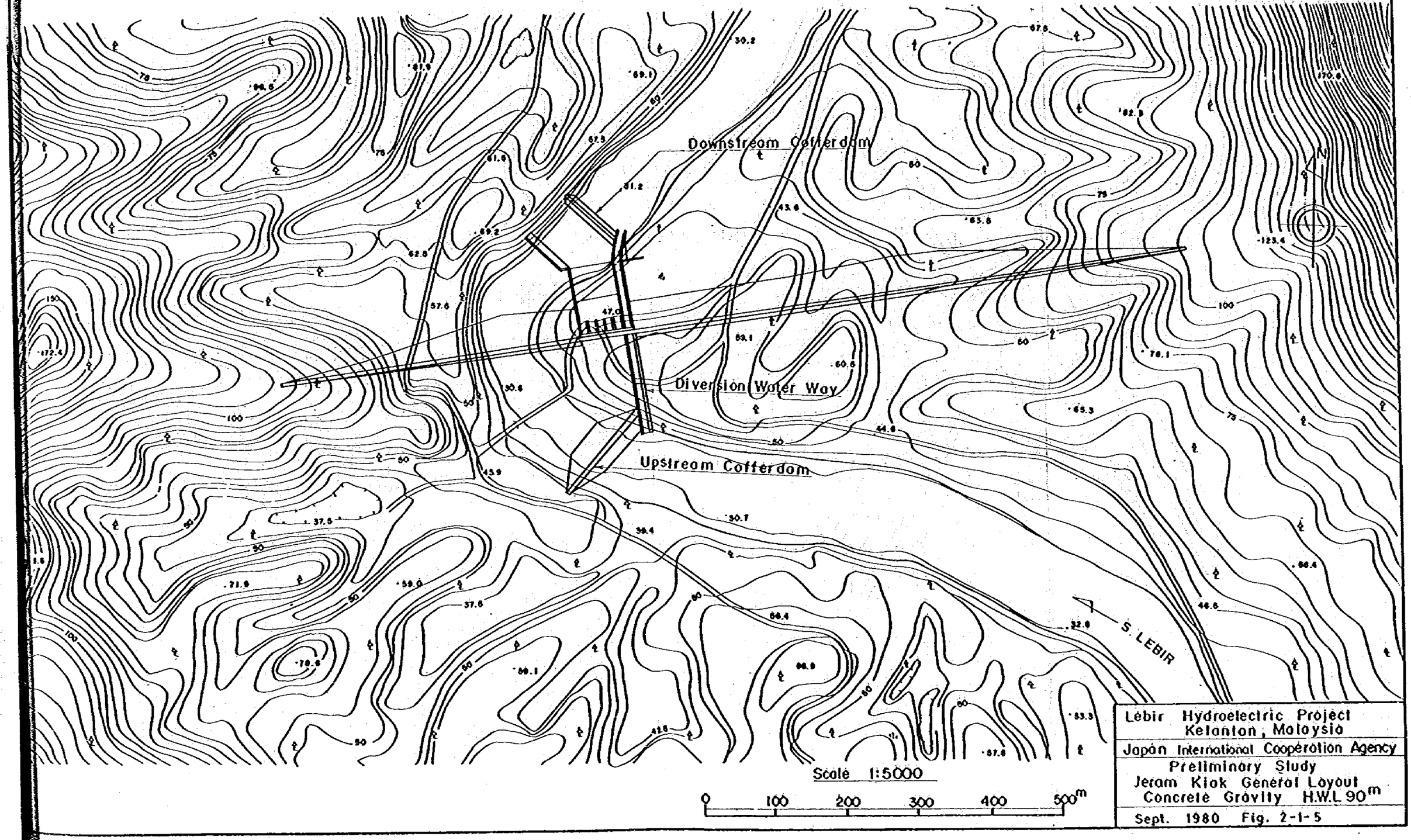

N
S. LEBIR
Upstream Cofferdom
Downstream Cofferdom
Main Dam
Diversion Tunnel
Saddle Dam 3
Scale 1:5000
0
100
200
300m
Lebir Hydroelectric Project
Kelantan , Malaysia
Japan International Cooperation Agency
Preliminary Study
Tualang General Layout
Concrete Gravity H.W.L 90m
Sept. 1980 Fig. 2-1-1



Lebir Hydroelectric Project
Kelantan , Malaysia
Japan International Cooperation Agency
Preliminary Study
Tuolong General Layout
Rock Fill H.W.L 90m
Sept. 1980 Fig. 2-1-2


N
Kg. J. PANJANG
Downstream Cofferdam
Diversion Tunnel
J. PANJANG
Main Dam
S. LEBIR
Upstream Cofferdam
S. LEBIR
EL. 91.5m
Saddle Dam 2
Saddle Dam 1
Scale 1:5000
0 100 200 300m
Lebir Hydroelectric Project
Kelantan, Malaysia
Japan International Cooperation Agency
Preliminary Study
Jeram Panjang General Layout
Concrete Gravity NWL. 90m
Sept. 1980 Fig 2-1-3


N
No. 1 PANJANG
Downstream Cofferdam
Diversion Tunnel
Spillway
No. 2 PANJANG
Upstream Cofferdam
S. LEBIR
Saddle Dam 1
Saddle Dam 2
Scale 1:5000
0 100 200 300m
Lebir Hydroelectric Project
Kelantan, Malaysia
Japan International Cooperation Agency
Preliminary Study
Jerom Panjang General Layout
Rock Fill HWL 90m
Sept. 1980 Fig 2-1-4

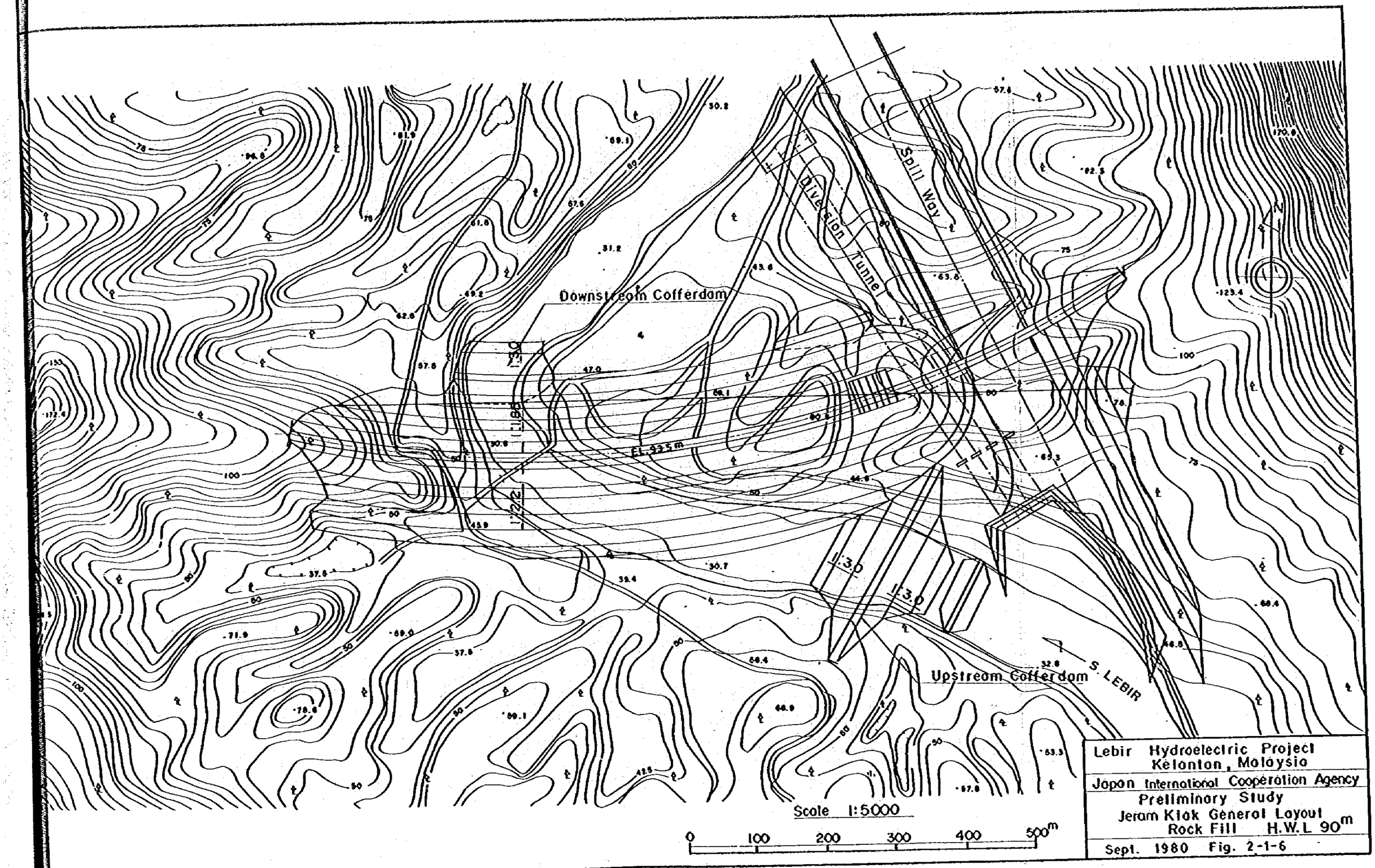


Lebir Hydroelectric Project
Kelanton, Malaysia

Japan International Coopération Agency

Preliminary Study
Jeram Kiok General Layout
Concrete Gravity H.W.L 90m

Sept. 1980 Fig. 2-1-5



Lebir Hydroelectric Project
Kelanton, Malaysia

Japan International Cooperation Agency

Preliminary Study
Jeram Kiak General Layout
Rock Fill H.W.L 90m

Sept. 1980 Fig. 2-1-6

Fig. 2-2 Benefit/Cost Analysis

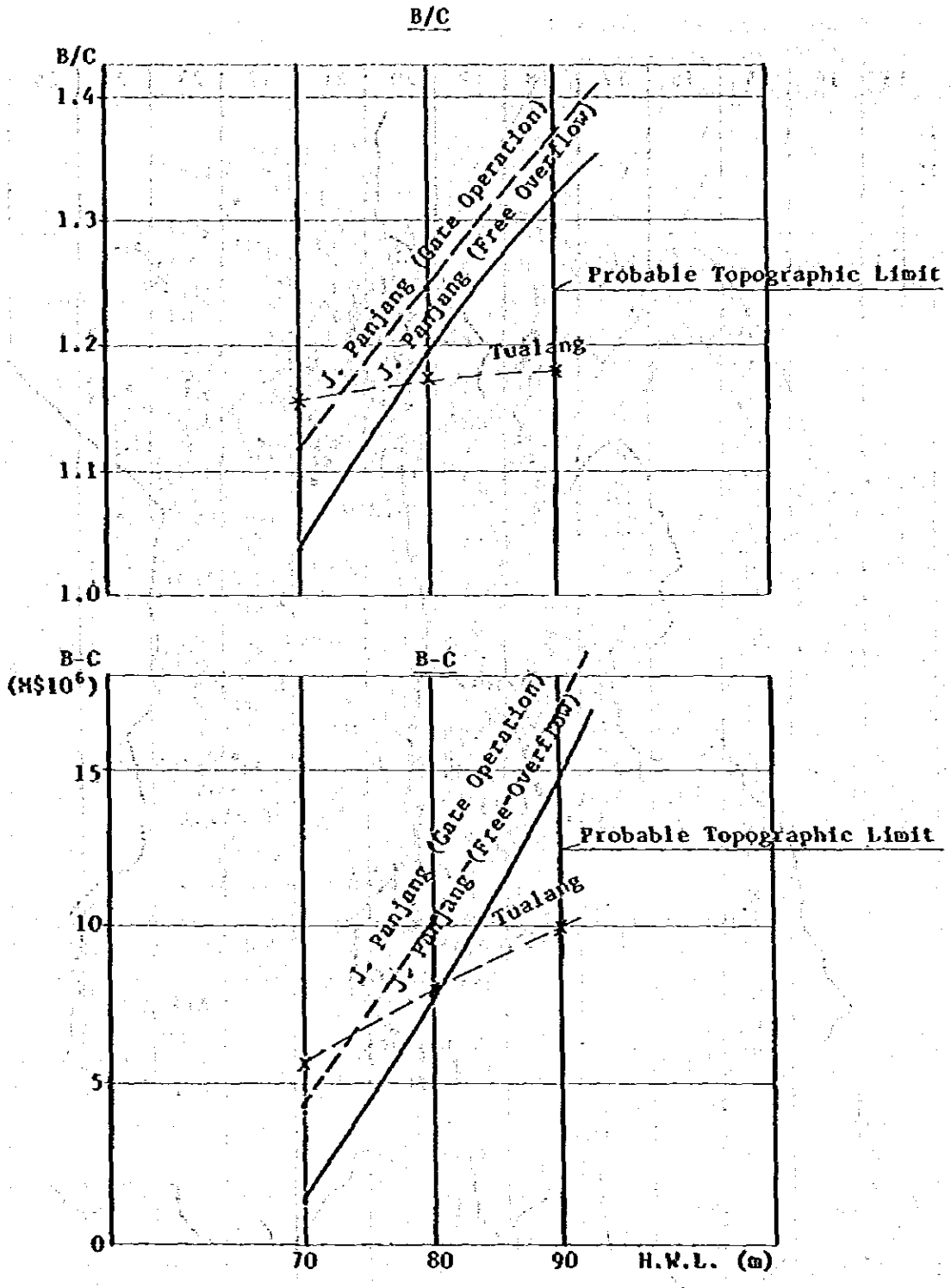


Fig. 3-1 Number and location of Stations

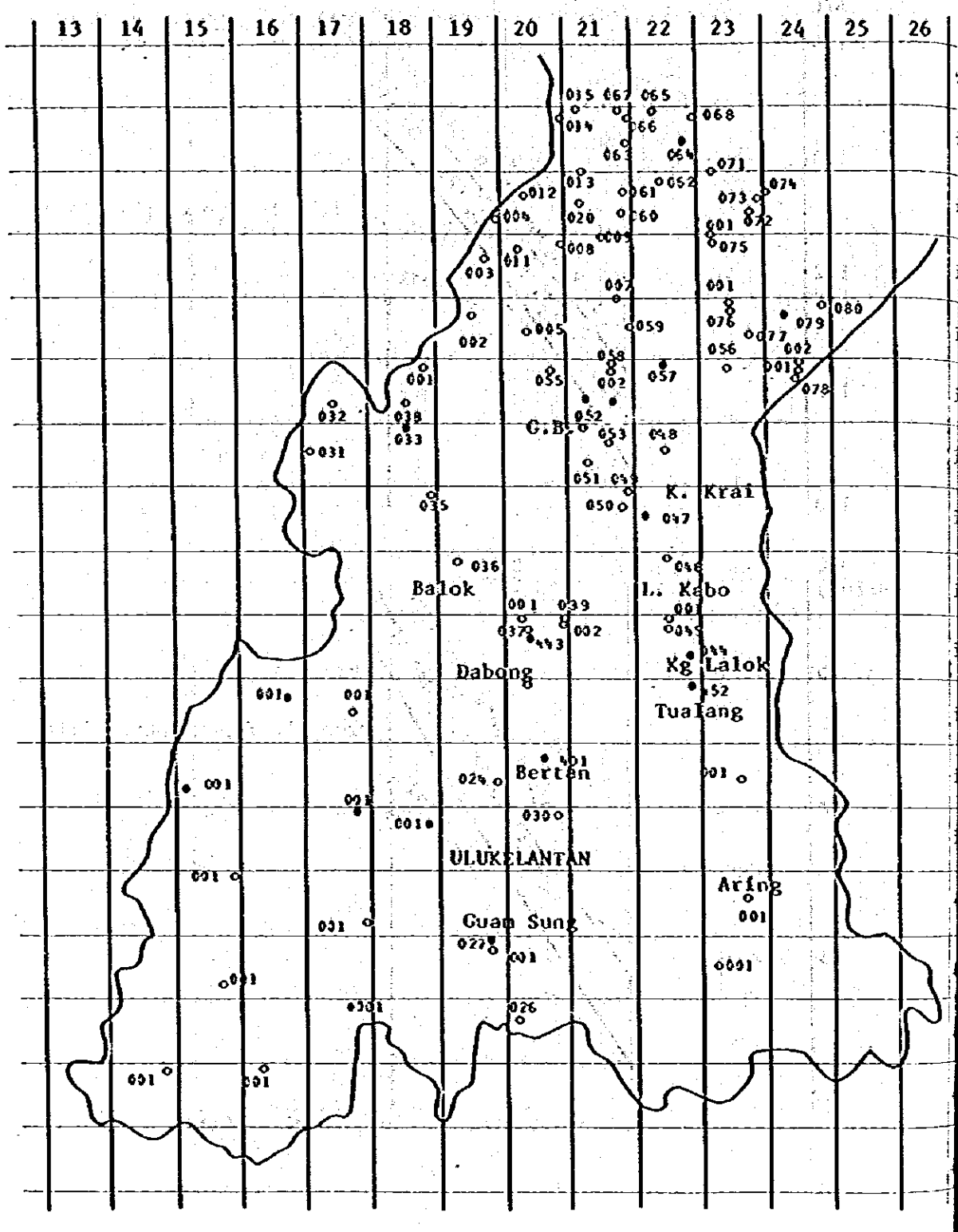


Fig. 4 - 1 Irrigation Projects (Existing and Proposed)

