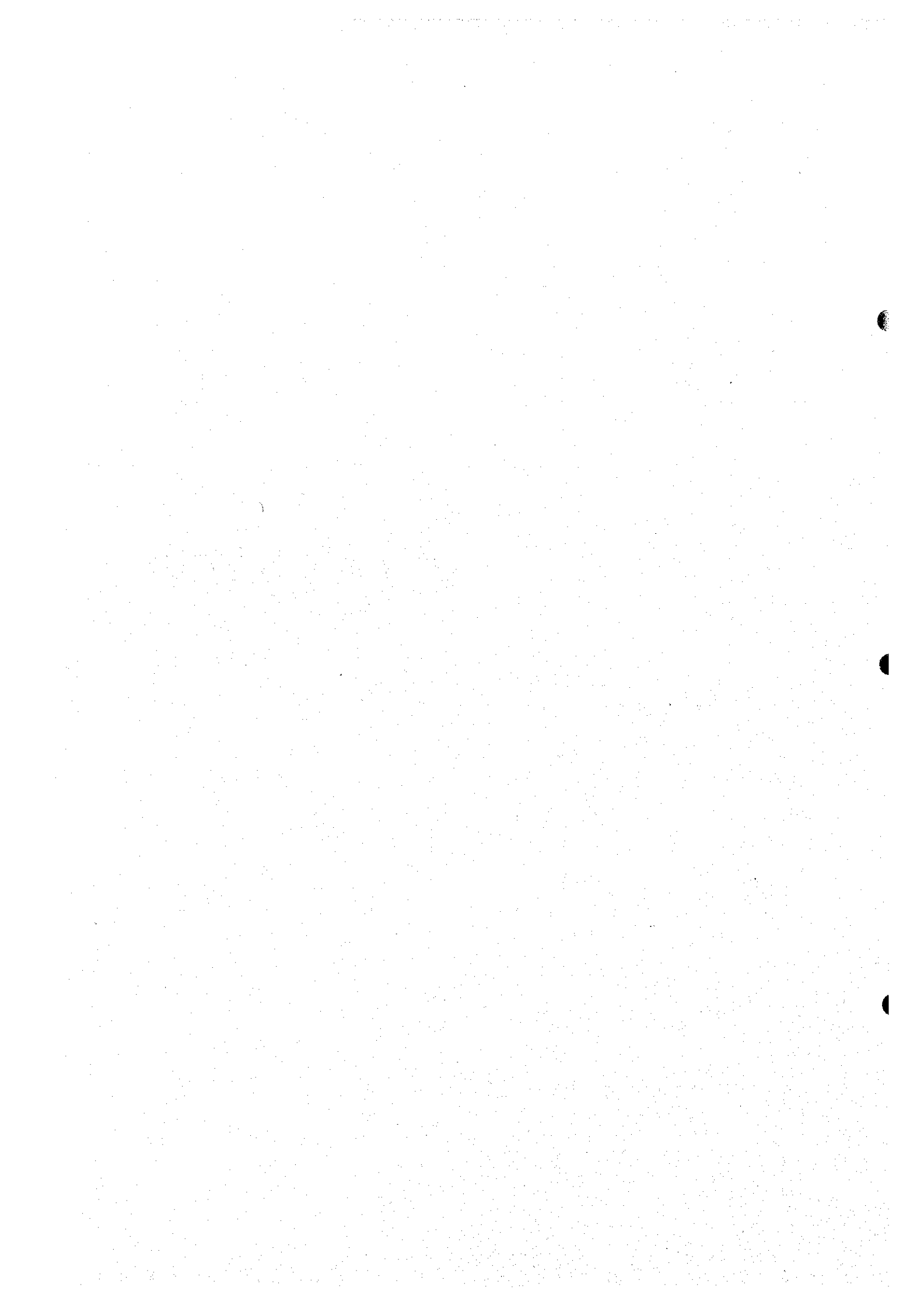
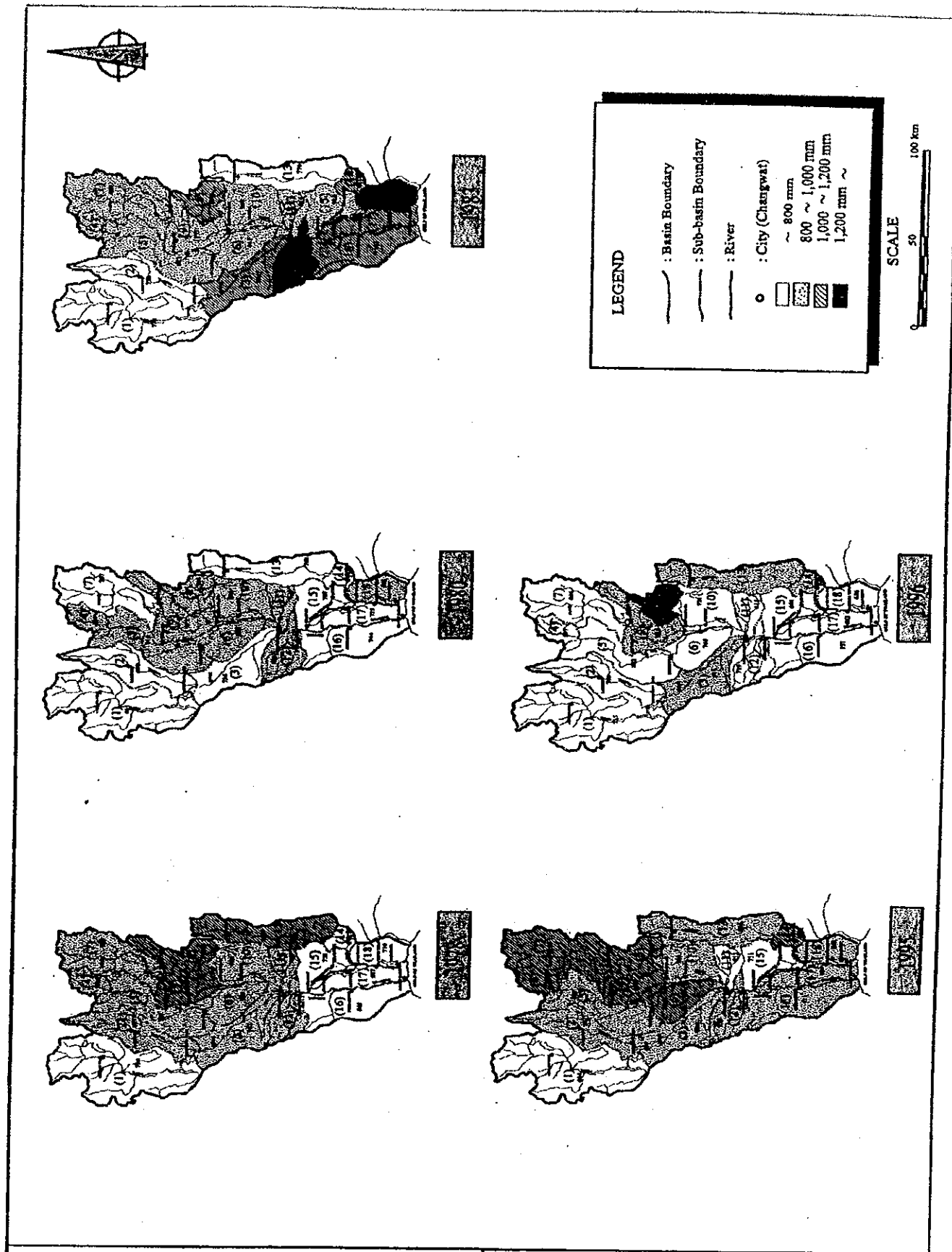


# *Figures*

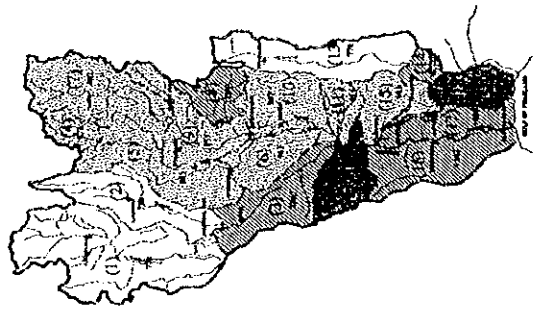




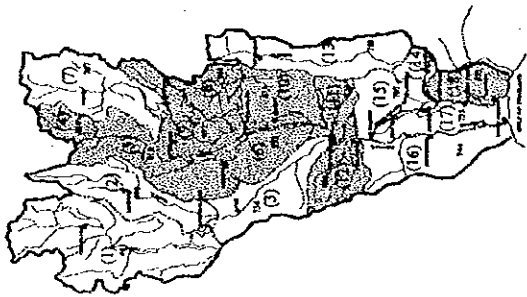
**STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN**

CTI ENGINEERING CO., LTD AND INA CORPORATION

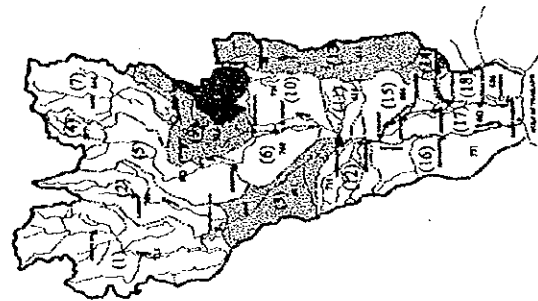
**Fig.1.3.1**  
**SPATIAL DISTRIBUTION OF JULY - DECEMBER RAINFALL**



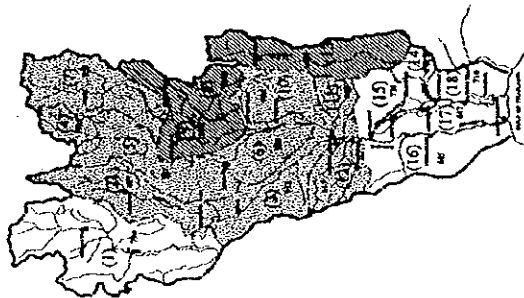
1983



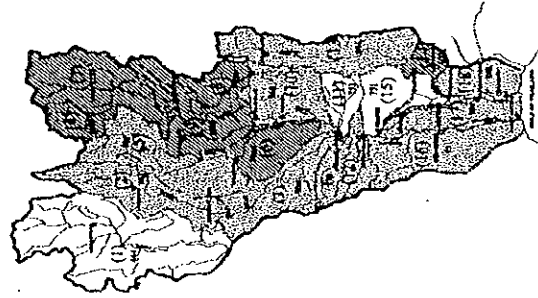
1984



1986



1988



1995

**LEGEND**

- : Basin Boundary
- : Sub-basin Boundary
- : River
- : City (Changwat)
- ~ 800 mm
- 800 ~ 1,000 mm
- 1,000 ~ 1,200 mm
- 1,200 mm ~

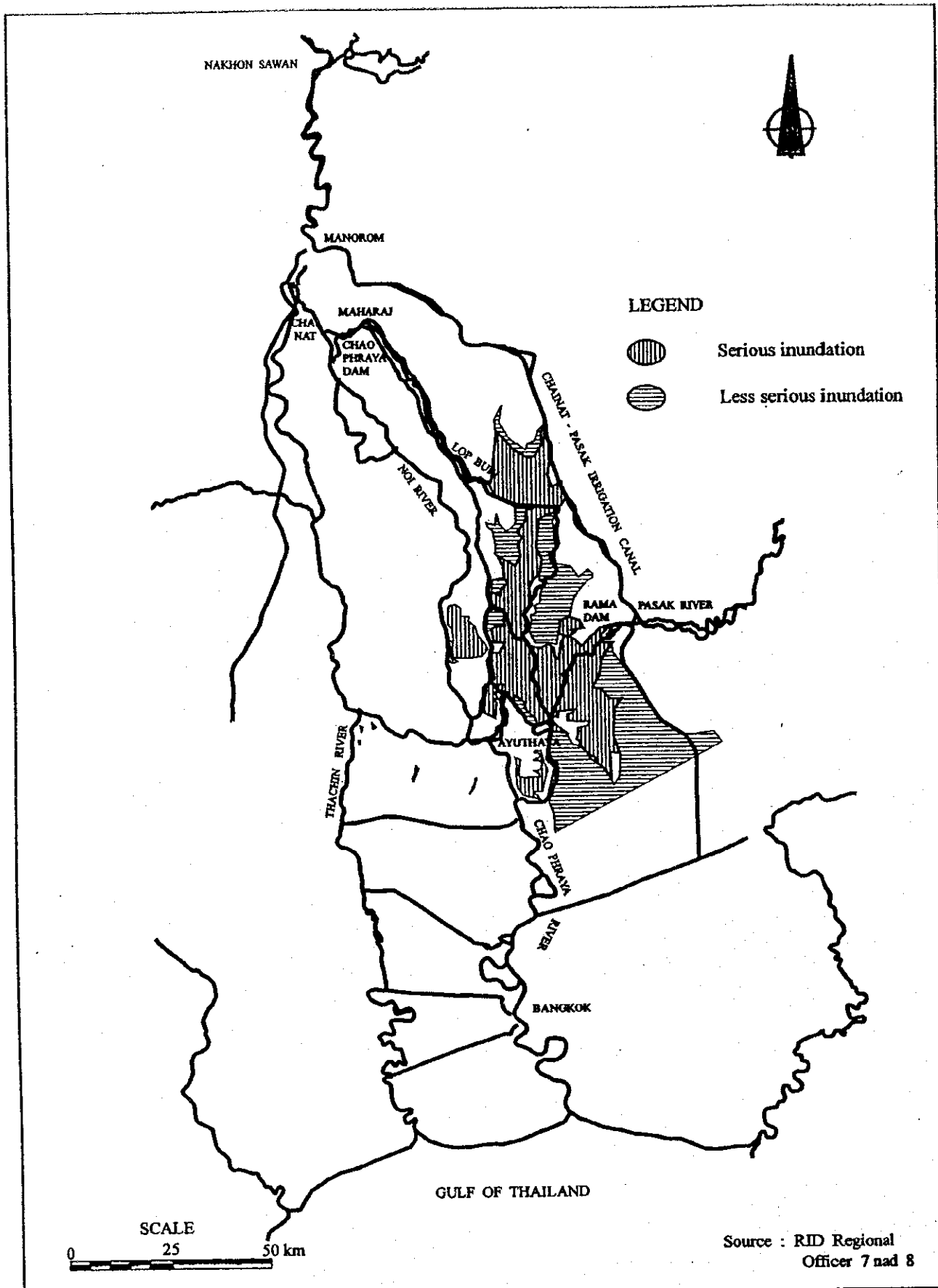


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.1.3.1

SPATIAL DISTRIBUTION OF JULY - DECEMBER RAINFALL

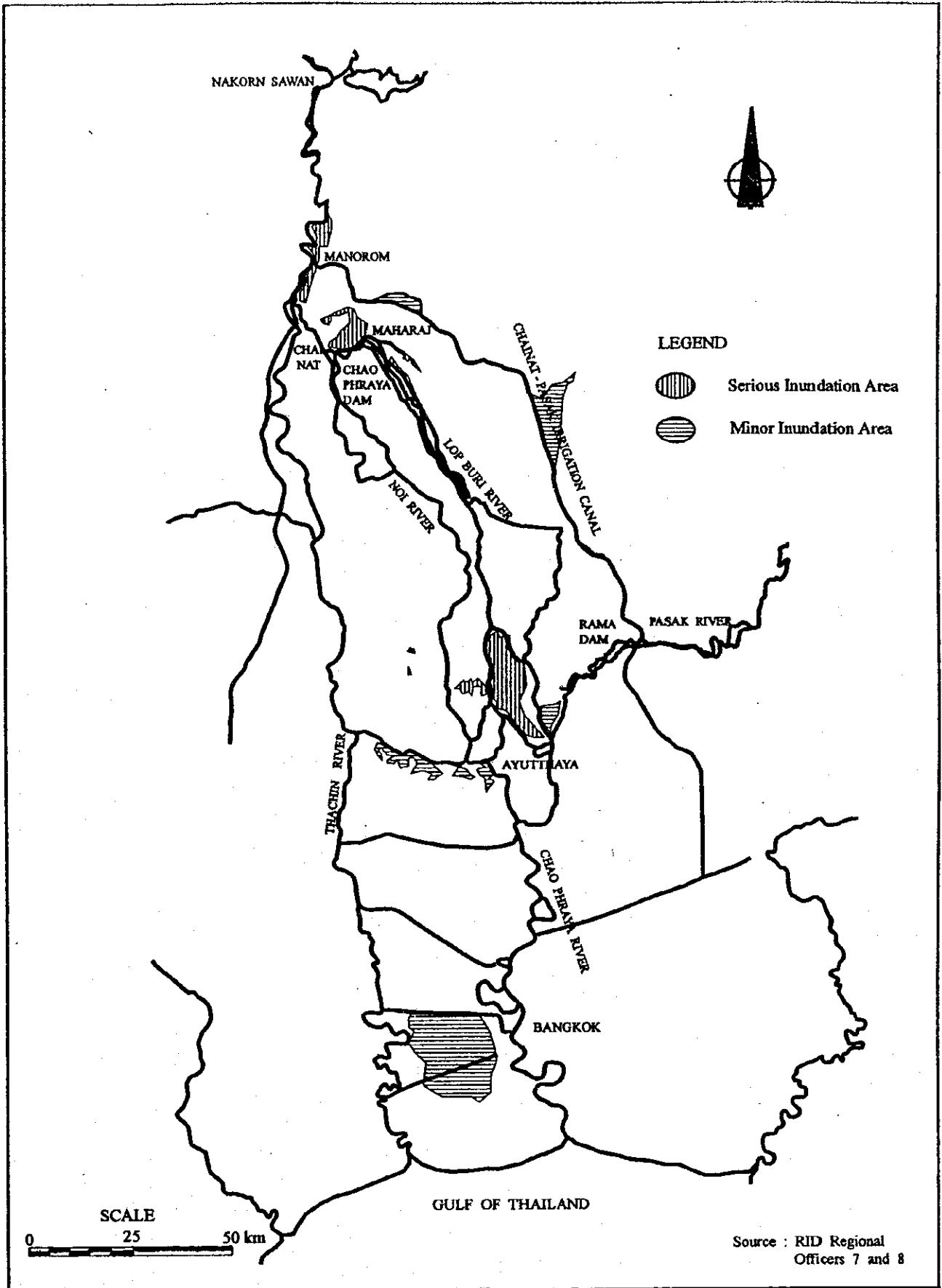


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.1.3.2 (1/5)

Inundation Map of Recent Flood (1978)

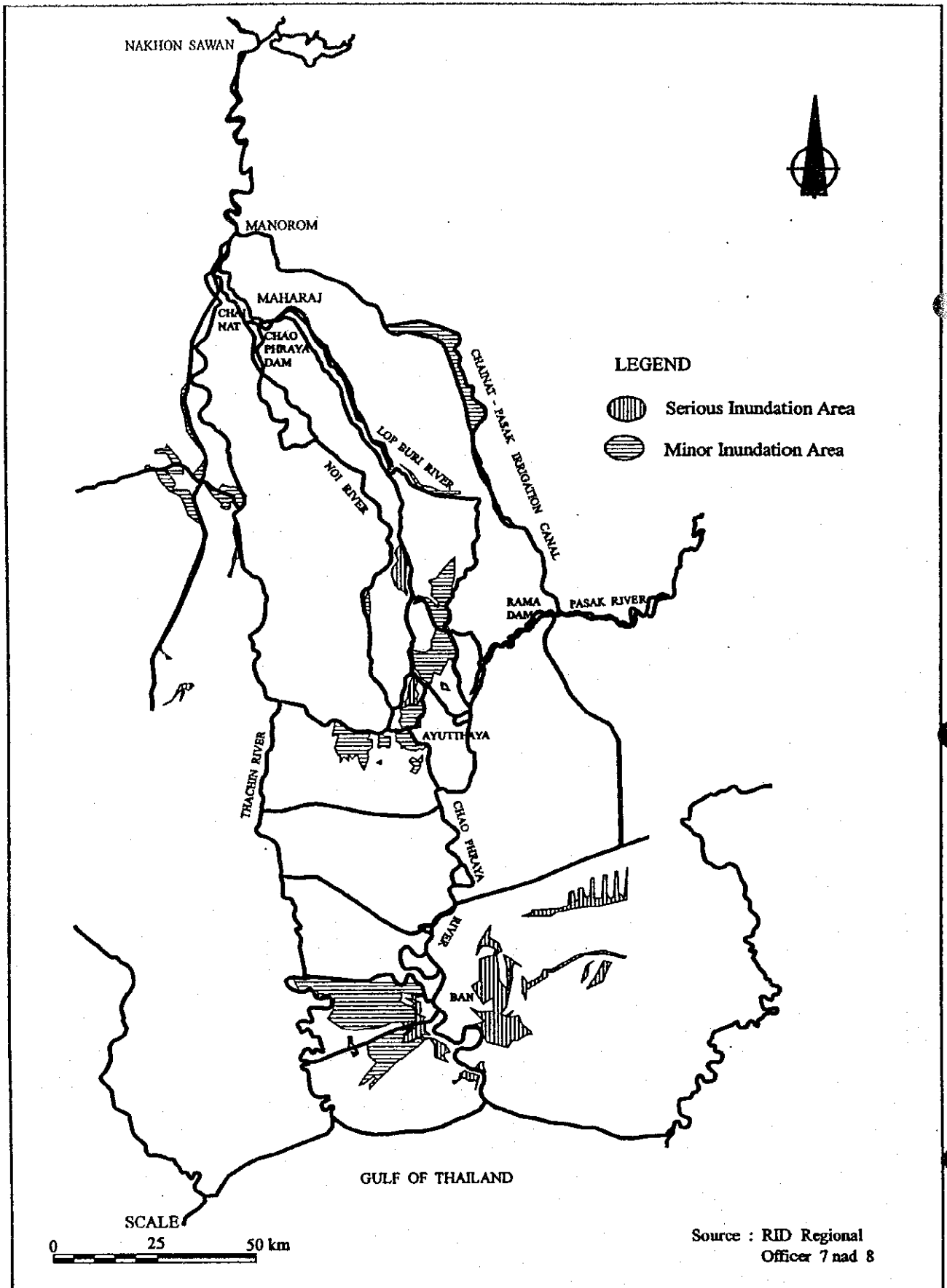


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.1.3.2 (2/5)

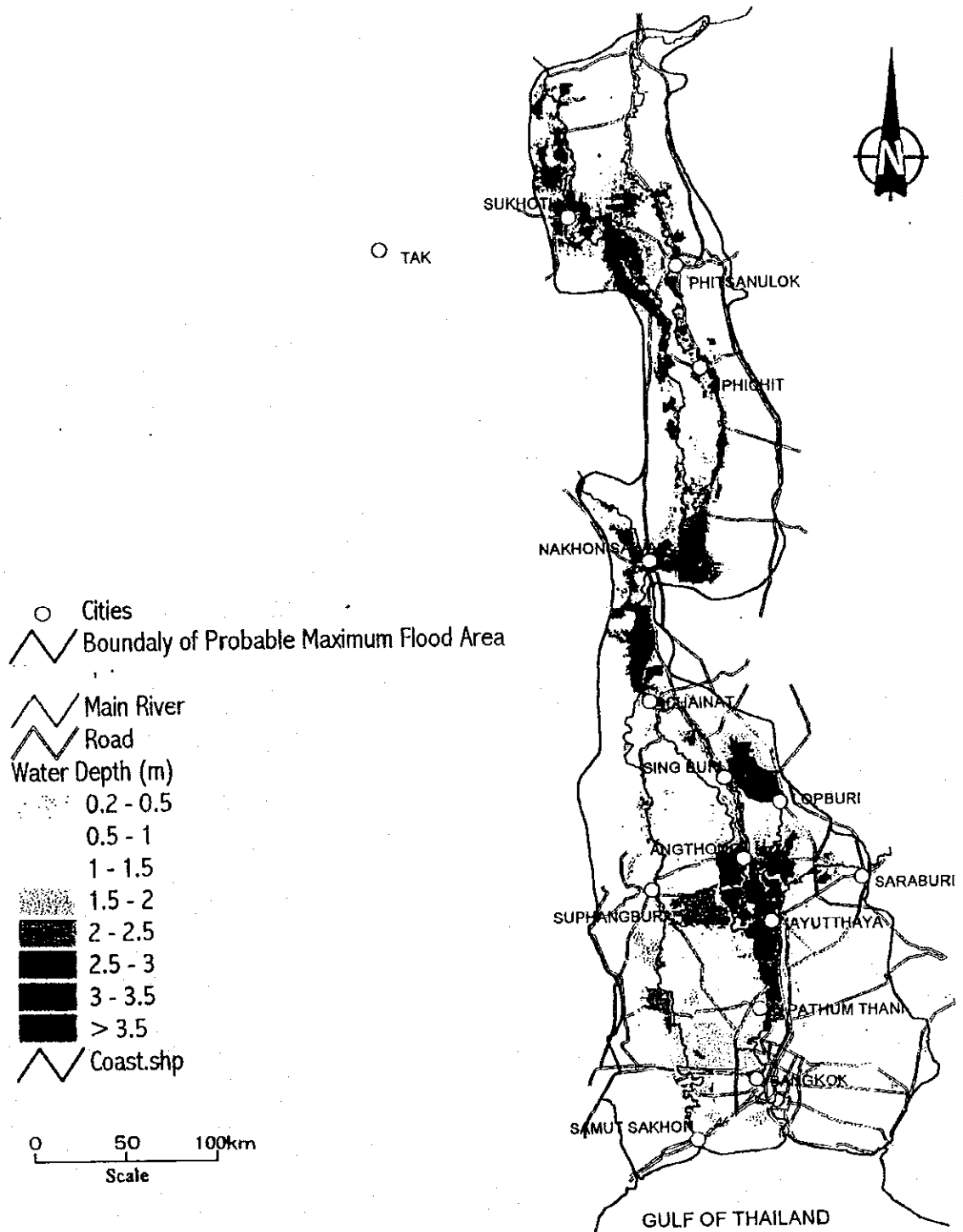
Inundation Map of Recent Flood (1980)



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Fig.1.3.2 (3/5)  
 Inundation Map of Recent Flood ( 1983 )

# SIMULATED FLOOD MAP - 1995

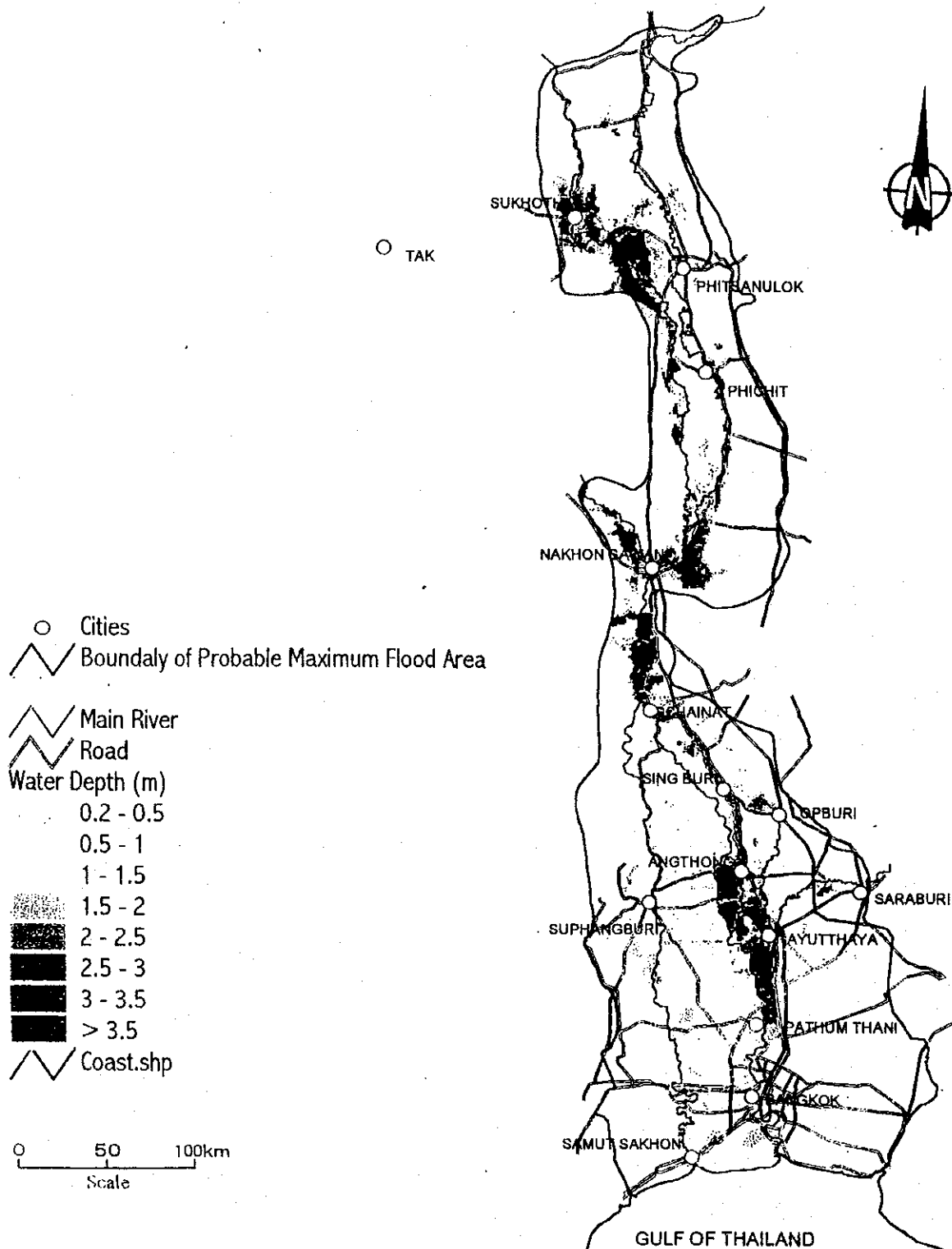


STUDY ON AN INTEGRATED PLAN FOR FLOOD  
 MITIGATION IN CHAOPHRAYA RIVER BASIN  
 CTI ENGINEERING CO., LTD & INA CORPORATION

Fig.1.3.2 (4/5)  
 INUNDATION MAP OF RECENT FLOOD (1995)

