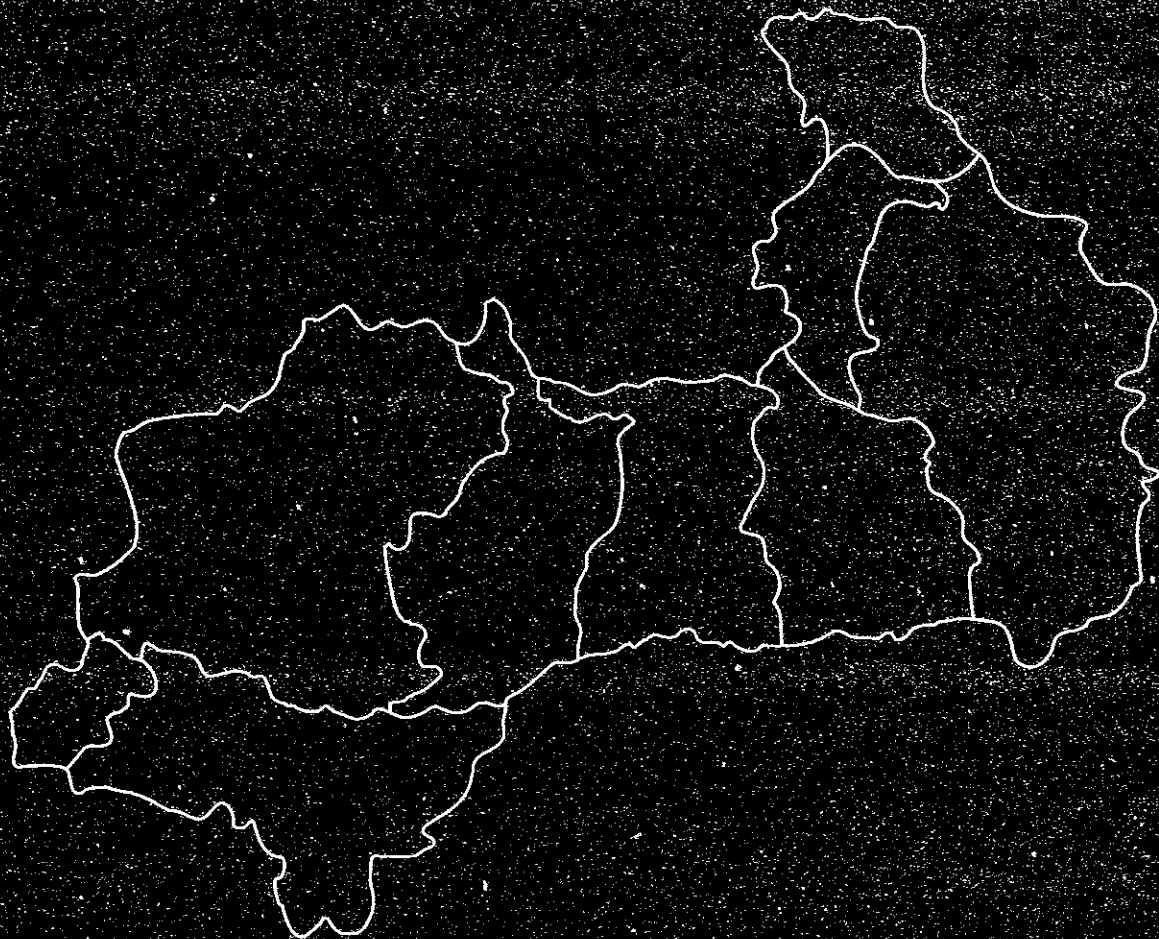


JAPAN INTERNATIONAL COOPERATION AGENCY

THE GOVERNMENT OF THE KINGDOM OF THAILAND  
NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT BOARD

**THE STUDY ON THE REGIONAL DEVELOPMENT PLAN  
FOR THE LOWER NORTHEAST AND  
THE UPPER EAST REGIONS  
IN THE KINGDOM OF THAILAND**

**FINAL REPORT**



**Executive Summary**

September, 1993

NIPPON KOEI CO., LTD.

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The study on the national development plan for the lower northeast and the upper east regions...

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## List of Reports

Executive Summary Report

Main Report

Sector Reports

1. Agriculture
2. Industry
3. Tourism
4. Trade and Distribution
5. Land and Environment
6. Water Resources
7. Power and Energy
8. Telecommunications
9. Transportation
10. Urban System
11. Socio-Economy and Social Systems
12. Finance and Institution
13. Preliminary Feasibility Analysis on Selected Priority Projects
  - Regional Artery Establishment
  - Small Pumping Reservoirs Development
  - Integrated Urban Development Program
  - Drip Irrigation Development
  - Dairy Industry
  - Meat Processing Industry
  - Animal Feed Manufacturing
14. Geographic Information System (GIS) and Regional Planning

国際協力事業団

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## PREFACE

In response to a request from the Government of the Kingdom of Thailand, the Government of Japan decided to conduct the Study on the Regional Development Plan for the Lower Northeast and Upper East Regions in the Kingdom of Thailand and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Thailand a study team headed by Dr. Tsuyoshi Hashimoto of Nippon Koei Co.,Ltd. from March 1992 to March 1993.

