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Land Use in Master Plan Area

Land Use	Area
Urbanized	216 km ²
Non-Urbanized	44 km ²
Total	260 km ²

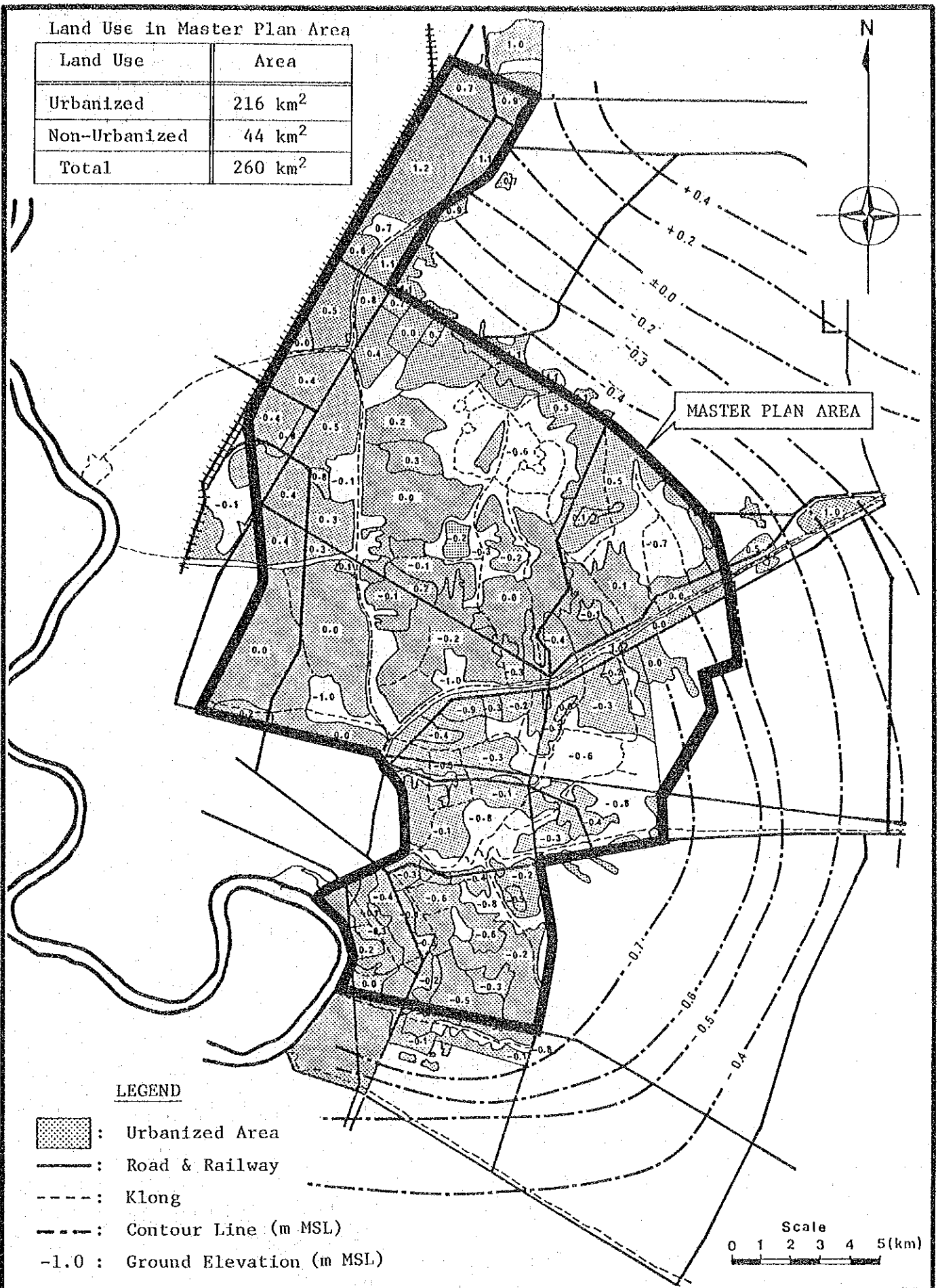


Fig. 7.1

ESTIMATED GROUND LEVEL IN URBANIZED AREA IN 2000

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

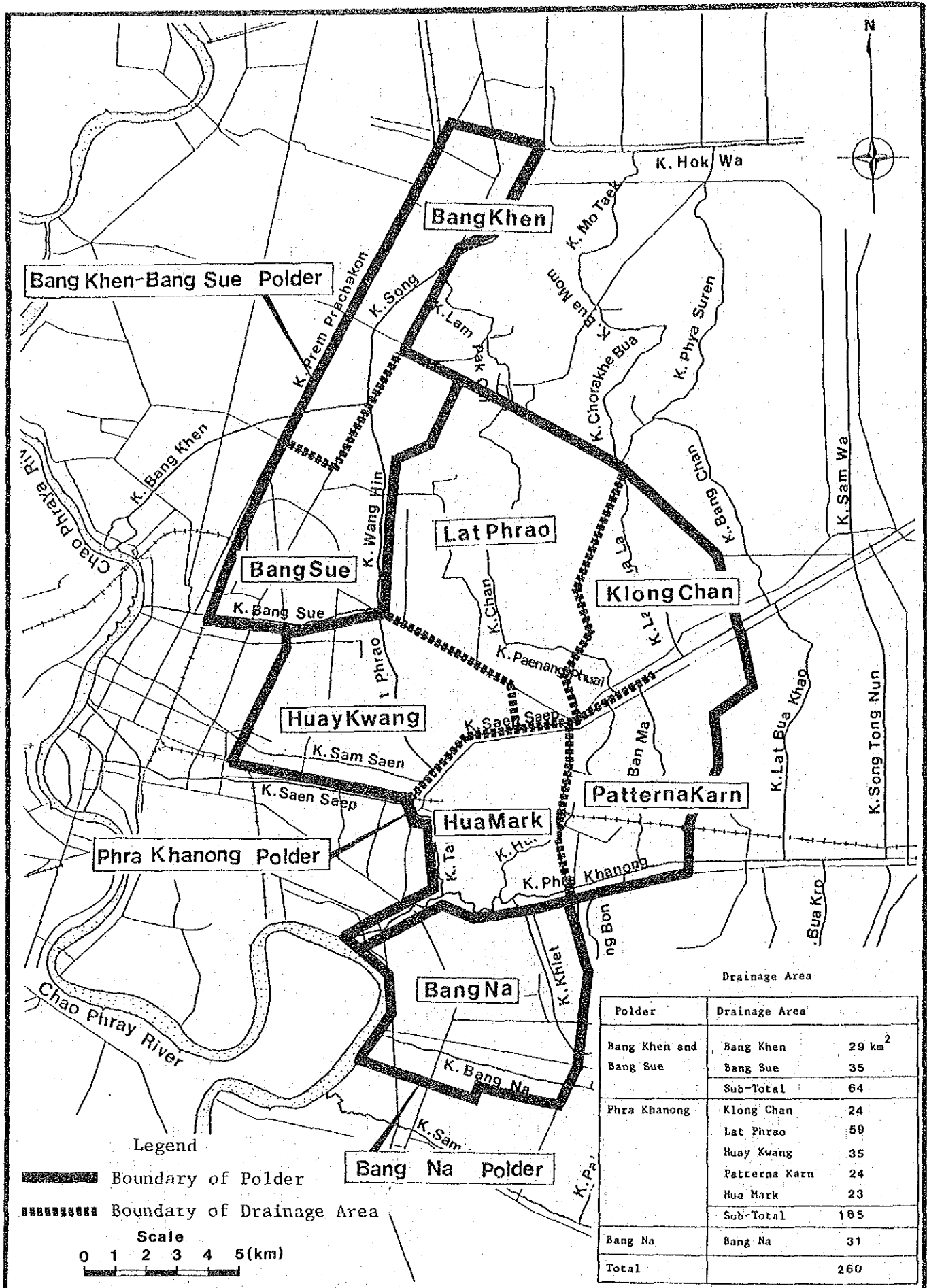


Fig. 7.2

ZONING OF DRAINAGE AREA

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

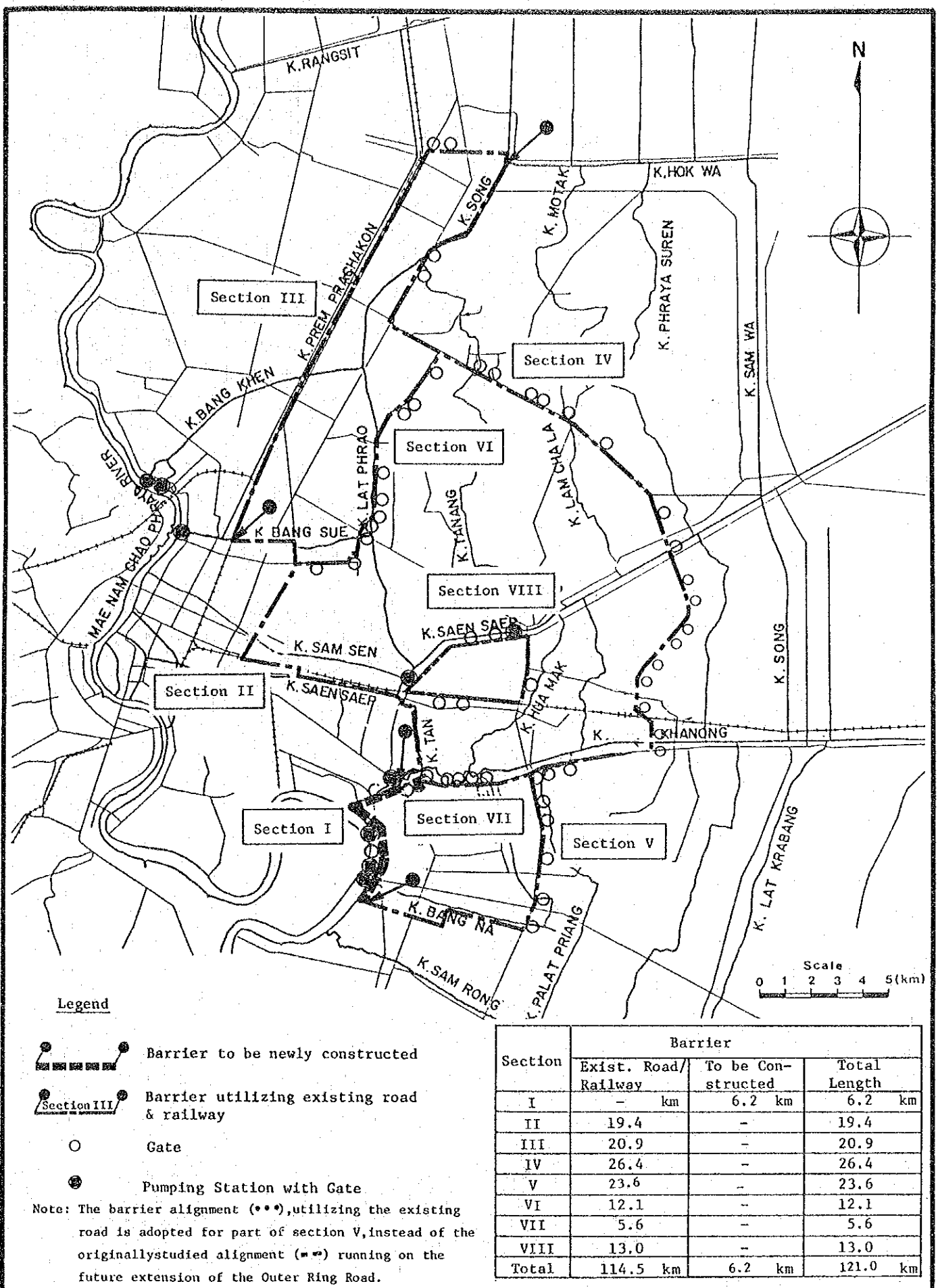
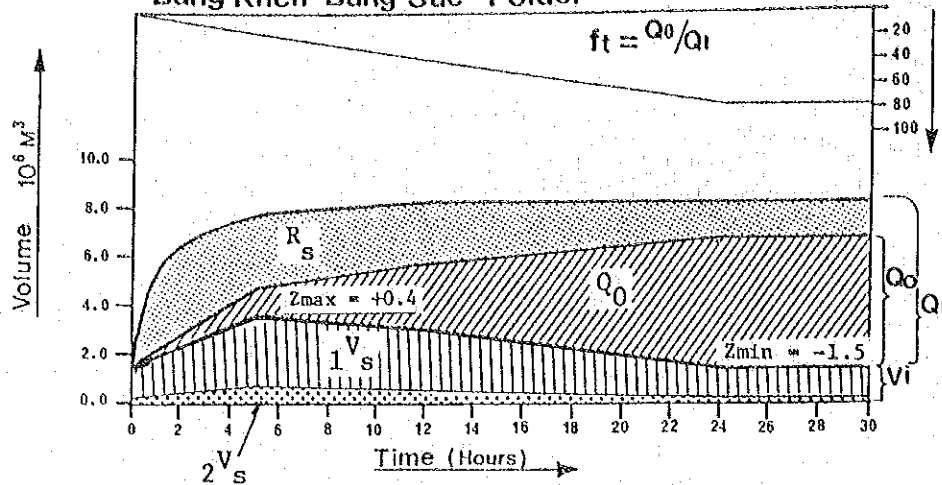


Fig. 7.3

PROPOSED BARRIER AND GATE

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

Bang Khen Bang Sue Polder

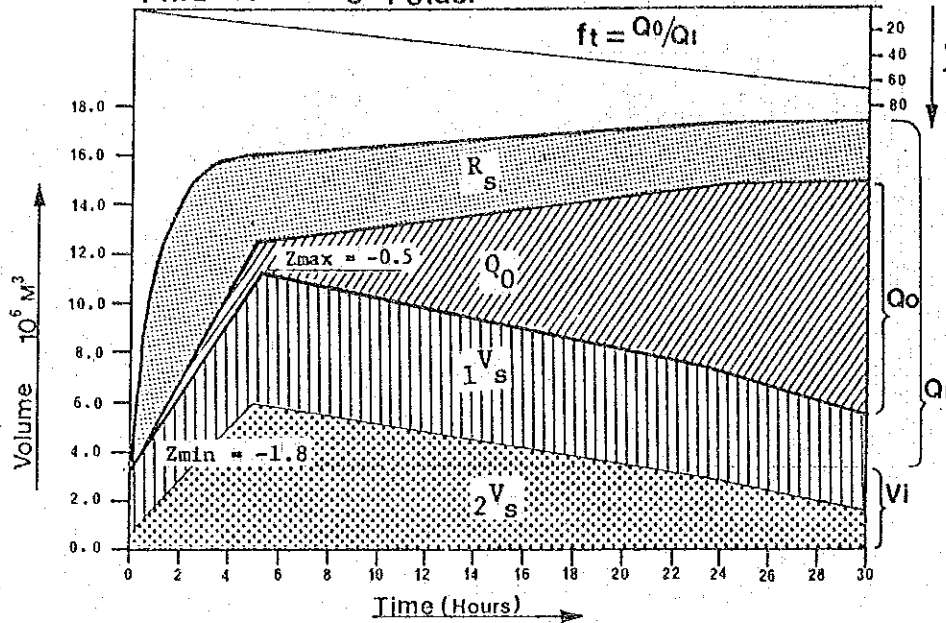


Polder Area=64+29^{*}93km²
 Design Rainfall
 2year Freq.
 $R_{24}^2 = 91\text{mm/day}$
 A.R.F=0.78

Pump Capacity
 Bangkhen P/S=15CMS
 Bang Sue P/S=50CMS
 Total =65CMS

* Additional area between
 Chao Phraya R. and Super
 Highway.

