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PRAI BARRAGE GATE OPERATION STUDY

INTERIM REPORT

(18th. JANUARY, 1988 -- 31th. MARCH, 1988)

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PRAI BARRAGE GATE OPERATION STUDY

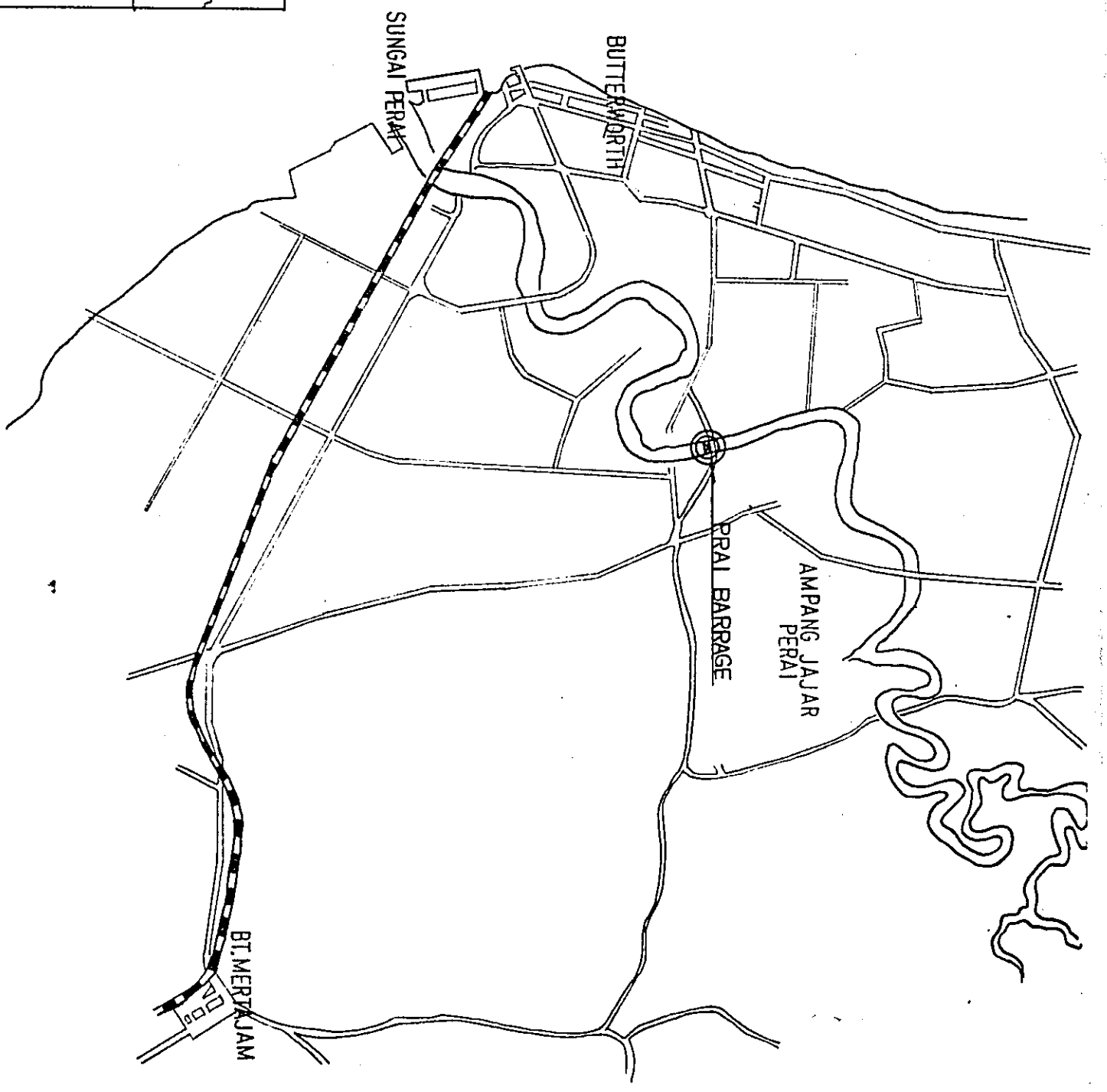
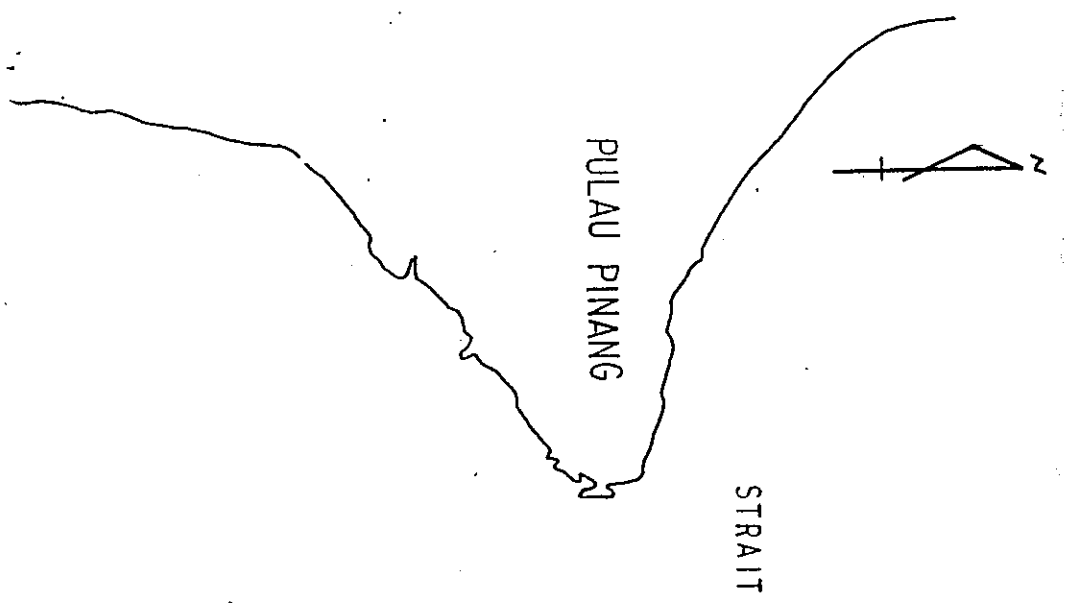
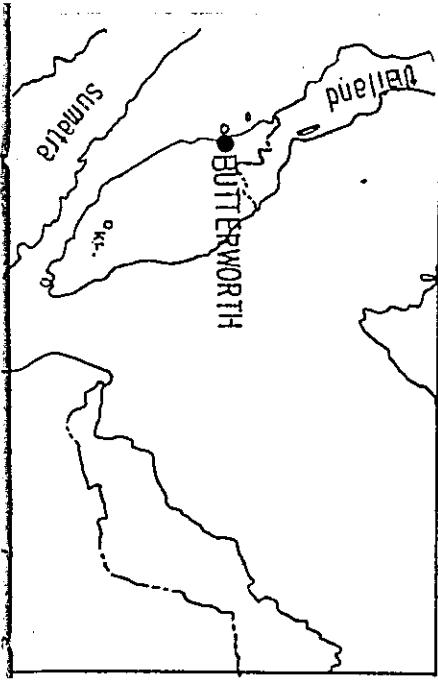
(18 JAN. - 31 MAR. 1988 IN MALAYSIA)

4
TAKASHI KATO

KOICHI MOGI

YUICHI YAMADA

YUJI CHIBA



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1. MINUTE

I Introduction

The objective of the Study are :

1. To analyze the unsteady flow hydraulic of the Sg. Prai within its tidal reaches using mathematical modelling approach.
2. To formulate gate operation procedures for the Prai Barrage so as to minimise flooding both upstream and downstream, while maintaining a controlled water level upstream, taking into consideration drainage and irrigation requirements of affected agricultural land.
3. To propose other countermeasures as are necessary, to mitigate flooding of low lying areas.

The main objective of this research is to collect data for the the mathematical simulation model and Gate Operation.

All the data collected by the Study Team will be used and bring back to Japan for analysis using the larger computer. Additional data will be collected by installing six nos. of automatic water level recorders along the Prai river and one no. of rainfall recorder at the Prai Barrage. This data will be collected later and sent to Japan for analysis for further checking and running the mathematical simulation model.

For the Gate operation, a manual will be made based on the result from the study of the mathematical simulation model. But from the site investigation of the Gates at the Prai Barrage, they are badly damaged and corroded. Therefore we collected the data and include the Gate maintenance in our Study.

II Collected Data

We had the collected data in the Data List.

1. Hydrological Data.)
-)
2. Surveying Data.)
-) Detailed data are in the Data List.
3. Data about the Gates.)
-)
4. Other necessary data.)

III Results of the Research

i) About Mathematical Simulation Model

We will use mathematical simulation model of Dr. Hidehiko Shiraishi (National Research Institute of Agricultural Engineering, Japan) and the model will be analysed by input the hydrological and surveying data.

1. Hydrological Data.

a) Tide table and rainfall.

b) Rainfall data.

$$T = 1/10 \quad R = 152.4 \text{ mm} \quad q = 1.359 \text{ m}^3/\text{sec}/\text{km}^2$$

$$T = 1/40 \quad R = 179.4 \text{ mm} \quad q = 1.604 \text{ m}^3/\text{sec}/\text{km}^2$$

About water level data, we use the water level station at Ara Kuda as that is the only one in Sg. Prai River Basin. This water level station is flood above 28 feet and we analyse only the ordinary discharge.

2. Surveying data

Longitudinal section levelling and cross section levelling at Sg. Prai.

1. Downstream of Barrage (survey at this time)
2. Upstream of Barrage (survey at 1986 and 1987)

the results are shown in Fig. 1-2. We used the simple program of the mini computer to run the aforesaid's data. After that we will extend our investigation of the mathematical simulation model by using the larger model of the computer in Japan.

We describe the outline of the results of the mathematical simulation model run by the mini-computer :-

A) At Spring Tide

1) At discharge of 10 years probable rainfall flows, flooding will occurred for areas around the Barrage and Sg. Samagahah. The result is due to the large discharge from Sg. Prai River basin with the opening of the Gate at the Barrage. We cannot solve the problem by Gate operation.

2) At ordinary discharge flows, flood occurred around the Prai Barrage but not for areas around Sg. Samagahah. If gate operation do in the wrong way, at spring tide, flood may occur by small discharge without heavy rainfall. This is the same condition as in May 1984.

B) Neap Tide

1) For discharge of 10 years probable rainfall flows, flood occurred around Sg. Samagahah. This result is due to the small capacity of the flow of the river and water level is about 2.0 m in Penang and continues high water level.

2) At ordinary discharge, both areas are not flooded.

iii). The present condition of prai barrage

(1) The history of PRAI BARRAGE

The history of PRAI BARRAGE is as Table-

This table is from 1979 to 1988.

(2) The present condition

The gate leaf is badly damage.

Some other facilities had damaged too.

Investigation was done mainly on 2 points.

Main points are as follow;

- 1 Gate leaf
- 2 Other facilities

General investigation done is as Table-

(3) The comparison to another gates

The study team visited another 2 gates for the understanding of Malaysians gates.

The comparison of gates is Table-

(4) The course of investigation

1 This time data collection's object is to recommend the method of rust protection.

It seems causes of rust are as follow;

- * Barnacles
- * Insufficient sand blasting
- * Salinity
- * Electrolytic corrosion
- * Polluted water (acid)

At first you should investigate which is the most important factor.

2 There are some shortage on the facility of FRAI BARRAGE.

For example ;

*There isn't the gate position indicator in the control office.

*There isn't the water level sensor and water flow sensor.

*Supply equipment to rolling part.

IV Continuation of Observation of Data

During rainy season, heavy rain continues and water level and tide are high. This is shown in Fig. 1-3 and Fig. 1-4

We want to continue of observation of data as these data are very important for further mathematical simulation model analysis.

V Conclusion

In this study, we do the best to collect data for the mathematical simulation model and gate operation. When we analyse the mathematical simulation model, we may have new problems such as the embankment, new gate for open channel, maintenance for the new gate etc. We will discuss all these problems after the analysis of the results from the larger computer in Japan.

It is a pleasure to acknowledge the hospitality and assistance of the members of the IADP DID and State DID. We are pleased to acknowledge the considerable assistance of our counterpart Ir. M. H. Chu.

DATA LIST

I) HYDROLOGICAL DATA

1. Tide Table

- 1984 Penang
- 1986 Penang
- 1987 Penang
- 1988 Penang

2. Water Level

i) Water level of Sg. Perai

Station No. 1A, 4, 5, 8 and 11.

11/3/1987 -- 20/3/87

ii) Water level of Sg. Perai

Station : Sg. Samagagah

6/4/87 -- 8/6/87

iii) Water level of Sg. Perai

Station : Titi Timbul

17/4/87 -- 8/6/87

iv) Water level of Sg. Perai

Station : Perai Barrage

10/7/88 -- 14/7/88

v) Water level of Sg. Perai (Study Team)

Station : 1A, 3, 3A

5/2/88 -- 6/2/88

vi) Water level of Sg. Perai (Study Team)

Station : 1A, 3, 3A, 11.

18/3/88 -- 19/3/88

vii) Water level of Sg. Kulim

Station : Ara Kuda

1978 -- 1987 (Daily)

1978 -- 1987 (Hourly)

3. Rainfall

<u>Station No.</u>	<u>Name</u>	<u>Monthly & Max. Records</u>	<u>Daily JFT Records</u>
5504035	Lahar Ikan Mati	1959 - 1980	1978 - 1987
	Parit Logan		1981 - 1987
5404041	Malakoff Estate (Ladang Malakoff)	1959 - 1980	1981 - 1987
	Sg. Dua	--	1981 - 1987
5404043	Sg. Kulim Headworks	1959 - 1980	1981 - 1987
5406083	Bukit Mertajam Estate	1959 - 1980	--
5304045	Bukit Berapit Reservoir	1959 - 1980	1981 - 1987
	(Hydrological Data Rainfall)		(Daily)
	(Records - Bahagian Parit dan)		
	(Taliair Kementerian Pertanian)		
	(Malaysia)		

4. Map

i) Place of Rainfall station & water level station.

ii) Rancangan Pengairan Sg. Kulim - Kawasan K2.