The team held discussions with the officials concerned of the Government of Thailand and conducted field surveys in the study area. After the team returned to Japan, further studies were carried out and the present report was prepared.

I hope that this report will contribute to the promotion of the master plan and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Thailand for their close cooperation extended to the team.

August, 1993

A handwritten signature in black ink, reading "Kensuke Yanagiya". The signature is written in a cursive style with a long horizontal line extending to the right.

Kensuke Yanagiya  
President

Japan International Cooperation Agency



August 31, 1993

Mr. Kensuke Yanagiya  
President  
Japan International Cooperation Agency  
Tokyo, Japan

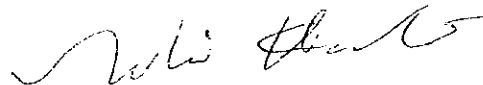
### Letter of Transmittal

It is my greatest pleasure to submit to you the Final Report for the Study on the Regional Development Plan for the Lower Northeast and Upper East Regions. We have been carrying out the study since February 1992 and successfully completed the work with close cooperation of the National Economic and Social Development Board (NESDB), Thailand. The Final Report is composed of Executive Summary Report, Main Report, 12 sector Reports and Preliminary Feasibility Analyses Report on Selected Priority Projects.

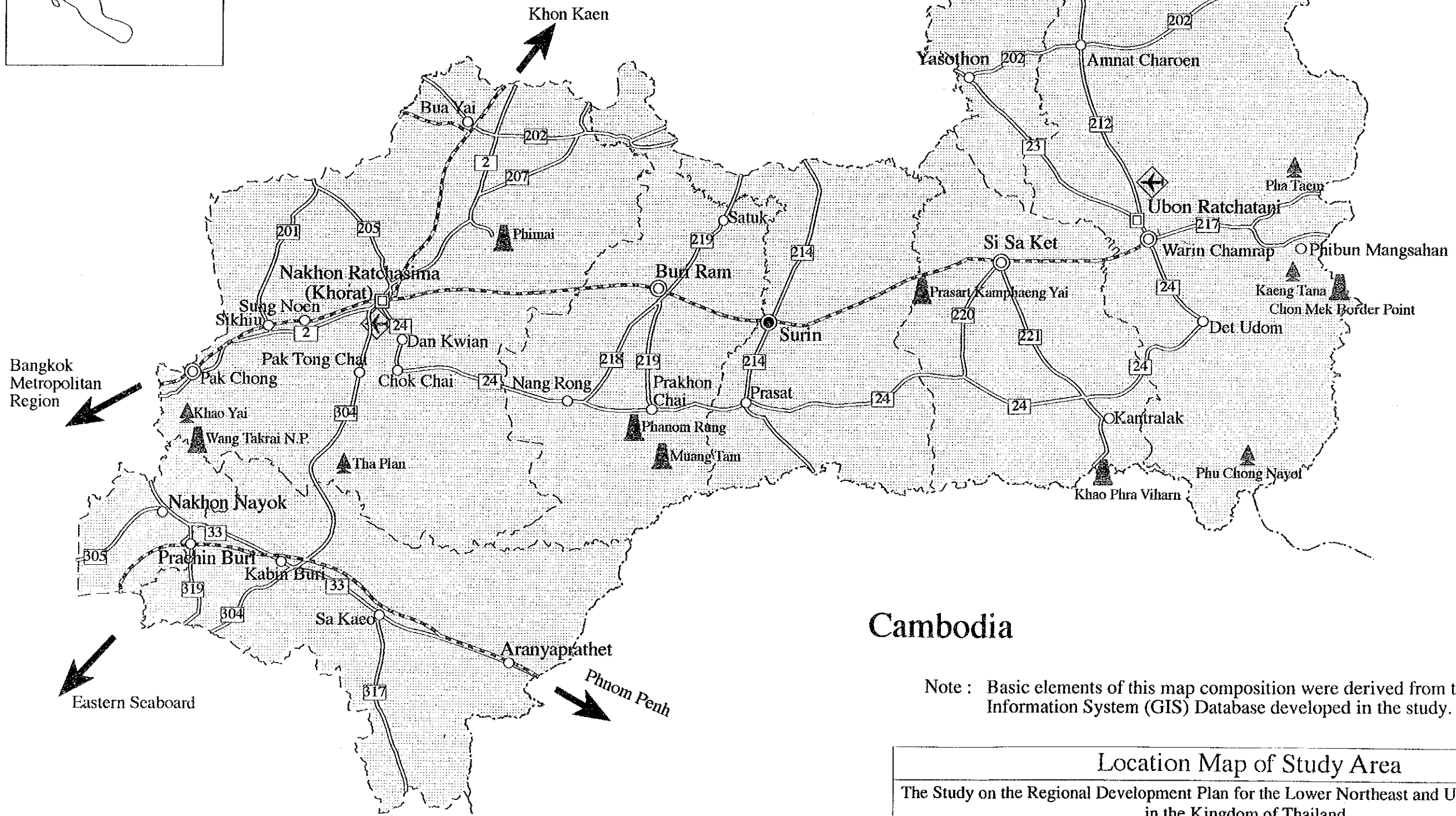
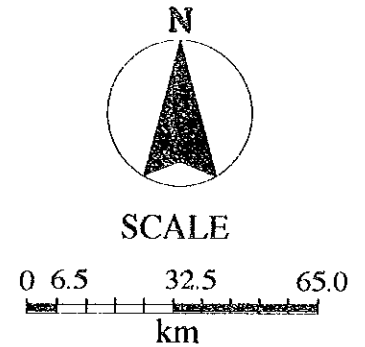
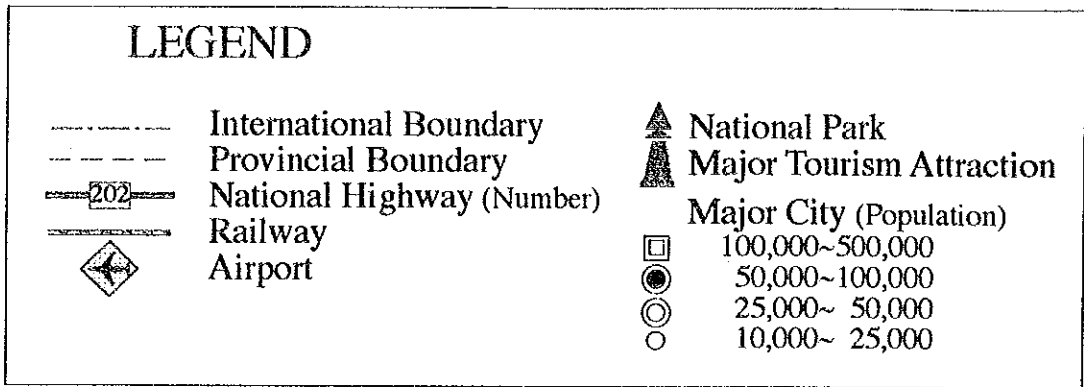
This Final Report is a product of the survey work by the Study Team as well as cooperative efforts of NESDB and all the other parties concerned. In the course of the Study, a number of opportunities were made available such as workshops, seminars and steering committee meetings to present the interim survey results to a wide range of participants including central and provincial government officers, academicians and researchers, private sector representatives and non-governmental organisations (NGOs). Comments and opinions raised at these opportunities were thoroughly analyzed and integrated into the Final Report to the extent possible.

