

Tables

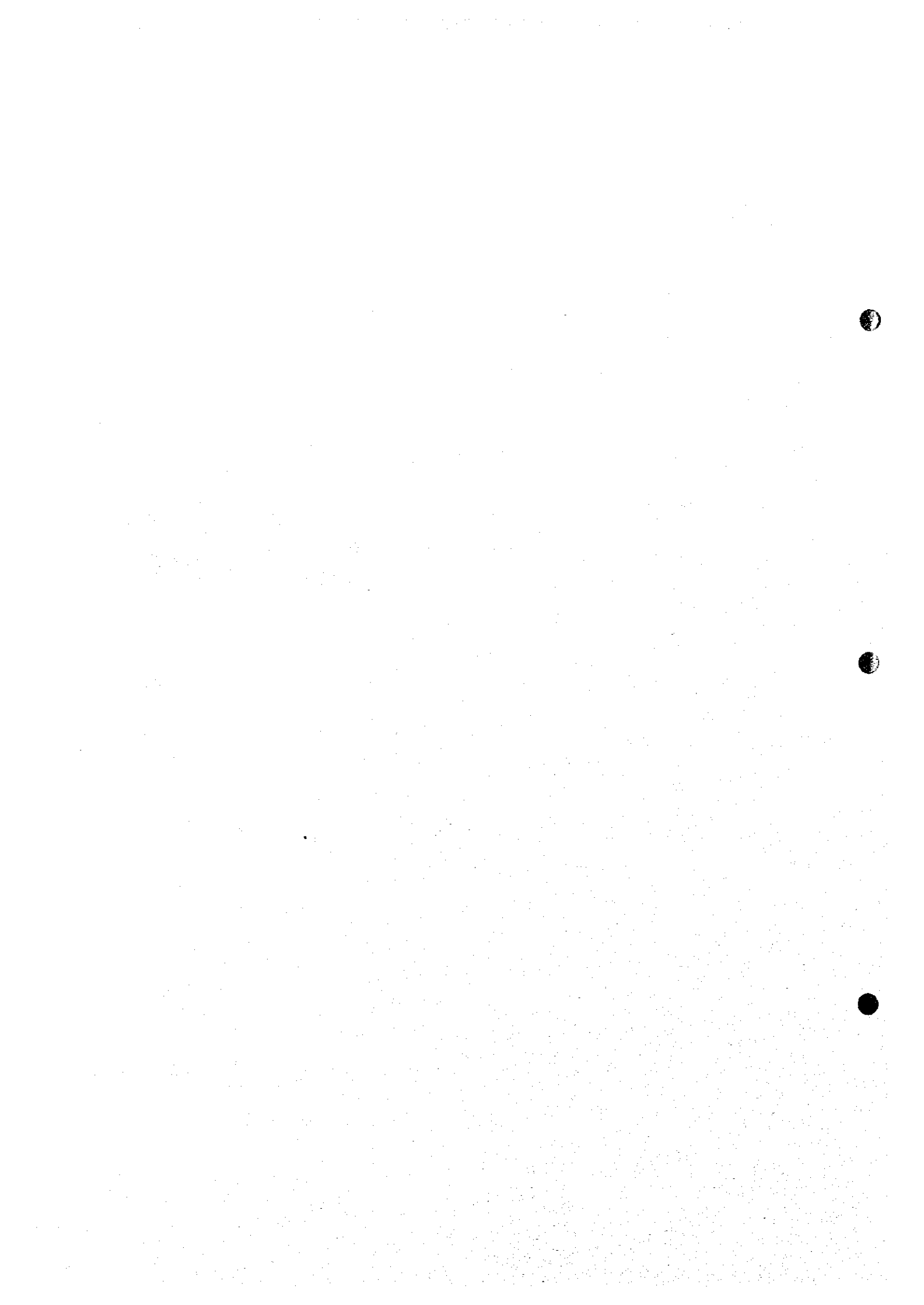


Table 1.1 LIST OF PROJECTS OR ACTIVITIES (NEED BIA)

List of Projects or Activities (1/2)		
items	types of projects or activities	size
1	dam or reservoir	storage volume 100,000,000 cubic meter or more or storage surface area 15 square kilometers or more
2	irrigation	irrigated area 80,000 rai (12,800 hectares) or more
3	commercial airport	all sizes
4	hotel or resort facilities located in areas adjacent to rivers, coastal areas, lakes or beaches or in the vicinity of national parks or historical parks	80 rooms or more
5	mass transit system under the Mass Transit System and Expressway Act or project as the same characteristic or mass transit which use rail	all sizes
6	mining as defined by the Mineral Act	all sizes
7	industrial estate as defined by the Industrial Authority of Thailand Act or projects with similar feature	all sizes
8	commercial port	with capacity for vessels of 500 gross tons or more
9	thermal power plant	capacity of 10 MW. or more
10	industries	using raw materials which is produced from oil refinery and/or natural gas separation with production capacity of 100 tons/day or more
	(1) petro chemical industry	
	(2) oil refinery	all sizes
	(3) natural gas separation or processing	all sizes
	(4) chlor-alkaline industry requiring sodium chloride (NaCl) as raw material for production of sodium carbonate (Na ² CO ³), sodium hydroxide (NaOH), hydro chloric acid (HCl), chlorine (Cl ²), sodium hypo-chloride (NaOCl) and beaching powder	production capacity of each or combined products of 100 tons/day or more
	(5) irons and/or steel industry	production capacity of 100 tons/day or more (production capacity shall be calculated by using furnaces capacity of ton/day multiply by 24 hours)
	(6) cement industry	all sizes
	(7) smelting industry other than iron and steel	production capacity 50 tons/day or more
(8) pulp industry	production capacity 50 tons/day or more	
11	all types of projects located in the areas where it has been approved by the Cabinet to be watershed area as class IB*	all sizes

*classification of watershed and the restriction of development is described in the following section.

List of Projects or Activities (2/2)

items	types of projects or activities	size
1	coastal reclamation	all sizes
2	building in areas adjacent to rivers, coastal areas, lakes or beaches or in the vicinity of national parks or historical park	1) height of 23 meters or more, or, 2) total floor area or any floor area in the building is 10,000 square meters or more
3	residential condominium as defined by the Condominium Act	80 units or more
4	land allocation for residential or commercial purpose	500 land plots or more or total developed area exceed 100 rai (16 hectares)
5	hospital which located 1) in area adjacent to rivers, coastal areas, lakes or beaches 2) in area other than (a)	1) in-patient's bed of 30 beds or more 2) in-patient's bed of 60 beds or more
6	pesticide industry or industry producing active ingredient by chemical process	all sizes
7	chemical fertilizers industry using chemical process in production	all sites
8	highway or road as defined by the Highway Act, passing through following areas 1) wildlife sanctuaries and wildlife non-hunting areas as defined by the Wildlife Conservation and Protection Act 2) National Park as defined by the National Park Act 3) watershed area classified as Class 2 by the Cabinet Resolution 4) mangrove forests designated as the National Forest Reserve 5) coastal area within 50 meters from the maximum sea level	all projects with equivalents to or above the minimum standard of rural highway including roadbed expansion

Table.1.2 CLASSES OF WATERSHEDS

Classes of Watersheds (prepared by Ministry of Science, Technology and Environment)		
Class	Description	Measures to be Followed
WSC1: Class 1A	areas of protection forest and head water source areas, usually at higher elevation with very steep slopes.	should remain in permanent forest cover
WSC1: Class 1B	areas of similar physical features and environment to 1A but portions of the area have been cleared for agricultural use or occupied by villages	require social conservation protection measures and where possible should be replanted to forest or maintained in permanent agro-forestry
WSC2: Class 2	areas of protection and/or commercial forests, usually at higher elevations with steep to very steep slopes. Landforms are less erosive than WSC 1A or 1B.	may be used for grazing or certain crops with soil protection measures
WSC3: Class 3	areas of uplands with steep slopes and less erosive landforms	may be used for commercial forests, grazing, fruit trees, or certain agricultural crops with need for soil conservation measures
WSC4: Class 4	areas of gently sloping lands suitable for raw crops, fruit trees, and grazing	moderate soil conservation measures are needed
WSC5: Class 5	gentle to flat areas used by paddy field or other agricultural uses	few restrictions needed

Table 2.1 TABLE OF INITIAL ENVIRONMENTAL EXAMINATION

ENVIRONMENTAL PARAMETERS PROJECT COMPONENTS	DEGREE OF IMPACT					
	RIVER TRAINING (new embankment)		DIVERSION CHANNEL		RETARDING BASIN	
	Slight	Moderate Significant Irreversible	Slight	Moderate Significant Irreversible	Slight	Moderate Significant Irreversible
Physical Resources						
(1) Surface Water Hydrology		X		X		X
(2) Surface Water Quality	X			X		X
(3) Ground water	X			X		
(4) Soils	X		X			
(5) Noise and Vibration	X		X			
Ecological Resources						
(1) Aquatic Ecosystem		X		X		X
(2) Forests	X		X			X
(3) Terrestrial Wildlife	X		X			X
(4) Endangered Species		X		X		X
Human Use Values						
(1) Navigation		X				X
(2) Land Transportation	X			X		X
(3) Flood Control	X			X		
(4) Agriculture		X		X		X
(5) Industries	X		X			X
(6) Mineral Development	X		X			X
Quality of Life Values						
(1) Socio-economic Values		X				X
(2) Cultural and Archaeological Values	X		X			X
(3) Aesthetic Values	X		X			X
(4) Resettlement		X		X		X
(5) Public Health and Safety	X			X		X
(6) Recreation	X		X			X
(7) Dedicated Area Uses		X				X

Table 4.1 SUGGESTIONS AND COMMENTS MADE BY PROBINCIAL OFFICES

- Regular dredging of river bed is needed (Sinburi)
- Should consider gate installation on all tributaries (Sinburi, Ayutthaya)
- Heightening of embankment is agreeable because of the minimal social impacts (Sinburi)
- Proper land use control is needed (Sinburi)
- Water storage should be sought at the same time (Sinburi)
- The final report is requested (Lopburi, Ayutthaya)
- Should consider function of irrigation canal and avoid conflicts (Ayutthaya)
- PWD has already made Feasibility Study Report on flood control in Ayutthaya (Ayutthaya, Pathum Thani)
- In Sena District, flood level was higher in 1996 than in 1995 (Ayutthaya)
- Ayutthaya province is undertaking land readjustment programme in some districts (Ayutthaya)
- There may be conflicts occur between the people who live inside of the dike and the outside (Ayutthaya)
- No impacts on archaeological site is expected (Ayutthaya)
- The plan need to be formulated based on reality and not by calculation (Ayutthaya)
- RID has planned to construct 24 on the right bank and 9 on the left of the Chao Phraya river by year 2000. Three of the 33 will be completed by this year. The height is 0.5 metre higher than the 1995 flood (Pathum Thani)
- Provincial office is obligated to spear budget to flood control, and it is getting bigger.

Table 4.2

MATERIALS USED IN DISTRICT LEVEL HEARINGS

There are 3 ways of heightening of embankment.