5. River Gauging Records for Sg. Kulim at Ara Kuda

20/4/87 -- 14/12/87 N = 35 Times

11/1/88 -- 22/2/88 N = 3 Times

6. Meteorological Data

At Penang 1/5/84 -- 31/5/84

II) SURVEYING DATA

1. SUNGAI PRAI CROSS SECTION AREA

2. Others data of survey

Site survey figures

III) GATE OPERATION S DATA

1. BOOK OF DATA

NO.	TITLE	NAME	REMARKS
1.	SUNGAI PRAI DRAINAGE AND RECLAMATION PROJECT VOLUME 2 (TENDER DOCUMENTS FOR SUBCONTRACT DOUBLE STAGE ROLLER GATE)		SEPTEMBER. 1968
2.	RANCANGAN MENAMBAK DAN MEMARIT SUNGAI PERAI (Sungai perai drainage and reclamation project) Instruction to Tenders		1978
3.	INSTRUCTION MANUAL OF OPERATION AND MAINTENANCE		Kontrek JFT. PP. 10A/78 KUMPULAN TEKNIK SDN. BHD.
4.	BRIEF OPERATION INSTRUCTION		KUMPULAN TEKNIK SDN. BHD.
5.	RANCANGAN MENAMBAK DAN MEMARIT SUNGAI PERAI (DOUBLE STAGE ROLLER GATES DESIGN OF HOIST AND ACCESSORIES)		JFT

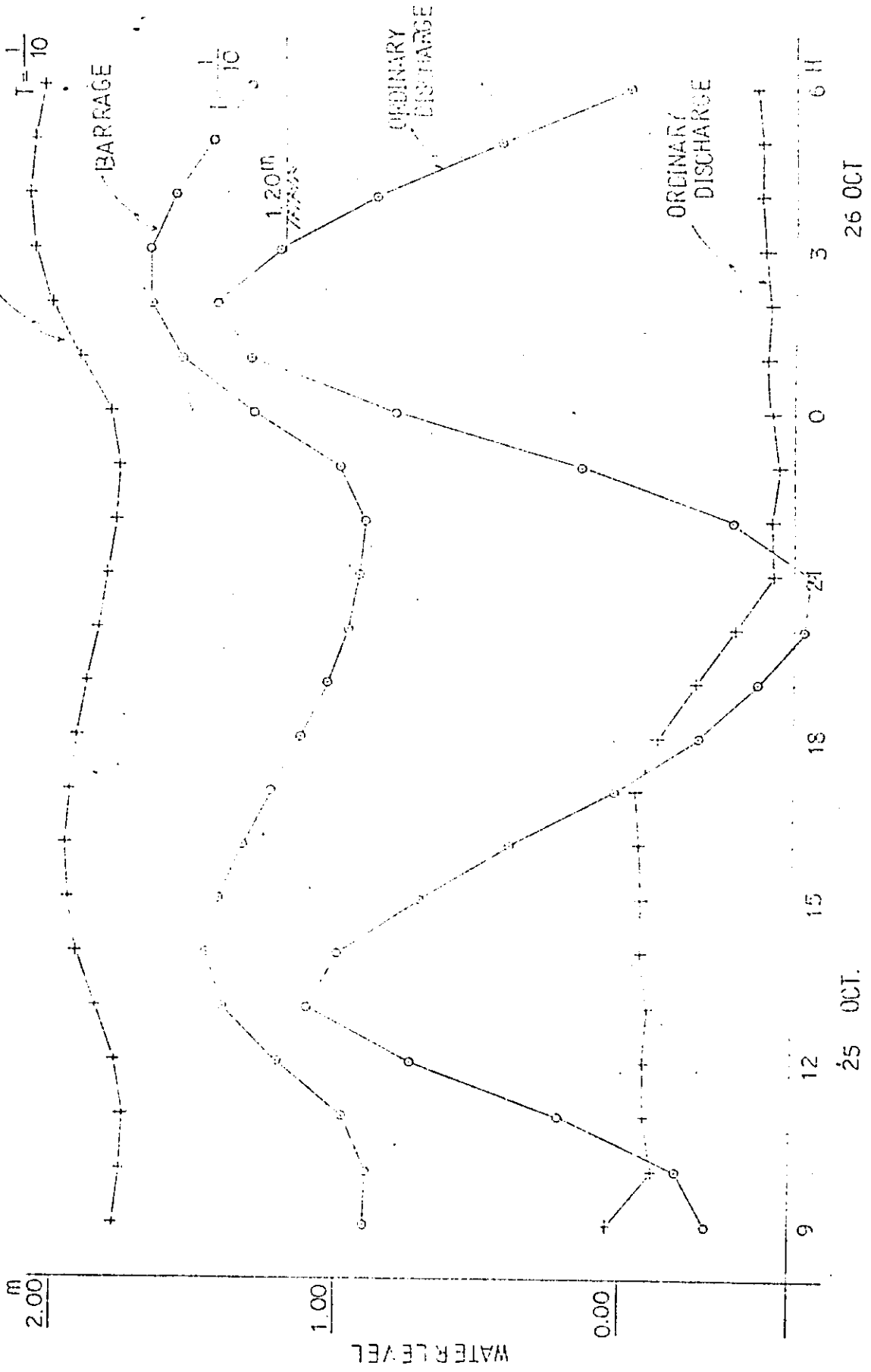
2. DATA OF GATE FIGURES

NO.	TITLE NAME	DRAWING NO.
1.	DOWNSTREAM ELEVATION, ELEVATION A-A AND B-B	B/1632
2.	ELECTORICAL CONTROL	KT/SP/E-1
3.	HYDRAURIC SYSTEM	KT/SP/E-2
4.	EQUIPMENT LAYOUT PLAN	KT/SP/E-3
5.	ASSEMBLY OF TOP LEAF	KT/SP/1Ba
6.	ASSEMBLY OF BOTTOM LEAF	KT/SP/2Ba
7.	TOP LEAF-SHOP DRAWING NO.1	KT/SP/3
8.	BOTTOM LEAF-SHOP DRAWING NO.1	KT/SP/4
9.	BOTTOM LEAF-DETAILS OF RUBBER SEALS	KT/SP/4B
10.	GENERAL LAY-OUT OF ROLLER GUIDES	KT/SP/5
11.	GENERAL DETAILS OF ROLLER GUIDES	KT/SP/6
12.	ROLLER GUIDES -- SHOP DRAWING NO. 1	KT/SP/7
13.	STOP - LOG ASSEMBLY AND DETAILS OF SEALS	KT/SP/19
14.	STOP - LOG ASSEMBLY OF LIFTING BEAM	KT/SP/20
15.	STOP - LOG DETAILS OF LIFTING BEAM	KT/SP/21
16.	STOP - LOG DETAILS OF HOOKS	KT/SP/22

NO.	TITLE NAME	DRAWING NO.
1.	LOCATION PLAN	P.P.103/1
2.	SITE PLAN	P.P.103/2
3.	GENERAL PLAN	P.P.103/3
4.	DOWNSTREAM ELEVATION, ELEVATION A-A & B-B	P.P.103/4
5.	ELEVATION AND SECTION OF INTERMEDIATE AND SIDE PIER	P.P.103/5
6.	UPSTREAM ELEVATION AND KEY PLAN OF PILING ARRANGEMENT FOR BARRAGE FLOOR	P.P.103/8
7.	DETAILS OF ROLLER GATE AND ERECTION STRAP	P.P.103/16
8.	TYPICAL SECTION OF DEVIATION OF CANAL AND DRAIN PIPE	P.P.103/31
9.	LOCATION PLAN OF DEVIATION ROAD	P.P.103/34

SPRING TIDE

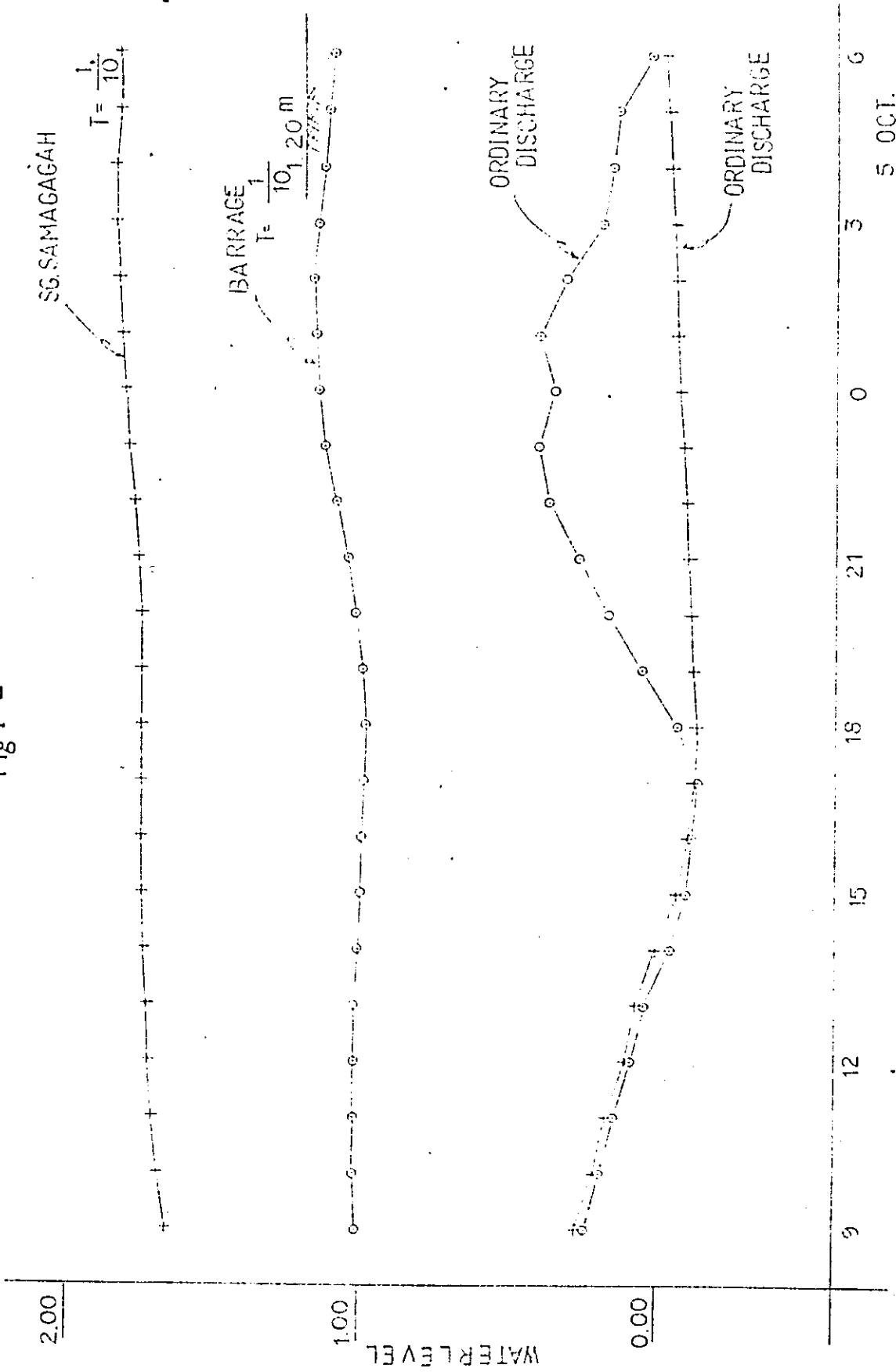
Fig I-1



1988

NEAP TIDE

Fig 1-2

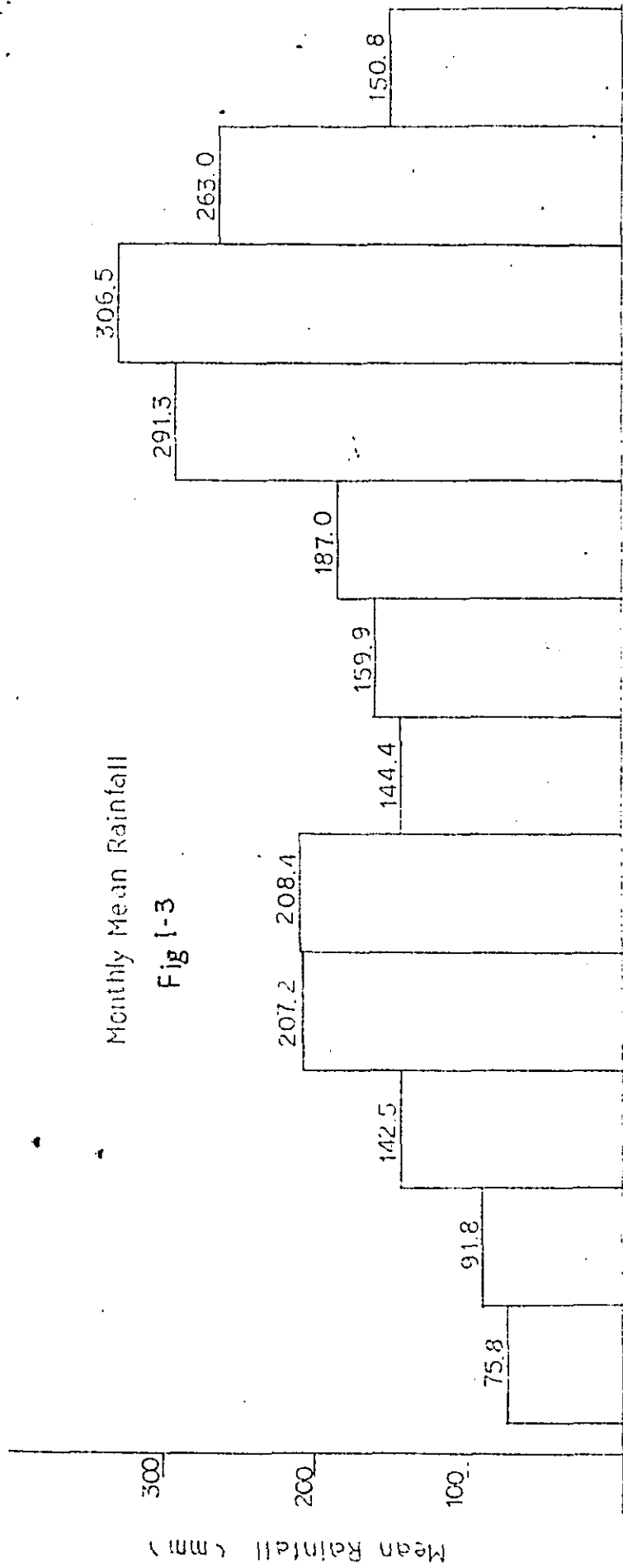


4 OCT. 1988

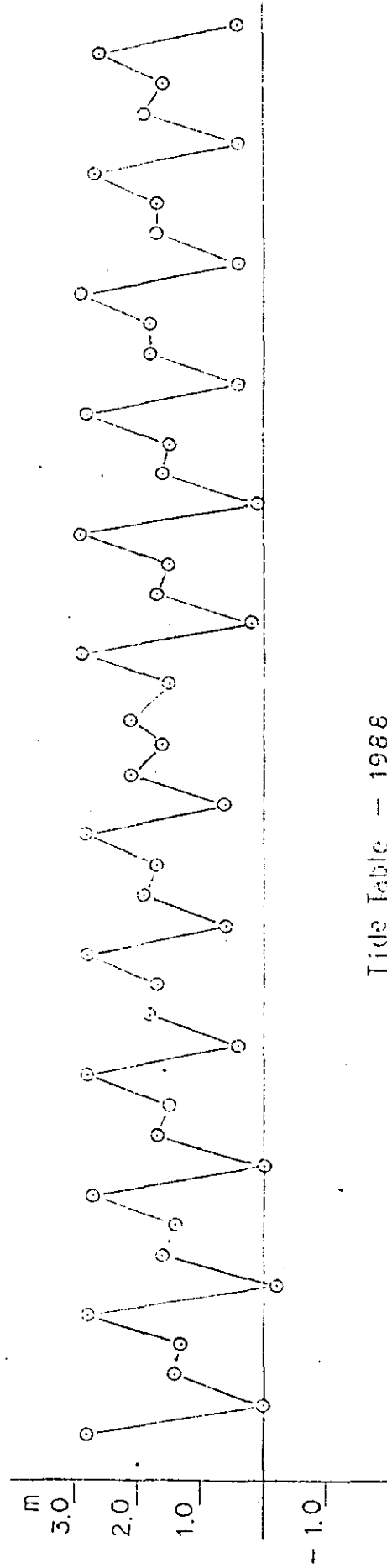
5 OCT.