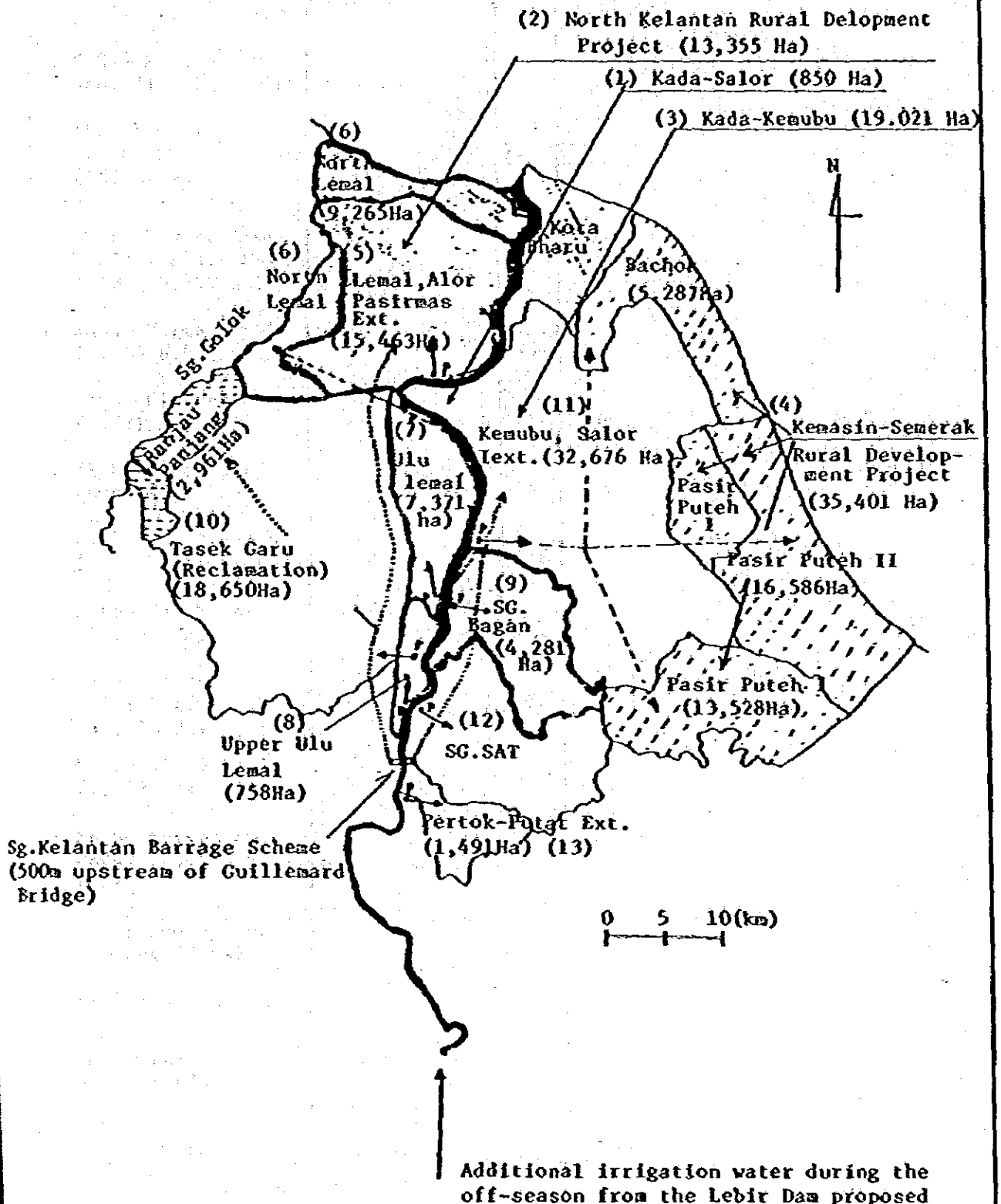
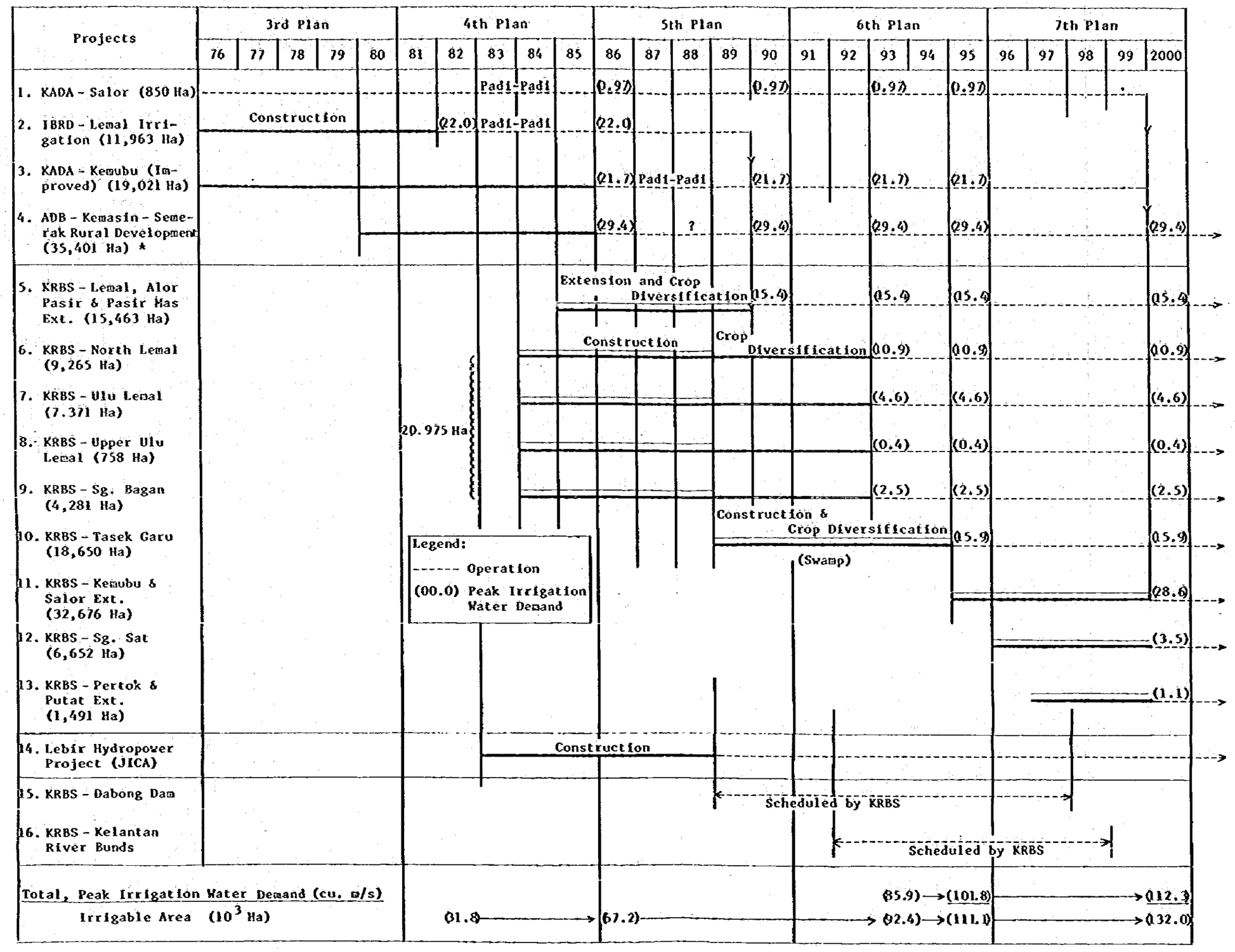
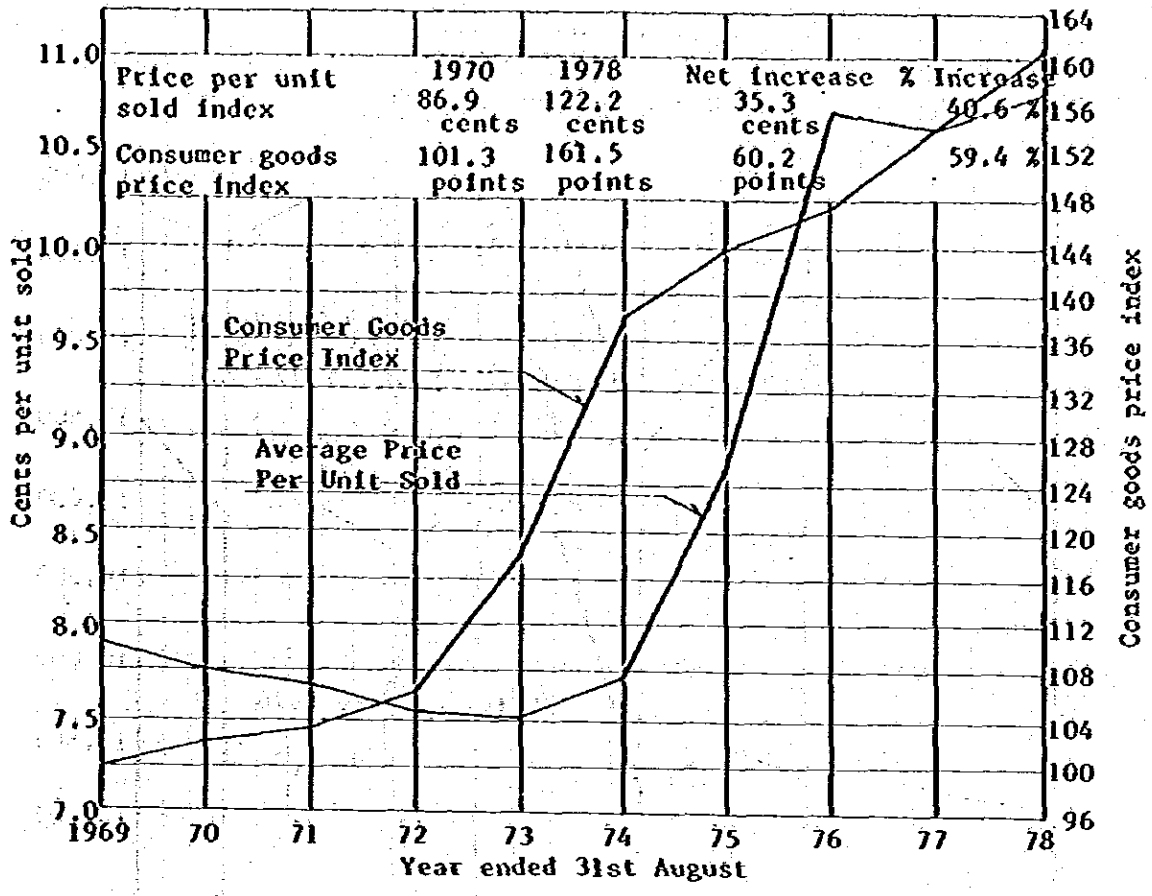


Fig. 4-2 Sequence of Development - Irrigation and Lebir Hydropower



* Includes the KRBS Projects for irrigation (Bachok and Pasir Putch, Stages I & II) and for drainage (sg. Machang Diversion, Lower Sg. Kemasin, Upper Sg. Semerak Diversion and Lower Sg. Semerak).

Fig. 4-3 Average Price Per Unit Sold in Comparison with Consumer Goods Price Index



Units Sold Per Consumer

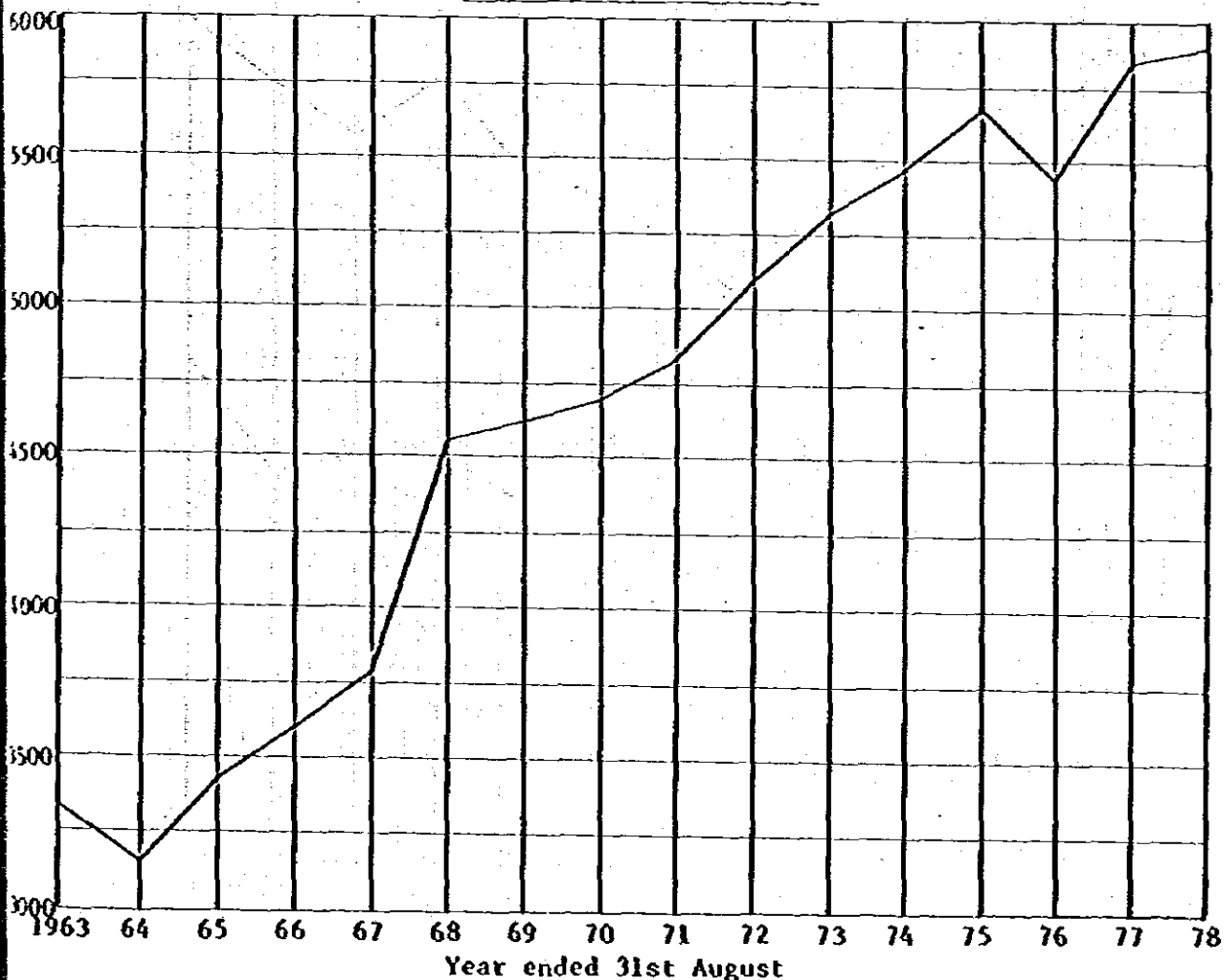
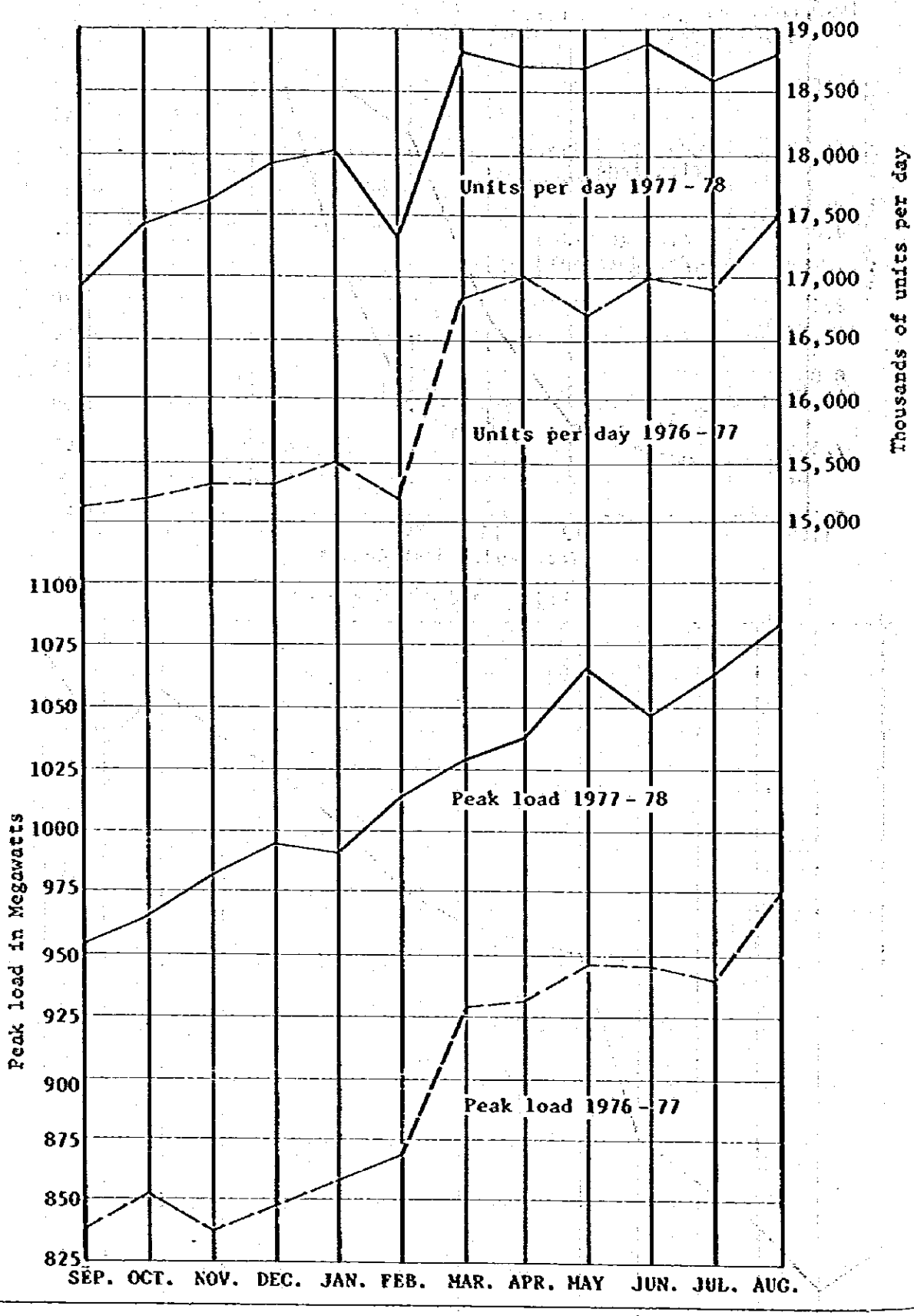


