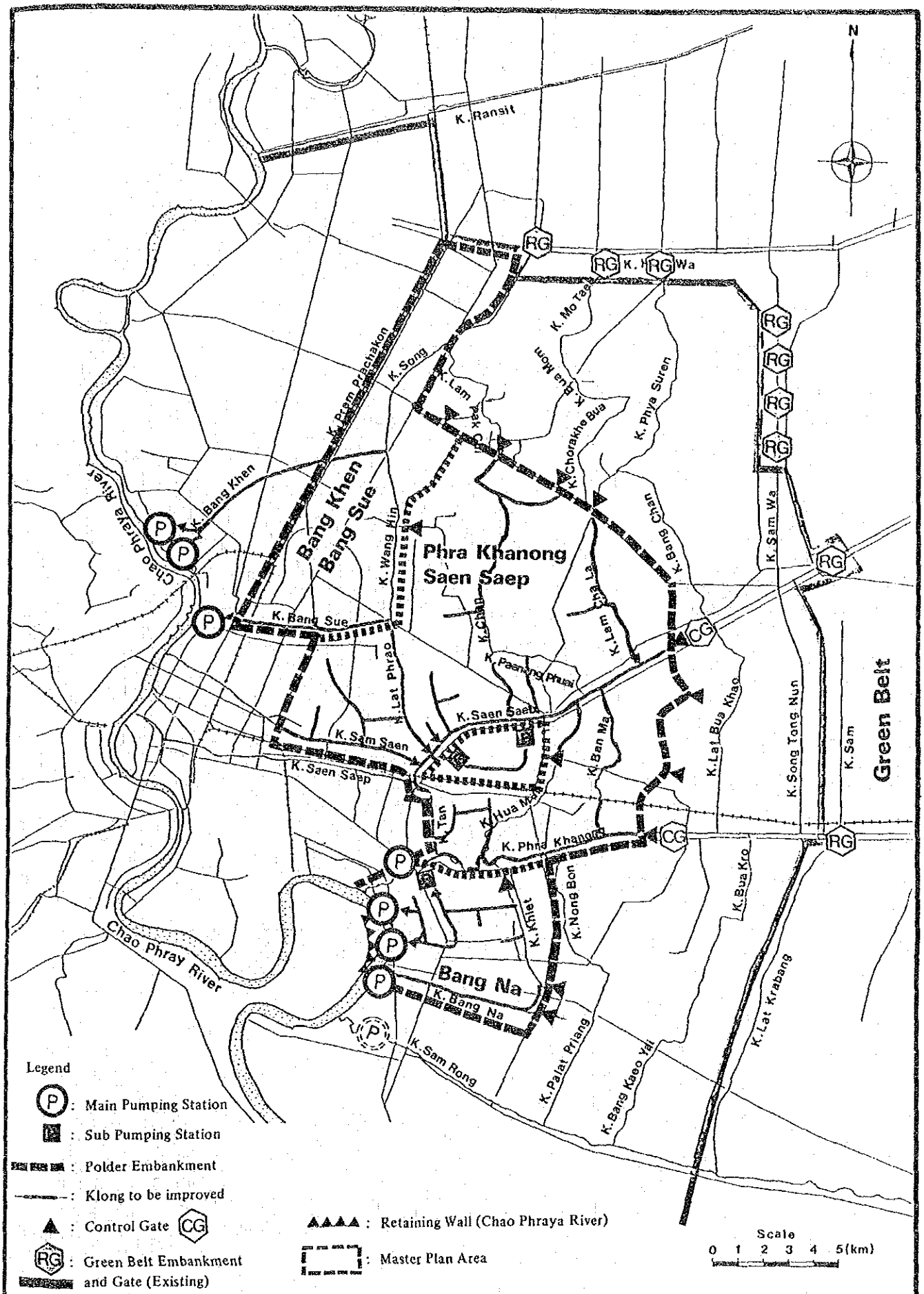
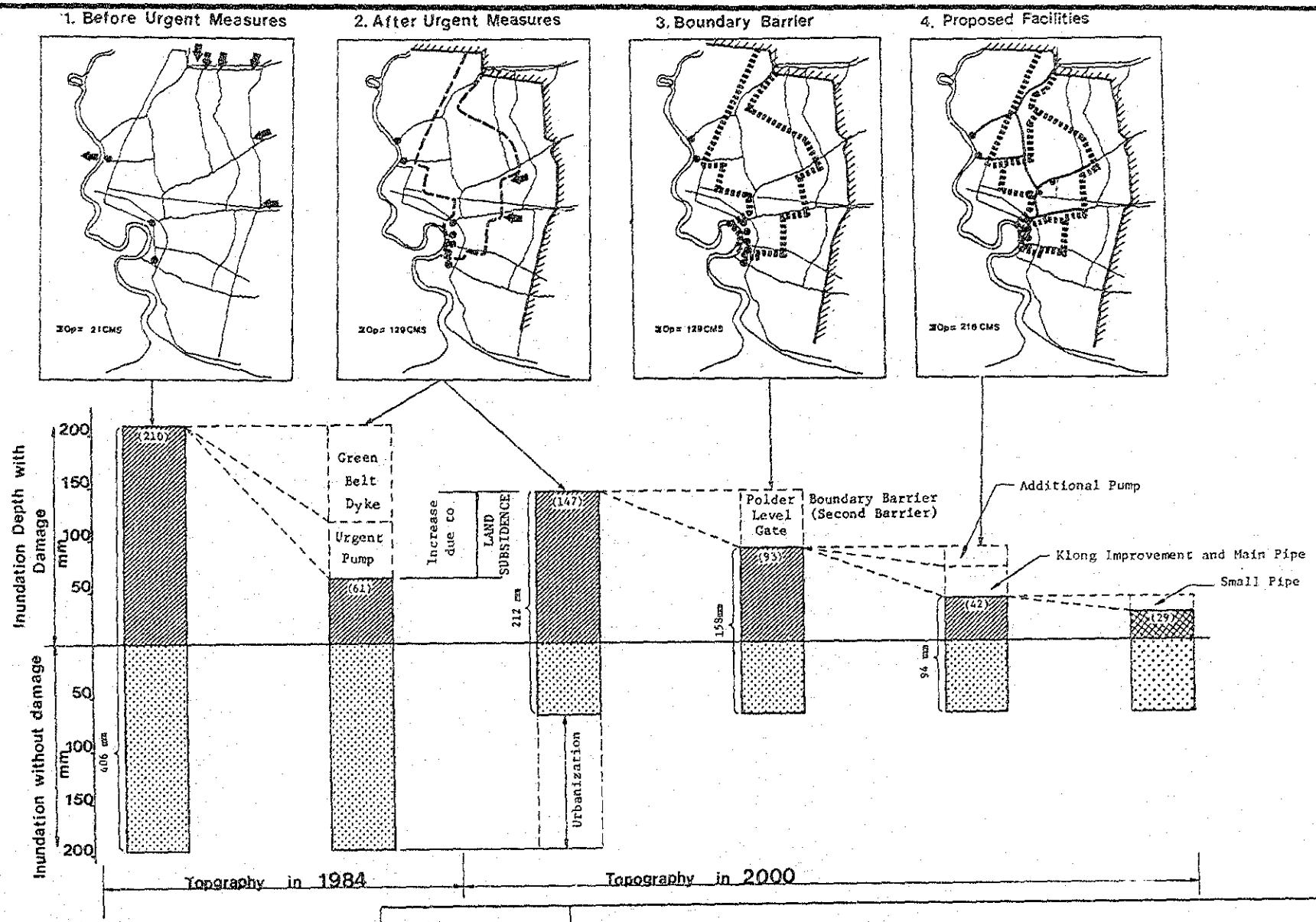


Fig. 4.3 FLOOD PROTECTION/DRAINAGE FACILITIES (MASTER PLAN)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



Note: Hydraulic effect is calculated for 5-year frequency rainfall.

Fig. 4.4 EFFECT OF THE PROPOSED PROJECT

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

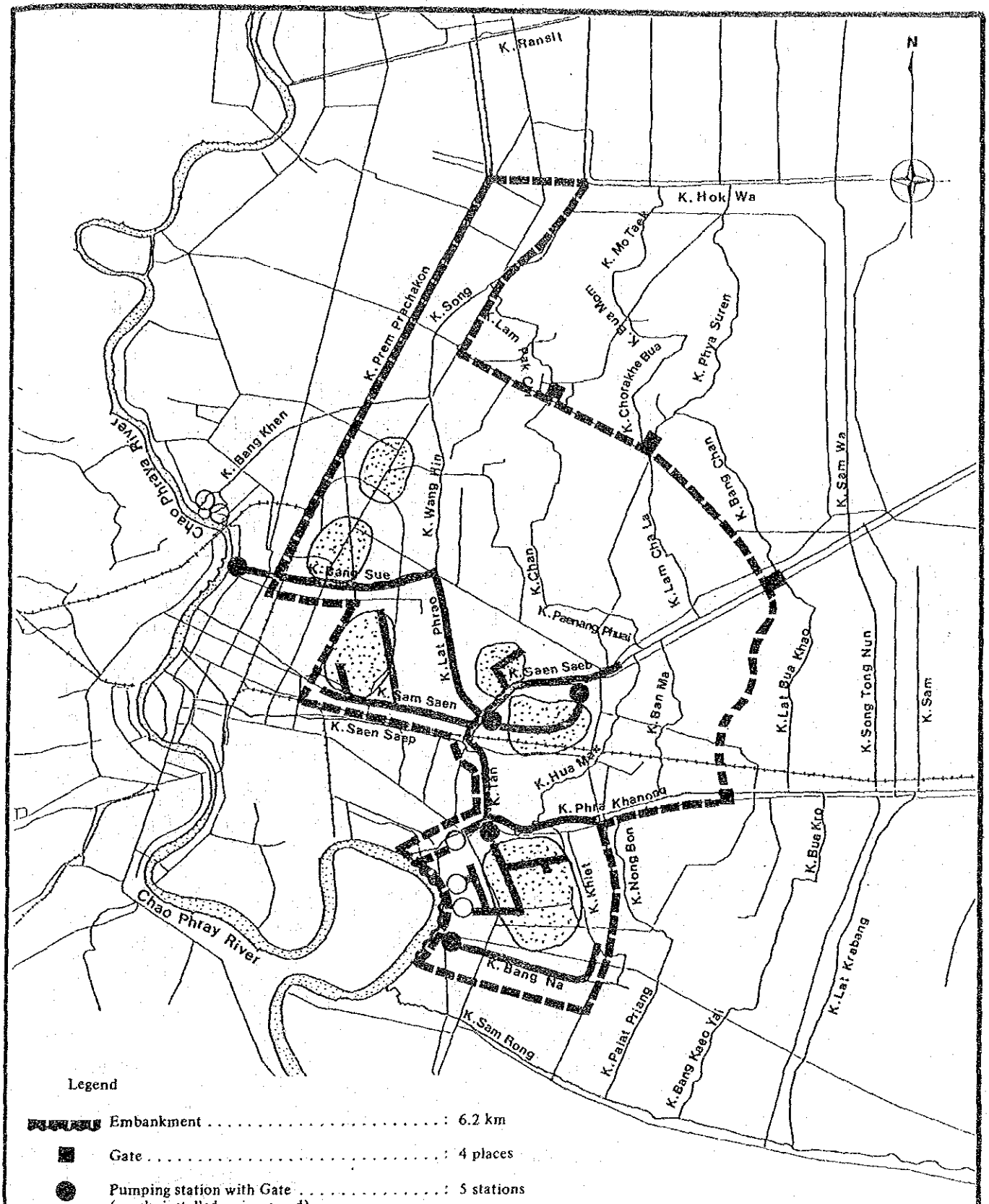
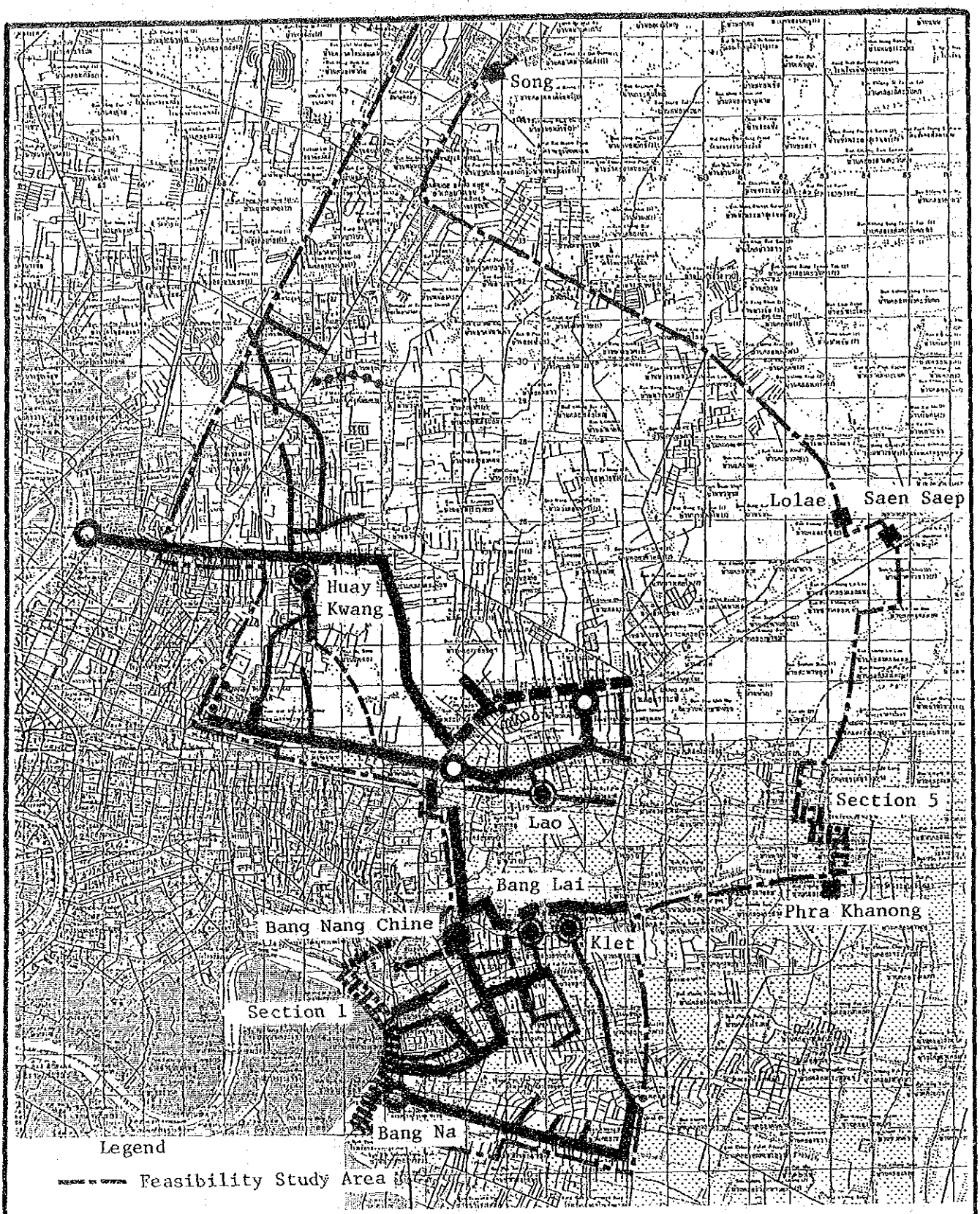


Fig. 4.5 FACILITIES AT FIRST STAGE PROPOSED BY MASTER PLAN

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



Dyke	Gate	Pumping Station	Klong	Drain Pipe	
▮▮▮▮▮▮▮	■	●	▬▬	●●●●●●	Same as proposed by Master Plan
▮▮▮▮▮▮▮	-	◉	▬▬	-	Revised / Added
▮▮▮▮▮▮▮	-	○	▬▬	-	Revised / Excluded

Fig. 4.6 COMPARISON BETWEEN MASTER PLAN STUDY AND FEASBILITY STUDY

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

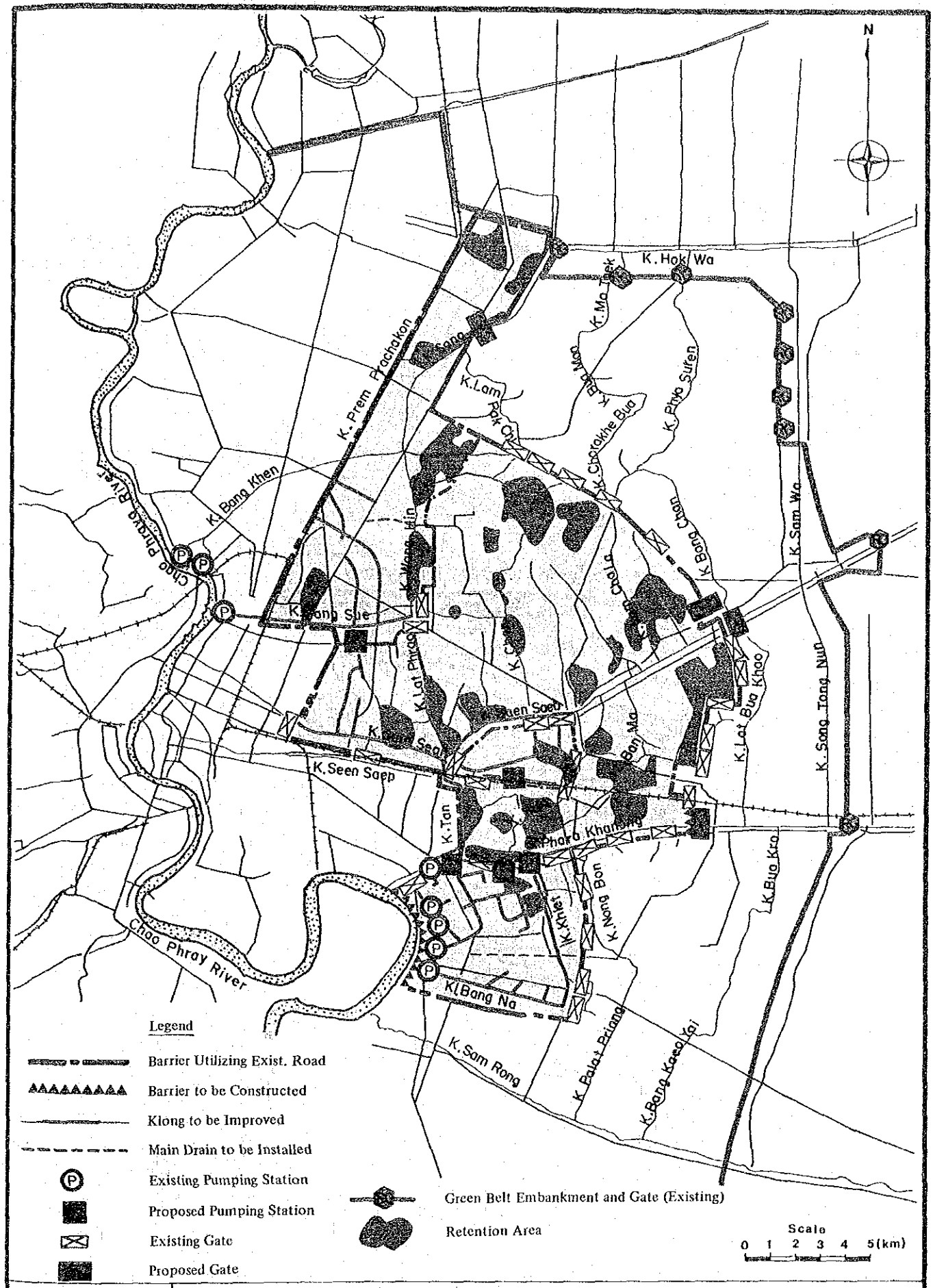
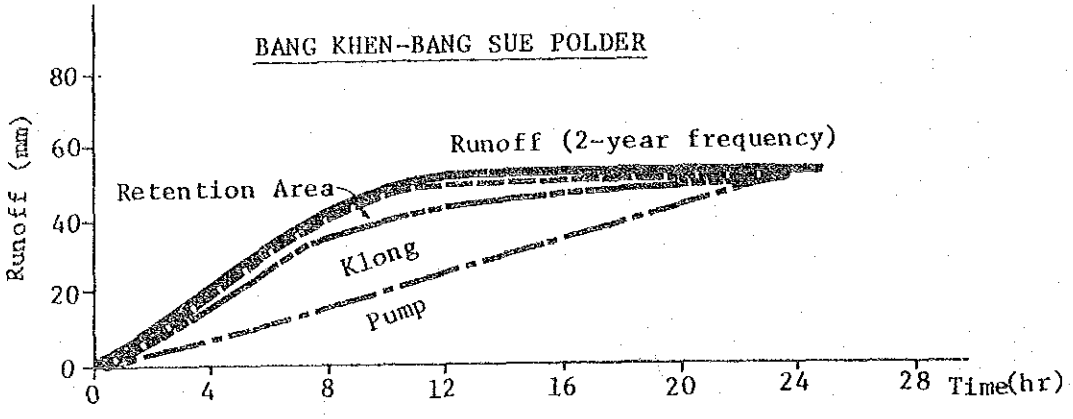
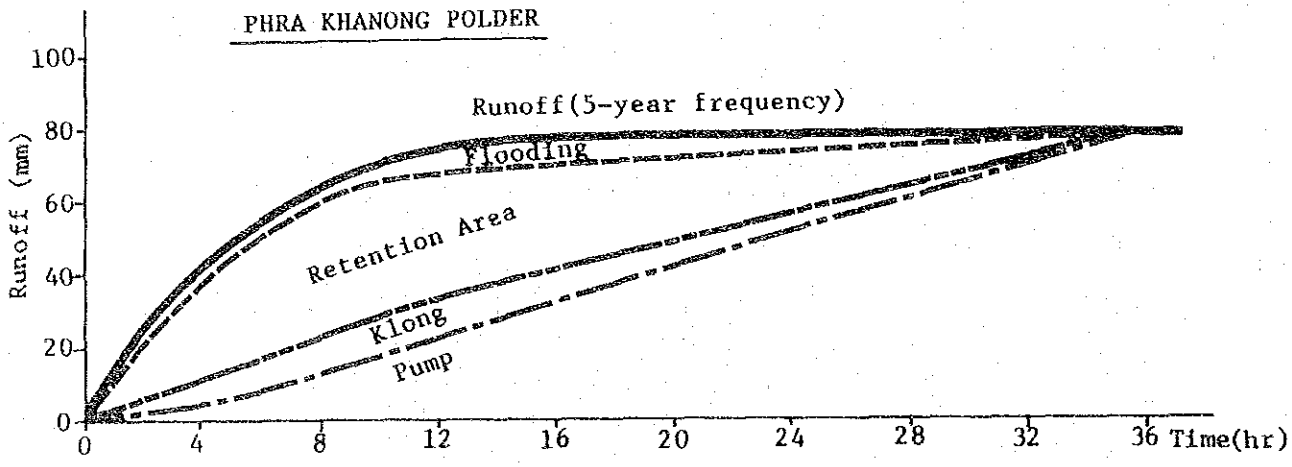