Monthly Mean Rainfall

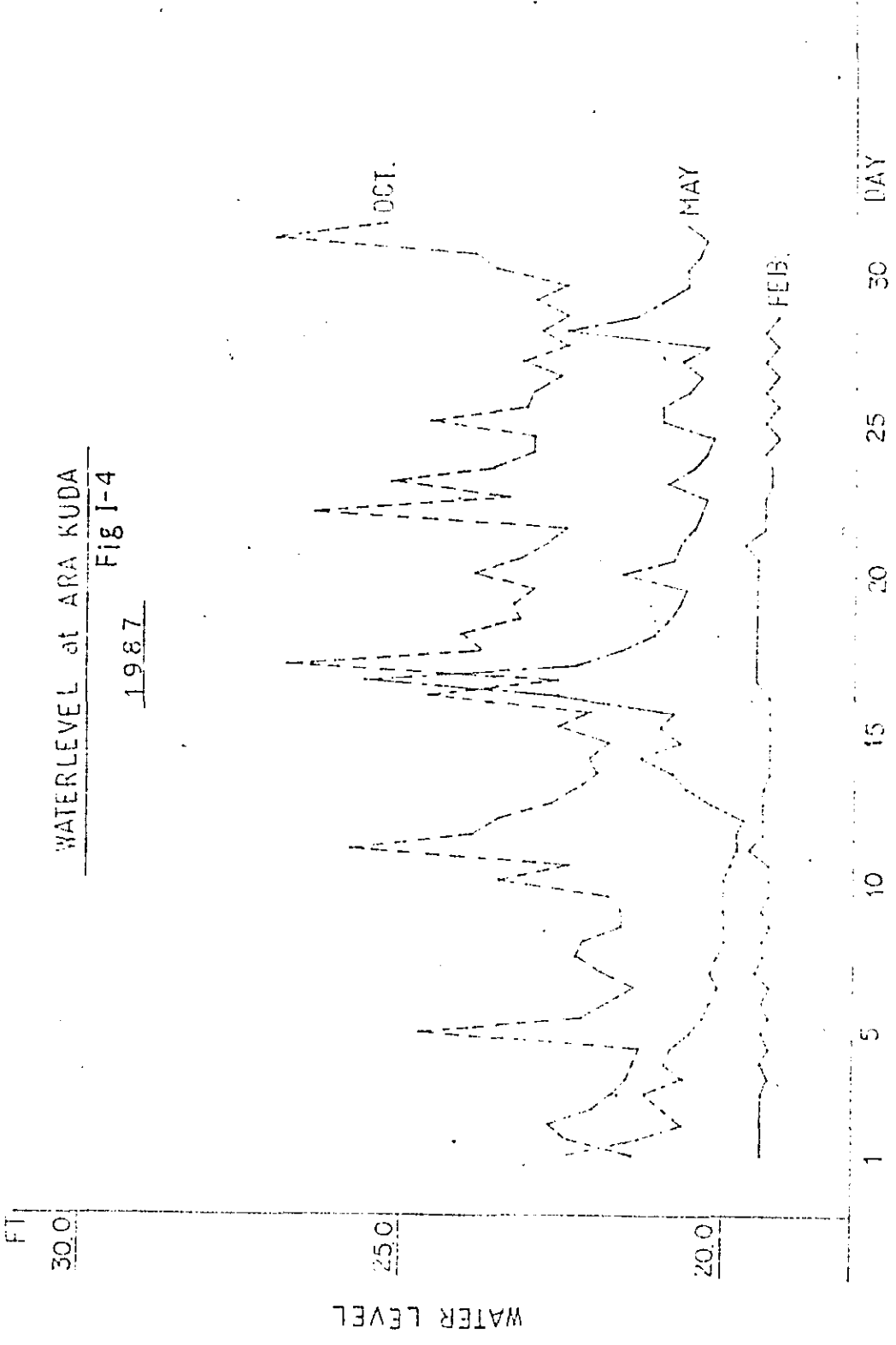
Fig 1-3



Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
------	------	------	------	------	------	------	------	------	------	------	------



Tide Table - 1988



WATERLEVEL at ARA KUDA

Fig I-4

1987.

WATER LEVEL

1978 ~ 1987 (N=10 Y.)

Water level	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	A Total	%
											16		16	16	0.4
18.5 ~ 18.9	22	30	9								3		64	80	2.2
19.0 ~ 19.4	56	96	92	40	8	30	53	82	1	1	4	24	487	567	15.5
19.5 ~ 19.9	93	74	93	73	40	100	166	114	48	26	15	46	888	1455	39.8
20.0 ~ 20.4	74	24	47	50	58	94*	45	44	72	61	30	40	639	2094	57.4
20.5 ~ 20.9*	31*	19*	27*	39	59*	36*	20*	33	43	31	29	40	407	2,501	68.5
21.0 ~ 21.4	18	16	14	38	55	18	11	12	36	48	15	37	318	2,819	77.2
21.5 ~ 21.9	7	7	10	20*	28	7	5	12	25	30	18	36	205	3,024	82.8
22.0 ~ 22.4	4	8	9	14	22	7	4	6*	15	30	52*	28	179	3,203	87.7
22.5 ~ 22.9	1	2	4	8	10	1	1	1	16*	22	38	20	124	3,327	91.1
23.0 ~ 23.4	2	2	1	7	9	2	1	4	14	22	21	13	98	3,425	93.8
23.5 ~ 23.9	1		1	1	1	1	2		5	12*	22	6	52	3,477	95.2
24.0 ~ 24.4		1	1	1	4	1		1	4	6	18	8	45	3,522	96.4
24.5 ~ 24.9	1	1		2	3		1		7	5	6	4	30	3,552	97.3
25.0 ~ 25.4			1		5	1			3	5	9		24	3,576	97.9
25.5 ~ 25.9		1		3	4	1	1		2	3	7	1	23	3,599	98.5
26.0 ~ 26.4				1					4	2	5		12	3,611	98.9
26.5 ~ 26.9				1					1	3	2	1	8	3,619	99.1
27.0 ~ 27.4			1	1				1	1	2	3	3	12	3,631	99.4
27.5 ~ 27.9					1				2	1	2	2	8	3,659	99.6
28.0 ~ 28.4		1		1							4	1	7	3,646	99.8
28.5 ~ 28.9									1		1		2	3,648	99.9
29.0 ~ 29.4					1								1	3,649	99.9
29.5 ~ 29.9															
30.0 ~ 30.4															
30.5 ~ 30.9						1							1	3,650	99.9
31.0 ~ 31.4															
31.5 ~ 31.9					2								2	3,652	100
32.0 ~ 32.4															
32.5 ~ 32.9															
FEET															
Total	310	282	310	300	310	300	310	310	300	310	300	310	3,652		

Tab. I-1 Water level Occur Account (at ARA KUCA)

Rem: * at 80% water level

Rem: Above 28.0ft. happened flood

1987														
Water level	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	A Total
18.5 ~ 18.9													34	34
19.0 ~ 19.4		20	12										105	139
19.5 ~ 19.9	27	8	14	20	1	9	21		5				46	185
20.0 ~ 20.4	4		2	8	8	9	4		7				33	218
20.5 ~ 20.9			2	2	11	5	2	11				8	24	242
21.0 ~ 21.4			1		6	2		4					18	260
21.5 ~ 21.9					1	1		6				4	29	289
22.0 ~ 22.4					2	3		3				5	22	311
22.5 ~ 22.9					1		1	1				7	14	325
23.0 ~ 23.4							1	1	2			5	8	333
23.5 ~ 23.9								1				2	10	343
24.0 ~ 24.4									2			6	6	349
24.5 ~ 24.9									1	1		1	4	353
25.0 ~ 25.4					1				1	1		1	4	357
25.5 ~ 25.9										1		1	2	359
26.0 ~ 26.4										1			1	360
26.5 ~ 26.9										1			1	361
27.0 ~ 27.4									1			1	2	363
27.5 ~ 27.9													1	364
28.0 ~ 28.4									1				1	365
28.5 ~ 28.9														
29.0 ~ 29.4														
29.5 ~ 29.9														
30.0 ~ 30.4														
30.5 ~ 30.9														
31.0 ~ 31.4														
31.5 ~ 31.9														
32.0 ~ 32.4														
32.5 ~ 32.9														
FEET														
Total	31	28	31	30	31	30	31	31	30	31	30	31	365	

Tab. I-2 Water level Occur. Account

THE HISTORY OF PRAI BARRAGE

year month	1978	1979	1980	1981
Jan.	FINALISING ON LAND ACQUISITION			25/1 GATE WORK COMPLETED
Feb.				
Mar.		28/3 SITE CLEARING		
Apr.				
May			< UNDER CONSTRUCTION >	
June		4/6 EXCAVATION OF BARRAGE		11/6 EARTH WORK COMPLETED
July				MAIN WORK COMPLETED
Aug.		22/8 PILING START		31/7 SPEED TEST OF GATES
Sep.				
Oct.				
Nov.	2/11 SITE INSPECTION			3, 4/11 SPEED TEST OF GATES
Dec.		28/12 FIRST CONCRETING STARTS	1, 6/12 FIX GATE GUIDE	

THE HISTORY OF BARRAGE

<i>year</i> <i>month</i>	1982	1983	1984	1985
<i>Jan.</i>				
<i>Feb.</i>	25, 26/2 SPEED TEST OF GATES			
<i>Mar.</i>			29/3 CONSTRUCTION OF GANGWAY	
<i>Apr.</i>	12/4 OPENING CEREMONY			
<i>May</i>				
<i>June</i>				
<i>July</i>				
<i>Aug.</i>				
<i>Sen.</i>	28/9 1/2" WIRE ROPE SNAPPED (GATE NO1) 3/4" WIRE ROPE SNAPPED (GATE NO4)		21/9 REPAIR&REPAINT GATE NO1	
<i>Oct.</i>				
<i>Nov.</i>		13/11 GATE NO3 FELL (WIRE SNAPPED)		
<i>Dec.</i>		19/12 FINAL PAYMENT OF CONTRACT		

THE HISTORY OF BARRAGE

<i>year</i> <i>month</i>	1986.	1987	1988
Jan.			
Feb.			
Mar.	13/3 GATE NO4 BELL (WIRE SNAPPED)	13/3 STEEL PLATE TEST	
Apr.		9/4 STEEL PLATE TEST	
May			
June			
July			
Aug.			
Sep.			
Oct.			
Nov.			
Dec.			

PRAI BARRAGE CHECK TABLE

TABLE --

NAME	COMMENT
TOTAL FACILITY	<p>There is the problem of operation.</p> <p>The cause is the adherence of rolling parts.</p>
HOISTING EQUIPMENT	<p>1. Adherence of rolling parts</p> <p>2. No damage of the wier .</p>
GATE GUIDE	<p>1. Rust condition</p> <p>2. Attachment condition to the concrete</p>
GATE LEAF	<p>1. Rust condition</p> <p>(1) Skin plate - No.2,3,4 inside corroded</p> <p>(2) Girder - Especially No.3,4 corroded</p> <p>(3) Roller - No.2,3,4 almost can not roll</p> <p>(4) Seal - Damaged</p> <p>(5) Others - Damaged</p>
<p>The present operation's objects are to maintain the h- ydraulic pressure system and hoisting equipment system.</p> <p>The present condition cannot function at ordinary oper- -ation.</p> <p>Now we cannot find the damage of wire rope. But the st- -ructural damage by rust is progressing.</p> <p>You should check the gate everyday. Especially you must check the wire rope and the supporting structure of ga- -te leaf.</p> <p>If you find the unusual condition on gates, you should correspond to the situation.</p>	

GATE COMPARISON TABLE

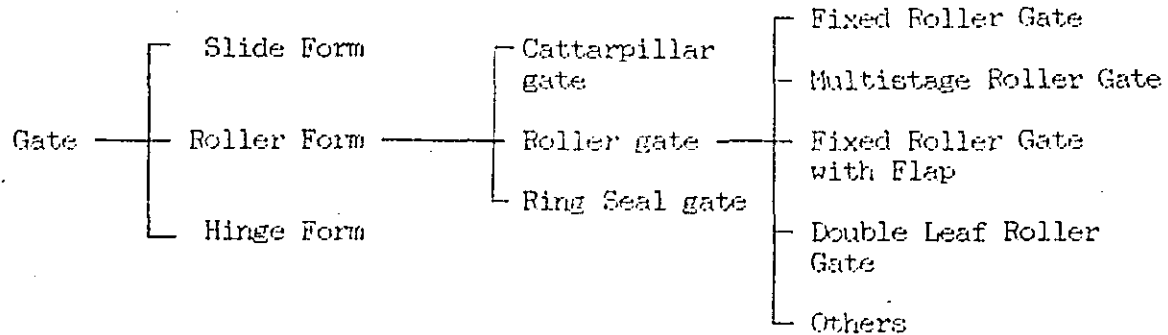
TABLE —

GATE NAME	PRAI BARRAGE	KERIAN BARRAGE	KEDAH BARRAGE
TYPE	DOUBLE LEAF ROLLER GATES	FIXED ROLLER GATES	FIXED ROLLER GATES
COMPLETION YEAR	1981	1975	1970
NUMBER of GATES	N = 4 gates H = 18 ft W = 45 ft	N = 5 gates H = 20 ft W = 45 ft	N = 7 gates H = 20 ft W = 45 ft
MATERIALS	STEEL	STEEL	STEEL
HISTORY	REPAIR gate NO. 1 (9.1984)	REPAIR ALL gates (1981)	NO REPAIR
CONDITION	IN RUST	NO RUST	NO RUST
IMPRESSION	<ul style="list-style-type: none"> • There are salinity differences between sites of 3 gates. <p>We can not see any barnacles at KERIAN and KEDAH BARRAGE. (It seems that the fact depends on the salinity.)</p>		

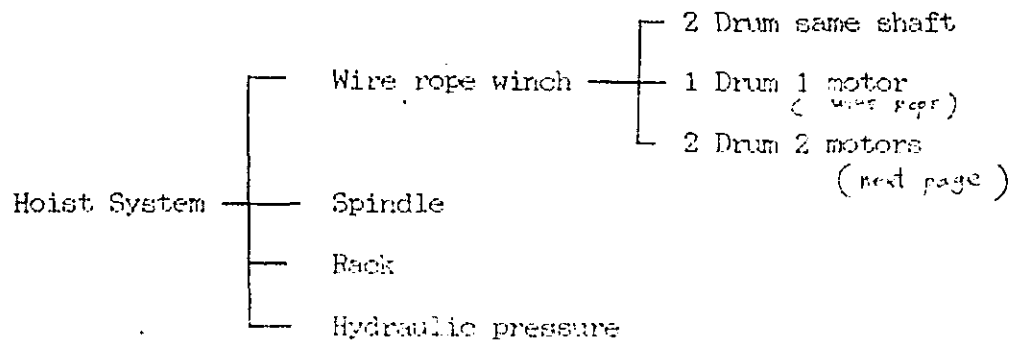
For further understanding :

1. Description of Double Leaf Gate

Different Gate forms are as follow :-



2. Gate Hoist



Advantages of 1 drum 1 motor :-

- * no need operation bridge
- * the ability is stable
- * it is very economical
- * no engagement with wire rope arrangement

Disadvantages

- * need to be careful for wire rope under water

3. The setting condition of the gate

Usually the gate is under more strigent condition than other type of steel structure. This is because they are always subject to sunshine,

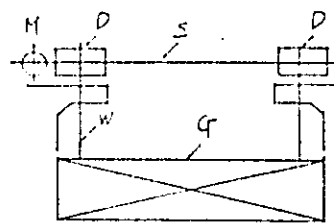
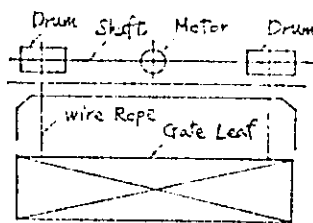
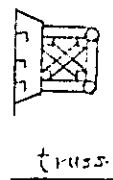
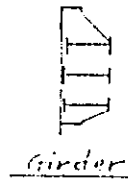
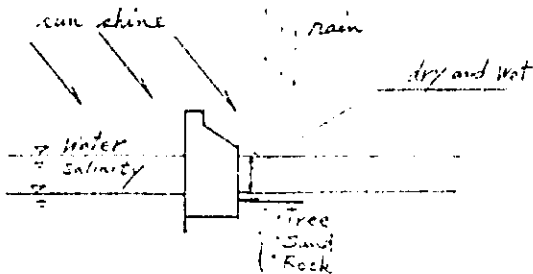
rain, dry and wet, water, collapse of sand and rock. Refer to the figure below. For Gate painting, it is important to paint the gate at the suitable time.