The Lower Northeast and Upper East Regions of Thailand have been one of the poorest regions in the country. With a number of favorable conditions, however, these regions are starting to see a chance for economic development along with the development of Eastern Seaboard and expanding economic transactions with the neighboring Indochina countries. The development of the LNE-UE regions will contribute to the poverty alleviation in the regions as well as further economic development of the country. Implementation of the master plan proposals contained in this Final Report will hold a key in this sense. I sincerely hope the Thai government with NESDB's initiative will promptly take necessary steps toward the realization of the master plan.

Sincerely yours,



Tsuyoshi Hashimoto  
Team Leader  
Study on the Regional Development Plan  
for the Lower Northeast and Upper East  
Regions



Note : Basic elements of this map composition were derived from the Geographic Information System (GIS) Database developed in the study.

**Location Map of Study Area**  
 The Study on the Regional Development Plan for the Lower Northeast and Upper East Regions in the Kingdom of Thailand





# EXECUTIVE SUMMARY

## Table of Contents

	page
1. LOWER NORTHEAST AND UPPER EAST (LNE-UE) REGIONS .....	1
2. OBJECTIVES AND BASIC STRATEGY FOR LNE-UE REGIONAL DEVELOPMENT.....	2
2.1 Objectives of LNE-UE Regional Development.....	2
2.2 Basic Strategy for LNE-UE Regional Development .....	2
3. DEVELOPMENT FRAMEWORKS FOR LNE-UE REGIONAL DEVELOPMENT .....	3
3.1 Socio-Economic Framework.....	3
3.2 Spatial Development Framework .....	4
4. LNE-UE DEVELOPMENT SCENARIO WITH PHASING.....	11
5. LNE-UE REGIONAL DEVELOPMENT MASTER PLAN.....	12
5.1 Regional/Inter-Regional Projects .....	12
5.2 Area Development Programs .....	17
5.3 Special Sector Programs .....	21
5.4 Other Regional and Local Projects .....	27
5.5 Indicative Investment Schedule .....	28
6. STRATEGY AND PROJECTS BY SECTOR .....	32
6.1 Economic Sectors.....	32
6.2 Natural Resources and Infrastructure Sectors .....	34
6.3 Human Development (Education, skill training and public health) .....	38
7. ACTION PLAN .....	40
7.1 Master Plan Adoption and Promotion.....	40
7.2 Core Projects Formulation and Implementation .....	41
7.3 Immediate Actions and Phase I Budget .....	43