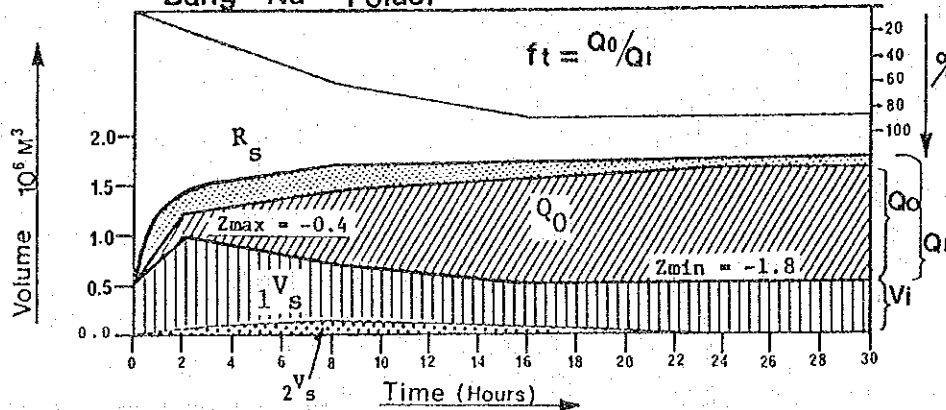
Phra Khanong Polder



Polder Area=165km²
 Design Rainfall
 5year Freq.
 $R_{24}^5 = 120\text{mm/day}$
 A.R.F=0.68

Pump Capacity
 Phra Khanong P/S=90CMS
 (Inner Polder Pump Capacity)
 North Hua Mark
 K.Gig P/S=3CMS
 K.Kacha P/S=6CMS

Bang Na Polder



Polder Area=31km²
 Design Rainfall
 2year Freq.
 $R_{24}^2 = 91\text{mm/day}$
 A.R.F=0.84

Pump Capacity
 Bang Jek P/S =6CMS
 Bang Oa P/S =18CMS
 Bang Na P/S =21CMS
 Bang Na ChineP/S = 9CMS
 Total =54CMS

- Legend Q_1 : Accumulated Rainfall $1V_s$: Storage in klongs
 Q_0 : Accumulated Discharge $2V_s$: Storage in Retention Area
 V_i : Initial Storage Volume Z_{max} : Average Maximum Water Level
 R_s : Ground Surface Storage Z_{min} : Maintenance Water Level

Fig. 7.4

EFFECT OF STORAGE FOR DRAINAGE AREA
 (RELATION BETWEEN STORAGE AND PUMP DISCHARGE)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

Conditions of Analysis

- 1) Model: Unsteady Flow Model
- 2) Topography: AD 2000
- 3) Land Use: AD 2000
- 4) Rainfall Distribution: 6hrs, Front Concentration Pattern
- 5) Rainfall Scale: Bang Khen, Bang Sue; 2 years Freq.
: Saen Saep, Phrakhanong; 5 years Freq.
: Bang Na; 2 years Freq.
- 6) Boundary Water Level: Scale; 100 years Freq.
(Chao Phraya R.): Pattern; Oct. 29, 1980
- 7) Klongs: Future Improved Conditions
- 8) Pump Capacity

- Bang Khen P.S.=15CMS
- Bang Sue..... P.S.=50CMS
- Phra Khanong ... P.S.=90CMS
- Hua Mark (Gig) .P.S.= 3CMS
- Hua Mark (Kacha)P.S.= 6CMS
- Bang Na Chine...P.S.= 9CMS
- Bang JekP.S.= 6CMS
- Bang OaP.S.=18CMS
- Bang NaP.S.=21CMS

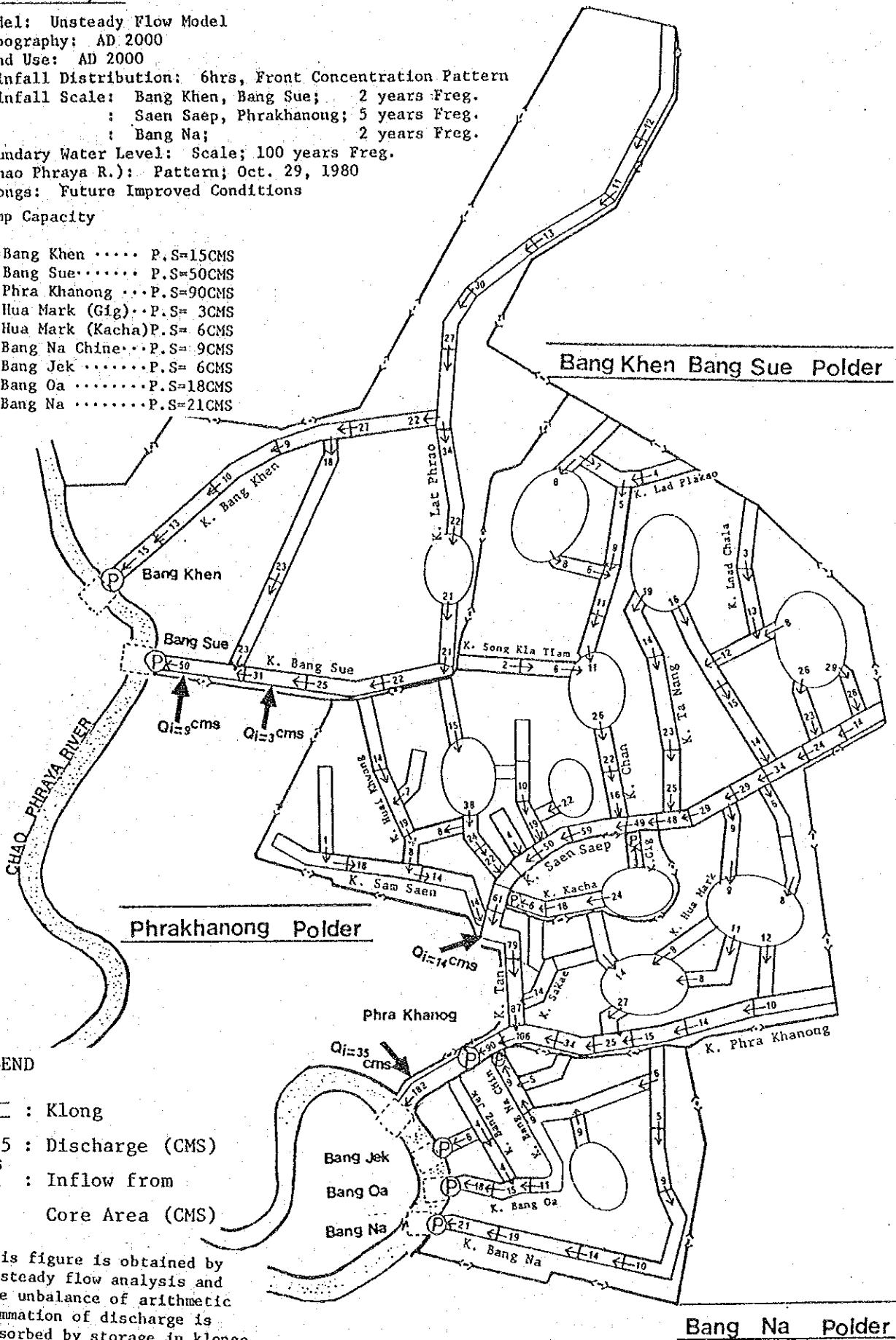


Fig. 7.5

SIMULATED MAXIMUM DISCHARGE IN KLONGS
(FINAL CONFIRMATION OF STEP IV ANALYSIS)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

Proposed Pump Capacity

Folder	Area (km ²)	Name of Pumping Station	Capacity (m ³ /sec)
BANG KHEN & BANG SUE	64+29 = 93	Bang Khan	15
		Bang Sue	50
		Sub-Total	65
PHRAKHANONG	165	Phra Khanong	90
BANG NA	31	Jek	6
		Bang Oa	18
		Bang Na	21
		Bang Na-Chine	9
		Sub-Total	54
Total	260+29 = 289		209
NORTH HIA MARK	9	Gig	3
		Kacha	6
		Sub-Total	9

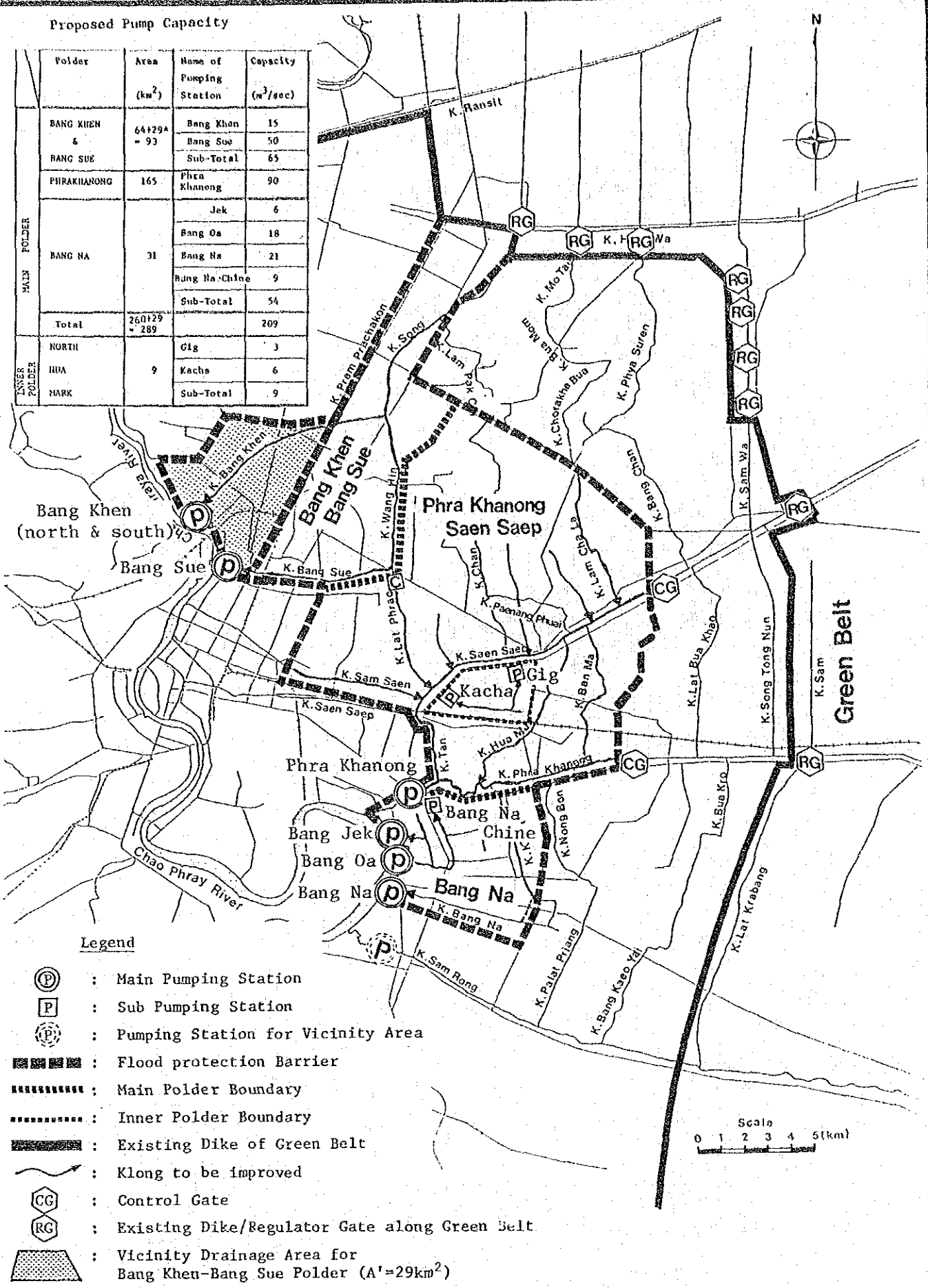


Fig. 7.6

PROPOSED PUMPING STATION

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

- Category I = new drain (7 km)
 - Category II = deepening and widening + construction of retaining walls (9 km)
 - Category III = deepening + construction of retaining walls (63 km)
 - Category IV = no improvement (II, 39 km) or dredging (I, 20 km)
 - Category V = deepening + widening (34 km)
- Total Klong Improvement Length = 133 km

Legend

- : Proposed Pumping Station
- : Klong
- : Retention Area
- : Boundary of Drainage Area