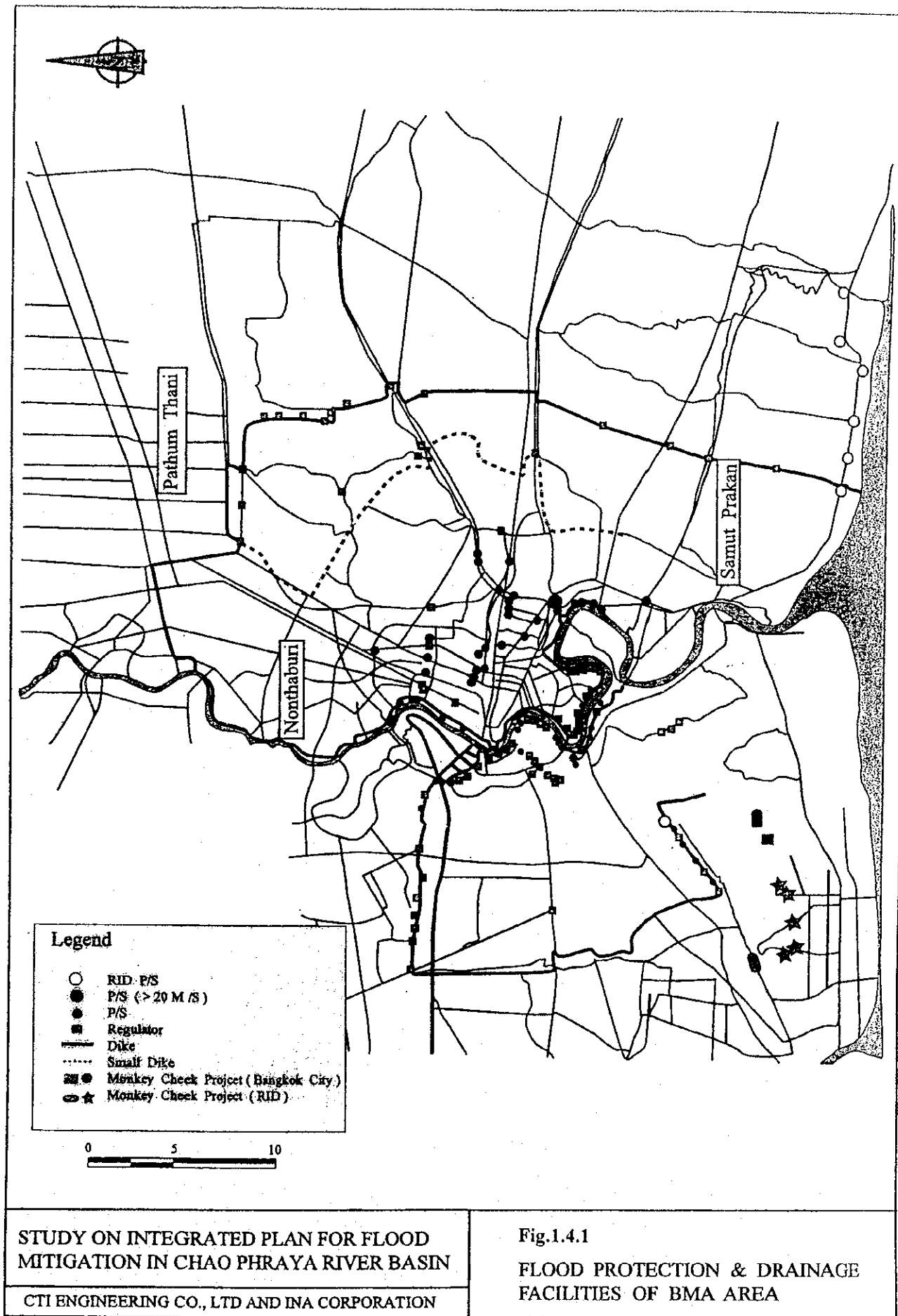


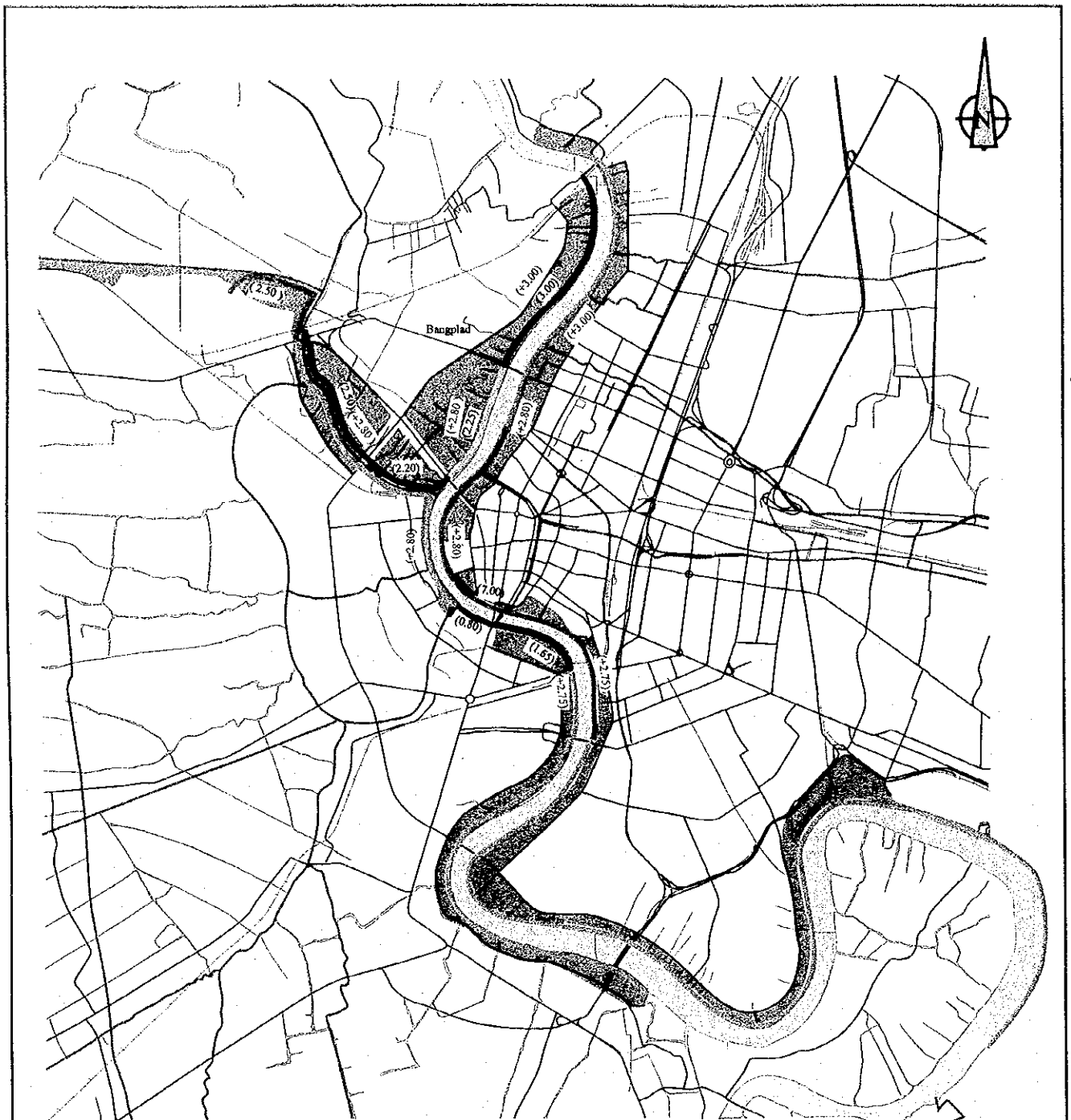
# SIMULATED FLOOD MAP - 1996












STUDY ON ON INTEGRATED PLAN FOR FLOOD  
 MITIGATION IN CHAOPHRAYA RIVER BASIN  
 CTI ENGINEERING CO., LTD & INA CORPORATION

**Fig.1.3.2 (5/5)**  
**INUNDATION MAP OF RECENT FLOOD (1996)**





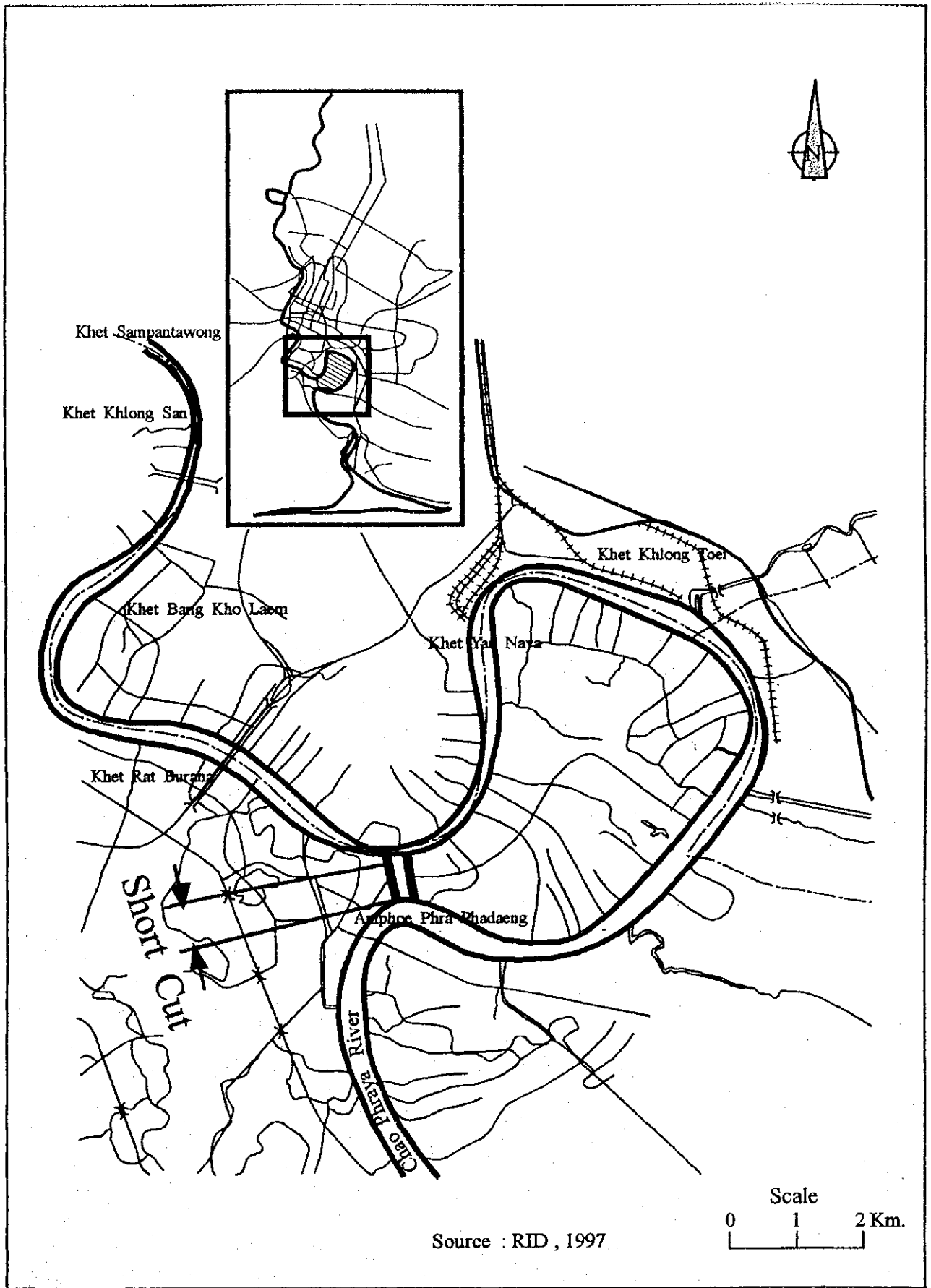
**Construction Project Flood Protection Chao Phraya River Basin  
(Elevation of under construction)**

	Flood Area .
	Bangplad Bangkoknoi Project (1997 - 2000 Budget 784 million Baht)
	Krungthon Bridge Project - Prapinkao Bridge (1996 - 1998 Budget 205.17 million Baht)
	Prapinkao Bridge Project - Charansanitwong Road (1996 - 1998 Budget 194 million Baht)
	Bangkoknoi West Side Canal Project and Mahasawad Canal (1996 - 1998 Budget 191.5 million Baht)
	Prapokkao Bridge Project - Klongsan (1996 - 1998 Budget 161.33 million Baht )
	Tevet Project - Sathorn (1996 - 1997 Budget 84.8 million Baht)
	Prapokkao Bridge Project - Bangkokyai Canal (1997 Budget 20.6 million Baht)
	Construction Project Flood Protection Chao Phraya River Basin a balance .
(+3.00)	Length of dike
(+3.00)	Elevation

**STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN**

CTI ENGINEERING CO., LTD AND INA CORPORATION

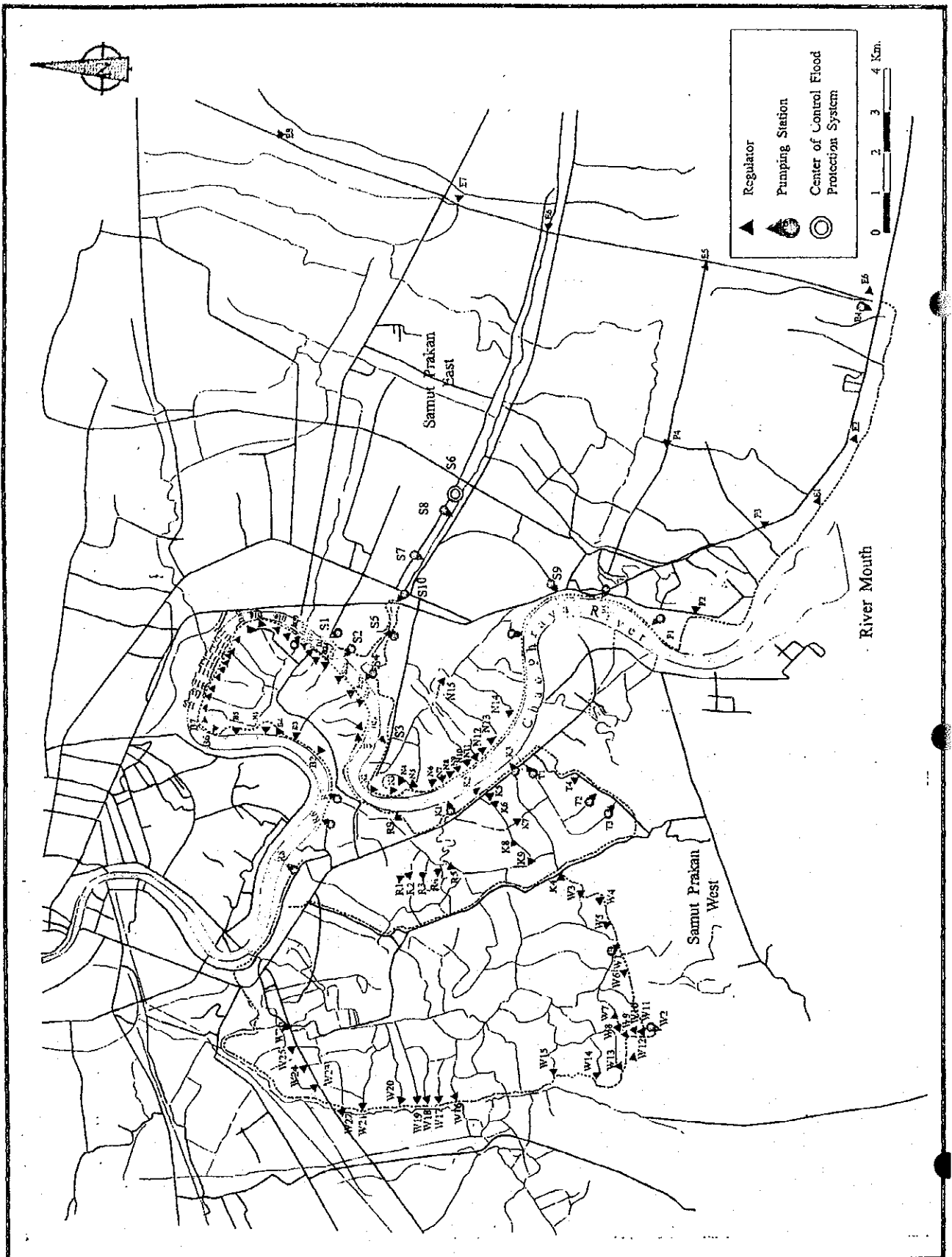
**Fig. 1.4.2 RIVER IMPROVEMENT PLAN FOR URBAN AREA ( BANGKOK )**



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

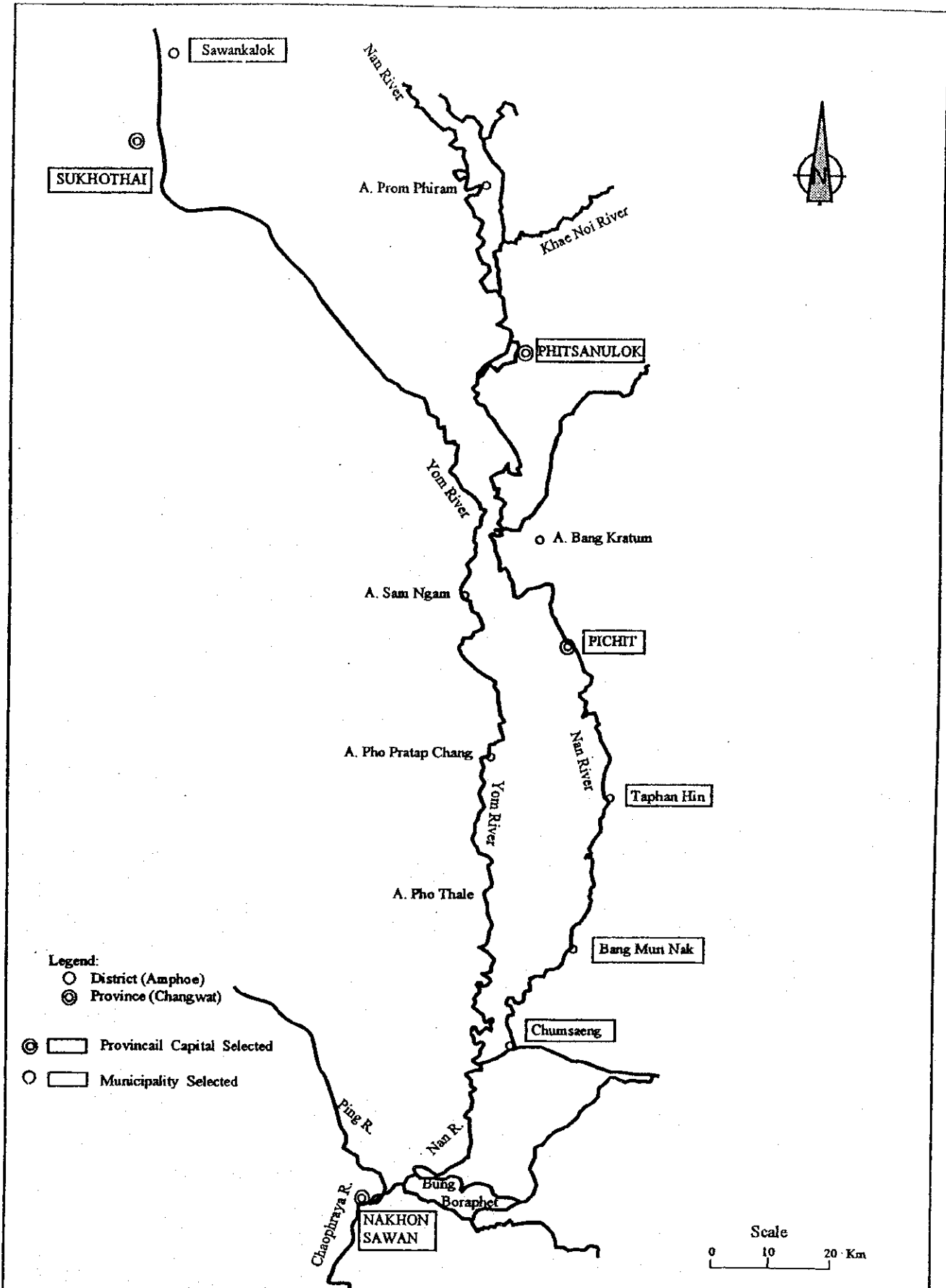
CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig.1.4.3  
RIVER IMPROVEMENT PLAN FOR LOOP - CUT OF BANGKOK PORT



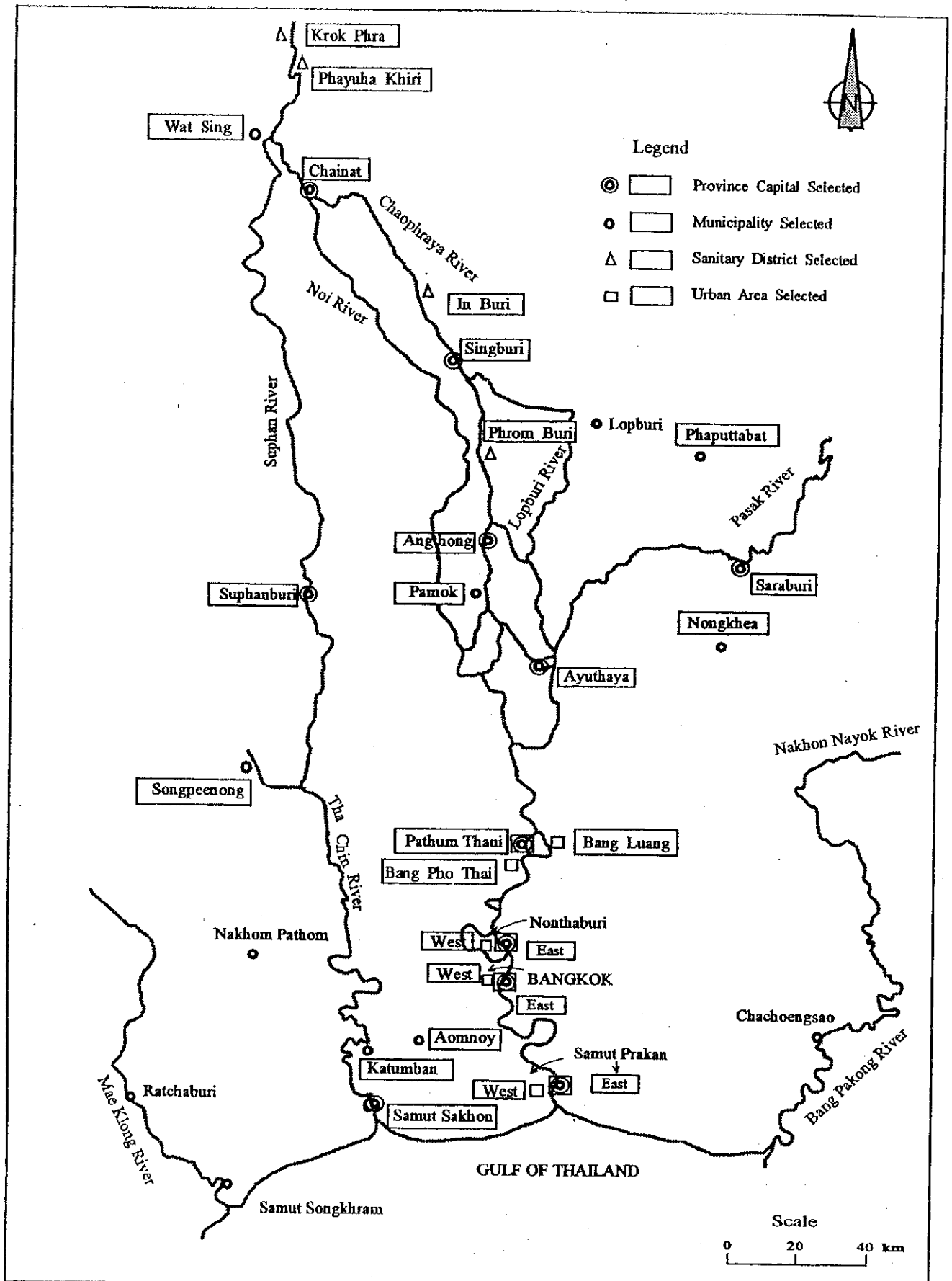
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN  
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Fig.1.4.4  
 RIVER IMPROVEMENT PLAN FOR URBAN AREA IN SAMUT PRAKAN



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN  
 CTI ENGINEERING CO., LTD. AND INA CORPORATION

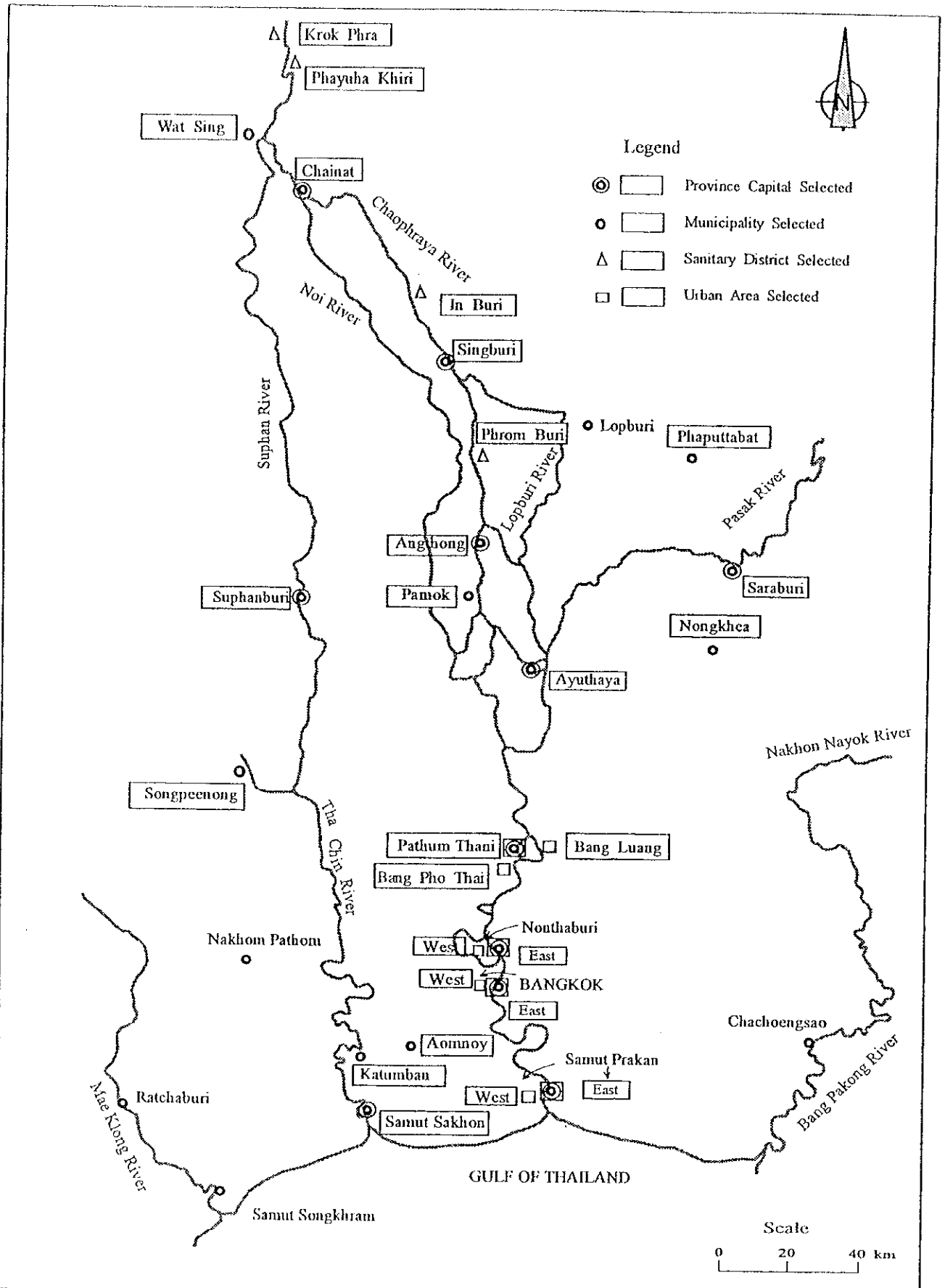
Fig.1.4.5 (1/2)  
 LOCATION OF SELECTED URBAN AREAS



**STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN**

CTI ENGINEERING CO., LTD AND INA CORPORATION

**Fig.1.4.5 (2/2)**  
**LOCATION OF SELECTED URBAN AREAS**

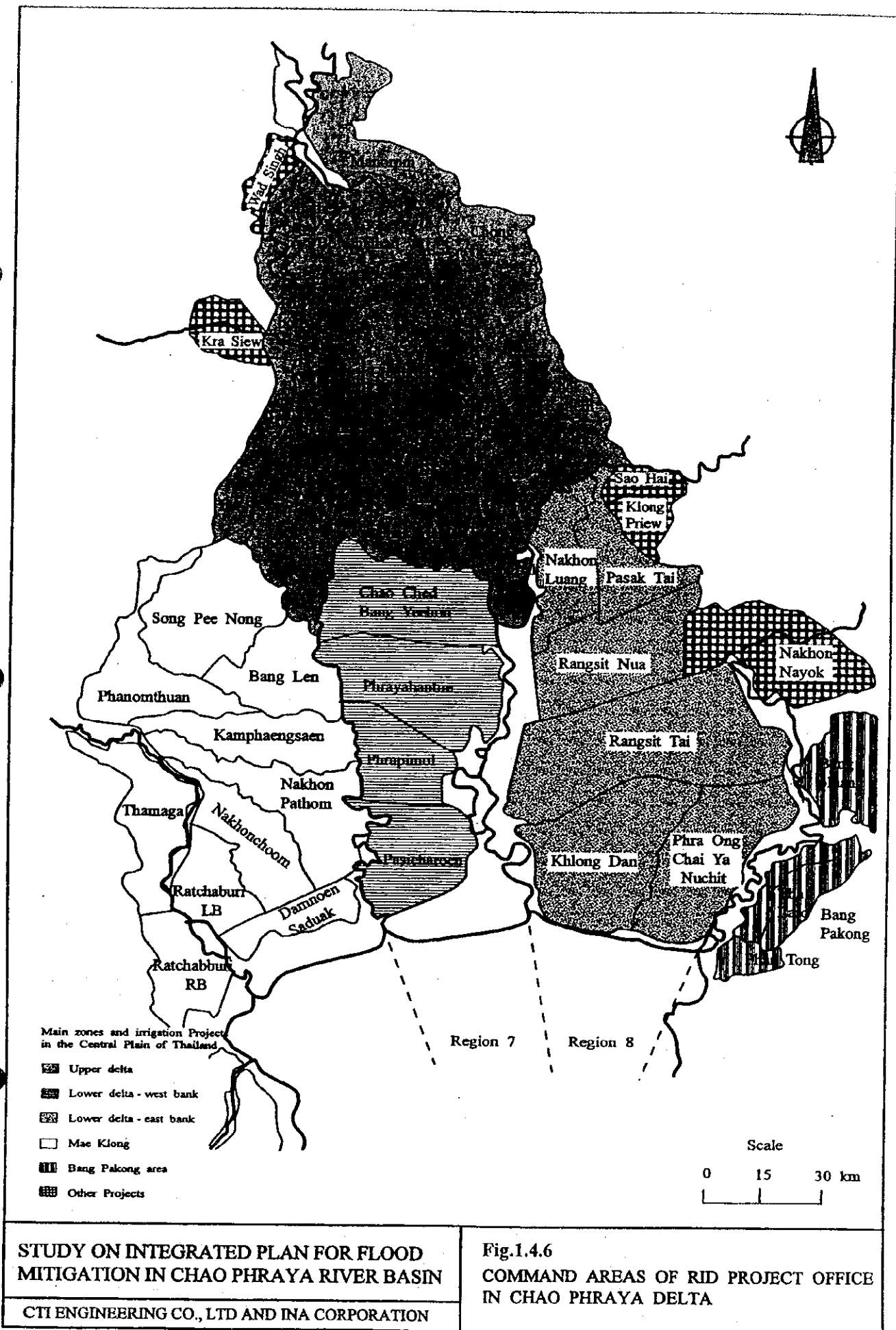


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig.1.4.5 (2/2)  
LOCATION OF SELECTED URBAN AREAS