## List of Tables

		page
Table 1	LNE-UE Socio-Economic Framework for Balanced Development Compared with National Targets.....	3
Table 2	Characterization of Major Urban Centers and Clustering.....	6
Table 3	Proposed Land Use for Development and Conservation.....	5
Table 4	Development Phasing - Characterization of Each Phase.....	11
Table 5	Implementation Phasing of Regional/Inter-Regional Projects ..	13
Table 6	Implementation Phasing of Greater Nakhon Ratchasima Industrial Center Development .....	18
Table 7	Implementation Phasing of Ubon Ratchathani Agro-Industrial Forefront Development .....	20
Table 8	Implementation Phasing of Buri Ram - Surin Integrated Central Area Development.....	22
Table 9	Indicative Investment Schedule for LNE-UE Regional Development .....	29
Table 10	Steps for Implementation of Core Projects .....	31
Table 11	Initial Steps in the Action Plan for LNE-UE Master Plan Implementation .....	41
Table 12	Immediate Actions to Implement the LNE-UE Master Plan and Phase I Budget .....	44
Table 13	Outline of Selected Priority Projects.....	47

## List of Figures

		page
Figure 1	GRDP Projection for LNE-UE .....	3
Figure 2	Development Axis/Arteries for LNE-UE .....	4
Figure 3	Proposed Land Use for Development and Conservation .....	9
Figure 4	Three Area Development Programs and Three Special Sector Programs .....	12
Figure 5	Core Projects in the Study Area .....	15
Figure 6	Components of Agricultural Diversification Program.....	23
Figure 7	Concept of Agricultural Diversification Program Implementation .....	24
Figure 8	Structure of Rural Environment Enhancement Program .....	25
Figure 9	Structure of Broad Based Border Activities Promotion Program .....	26

## Abbreviations

AAT	Airports Authority of Thailand [MOTC]
ADB	Asian Development Bank
AED	Agricultural Extension Department [MOAC]
BAAC	Bank for Agriculture and Agricultural Cooperatives [MOF]
BMA	Bangkok Metropolitan Area
BMR	Bangkok Metropolitan Region
BOB	Bureau of the Budget [OPM]
BOI	Board of Investment [OPM]
BOT	Bank of Thailand
CAO	Changwat Administration Organization [MOIT]
CAT	Communication Authority of Thailand [MOTC]
CDD	Community Development Department [MOIT]
CPD	Cooperatives Promotion Department [MOAC]
CRDP	Coordinating Committee for the Royal Development Projects
DFPOT	Dairy Farming Promotion Organization of Thailand [MOAC]
DOA	Department of Aviation [MOTC]
DOH	Department of Highways [MOTC]
DOLA	Department of Local Administration [MOIT]
DRDC	District Rural (or Regional) Development Committee
DTEC	Department of Technical and Economic Cooperation [OPM]
EGAT	Electricity Generating Authority of Thailand [OPM]
ESBC	Eastern Seaboard Committee [NESDB]
ERTAT	Expressway and Rapid Transit Authority of Thailand [MOIT]
ETOT	Express Transportation Organization of Thailand [MOTC]
FIO	Forest Industry Organization [MOAC]
GCST	Government Cold Storage Organization [MOAC]
IEAT	Industrial Estate Authority of Thailand [MOID]
IFCT	Industrial Finance Corporation of Thailand
IPD	Industry Promotion Department [MOID]
ITD	Internal Trade Department [MOC]
JICA	Japan International Cooperation Agency
JPPCC	Joint Public / Private Consultative Committee [BOI]
LDD	Livestock Development Department [MOAC]
LNE-UE	Lower Northeast - Upper East
LTD	Land Transport Department [MOTC]
MOAC	Ministry of Agriculture and Cooperatives
MO	Marketing Organization [MOIT]
MOC	Ministry of Commerce
MOD	Ministry of Defence
MOE	Ministry of Education
MOF	Ministry of Finance
MOFF	Marketing Organization for Farmers [MOAC]
MOID	Ministry of Industry
MOIT	Ministry of Interior
MOPH	Ministry of Public Health
MOTC	Ministry of Transport and Communications
MOUA	Ministry of University Affairs
MSTE	Ministry of Science, Technology and Environment
NEB	National Environment Board [MSTE]
NESDB	National Economic and Social Development Board [OPM]