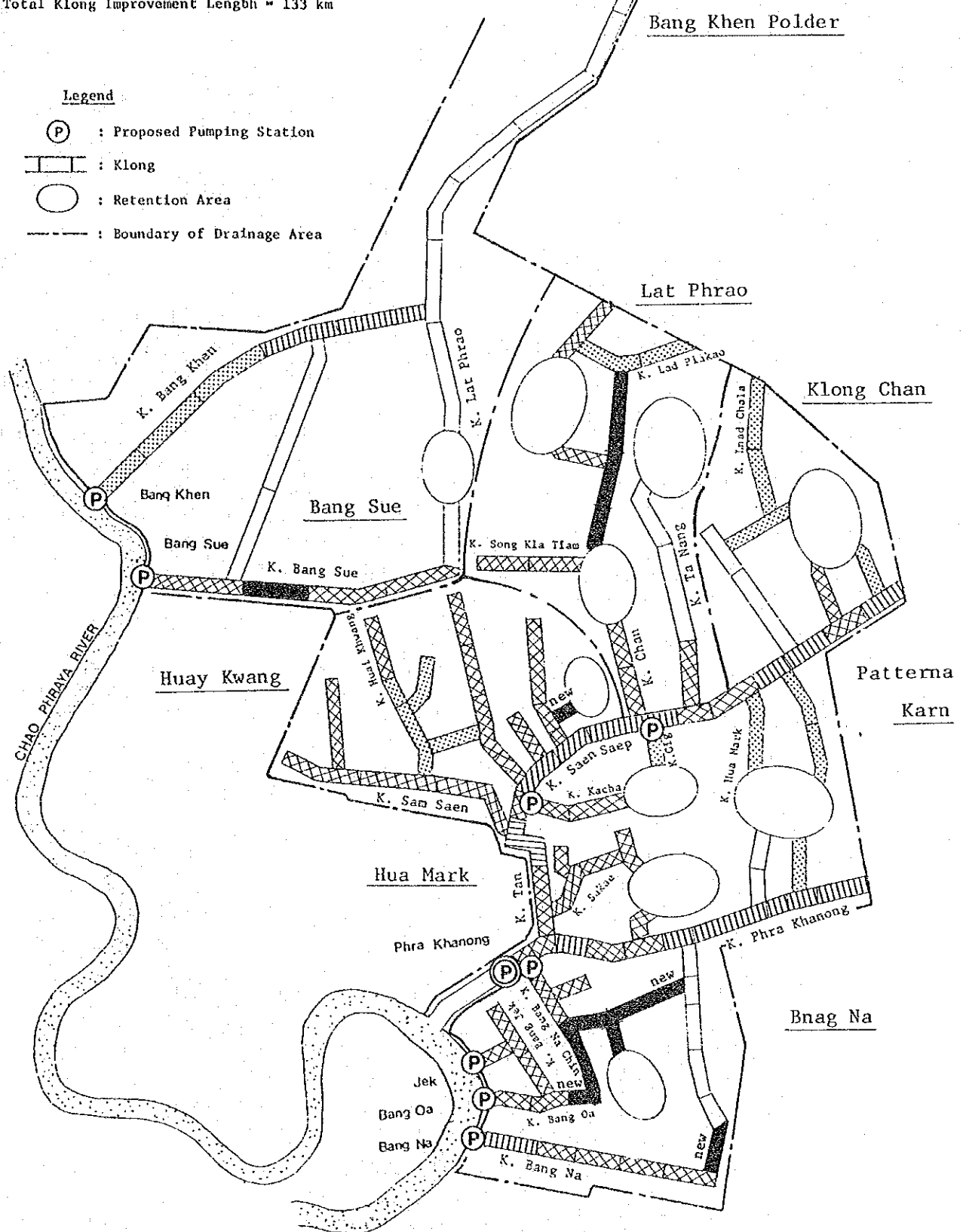
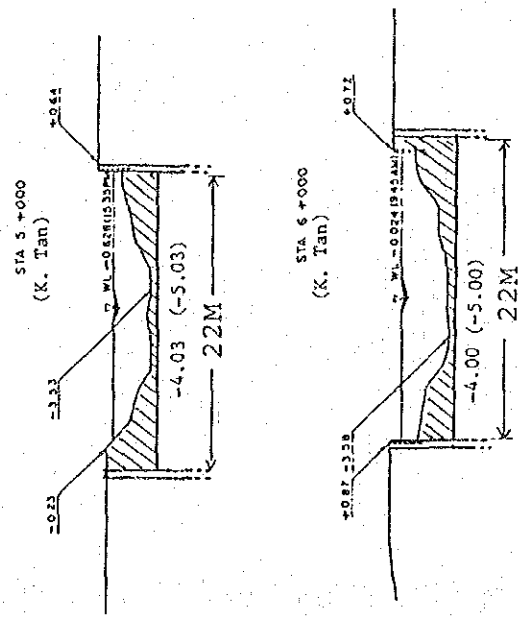
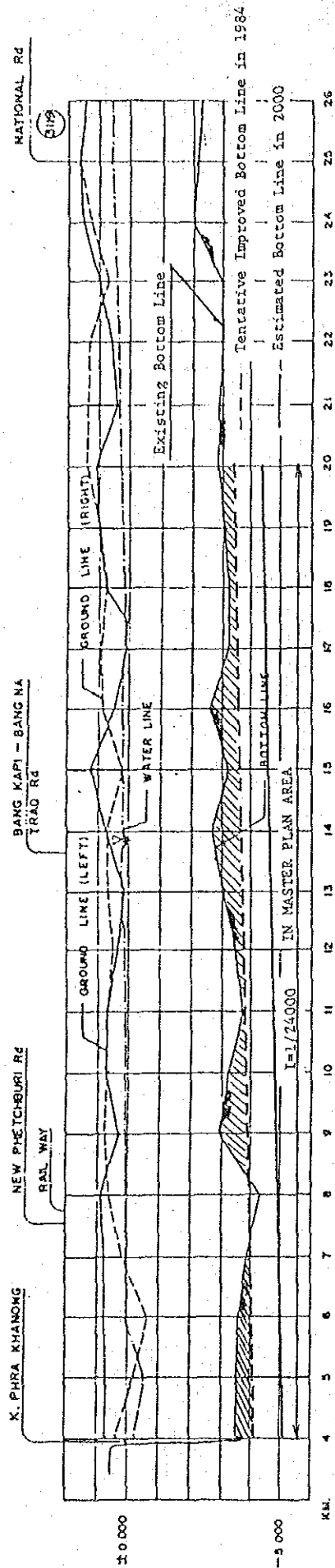


Fig. 7.7

PROPOSED KLONG IMPROVEMENT

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

KLONG SAEN SAEP



Legend

- I: Estimated Gradient of Bottom Line
- 3.8 : Elevation of Tentative Improved Bottom in 1984
- (-4.8) : Elevation of Estimated Bottom in 2000
- : Proposed Dredging Area