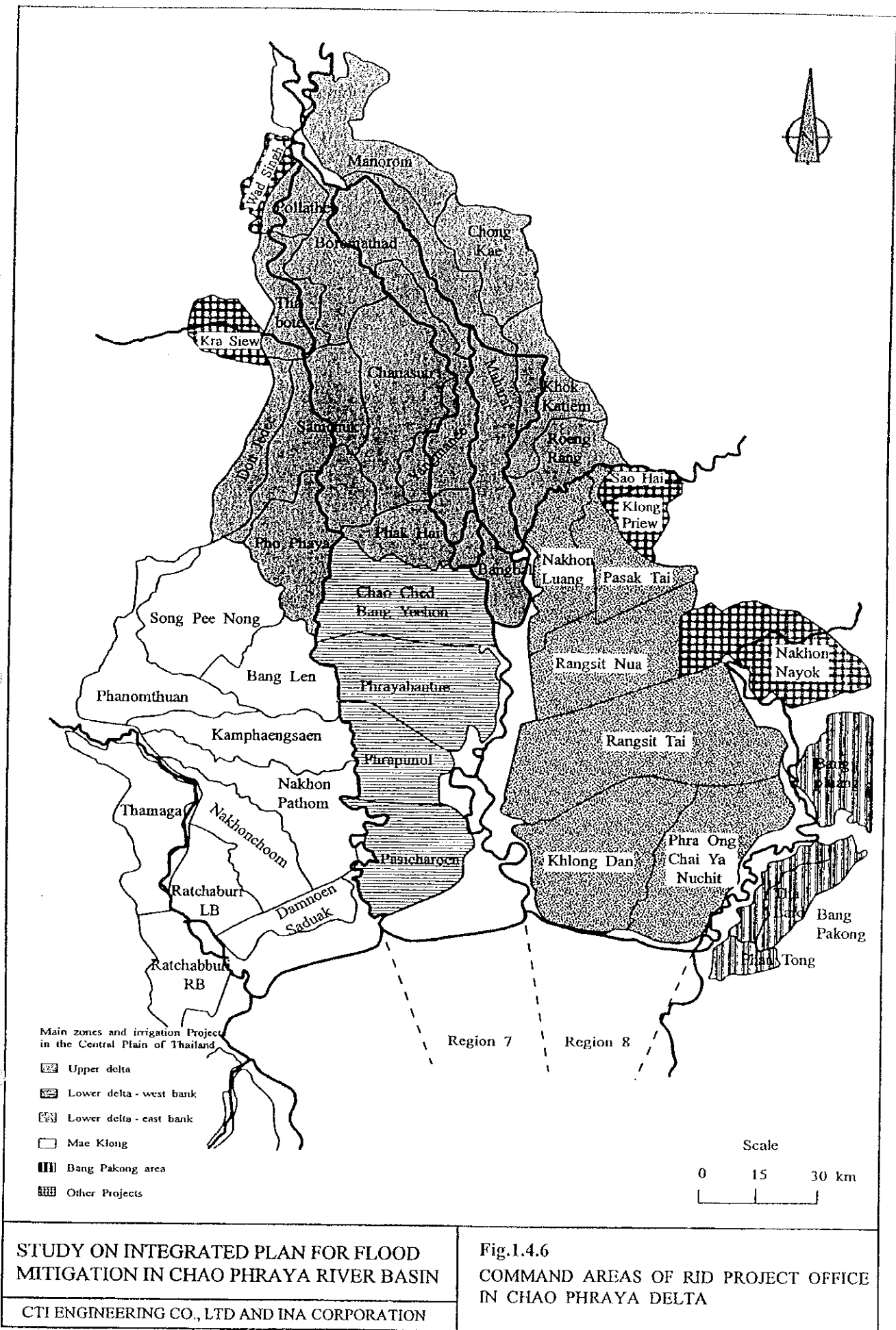


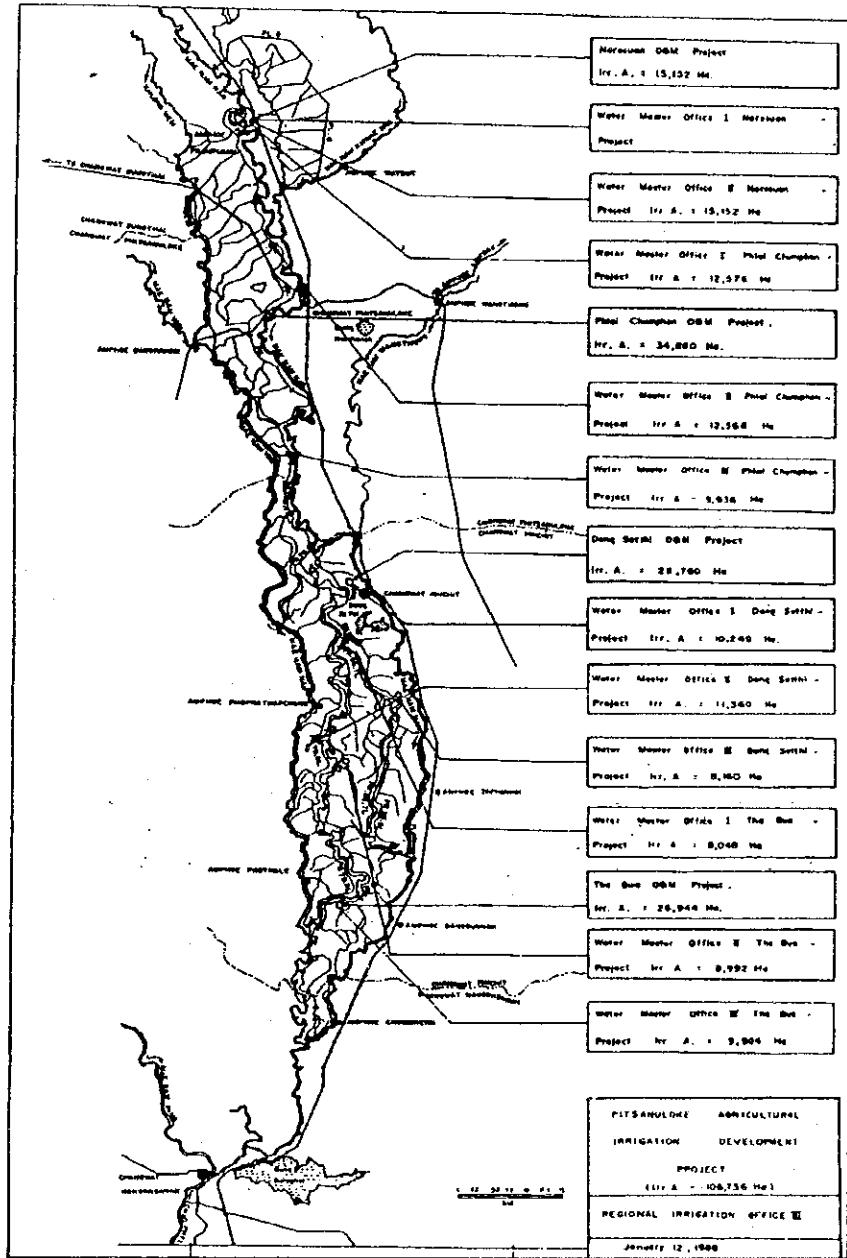


**STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN**

CTI ENGINEERING CO., LTD AND INA CORPORATION

**Fig.1.4.6**  
**COMMAND AREAS OF RID PROJECT OFFICE**  
**IN CHAO PHRAYA DELTA**



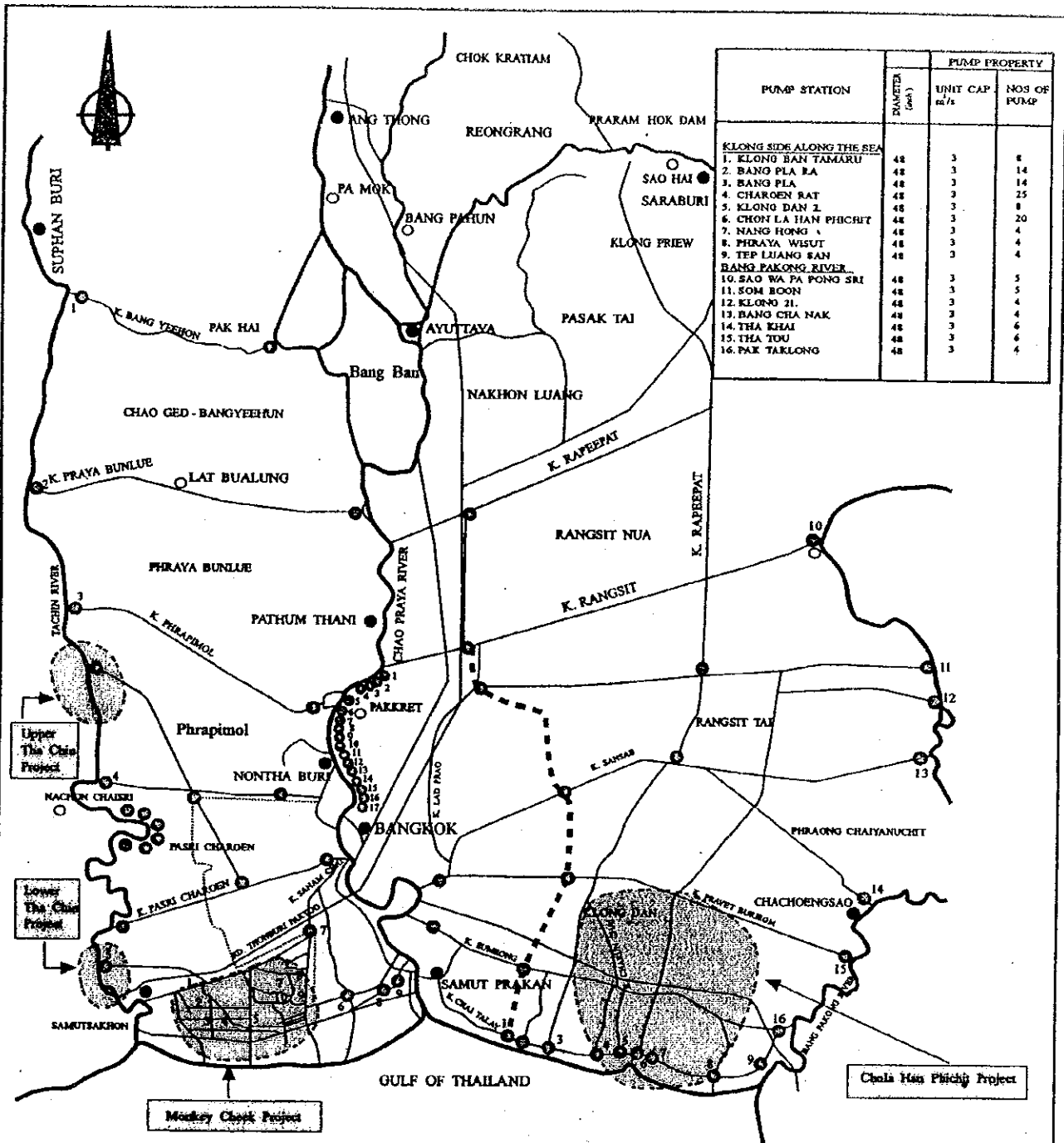


**STUDY ON INTEGRATED PLAN FOR FLOOD  
MITIGATION IN CHAO PHRAYA RIVER BASIN**

**CTI ENGINEERING CO., LTD AND INA CORPORATION**

**Fig.1.4.7**

**COMMAND AREA OF RID PROJECT OFFICE IN  
YOM-NAN BASIN**



PUMP STATION	PUMP PROPERTY		
	DIAMETER (inch)	UNIT CAP. m <sup>3</sup> /s	NOS OF PUMP
<b>KLONG SIDE ALONG THE SEA</b>			
1. KLONG BAN TAMARU	48	3	8
2. BANG PLA BA	48	3	14
3. BANG PLA	48	3	25
4. CHAROEN RAT	48	3	8
5. KLONG DAN 2	48	3	20
6. CHON LA HAN PHICHIT	48	3	4
7. NANG HONG 1	48	3	4
8. PHRAYA WISUT	48	3	4
9. TEP LIANG SAN	48	3	4
<b>BANG PAKONG RIVER</b>			
10. SAO WA PA PONG SRI	48	3	5
11. SOM BOON	48	3	5
12. KLONG 21	48	3	4
13. BANG CHA NAK	48	3	4
14. THA KHAI	48	3	6
15. THA TOU	48	3	6
16. PAK TAKLONG	48	3	4

PUMP STATION	PUMP PROPERTY		
	DIAMETER (inch)	UNIT CAP. m <sup>3</sup> /s	NOS OF PUMP
<b>EAST BANK</b>			
1. KLONG BAN TAI	48	3	3
2. BAN KAO	24	1	2
3. BAN PHUNG	48	3	3
4. BANG PAD NAI	48	3	3
5. WAT KHLANG KET	20	0.5	3
6. BANG TAJAT	48	3	4
7. BANG THAOLANCE	48	3	2
8. BANG SUE NOI	28	0.5	3
9. BANG KA SOR	20	0.5	3

PUMP STATION	PUMP PROPERTY		
	DIAMETER (inch)	UNIT CAP. m <sup>3</sup> /s	NOS OF PUMP
<b>WEST BANK</b>			
10. BANG SUE NOI	48	3	2
11. MA KHAM PRONG	20	0.5	3
12. BANG PHRACK 1	20	0.5	3
13. BANG PHRACK	48	3	2
14. BANG TA NOW SRI	48	3	2
15. BANG KHUN THAN	20	0.5	3
16. BANG MOON NAK	20	0.5	3
17. BANG KHEN KAO	48	3	3
18. BANG KHEN MAI	48	3	4

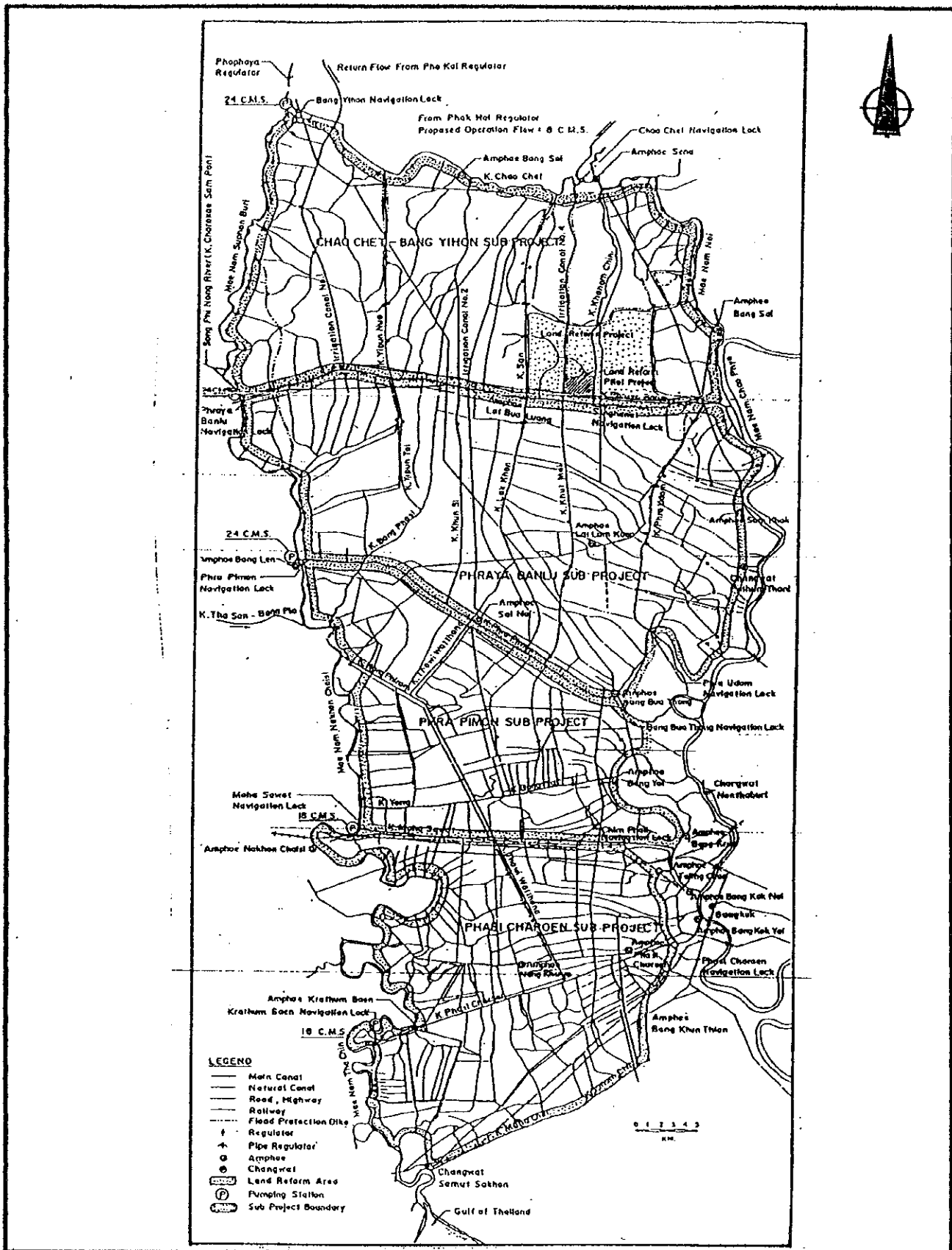
PUMP STATION	PUMP PROPERTY		
	DIAMETER (inch)	UNIT CAP. m <sup>3</sup> /s	NOS OF PUMP
<b>THACHIN RIVER</b>			
1. BANG YEHEON	48	3	8
2. PHRAYA BUNLUE	48	3	8
3. PHRAPIMOL	48	3	8
4. KLONG MAHA SAWAT	48	3	6
5. KLONG SRI WA PASAWAT	48	3	4
6. KLONG CHOK KRABU	24	1	2
<b>THE SIDE ALONG THE SEA</b>			
7. KLONG RATCHAMONTRI	48	3	3
8. KLONG SUAN	48	3	6
9. KLONG KRA OOM	48	3	3

**STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN**

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig.1.4.8

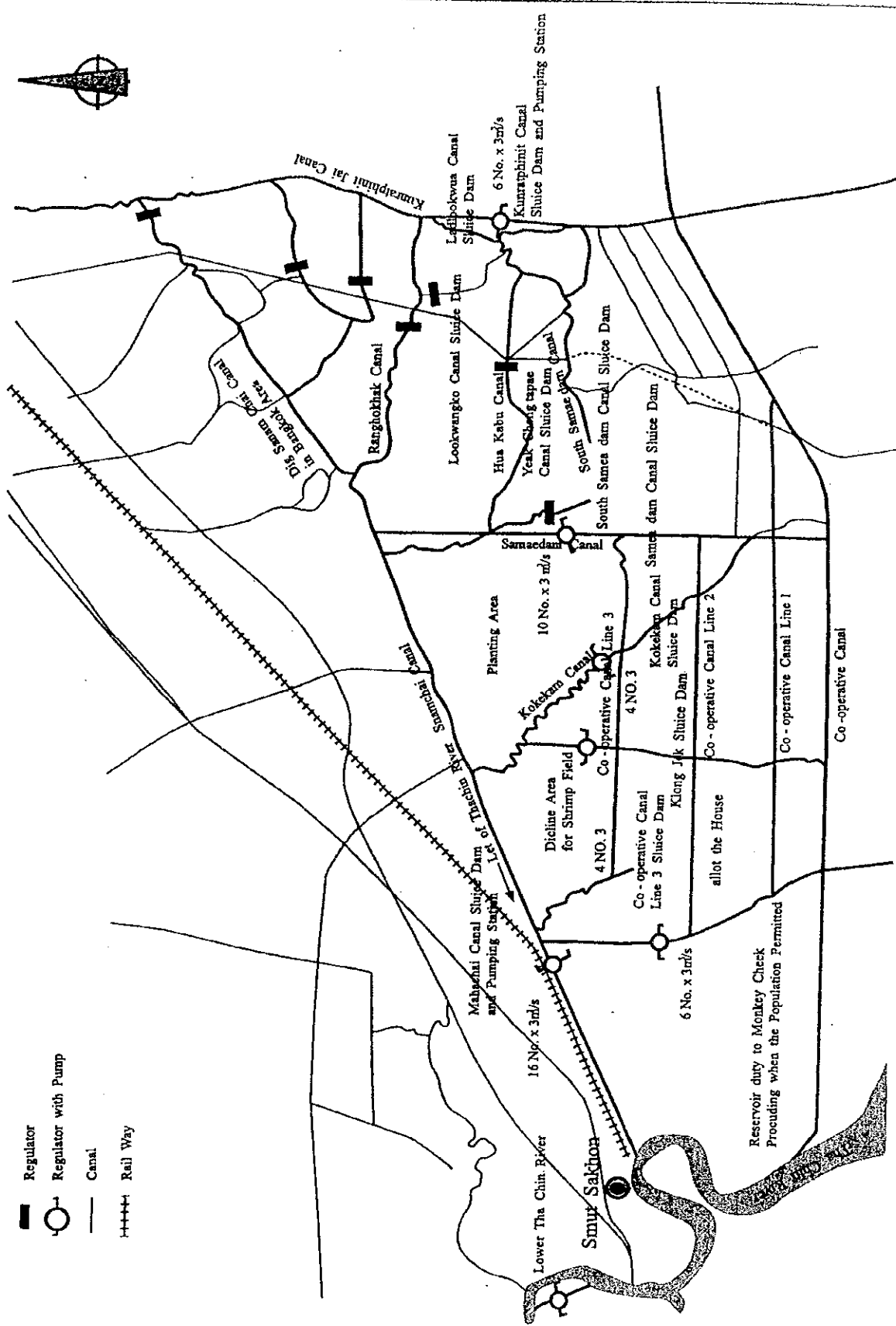
RID DRAINAGE FACILITIES AND ON-GOING PROJECT.



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN  
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Fig.1.4.9  
WEST BANK OF LOWER DELTA

MONKEY CHEEK PROJECT " KHLONG MAHA CHAI - KHLONG SANAM CHAI "

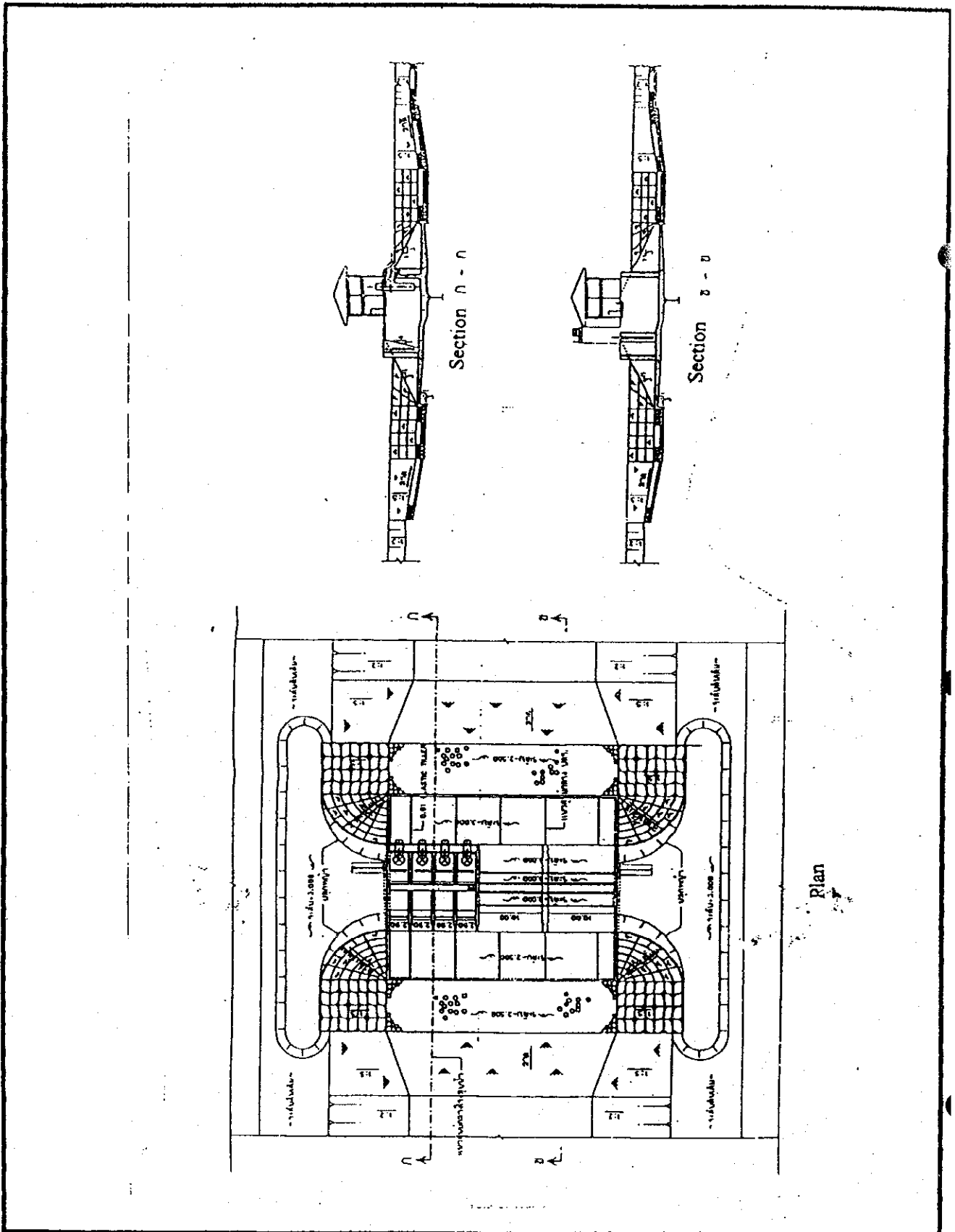


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

Fig.1.4.10

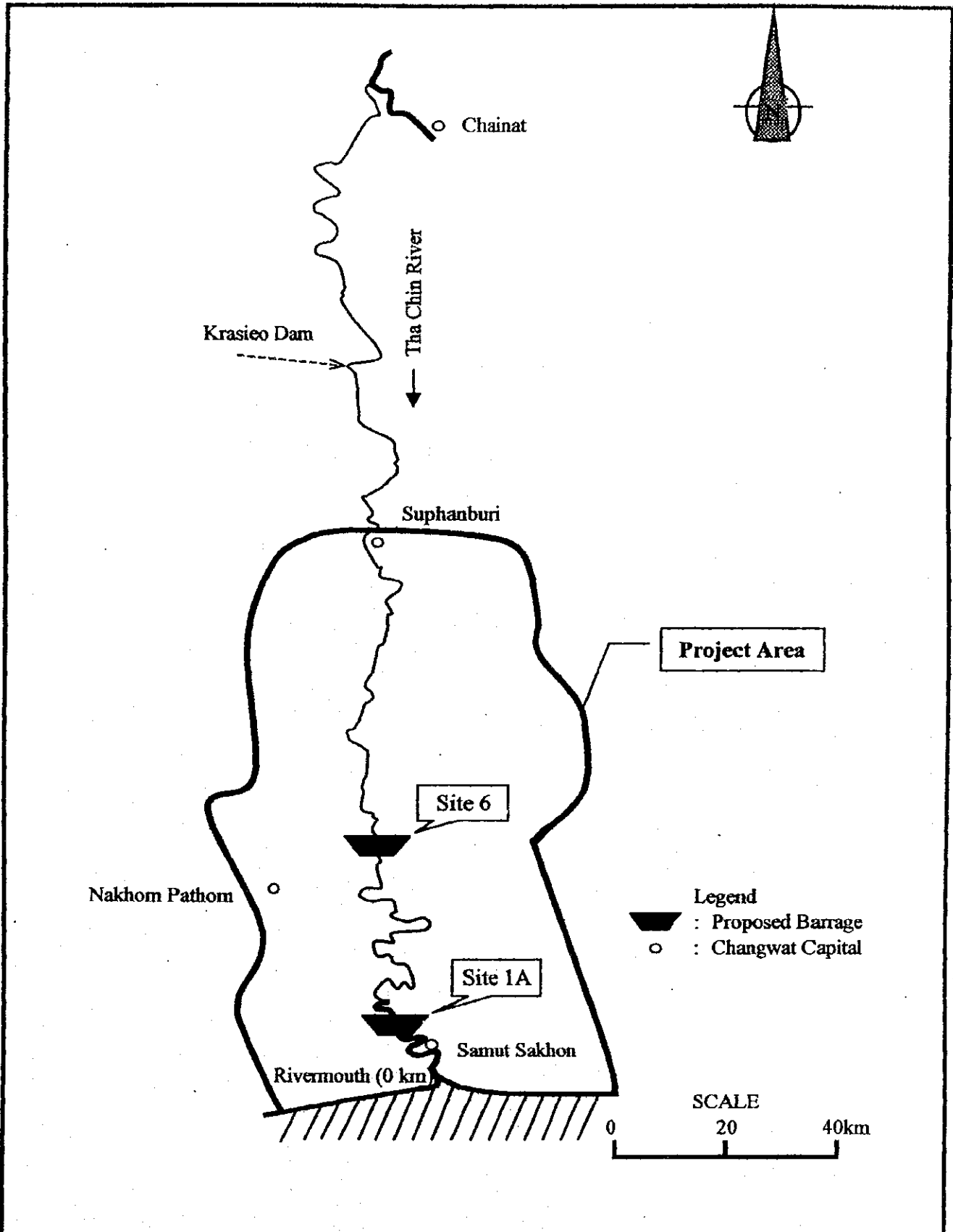
MONKEY CHEEK PROJECT

CTI ENGINEERING CO., LTD AND INA CORPORATION



STUDY ON INTEGRATED PLAN FOR FLOOD  
 MITIGATION IN CHAO PHRAYA RIVER BASIN  
 CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig.1.4.11  
 TYPICAL LAYOUT OF REGULATOR/PUMP  
 STATION