- 1) *Heightening of road (existing embankment)*
- 2) *Construction of new dike along the river*
- 3) *Construction of new wall along the river*

<i>Alternatives</i>	<i>Goods</i>	<i>Bads</i>
<i>1) Heightening of road</i>	<i>• Almost no resettlement needed</i>	<i>• Flood water level will be higher, (specifically explained by figures), but the duration will be almost the same</i>
<i>2) Construction of new dike at water front</i>	<i>• Houses will not be affected by smaller floods (5-year return period)</i>	<i>• Resettlement needed h=1m, 10 m of width h=2m, 14 m of width h=3m, 18 m of width • Inconvenient access to riverside</i>
<i>3) Construction of new concrete wall</i>	<i>• Houses will not be affected by smaller floods (5 year return period) • Resettlement needed (relatively small)</i>	<i>• Degrades aesthetic view • Inconvenient access to riverside</i>

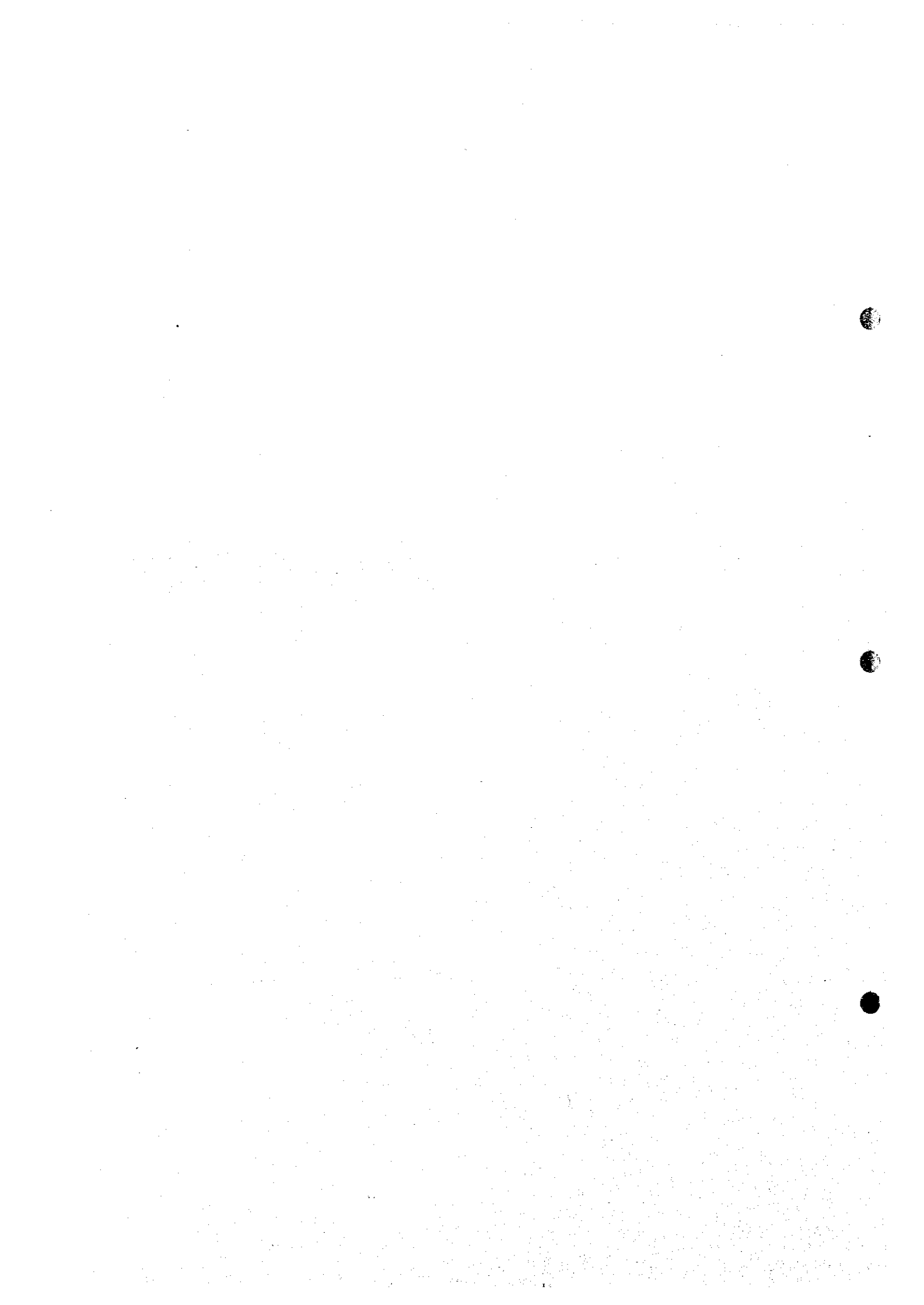
Question-1: What sectors of your Tambon receive heavy damages due to the flood?

- *Agriculture*
- *Houses*
- *Roads*
- *Fishery*
- *Temples*
- *Wells*
- *Others*

Question-2: Which aspects of "flood" are the causes of damages to (the sector) in your area?

- *The velocity of flood flow*
- *The duration*
- *The height of water level*
- *The speed of raising water level*
- *Operation of gate*
- *There is structural problems in dikes*
- *Others*

Figures



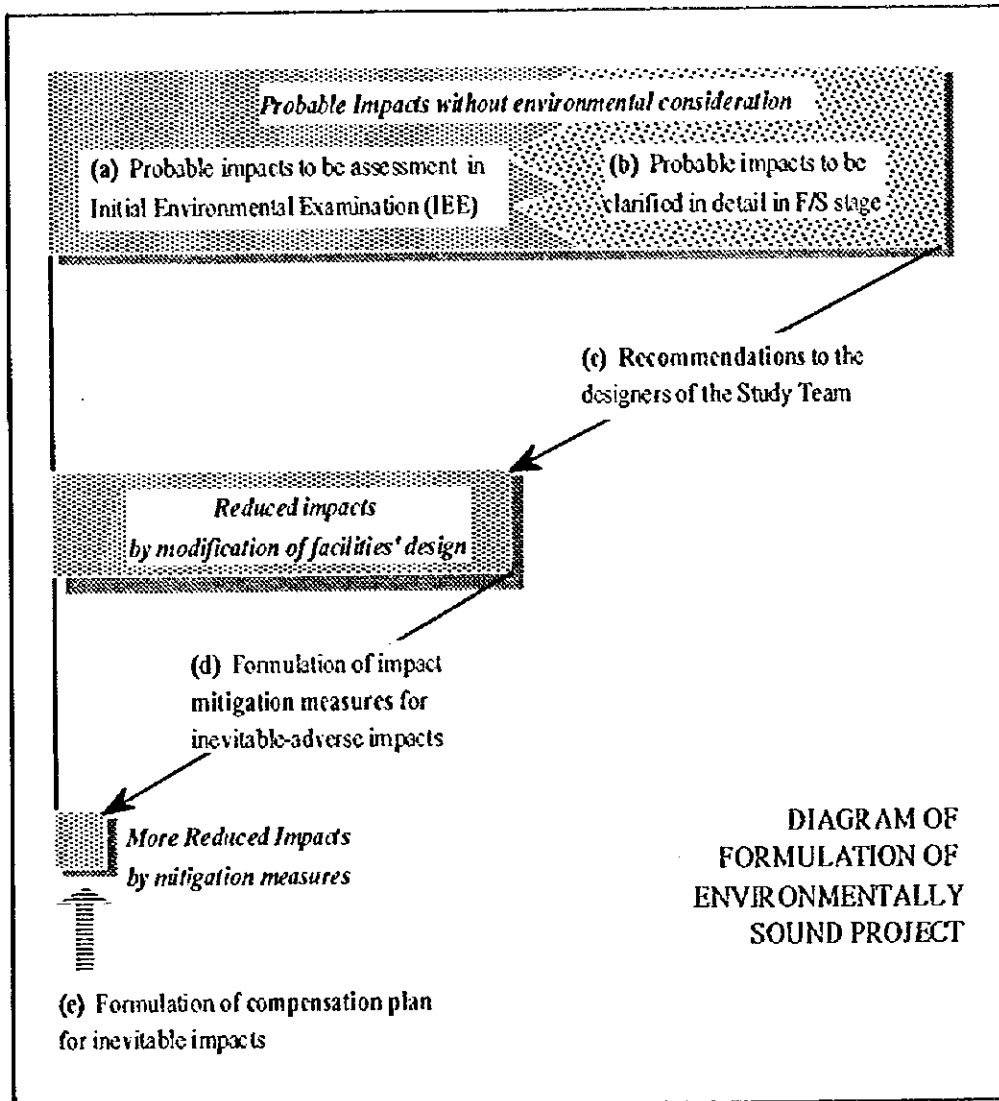
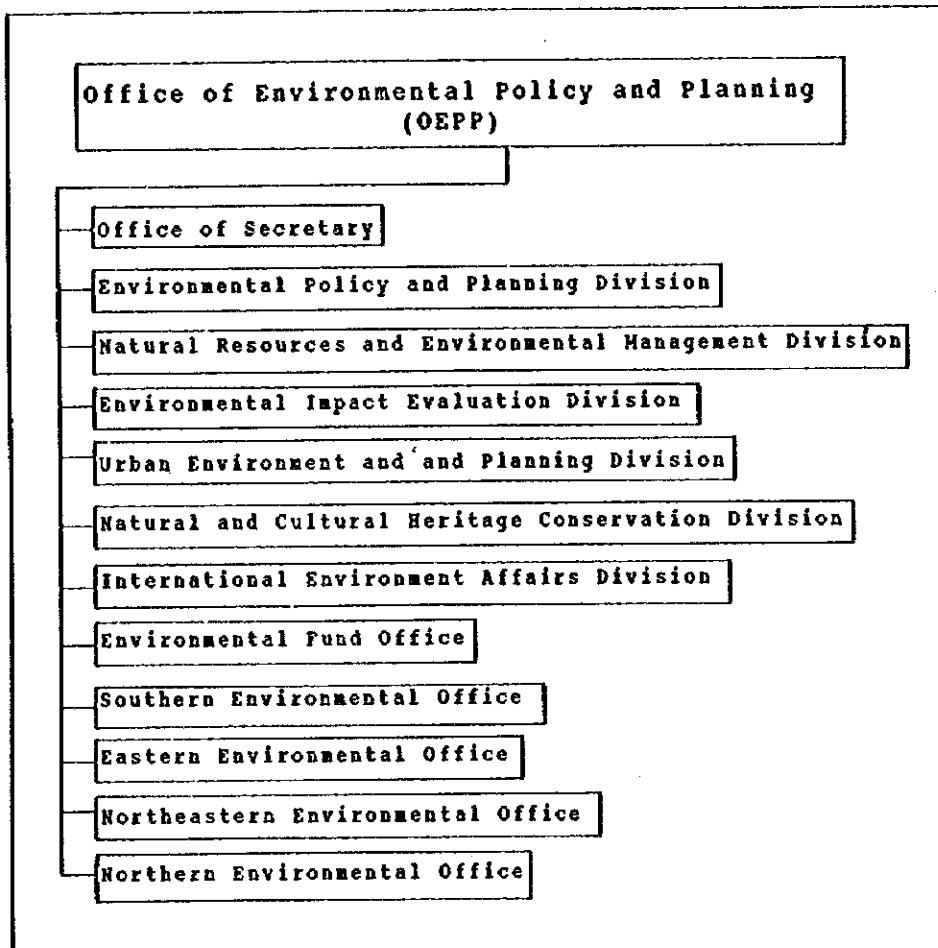


