APPENDIX

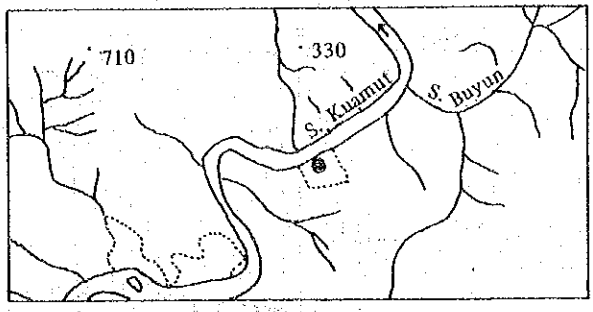
APPENDIX A

SKETCH OF STATION LOCATION
KINABATANGAN RIVER

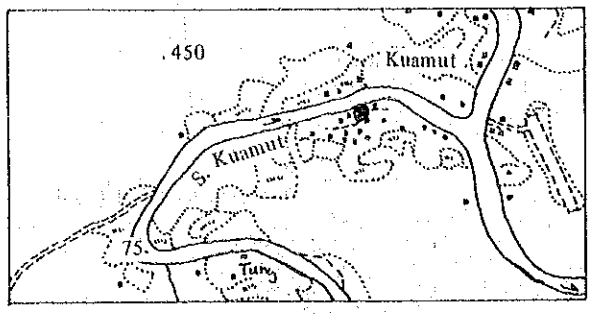
Information map of New Station Location

Scale: 1 : 50,000

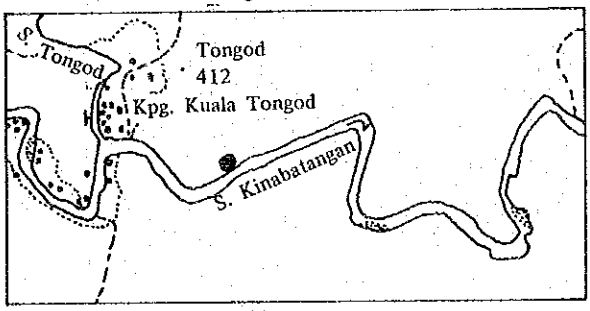
Ulu Kuamut Station



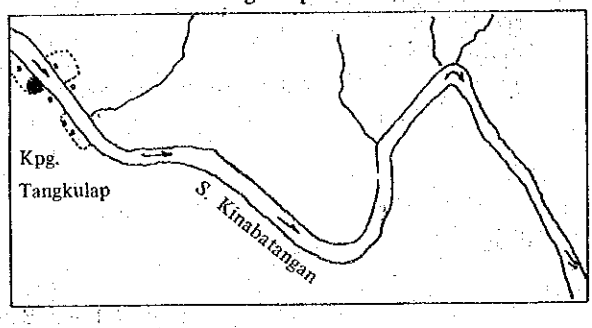
Kuamut Station



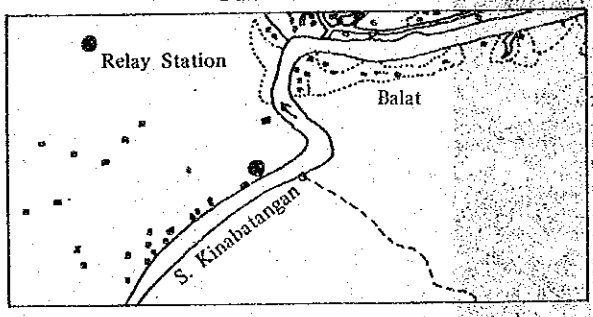
Tongod Station



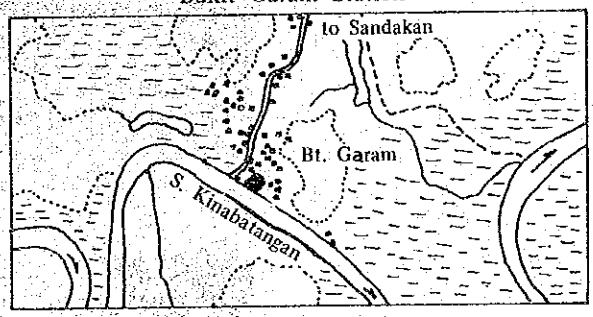
Tangkulap Station



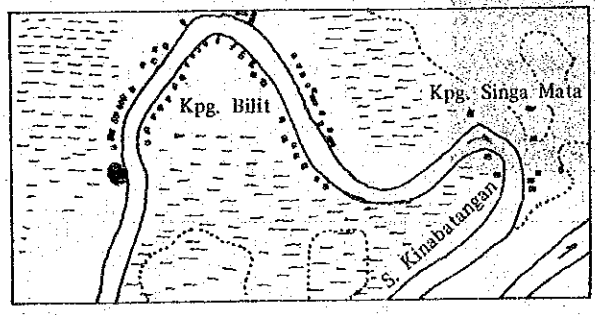
Balat Station



Bukit Garam Station

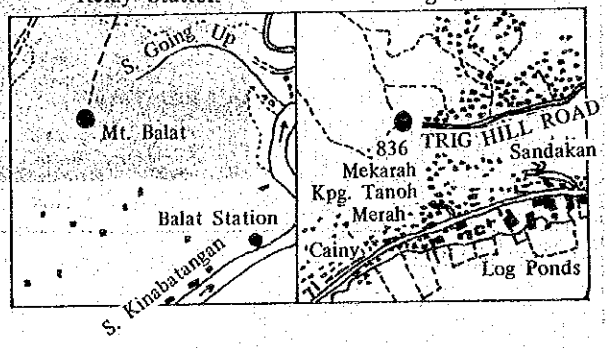


Bilit Station



Relay Station

Trig Hill

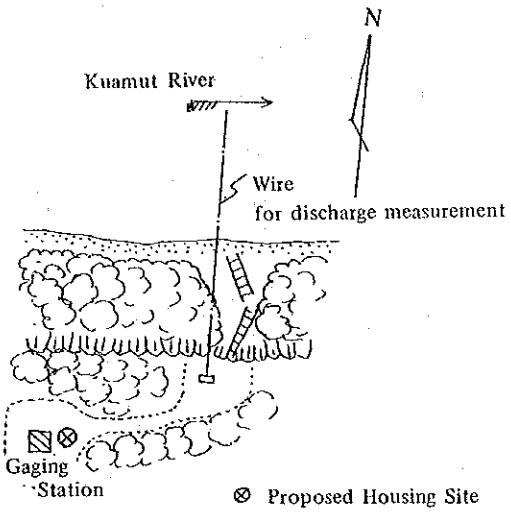


FFC: Kota Kinabalu
Monitoring St.: Sandakan DID office
●: New Station Location

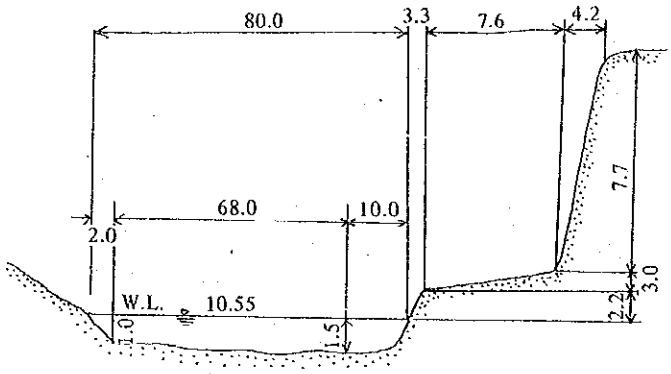
RIVER NAME	Kinabatangan	STATION NAME	Ulu Kuamut	STAGE	Rainfall, Water level

SKETCH

PLAN



SECTION



PHOTO

(Right Bank)

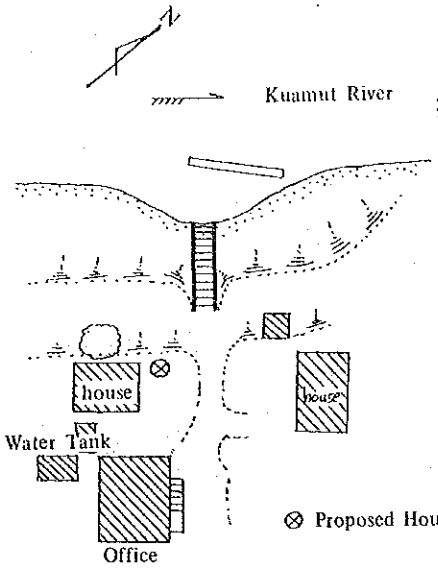
(Nov 7, 1979)

INSTALATION

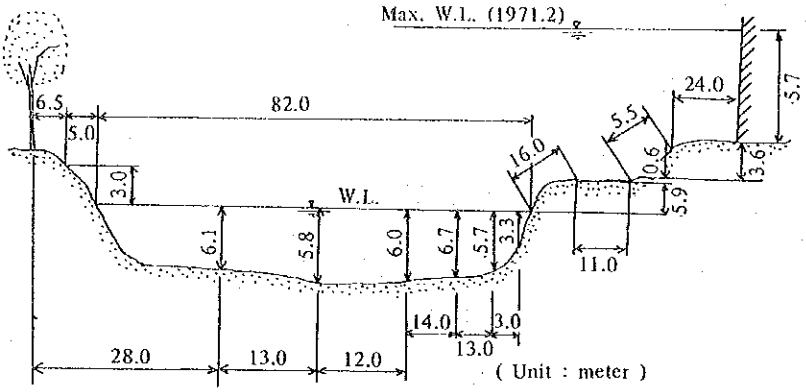
RIVER NAME	Kinabatangan	STATION NAME	Kuamut	STAGE	Water level, Rainfall

SKETCH

PLAN



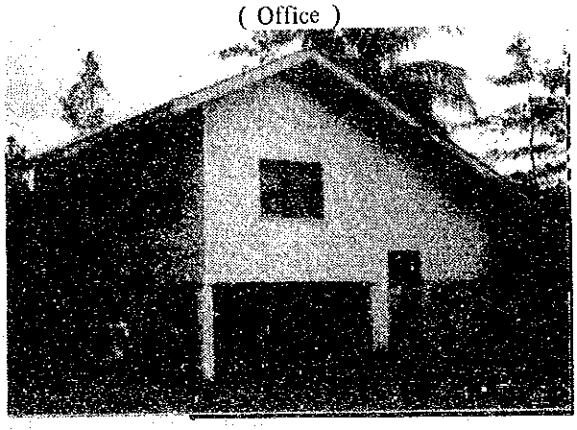
SECTION



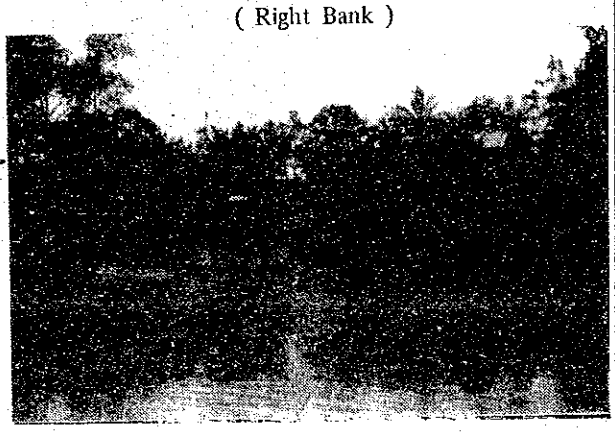
PHOTO

(Right Bank)

(Office)



(Right Bank)



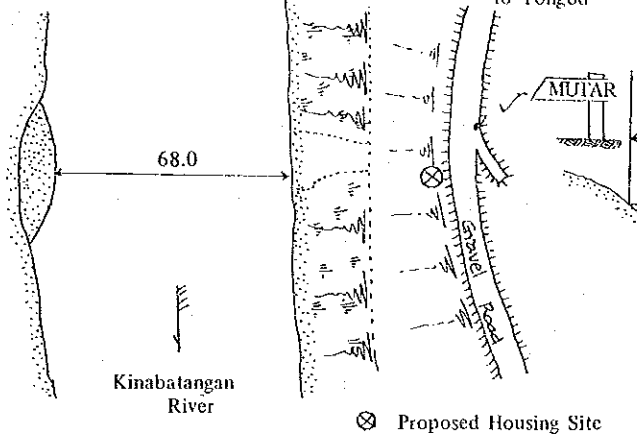
(Nov. 5, 1979)

INSTALATION

RIVER NAME	Kinabatangan	STATION NAME	Tongod	STAGE	Rainfall, Water level

SKETCH

PLAN



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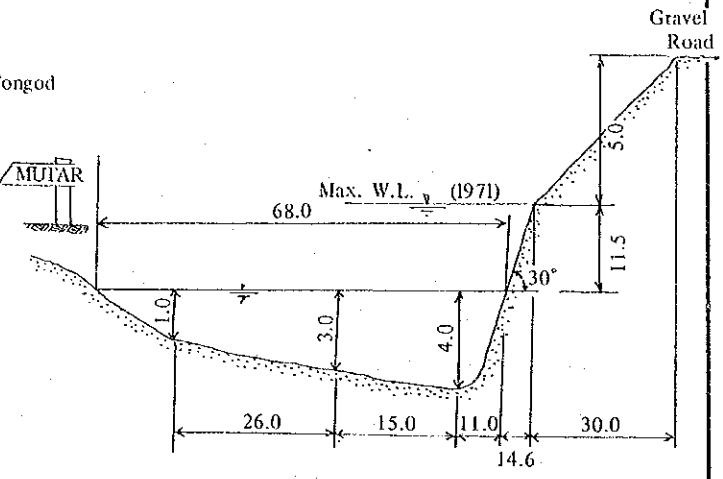
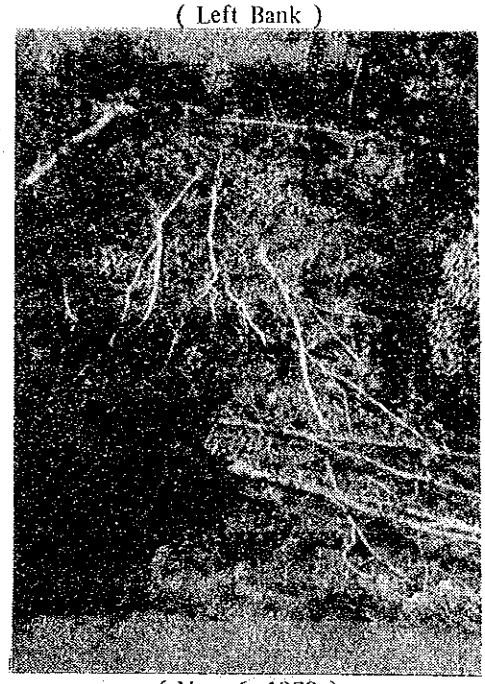


(Unit : meter)

PHOTO

(Left Bank)



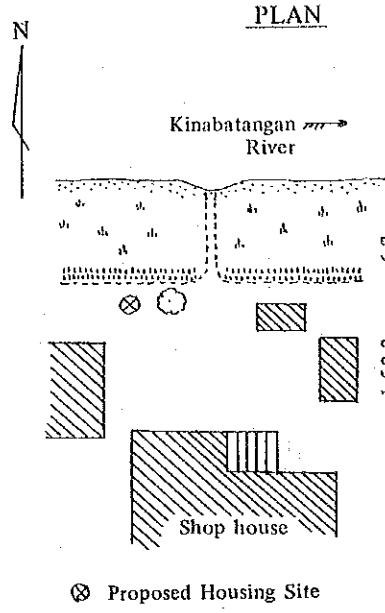
(Nov. 6, 1979)

INSTALATION

RIVER NAME	Kinabatangan	STATION NAME	Tangkulap	STAGE	Rainfall, Water level

SKETCH

PLAN



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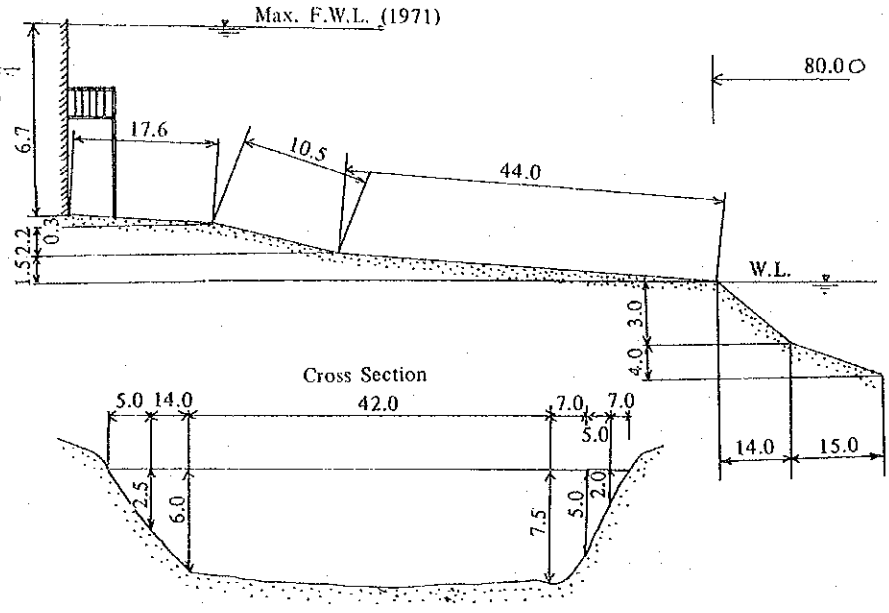
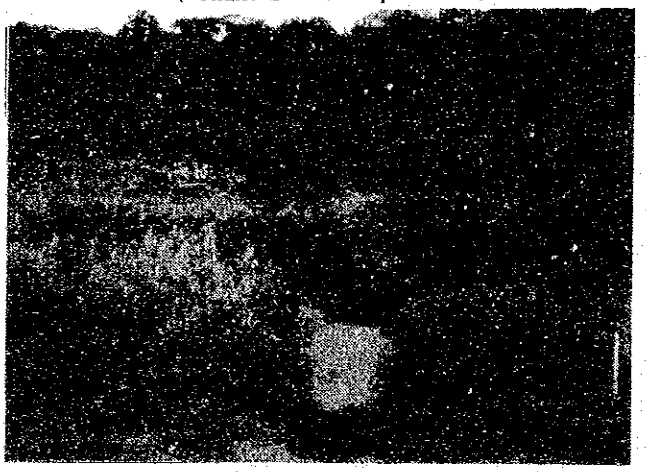


Cross Section

PHOTO

Water level gaging station

(Right Bank, Shop house)



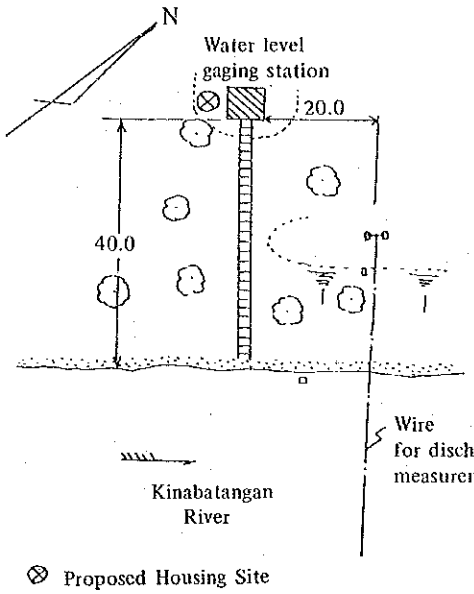
(Nov. 6, 1979)

INSTALATION

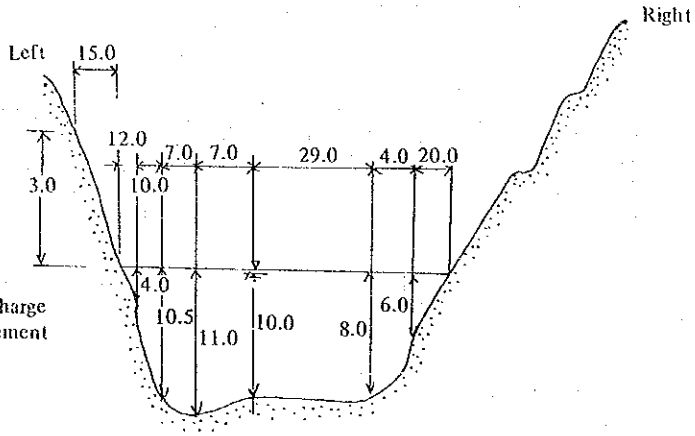
RIVER NAME	Kinabatangan	STATION NAME	Balat	STAGE	Rainfall, Water level

SKETCH

PLAN

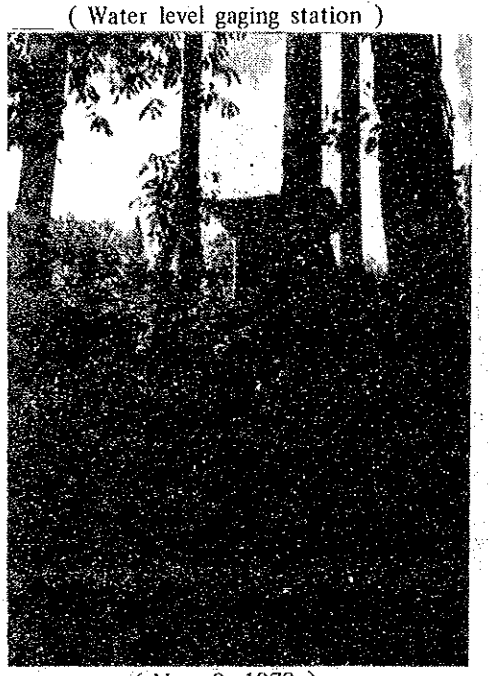


SECTION



PHOTO

(Water level gaging station)



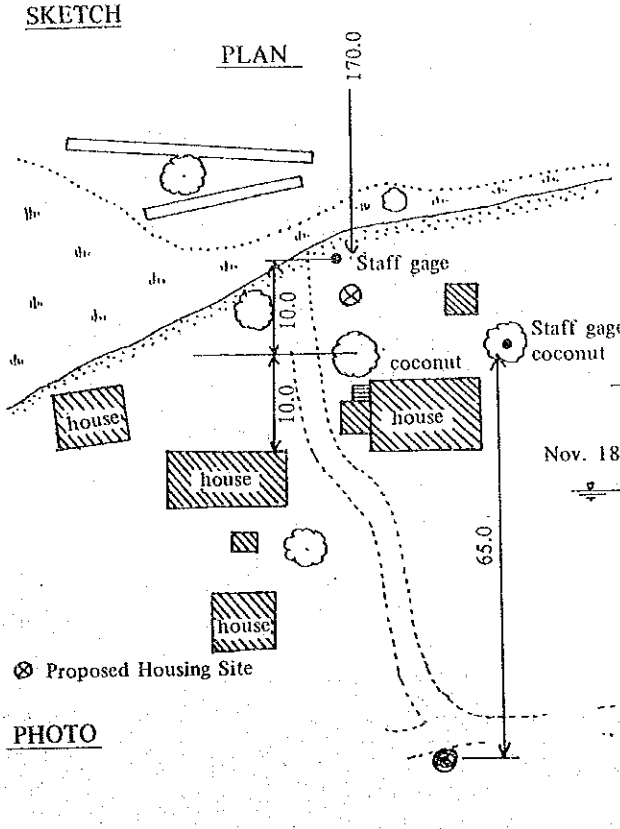
(Nov. 8, 1979)

INSTALATION

RIVER NAME	Kinabatangan	STATION NAME	Bukit Garam	STAGE	Rainfall, Water level

SKETCH

PLAN



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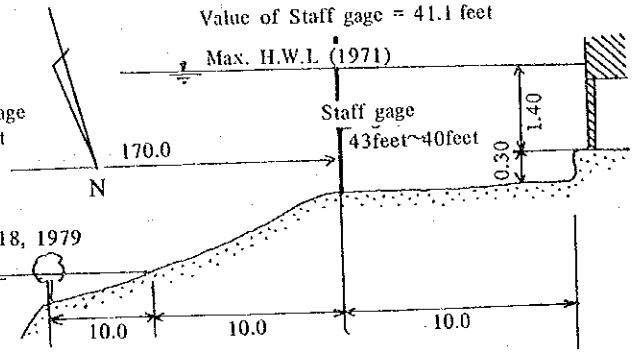


PHOTO

(New Station Site)

(Nov. 18, 1979)

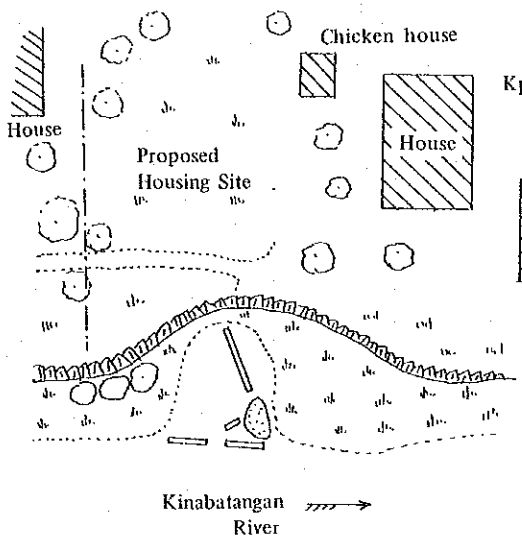
(Staff gage)

INSTALATION

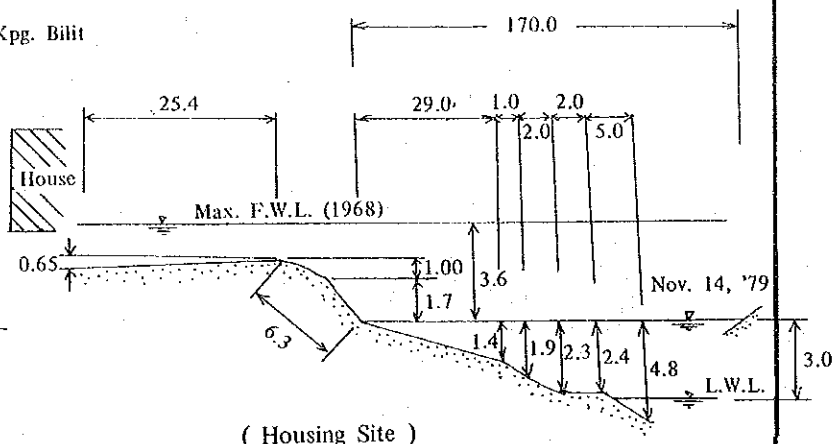
RIVER NAME	Kinabatangan	STATION NAME	Bilit	STAGE	Water level

SKETCH

PLAN



SECTION



(Housing Site)

PHOTO

(Nov. 14, 1979)

(Water level gaging site)

(Kinabatangan River Cross Section)

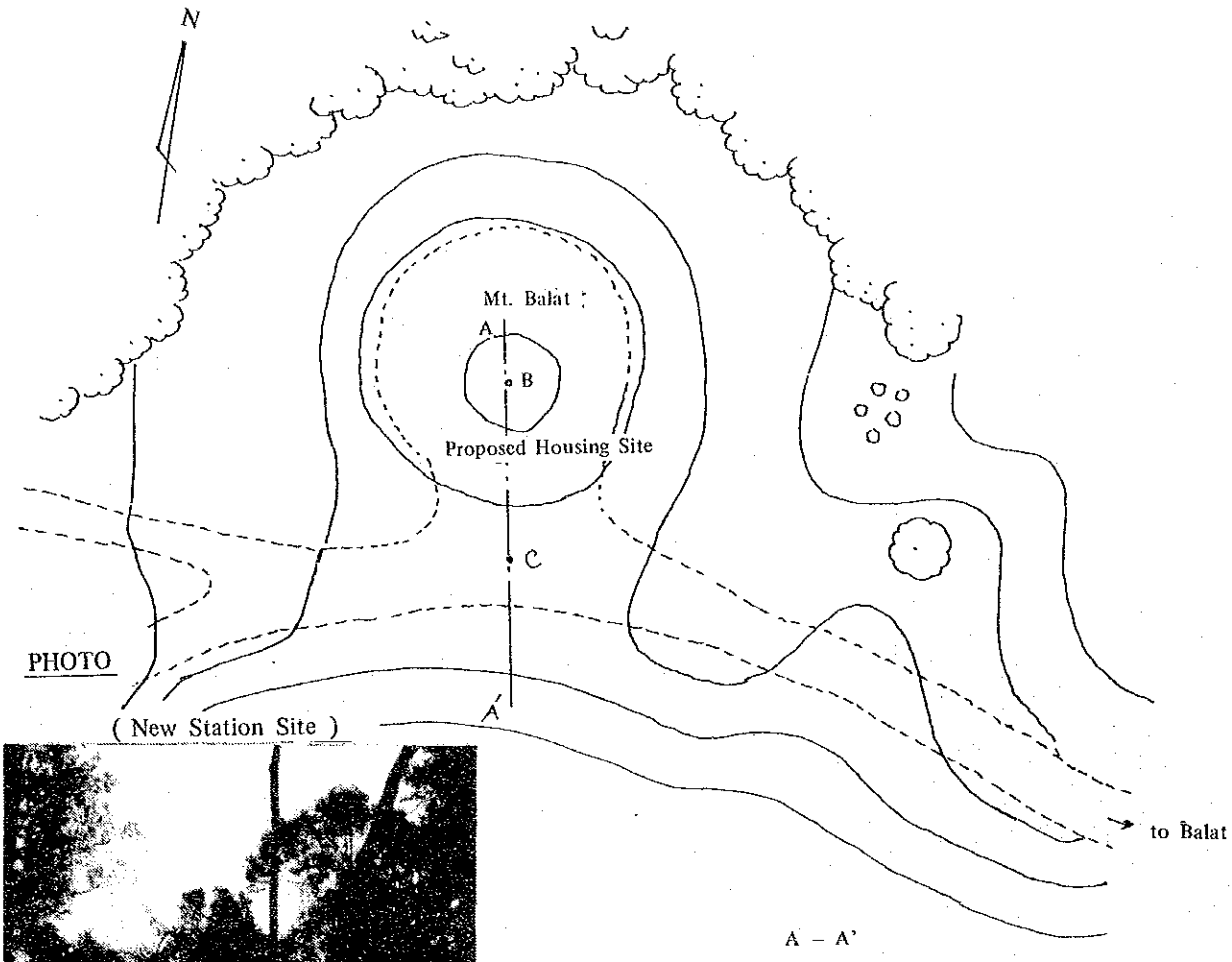
INSTALATION

RIVER NAME	Kinabatangan	STATION NAME	Mt. Balat Relay Relay Center	STAGE	Relay Center

SKETCH

PLAN

SECTION

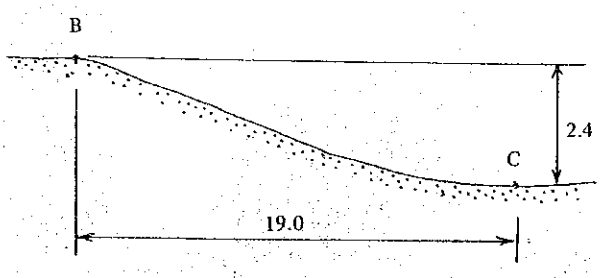


PHOTO

(New Station Site)

(Nov. 18, 1979)

A – A'