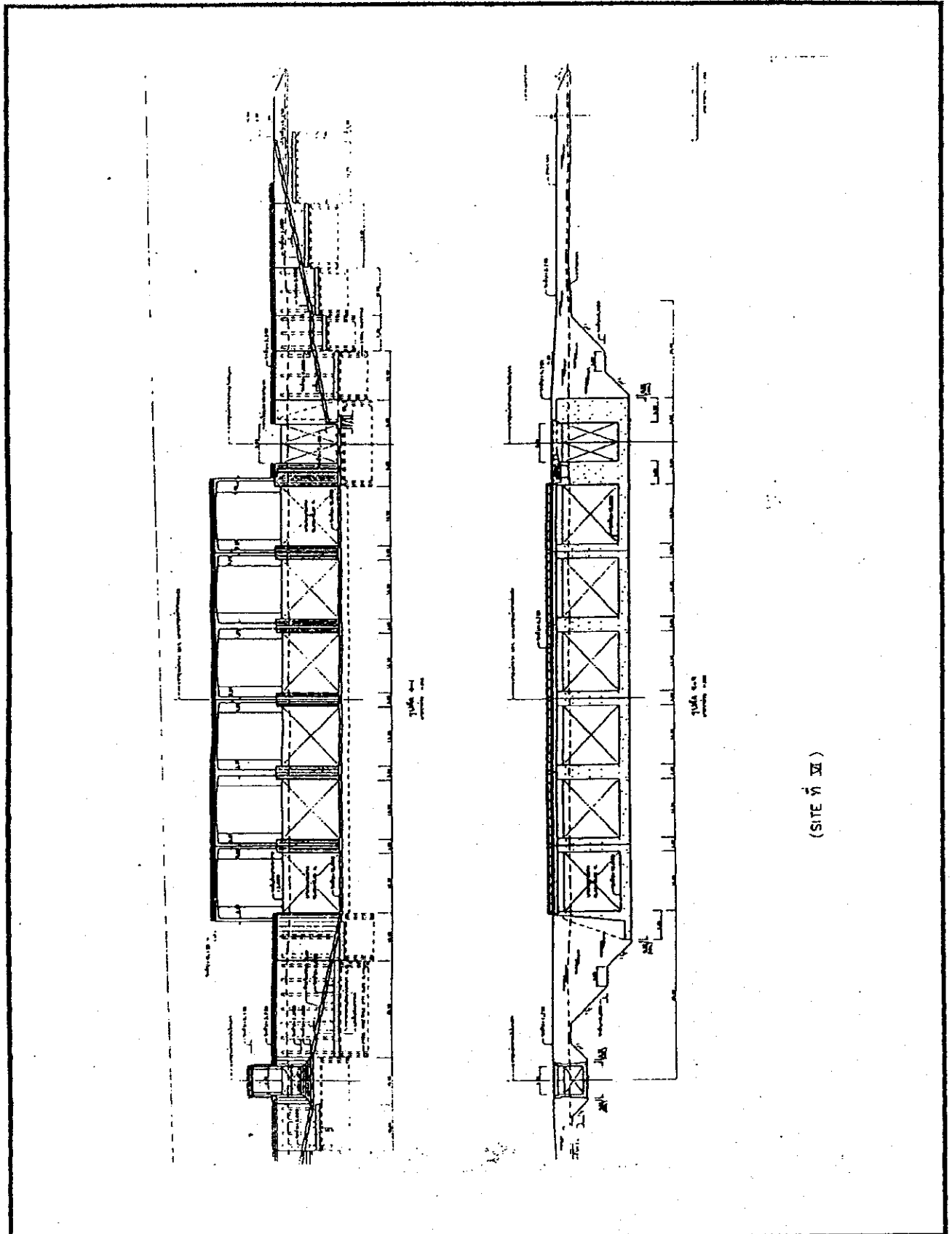
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.1.4.12

UPPER THA CHIN AND LOWER THA CHIN PROJECT





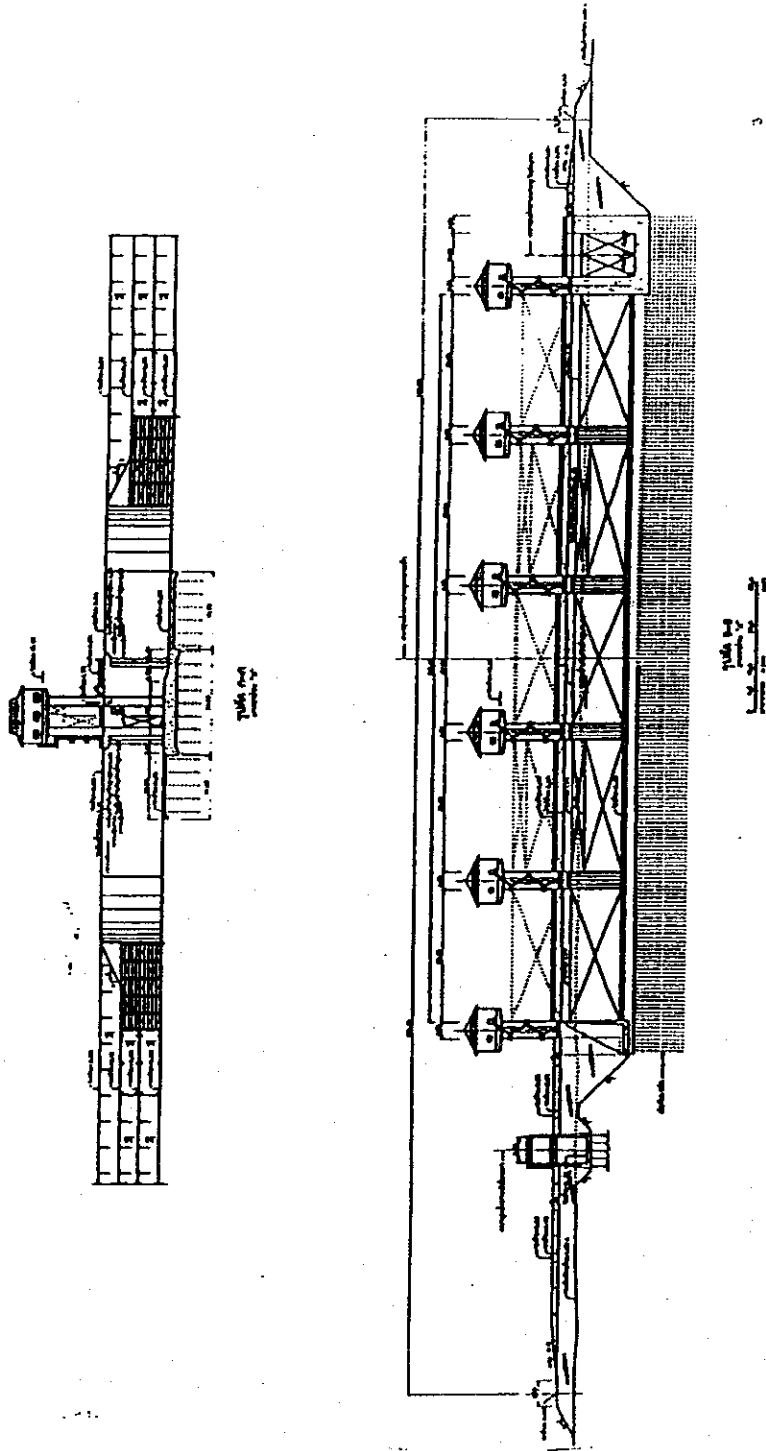
(SITE 6)

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MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.1.4.13

UPPER THA CHIN PROJECT (SITE 6)

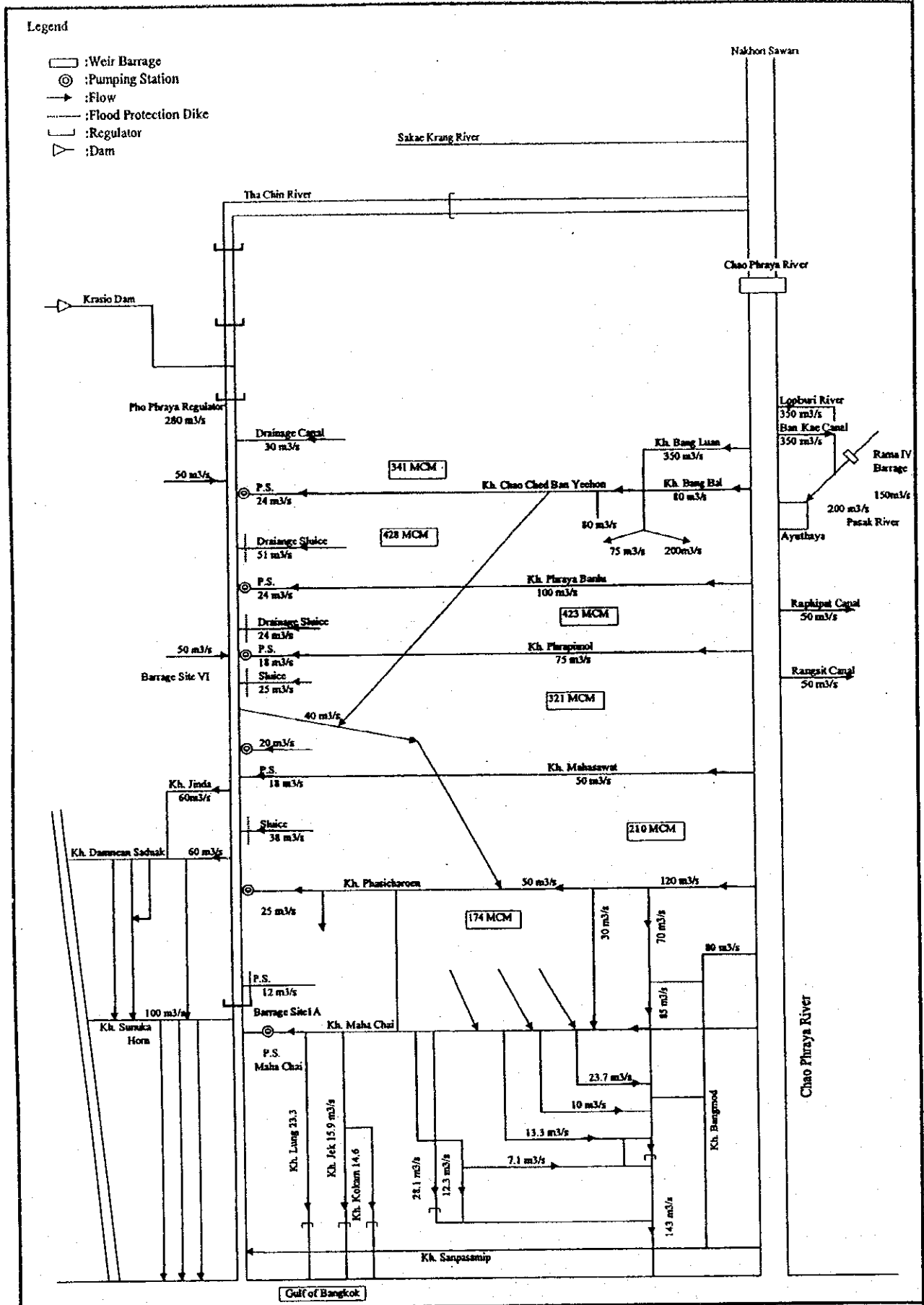


STUDY ON INTEGRATED PLAN FOR FLOOD  
MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

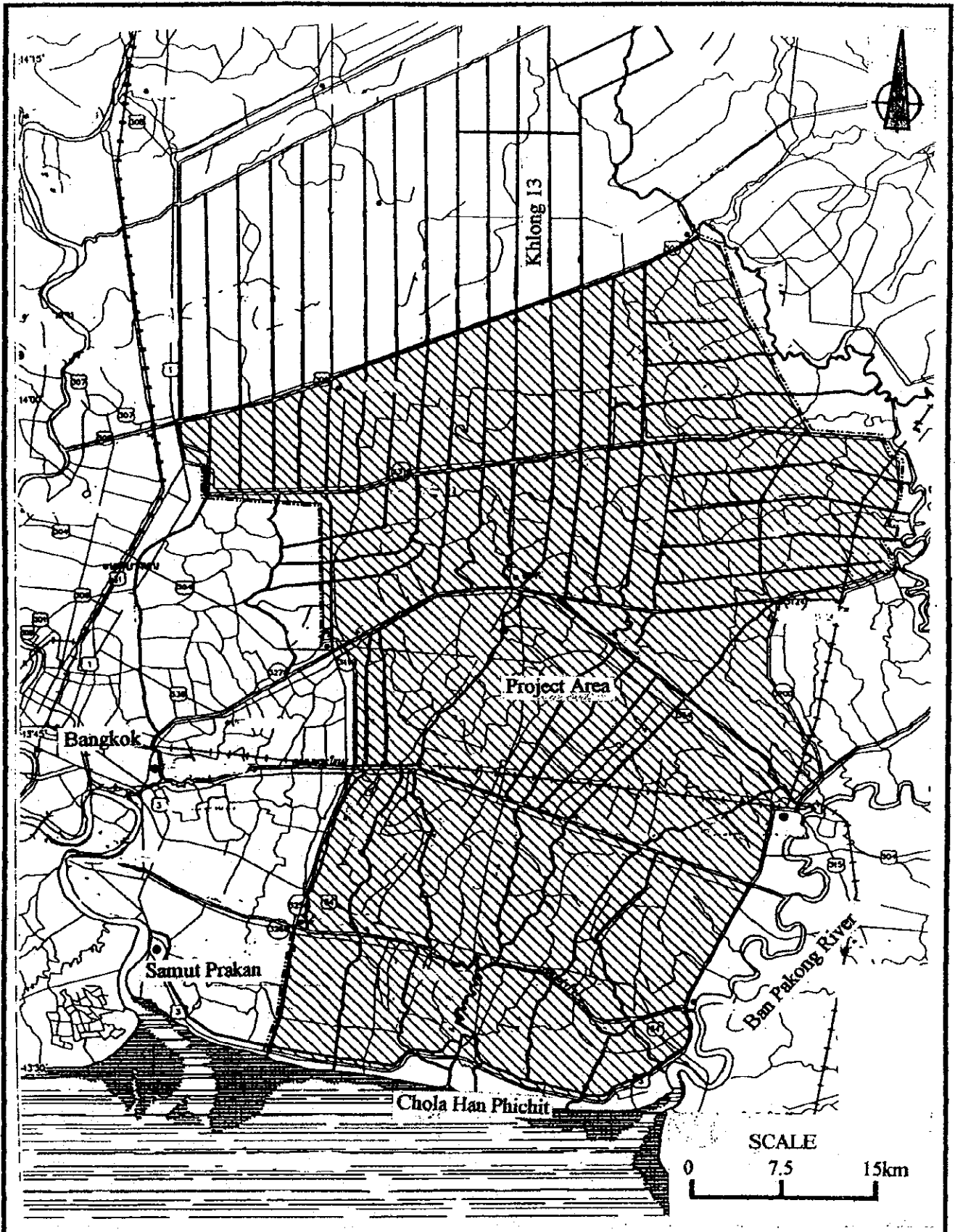
Fig.1.4.14

LOWER THA CHIN PROJECT (SITE 1A)



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**Fig.1.4.15**  
**FLOW DIAGRAM OF THE WEST BANK**

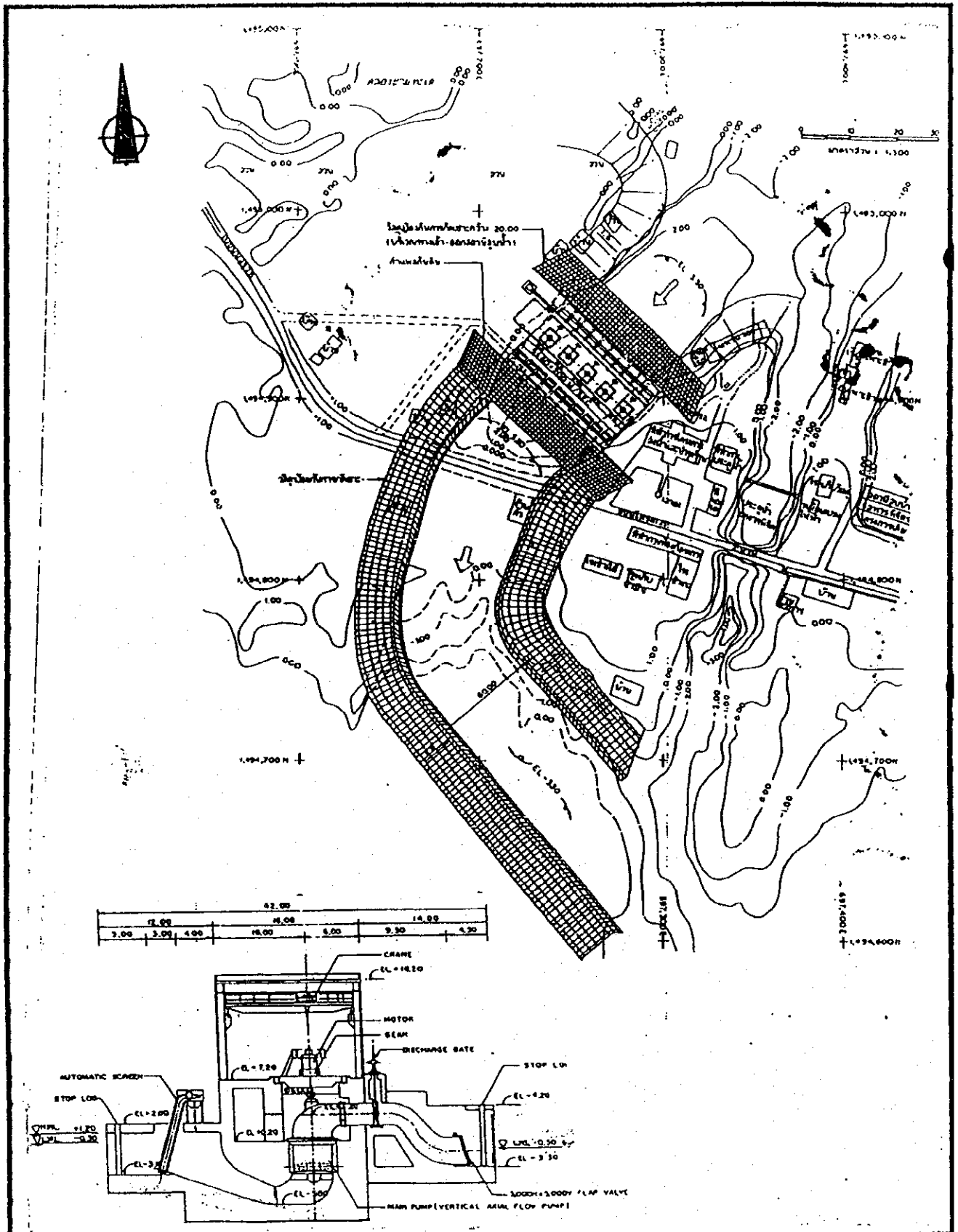


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.1.4.16

CHOLA HAN PHICHIT 2 PROJECT AREA

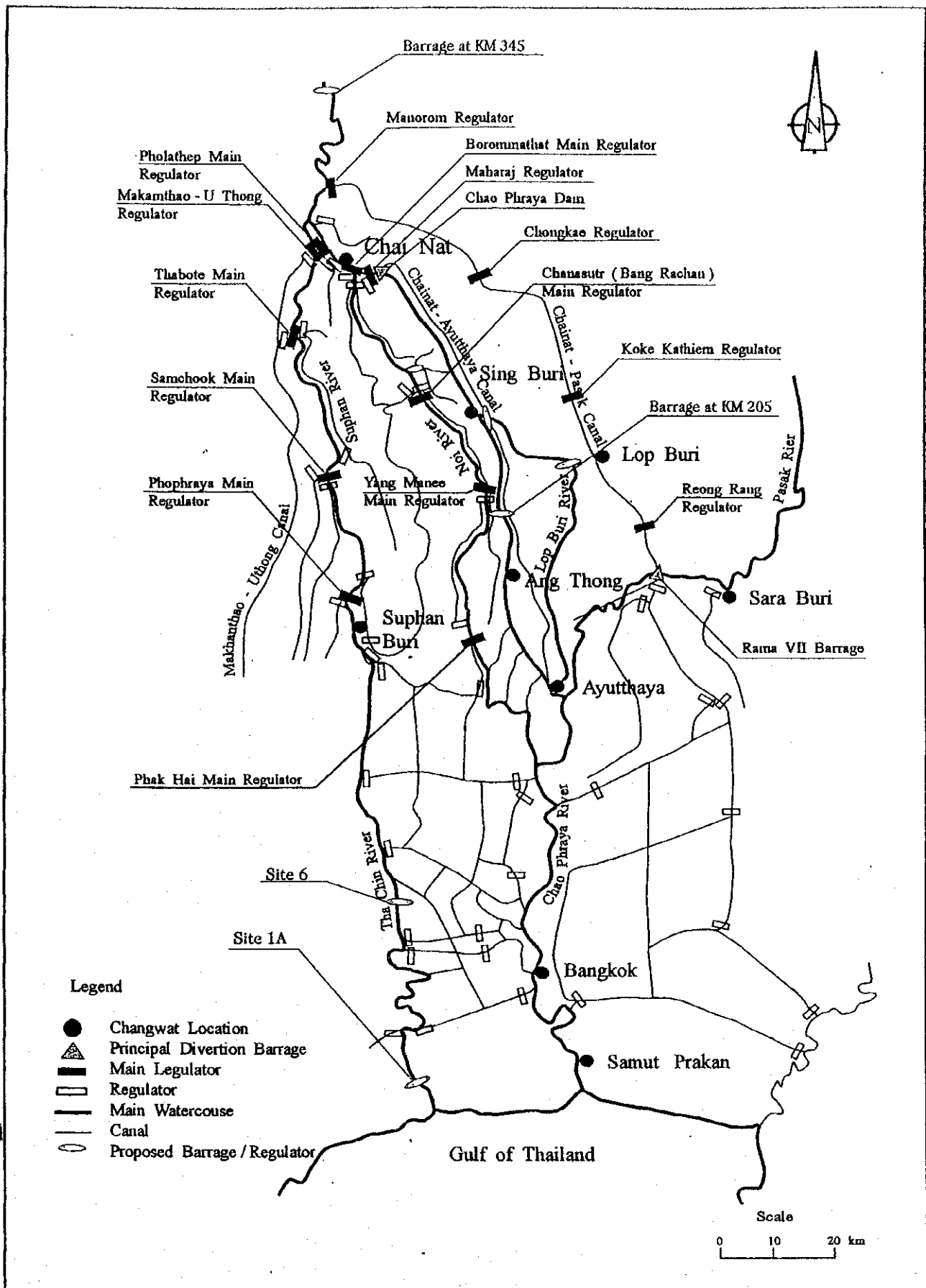


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Fig.1.4.17

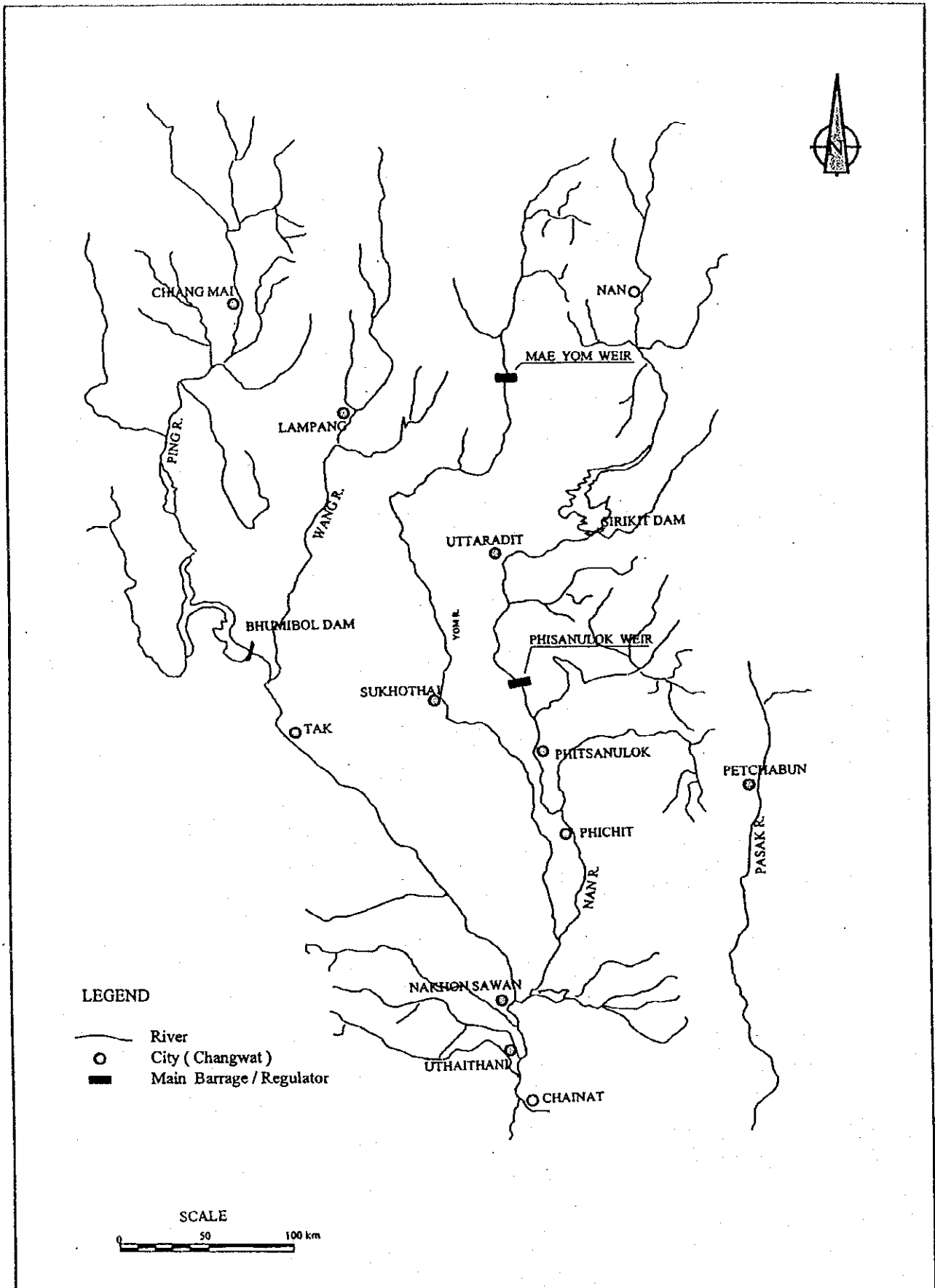
PROPOSED CHOLA HAN PICHIT PUMPING STATION



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

Fig.1.4.18 (1/2)  
LOCATION OF EXISTING AND PROPOSED WEIR / BARRAGE / REGULATORS ( 1/2 )

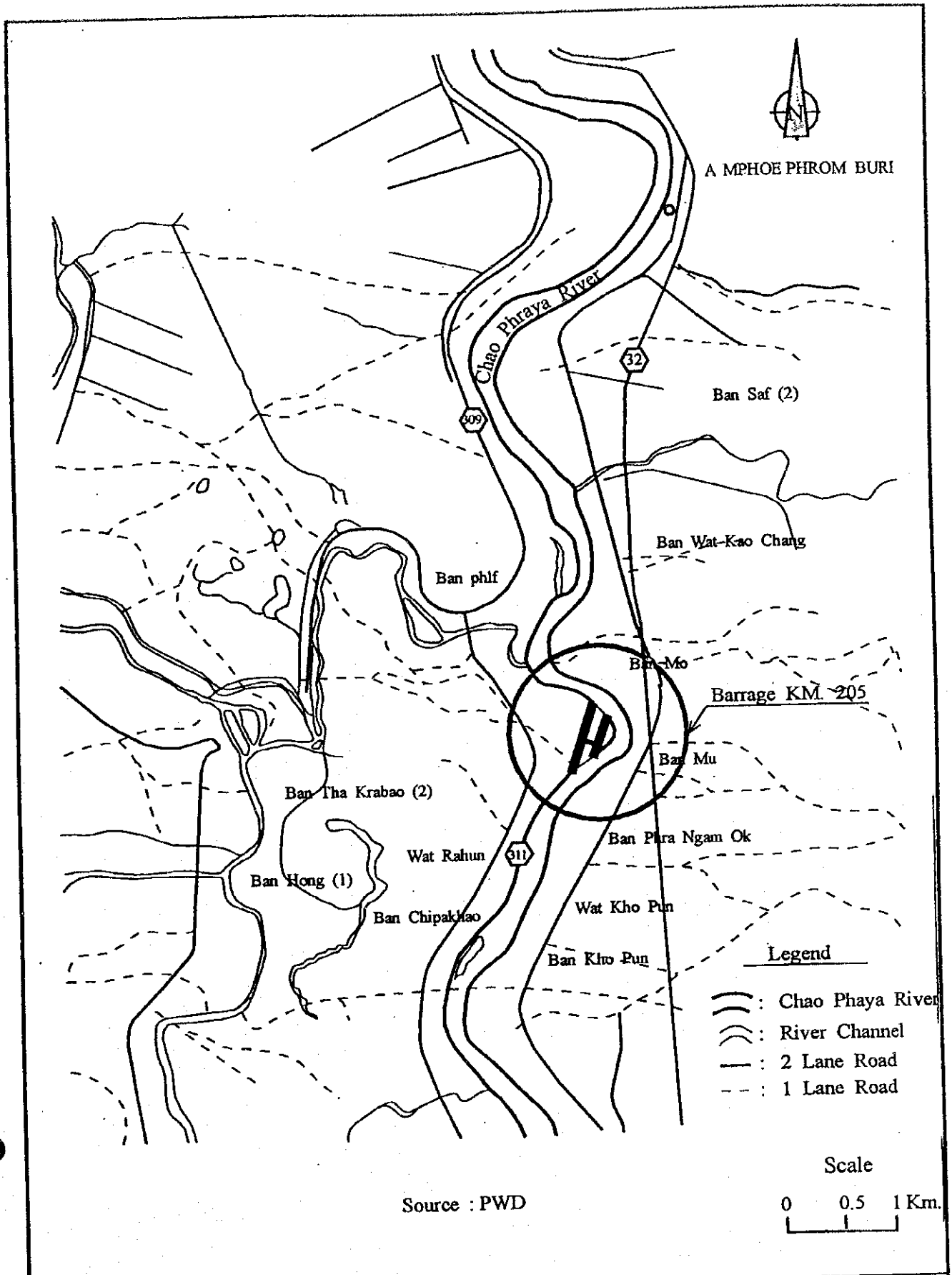
CTI ENGINEERING CO., LTD AND INA CORPORATION