Fig. 4-4 Load Curve Western Network



Thousands of units per day

Fig. 4-5 Typical Daily Load Curves

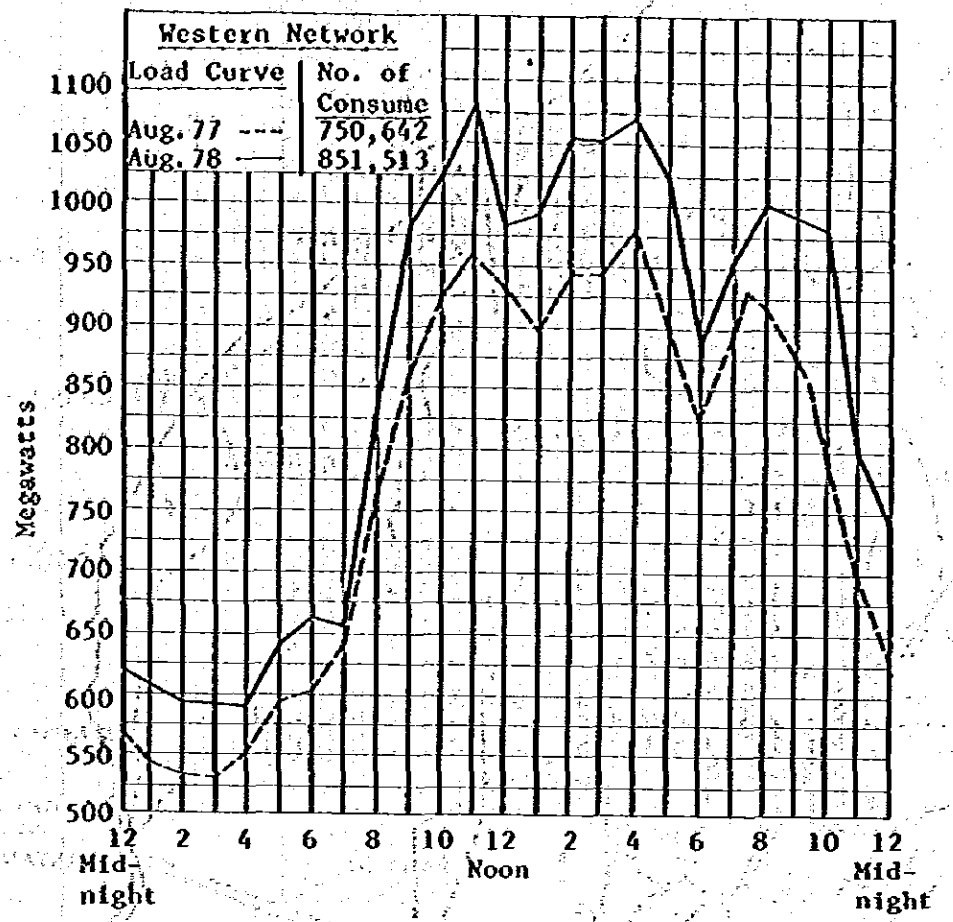


Fig. 4-6 Load Curve of Local Area

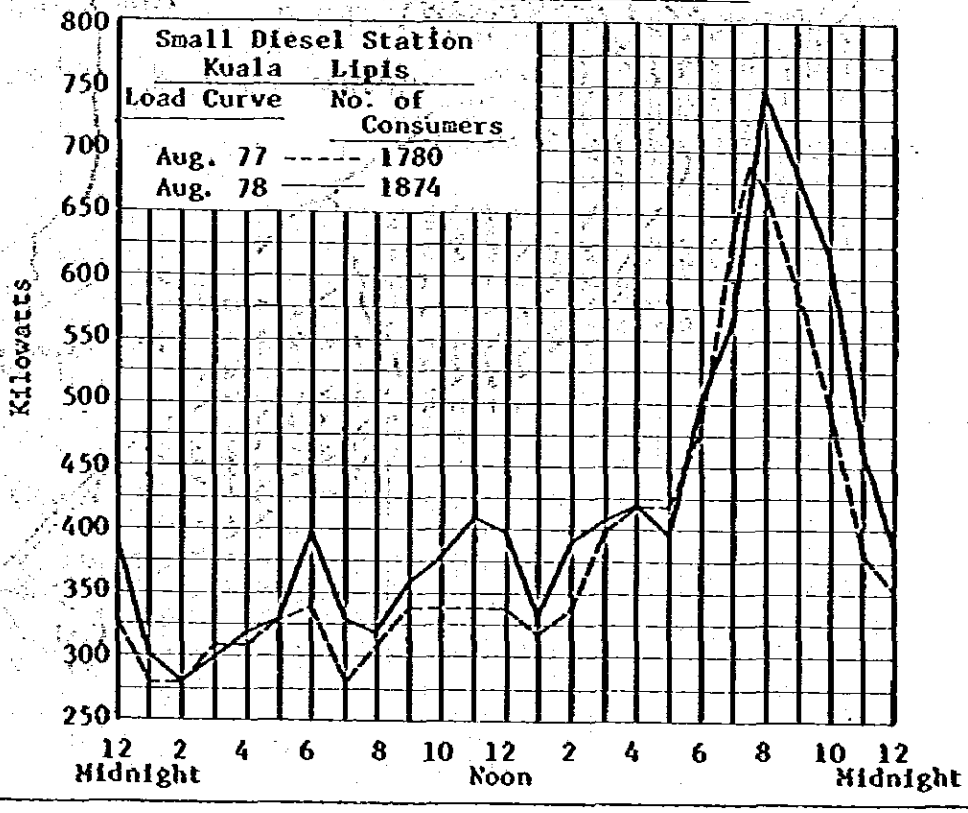


Fig. 4-7 Location Map of Main Pla

Fig. 4-8

DEVELOPMENT PROGRAMME

a. GAS TURBINE 4x20MW JAN. 1979	b. TEMENGOR 3x85MW FEB. 1979	c. GAS TURBINE 1x 20MW MAY 1979	d. PRAI 1x120MW, No. 4 AUG. 1979	e. PRAI 1x120MW, No.5 FEB. 1980	f. PRAI 1x120MW, No. 6 AUG. 1980
g. P. GUDANG 1x120MW, No.1 FEB. 1981	h. P. GUDANG 1x120MW, No.2 AUG. 1981	i. CBPS G. Turbine 2x80MW AUG. 1982	j. BERSIA 3x24MW AUG. 1983	k. KENERING 3x40MW FEB. 1984	l. PAKA 4x75MW FEB. 1984
m. TRENGGANU 2x100MW No. 1&2 AUG. 1984	n. TRENGGANU 2x100MW No. 3&4 FEB. 1985	o. P. KELANG 1x300MW, No.1 FEB. 1985	p. PAKA 2x75MW AUG. 1985	q. P. KELANG 1x300MW, No.2 FEB. 1986	r. P. GUDANG 1x300MW, No.3 AUG. 1986
s. P. GUDANG 1x300MW, No. 4 AUG. 1987	t. P. KELANG 1x300MW, No. 3 AUG. 1988	u. P. KELANG 1x300MW, No.4 FEB. 1989	v. P. KELANG 1x300MW, No. 5 AUG. 1989	w. P. KELANG 1x300MW, No. 6 FEB. 1990	x. P. KELANG 1x300MW, No.7 AUG. 1990

GAS TURBINE

COMBINED CYCLE

STEAM

HYDRO

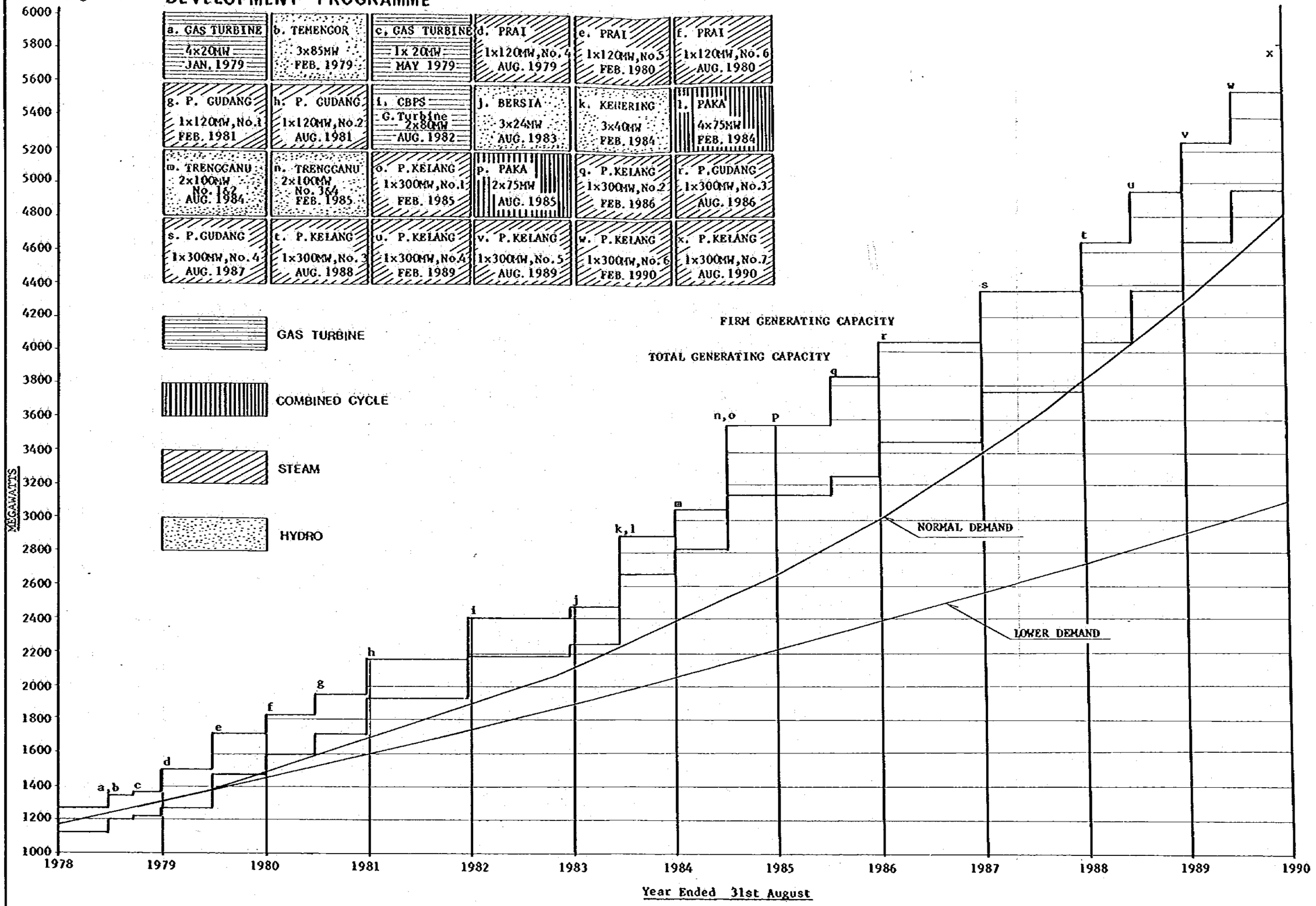


Fig. 6 - 1 Mean Monthly Rainfalls

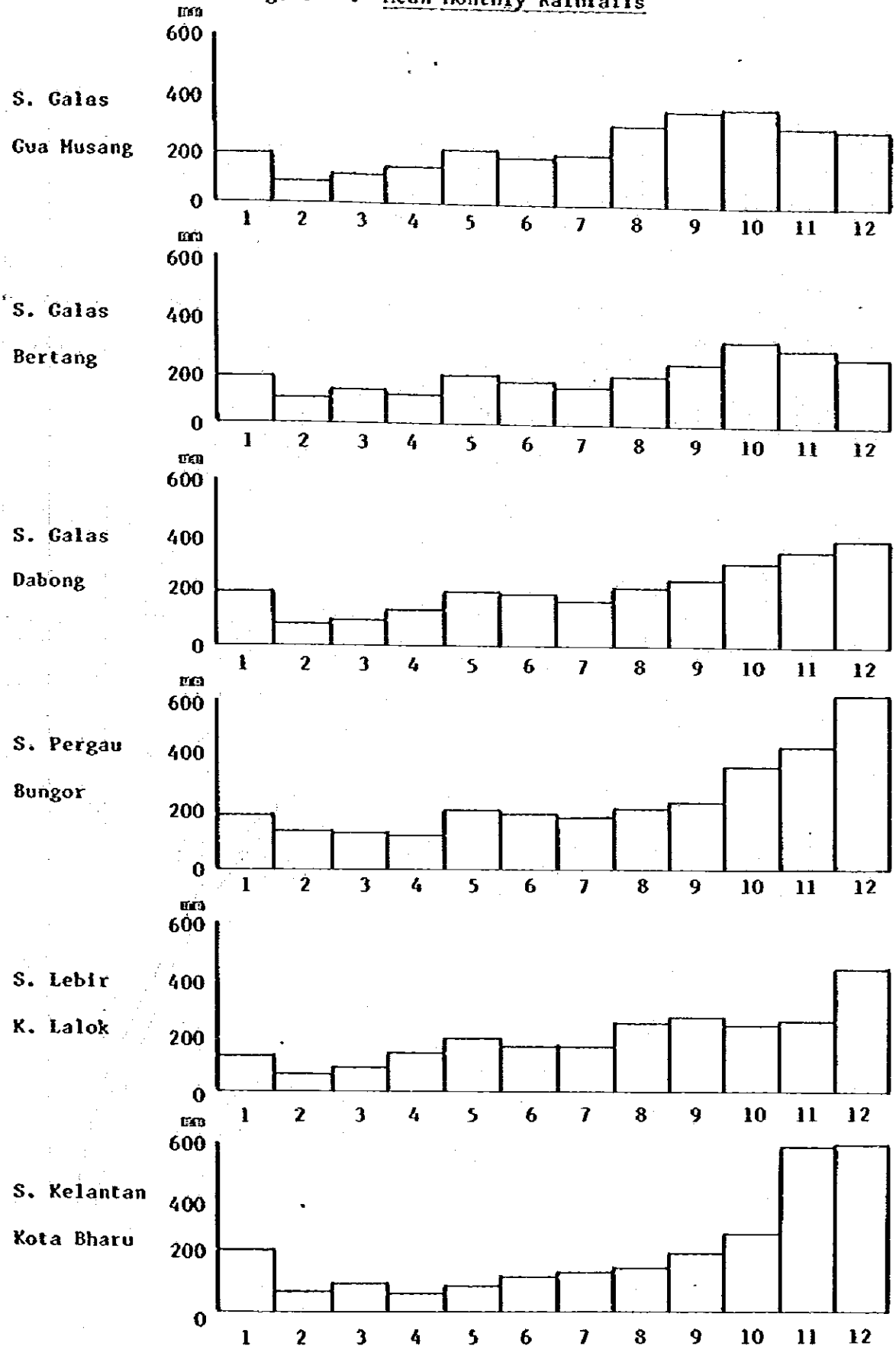


Fig. 6 - 2 Water Level - Discharge Curve (Tualang)