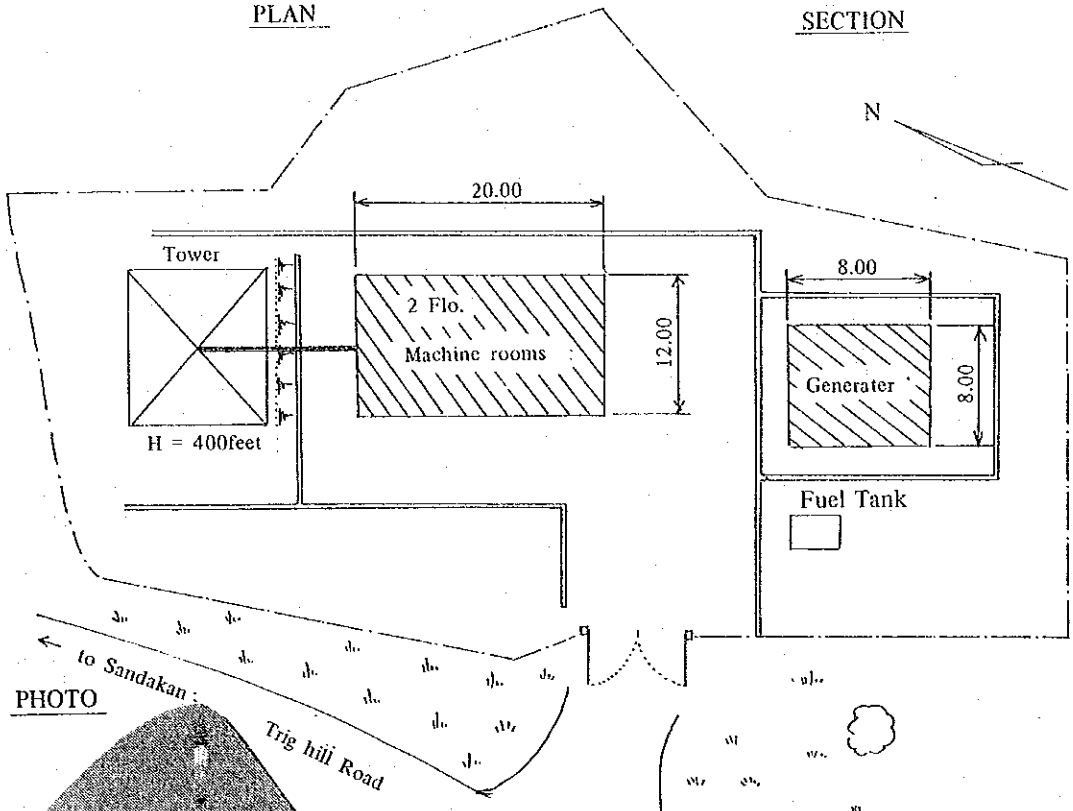
INSTALATION

RIVER NAME	Kinabatangan	STATION NAME	Trig hill	STAGE	Relay Center

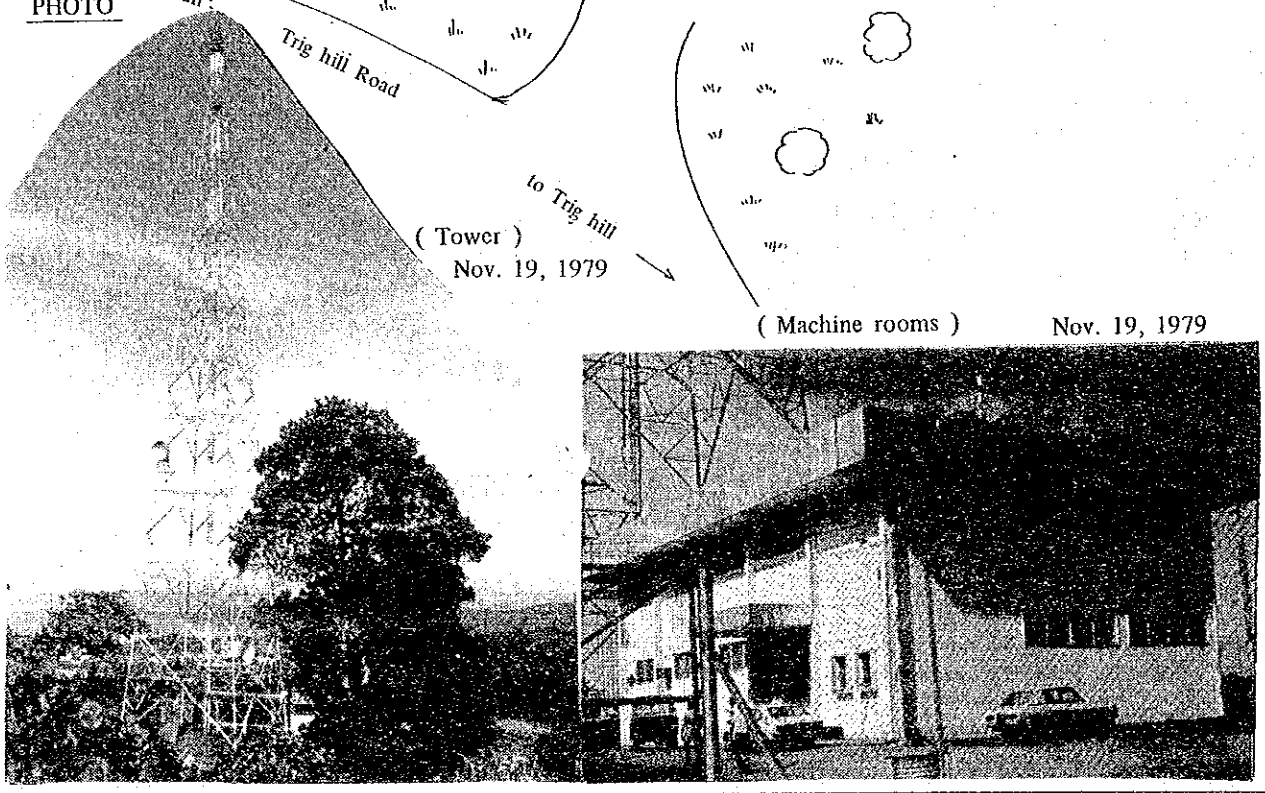
SKETCH

PLAN

SECTION



PHOTO



(Tower)
Nov. 19, 1979

(Machine rooms)
Nov. 19, 1979

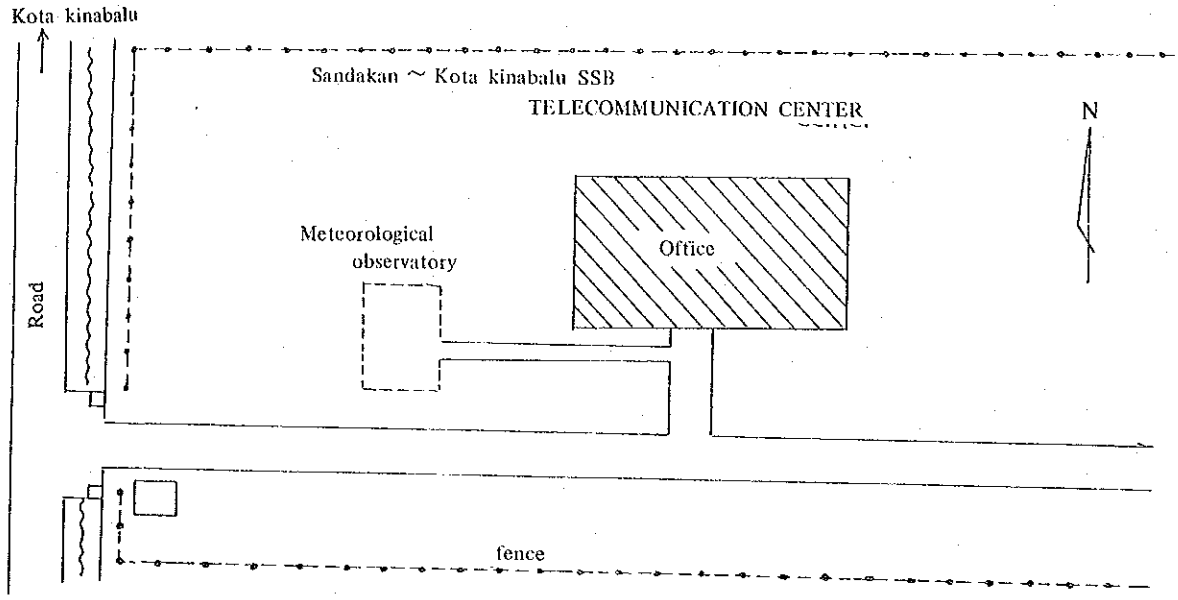
INSTALATION

RIVER NAME	Kinabatangan	STATION NAME	Kota Kinabalu	STAGE	Flood Control Center

SKETCH

PLAN

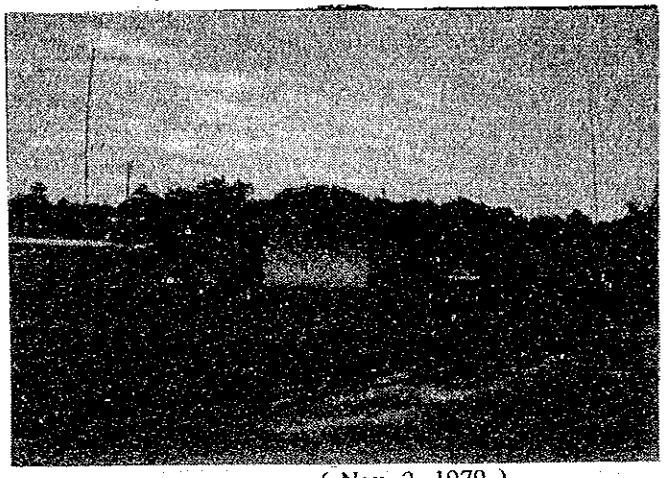
SECTION



Location of Flood Control Center

PHOTO

(SSB Telecommunication Center)



(Nov. 2, 1979)

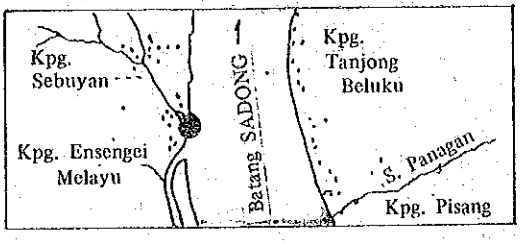
INSTALATION

Non-Civil work (in System)

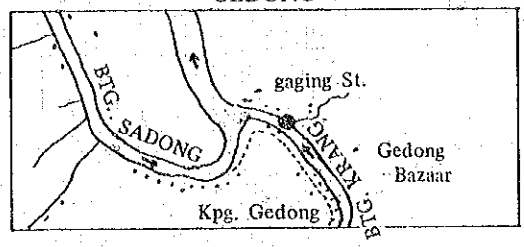
APPENDIX B

SKETCH OF STATION LOCATION
SADONG RIVER

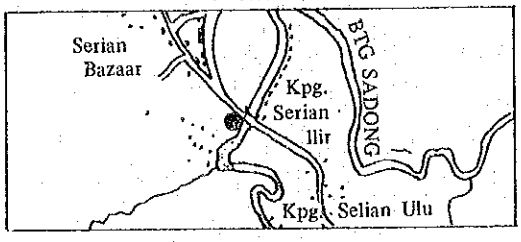
ENSENGEI



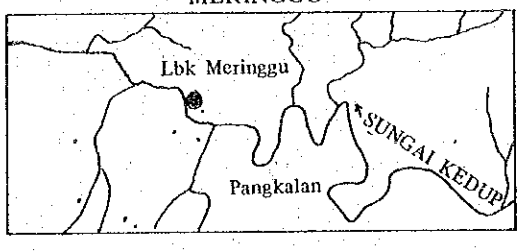
GEDONG



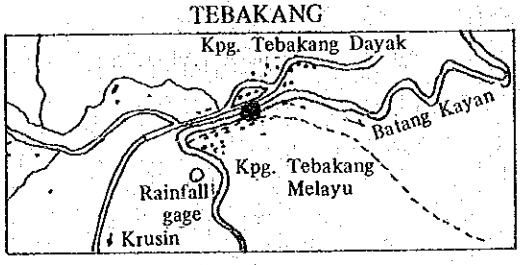
SERIAN



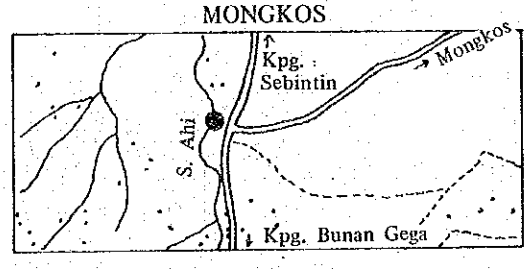
MERINGGU



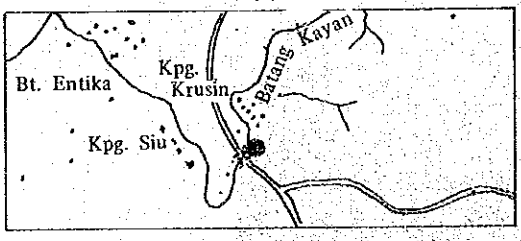
TEBAKANG



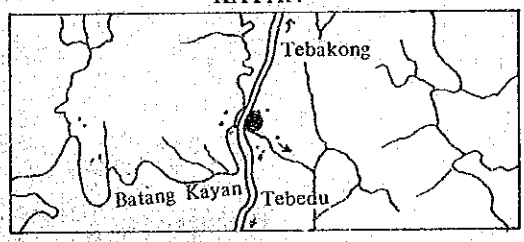
MONGKOS



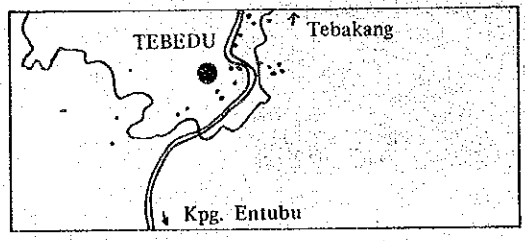
KRUSIN



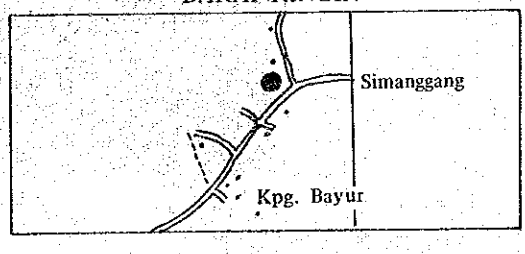
KAYAN



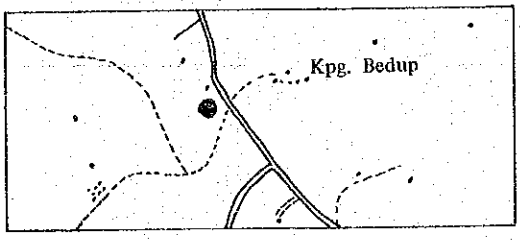
TEBEDU



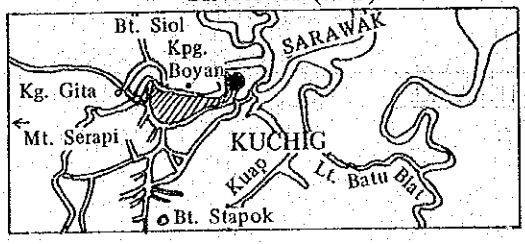
BARAI RINGIN



BEDUP



BINTAWA (FFC)

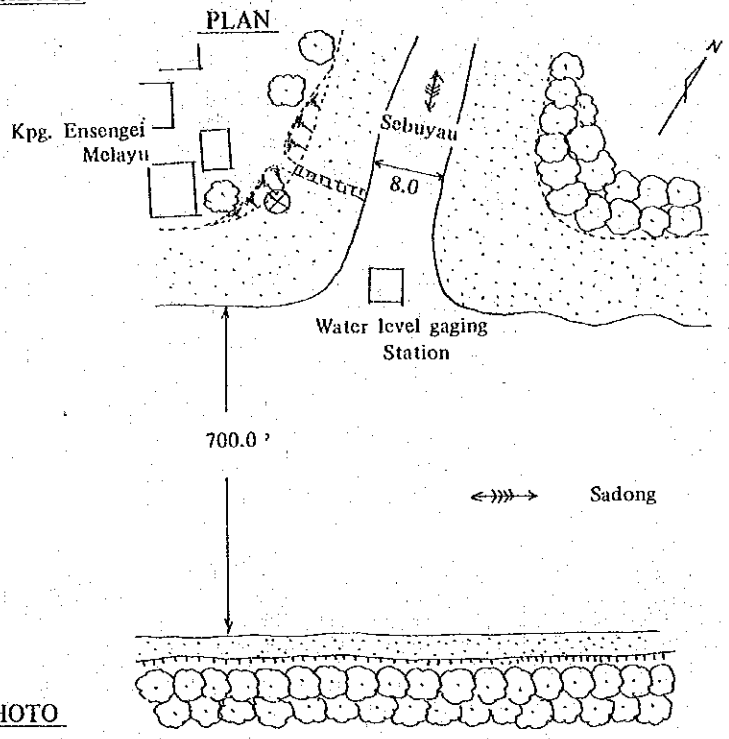


Relay Station: Serapi Mt. ●: New Station Location

RIVER NAME	Sadong	STATION NAME	Ensengei	STAGE	Water level (tide)

SKETCH

PLAN



PHOTO

(Ensengei Water level gaging Station)

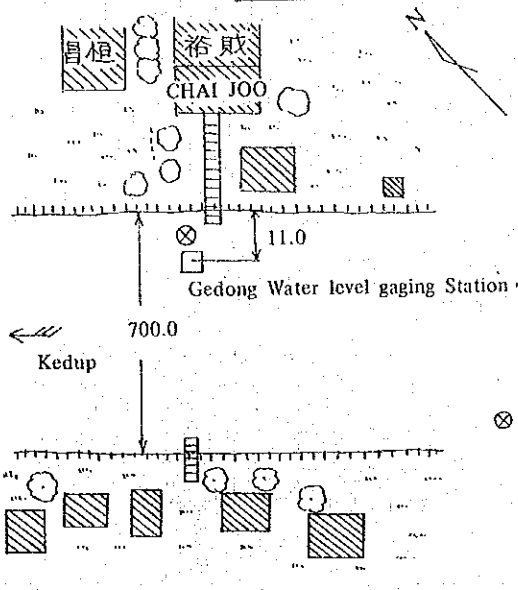
(Dec. 6, 1979)

INSTALATION

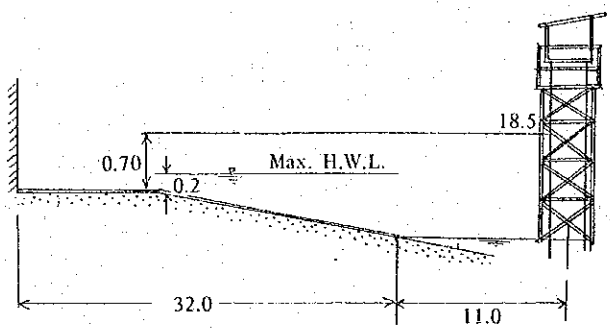
RIVER NAME	Sadong	STATION NAME	Gedong	STAGE	Water level

SKETCH

PLAN



SECTION



Daily tide: Dec. 3~/79'
18' – 6' = 12feet

PHOTO

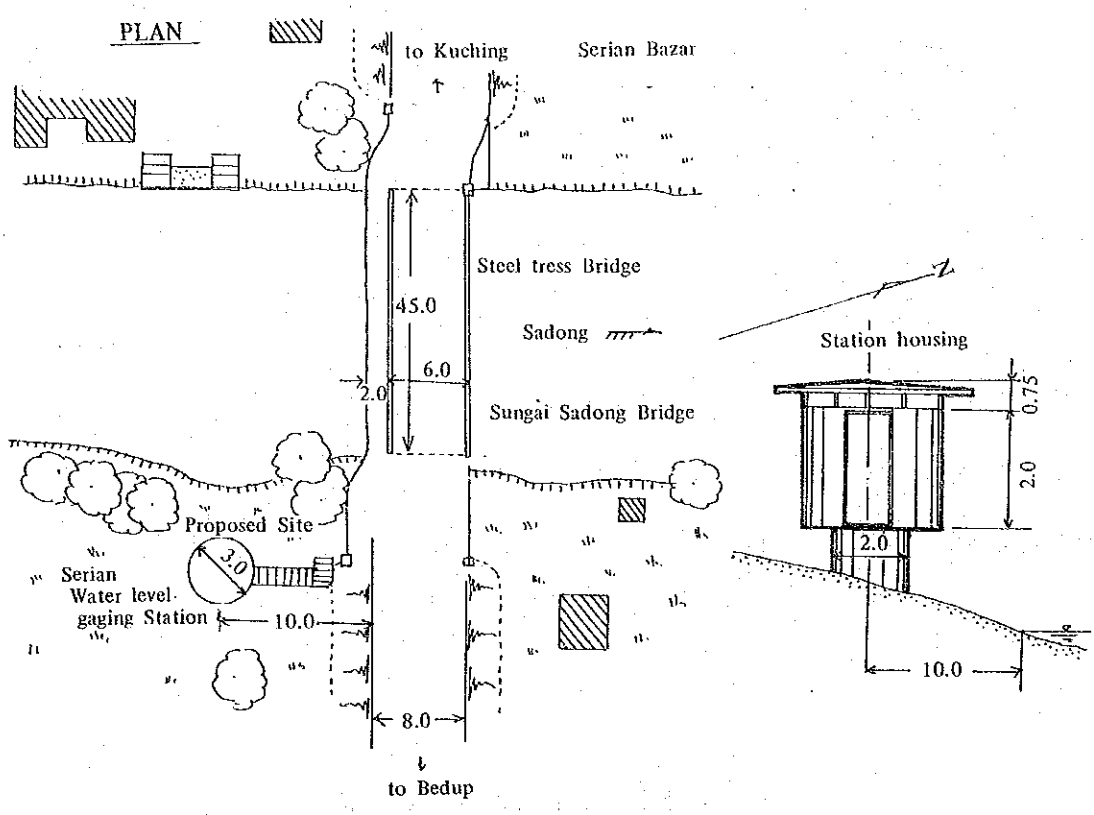
(Gedong Water level gaging Station)

(Dec. 10, 1979)

INSTALATION

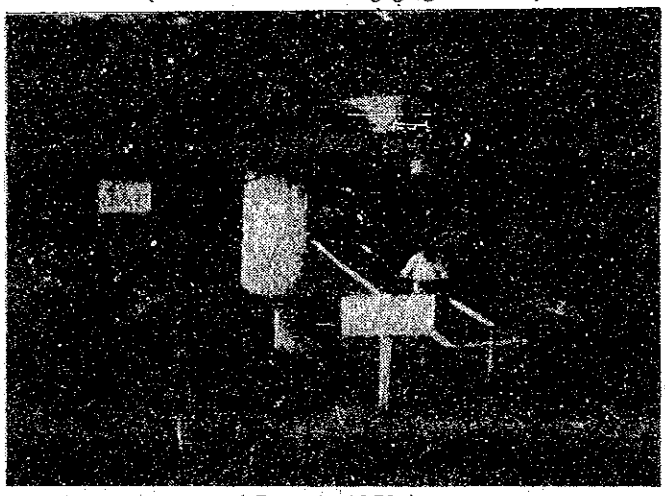
RIVER NAME	Sadong	STATION NAME	Serian	STAGE	Water level Rainfall

SKETCH



PHOTO

(Serian Water level gaging Station)



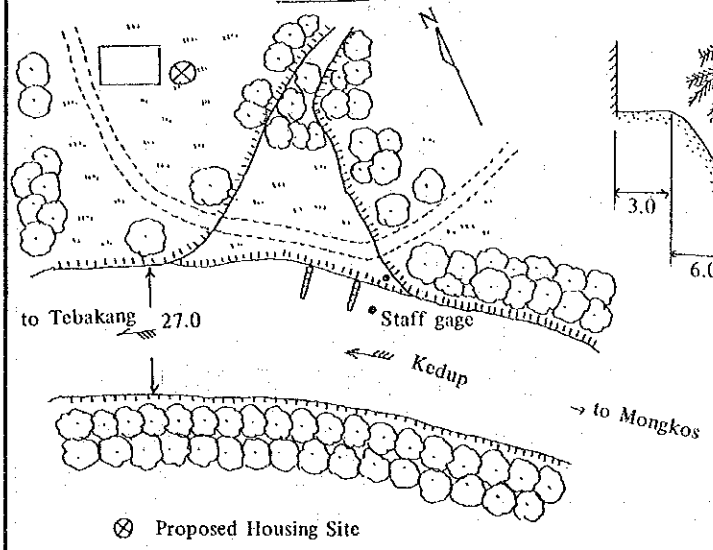
(Dec. 1, 1979)

INSTALATION

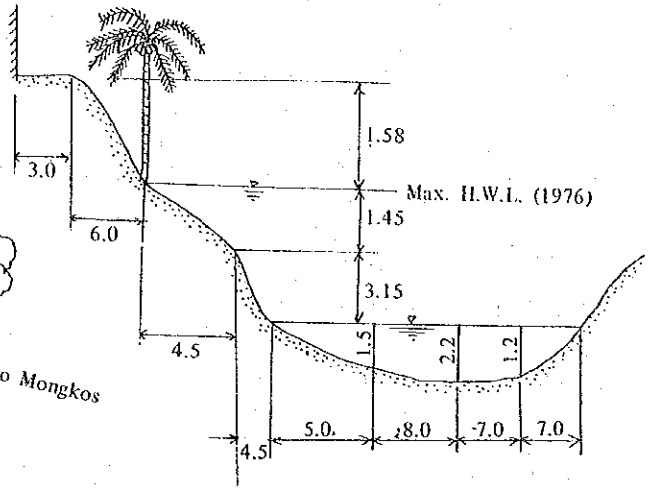
RIVER NAME	Sadong	STATION NAME	Meringgu	STAGE	Water level

SKETCH

PLAN



SECTION



(Meringgu Water level gaging Station (Staff gage))

PHOTO

(Dec. 4, 1979)

(Proposed Housing Site)

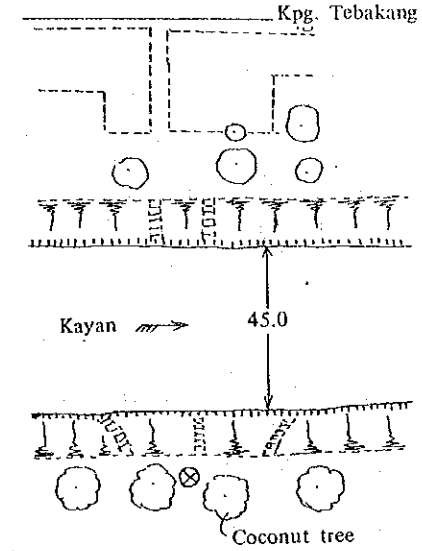
(Dec. 4, 1979)

INSTALATION

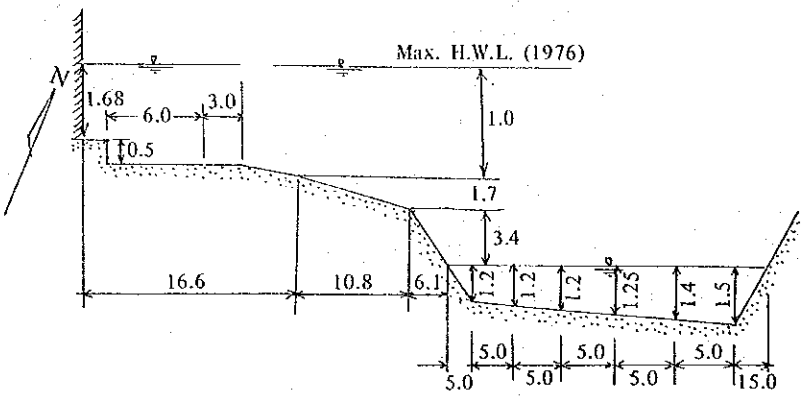
RIVER NAME	Sadong	STATION NAME	Tebakang	STAGE	Water level, Rainfall

SKETCH

PLAN



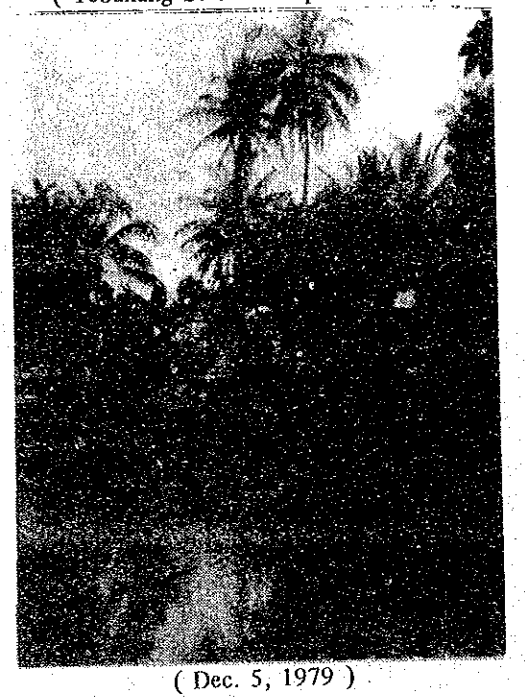
SECTION



⊗ Proposed Housing Site

PHOTO

(Tebakang Station Proposed Site)



(Dec. 5, 1979)

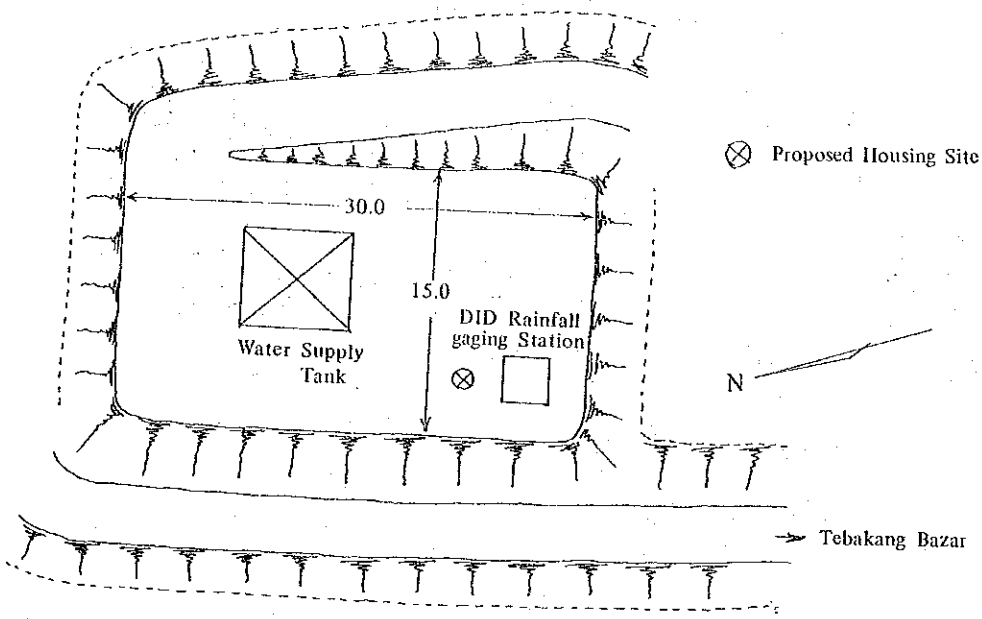
INSTALATION

RIVER NAME	Sadong	STATION NAME	Tebakang	STAGE	Rainfall

SKETCH

PLAN

SECTION



PHOTO

(Tebakang Rainfall gaging Station)

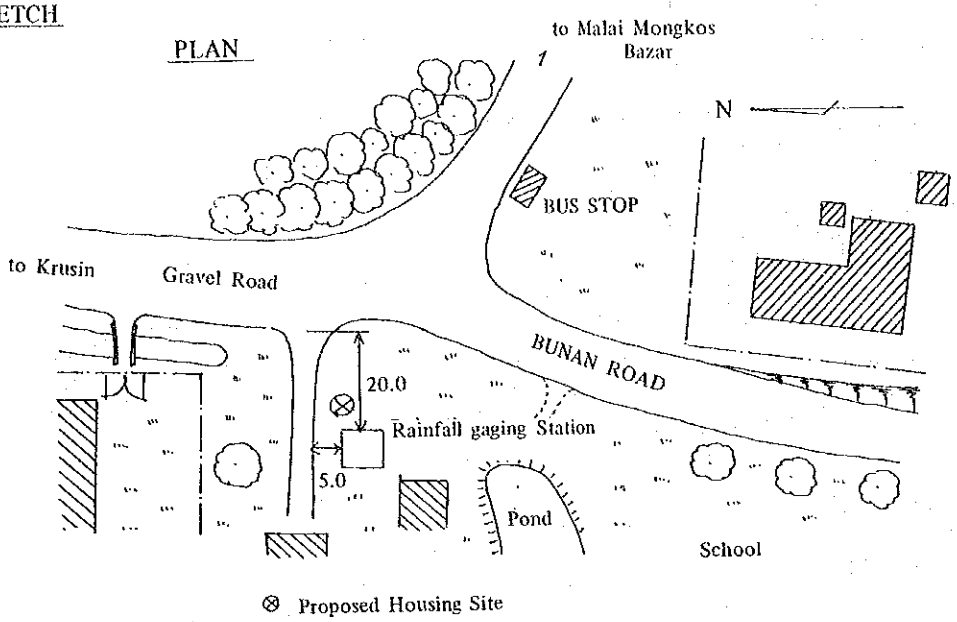
(Dec. 5, 1979)

