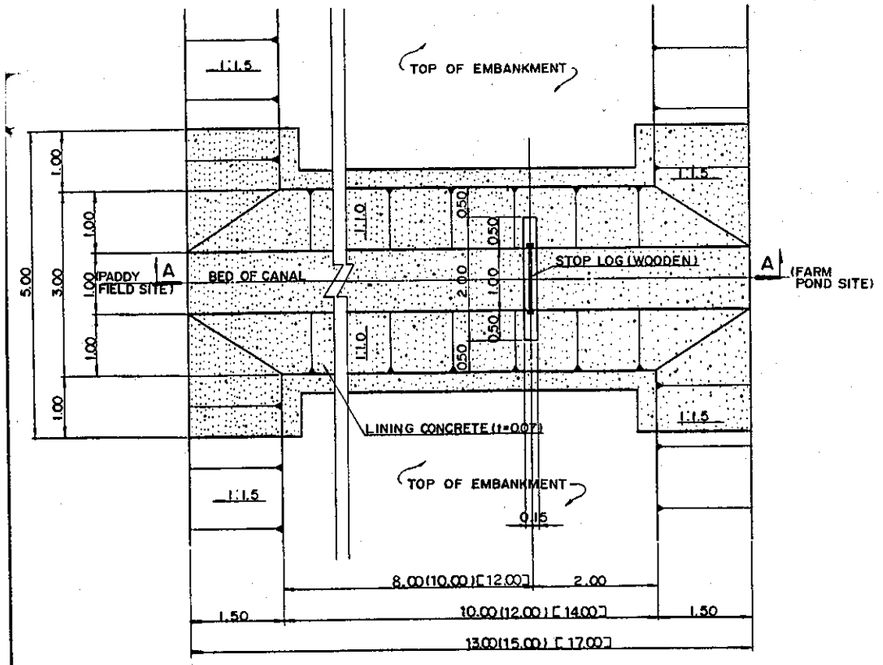
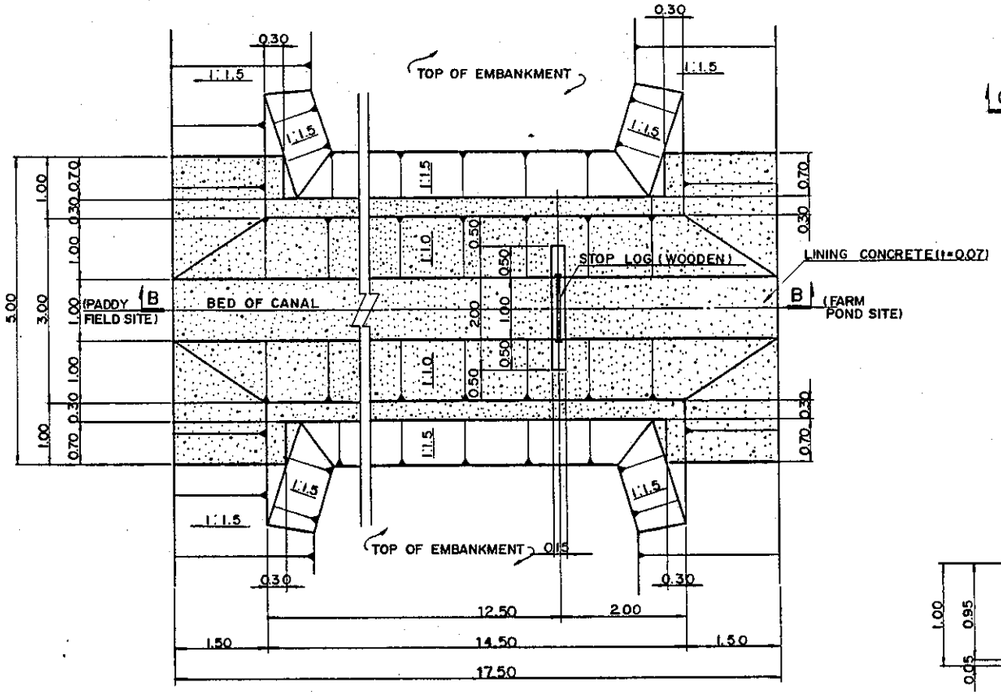


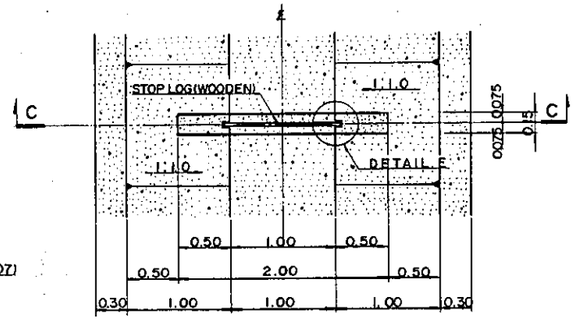
PLANE OF INLET (EMBANKMENT HEIGHT = 1.0m)

SCALE 1 : 50



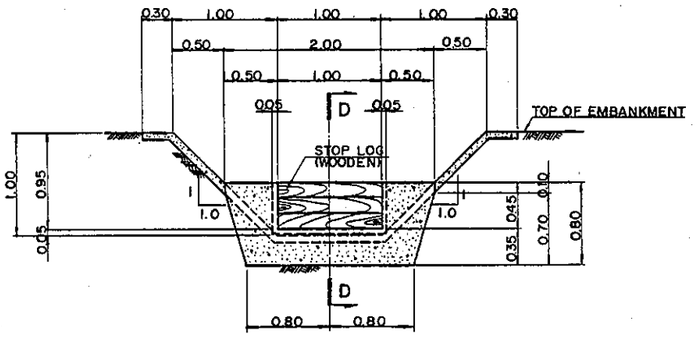
PLANE OF INLET (EMBANKMENT HEIGHT = 1.5m)

SCALE 1 : 50



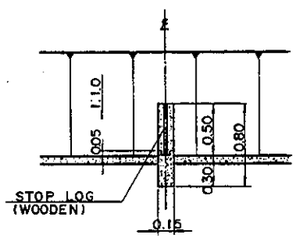
PLANE OF FLASH BOARD WEIR

SCALE 1 : 30



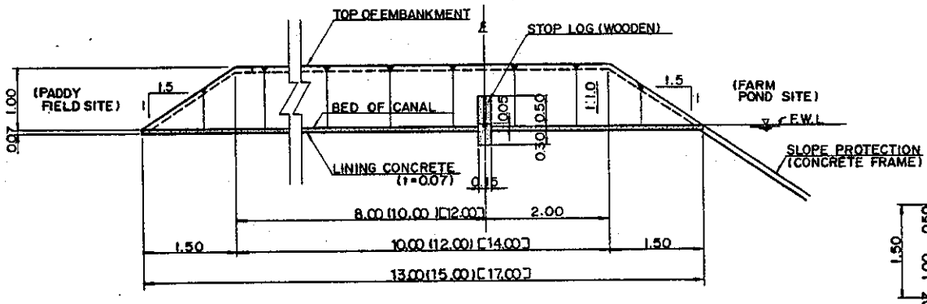
SECTION C – C

SCALE 1 : 30



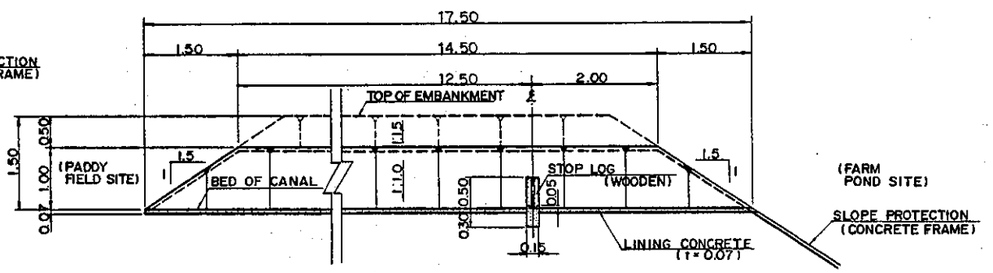
SECTION D – D

SCALE 1 : 30



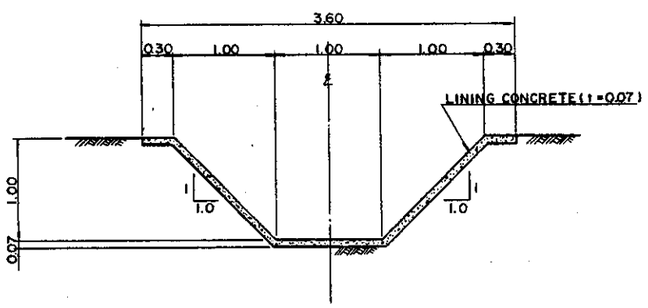
LONGITUDINAL (SECTION A – A)

SCALE 1 : 50



LONGITUDINAL (SECTION B – B)

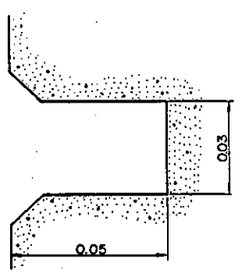
SCALE 1 : 50



STANDARD SECTION

SCALE 1 : 30

- THE LENGTH OF INLET IS ADJUSTED TO THE EMBANKMENT LENGTH. THE TOLERANCE IS PLUS OR MINUS 1.5 MS. AGAINST THE STANDARD LENGTH WRITTEN IN THE DRAWING.



DETAIL E

SCALE 1 : 1

NOTE.

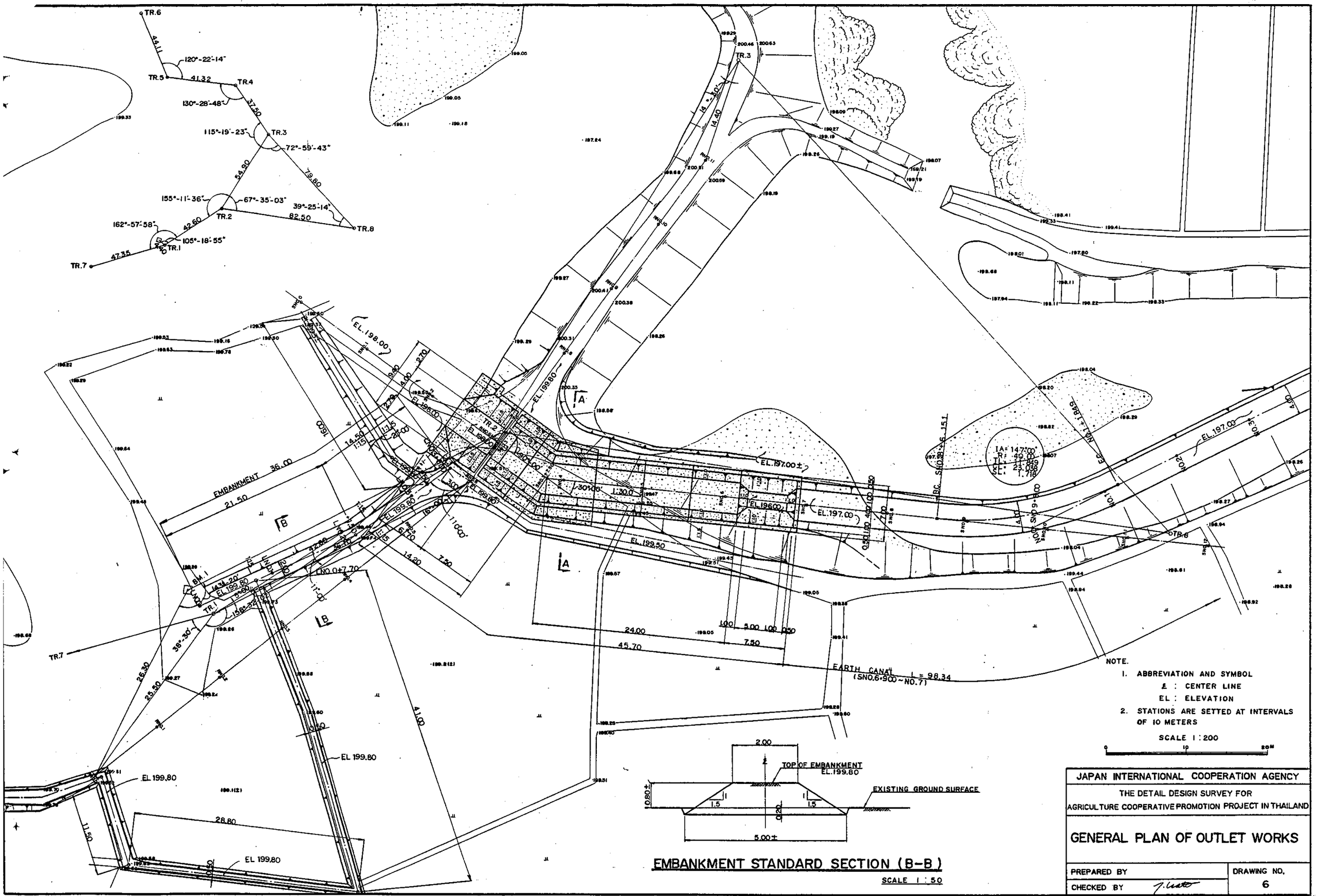
1. ABBREVIATION AND SYMBOL
   ℄ : CENTER LINE
2. WOODEN PARTS SHALL BE TREATED WITH WATERPROOF CHEMICAL FOR AGENT.

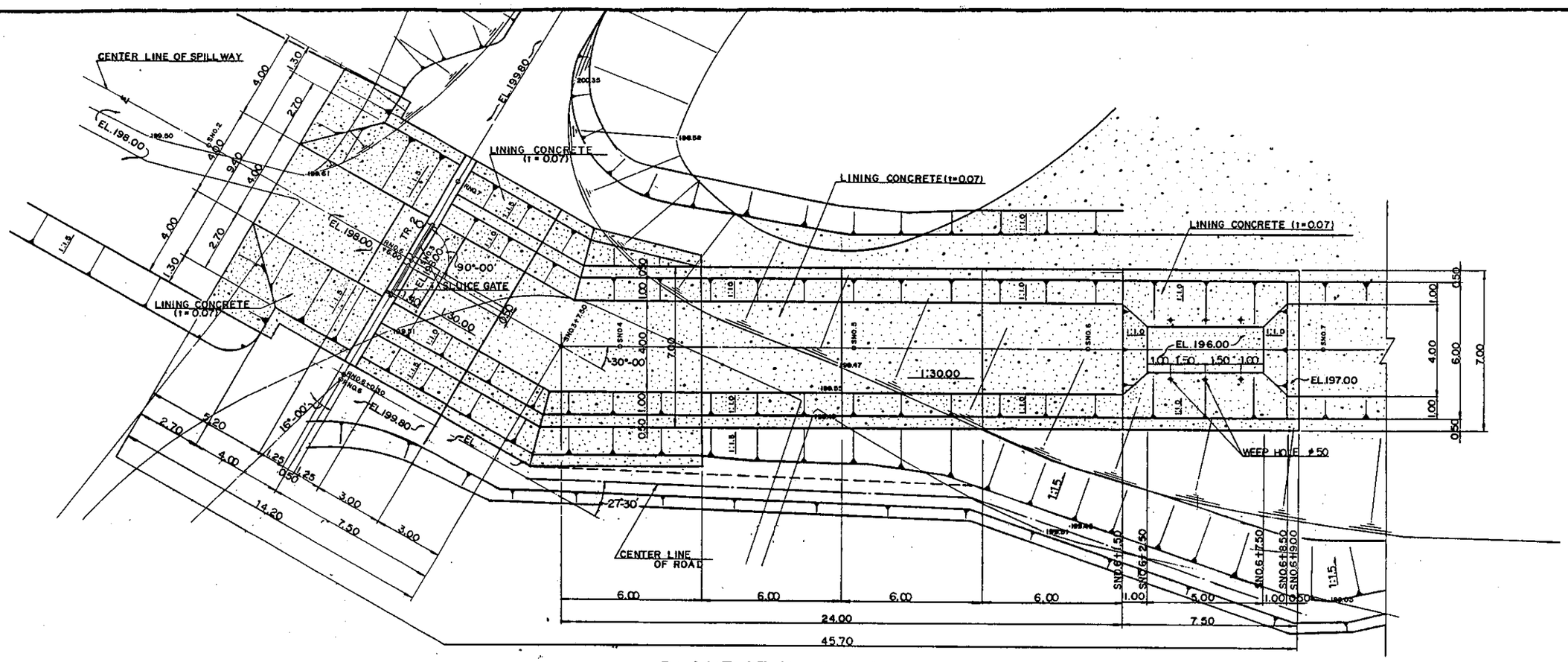
JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATIVE PROMOTION PROJECT IN THAILAND

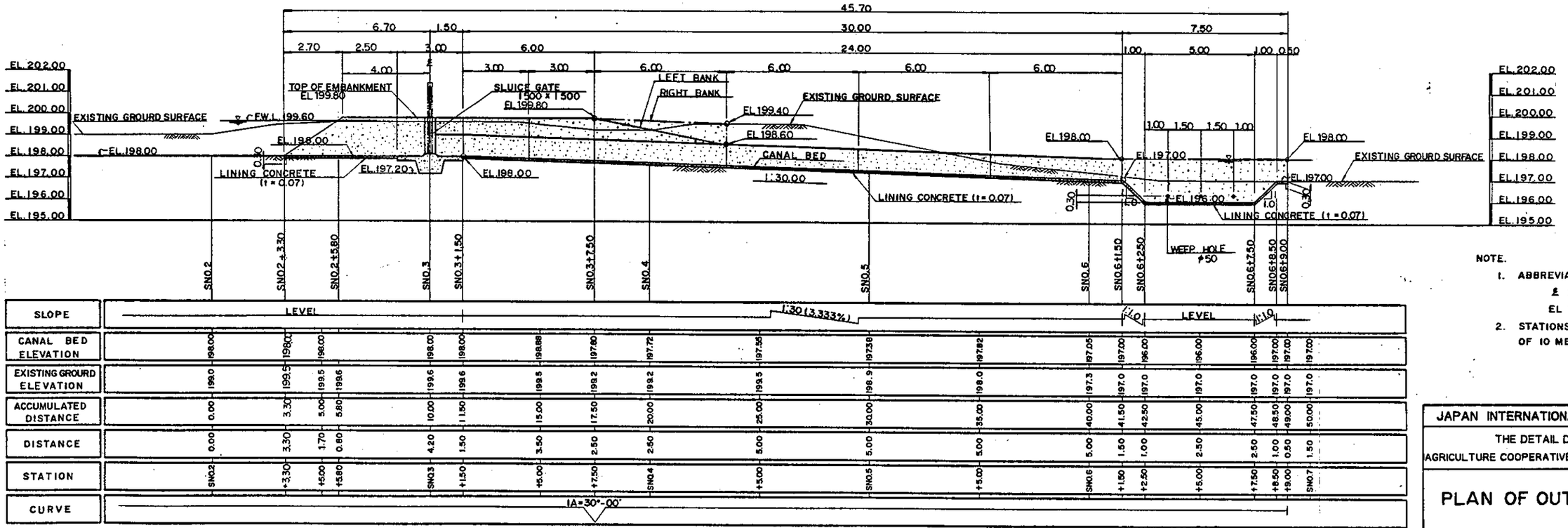
PLAN OF INLET

PREPARED BY	DRAWING NO.
CHECKED BY	5


TR.6
TR.5
TR.4
TR.3
TR.2
TR.1
TR.7
TR.8
44.11
120°-22'-14"
41.32
130°-28'-48"
37.50
115°-19'-23"
72°-55'-43"
54.90
79.80
155°-11'-36"
67°-35'-03"
39°-25'-14"
162°-57'-58"
42.60
82.50
105°-18'-55"
47.35
EL.198.00
EL.199.80
EL.199.50
EL.197.00±
EL.196.00
EMBANKMENT 36.00
21.50
BM.1
EL 199.80
TUNNEL
NO.0+7.70
EARTH CANAL L = 98.34
(SNO.6+900 ~ NO.7)
24.00
45.70
7.50
28.80
11.50
EL 199.80
TOP OF EMBANKMENT
EL.199.80
EXISTING GROUND SURFACE
2.00
5.00±
EMBANKMENT STANDARD SECTION (B-B)
SCALE 1 : 50
NOTE.
1. ABBREVIATION AND SYMBOL
℄ : CENTER LINE
EL : ELEVATION
2. STATIONS ARE SETTED AT INTERVALS OF 10 METERS
SCALE 1 : 200
JAPAN INTERNATIONAL COOPERATION AGENCY
THE DETAIL DESIGN SURVEY FOR
AGRICULTURE COOPERATIVE PROMOTION PROJECT IN THAILAND
GENERAL PLAN OF OUTLET WORKS
PREPARED BY
CHECKED BY
DRAWING NO.
6



PLANE OF SPILLWAY SCALE 1:100



LONGITUDINAL SECTION SPILLWAY SCALE 1:100

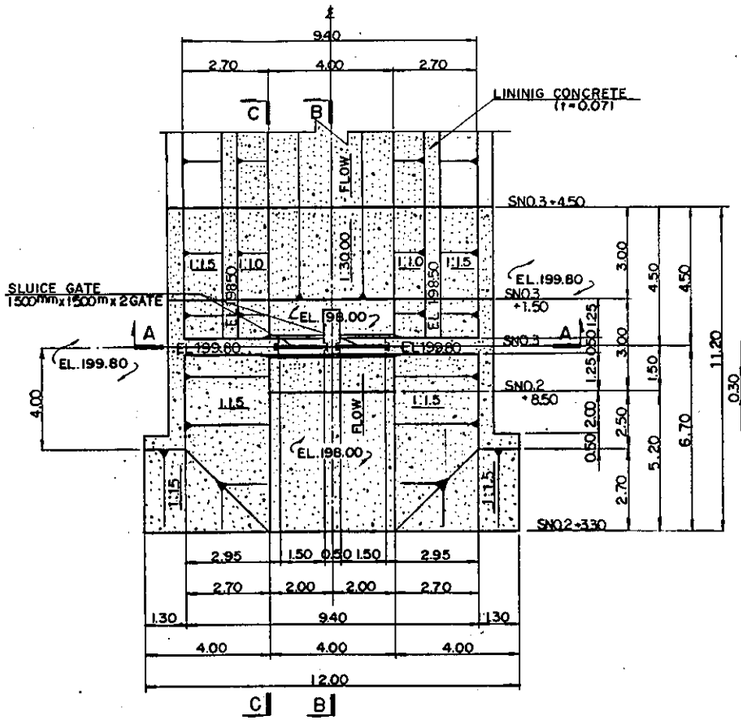
NOTE.
1. ABBREVIATION AND SYMBOL
   ℄ : CENTER LINE
   EL : ELEVATION
2. STATIONS ARE SETTED AT INTERVALS OF 10 METERS

JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATIVE PROMOTION PROJECT IN THAILAND

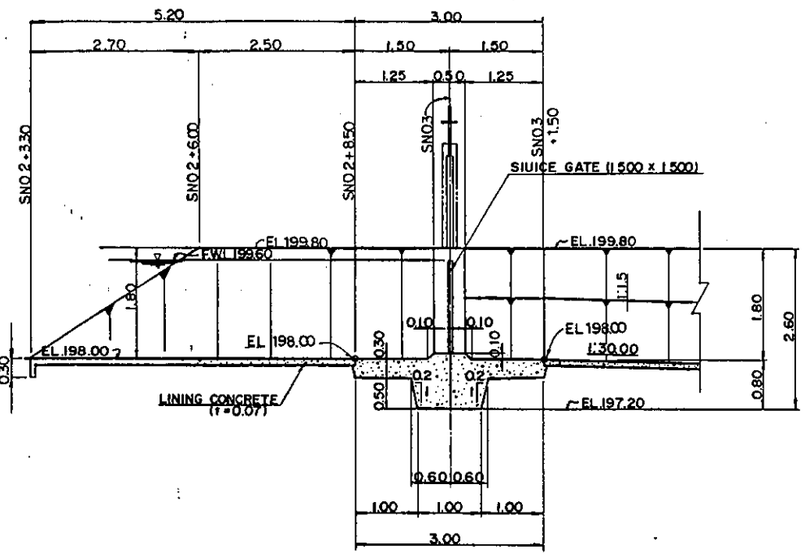
PLAN OF OUTLET WORKS (1)

PREPARED BY	DRAWING NO.
CHECKED BY	7



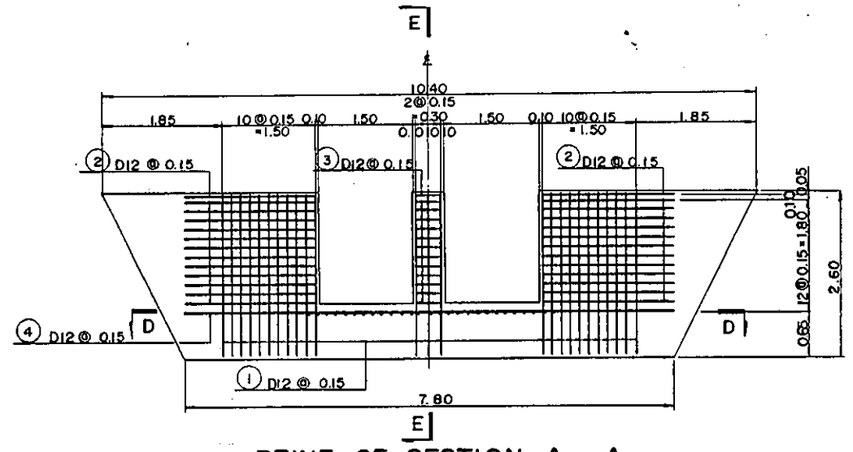
PLANE OF SPILLWAY

SCALE 1:100



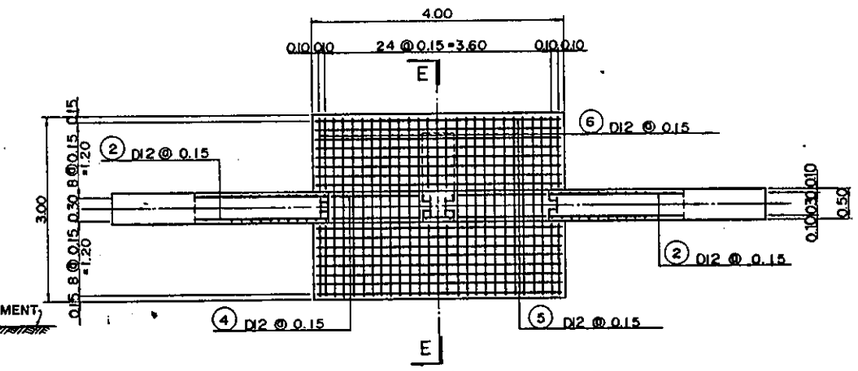
SECTION B—B

SCALE 1:50



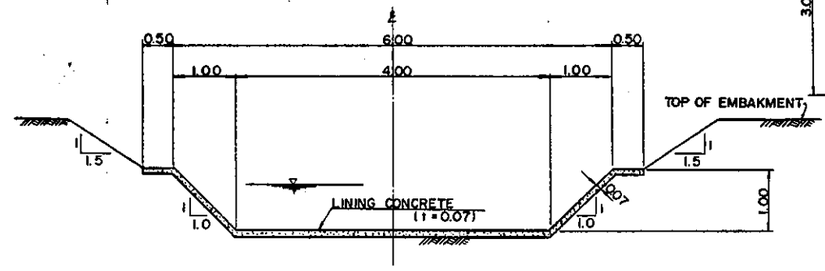
REINF. OF SECTION A—A

SCALE 1:50



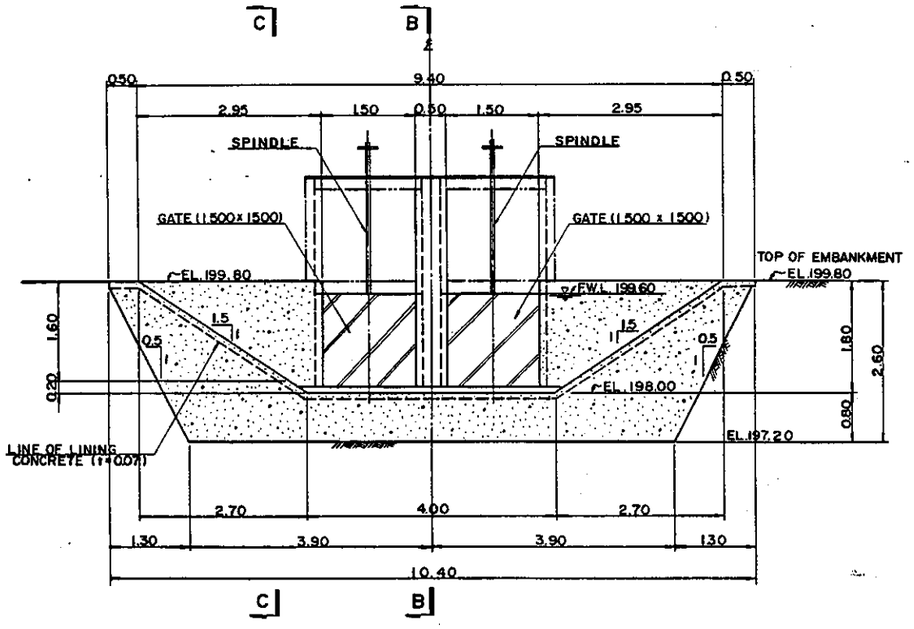
REINF. OF SECTION D—D

SCALE 1:50



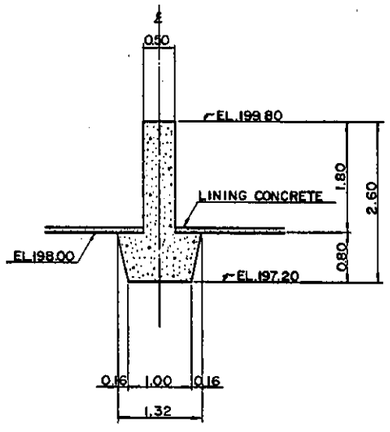
SPILL WAY STANDARD SECTION

SCALE 1:50



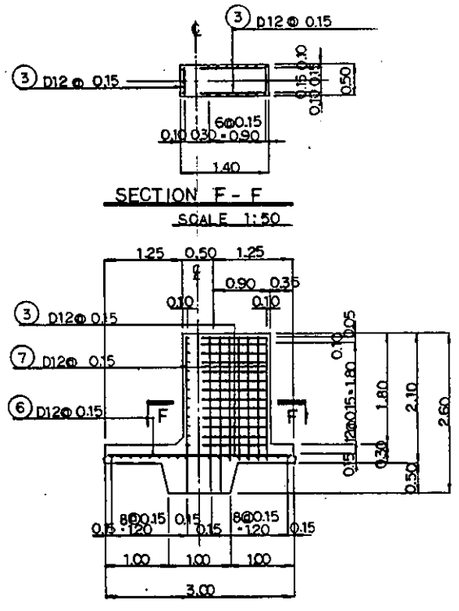
SECTION A—A

SCALE 1:50



SECTION C—C

SCALE 1:50



SECTION E-E

SCALE 1:50

SECTION F-F

SCALE 1:50

NOTE.