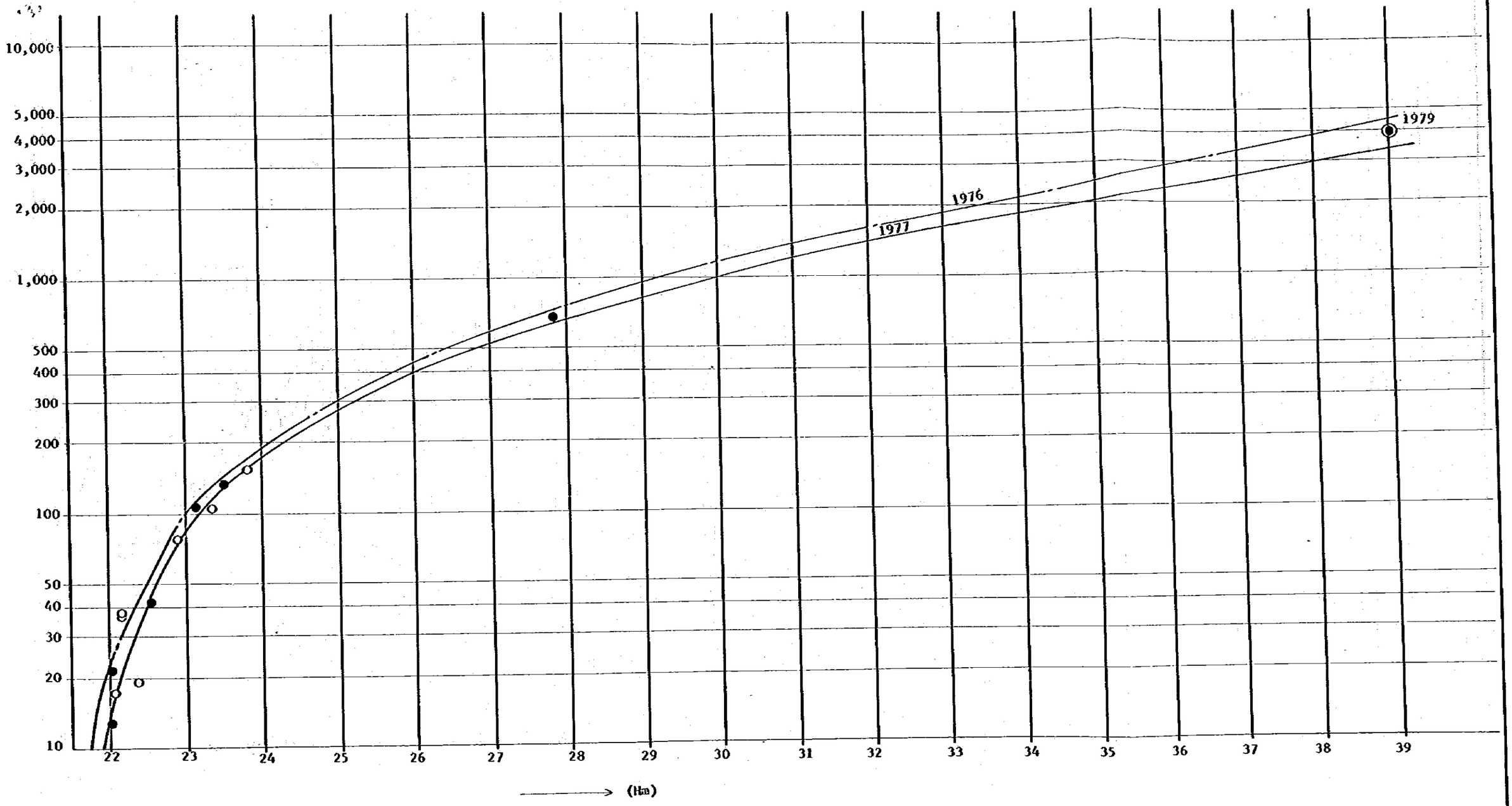


Fig 6 - 3 Daily Discharge Curve at Yuelong

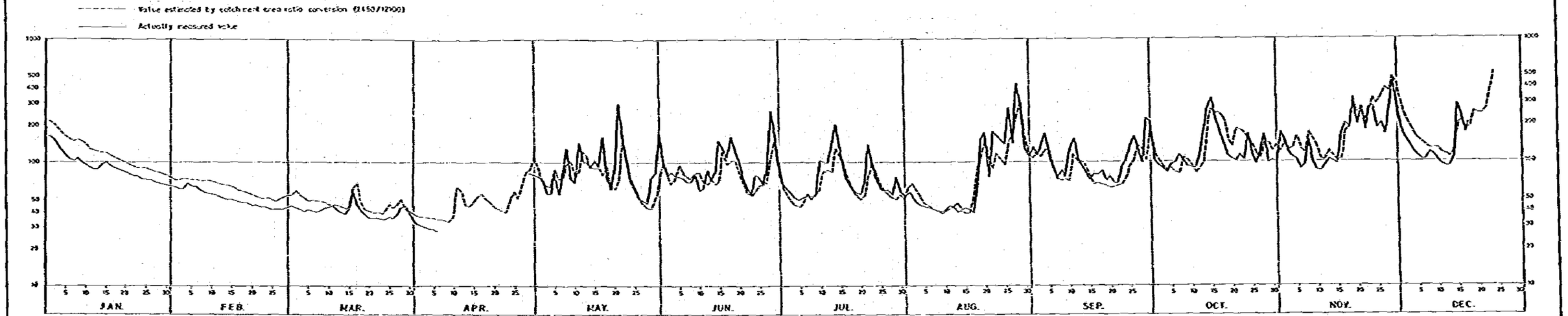


Fig. 6 - 4 Double Mass Curve

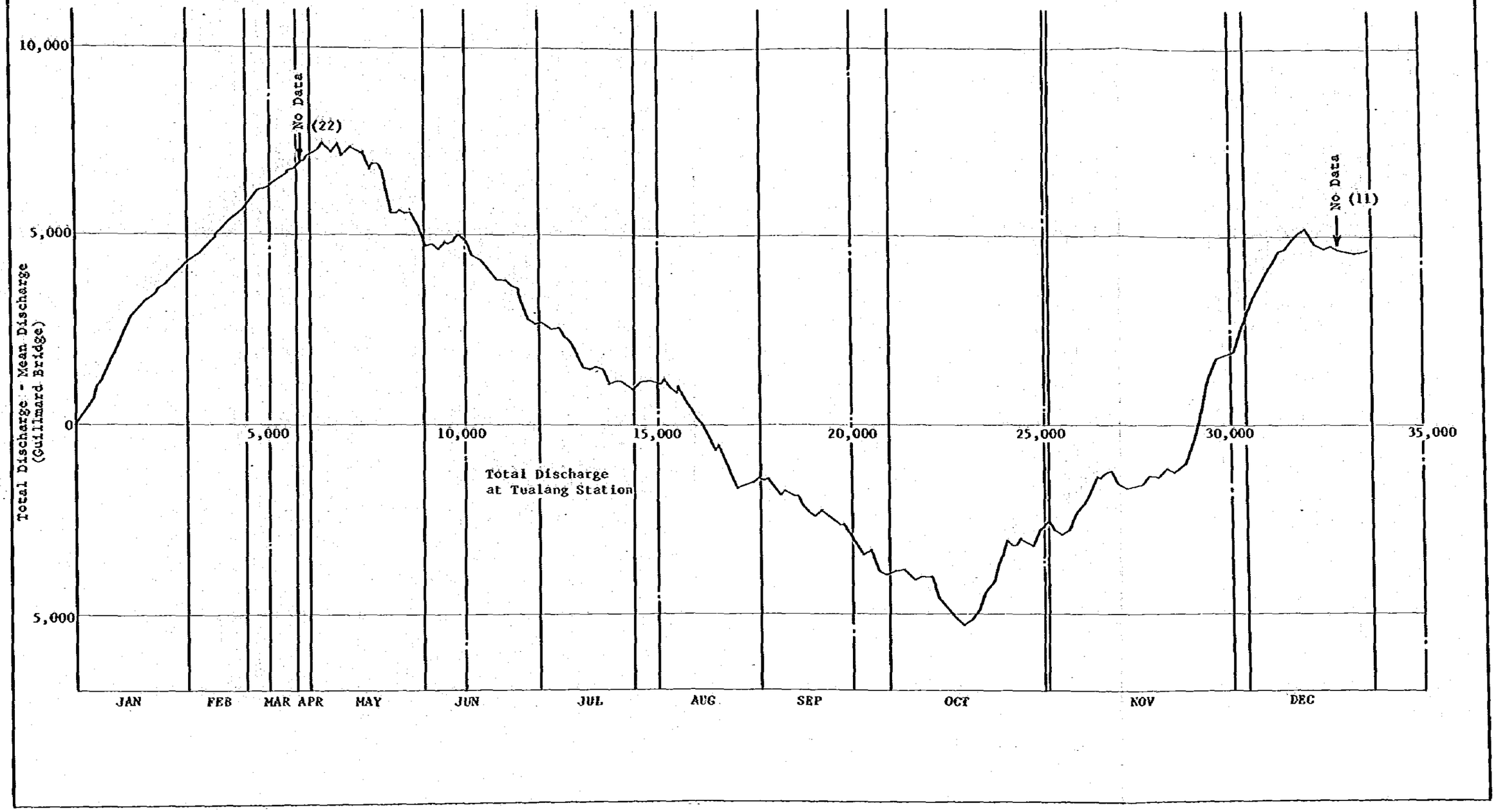


Fig. 6-5 Correlation between Monthly Discharge at Tualang and Guillemard Bridge

• $y = 0.1805_x - 22.741$ ($r = 0.9817$) (Oct. - Mar.)

◦ $y = 0.2880_x - 627.398$ ($r = 0.9951$) (Apr. - Sep.)

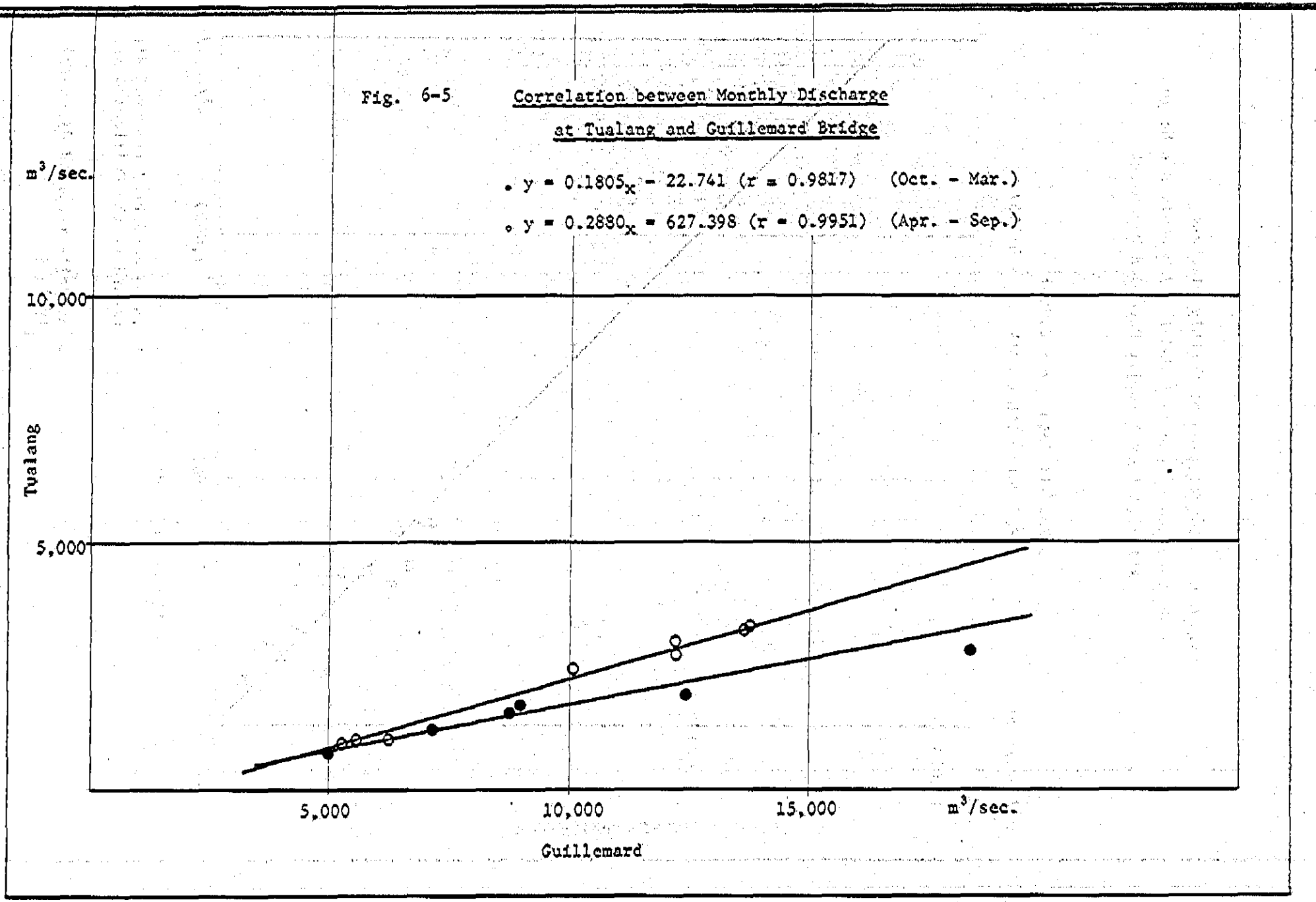


Fig. 6-6 Correlation of Monthly Discharge Synthesized by the Tank Model and Monthly Discharge Estimated from Actually Recorded Discharge

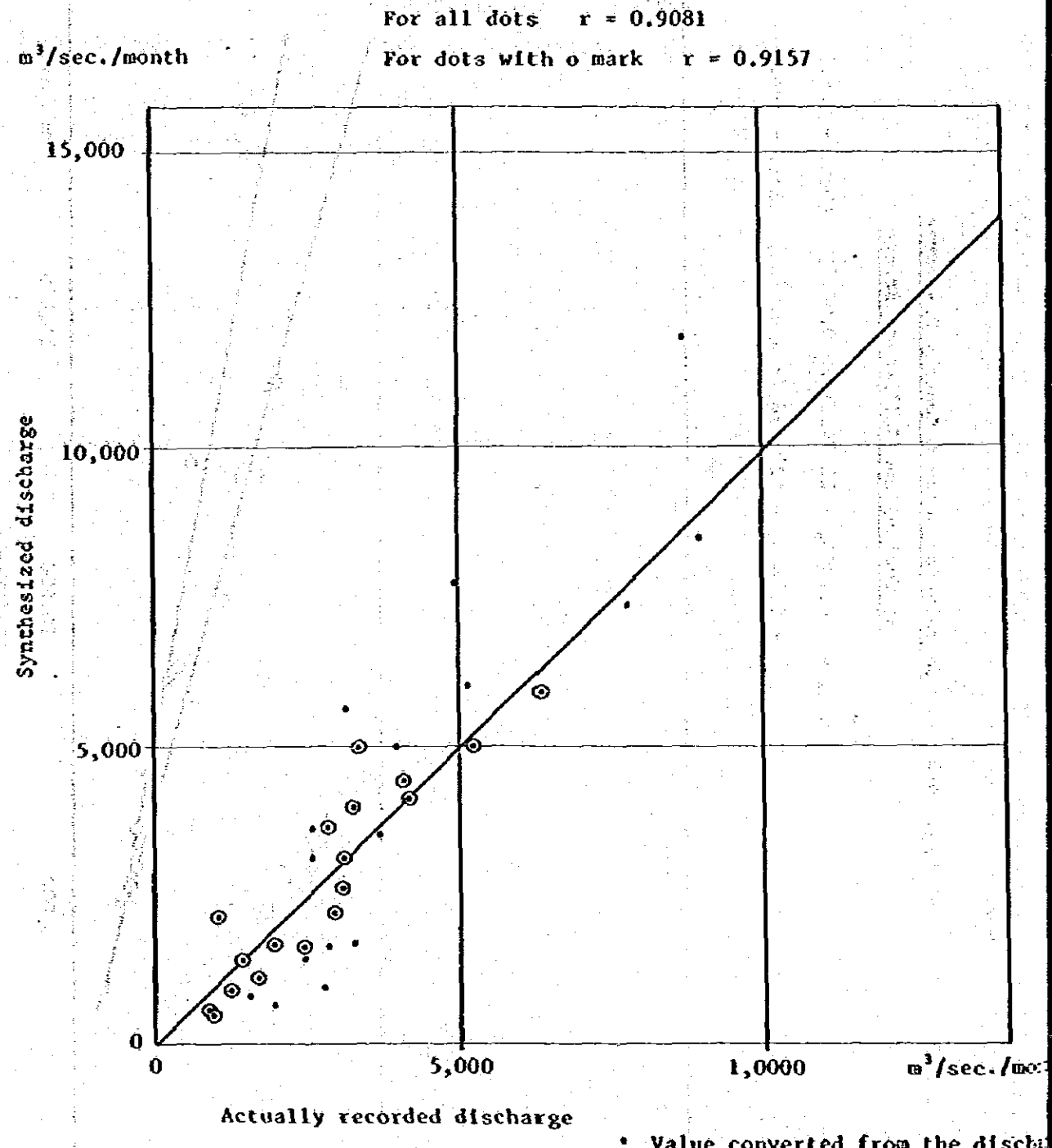


Fig. 6-7 Correlation of Peak Discharge at Tualang and the Guillemard Bridge

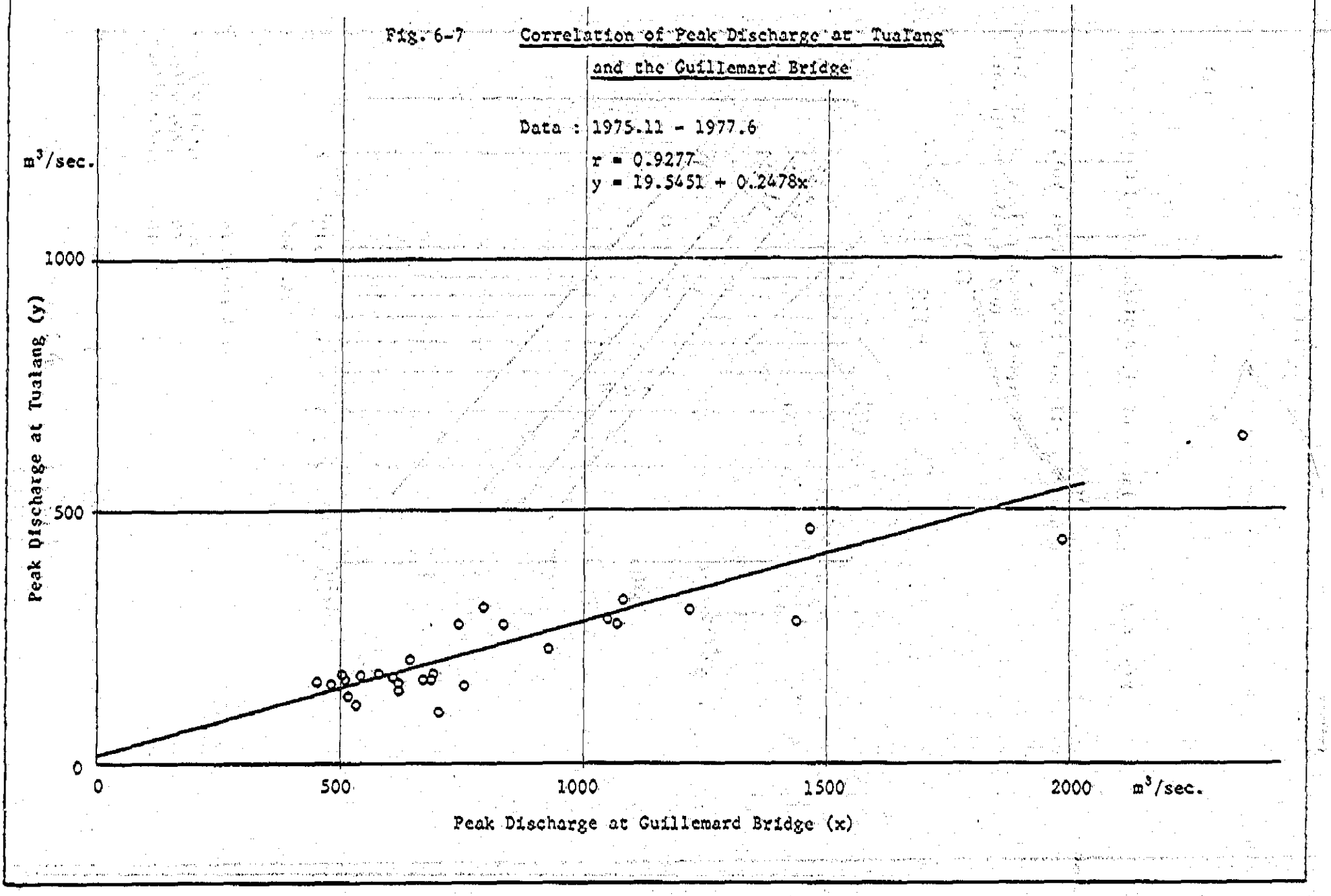
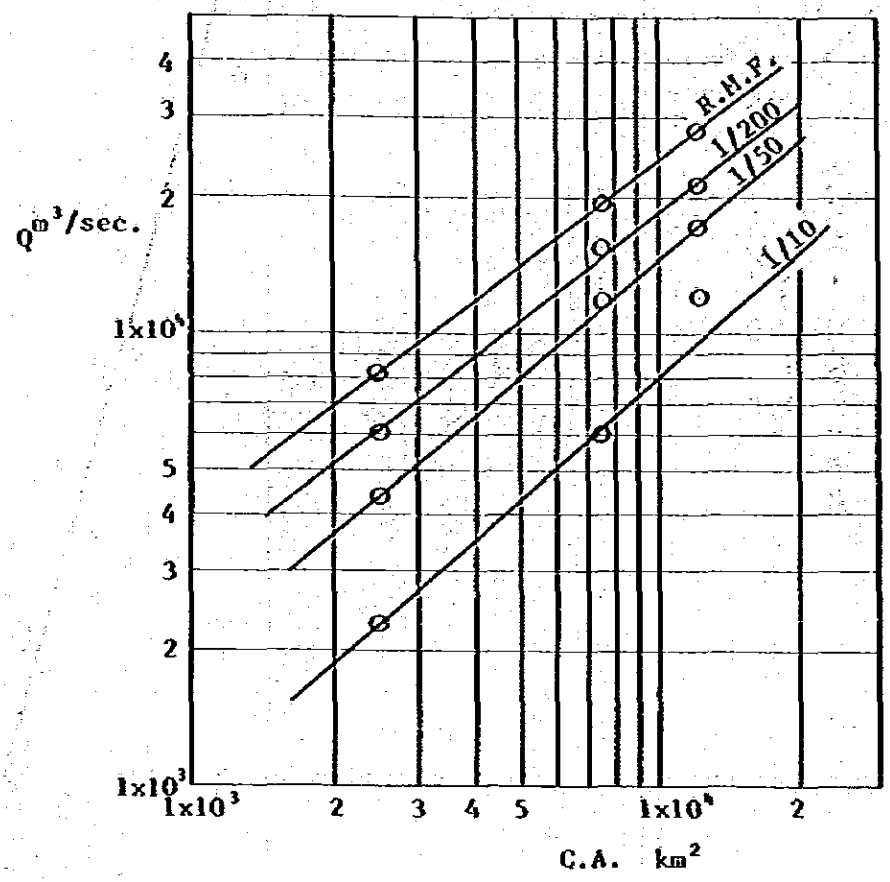


Fig. 6-8 Correlation of Flood Discharge and Catchment Area

Source : Guillemard FINAL REPORT Vol. 1

ENEX Report Dabong FIRST INTERIM REPORT P
Tualang FINAL REPORT Vol. 3



JICA ESTIMATE

1/200	5,800 m³/sec.
1/ 50	4,200 m³/sec.
1/ 10	2,600 m³/sec.