INSTALATION

RIVER NAME	Sadong	STATION NAME	Mongkos	STAGE	Rainfall

SKETCH

PLAN



PHOTO

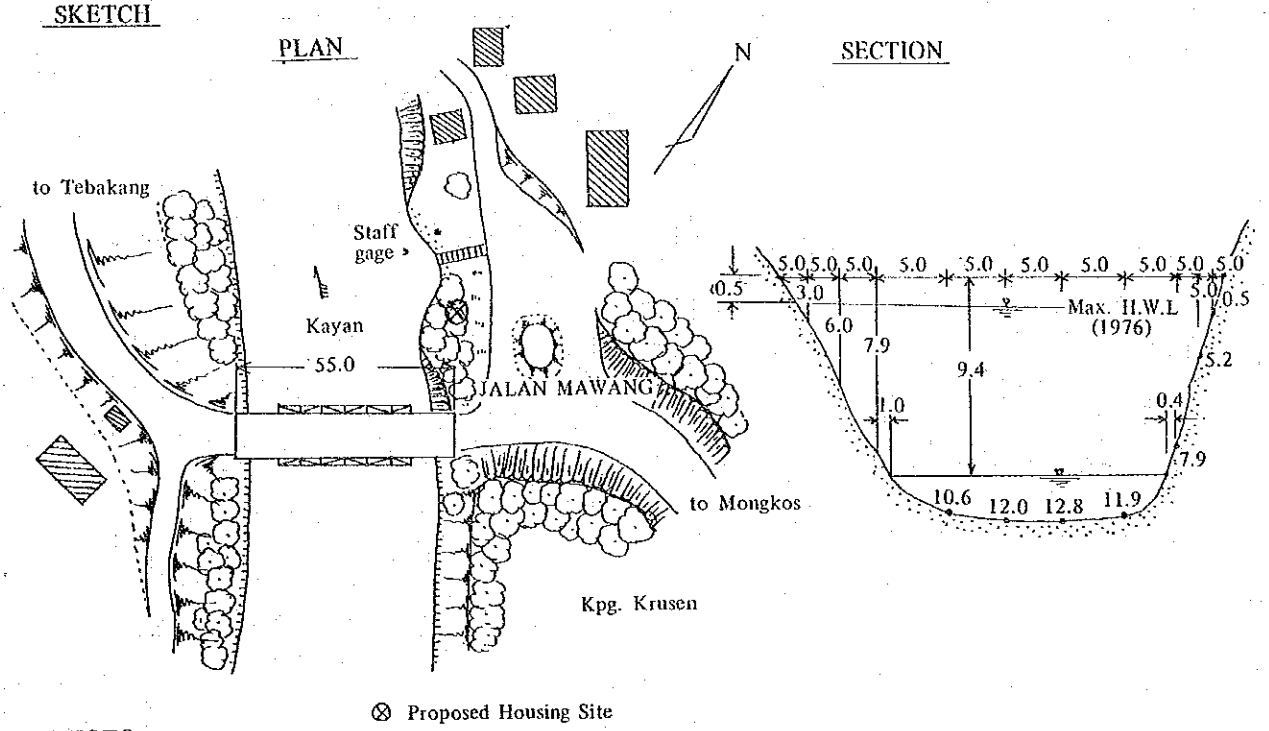
(Mongkos Rainfall gaging Station)

(Dec. 4, 1979)

INSTALATION

RIVER NAME	Sadong	STATION NAME	Krusin	STAGE	Water level

SKETCH



PHOTO

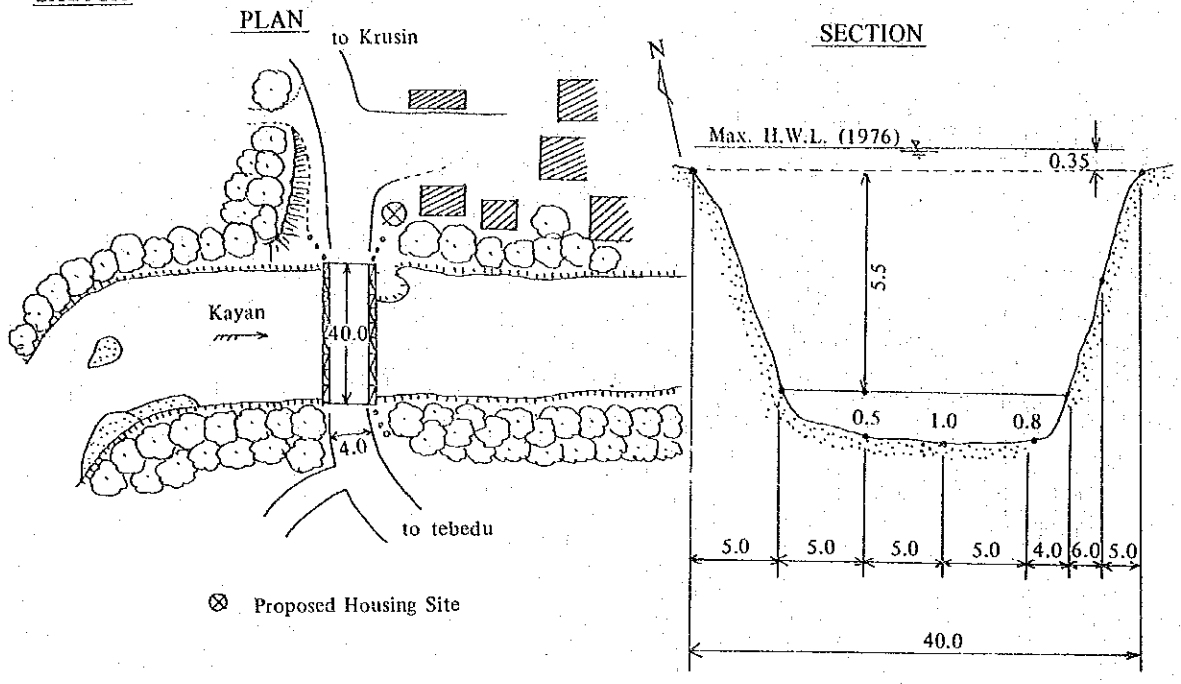
(Krusin Water level gaging Station (Staff gage))

(Dec. 4, 1979)

INSTALATION

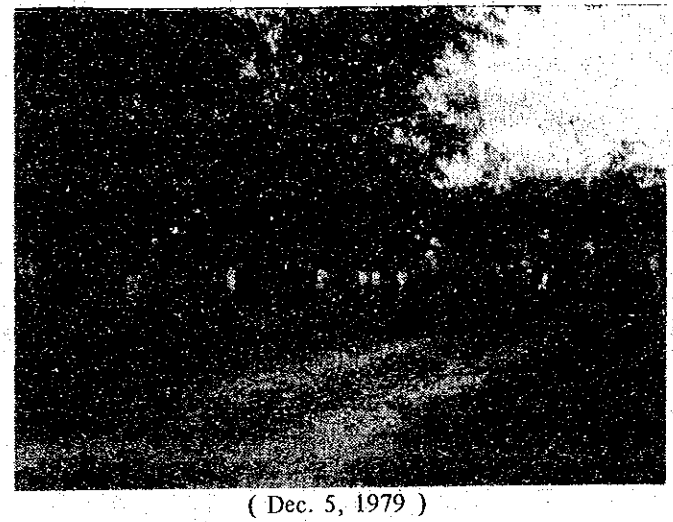
RIVER NAME	Sadong	STATION NAME	Kayan	STAGE	Water level

SKETCH



PHOTO

(Kayan Station Proposed Site)



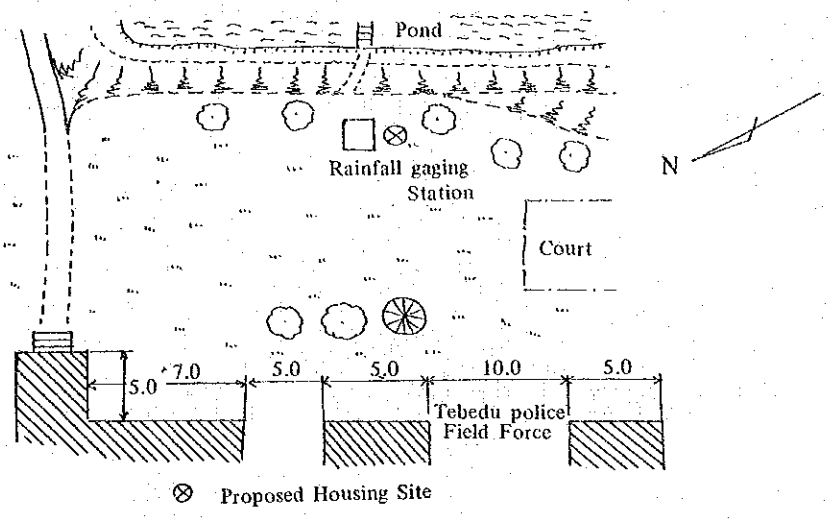
(Dec. 5, 1979)

INSTALATION

RIVER NAME	Sadong	STATION NAME	Tebedu	STAGE	Rainfall

SKETCH

PLAN



PHOTO

(Tebedu Rainfall gaging Station)

(Dec. 5, 1979)

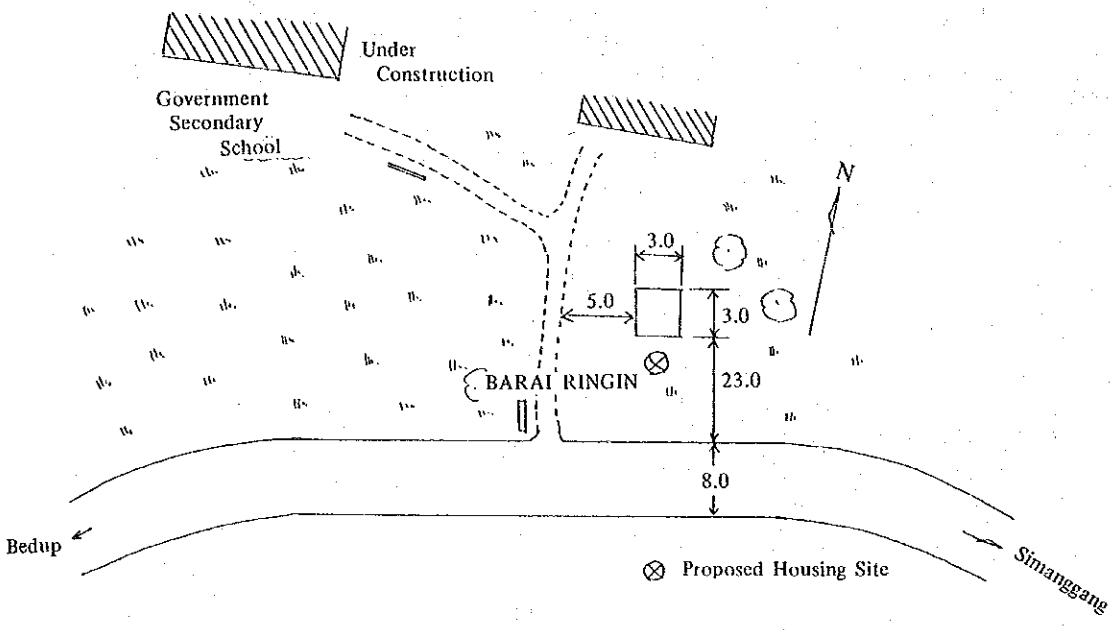
(Proposed Housing Site)

INSTALATION

RIVER NAME	Sadong	STATION NAME	Balai Ringin	STAGE	Rainfall

SKETCH

PLAN



PHOTO

(Balai Ringin Rainfall gaging Station)

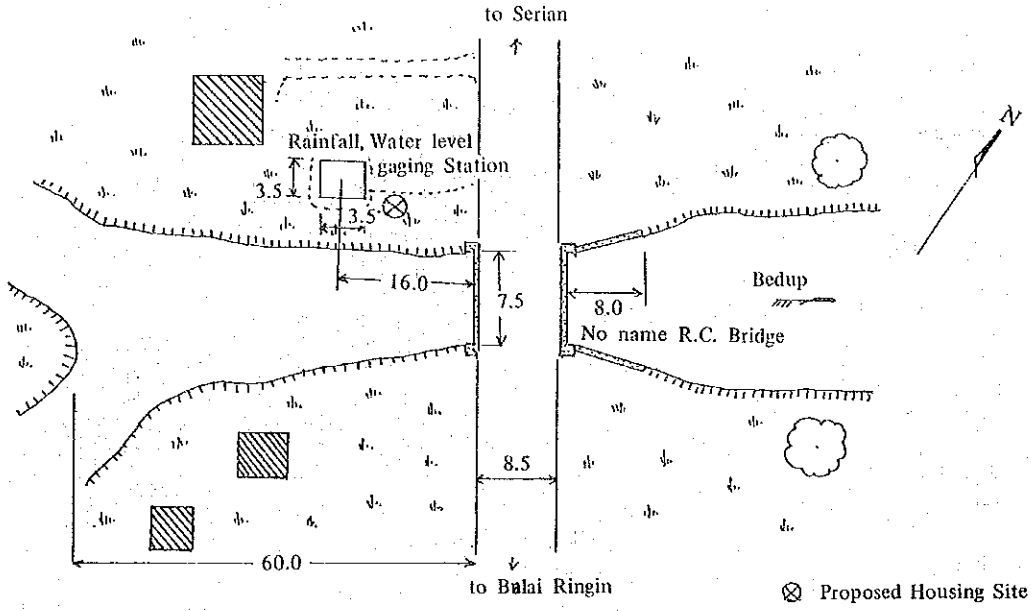
(Dec. 1, 1979)

INSTALATION

RIVER NAME	Sadong	STATION NAME	Bedup	STAGE	Rainfall

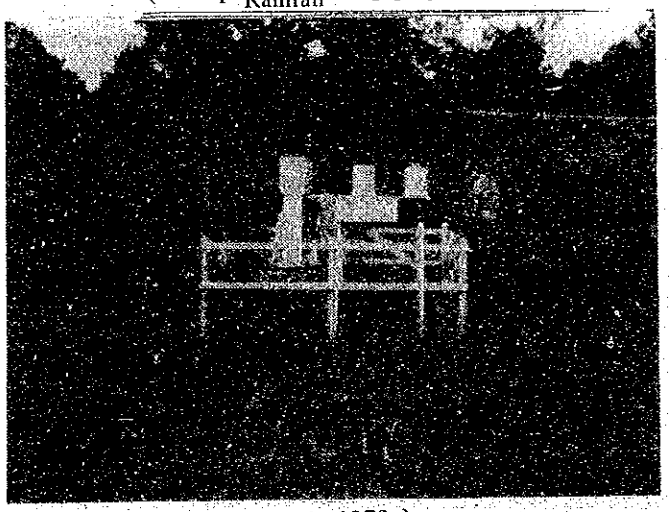
SKETCH

PLAN



PHOTO

(Bedup Water level Rainfall gaging Station)



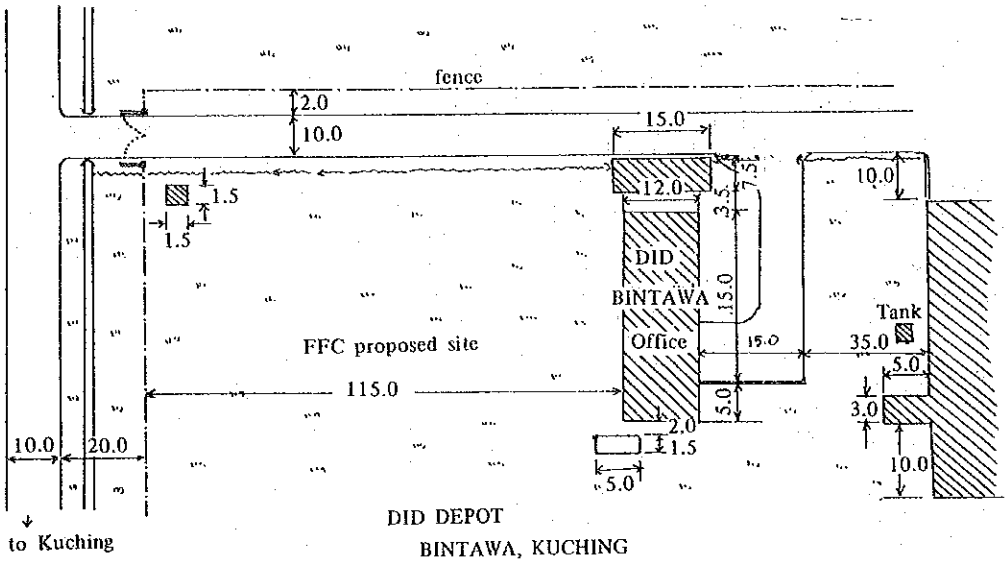
(Dec. 1, 1979)

INSTALATION

RIVER NAME	Sadong	STATION NAME	Master Flood Forecasting	STAGE	Control Station

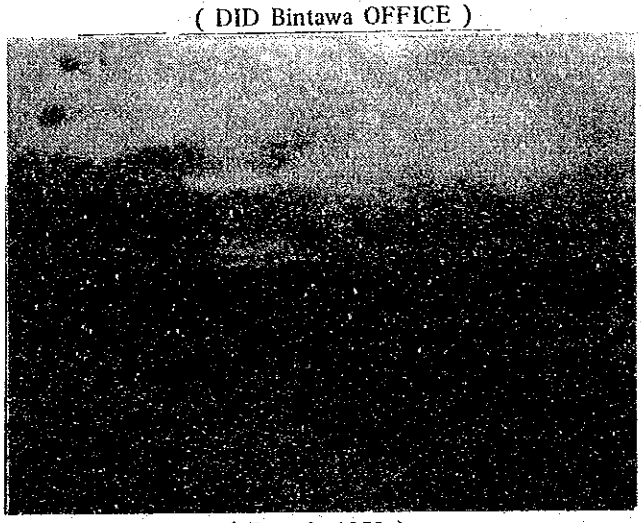
SKETCH

PLAN



PHOTO

(DID Bintawa OFFICE)



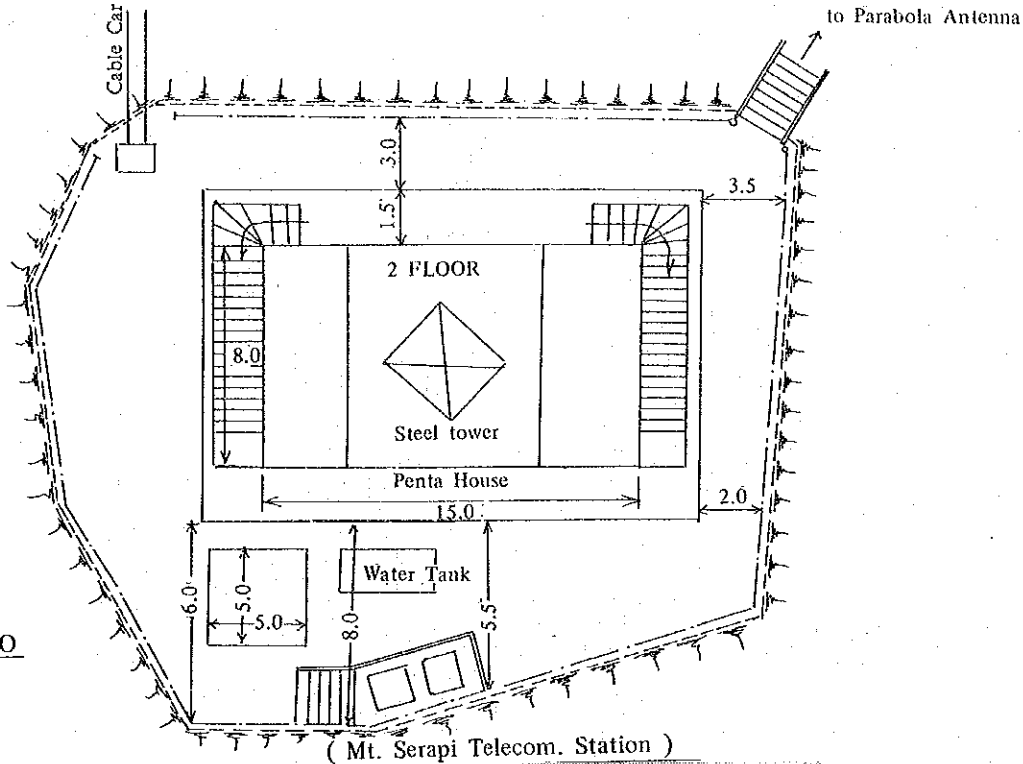
(Dec. 3, 1979)

INSTALATION

RIVER NAME	Sadong	STATION NAME	Mt. Serapi	STAGE	Relay Station

SKETCH

PLAN



(Mt. Serapi Telecom. Station)

PHOTO

(Dec. 8, 1979)

INSTALATION

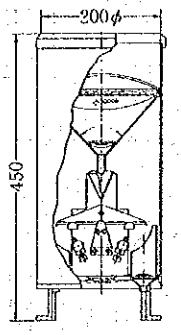
APPENDIX C

EXAMPLE OF GAUGING EQUIPMENT

Fig. TIPPING/BUCKET TYPE RAINFALL GAGE

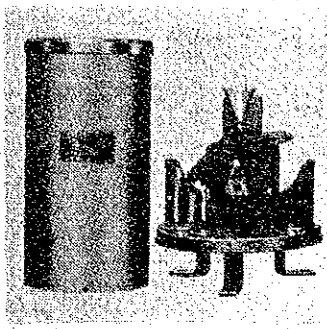
UNIT: mm

RAINFALL GAGE



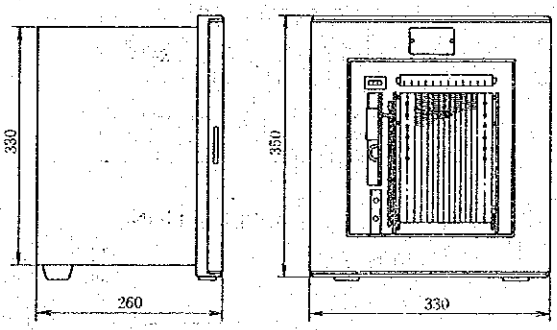
Scale

APPLICATION

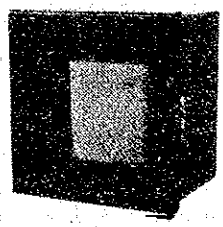


RAINFALL GAGE

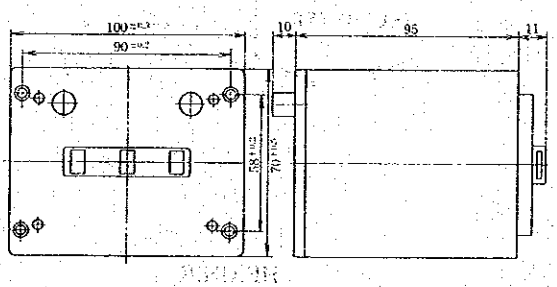
RAINFALL RECORDER

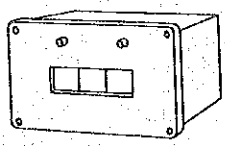


RECORDER



MODULATER OF RAINFALL PULSE

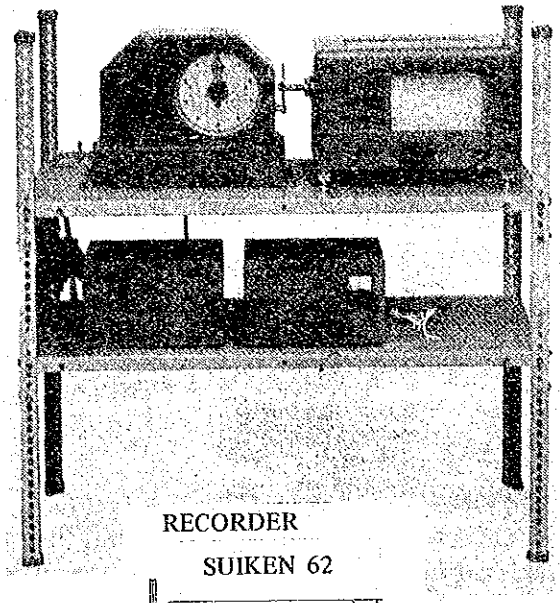




MODULATER

TELEMETER

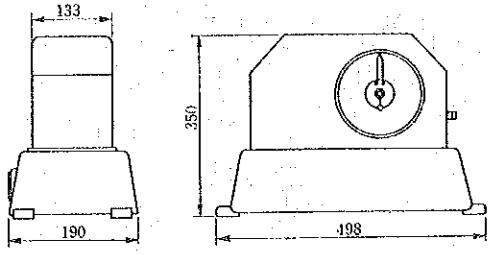
Fig. WATER LEVEL GAGE (BUBBLE TYPE)



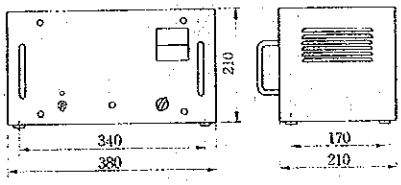
RECORDER

SUIKEN 62

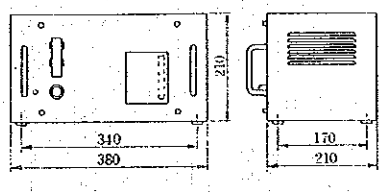
WATER LEVEL GAGE

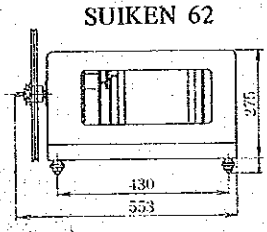


CONTROL

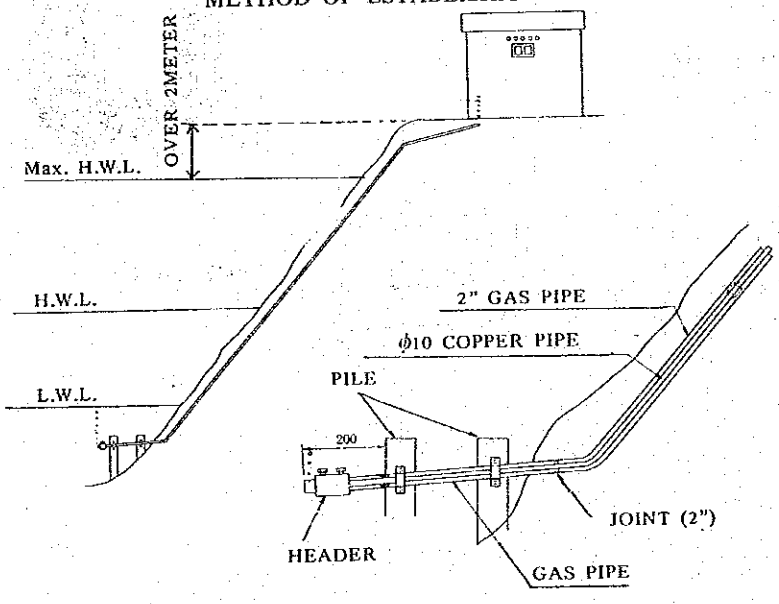


BLOWER

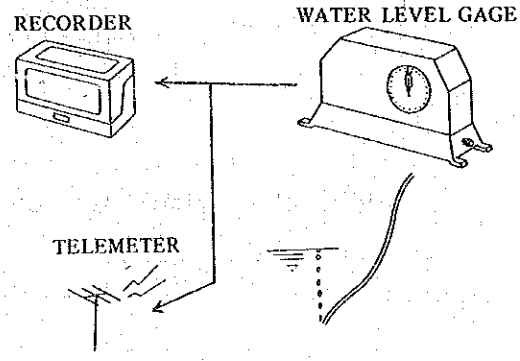




METHOD OF ESTABLISHMENT



APPLICATION



STAFF GAGE

(PLASTIC BOARD L=1.0meter)

HEADER

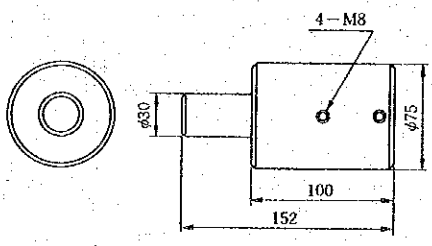


Fig. WATER LEVEL GAGE (FLOAT TYPE SUIKEN 62)
WITH DUNPER SUIKEN 70

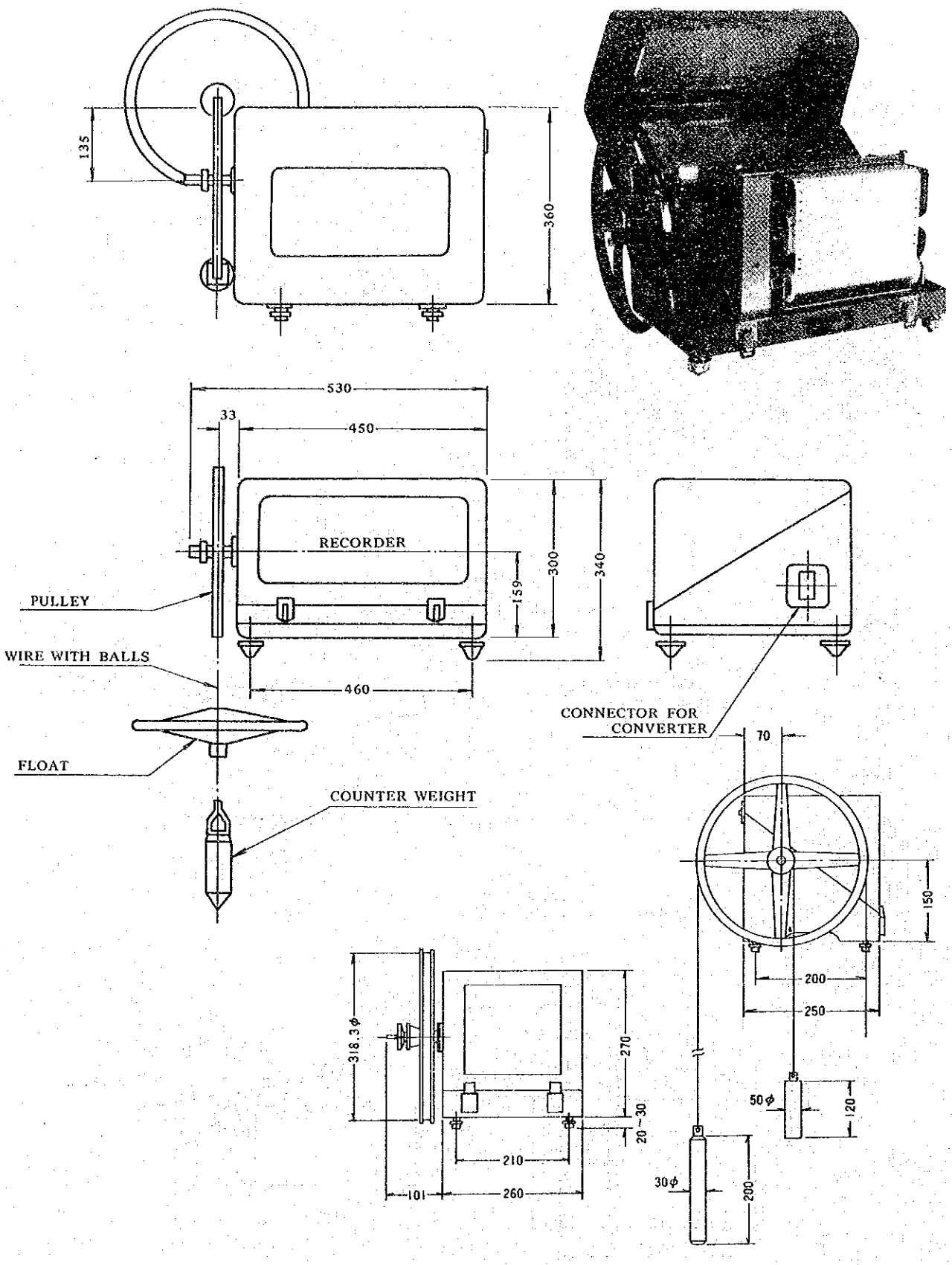
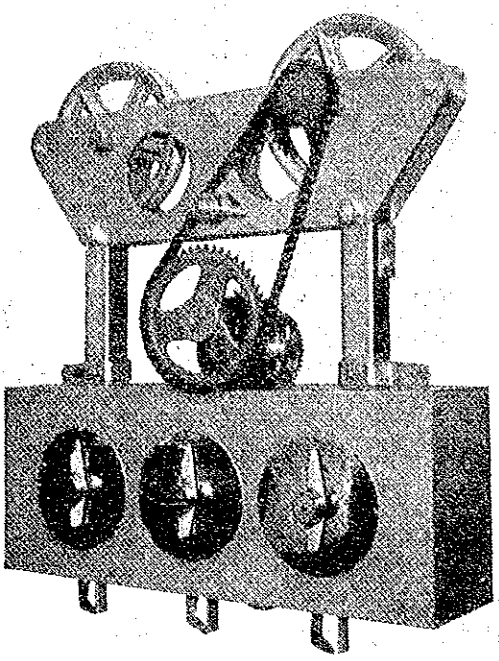
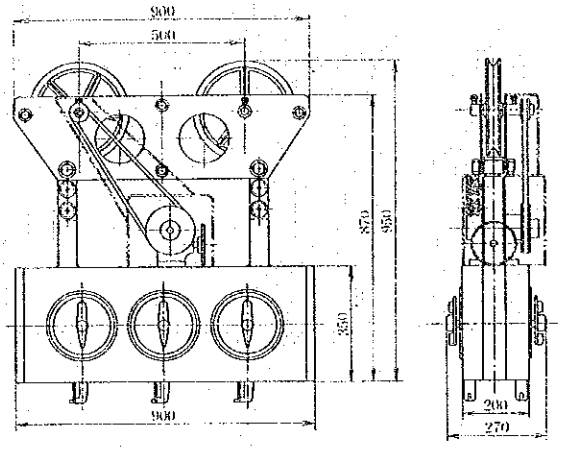