DIAGRAM OF FORMULATION OF ENVIRONMENTALLY SOUND PROJECT

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

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 1.1 FORMULATION OF ENVIRONMENTAL Y SOUND PROJECT



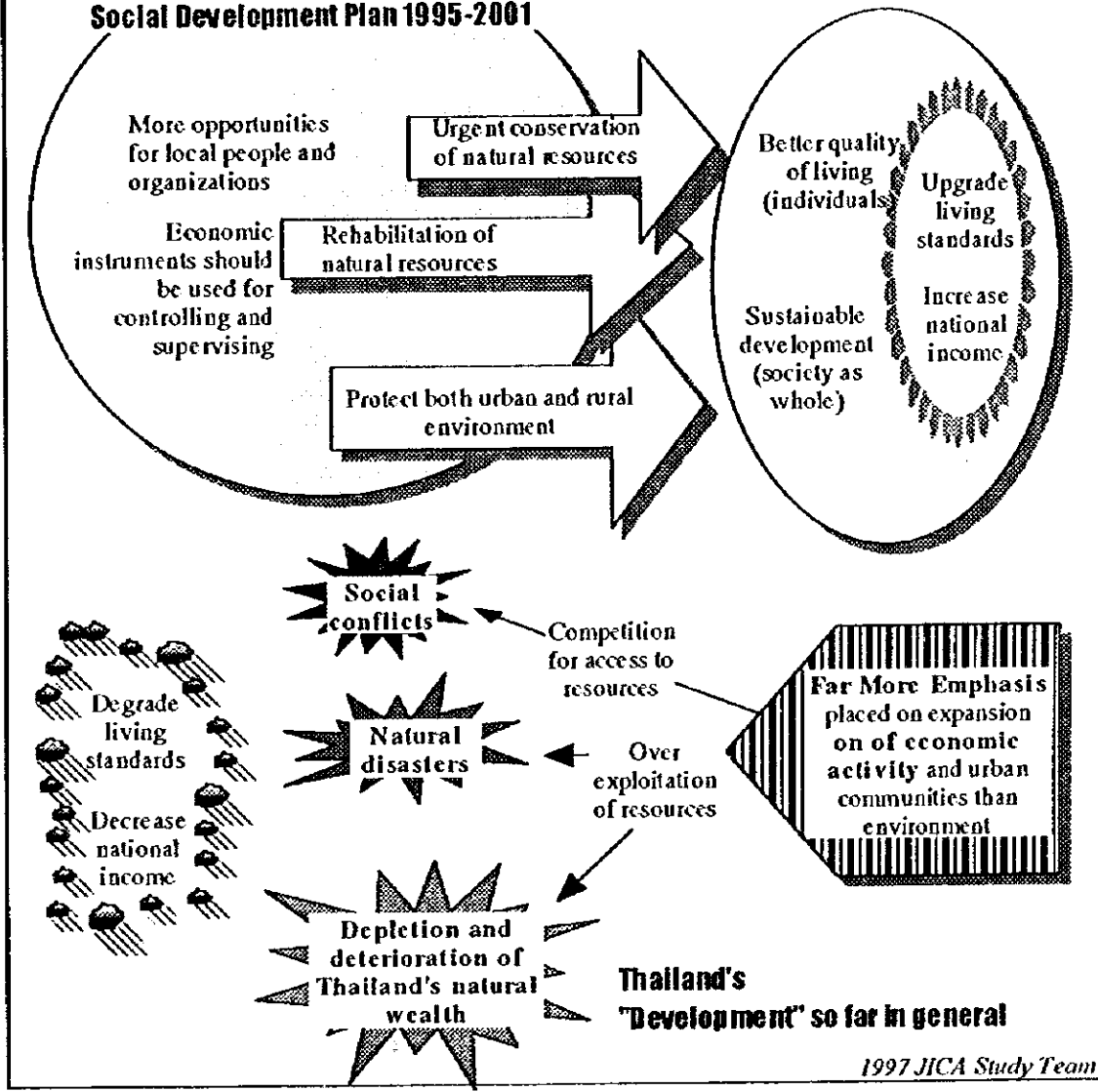
STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 1.2
ORGANISATION CHART OF OEPP

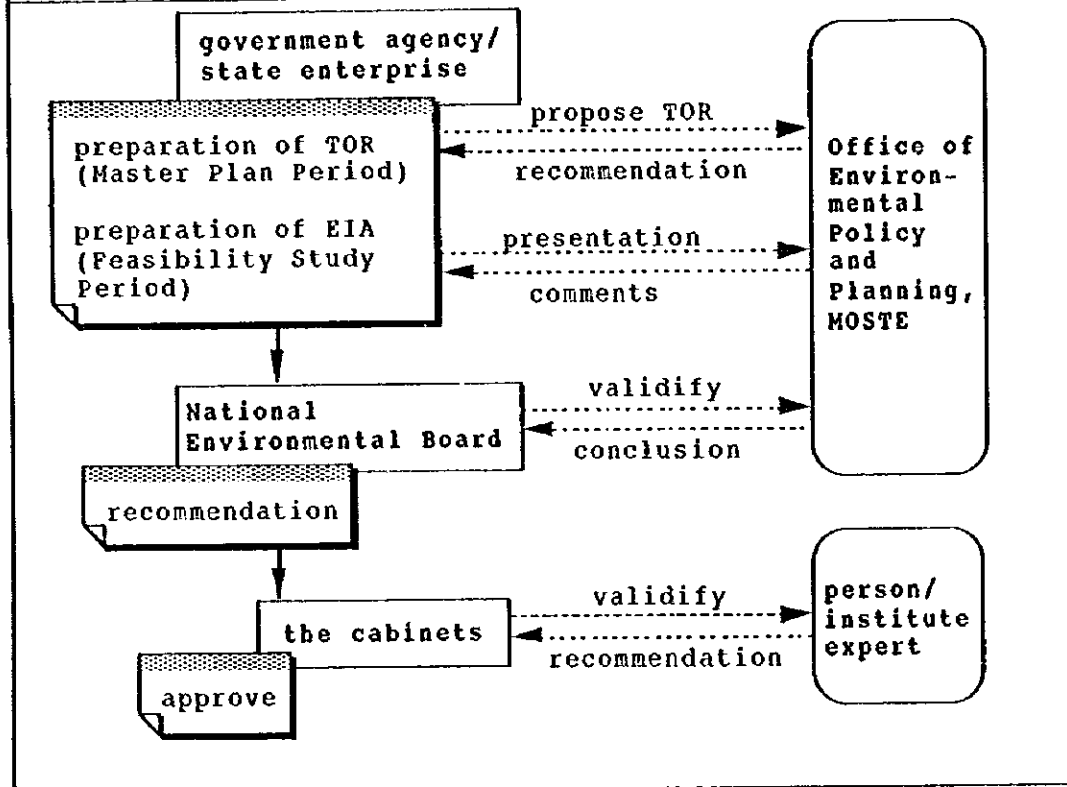
Diagram of Structure of Environmental Problems in Thailand and
 The Eighth National Economic and Social Development Plan (1997-2001)

(Environmental aspects of)
**The Eighth National Economic and
 Social Development Plan 1995-2001**



1997 JICA Study Team

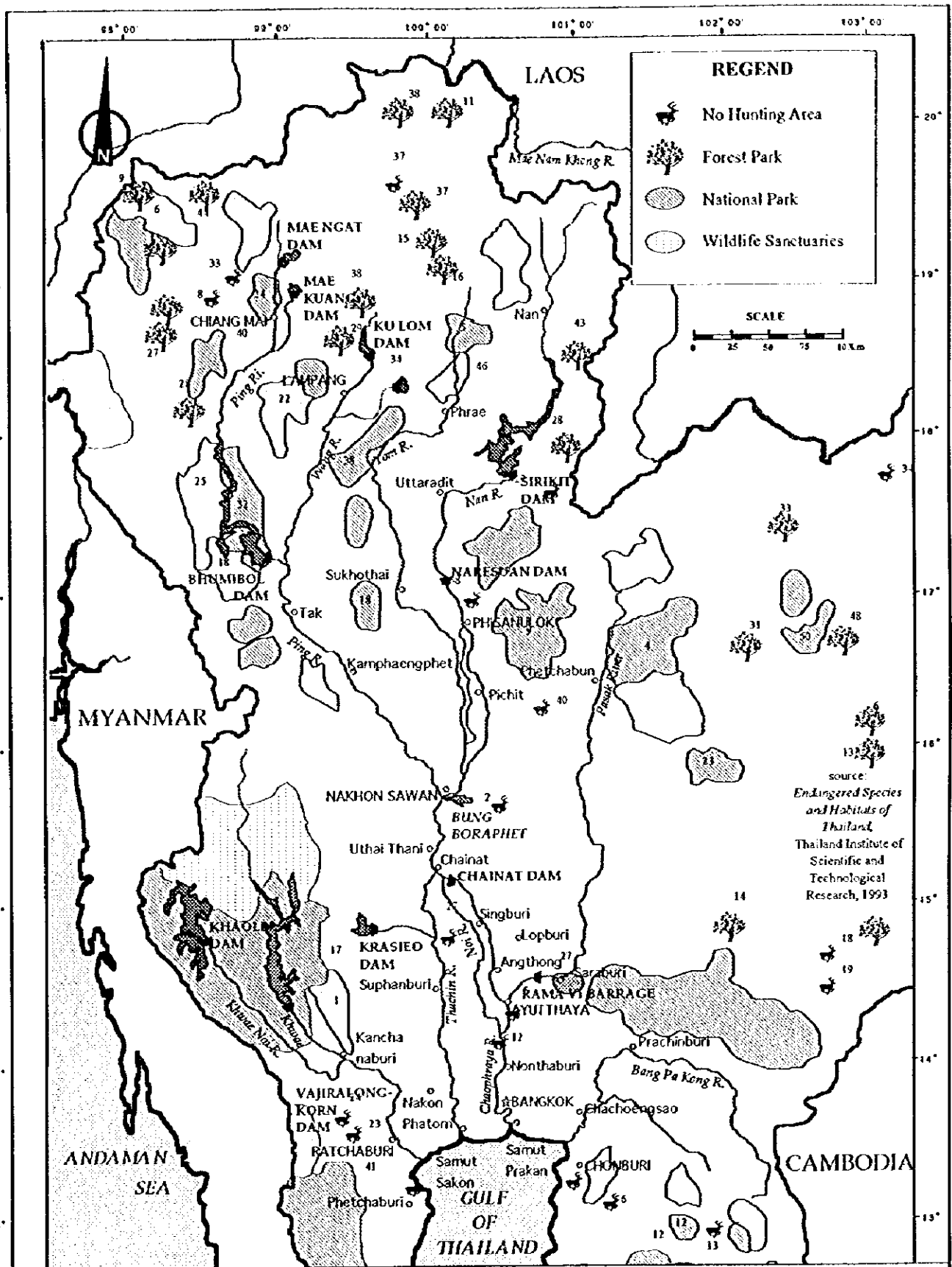
EIA Proccess for Government Agency
 prepared by Environmental Impact Evaluation Division, OEPP
 (June 1993)