Fig. 4.7. PROPOSED FACILITIES IN THE FEASIBILITY STUDY

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D





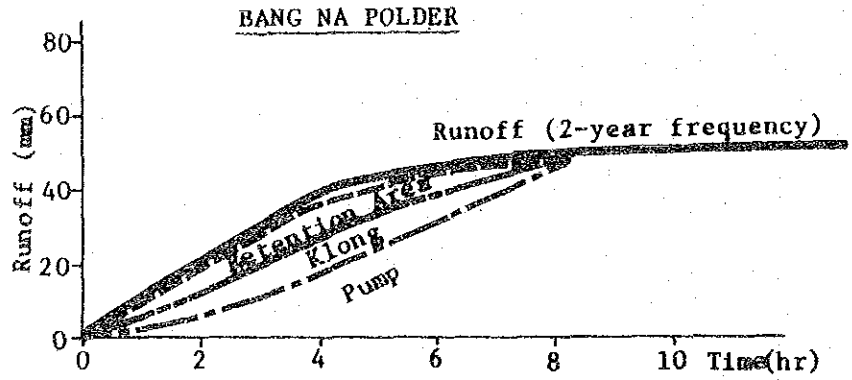


Fig. 4.8	RELATIONSHIP BETWEEN PUMP DISCHARGE AND STORAGE CAPACITY

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

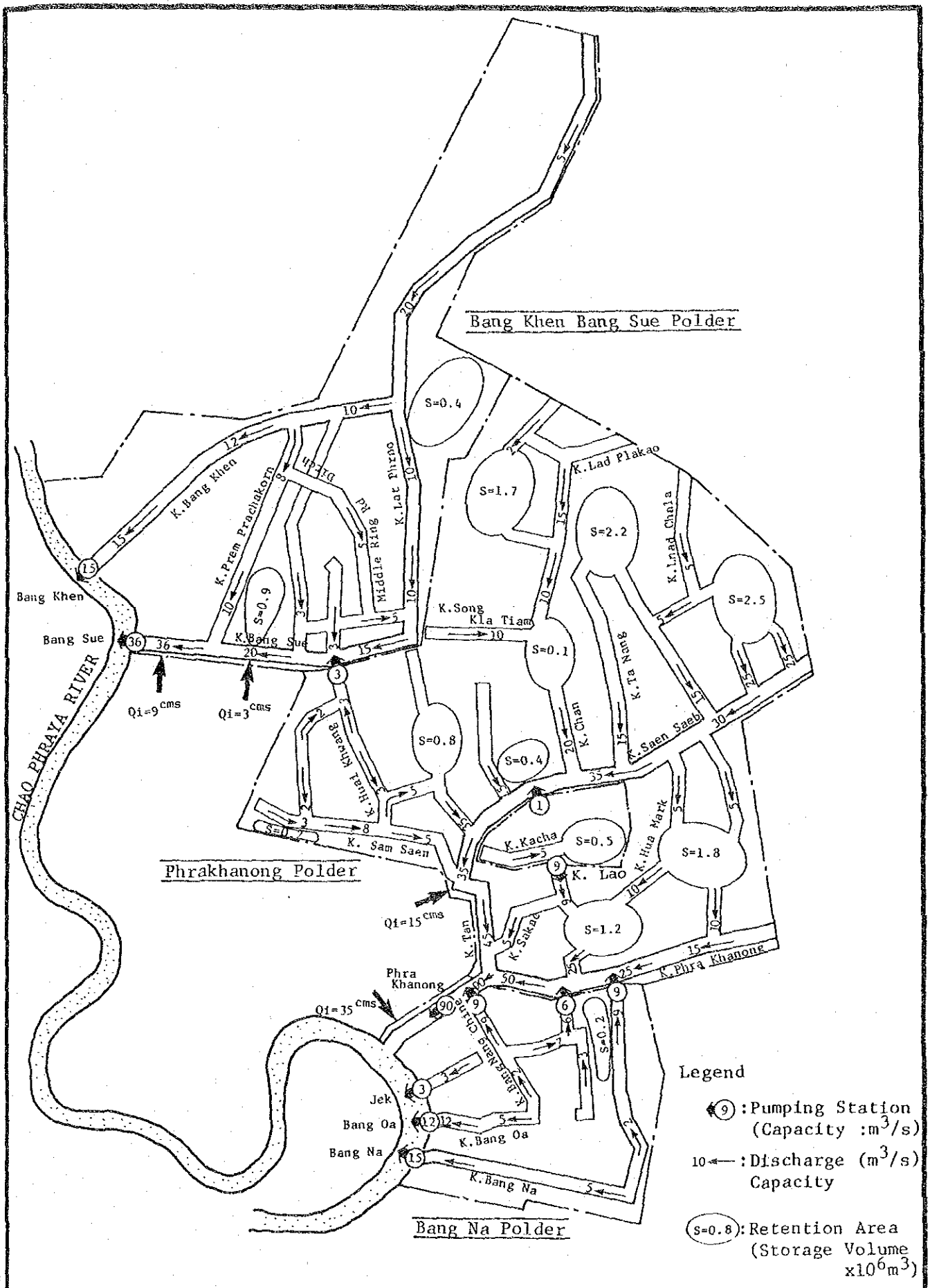


Fig. 4.9 PLANNED DISCHARGE

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

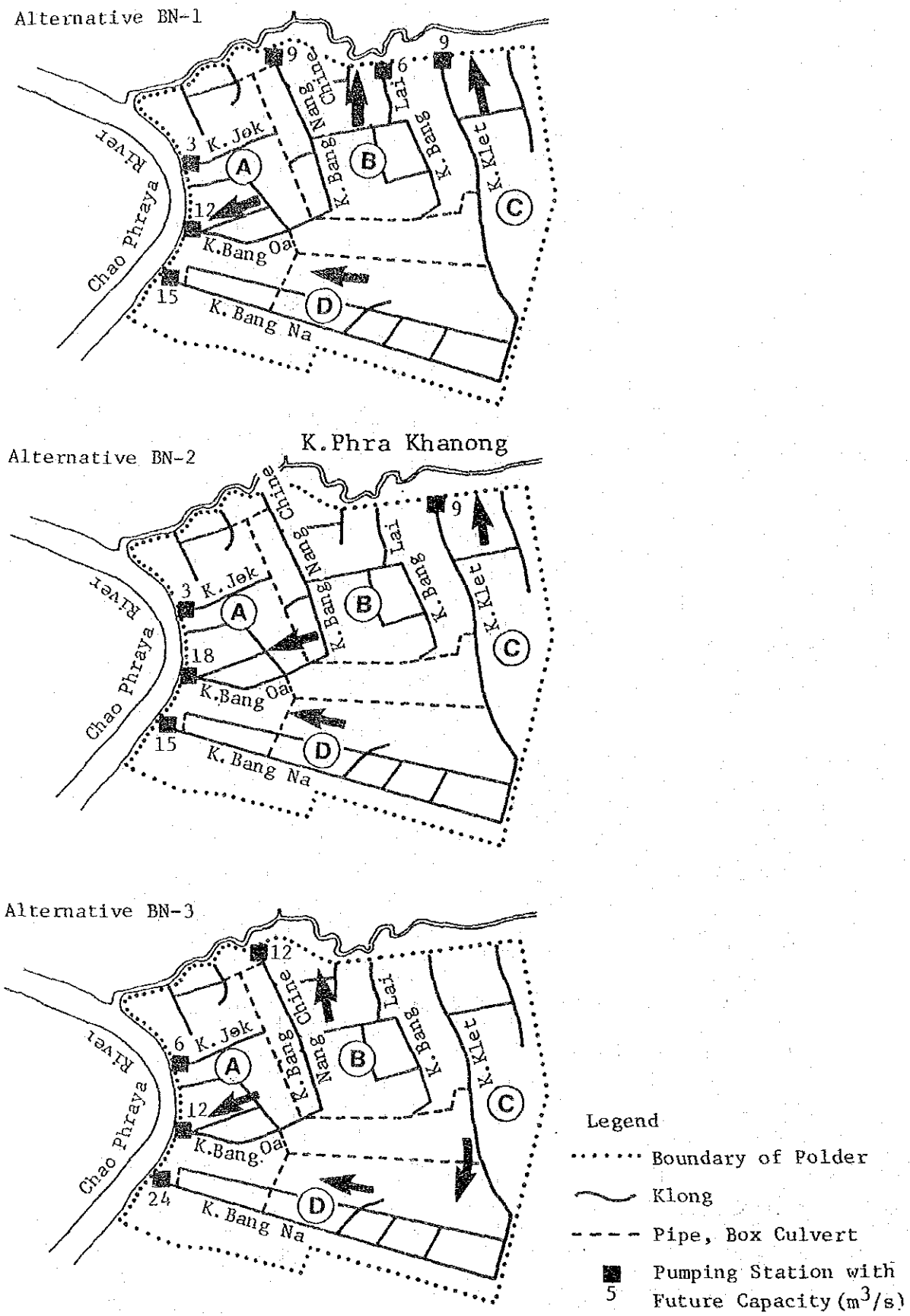
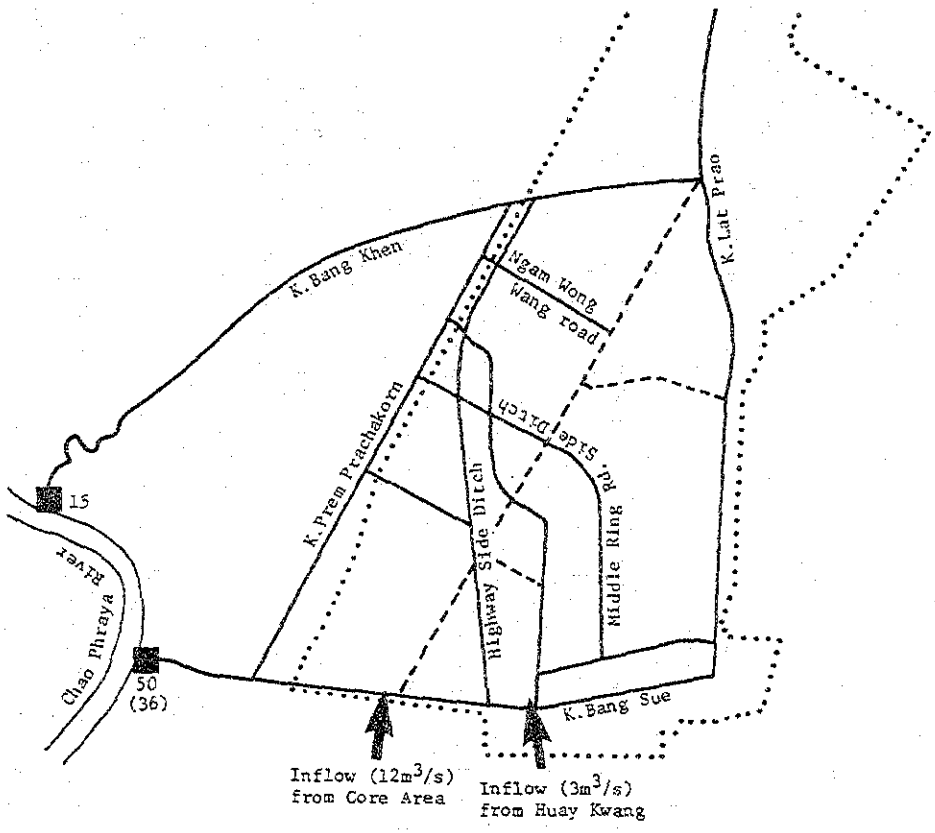


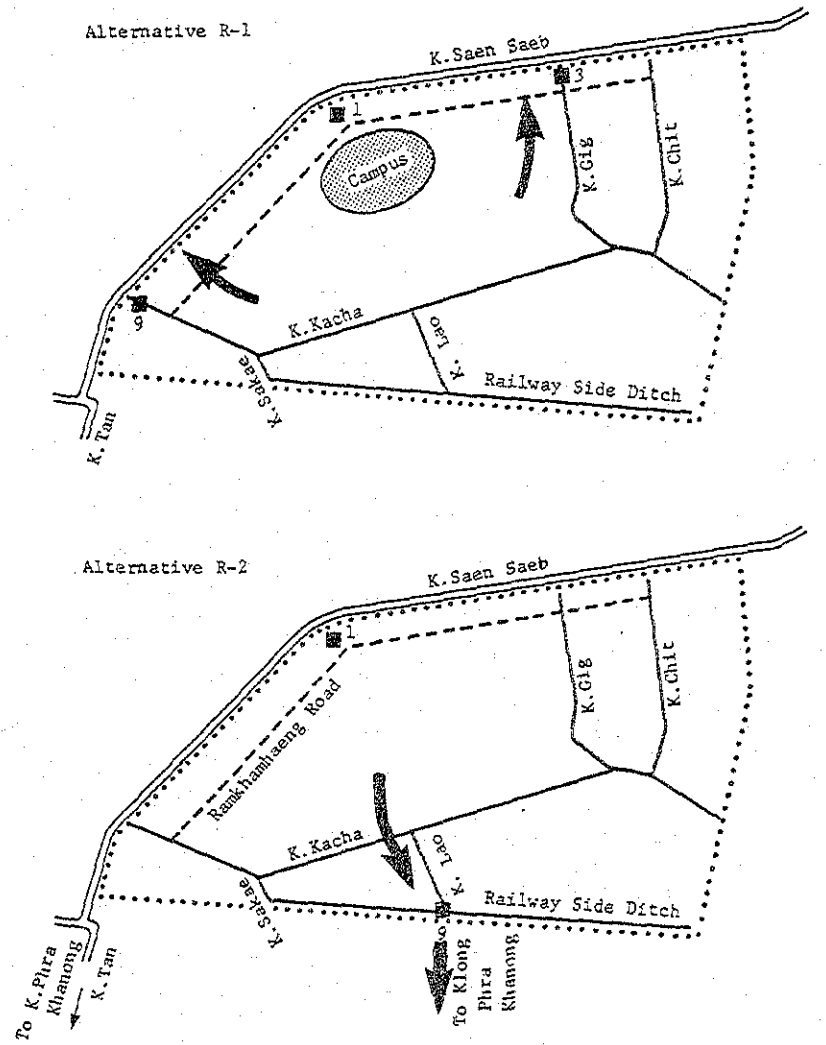
Fig. 4.10 DRAINAGE ALTERNATIVES IN BANG NA POLDER

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



Bang Sue Area



Ram khamhaeng Polder

Legend

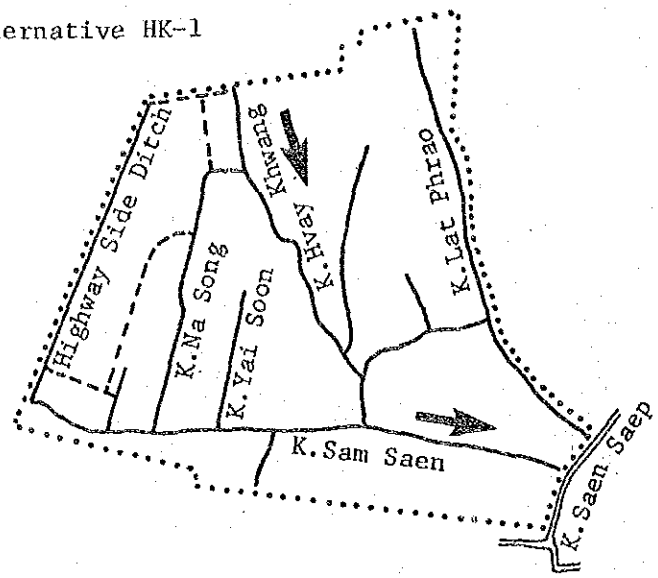
- Boundary of Polder
- Klong
- Pipe, Box Culvert
- 5 Pumping Station with Future Capacity,(m^3/s)

Fig. 4.11 DRAINAGE ALTERNATIVES IN RAMKHAMHAENG POLDER AND BANG SUE AREA

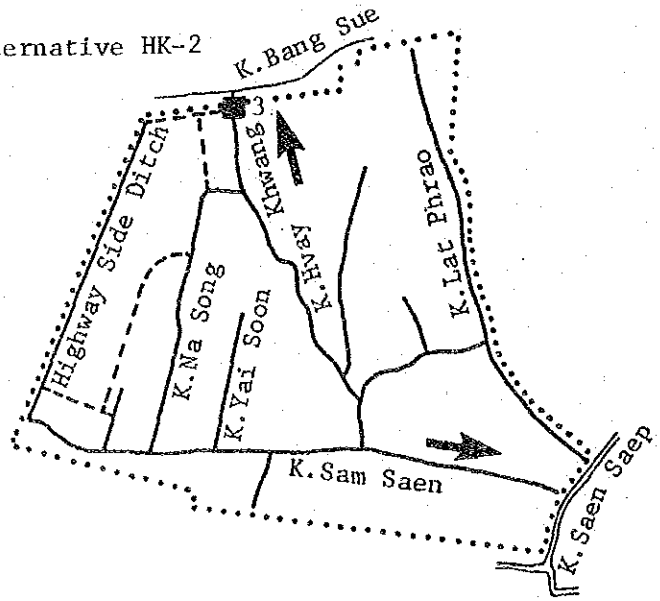
FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E. 1986A.D.

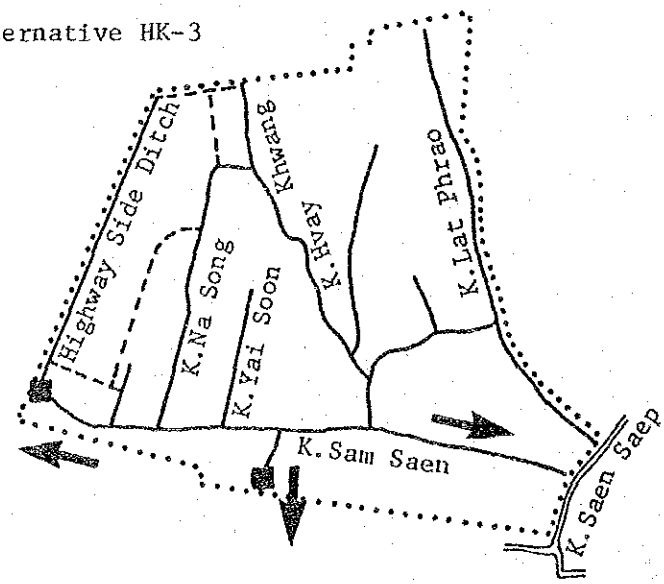
Alternative HK-1



Alternative HK-2



Alternative HK-3



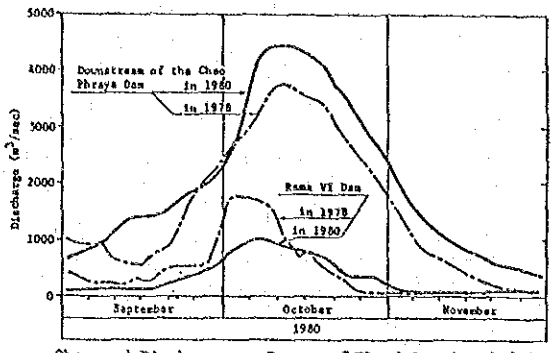
Legend

- Boundary of Drainage Area
- Klong
- Pipe, Box Culvert
- 5 Pumping Station with Future Capacity (m^3/s)

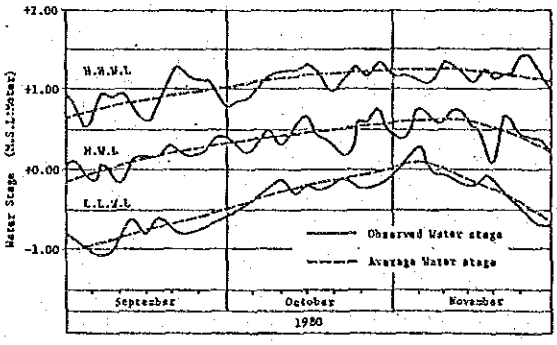
Fig. 4.12 DRAINAGE ALTERNATIVES IN WEST HUAY KWANG AREA

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

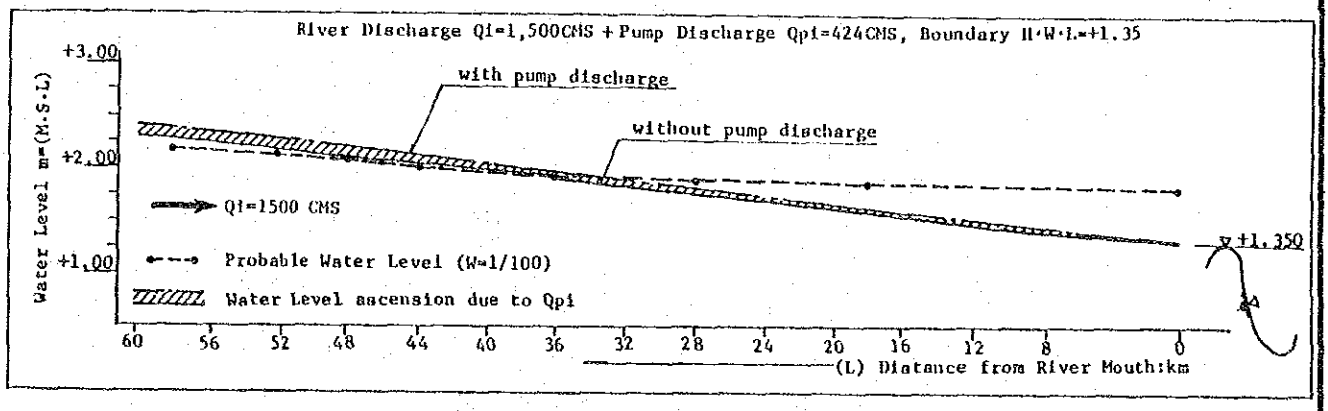
JICA 2529B.E 1986A.D



Observed Discharge Source; [Flood Routing And Control Alternatives of Chao Phraya. River for Bangkok. AIT March 1985]



Water stage at Bangkok Port Source: [Master Plan on Flood Protection Drainage Project in Eastern Suburban-Bangkok JICA March 1985]