Fig 6-9 Discharge Fluctuation at the Guillemard Bridge $Q_B = 100.0\ m^3/s$

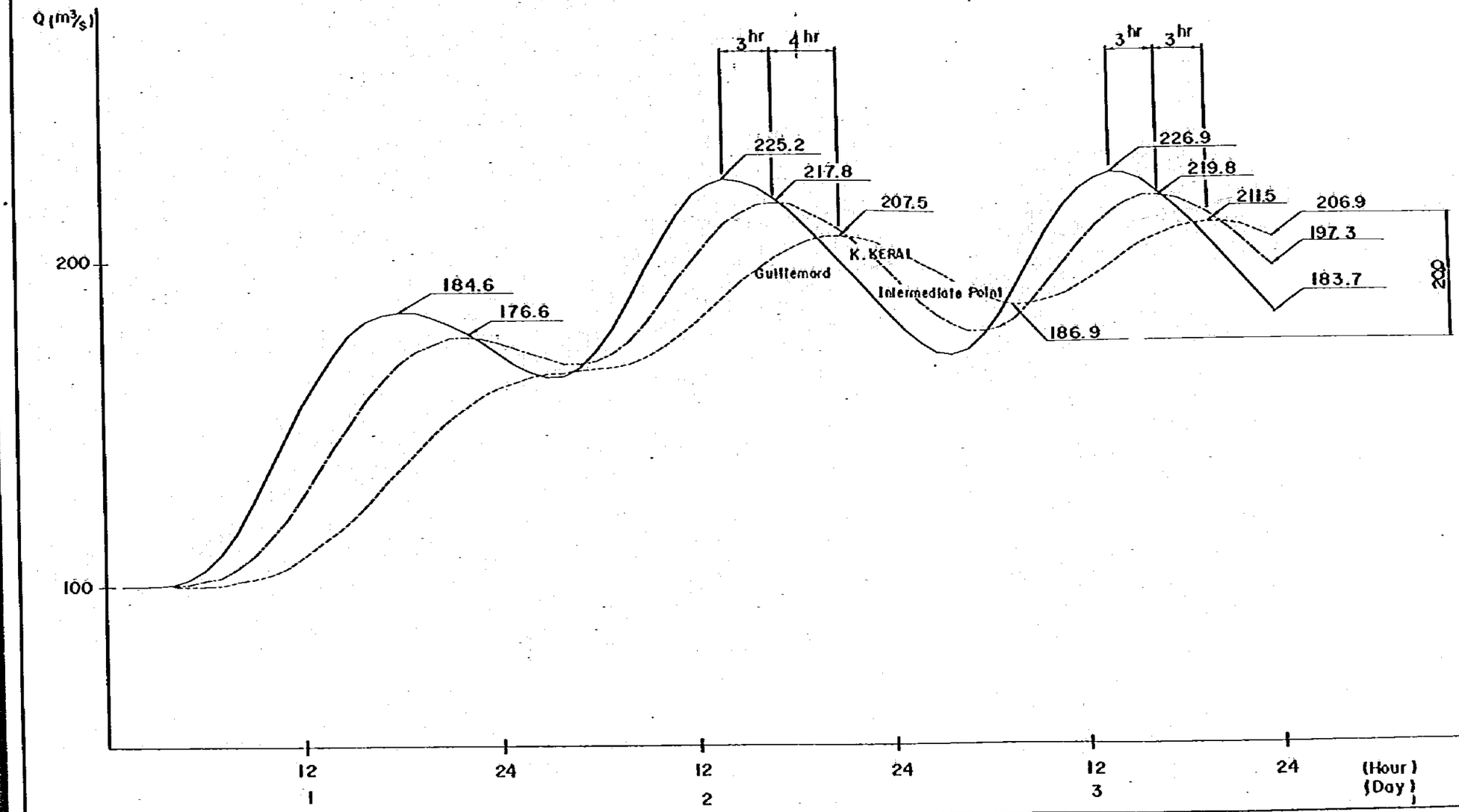


Fig. 7 - 1 Location of Water Quality Stations

(No. 642 and No. 652)

Fig. 7 - 1 Location of Water Quality Stations

(No. 642 and No. 652)

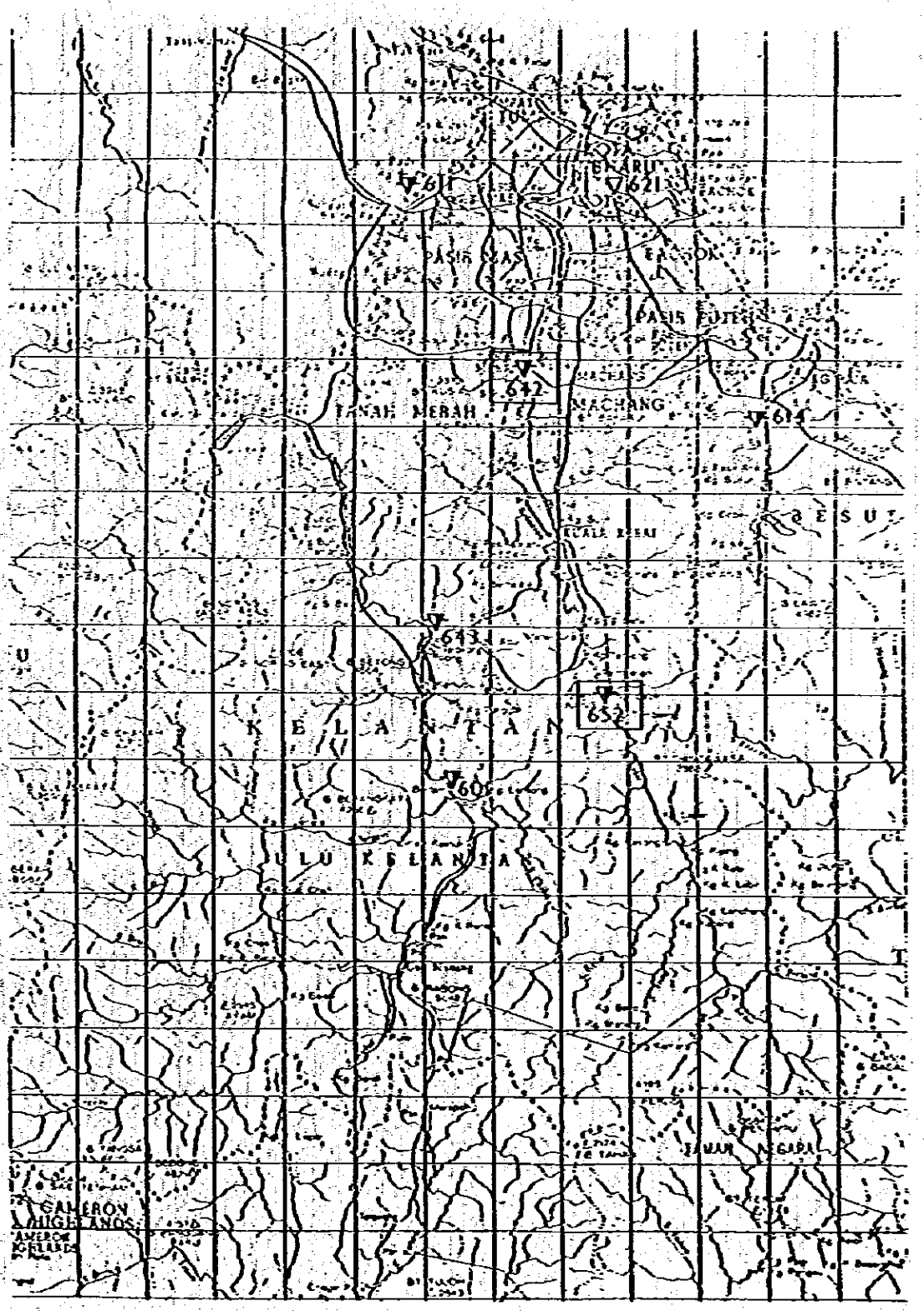


Fig. 7 - 2 Location of Water Quality Stations

(No. 643)

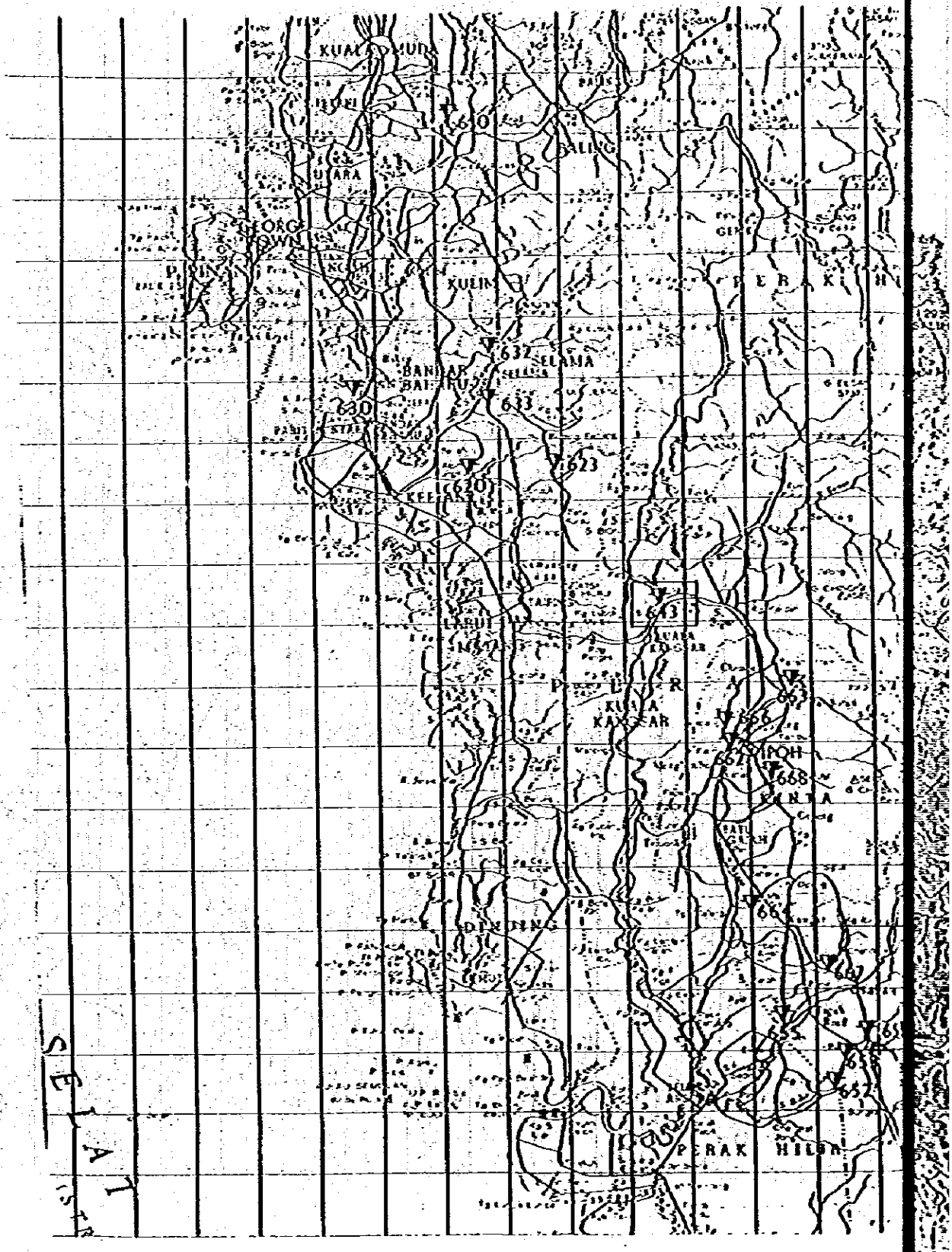
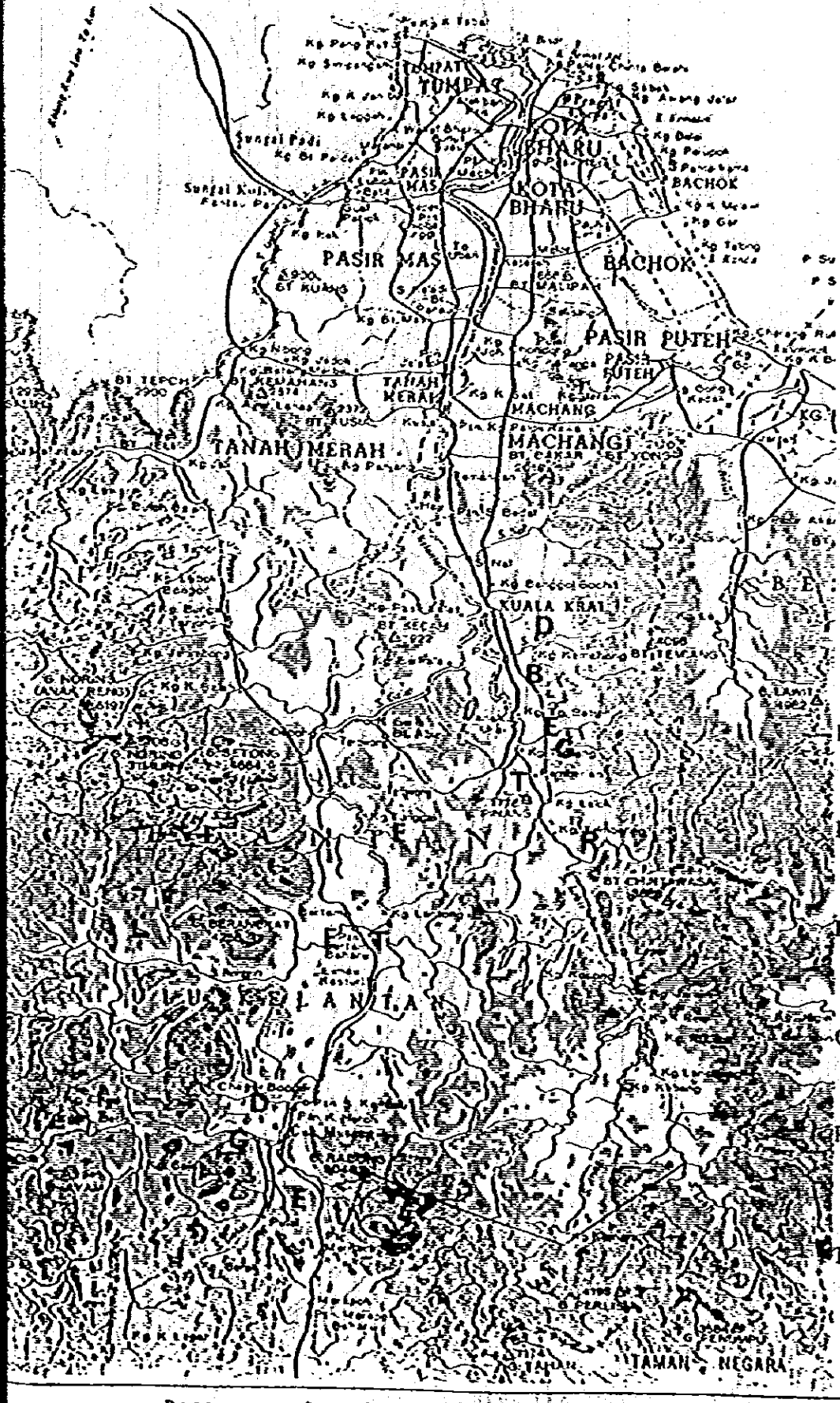
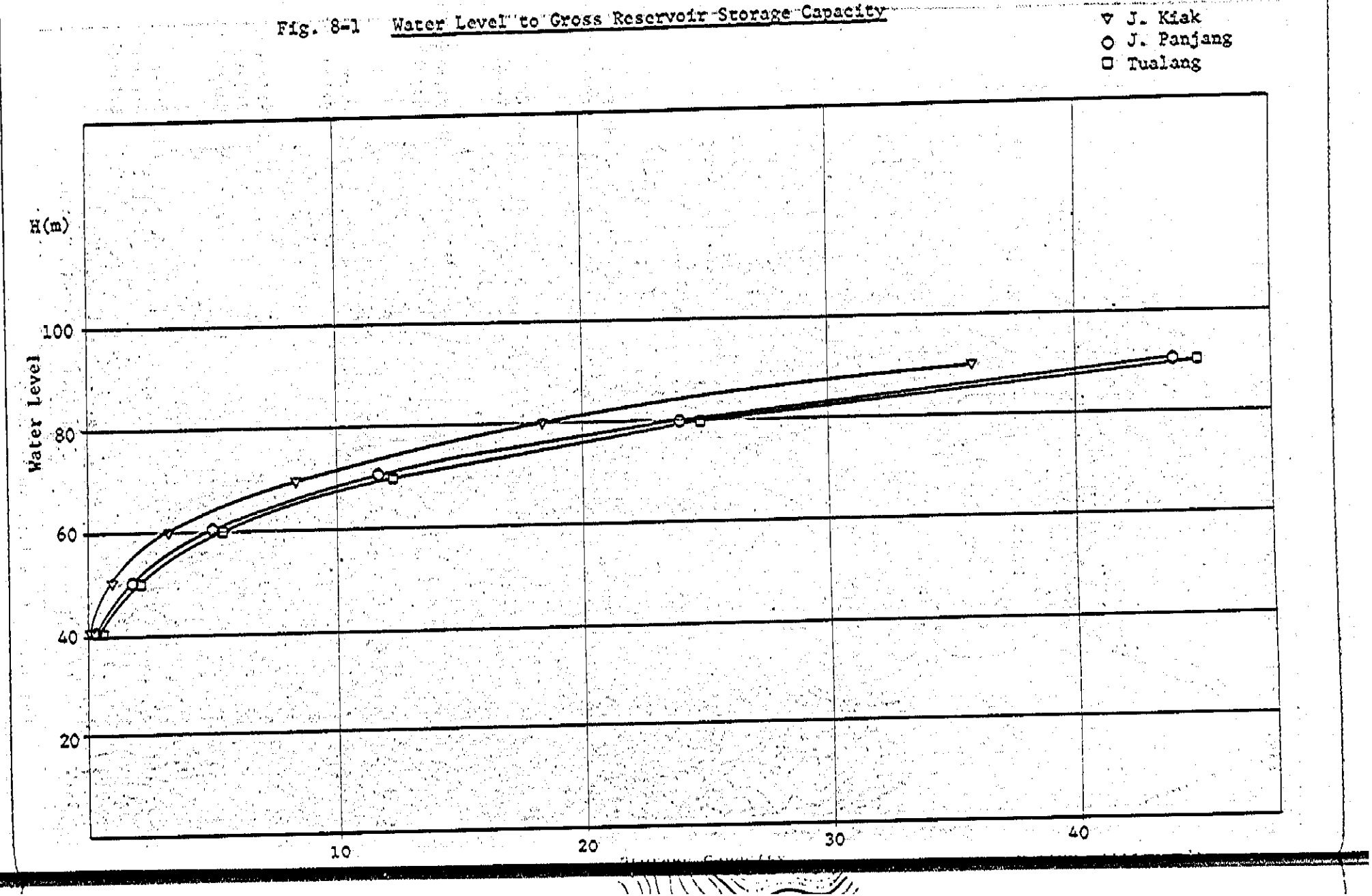