1. ABBREVIATION AND SYMBOL
   ℄ : CENTER LINE
   EL : ELEVATION
2. ALL REINFORCING STEEL TO BE DEFORM BAR

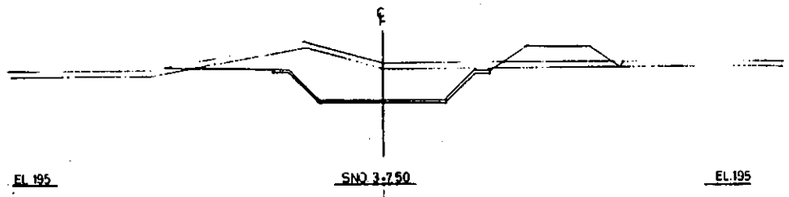
LENGH OF LAP AND ANCHORAGE (USE SD30)
30 BAR DIAMETER
COVER FOR REINFORCING TO BE 5cm MINIMUM

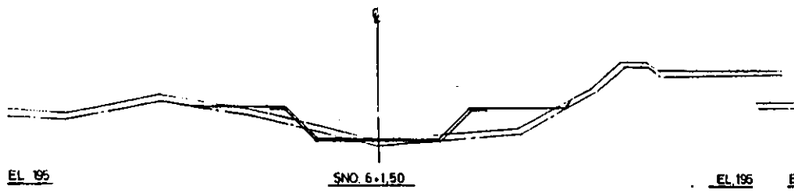
JAPAN INTERNATIONAL COOPERATION AGENCY

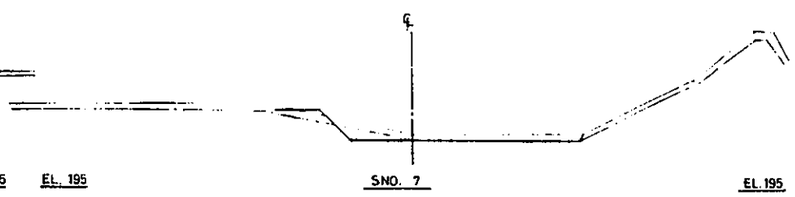
THE DETAIL DESIGN SURVEY FOR
AGRICULTURE COOPERATIVE PROMOTION PROJECT IN THAILAND

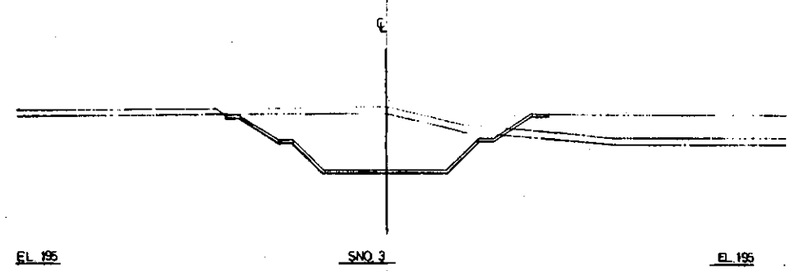
PLAN OF OUTLET WORKS (2)

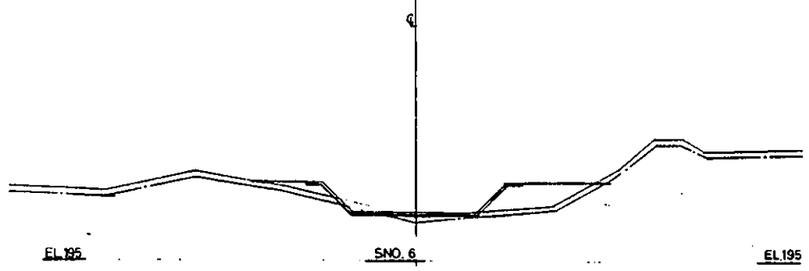
PREPARED BY	DRAWING NO.
CHECKED BY	8

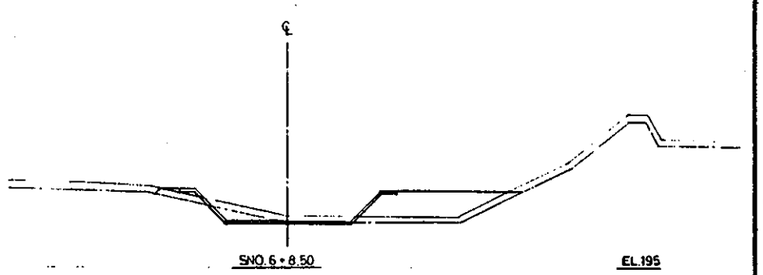


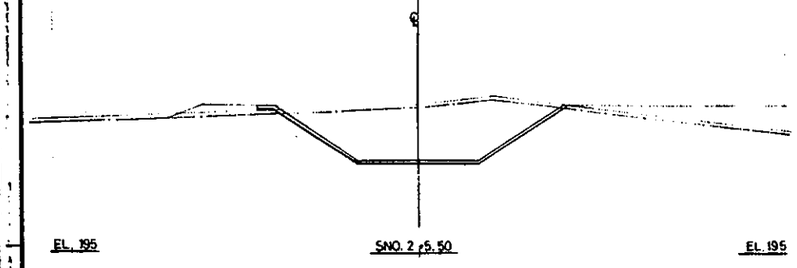


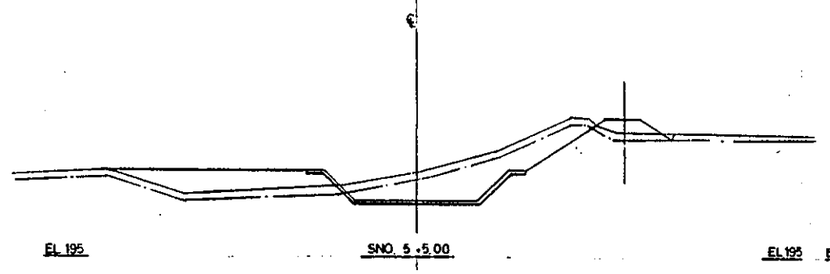


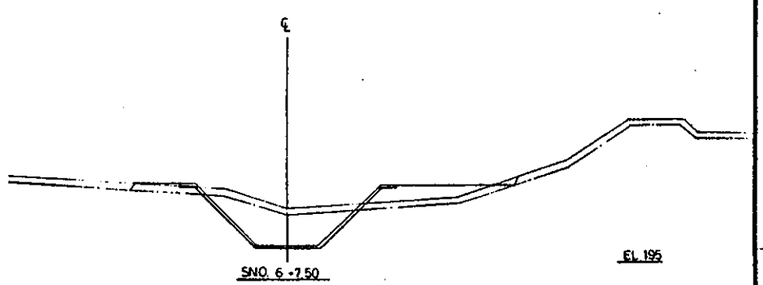


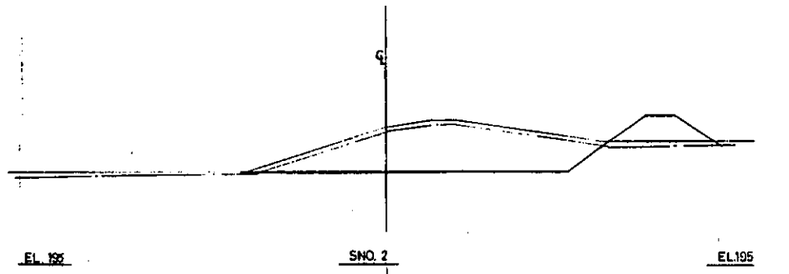


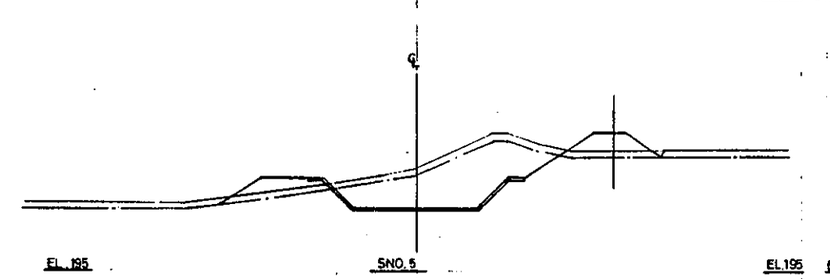


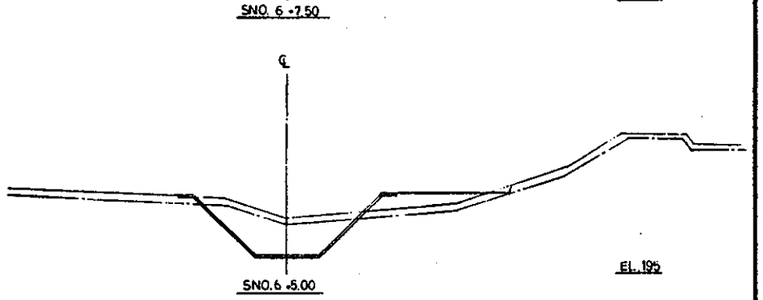


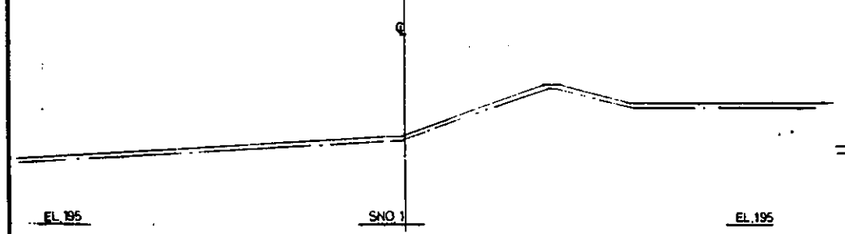


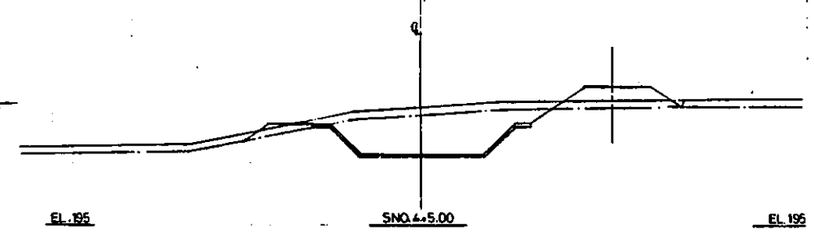


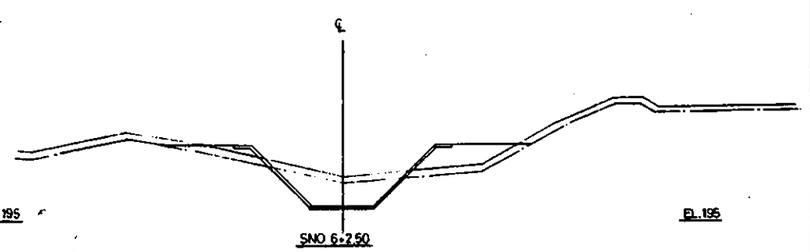


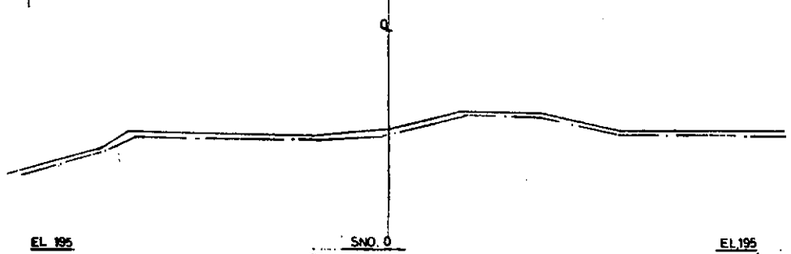


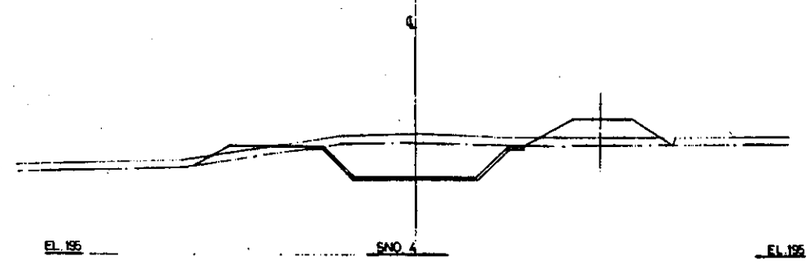












NOTE

1) ABBREVIATION AND SYMBOL

℄ – CENTER LINE

EL. – ELEVATION

2) STATION NO. ARE SHOWN IN DRAWING NO. 6

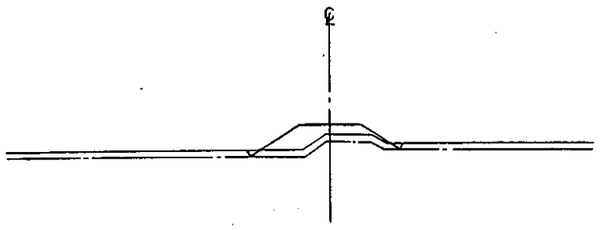
CROSS SECTION
scale 1:100

JAPAN INTERNATIONAL COOPERATION AGENCY

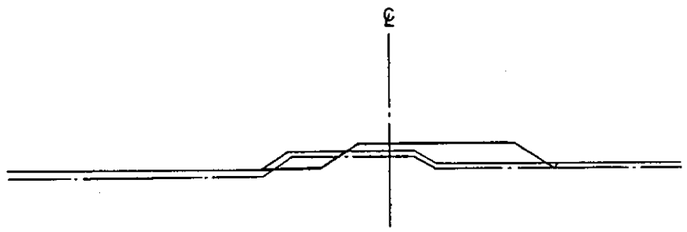
THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATION PROMOTION PROJECT IN THAILAND

CROSS SECTION (1)

PREPARED BY	DRAWING NO.
CHECKED BY	9



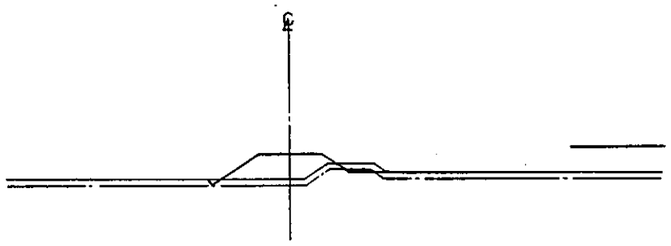
L NO. 1 + 5.00



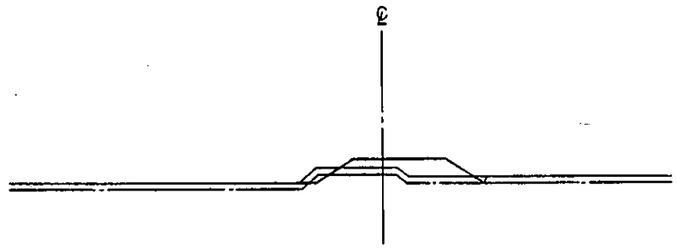
L NO. 3 + 6.00

NOTE.

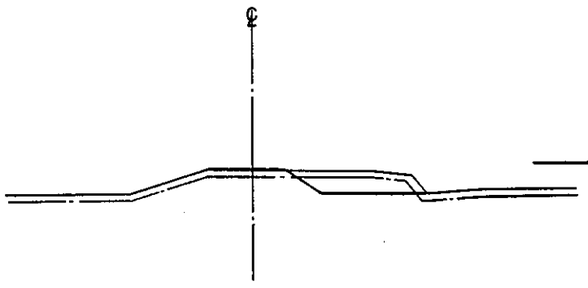
1. ABBREVIATION AND SYMBOL
   ℄ : CENTER LINE
   EL: ELEVATION
2. STATION NO. ARE SHOWN IN DRAWING NO. 6



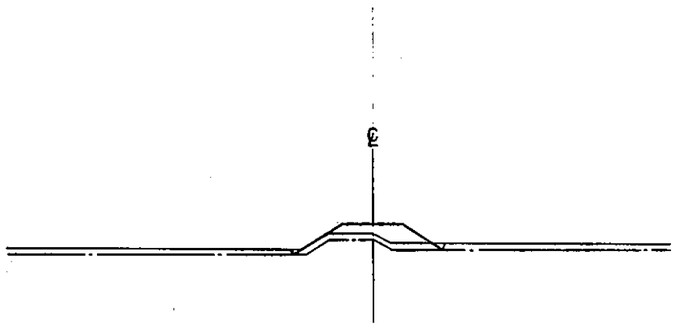
L NO. 1



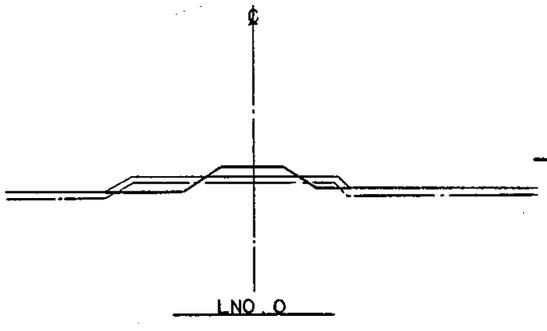
L NO. 3



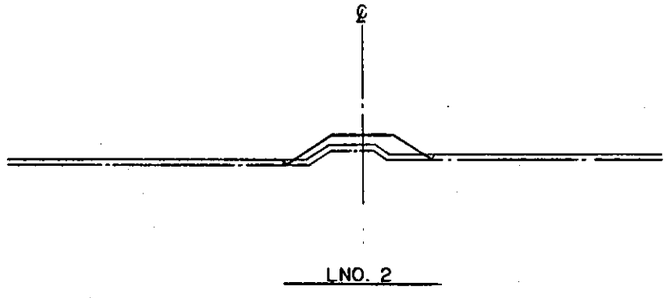
L NO. 0 + 5.00



L NO. 2 + 5.00



L NO. 0

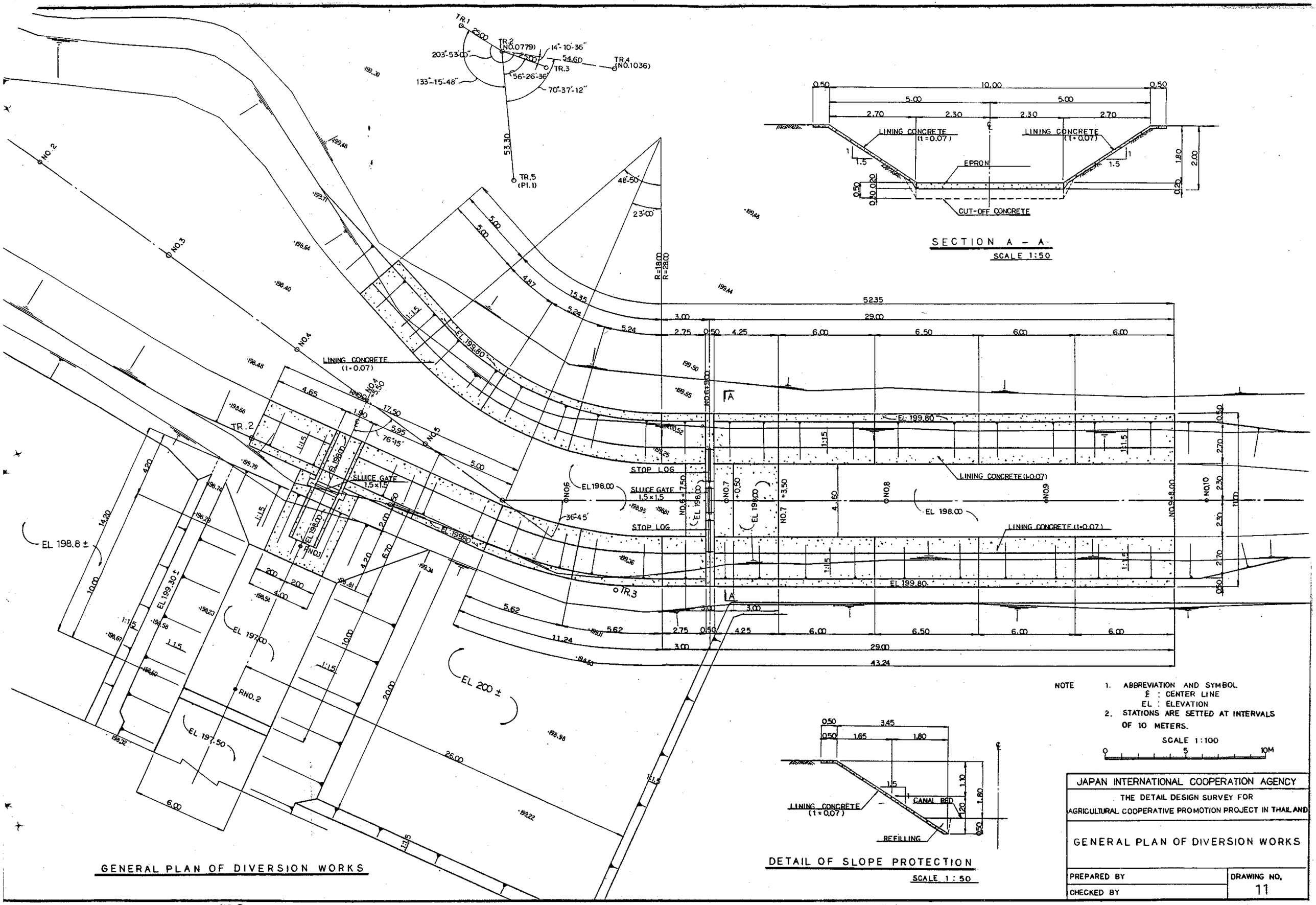


L NO. 2

EARTHWORK CROSS SECTION

SCALE 1:100

JAPAN INTERNATIONAL COOPERATION AGENCY	
THE DETAIL DESIGN SURVEY FOR AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND	
CROSS SECTION (2)	
PREPARED BY	DRAWING NO. 10
CHECKED BY	



SECTION A – A

SCALE 1:50

DETAIL OF SLOPE PROTECTION

SCALE 1 : 50

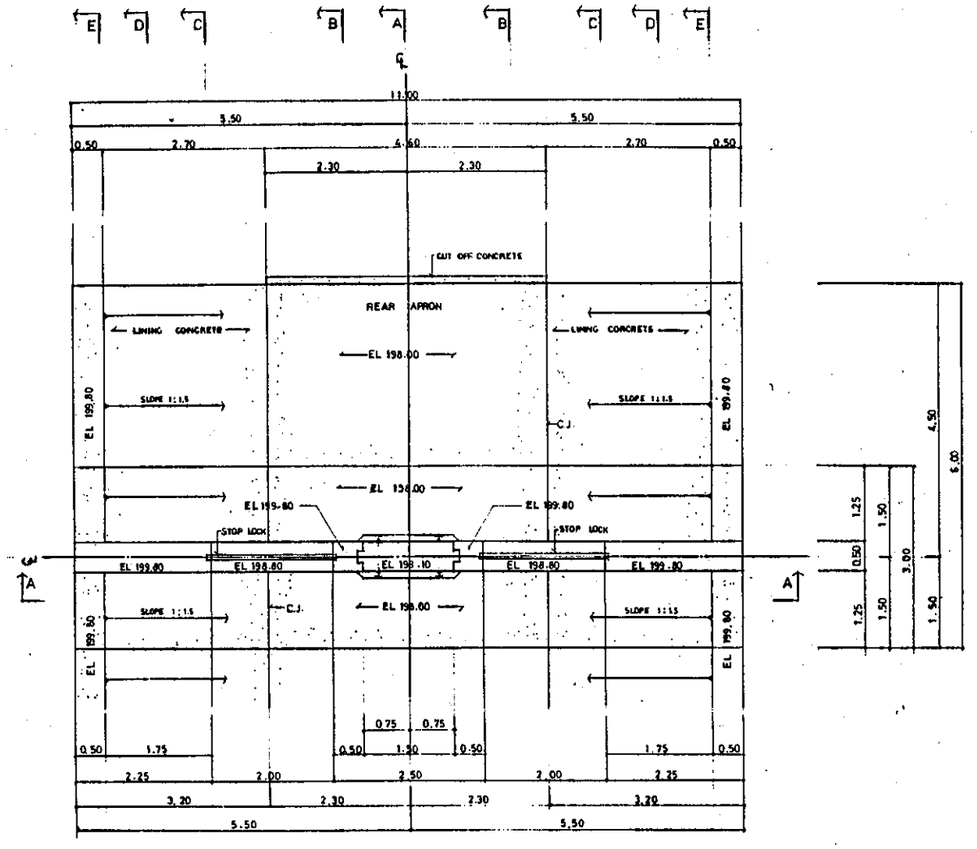
NOTE

1. ABBREVIATION AND SYMBOL
   ℄ : CENTER LINE
   EL : ELEVATION
2. STATIONS ARE SETTED AT INTERVALS OF 10 METERS.

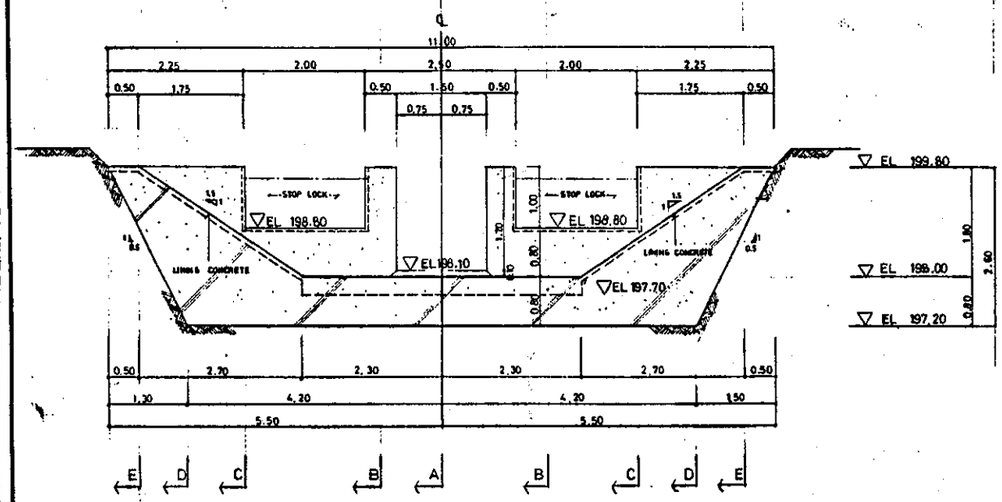
SCALE 1:100

0 5 10M

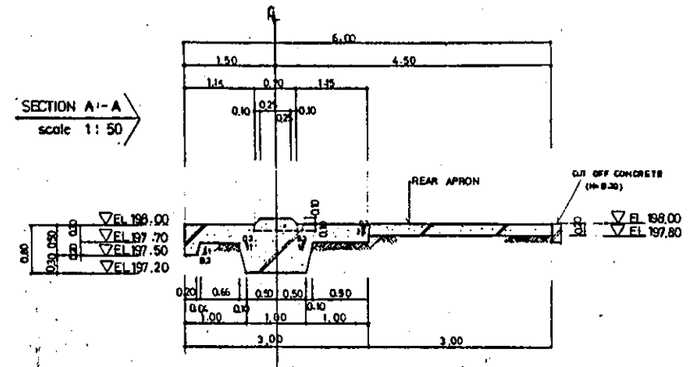
JAPAN INTERNATIONAL COOPERATION AGENCY	
THE DETAIL DESIGN SURVEY FOR AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND	
GENERAL PLAN OF DIVERSION WORKS	
PREPARED BY	DRAWING NO. 11
CHECKED BY	

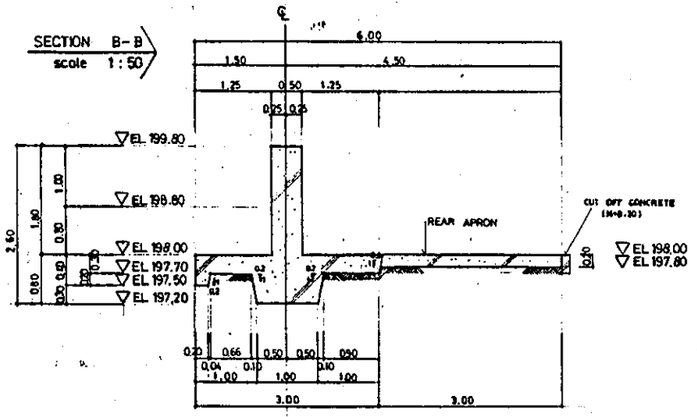


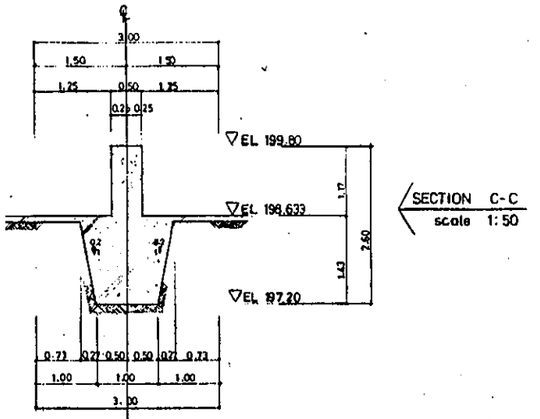
PLAN OF DIVERSION WORKS
scale 1:50

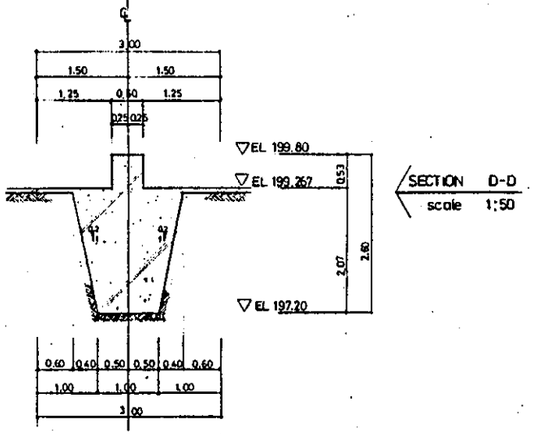


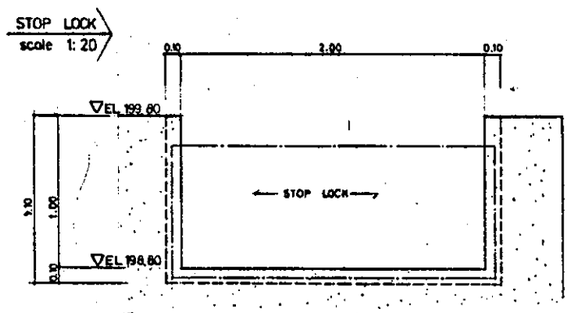
LONGITUDINAL SECTION (A-A)
scale 1:50

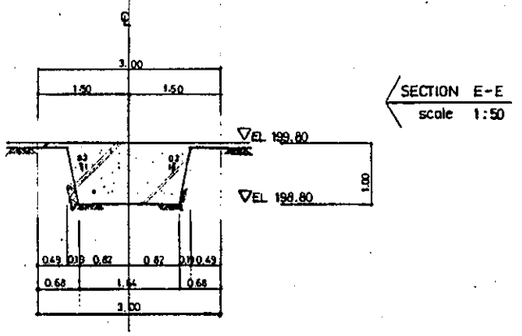


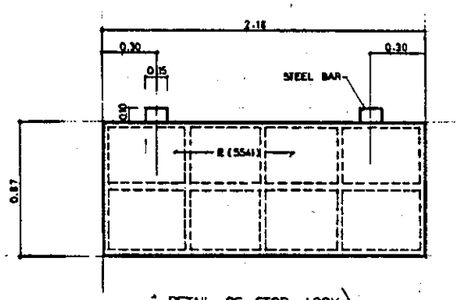












NOTE

1.) ABBREVIATION AND SYMBOL
- ℄ — CENTER LINE
- EL. — ELEVATION
- C.J. — CONTRACTION JOINT

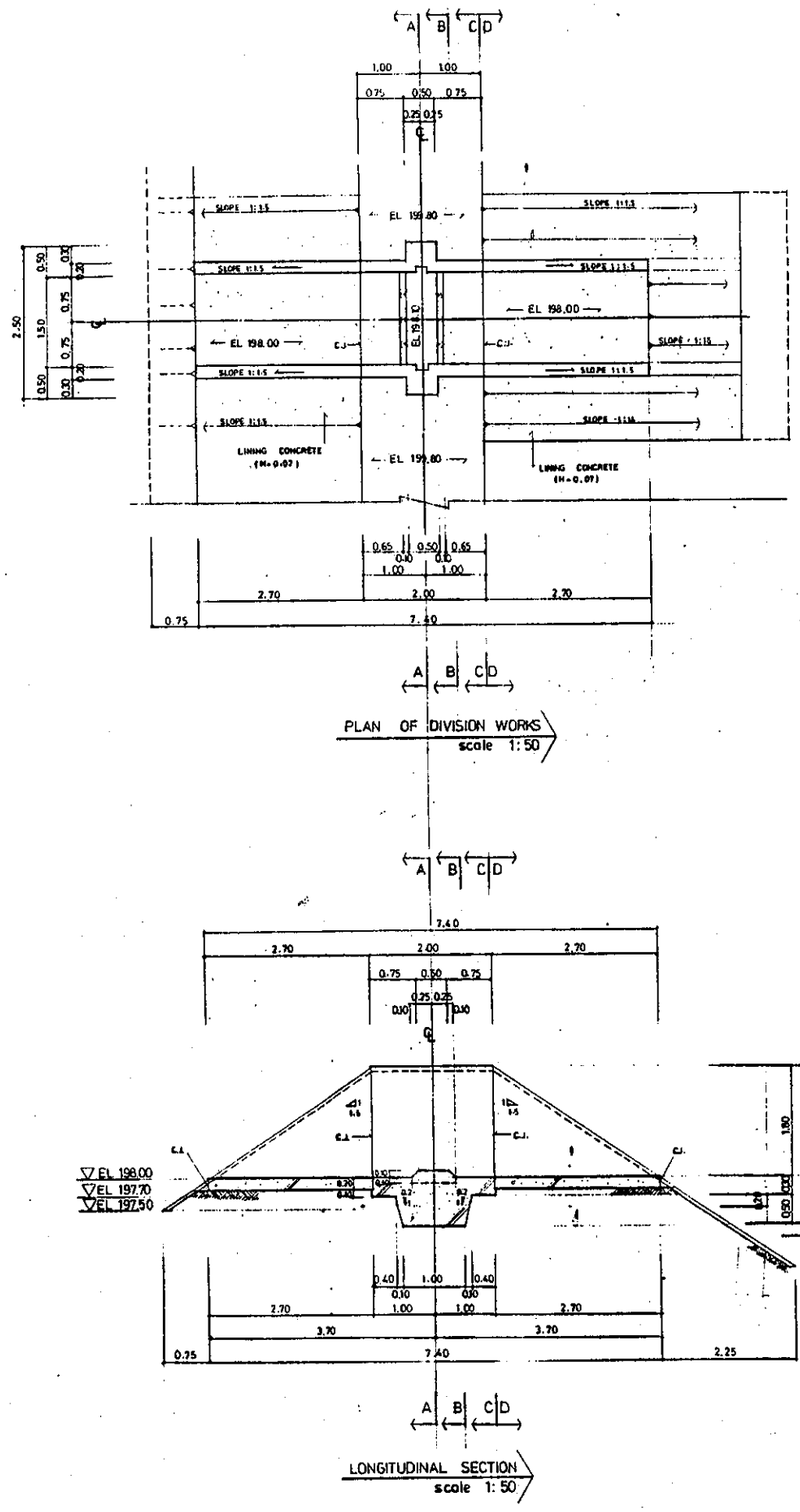
2.) JOINT TREATMENT
- C.J. — OIL PAINT

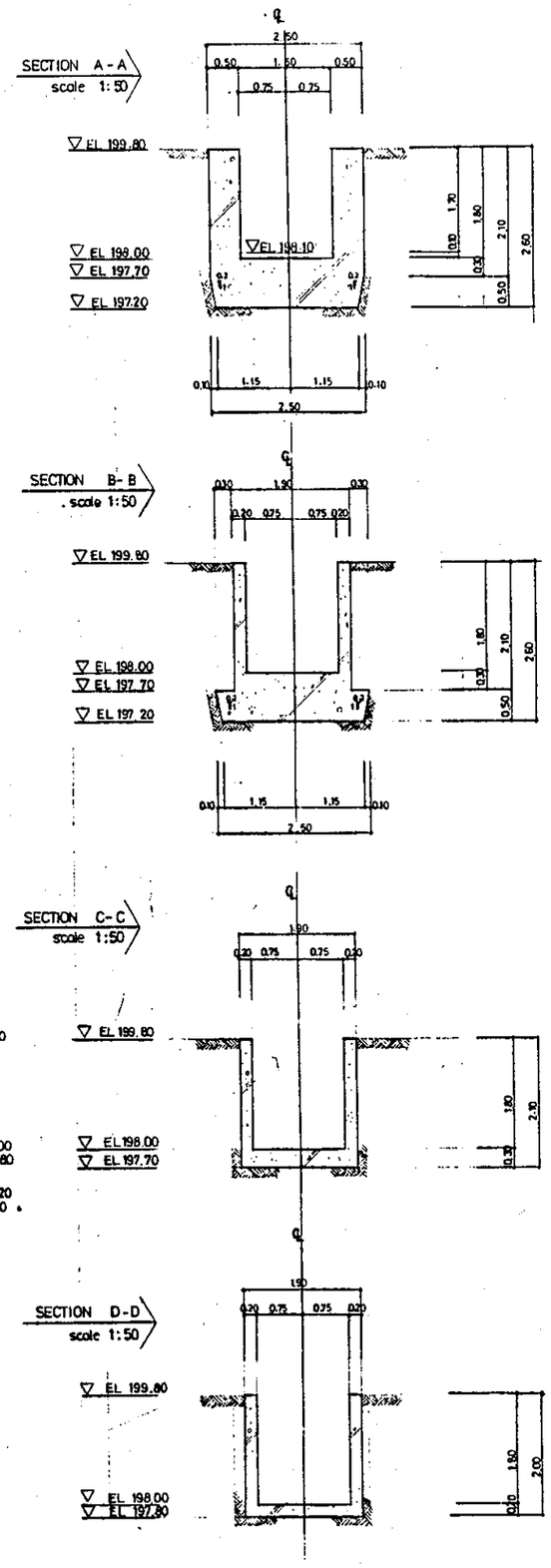
JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR
AGRICULTURE COOPERATION PROMOTION PROJECT IN THAILAND

PLAN OF DIVISION WORKS (1)

PREPARED BY	DRAWING NO.
CHECKED BY	12





NOTE

1.) ABBREVIATION AND SYMBOL

℄ — CENTER LINE OF DIVISION WORKS

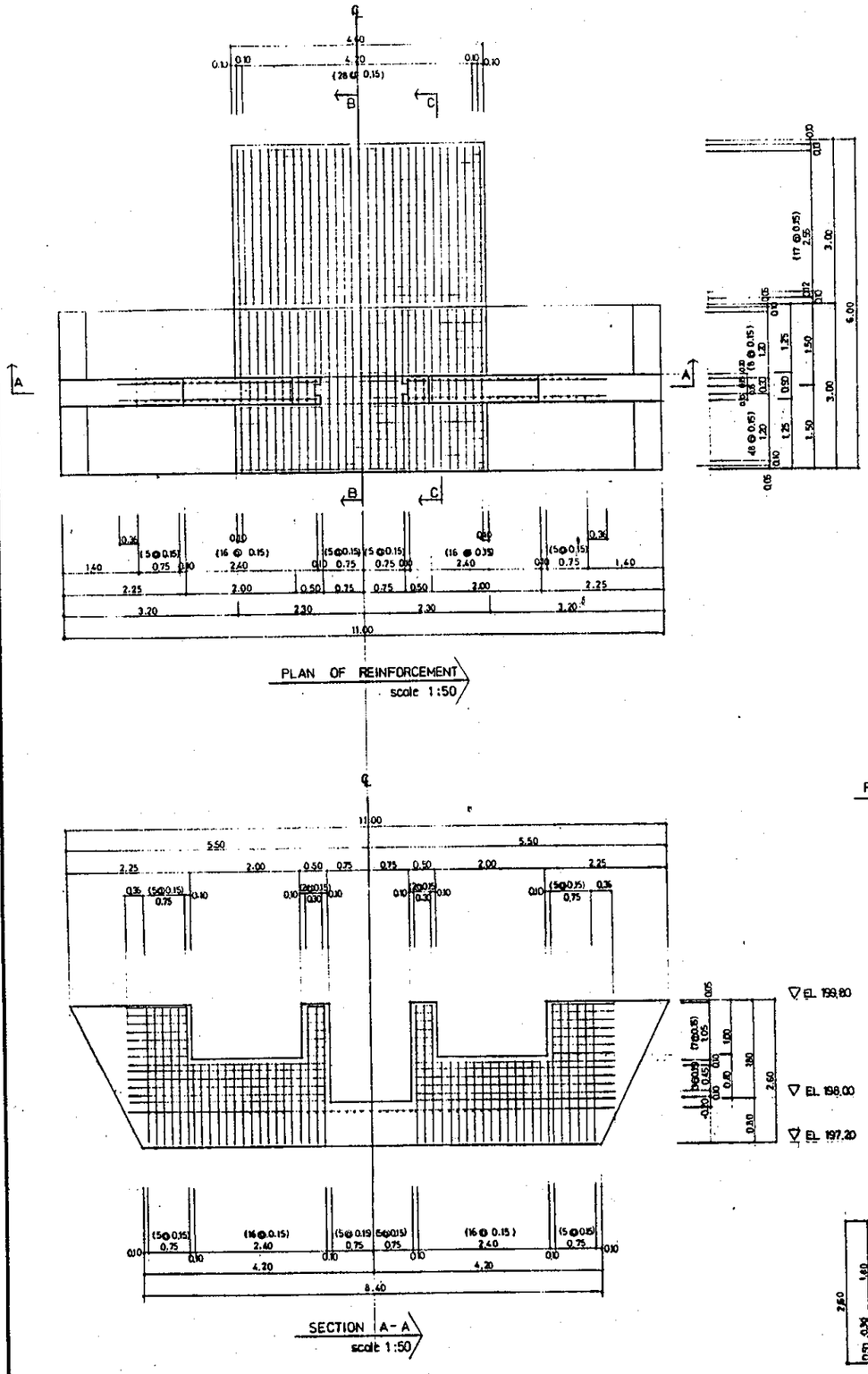
EL — ELEVATION

C.J. — CONTRACTION JOINT

2.) JOINT TREATMENT

C.J. — OIL PAINT

JAPAN INTERNATIONAL COOPERATION AGENCY	
THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATION PROMOTION PROJECT IN THAILAND	
PLAN OF DIVISION WORKS (2)	
PREPARED BY	DRAWING NO. 13
CHECKED BY	



NOTE

1.) ABBREVIATION AND SYMBOL

℄ — CENTER LINE

2.) ALL REINFORCING STEEL ARE — D 12

3.) LENGTH OF LAP AND ANCHORAGE (USE SR 30)

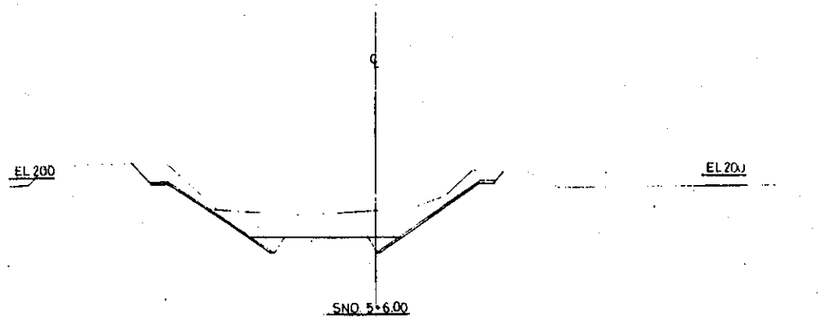
35 BAR DIAMETER COVER FOR REINFORCING TO BE 5cm. MINIMUM

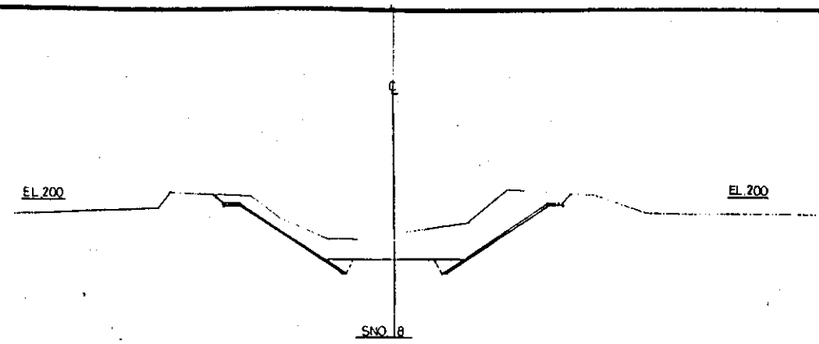
JAPAN INTERNATIONAL COOPERATION AGENCY

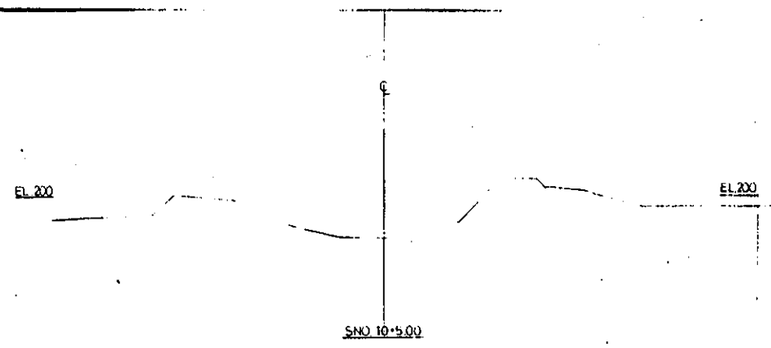
THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATION PROMOTION PROJECT IN THAILAND

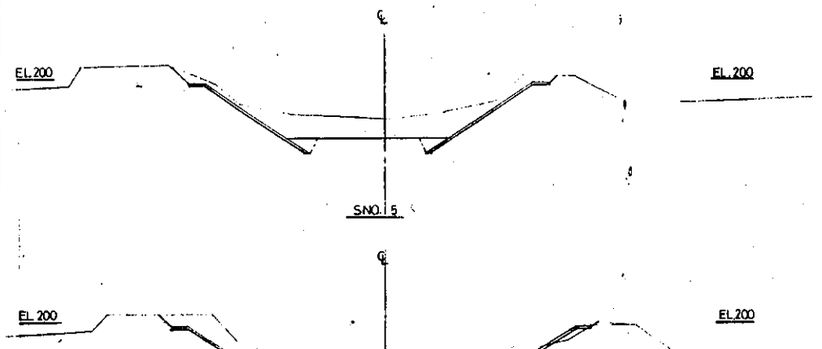
PLAN OF REINFORCEMENT

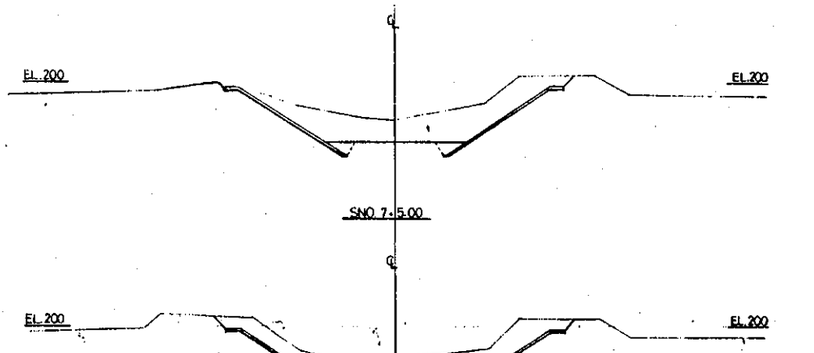
PREPARED BY	DRAWING NO.
CHECKED BY	14

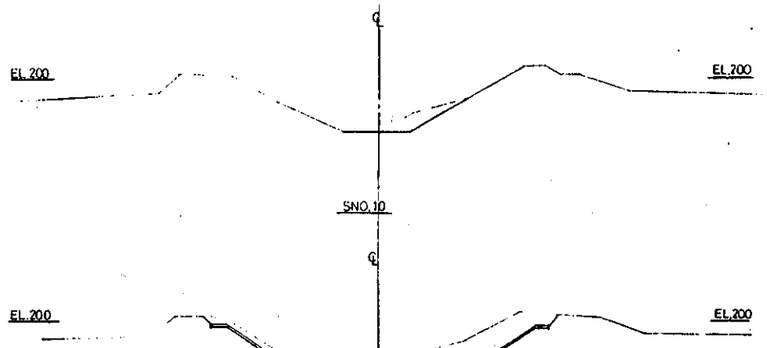


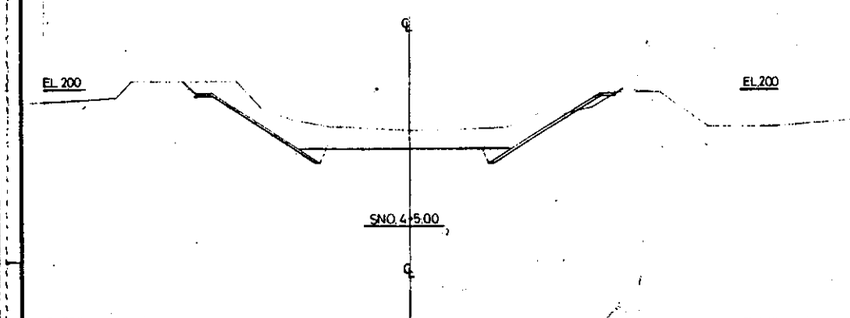


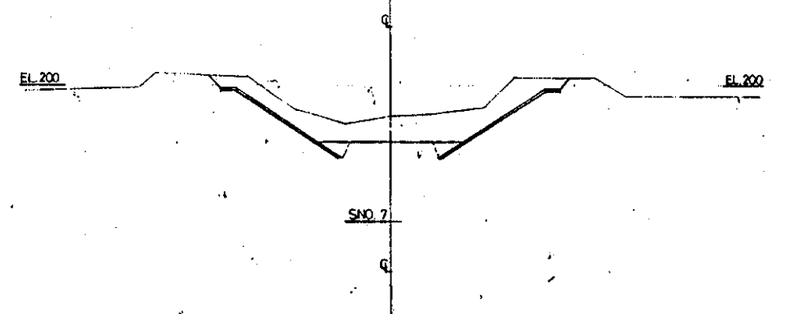


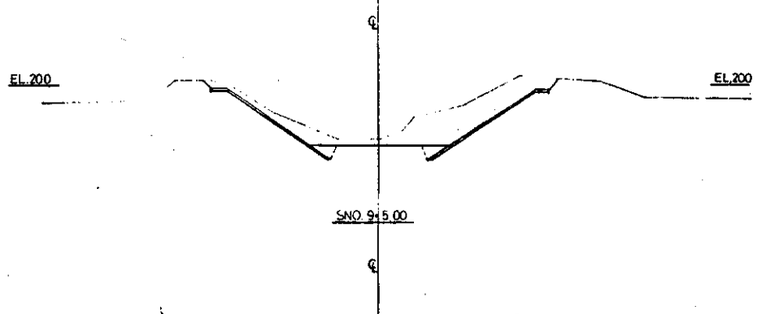


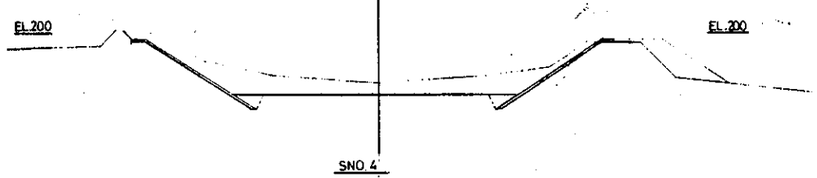


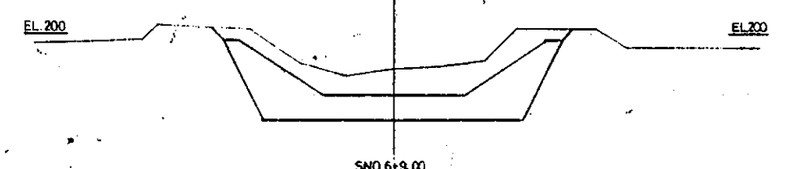


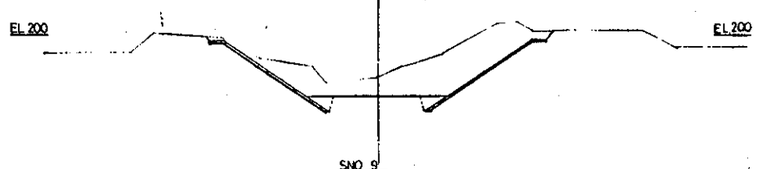


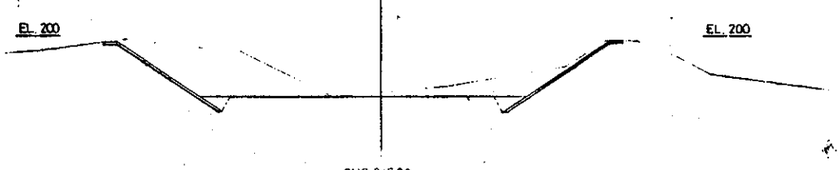


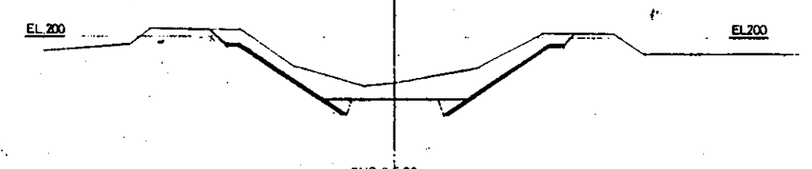


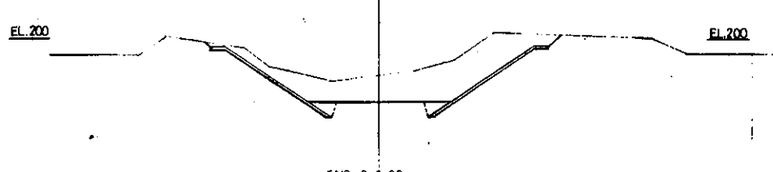


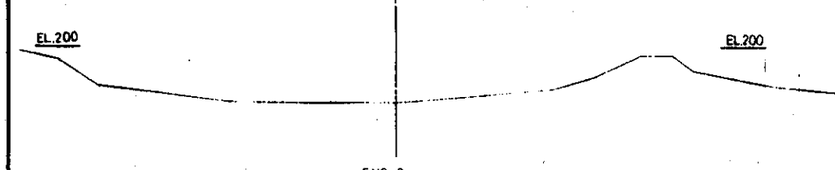


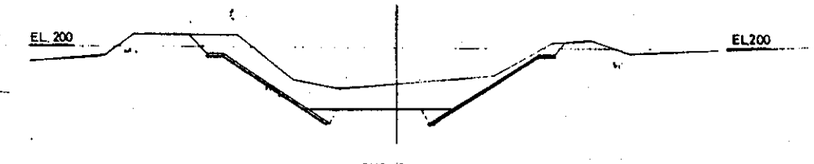










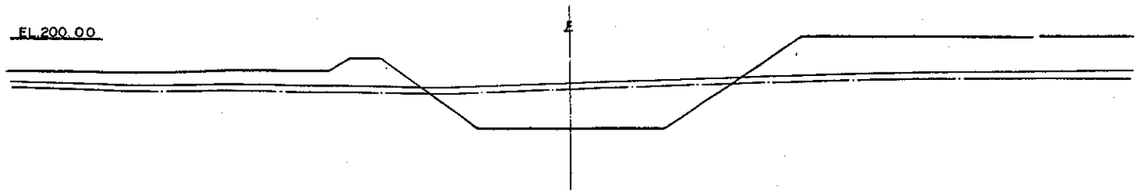


CROSS SECTION
scale 1: 100

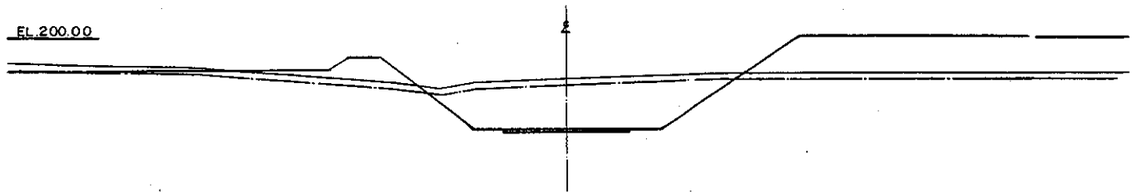
NOTE

1.) ABBREVIATION AND SYMBOL
℄ — CENTER LINE
EL — ELEVATION
2.) STATION NO. ARE SHOWN IN DRAWING NO. 12.

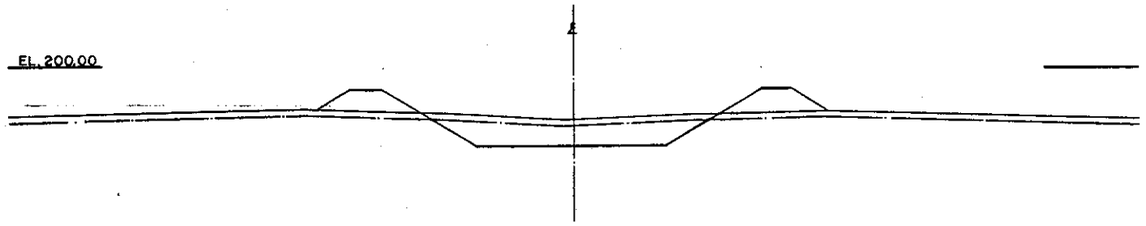
JAPAN INTERNATIONAL COOPERATION AGENCY	
THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATION PROMOTION PROJECT IN THAILAND	
CROSS SECTION (1)	
PREPARED BY	DRAWING NO. 15
CHECKED BY	



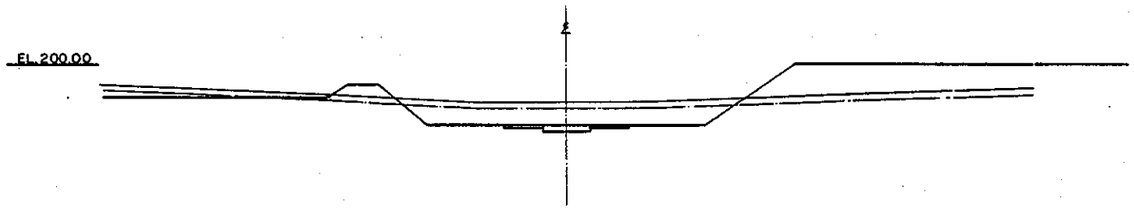
RNO. 1 + 6.20



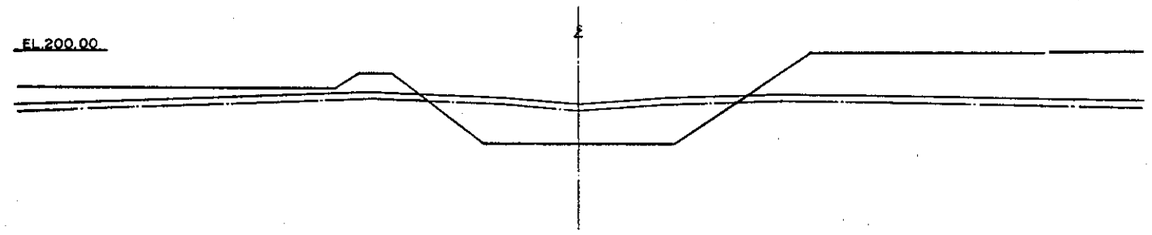
RNO. 1 + 1.20



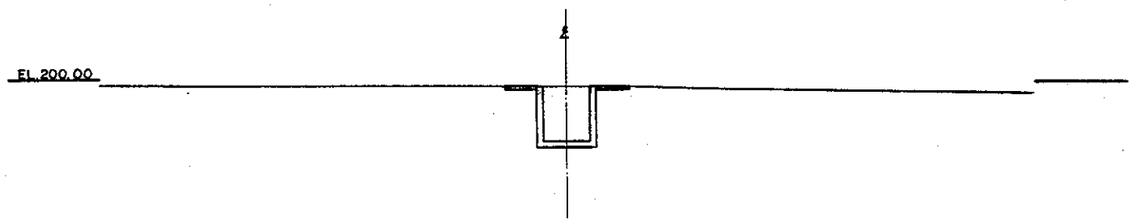
RNO. 2 + 5.00



RNO. 0 + 9.70



RNO. 2 + 1.20



RNO. 0 + 7.00

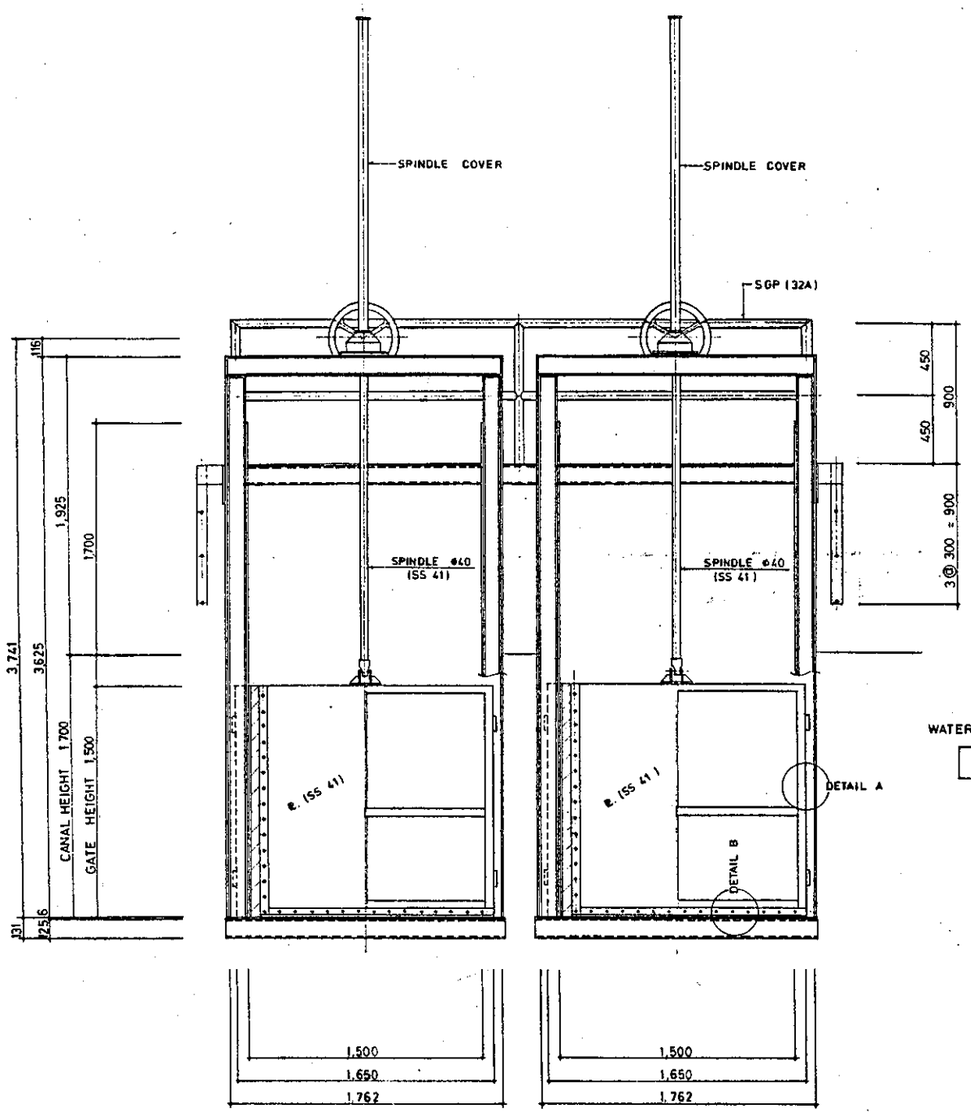
EARTHWORK CROSS SECTION

SCALE 1 : 100

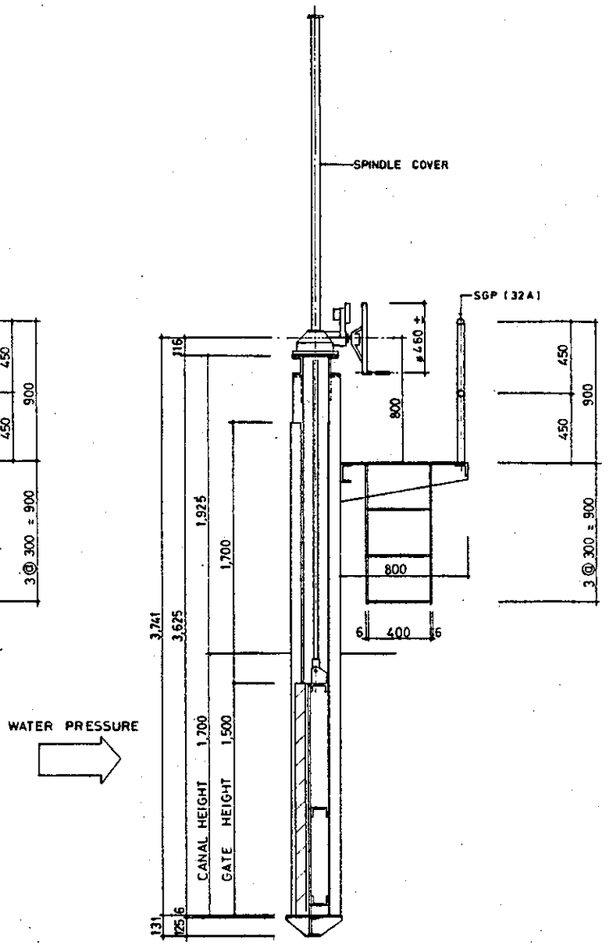
NOTE.

1. ABBREVIATION AND SYMBOL
   ℄ : CENTER LINE
   EL : ELEVATION
2. STATION NO. ARE SHOWN IN DRAWING NO. 12

JAPAN INTERNATIONAL COOPERATION AGENCY	
THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATIVE PROMOTION PROJECT IN THAILAND	
CROSS SECTION (2)	
PREPARED BY	DRAWING NO. 16
CHECKED BY	

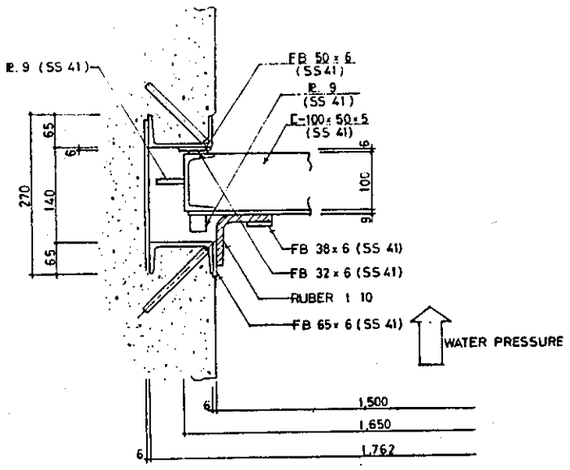


FRONT ELEVATION
1 : 20

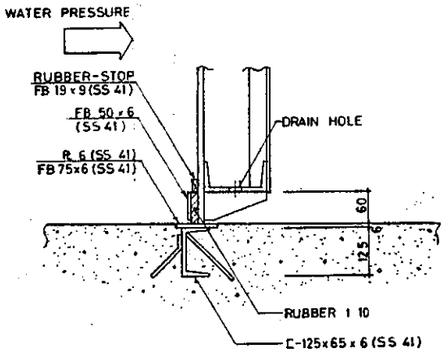


WATER PRESSURE

SECTION
1 : 20



DETAIL A
1 : 5

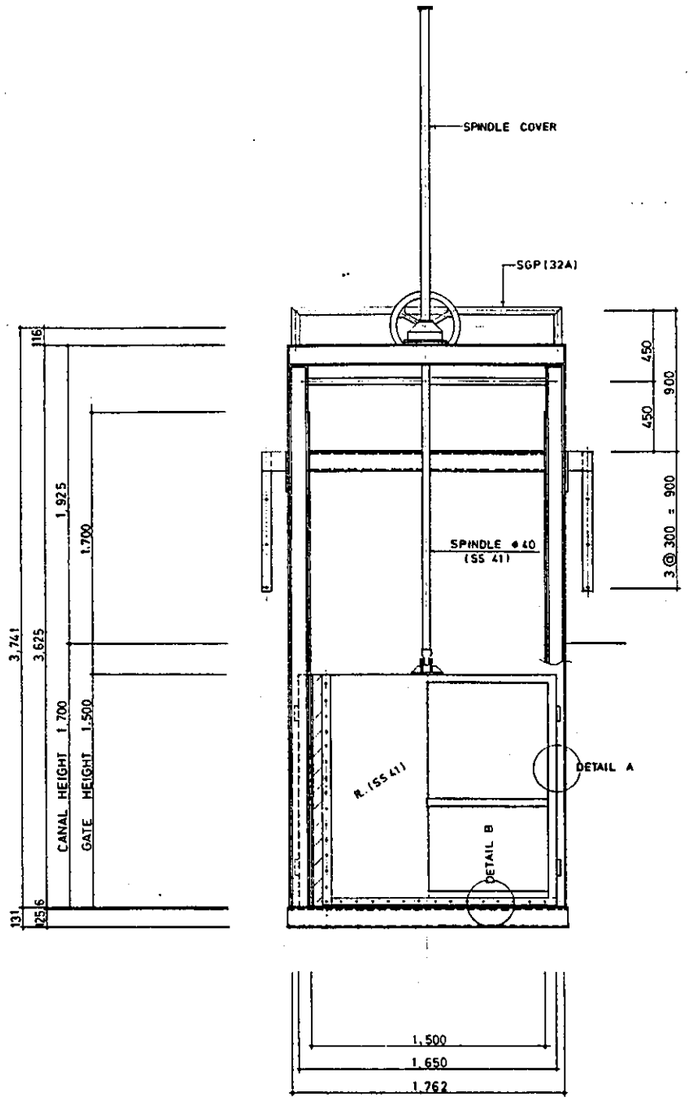


DETAIL B
1 : 5

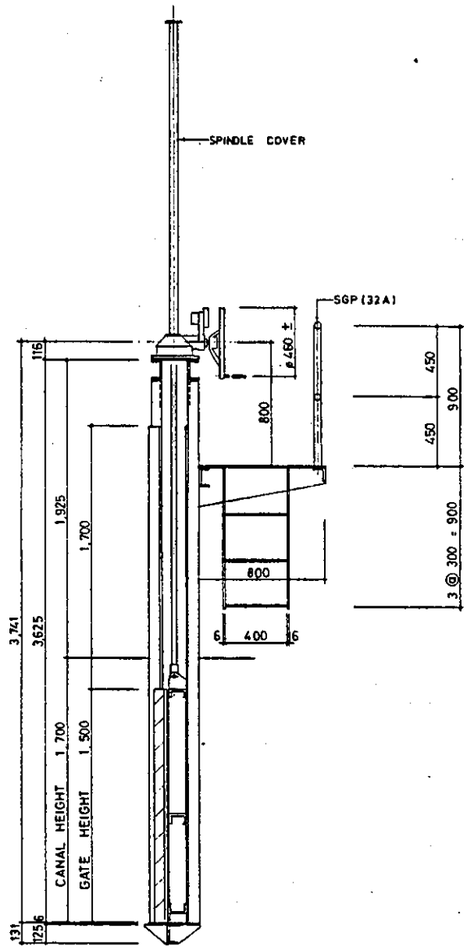
NOTE

1) PAINTING : EPOXY RESIN
2) GATE TYPE : SLUICE GATE (3 SECTION WATERTIGHT, HAND-OPERATED BEVEL GEAR)
3) ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE INDICATED

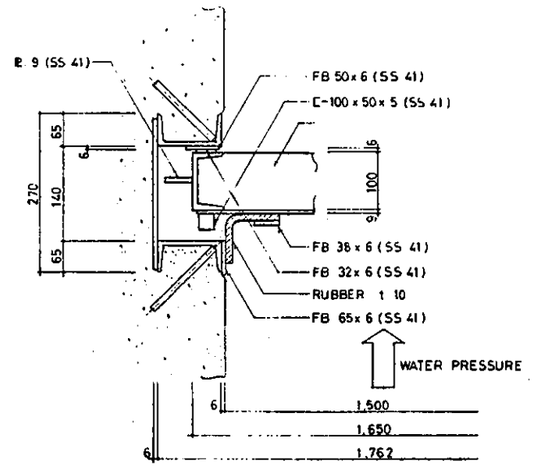
JAPAN INTERNATIONAL COOPERATION AGENCY	
THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATION PROMOTION PROJECT IN THAILAND	
DETAIL OF SLUICE GATE (1)	
PREPARED BY	DRAWING NO. 17
CHECKED BY	



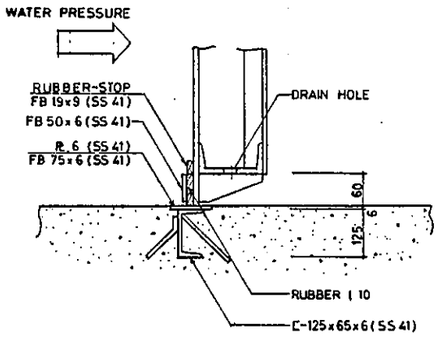
FRONT ELEVATION
1 : 20



SECTION
1 : 20



DETAIL A
1 : 5

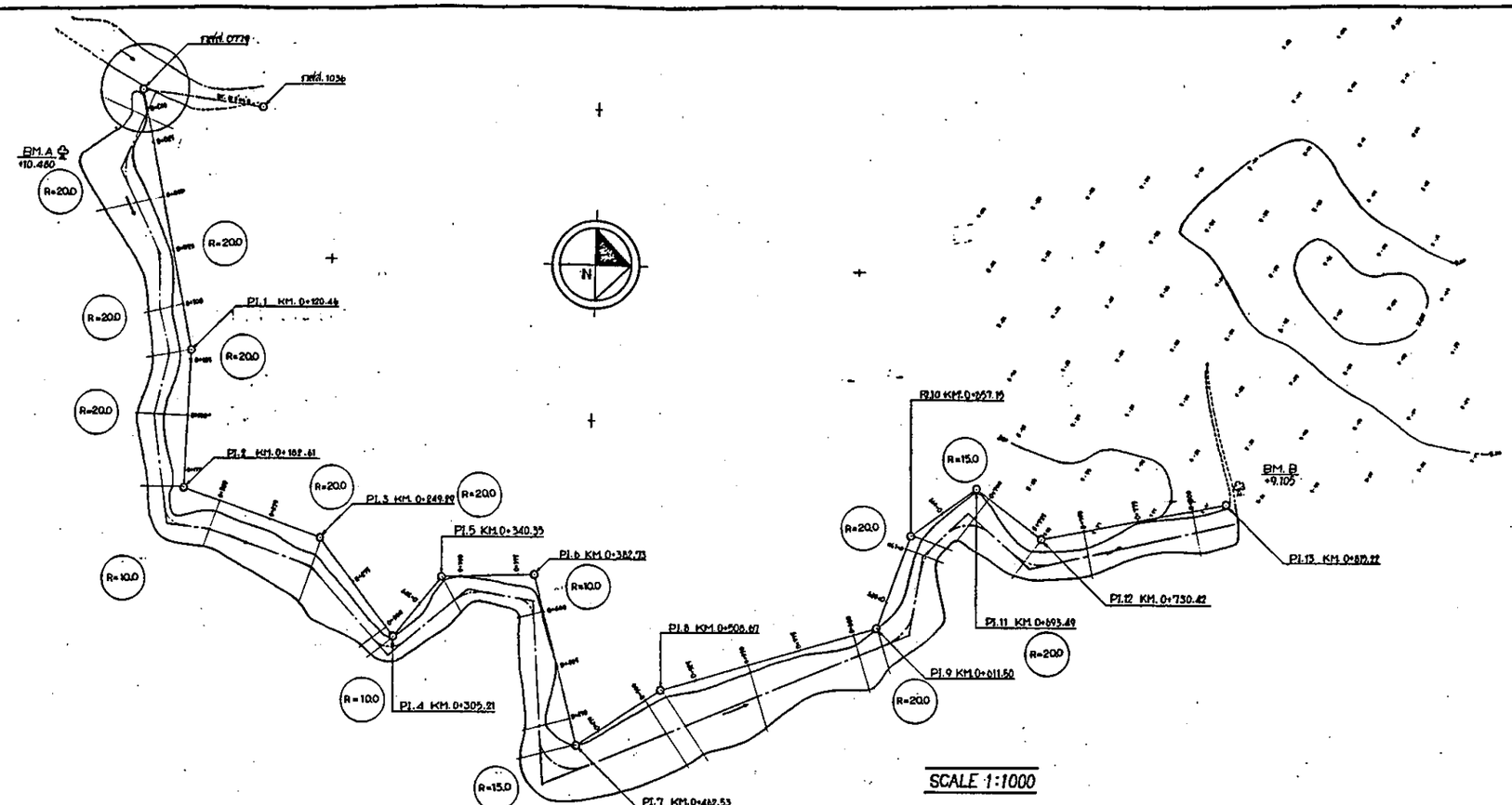


DETAIL B
1 : 5

NOTE

1) PAINTING : EPOXY RESIN
2) GATE TYPE : SLUICE GATE (3 SECTION WATERTIGHT HAND-OPERATED BEVEL GEAR)
3) ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE INDICATED

JAPAN INTERNATIONAL COOPERATION AGENCY	
THE DETAIL DESIGN SURVEY FOR AGRICULTURE COOPERATION PROMOTION PROJECT IN THAILAND	
DETAIL OF SLUICE GATE (2)	
PREPARED BY	DRAWING NO.
CHECKED BY	18

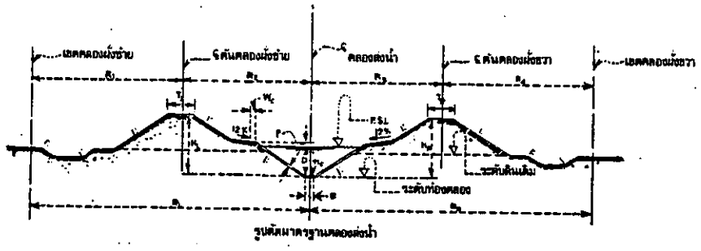


DATA

STA.	ANG		DIST.M		ELEV.M
1036					10.254
0779	70	37.2	54	55	9.797
1	993	34.0	120	45	9.650
2	106	48.5	62	95	9.733
3	279	39.2	66	66	9.471
4	76	50.4	99	92	9.533
5	229	41.7	99	34	9.261
6	277	44.7	42	38	9.244
7	71	06.6	79	80	8.988
8	196	38.1	46	16	9.091
9	191	17.6	102	61	9.069
10	214	44.1	49	05	9.009
11	255	59.1	36	34	8.964
12	131	30.8	36	93	8.718
13	-	-	84	80	8.808
BM. A					10.480
BM. B					9.105

STA. 0779 → STA. 1036 Br. N 7°06'E

รูปตัดตามยาว ระยะทางเป็น กม.
มาตราส่วน { ตั้ง 1:100 / ราบ 1:1000



ตารางแสดงรายละเอียดคลองส่งน้ำ

ตอน ชื่อ คลอง	Q	A	V	R	S	n	B	B_1	B_2	T_1	T_2	H_1	H_2	B_1	B_2	B_3	B_4	I	W_1

ตารางรายละเอียดคลองโค้ง

โค้งที่									
R									
θ									
T									
L									
Ext.									
C.L.									
ข้อสังเกต									

JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR
AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND

CANAL WORKS (1)

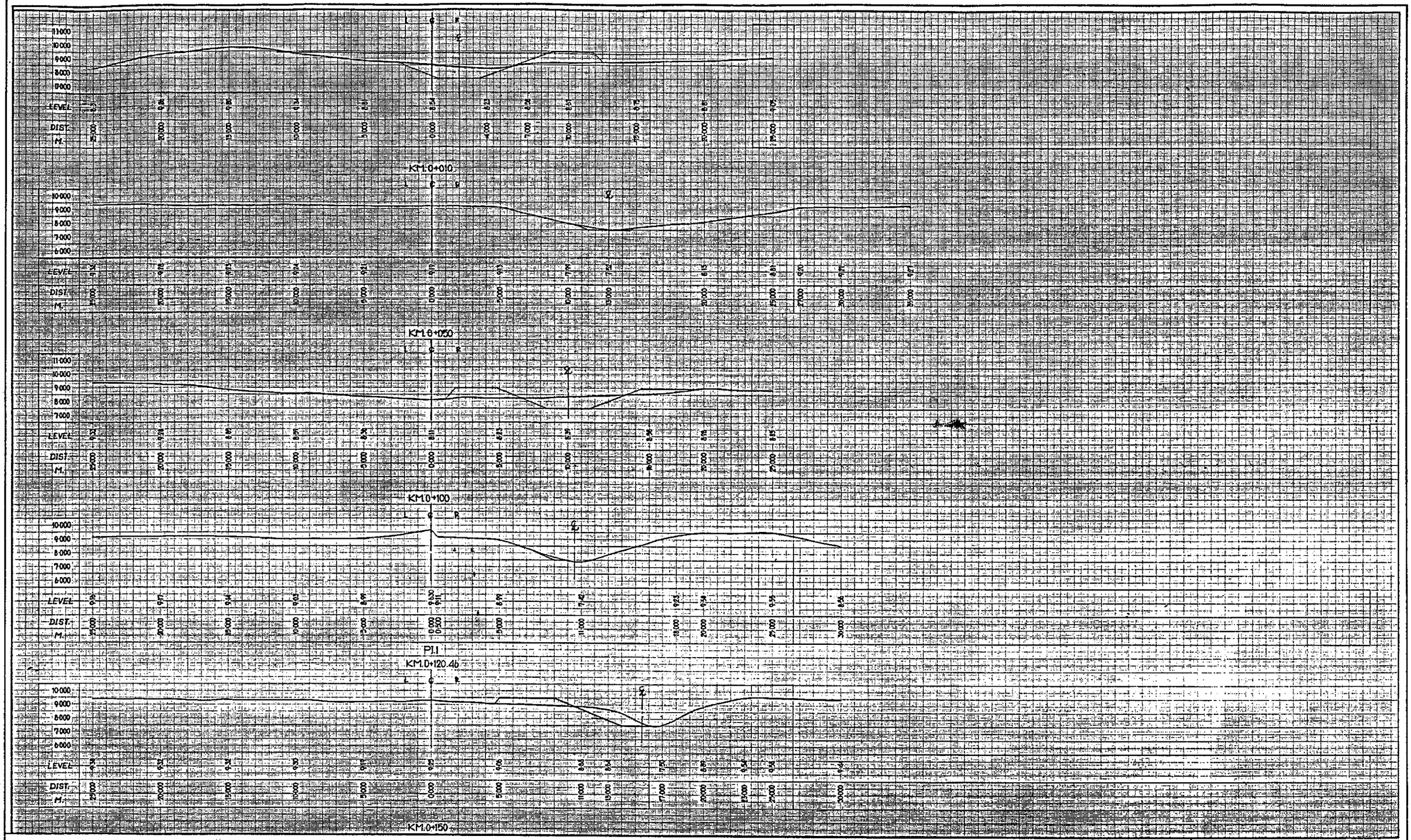
PREPARED BY

CHECKED BY

DRAWING NO. 19

แบบ 1003
แก้ไขครั้งที่ 1

ส.ว. | แผ่นที่ 1



JAPAN INTERNATIONAL COOPERATION AGENCY

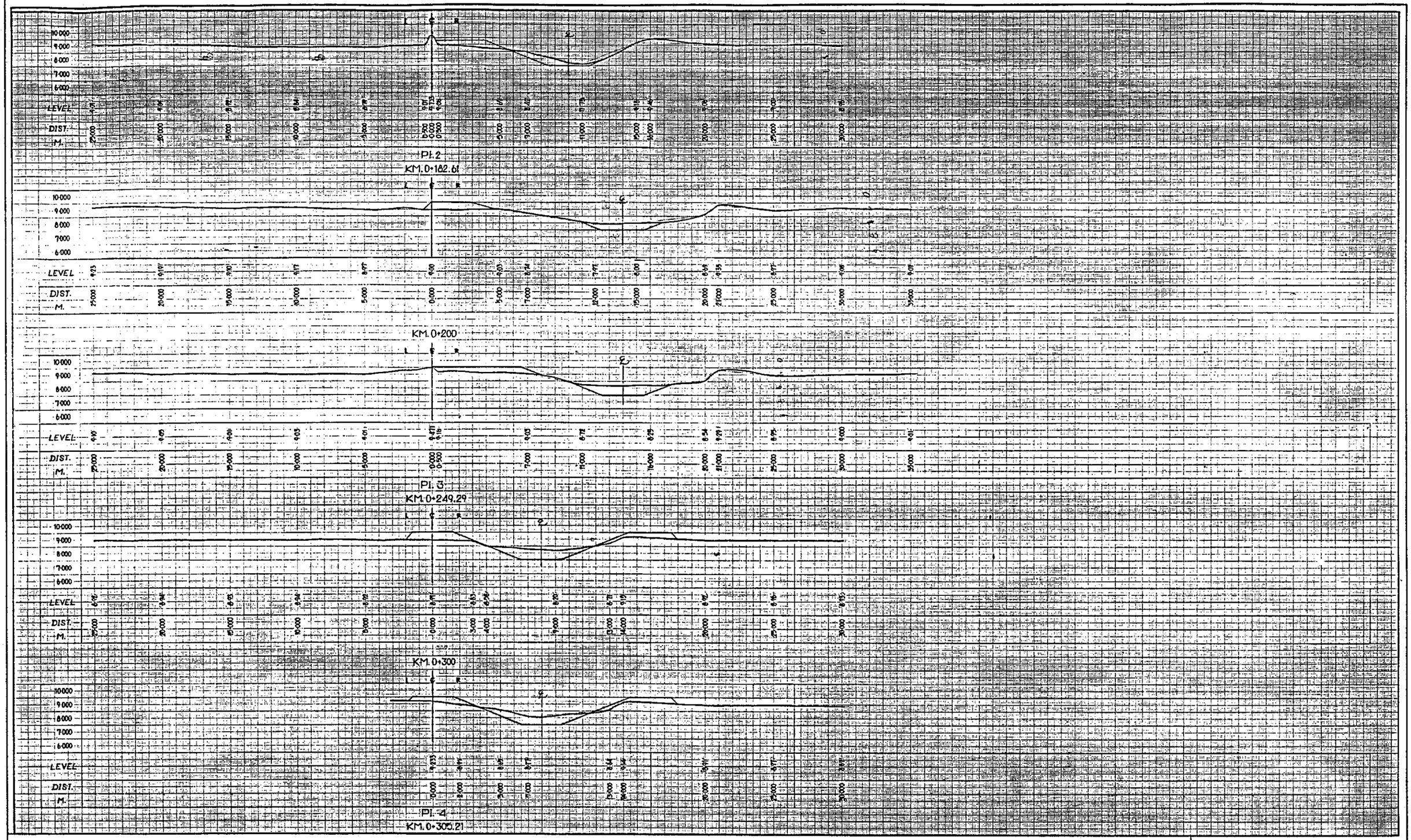
THE DETAL DESIGN SURVEY FOR
AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND

CANAL WORKS (2)

PREPARED BY

CHECKED BY

DRAWING NO. 20



มาตราส่วน { ตั้ง 1:
รวม 1:

JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR
AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND

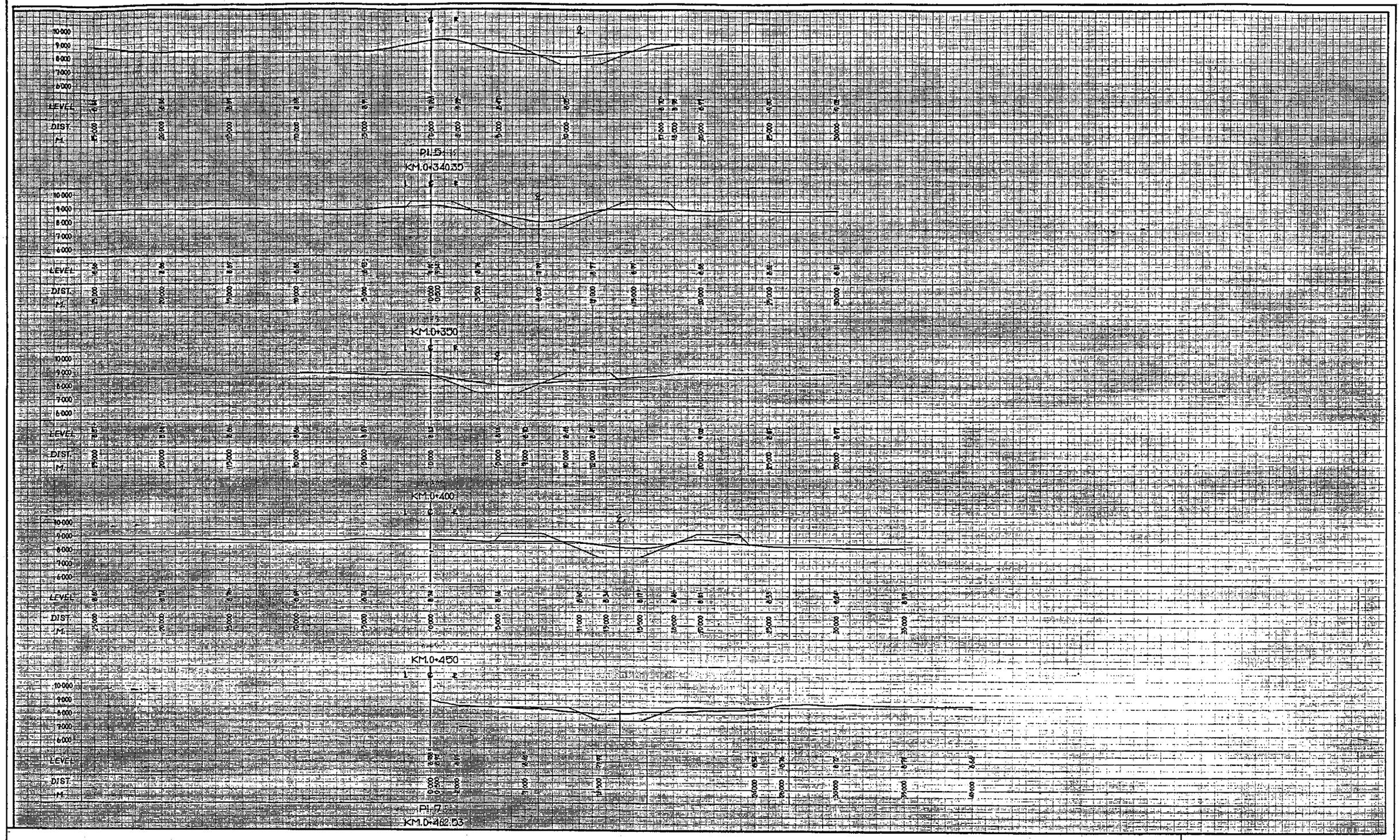
CANAL WORKS (3)

PREPARED BY

CHECKED BY

DRAWING NO. 21

410



JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR
AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND

CANAL WORKS (4)

PREPARED BY

CHECKED BY

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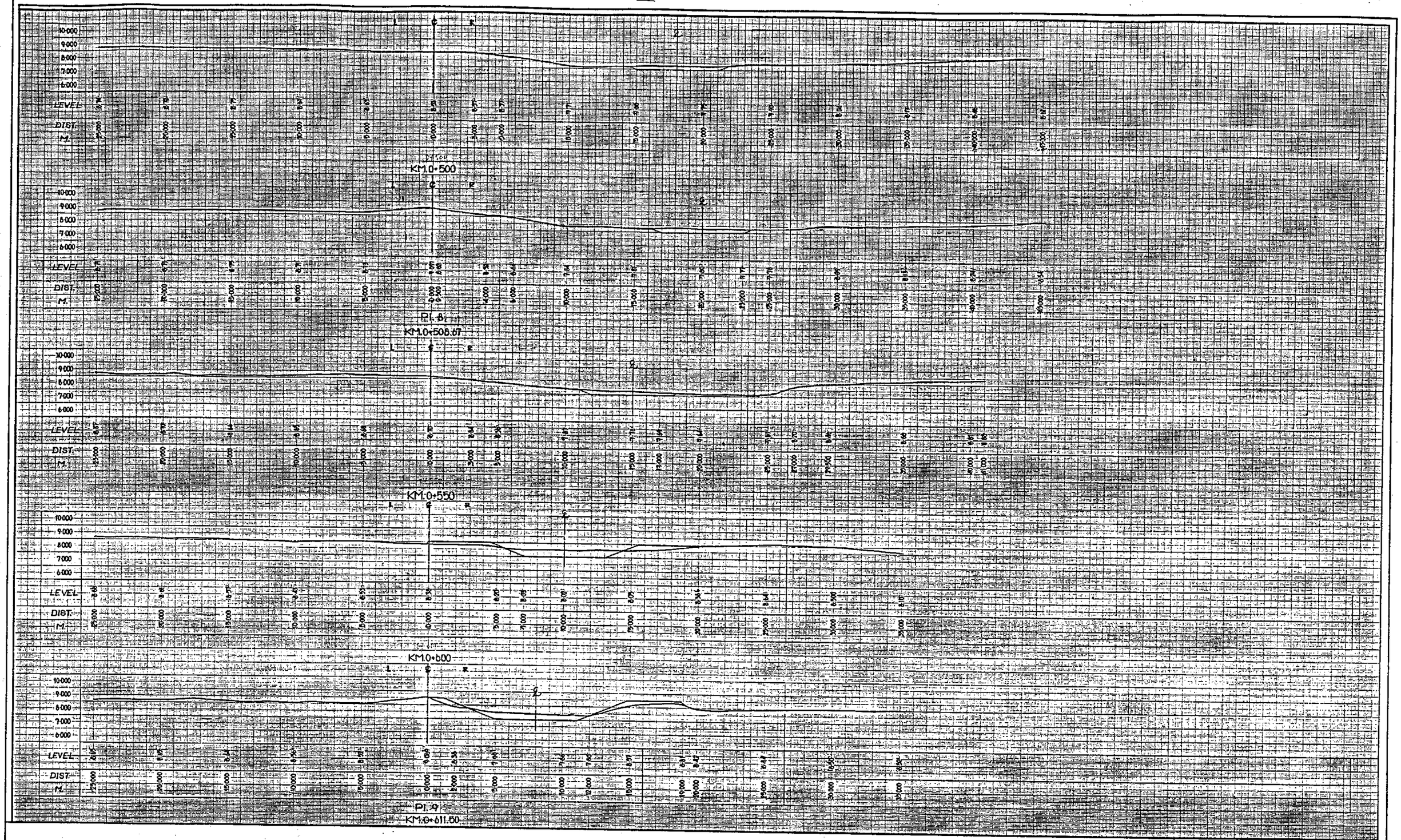

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รวม 1:

JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR
AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND

CANAL WORKS (5)

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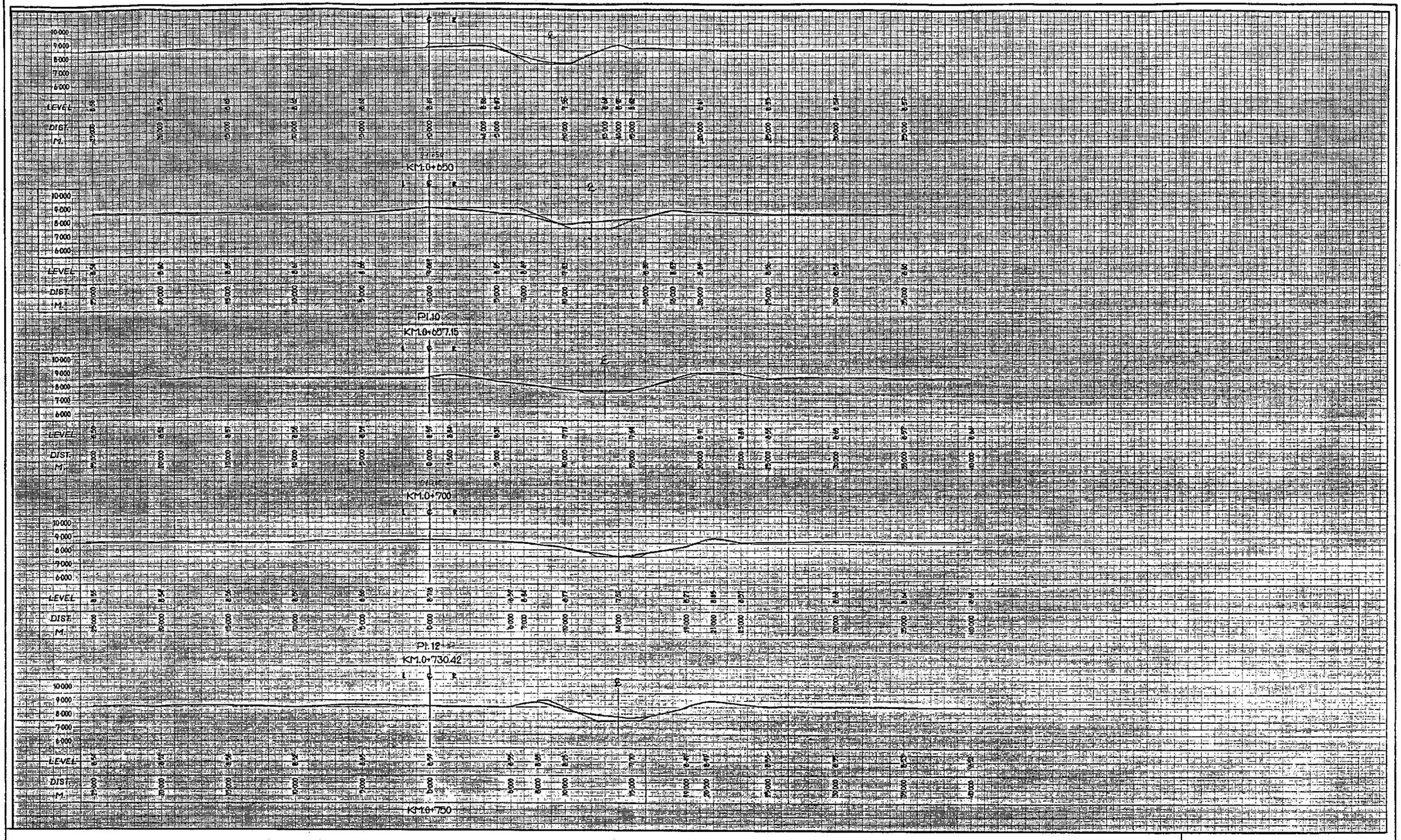

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ราบ 1:

JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR
AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND

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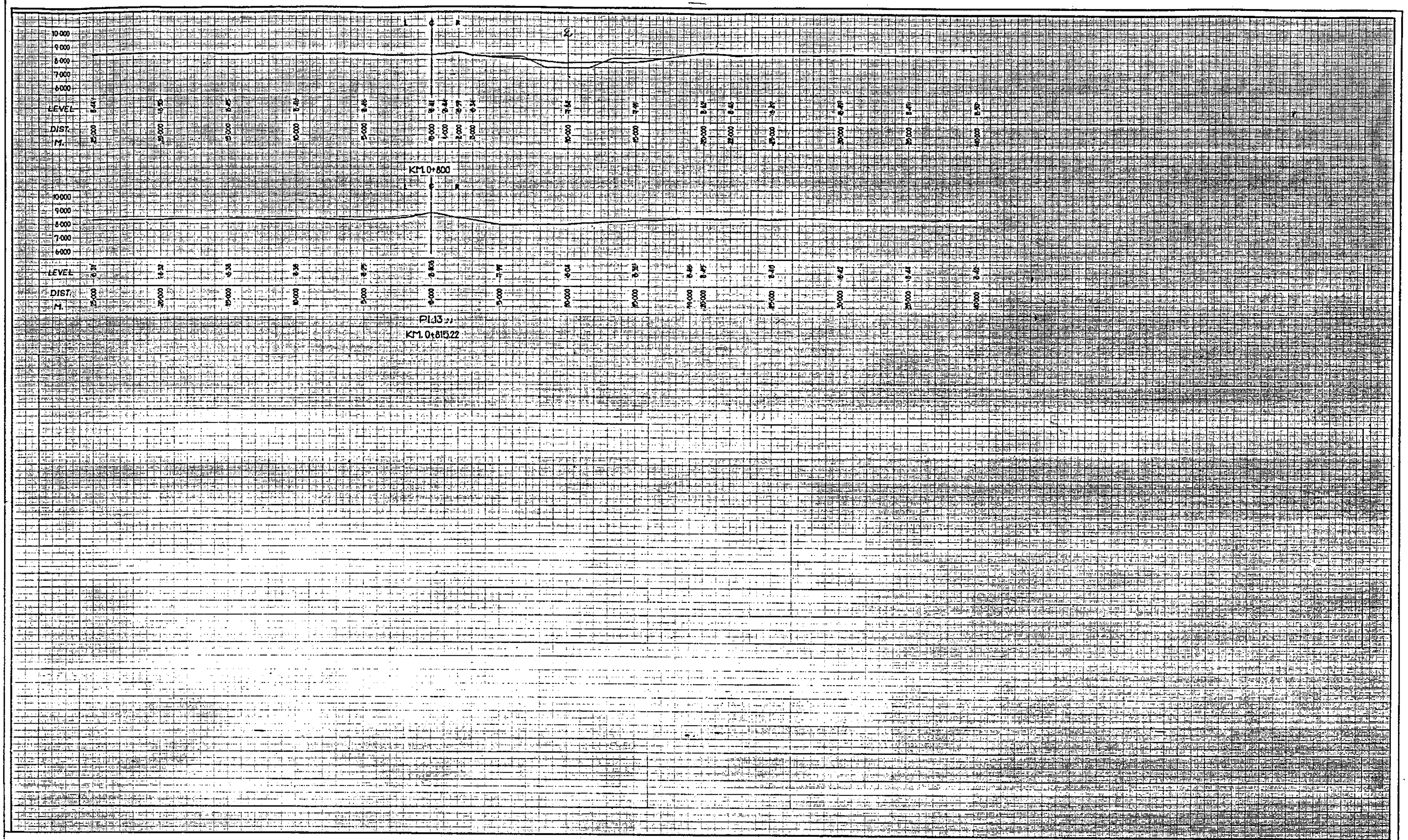

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JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR
AGRICULTURAL COOPERATIVE PROMOTION PROJECT IN THAILAND

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第8章　工事完了に係る発注側への提出レポート

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

BANGKOK OFFICE

No. 885/61 September 4, 1986

Mr. Chern Bamrungwong
Director-General
Cooperatives Promotion Department
Ministry of Agriculture and Cooperatives
Bangkok

Dear Mr. Chern,

It is an honour to inform that the Construction of Model infrastructure on Agricultural Cooperative Promotion Project in Thailand has duly been completed on 24th August, 1986, and the irrigation facilities are to be delivered to the Cooperatives Promotion Department.

I would like to express my appreciation for your cooperation and expect these irrigation facilities to produce excellent results.

Sincerely yours,

for Michimoto GOTO
Resident Representative, Bangkok Office
Japan International Cooperation Agency

AGRICULTURAL COOPERATIVE PROMOTION PROJECT

COOPERATIVES PROMOTION DEPARTMENT
MINISTRY OF AGRICULTURE AND COOPERATIVES
TEVEJ, BANGKOK

Ref. No._____

การบำรุงรักษาบ่อน้ำเบื้องต้นที่ควรปฏิบัติ

๑. รางน้ำที่ทำคอนกรีตกาดสำหรับเป็นรางน้ำให้น้ำจากที่นาไหลลงบ่อน้ำนั้น พยายามอย่าให้น้ำไหลล้นราง โดยปิดประตูกันน้ำไม้ไว้ตลอดเวลา และถ้าจะปล่อยน้ำจากท้องนาให้ไหลลงบ่อควรจะเปิดประตูไม้นี้ขึ้นเล็กน้อย ประมาณ ๕ - ๑๐ ซ.ม.เพื่อบังคับไม่ให้น้ำไหลลงบ่อในปริมาณที่มากเกินไปจนล้นท่วมรางที่ทำขึ้น

๒. ควรบำรุงรักษาวัชพืชส่วนที่ปกคลุมหน้าดินให้ดีตลอดเวลา เพื่อไม่ให้ริมบ่อเกิดการพังทะลาย เนื่องจากน้ำฝนที่ไหลเซาะ

๓. คันดินที่ที่ทำเป็นขอบด้านบนบ่อทั้ง ๒ ข้าง จะต้องตรวจสอบและซ่อมแซมให้อยู่ในสภาพที่กันน้ำได้ตลอดเวลา

๔. อย่าเดินบนหินที่โรยทอดลงไปในบ่อเด็ดขาด เพราะอาจจะทำให้หินไหลเคลื่อนออกจากที่บังคับ จนเป็นเหตุให้เกิดการพังทะลายของรางน้ำปูนกาดที่ทำขึ้น

การบำรุงรักษาเบื้องต้นนี้ ควรจะกระทำต่อเนื่องตลอดเวลา

TAKAHIRO KATO
JICA EXPERT

รับทราบ _____ สกกรณ์อำเภอคง
_____ หัวหน้ากลุ่มตัวอย่าง

AGRICULTURAL COOPERATIVE PROMOTION PROJECT

COOPERATIVES PROMOTION DEPARTMENT
MINISTRY OF AGRICULTURE AND COOPERATIVES
TEVEJ, BANGKOK

Ref. No._____

การบำรุงรักษาเบื้องต้นสำหรับประตูเก็บกักน้ำ

๑. ตรวจสอบระดับน้ำทุก ๆ วัน
๒. เมื่อเกิดน้ำมากหรือเกิดน้ำท่วม ให้เปิดประตูน้ำทั้งหมด รวมทั้งแผงเหล็กกันน้ำด้วย
๓. อย่า ปิดประตูน้ำในช่วงฤดูฝนเด็ดขาด ให้เปิดอยู่ตลอดเวลา คือช่วงตั้งแต่เดือนกันยายน ถึง เดือนตุลาคม
๔. ในขณะที่ปิดประตูน้ำอยู่นั้น ถ้าเกิดมีน้ำไหลท่วมพื้นนา ทางด้านที่ลุ่มส่วนที่อยู่หน้าประตูน้ำแล้ว ควรจะเปิดประตูน้ำ เพื่อให้น้ำระบายออกทางด้านหลังประตู

TAKAHIRO KATO
JICA EXPERT

_____ สหกรณ์อำเภอจักราช

_____ หัวหน้ากลุ่มตัวอย่าง

September 4, 1986

Mr.Chern Bamrungwong

Director General

Cooperatives Promotion Department

Subj: Report on the completion of construction work and Note on the operation of irrigation facilities.

Dear Sir:

It is an honour to report that the construction of Model infrastructure on Agricultural Cooperative Promotion Project has been duly completed by 24th August, 1986 in accordance with R/D (Record and Discussions) between the Government of Japan and the Government of Kingdom of Thailand.

Technical Notes for the operation and maintenance of irrigation facilities are attached herewith. I expect these irrigation facilities to produce excellent results.

I would like to express my sincere appreciation of your kind cooperations during my supervision on the construction works.

Yours sincerely,

Takahiro KATO

Expert of JICA

CC: Mr.Shizuo SATO

CC: Mr.Eitaro MITOMA

SUPERVISING REPORT

OF

CONSTRUCTION OF MODEL INFRASTRUCTURE

ON

AGRICULTURAL COOPERATIVE PROMOTION PROJECT

1. Introduction

Agricultural Cooperative Promotion Project has been executed for aiming at five model farmer's organizations selected from Nakorn Ratchasima Province located in North-east Thailand in accordance with the Record of Discussions signed on July 6, 1984. The purposes of the the project are the improvement of agricultural productivities, the promotion of the distribution of agricultural products and materials for production and the settlement of socio-economic fundation of the agriculture through the organization of farmer's activities.

The construction of Model Infrastructure has been implemented based on the Detailed Design carried out from October 16 to December 14, 1985 for aiming at two farmer's organizations of the five above mentioned in Kong Samaki and Chakkarat area.

Main cropping in the area is paddy rainfed during wet season.

Annual rainfall in the area is in the range of 1,000 mm to 1,300 mm with concentration in wet season during May through October. The distribution of monthly rainfall fluctuates rather great, and about 20 days drought in July and August gives great deal of damage.

Taking account into the circumstances above mentioned, the construction of Model Infrastructure consists of the farm pond to supply irrigation water for the paddy in Kong Samaki area and the weirs to store stream water for the irrigation and to control the flood in Chakkarat area.

2. Kong Samaki area

2-1. Planning and design of farm ponds

1) Water utilization plan

In May, early wet season, the amount of irrigation water in enough for land preparation and nursery. However, in July and August, irrigation water is insufficient for a cultivation because of lack of irrigation facilities and small amount of a rainfall. Therefore, small scale farm ponds were proposed to store surplus rainfall in early wet season, and to supply irrigation water during dry season. These farm ponds can also contribute to the upland after cultivation of paddy.

2) Location of small scale farm ponds

The location of farm ponds was dicided in consideration of catchment areas and benefit areas. Further more, farm ponds were planned to be around the boundaries between individual benefitial areas from the viewpoint of cooperative management.

3) Storage capacity of farm ponds

Storage capacity of farm pond was determined taking into account 5 days water requirement in proportion to the each benefitial area. The factors of a rainfall, ground water, reuse of water were ignored as a safety factor.

4) Dimension of farm ponds

The decided dimensions of farm ponds are as follows.

Type	Storage (cum)	Size (m)	Depth (m)	Slope gradient	The number of ponds
A	1,800	26x26	5.0	1 : 1.5	2
B	2,600	30x30	5.0	1 : 1.5	2
C	3,300	33x33	5.0	1 : 1.5	3
D	5,400	40x40	5.0	1 : 1.5	4

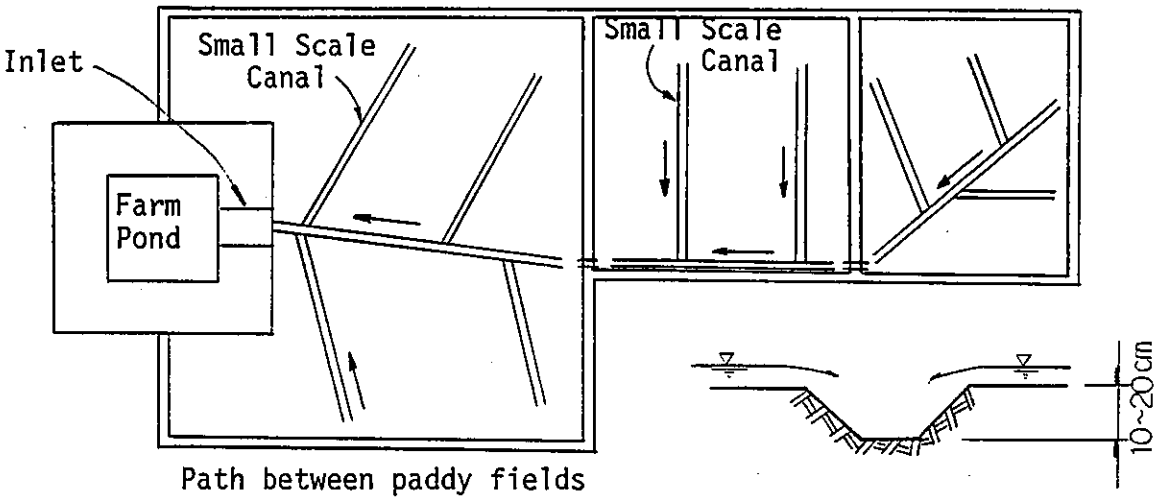
Total storage amount : 40,300 cum

2-2. Management of irrigation water

1) Water collection into farm pond

Available water of farm pond depends on the amount of rainfall and catchment area that consists of its own area and neighboring paddy field.

The amount of inflow water from paddy field is influenced by the efficiency of water collection into farm ponds. Therefore, a leveling of paddy field and a construction of catch drain are required for smooth water collection as illustrated as follows.



Standard Section of Small Scale Canal

Fig. 2-1

2) Irrigation area

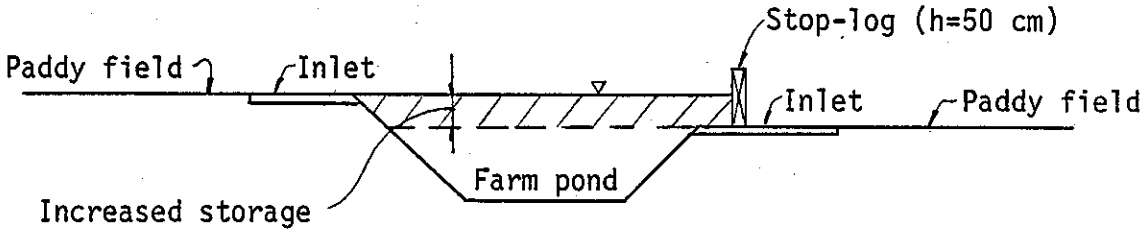
Storage capacity of farm pond is derived from total amount of 5 days water requirement of benefit area. Therefore, the reduction of irrigable area may occure according to the duration of the drought.

3) Inlet and stop-log

The functions of inlet and stop-log are as follows.

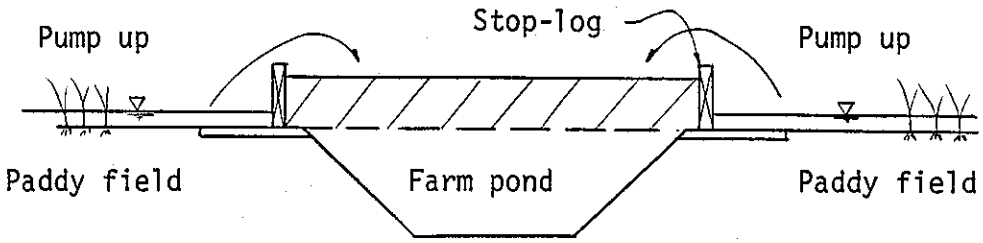
i) Increase of water storage by the stop-log

It is possible to increase water storage of farm pond by closing the stop-log set up at the inlet designed about 20 cm lower than the surface of the paddy field to drain a rainfall effectively.



ii) Inclease of water storage by pumping up

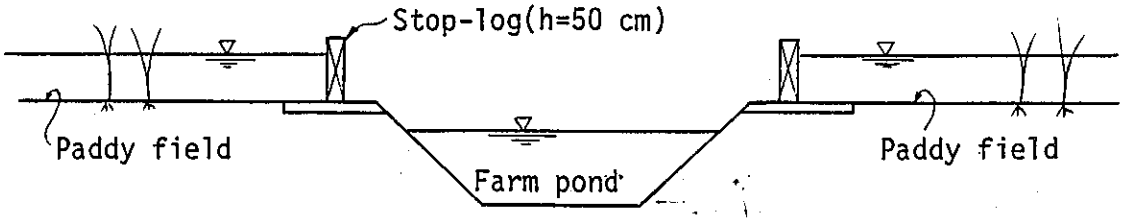
Increase of water storage of farm pond by pumping up surplus water of paddy field in wet season.



iii) Keeping the depth of flooding water of paddy field

Prevention of the outflow by closing the stop-log from adjoining paddy field in to farm pond keeps the depth of flooding water of paddy field.

Plugging of the space between the stop-log and the groove with clay soil makes it possible to prevent the stop-log from a leakage of water.



It is possible to prevent a water lead of the stop-log by plugging of the space between stop-log (wooden 1,000 B x 500 H) and groove with clay soil.

2-3. Operation and maintenance of farm ponds

1) Prevention of a soil inflow into farm ponds

Each farm pond has two or three inlets of which canal elevation is designed about 20 cm lower than the surface of the paddy field in order to drain effectively. The elevation of the stop=log bottom is designed 5 cm higher than inlet canal in order to prevent the soil inflow into farm pond and to store the soil in inlet canal. Therefore, it is necessary to remove the soil stored in inlet canal as soon as possible in order to maintain this function.

In the case of large soil inflow, wooden gate of about 10 cm height should be set up at the stop-log in order to slow down the velocity of flowing water and to reduce soil inflow into the farm pond.

2) Prevention of a erosion in the slope of farm ponds

A method of sod facing is adopted as a means to prevent a erosion in the slope of farm pond, and is especially effective around the boundaries between concrete and excavated/embanked soil structure because of a liability of the erosion.

The extent of sod facing is the area of embankment slope above paddy field elevation (sull water level of farm pond).

On the occation of sod facing, sufficient water should be supplied on the foundation of the sod, and the density of the sod should be considered in the viewpoint of working efficiency and period.

3) Slope protection

A walking on slope pretection should be prohibited because of a possibility of the collapse of the gravel in concrete flames.

4) Safety facilities

Safety facilities such as a fence should be set up to prevent children from falling down into farm ponds.

5) The position to step into farm pond for pump setting and so forth should be fixed to protect the slope.

2-4. Advancement of storage efficiency of small scale farm ponds

The reduction of the evaporation from water surface of farm pond advance storage efficiency, and the methods to reduce the the evaporation are considered as follows.

1) Reduction of wind velocity
2) Reduction of evaporation by an equatic plant

1) Reduction of wind velocity

Ordinary wind velocity in the area is in the range of 1.0 to 2.0 meter per second. Wind velocity has strong influence on evaporation speed, and the plants on the embankment influence wind velocity strongly.

The plants should be selected with consideration of the possibility of dense planting and their height expected 3.0 to 4.5 m height.

By way of example, the plants cultivating on the embankment in Khon Kaen are shown as follows.

i) Acasia, Seshania (woody leguminous)

The leaves can be used as green manure, and tree crown supply a shade for farmers and crops.

ii) Lime, Pummelo (citrus)

Citrus grows on wide variety of soils, from coarse sends to heavy clays. Because citrus has many kinds of rootstockes against salinity and so on, adquate selection of the rootstocks seems to be key points for the successful cultivation.

iii) Banana, Papaya, Mango, Jujube (fruit trees)

Considering good drainage condition of the embankment, fruit trees grow well under sufficient water supply.

iv) Tamarind, Jackfruit

As these can be seen in North-east Thailand, there are high possibility of growing up.

(The authority : Report of Integrated Small-Scale Rural Development (4))

2) Reduction of evaporation by an aquatic plant

It is possible that aquatic plants reduce the evaporation from water surface under the condition that the evapo-transpiration is less than the evaporation. There are no plants applicable to the condition above mentioned now.

2-5. Prevention from salt damage

The results of water quality analysis in Kong Samaki area are shown in Table 2-1, Fig. 2-2, 2-3

Symbol	Site	Kind of Water
A	Existing farm pond	Storage water
B	Test pit No. 1	Ground water (depth 2.0m)
C	Test pit No. 2	Ground water (depth 2.0m)
D	Provincial office	Ground water (deep well)
E	Hospital	Ground water (deep well)
F	New farm pond, P1	Ground water (depth 5.0m)
G	New farm pond, P9	Ground water (depth 5.0m)

Sample A - E was gathered in wet season (October, 1985).
F and G was in dry season (April, 1986).

Table 2-1

Symbol	E.C. mmhos/cm 25°	PH	SAR	Sodium Hazard	Salinity Hazard
A	0.11	6	0.85	S1	C1
B	1.15	7	14.6	S3	C3
C	1.20	6	16.2	S3	C3
D	3.20	6	31.5	S4	C4
E	3.30	6	22.4	S4	C4
F	0.75	7.5	6.50	S2	C3
G	0.87	7.7	17.4	S3	C3

According to "United State Deaprtment of Agriculture (USDA)", water smaples were classified into four groups as shown Fig. 2-2.

Ground water in deep well is not able to be used for irrigation water under ordinary conditions because its sodium and salinity hazard are classified into S4 and C4.
Ground water within 5 meters below ground surface in farm ponds construction area may be applicable to a irrigation under the condition of the dilution with the rainfall. This is obvious from the result of existing farm pond (A).

There is little difference in water quality between dry and wet season in comparison with the results of water quality analysis of sample B, C, F and G. Therefore, it is presumable that water quality of farm ponds does not deteriorate extremely in condition that ground water become predominant in storage water during dry season.
However, it is unavoidable that the salinity hazard rise by the evaporation.

In all cases, the dilution of ground water with the rainfall is desirable for a irrigation. It is necessary to check irrigation water quality all the year round and salt accumulation into paddy field over a long period.

A leaching with plentiful rainfall at the end of wet season is effective method to prevent paddy fields from salt accumulation. Canal position should be changed for effective leaching as follows.

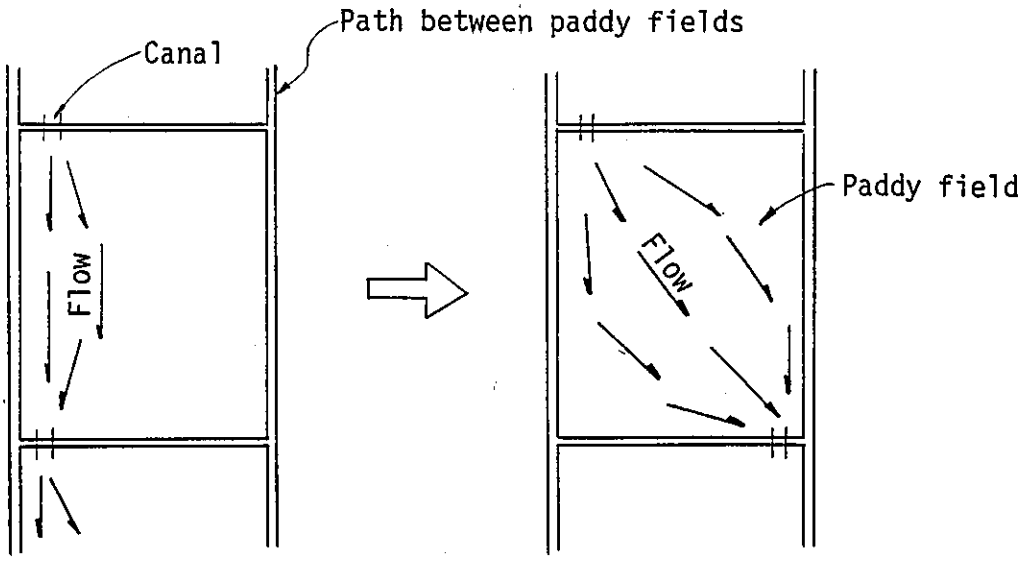
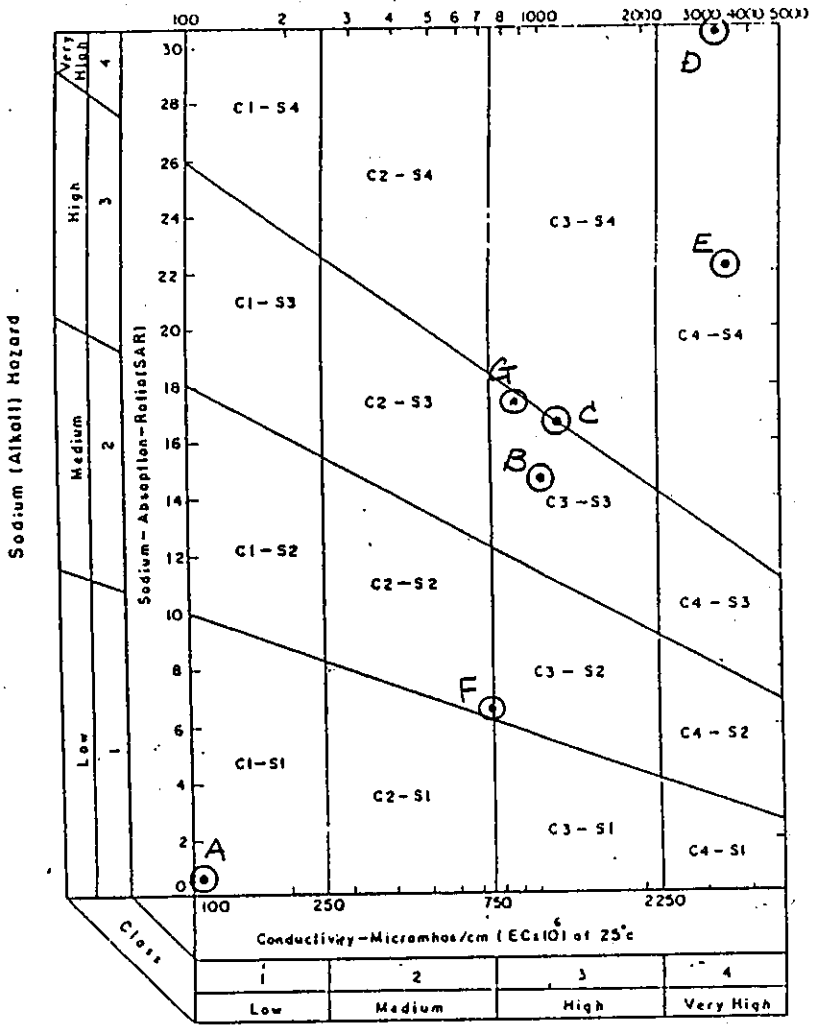


Fig. 2-4

Fig 2-2 WATER QUALITY CLASSIFICATION



S_1	Low sodium water can be used for irrigation in almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium sensitive crops such as stonefruit trees and avocados may accumulate injurious concentrations of sodium.	C_1	Low salinity water can be used for irrigation with most crops on most soils with little likelihood, that soil salinity will develop. Some leaching is required but this occurs under normal irrigation practices, except in soils of extremely low permeability.
S_2	Medium water will present an appreciable sodium hazard in fine textured soils having high cation exchange capacity, especially under low leaching conditions unless gypsum is present in the soil. This water may be used on coarse textured or organic soils with good permeability.	C_2	Medium salinity water can be used if a moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.
S_3	High sodium water may produce harmful levels of exchangeable sodium in most soils, and will require special soils management; good drainage, high leaching, and organic matter conditions. Gypsiferous soils may not develop harmful levels of exchangeable sodium from such waters. Chemical amendments may be required for replacement of exchangeable sodium, except that amendments may not be feasible in the case of waters of very high salinity.	C_3	High salinity water cannot be used on soils with restricted drainage, even with adequate drainage, special treatment for salinity control may be required, and plants with good salt tolerance should be selected.
S_4	Very high sodium water is generally unsatisfactory for irrigation pruposes, except at low and perhaps medium salinity where the solution of calcium from the soil or used of gypsum or other amendments may make the use of these waters feasible.	C_4	Very high salinity water is not suitable for irrigation under ordinary conditions, but may be used occasionally under very special cercumstances. The soils must be permeable, drainage condition must be adequate, irrigation water must be applied in excess to provide consierable leaching and very salt-tolerance crops should be selected.

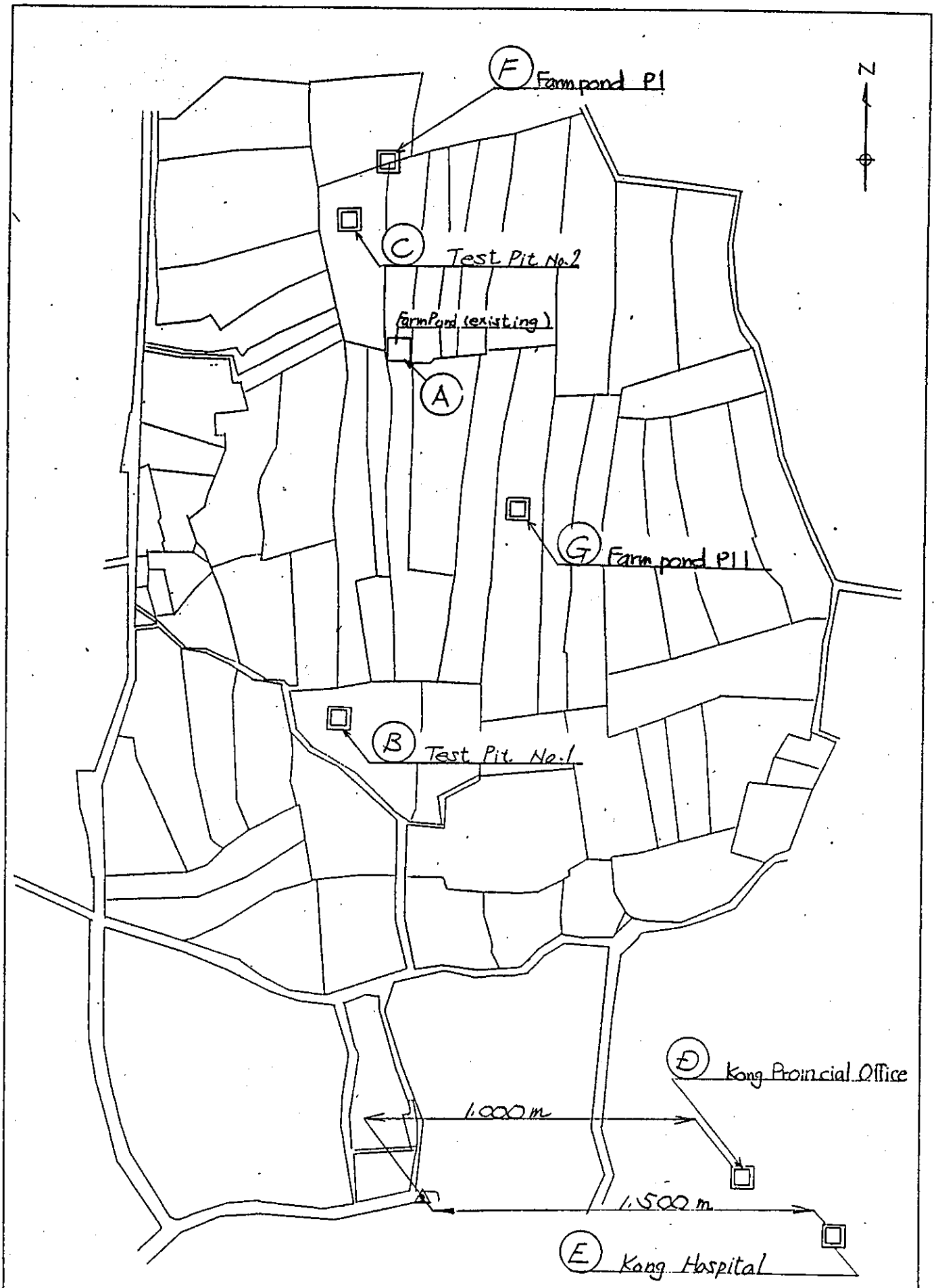


Fig 2-3 Location of Water sample scale 1:1000
(Kong Samaki)

2-6. Multi purpose utilization of farm ponds

1) Field cropping

It is very useful to cultivate the crops at the field of the embankment of farm ponds and at paddy field during dry season. The examples in the Integrated Small-Scale Rural Development Project in Khon Kaen are shown as follows.

- Chili pepper, Chinese leek - liable to be attacked by insects or diseases
- Cabbage, Chinese cabbage - liable to be attacked by insects
- Tamato, egg plant
- Long yard bean - cultivated in the paddy field

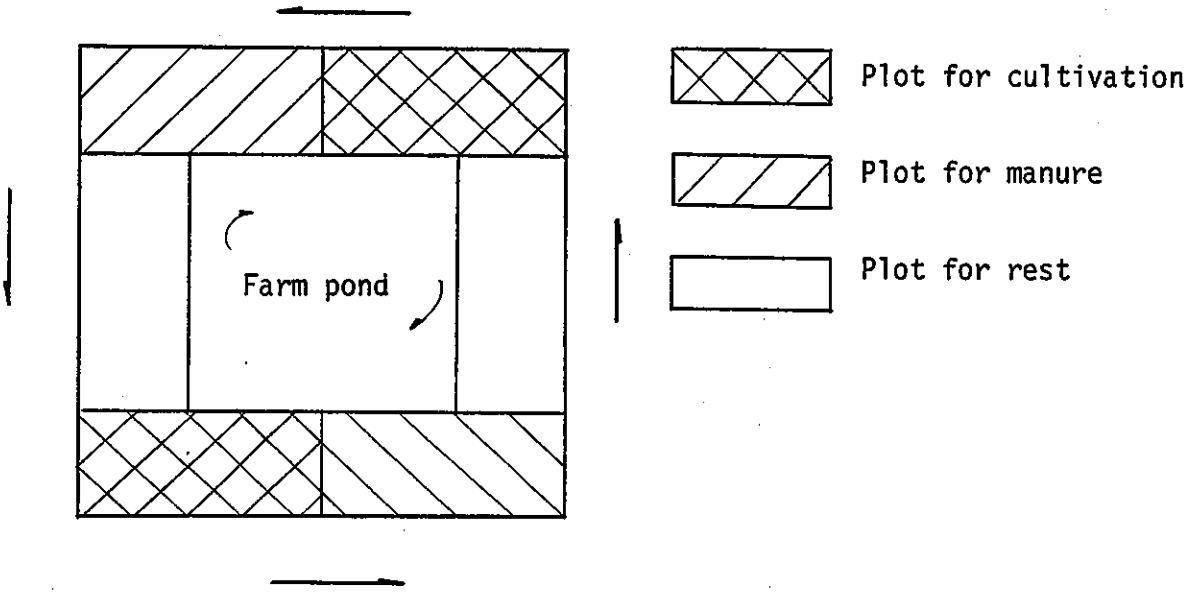
other kinds of crops recommended

- Swiss chard
- Table beet - saline tolerance
- Asparagus
- Hyacinth bean - heat tolerance
- Pumpkin
- Bottle gourd
- Onion
- Garlic
- Corn - in the paddy field

As to field cropping above mentioned, a mixed cropping with chili pepper, chinese leek and coriander is effective to protect them from the damages by insects.

The field should be divided into three areas for cropping, for manure and for rest as shown in Fig. 2-5 for the purpose of the improvement of soil conditions and the increase of yield. The expected rotation cycle is about three or four months.

Fig 2-5



(the authority ; Integrated Small-Scale Rural Development)

2) Fish farming

Fish farming in farm ponds is useful in supplying the protein to inhabitants. However, there is a limit of the kinds of fishes in the viewpoints of water qualities. Tilapia fish, giant prawn, carp and crucian are suitable under high temperature, poor mutriment and salinity conditions, and tilapia fish are recommendable. It is necessary for fish farming to make the pond nutritious, but excessive nutritiousness make water quality worse.

Therefore, spontaneous generation of plankton with the breeding of an aquatic plants and utilization of a water grass as a feed are recommendable in fish farming.

2-7. Location of farm pond

Location of farm pond ought to be considered under the following conditions, if the Government of Thailand plan farm pond depending on the rainfall in the future.

1) Efficiency of the drainage of the rainfall
2) Utilization of ground water
3) Possibility of repeating irrigation
4) Geological and soil condition

1) Efficiency of the drainage of a rainfall

A investigation into a state of run off and drainage basin are required in detail.

2) Utilization of ground water

A investigation into water table, seasonal fluctuation of water level and water quality by the use of bore hole wells are required.

3) Possibility of repeating irrigation

A part of irrigation water supplied in upper paddy field area exude and drain into lower reaches of a canal or farm ponds. A repeated utilization of irrigation water resources by means of pumping up from farm pond into upper paddy field area is desirable.

4) Geological and soil conditions

Geological and soil investigation by using of test pits and auger-borings should be carried out in order to study slope safety and infiltration loss of farm pond. The construction cost of farm pond largely depends on excavation volume of the rock. Therefore, it is necessary to investigate the elevation of the bedrock.

3. Chakkarat area

3-1. Conditions of irrigation and drainage

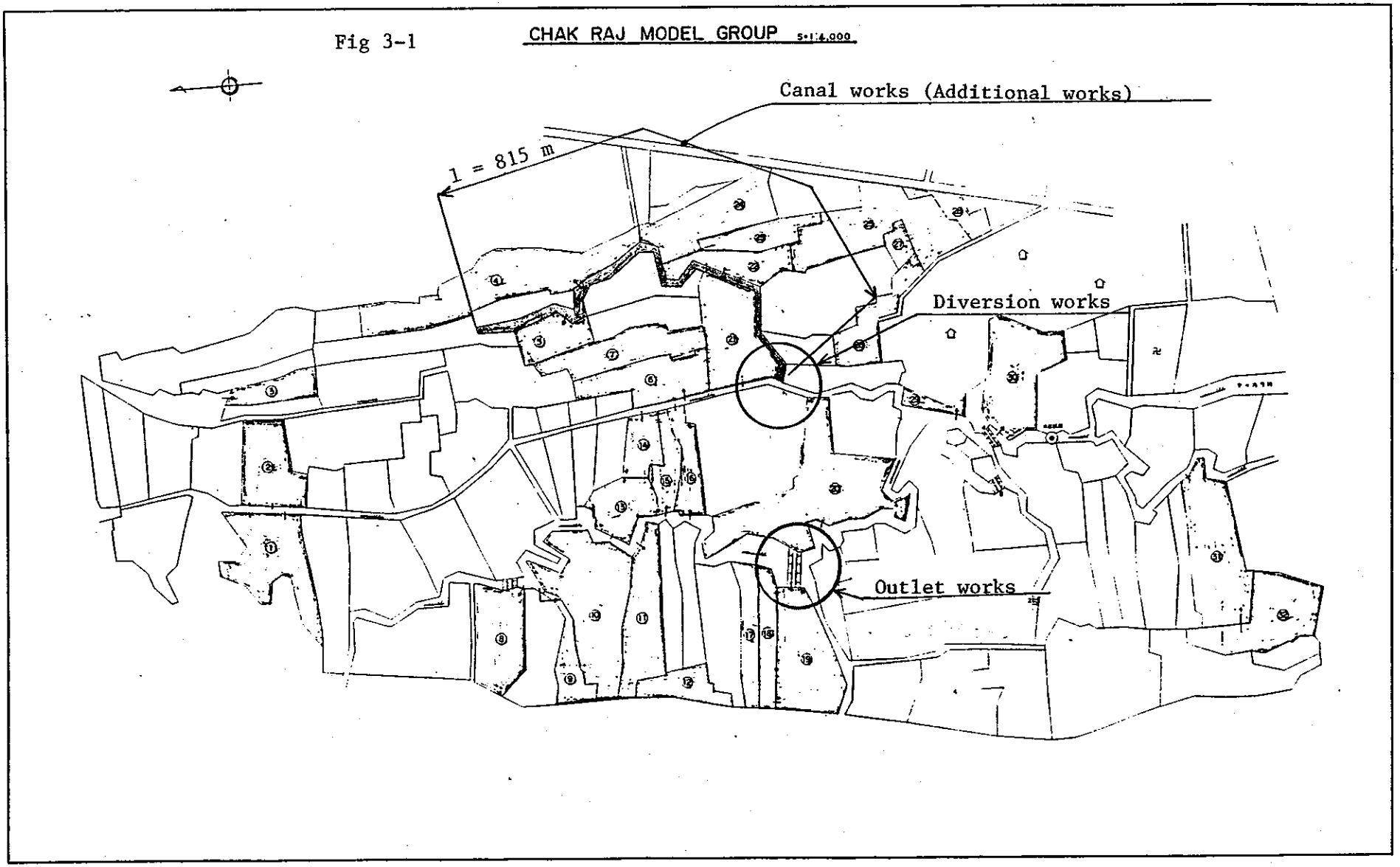
Irrigation water in the area is supplied from the Chakkarat River originated from Dong Paya Yen. The Chakkarat River flows meanderingly to the north through the center of the area, and meets the Mum River at Pimai. The topography of the catchment area is nearly flat plain, and the soil is alluvial.

There are several intake weirs along the Chakkarat River. The types of intake facilities are open ditch or culvert combined with a weir. Irrigation water flows down from the field to field, so called plot irrigation system. The dike of the Chakkarat River is on a small scale, and is constructed by the method of cut and bank.

The drainage basin of the Chakkarat River within Chakkarat area is more than 800 km^2. The river has no water in the beginning of wet season, May and June, because the amount of rainfall is so small that the outflow percolates. It is the end of wet season, September and October, that the outflow can be used for a irrigation, but paddy field suffer often from a flooding because of the poor conditions of the dike.

In consideration of the conditions above mentioned, outlet works (Site A) and Diversion works (Site B) were constructed. (See Fig. 3-1)

Fig 3-1


CHAK RAJ MODEL GROUP S=1:4,000
Canal works (Additional works)
l = 815 m
Diversion works
Outlet works

3-2. Planning and design

1) Outlet works (Site A)

Intake weir at site A have no outlet works. Left bank was damaged by a overflow and a piping. It prevents the intake weir from the storage of irrigation water, and damages paddy field extended behind.

Rehabilitation works were planned in order to store irrigation water and to have spillway function.

2) Diversion works (Site B)

Site B is the division point to supply paddy field located in right bank with irrigation water. Existing division facility is in the form of a culvert, but its scale is too small to divert irrigation water sufficiently.

The repairs of existing division facility and weir were planned for the purpose of the increase of irrigation water diverted and the storage of river water.

3) Canal works (Site C, additional works)

The repairs for existing canal were executed for the purpose of the increase of the storage capacity in the canal. The length of the canal is about 800 m and its beginning point is located at the diversion works above mentioned.

3-3. Water control

A ground plan of Chakkarat area is shown in Fig. 3-1. Outlet works and Diversion works are located in the center of Chakkarat area. These have sluice gates to store the river water or to discharge the flood. Diversion works also has a sluice gate to take irrigation water for the canal connected at the right bank.

Gate Scale

Site	Low water level	High Water level	Height of gate	Width of gate	The number of gates
Outlet works	WL.198.10	WL.199.60	1.5 m	1.5 m	2
Diversion works	WL.198.10	WL.199.60	1.5 m	1.5 m	1
*)Stop-log gate	WL.198.80	WL.199.60	0.8 m	2.0 m	2
Diversion works	WL.198.10	WL.199.60	1.5 m	1.5 m	1

*) : Stop-log gate is set at Diversion works. The total gate cross-sectional area of flow, sluice gate and stop-log gates, is the almost same as the cross-sectional area to prevent from the water level rising caused by flood compared with existing water level.

The longitudinal section of Outlet works, Diversion works and Diversion works is shown in Fig. 3-2.

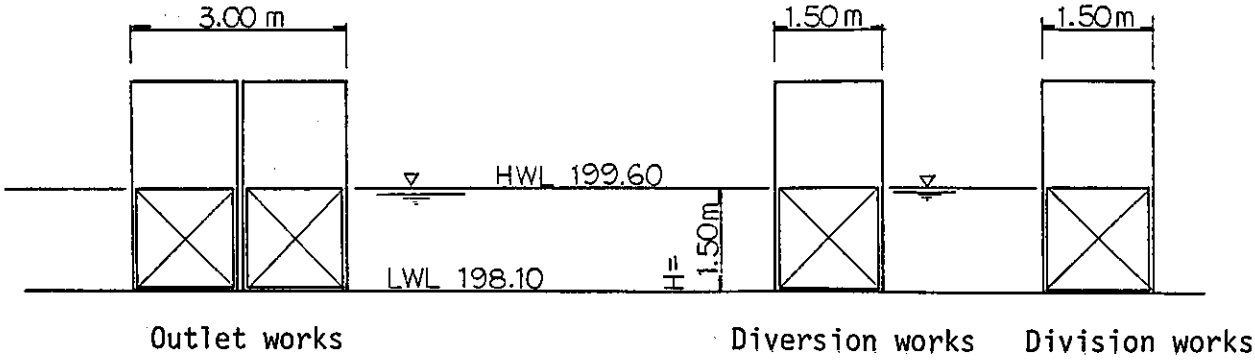


Fig. 3-2 Longitudinal section

All the gates are set in the same elevation.

3-4. Gate operation

Three ways of gate operation are planned here is the viewpoint of the period in wet season.

1) The first wet season (May - August)

As a flood hardly happen, all gates are kept closed to store the river water. The water level should be observed every day, and the attention should be paid for it after rain falls especially. The flow over the gates or banks is absolutely forbidden. On the occasion of the overflow, the sluice gates should be opened quickly, and the water level should be observed all the time.

The scale attached to gate flame is helpful to operate the gates, and gate operation ought to be learned empirically.

2) The latter wet season (September - October)

All gates are kept open in principle. To close the gates is permitted in the case of water supply for a irrigation. However, the gates should be closed at the last stage of river outflow. The gates should be opened as soon as the water supply is completed.

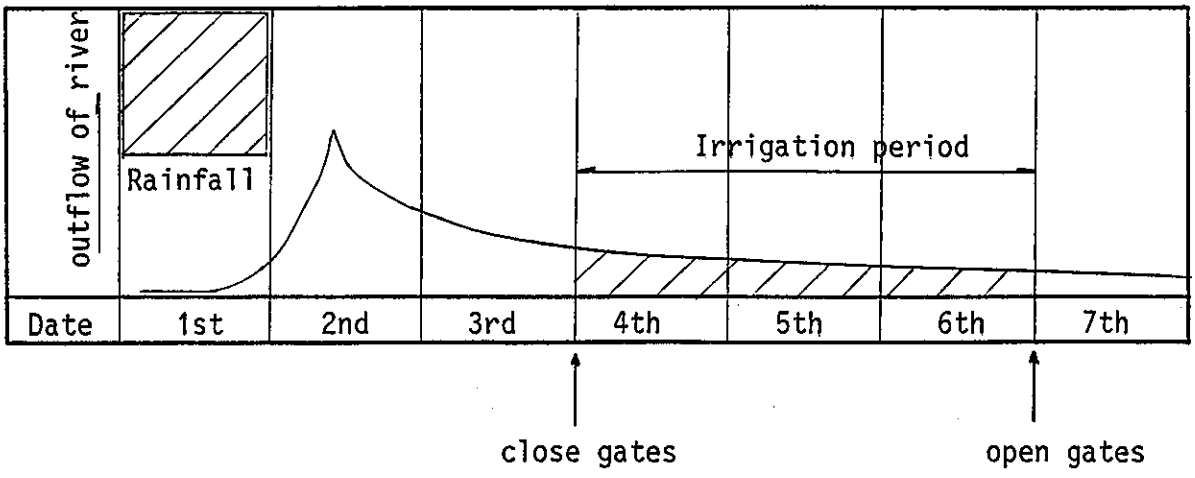


Fig. 3-3

3) The last stage of wet season

The gates should be operated in the ways indicated in Fig. 3-3. to store irrigation water for dry season in principle.

If there is a rainfall in the condition that the river is filled with water, the water level should be lowered before the increase of the outflow, and should be observed against unexpected flood.

3-5. Organization of gate management

A organization of gate management is required and one person should be employed as a gate manager. Gate manager has a obligation to adjust the hopes of all farmers in Chakkarat area concerning gate operation. The gates should not be operated without the approval of gate manager.

3-6. Maintenance for gates

Maintenance for gates is as follows.

1) Painting gates and stages (once or twice a year)
2) Application of grease to spindles and bevel gears (once a month)
3) Removal of soil collecting at up and downstream of gates (usually)
4) Removal of floatings, driftwood and so on (usually)
5) Exchange of water stop rubbers
6) Keeping of stop-log gates

3-7. Canal works

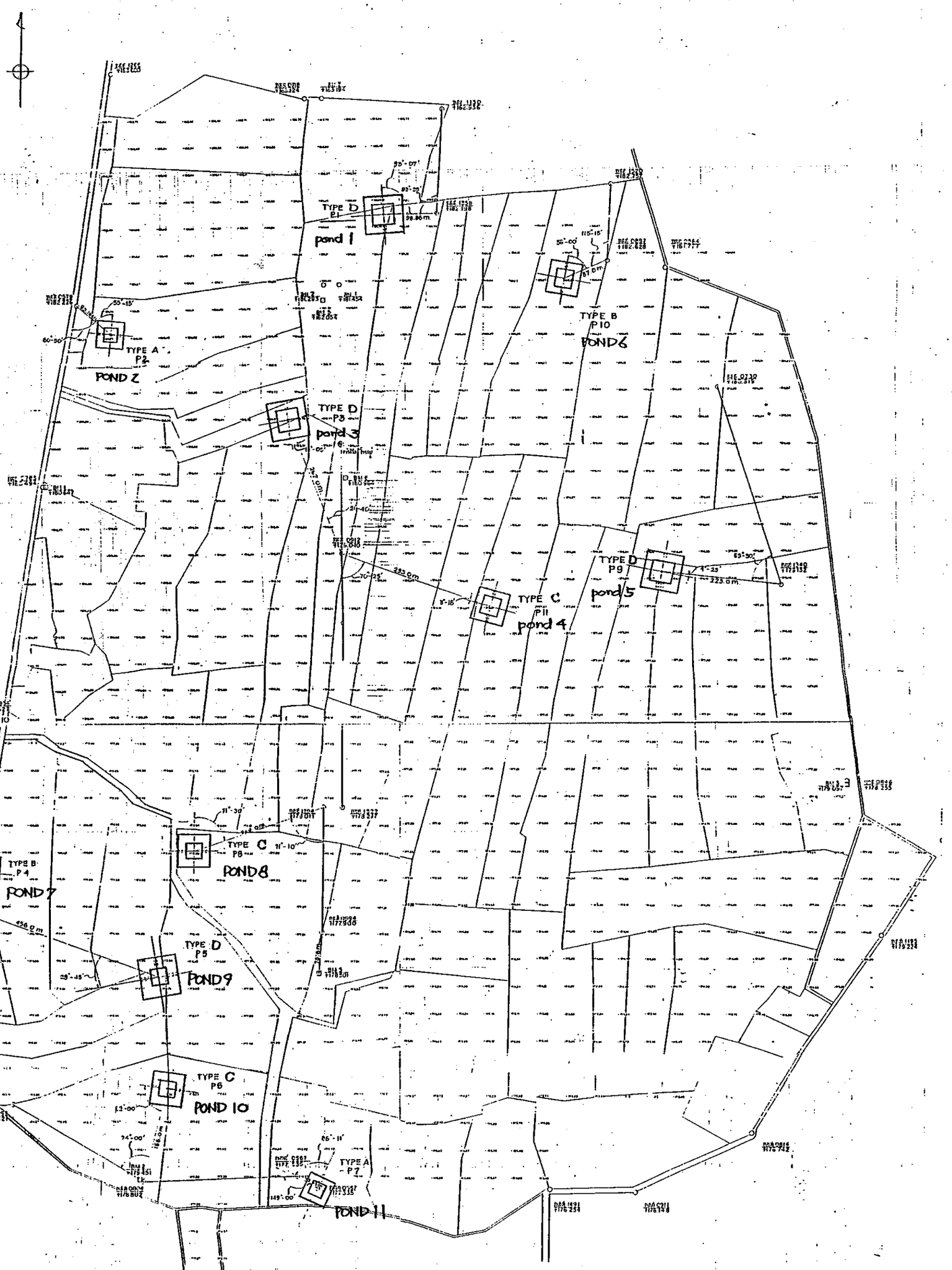
Canal excavation was carried out for the purpose of increase storage canal in canal. There are 5 existing weirs in canal and the weirs were not removed by the request of farmers.
The weirs are required for irrigation, but they obstruct river water to flow down to the end of the canal. The embankment on either bank of the canal and removal of existing weirs make stabilizing supply of irrigation water possible.

4. Conclusion

The Project is undertaken for the purpose of the promotion of the cooperation by farmers and the stabilization of socio-economic fundation for farmers by organizing their activities.

We trust that the construction of facilities for water resources in Kong Samaki and Chakkarat area will have a great great effect on the improvements in the flood control, irrigation and crop yields.

Furthermore the effects of the Project may spread as a good model for the projects undertaken in the Kingdom of Thailand in the future.



TYPE	CAPACITY	NUMBER
A	1 800 cum	2
B	2 600	2
C	3 300	3
D	5 400	4
TOTAL	40 300 cum	11

JAPAN INTERNATIONAL COOPERATION AGENCY

THE DETAIL DESIGN SURVEY FOR
AGRICULTURE COOPERATIVE PROMOTION PROJECT IN THAILAND

KONG SAMAKI

LOCATION OF FARM PONDS

PREPARED BY

CHECKED NO.

DRAWING NO.