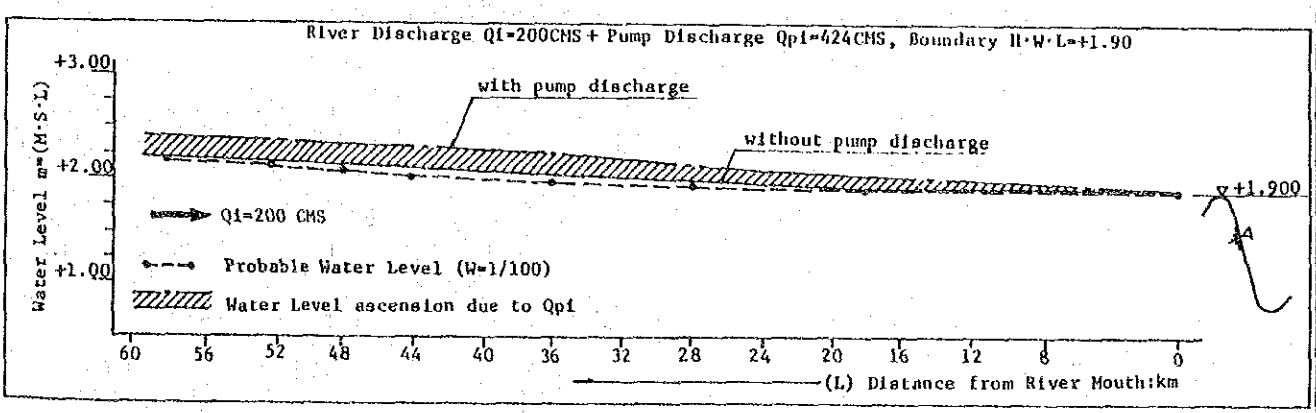
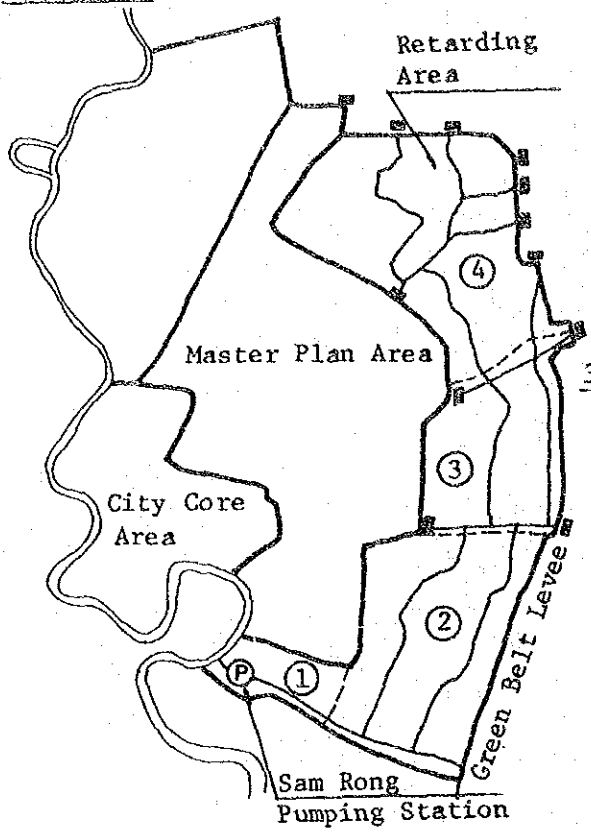


Fig. 4.13 WATER LEVEL ASCENSION OF THE CHAO PHRAYA RIVER

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

1) Key Map



2. Calculation Cases

CASE	Topo-graphy	Pump Capacity	Green Belt	2nd Barrier (Gate)	Klong Section
A	Present (1984)	3 CMS	Nothing	Nothing	Same as present
B	"	75 CMS	Existing	"	"
C	"	75 CMS	"	Existing	"
D	Future (2000)	75 CMS	"	"	"

3. Conditions of Analysis

1) Model : Storage Basin Model
2) Rainfall : 5 years Freq. Scale. AD1980 Pattern
3) Boundary Water Level : 100 years Freq. Scal. in Chao Phraya R. AD1980 Pattern at Bangkok Port
4) Boundary Inflow : Same as result of verification for flooding in 1980

Result of Analysis

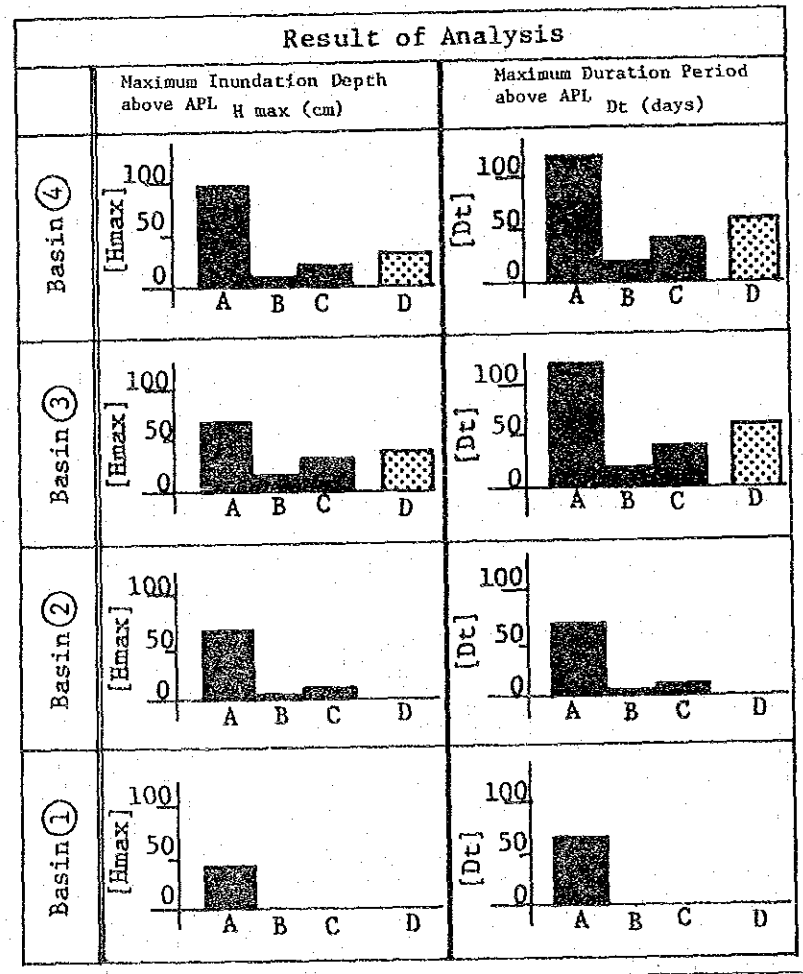
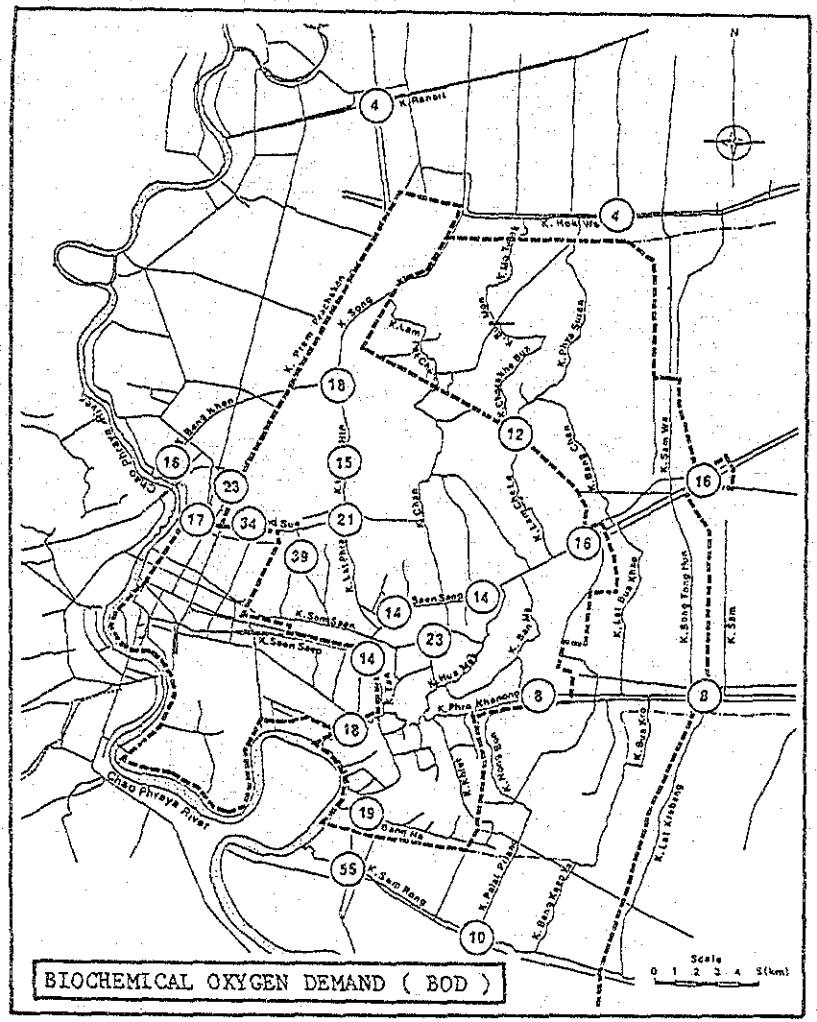
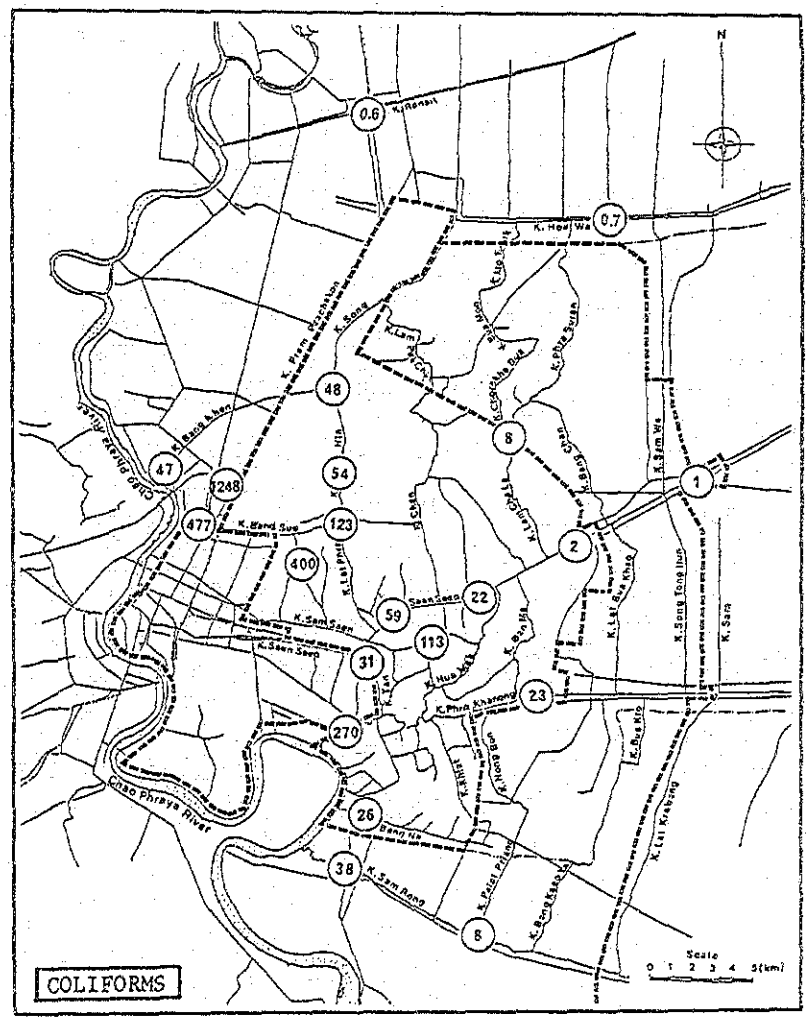


Fig. 4.14 FLOOD CONTROL EFFECT IN THE RETARDING AREA



BIOCHEMICAL OXYGEN DEMAND (BOD)



COLIFORMS

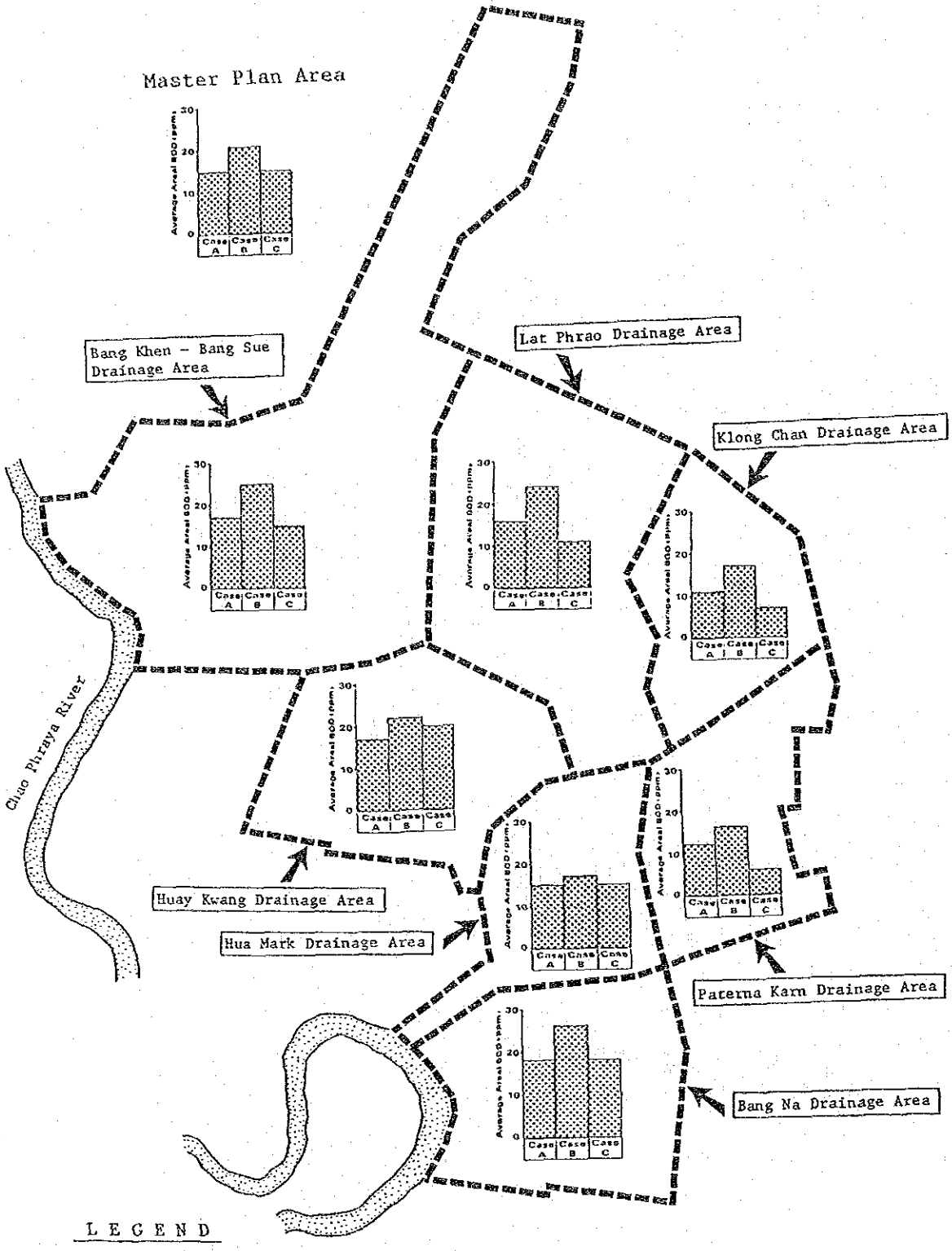
Note 1. Unit of BOD and Coliforms are mg/l and x 10^4 MPN/ml respectively.

2. These data are based on survey by DDS between 1980 and 1985.

Fig. 4.15 BIOCHEMICAL OXYGEN DEMAND (BOD) AND COLIFORMS OBSERVED IN THE STUDY AREA

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



L E G E N D

Case A : BOD value observed before the Project

Case B : BOD value estimated after the Project without flushing measure

Case C : BOD value estimated after the Project with flushing measure

Note : 1. Unit of BOD value is mg/l. (ppm)

2. Observed BOD value is based on the DDS data.

3. Estimated BOD value is based on the caluculation by complete mixed flow model.

Fig. 4.16 WATER QUALITY DETERIORATION DUE TO THE PROJECT AND EFFECT OF FLUSHING

Chapter 5

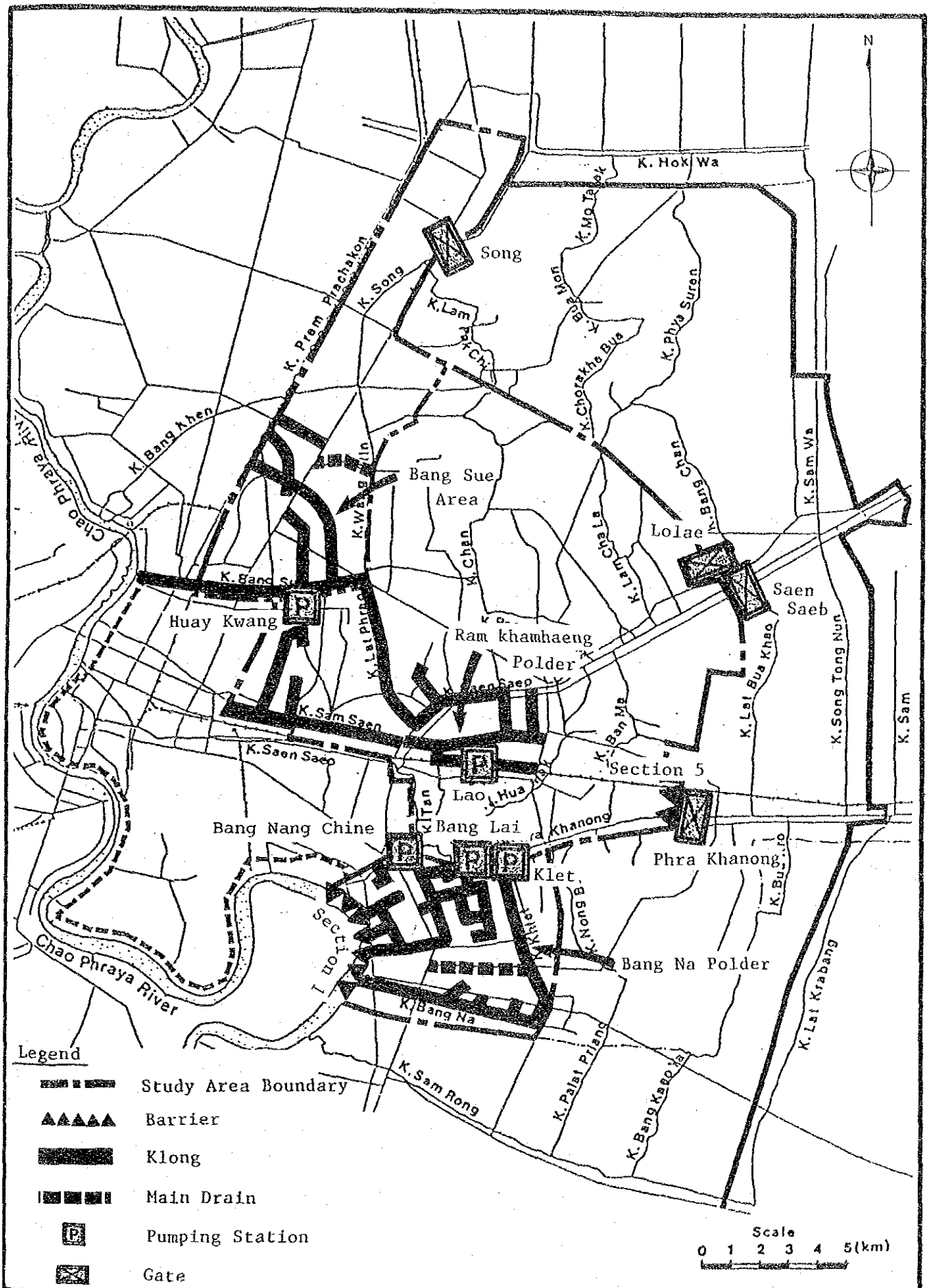
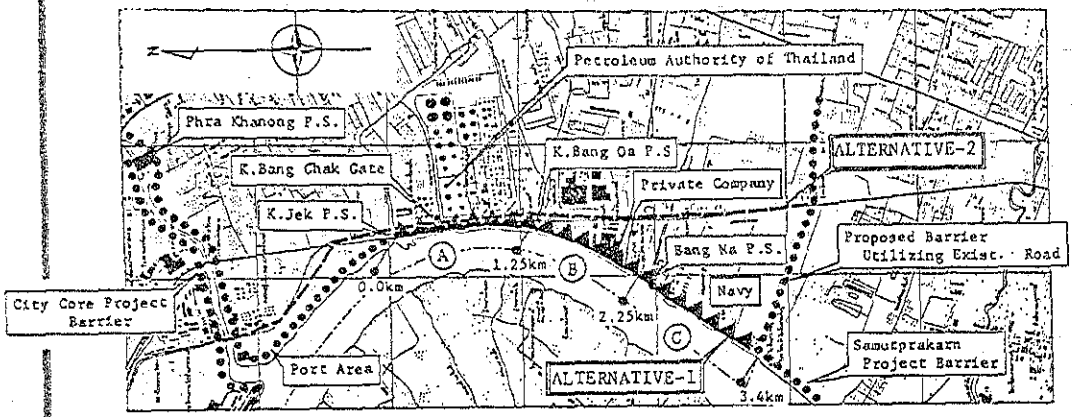


Fig. 5.1 LOCATIONS OF THE PROPOSED WORKS

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

Along Chao Phraya River (L=3.4km)

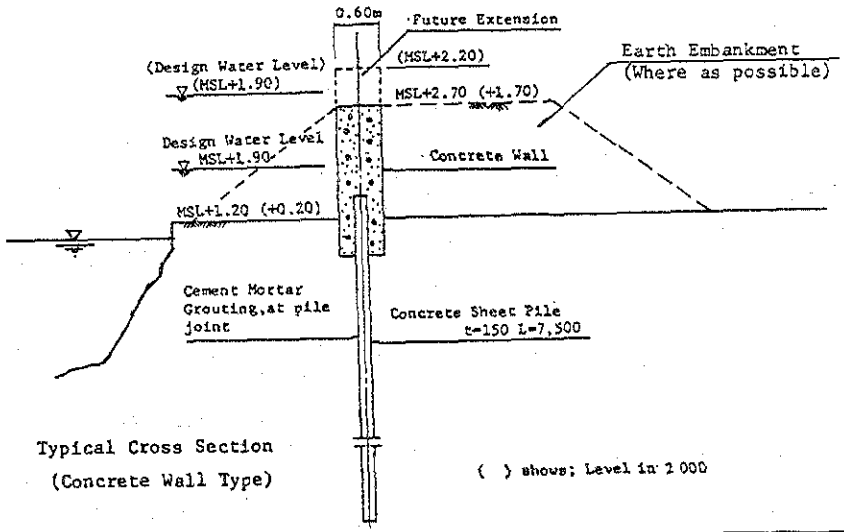


BARRIER ALIGNMENT

▲▲▲▲▲ : ALTERNATIVE-1 (Adopted in this study)