Fig. 7.8

KLONG SAEN SAEP IMPROVEMENT WORKS

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN - BANGKOK

KLONG PHRA KHANONG

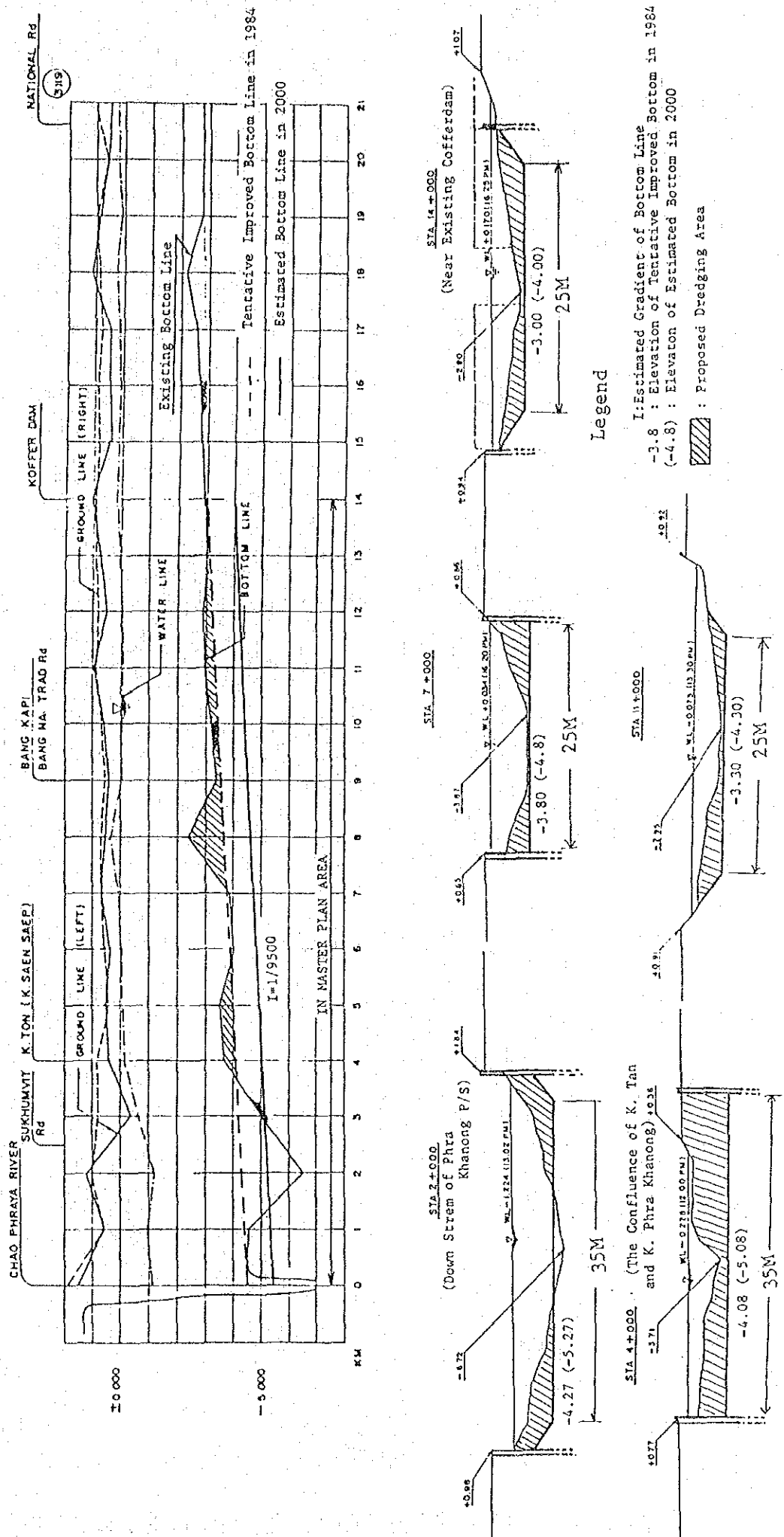


Fig. 7.9

KLONG PHRA KHANONG IMPROVEMENT WORKS

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN - BANGKOK

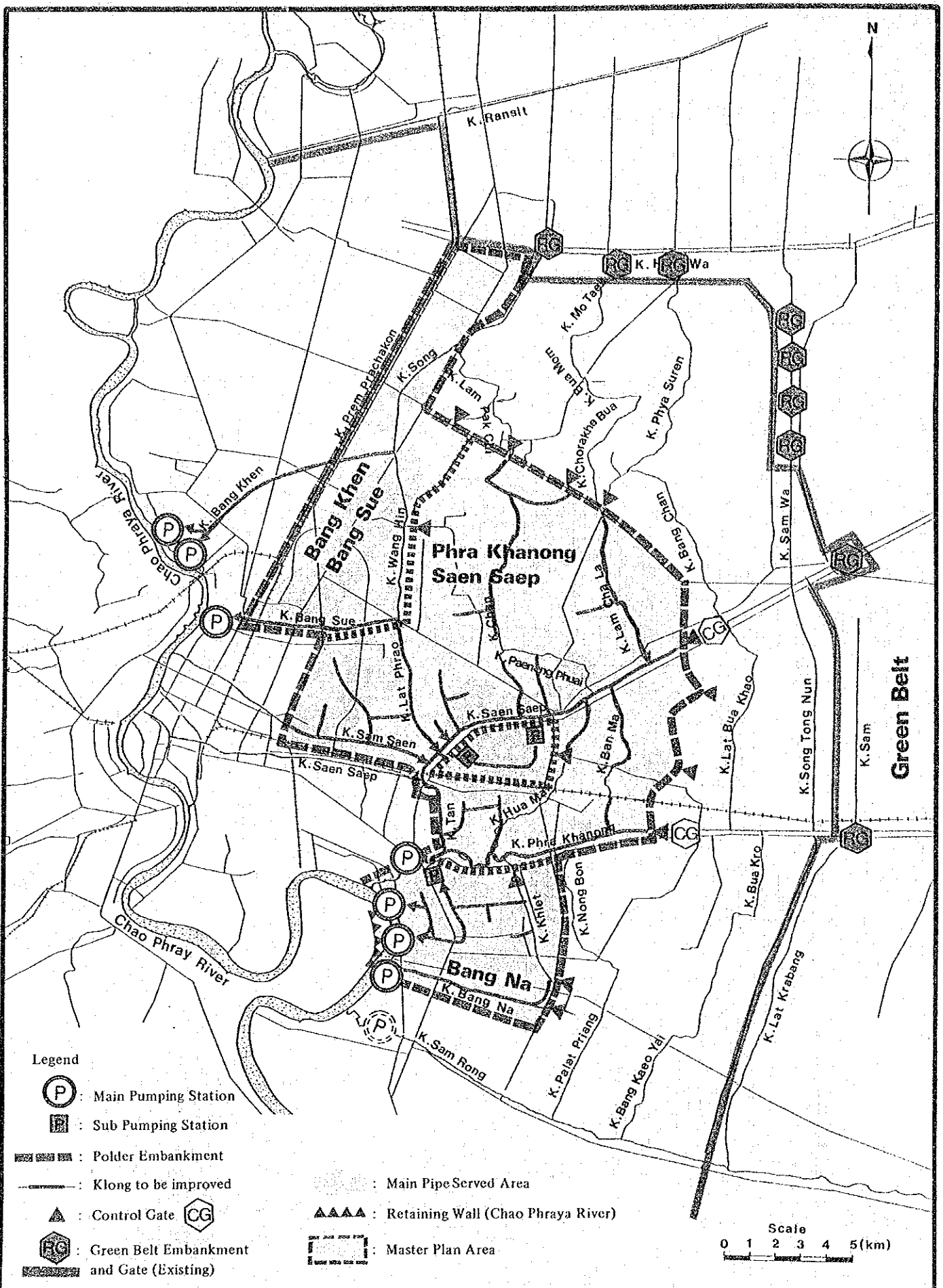


Fig. 7 . 10

PROPOSED FLOOD PROTECTION/DRAINAGE FACILITIES

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

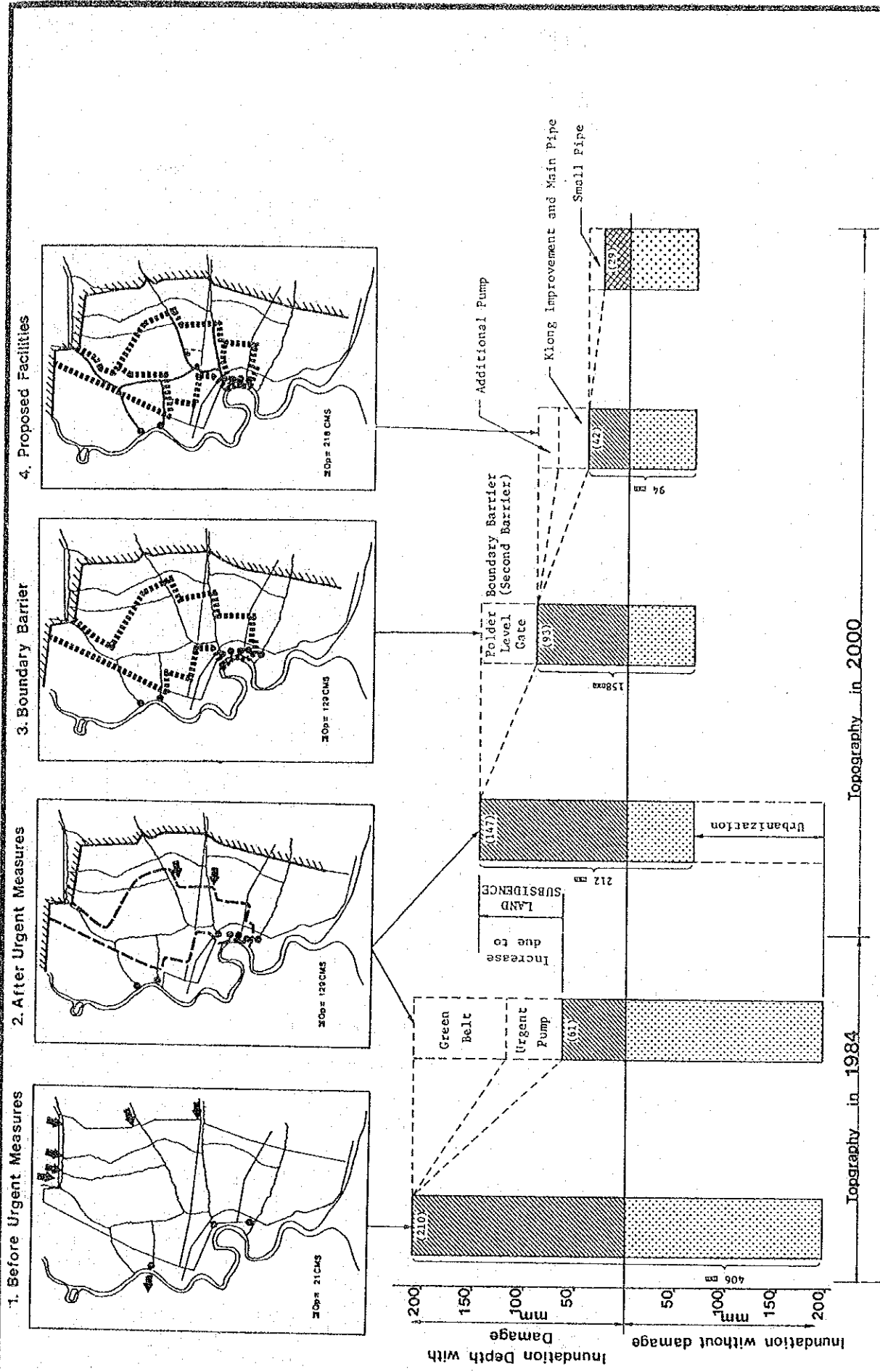


Fig. 7.11 HYDROLOGICAL EFFECT OF THE PROPOSED PROJECT

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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

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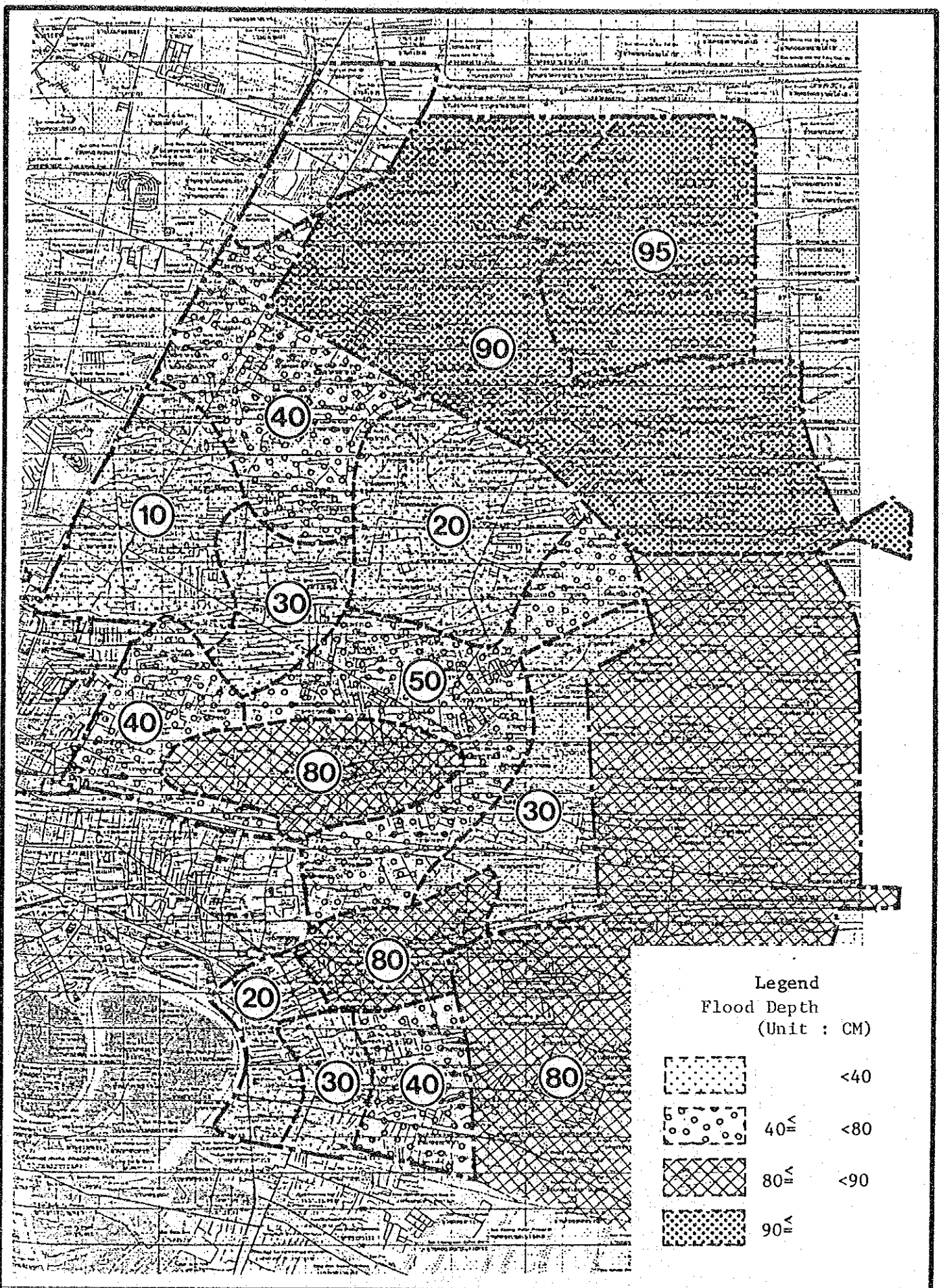


Fig. 8.1 OBSERVED FLOODED AREA IN 1983 (BEFORE URGET MEASURES)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

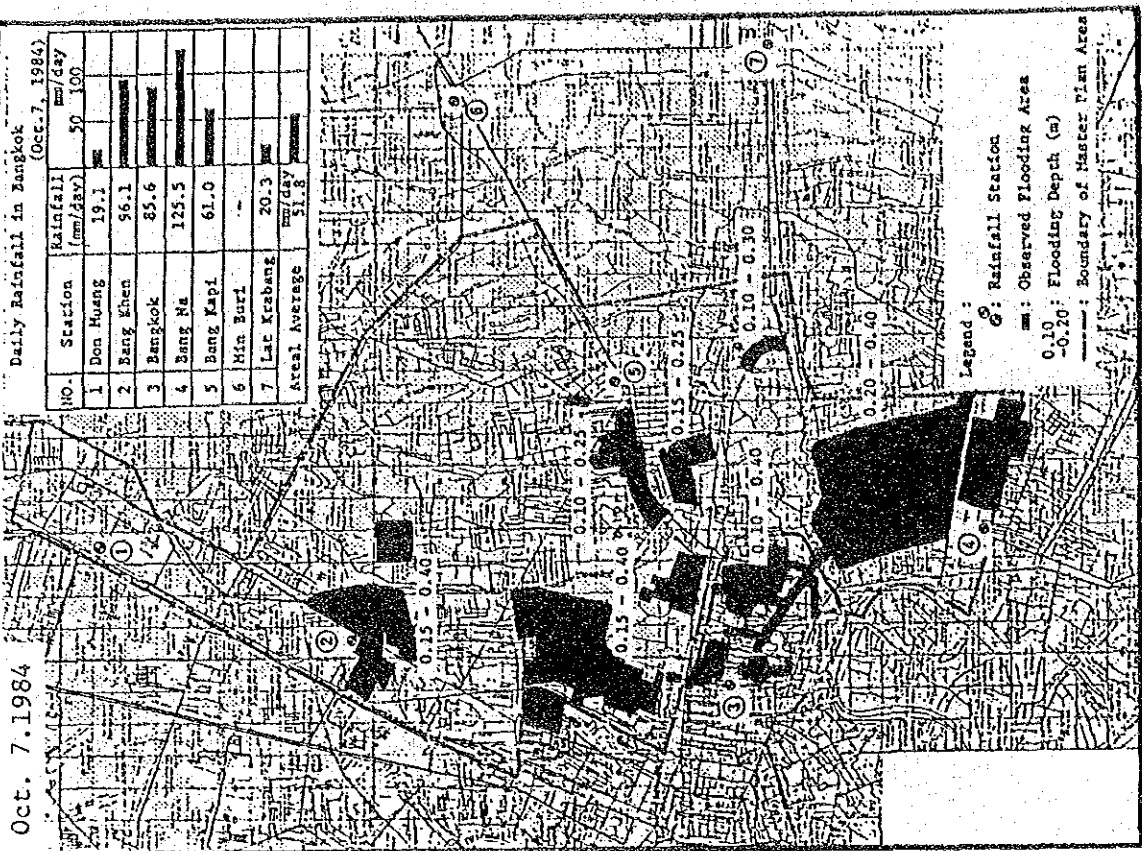
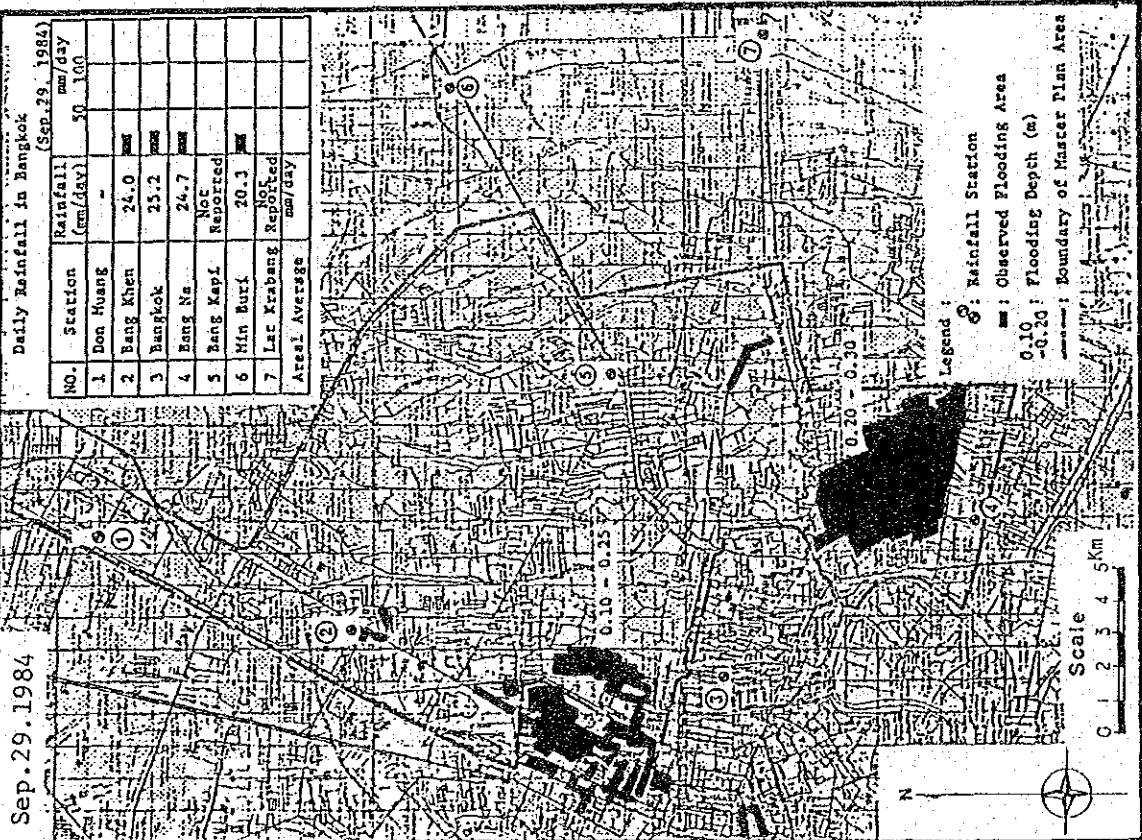
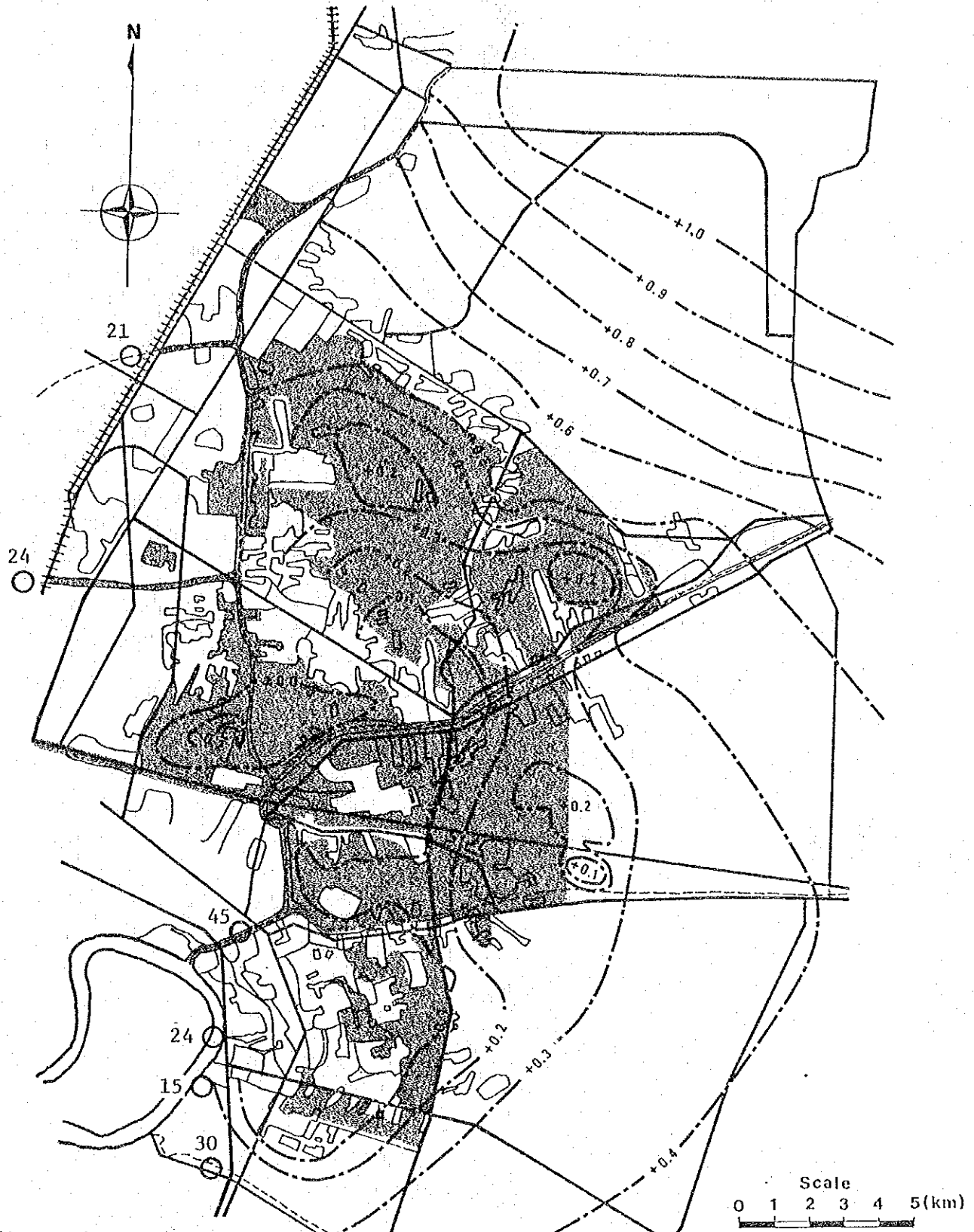