4. Maintenance Plan

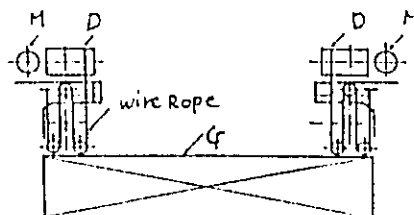
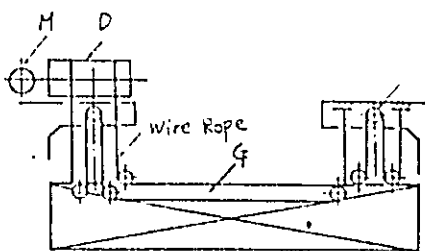
In general, when we use the gates for different objectives, we must maintain the facility at the same time. For that purpose we must check the gate condition of the gates. Hence we need the maintenance plan.

For example, the plan has to include the rotation of checking staff, checking points and the method of checking. It is also very important to report the result correctly the officer after checking.

In this type of hoist system, wire rope maintenance is very important.

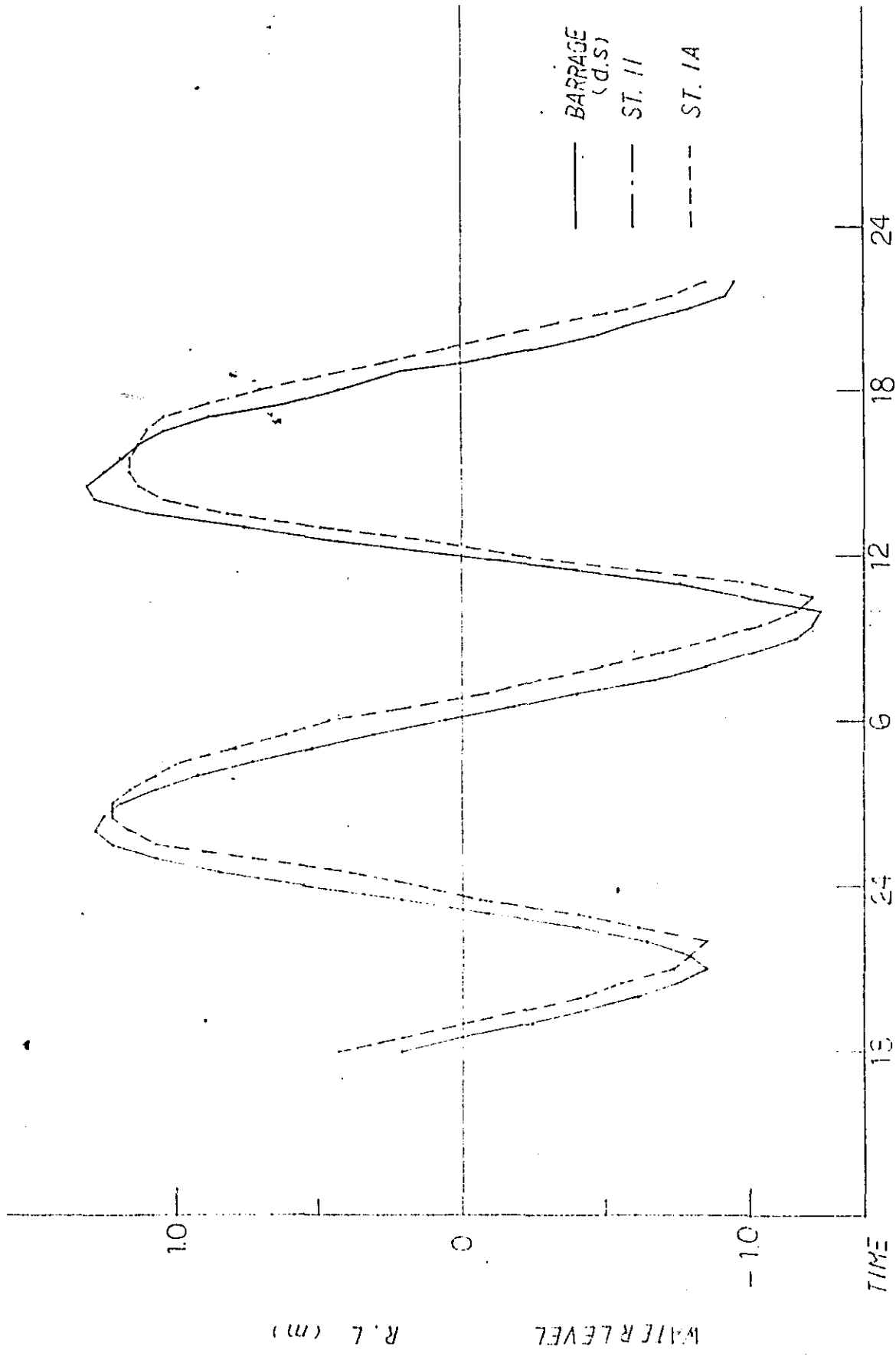


• 2 Drum Same Shaft



• 1 Drum Wire rope.

• 2 Drum 2 Motors



DATE 18 MAR 19 MAR. 1988

OBSERVATION OF WATERLEVEL

INTERNATIONAL COOPERATION AGENCY

Box 216, Mitsui Bldg., Shinjuku-ku, Tokyo, Japan.

()

	Description of Goods	Quantity	Unit Price	Amount
	Water Level Meter Model: No.48	6 sets	@¥171,000.	¥1,026,000.-
	Paper for Water Level Meter	6 pcs	3,700.	22,200.-
	Rain Gauge Model: No.34	1 set		114,000.-
	Paper for Rain Gauge	1 pce		2,000.-
	Pocket Computer SHARP PC-1600K	1 "		62,800.-
	Printer CE-1600P	1 "		62,800.-
	Disc Drive CE-1600F	1 "		35,820.-
	Disc	1 case		8,820.-
	Pen	2 sets	630.	1,260.-
	Roll Paper	10 rolls	230.	2,300.-
	Transformer	1 set		4,000.-
	Transceiver Model: IC-u2 ICOM	2 pcs	28,600.	57,200.-
	Camera	1 pce		48,000.-
	Total : 10 sets, 13 pcs, 1 case & 10 rolls			¥1,447,200.-

MINUTES OF MEETING

ON

INTERIM REPORT

FOR

THE PRAI BARRAGE GATE OPERATION STUDY

FEBRUARY 15, 1988

KUALA LUMPUR

Joseph 15/2/88

.....
IR. JOSEPH YEOH HOH HOH
ASST DIRECTOR-GENERAL,
DRAINAGE AND IRRIGATION DEPARTMENT,
MALAYSIA.

Takashi Kato

.....
MR. TAKASHI KATO
STUDY TEAM LEADER,
JICA.

PRAI BARRAGE GATE OPERATION STUDY

Minutes of Meeting held on
15th February 1988 in DID HQ, KL

1. Objective

The meeting was convened to discuss the Interim Report submitted by the Study Team of the Prai Barrage Gate Operation Study:

2. Attendance

The list of attendance is as shown in Annex I.

3. Opening Remarks by Chairman

The Chairman welcomed the members of the Study Team and stated that the purpose of the meeting was to discuss the Interim Report and to make comments as necessary so that the Study Team could proceed with their work.

4. Briefing by Study Team Leader

The Study Team Leader briefed the meeting on the Interim Report submitted (Annex II). He explained that the report highlighted the findings of the Study Team to date and set out the plan of gate operation simulation analysis. The Study Team had been carrying out data collection since its arrival and there had been a technical meeting with DID on 4th February 1988.

5. Plan of Gate Operation Simulation Analysis

For the plan of gate operation simulation analysis, the Study Team will consider three cases of simulation as follows :

- (i) Case 1 - Simulate the existing condition in which the gates are kept open and not operated.
- (ii) Case 2 - Simulate the planned condition in which the gates are operated to prevent the ingress of water upstream of the gate and to maintain the water level upstream at R.L. +0.61 m.
- (iii) Case 3 - Simulate the condition in which the gates will be operated to allow some ingress of water upstream during certain periods of spring high tide so as to prevent flooding of the downstream low-lying areas.

After some discussions on the need for Case 3, the meeting agreed to accept the proposed plan of simulation analysis.

DID requested that the sediment transport phenomena should be studied. The Study Team Leader confirmed that the study will include sediment transport within the river channel but will exclude sedimentation problems in the estuary.

6. Requests for Data Collection

The meeting discussed on the data to be collected. DID will provide to the Study Team all the information requested, if they are available. DID Hydrology Branch will consider installing 1 or 2 water level recorders pending the arrival of the 6 recorders from Japan. The priority location for a recorder will be at the river mouth.

7. Other Comments

Mr. Yamada informed the meeting that three of the gates had deteriorated very badly due to corrosion and the gates would have to be repaired or replaced before gate operations can be carried out. He suggested that DID should consider using stainless steel or aluminium for the new gates. DID requested for the Study Team to look into the corrosion problem as well as the problem of barnacles attack.

DID will arrange for the Study Team to visit the Sg. Kedah and the Sg. Krian barrages.

Study Team

1. Mr. Takashi Kato - Team Leader
2. Mr. Feichi Morigi - Deputy Team Leader
3. Mr. Taji Chiba - Member
4. Mr. Taichi Yamada - Member

Drainage and Irrigation Department, Malaysia

1. Ir. Joseph Yeoh Hoh Hoh - Asst. Director-General (North)
(Chairman)
2. Ir. Sardar Ali b Raunkee - Chief Planning Engineer
3. Ir. Saw Hin Seang - State Director, Pulau Pinang
4. Ir. Samali b Midun - Senior Engineer,
Coastal Engineering Unit
5. Ir. John Abraham - Senior Engineer, Design
6. Ir. Jamal b Abdullah - Senior Engineer, Hydrology
7. Mr. Akira Makino - JICA Expert
8. Ir. Lim Taik Keat - Senior Engineer, Water Resources

Interim information on PRAI BARRAGE GATE OPERATION STUDY

Place : D.I.D. Hq. K.L.

Date : 15th. February, 1988.

Time : 9:00 a.m. to 11:00 a.m.

1. Background

In 1968, The Prai Barrage was planned to prevent ingression of saline water and to maintain the water upstream at a controlled level through the operation of the gate. The barrage structure has been completed in 1980.

In May 1984, the state Drainage and Irrigation Department have made attempts to formulate gate operation procedures. But, the attempts caused inundation in lowlying area. There is thus a need to investigate the cause and the effect through the use of mathematical modeling of river behavior. JICA has recognized the necessity of study and send the study team to the site for collecting data.

The study team has carried out the data collection since the 19th Jan. 1988 with the cooperation of the state D.I.D Pulau Pinang and D.I.D. I.A.D.P. The study team, the State D.I.D. confirmed all the items of the data collection and requests at the meeting on the 4th Feb. 1988.

2. Study objectives and schedule

The objectives of the study are as follow:

- 1) To analyse the tidal flow hydraulic behavior of Sg. Prai using mathematical model simulation method,
- 2) To formulate gate operation procedures for the Prai Barrage, so as to minimise flooding both upstream and downstream, while maintaining a controlled water level of upstream reach, taking into consideration of drainage and irrigation requirements of the affected agricultural land.
- 3) To propose other countermeasures as are necessary, to mitigate flooding of lowlying areas.

Study team will add the following object as the result of the meeting on the 4th Feb., 1988.

- 4) To recommend the method to protect the gate from corrosion.

The mathematical model simulation of tidal flow is the most effective method for the practice of this study. The analysis of this simulation demand the data modeling of Sg. Prai and the related data. The field investigation and data collection for the modeling will be carried out to 31 Mar., 1988. After the data collection, the analysis shall be put into practice in Japan, and shall be ended on September, 1988.

3. Report on findings of the study team

Main findings are as follow :

- i) The study team confirmed the fact that the water fluctuation range of Prai river's mouth is larger than that of Penang from the data of 1987.
- ii) The study team confirmed the water level record in the attempted operation coincide with the collected data of 17th. May, 1984.
- iii) The study team confirmed the elevation of the flood occurred area.
- iv) Investigation of the gates.

The progress of gate corrosion is serious. Sand blasting and Cathodic protection are very difficult to carry out properly in Malaysia. As a result of the imperfect protection, the gates have become seriously corroded.

4. Plan of gate operation simulation analysis.

i) On the 4th Feb. 1988 meeting three cases of Study have been requested to look into the operation of the Barrage as follow :

Case 1

Simulate the existing condition in which the Perai Barrage gates are opened and not operated.

Case 2

Simulate the planned condition in which the Perai Barrage Gates are operated to prevent the flow of rising tide and to maintain the water level upstream at R.L. +0.61 m (2.0 ft.)

Case 3

Simulate the condition under compromised operation which the Perai Barrage gates are operated to prevent the rising of tide flow, taking into consideration to prevent flooding of downstream low lying area.

5. Requests of data collection

The results of the meeting on the 4th Feb. 1988 are as follow :-

a) Collected Data

Main Collected data are as follow :-

- i) River cross section (not sufficient)
- ii) Tide table
- iii) Hydrology (not sufficient)
- iv) Meteorological data (not sufficient)
- v) Gate operation data (not sufficient)
- vi) Gates (not sufficient)

b) Requests from the Study Team

The Study Team requested the data collection as follow :-

The detailed contents are written on Attachment 3.

- i) Hydrology
- ii) Meteorological data
- iii) Gate operation data

Action : State D.I.D.

- iv) Gates (The study team requested to collect the operation manuals of other gates in Malaysia)

Action : D.I.D. Ipoh Workshop

- v) Rainy Season Data

The study team requested to collect data of rainy season during April to September. Data Required :

- 1) Rainfall data
- 2) Water Level data

Action : State D.I.D.

- vi) The Study Team requested to cooperate with the surveying team to confirm the survey for the Sg. Perai Basin.