Fig. FLOAT DROPPER

UNIT: mm

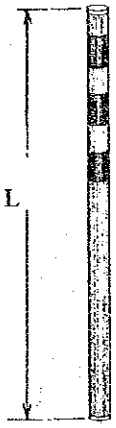


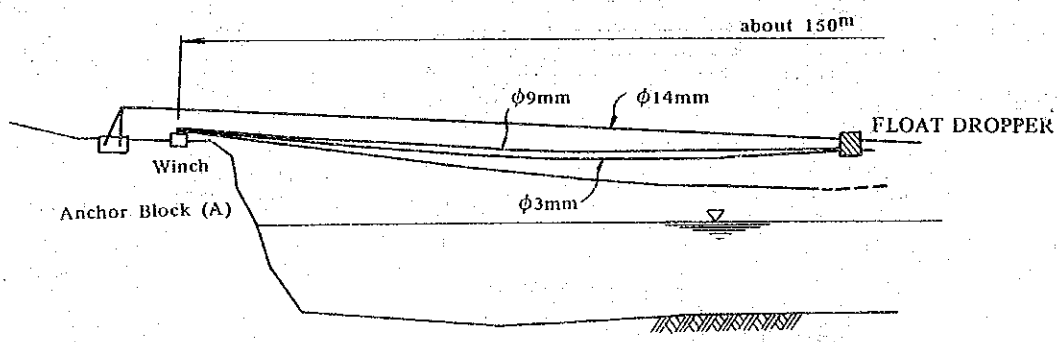
FLOAT DROPPER



FLOATER DROPPING FACILITIES

FLOAT





Detail of Anchor Block (A)

Detail of Winch

LENGTH: 0.3, 0.5, 0.6, 1.0 METER

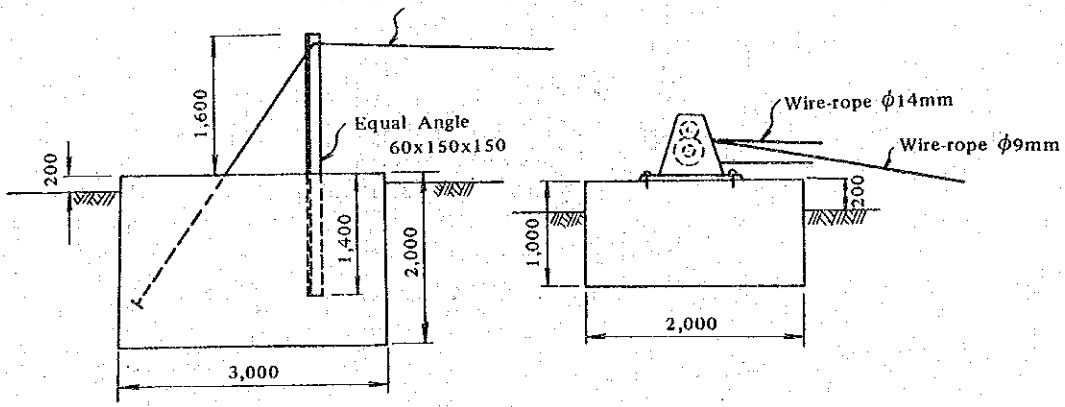
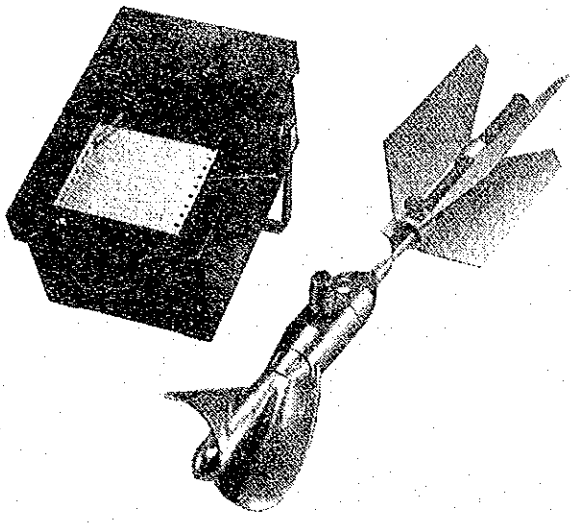
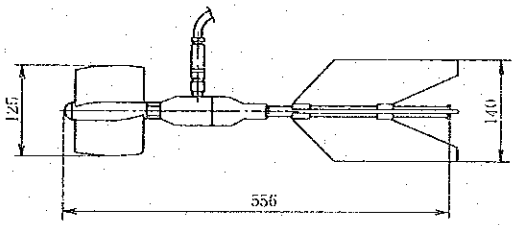


Fig. CURRENT METER

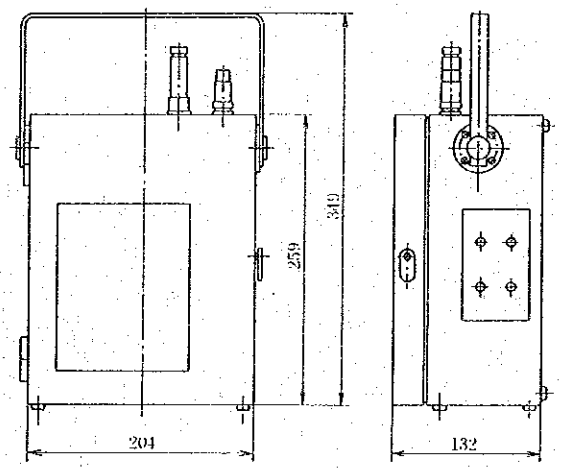
AUTOMATIC RECORDER TYPE UNIT: mm



CURRENT METER



RECORDER



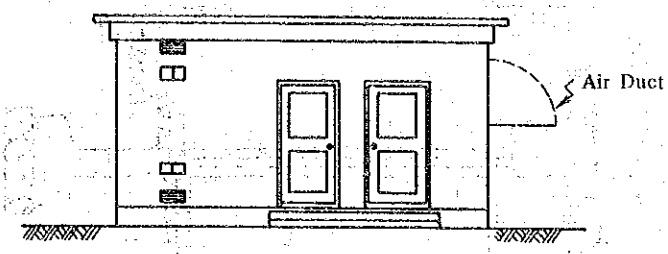
APPENDIX D

HOUSING AND TELE POLE

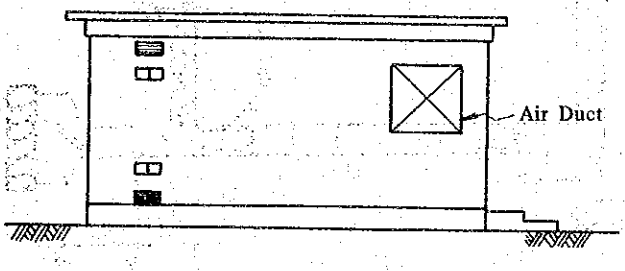
Fig. RELAY STATION HOUSE

5m x 5m UNIT: mm

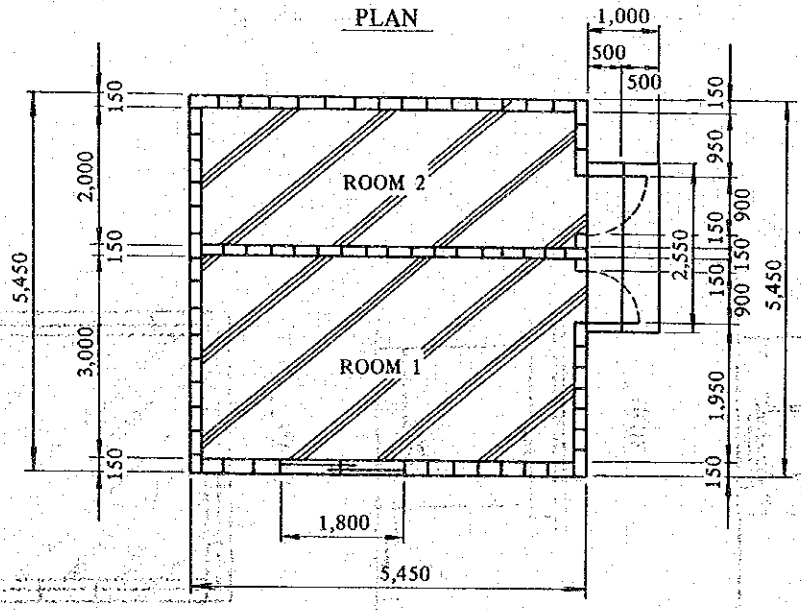
ELEVATION



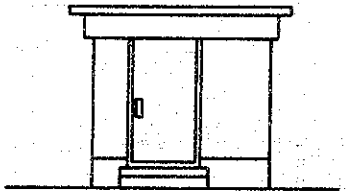
SIDE



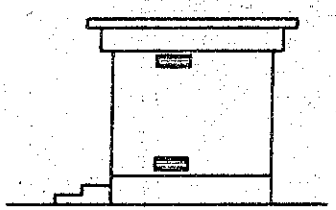
PLAN



ELEVATION



SIDE



PLAN

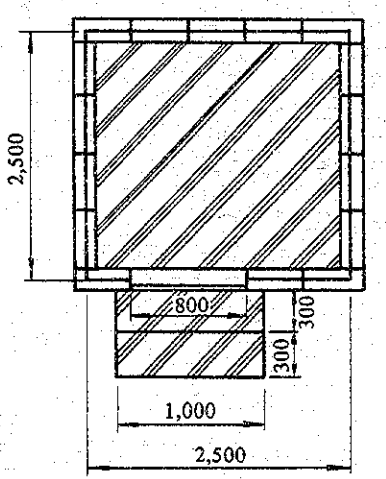
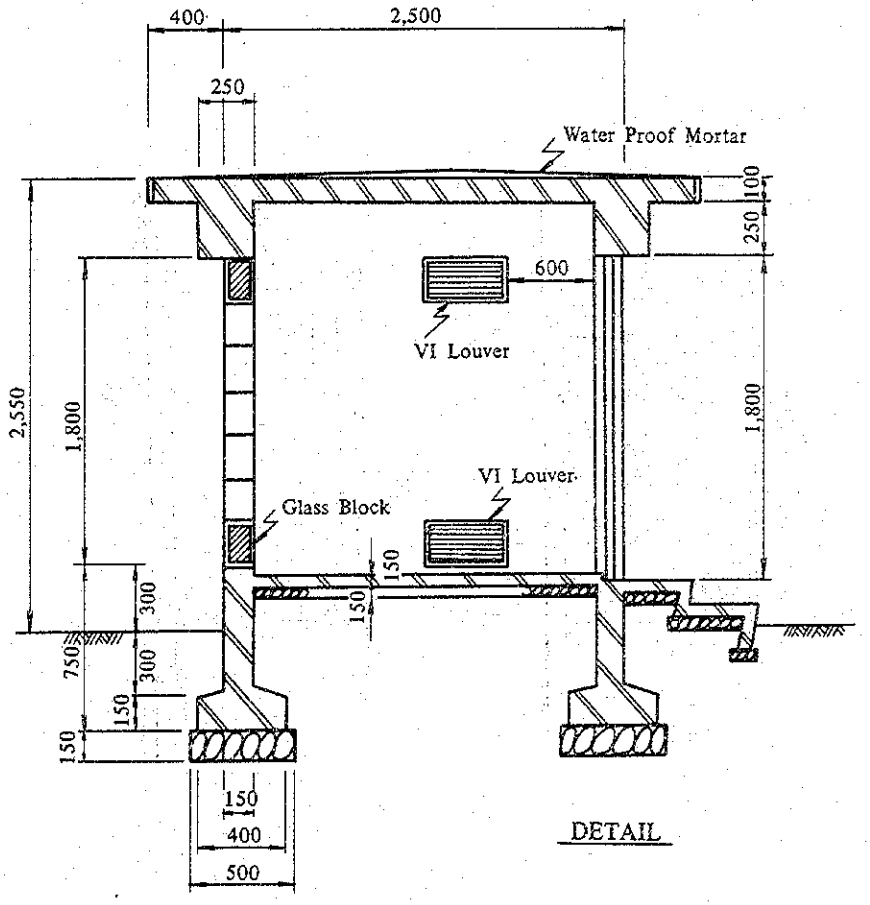


Fig. STATION HOUSE TYPE 2.50 x 2.50

UNIT: mm



DETAIL

Fig. STEEL TOWER FOR WATERLEVEL AND RAINFALL STATION

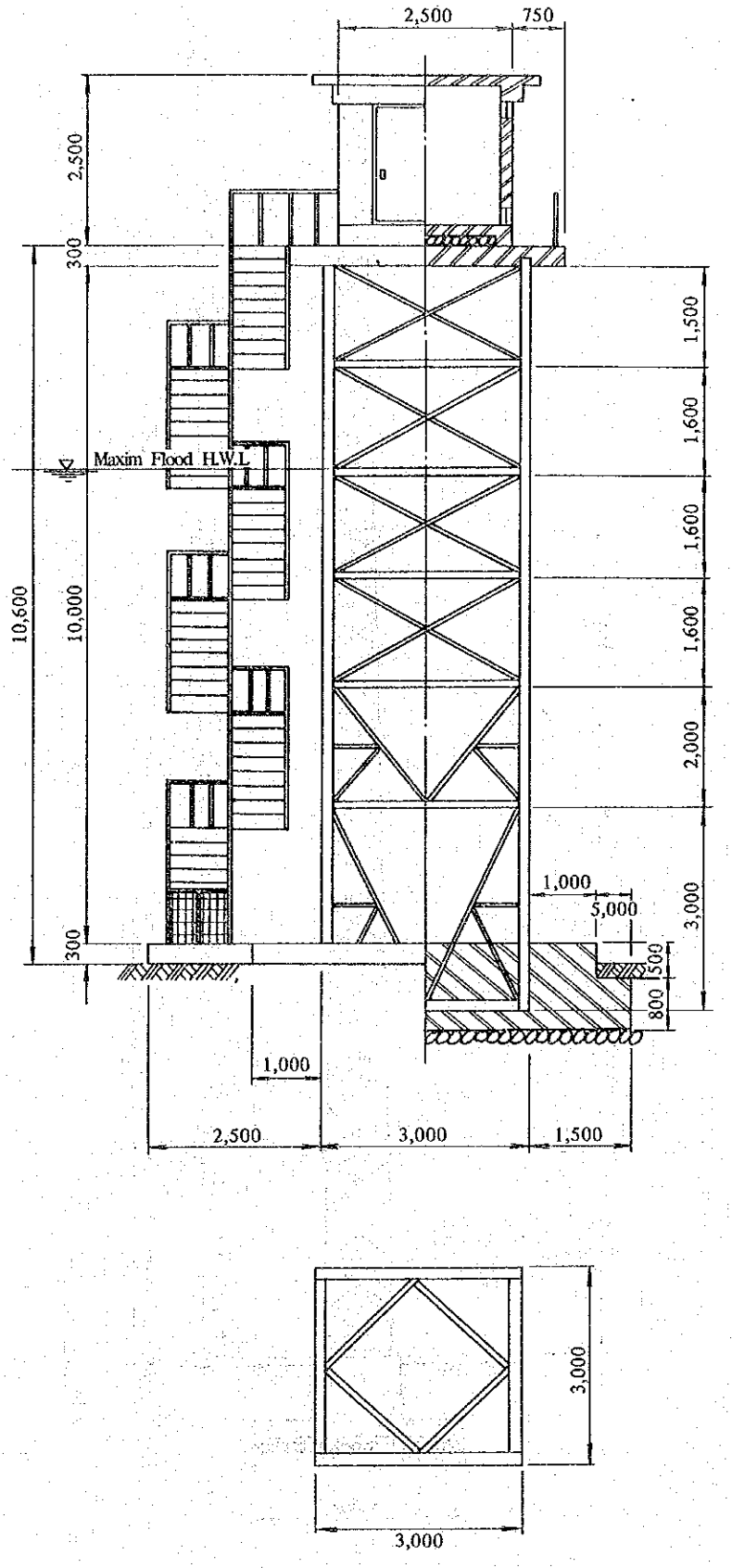


Fig. TRIANGULAR TOWER H = 30M

UNIT: mm

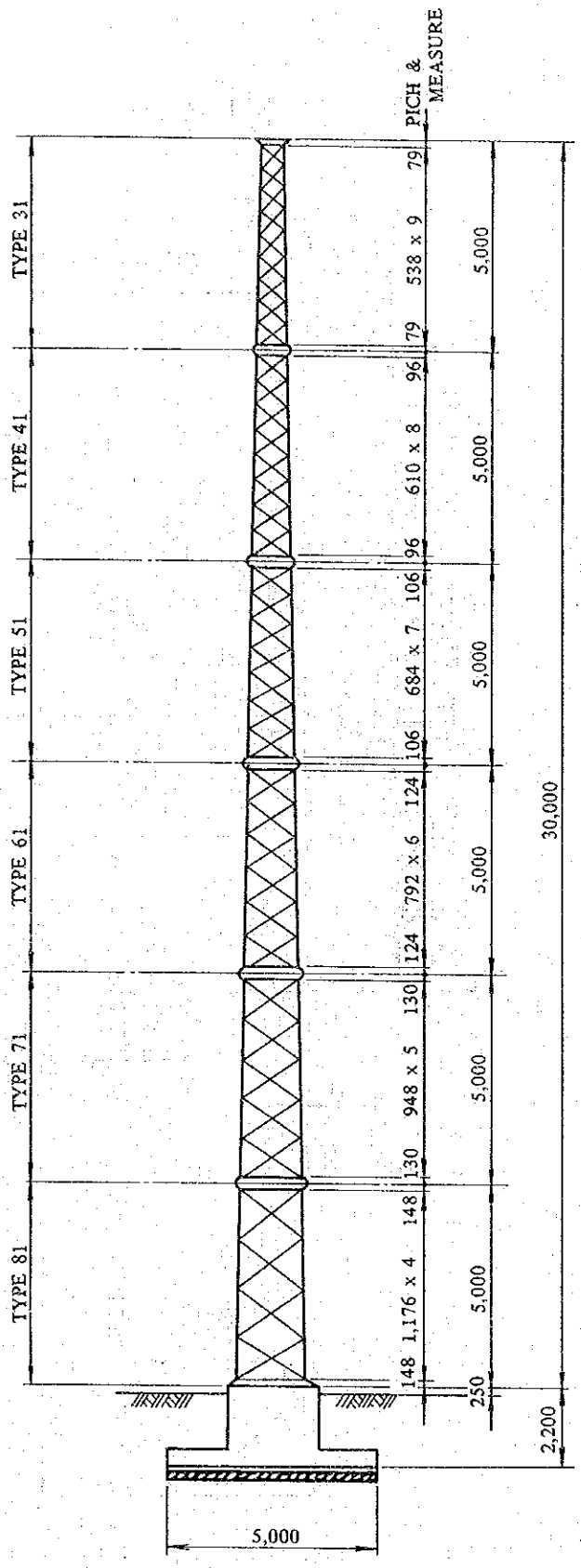
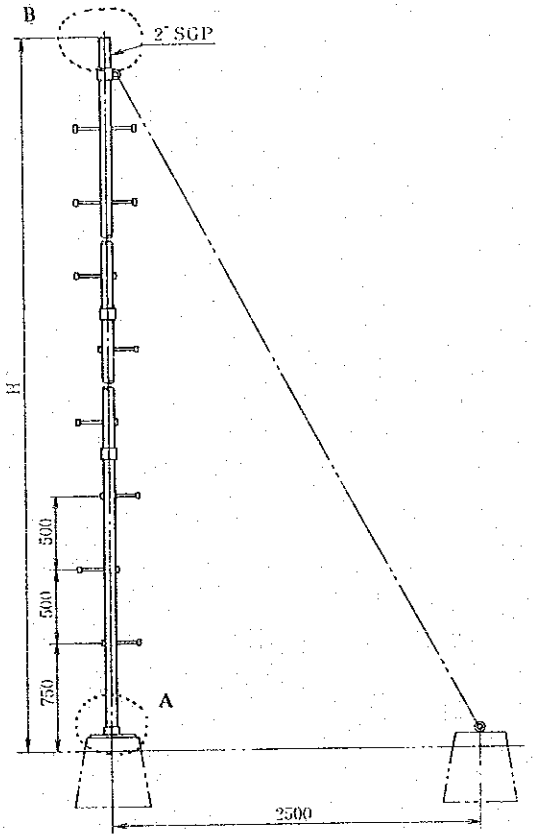
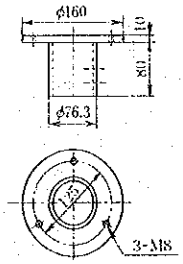


Fig. STEEL TELE POLE H = 10M

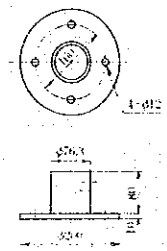
UNIT: mm



B - DETAIL



A - DETAIL



PIPE:	2 inchs, Gas Pipe
LENGTH:	Unit of Pipe 3.00m
FIXED TYPE:	Anchor Bolt and Wire
COLOR:	Silver

APPENDIX E

Flood Warning System in Kinabatangan and Sadong River Basins

1. Cost Estimate of Flood Warning System

Project cost of the three proposed alternative plans for warning system in Kinabatangan River Basin and Sadong River Basin are estimated as follows:

Table-1-1 Estimated Cost of Flood Warning System in Kinabatangan River Basin

(US$)

Item		Amount	Remarks
Case 1	Construction Cost	1,252,700	
	Contingency	124,300	
	Sub-total	1,377,000	
	Consulting Services	187,000	
	Total	1,564,000	
Case 2	Construction Cost	615,240	
	Contingency	61,760	
	Sub-total	677,000	
	Consulting Services	92,000	
	Total	769,000	
Case 3	Construction Cost	221,480	
	Contingency	24,520	
	Sub-total	246,000	
	Consulting Services	44,000	
	Total	290,000	

Table 1-2 Estimated Cost of Flood Warning System in Sadong River Basin

(US$)

Item		Amount	Remarks
Case 1	Construction Cost	650,820	
	Contingency	64,180	
	Sub-total	715,000	
	Consulting Services	97,000	
	Total	812,000	
Case 2	Construction Cost	344,820	
	Contingency	34,180	
	Sub-total	379,000	
	Consulting Services	51,000	
	Total	430,000	
Case 3	Construction Cost	145,080	
	Contingency	13,920	
	Sub-total	159,000	
	Consulting Services	21,000	
	Total	180,000	

Fig. 1-1 Warning System Block Diagram
(Motor Siren and Loudspeaker)

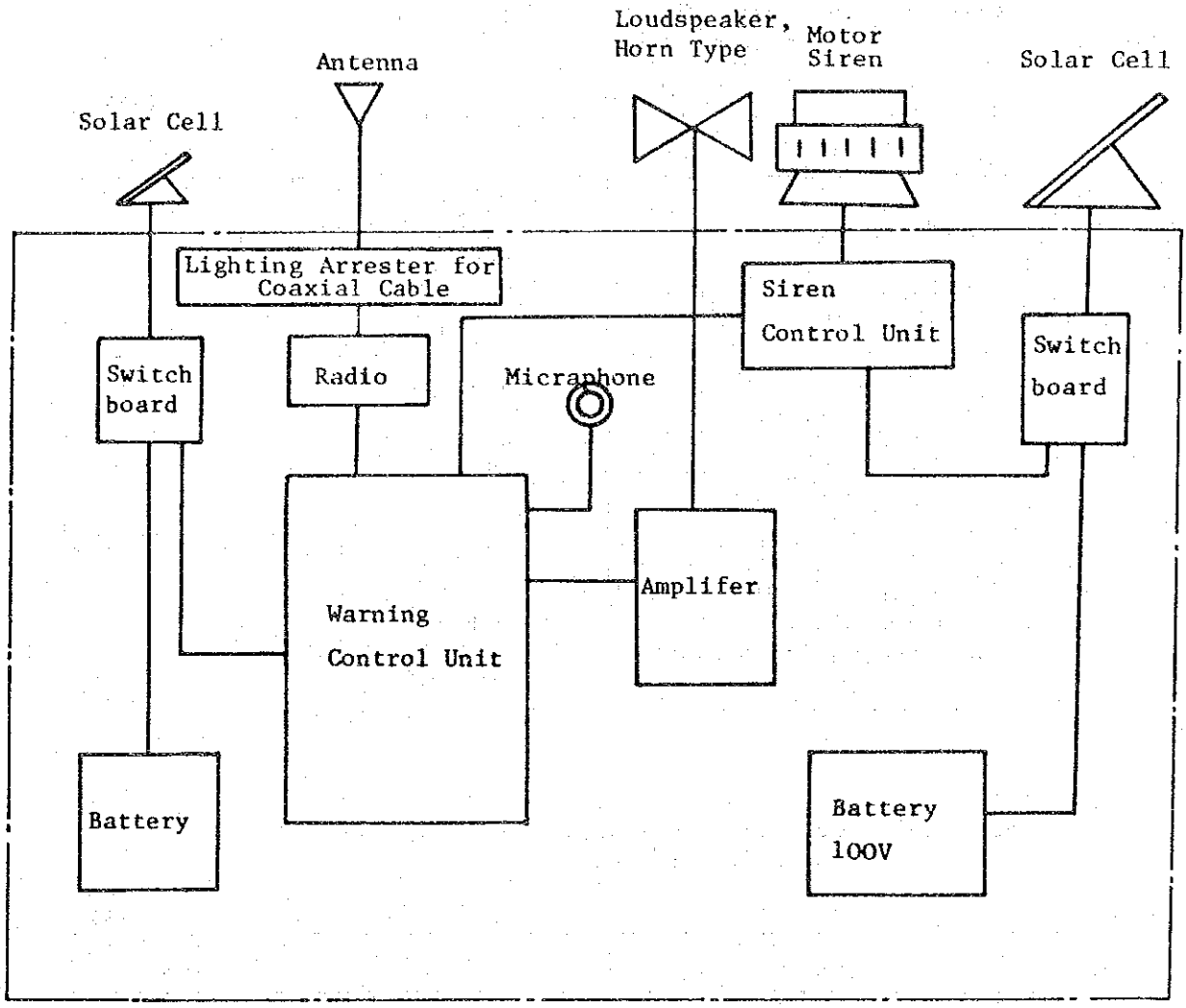
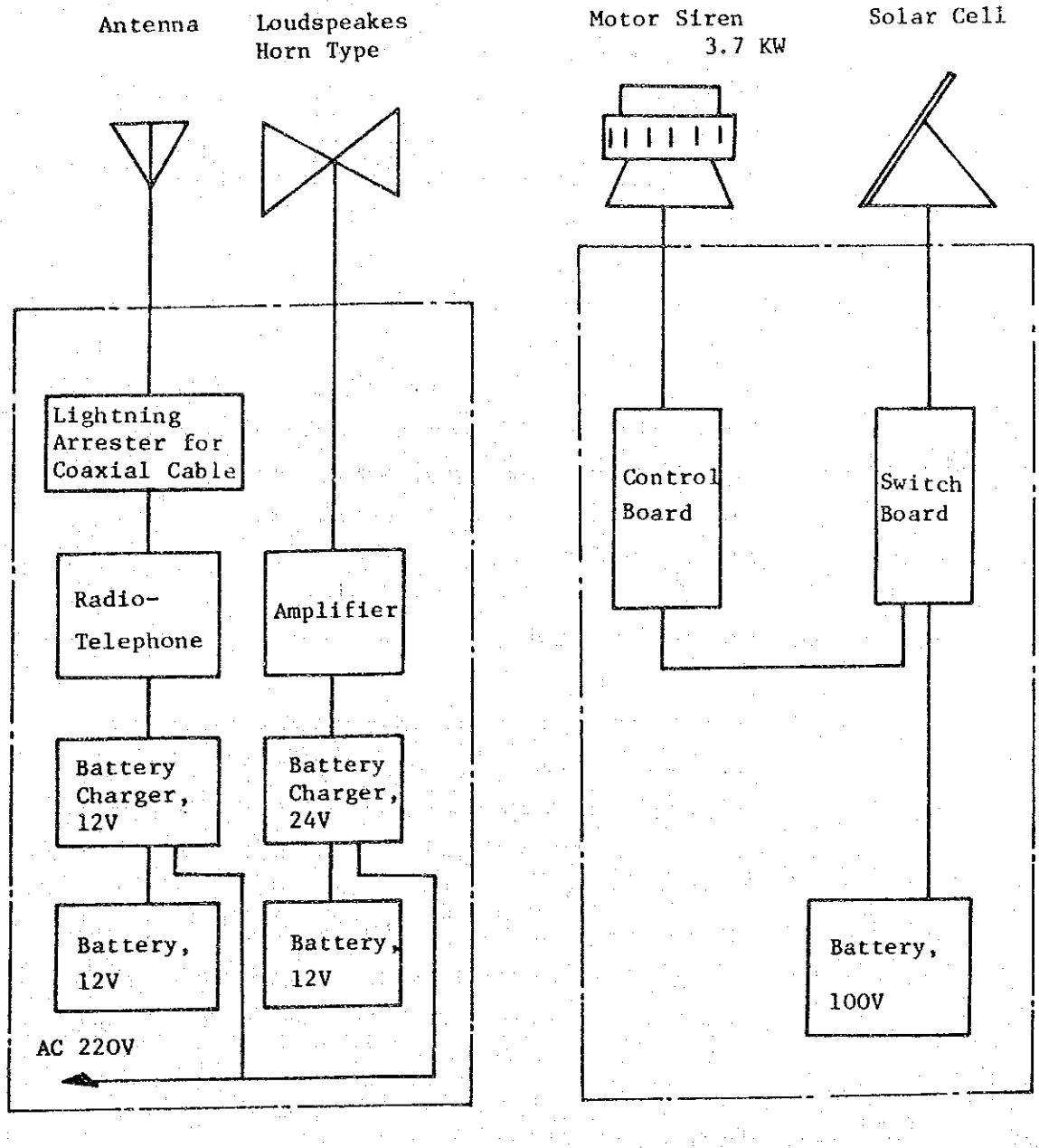


Fig. 1-2 Warning System Block Diagram
(Motor Siren and Loudspeaker)



2. Kinabatangan River Flood Warning System

a. Siren and Speaker Warning System (Case 1)

a-1. Area Subject to Warning

Motor sirens and loudspeakers are to be placed along the river so as to cover major Kampungs of Kuamut, Balat, Pintasan, Lamag Bukit Garam and Bilit within proposed target area of the flood forecasting and warning.

a-2. Warning Apparatus

Warning is to be sent out from motor sirens and loudspeakers each producing imitated sound and voice message. Normally, motor siren is used. When the siren cannot be used due to malfunction loudspeaker is used.

a-3. Warning Procedure

Warning apparatus may be activated directly by radio control either by Flood Control Center or other relevant administrative agency. This method is advantageous since all apparatus may be activated simultaneously. Checking system for orderly function, however, is highly complicated and very costly. Through management and maintenance is required to prevent possible harm to the apparatus and theft of diesel fuel.

a-4. Warning Notice Board

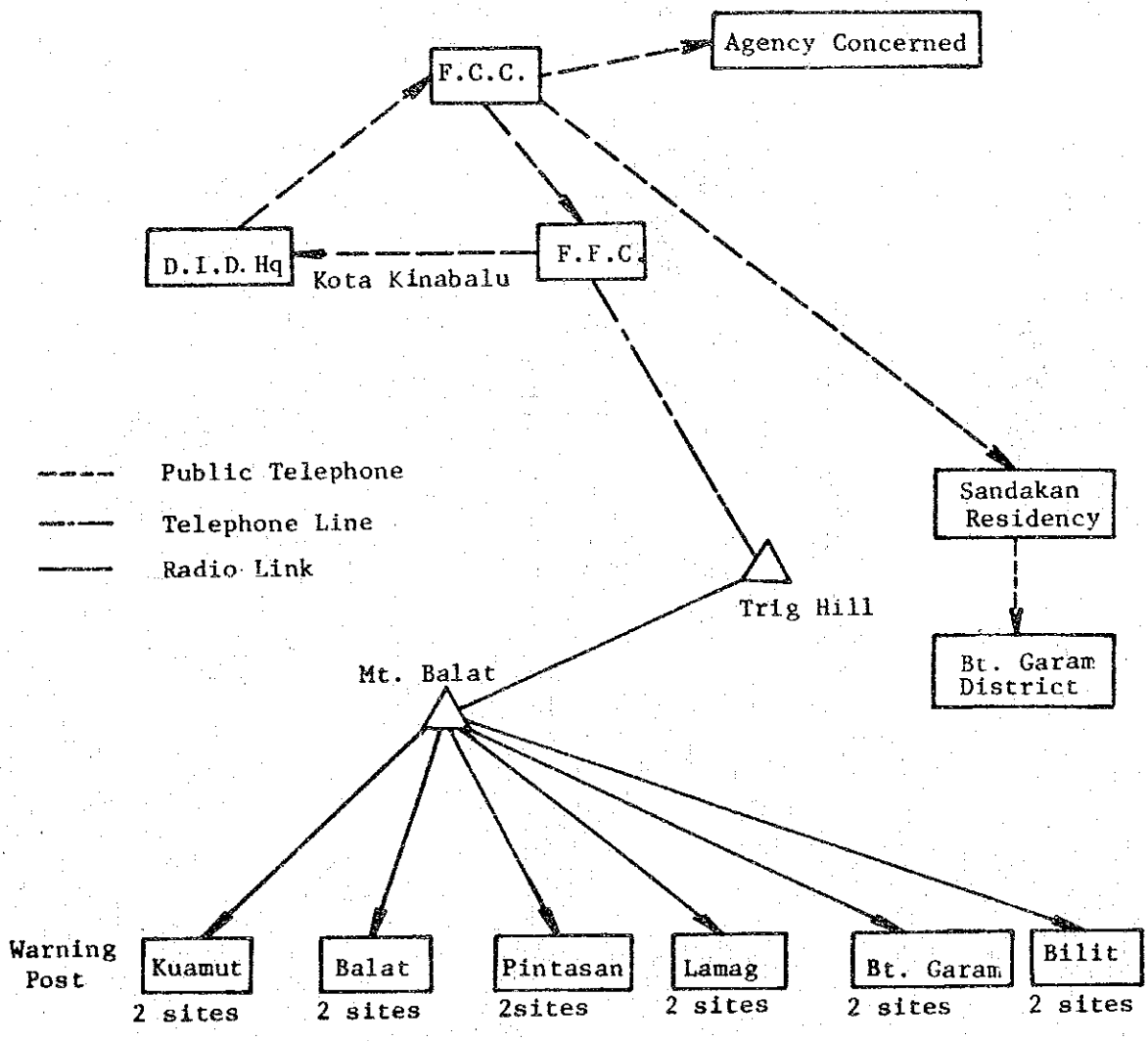
For informing the inhabitants of possible floods, warning notice boards are to be placed together with the warning apparatus and other principal locations along the river.

a-5. Warning System Configuration

The following figure shows an example of warning system configuration.