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

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 1.4
 EIA PROCESS

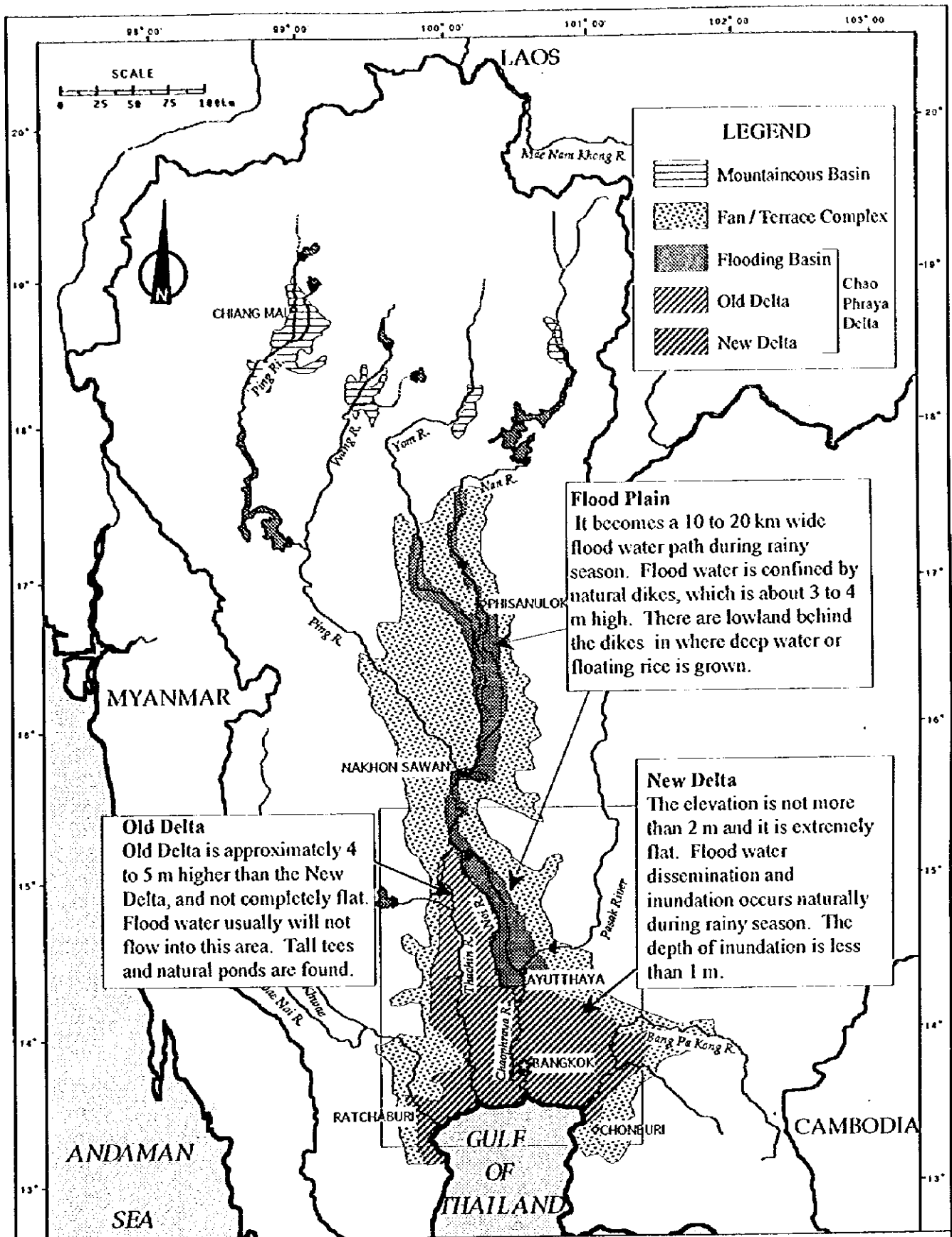


STUDY OF INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

Fig. 1.5 PROTECTED AREAS IN CHAO PHRAYA BASIN

CTI ENGINEERING CO., LTD. AND INA CORPORATION

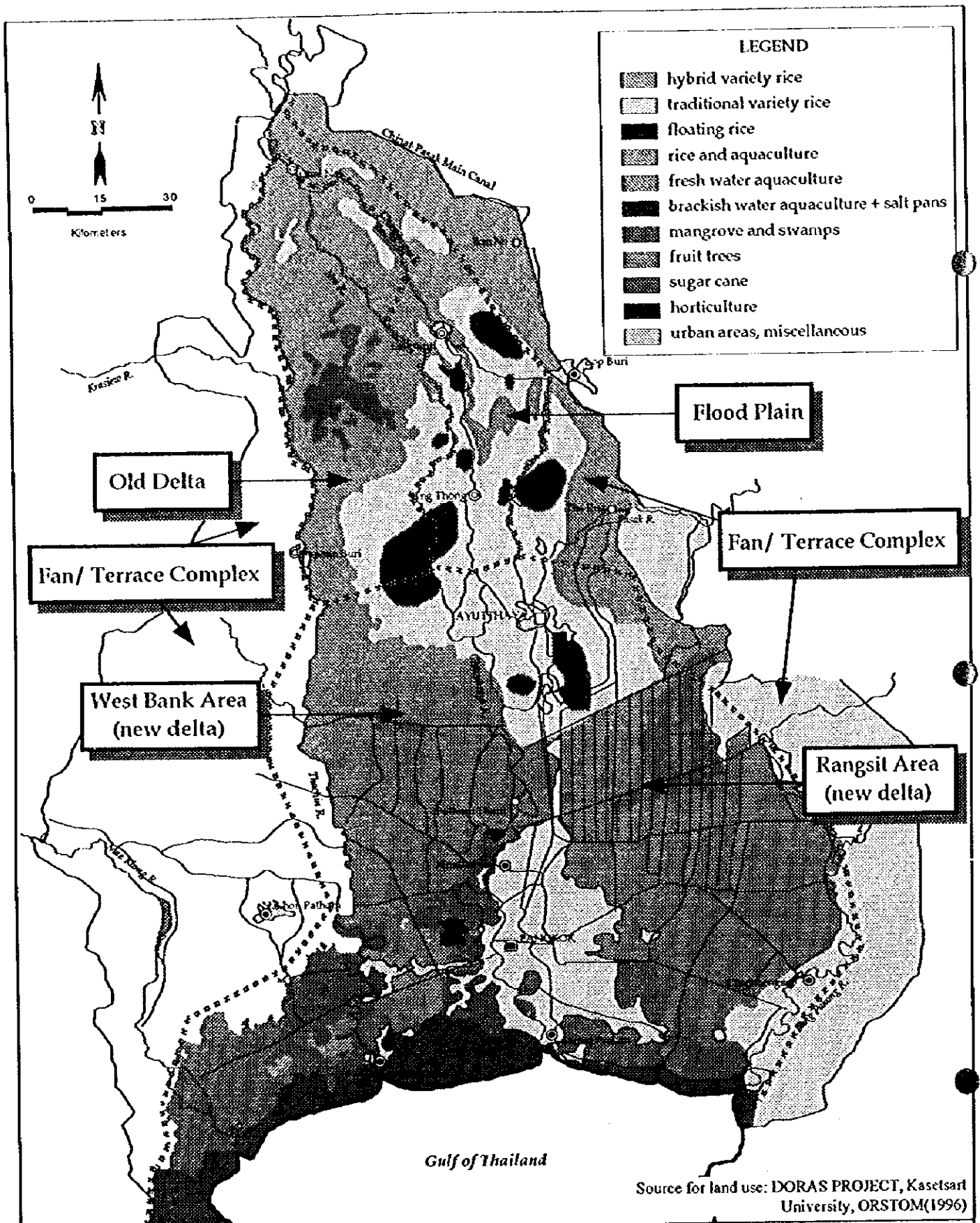
101° 00' 102° 00' 103° 00'



IEE REPORT FOR INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

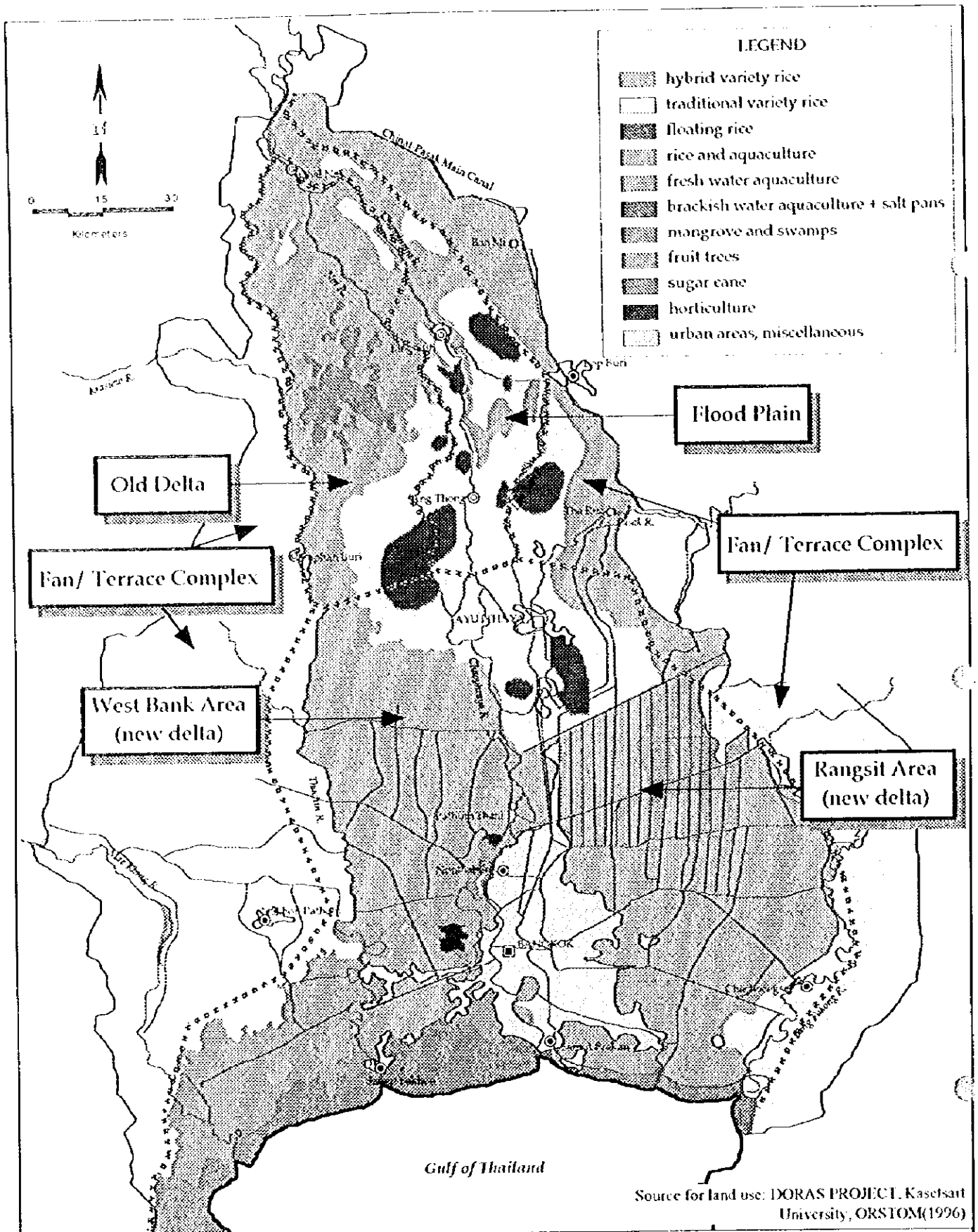
Fig. 2.2 LAND FORM OF CHAO PHRAYA WATERSHED



IEE REPORT FOR INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

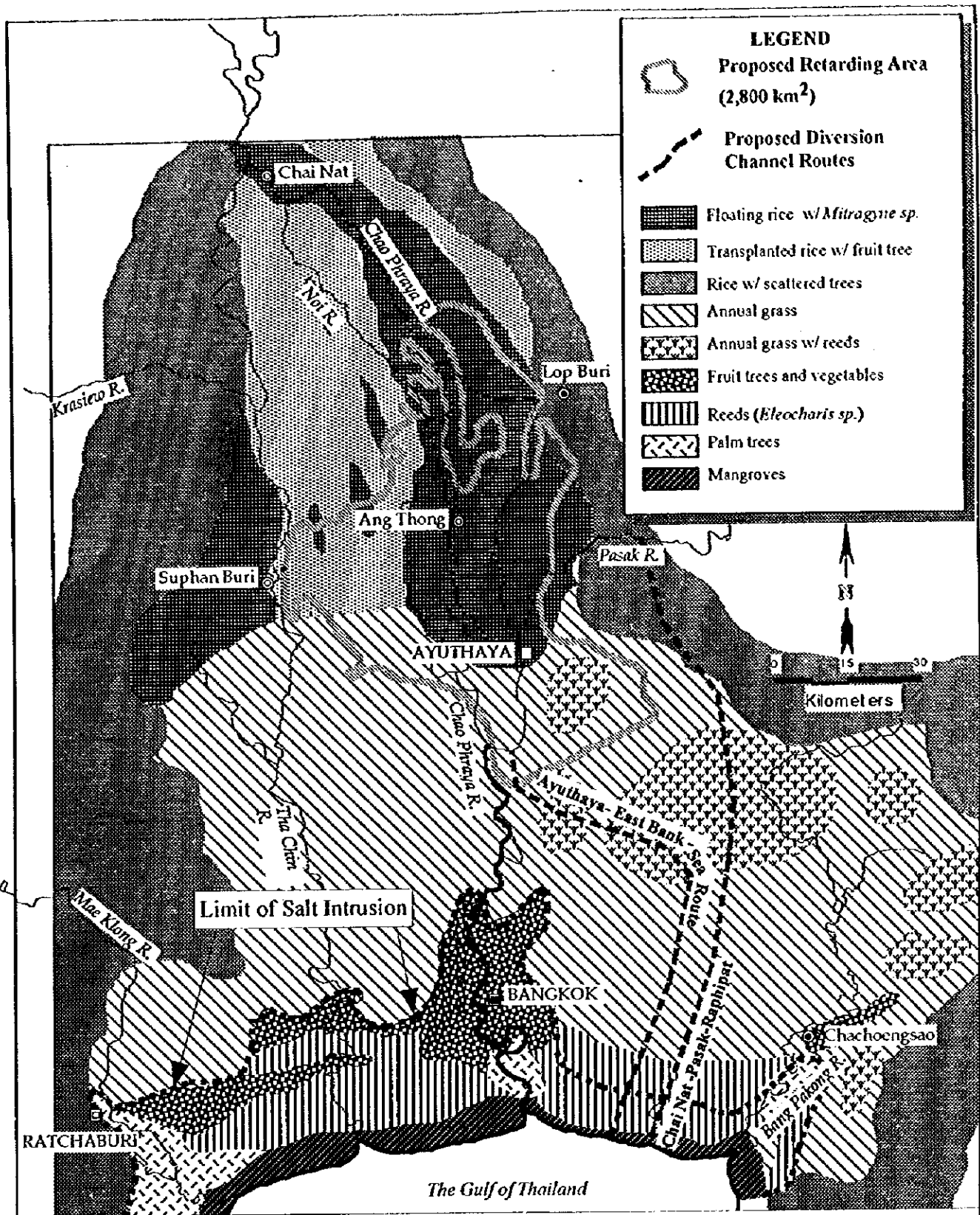
Fig. 2.3
LAND USE OF CHAO PHRAYA DELTA AND LANDFORM