DATA LIST

Tide table

year	1984	1985	1986	1987	1988
Tide table of Penang	*		*	*	*

* : collected

Water level record

term	15-18 May 1984	11-20 Mar. 1987	5-6 Feb. 1988
St. No.1a		*	*
St. No.3			*
St. No.3a	*		*
St. No.4		*	
St. No.5		*	
St. No.8		*	
St. No.11		*	

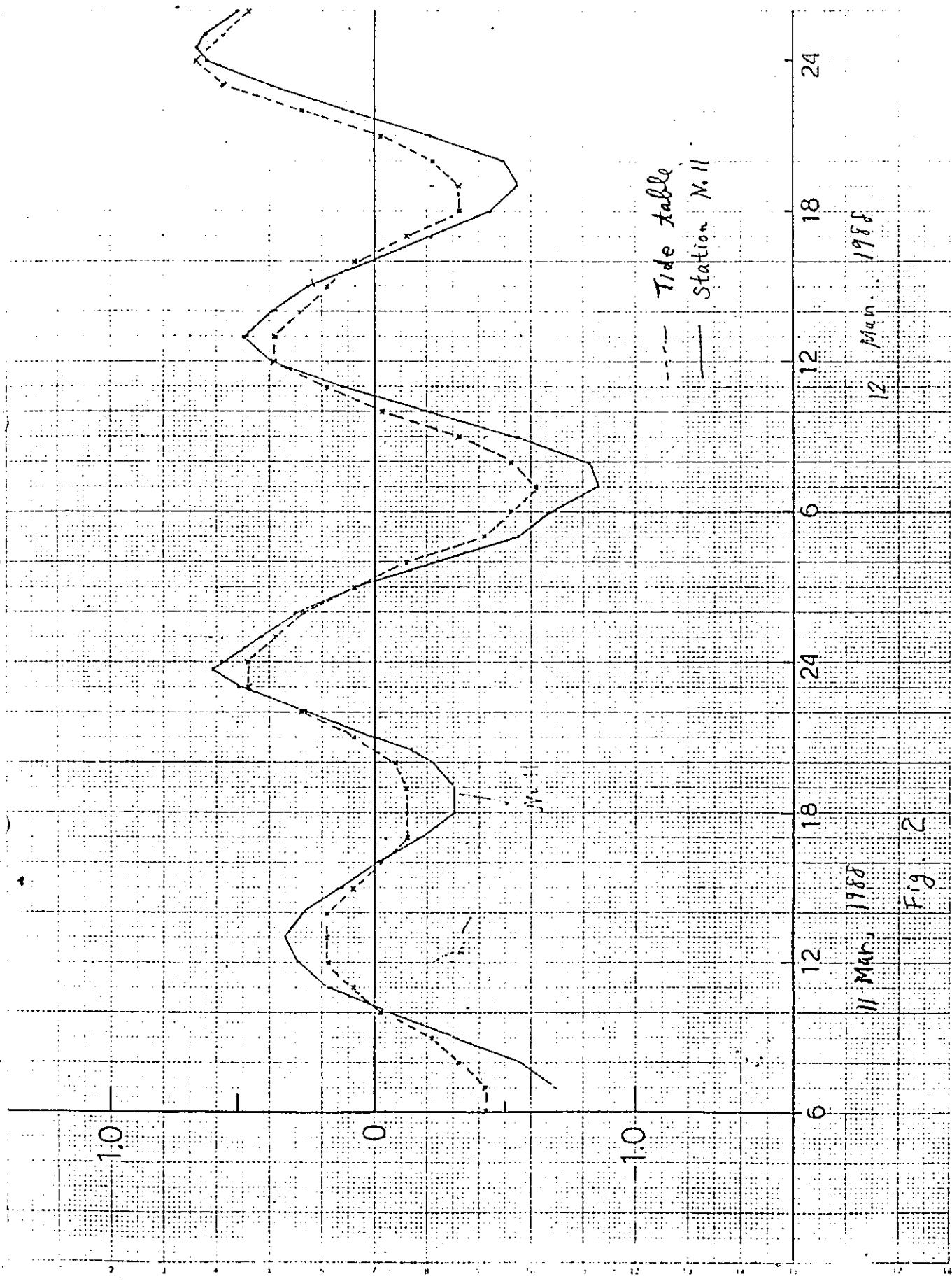
St. No.1a : Titi Timbul, St. No.5 : d/s Barrage, St. No.3a : d/s Barrage,

St. No.11 : estuary

River cross section of Sq. Phai

year	1987	1988
upstream of Barrage	*	
downstream of Barrage		under surveying

* : collected



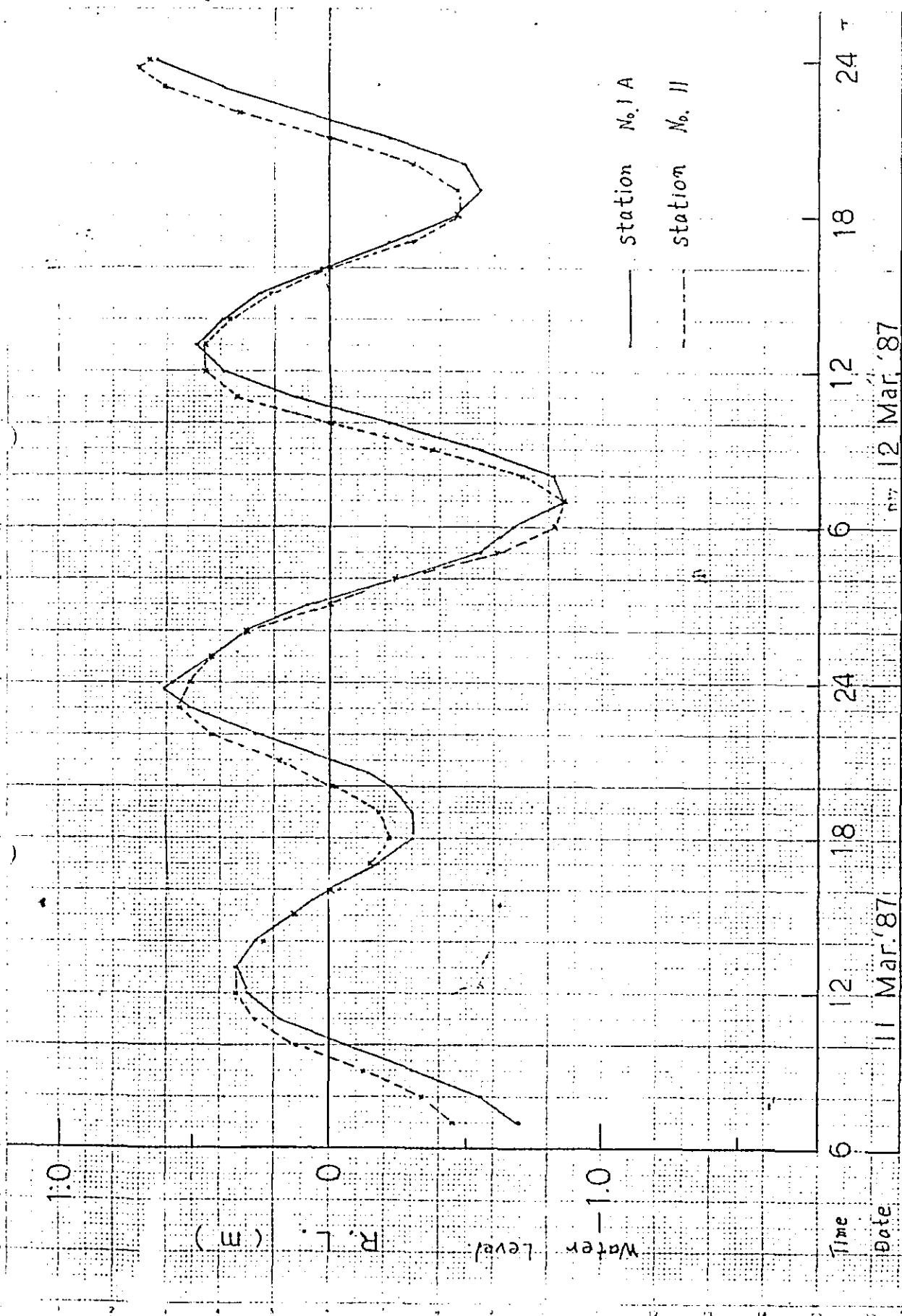


Fig. 3 Relation of Water Level between St. No. 1A and St. No. 11

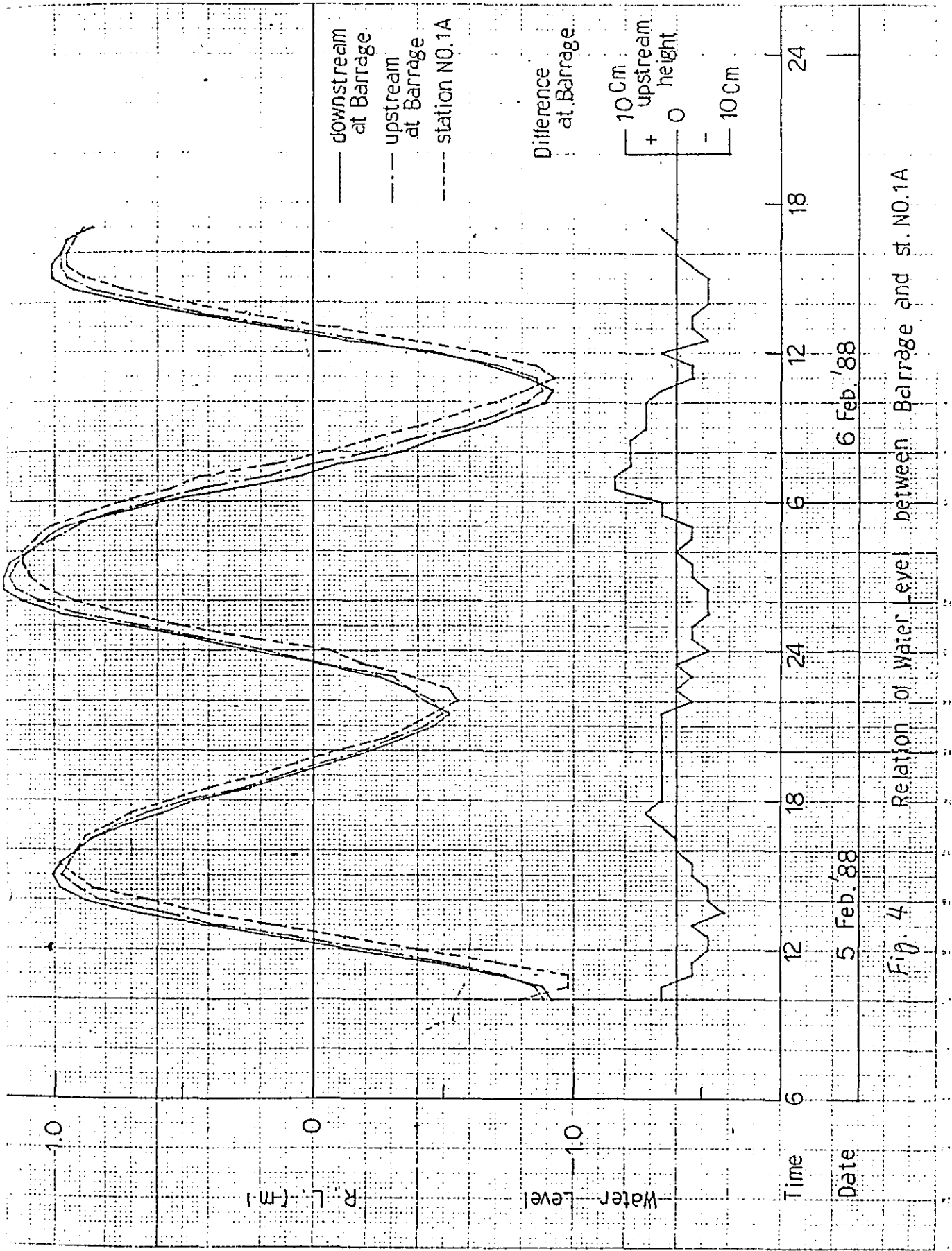


Fig. 4 Relation of Water Level between Barrage and st. NO. 1A

Interim information on PRAI BARRAGE GATE OPERATION STUDY

1. Background

In 1968, The Prai Barrage was planned under the technical assistance of the Japanese Overseas Technical Cooperation Agency. The barrage was located some 8 km from the Sg. Prai river estuary and its primary function was to prevent ingress of saline water and to maintain the water upstream at a controlled level through the operation of the gate. The barrage structure has been completed in 1980.

In May 1984, the state Drainage and Irrigation Department have made attempts to formulate gate operation procedures so as to achieve the primary function of maintaining a controlled water level upstream. then, attempts to close the gates have only resulted in aggravating the tide levels on the down stream reach of the river, causing inundation in lowlying area. There is thus a need to investigate the cause and the effect through the use of mathematical modeling of river behavior. JICA has recognized the nesity to check and our study team have been sent to the site for collecting data.

2. Study objectives and schedule

The objectives of the study are:

- 1) To analyse the tidal flow hydraulic behavior of Sg. Prai using mathematical model simulation method,
- 2) To formulate gate operation procedures for the Prai Barrage, so as to minimise flooding both upstream and downstream, while maintaining a controlled water level of upstream reach, taking into consideration of drainage and irrigation requirements of the

affected agricultural land.

- 3) To propose other countermeasures as are necessary, to mitigate flooding of lowlying areas.

The mathematical model simulation of tidal flow is the most effective method for the practice of this study. The analysis of this simulation demand the data modeling of Sg. Prai and related data as are mentioned in the later part.

The field investigation and data collection for the modeling are carried out from 19 Jan. to 31 Mar., 1988 by our study team. After the data collection, the analysis shall be put into practice in Japan, and shall be ended on september, 1988.

3. Data for study

- 1) the following data are required to make the mathematical simulation model.
 - a. Topographic surveying data as the hydraulic cross section of the river
 - b. Tidal fluctuation as the boundary condition of downstream end.
 - c. Hydrological data (run off data) as the boundary condition of upstream end and the lateral inflow along river.
 - d. Water level records of more than three (3) stations as to confirm the model,
 - e. Other data

2) River cross section

	upstream of barrage	downstream of barrage
cross section	ok	under surveying
sidearea of bank	10 to 20 m both side of bank	required 100 m on both side of bank

We have to study and check the influence due to the increase of water level and capacity (Sg. Prai).

Also we have to survey the cross section of the river. we will survey the necessary width of th river according to the levels of the bank. And our study team will survey the supplementary cross section as according to demand.

3) Tide — *collected* —

The station of tide near Sg. Prai is the penang station. F/S report mentioned that the seasonal change in the mean level at Pontoon bridge in 1966, was about 0.26 ft (0.08 m) figher than that of Penang. The relation between the river mouth water level of Sg. Prai in 1987 and the tide table of Penang are shown as Fig. 1. The water level of Sg. Prai river mouth is higher than that of Penang.

The collected tide table are in 1984,1986,1987 and 1988.

4) Hydrology

Object

The object of hydrology study is to decide the runoff discharge of Sg. Prai for computer simulation.

Method

< 1st. step >

To estimate the runoff percentage

< 2nd. step >

To calculate the runoff discharge from the runoff percentage for this study we need the peak discharge.

FIG - 2

FIG - 3

1st.step

We will decide the Q-T curve in according with some rain fall data above 50 mm/day.

We can get the runoff percentage from Q-T curve.

2nd.step

We will draw F-R curve from the data 1st. step.

We can get the run off percentage from F-R curve and we need the runoff discharge of return period

($W = 1/2$ year, $W = 1/5$ year, $W = 1/20$ year, $W = 1/40$ year etc.)