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CTI ENGINEERING CO., LTD AND INA CORPORATION

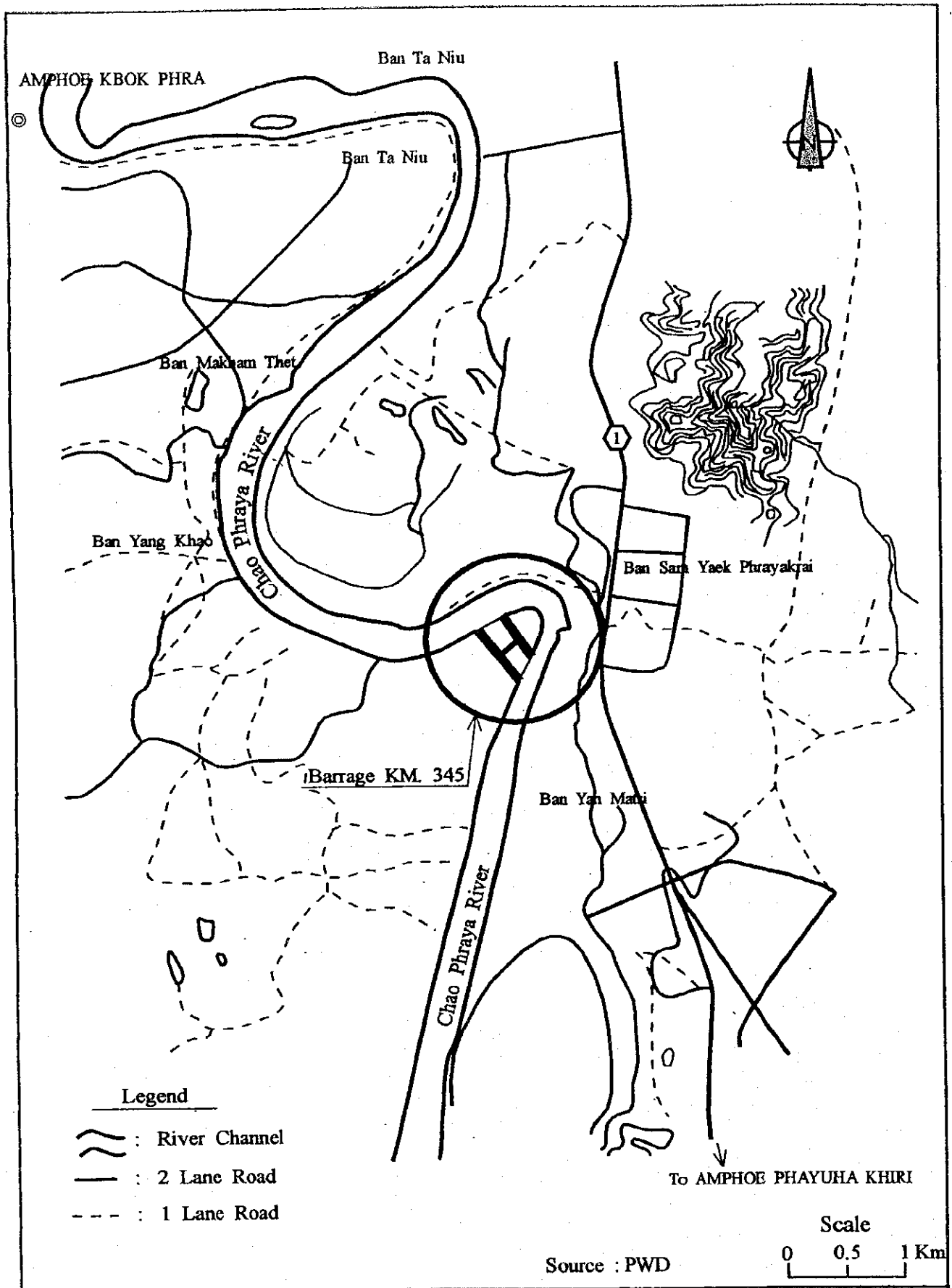
**Fig.1.4.18 (2/2)**  
**LOCATION OF EXISTING AND PROPOSED WEIR / BARRAGE / REGULATORS (2/2)**



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN  
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Fig.1.4.19  
 LOCATION OF BARRAGE KM. AT 205