Fig. 8.2

OBSERVED FLOOD AREA IN 1984 (AFTER URGENT MEASURES)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK



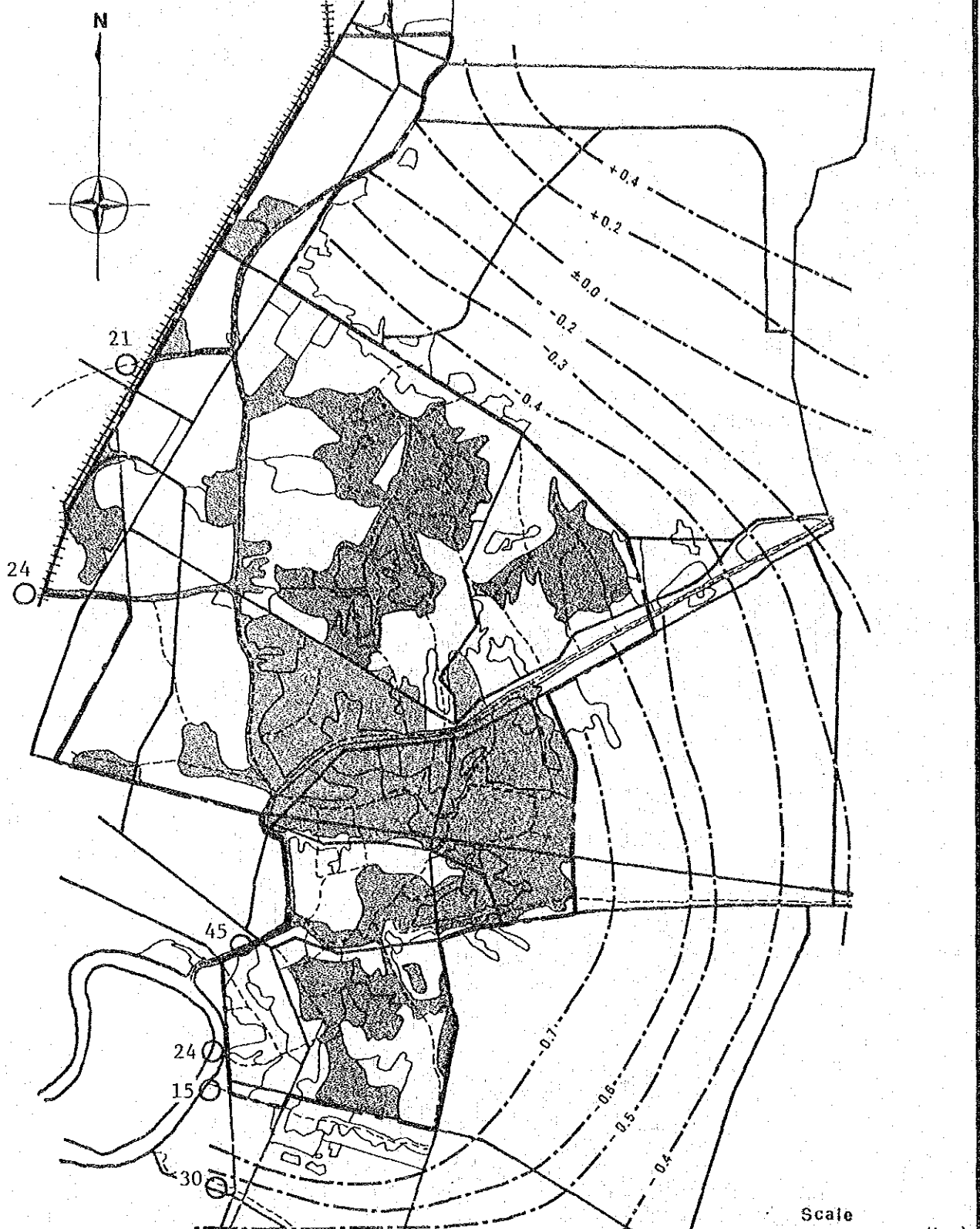
Condition for Estimation
 Rainfall : 5year Freq.
 Topography : 1984 A.D.
 (Fig.2.2)
 Drainage System :
 Urgent Measures (Fig.4.3)

Legend

- 24 ○ Pump Capacity of 24CMS
- Estimated Flooded Area

Fig. 8.3 ESTIMATED FLOOD AREA IN 1984 (FOR 5-YEAR RETURN PERIOD RAINFALL BY URGENT FLOOD PROTECTION MEASURES)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

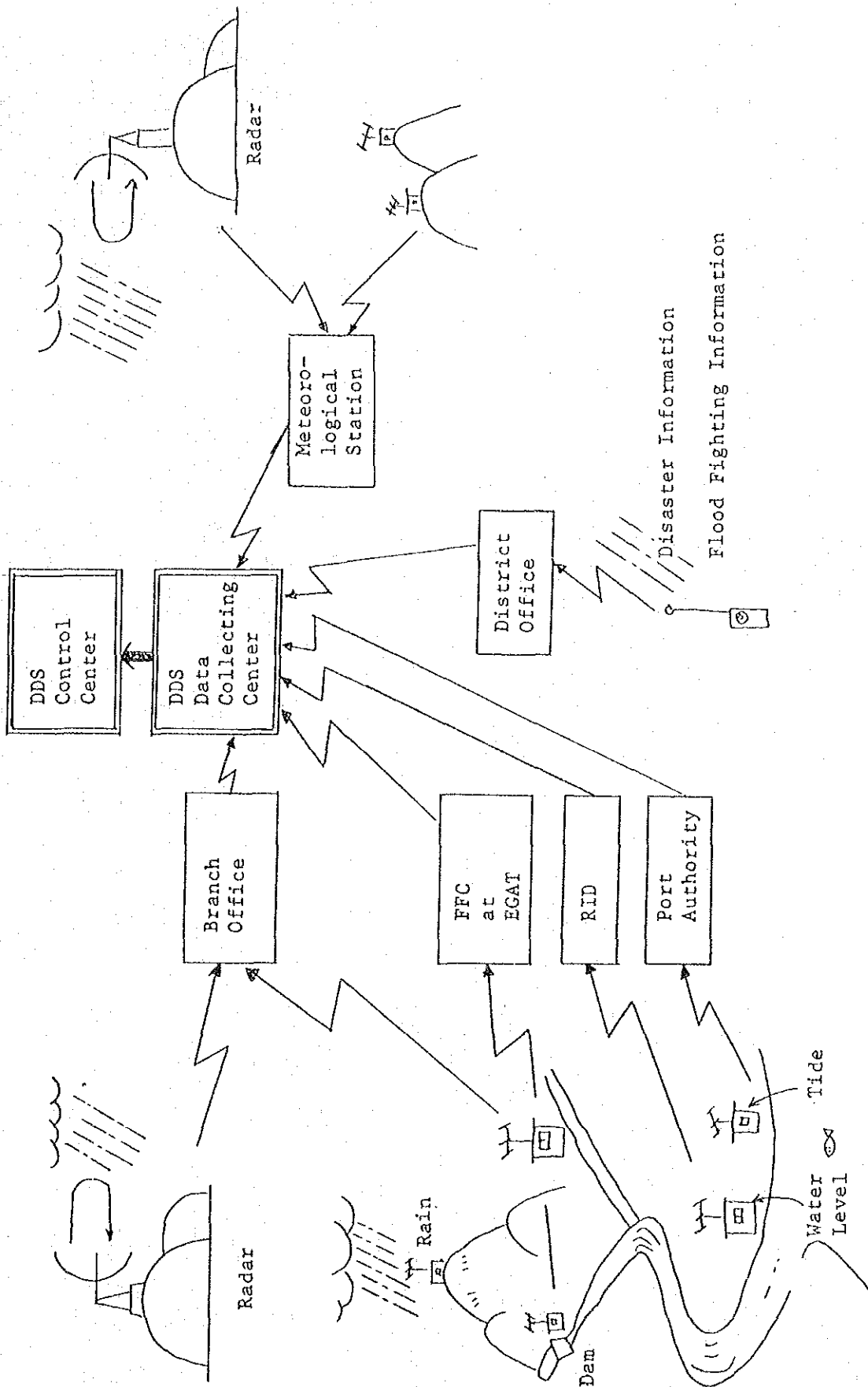


Condition for Estimation
 Rainfall : 5year Freq.
 Topography : 1984 A.D.
 (Fig.7.1)
 Drainage System :
 Urgent Measures (Fig.4.3)

Fig. 8.4

ESTIMATED FLOOD AREA IN 2000 (FOR 5-YEAR RETURN PERIOD RAINFALL BY URGENT FLOOD PROTECTION MEASURES)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK



DATA COLLECTION SYSTEM

Fig. 8.5

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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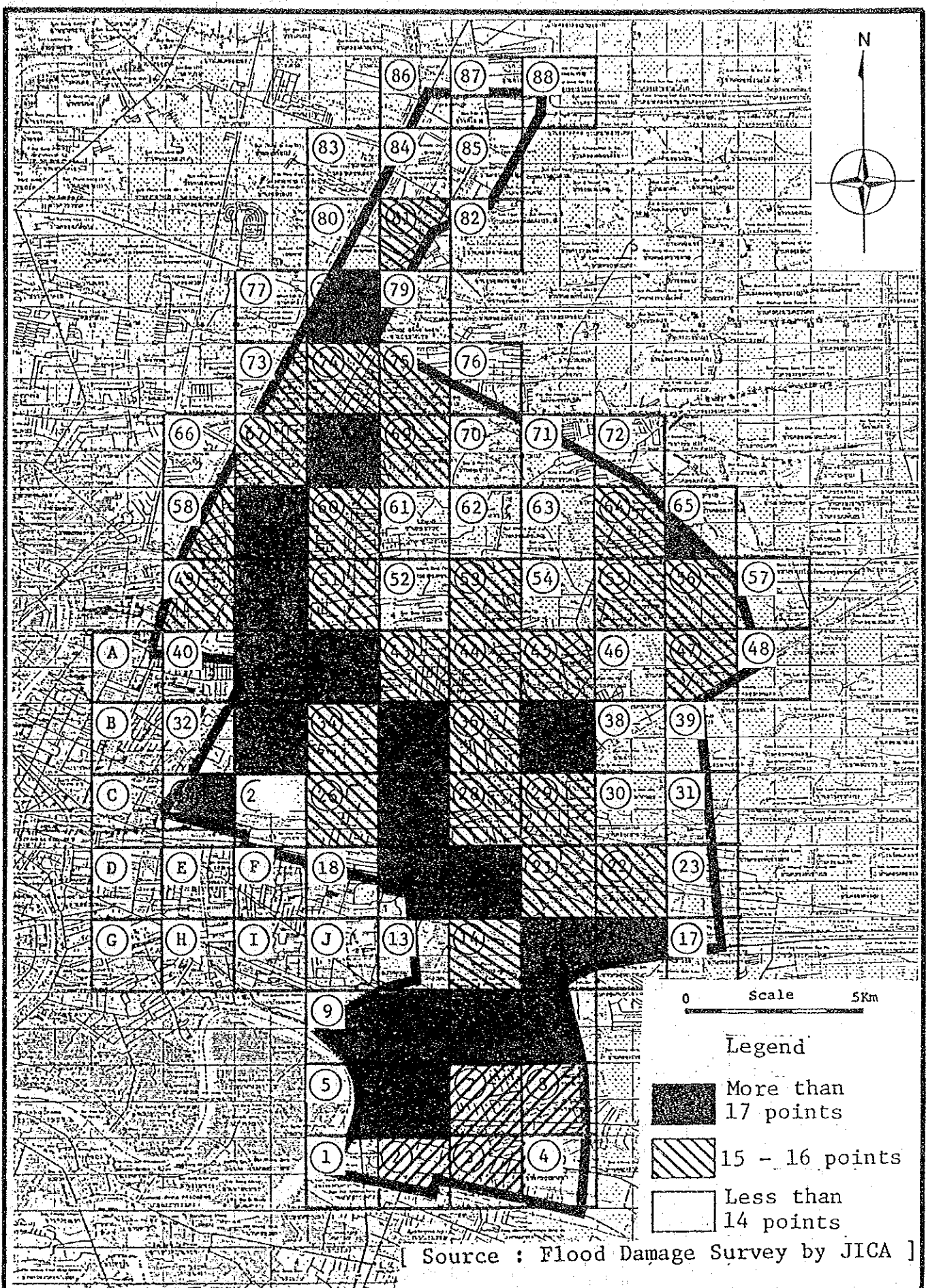