NESDC	National Economic and Social Development Committee
NHA	National Housing Authority [MOIT]
NRDC	National Rural (or Regional) Development Committee
OARD	Office of Accelerated Rural Development [MOIT]
OCSC	Office of the Civil Service Commission [OPM]
OECF	Overseas Economic Cooperation Fund (Japan)
OPM	Office of Prime Minister
OPP	Office of Policy and Planning [MOIT]
PDA	Provincial Development Committee
PEA	Provincial Electricity Authority [MOIT]
PRDC	Provincial Regional Development Committee
PRDCC	Provincial Rural (or Regional) Development Coordination Center
PWA	Provincial Waterworks Authority [MOIT]
PWD	Public Works Department [MOIT]
PWO	Public Warehouse Organization [MOC]
RFD	Royal Forest Department [MOAC]
RID	Royal Irrigation Department [MOAC]
SNRDC	Office of the Secretary to the National Rural (or Regional) Development Committee
SRT	State Railway of Thailand [MOTC]
TAT	Tourism Authority of Thailand [OPM]
TCPD	Town and Country Planning Department [MOIT]
TOT	Telephone Organization of Thailand [MOTC]
TRDC	Tambon Rural Development Committee
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization
USAID	United State Agency for International Development

## Abbreviation of Measures

### Length

mm	=	millimeter
m	=	meter
km	=	kilometer

### Area

ha	=	hectare
km <sup>2</sup>	=	square kilometer

### Volume

l	=	lit = litre
m <sup>3</sup>	=	cubic meter
MCM	=	million cubic meter

### Weight

mg	=	milligram
g	=	gram
kg	=	kilogram
t	=	ton = MT = metric
ton		

### Time

sec	=	second
hr	=	hour
d	=	day
yr	=	year

### Money

US\$	=	U.S. dollar
B	=	Baht
(1 U.S.dollar = 25.2 Baht, as of July 1993)		

### Energy

kcal	=	kilocalorie
J	=	joule
MJ	=	megajoule
HP	=	horsepower
TOE	=	tons of oil equivalent
kW	=	kilowatt
MW	=	megawatt
kWh	=	kilowatt-hour
GWh	=	gigawatt-hour