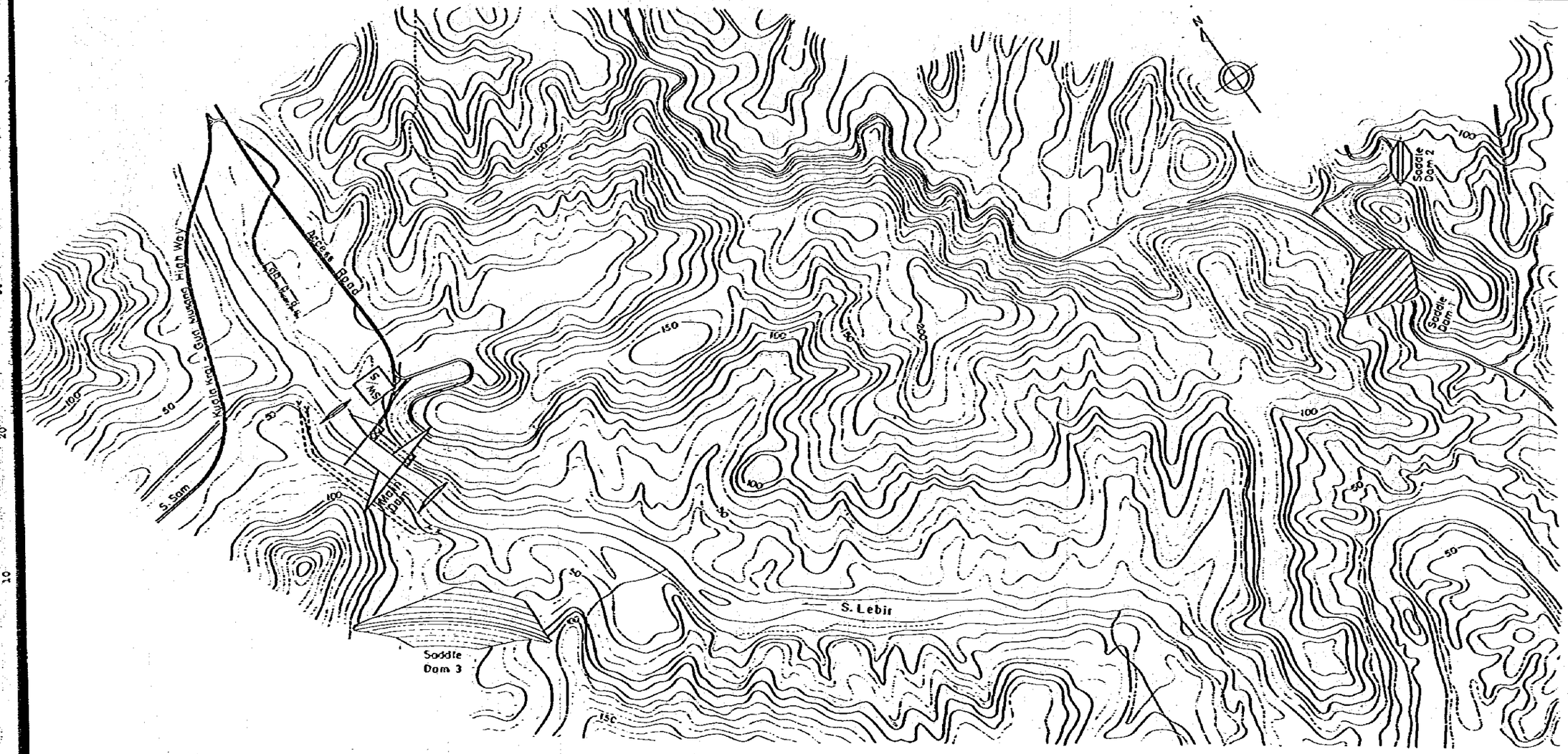
Fig. 7 - 3 Location of Habitants of Wild Animals



Resource: Game Dep. in Kelantan

Fig. 8-1 Water Level to Gross Reservoir Storage Capacity

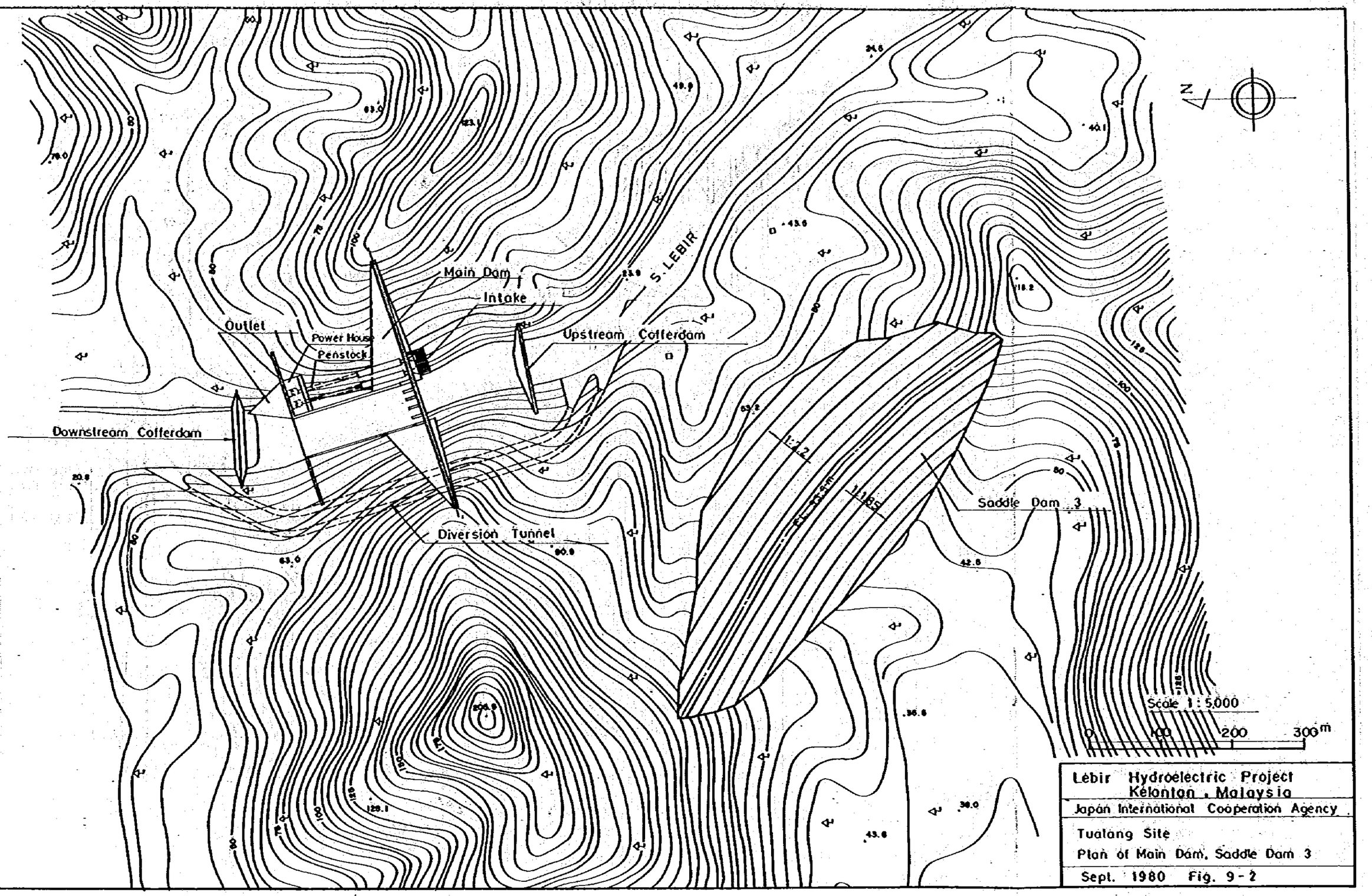




Scale 1:10000

0 100 200 300 400 500 (m)

Lebir Hydroelectric Project Kelanton, Malaysia	
Japan International Cooperation Agency	
Tualang Site General Plan	
Sept. 1980	Fig. 9-1



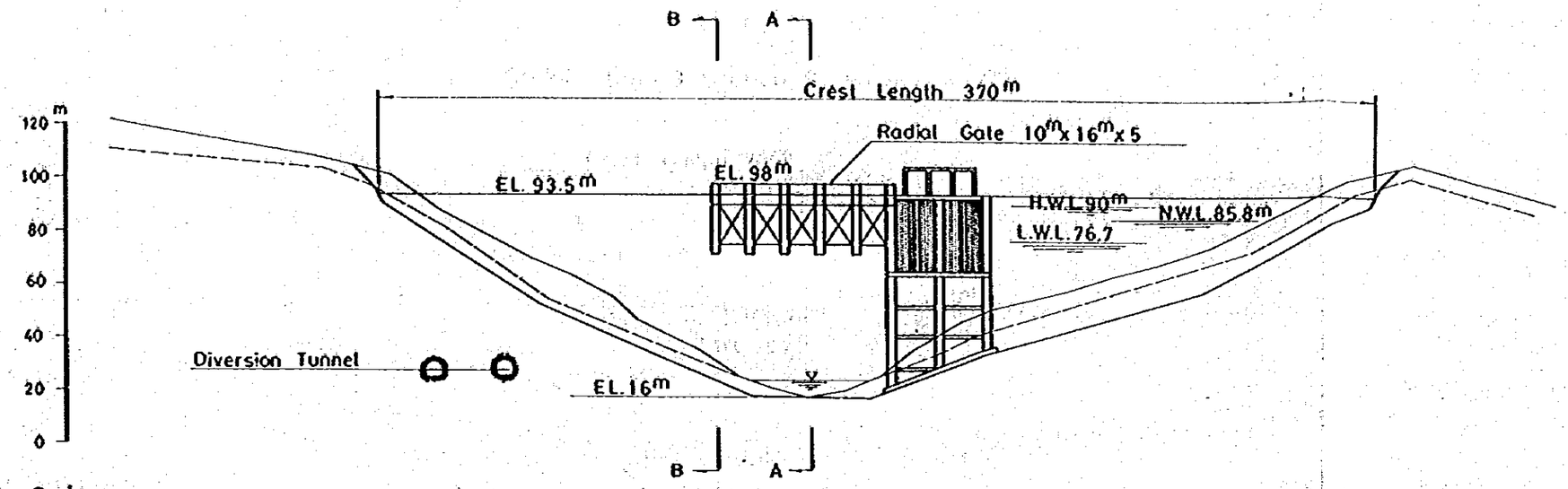
Lebir Hydroelectric Project
Kelantan, Malaysia

Japan International Cooperation Agency

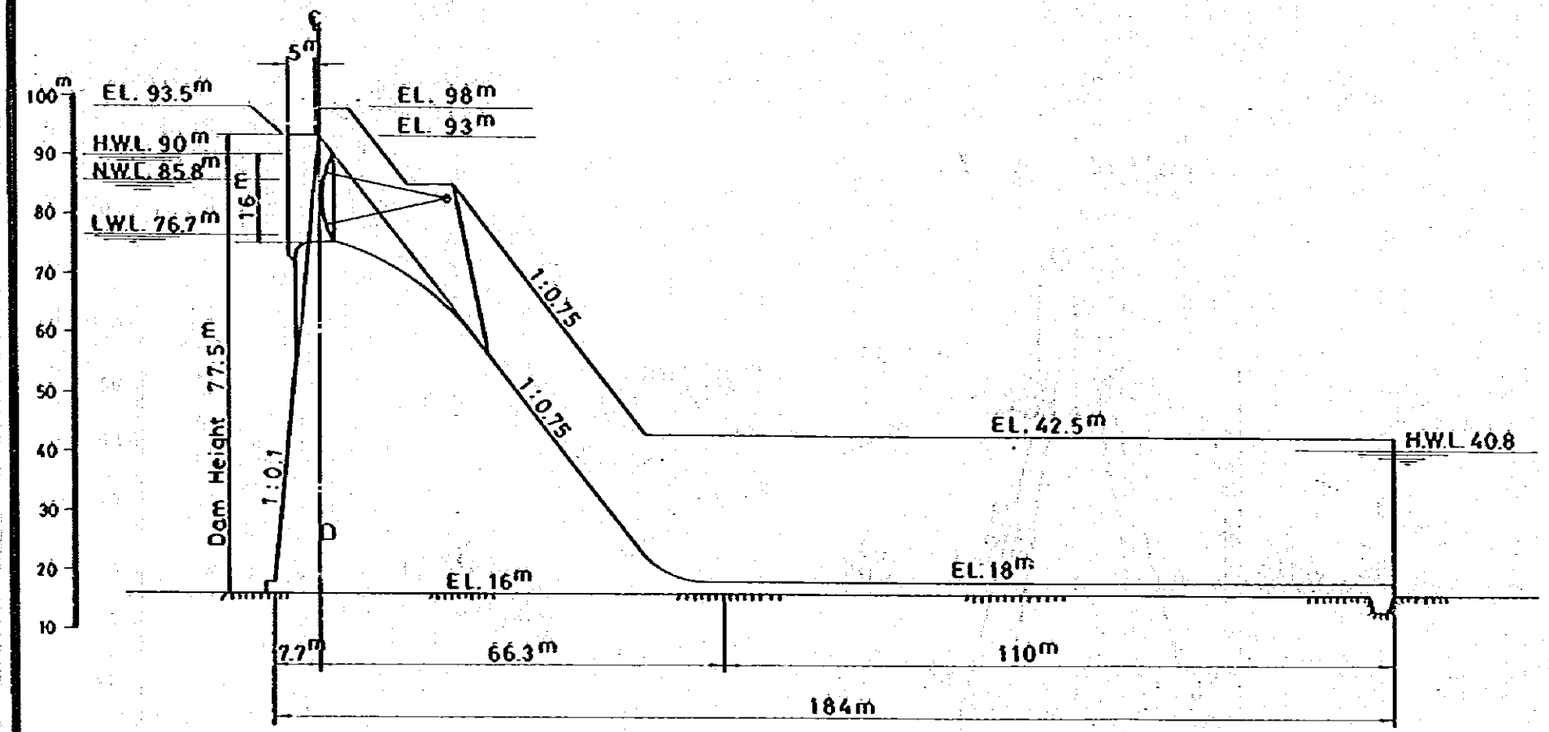
Tualang Site
Plan of Main Dam, Saddle Dam 3

Sept. 1980 Fig. 9-2

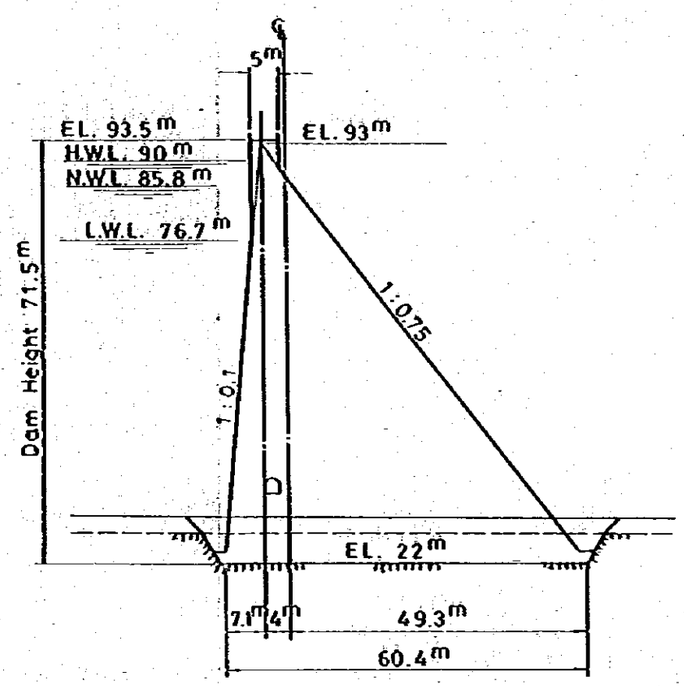
Main Dam Section S = 1/2,000



A - A S = 1/1,000



B - B S = 1/1,000

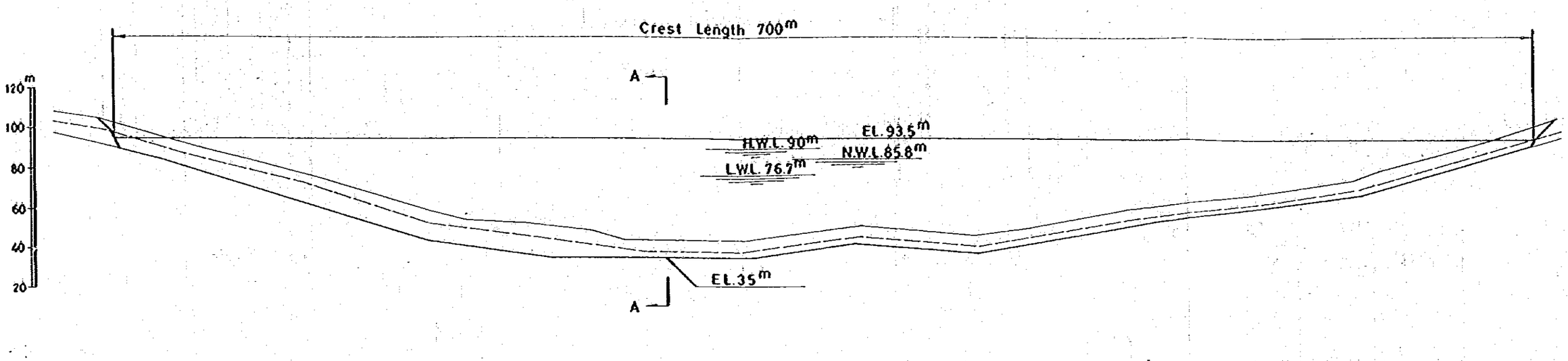


S = 1/2,000 0 20 40 60 80 100 (m)