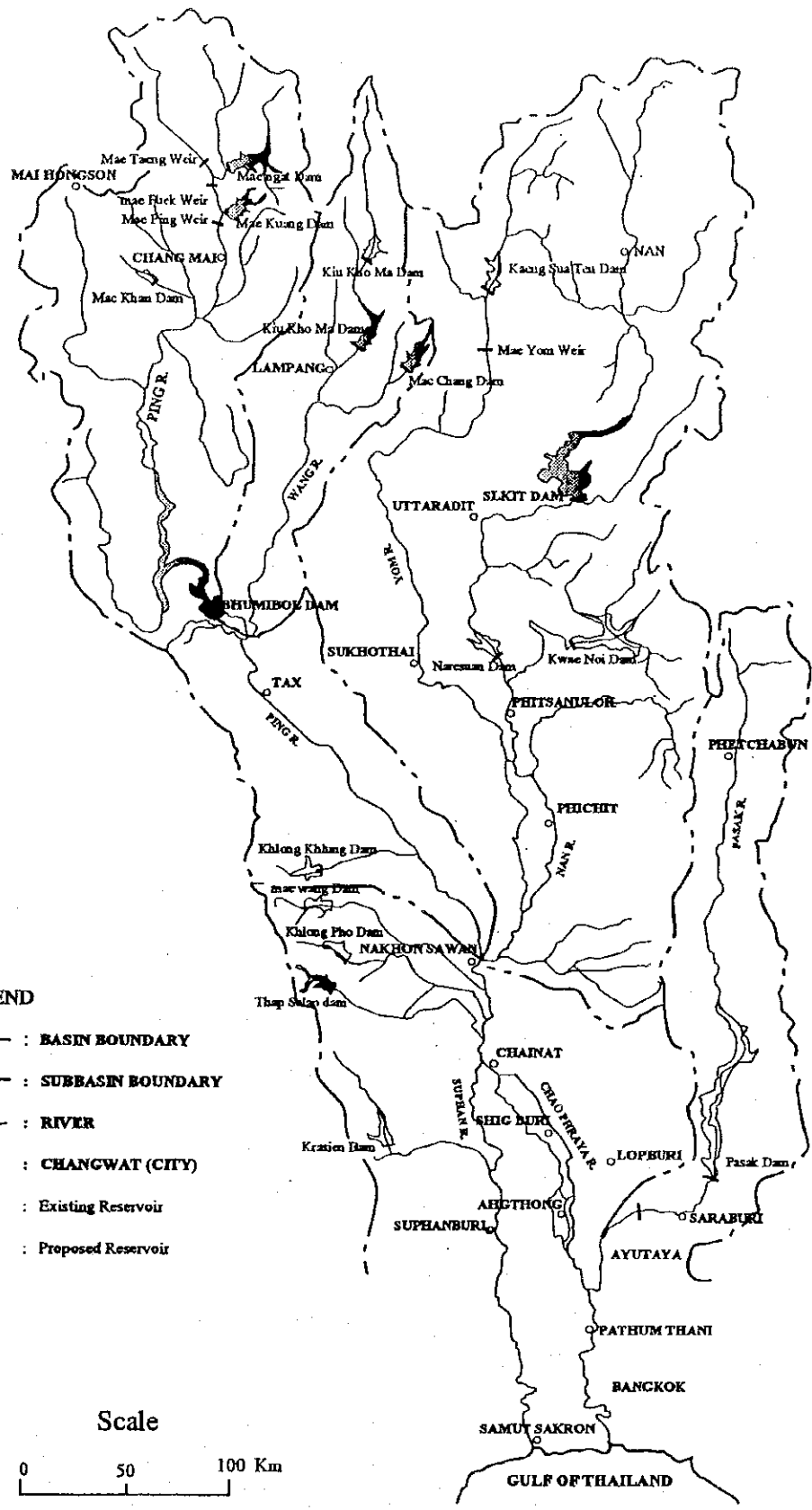


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.1.4.20

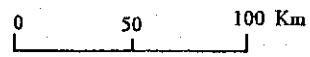
LOCATION OF BARRAGE AT KM.345



**LEGEND**

- — — — — : BASIN BOUNDARY
- - - - - : SUBBASIN BOUNDARY
- ~~~~~ : RIVER
- o : CHANGWAT (CITY)
- ▬ : Existing Reservoir
- ▭ : Proposed Reservoir

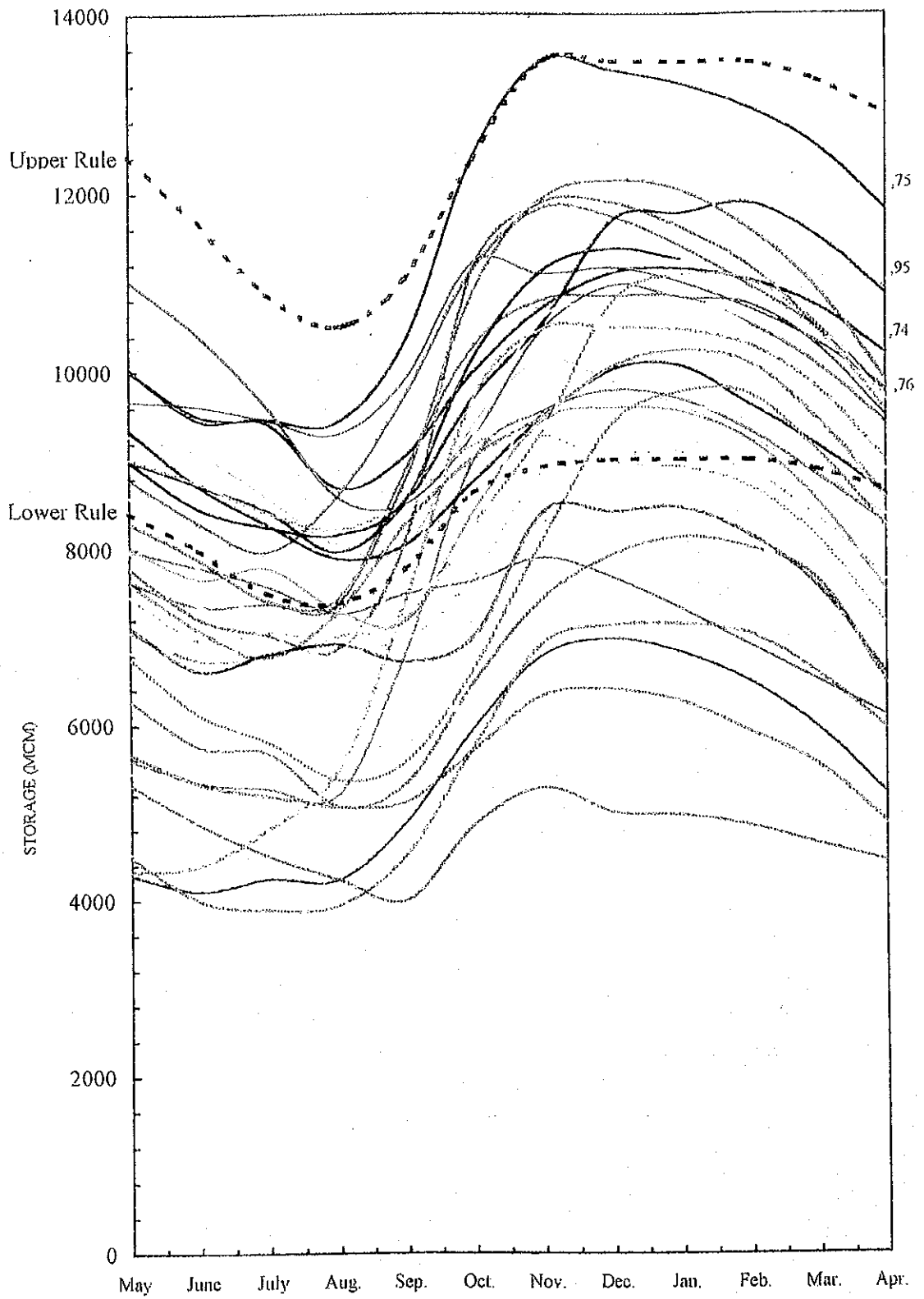
**Scale**



**STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN**  
 CTI ENGINEERING CO., LTD AND INA CORPORATION

**Fig.1.5.1 LOCATION OF EXISTING/ PROPOSED DAMS IN THE CHAO PHRAYA BASIN**

BHUMIBOL RESERVOIR OPERATION



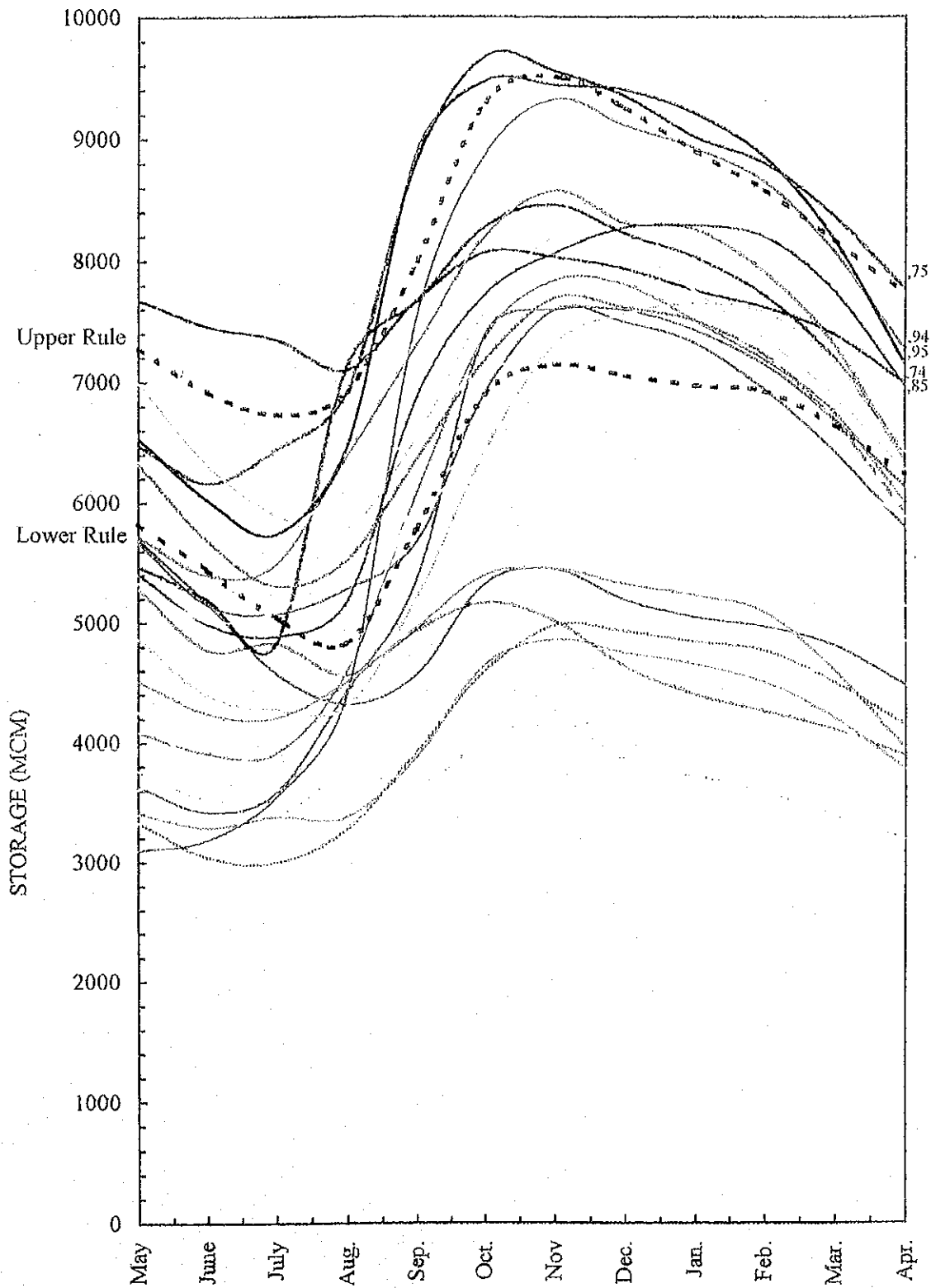
STUDY ON INTEGRATED PLAN FOR FLOOD  
MITIGATION IN CHAO PHRAYA RIVER BASIN

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**Fig.1.5.2**

BHUMIBOL RESERVOIR OPERATION

### SIRIKIT RESERVOIR OPERATION

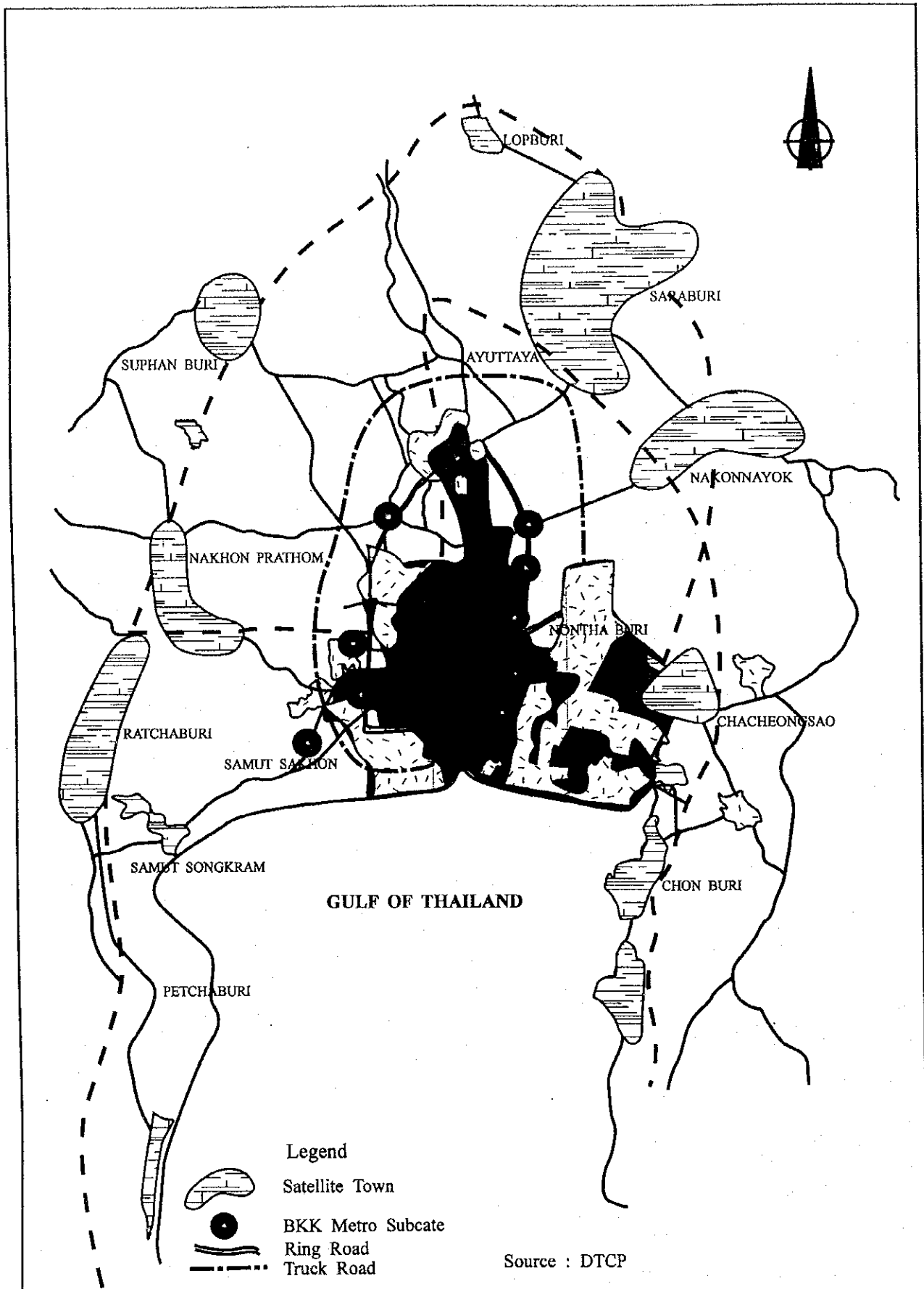


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.1.5.3

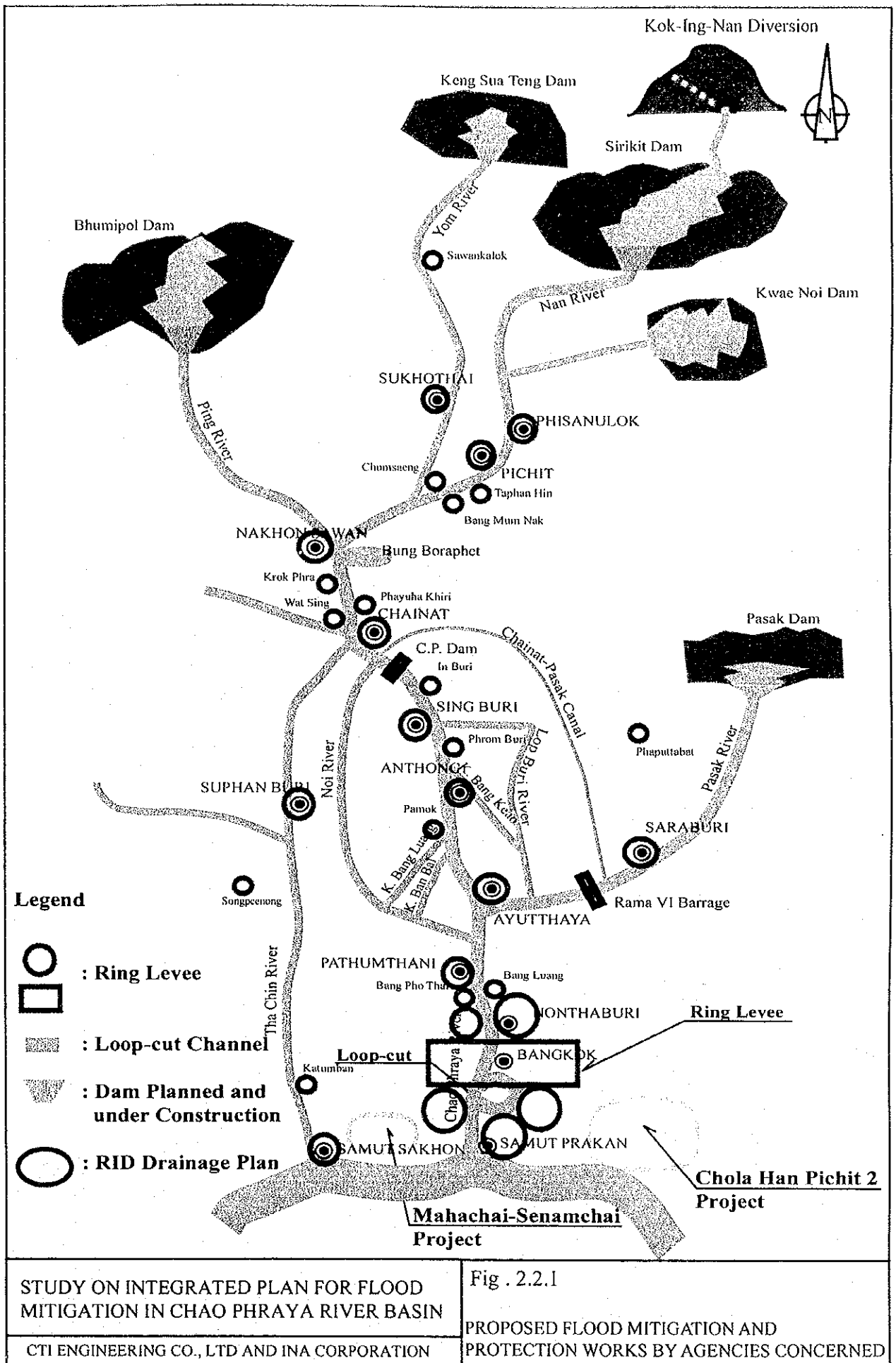
SIRIKIT RESERVOIR OPERATION



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig . 1.5.4 RING ROAD AND TRUCK ROUTE

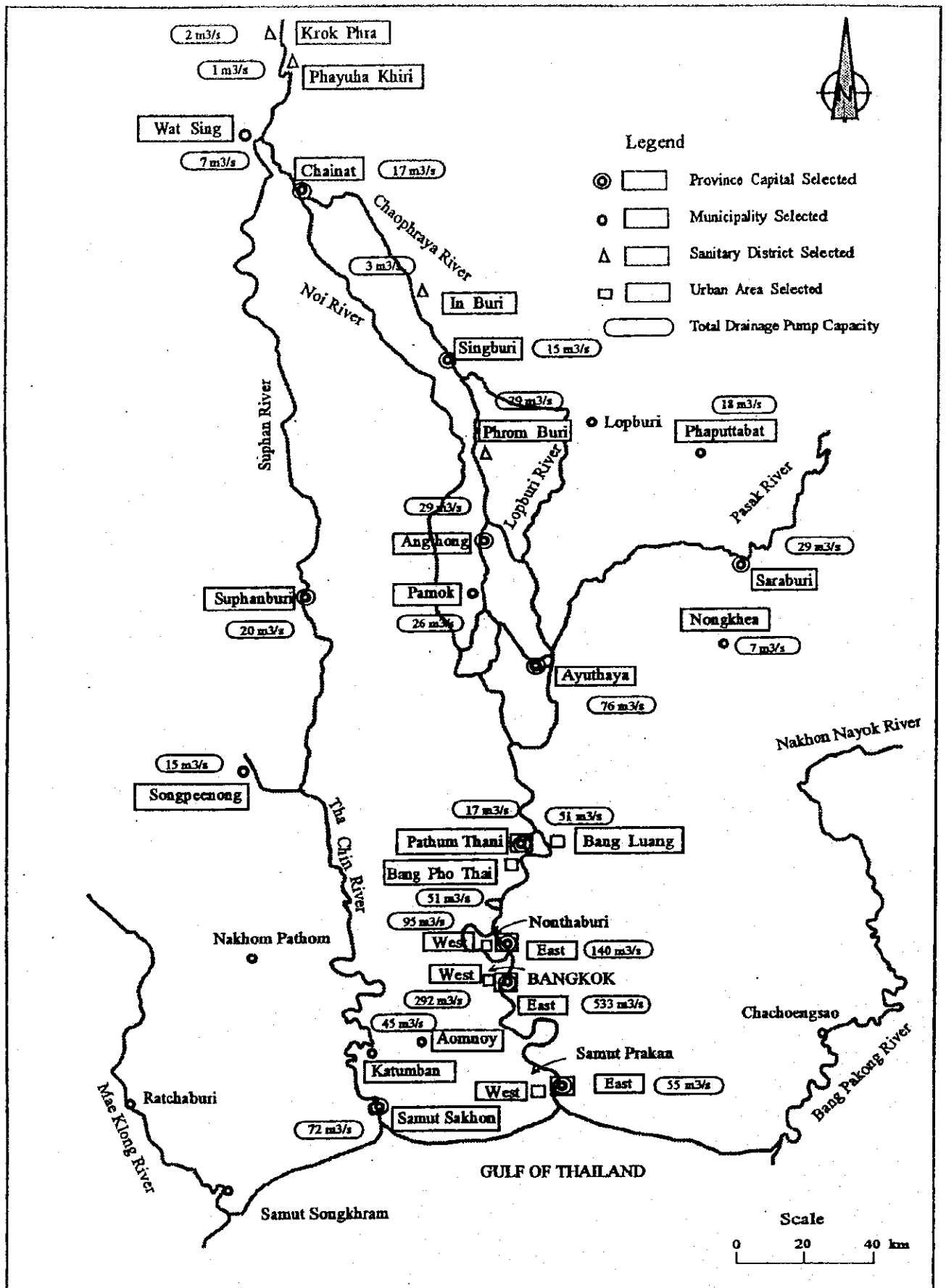


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

Fig. 2.2.1

CTI ENGINEERING CO., LTD AND INA CORPORATION

PROPOSED FLOOD MITIGATION AND PROTECTION WORKS BY AGENCIES CONCERNED

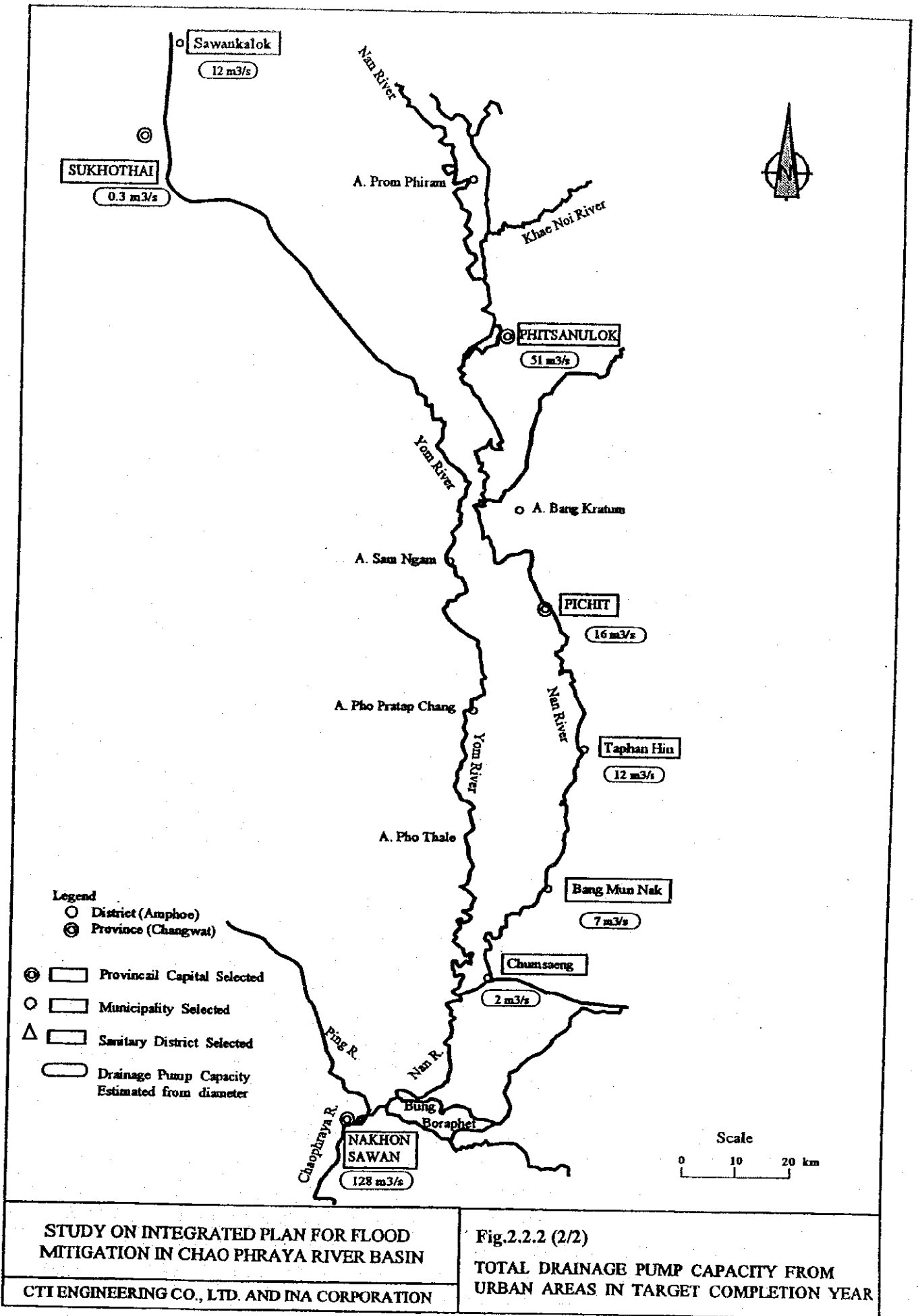


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig.2.2.2 (1/2)

TOTAL DRAINAGE PUMP CAPACITY FROM URBAN AREAS IN TARGET COMPLETION YEAR



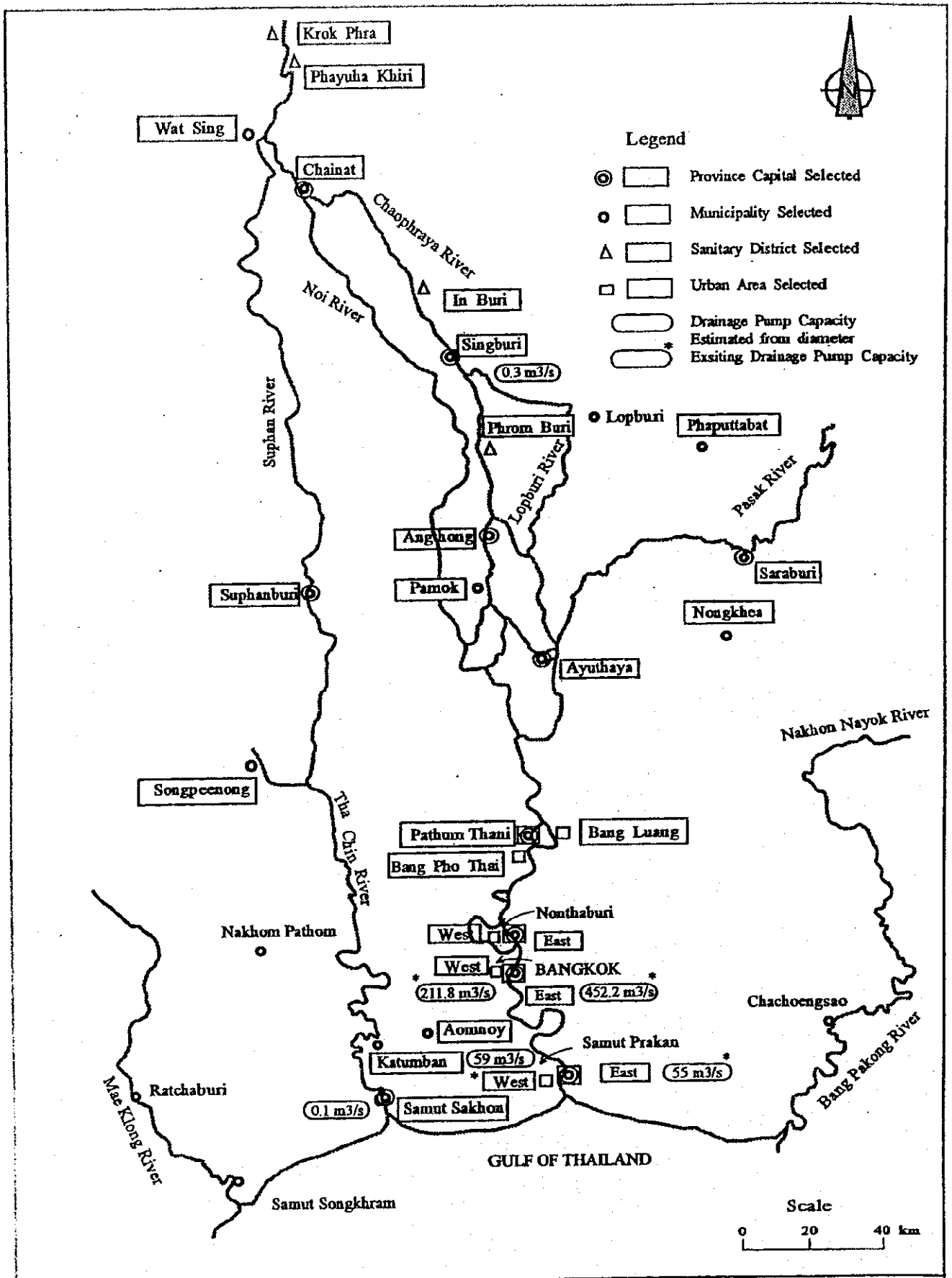
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

Fig.2.2.2 (2/2)

TOTAL DRAINAGE PUMP CAPACITY FROM URBAN AREAS IN TARGET COMPLETION YEAR

CTI ENGINEERING CO., LTD. AND INA CORPORATION



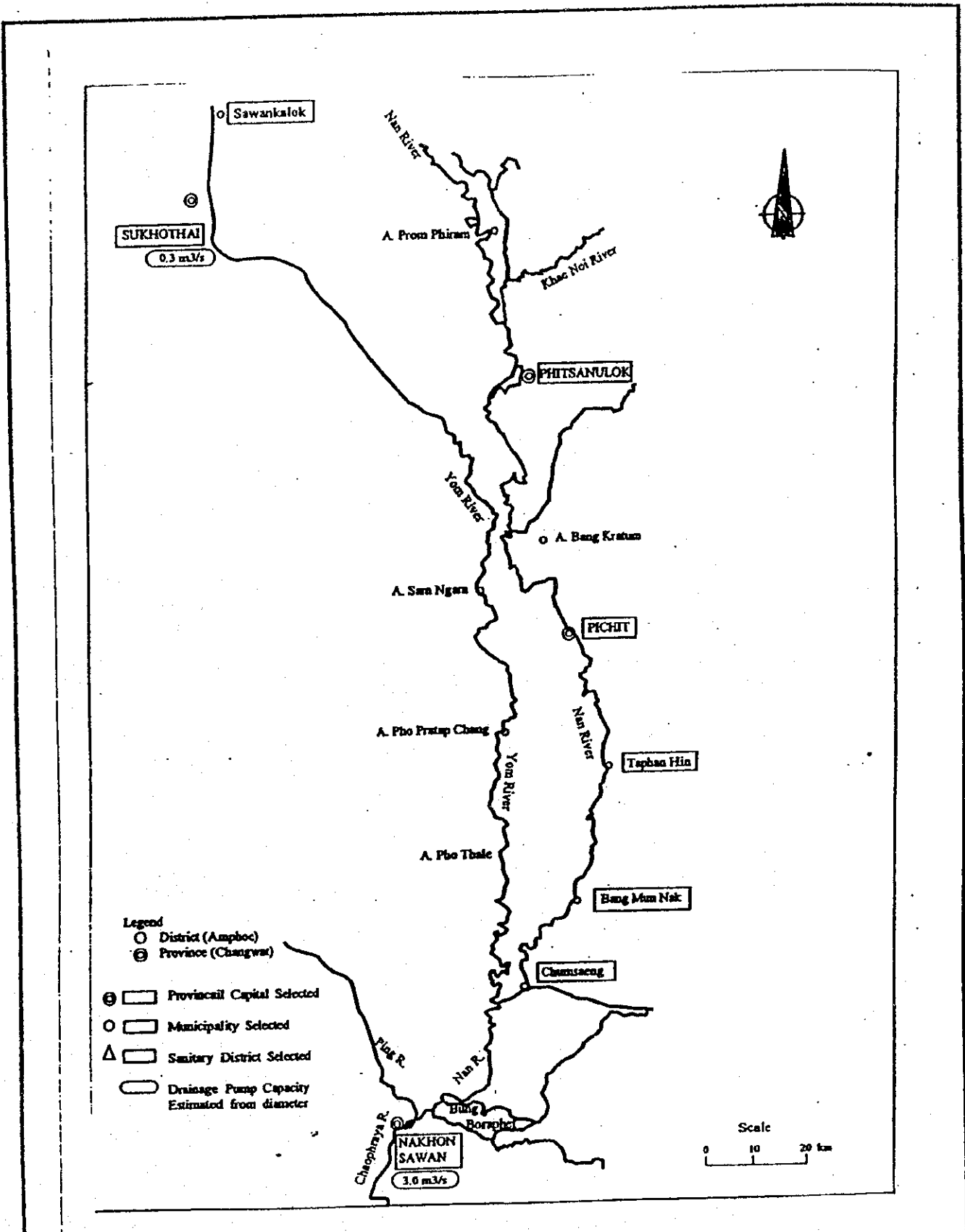


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig.2.2.3 (1/2)

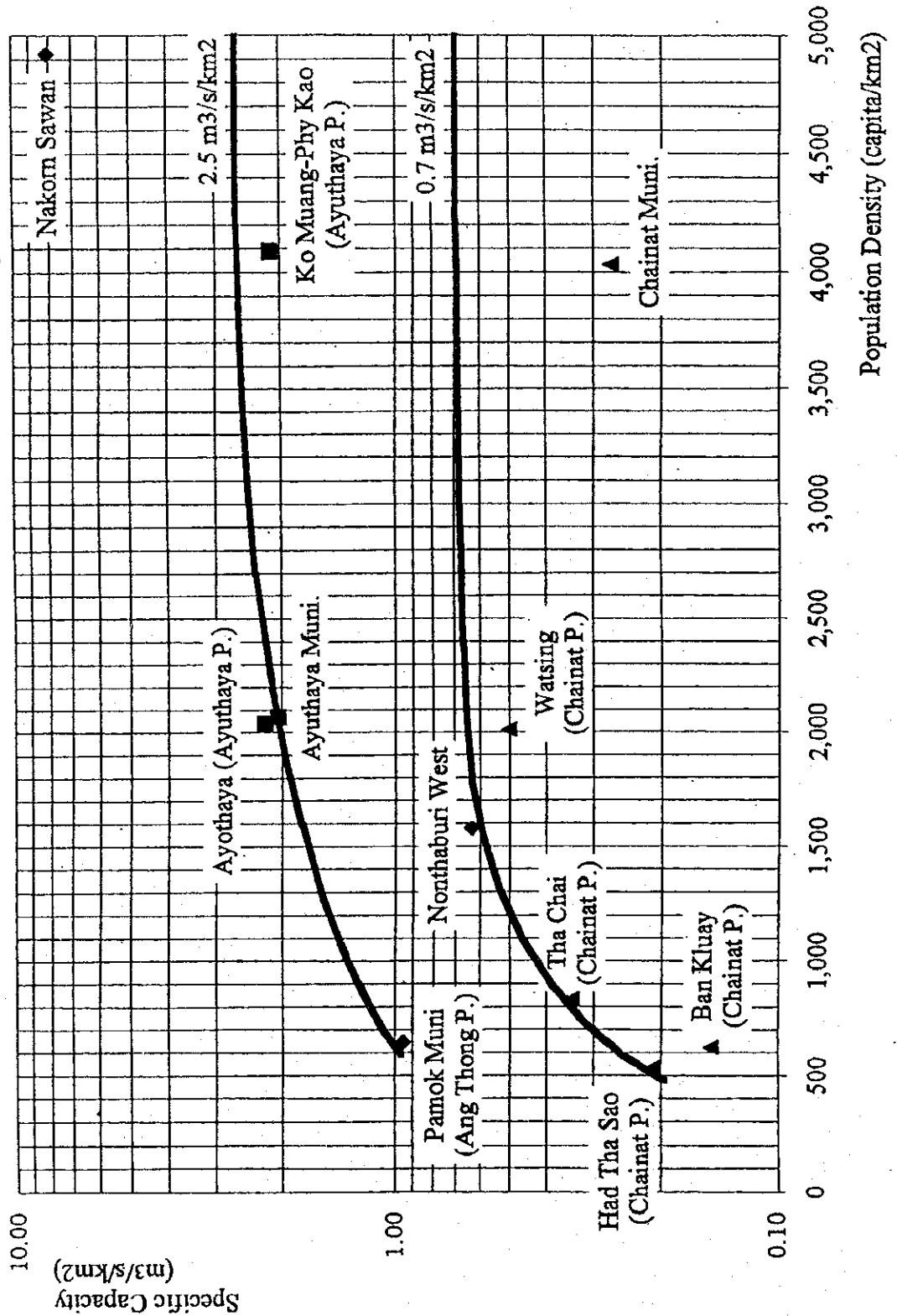
EXISTING DRAINAGE PUMP CAPACITY FROM URBAN AREAS



**STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN**

**Fig.2.2.3 (2/2) EXISTING DRAINAGE PUMP CAPACITY FROM URBAN AREAS**

CTI ENGINEERING CO., LTD AND INA CORPORATION

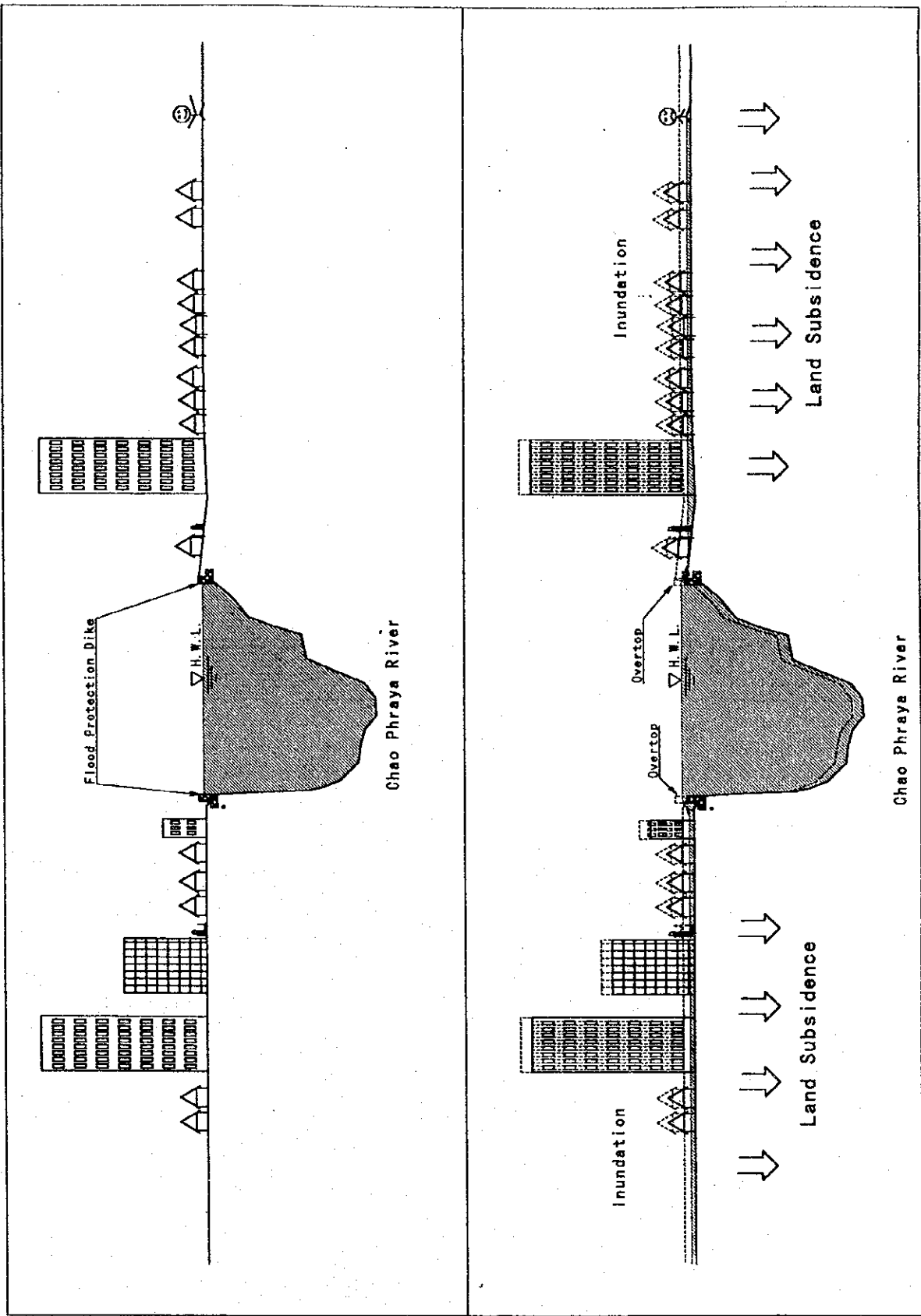


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Fig.2.2.4

SPECIFIC DRAINAGE CAPACITY PER POPULATION DENSITY

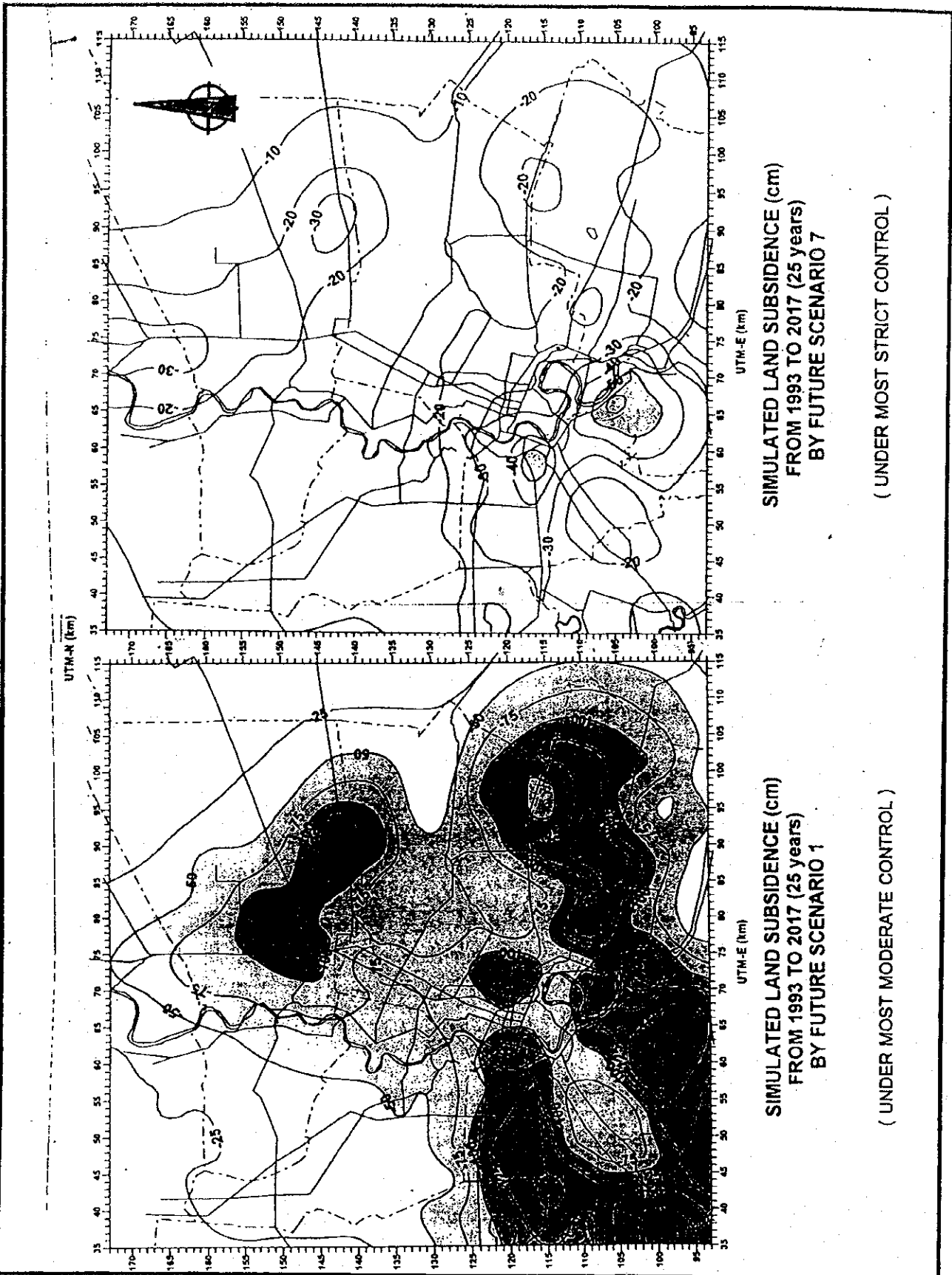


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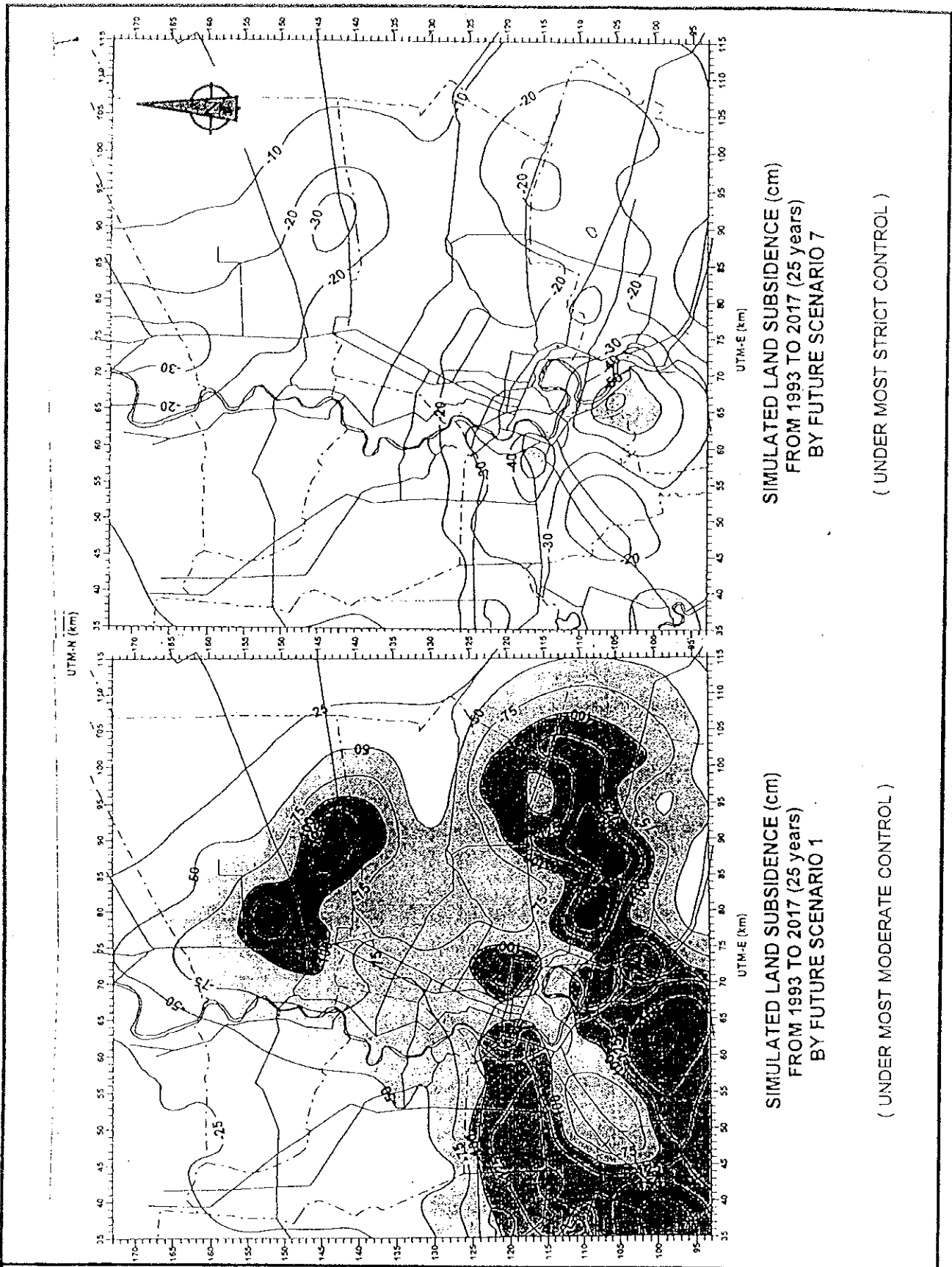
Fig.2.2.5

INFLUENCE WHICH BE CAUSED BY LAND SUBSIDENCE



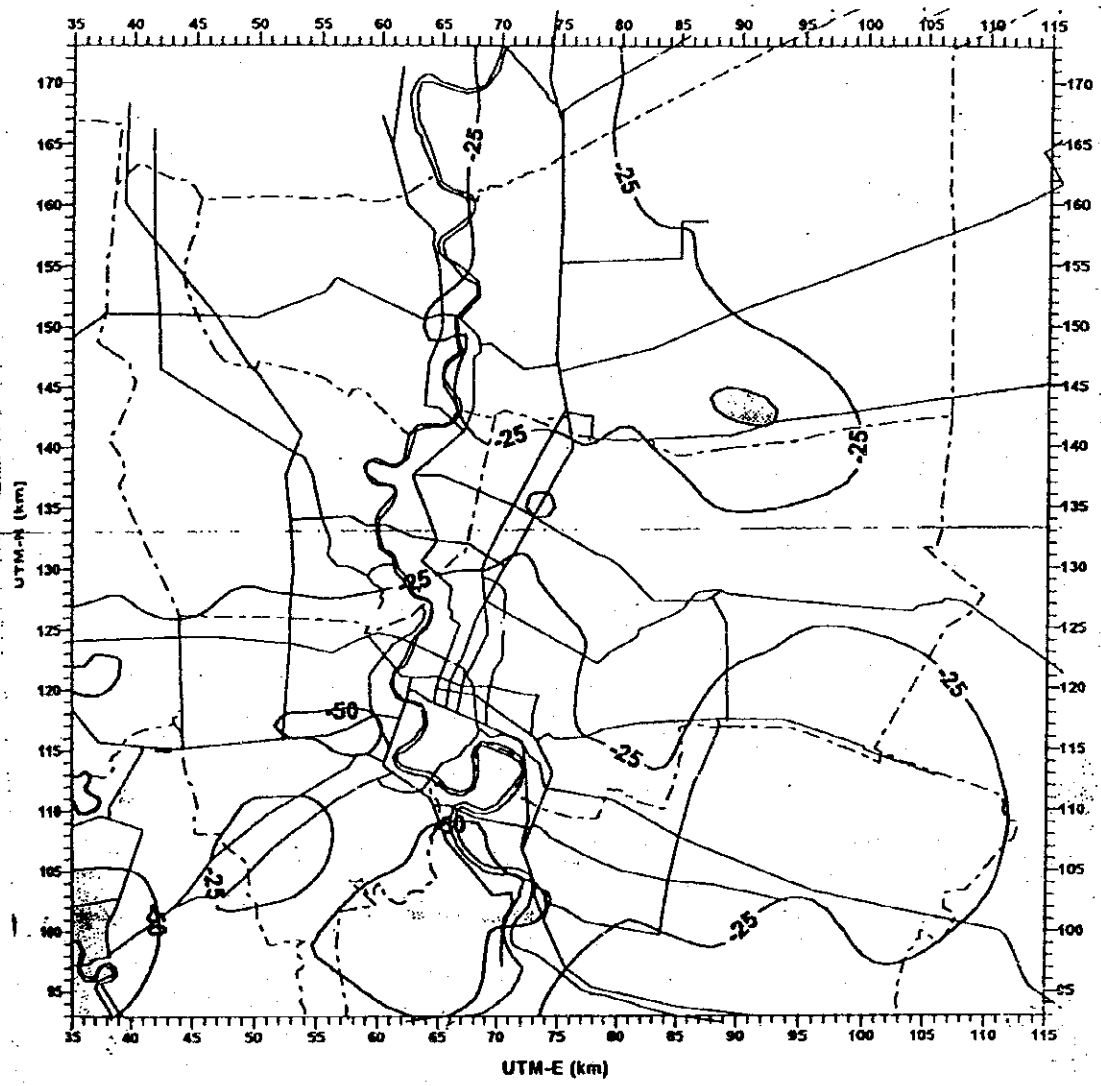
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Fig.2.2.6 (1/2)  
 SIMULATED LAND SUBSIDENCE BY FUTURE SCENARIO



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Fig.2.2.6 (1/2)  
 SIMULATED LAND SUBSIDENCE BY FUTURE SCENARIO



**SIMULATED LAND SUBSIDENCE (cm)  
FROM 1993 TO 2017 (25 years)  
BY FUTURE SCENARIO 5B**

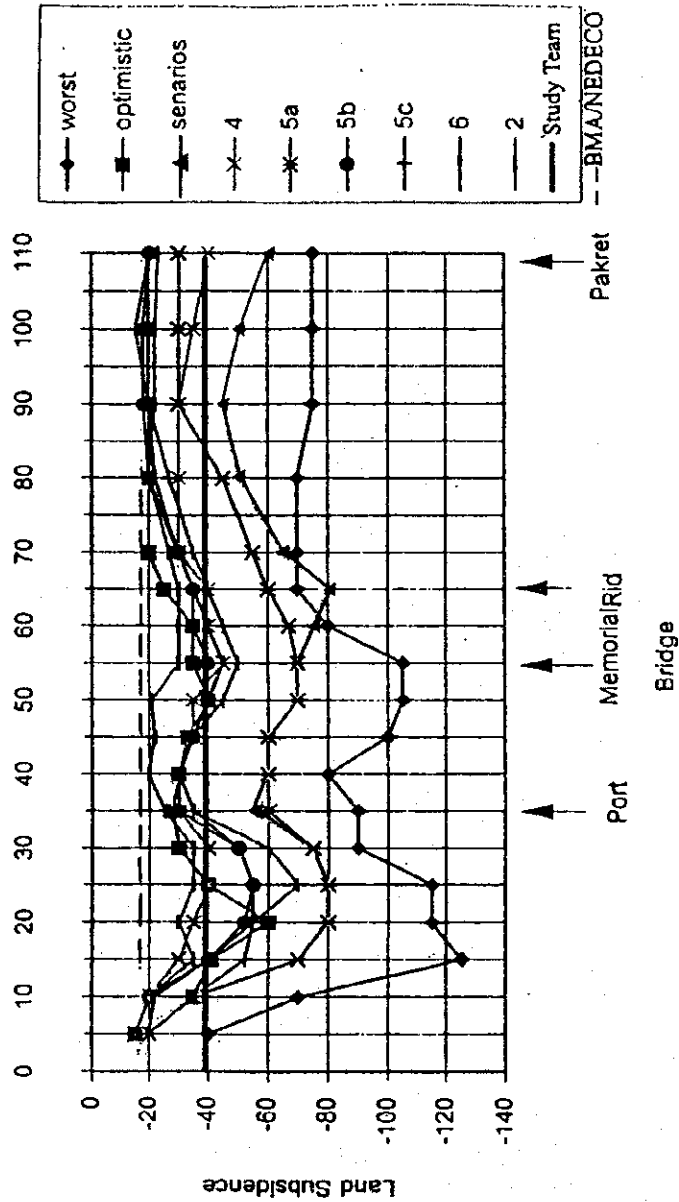
( UNDER MODERATE CONTROL IN 2017 )

Source : KOKUSAI, Jica (1995)

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MITIGATION IN CHAO PHRAYA RIVER BASIN  
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Fig.2.2.6 (2/2)  
SIMULATED LAND SUBSIDENCE BY FEATURE  
SCENARIO

Land Subsidence in 2017 Along Chao Phraya River



Source: JICA / Kokusai, 1995  
BMA / NEDECO, 1996

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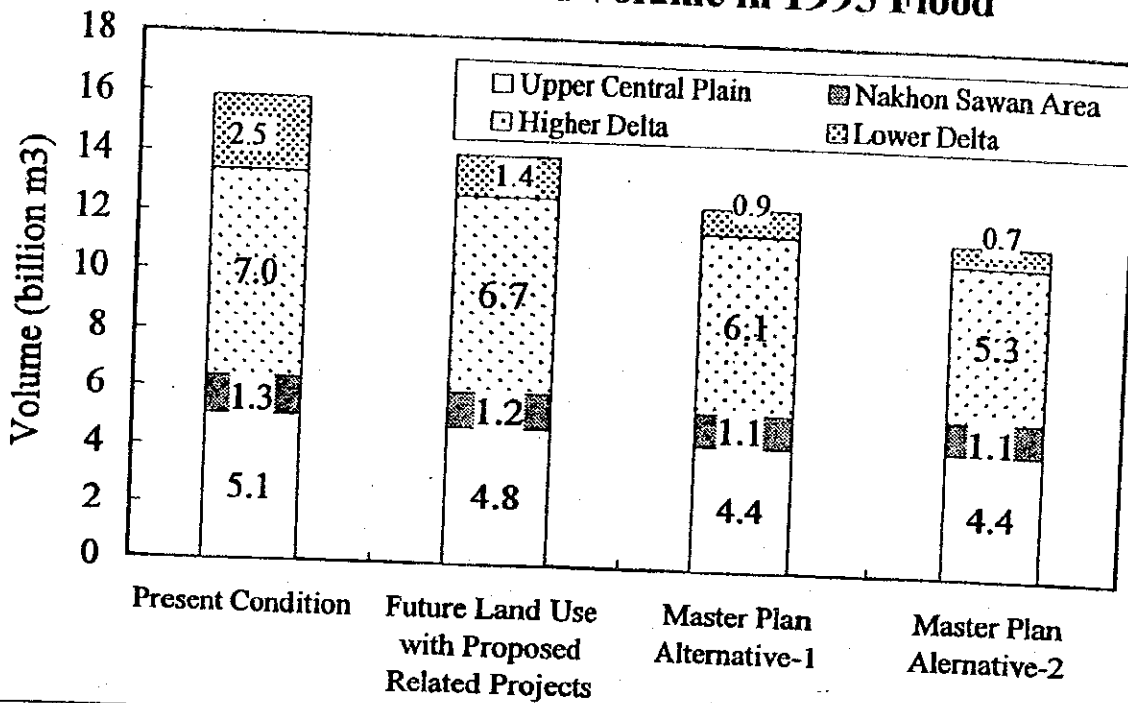
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Fig.2.2.7

ESTIMATED LAND SUBSIDENCE IN 2017 ALONG CHAO PHRAYA RIVER



### Inundation Volume in 1995 Flood



### Flood Damage in 1995 Flood

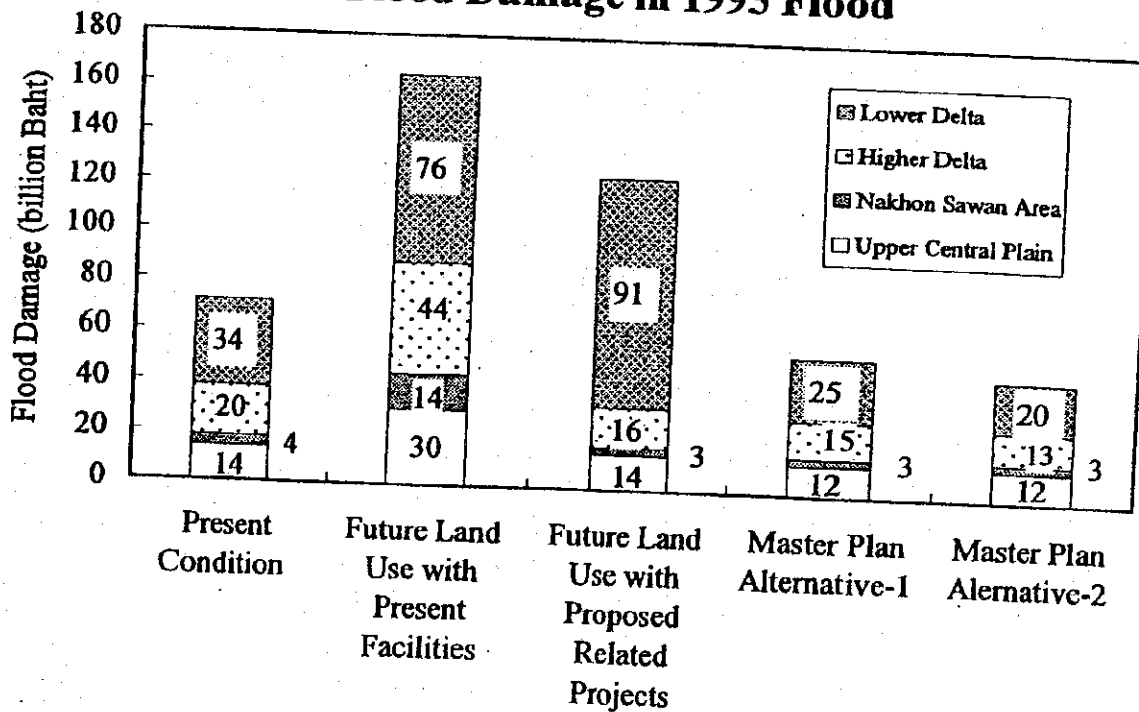
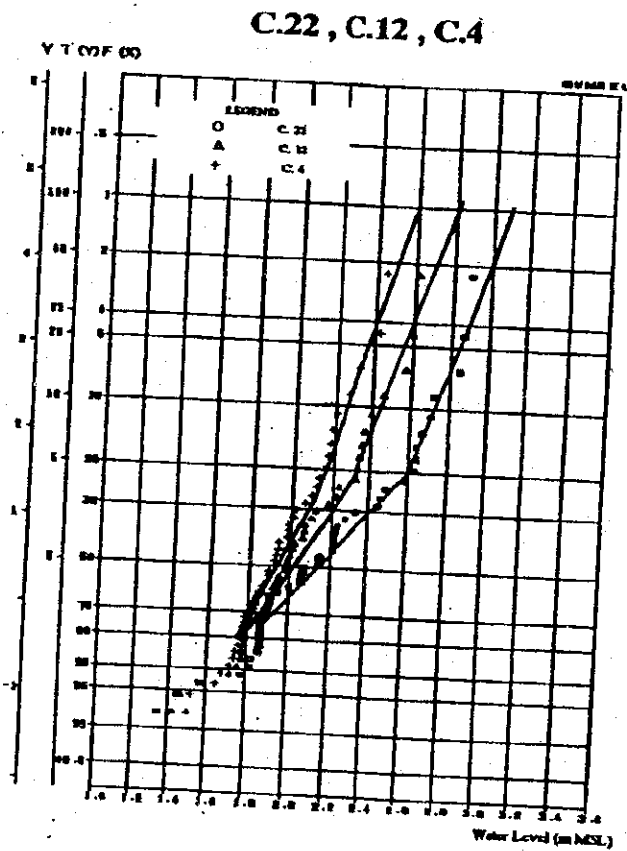


Fig.2.2.8 CHANGE OF INUNDATION VOLUME AND FLOOD DAMAGE

River	Station	Probable Maximum Water Level by Return Period(m MSL)					
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Chao Phraya	C.22(Pak Kret)	2.15	2.61	2.72	2.86	2.96	3.07
	C.12(Samsen)	2.00	2.34	2.45	2.60	2.70	2.80
	C.4(Mem.Bridge)	1.92	2.16	2.25	2.39	2.48	2.57



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MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.2.2.9

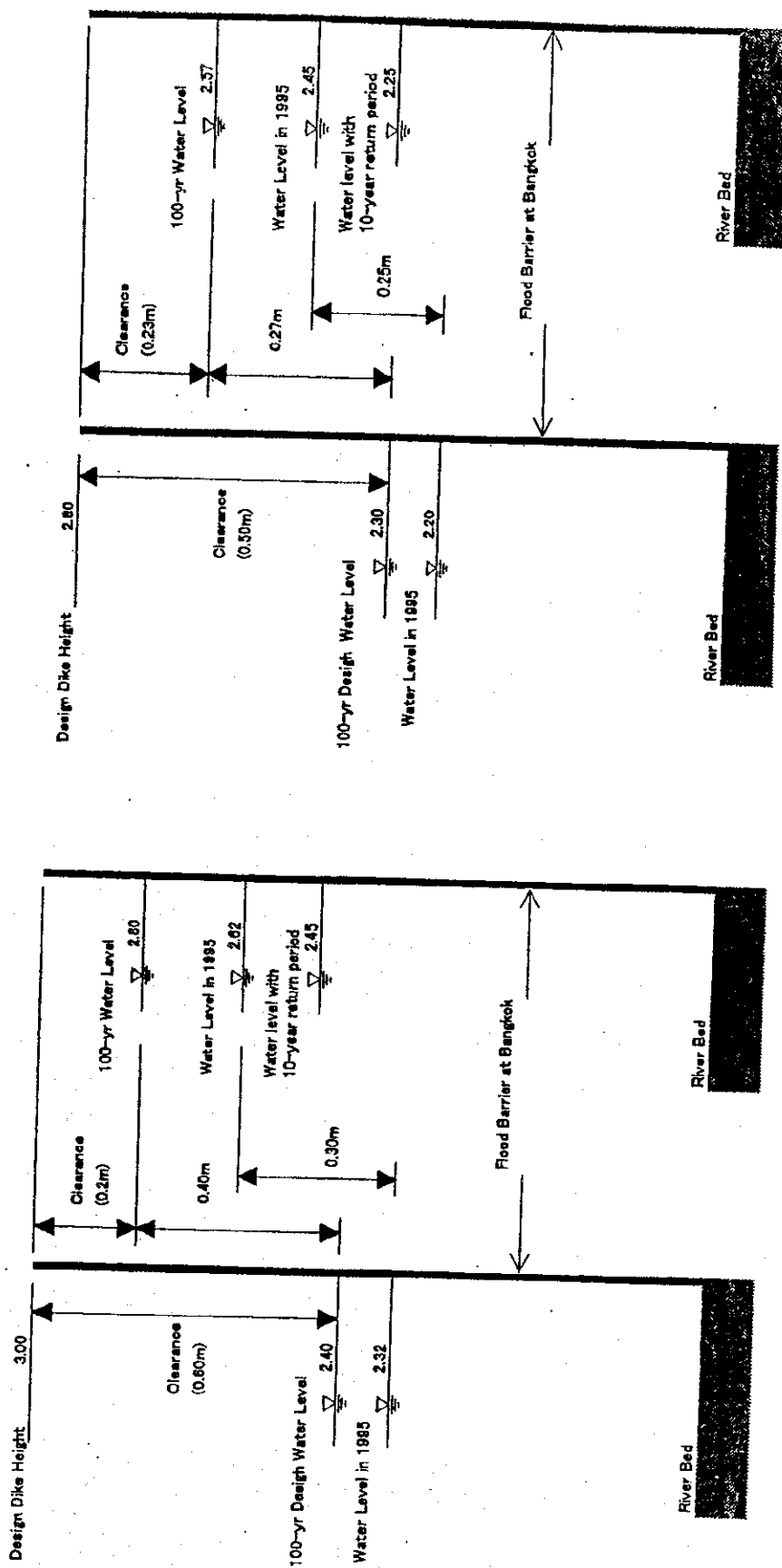
PROVABLE MAXIMUM WATER LEVEL IN  
FUTURE BASIN CONDITION

Future Basin Condition

Present Condition

Future Basin Condition

Present Condition



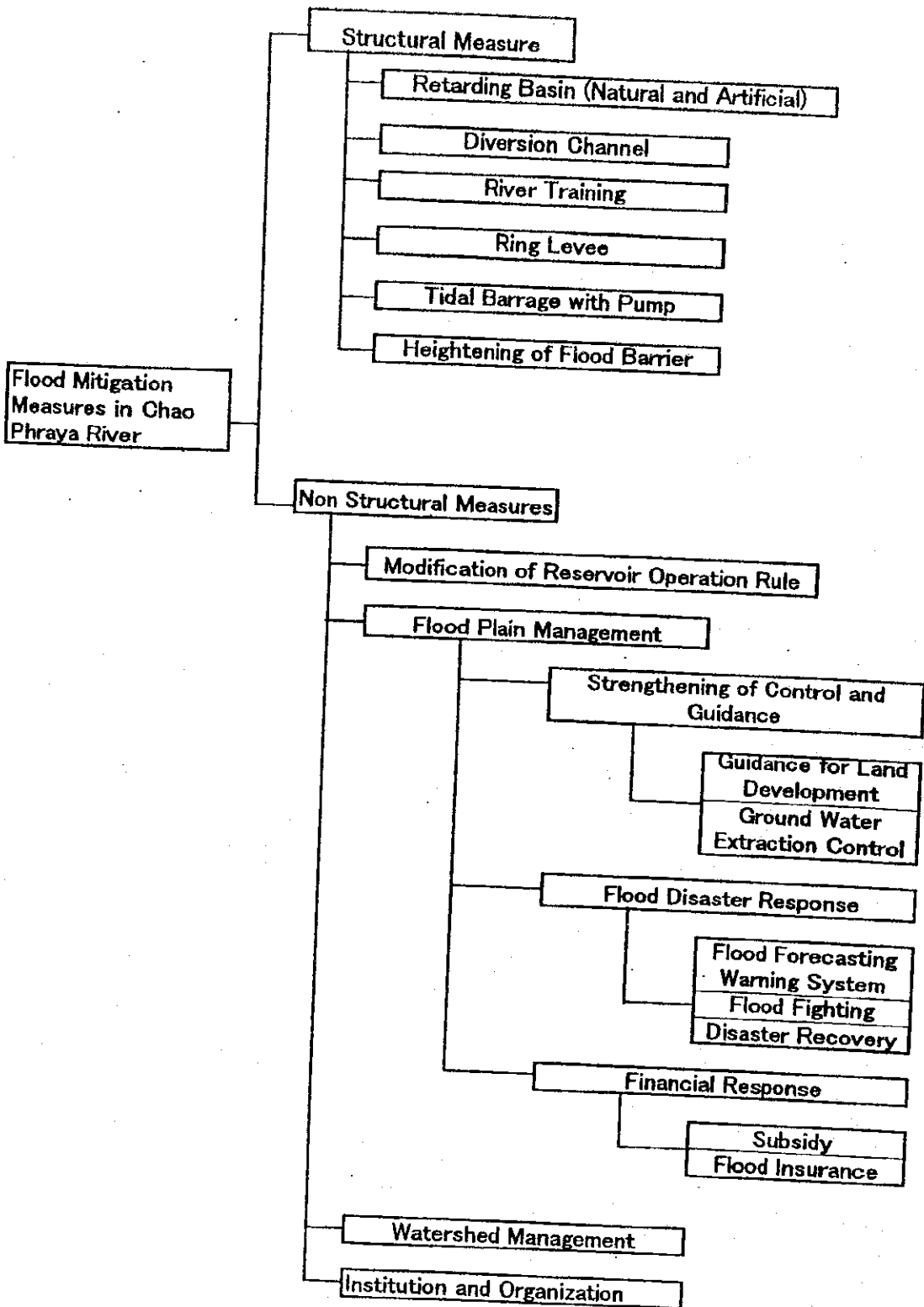
Memorial Bridge (C.4)

Samsen (C.12)

unit : (m MSC)

STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN  
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Fig.2.2.10  
INFLUENCE TO WATER LEVEL IN BANGKOK BY FUTURE DEVELOPMENT

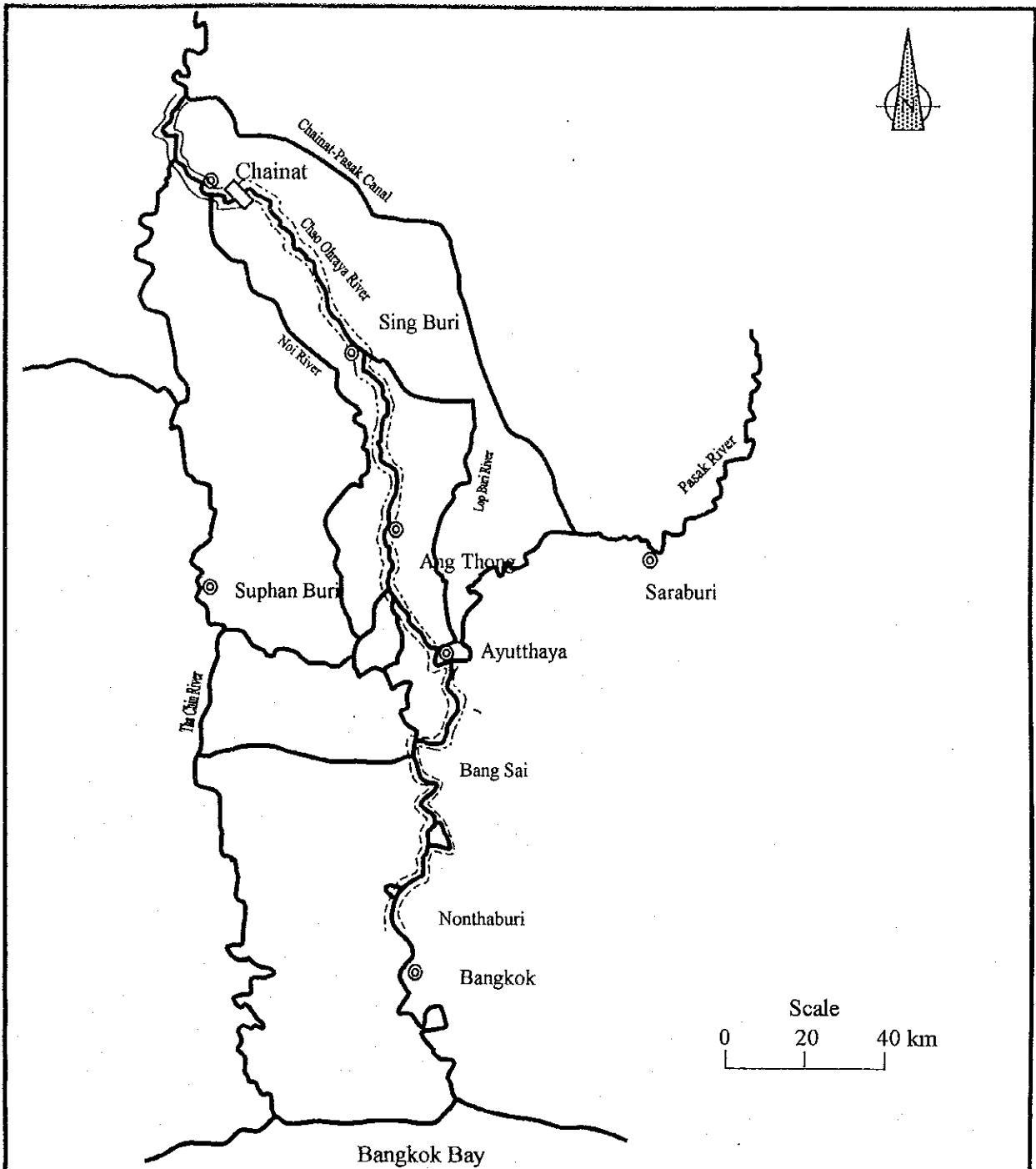


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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Fig.2.4.1

CONCEIVABLE MEASURES FOR COMPREHENSIVE FLOOD MITIGATION IN THE CHAO PHRAYA



River Improvement of Chao Phraya River

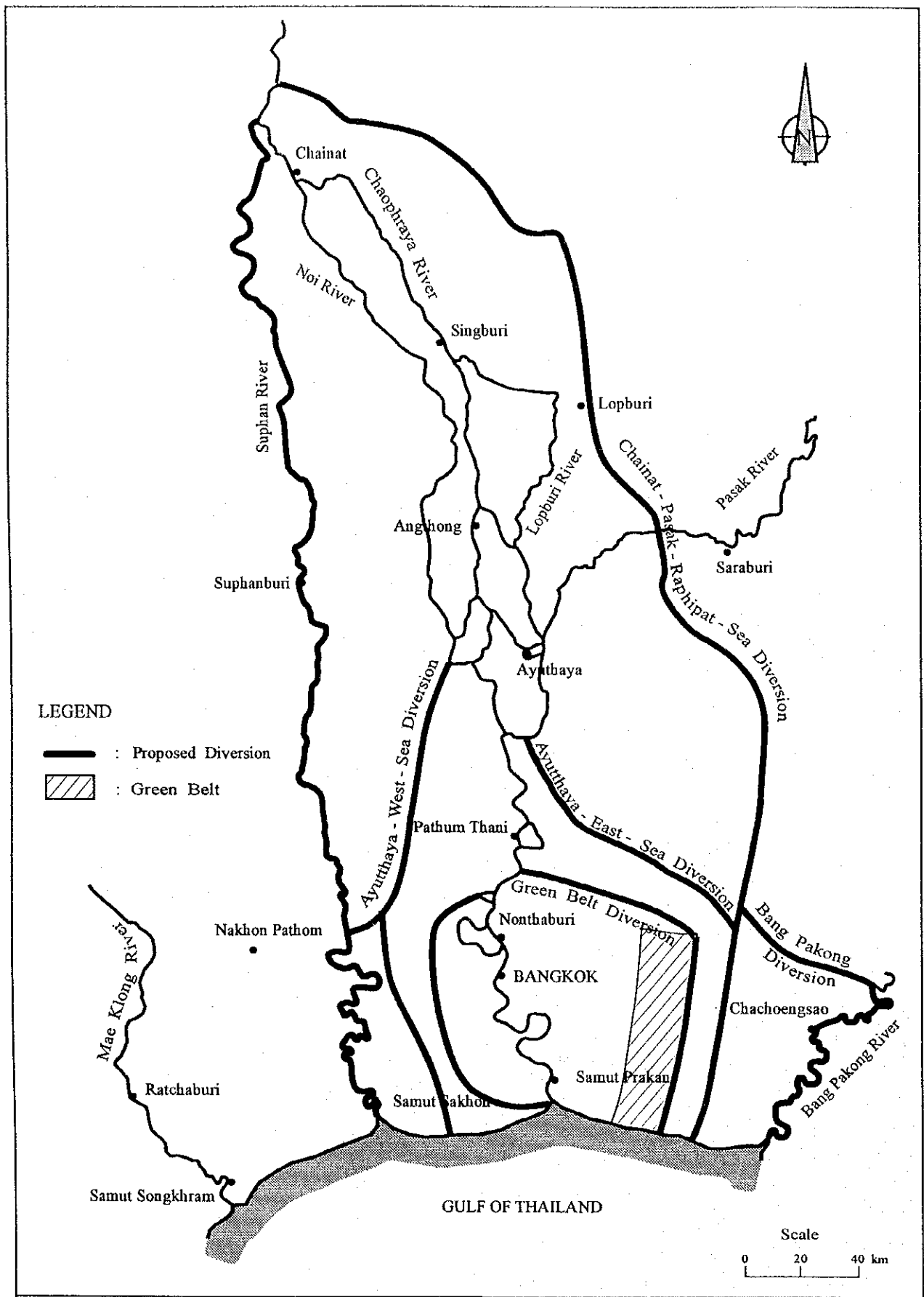
Line	Improvement Section		Provability	Design Crown Level (MSL)	Line	Improvement Section		Provability	Design Crown Level (MSL)