IEE REPORT FOR INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CH ENGINEERING CO. LTD AND INA CORPORATION

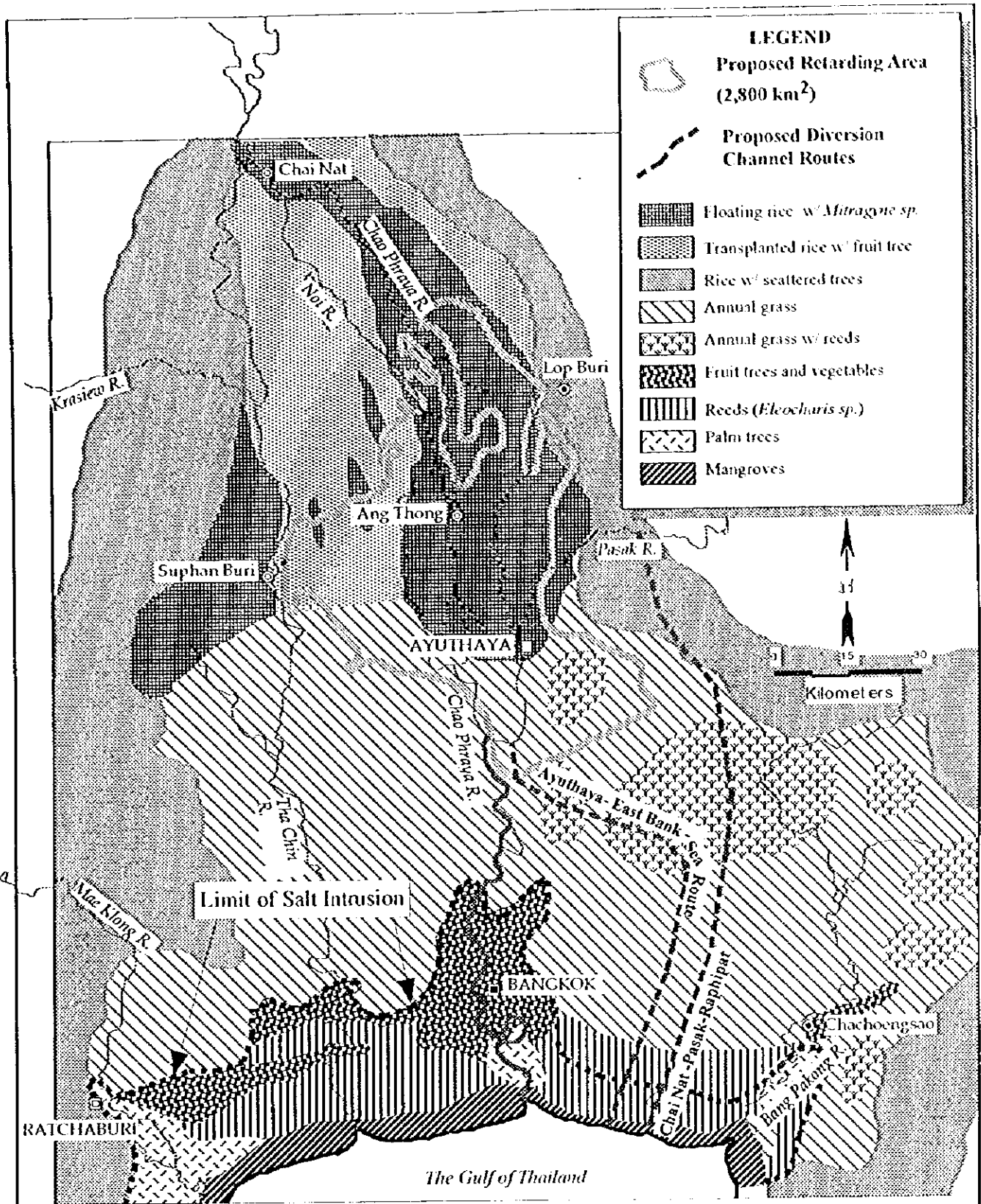
Fig. 2.3
LAND USE OF CHAO PHRAYA DELTA AND LANDFORM



Source: TAKAYA, Yosikazu, *Agricultural Development of a Tropical Delta: A Study of the Chao Phraya Delta* (1987), Kyoto University

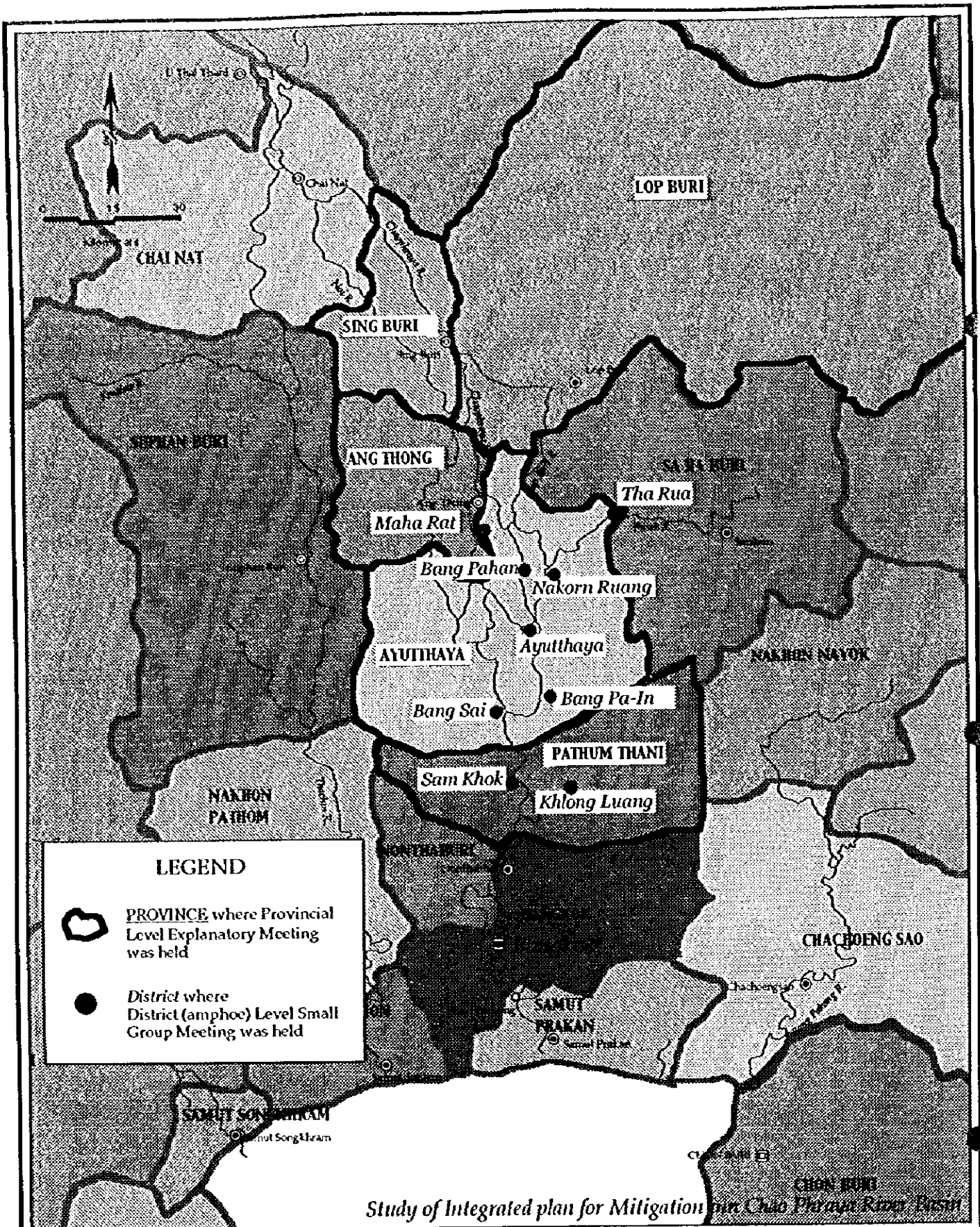
IEE REPORT FOR INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 2.4
 PROPOSED PROJECTS AND NATURAL VEGETATION



IEE REPORT FOR INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
 CH ENGINEERING CO., LTD AND INA CORPORATION

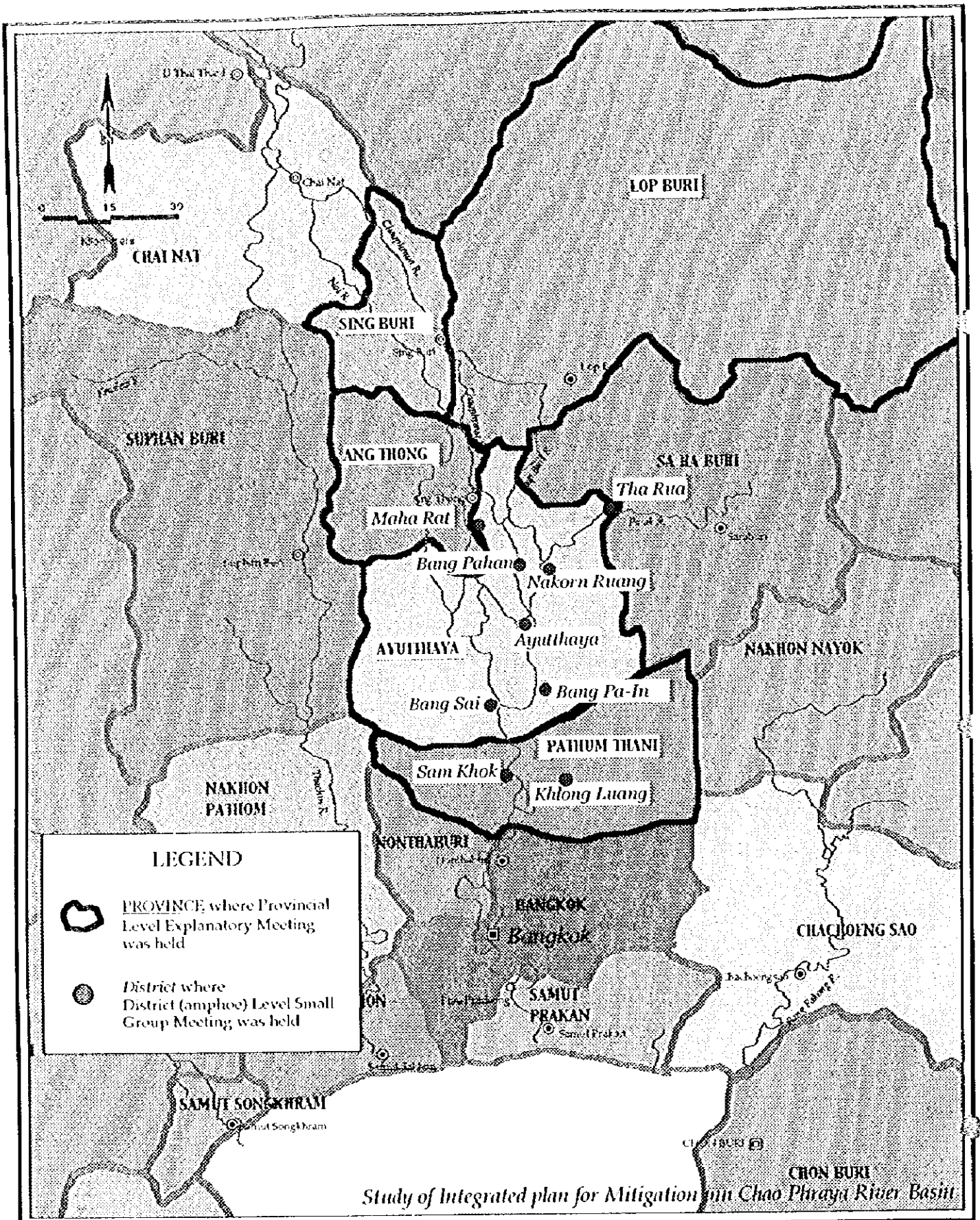
Fig. 2.4
 PROPOSED PROJECTS AND NATURAL VEGETATION



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

CTI ENGINEERING CO., AND INA CORPORATION

Fig. 4.1
VENUES OF PUBLIC CONSULTATION



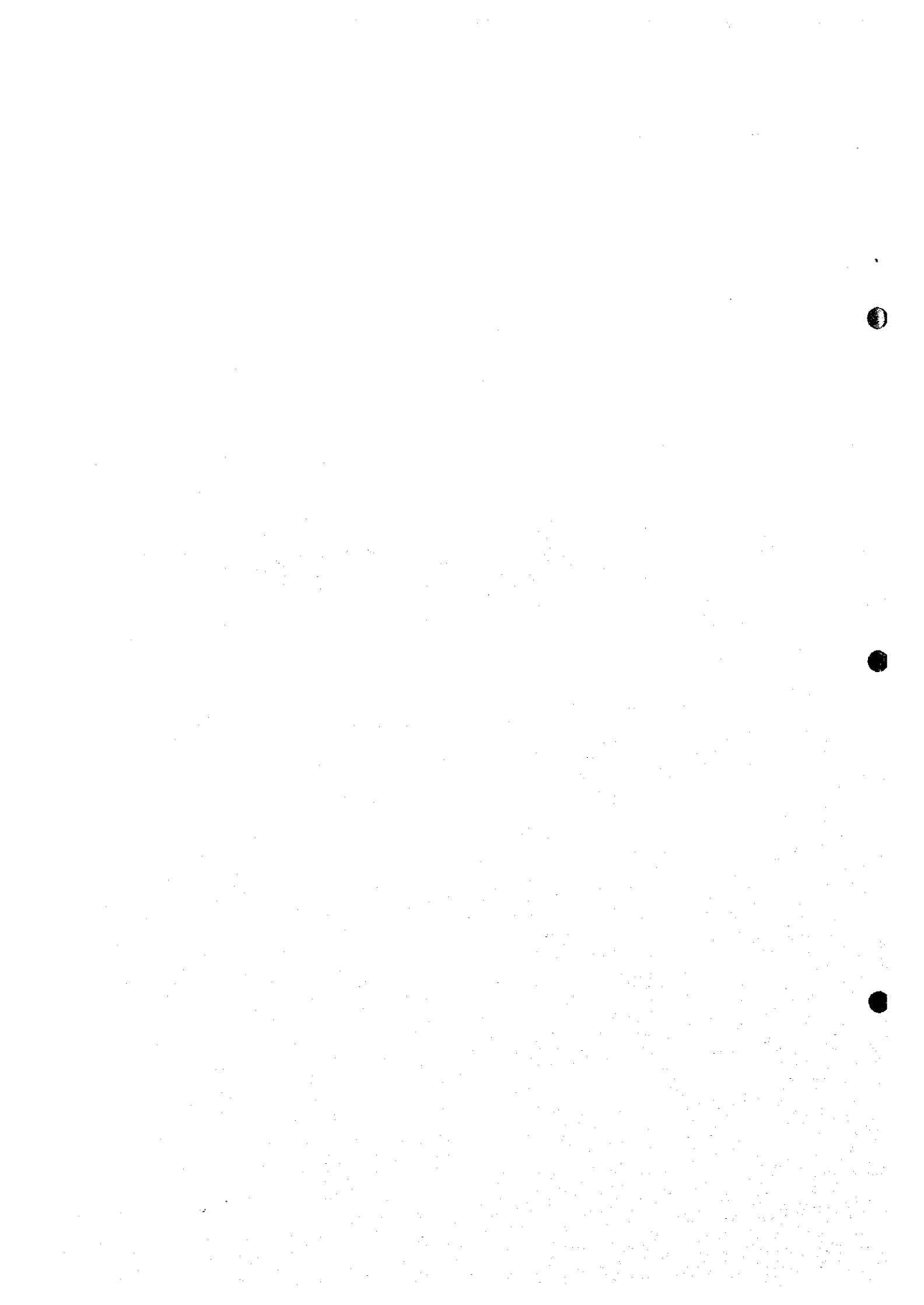
Study of Integrated plan for Mitigation in Chao Phraya River Basin

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

Fig. 4.1
VENUES OF PUBLIC CONSULTATION

CH ENGINEERING CO., AND INA CORPORATION

Appendices



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

ROYAL IRRIGATION DEPARTMENT
KINGDOM OF THAILAND

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

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

APRIL 1998

CTI ENGINEERING CO., LTD.
INA CORPORATION

Initial Environmental Examination (IEE) for the Study on Integrated Plan for Flood Mitigation in the Chao Phraya River Basin

Table of Contents

Chapter 1. INTRODUCTION

1. 1 Objectives and Scope of IEE -----	1
1. 2 Governmental Review -----	1
1. 3 Mandatory of ETA -----	1
1. 4 Organization of IEE Report -----	4

Chapter 2. OUTLINE OF PROJECTS AND PROJECT SITES

2. 1 Description of Proposed Project -----	6
2. 2 General Description of Project Site -----	9

Chapter 3. PROBABLE ENVIRONMENTAL EFFECTS

3. 1 River Training -----	12
3. 2 Flood Diversion Channel -----	23
3. 3 Retarding Basin -----	36

Chapter 4. CONCLUSION

4. 1 Summary of IEE -----	46
4. 2 River Training -----	46
4. 3 Diversion Channel -----	47
4. 4 Retarding Basin -----	48

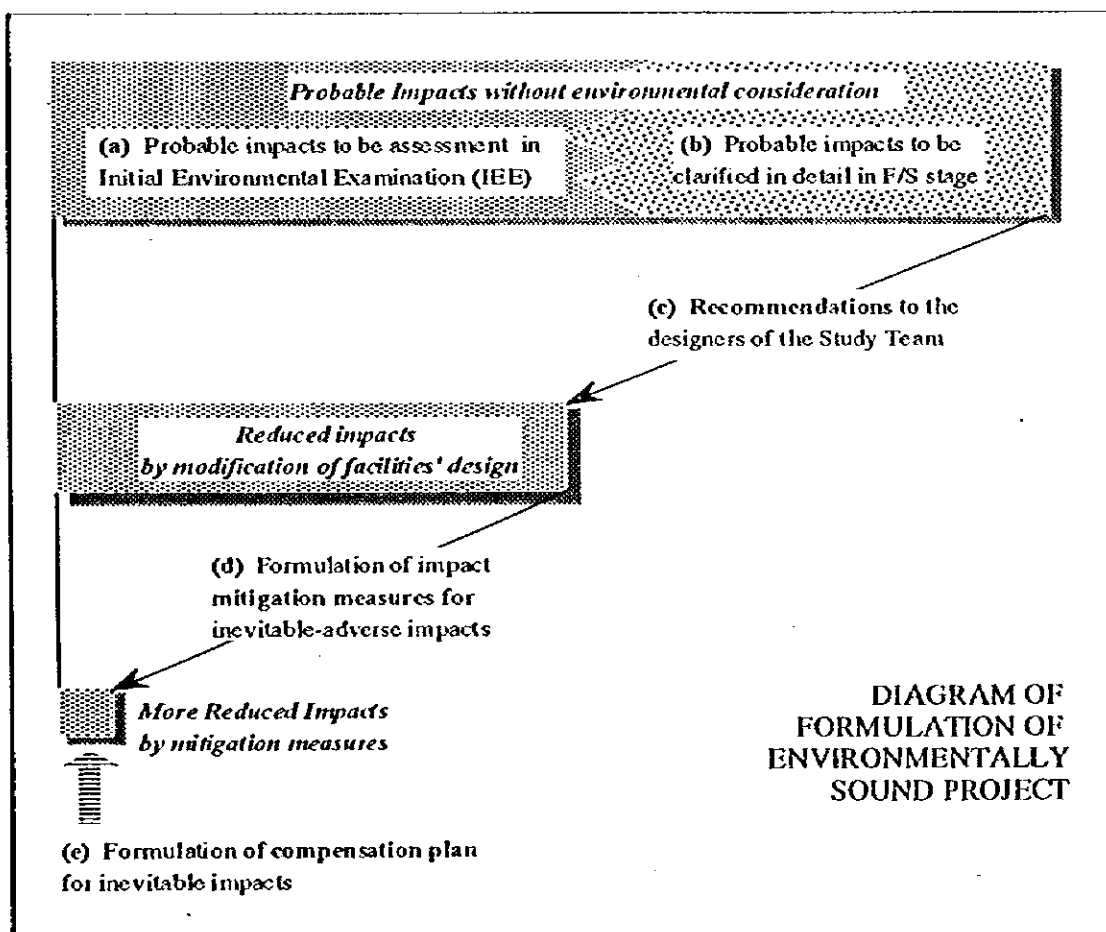
Appendix

CHAPTER 1. INTRODUCTION

1.1 Objective and Scope of IEE

In planning of any project, the possible effects of the project on environmental values must be taken into account as one of the major factors of pre-feasibility process from the earliest stage of planning, according to Manual of NEB Guidelines for Preparation of Environmental Impact Evaluation. For selection and development of environmentally wholesome project plan, Initial Environmental Examination (IEE) was conducted. The main objective of IEE is to determine whether a full-scale Environmental Impact Assessment (EIA) will be needed or not in the following feasibility study, and if the conclusion is that EIA is needed, outline of farther environmental study will be prepared. Therefore this IEE was carried out only to the depth that to suffice the above stated purpose. The parameters used in this IEE are as the same parameter as the ones listed in full-scale environmental study of NEB Guidelines.

As the figure shown below, IEE is a part of a process of formulation of environmentally sound project. IEE will assess probable impacts of proposed projects, and make outline of further assessment. For those inevitable impacts expected even after the modification of original design, mitigation plans will be formulated, and for those impacts that are not mitigable, compensation plans will be formulated in feasibility study period.



1.2 Governmental Review

Three major facilities are tentatively chosen as the alternatives for flood control measures being considered in the "Study on Integrated Plan for Flood Mitigation in the Chao Phraya River Basin" (the Study) from engineering stand points of view. They are river training, flood diversion channel, and retarding basin, as of December 1998. The best among these, or a best combination of these measures will be selected in the Master Plan study phase, for the Feasibility Study. Except "roop-cut" in the river training measure, the rest of all alternatives, which will be described in following pages, will be large-scale projects. Although the EIA requirement of Ministerial Decree of Ministry of Science, Technology and Environment does not state that flood control facilities are obligated to prepare EIA, the project will need environmental impact analysis and formulation of environmental countermeasures that will be incorporated into the Feasibility Study owed to their expected impacts on the sites and the surroundings. Comments of Office of Environmental Policy and Planning (OEPP) shall be obtained at each phase of study.

1.3 Mandatory of EIA

Projects or activities of government agency, state enterprise or private persons who are required to prepare EIA (Environmental Impact Assessment) report are specified by the Notification of the Ministry of Science, Technology and Environment by the name of the Mr. Pajitra Auetaweekul, the Minister under the Enhancement of National Environment Quality Act B.E. 2535. The notification, shown below, was published in the Government Gazette Vol. 109, No. 130 (October 8, 1992) and additional types of projects and activities in the Government Gazette Vol. 109, No. 136 (October 22, 1992).

List of Projects or Activities (1/2)

Items	Types of projects or activities	Size
1	Dam or reservoir	Storage volume 100,000,000 cubic meter or more or storage surface area 15 square kilometers or more
2	Irrigation	Irrigated area 80,000 rais (12,800 hectares) or more
3	Commercial airport	All sizes
4	Hotel or resort facilities located in areas adjacent to rivers, coastal areas, lakes or beaches or in the vicinity of national parks or historical parks	80 rooms or more
5	Mass transit system under the Mass Transit System and Expressway Act or project as the same characteristic or mass transit which use rail	All sizes
6	Mining as defined by the Mineral Act	All sizes
7	Industrial estate as defined by the Industrial Authority of Thailand Act or projects with similar feature	All sizes
8	Commercial port	With capacity for vessels of 500 gross tons or more
9	Thermal power plant	Capacity of 10 MW. or more
10	Industries (a) Petro chemical industry (b) Oil refinery (c) Natural gas separation or processing (d) Chlor-alkaline industry requiring sodium chloride (NaCl) as raw material for production of sodium carbonate (Na ₂ CO ₂), sodium hydroxide (NaOH), hydro chloric acid (HCl), chlorine (Cl ₂), sodium hypo-chloride (NaOCl) and bleaching powder (e) Irons and/or steel industry (f) Cement industry (g) Smelting industry other than iron and steel (h) Pulp industry	(a) Using raw materials which is produced from oil refinery and/or natural gas separation with production capacity of 100 tons/day or more (b) All sizes (c) All sizes (d) Production capacity of each or combined products of 100 tons/day or more (e) Production capacity of 100 tons/day or more (production capacity shall be calculated by using furnaces capacity of ton/day multiply by 24 hours) (f) All sizes (g) Production capacity 50 tons/day or more (h) Production capacity 50 tons/day or more
11	All types of projects located in the areas where it has been approved by the Cabinet to be watershed area as class 1B*	All sizes

List of Projects or Activities (2/2)

Items	Types of projects or activities	Size
1.	Coastal reclamation	All sizes
2.	Building in areas adjacent to rivers, coastal areas, lakes or beaches or in the vicinity of national parks or historical park	(a) Height of 23 meters or more, or, (b) Total floor area or any floor area in the building is 10,000 square meters or more
3.	Residential condominium as defined by the Condominium Act	80 units or more
3.	Residential condominium as defined by the Condominium Act	80 units or more
4.	Land allocation for residential or commercial purpose	500 land plots or more or total developed area exceed 100 rais (16 hectares)
5.	Hospital which located	(a) In area adjacent to rivers, coastal areas, lakes or beaches (b) In area other than (a) : (i) In-patient's bed of 30 beds or more, (ii) In-patient's bed of 60
6.	Pesticide industry or industry producing active ingredient by chemical process	All sizes
7.	Chemical fertilizers industry using chemical process in production	All sizes
8.	Highway or road as defined by the Highway Act, passing through following areas	(a) Wildlife sanctuaries and wildlife non-hunting areas as defined by the Wildlife Conservation and Protection Act (b) National Park as defined by the National Park Act (c) Watershed area classified as Class 2 by the Cabinet Resolution (d) Mangrove forests designated as the National Forest Reserve (e) Coastal area within 50 meters from the maximum sea level All projects with equivalents to or above the minimum standard of rural highway including roadbed expansion

1.4 Organization of the IEE Report

This IEE report contains four major sections as follows:

(1) Description of proposed project and the sites

A brief description of tentatively proposed flood control measures such as river training, flood diversion channel, and retarding basin, and the site description.

(2) Discussion of probable environmental effects

Environment likely to be affected is discussed and evaluated according to each parameter in the Guidelines for each project. The parameters utilized for the evaluation of each facilities' environmental impacts are of following Supplemental EIS Guidelines in Manual of NEB.

- Supplemental Guidelines of *Highways*: river training (roop-cut, widening, embankment), Diversion Channel
- Supplemental Guidelines of *Dams and Reservoirs*: retarding basin

(3) Tabulation of Initial Evaluation

A table that shows a summary of results of environmental impacts of each projects on each parameter.

(4) Summary

Brief explanations of the conclusions of the IEE and the reasonings.

Chapter 2. OUTLINE OF PROJECTS AND PROJECT SITES

2. 1 Description of Proposed Projects

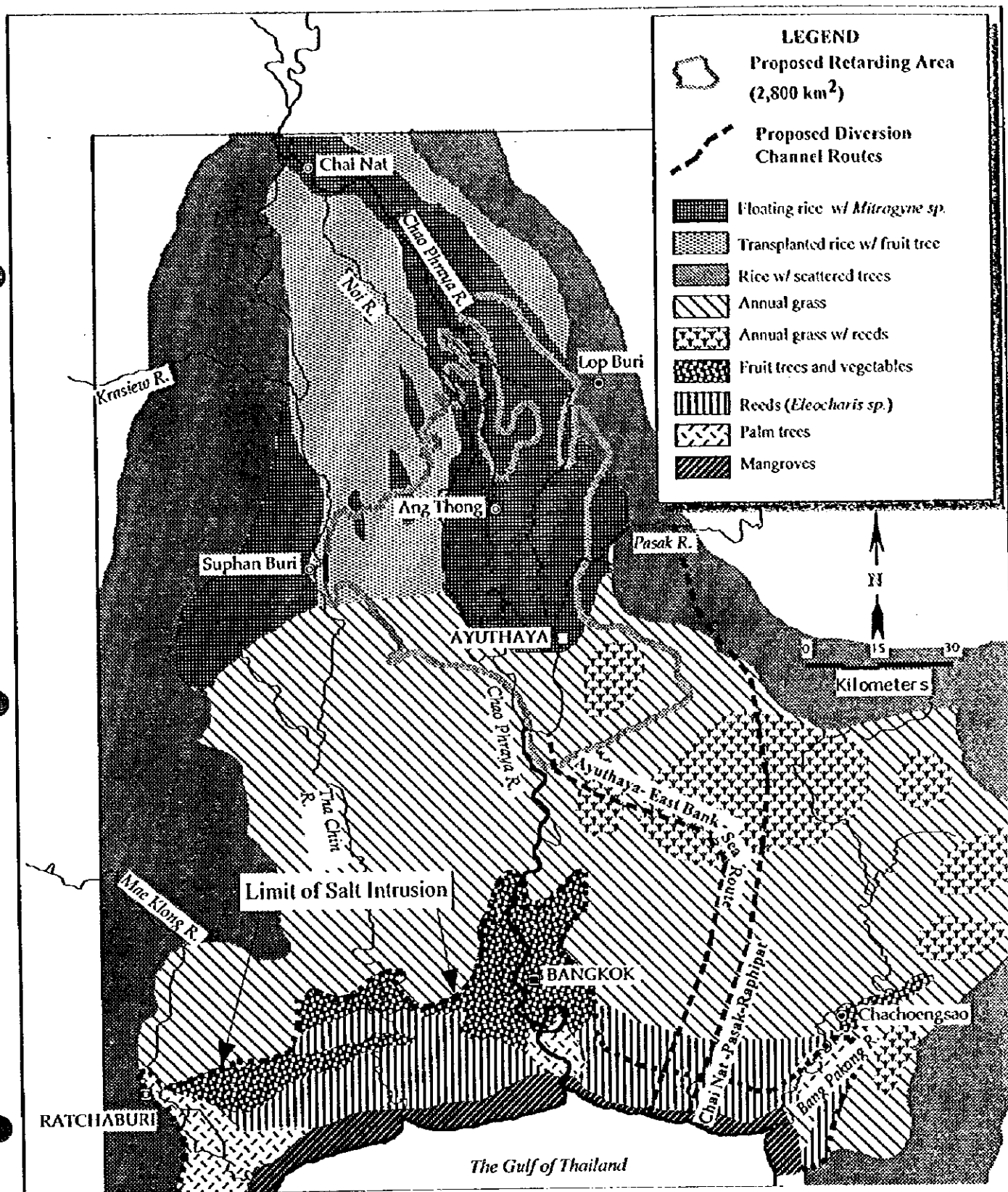
The brief outlines of each proposed project and the general settings of the project sites will be described in this section. A term "proposed project" used in this section refers to *only the largest outlines of projects* that are chosen at the primary stage of selecting process of the best alternative (s). The proposed projects are: river training, flood diversion channel, and retarding basin. IEE was conducted on these proposed projects, and in the following chapter, "PROBABLE ENVIRONMENTAL EFFECTS."

2. 1. 1 River Training

A term, river training, refers to increasing discharge capacity, cubic meter per second, of the river. By implementation of river training works, flood water may flow downstream faster than without the project. River training generally includes heightening of the embankment, widening and shortcut of river channel, and excavation of the river bed. For mitigating of flood damage in Bangkok and the surrounding area, all the measures above except excavation are proposed, and the location of river training works could be any stretch of the Chao Phraya river and the Tha Chin river where it is concerned effectively mitigate flood. IEE was conducted on the changes will be made by the outline of river training works. However, only minor river training works might be possible to implement for the Chao Phraya river and the Tha Chin river because confining flood water in river lines may cause flooding in cities downstream.

2. 1. 2 Flood Diversion Channel

Ten flood diversion channel routes (Fig. 2.1) are proposed to divert flood water from upstream of the Chao Phraya river, or from the major tributary, to the Gulf of Thailand. All these routes are intended to divert flood water from the Chao Phraya river that might overflow dikes at the stretch along Bangkok, otherwise. The study is now in a selecting process of choosing the best among the alternatives. In order to minimize construction cost and social conflicts, sparsely populated area shall be chosen for the routes. Some routes will use existing irrigation canals by widening and excavating while other stretches in built-in area will be bypassed by new course to minimize number of relocation. Table 2.1 shows the estimation of construction cost, including land acquisition, and number of houses needed to be relocated for each proposed diversion routes.



Source: TAKAYA, Yosikazu, *Agricultural Development of a Tropical Delta: A Study of the Chao Phraya Delta* (1987), Kyoto University

IEE REPORT FOR INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Figure 2.1
PROPOSED PROJECTS AND NATURAL VEGETATION

Table-2.1 NUMBER OF HOUSES NEED RELOCATION

Case	Diversion Route (Distance -km)	Case-a		Case-b		Case-c	
		Cost (mil Baht)	Relocation of Houses	Cost (mil Baht)	Relocation of Houses	Cost (mil Baht)	Relocation of Houses
1	Tha Chin R. (319)	153,056	6,500	92,554	4,000	40,408	1,500
2	Chainat-Pasak-Rahpipat-Sea (260)	162,345	2,400	111,734	2,200	58,644	1,700
3	Chainat-Pasak-Rahpipat-Ban Pakong R (362)	240,824	3,000	161,804	2,800	87,789	2,000
4	Pasak-Rahpipat Sea (127)	81,032	1,400	58,193	1,200	35,174	1,000
5	Pasak-Rahpipat-Ban Pakong R (229)	175,064	2,000	119,871	1,900	69,433	1,300
6	Ayuthaya-West Bank- Sea (105)	129,692	3,200	91,143	2,900	52,555	2,200
7	Ayuthaya-West Bank- Tha Chin (160)	152,832	3,600	95,798	2,500	46,162	1,500
8	Ayuthaya-East Bank-Sea (96)	122,413	1,600	86,044	1,500	49,471	1,400
9	Chaophraya II (57)	128,114	11,000	89,298	8,000	50,526	5,700
10	Green Belt -Sea (78)	164,700	2,500	115,412	2,300	65,919	2,300

The flow rates to be studied are as follows, however, the proposed diversion channels' dimensional specifications are not exactly decided yet.

- Capacity Study Case - a : 1,500 m³/s
- ditto Case - b : 1,000 m³/s
- ditto Case - c : 500 m³/s

Table 2.1 DIMENTION OF CROSS SECTION OF DIVERSION CHANNEL

Case	Diversion Route	Channel Width of Case Study-a Flow rate: 1,500 m ³ /s	Channel Width of Case Study-b Flow rate: 1,000 m ³ /s	Channel Width of Case Study-c Flow rate: 500 m ³ /s
1	Tha Chin R. (Upper stretch)	124 m	95 m	65 m
1	Tha Chin R. (middle stretch)	131 m	103 m	75 m
1	Tha Chin R. (lower stretch)	318 m	233 m	159 m
2	Rahpipat-Sea	202 m	146 m	90 m
3	Chainat-Pasak	277 m	195 m	113 m
4	Pasak-Rahpipat-Sea	483 m	399 m	315 m
5	Rahpipat-Ban Pakong R. (1/2)	399 m	315 m	230 m
5	Rahpipat-Ban Pakong R. (2/2)	483 m	399 m	315 m
6	Ayuthaya-West Bank- Sea	305 m	215 m	125 m
8	Ayuthaya-East Bank-Sea	305 m	215 m	125 m
9	Chaophraya II	333 m	234 m	134 m
10	Green Belt -Sea	343 m	267 m	151 m

2. 1. 3 Retarding Basin

Retarding basin, which retains flood water for certain period and mitigate degree of severance of flood, is also a one of the alternative measures for flood control. Proposed site for the retarding basin is placed at the center to upper part of the Chao Phraya delta along the Chao Phraya river line (Fig. 2.1). It lets flood water into the area at beginning of flood period, and cut the peak of flood flow of the Chao Phraya river, and release the stored flood water into the Chao Phraya river back again after flood peak period. Size of the proposed area is approximately 2,800 km² in where deep-water rice cultivation are dominant, and partially used for floating rice.

There are no certain flood control facilities designed yet for the retarding basin, however, this Initial Environmental Examination report will presume small regulators shall be installed and divert flood water into the retarding area, and the area will hold the water for certain period of time which is longer than what is happening naturally every year.

2. 2 General Description of Project Site

2. 2. 1 Characteristics of Land form along Chao Phraya River

The Chao Phraya Delta can be divided into the three major parts, such as flood plain, new delta, and old delta (Fig. 2.2), according to Takaya (1987). There are clear differences among them in their topographies, flood damages, and ways to coop or take advantages of the Chao Phraya rivers seasonal changes. Significance of being acquainted with characteristics of the project site lies on selecting suitable flood control measure (s) for the feasibility study. It also enhances ideas for what problems the higher priorities should be given when formulating mitigation measures and compensation measures.

(1) Flood Plain

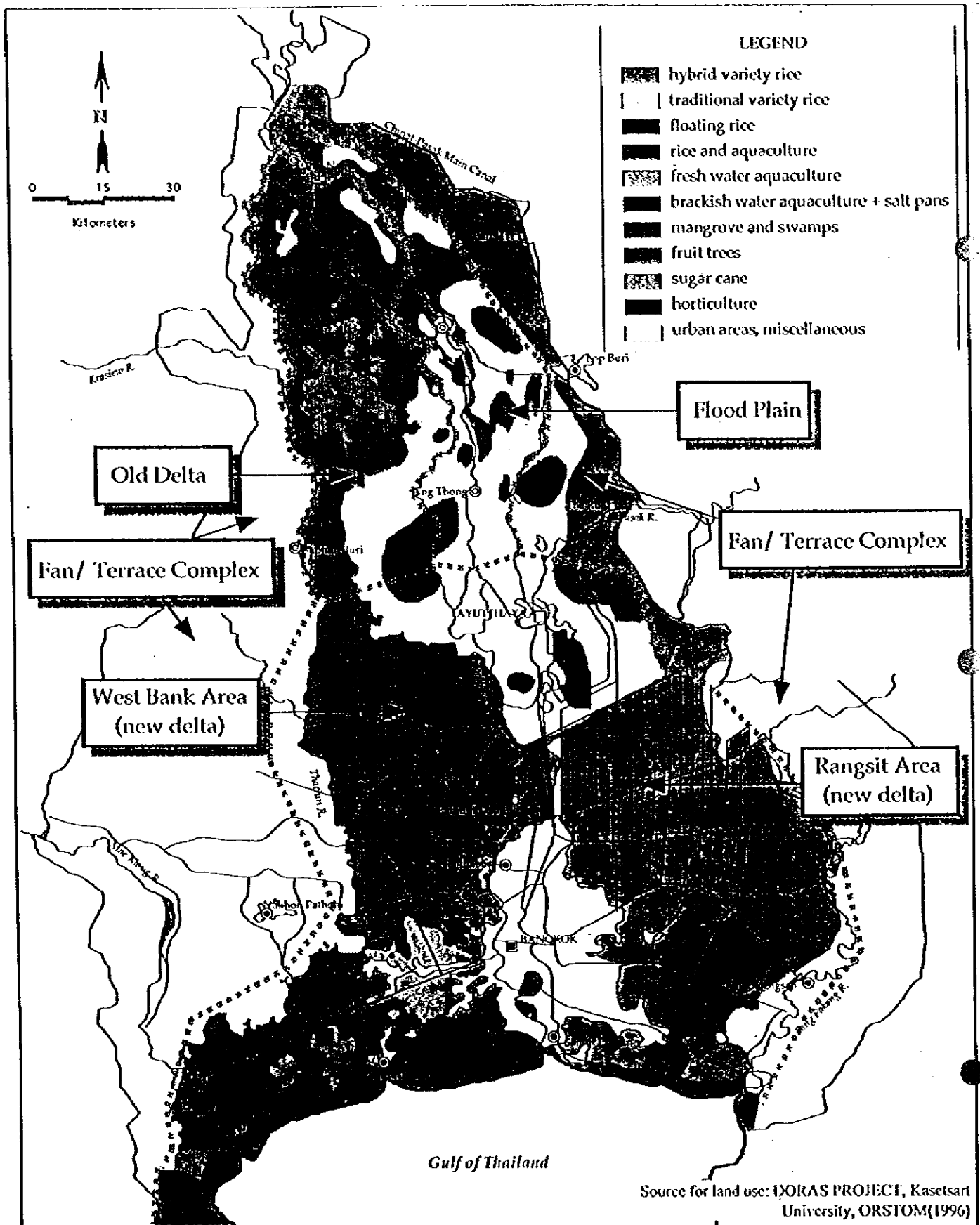
Flood plain becomes a 10 to 20 km wide flood water path during rainy season. Flood water is confined by natural dikes, which are about 3 to 4 m high. The water body expands, but it will not be disseminated. There are lowland behind the natural dikes in where deep water rice or floating rice is grown.

(2) New Delta

The elevation is not more than 2 m and it is extremely flat. Flood water dissemination and inundation occur naturally during rainy season. The depth of inundation is about 50 cm to 1 m.

(3) Old Delta

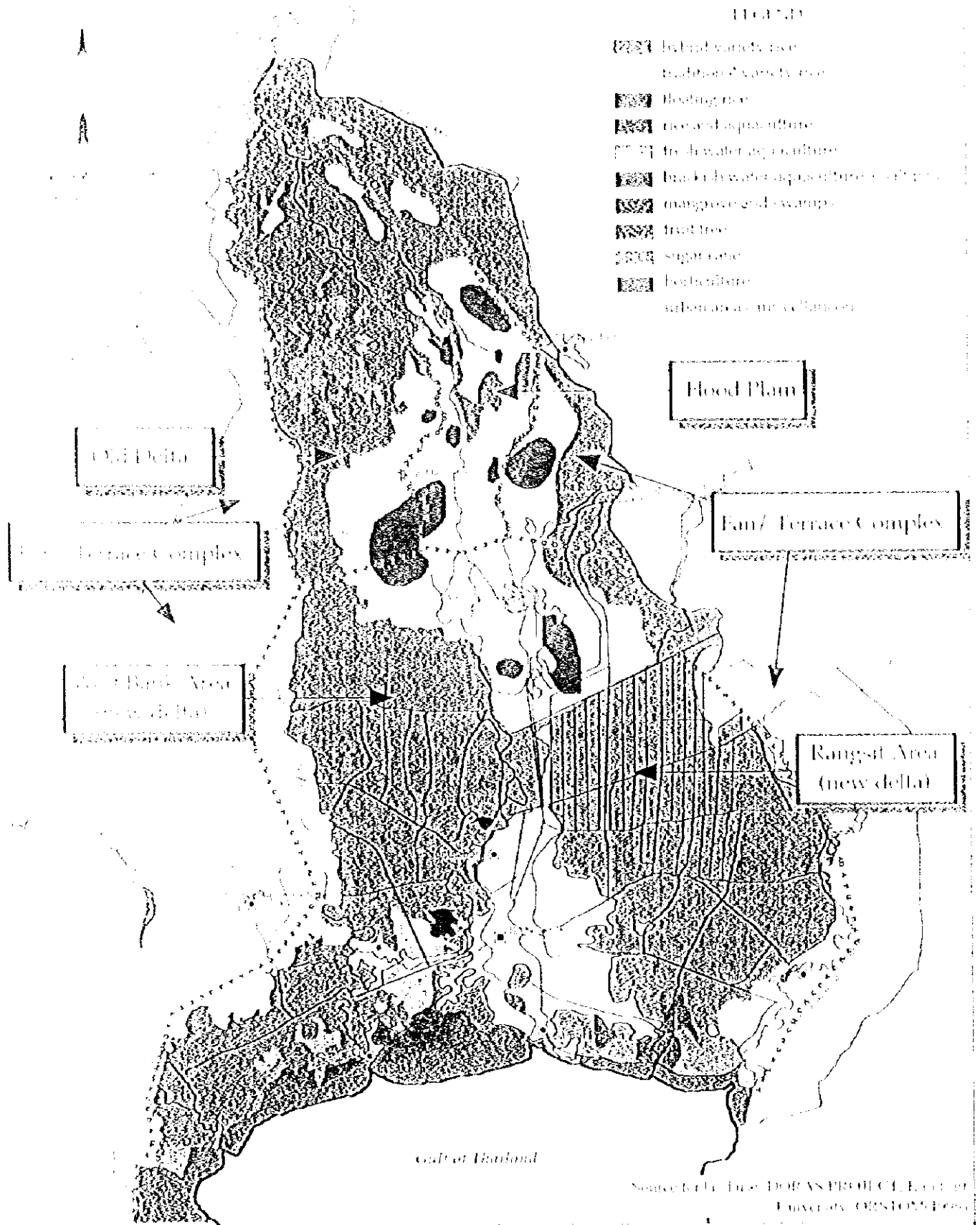
Old Delta is approximately 4 to 5 m higher than the New Delta, and not completely flat like the new delta. Flood water usually will not flow into this area. Tall trees and natural ponds are found.



IEE REPORT FOR INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Figure 2.2
LAND USE OF CHAO PHRAYA DELTA AND LANDFORM



FEI REPORT FOR INTEGRATED PLAN FOR FLOOD
 MITIGATION IN CHAO PHRAYA RIVER BASIN
 CH2 ENGINEERING CO., LTD AND INVA CORPORATION

Figure 2.2
 LAND USE OF CHAO PHRAYA DELTA
 AND LANDFORM