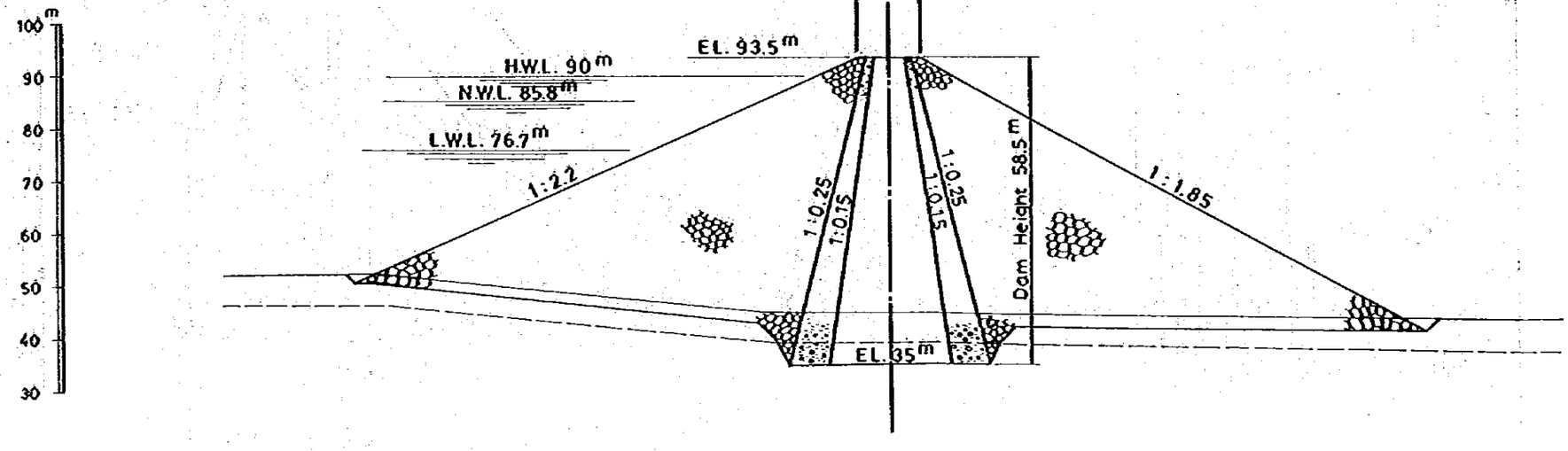
S = 1/1,000 0 10 20 30 40 50 (m)

Lebir Hydroelectric Project Kelantan, Malaysia
Japan International Cooperation Agency
Tualang Site. Main Dam Section
Sept. 1980 Fig. 9-3

Saddle Dam 3 Section S = 1/2000



A - A S = 1/1000

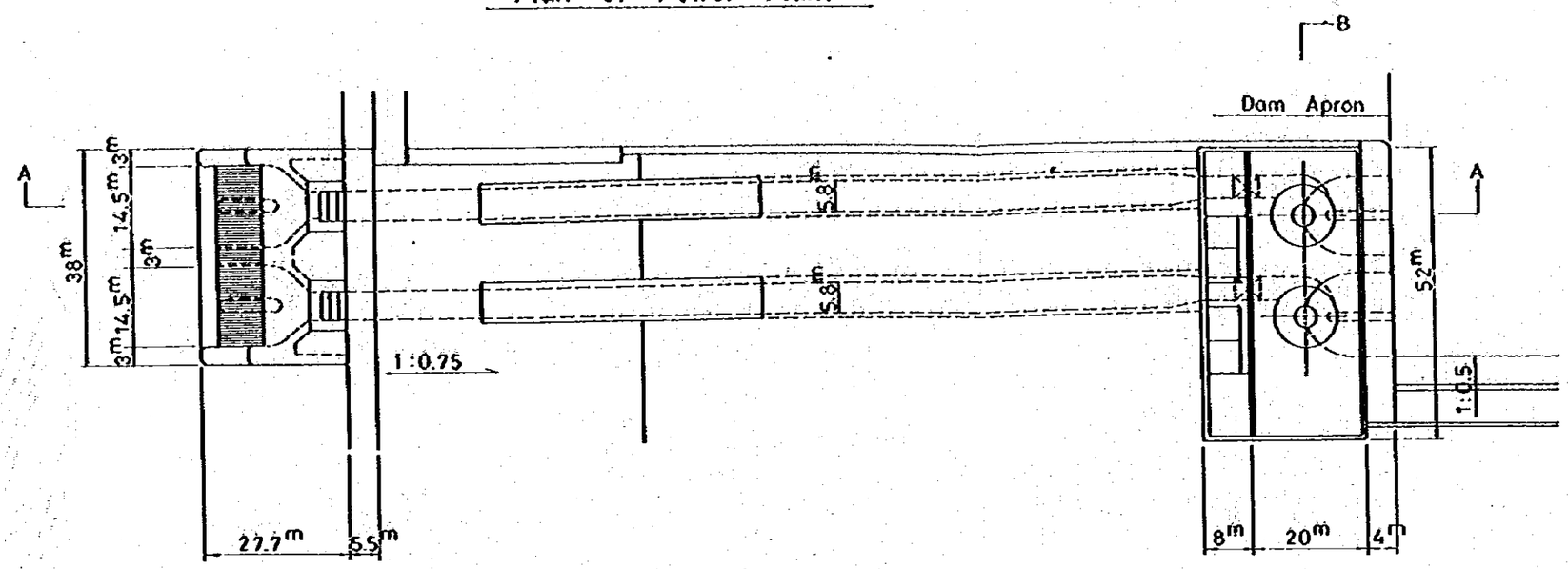


S=1/2000 0 20 40 60 80 100 (m)

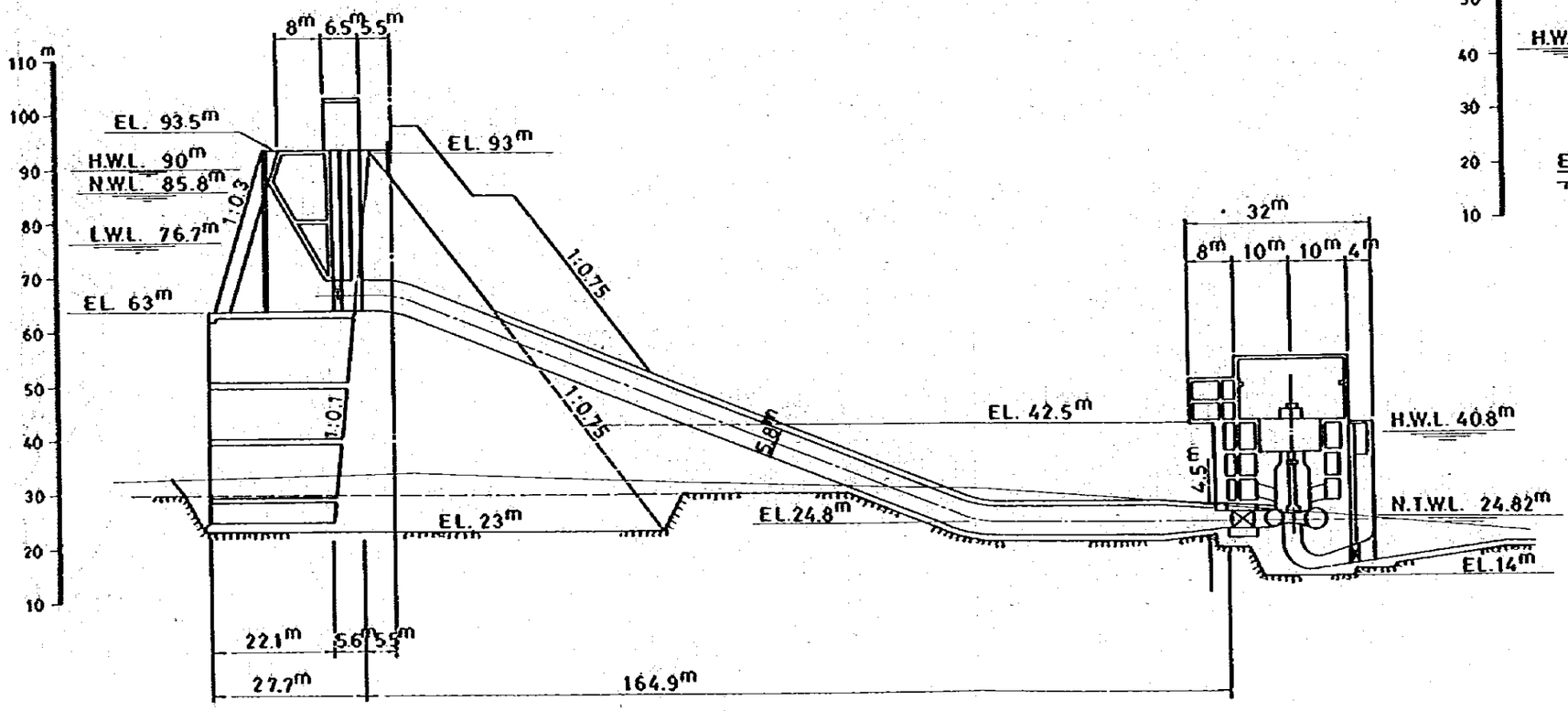
S=1/1000 0 10 20 30 40 50 (m)

Lebir Hydroelectric Project Kelantan, Malaysia
Japan International Cooperation Agency
Tualang Site Saddle Dam 3 Section
Sept. 1980 Fig. 9-4

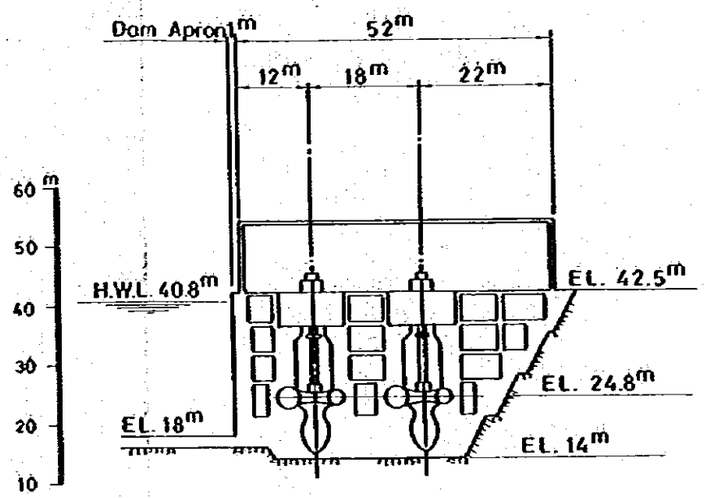
Plan of Power Plant



A - A

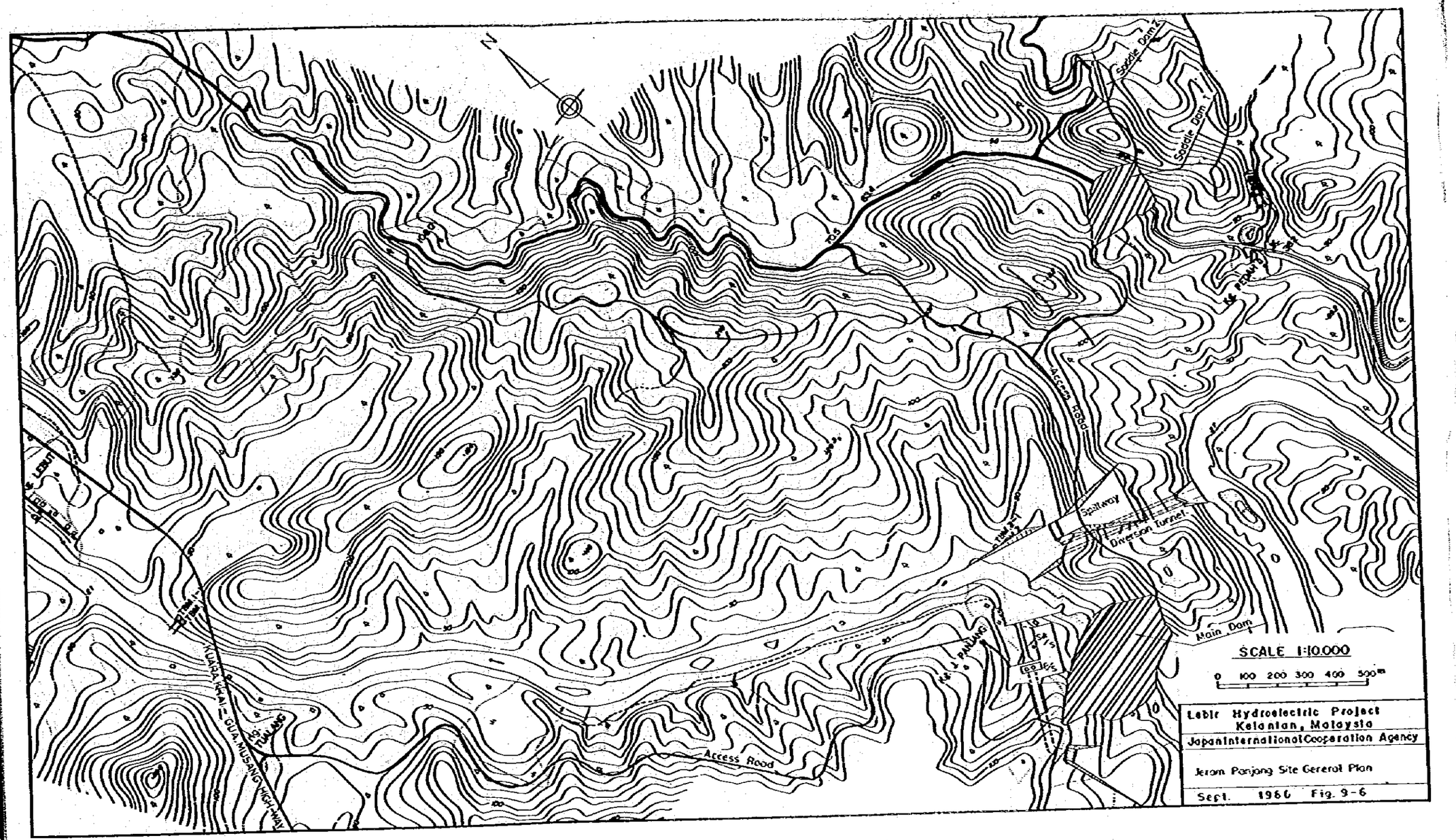


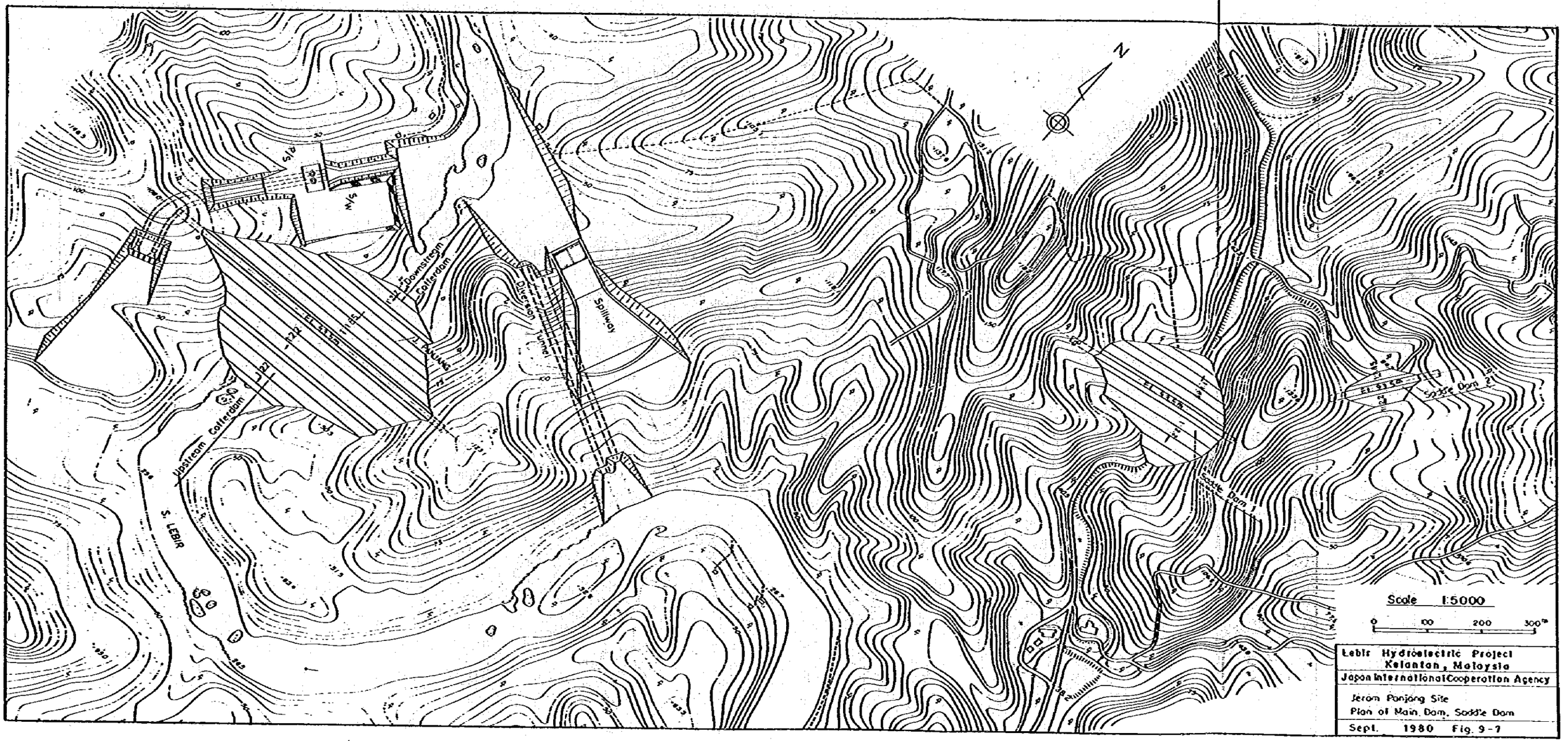
B - B



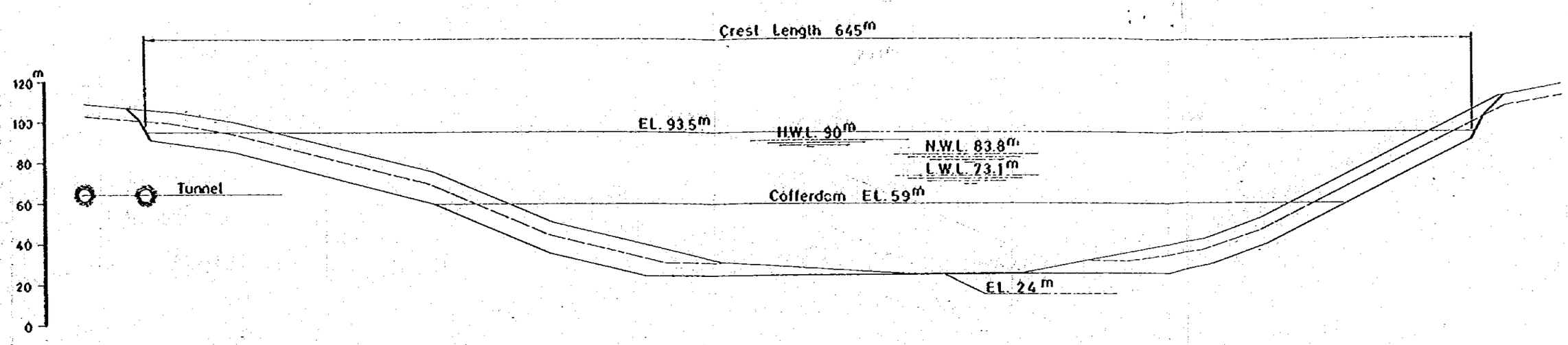
S = 1/1,000 0 10 20 30 40 50 (m)