Fig. 9.1

PRIORITY MESH FOR DRAINAGE SYSTEM BY RATING METHOD

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

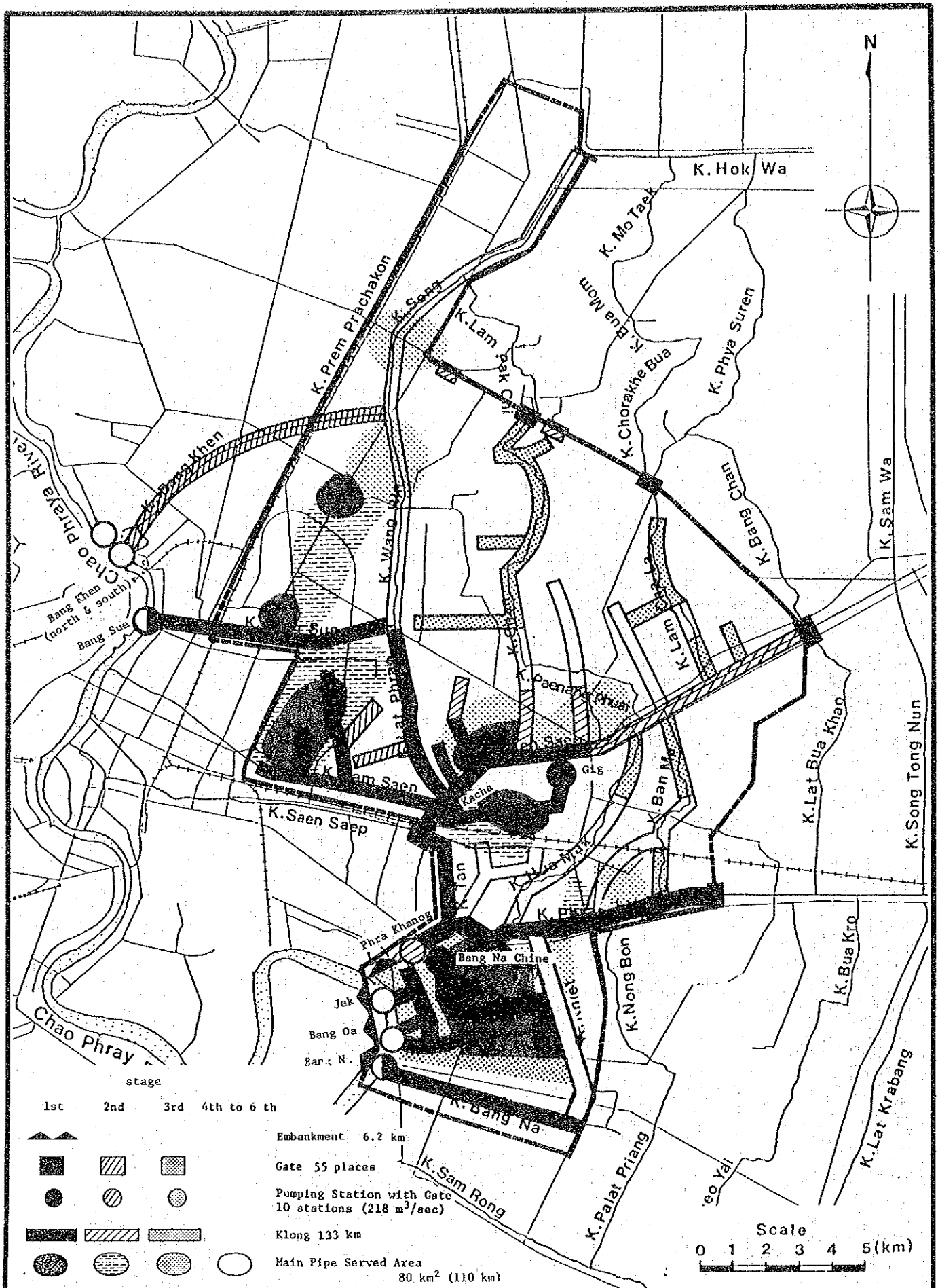


Fig. 9.2

IMPLEMENTATION SCHEDULE

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

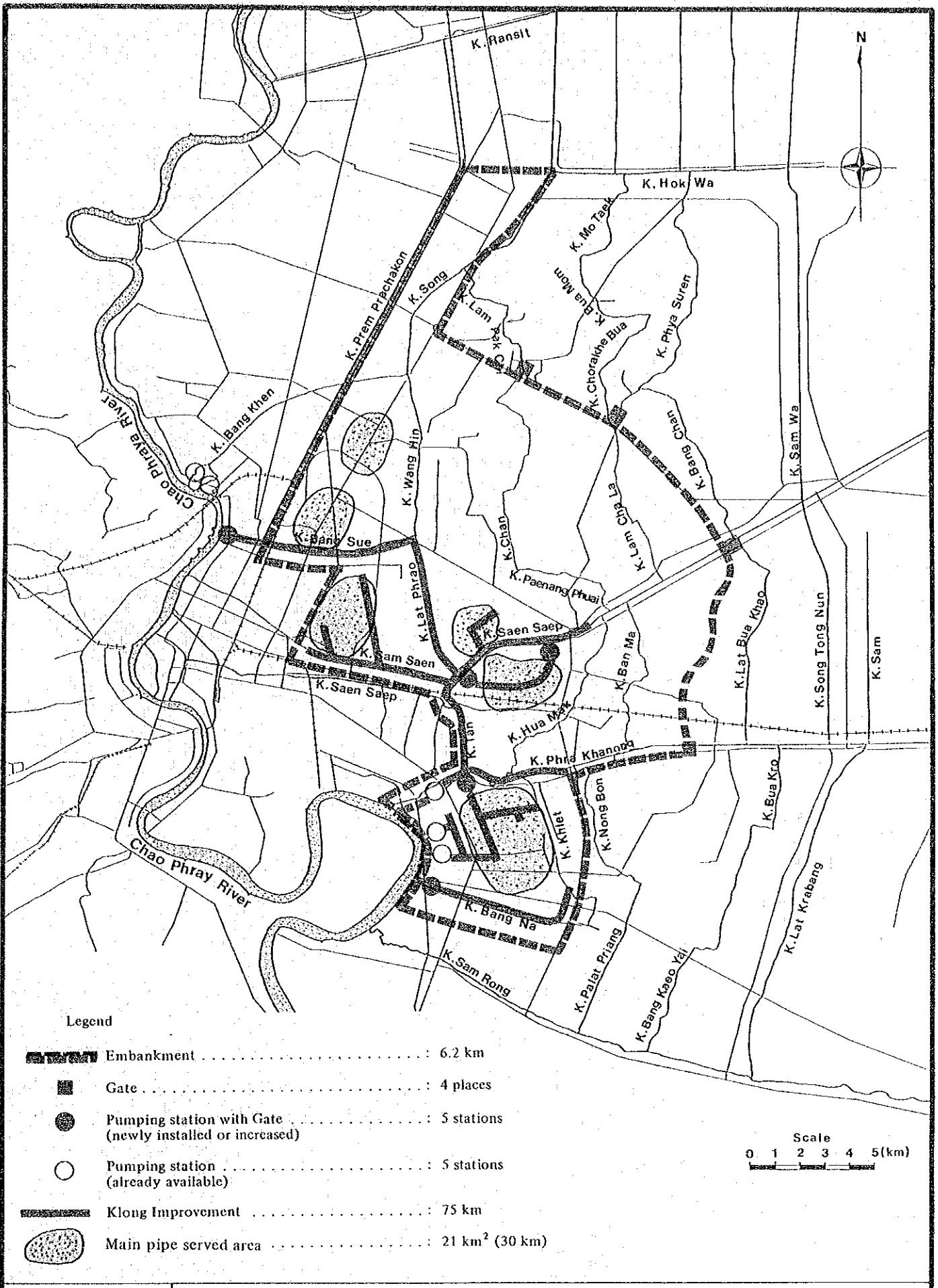
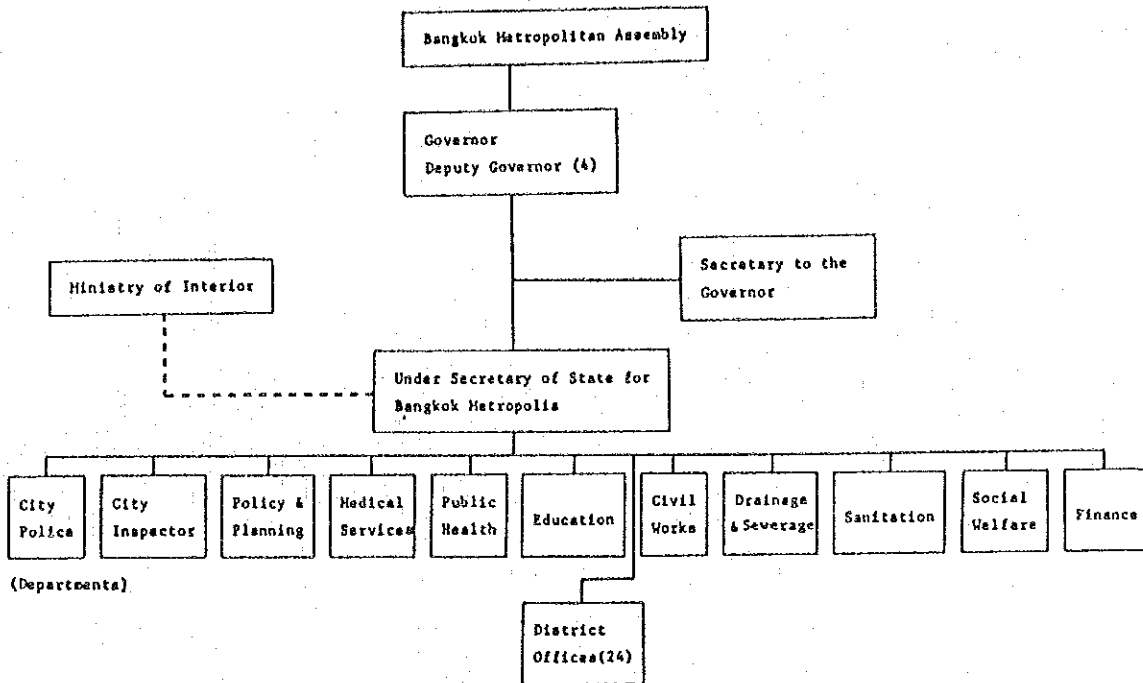


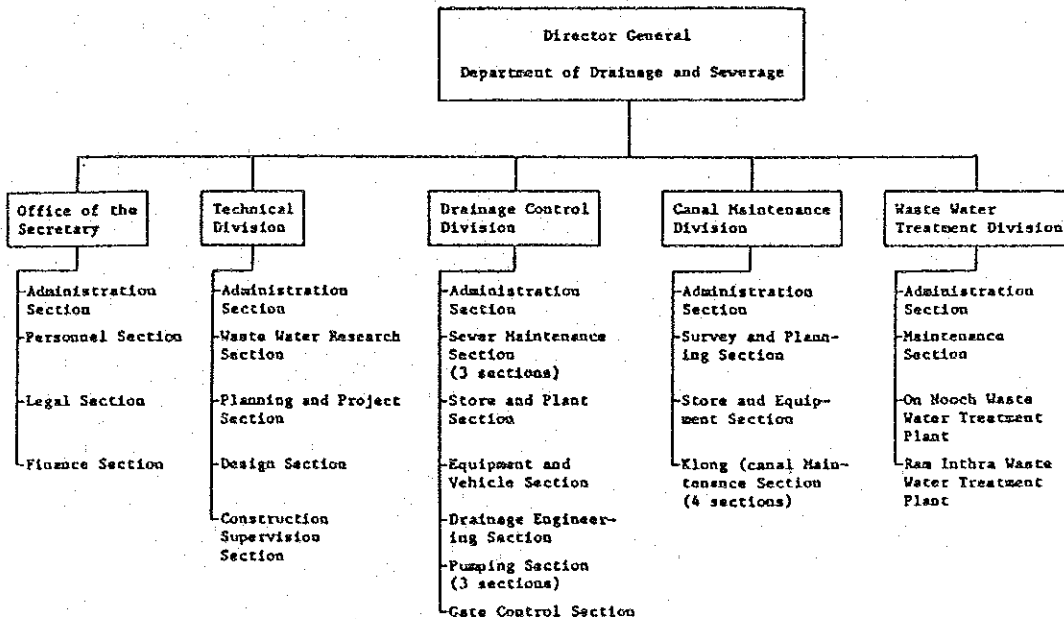
Fig. 9 . 3 PROPOSED FACILITIES AT FIRST STAGE
MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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BANGKOK METROPOLITAN ADMINISTRATION