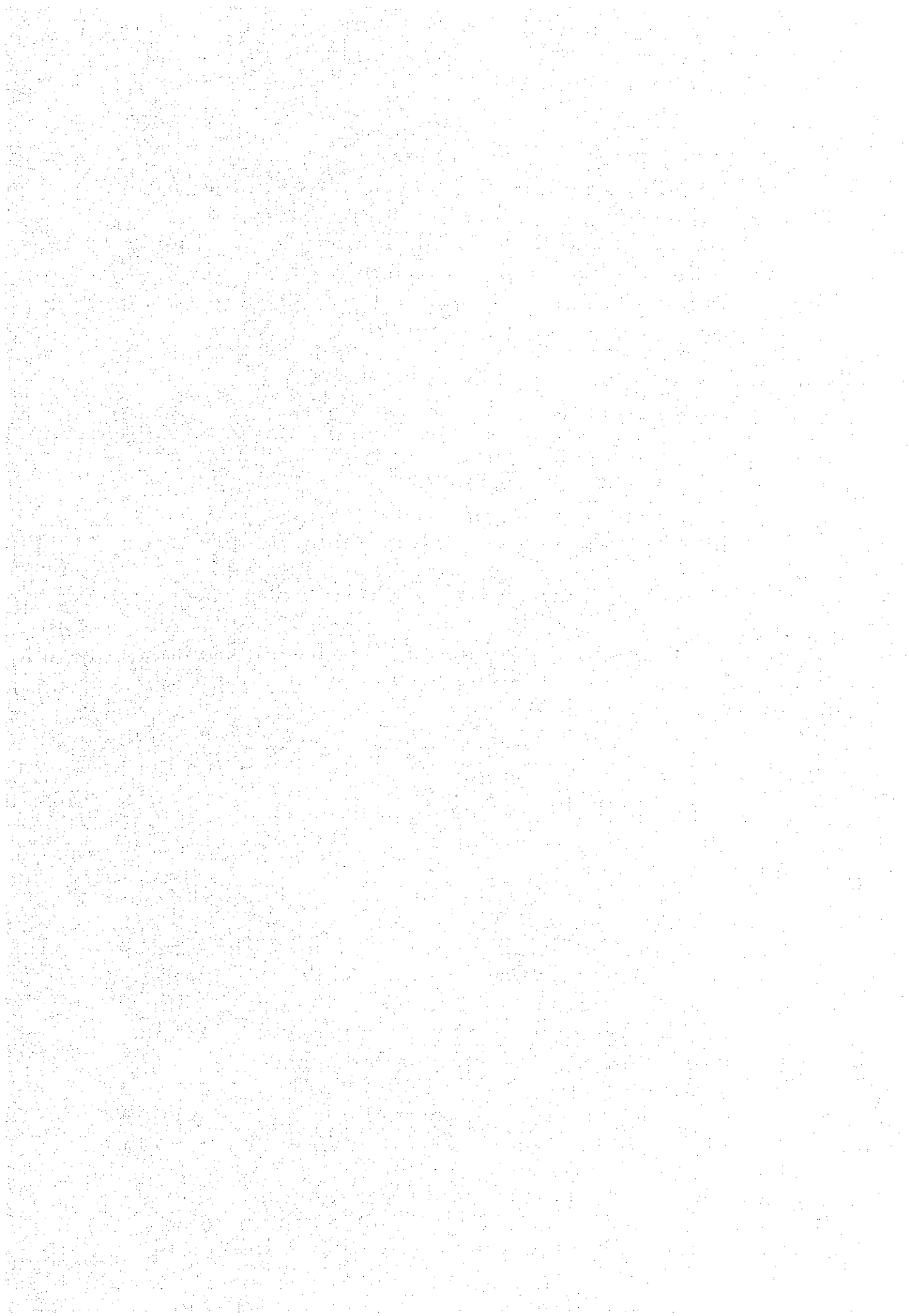
### Others

%	=	percent
°	=	degree
'	=	minute
°C	=	degree Celsius
cap.	=	capita
md	=	man-day
mil.	=	million
no.	=	number
pers.	=	person
PCU	=	passenger car unit
ppb	=	parts per billion

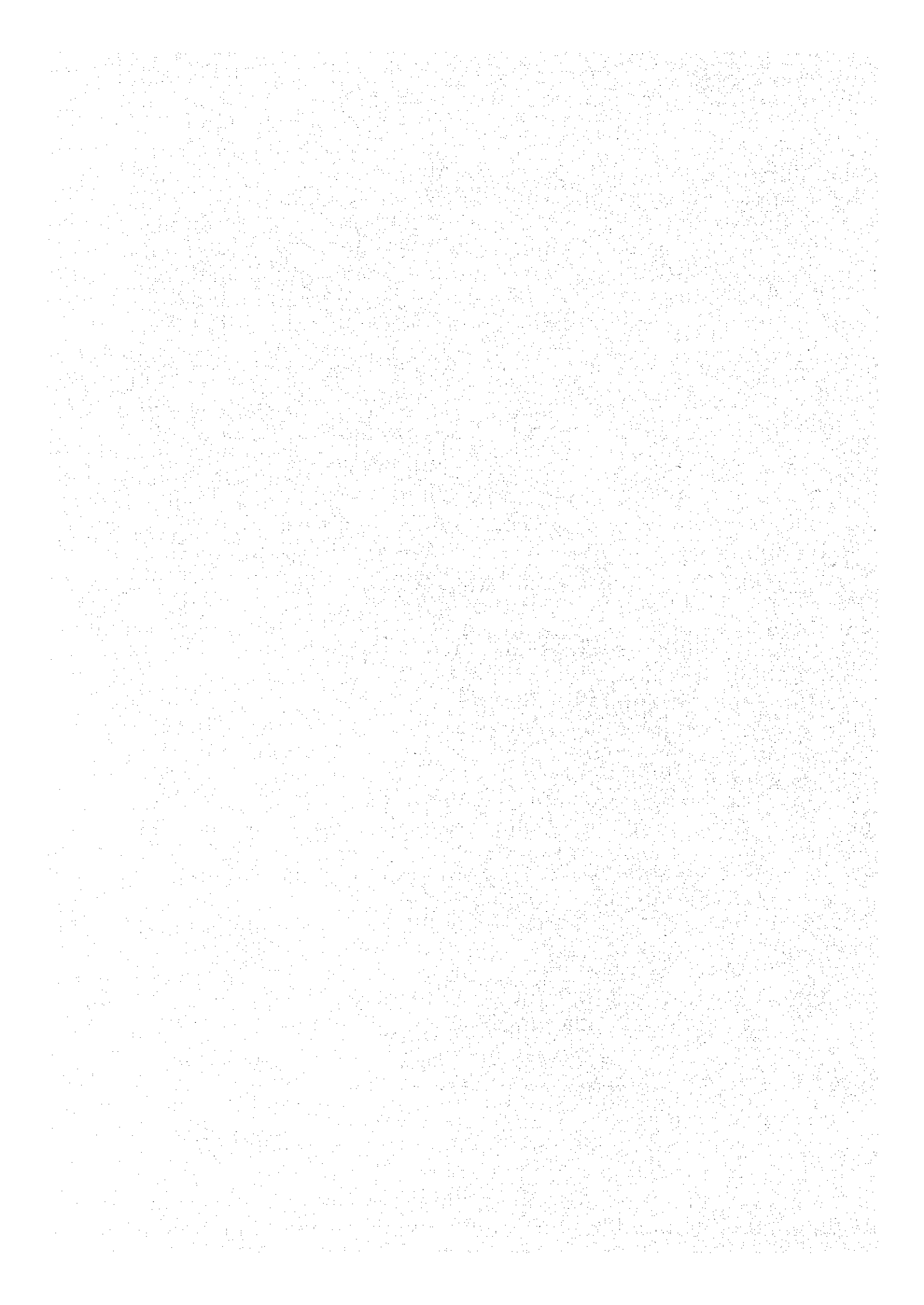
### Unit Conversions

1 rai	=	0.16 hectare
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## EXECUTIVE SUMMARY