Data collection

We want the following data for the beforesaid runoff analysis.

a. Water level data

We want the data under the following conditions

The data should satisfy all conditions.

- i) The observing place is not affected by tide
- ii) There is a H-Q curve and we can exchange the runoff discharge,
- iii) There is a W.L. data by hour.

b. Rainfall data

- i) rainfall data by the hour. At the place where we can get the (a) water level data.
- ii) rainfall data by month and maximum total rainfall data during a day, two days and three days. (daily data is important)

The place are following:

code	station name
(A) 5504035	LAHAR IKAN MATI
(C) 5404041	MARAKOFF ESTATE
(D) 5403042	METEOROLOGICAL STATION BUTTERNORTH
(G) 5404043	SG.KLIM HEADWORK
(I) 5404044	BUKIT MERAH PADI STATION
(J) 5304047	BUKIT MERTAJAM ESTATE
(L) 5304045	BUKIT BERAPIT RESEVOIR

* Another rainfall observatory

Object

- i) To define the maximum days rainfall of returnperiod,
- ii) To check the Q-T curve by these rain fall data.

5) Meteorological data

We can know the general weather from F/S. But we would like reconfirm the weather for the month of May, 1984. Especiary we want to investigate the weather:

- i. Atomospheric pressure
- ii. Wind speed and direction
- iii. Air temperature
- iv. Humidity
- v. Rainfall
- vi. Sunshine

6) The general of land use

We must check the allowable flooding time for crop. So, we would like to get the plan of planting schedule along the Sg. Prai.

4. On first attempt closing gate operation data

The first operation of gate was attempted on 17 May, 1984. The peak of water level of downstream cause the inundation in lowlying area of the Prai barrage. The water level record are shown as Fig. 4, and its peak is R.L. 1.64 m (5.4 ft). the inundation depth which were hearing data from residents around the area are about 0.3 m (1ft), and the grand level of the lowlying area of downstream of the Prai barrage are about R.L. 1.2 m to 1.4 m.

The water level record in attempt operation coincide with above data.

There is no report on this matter.

5. Gate

1) Gate operation at 17 May, 1984

We would like to difine the flood situation

We want to investigate the operation of gate on 17 May, 1984.

2) Each gate

We should prepare to repair the gate

We want to know about the correct condition of the gates.

- a. gate
- b. machine
- c. electricity

< content >

- i. moving time from 17 May, 1984
- ii. situation (sunk in the water or not, duration)
- iii. maintenance plan
- d. The situation when the weir snapped
- e. the figures of gate details

3) Measurement of rust not required

We should measure the damage of rust.

As the result we can estimate the method of repair and cost for the work.

- i. what company have the machine to measure the rust ?
- ii. How much does it cost to investigate the gate ?

6. Related information

1) The data for embankment

We would like to collect the data in case for the construction of embankment, taking into consideration of the following situation:

- a. ship transportation
- b. city planning
- c. factory planning
- d. road planning
- e. agricultural planning

f. others

2) The data of the drainage canal in upstream area

We would like to check the cross section of the drainage canal for the cross sections of drains that flows into Sg. Prai from paddy field is sufficient or not.

We should investigate place of narrow cross sections. For example, near the bridge or the box culvert.

3) The data of development in Sg. Prai river basin

a. development plan

If there is a big development plan in catchment area, the runoff percentage will increase. We should check the flood at that time

Minutes of Meeting

on

The Plan and Processing of Data Collection

between

The Frai Barrage Gate Operation Study Team

and

State Drainage and Irrigation Department, Penang

Place : Pejabat J.P.T. Daerah Seberang Jaya

Date : 4th. February, 1968.

Time : 9:00 a.m. to 11:00 a.m.

The Frai Barrage gate Operation Study Team and the State Drainage and Irrigation Department agreed on the minutes of the meeting on the Plan and Processing of Data Collection.

The Study Team had carried out the Data collection since its arrival on the 18th. January, 1968. They also had defined the results and requests for the Data Collection. The State D.I.D. and D.I.D. IADP had cooperated with the Study team for data collection. The State D.I.D. and D.I.D. IADP had confirmed the items of Data Collection and requested new items of Study.

Attendents of Meeting are listed as attachment 1 and the results of the meeting on the Plan and Processing of Data Collection are as attachment 2. The Plan and Processing of Data Collection from the Study Team is in attachment 3.

Fulau Pinang, 5th. February, 1968.



(Ir. Saw Hin Seang)
Director State D.I.D



(Takashi Kato)
Leader of Study Team

Attachment - 1

Attendents of Meeting :-

1. Drainage and Irrigation Department Malaysia

In. Saw Hin Seang Director State D.I.D. Pulau Pinang
In. Lim Tek Keat D.I.D. Headquarter K.L.
In. Yap Cheng Aun D.I.D. Ipoh Workshop
In. Cheng Pek Siang D.I.D. IADP
) In. Chu Meng Heng D.I.D. IADP
In. Ismail Zakariah D.I.D. District Engineer Seberang Perai
In. Akira Makino D.I.D. Headquarter K.L.(JICA)

2. The Perai Barrage Operation Study Team

In. Takashi Kato
In. Koichi Mogi
In. Yuichi Yamada
In. Yuji Chiba
)

Attachment - 2

The results of the meeting on the Plan and Processing of Data Collection are as follow :-

a) Collected Data

Main Collected data are as follow :-

- i) River cross section (not sufficient)
- ii) Tide table
- iii) Hydrology (not sufficient)
- iv) Meteorological data (not sufficient)
- v) Gate operation data (not sufficient)
- vi) Gates (not sufficient)

b) Findings

Main findings are as follow :-

- i) We confirmed the fact that the water level of Prai river's mouth is higher than that of Penang from the data of 1987.
- ii) We confirmed the water level record in the attempted operation coincide with the collected data of 17th. May, 1984.

2. Requests

a) Requests from the Study Team

The Study Team requested the data collection as follow :-

The detailed contents are written on Attachment 3.

- i) Hydrology
- ii) Meteorological data
- iii) Gate operation data

iv) Gates (The study team requested to collect the operation manuals of other gates in Malaysia)

Action : D.I.D. Ipoh Workshop

v) Rainy Season Data

The study team requested to collect data of rainy season during April to September.

Data Required : 1) Rainfall data

2) Water Level data

Action : State D.I.D.

vi) The Study Team requested to cooperate with the surveying team to confirm the survey for the Sg. Perai Basin.

Requests from the D.I.D. IADP and State D.I.D.

i) Three cases of Study have been requested to look into the operation of the Barrage :-

Case 1

Simulate the existing condition in which the Perai Barrage gates are opened and not operated.

Case 2

Simulate the planned condition in which the Perai Barrage Gates are operated to prevent the flow of rising tide and to maintain the water level upstream at R.L. +0.61 m (2.0 ft.)

Case 3

Simulate the condition under compromised operation which the Perai Barrage gates are operated to prevent the rising of tide flow, taking into consideration to prevent flooding of downstream low lying area.

ii) Protection of the Gates

Sand blasting and Cathodic protection are very difficult to carry out properly in Malaysia. As a result of the imperfect protection, the gates have become seriously corroded. The Study team will investigate the following items for the Gates :-

- * How to maintain the Gate easily
- * How to prevent the rust

iii) New design of gates

The proposed new design of gates need further investigation and decision by the State D.I.D. and Ipoh Workshop. The study team suggested the necessity of new Gates may be considered from i) cost of repair of existing gates , ii) cost of new gates .

Investigation on the design of new gates is not included in the object of this Study Team. It is suggested that this request may be forwarded to the JICA for consideration.

Attachment 3

Interim information on PRAI BARRAGE GATE OPERATION STUDY

1. Background

In 1968, The Prai Barrage was planned under the technical assistance of the Japanese Overseas Technical Cooperation Agency. The barrage was

located some 8 km from the 'Sg. Prai river estuary and its primary function was to prevent ingression of saline water and to maintain the water upstream at a controlled level through the operation of the gate. The barrage structure has been completed in 1980.

In May 1984, the state Drainage and Irrigation Department have made attempts to formulate gate operation procedures so as to achieve the primary function of maintaining a controlled water level upstream. then, attempts to close the gates have only resulted in aggravating the tide levels on the down stream reach of the river, causing inundation in lowlying area. There is thus a need to investigate the cause and the effect through the use of mathematical modeling of river behavior. JICA has recognized the nesesity to check and our study team have been sent to the site for collecting data.

2. Study objectives and schedule

The objectives of the study are:

- 1) To analyse the tidal flow hydraulic behavior of 'Sg. Prai using mathematical model simulation method,
- 2) To formulate gate operation procedures for the Prai Barrage, so as to minimize flooding both upstream and downstream, while maintaining a controlled water level of upstream reach, taking into consideration of drainage and irrigation requirements of the affected agricultural land.
- 3) To propose other countermeasures as are necessary, to mitigate flooding of lowlying areas.

The mathematical model simulation of tidal flow is the most effective

method for the practice of this study. The analysis of this simulation demand the data modeling of Sq. Pral and related data as are mentioned in the later part.

The field investigation and data collection for the modeling are carried out from 19 Jan. to 31 Mar., 1989 by our study team. After the data collection, the analysis shall be put into practice in Japan, and shall be ended on september, 1989.

3. Data for study

- 1) the following data are required to make the mathematical simulation model.
 - a. Topographic surveying data as the hydraulic cross section of the river
 - b. Tidal fluctuation as the boundary condition of downstream end.
 - c. Hydrological data (run off data) as the boundary condition of upstream end and the lateral inflow along river.
 - d. Water level records of more than three (3) stations as to confirm the model,
 - e. Other data

2) River cross section

upstream of barrage

downstream of barrage

cross section	ok	under surveying
sidearea of bank	10 to 20 m both side of bank	required 100 m on both side of bank

We have to study and check the influence due to the increase of water level and capacity (Sg. Prai).

Also we have to survey the cross section of the river. we will survey the necessary width of th river according to the levels of the bank. And our study team will survey the supplementary cross section as according to demand.

3) Tide — Collected —

The station of tide near Sg. Prai is the penang station. F/S report mentioned that the seasonal change in the mean level at Pontoon bridge in 1966, was about 0.26 ft (0.08 m) higher than that of Penang. The relation between the river mouth water level of Sg. Prai in 1987 and the tide table of Penang are shown as Fig. 1. The water level of Sg. Prai river mouth is higher than that of Penang.

The collected tide table are in 1984, 1985, 1987 and 1988.

4) Hydrology

Object

The object of hydrology study is to devide the runoff discharge of Sg. Prai for computer simulation.

Method

< 1st. step >

To estimate the runoff percentage

< 2nd. step >

To calculate the runoff discharge from the runoff percentage for this study we need the peak discharge.

1st. step

We will decide the Q-T curve in according with some rain fall data above 50 mm/day.

We can get the runoff percentage from Q-T curve.

2nd. step

We will draw F-R curve from the data 1st. step.

We can get the runoff percentage from F-R curve and we need the runoff discharge of return period

($W= 1/2$ year, $W= 1/5$ year, $W= 1/20$ year, $W= 1/40$ year etc.)

Data collection

We want the following data for the beforosaid runoff analysis.

a. Water level data

We want the data under the following conditions

The data should satisfy all conditions.

i) The observing place is not affected by tide

ii) There is a H-Q curve and we can exchange the runoff discharge,

iii) There is a W.L. data by hour.

b. Rainfall data

i) rainfall data by the hour. At the place where we can get the (a) water level data.

ii) rainfall data by month and maximum total rainfall data during a day, two days and three days. (daily data is important)

The place are following:

code	station name
(A) 5504035	LAHAR IKAN MATI
(C) 5404041	MARAKOFF ESTATE
(D) 5403042	METEOROLOGICAL STATION BUTTERWORTH
(G) 5404043	SG. KLIM HEADWORK
(I) 5404044	BUKIT NEBAH PADI STATION
(J) 5304047	BUKIT MERTAJAH ESTATE
(L) 5304045	BUKIT SERAPIT RESERVOIR

* Another rainfall observatory

Object

- i) To define the maximum days rainfall of return period,
- ii) To check the Q-T curve by these rain fall data.

5) Meteorological data

We can know the general weather from F/S. But we would like reconfirm the weather for the month of May, 1984. Especially we want to investigate the weather:

- i. Atmospheric pressure

- ii. Wind speed and direction
- iii. Air temperature
- iv. Humidity
- v. Rainfall
- vi. Sunshine

6) The general of land use .

We must check the allowable flooding time for crop. So, we would like to get the plan of planting schedule along the Sg. Prai.

4. On first attempt closing gate operation data

The first operation of gate was attempted on 17 May, 1984. The peak of water level of downstream cause the inundation in lowlying area of the Prai barrage. The water level record are shown as Fig. 4, and its peak is R.L. 1.64 m (5.4 ft). the inundation depth which were hearing data from residents around the area are about 0.3 m (1ft), and the ground level of the lowlying area of downstream of the Prai barrage are about R.L. 1.2 m to 1.4 m.

The water level record in attempt operation coincide with above data.

) There is no report on this matter.

4. Gate

1) Gate operation at 17 May, 1984

We would like to define the flood situation

We want to investigate the operation of gate on 17 May, 1984.

2) Each gate

We should prepare to repair the gate

We want to know about the correct condition of the gates.

a. gate

b. machine

c. electricity

< content >

i. moving time from 17 may, 1984

ii. situation (sunk in the water or not, duration)

iii. maintenance plan

d. The situation when the weir snapped

e. the figures of gate details

3) Measurement of rust (Not required)

) We should measure the damage of rust.

As the result we can estimate the method of repair and cost for the work.

i. what company have the machine to measure the rust ?

ii. How much does it cost to investigate the gate ?

5.Related information

1) The data for embankment

We would like to collect the data in case for the construction of embankment, taking into consideration of the following situation:

) a. ship transportation

b. city planning

c. factory planning

d. road planning

e. agricultural planning

f. others

2) The data of the drainage canal in upstream area

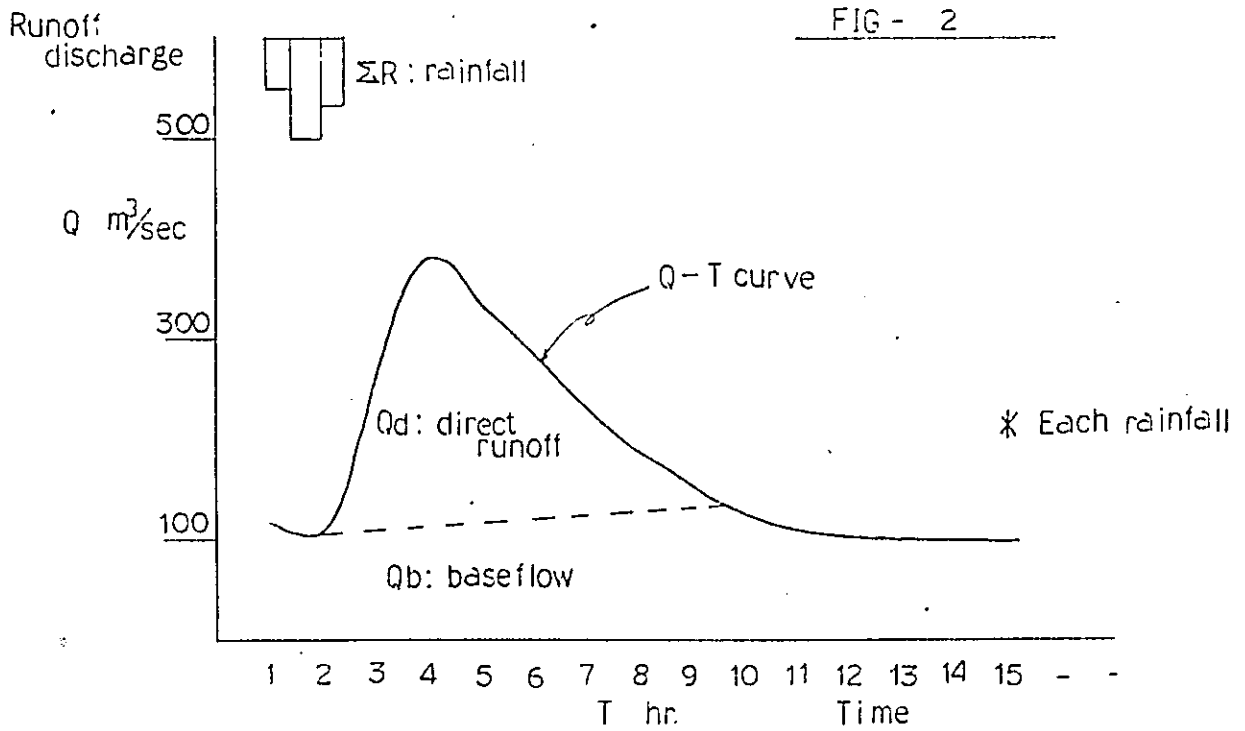
We would like to check the cross section of the drainage canal for the cross sections of drains that flows into Sq. Prai from paddy field is sufficient or not.