— — — : ALTERNATIVE-2

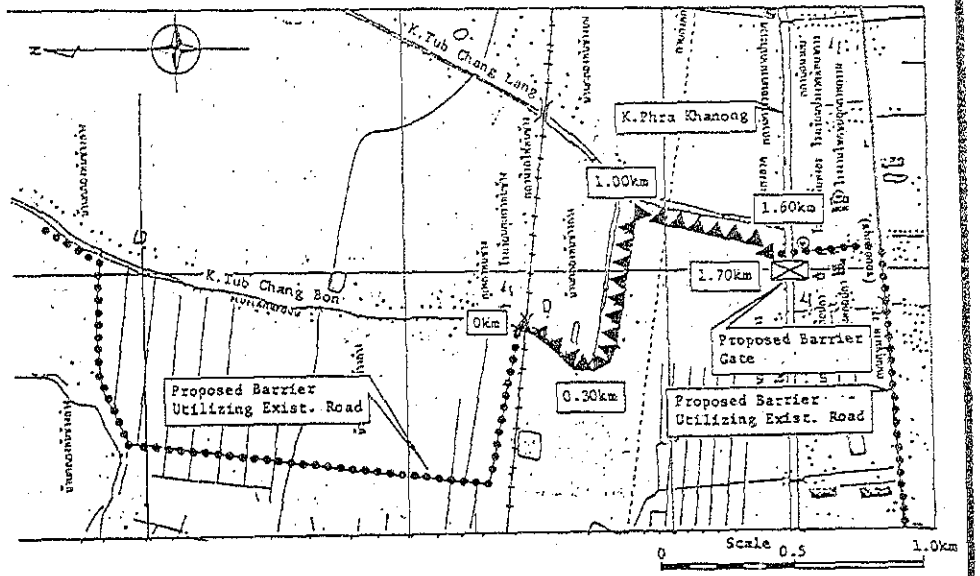
Scale 0 1 2km

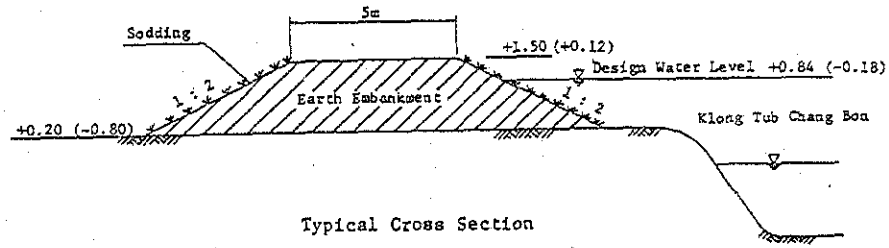


Typical Cross Section
(Concrete Wall Type)

( ) shows; Level in 2 000

Along Tub Chang Bon (L=1.7km)





Typical Cross Section
(Earth Embankment Type)

Legend

▲▲▲▲▲ : Barrier to be Newly Constructed

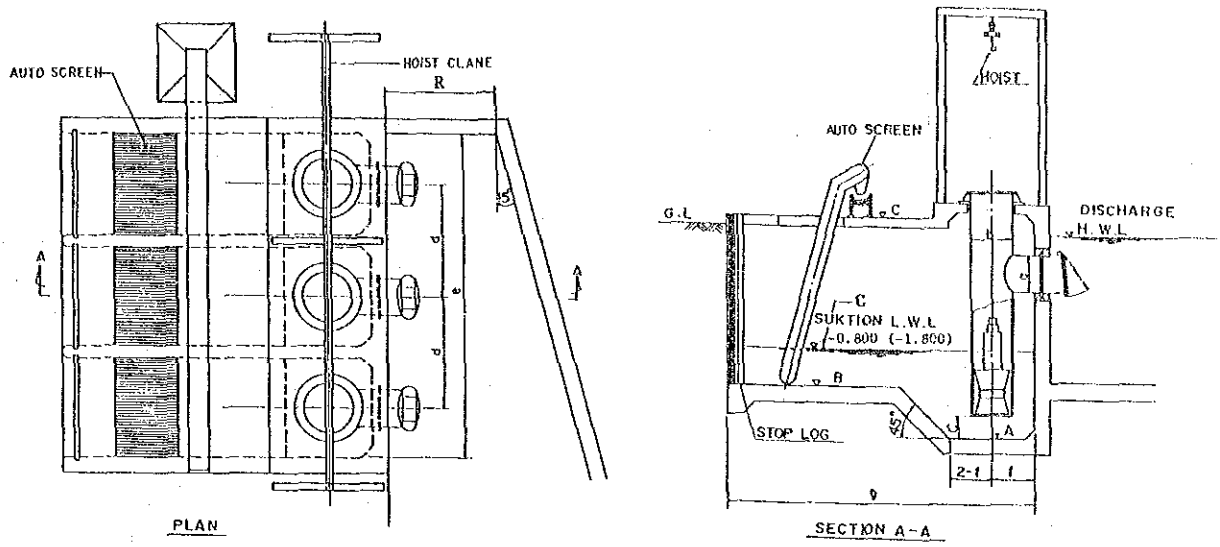
●●●●●●● : Barrier Utilizing Esisting Roads.

Note : Figure in Parenthesis shows future elevation considering land subsidence and settlement

Fig. 5.2 ALIGNMENT AND TYPICAL DESIGN OF FLOOD PROTECTION BARRIER

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529(B.E) 1986(A.D)



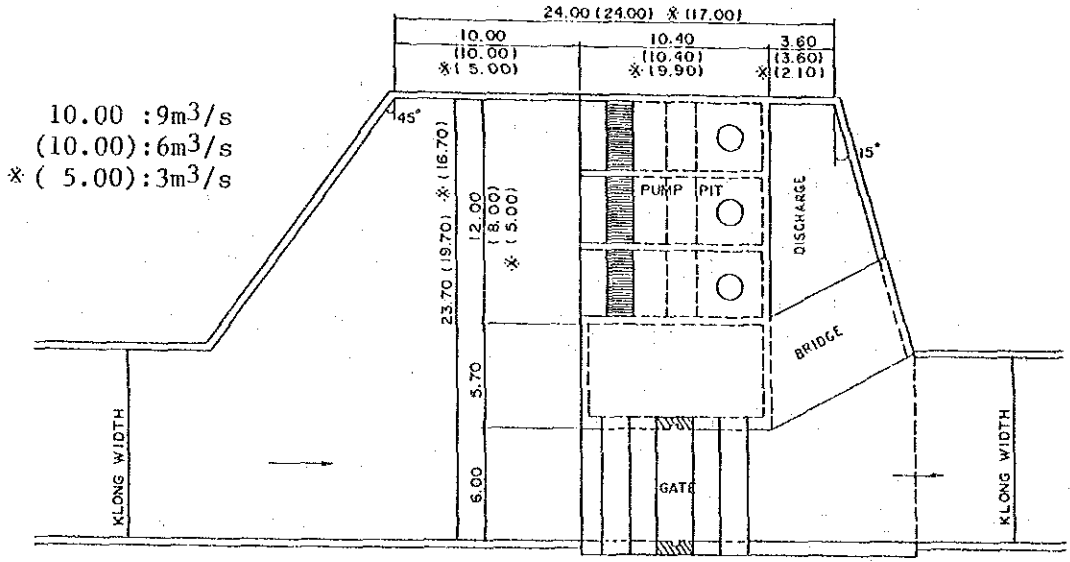


Table of Elevation and Dimension

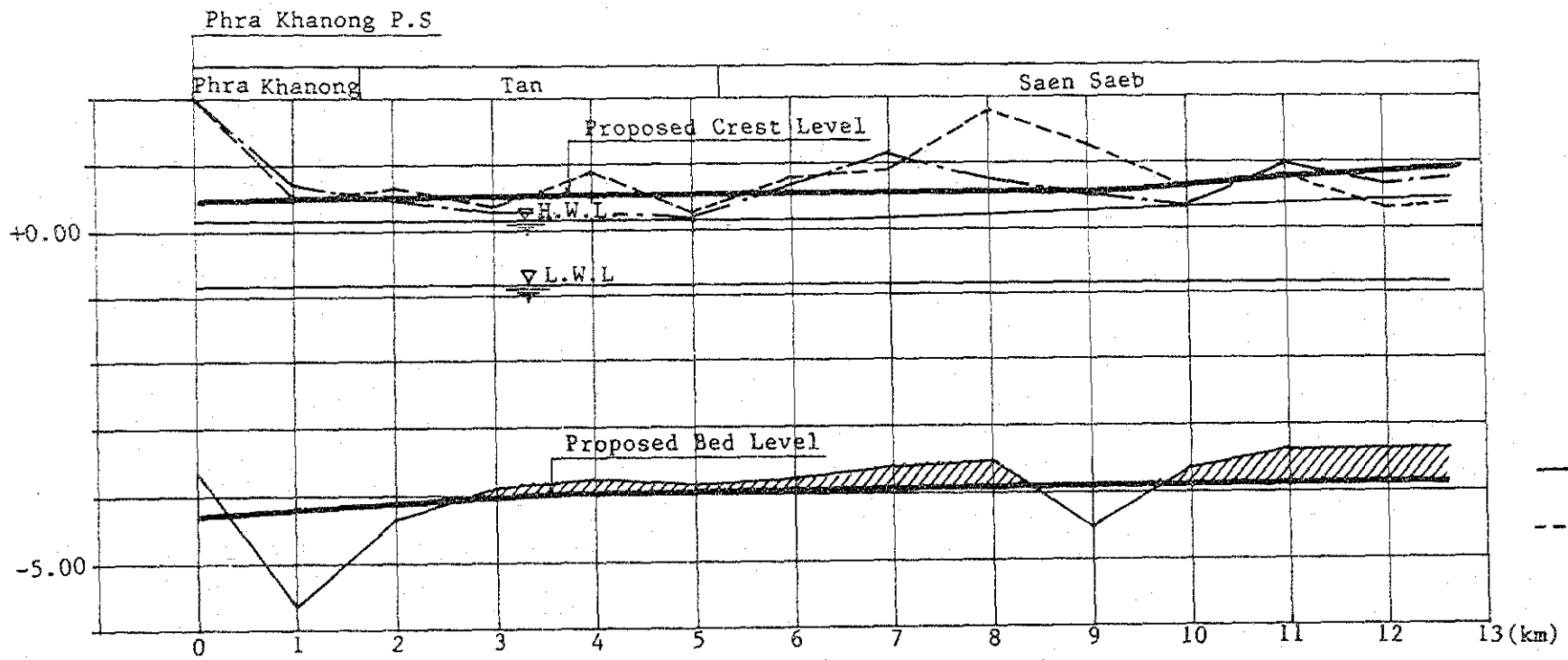
[Unit:m MSL]

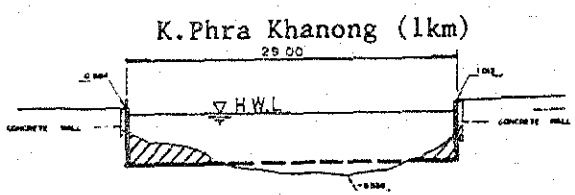
NAME OF PUMPING STATION	NO.S OF PUMP	TOTAL CAPACITY	ELEVATION				DIMENSION							DISCHARGE
			G.L	A	B	C	a	b	c	d	e	f	g	HWL
K.BANG NANG CHINE	3	9 m3/S	+0.600 (-0.400)	-4.800 (-5.800)	-3.430 (-4.430)	+1.100 (+0.100)	1.200	1.400	0.700	3.600	12.000	1.400	10.000	-0.180 (-1.180)
K.KLET	3	9	+0.800 (-0.200)	-4.800 (-5.800)	-3.600 (-4.600)	+1.300 (+0.300)	〃	〃	〃	〃	〃	〃	〃	-0.160 (-1.160)
K.LAO	3	9	+0.600 (-0.400)	-4.800 (-5.800)	-3.500 (-4.500)	+1.100 (+0.100)	〃	〃	〃	〃	〃	〃	〃	+0.200 (-0.800)
K.BANG LAI	2	6 m3/S	+0.700 (-0.300)	-4.800 (-5.800)	-3.500 (-4.500)	+1.200 (+0.200)	〃	〃	〃	〃	8.000	〃	〃	-0.165 (-1.165)
K.HUAY KWANG	2	3 m3/S	+0.700 (0.000)	-3.600 (-4.300)	-2.000 (-2.700)	+1.500 (+0.800)	0.700	0.900	0.450	2.100	5.000	1.200	9.500	+0.900 (+0.200)

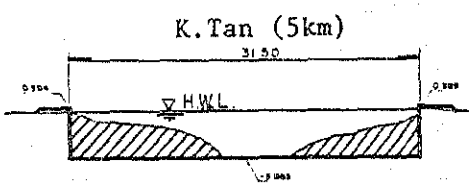
0.700:Elevation at present (m MSL)

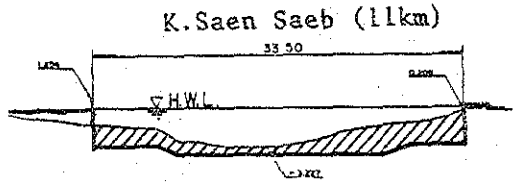
(-0.300):Elevation in 2000 (m MSL)

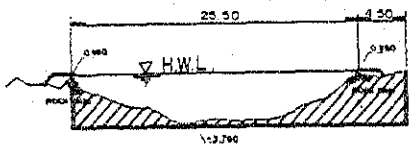
Fig. 5.3 TYPICAL DESIGN OF PUMPING STATION

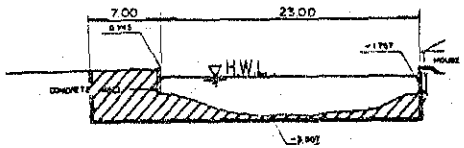












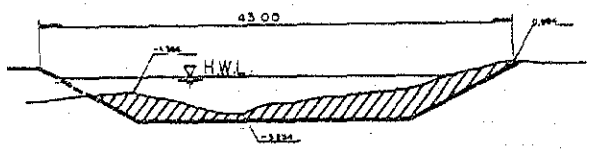
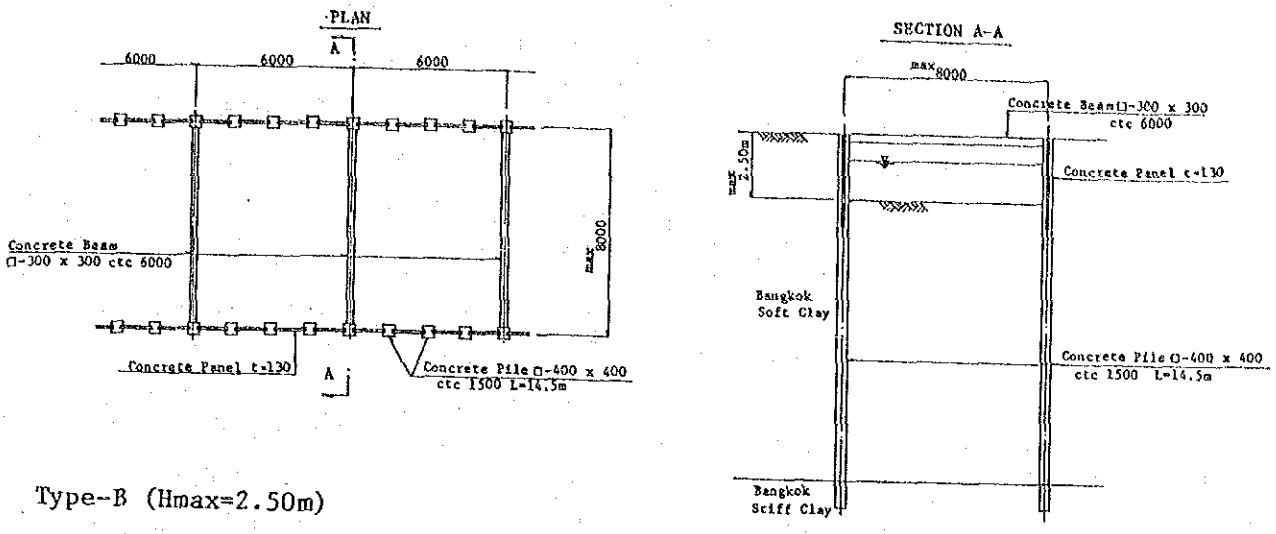


Fig. 5.4 PROFILE AND CROSS SECTIONS IN KLONGS PHRA KHANONG, TAN AND SAEN SAEB

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

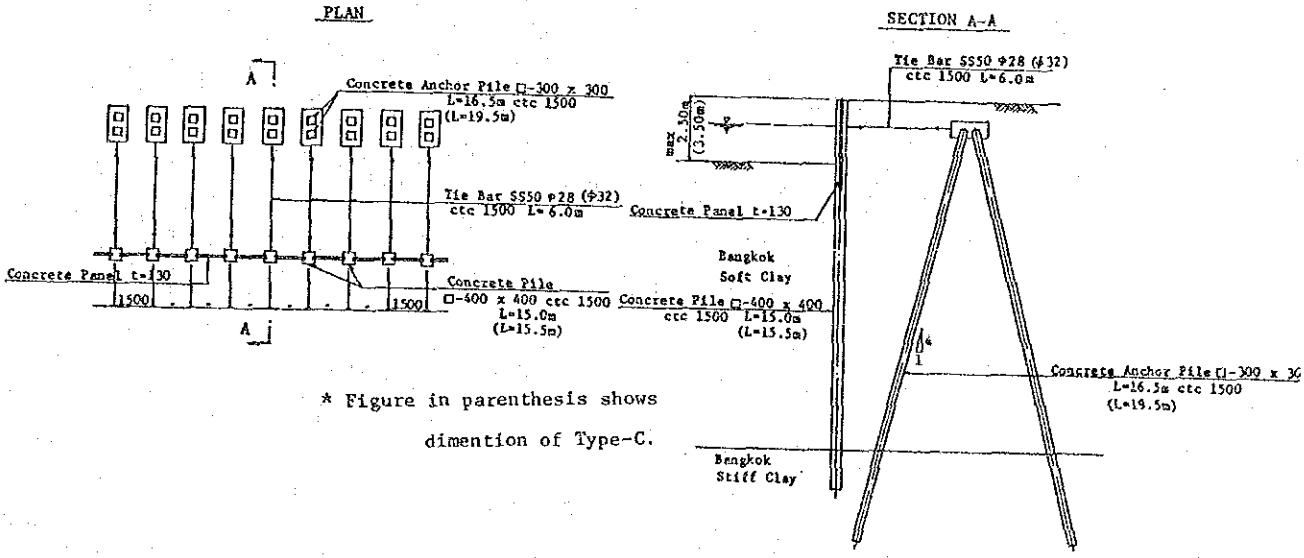
JICA 2529 B.E. 1986 A.D.

Type-A (Hmax=2.50m)



Type-B (Hmax=2.50m)

Type-C (Hmax=3.50m)



* Figure in parenthesis shows dimention of Type-C.