**Lower Northeast and Upper East (LNE-UE) Regional Development capturing emerging opportunities for interactions with the Eastern Seaboard and Indochina: an essential condition for renewed growth of the Thai economy**

### **1. LOWER NORTHEAST AND UPPER EAST (LNE-UE) REGIONS**

The Lower Northeast and Upper East regions consist of seven provinces of Ubon Ratchathani, Mukdahan, Yasothon, Surin, Si Sa Ket, Nakhon Ratchasima and Buri Ram in the Lower Northeast, and two provinces of Prachin Buri and Nakhon Nayok in the Upper East. The total land area is 88,971 km<sup>2</sup>, corresponding to 17.3% of the kingdom's land area. The total population of 9,909 thousand in 1990 accounted for 18.2% of the national population. The gross regional domestic product (GRDP) of LNE-UE was 42,874 million bahts in 1989 in 1972 price level, accounting for 6.8% of the gross domestic product of Thailand.

#### Position of LNE-UE

Relative position of the LNE-UE regions in the national economic and spatial development may be summarized as follows.

- (1) One of the least development areas
- (2) Largest out-migrating area to the Bangkok Metropolitan Area
- (3) Alternative locations for industries
- (4) Extensive hinterland of the Eastern Seaboard
- (5) Gateway to Indochina countries

**The development of the LNE-UE regions would not only contribute to the national development goals of poverty alleviation and rectification of income disparity among regions, but constitute an essential condition for continuing and renewed growth of the Thai economy.**

## **2. OBJECTIVES AND BASIC STRATEGY FOR LNE-UE REGIONAL DEVELOPMENT**

### **2.1 Objectives of LNE-UE Regional Development**

The following objectives have been established for LNE-UE regional development, generally in line with the national development policies and the guidelines for the Northeast.

- (1) To increase income levels of local people to narrow gaps with the national average income by creating employment opportunities in manufacturing and services sectors, increasing agricultural production especially during the dry season through crop diversification and livestock improvement, and promoting inter-linkages between these sectors;
- (2) To enhance the quality of land and water environment for environmentally sound and sustainable development in order to support higher levels of primary production, to add to tourism value for both domestic and foreign tourists, and to promote physical and moral sanitation of local people; and
- (3) To promote people's participation in regional development for socially viable development through project planning and implementation incorporating socio-cultural value of local people, organizing rural people and utilizing indigenous systems to encourage self-help efforts for production, marketing and basic services.

### **2.2 Basic Strategy for LNE-UE Regional Development**

Elements of the basic strategy for LNE-UE regional development address to rural land use, urban functions, linkages between urban centers and between urban and rural areas, and integrated water management. It may be expressed in sum as follows:

- (1) Implementation of key infrastructure development projects related to transportation artery and water resources to transform the development structure of LNE-UE;
- (2) Selective improvement of urban infrastructure and services in accordance with expected functional division among major urban centers to support a wide range of activities related to emerging opportunities for increased economic interactions with the Indochina countries and the ESB induced development; and
- (3) Preferential implementation of the new land policies and strategy to clarify land tenure and land use, allocate lands and impose land taxes for more rational land use.

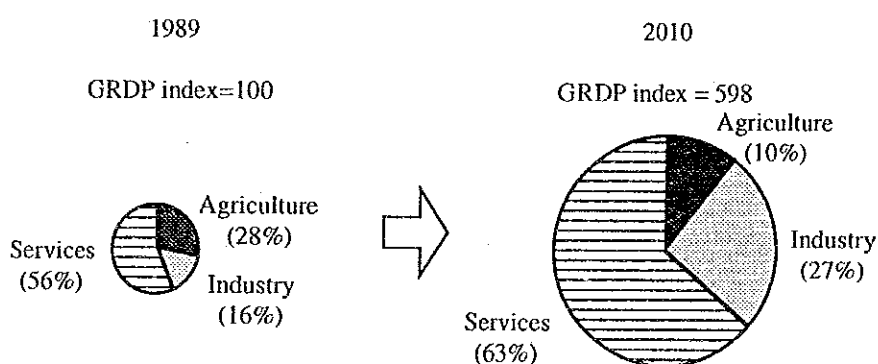
### 3. DEVELOPMENT FRAMEWORKS FOR LNE-UE REGIONAL DEVELOPMENT

#### 3.1 Socio-Economic Framework

A socio-economic framework has been worked out for the balanced development of the LNE-UE regions to the year 2010. The framework specifies the level of development expected in the target year by selected socio-economic indices projected in a mutually consistent way. Main indices used are the GRDP and its breakdown into agriculture, industry and services, population, employment, and the per capita GRDP.