We should investigate place of narrow cross sections. For example, near the bridge or the box culvert.

3) The data of development in Sg. Prai river basin

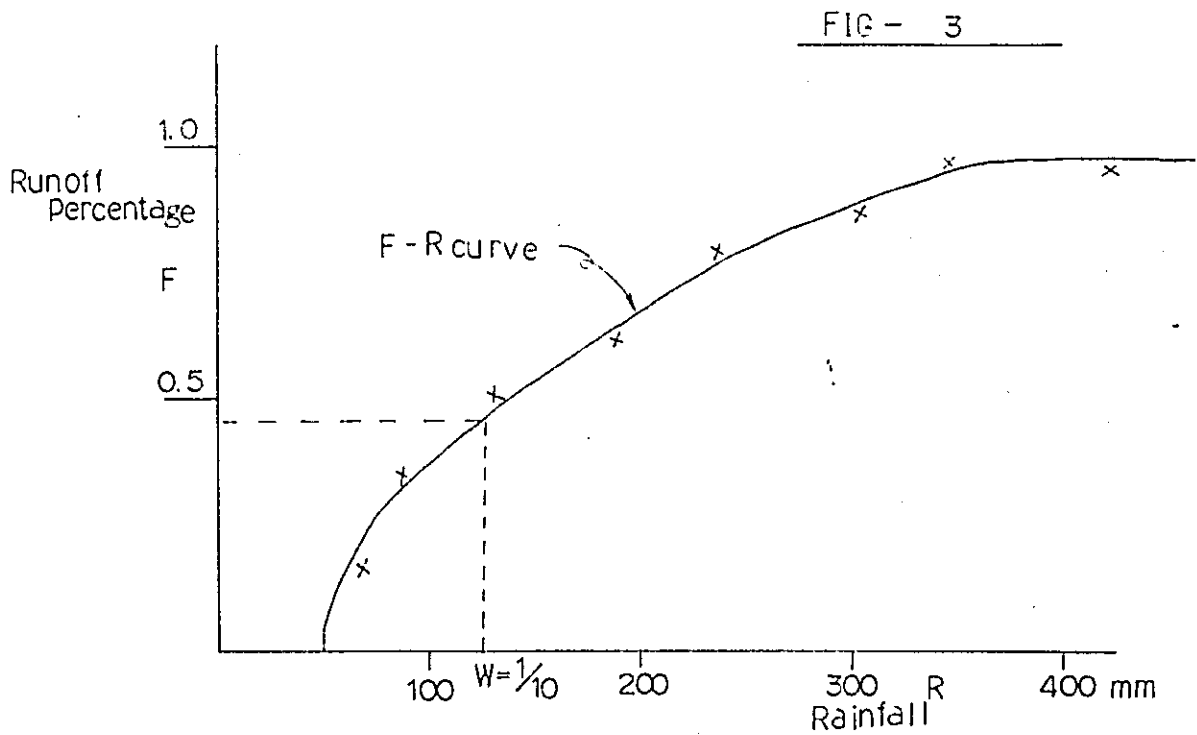
a. development plan

If there is a big development plan in catchment area, the runoff percentage will increase. We should check the flood at that time



$$F = \frac{Q_d}{\Sigma R \cdot CA}$$

CA: Catchment area



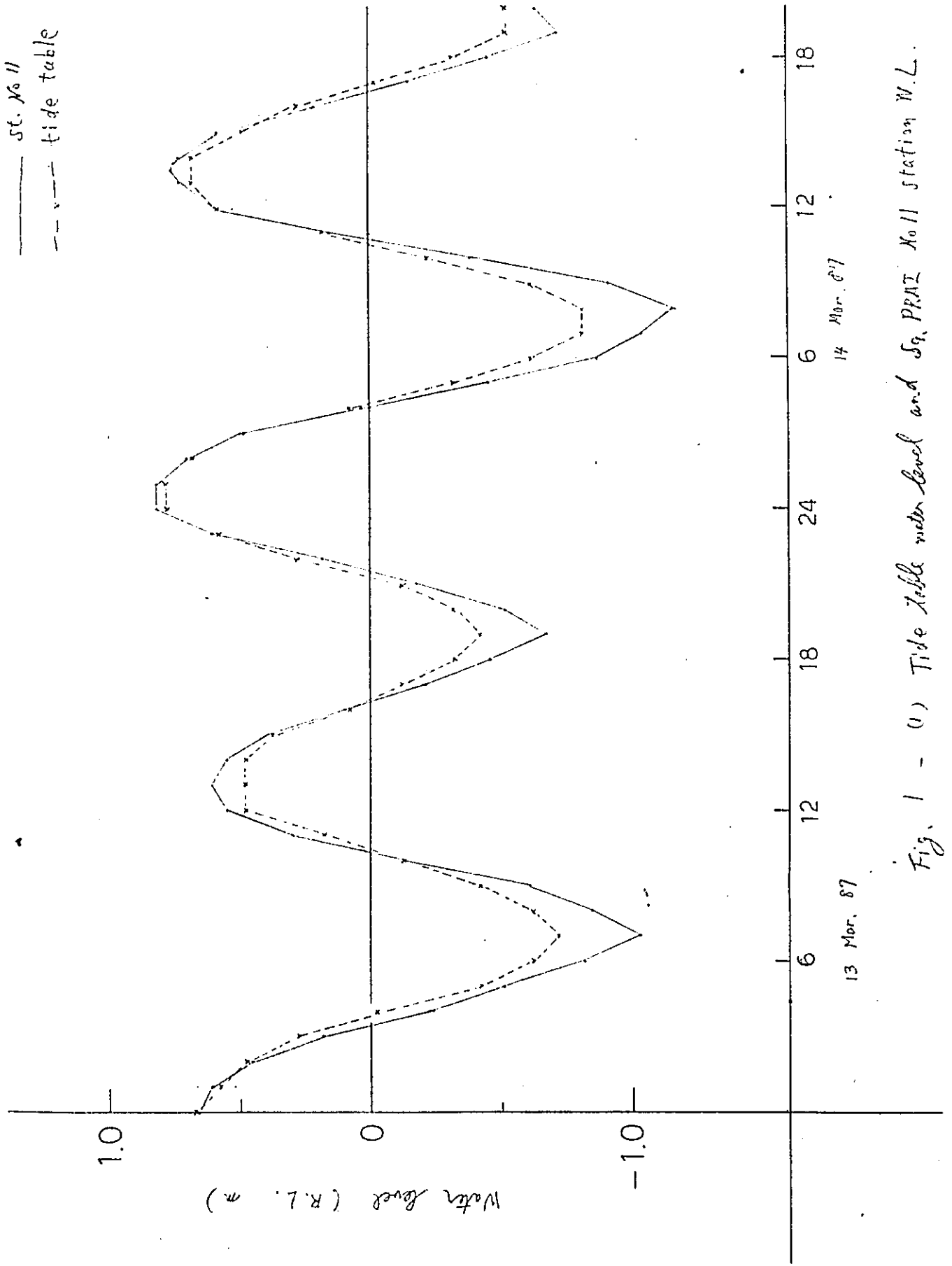
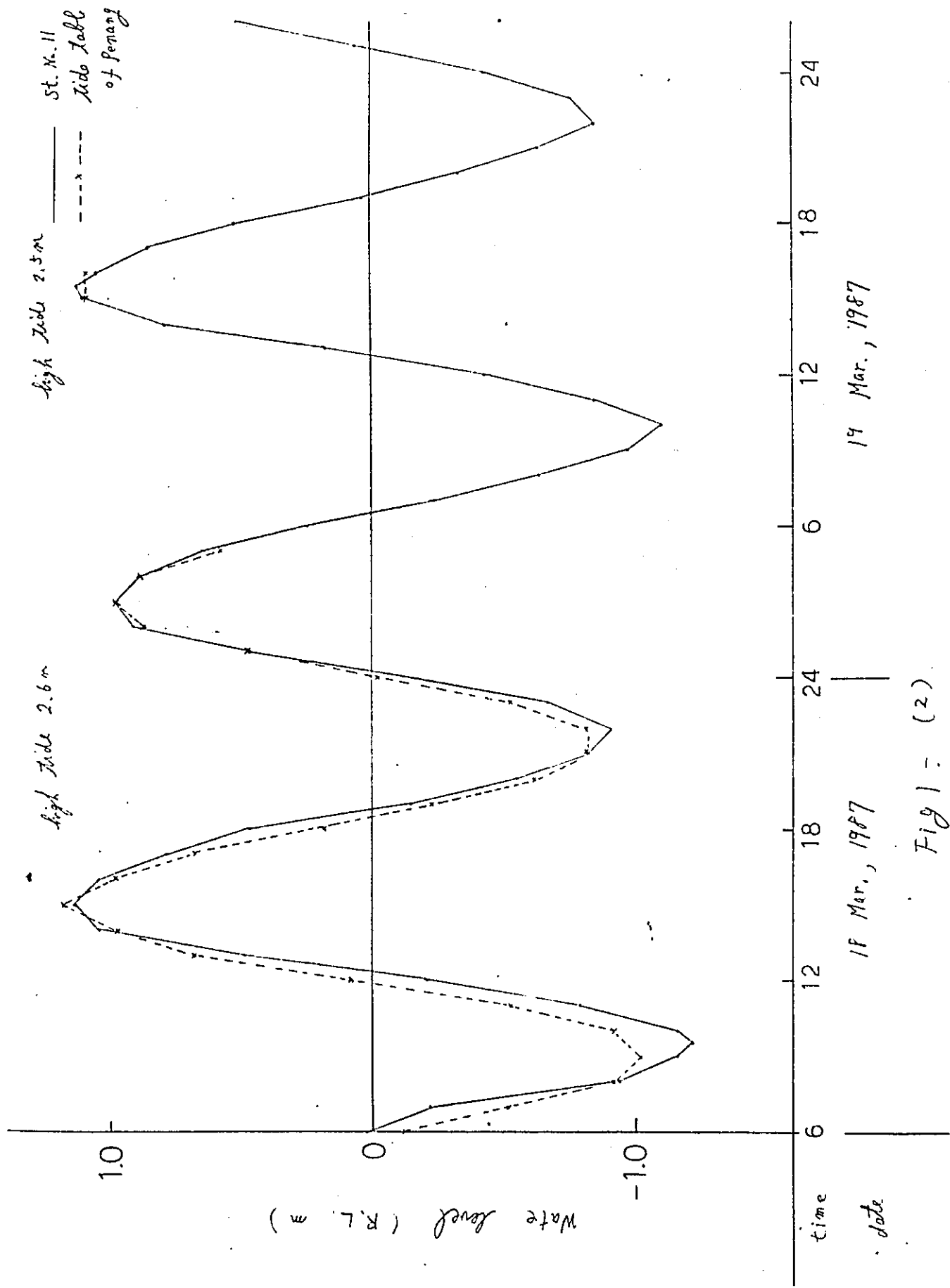


Fig. 1 - (1) Tide table water level and Sq. PRAZ No. 11 station W.L.



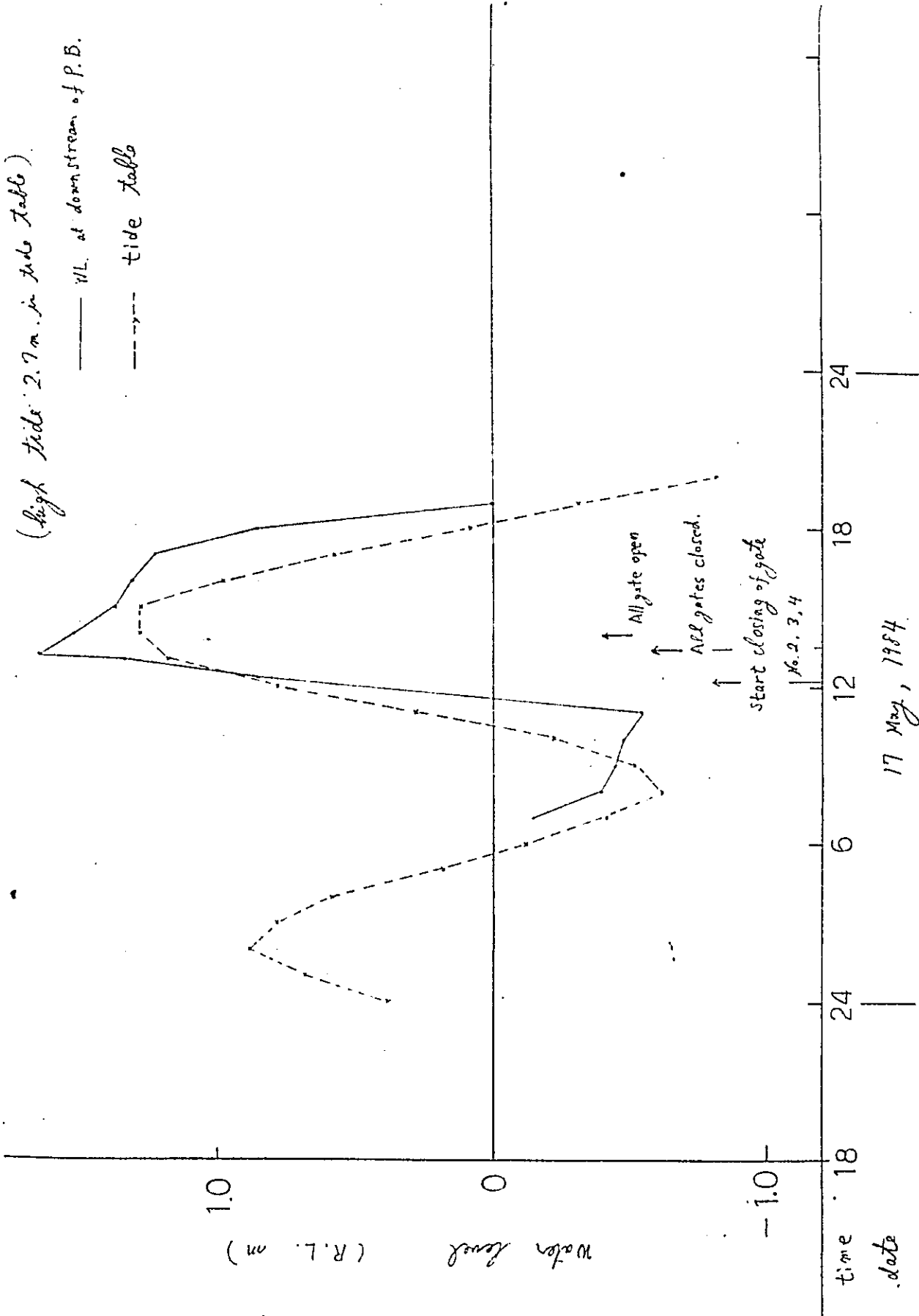


Fig. 4 water level in attempt operation on 17 May, 1984.