	Downstream	Upstream				Downstream	Upstream		
————	CP. Dam	Manorom	25-year	17.0 - 21.0	————	CP. Dam	Manorom	25-year	17.0 - 21.0
-----	Ayutthaya	CP. Dam	25-year	5.8 - 17.0	-----	Sing Buri	CP. Dam	25-year	12.0 - 17.0
-----	Bang Sai	Ayutthaya	25-year	4.2 - 5.0	-----	Ang Thong	Sing Buri	25-year	7.0 - 12.0
-----	Nonthaburi	Bang Sai	25-year	3.0 - 4.2	-----	Nonthaburi	Ang Thong	25-year	3.0 - 7.0

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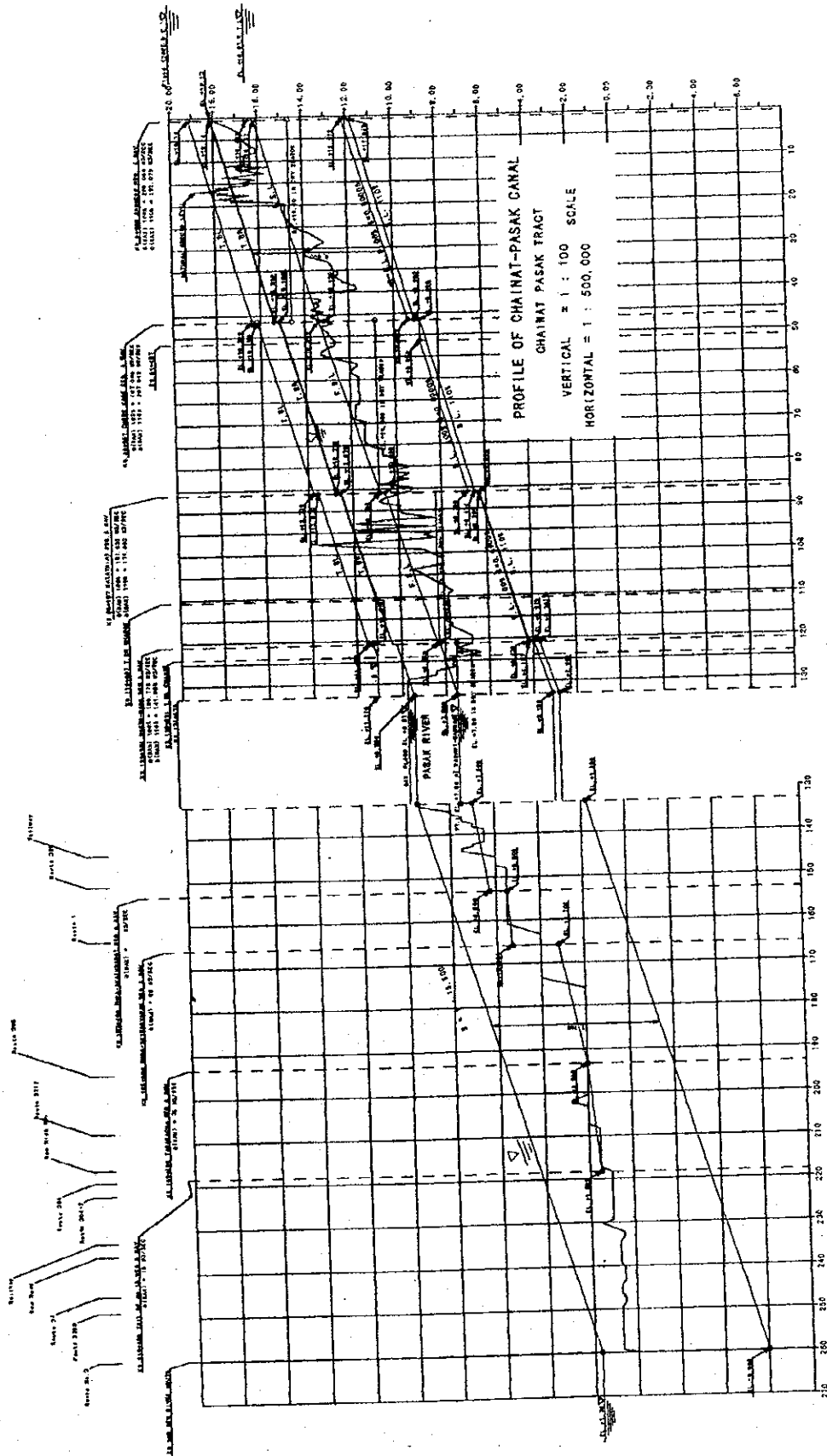
Fig.3.1.1

RIVER IMPROVEMENT OF RID



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Fig. 3.1.2  
 CONCEIVABLE DIVERSIONS CHANNEL ROUTES

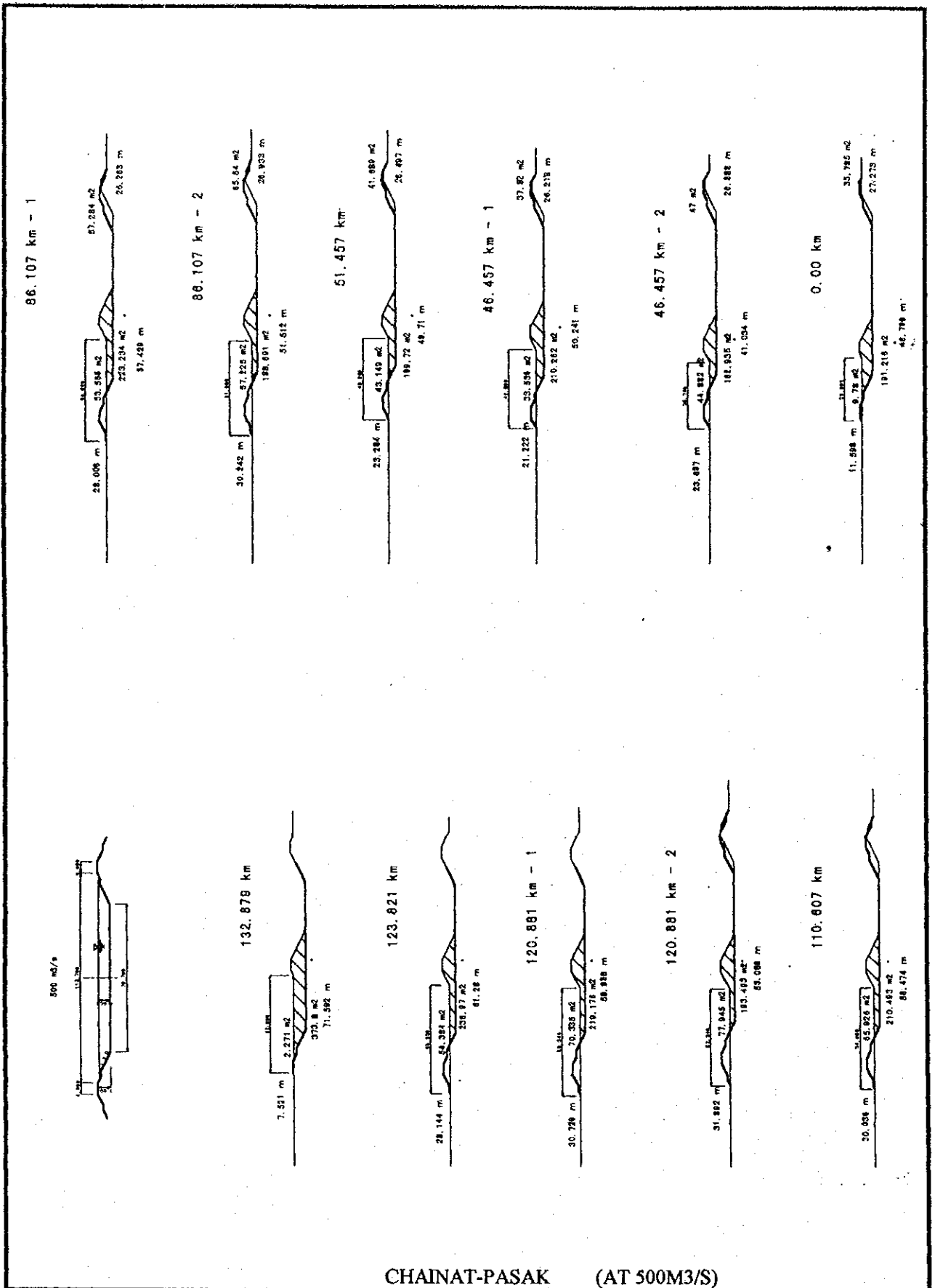


CHAINAT-PASAK-RAPHIPAT-SEA AS A SAMPLE

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Fig.3.1.3  
LONGITUDINAL PROFILE FOR PROPOSED DIVERSION



CHAINAT-PASAK (AT 500M3/S)

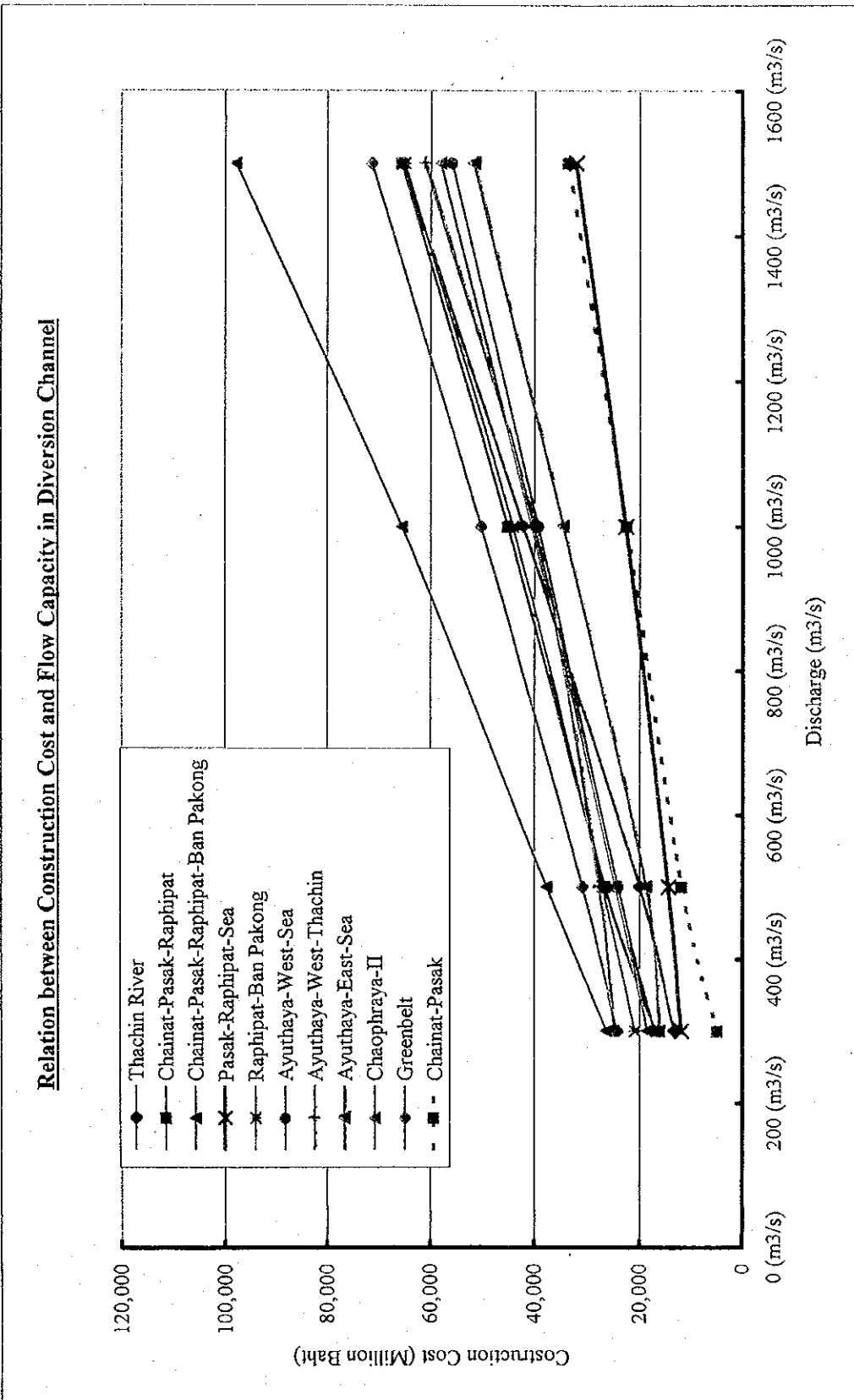
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

Fig.3.1.4

CROSS SECTION FOR PROPOSED DIVERSION

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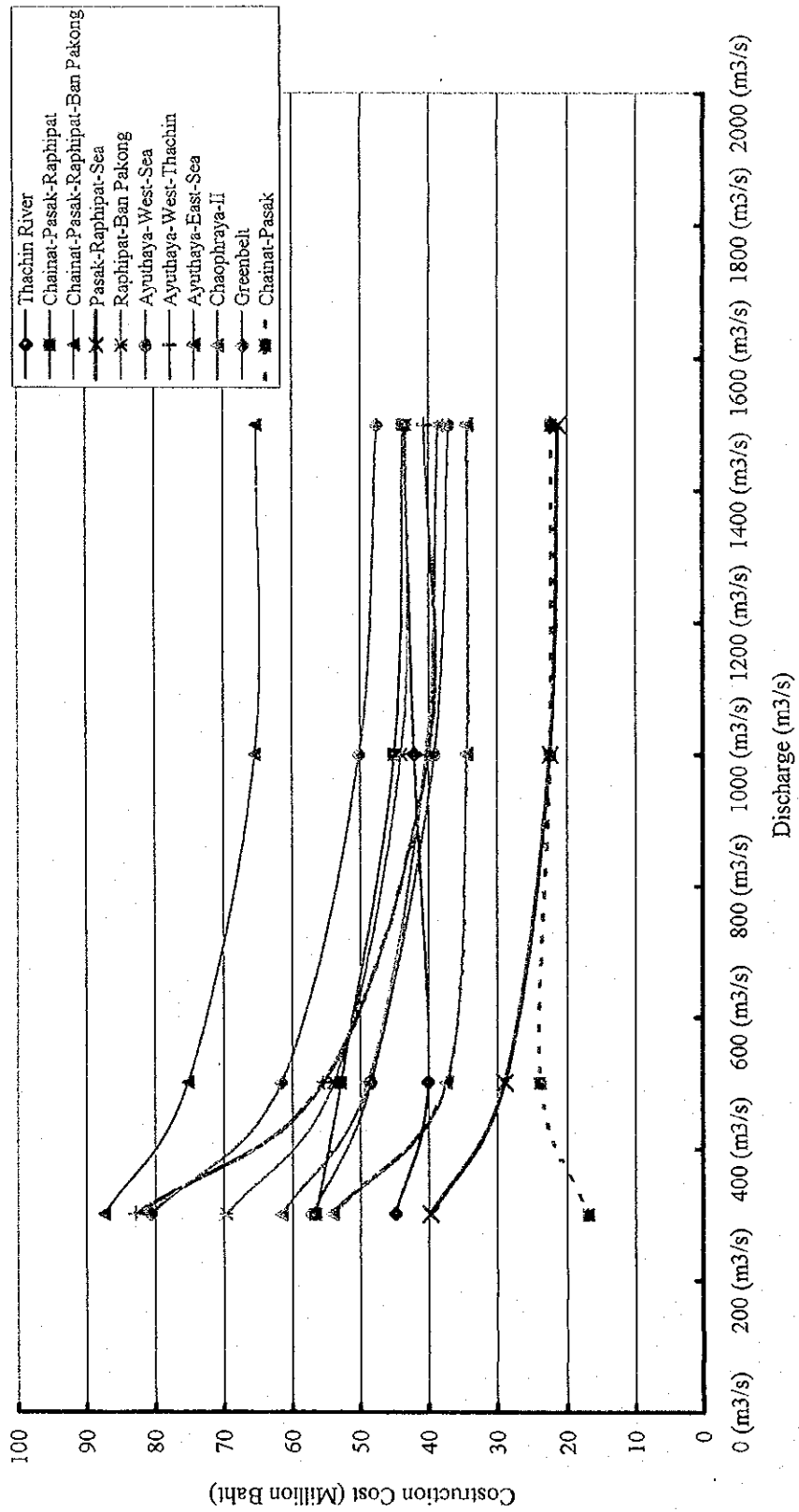
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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**Fig.3.1.5**

RELATION BETWEEN CONSTRUCTION COST AND DIVERSION CAPACITY

**Construction Cost Curve per 1.0m<sup>3</sup>/s of Proposed Diversion Channels**

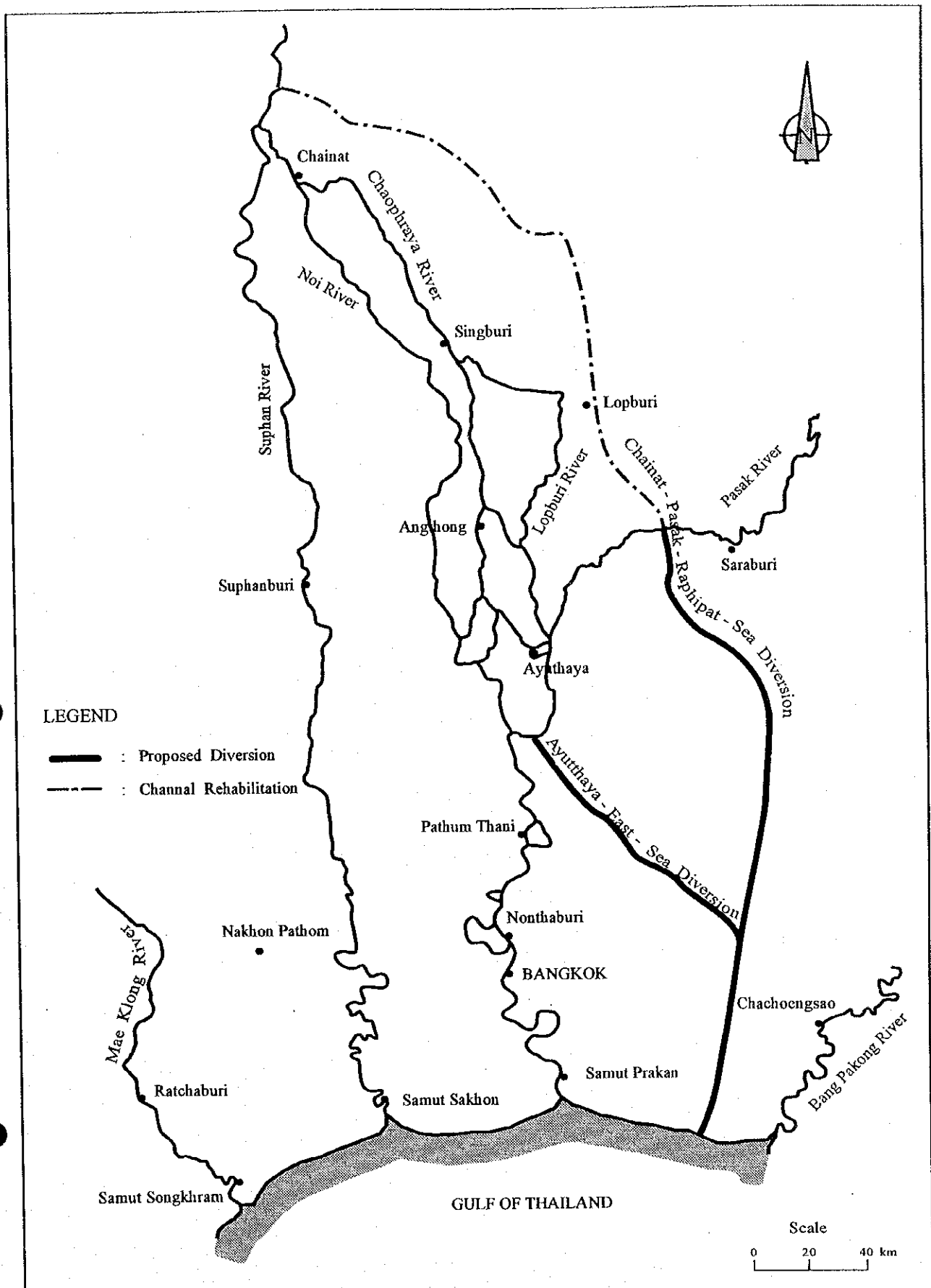


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**Fig.3.1.6**

CONSTRUCTION COST CURVE PER 1.0 M<sup>3</sup>/S OF DIVERSION ROUTES

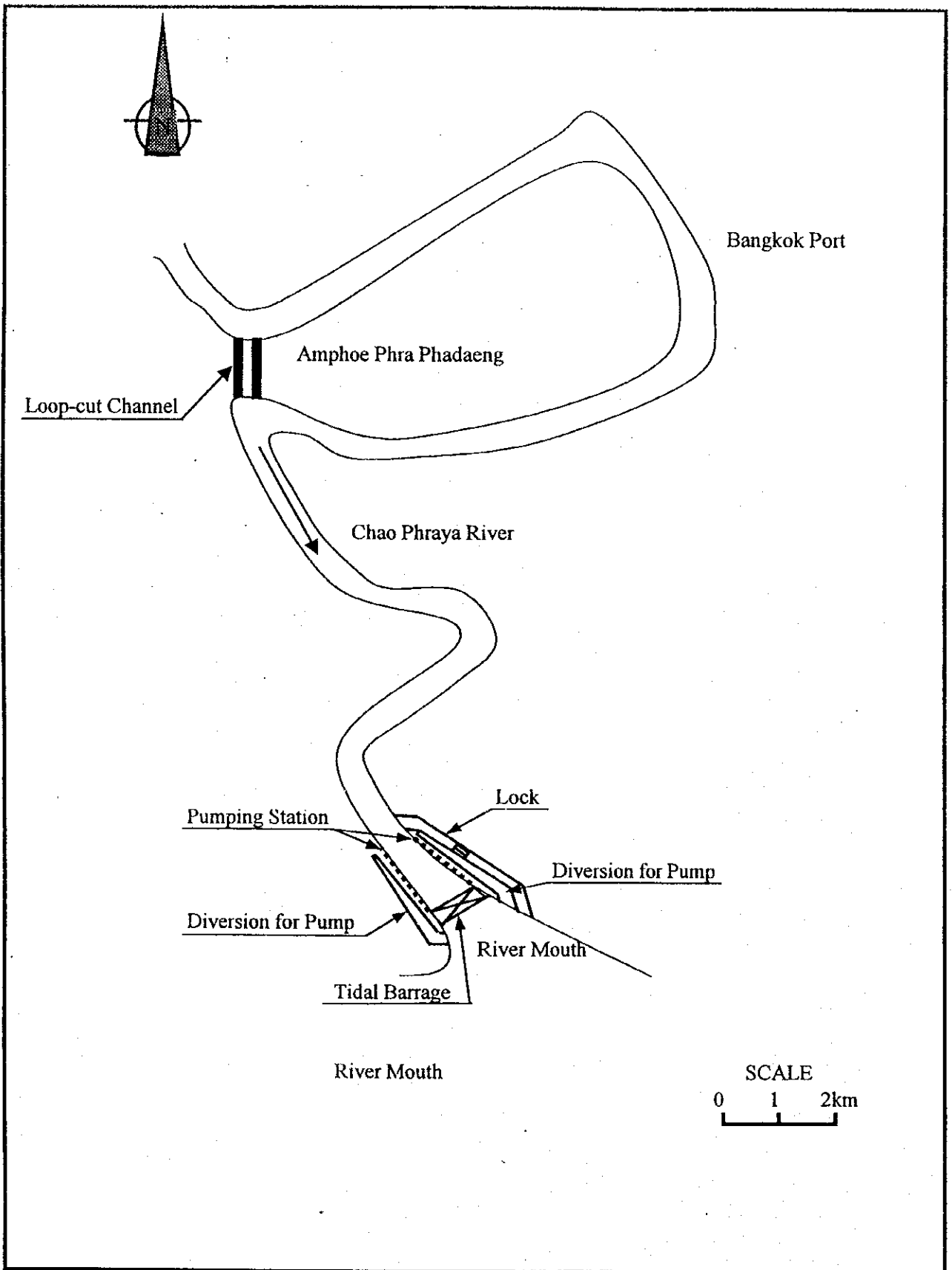


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Fig. 3.1.7

APPLICABLE DIVERSION ROUTE

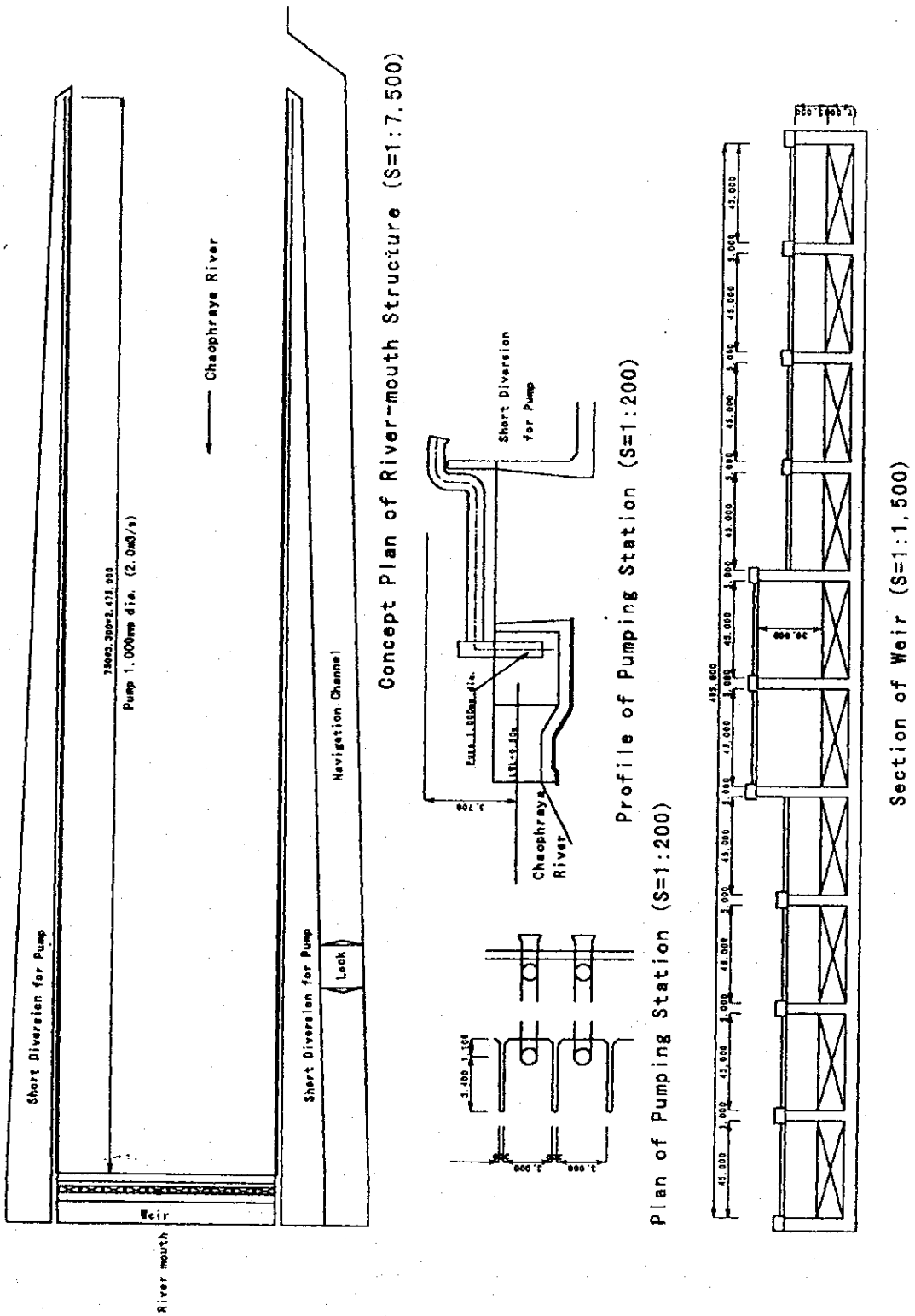


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Fig.3.1.8

LOCATION OF TIDAL BARRAGE

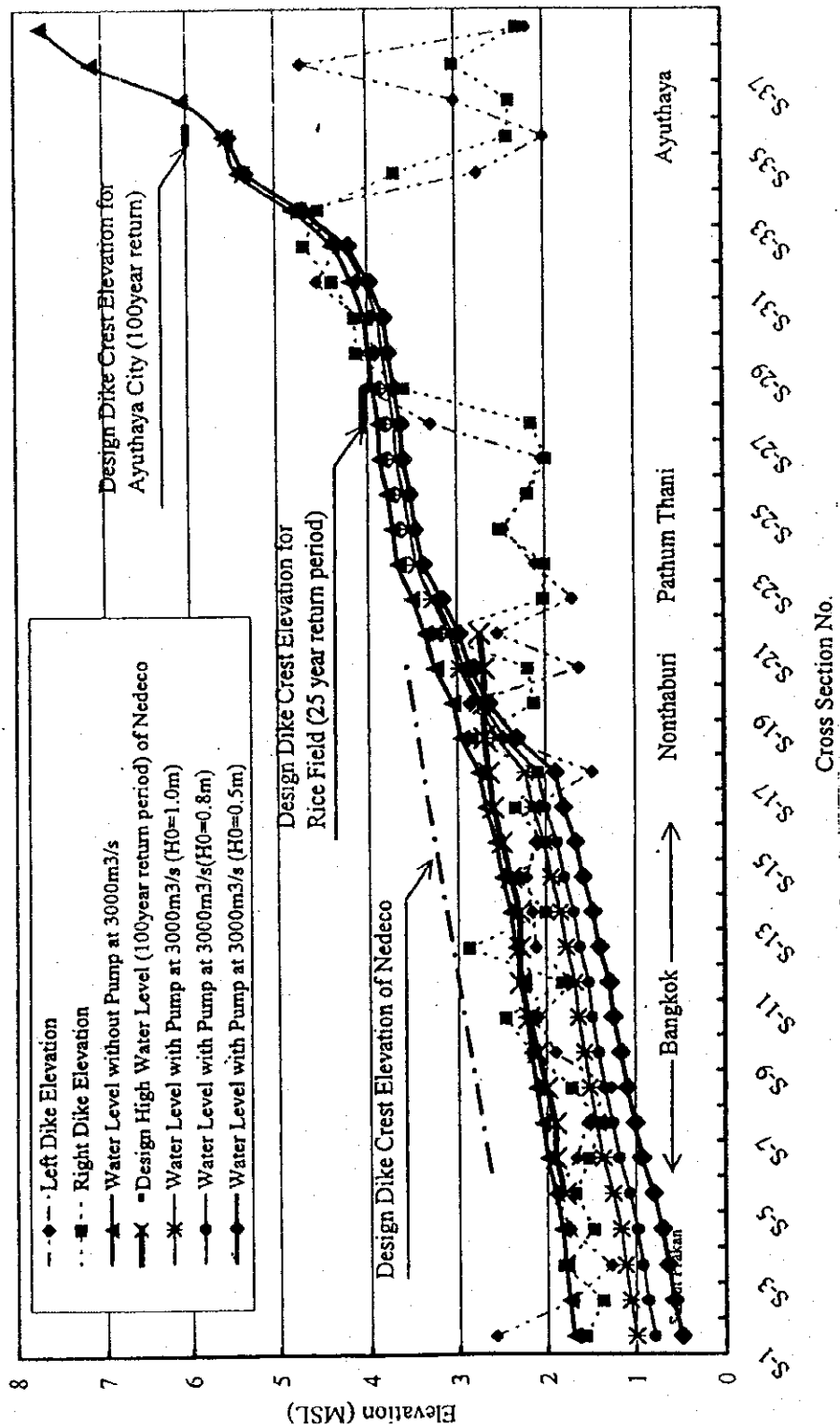


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Fig.3.1.9

GENERAL PLAN OF TIDAL BARRAGE AND PUMP

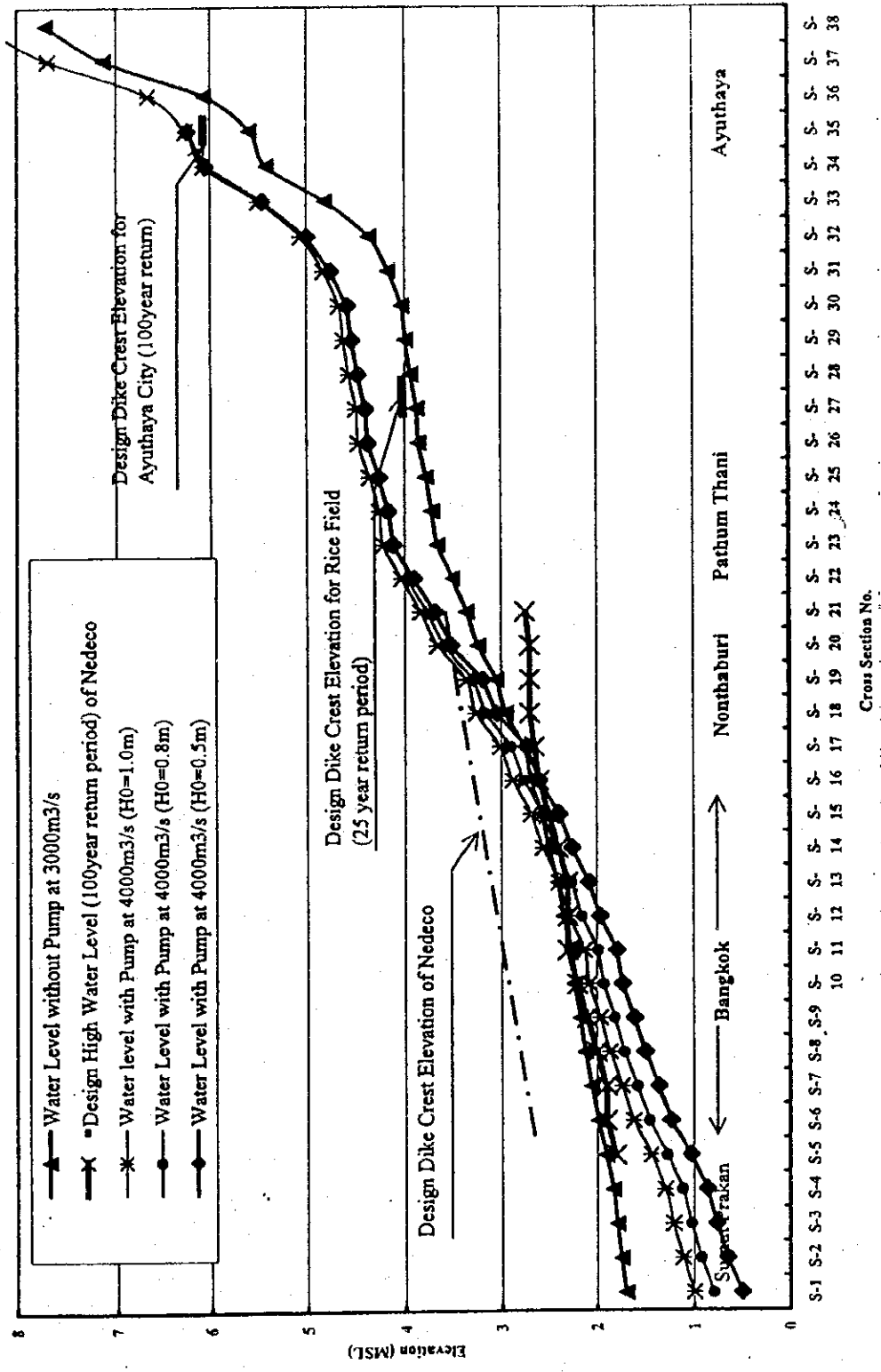


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Fig.3.1.10 (1/2)

NON-UNIFORM CALCULATION RESULTS (1/2) (Q=3,000M3/S)

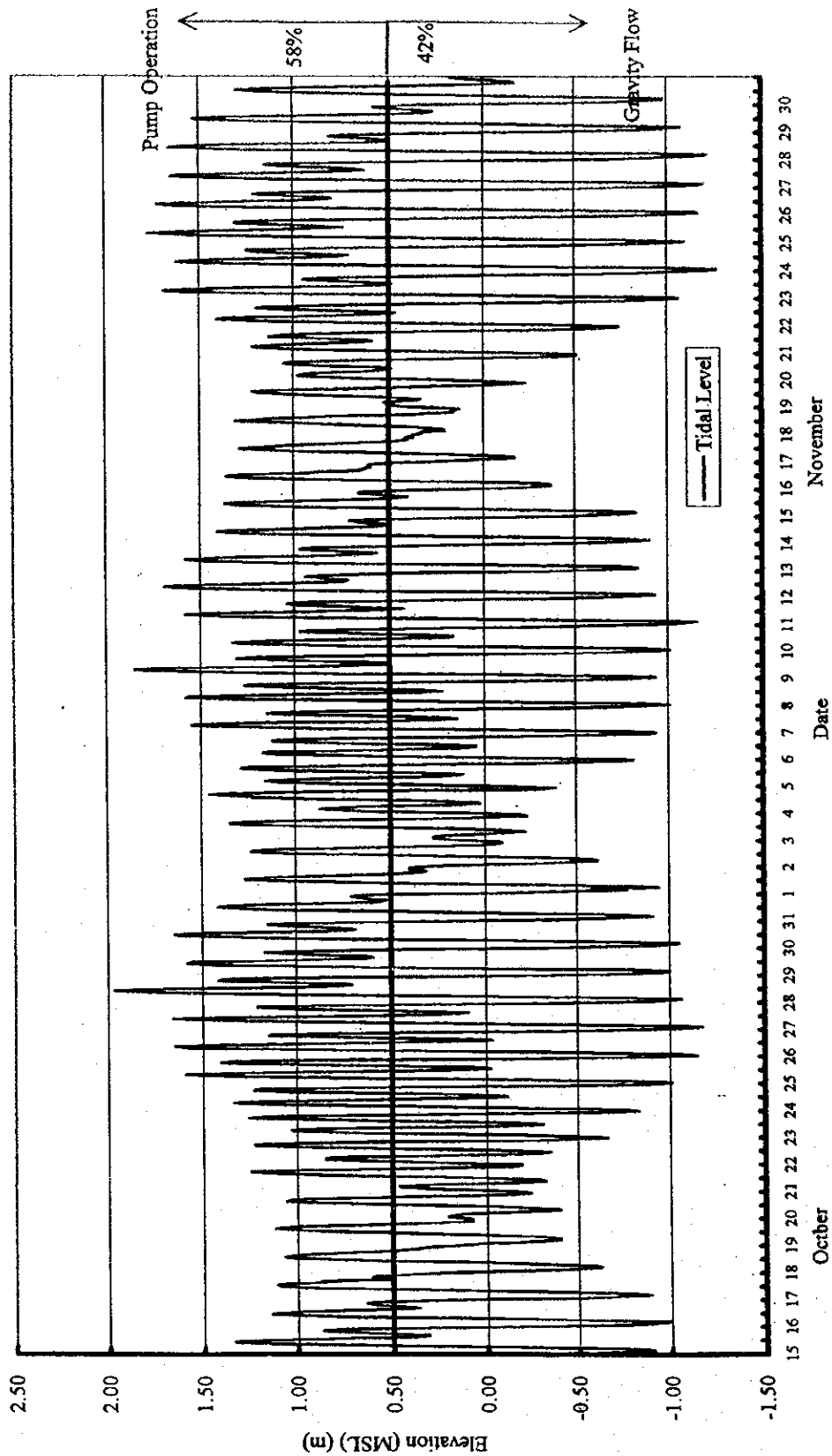


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Fig.3.1.10 (2/2)  
NON-UNIFORM CALCULATION RESULTS (2/2) (Q=4,000M<sup>3</sup>/S)

Tidal Level from 15th Oct. to 30th Nov.



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Fig.3.1.11

TIDAL LEVEL AT RIVER MOUTH (FROM 15TH OCT. TO 30TH NOV.)