DEPARTMENT OF DRAINAGE AND SEWERAGE

Fig. 10.1

ORGANIZATION CHART OF BMA AND DDS

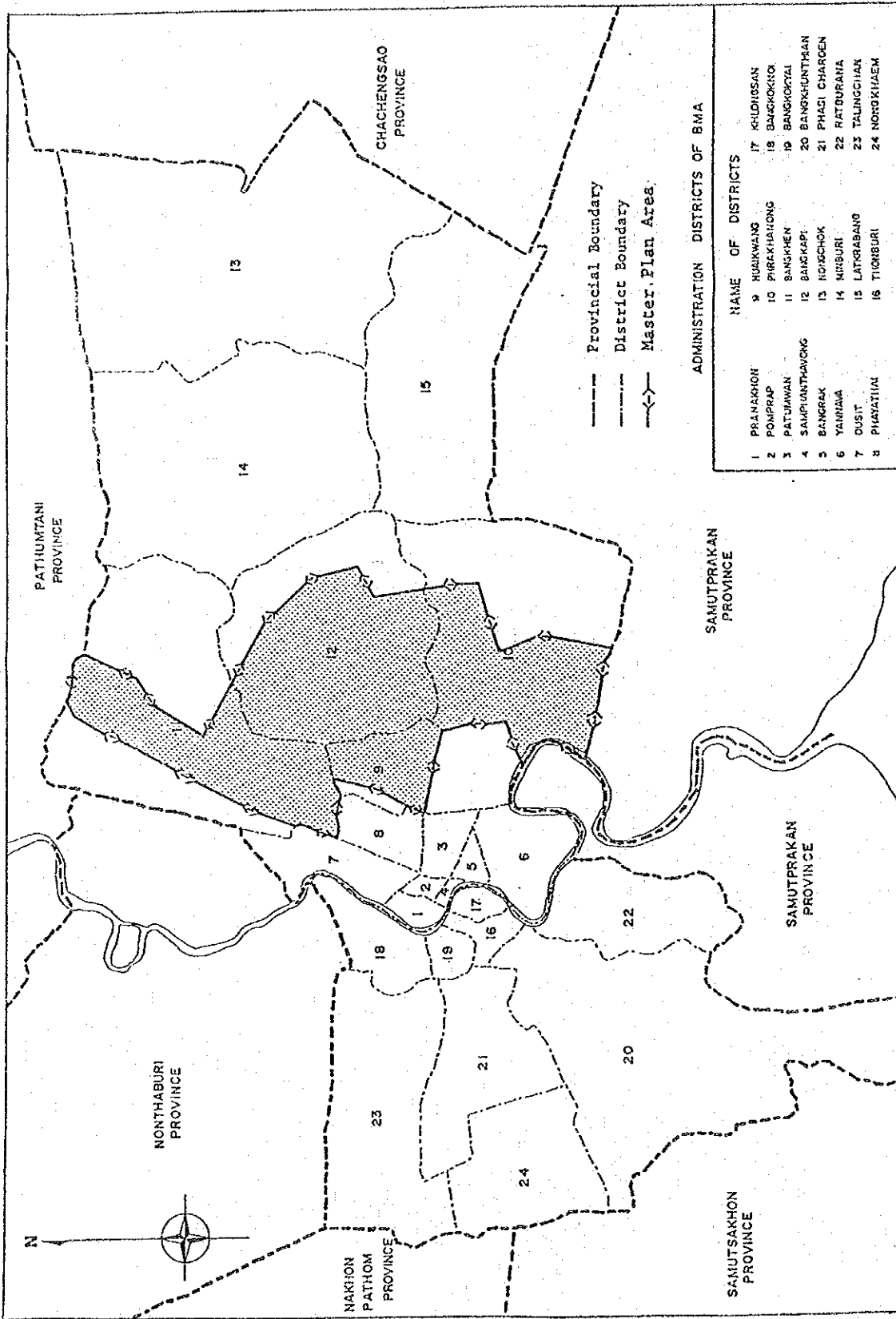
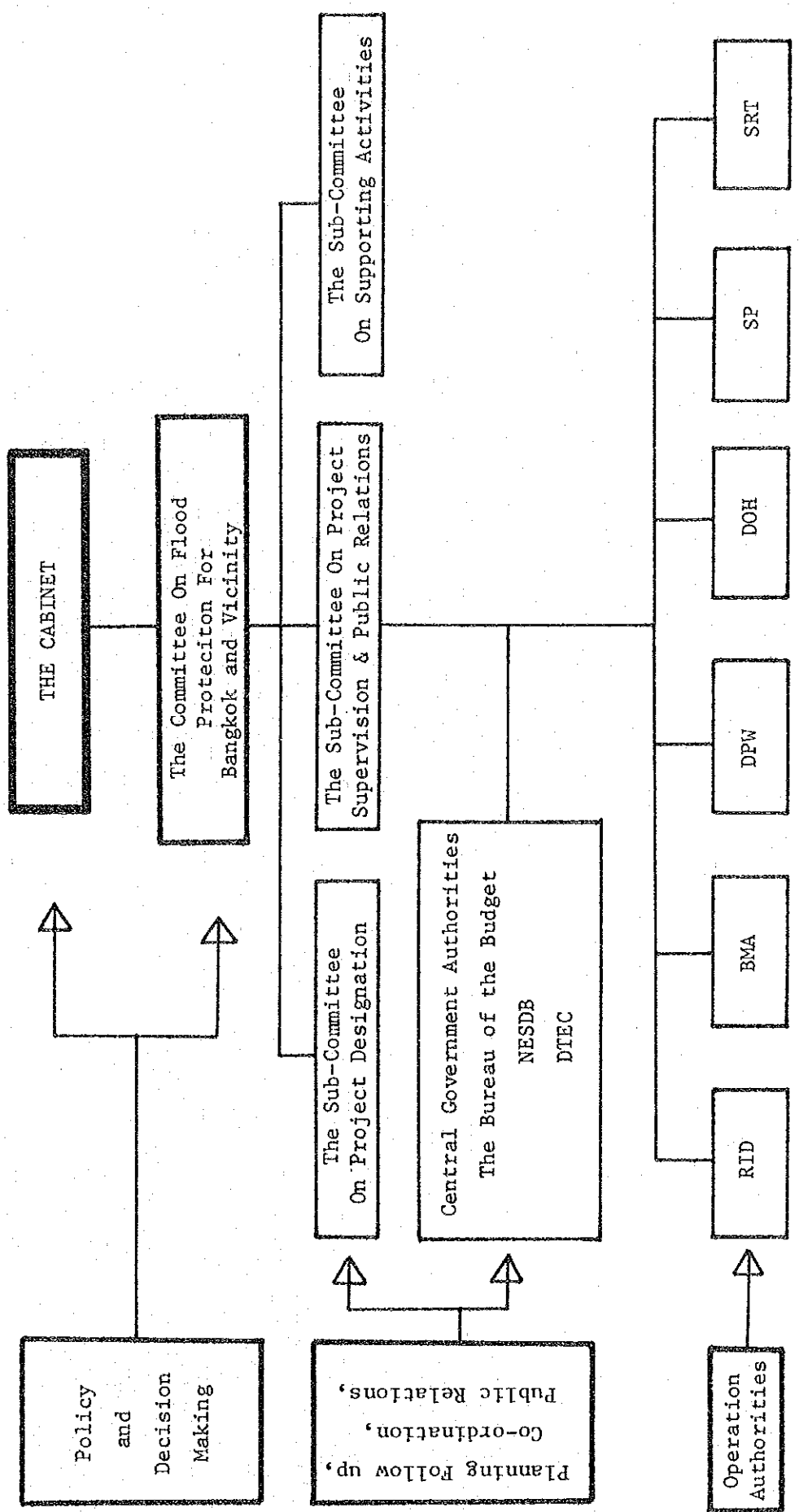


Fig. 10.2 ADMINISTRATIVE DISTRICTS OF BMA

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK



ORGANIZATION OF THE URGENT COMMITTEE

Fig. 10.3

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN - BANGKOK

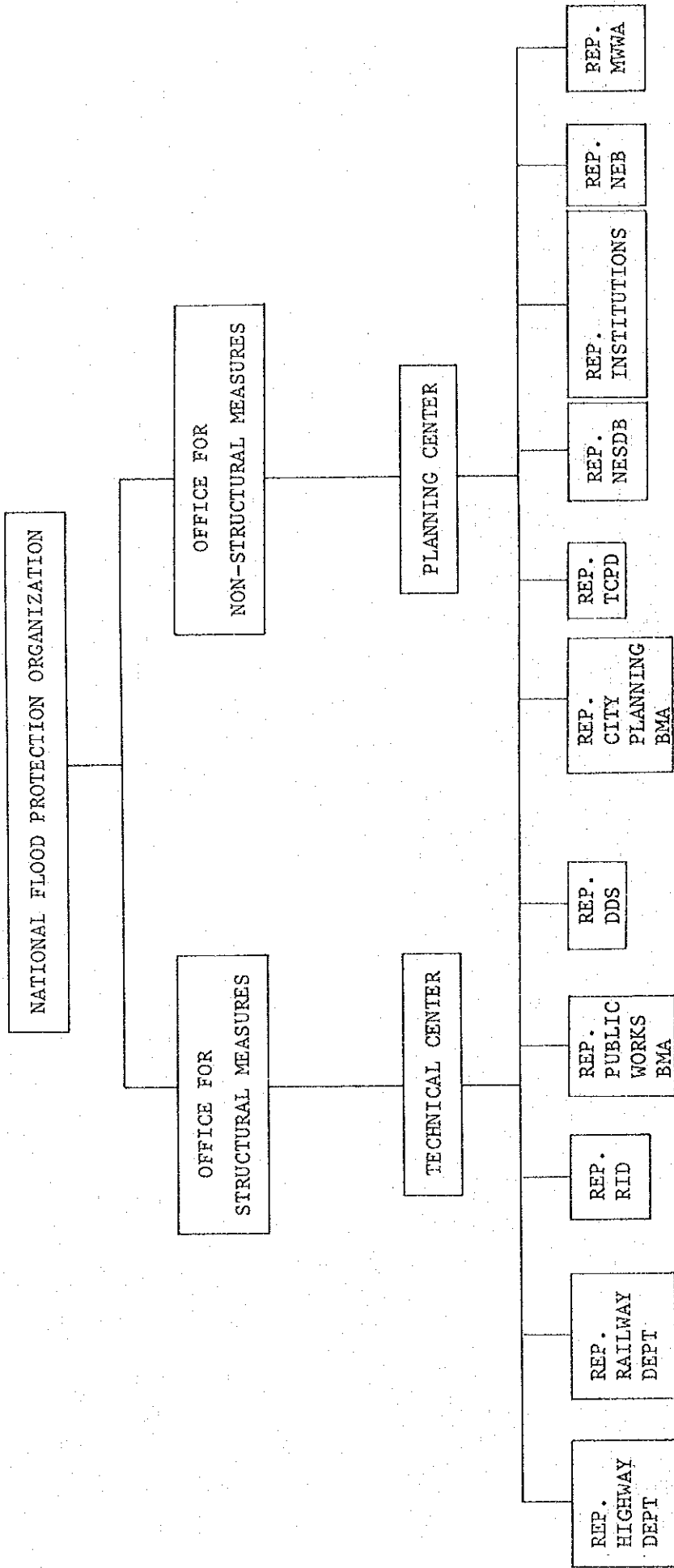


Fig. 10.4 PROPOSED ORGANIZATION SCHEME (1)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN - BANGKOK