Station Name																		
Year	Summary of Rainfall (mm)												Max	Min	Total	Average		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					Total	Max
1958																		
1959																		
1960																		
1961																		
1962																		
1963																		
1964																		
1965																		
1966																		
1967																		
1968																		
1969																		
1970																		
1971																		
1972																		
1973																		
1974																		
1975																		
1976																		
1977																		
1978																		
1979																		
1980																		
1981																		
1982																		
1983																		
1984																		
1985																		
1986																		
1987																		
Total																		
Mean																		

There is data

There is not data

67
5
70

coming

OK

There is not data

GATE (BOOKS OF REFERENCE)

No.	BOOK'S NAME	REMARKS	
1	Kontek JPT. PP. 10A/78 Double Stage Roller Gates for Sungai Perai Barrage Instruction manual of operation and maintenance.	KUMPULAN TEKNIK SDN. BHD.	OK
2	Brief Operation Instruction	KUMPULAN TEKNIK SDN. BHD.	OK
3	Tender Documents For Sub-Contract Double Stage Roller Gates	Sg. Perai Drainage and Reclamation Project VOLUME II. 1968	OK
4	Sub-Contract for Double Stage Roller Gates	" Instructions to Tenderer 1978	OK.
5	Approval document of all paints and coatings		<u>State D.I.D.</u>
6	Newspapers informed of the flood		<u>State D.I.D.</u>
7			

GATE FIGURE

No.	Figure's Name	Drawing No.	Remark	
1	Sungai Perai Tidal Barrage (Electrical Control)	KT/SP/E-1	Kumpulan Teknik SDN. BHD.	OK
2	Sungai Perai Tidal Barrage (Hydraulic system)	KT/SP/E-2	Kumpulan Teknik SDN. BHD.	OK
3	Sungai Perai Tidal Barrage (Equipment Layout plan)	KT/SP/E-3	Kumpulan Teknik SDN. BHD. Scale 1" = 25'	OK
4	Detail figure of gates			OK
5				
6				
7				

3. Observation of water level

We will observe the water level at $5\frac{1}{2}$ and $18\frac{1}{3} \sim 19\frac{1}{3}$.
We will be able to get the high tide data.

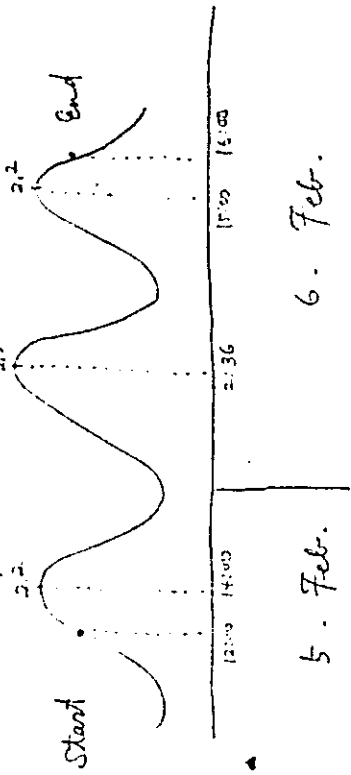
< Object >

To increase the accuracy of simulation model

< Duration >

About 24 hours

[For example] $4\frac{1}{2}/88 \sim 5\frac{1}{2}/88$

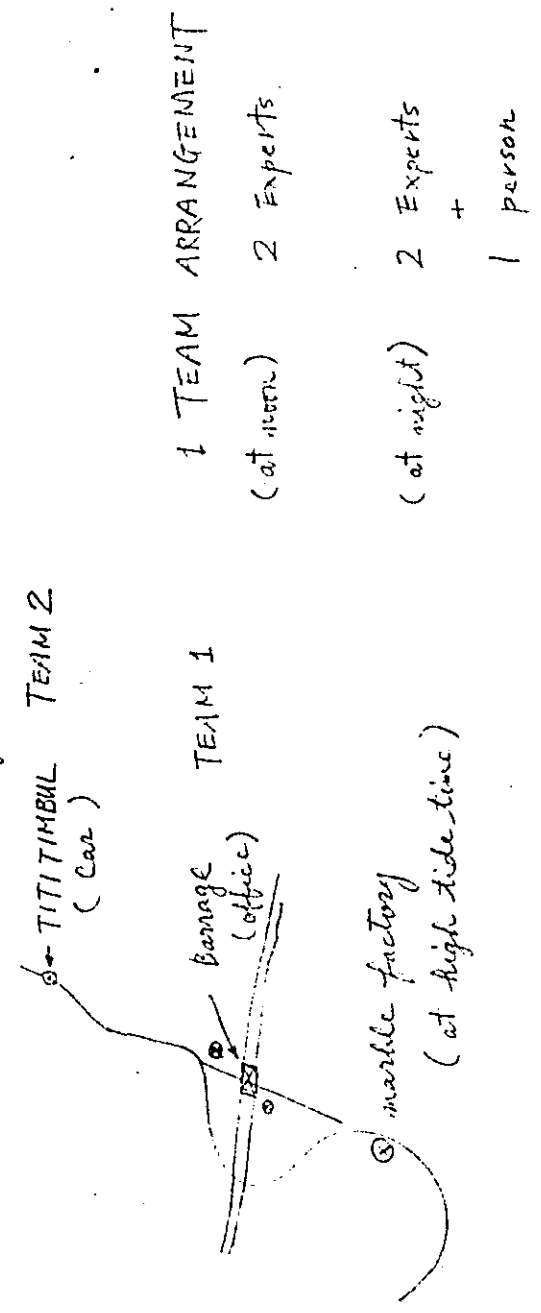


< Interval of observation >

30 min.

We will observe the w.l. at high tide time.

< Observation places and arrangement >



(remarks) 1. To clean the staff gauge.

6. Water level data for simulation ~ OK ~

1). NO. 1A TITI TIMBUL

2). SG. SAMA GAGAH.

3). NO. 7

4). NO. 5

5). NO. 8

6). NO. 11

CHECK LIST TABLE. (3. (H) Hydrology, 3. (M) Meteorological data, 6. Related information)

(We will get the data for simulation analysis)

1 Rainfall data ~ Requested ~ (ref. Table. 1) Action ; State D.I.D.

(1) an observation station

- A) 5504035 LAHAR IKAN MATI
- C) 5404041 MARAKOFF ESTATE
- D) 5403042 METEOROLOGICAL STATION BUTTERWORTH
- G) 5404043 SG. KLIM HEADWORKS
- I) 5404044 BUKIT MERAH PADI STATION
- J) 5304047 BUKIT MERTAJAM ESTATE
- L) 5304045 BUKIT BERAPIT RESERVOIR

2. another observation station (nearby)

(2) a term ~ Requested ~ Action ; State D.I.D.

i) 1 Day maximum 1967 ~ '70, 1981 ~ '87

ii) Monthly 1981 ~ '87

(3) the data by the hour ~ Requested ~ Action ; State D.I.D.

2 The runoff discharge (same as 3. 4). 2)

the data by the hour ~ Requested ~ Action ; State D.I.D.

3 Meteorological data ~ 1984.5.1 ~ 31 ~

~ Requested ~ the data by the day Action ; State D.I.D.

- 1) Atmospheric pressure
- 2) Air temperature
- 3) Humidity
- 4) Sunshine
- 5) Rainfall
- 6) Wind speed

4. Land use ~ Requested ~
cropping pattern

Action ; State D.I.D.

5 Related information ~ Requested ~

not Required

ex. 1) Ship transport

2) Development plan

i) city planning

ii) Factory planning

iii) Road planning

iv) Agricultural planning

v) Other's planning

The area is fully developed,
so, the following information
are not required.

3) The data of the drainage canal in upstream area. D.I.D. IADP

4) The data of development in Sg. Prai river basin not required

CHECK LIST TABLE

(4. gate operation data 5. gate)

4. Gate operation data

i) The report of gate operation on 17th May, 1984.

Action ; State D.I.D.

5. Gate

i) The way how to operate the gate

- do. -

ii) moving time from 17 May, 1984

- do. -

iii) situation

- do. -

iv) the figures of gate

collected

2. A DAILY OF OPERATION STUDY

A DAILY OF GATE OPERATION STUDY

JAN. 18 (MON) ARRIVED AT KUALA LUMPUR
JAN. 19 (TUE) PAID COURTESY CALL ON D.I.D
EMBASSY OF JAPAN AND JICA.KL OFFICE
JAN. 20 (WED) ARRIVED AT PENANG
PAID COURTESY CALL ON STATE D.I.D PENANG
JAN. 21 (THU) DISCUSSION OF THE PREPARATION OF THE STUDY
JAN. 22 (FRI) DISCUSSION OF STUDY (STATE D.I.D)
JAN. 23 (SAT) DISCUSSION OF RIVER SURVEYING
AND CHECK OF CROSSLEVELING OF RIVER
JAN. 24 (SUN) * * *

JAN. 25 (MON) MEETING OF SURVEYING ON DOWNSTREAM CROSS SECTION
JAN. 26 (TUE) FIELD INVESTIGATION IN K2 K3 AREA
JAN. 27 (WED) MEETING ON SURVEYING AT FIELD INVESTIGATION OF PRAI BARRAGE
MEETING ON INSTALLING OF AUTOMATIC WATERLEVEL RECORDER
JAN. 28 (THU) STUDY OF COLLECTION DATA
COLLECTION OF DATA AT STATE D.I.D OFFICE
JAN. 29 (FRI) MEETING ON OBSERVATION OF WATERLEVEL (5-6 FEB. 1988)
JAN. 30 (SAT) FIELD INVESTIGATION IN SWAMP AREA
JAN. 31 (SUN) * * *

FEB. 1 (MON) STUDY OF COLLECTION DATA
VISITED BY OFFICER OF JICA
FEB. 2 (TUE) HOLIDAY BY TAIPU SAM
FEB. 3 (WED) MAKE REPORT FOR DISCUSSION (4 FEB.)
INVESTIGATION OF PRAI BARRAGE
FEB. 4 (THU) DISCUSSION OF THE STUDY
FEB. 5 (FRI) OBSERVATION OF WATERLEVEL AT SG. PRAI
VISITED BY OFFICER OF JICA
FEB. 6 (SAT) OBSERVATION OF WATERLEVEL AT SG. PRAI
FEB. 7 (SUN) * * *

FEB. 8 (MON) STUDY OF COLLECTION DATA
FEB. 9 (TUE) --- DO ---
FEB. 10 (WED) TESTRUN OF SIMULATION MODEL BY MINI-COMPUTER
MEETING ON SURVEYING AT RIVER
FEB. 11 (THU) STUDY OF COLLECTION DATA
FEB. 12 (FRI) STUDY OF COLLECTION DATA
LEFT PENANG FOR KL
FEB. 13 (SAT) STUDY OF COLLECTION DATA
MAKE A INTERIM REPORT
FEB. 14 (SUN) * * *

FEB. 15 (MON) MEETING OF STUDY AT D.I.D HEADQUARTER K.L
 FEB. 16 (TUE) ARRANGED DISCUSSION OF THE INTERIM REPORT
 FEB. 17 (WED) TAKASHI KATO (TEAM LEADER) RETURN TO JAPAN
 HOLIDAY BY CHINESE NEW YEAR
 FEB. 18 (THU) HOLIDAY BY CHINESE NEW YEAR
 FEB. 19 (FRI) COLLECTED ON THE DATA (A METEOROLOGICAL OBSERVATORY ATK.L)
 FEB. 20 (SAT) COLLECTED ON THE DATA
 FEB. 21 (SUN) * * *

FEB. 22 (MON) STUDY OF COLLECTION DATA
 FEB. 23 (TUE) STUDY OF COLLECTION DATA
 SURVEYING AT UPSTREAM ON BARRAGE (LEFT SIDE)
 FEB. 24 (WED) STUDY OF COLLECTION DATA
 FEB. 25 (THU) SURVEYING AT UPSTREAM ON BARRAGE (RIGHT SIDE)
 FEB. 26 (FRI) STUDY OF COLLECTION DATA
 FEB. 27 (SAT) --- DO ---
 FEB. 28 (SUN) * * *

FEB. 29 (MON) INVESTIGATED WATERLEVEL STATION AND RAINFALL STATION

MAR. 1 (TUE) ARRIVED OBSERVATION,S INSTRUMENT FROM JAPAN (JICA)
 MAR. 2 (WED) INVESTIGATION AT KERIAN BARRAGE (PERAK STATE)
 MAR. 3 (THU) STUDY OF COLLECTION DATA
 MAR. 4 (FRI) INVESTIGATION FOR FIXED AUTOMATIC WATERLEVEL RECORDER
 MAR. 5 (SAT) STUDY OF COLLECTION DATA
 MAR. 6 (SUN) * * *

MAR. 7 (MON) INVESTIGATION AT MADA BARRAGE (KEDAK STATE)
 MAR. 8 (TUE) COLLECTED ON THE DATA AT MADA
 MAR. 9 (WED) SURVEYING FOR DRAINAGE CHANEL AT DOWNSTREAM ON BARRAGE
 MAR. 10 (THU) STUDY OF COLLECTION DATA
 MAR. 11 (FRI) INVESTIGATED BARRAGE AND FACTORY AREA
 AT DOWNSTREAM ON BARRAGE (RIGHT SIDE)
 MAR. 12 (SAT) INVESTIGATED BARRAGE
 MAR. 13 (SUN) * * *

MAR. 14 (MON) FIXED AUTOMATIC WATERLEVEL RECORDER
 MAR. 15 (TUE) --- DO ---
 MAR. 16 (WED) --- DO ---
 MAR. 17 (THU) STUDY OF COLLECTION DATA AND WRITE REPORT
 MAR. 18 (FRI) --- DO ---
 MAR. 19 (SAT) OBSERVATION OF WATERLEVEL
 MAR. 20 (SUN) * * *

MAR. 21 (MON) STUDY OF COLLECTION DATA AND WRITE REPORT
MAR. 22 (TUE) --- DO ---
MAR. 23 (WED) --- DO ---
MAR. 24 (THU) MEETING ON STUDY WITH STATE D.I.D AT KOMTAR
MAR. 25 (FRI) WRITE REPORT
MAR. 26 (SAT) WRITE REPORT AND TO K.L
MAR. 27 (SUN) * * *

MAR. 28 (MON) WRITE REPORT
MAR. 29 (TUE) MEETING ON STUDY AT D.I.D K.L
MAR. 30 (WED) LEAVE MALAYSIA AND TO JAPAN