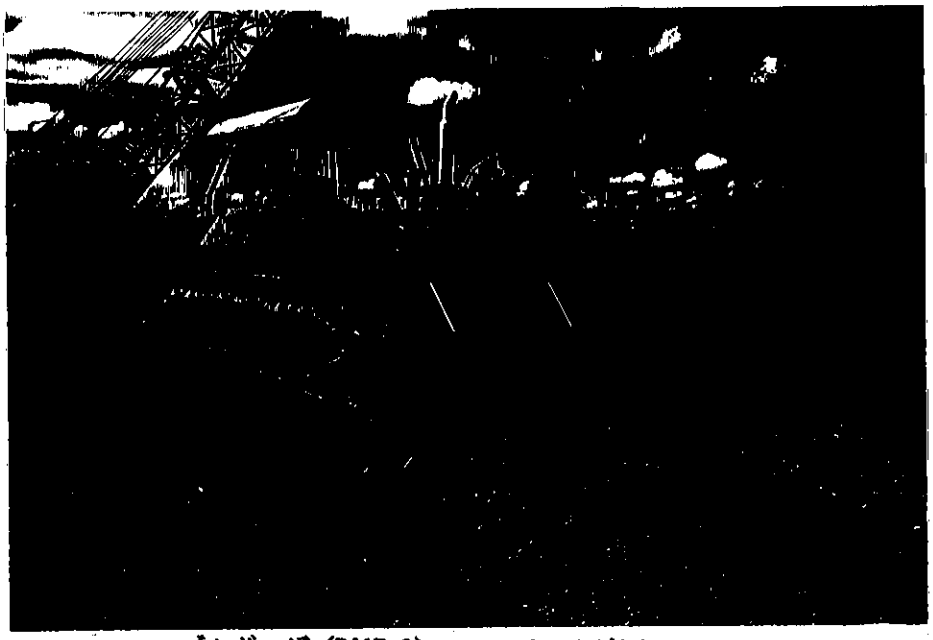
443

現場施工写真

コンサマキ地区

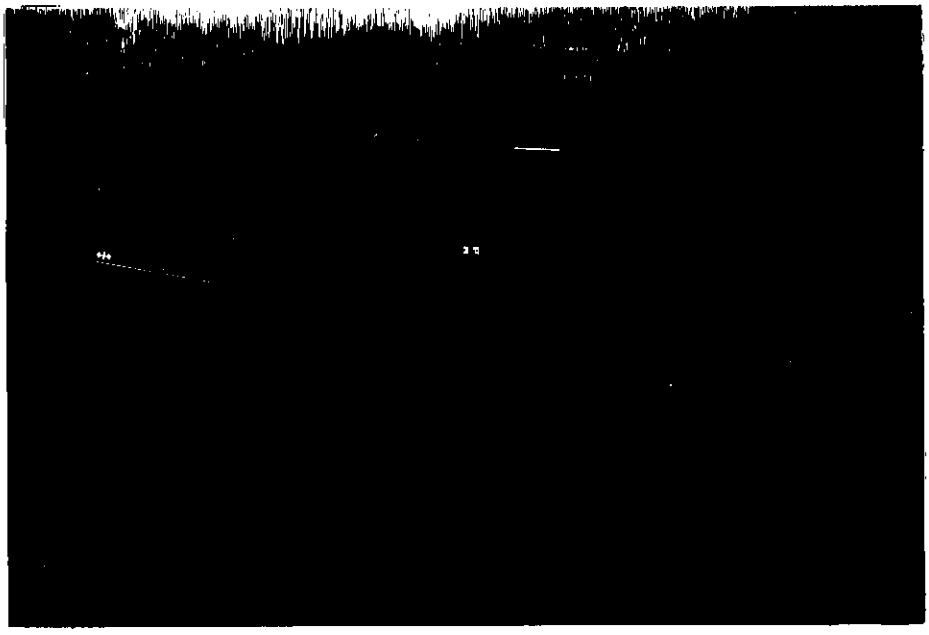
灌池案内のための看板

灌池番号を示す看板



ブルドーザ（D41P-3）　コンサマキ地区

ブルドーザ（D31P-17A）　キャカラ地区



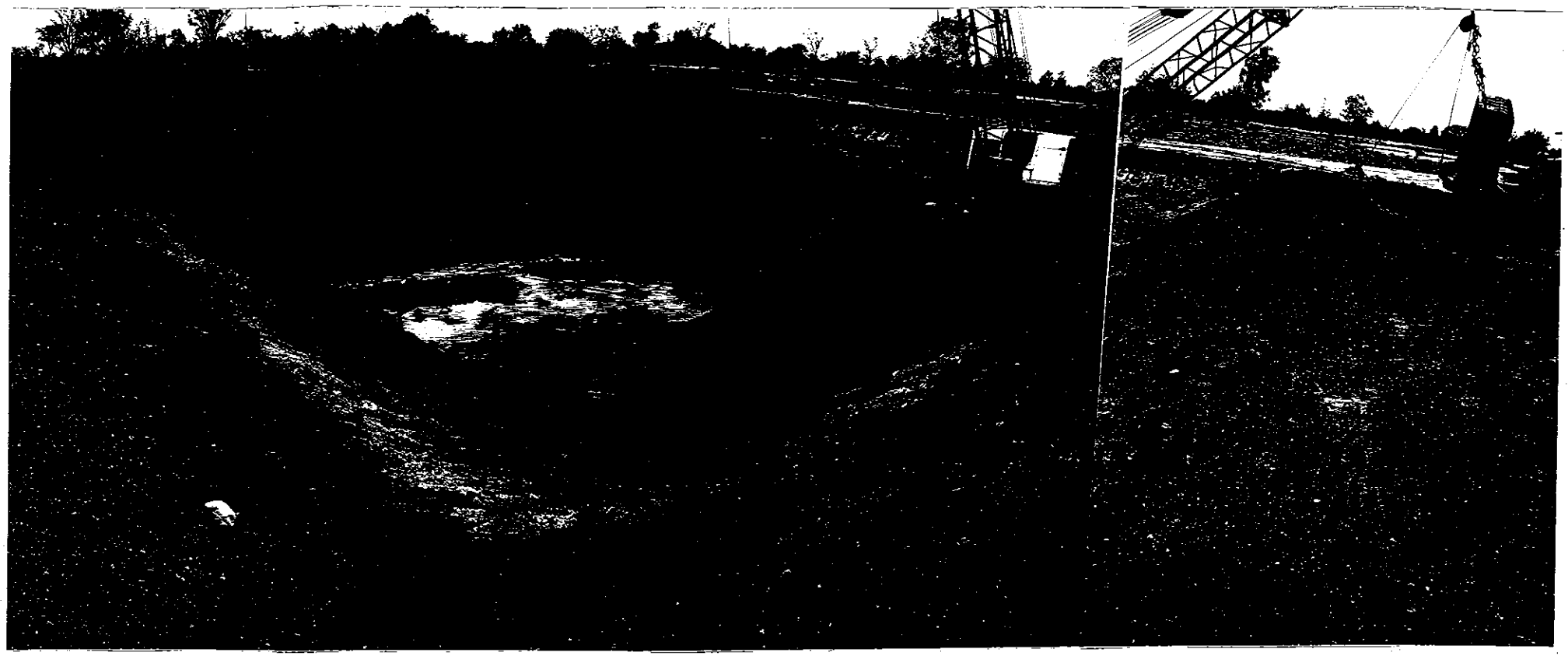
バックホウ PC150LC-3　キャカラ地区

コンサマキ地区　溜池

P1　溜池施工前

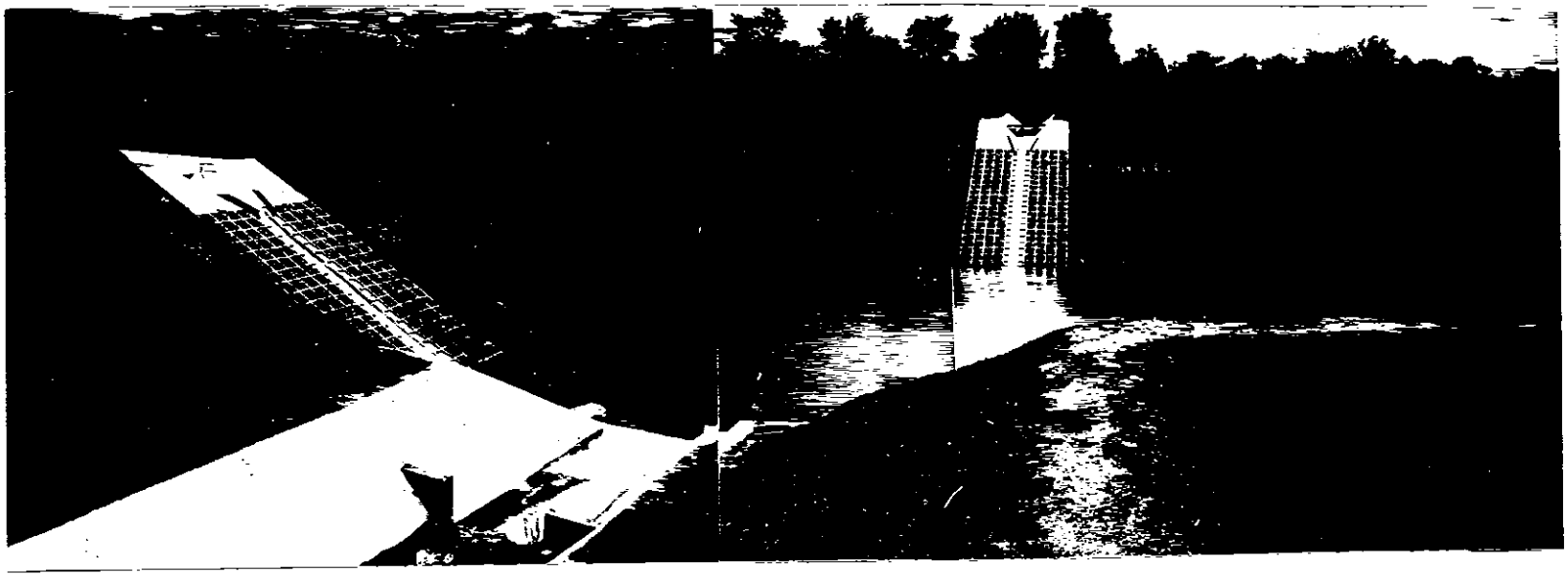
P1　溜池施工後

P1　クラムシェルによる溜池掘削

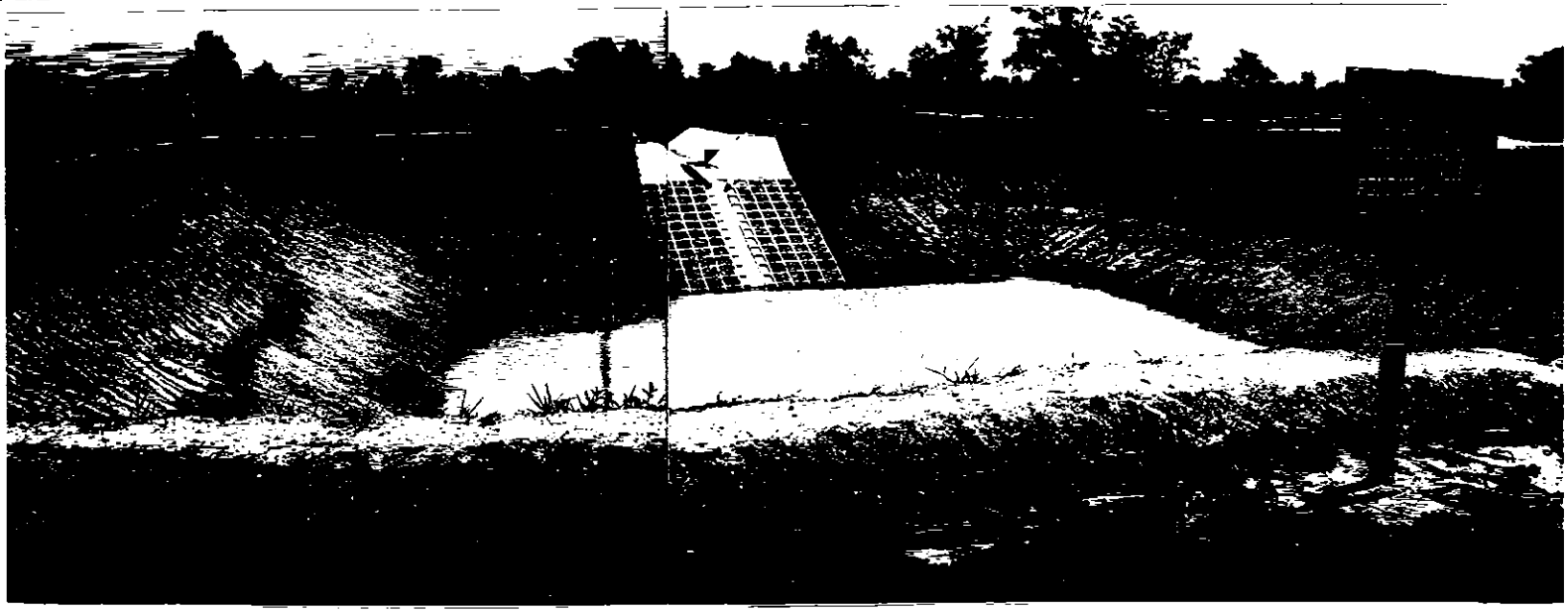


P1　クラムシェルによる潘池掘削，ブルドーザによる掘削土まき出し

P1　潘池内施工後

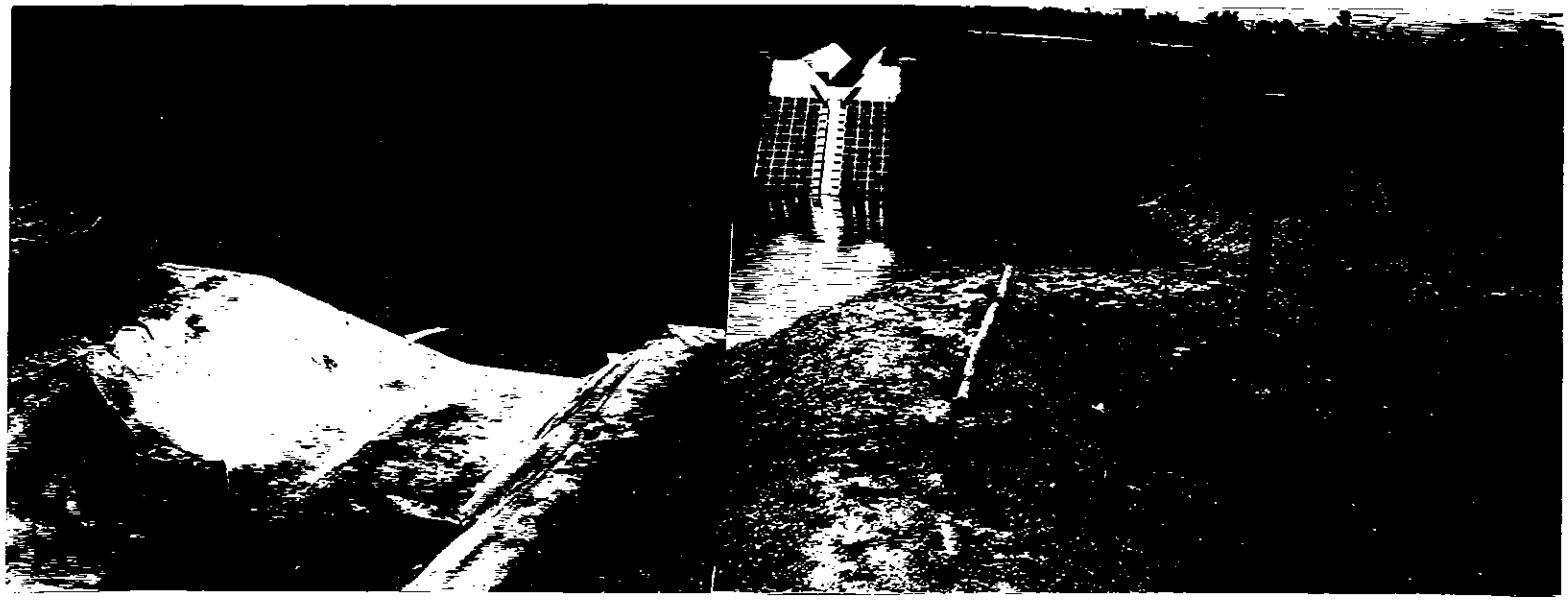


P2　潘池内施工後

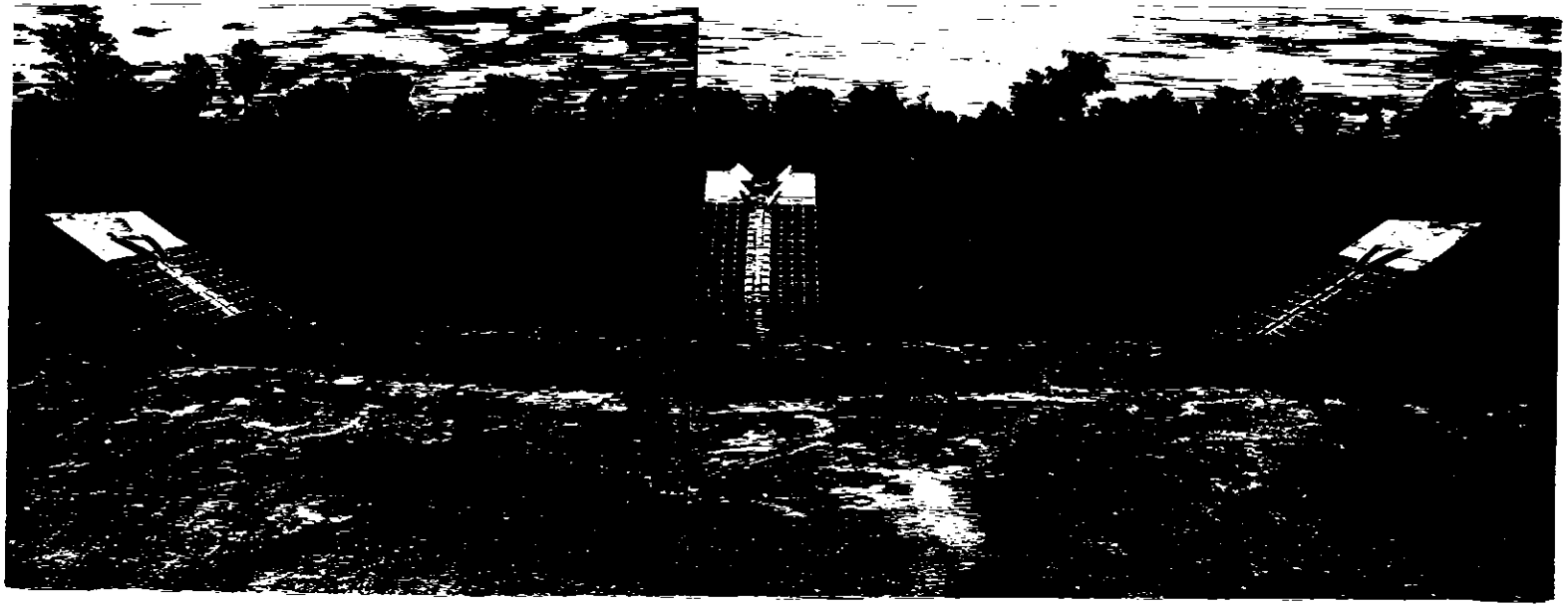


P3　潘池内施工後

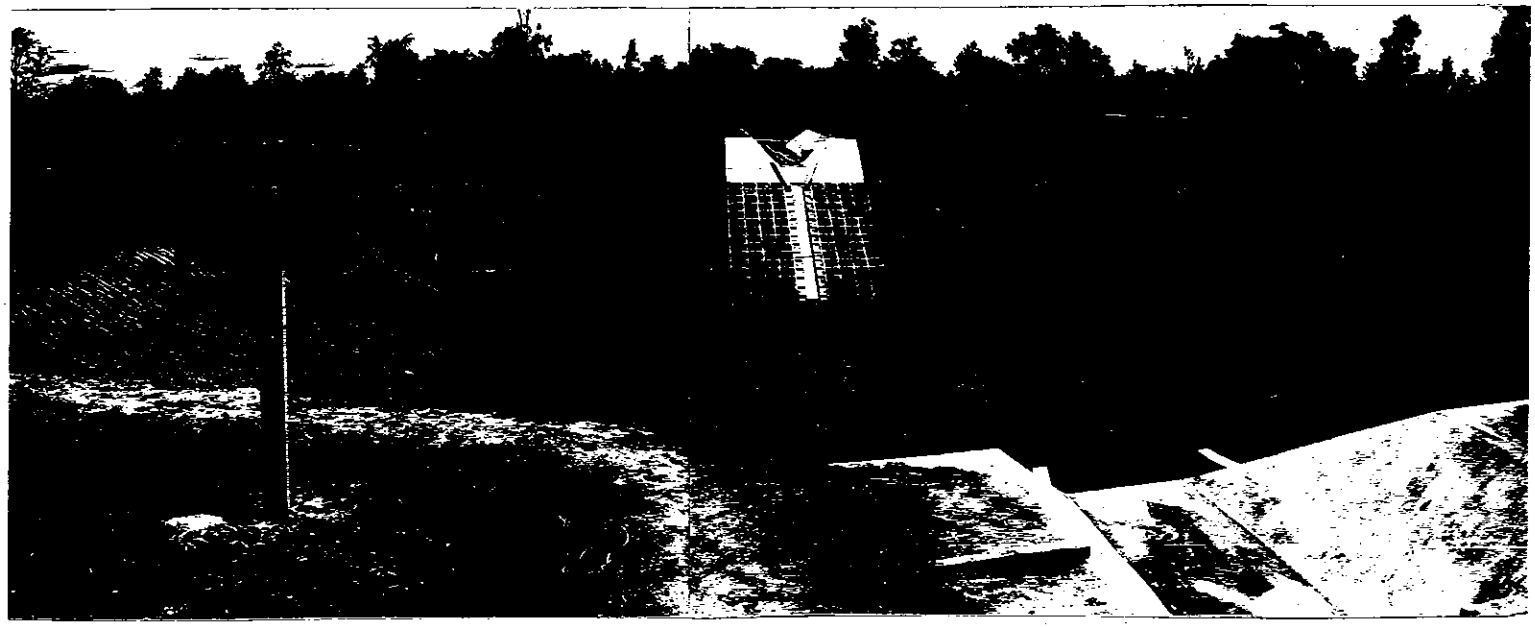
P4　潘池内施工後



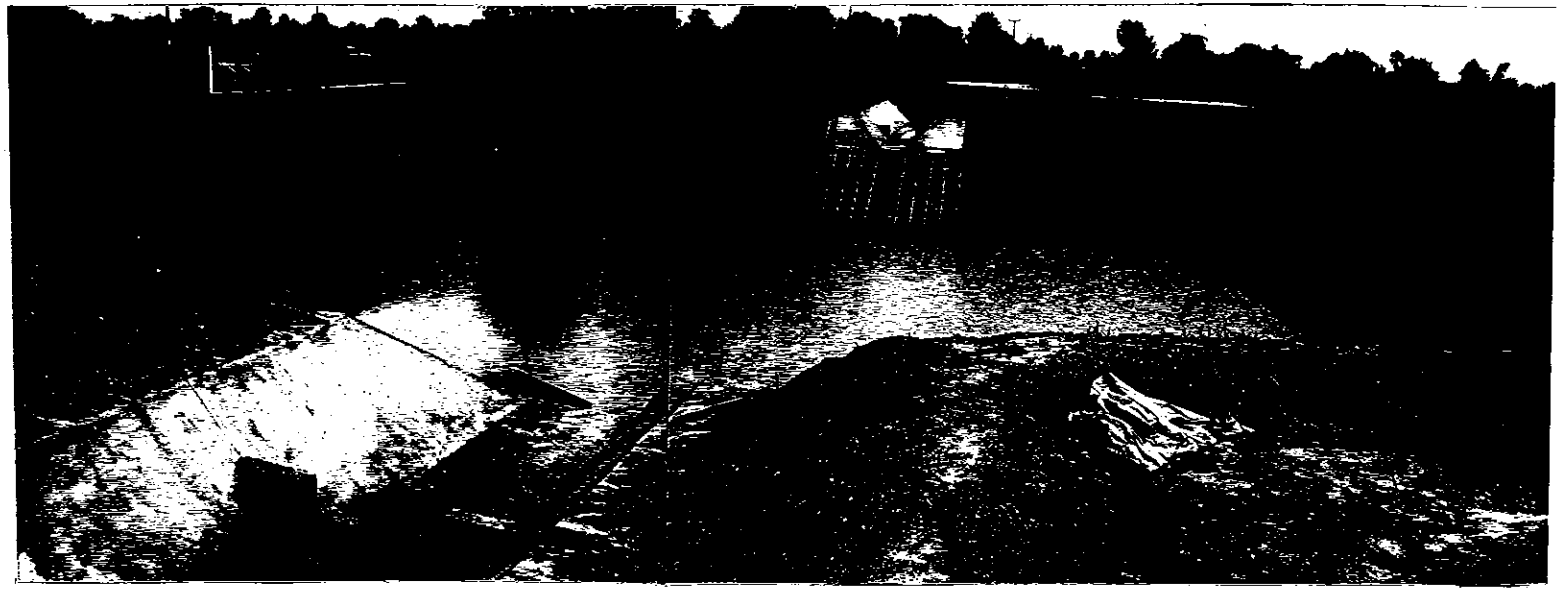
P5　潘池内施工後



P6　淵池内施工後

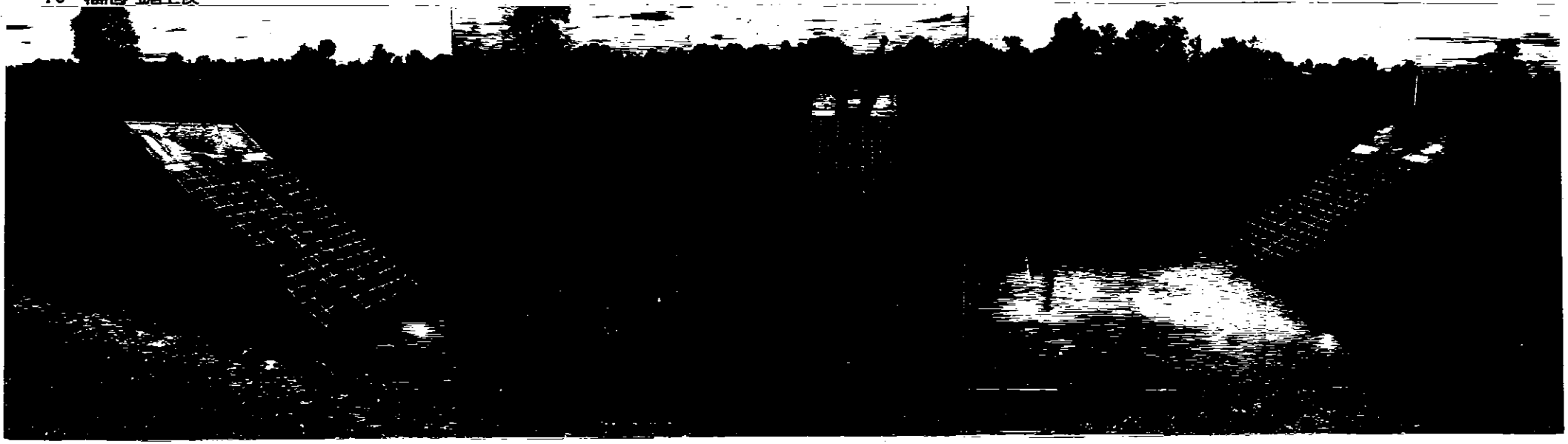


P7　淵池内施工後

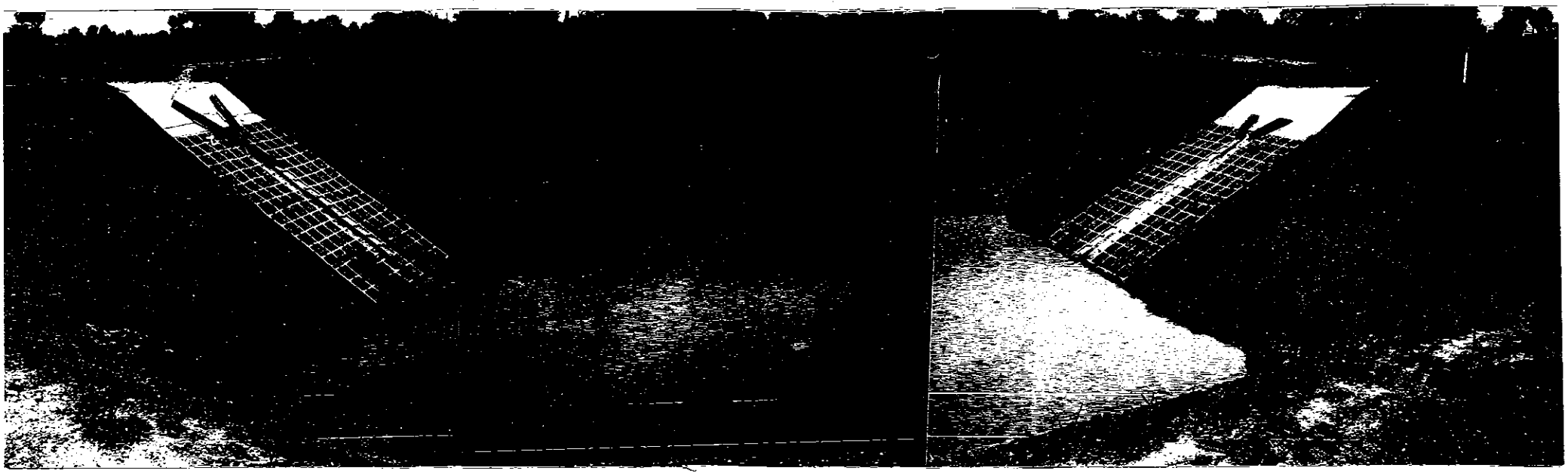


P8　潘池内施工後

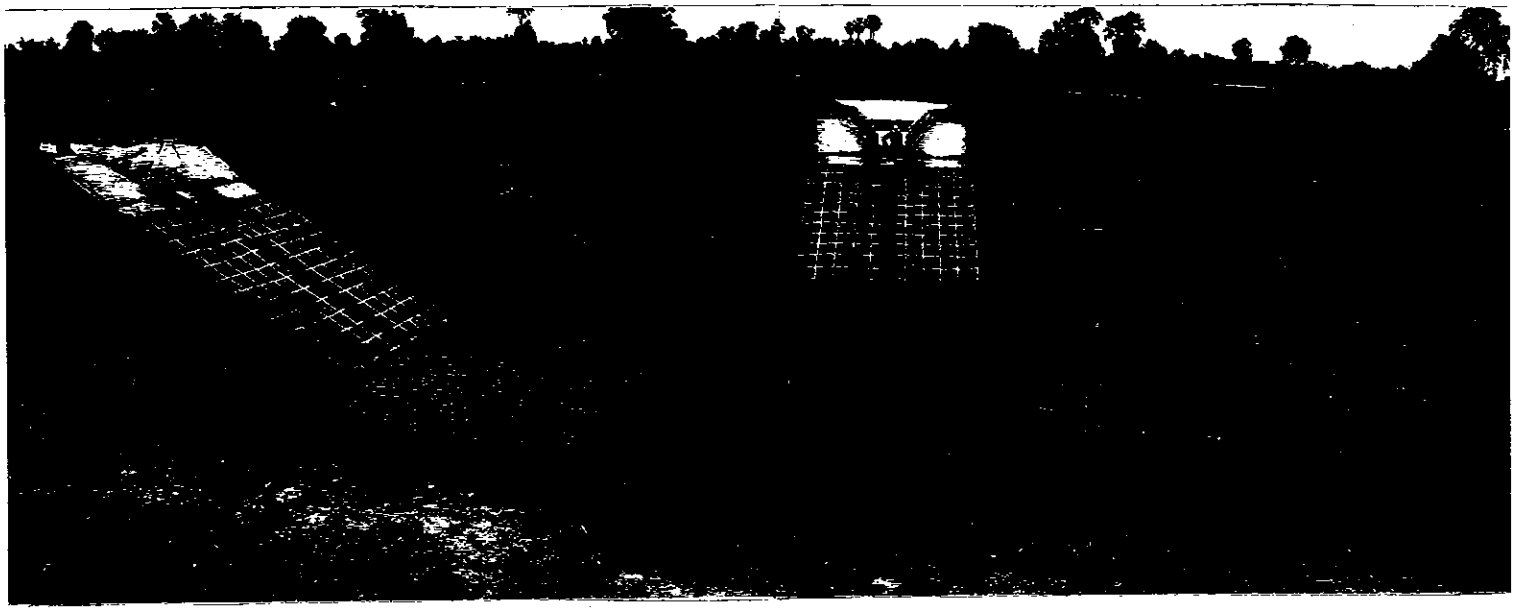
P9　潘池内施工後



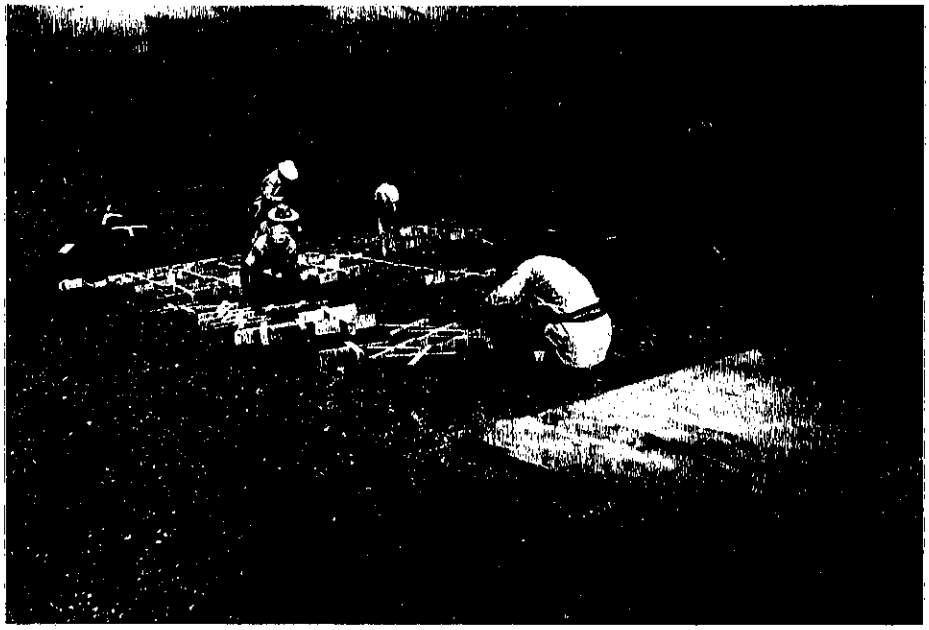
P10 溜池内施工後



P11 溜池内施工後

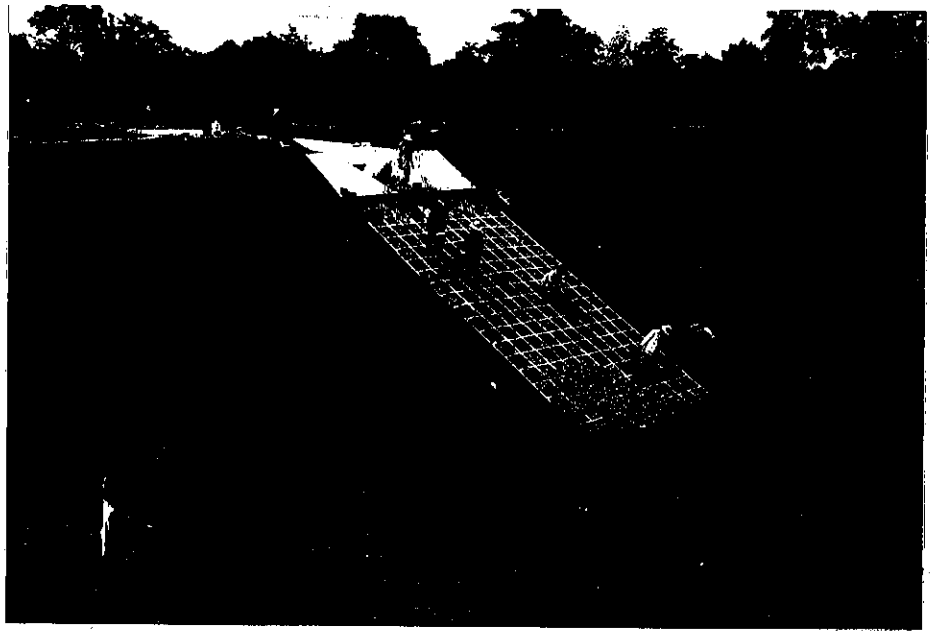


コンクリートフレーム設置