Type-D (Hmax=4.50m)

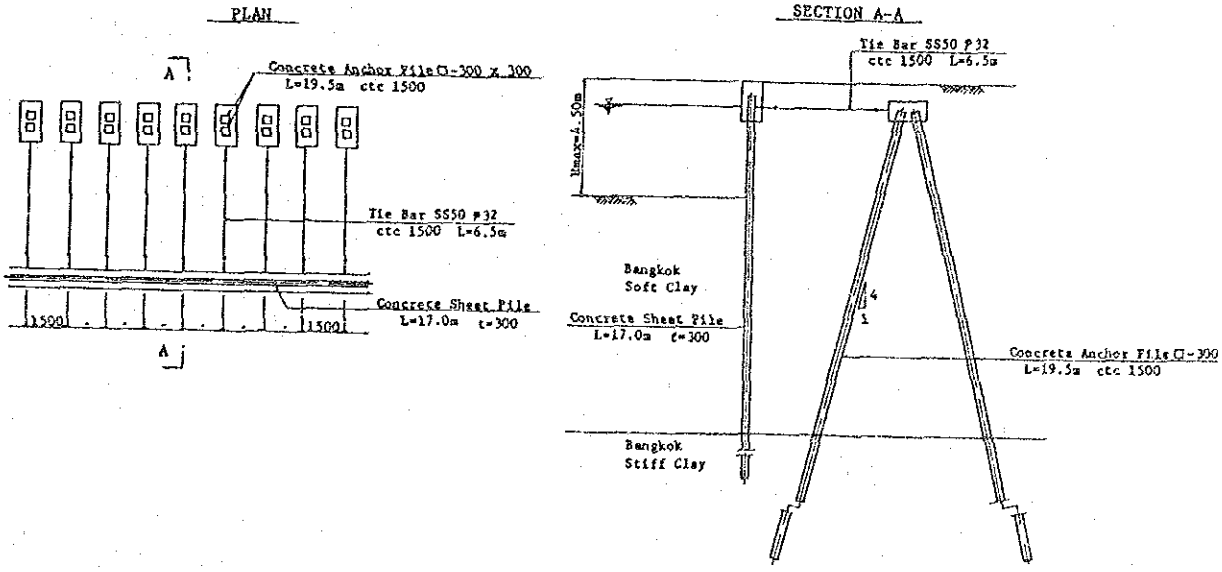
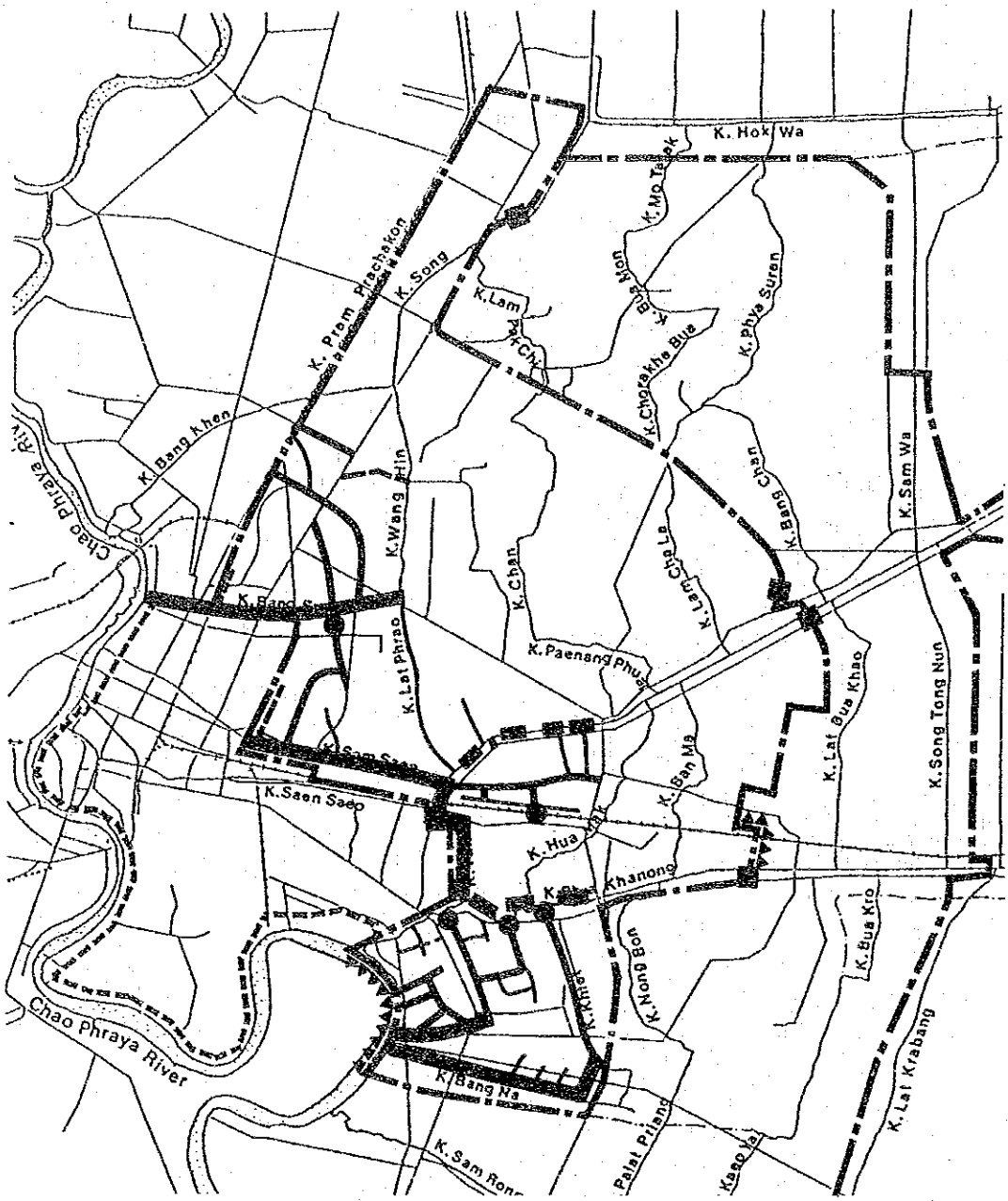


Fig. 5.5	TYPICAL DESIGN OF RETAINING WALL

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



Legend

(1988~1989)	(1990)	(1991)
Barrier	Klong	Klong
Gate	Drain	Drain
Pumping Station		
Klong		

Fig. 5.6 IMPLEMENTATION SCHEDULE

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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Chapter 6

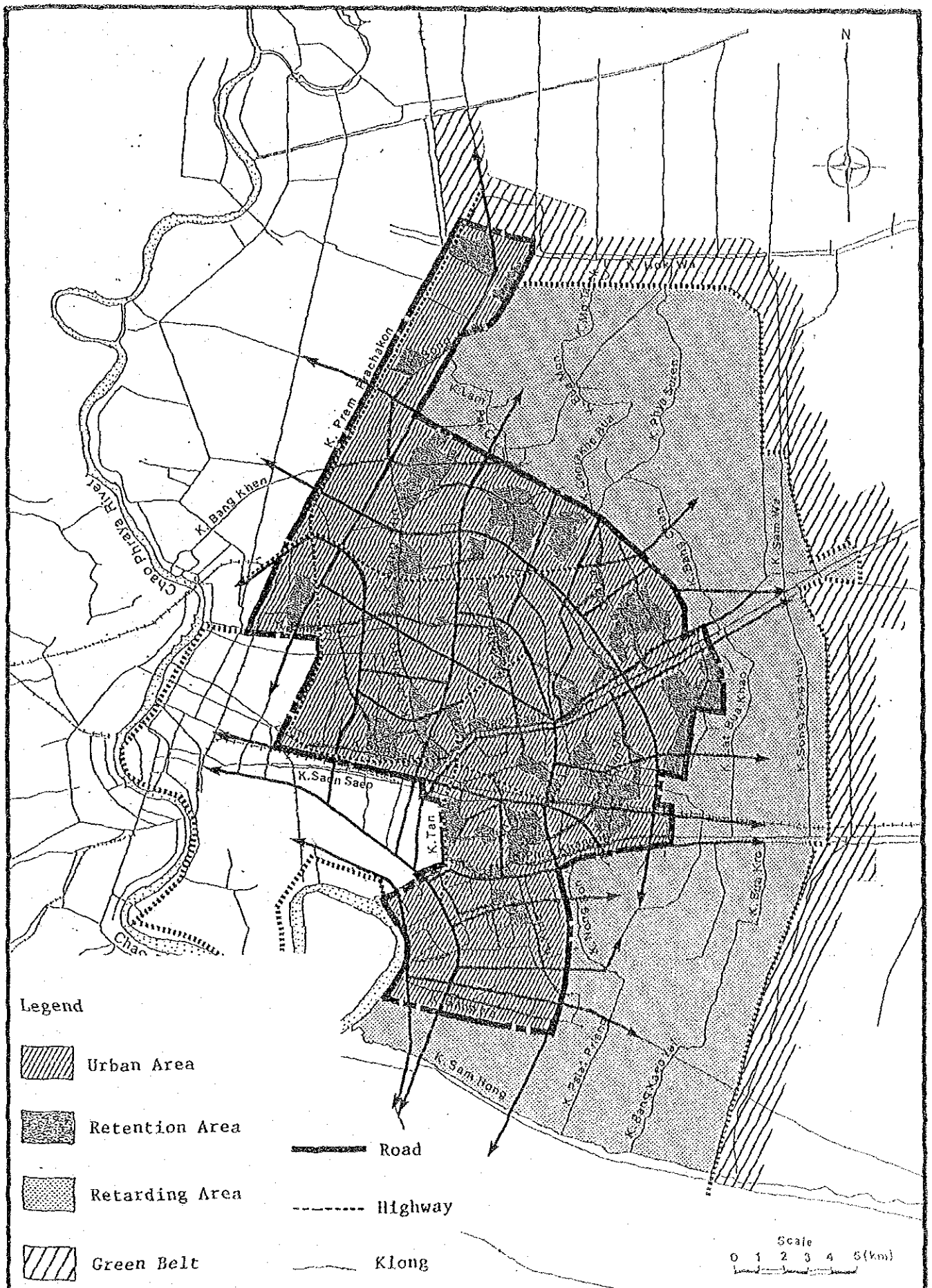

Fig. 6.1 PROPOSED ZONING IN EASTERN SUBURBS

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN BANGKOK

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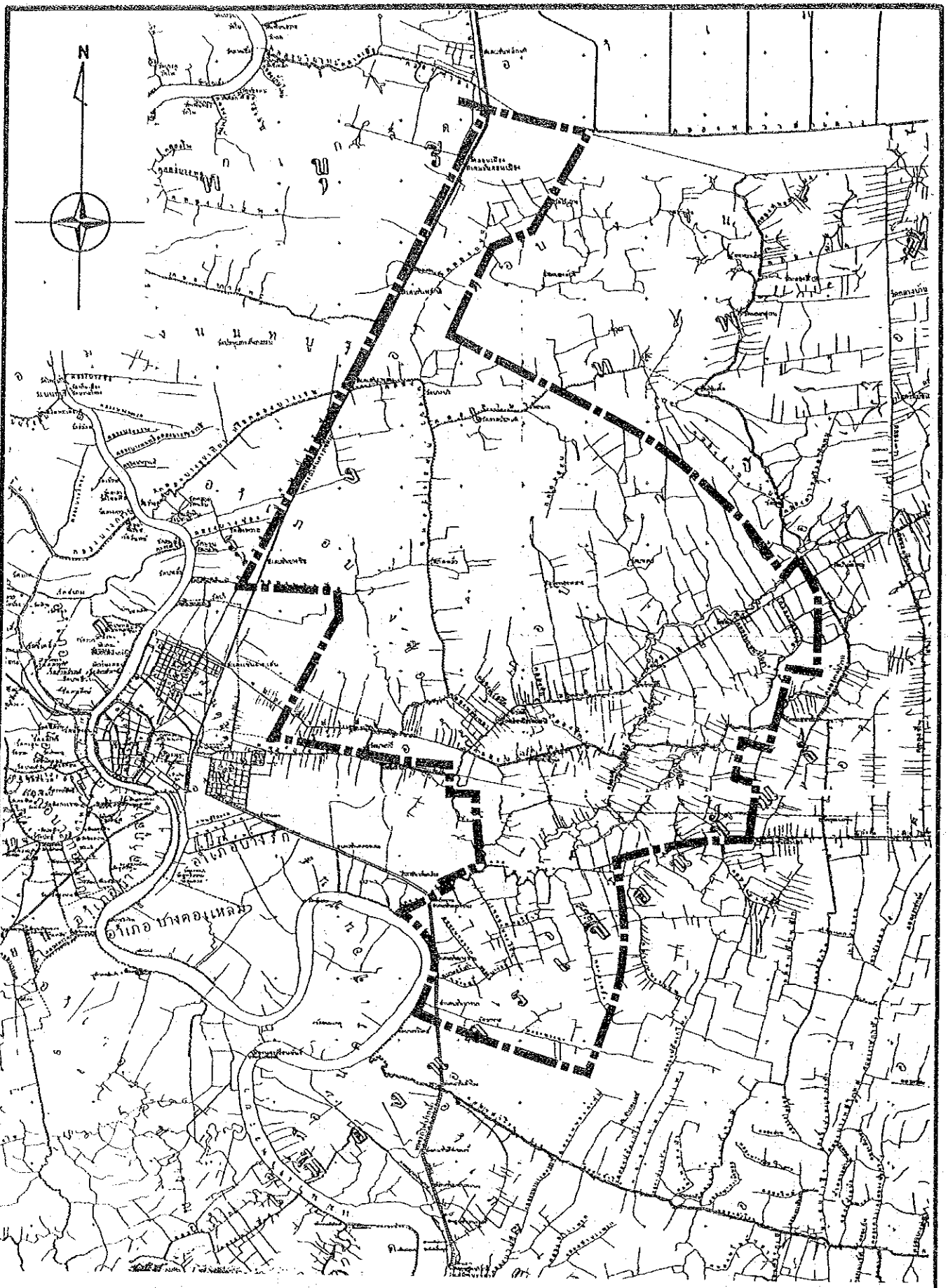

(Source: 1910 Map of RTSD)

Fig. 6.2 KLONG NETWORK IN EASTERN SUBURBS (1910)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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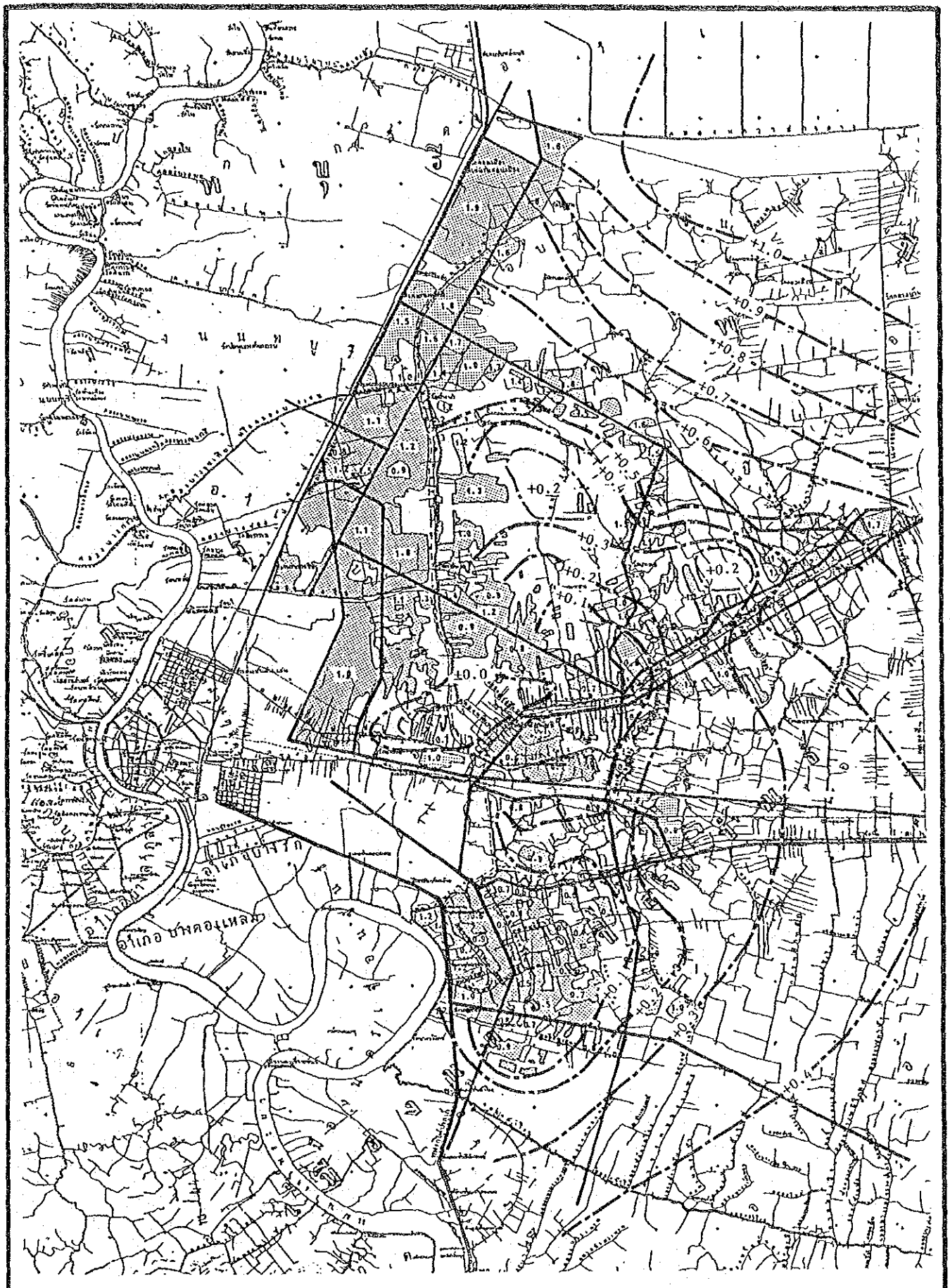

Fig. 6.3 KLONG NETWORK (1910) AND GROUND ELEVATION (1984)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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Chapter 7

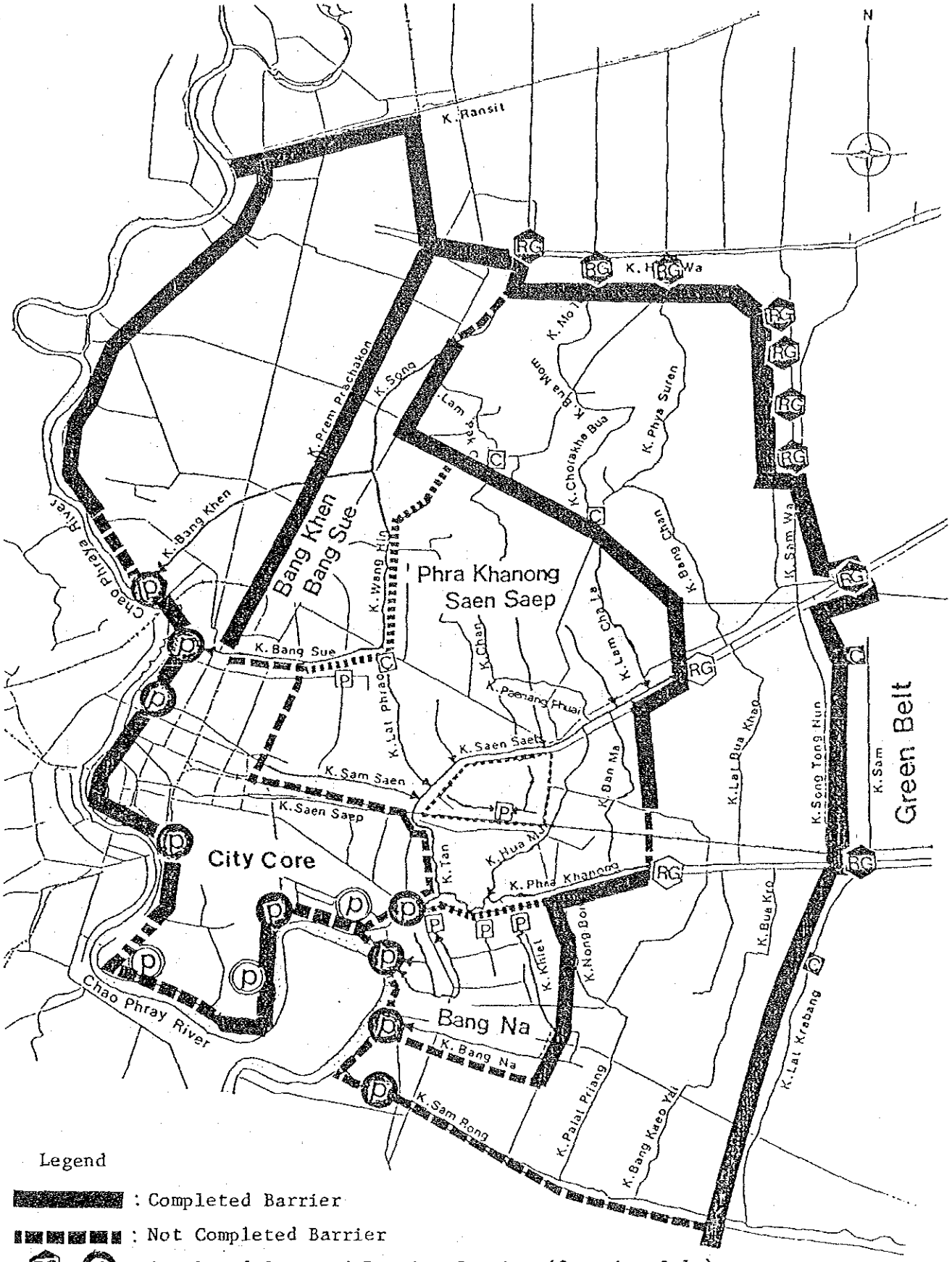
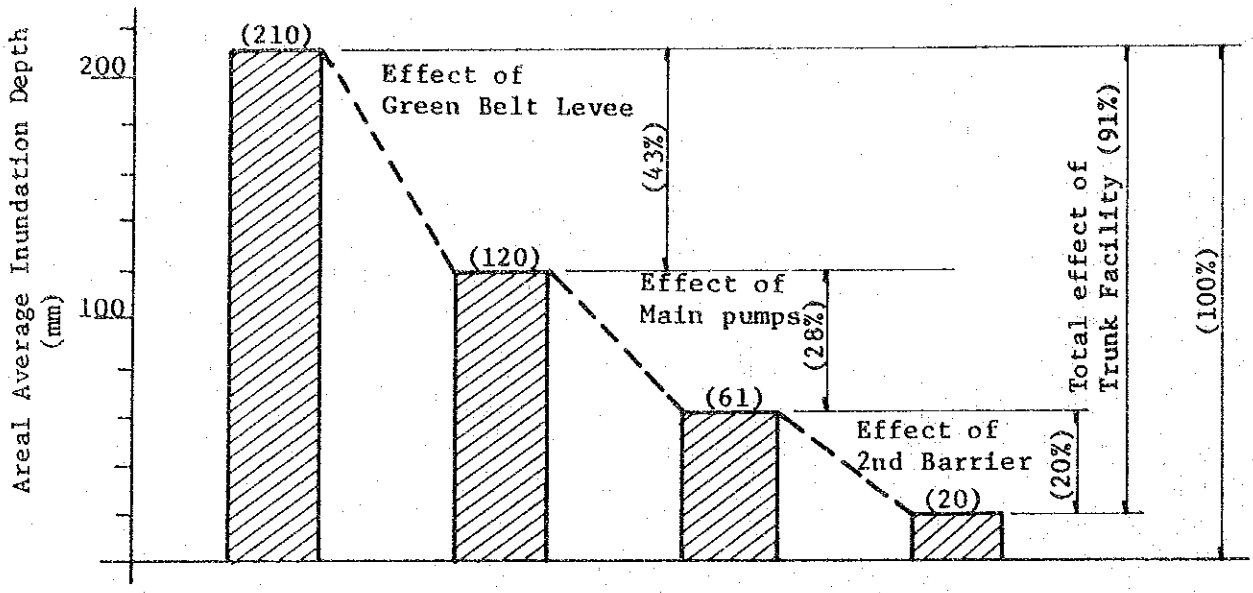


Fig. 7.1 CONDITION OF DEVELOPMENT OF TRUNK FACILITIES IN 1985

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

(1) Hydraulic Effects of Trunk Facilities
(In the Master Plan Area)