Fig.2-1 Warning System Network by Moter Siren and Loudspeaker

(Kinabatangan River Basin)



*The radio wave propagation test for this waining system has not been conducted.

Fig. 2-2 Proposed Facility Site for Flood Warning System
(Kinabatangan River Basin)

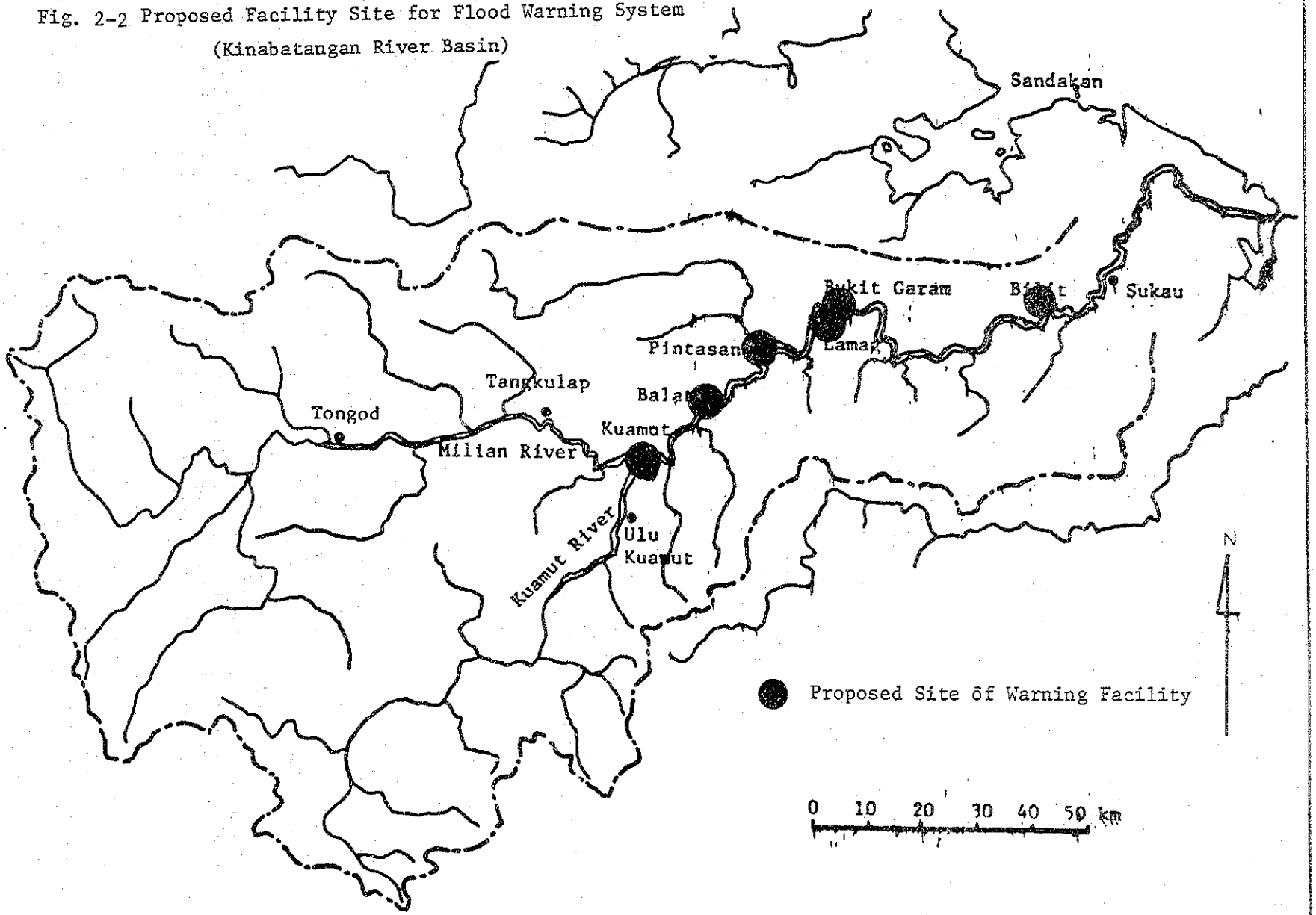


Table 2-1 Estimated Cost (1)

(US$)

Item	Unit Price	Q'ty	Amount	Remarks
. Warning Control Station				Remote Control
Warning Control Equipment	46,600	1	46,600	facility to
Recording Equipment	11,190	1	11,190	be included
Radio Equipment	1,220	1	1,220	in Flood
Antenna System	2,300	1	2,300	Forecasting
Spare Parts	2,080	1	2,080	Center
Test Equipment	2,190	1	2,190	
Installation Material	910	1	910	
Sub total			66,490	
. Relay Station (Trig hill)				
Relay Equipment	16,400	1	16,400	Telecon
Radio Equipment	2,700	2	5,400	Department
Ballery Charger	4,100	1	4,100	station
Alkaline Battery	3,300	1	3,300	facility to
Lighting Arrester	300	1	300	be used
Antenna	500	1	500	
Accessories	1,000	1	1,000	
Installation Materials (Cables)	1,000	1	1,000	
Spare Parts	1,000	1	1,000	
A V R	2,300	1	2,300	
Sub total			35,300	
. Warning Station				Remote Control
Warning Equipment	8,830	12	105,960	
Moter Siren Equipment	10,210	12	122,520	
Speaker Equipment	1,850	12	22,200	
Power Supply Equipment	24,620	12	295,440	for Motor Siren
"	5,770	12	69,240	for Warning
Antenna System	300	12	3,600	Equipment
Radio Equipment	1,220	12	14,640	
Installation Materials	6,790	12	81,480	
Sub total			715,080	
. Civil Works				
Housing	6,000	12	72,000	2.5x2.5m
Tower for Housing	15,000	12	180,000	H = 10.0m
Tele Pole	10,100	12	121,200	H = 10.0m
Sub total			373,200	
Sub Total			1,190,070	

Table 2-2 Estimated Cost (2)

(US$)

Item	Unit Price	Q'ty	Amount	Remarks
. Relay Station (Mt. Balat)				
Relay Equipment	17,200	2	34,400	Station
Radio Equipment	2,700	4	10,800	housing and
Solar Cell	7,800	1	7,800	tower for
Alkaline Storage Battery	3,300	1	3,300	telemetry
Generator Motor	500	1	500	to be made
Lighting Arrester	300	2	600	use of
Antenna	500	4	2,000	
Distributor	300	1	300	
Accessory	1,000	1	1,000	
Installation Materials (Cables)	1,000	1	1,000	
Spare Parts	1,000	1	1,000	
Sub Total			62,700	
Total			1,252,700	

b. Warning by Vehicle and Boat (Case 2)

b-1. Area Subject to Warning

Area adjacent to the river and the roads within the proposed target area of the flood forecasting and warning.

b-2. Warning Apparatus

Remote control motor siren and loudspeakers are to be installed at Kuamut and Bukit Garam. As such apparatus is activated, warning boats would start patrolling the area sending out warning by mannually operated apparatus on board.

b-3. Warning System Configuration

The following figure shows an example of warning system configuration.

b-4. Cost Estimate

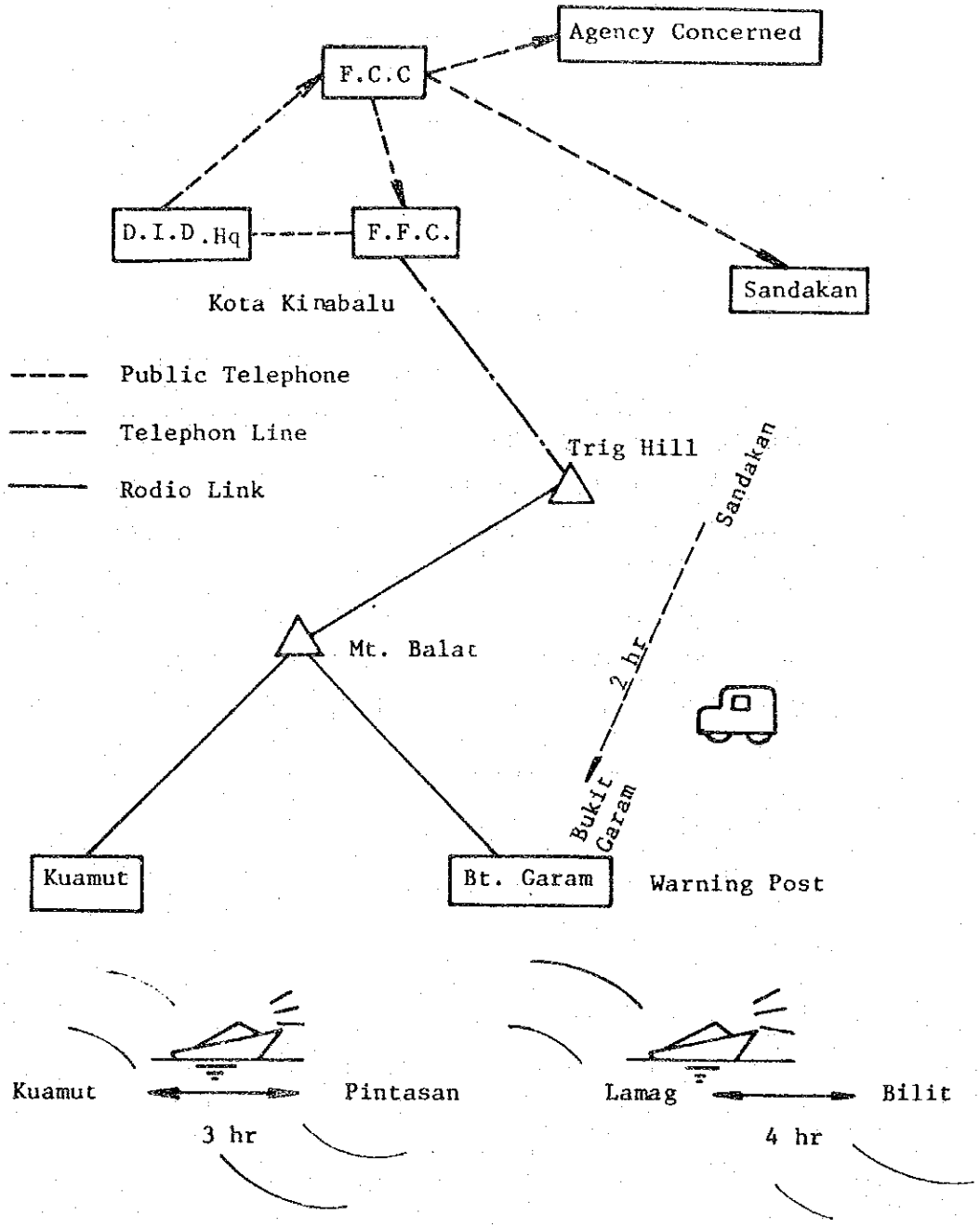
Table 2-3 Estimated Cost (Case 2)

(US$)

Items		Q'ty		Remarks
. Warning Control Station		1	66,490	Remote Control facility to be included in Flood Forecasting Center
. Relay Station (Trig hill)		1	35,300	
. Relay Station (Mr. Balat)		1	62,700	
Sub total			164,490	
. Warning Station		2	119,180	Remote Control
. Warning Station		3		Manual type
Control Equipment	1,960	3	5,880	
Motor Siren Equipment	7,450	3	22,350	
Power Supply Equipment	24,620	3	73,860	for Moter Siren
Power Supply Equipment	2,790	3	8,370	for Radio Equipment
Radio Equipment	1,220	3	3,660	
Antenna System	300	3	900	
Installation Materials	6,330	3	18,990	
Spare Parts	2,080	3	6,240	
Speakar Equipment	4,200	3	12,600	
Sub total			152,850	
. Warning Sub Control St.		3		Sandakan, Kuwait
Radio Equipment	3,060	3	9,180	Bunkit Garam
Antenna System	2,300	3	6,900	
Sub total			16,080	
. Vehicle				
Boat	25,000	2	50,000	
Car	30,000	1	30,000	
Portable Radio Equipment	880	3	2,640	
. Civil Works				
Housing	15,000	2	30,000	5.0 x 5.0m
Tower for Housing	15,000	2	30,000	H = 10.0m
Tele Pole	10,100	2	20,000	H = 10.0m
Sub total			162,640	
Total			615,240	

Fig.2-3. Warning System Network by Moter Siren and Loudspeaker

(kinabatangan River Basin)



* The radio wave propagation test for this warning system has not been conducted.

c. Warning by Radio Receiver (Case 3)

c-1. Area Subject to Warning

Radio receivers are to be placed in the major Kampung of Kuamut, Balat, Pintasan, Lamag, Bukit Garam and Bilit.

c-2. Warning System Configuration

Fig. shows an example of system configuration.

c-3. Cost Estimate

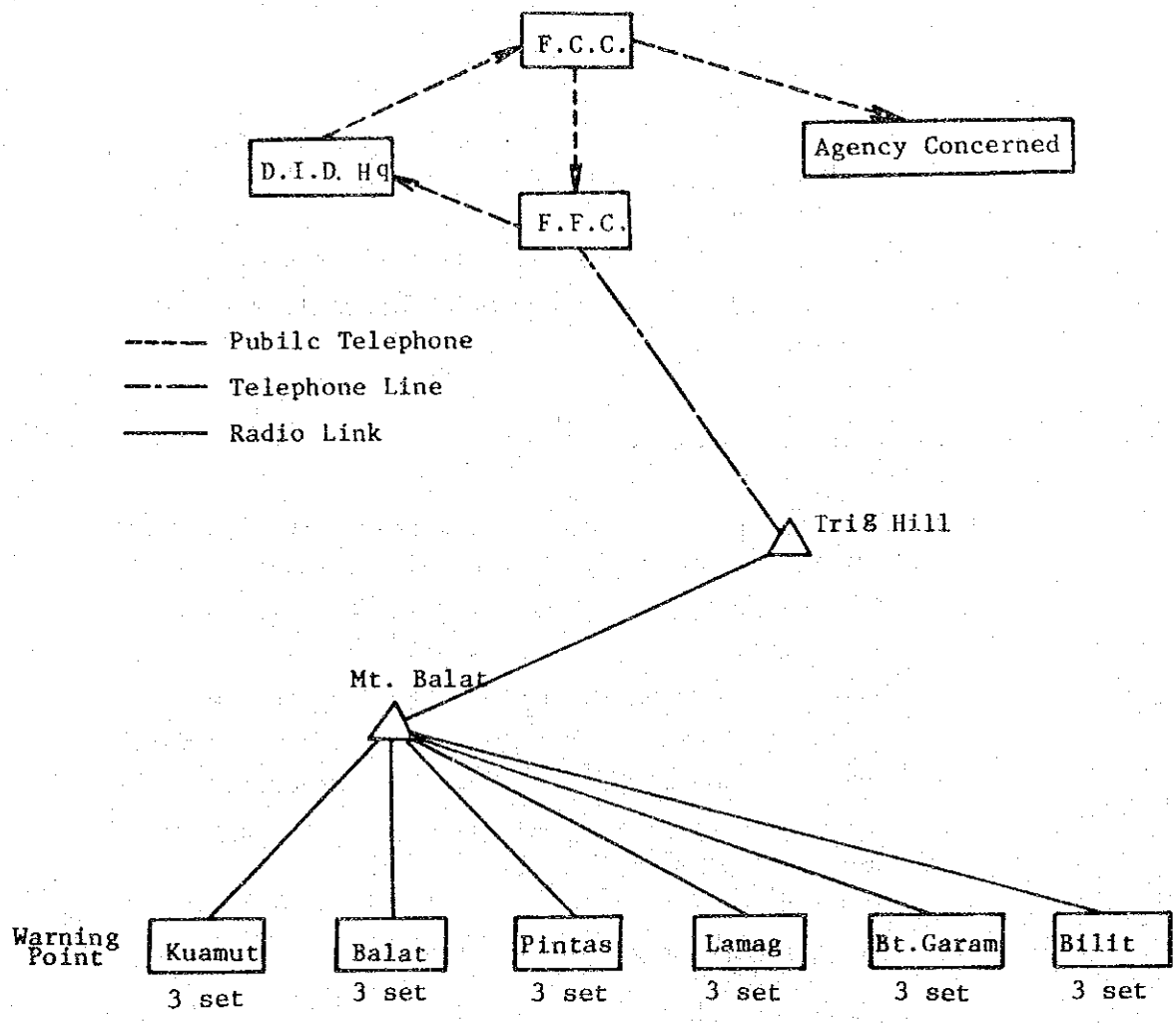
Table- Estimated Cost

(US$)

Item	Unit Price	Q'ty	Amount	Remarks
Warning Control Station		1	16,080	
Relay Station (Trig hill)		1	35,300	
Relay Station (Mr. Balat)		1	62,700	Tower and housing for telecasting to be used
Radio Equipment	1,300	18	23,400	
Antenna System	300	18	5,400	
Installation Materials	1,000	18	18,000	
Tele Pole	10,100	6	60,600	6(six) kampung
Total			221,480	

Fig. 2-4 Flood Warning System Network by Receiver

(Kinabatangan River Basin)



* The radio wave propagation test for this waining system has not been conducted.

Sadong River Flood Warning System

a. Siren and Speaker Warning System (Case 1)

a-1. Area Subject to Warning

Motor sirens and loudspeakers are to be placed along the river so as to cover major Kampungs of Tebakang, Serian, Tanah Puteh, Sebamban and Gedong within proposed target area of the flood forecasting and warning.

a-2. Warning Apparatus

Warning is to be sent out from motor sirens and loudspeakers each producing imitated sound and voice message. Normally, motor siren is used. When the siren cannot be used due to malfunction, loudspeaker is used.

a-3. Warning Procedure

Warning apparatus may be activated directly by radio control either by Flood Control Center or other relevant administrative agency. This method is advantageous since all apparatus may be activated simultaneously. Checking system for orderly function, however, is highly complicated and very costly. Through management and maintenance is required to prevent possible harm to the apparatus and theft of diesel fuel.

a-4. Warning Notice Board

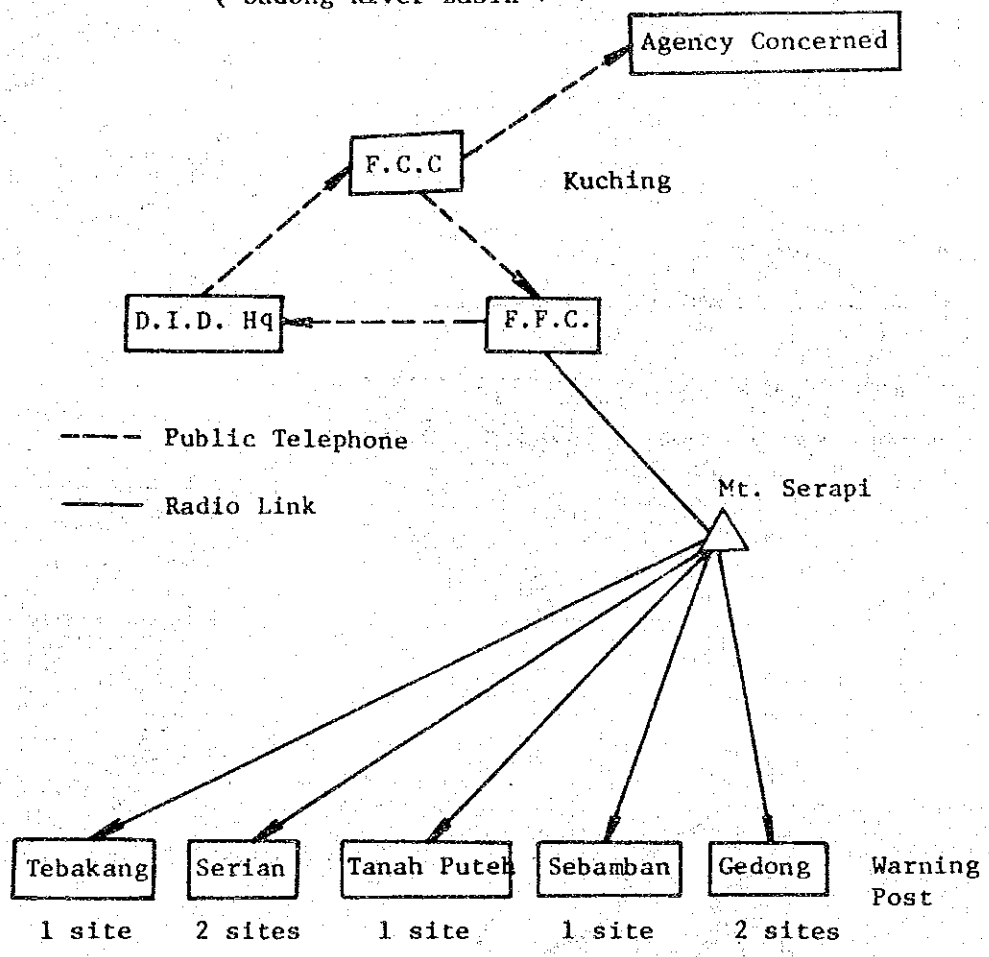
For informing the inhabitants of possible floods, warning notice boards are to be placed togehter with the warning apparatus and other principal locations along the river.

a-5. Warning System Configuration

The following figure shows an example of warning system configuration.

Fig. 3-1 Flood Warning System Network by Motor Siren and Loudspeaker (case 1)

(Sadong River Basin)



* Radio wave propagation test for proposed system has not been Conducted.

Fig.3-2 Proposed Facility Site for Flood Warning System

(Sadong River Basin)

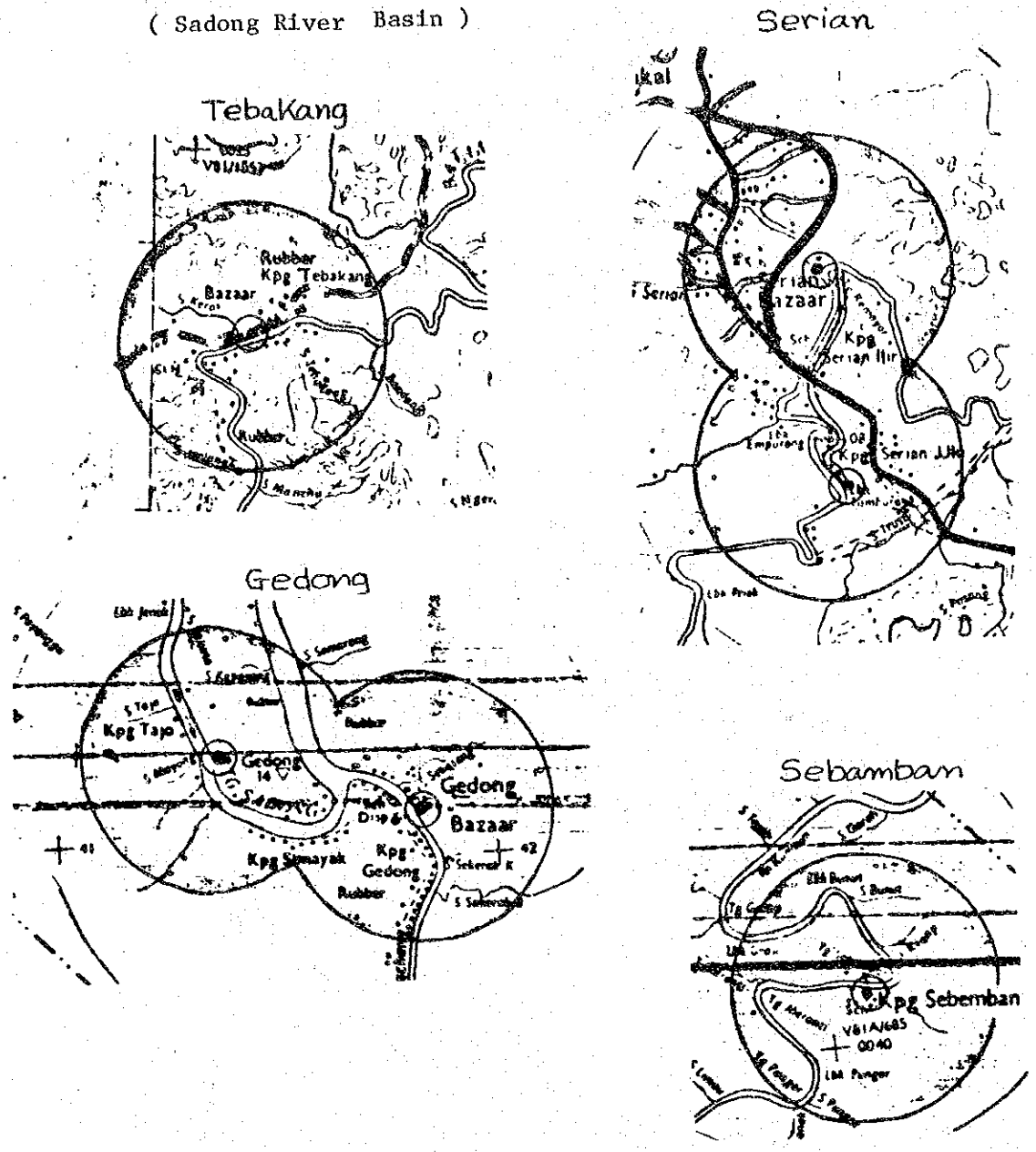


Table 3-1 Estimated Cost

Item	Unit Price	Q'ty	Amount	Remarks
. Warning Control Station				Remote Control facility to be included in Flood Forecasting Center
Warning Control Equipment		1	46,600	
Recording Equipment		1	11,190	
Radio Equipment		1	1,220	
Antenna System		1	2,300	
Spare Part		1	2,080	
Test Equipment		1	2,190	
Installation Material		1	910	
Sub Total			66,490	
. Relay Station (Mr. Serapi)				
Relay Equipment		1	17,200	Housing for telemetry to be used
Radio Equipment		1	9,600	
Power Supply Equipment		1	9,700	
Cables		1	1,000	
Others		1	2,000	
Sub Total			39,500	
. Warning Station				Remote Control
Warning Equipment	8,830	7	61,810	
Moter Siren Equipment	10,210	7	71,470	
Loud Speaker Equipment	1,850	7	12,950	
Power Supply Equipment	24,620	7	172,340	for Moter Siren
Power Supply Equipment	5,770	7	40,390	for Warning Equipment
Antenna System	300	7	2,100	
Radio Equipment	1,220	7	8,540	
Installation Material	6,790	7	47,530	
Sub Total			417,130	
. Civil Works				
Housing	6,000	7	42,000	
Tower for Housing		1	15,000	
Tele Pole	10,100	7	70,700	
Sub Total			127,700	
Total			650,820	

b. Warning by Vehicle and Boat (Case 2)

b-1. Area Subject to Warning

Area adjacent to the river and the roads within the proposed target area of the flood forecasting and warning.

b-2. Warning Apparatus

Remote control motor siren and loudspeaker are to be installed at Gedong. As such apparatus is activated, warning boats would start patrolling the area sending out warning by manually operated apparatus on board. On the other hand, patrol vehicle is dispatched by Flood Control Center to Serian and Tebakang for warning.

b-3. Warning System Configuration

Following diagram shows an example of warning system configuration.

b-4. Cost Estimate

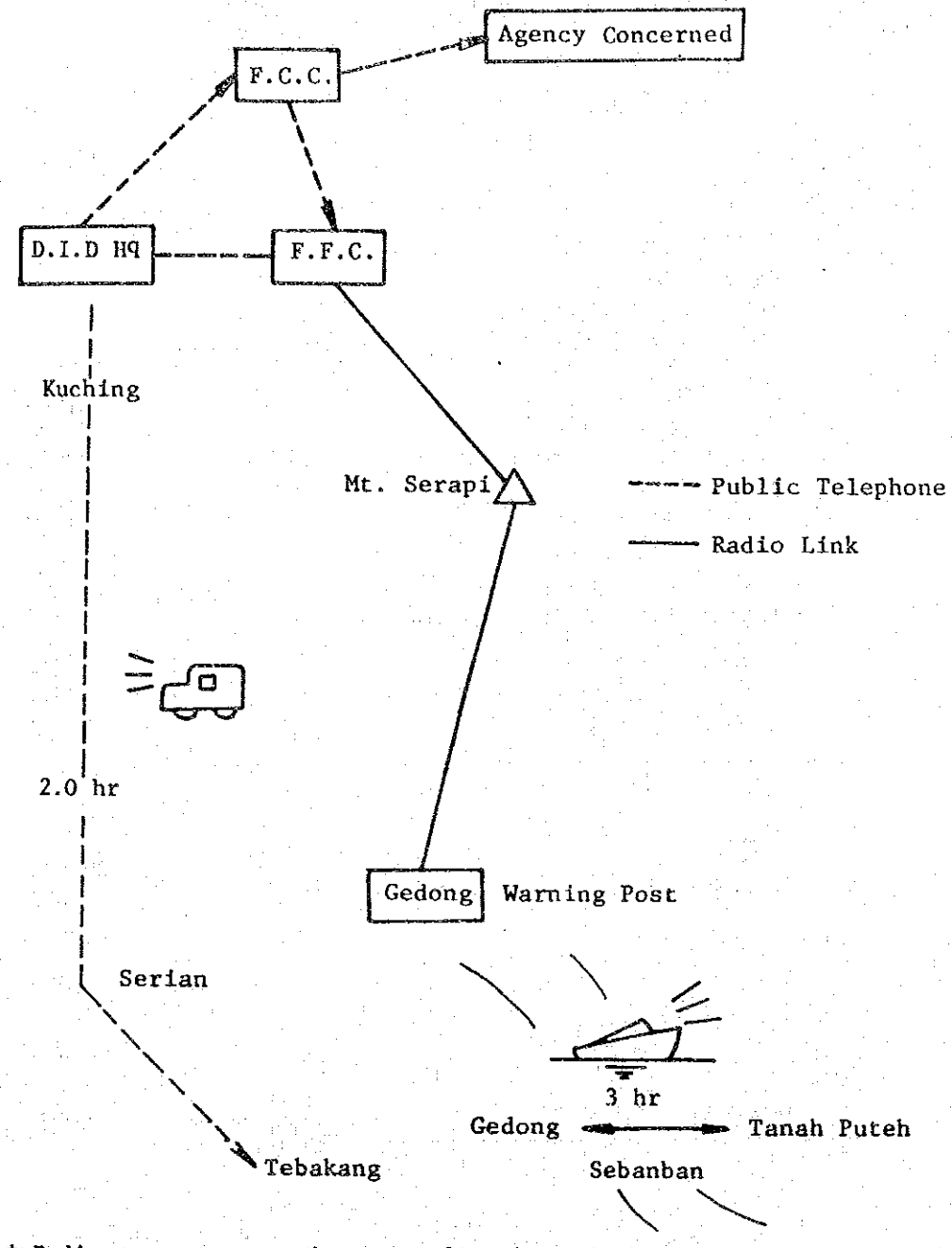
Table 3-2 Estimated Cost

(US$)