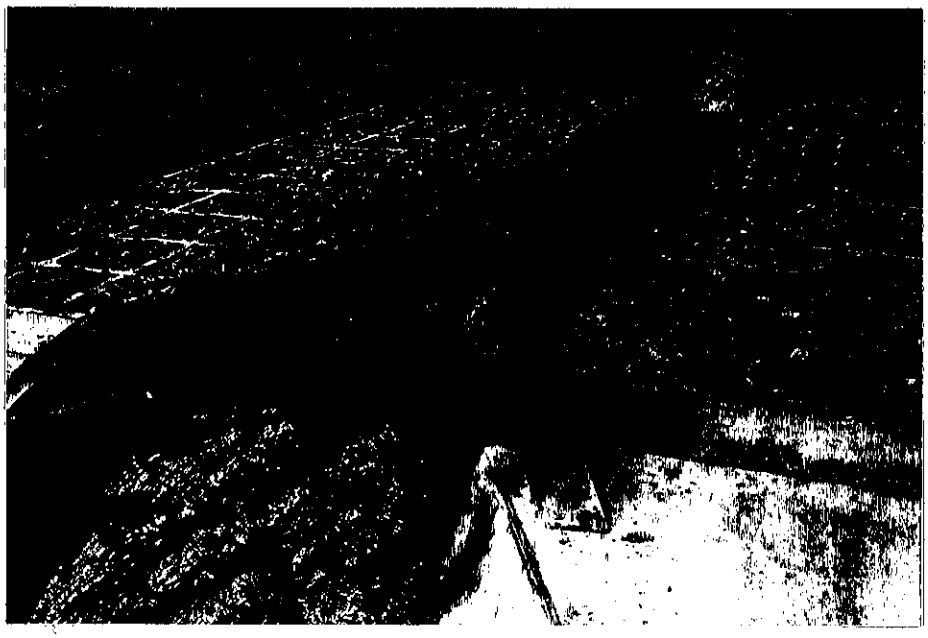


斜

中詰砕石施工



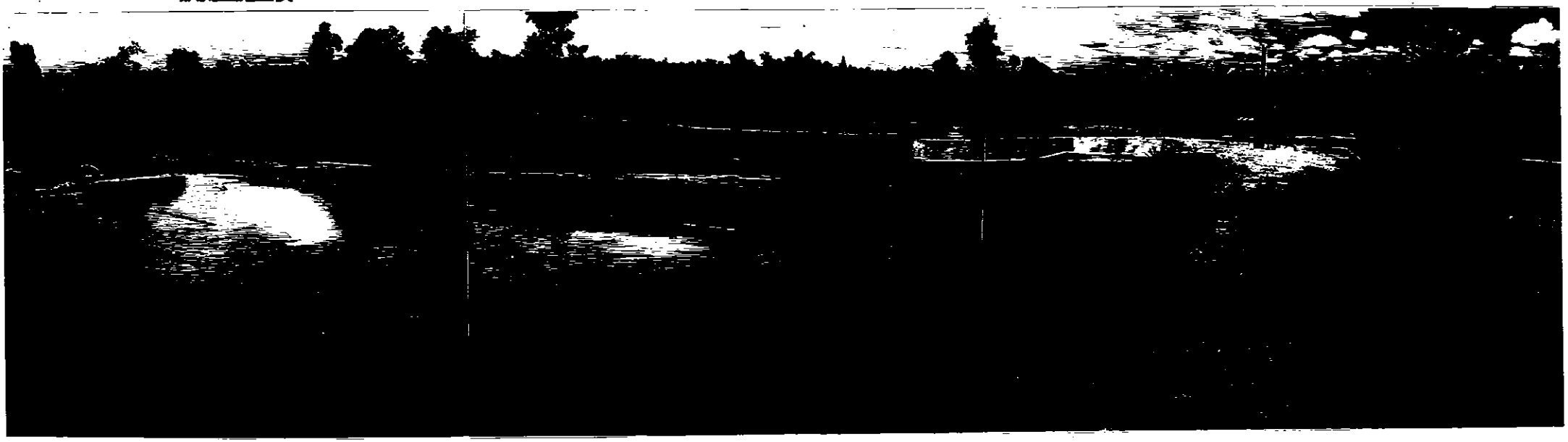
潘池流入工



キャカラ地区

放流工施工前

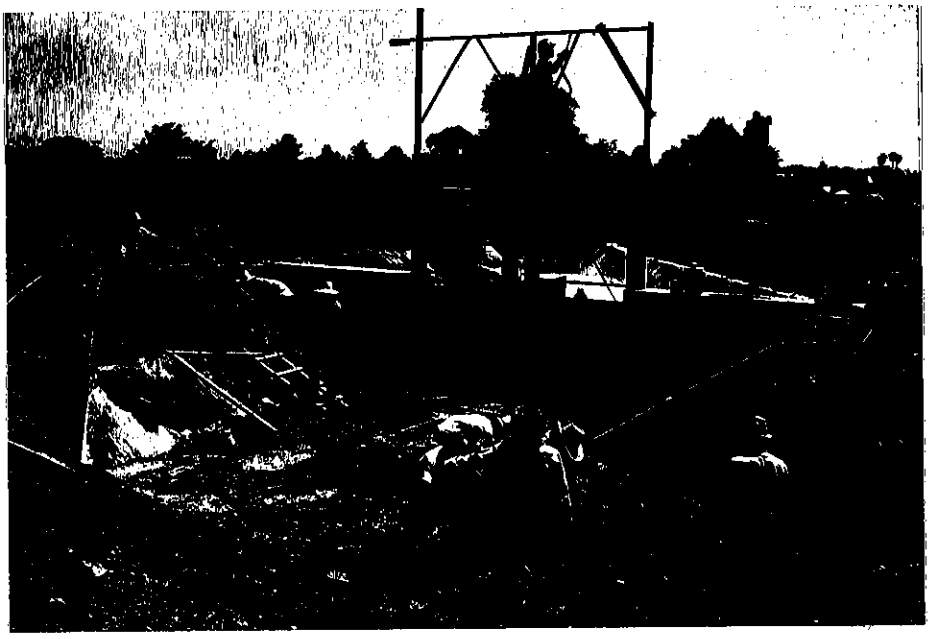
放流工施工後



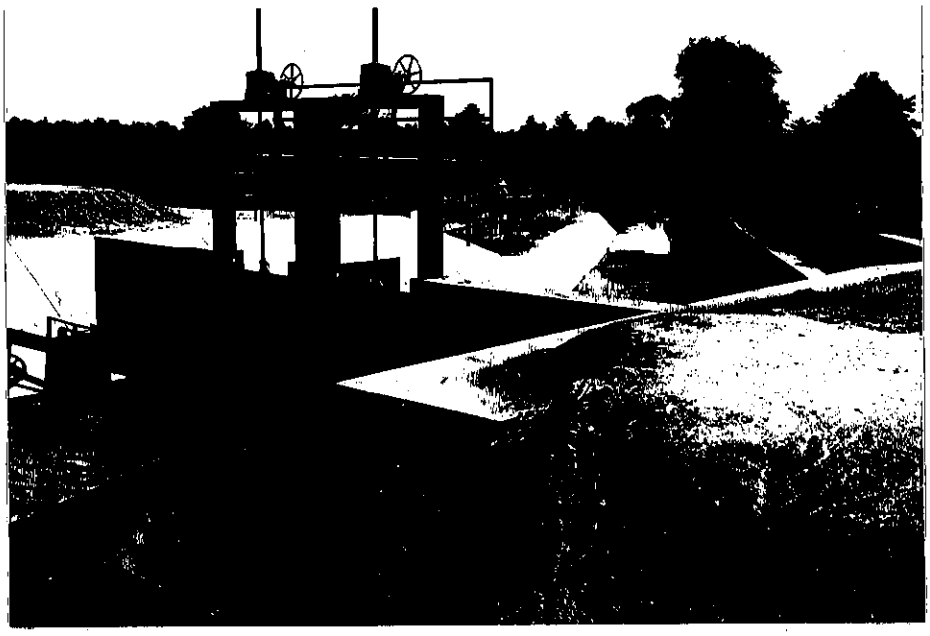
放流工工事

施工前

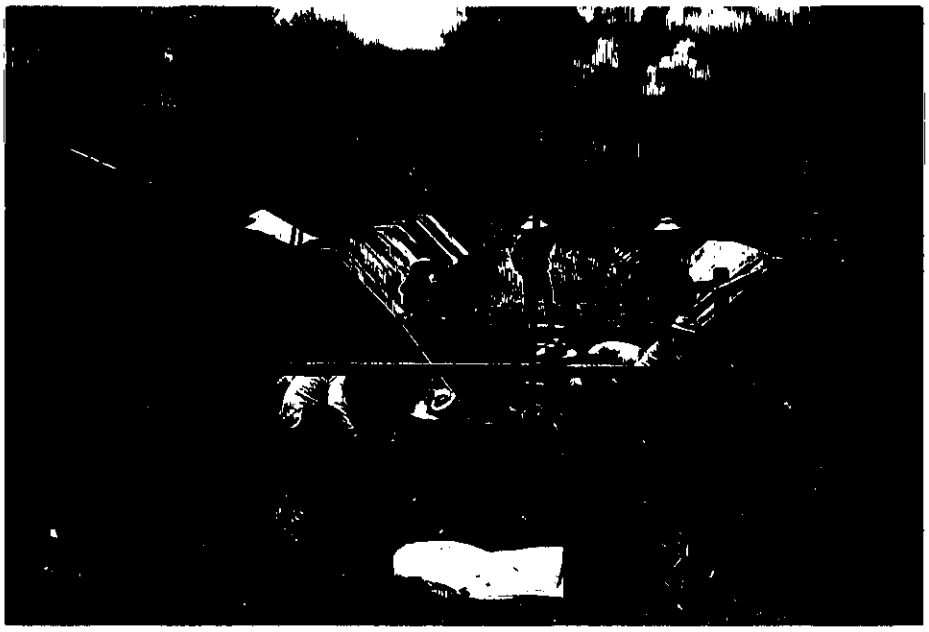
スルースゲート設置及び
ライニングコンクリート施工



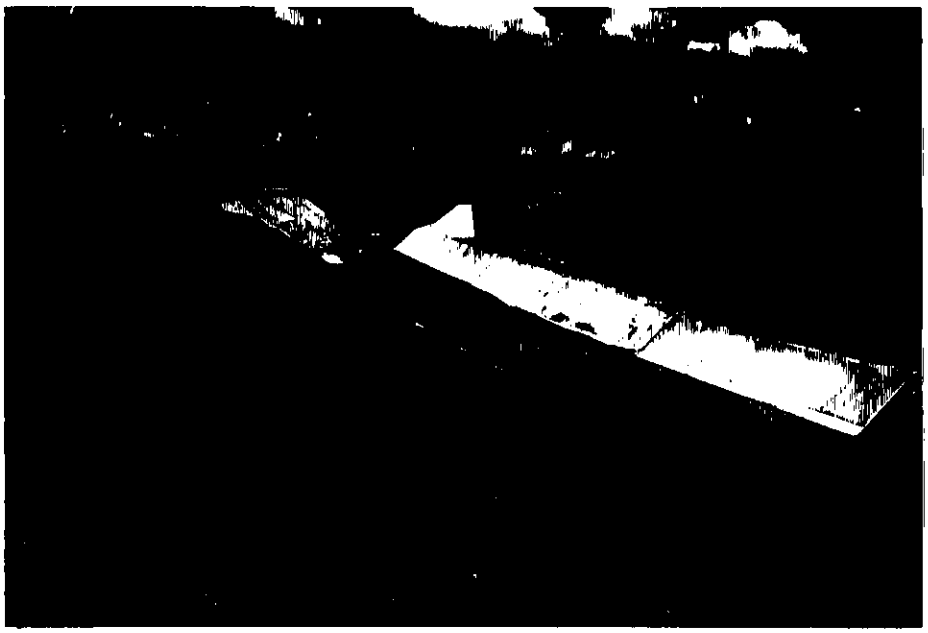
施工完了



放流工下流部
ライニングコンクリート工事

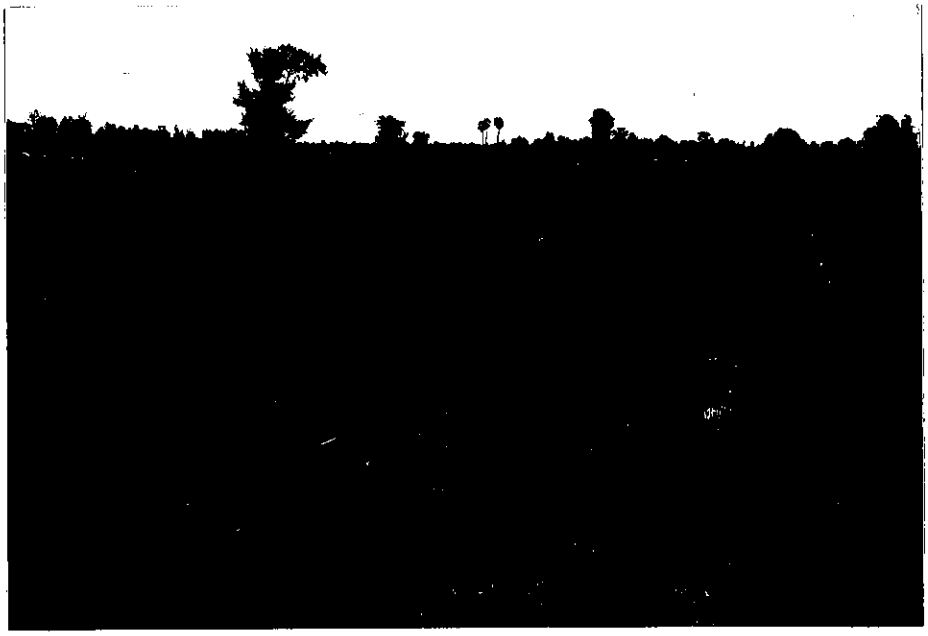


放流工全景
（下流より）



キャカラ地区取水工工事

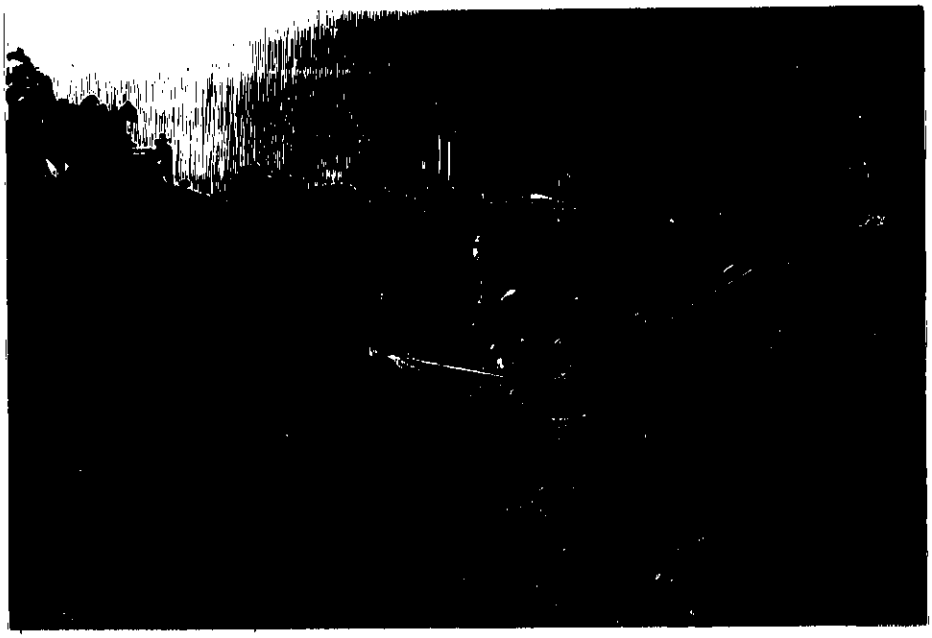
施工前



固定堰部及び
ライニングコンクリート施工

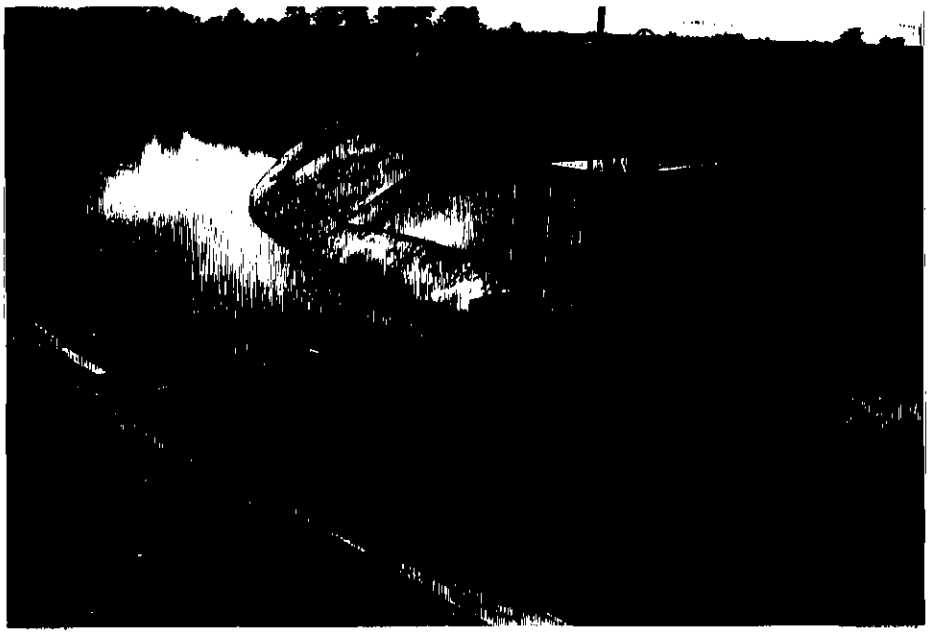
施工完了

キヤカラ川地区護岸工事
ライニングコンクリート打設前



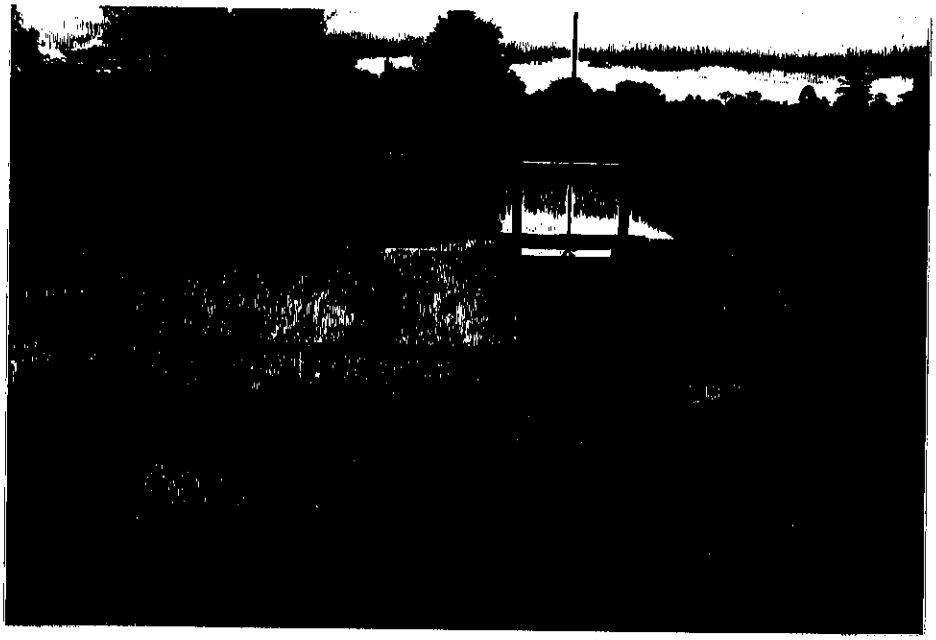
キャカラ川護岸工事
ライニングコンクリート施工

固定堰全景
（下流より）

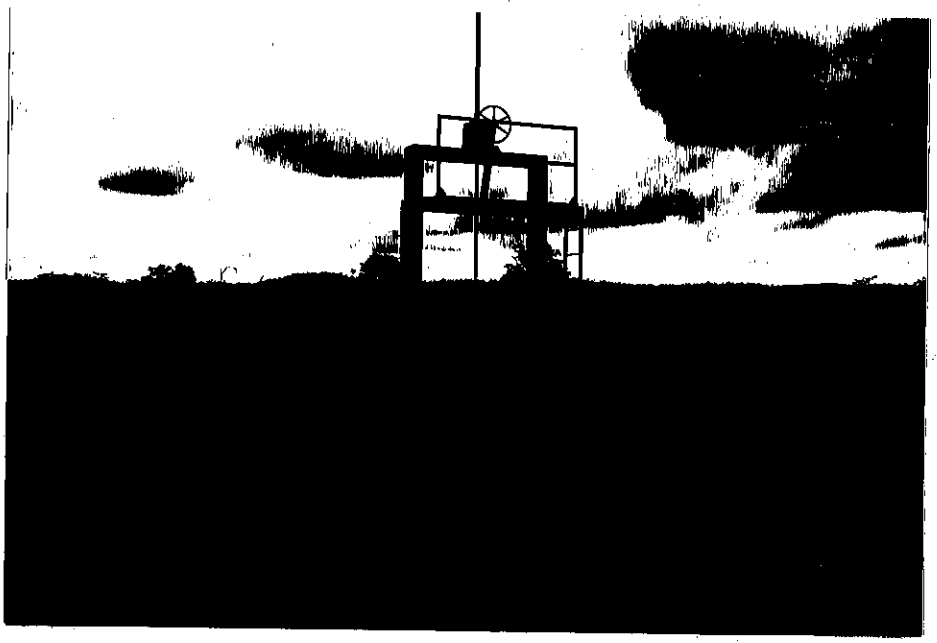


施工前

施工完了



分水工ゲート
（下流より）

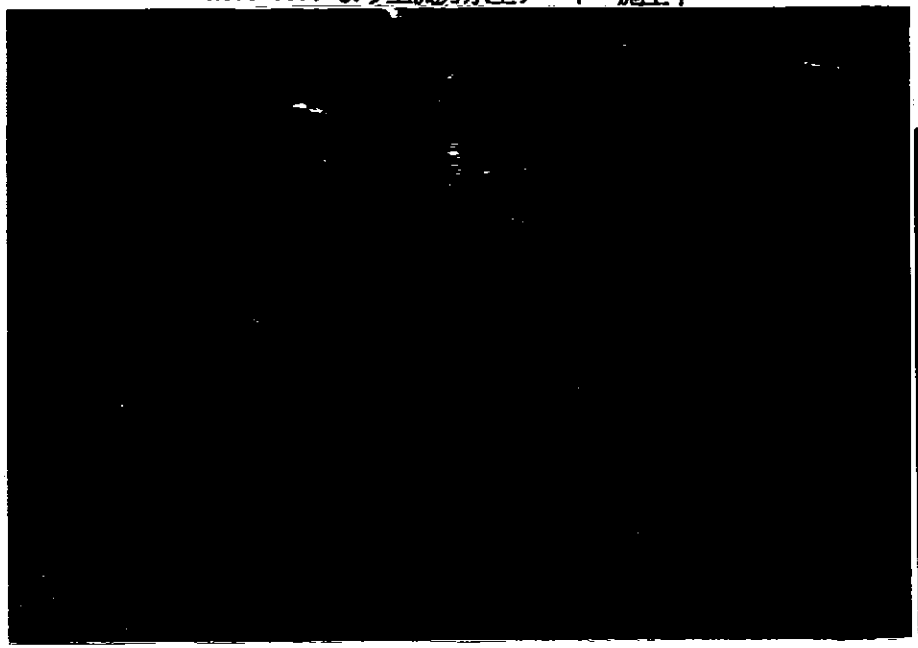


水路工事（追加工事）

水路工事　　始点(No.0)施工中

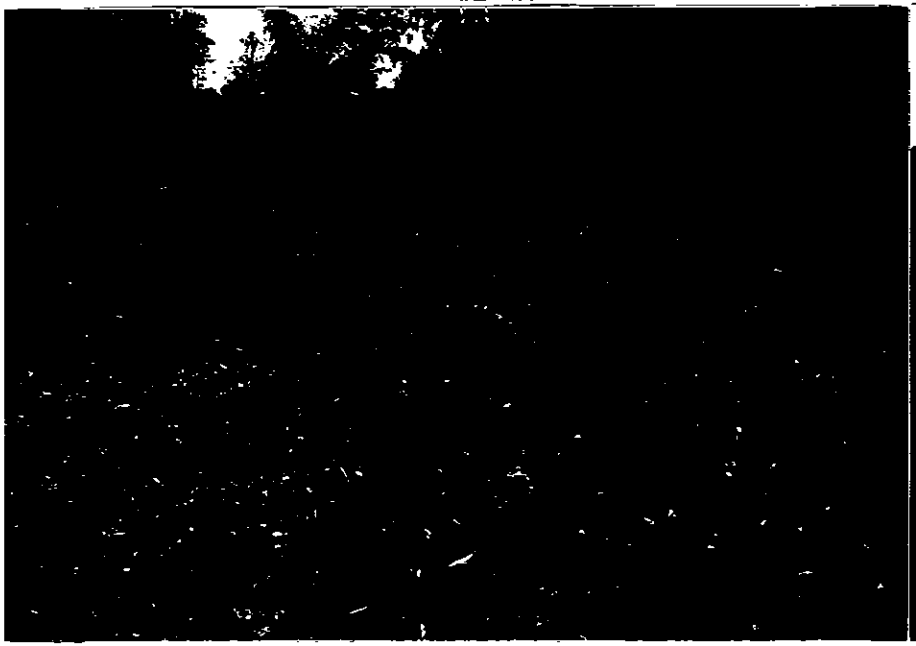
施工完了

No.0+30.0 より上流分水工ゲート　施工中



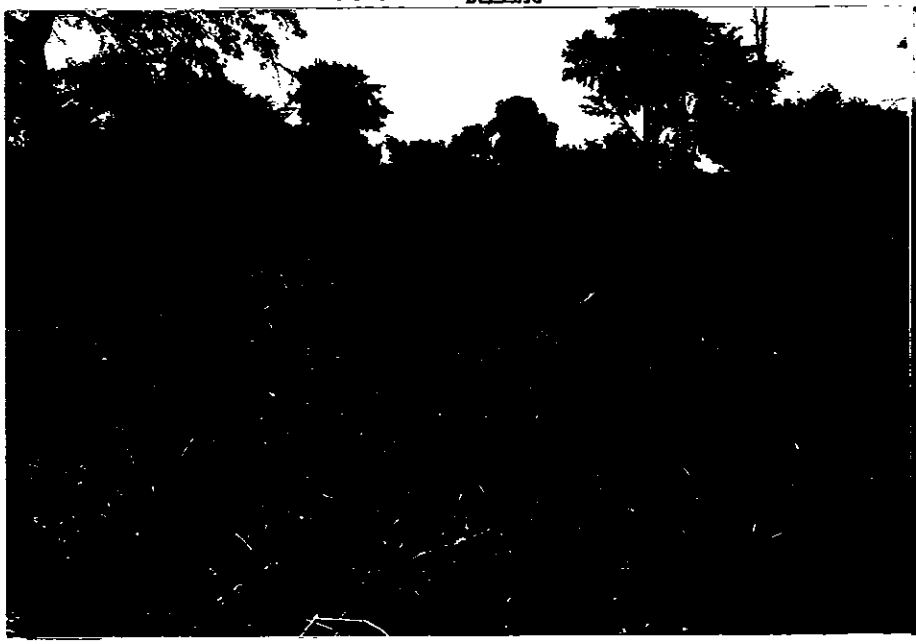
施工完了

No.0+75.0　施工前



施工後

No.0+　施工前



施工後