Note Topography condition: Present, 1985
Model: 9 Basin storage Model

(2) Observed Effect in Klong Saen Saeb

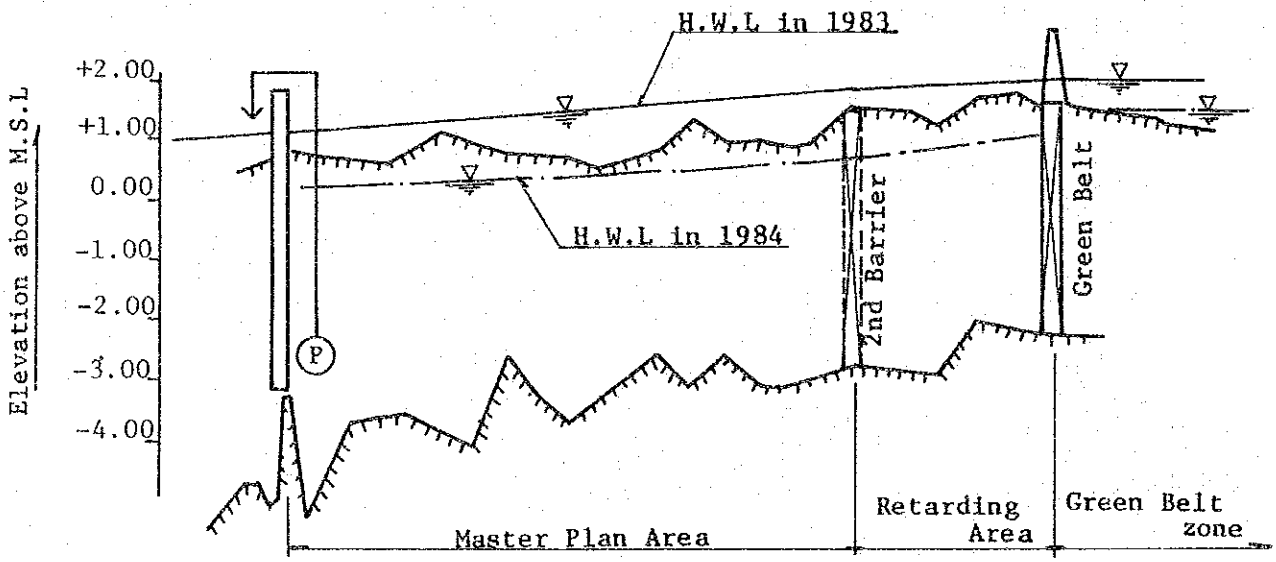
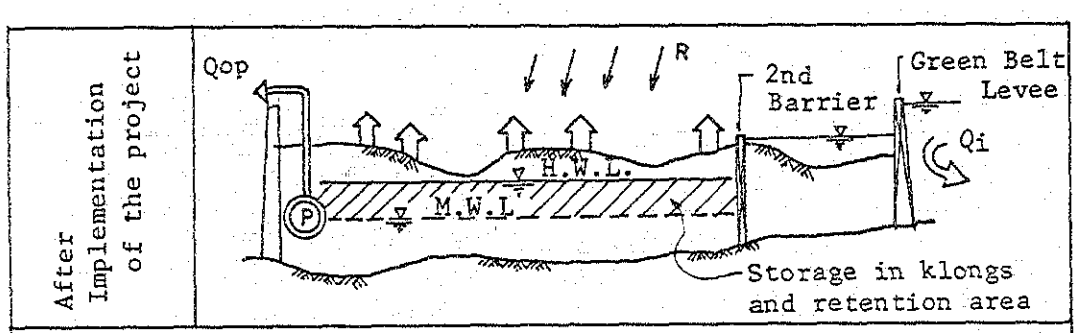


Fig. 7.2 HYDRAULIC EFFECTS OF TRUNK FACILITIES

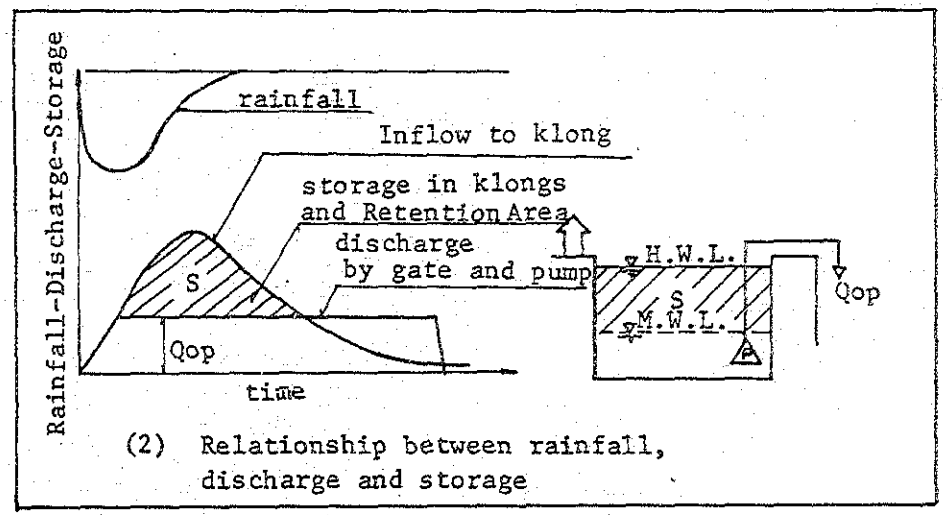
FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

1. Concept of Rainwater Storage



(1) Hydraulic Effect of Project



(2) Relationship between rainfall, discharge and storage

2. Design Storage Capacity

Polder	① Areal Average Design Rainfall	② Storage Capacity in Klong & Retention Area	②/① (%)
Bang Khen Bang Sue	* 90mm	23mm	26%
Phra Khanong	** 82mm	48mm	58%
Bang Na	* 76mm	34mm	45%

Note : *--Design point rainfall is 91mm/day as 2 years frequency.

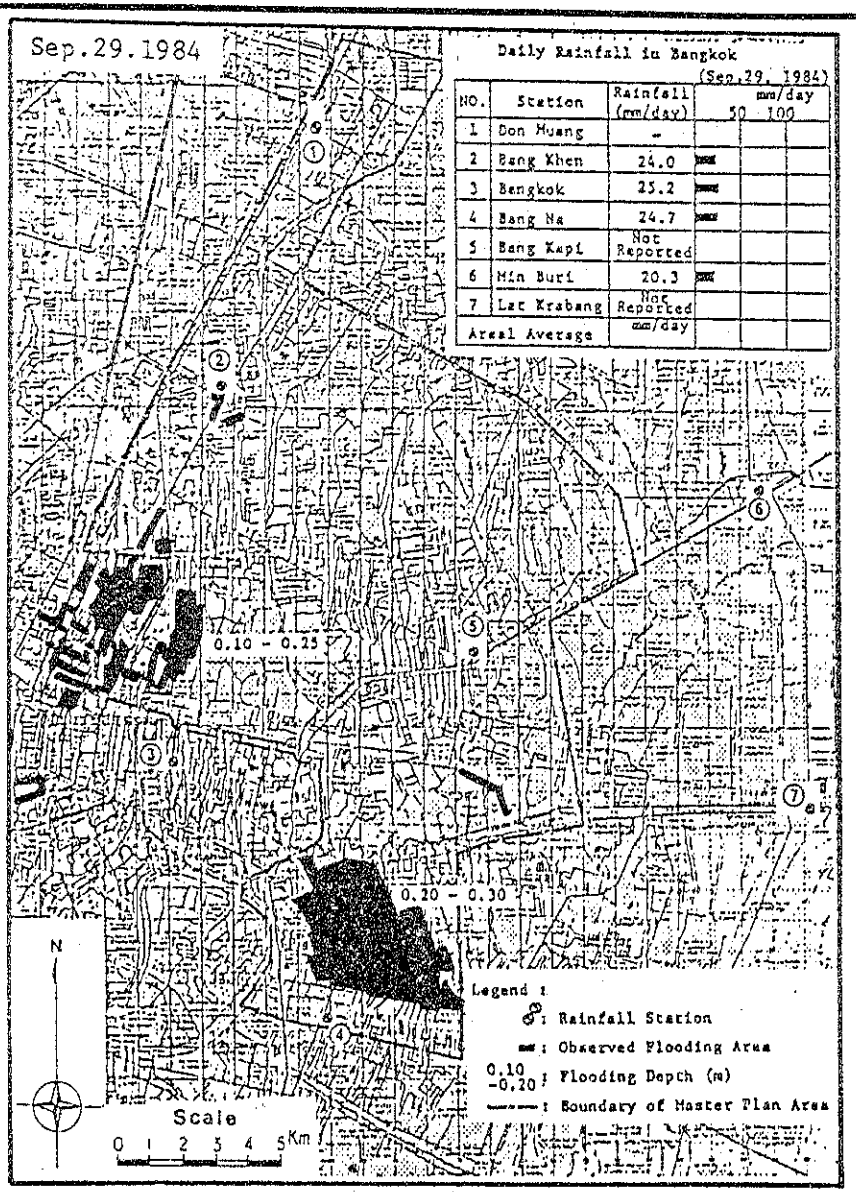
**--Design point rainfall is 120mm/day as 5 years frequency.

Legend

Qi: Inflow from outer area
Qo: Drain by pumping station and gate
R: Rainfall
S: Storage in klong and retention area
Ri: Accumulated rainfall
H.W.L.: High water level
M.W.L.: Maintenance water level

Fig. 7.3 CONCEPT OF RAINWATER STORAGE AND DESIGN STORAGE CAPACITY

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK



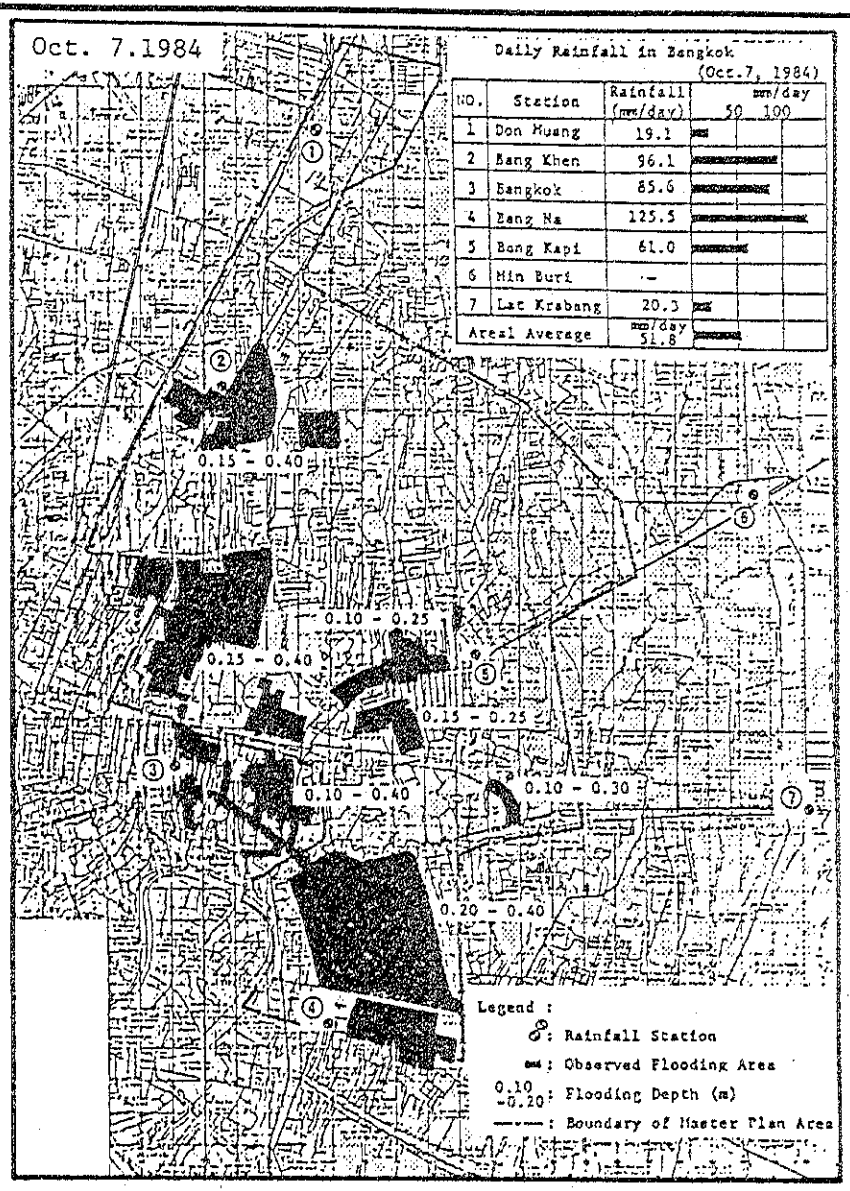


Fig. 7.4 LOCAL FLOODED AREA AFTER COMPLETION OF URGENT MEASURES IN 1984

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529 B.E 1986 A.D

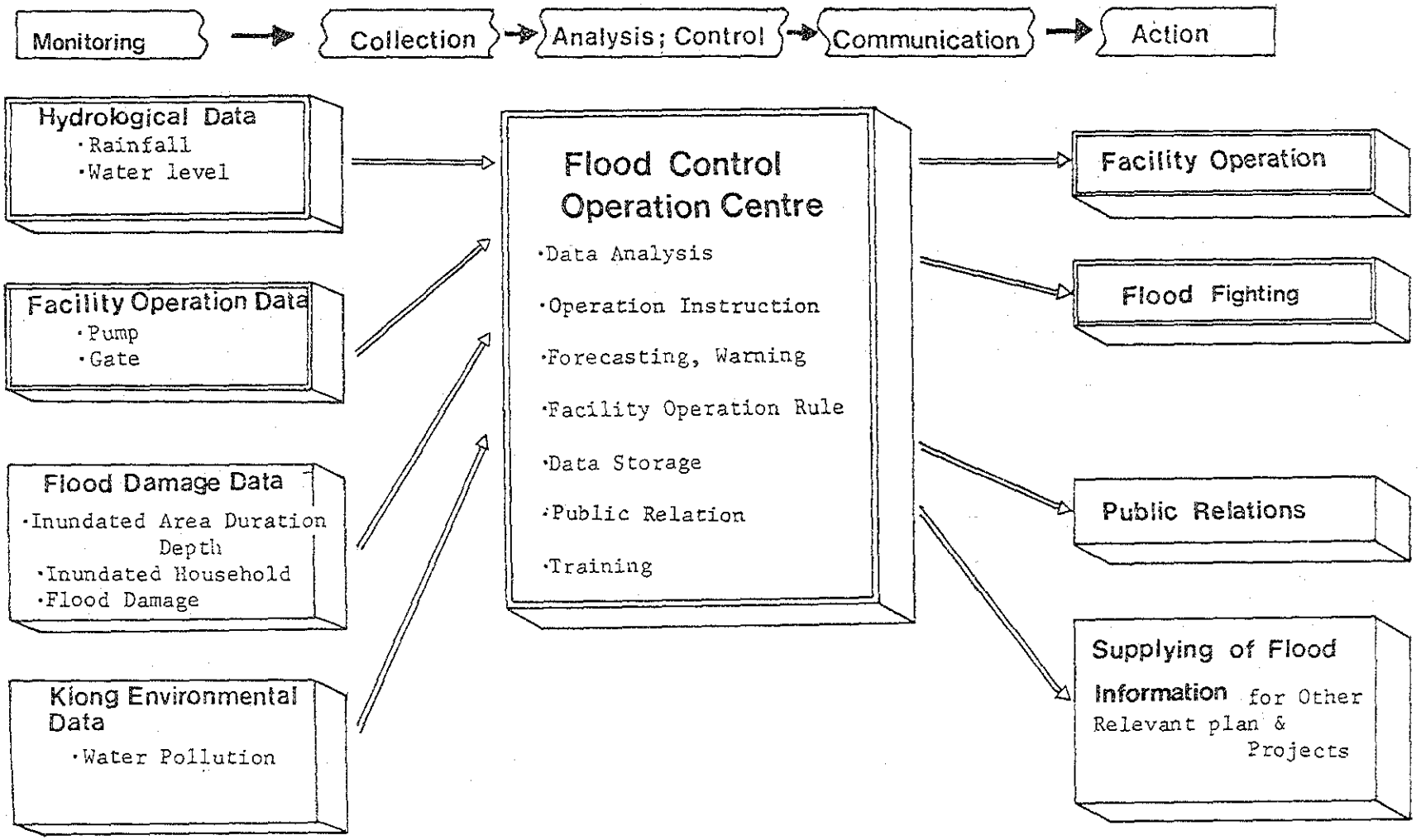


Fig. 7.5 CONCEPT OF FLOOD CONTROL OPERATION SYSTEM

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

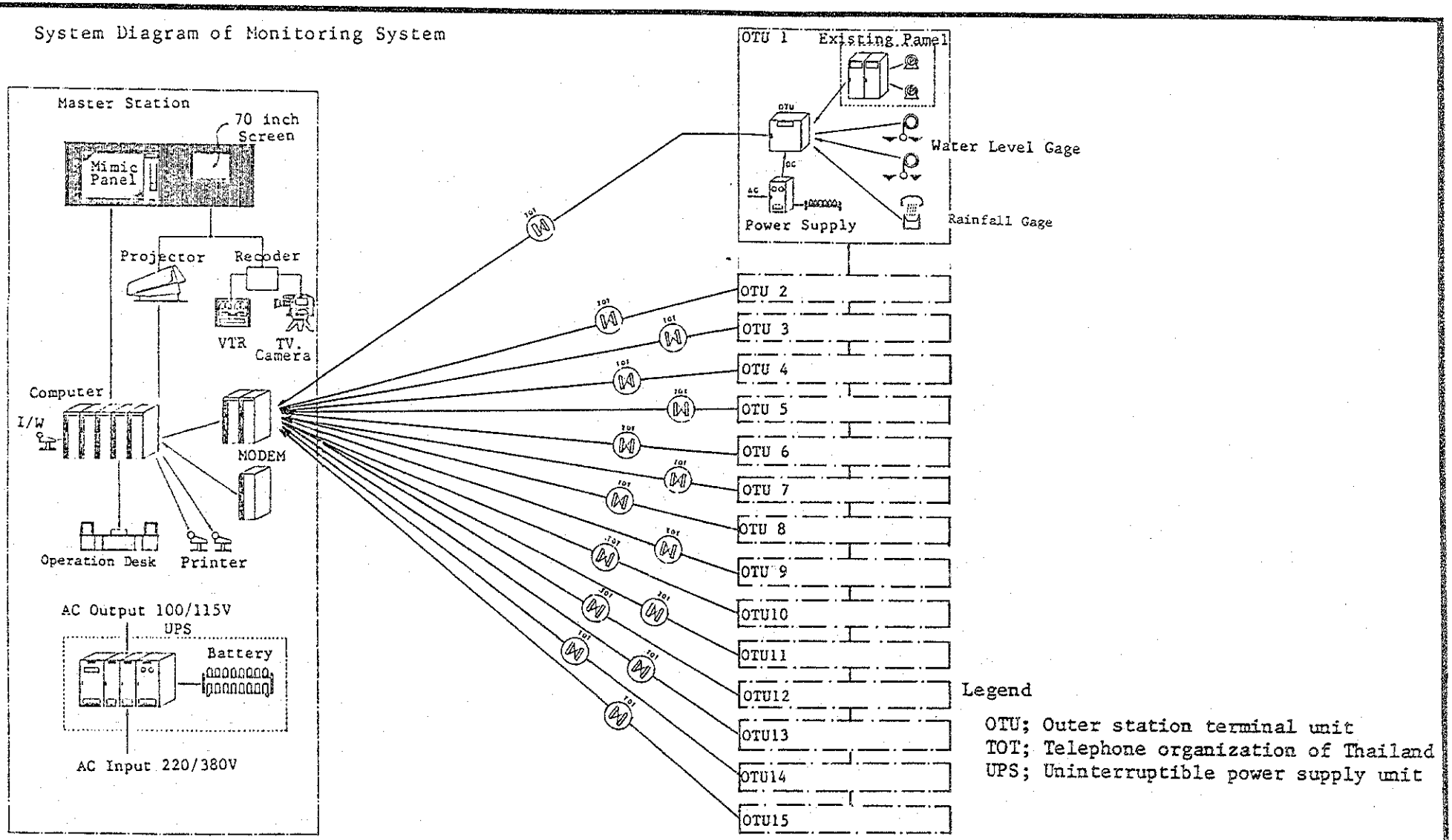


Fig. 7.6 SCHEMATIC DIAGRAM OF MONITORING SYSTEM

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

LEGEND

Newly Stations

- Rain gauge and two water level meters
- Rain gauge and water level meters
- Two water level meters

Fig. 7.7 LOCATION MAP OF PROPOSED MONITORING STATIONS

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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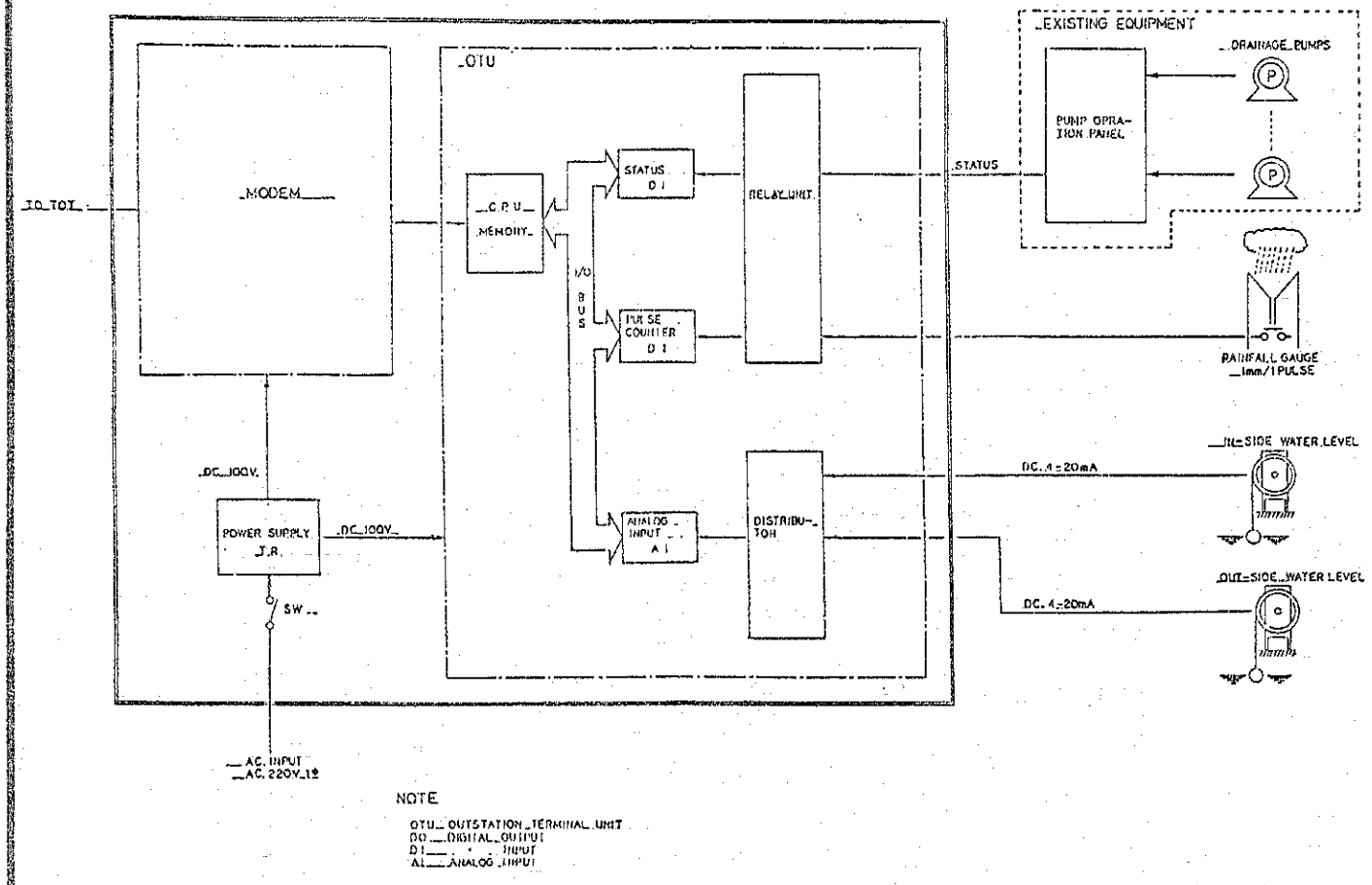
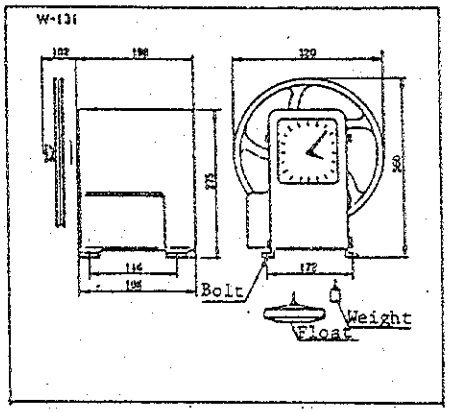
(1) Block Diagram of Outer Station Terminal Unit (OTU)



NOTE

OTU OUTSTATION TERMINAL UNIT
DO DIGITAL OUTPUT
DI " " INPUT
AI ANALOG INPUT

(2) Water Level Gage (Sample)



(3) Rainfall Gage (Sample)

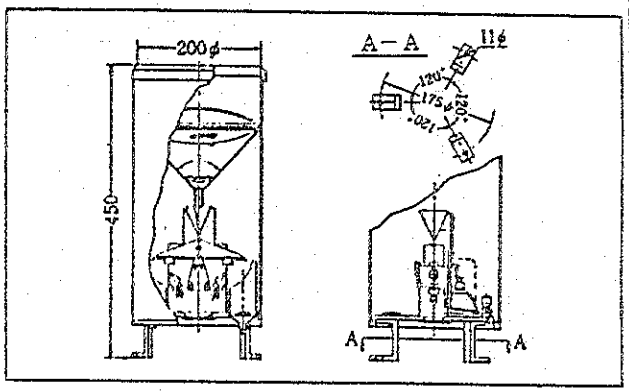


Fig. 7.8	SCHEMATIC DIAGRAM OF MONITORING STATION

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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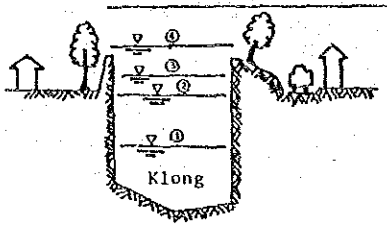
(1) Outline of the Flood Control Regulations

		Action of Centre	ESTIMATED WATER LEVEL	FACILITY OPERATION			FLOOD FIGHTING	ANNOUNCEMENT
				Gate of Barrier	Main Pump	Sub-Main Pump		
Standard in not Rainy Time		Carefully control and operation of facilities to avoid extream conflict due to the water level difference between inside and outside area					—	—
Standard in Rainy Time	Occurrance of Rainfall / Rainfall Forecasting by Meteorological Depc.	Confirmation of Rainfall & Water Level (Monitoring) / Flood Forecasting Analysis (Estimation of Water Level)	Maintaining W.L	Close in principle	Pre-Discharge	—	—	—
			Excess of Maintaining W.L.	Close	Full-Discharge	Pre-Discharge	Preparation	—
			Excess of Warning W.L.	-"-	Full-Discharge	Full-Discharge	Calling (Augment Patrolling)	Caution
			Excess of Design High W.L (Flood Level)	-"-	-"-	Full-Discharge	Emergency Action Augment Fighters, Movable Pumps & Sand Bags	Warning
			Flooding (Overbank Spillage	-"-	-"-	-"-	-"-	(Evacuation)

Kinds of Water Level in Klong



① Maintaining Water Level
② Warning Water Level
③ Design High Water Level
④ Flooding Water Level

(2) Concept of Predischarge Operation of Main Pumping Station

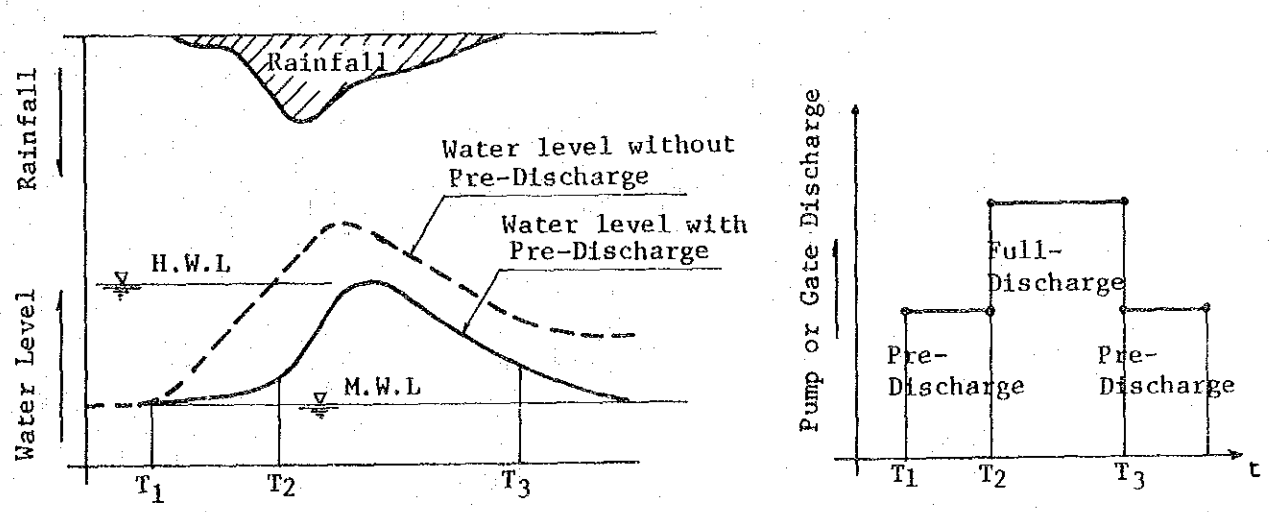


Fig. 7.9 OUTLINE OF THE FLOOD CONTROL REGULATIONS

Chapter 8

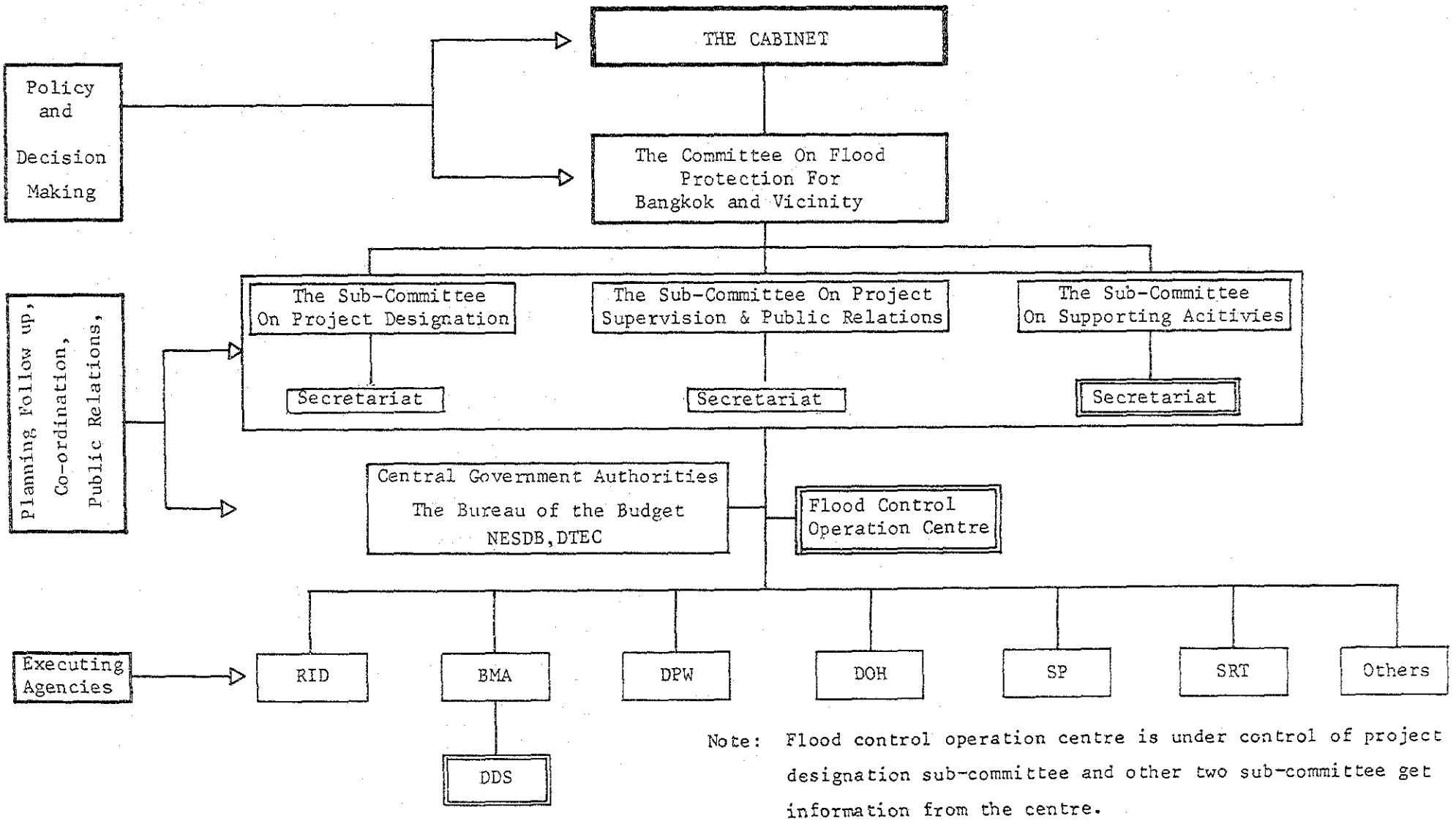


Fig. 8.1 INSTITUTIONAL FRAMEWORK FOR THE PROJECT IMPLEMENTATION IN THE AREA

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

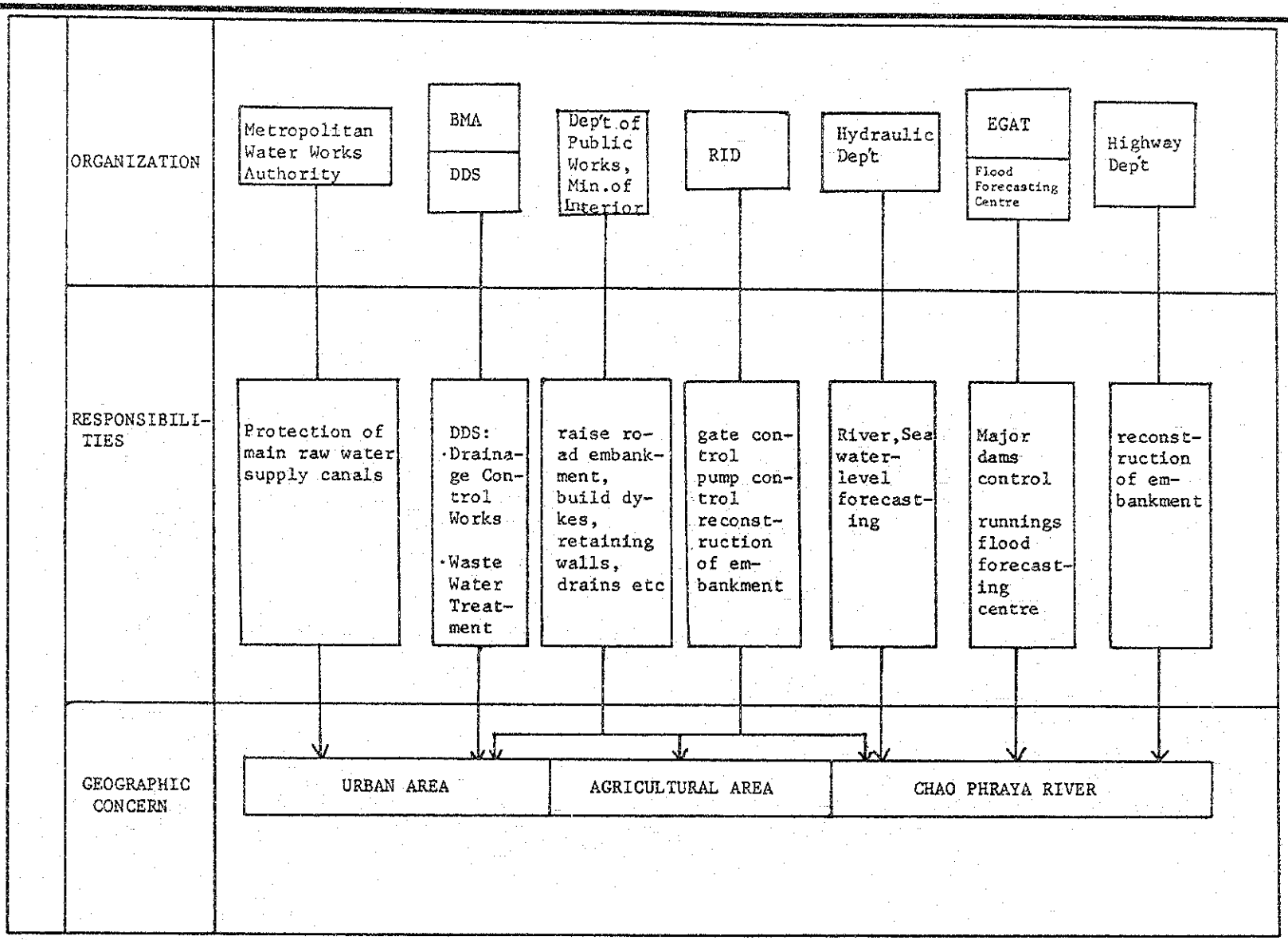


Fig. 8.2 CURRENT FLOOD CONTROL-RELATED ORGANIZATIONS AND RESPECTIVE RESPONSIBILITIES

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

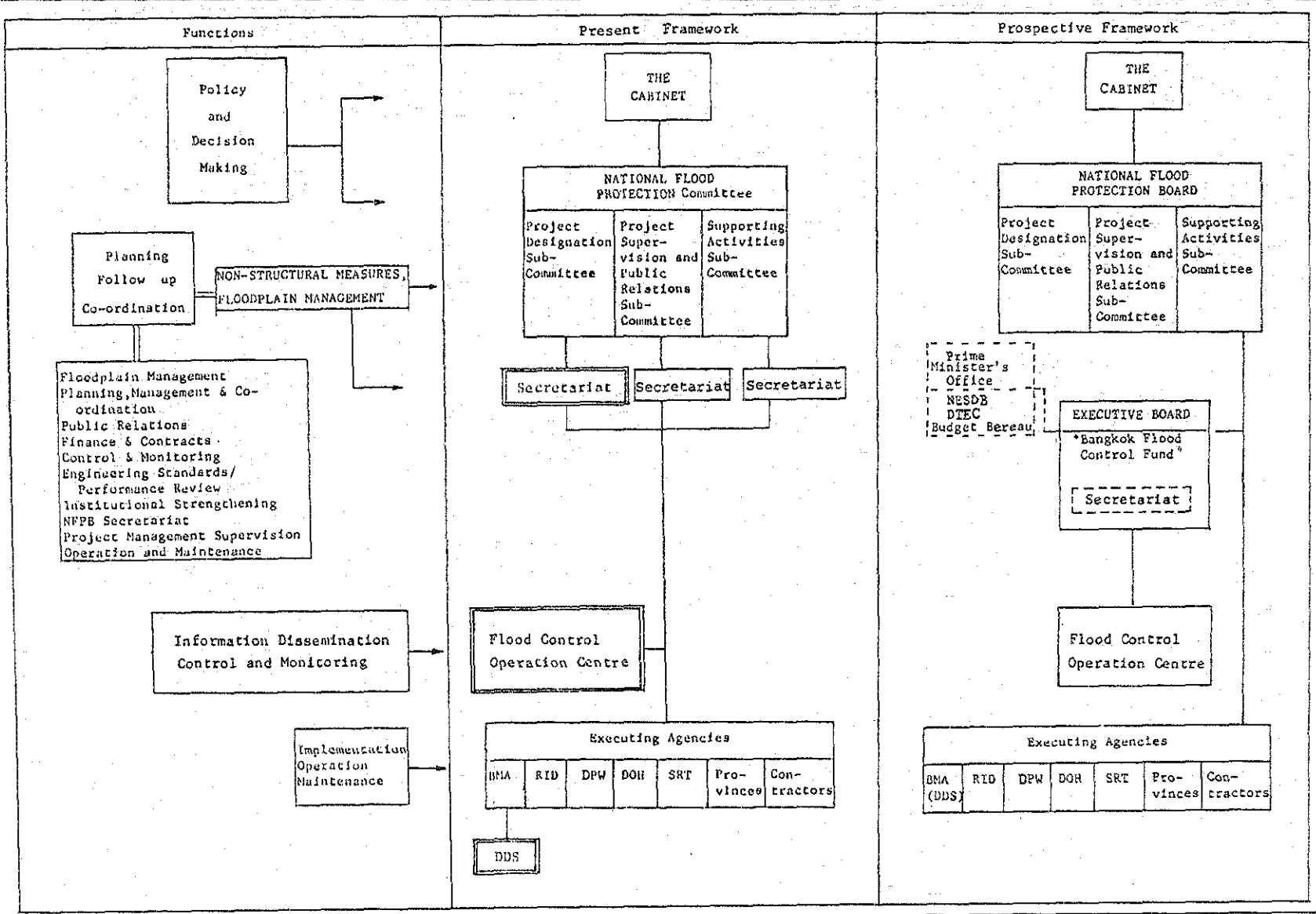


Fig. 8.3 PRESENT AND PROSPECTIVE INSTITUTIONAL FRAMEWORK

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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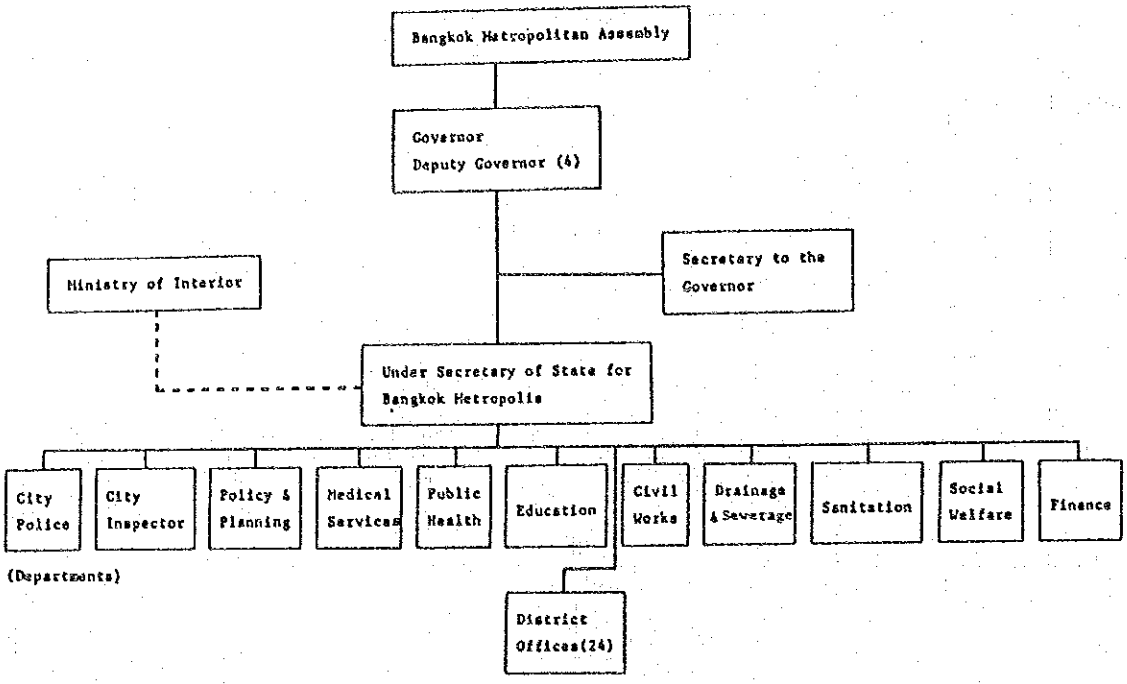
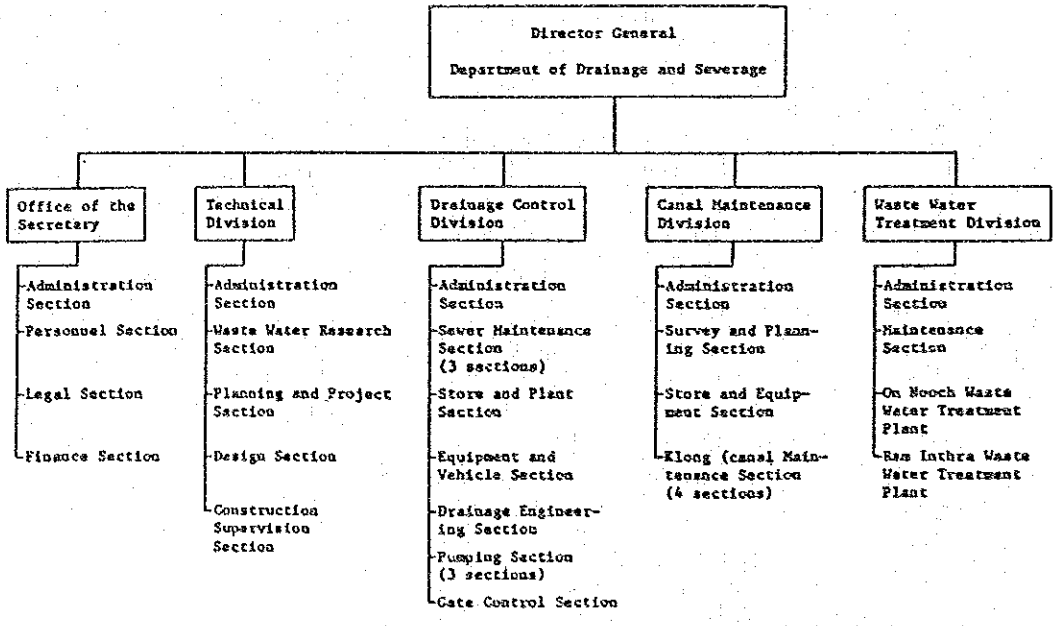


BANGKOK METROPOLITAN ADMINISTRATION



DEPARTMENT OF DRAINAGE AND SEWERAGE

Fig. 8.4 ORGANIZATION CHART OF BMA AND DDS

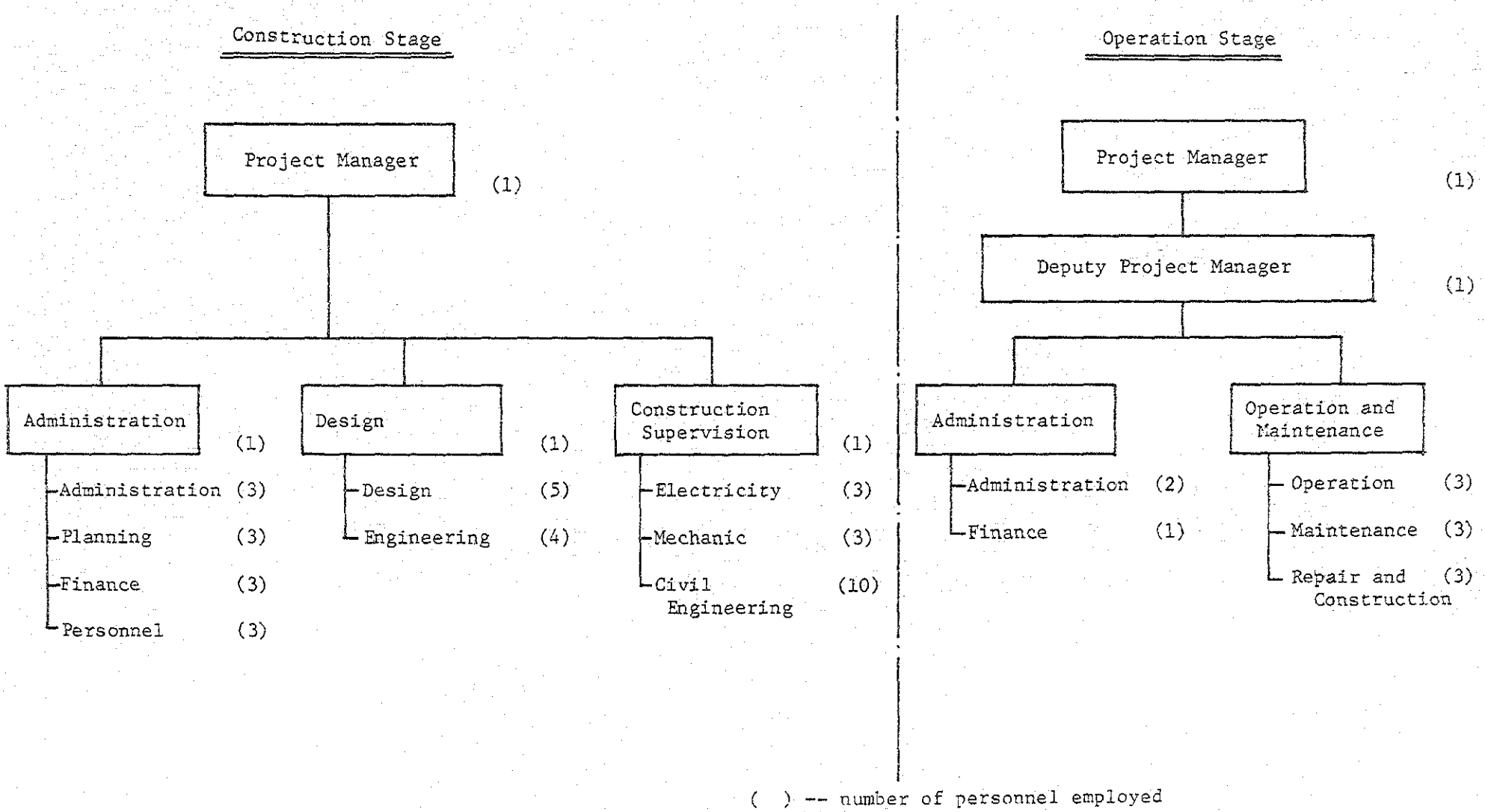


Fig. 8.5 PROJECT ORGANIZATION BY ITS ACTIVITIES

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

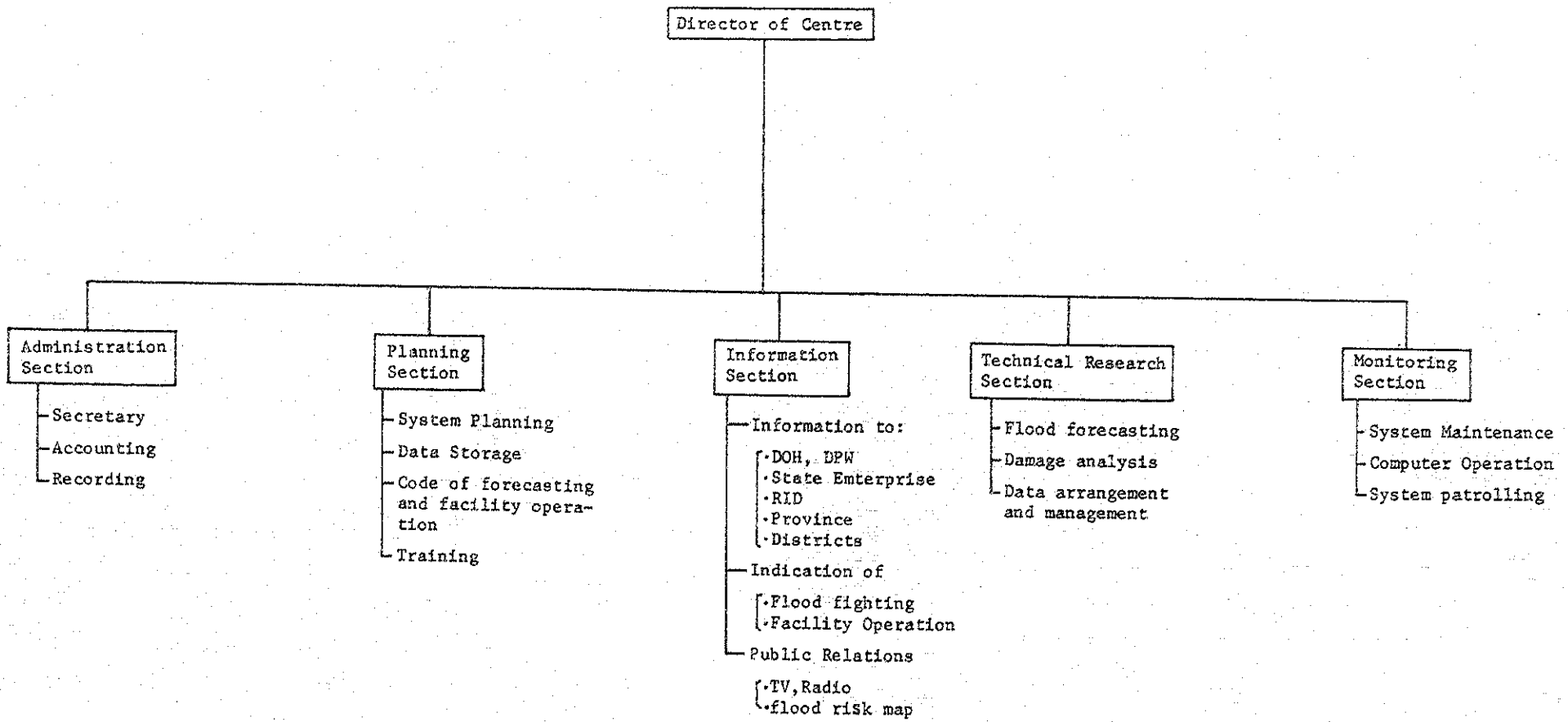


Fig. 8.6 ORGANIZATION CHART OF THE FLOOD CONTROL OPERATION CENTER

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

Chapter 9

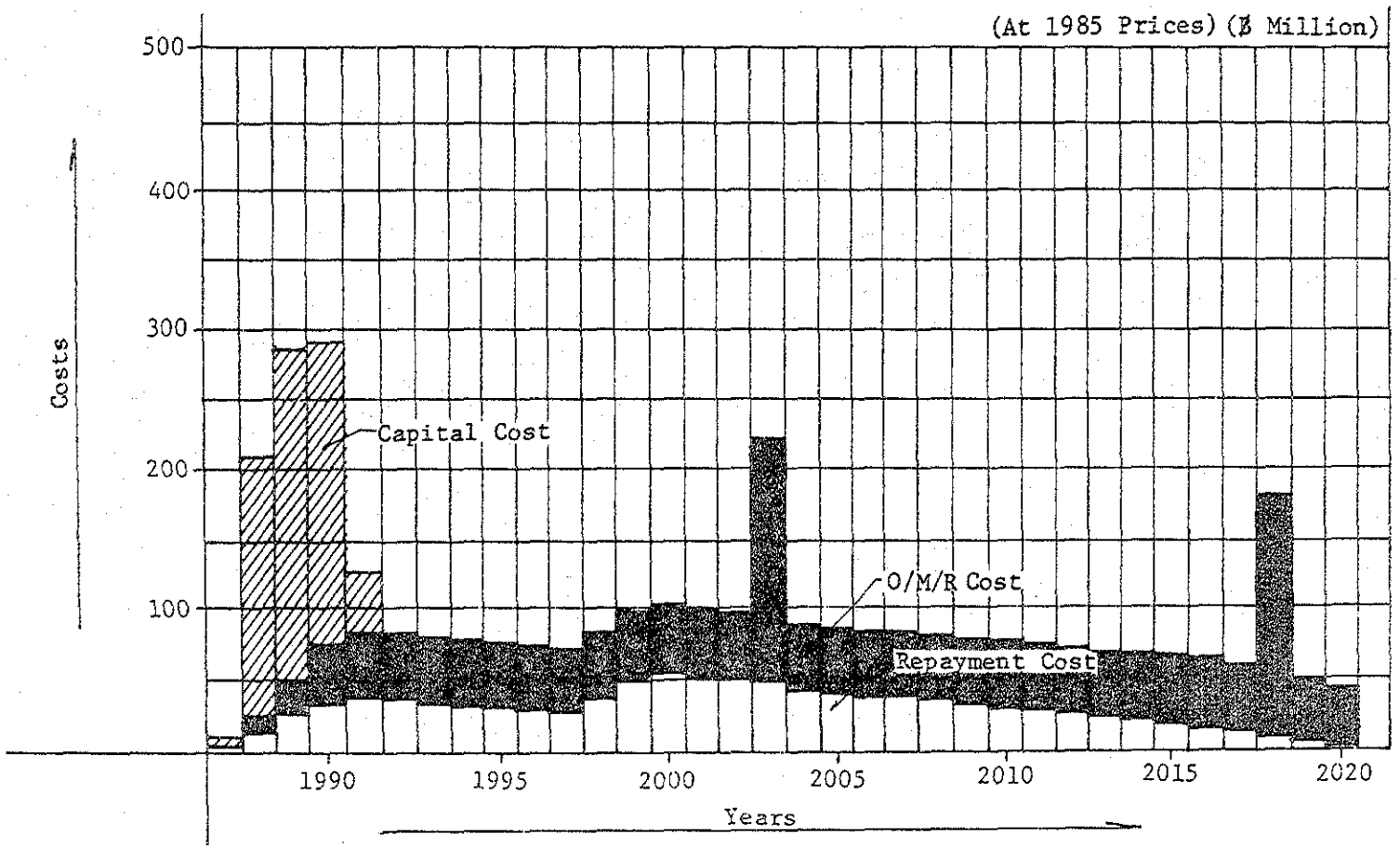


Fig. 9.1 ANNUAL COSTS FOR CAPITAL, REPAYMENT & O/M/R

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

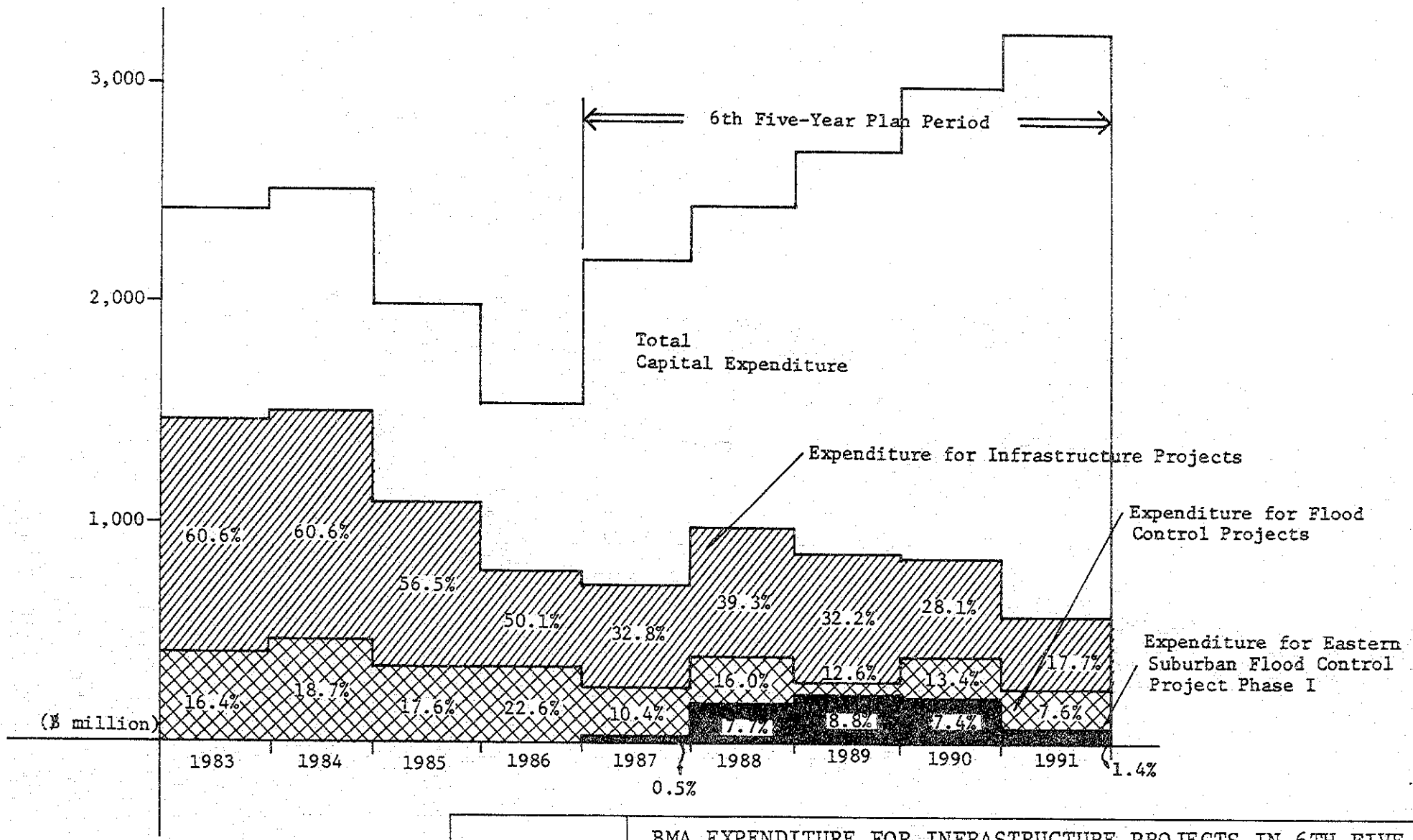


Fig. 9.2 BMA EXPENDITURE FOR INFRASTRUCTURE PROJECTS IN 6TH FIVE-YEAR PLAN

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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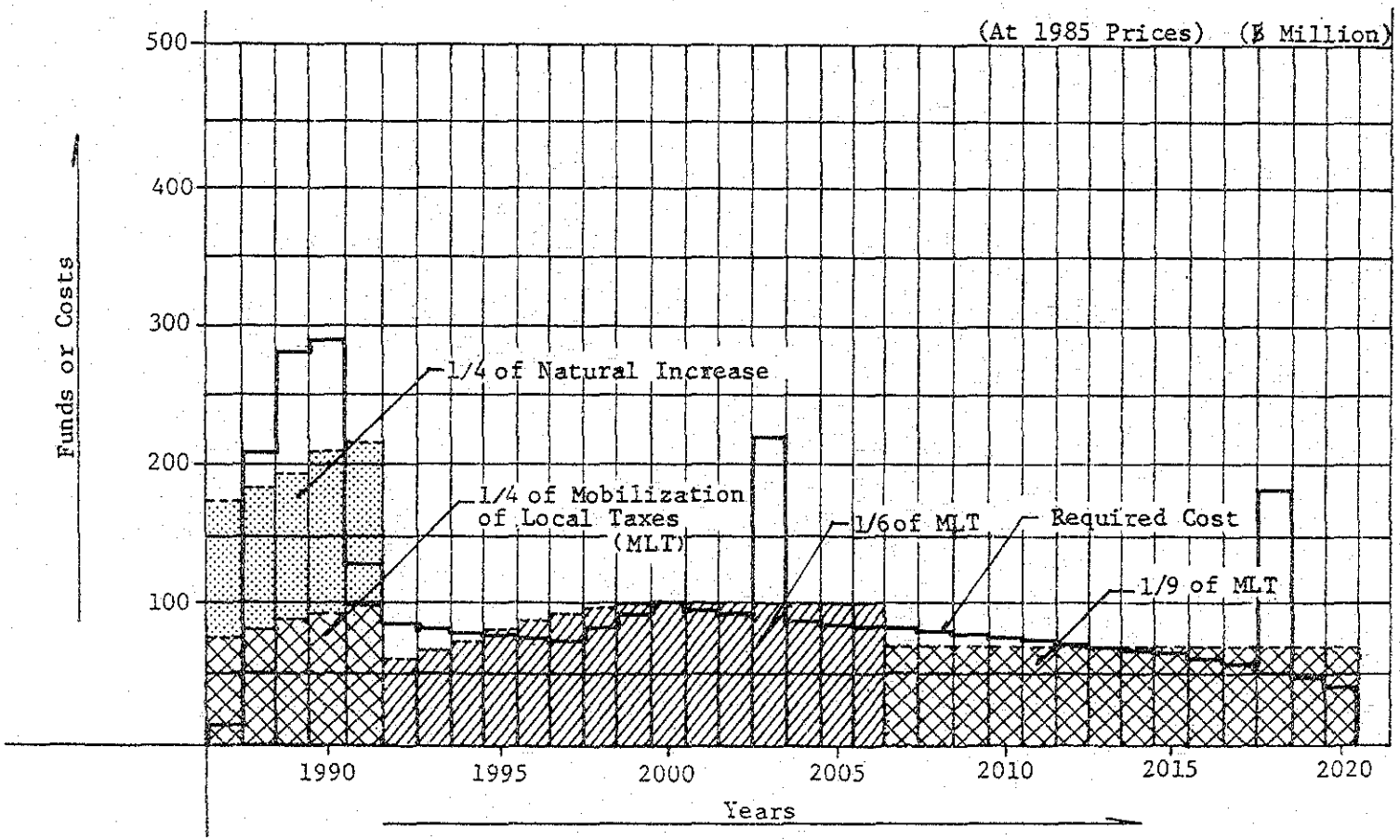
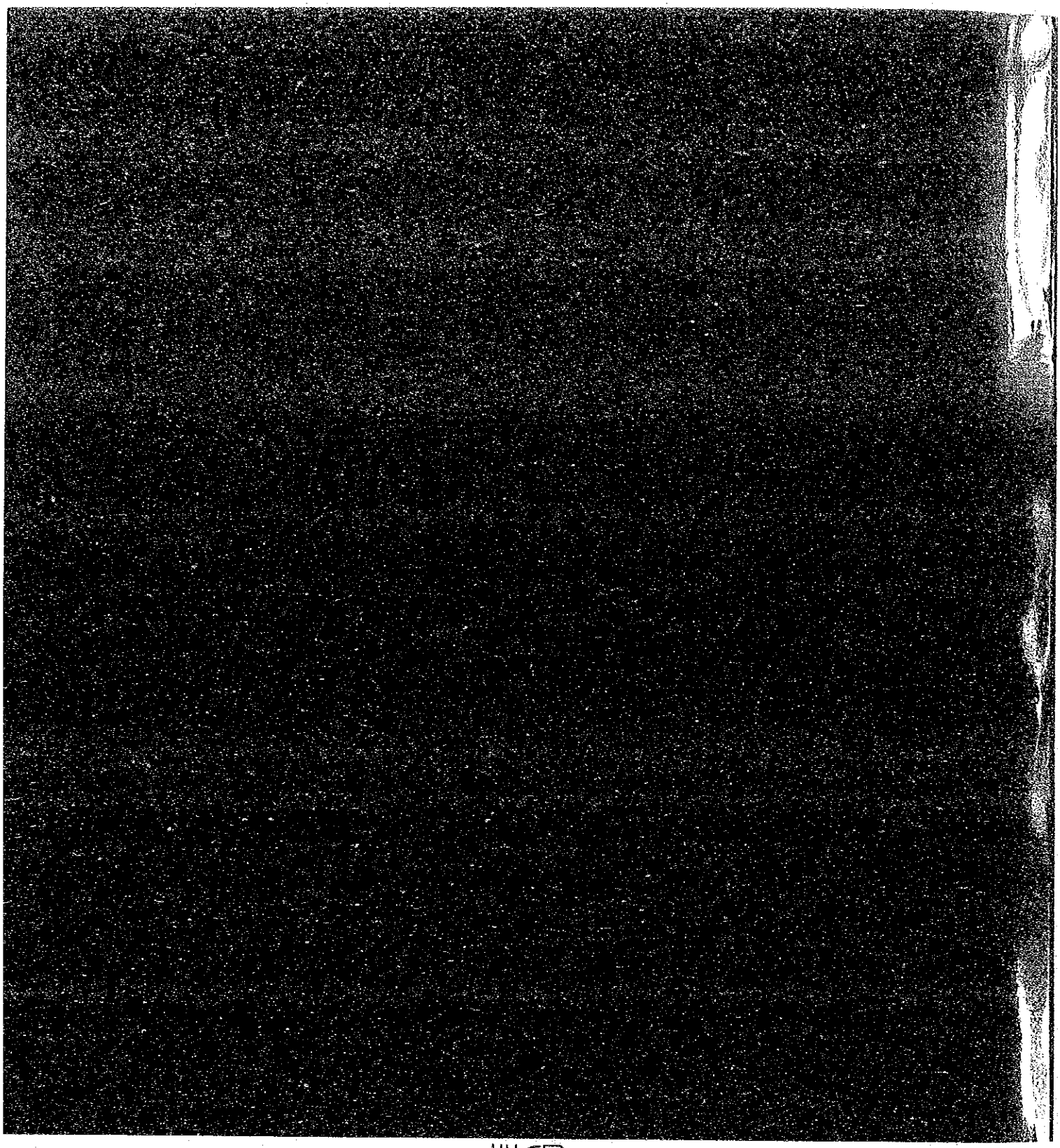


Fig. 9.3 CAPITAL RAISING & COST RECOVERY SCHEDULE

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK



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