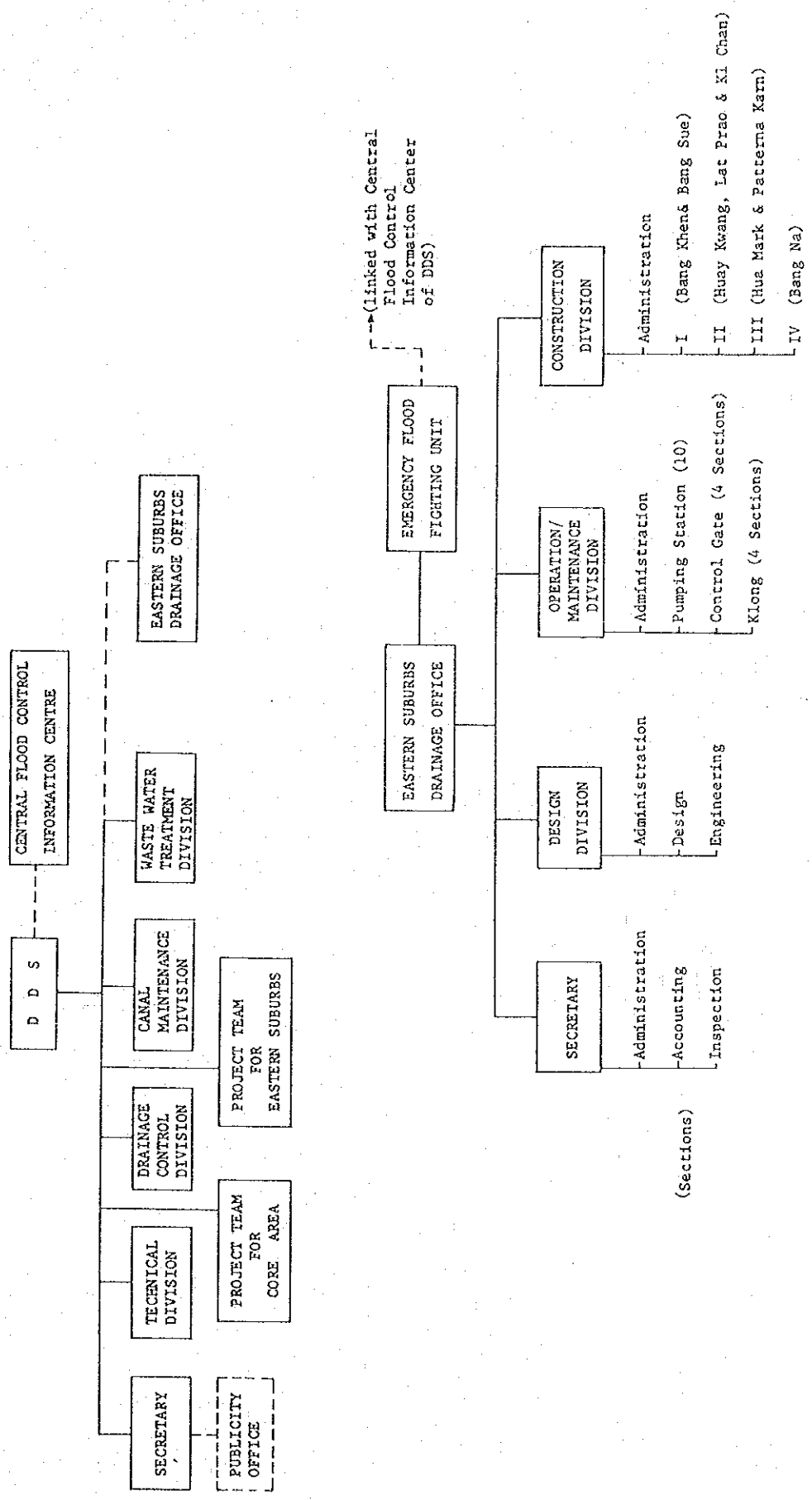


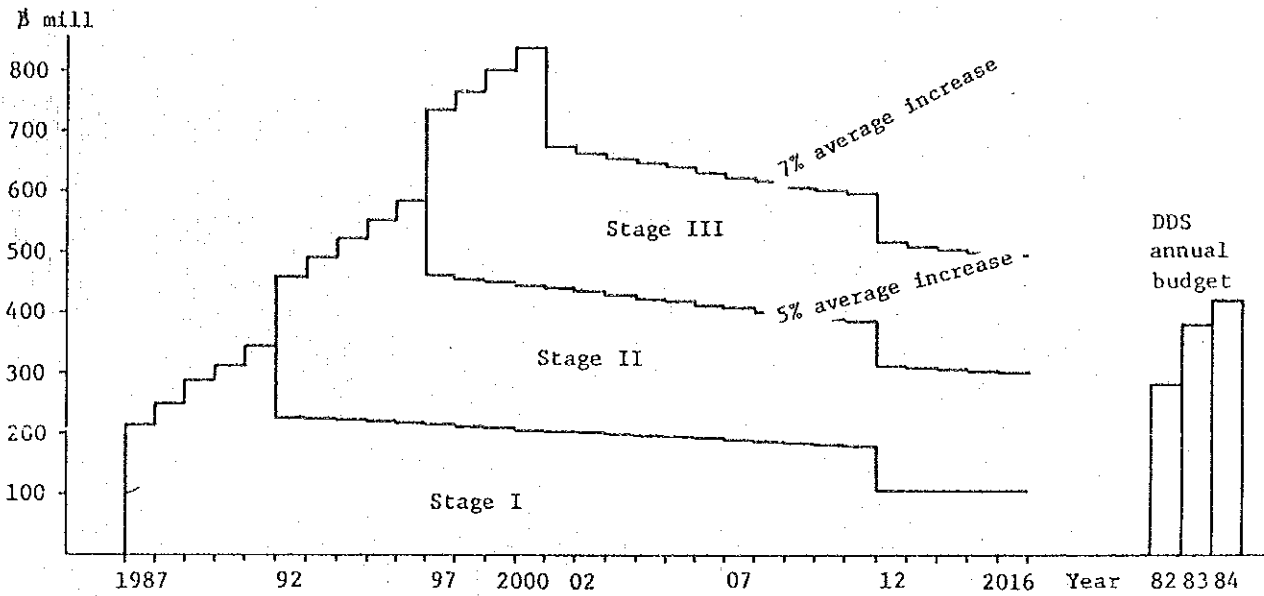
Fig. 10.5

PROPOSED ORGANIZATION SCHEME (2)

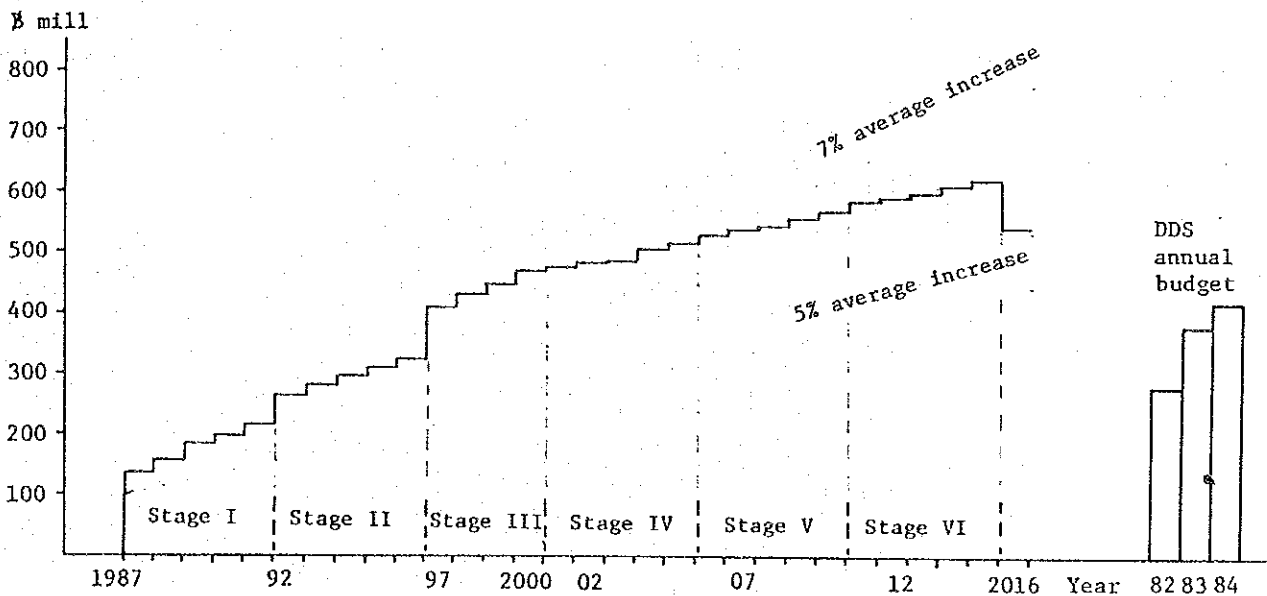
MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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Implementation Schedule 1 (Completion by 2000)



Implementation Schedule 2 (Completion by 2015)

Fig. 11.1

CASH FLOW SCHEDULE OF BMA FOR ALL STAGES

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

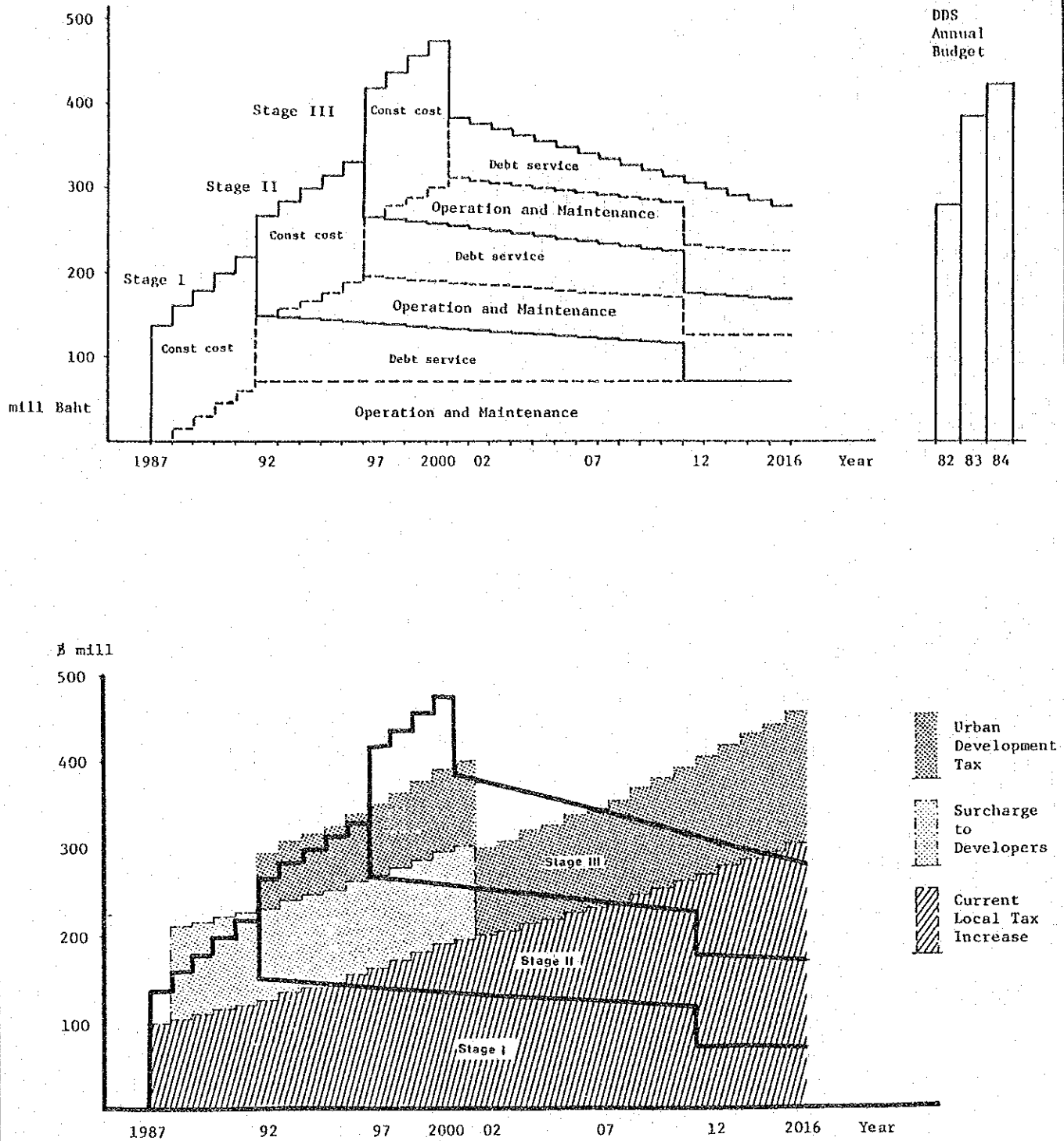


Fig. 11.2

CASH FLOW SCHEDULE OF BMA FOR STAGE I, II & III

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

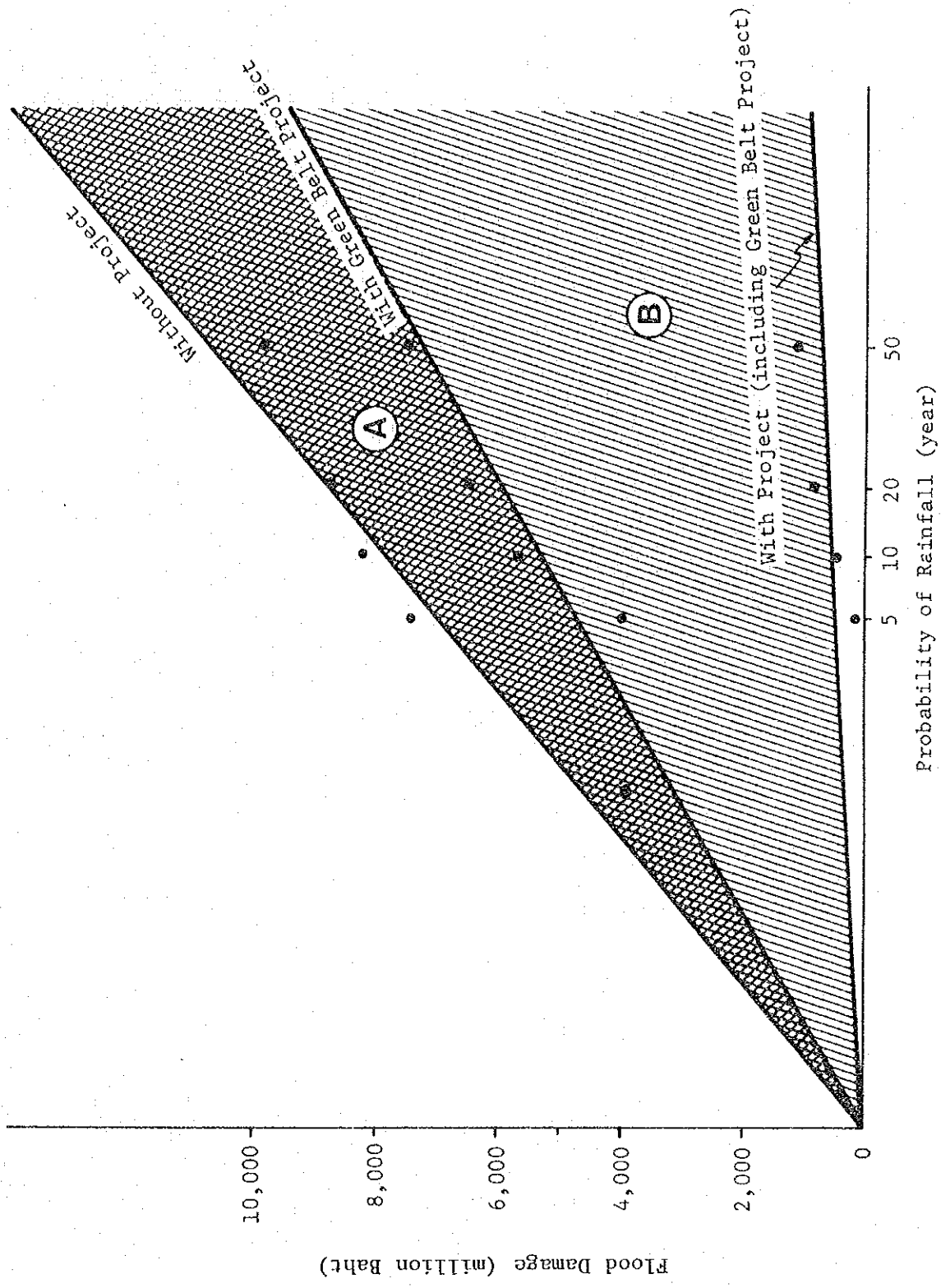


Fig. 11.3 RELATION BETWEEN THE PROBABLE RAINFALL AND THE FLOOD DAMAGE

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA