

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

ROYAL GOVERNMENT OF THAILAND  
MINISTRY OF AGRICULTURE AND COOPERATIVES  
THE KINGDOM OF THAILAND

THE STUDY  
ON  
THE CHONG CHAN WATER DIVERSION PROJECT  
IN  
THE KINGDOM OF THAILAND

MAIN REPORT

Final Feasibility Study

MARCH 1974

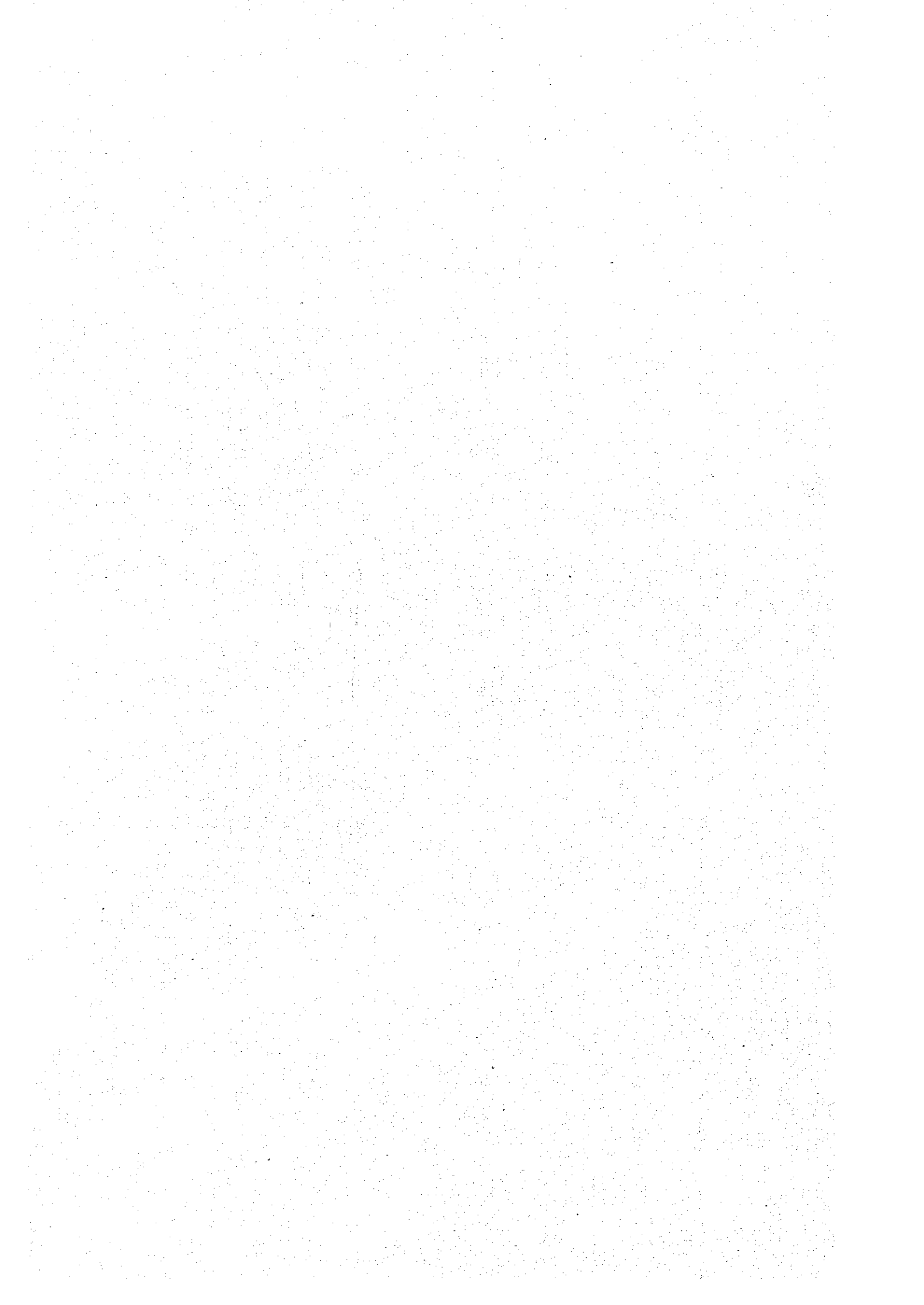
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JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

ROYAL IRRIGATION DEPARTMENT  
MINISTRY OF AGRICULTURE AND COOPERATIVES  
THE KINGDOM OF THAILAND

**THE STUDY**  
**ON**  
**THE KOK-ING-NAN WATER DIVERSION PROJECT**  
**IN**  
**THE KINGDOM OF THAILAND**

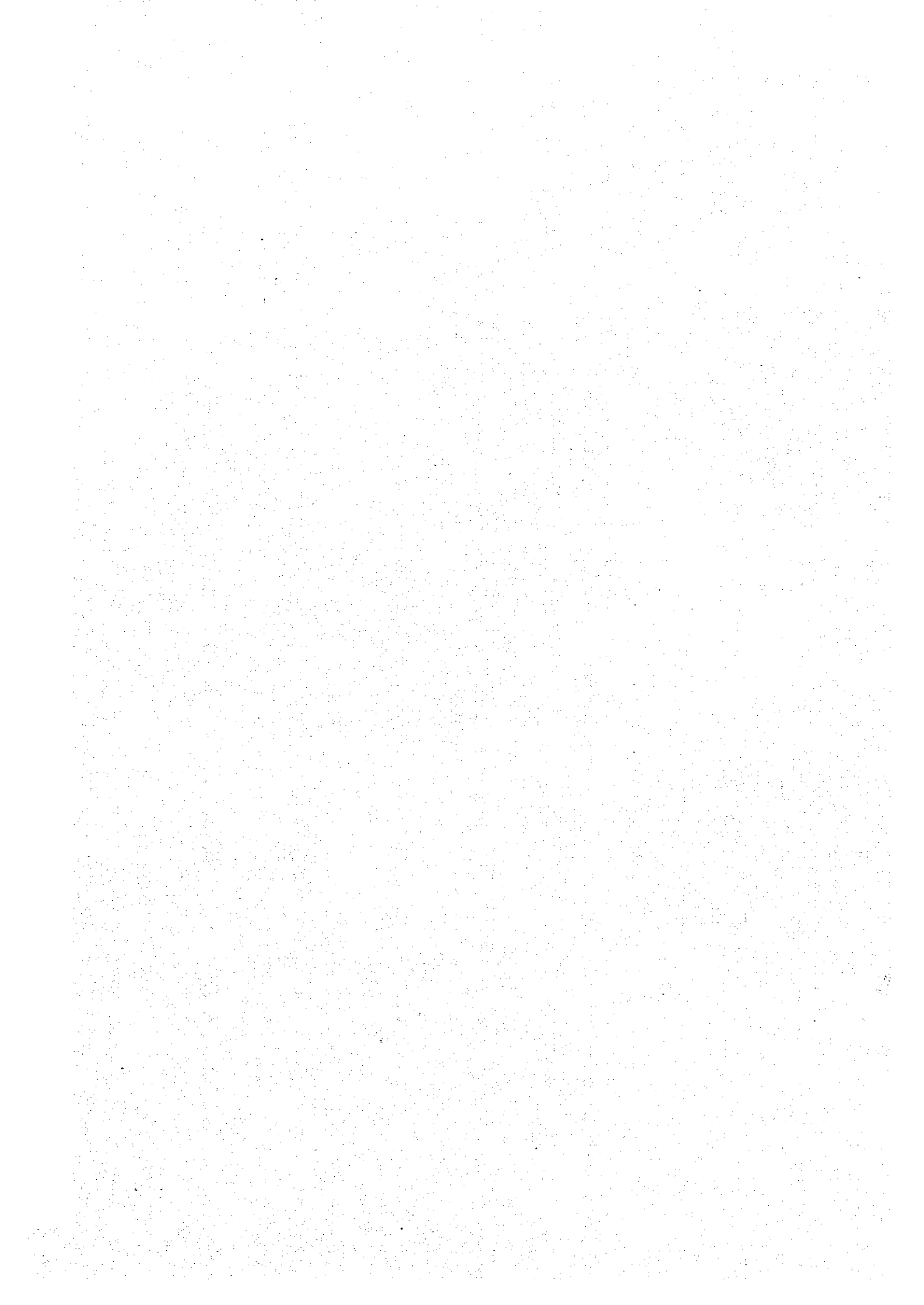
**MAIN REPORT**  
**(Conceptual Planning Study)**

MARCH 1997

SANYU CONSULTANTS INC.  
NIPPON KOEI CO., LTD.



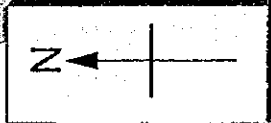
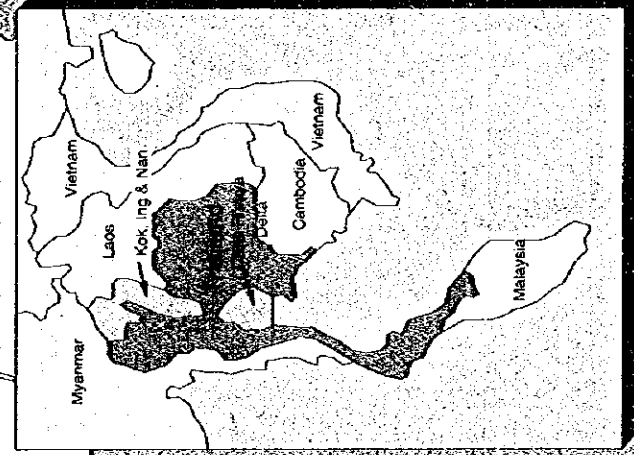
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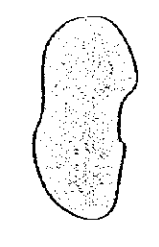


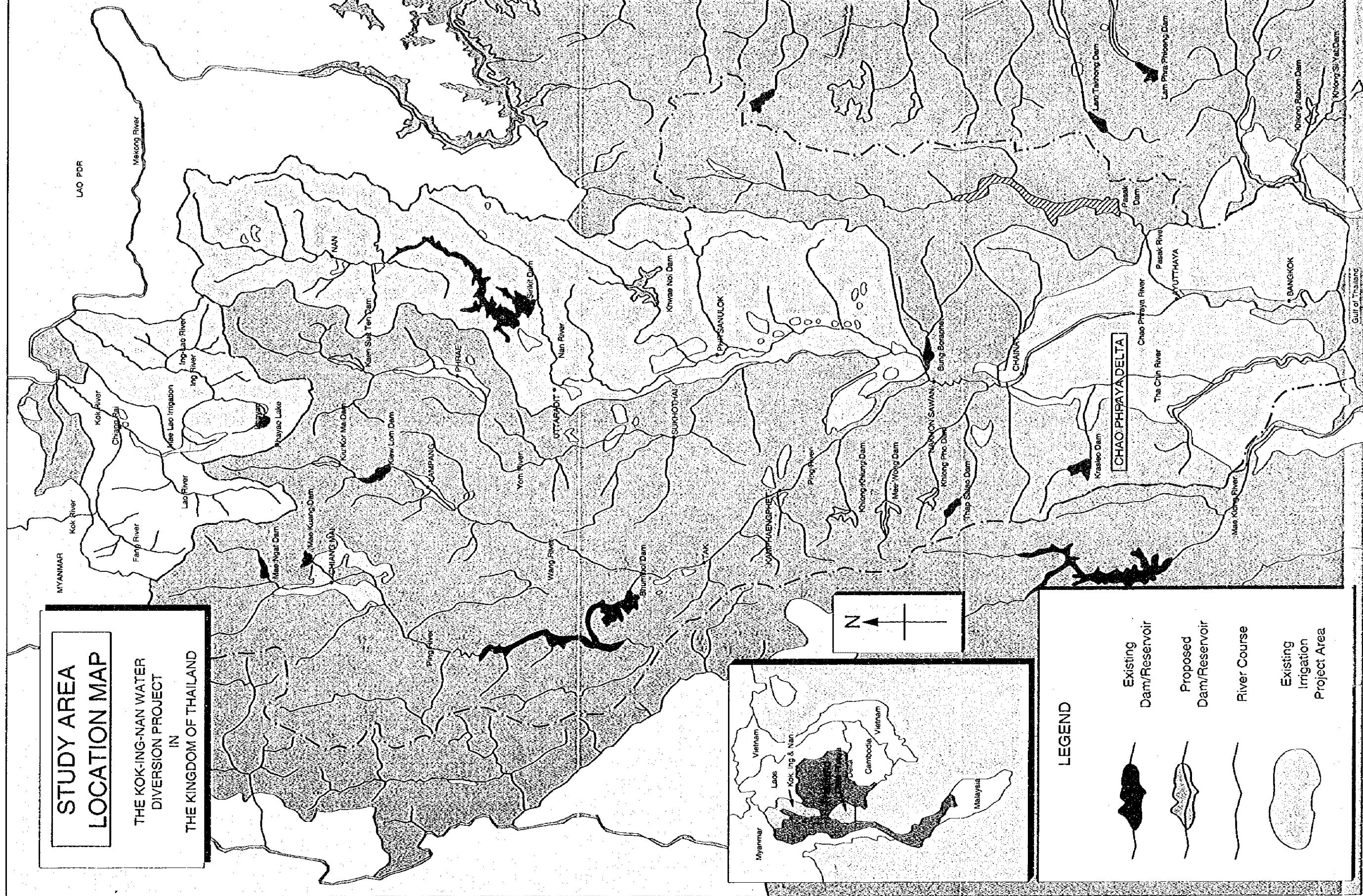
# STUDY AREA LOCATION MAP

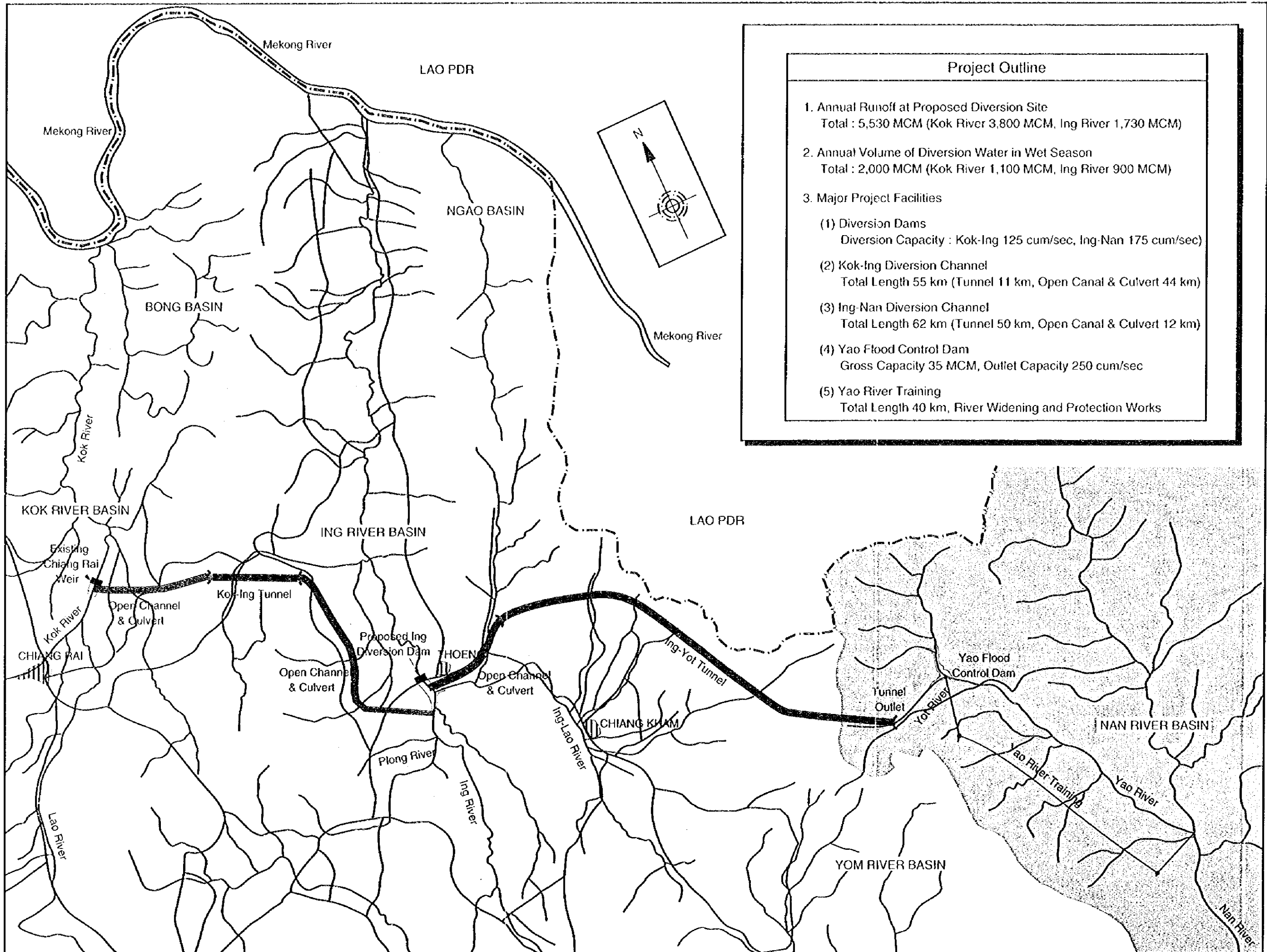
THE KOK-ING-NAN WATER  
DIVERSION PROJECT  
IN  
THE KINGDOM OF THAILAND



## LEGEND

-  Existing Dam/Reservoir
-  Proposed Dam/Reservoir
-  River Course
-  Existing Irrigation Project Area





Project Outline	
1. Annual Runoff at Proposed Diversion Site	Total : 5,530 MCM (Kok River 3,800 MCM, Ing River 1,730 MCM)
2. Annual Volume of Diversion Water in Wet Season	Total : 2,000 MCM (Kok River 1,100 MCM, Ing River 900 MCM)
3. Major Project Facilities	
(1) Diversion Dams	Diversion Capacity : Kok-Ing 125 cum/sec, Ing-Nan 175 cum/sec)
(2) Kok-Ing Diversion Channel	Total Length 55 km (Tunnel 11 km, Open Canal & Culvert 44 km)
(3) Ing-Nan Diversion Channel	Total Length 62 km (Tunnel 50 km, Open Canal & Culvert 12 km)
(4) Yao Flood Control Dam	Gross Capacity 35 MCM, Outlet Capacity 250 cum/sec
(5) Yao River Training	Total Length 40 km, River Widening and Protection Works

## Key Indicators Involved in the Kok-Ing-Nan Water Diversion Project

### 1. Chao Phraya Basin In Need of Water by Transbasin Water Diversion

Drainage Area	158,000 sq km
Potential Farmland Area	5,900,000 ha
Available Water Resources	33,000 MCM/year
Specific Runoff Yield	210 mm
Water Demand	25,300 MCM (1993), 33,330 MCM (2016)
Population	22.6 million (1993), 26.7 million (2016)
GDP	1,750 billion Baht (US\$ 70 billion) in 1994
GDP per Capita	79,000 Baht (US\$ 3,200) in 1994

### 2. Water Resources in Kok and Ing Basins

Item	Kok	Ing	Total
Drainage Area at River Mouth (sq km)	10,875	7,120	17,995
Average Annual Runoff at River Mouth (MCM)	5,300	2,300	7,600
Average Annual Runoff at Diversion Site (MCM)	3,800	1,700	5,500
Planned Diversion Water in Wet Season (MCM)	1,100	900	2,000
Planned Diversion Water in Dry Season (MCM)	200	-	200

### 3. Irrigation Beneficial Area by Alternative Water Use Plans

Beneficial Area	Plan A	Plan B	Plan C
Existing Phitsanulok Area	23,100	17,000	13,000
New Phitsanulok Stage II Area	-	-	147,000
Existing Delta Area	246,900	207,000	175,000
Kok & Ing New Developed Area	32,000	32,000	32,000
Total	302,000	256,000	367,000

### 4. Increasing Municipal and Industrial Water in Lower Nan and Delta Area

Increasing Amount from 1993 to 2016 = 1,240 MCM/year (620 MCM in dry season)

### 5. Project Facility

- |                               |  |
|-------------------------------|--|
| (1) Kok Diversion Dam         | Intake Capacity 125 cu m/sec                   |
| (2) Kok-Ing Diversion Channel | 55 km including open canal, culvert and tunnel |
| (3) Ing Diversion Dam         | Intake capacity 175 cu.m/sec                   |
| (4) Lao Diversion Canal       | 12.4 km consisting of culvert and tunnel       |
| (5) Ing-Yot Diversion Tunnel  | Tunnel of 50 km and shafts of 17 km            |
| (6) Yao Flood Control Dam     | Dam Height of 37 m, storage of 35 MCM          |
| (7) Yao River Training        | Length of 40 km                                |

### 6. Project Cost

47,600 million Baht for water use plans A and B  
55,600 million Baht for water use plan C

### 7. Project Evaluation

Item	Plan A	Plan B	Plan C
(1) Incremental Benefit (10 <sup>6</sup> Baht)			
Irrigated Agriculture	6,261	4,312	5,435
Municipal & Industrial Water of 1,240 MCM/year	4,024	4,024	4,024
Hydro-power Generation	328	328	328
Total	10,613	8,664	9,787
(2) EIRR (%)	15.1	13.2	12.7



## LIST OF ABBREVIATIONS

AIT	Asian Institute of Technology
ALRO	Agricultural Land Reform Office
ARD	Accelerated Rural Development, MOI
ASDECON	ASDECON Corporation
BMA	Bangkok Metropolitan Administration
CPD	Cooperatives Promotion Department, MOAC
DEDP	Department of Energy Development and Promotion
DLD	Department of Land Development, MOAC
DMR	Department of Mineral Resources, Ministry of Industry
DOF	Department of Fishery
DOH	Department of Health, Ministry of Public Health
DPW	Department of Public Works
DTEC	Department of Technical and Economic Cooperation
EGAT	Electricity Generating Authority of Thailand
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization of the United Nations
IEAT	Industrial Estate Authority of Thailand
JICA	Japan International Cooperation Agency
KINWDP	Kok-Ing-Nan Water Diversion Project
MD	Meteorological Department, Ministry of Communications
MOAC	Ministry of Agriculture and Cooperatives
MOI	Ministry of Interior
MOSTE	Ministry of Science, Technology and Environment
MWA	Metropolitan Waterworks Authority
NEA	National Energy Administration
NEB	National Environmental Board
NESDB	National Economic and Social Development Board of Thailand
NRDC	National Rural Development Committee
NSC	National Security Command
NWRC	National Water Resources Committee
NWRB	National Water Resources Board
OECE	Overseas Economic Cooperation Fund
OEPP	Office of Environmental Policy and Planning
PANYA	PANYA Consultants
PAO	Provincial Administration Organization
PPD	Project Planning Division, RID
PWA	Provincial Waterworks Authority
PWD	Public Works Department, MOAC
RID	Royal Irrigation Department, MOAC
RDPB	Royal Development Project Board
RFD	Royal Forestry Department
TDRI	Thailand Development Research Institute
TEAM	TEAM Consultants
SCT	Sanyu Consultants (Thailand) Inc.
WHO	World Health Organization
WMO	World Meteorological Organization



**Kok-Ing-Nan Water Diversion Project  
Conceptual Planning....Main Report**

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**CHAPTER 1**  
**INTRODUCTION**



## CHAPTER 1 INTRODUCTION

### 1.1 Background of the Study

The Chao Phraya river basin has a large drainage area of 158,000 sq.km consisting of the major sub-basins of the Nan, Yom, Wang, Ping, Sakae Krung, Pasak and Delta area and has been playing a vitally important role in the economic development in the country supporting the national food security and the export of agricultural products favored with the fertile farmland area of 5.9 million ha. In the area surrounding the Bangkok Metropolis, the lowermost reach of the basin, expansion of the urban area and a rapid industrial development are observed.

Keeping the pace with the rapid and successful economic development in Thailand in the recent years, the water demand for irrigation, domestic and industrial use and others has increased year by year and reaches to the large amount of 25,300 MCM in the year of 1993. The agricultural and industrial development in Thailand will be further progressed toward 21 century, as a result the total water demand in the year of 2016 is estimated to reach at the huge amount of 33,300 MCM, among which especially the irrigation water demand in the basin will increase considerably to 27,400 MCM in the year of 2016 from 20,300 MCM in the year of 1993, because of increasing irrigation water in dry seasons as derived from the acceleration of second crops plantation in the basin.

While, the potential water resources in the Chao Phraya basin consisting of the Nan, Yom, Wang, Ping, Sakae Krung and Pasak sub-basins are limited at about 34,540 MCM and are mostly concentrated in wet season from June to November without requiring much irrigation water covered by the plenty of effective rainfall for crop plantation. The potential water resources at the Chainat barrage, from where irrigation water is diverted and distributed to the Chao Phraya delta area, are 22,490 MCM, only 6,000 MCM of which is available in dry season.

In order to alleviate the constraint of water shortage during dry season, a number of storage dams to retain the rich runoff in wet season and use it in dry season have been planned, constructed and operated in the Chao Phraya basin. Bhumibol dam with the active capacity of 9,660 MCM on the Ping river and Sirikit dam with the capacity of 6,660 MCM on the Nan river are the notable dams in Thailand.

The developed water by storage dams in the basin, however, is still not sufficient to meet the water demand for various water users. Water demand in the Chao Phraya basin are summarized as follows in accordance with the report of Water Resources Development for 25 Basins prepared by NESDB in 1993.

Water Demand in Chao Phraya Basin by NESDB's Study

Water User Sector	Water Demand (MCM)		Increasing Rate (%)
	At Present (1993)	In Future (2016)	
Agriculture	20,260	27,360	135
Domestic/Municipal Uses	1,600	2,420	150
Industry/Tourism Uses	580	1,150	200
Environmental Balance	2,860	2,400	80
<b>Total</b>	<b>25,300</b>	<b>33,330</b>	<b>130</b>

On the other hand, the new water resources development to cope with the increasing water demand has been studied by RID and other agencies concerned since 1980. The new water resources development, however, has faced more difficulty due to lack of proper damsites to store the water economically and more consideration needed for environmental impact and its mitigation measures. In addition, the water resources development in sub-basins to use the developed water within their own beneficial area will bring another water shortage problem in the lower Chao Phraya delta area, which receives major runoff contribution from the upstream sub-basins. In accordance with the RID's plan, the large and medium scale water resources development projects to be newly implemented in future in the Chao Phraya basin will produce about 4,000 MCM of additional water, of which available water resources in dry season are estimated at about 1,000 MCM only.

In order to solve the water shortage problem in the Chao Phraya basin, a number of transbasin projects to divert the water from the Mekong and Salwin rivers to the Chao Phraya basin had been studied by Thai Government since 1980. Those transbasin projects, however, are judged to be less viable for implementation due to difficulty to use the water in the international river, the large environmental impact for constructing large reservoir to retain the bulk water in wet season, etc., as a result, further studies have been canceled or suspended to date.

In 1991, RID set up the preliminary plan for the transbasin water diversion from the Kok and Ing rivers to the existing Sirikit dam through the Nan river. The plan is consisting of two



diversion dams on the Kok and Ing rivers to divert their runoffs, the diversion channel with a long distance to connect two diversion dams and the diversion tunnel of large capacity to convey the diverted water to the Nan river, etc. The plan was considered to be highly feasible, as compared with a number of alternative transbasin plans ever studied, with favorable development merits as stated below;

- Water diversion from the rivers situated in Thailand territory
- Abundantly available runoff in Kok and Ing rivers
- Effective use of the existing facilities such as the Sirikit reservoir
- Less environmental impact
- Active contribution for rural development in Kok and Ing river basins

To further ascertain the feasibility, soundness and viability of the proposed plan together with assessment of environmental impact to be induced by the project, RID requested to the Japanese Government to carry out the feasibility study under the technical cooperation program. In response to the request of RID, Japan International Cooperation Agency dispatched the JICA Study Team in August 1996 to commence the Phase I study to justify the necessity and viability of the project and to conduct the initial environmental examination in the project area.

## **1.2 Objectives of the Study**

The objectives of the Study are;

- (1) To investigate and justify in Phase I study the necessity and viability of the project, which aims to contribute to agricultural and other development in the Kok, Ing and Chao Phraya river basins, through the study for the water resources potentiality, water demand projection, and the various alternative plans and projects ever studied/proposed within the Chao Phraya basin or transbasin projects from the other river basins.
- (2) In case that the project is justified to be necessary and viable through the Phase I study, to conduct as the Phase II study a feasibility study for the project in order to confirm the project plan sound technically, socially and environmentally.

- (3) To conduct a study on the environmental impact assessment toward the implementation of the project.
- (4) To carry out technology transfer to the Thai counterpart personnel in the course of the study.

### **1.3 Study Area**

The study shall cover (1) the project area consisting of the Kok, Ing and upper Nan river basins where the water diversion plan is set up, and (2) the Chao Phraya basin consisting of the direct beneficial area of the Nan and Chao Phraya Delta and other large sub-basins of the Yom, Wang, Ping, etc.

### **1.4 Scope of the Study**

RID, the Ministry of Agriculture and Cooperatives has already initiated the Feasibility Study and Environmental Impact Study on Kok-Ing-Nan Water Diversion Project (Project) from March 1996. Accordingly the Study will be conducted to supplement and strength the RID study (Thai side Study), dividing into two phases as follows;

Phase I: Conceptual Planning and Initial Environmental Examination (IEE)

Phase II: Feasibility Study and Environmental Impact Assessment (EIA)

The Phase I study is to be conducted in order to investigate and justify the necessity and viability of the project, while the Phase II study is to be performed on the condition that the necessity and viability of the project are confirmed through the Phase I study.

### **1.5 Personnel Engaged in the Study**

Personnel engaged in the Study such as members of JICA Advisory Committee, RID Steering Committee and JICA Study Team are as shown in the Appendix attached at the end of this report.