Lebir Hydroelectric Project Kelantan, Malaysia
Japan International Cooperation Agency
Tualang Site Plan and Section of Power Plant
Sept. 1980 Fig. 9-5

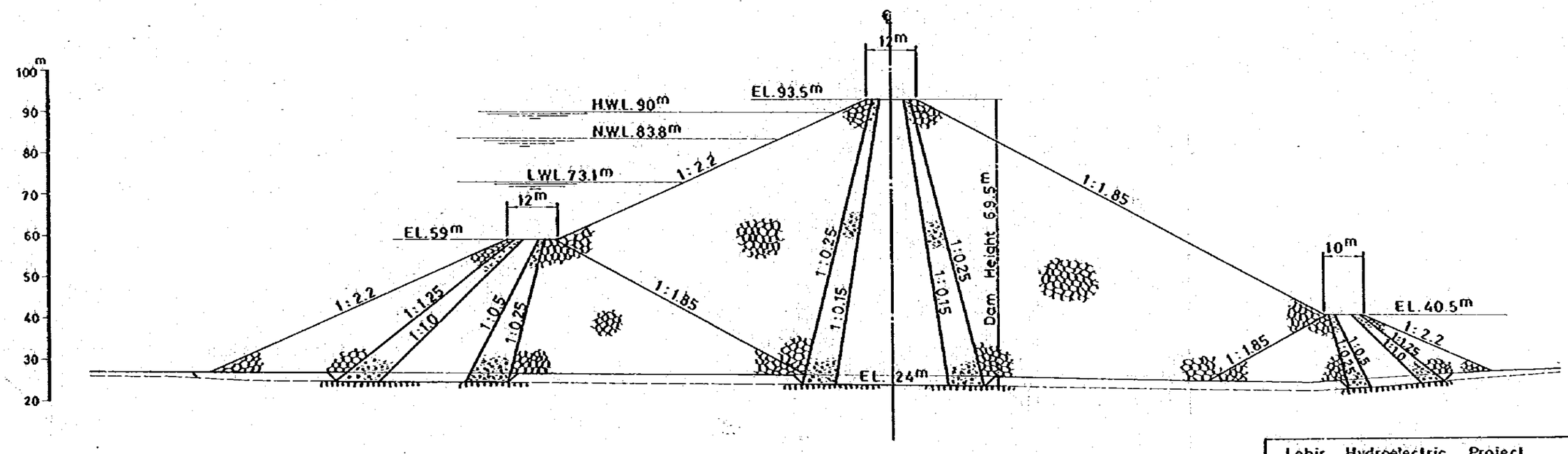

N
Saddle Dam 2
Saddle Dam 1
Access Road
Spillway
Diversion Tunnel
Main Dam
Access Road
KUALA KRAI - GUA MUSANG HIGH-WAY
SG. TUALANG
SG. PANJANG
SCALE 1:10,000
0 100 200 300 400 500m
Lebir Hydroelectric Project
Kelantan, Malaysia
Japan International Cooperation Agency
Jeram Panjang Site General Plan
Sept. 1986 Fig. 9-6


N
P/S
Downstream Cofferdam
Diversion Tunnel
Spillway
Upstream Cofferdam
S. LEBIR
Saddle Dam 1
Saddle Dam 2
Scale 1:5000
0 100 200 300m
Lebir Hydroelectric Project
Kelantan, Malaysia
Japan International Cooperation Agency
Jerom Panjang Site
Plan of Main Dam, Saddle Dam
Sept. 1980 Fig. 9-7

Longitudinal Section S = 1/2,000



Typical Section S = 1/1,000

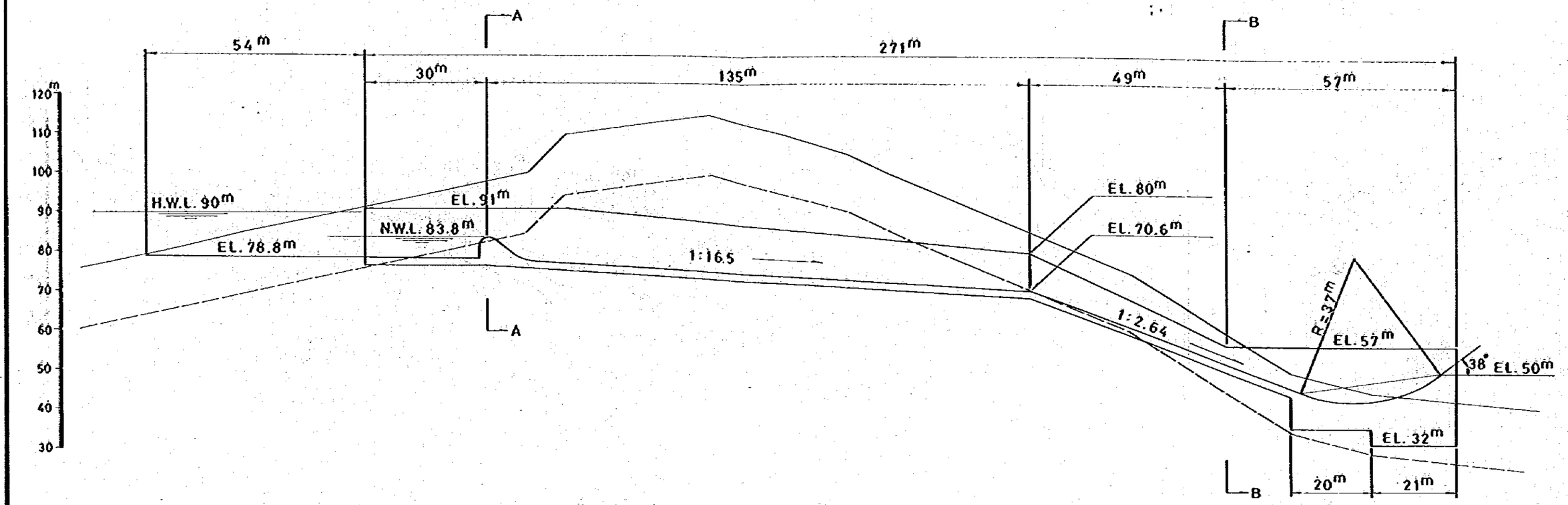


S = 1/2,000 0 20 40 60 80 100 (m)

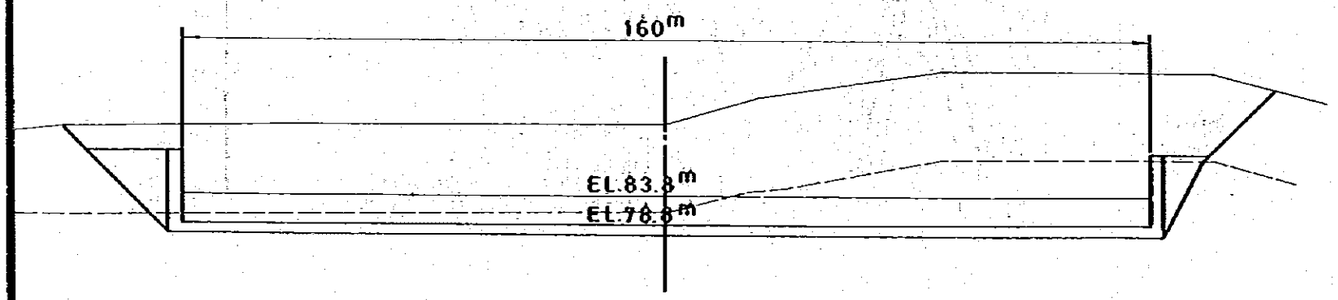
S = 1/1,000 0 10 20 30 40 50 (m)

Lebir Hydroelectric Project Kelantan, Malaysia
Japan International Cooperation Agency
Jeram Panjang Site Main Dam Section
Sept. 1980 Fig. 9-8

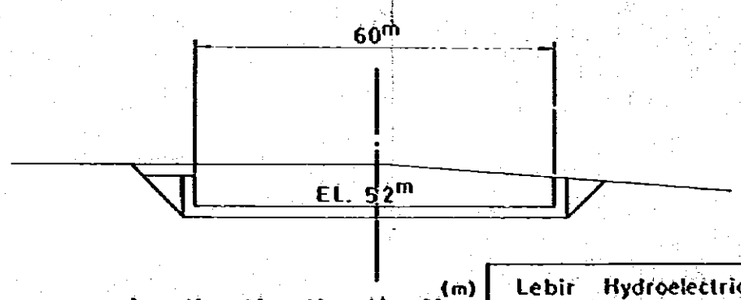
Longitudinal Section



A - A



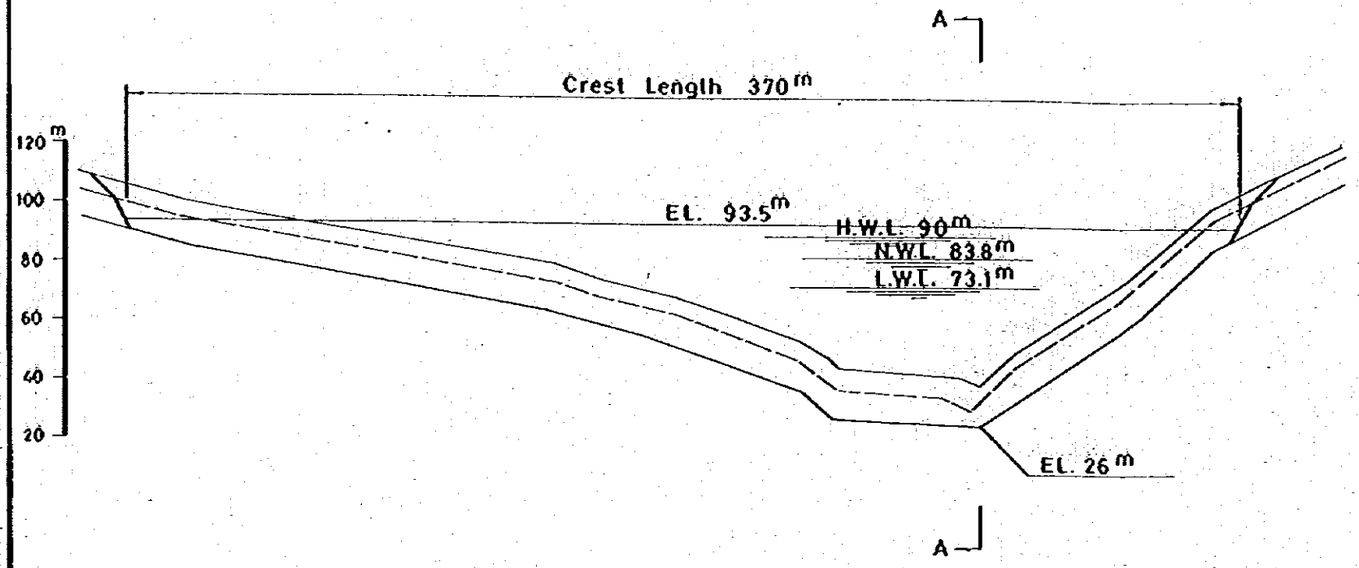
B - B



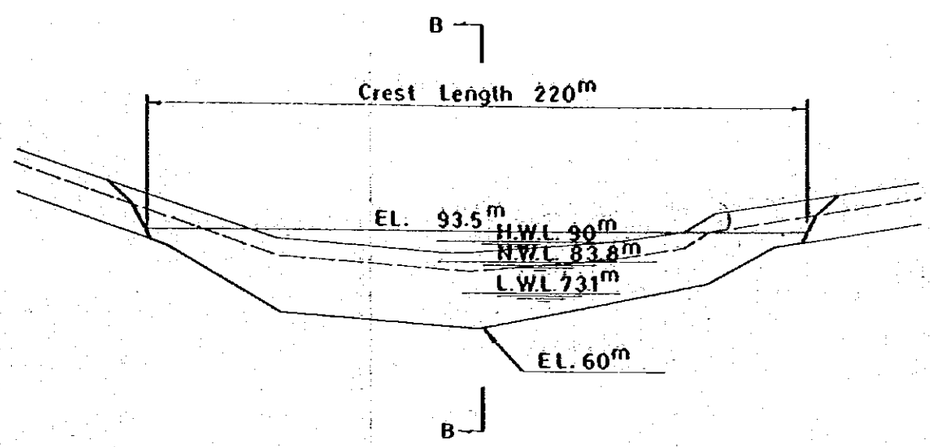
S = 1/1000 0 10 20 30 40 50 (m)

Lebir Hydroelectric Project Kelantan, Malaysia
Japan International Cooperation Agency
Jeram Panjang Site Spillway Section
Sept. 1980 Fig. 9-9

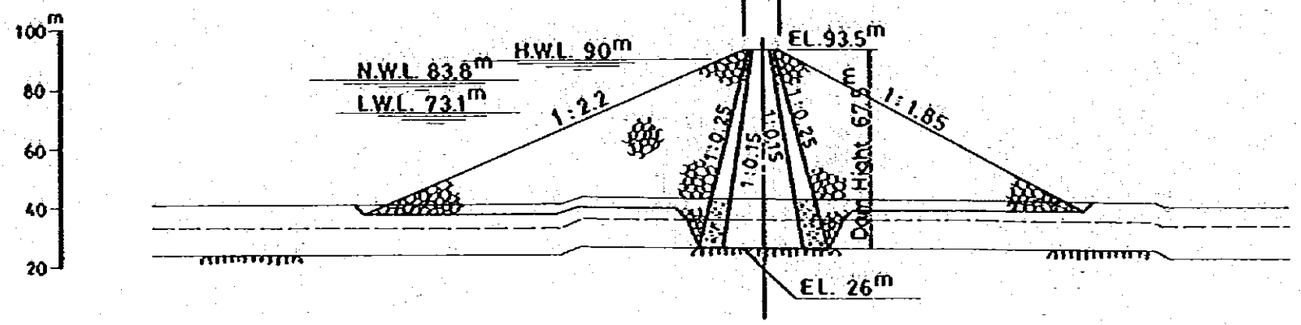
Saddle Dam 1 Section



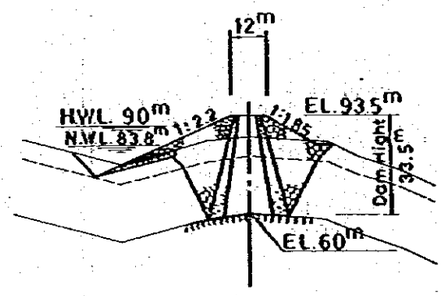
Saddle Dam 2 Section



A - A

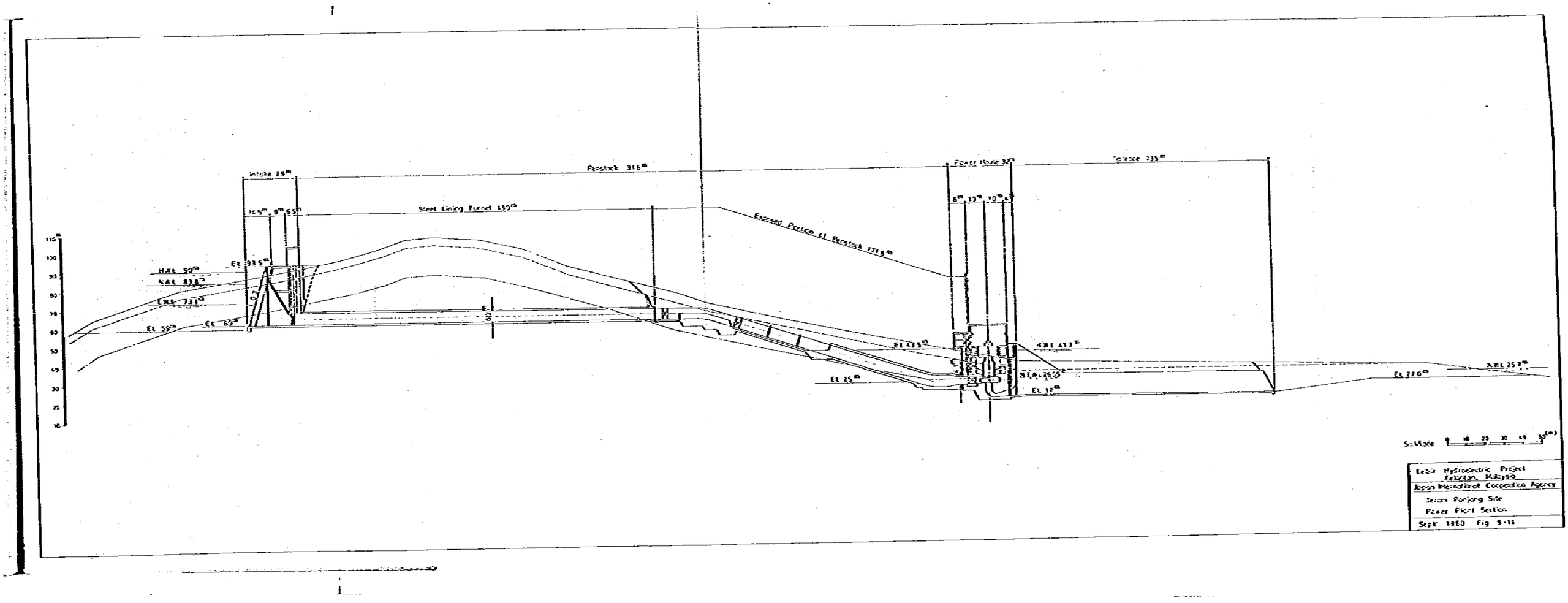


B - B



S = 1/2000 0 20 40 60 80 100 (m)

Lebir Hydroelectric Project Kelantan, Malaysia
Japan International Cooperation Agency
Jeram Panjang Site Saddle Dam 1, 2, Section
Sept. 1980 Fig. 9-10


Intake 29m
Penstock 316m
Steel Lining Turret 332m
Power House 32m
Surface 335m
Exposed Portion of Penstock 371.5m
EL 335m
EL 59m
EL 62m
EL 25m
EL 33m
EL 226m
Section
Kedah Hydroelectric Project
Kelantan, Malaysia
Japan International Cooperation Agency
Jeram Panjang Site
Power Plant Section
Sept 1980 Fig 5-11