Item	Unit Price	Q'ty	Amount	Remarks
. Warning Control Station		1	66,490	Remote Control
. Relay Station (Mt. Serapi)		1	39,500	
. Warning Station		1	59,590	Remote Control
. Warning Station				
Control Equipment	1,960	2	3,920	
Motor Siren Equipment	7,450	2	14,900	
Power Supply Equipment	24,620	2	49,240	
"	2,790	2	5,580	
Radio Equipment	1,220	2	2,440	
Antenna System	300	2	600	
Installation Materials	6,330	2	12,660	
Spare Parts	2,080	4	4,160	
Loud Speaker Equipment	4,200	2	8,400	
Sub Total			101,900	
. Warning Sub Control Station				Gedong
Radio Equipment		1	3,060	
Antenna System		1	2,300	
Sub Total			5,360	
. Vehicle				
Boat		1	25,000	
Car		1	30,000	
Portable Radio Equipment		1	880	
. Civil Works				
Housing		1	6,000	
Tele pole		1	10,100	
Sub Total			71,980	
Total			344,820	

Fig. 3-3 Flood Warning System Network by Patrol Car and Boat (case)

(Sadong River Basin)



* Radio wave propagation test for the proposed system has not been conducted

c. Warning by Radio Receiver (Case 3)

c-1. Area Subject to Warning

Three radio receivers are to be placed in each of the major Kampungs of Tebakang, Serian, Tanah Puteh, Sebamban and Gedong.

c-2. Warning System Configuration

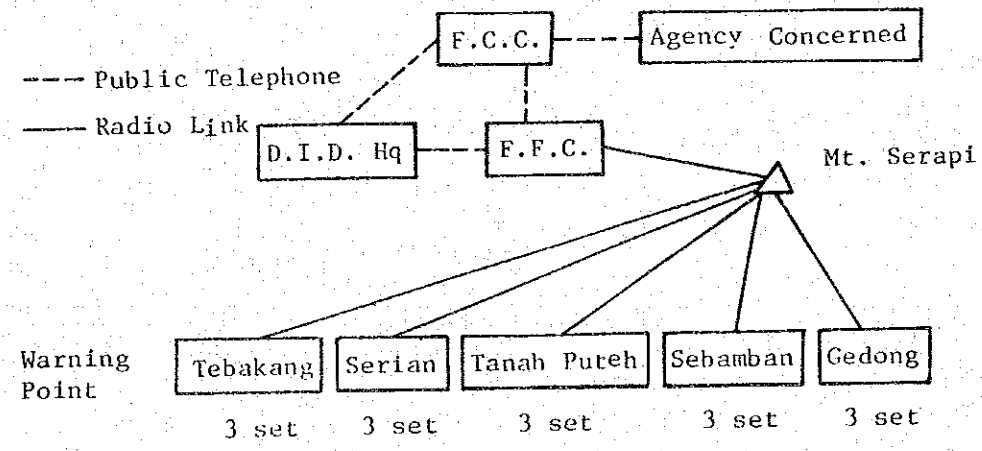
Following example shows an example of warning system configuration.

c-3. Cost Estimate

Table 3-3 Estimated Cost (Case 3)

Item	Unit Price	Q'ty	Amount	Remarks
Warning Control System		1	16,080	
Relay Station (Mr. Serapi)		1	39,500	
Radio Equipment	1,300	15	19,500	
Antenna Systems	300	15	4,500	
Installation Materials	1,000	15	15,000	
Tele pole	10,000	5	50,500	5 Kampang
Total			145,080	

Fig.3-4 Flood warning System Network by Radio Receiver (case 3)



*Radio wave propagation test for the proposed system has not been conducted

APPENDIX F

COST ESTIMATION
OF
ALTERANTIVE SCHEME

1. Kinabatangan River Basin

1-1 Total Cost of Alternative Scheme

1-(1) Alternative System A

The flood forecasting accuracy of this alternative plan is expected to be a little less than the original proposed system due to reduction in number of observation stations. Hydrological observation would be limited to water level gauging to be conducted at Tangkulap, Ulu Kuamut, Balat and Bukit Garam. No discharge observation facility is proposed. Project cost would be as stated in the table below.

Table 1-1 Total Cost of Alternative A (Kinabatangan River Basin)

(US$)

Item	Observation Station	Flood Forecasting System	Total	Remarks
Equipments	58,660	515,700	574,360	
Facilities	110,000	140,100	250,100	
Sub-total	168,660	655,800	824,460	
Contingency	17,340	65,200	82,540	
Total	186,000	721,000	907,000	

Consulting Services	180,000
° Training	
Training Overseas	27,000
On-the-job Training	63,000
° Supervising	
Detailed Design	54,000
Contract and Procurement	9,000
Design Modification	27,000

(US$ 1=¥ 220)

1-(2) Alternative System B

In this alternative plan, no monitoring station is to be placed, which is proposed to be placed in Sandakan in Alternative System A. Project cost would be as stated in table below.

Table 1-2 Total Cost of Alternative B (Kinabatangan River Basin)

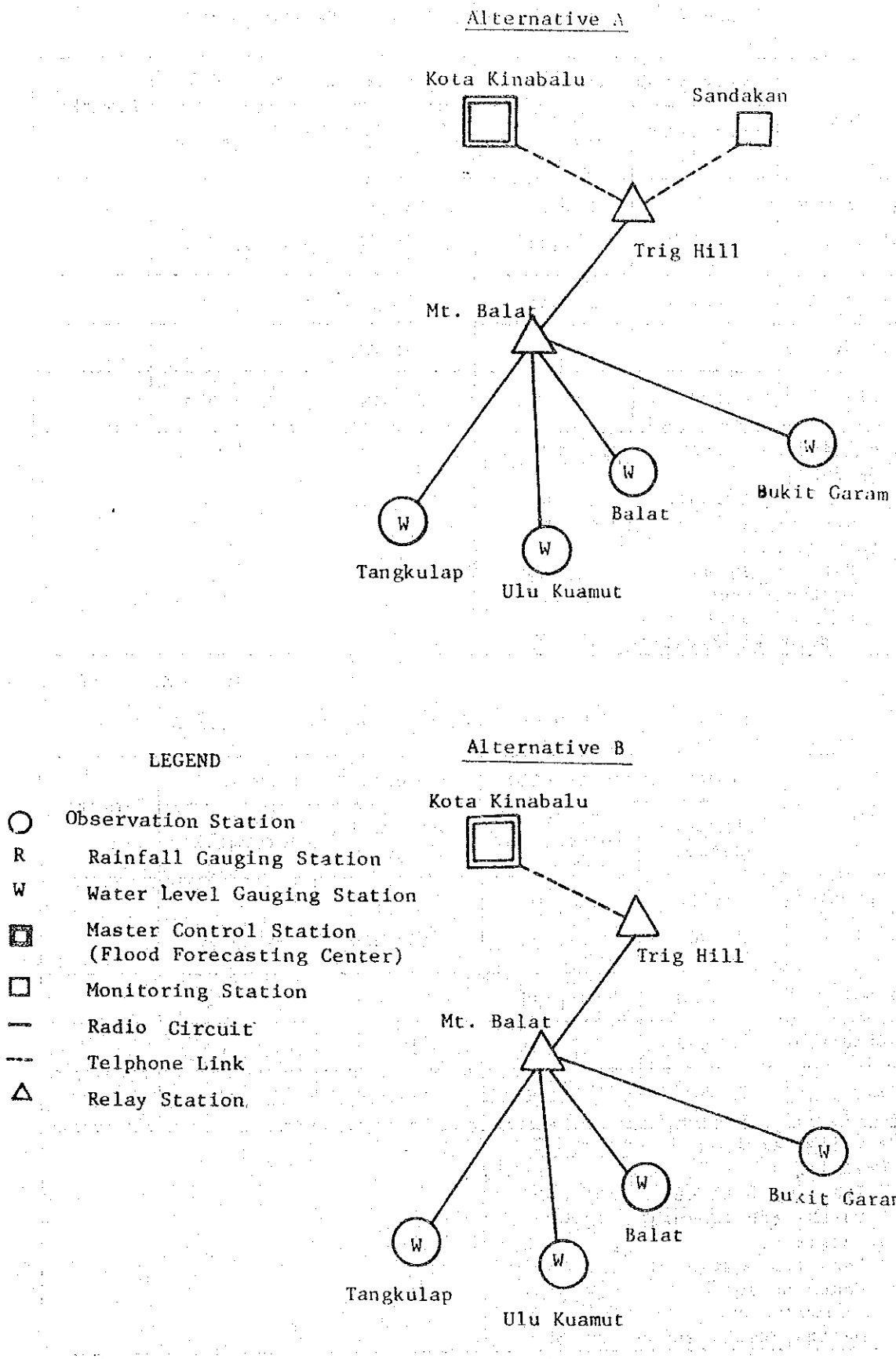
(US$)

Item	Observation Station	Flood Forecasting System	Total	Remarks
Equipments	58,660	434,500	493,160	
Facilities	110,000	130,100	240,100	
Sub-total	168,660	564,600	733,260	
Contingency	17,340	56,400	73,740	
Total	186,000	621,000	807,000	

Consulting Services	160,000
° Training	
Training Overseas	24,000
On-the-job Training	56,000
° Supervising	
Detailed Design	48,000
Contract and Procurement	8,000
Design Modification	24,000

(US$ 1=¥ 220)

Fig. 1-1 System Network



1-2 Currency Allocation (Kinabatangan River Basin)

Table 1-3 Currency Allocation of Alternative A

Item	Foreign Currency (US$)		Local Currency (M$)		Remarks
	Observation Station	Flood Forecasting System	Observation Station	Flood Forecasting System	
Equipments	45,808	515,700	26,989	-	
Facilities	20,000	57,195	189,000	203,314	
Sub-total	65,808	572,895	215,989	203,314	
Contingency	6,192	57,105	22,011	20,686	
Total	72,000	630,000	238,000	224,000	
Consulting Services		180,000			
° Training					
Training Overseas		27,000			
On-the-job Training		63,000			
° Supervising					
Detailed Design		54,000			
Contract and Procurement		9,000			
Design Modification		27,000			

(US$ 1=M$ 2.1=¥ 220)

Table 1-4 Currency Allocation of Alternative B

Item	Foreign Currency (US$)		Local Currency (M$)		Remarks
	Observation Station	Flood Forecasting System	Observation Station	Flood Forecasting System	
Equipments	45,808	434,500	26,989	-	
Facilities	20,000	57,195	189,000	129,814	
Sub-total	65,808	491,695	215,989	129,814	
Contingency	6,192	49,305	22,011	20,686	
Total	72,000	541,000	238,000	224,000	
Consulting Services		160,000			
° Training					
Training Overseas		24,000			
On-the-job Training		56,000			
° Supervising					
Detailed Design		48,000			
Contract and Procurement		8,000			
Design Modification		24,000			

(US$ 1=M$ 2.1=¥ 220)

2. Sadong River Basin

2-1 Total Cost of Alternative Scheme

The flood forecasting accuracy of this alternative plan is expected to be a little less than the original proposed system due to reduction in number of observation stations. Hydrological observation would be limited to four locations of Krusin, Meringgu, Serian and Gedong. No discharge observation facility is proposed. Project cost would be as stated in the table below.

Table 2-1 Total Cost of Alternative A (Sadong River Basin)

(US$)

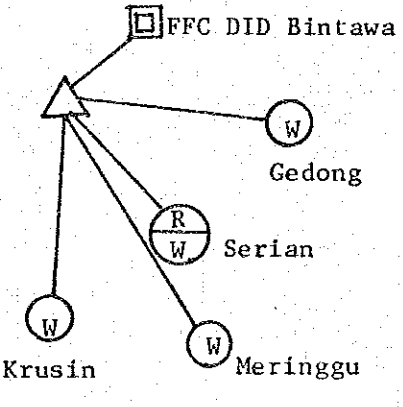
Item	Observation Station	Flood Forecasting System	Total	Remarks
Equipments	46,160	302,200	348,360	
Facilities	30,600	106,400	137,000	
Sub-total	76,760	408,600	485,360	
Contingency	7,240	41,400	48,640	
Total	84,000	450,000	534,000	

Consulting Services	106,000
° Training	
Training Overseas	16,000
On-the-job Training	37,000
° Supervising	
Detailed Design	32,000
Contract and Procurement	5,000
Design Modification	16,000

(US$ 1=¥ 220)

LEGEND

- ○ Observation Station
- R Rainfall Gauging Station
- W Water Level Gauging Station
- ◘ Master Control Station (Flood Forecasting Center)
- △ Relay Circuit
- — Radio Link



2-2 Currency Allocation

Table 2-2 Currency Allocation of Alternative A
(Sadong River Basin)

Item	Foreign Currency (US$)		Local Currency (M$)		Remarks
	Observation Station	Flood Forecasting System	Observation Station	Flood Forecasting System	
Equipments	35,718	302,200	21,928	-	
Facilities	-	23,620	64,260	173,838	
Sub-total	35,718	325,820	86,188	173,838	
Contingency	3,282	32,180	8,812	17,162	
Total	39,000	358,000	95,000	191,000	
Consulting Services	106,000				
° Training					
Training Overseas	16,000				
On-the-job Training	37,000				
° Supervising					
Detailed Design	32,000				
Contract and Procurement	5,000				
Design Modification	16,000				

(US$ 1=¥ 220)

APPENDIX G

TERRAIN PROFILE

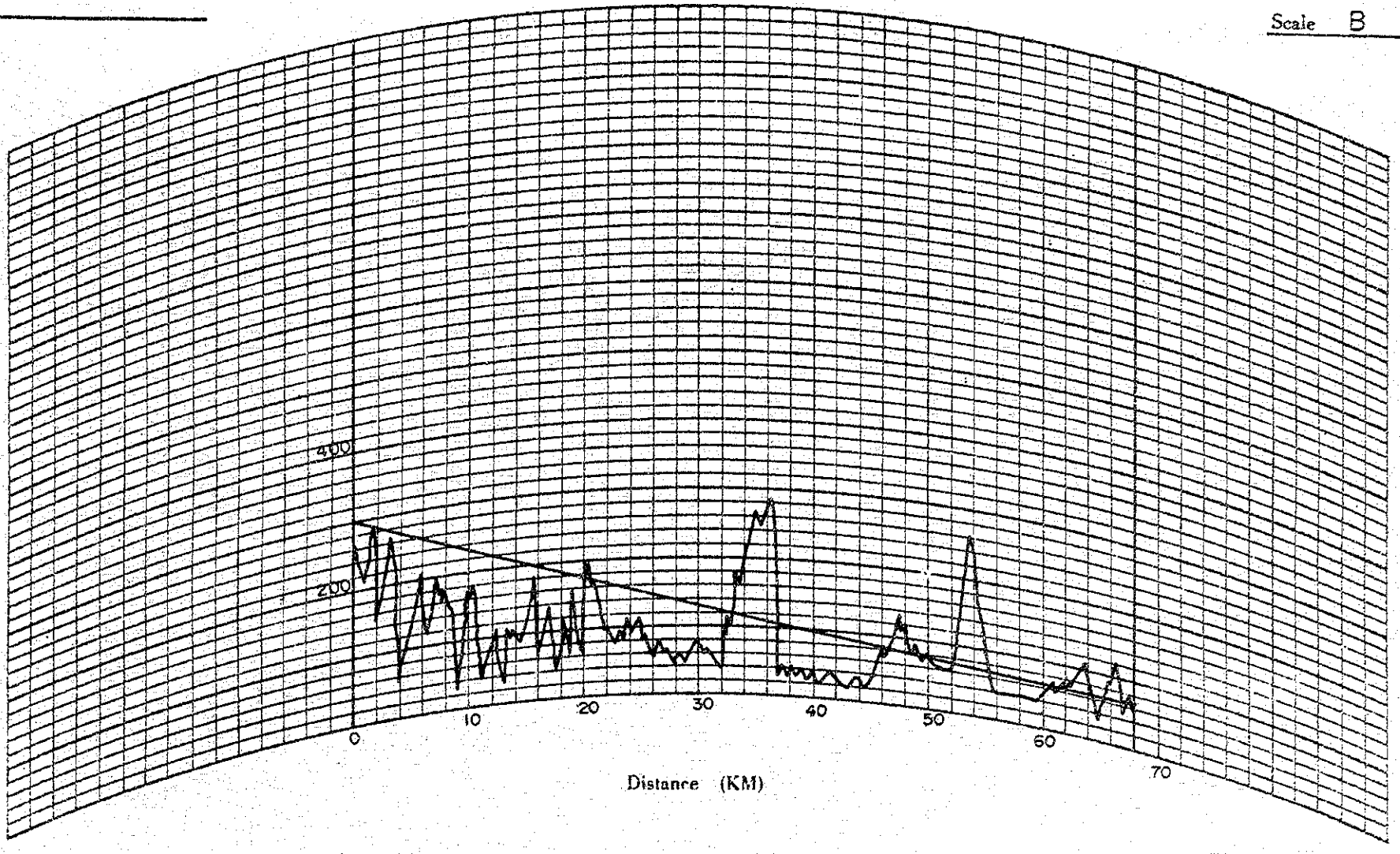
PROFILE (K=⅓)

Scale B

Full Scale
A= 4000m
B= 1000m
C= 250m

G - 1

Height(m)



Height(m)

Full Scale
A= 240km
B= 120km
C= 60km

Mt. Balat		Tangod
Altitude 275 m	68.0 KM	Altitude 45 m
Antenna Height 30 m		Antenna Height 30 m

DATE	DESIGN	TRACED	CHECKED	APPR

DRAW NO. M.PE

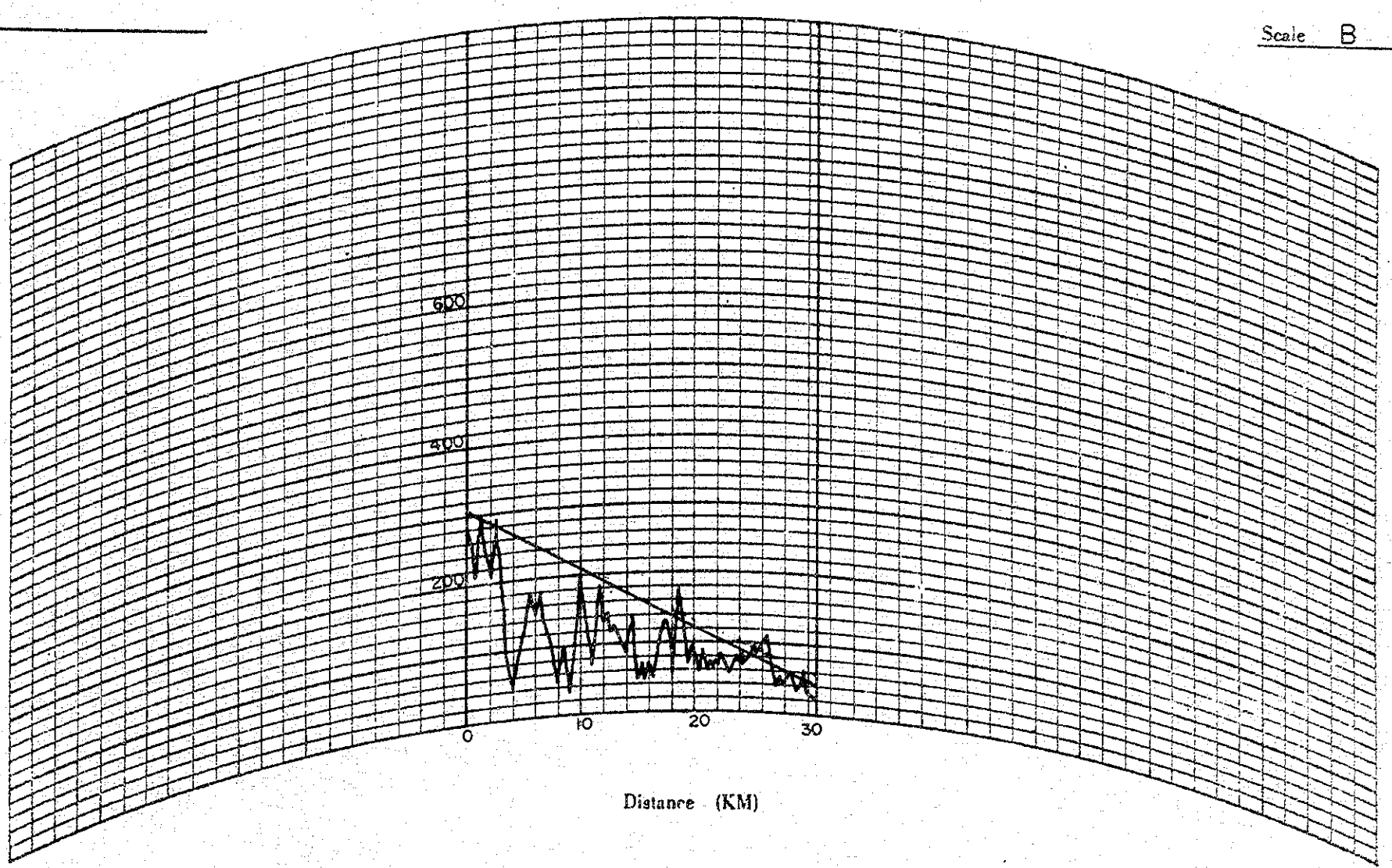
PROFILE (K=⅓)

Scale B

Full Scale
A= 4000m
Ⓑ= 1000m
C= 250m

G - 2

Height(m)



Height(m)

Full Scale
A= 240km
Ⓑ= 120km
C= 60km

Mt. Balat		Tangkulap
Altitude 275 m	31.1 KM	Altitude 25 m
Antenna Height 30 m		Antenna Height 10 m

DATE	DESIGN	TRACED	CHECKED	APPR

DRAW NO. M.PE

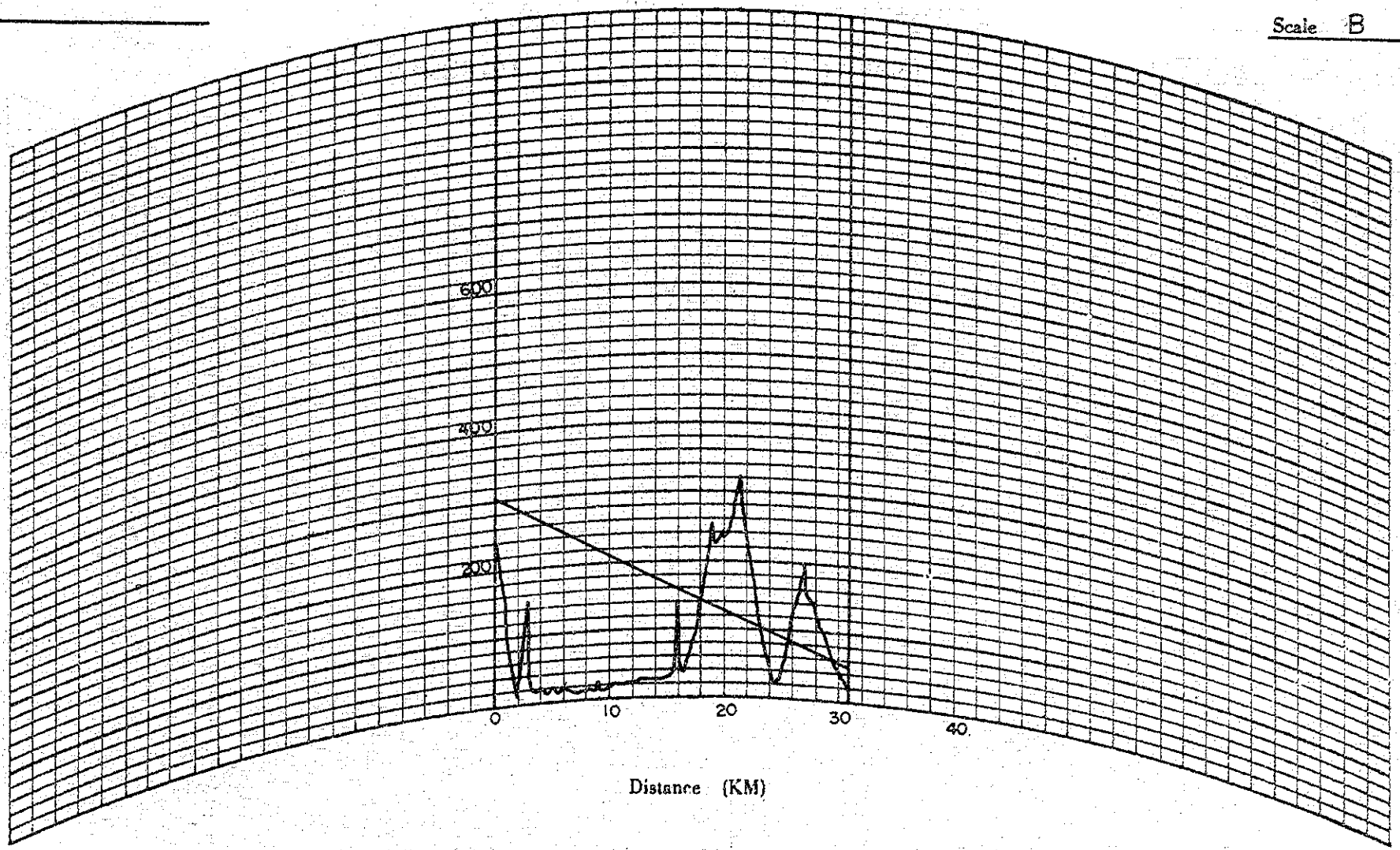
PROFILE (K=4/3)

Scale B

Full Scale
A= 4000m
B= 1000m
C= 250m

C-3

Height(m)



Height(m)

Full Scale
A=240km
B=120km
C= 60km

Mt. Baiat		Ula Kuamut
Altitude 275 m	31.3 KM	Altitude 25 m
Antenna Height 30 m		Antenna Height 30 m

DATE	DESIGN	TRACED	CHECKED	APPR

DRAW NO. M.PE

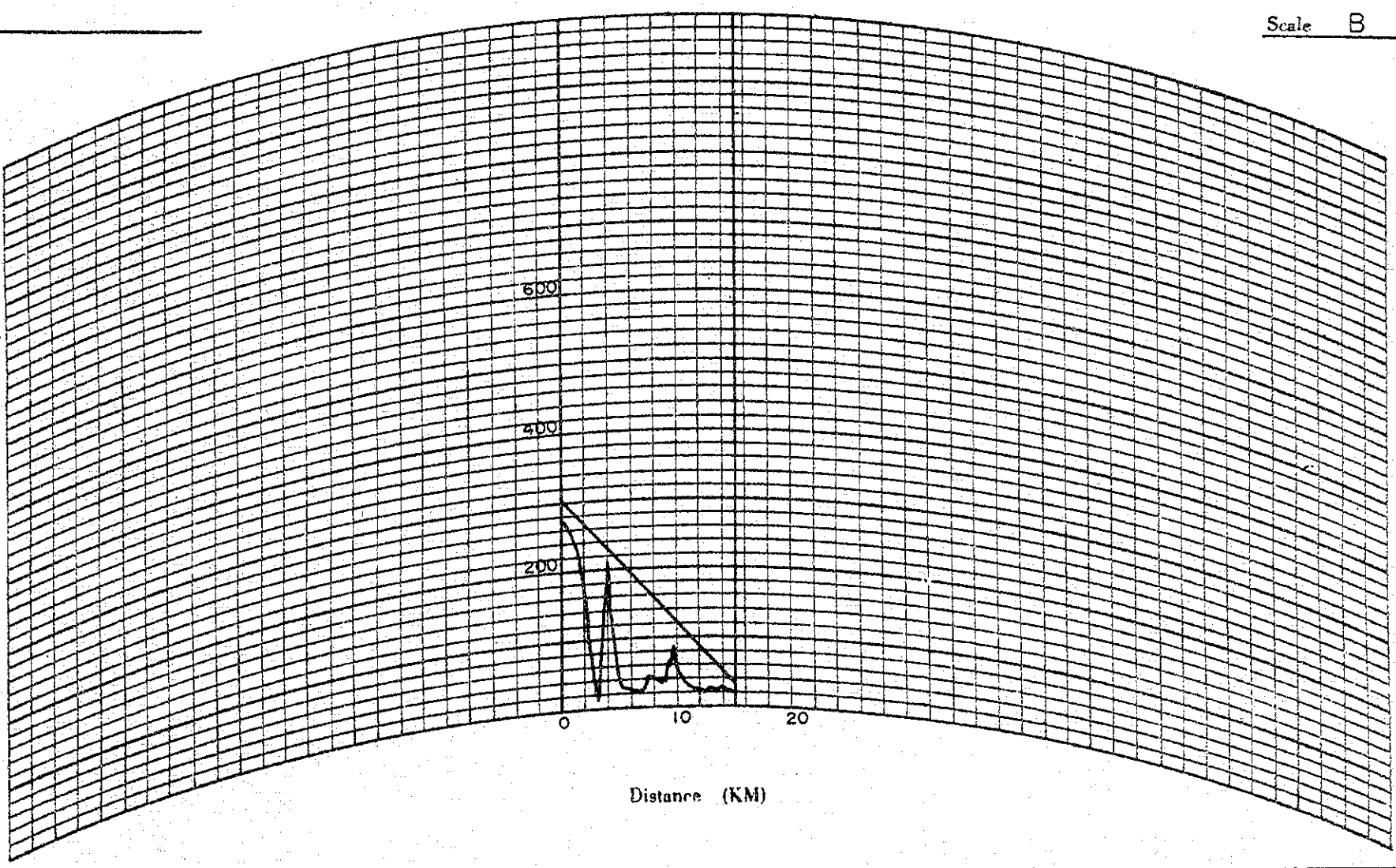
PROFILE (K=4/3)

Scale B

Full Scale
A= 4000m
B= 1000m
C= 250m

G - 4

Height(m)



Height(m)

Full Scale
A=240km
B=120km
C= 60km

Mt. Balat		Kuamut
Altitude 275 m	15.3 KM	Altitude 20 m
Antenna Height 30 m		Antenna Height 10 m

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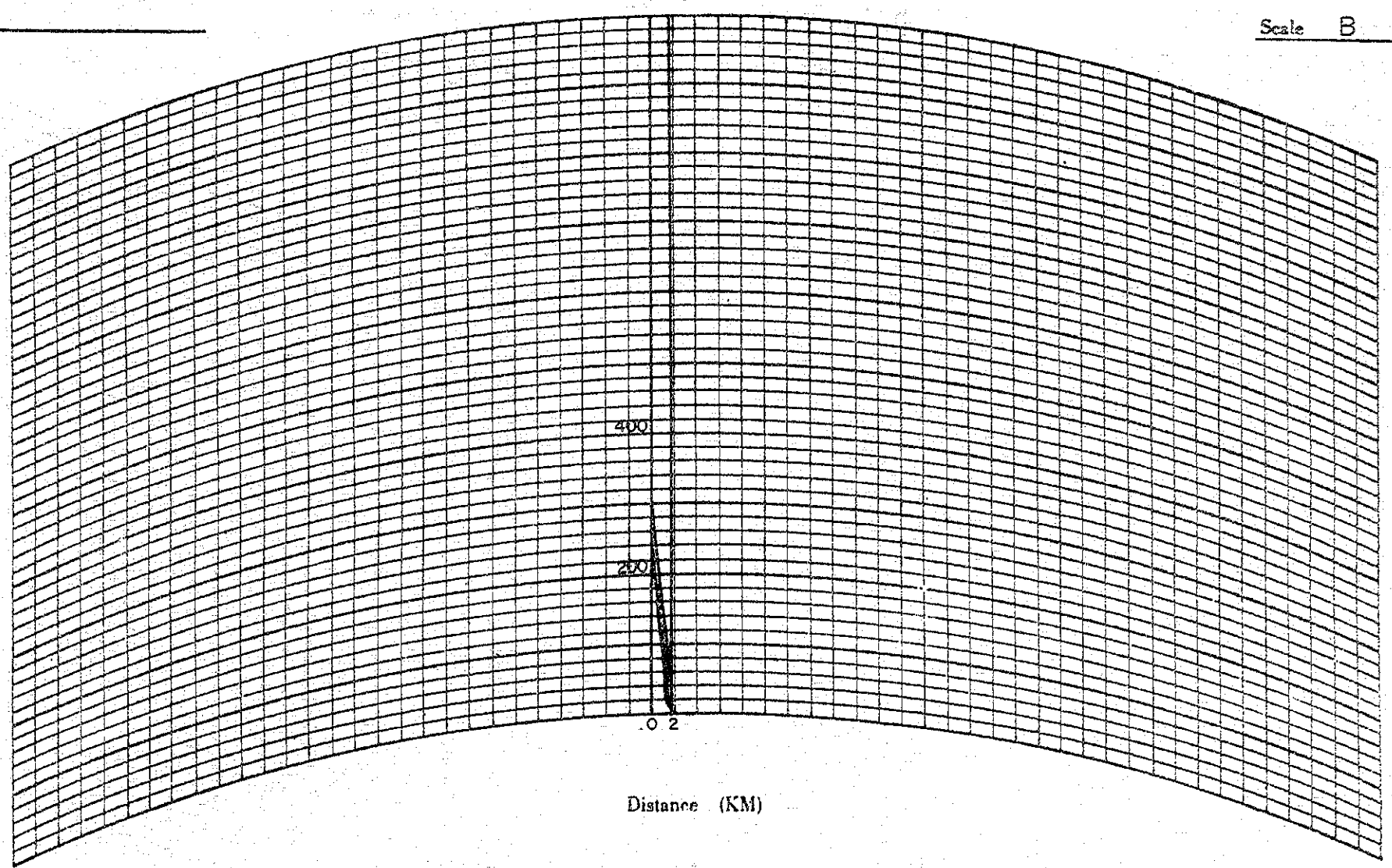
DRAW NO. M.PE				

PROFILE (K=⅓)

Scale B



Full Scale
A=240km
B=120km
C= 60km

Mt. Balat		Balat
Altitude 275 m	1.5 KM	Altitude 15 m
Antenna Height 30 m		Antenna Height 10 m

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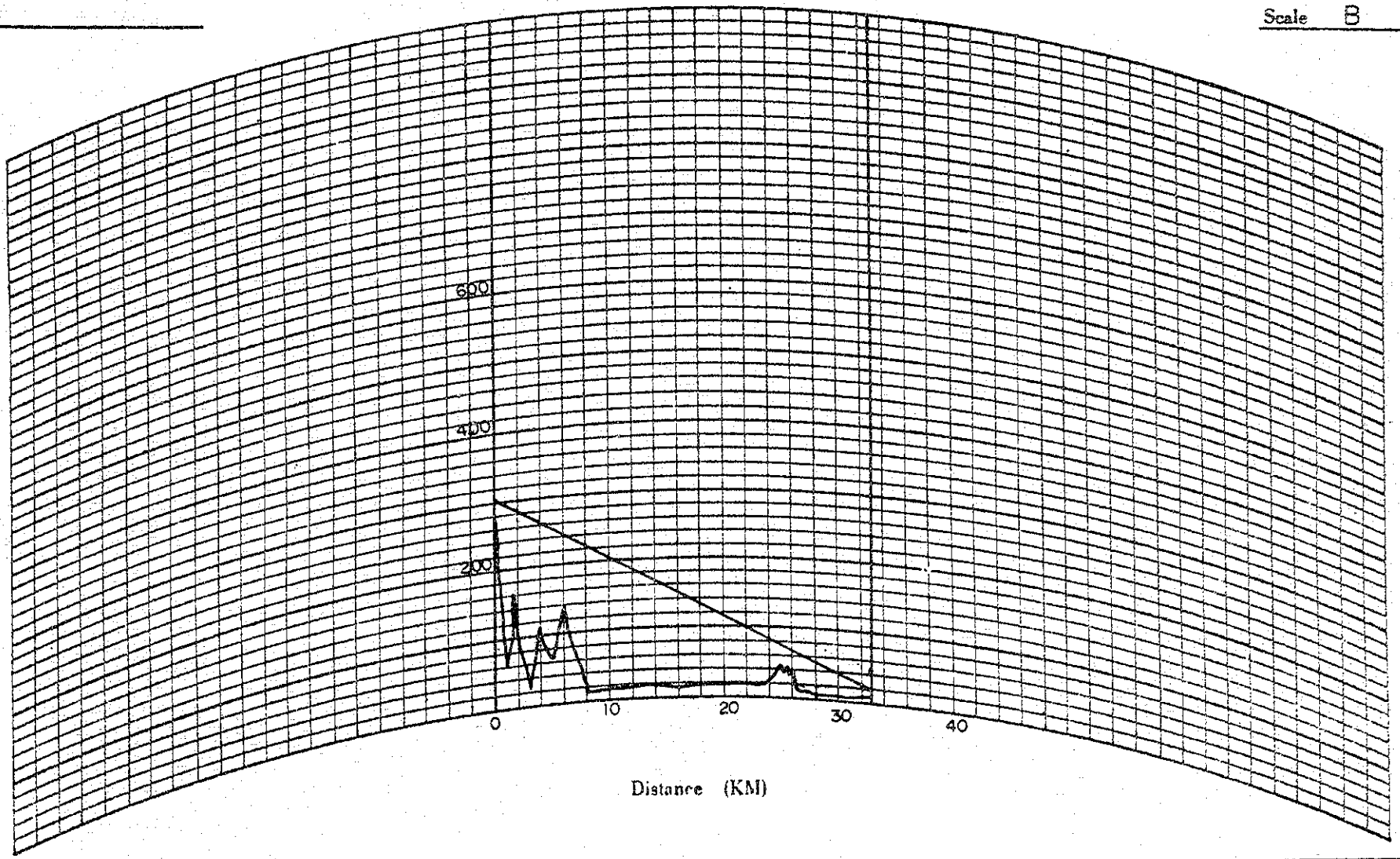
PROFILE (K=4/3)

Scale B

Full Scale
A=4000m
B=1000m
C= 250m

9 - 6

Height(m)



Height(m)

Full Scale
A=240km
B=120km
C= 60km

Mt. Balat		Bukit Garam
Altitude 275 m	32.9 KM	Altitude 8 m
Antenna Height 30 m		Antenna Height 10 m

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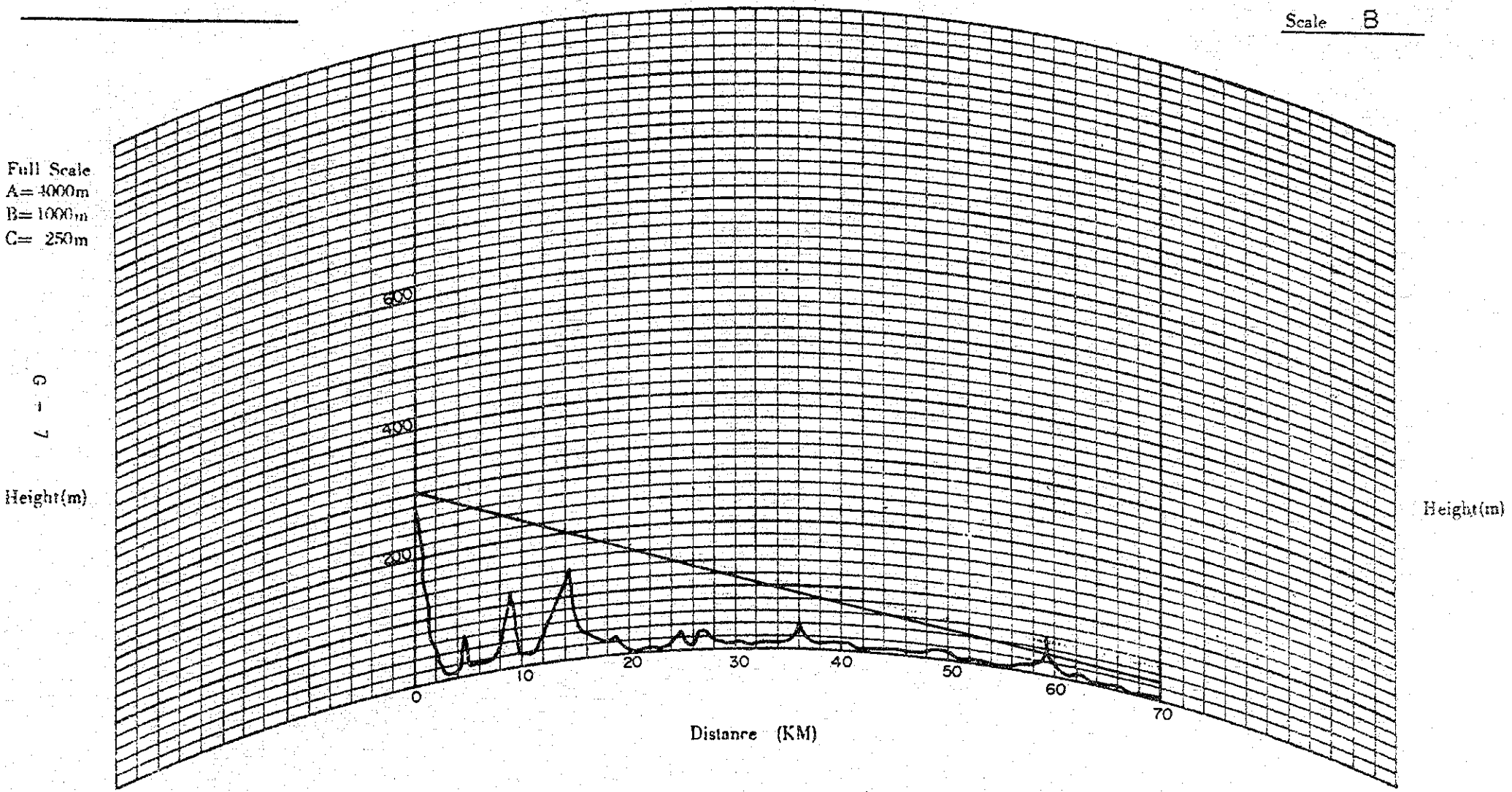
PROFILE (K=4/3)

Scale B



Full Scale
A= 240km
B= 120km
C= 60km

Mt. Balat		Bilit
Altitude 275 m	70.0 KM	Altitude 5 m
Antenna Height 30 m		Antenna Height 30 m

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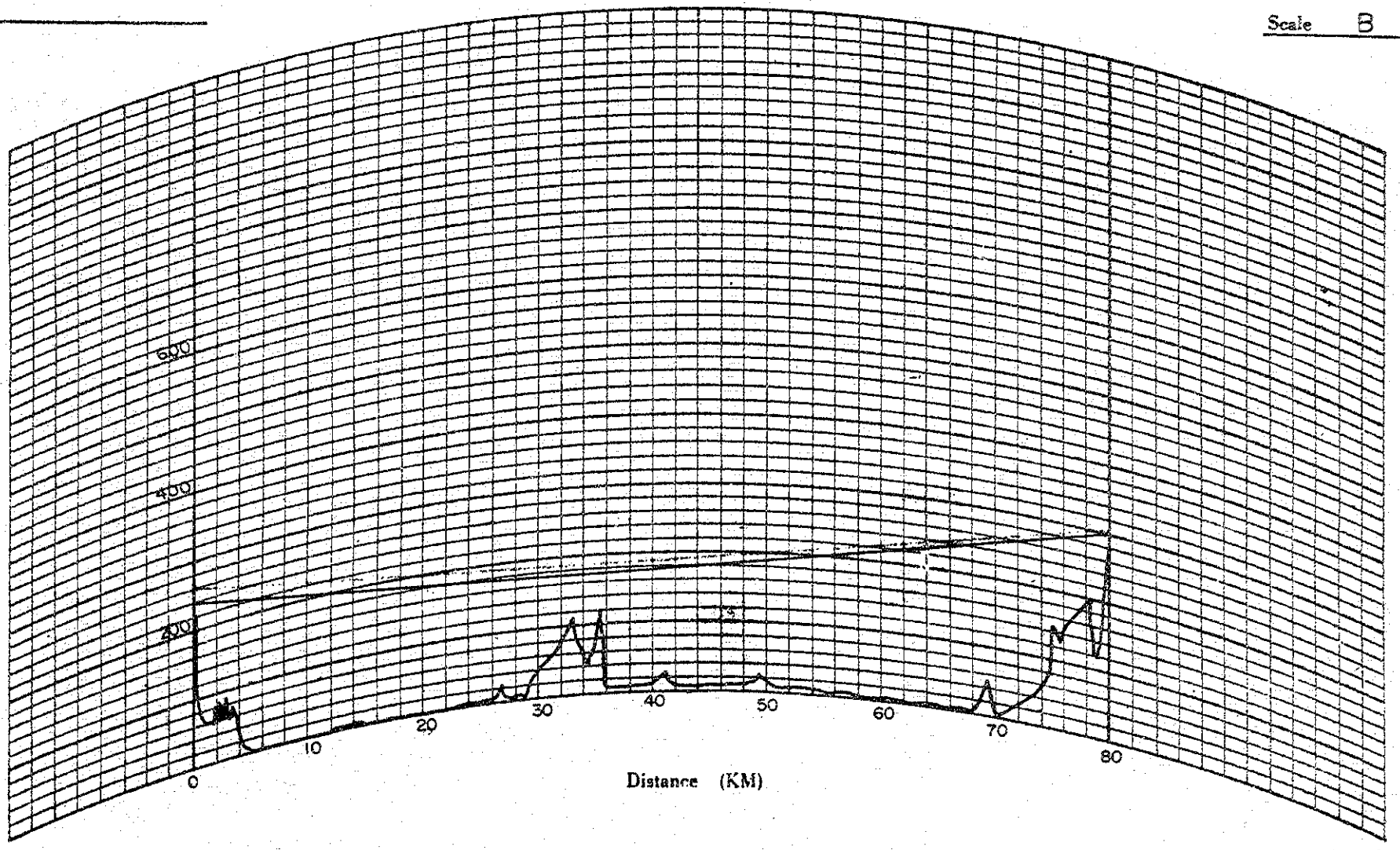
PROFILE (K=⅓)

Scale B

Full Scale
A=4000m
B=1000m
C= 250m

Height(m)



Full Scale
A=240km
B=120km
C= 60km

Trig Hill		Mt. Balat
Altitude 230 m	80.2 KM	Altitude 275 m
Antenna Height 10 m		Antenna Height 30 m

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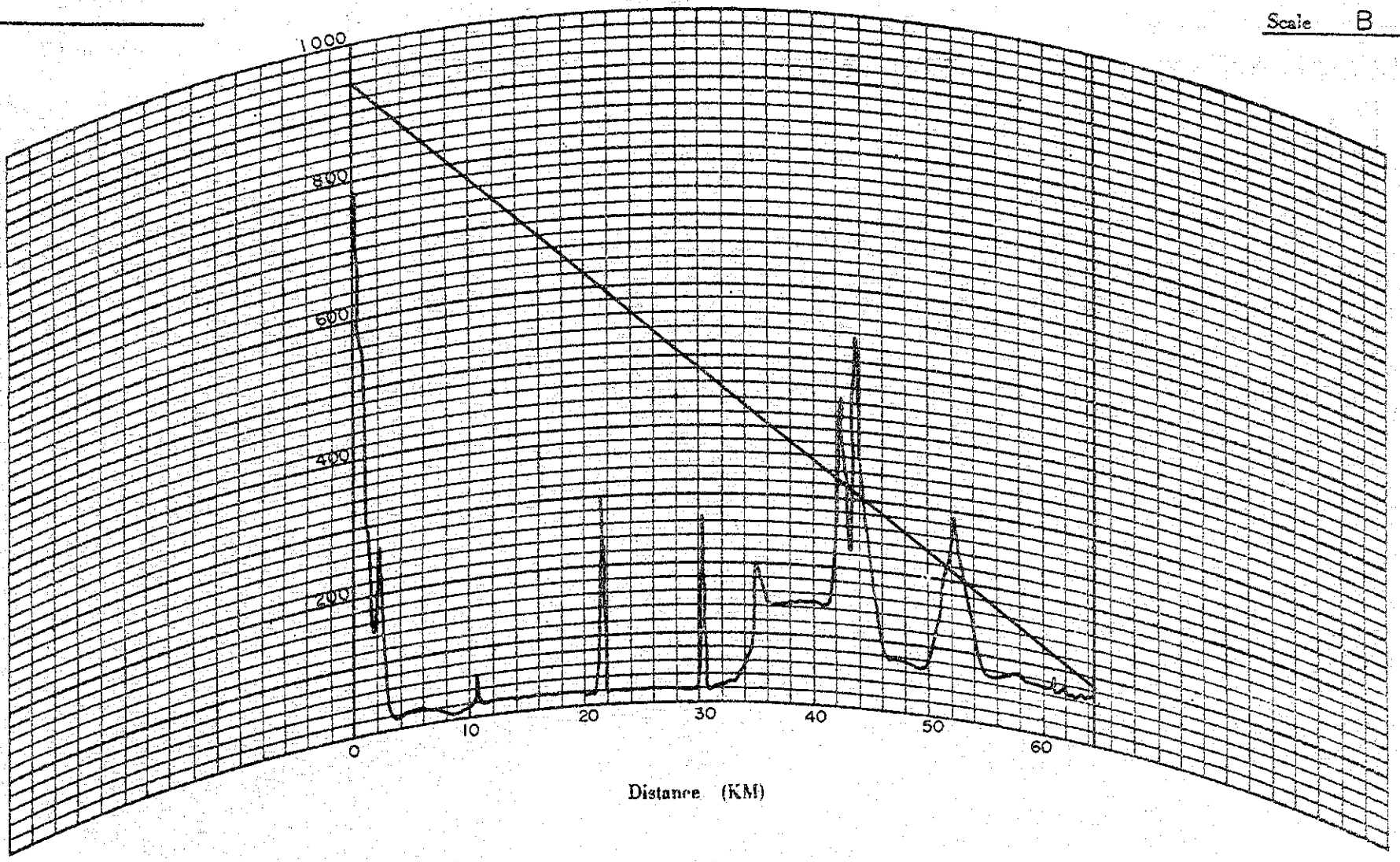
DRAW NO. M.PE				

PROFILE (K=⅔)

Scale B



Full Scale
A= 4000m
B= 1000m
C= 250m

G - 9

Full Scale
A= 240km
B= 120km
C= 60km

Mt. Serapi		Tebedu
Altitude 910 m	64.3 KM	Altitude 76 m
Antenna Height 30 m		Antenna Height 19 m

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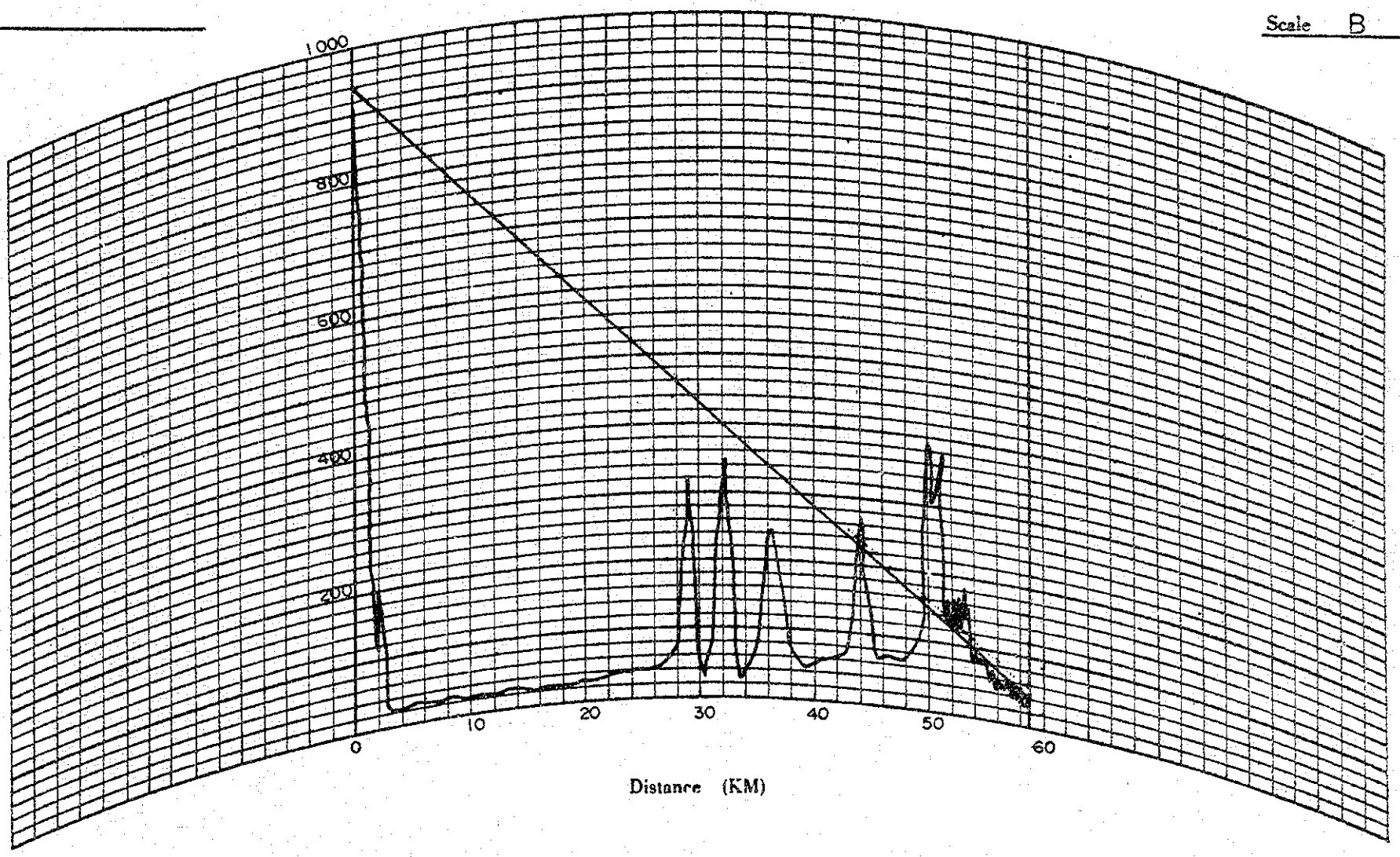
PROFILE (K=⅓)

Scale B



Full Scale
A= 1000m
B= 1000m
C= 250m

C - 10

Height(m)

Height(m)

Full Scale
A=240km
B=120km
C= 60km

Mt. Serapi		Kayan. River
Altitude 910 m	58.4 KM	Altitude 30 m
Antenna Height 30 m		Antenna Height 10 m

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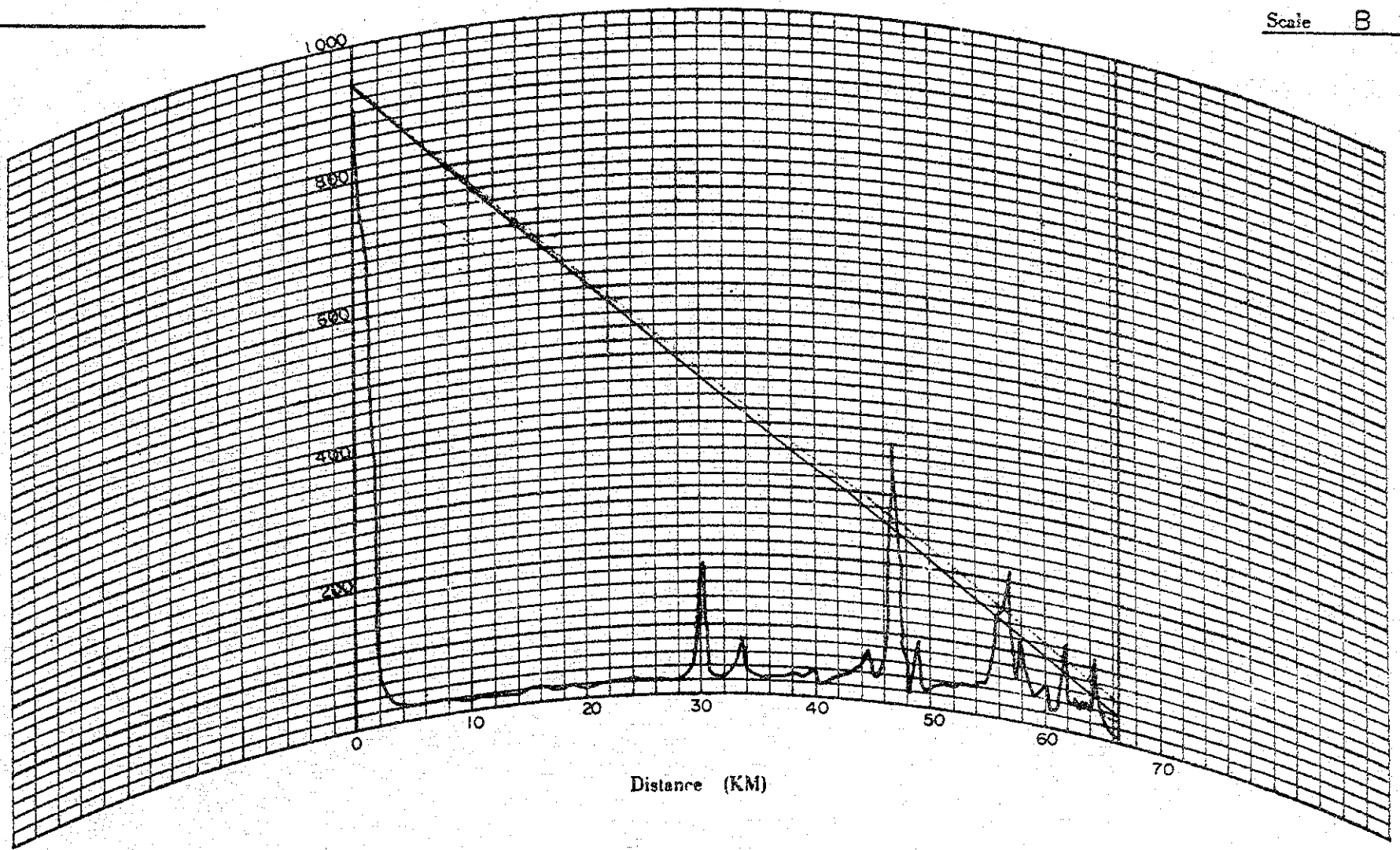
PROFILE (K=⅓)

Scale B



Full Scale
A=1000m
B=1000m
C= 250m

G - 11

Full Scale
A=240km
B=120km
C= 60km

Mt. Serapi

Altitude 910 m

Antenna Height 30 m

66.3 KM

Krusin

Altitude 10 m

Antenna Height 10 m

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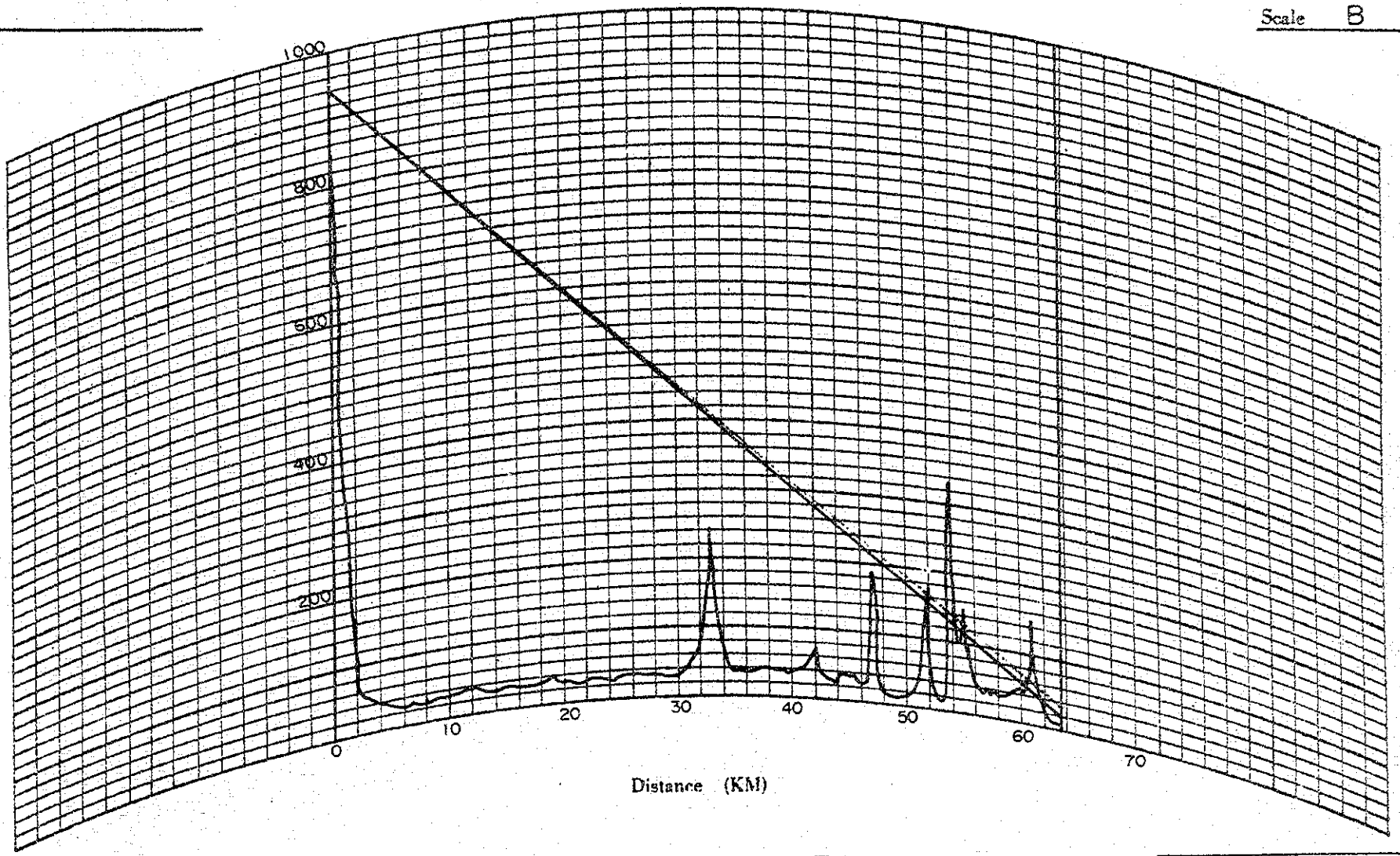
PROFILE (K=4/3)

Scale B



Full Scale
A= 4000m
B= 1000m
C= 250m

Height(m)

Height(m)

G - 12

Full Scale
A= 240km
B= 120km
C= 60km

Mt. Serapi		Tebakang
Altitude 910 m	63.7 KM	Altitude 10 m
Antenna Height 30 m		Antenna Height 10 m

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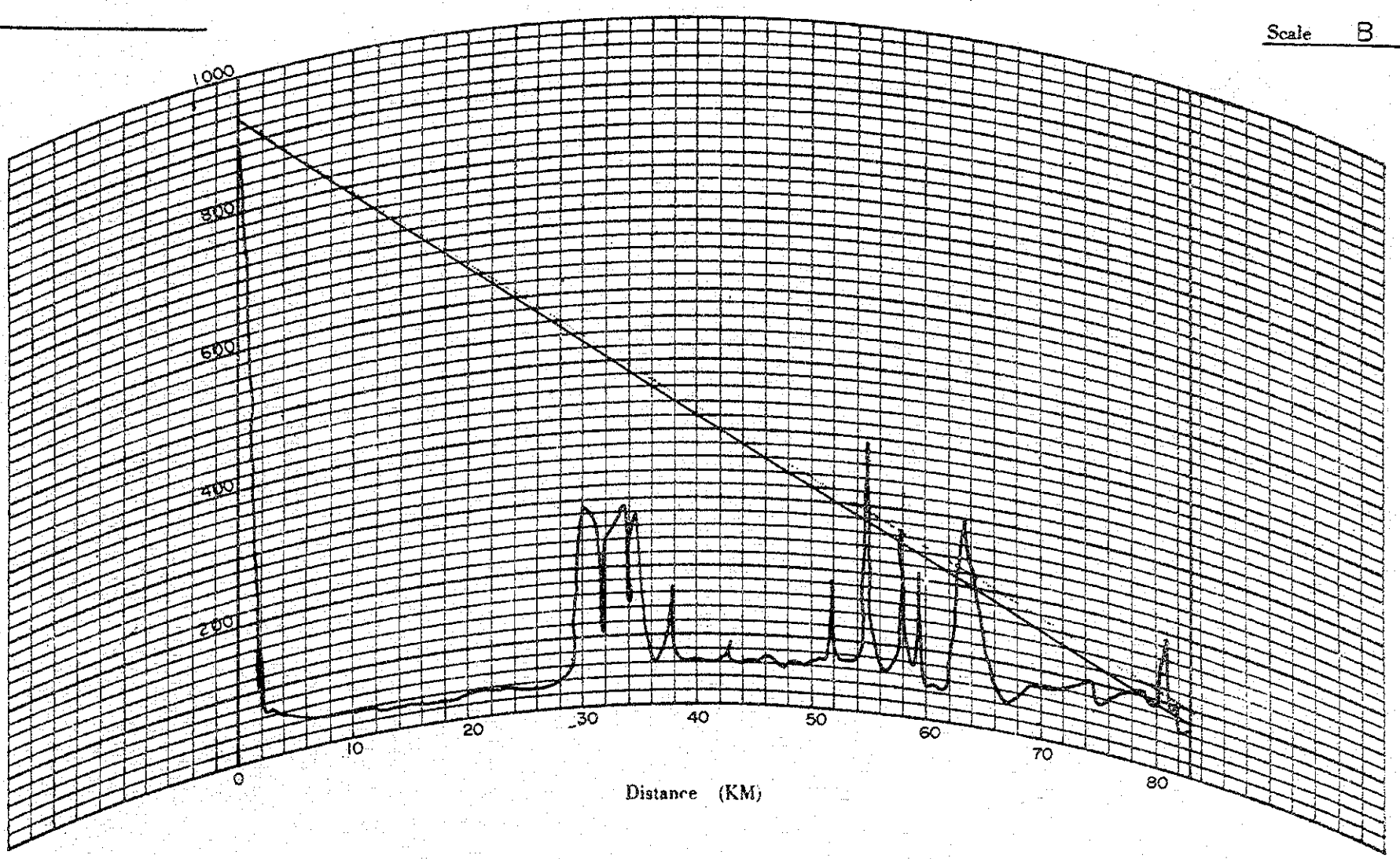
DRAW NO. M.PE				

PROFILE (K=⅓)

Scale B



Full Scale
A= 4000m
B= 1000m
C= 250m

Height(m)

G - 13

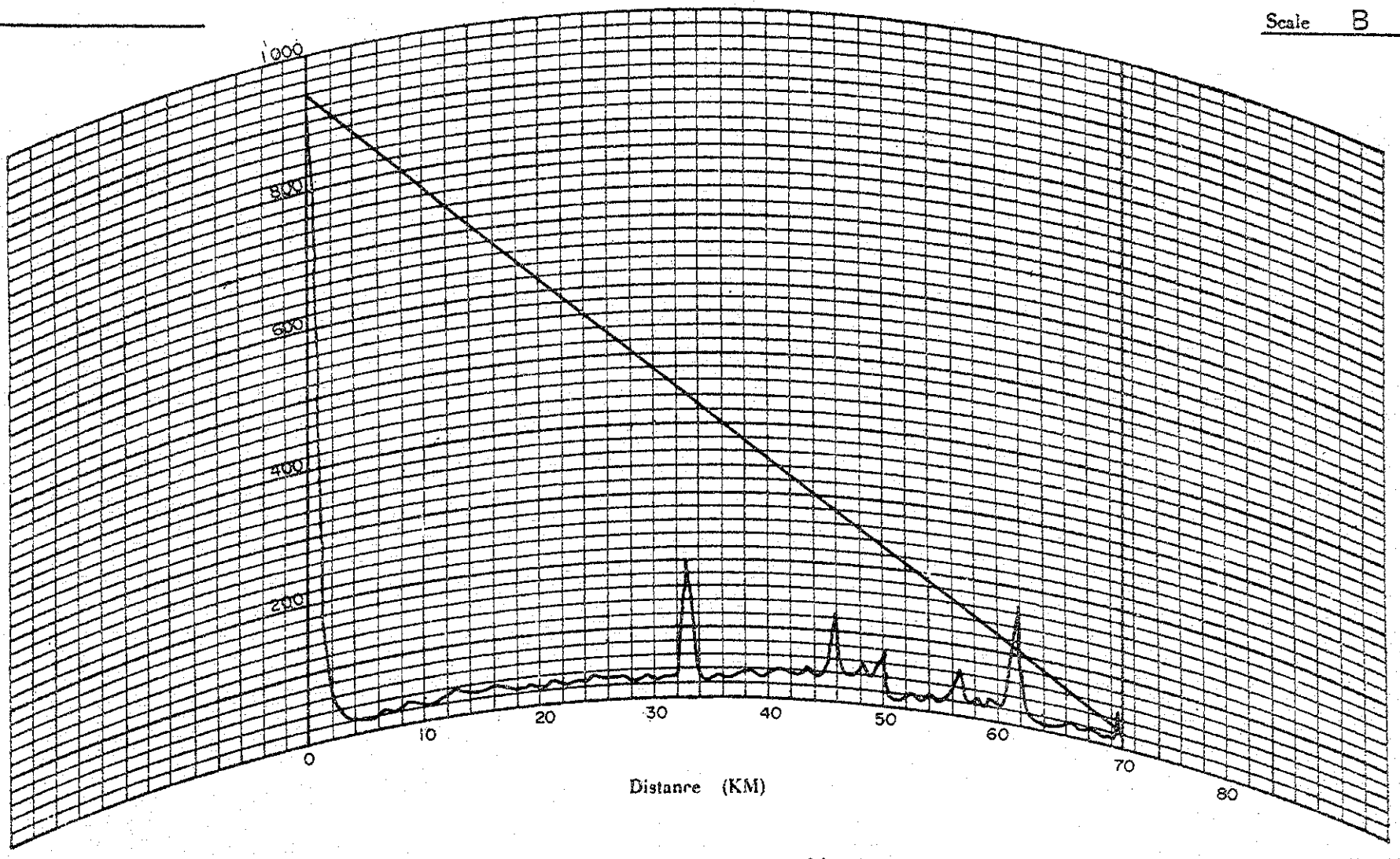
Full Scale
A=240km
B=120km
C= 60km

Mt. Serapi		Mongkos
Altitude 910 m	82.7 KM	Altitude 70 m
Antenna Height 30 m		Antenna Height 10 m

DATE	DESIGN	TRACED	CHECKED	APPR
DRAW NO. M.PE				

PROFILE (K=⅓)

Scale B



Full Scale
A= 4000m
B= 1000m
C= 250m

Height(m)

Height(m)

G - 14

Full Scale
A= 240km
B= 120km
C= 60km

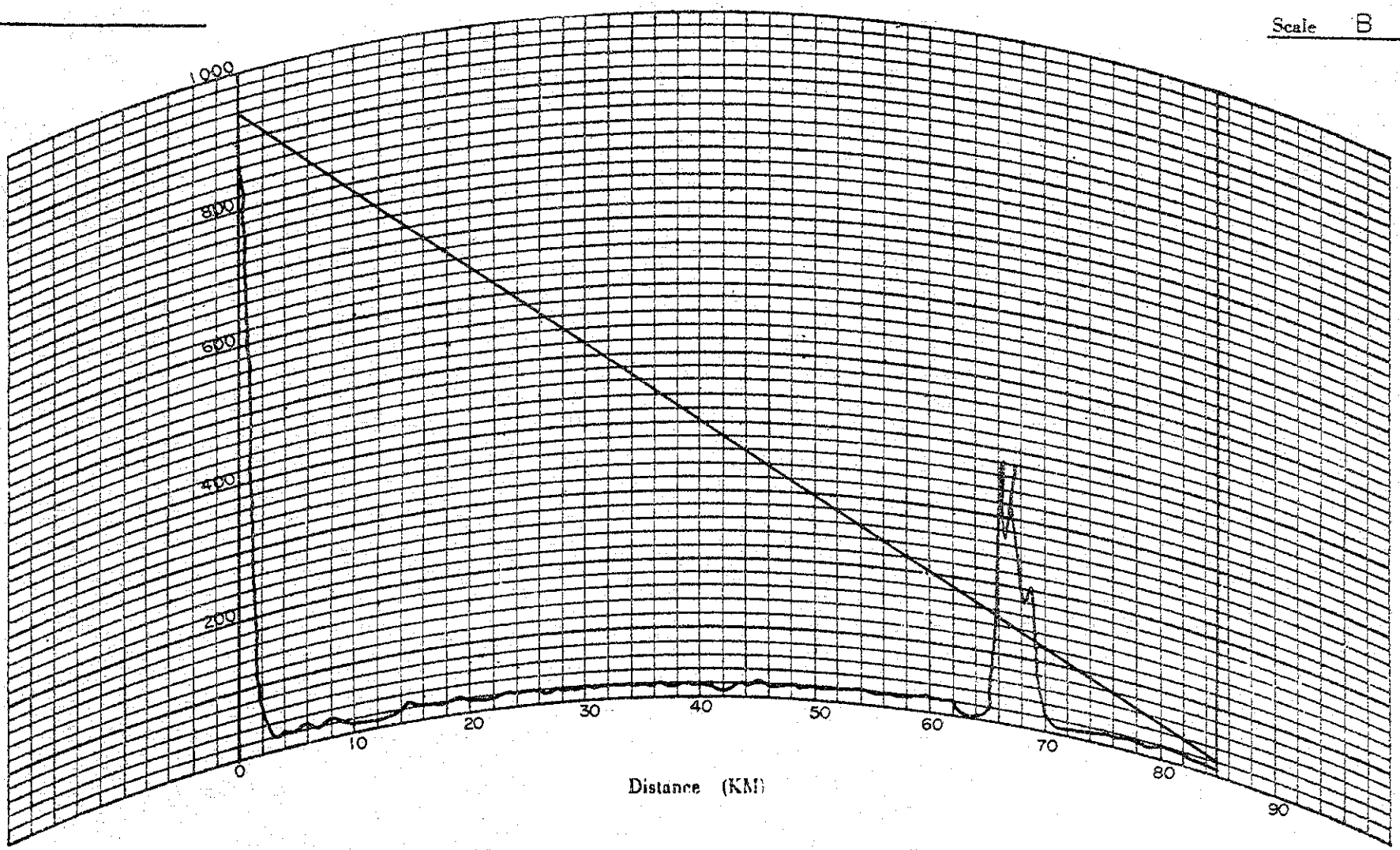
Mt. Sefapi		Meringgu
Altitude 910 m	71.0 KM	Altitude 15 m
Antenna Height 30 m		Antenna Height 10 m

DATE	DESIGN	TRACED	CHECKED	APPR

DRAW NO. M.PE

PROFILE (K=⅓)

Scale B



Full Scale
A=4000m
B=1000m
C= 250m

G - 15

Full Scale
A=240km
B=120km
C= 60km

Mt. Serapi		Balai Ringin
Altitude 910 m	85 KM	Altitude 10 m
Antenna Height 30 m		Antenna Height 10 m

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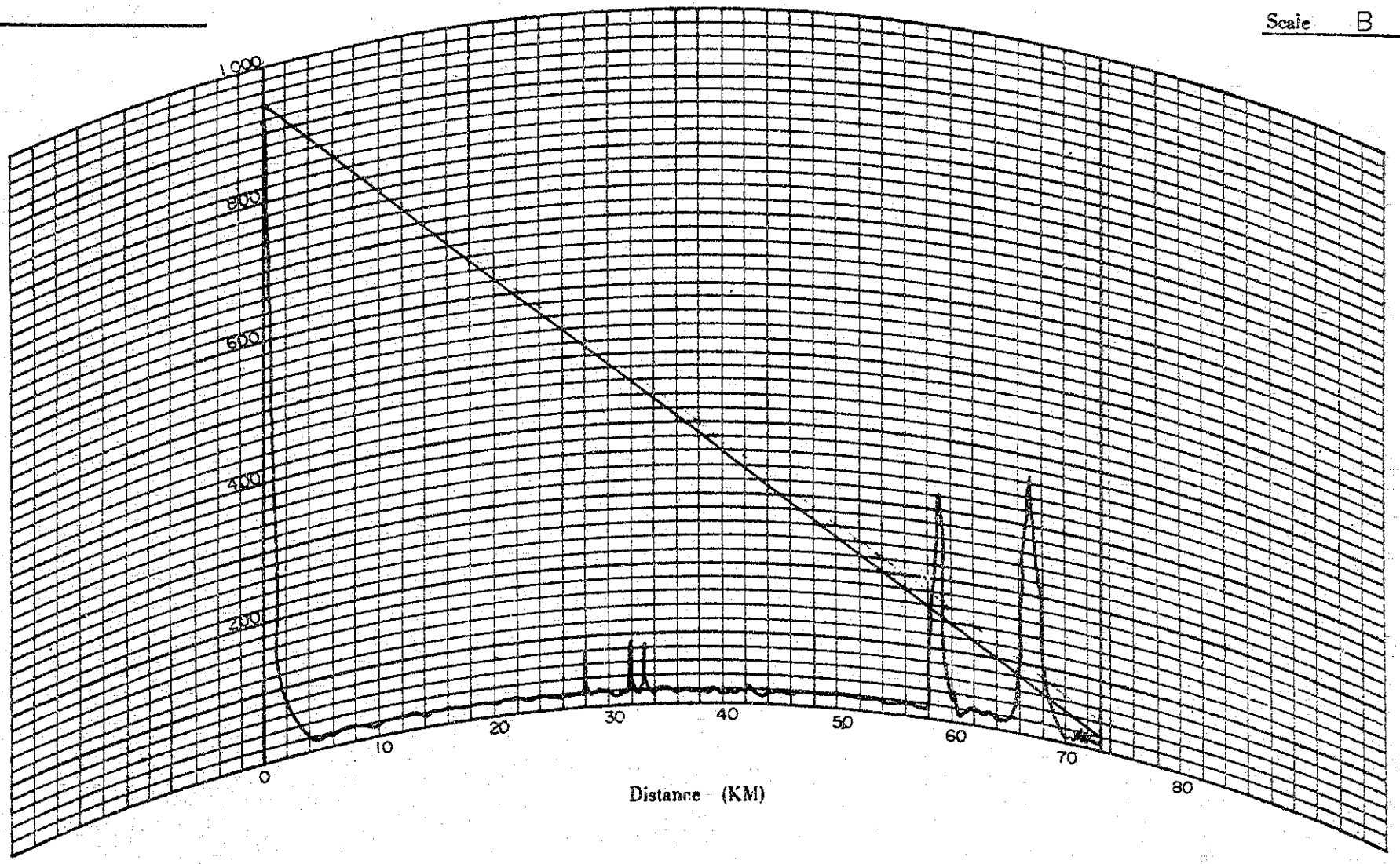
PROFILE (K=⅓)

Scale B



Full Scale
A=4000m
B=1000m
C= 250m

G - 16

Full Scale
A=240km
B=120km
C= 60km

Mt. Serapi		Bedup
Altitude 910 m	73.3 KM	Altitude 10 m
Antenna Height 30 m		Antenna Height 10 m

DATE	DESIGN	TRACED	CHECKED	APPR
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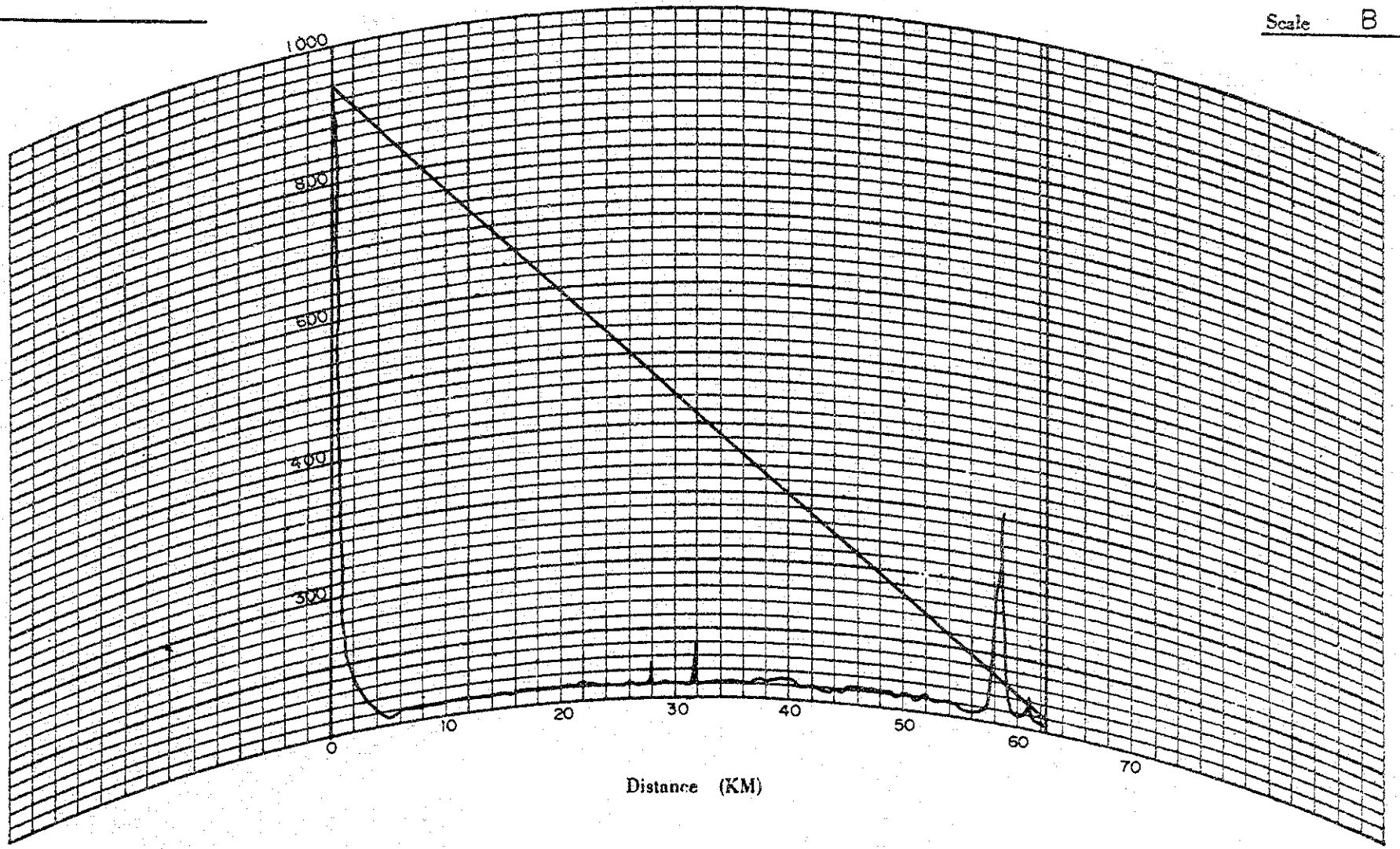
PROFILE (K=⅓)

Scale B



Full Scale
A= 4000m
B= 1000m
C= 250m

G - 17

Full Scale
A= 240km
B= 120km
C= 60km

Mt. Serapi		Serian
Altitude 910 m	62.8 KM	Altitude 10 m
Antenna Height 30 m		Antenna Height 10 m

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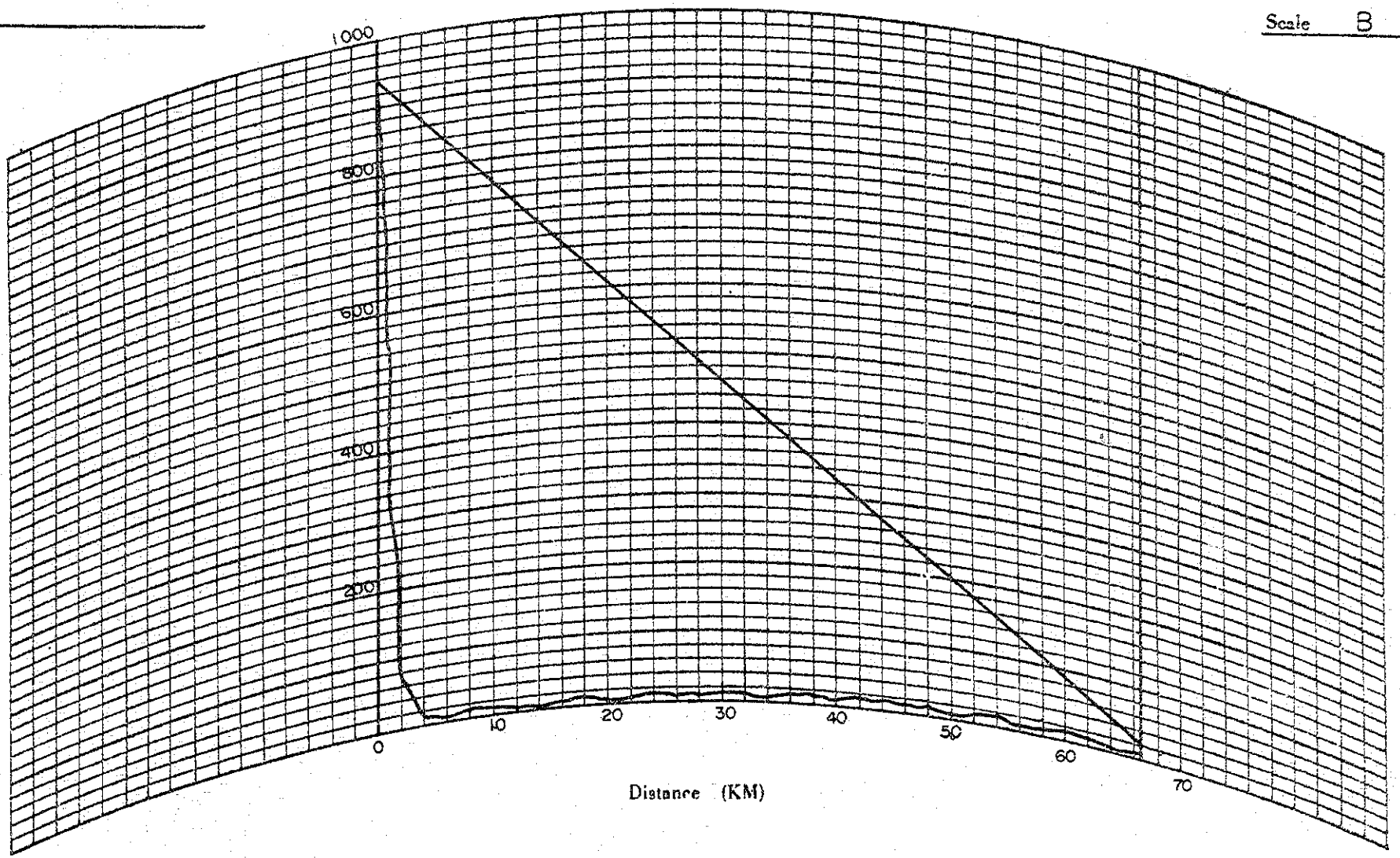
PROFILE (K=⅓)

Scale B



Full Scale
A=4000m
B=1000m
C= 250m

G - 18

Height(m)

Height(m)

Full Scale
A=240km
B=120km
C= 60km

Mt. Serapi		Gedong
Altitude 910 m	66.5 KM	Altitude 10 m
Antenna Height 30 m		Antenna Height 10 m

DATE	DESIGN	TRACED	CHECKED	APPR

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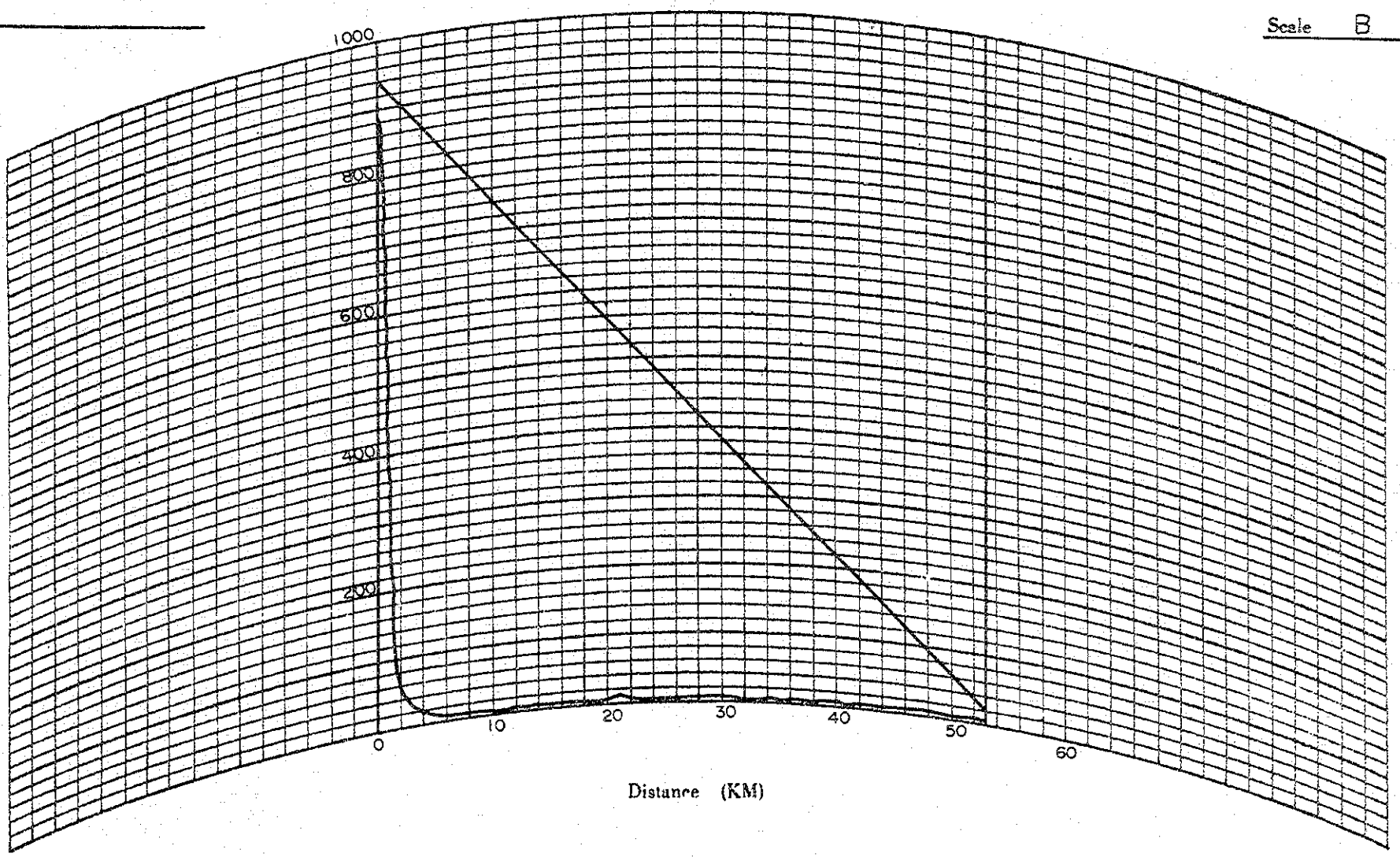
PROFILE (K=4/3)

Scale B



Full Scale
A=4000m
B=1000m
C= 250m

Full Scale
A=240km
B=120km
C= 60km

Mt. Serapi		Ensengei
Altitude 910 m	53.1 KM	Altitude 5 m
Antenna Height 30 m		Antenna Height 10 m

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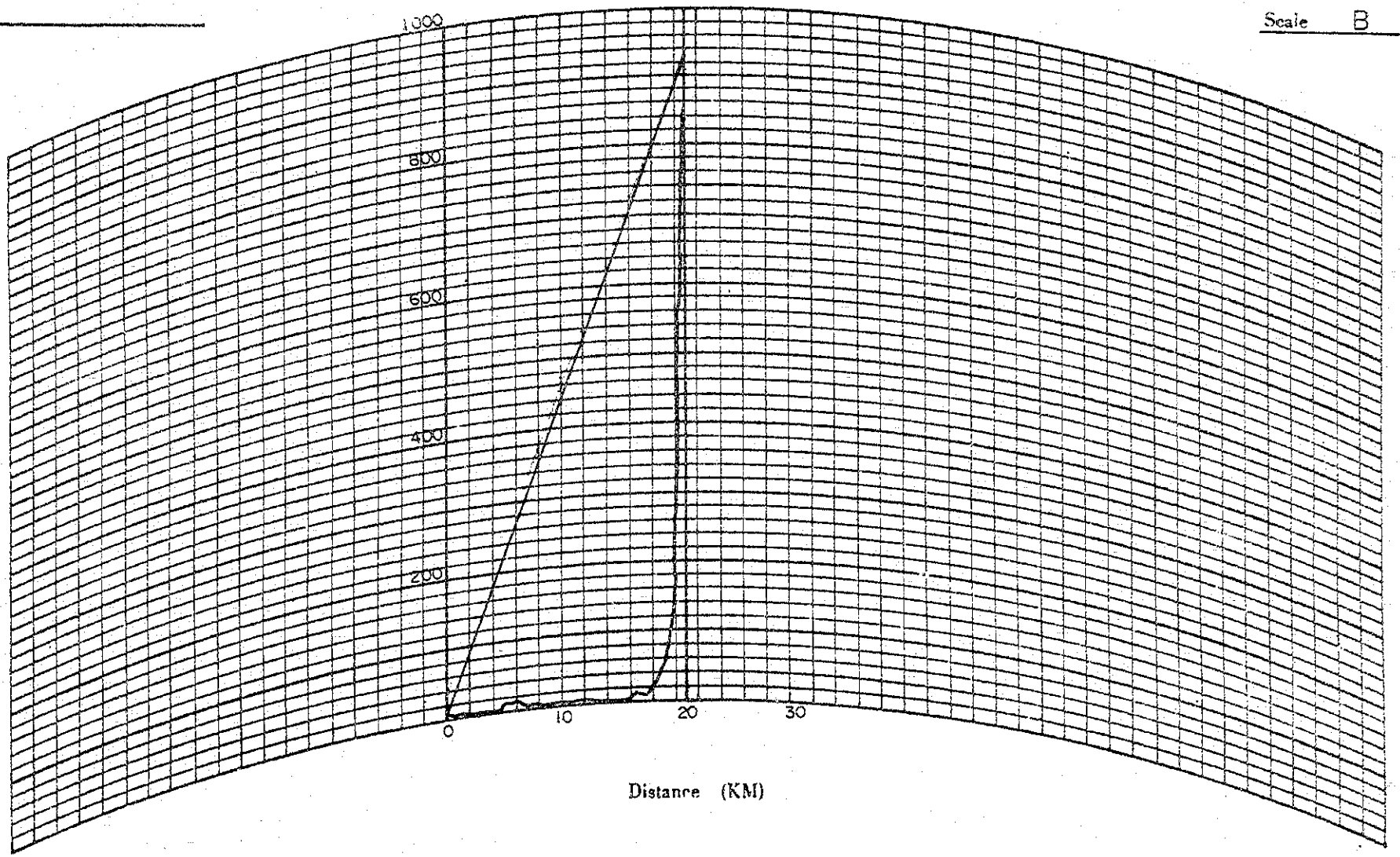
PROFILE (K=4/3)

Scale B



Full Scale
A= 4000m
B= 1000m
C= 250m

G - 20

Height(m)

Full Scale
A=240km
B=120km
C= 60km

DID Bintawa		Mt. Serapi
Altitude 55 m	21.5 KM	Altitude 910 m
Antenna Height 10 m		Antenna Height 30 m

DATE	DESIGN	TRACED	CHECKED	APPR

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