The projected GRDP is illustrated in Figure 1. Expected growth performance of the LNE-UE regional development to the year 2010 is compared in Table 1 with growth targets of the kingdom.

**Figure 1 GRDP Projection for LNE-UE**



**Table 1 LNE-UE Socio-Economic Framework for Balanced Development Compared with National Targets**

(Unit : % per annum)

Sector	Thailand Seventh Five Year Plan Targets	LNE-UE Regions Socio-Economic Framework for Balanced Development
GDP/GRDP	8.2	8.9
Agriculture	3.4	3.9
Industry	8.9 ~ 9.5	11.5
Service	8.1	9.5
Per capita GDP/GRDP (Baht per person)	71,000 in 1996 (1991 price)	54,000 (1989 price)

### 3.2 Spatial Development Framework

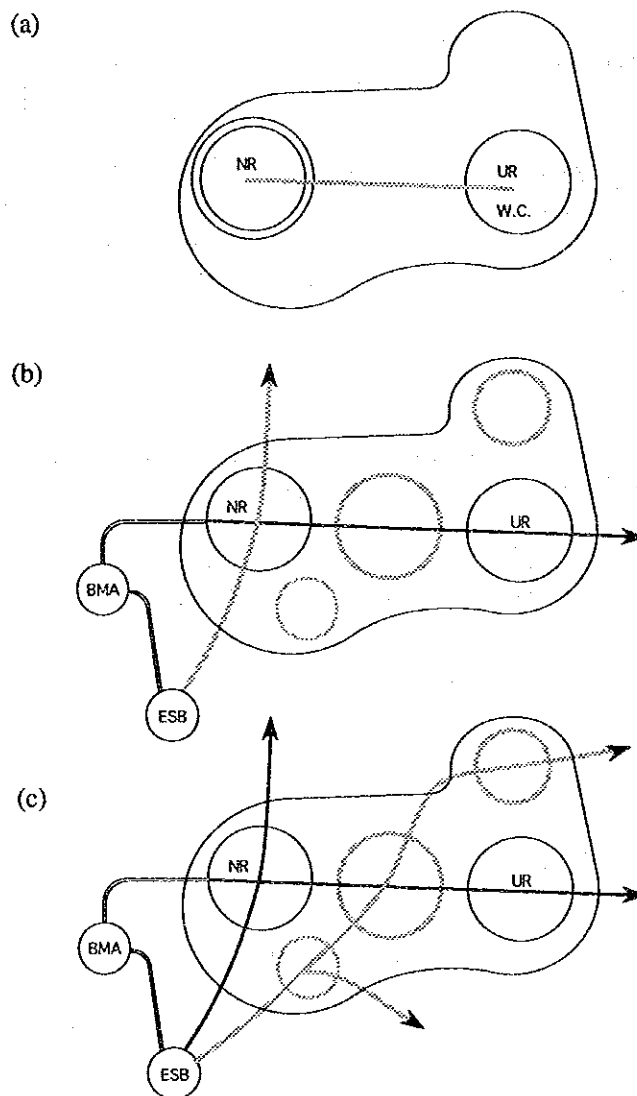
#### Development axis/arteries

The largest urban agglomeration in LNE-UE is that of Nakhon Ratchasima, closely followed by the Ubon Ratchathani - Warin chamrap agglomeration. They together will make the east-west development axis (Figure 2(a)).

A new development axis is rapidly forming: leading from the ESB, passing through Prachin Buri and Nakhon Ratchasima to reach Khon Kaen and the further north. This may be called the Northeast Industrial Development Corridor (Figure 2(b)).

A new regional artery is proposed to pass through the central part of LNE-UE: leading from the ESB, linking the Upper East and the lower Northeast, and reaching Mukdahan (Figure 2(c)).

**Figure 2 Development Axis/Arteries for LNE-UE**



### Urban clusters

The Seventh Five Year Plan represents a major departure from the past in urban development strategy of the Thai government. A new strategy, called regional network approach, views cities and towns within a region or subregion as members of a cluster of urban centers. These centers interact with one another as well as with their hinterlands to realize in totality more than the sum of parts.

In accordance with the regional network approach to urban development, several urban clusters may be defined to guide the urban development in the Study Area. Each cluster consists of a major urban center(s) and other lower-tier centers, which would complement one another to realize distinct characteristics to perform expected functions. The characterization and priority of each cluster are summarized in Table 2.

### Land use framework

Land potential has been evaluated to identify potential area for each of five land use categories. This result has been compared with the present land use by using a GIS, and land use for development and conservation has been proposed as shown in Figure 3. It is summarized in Table 3.

**Table 3 Proposed Land Use for Development and Conservation**

(Unit : 1,000 rai)

Land Zone Province	Protected Areas	Reforestation Areas	Paddy Cultivation Areas	Field and Tree Crops Area	Development Areas	Total
Nakhon Nayok	413	6	850	52	3	1,324
Prachin Buri	1,589	541	1,763	1,854	1,528	7,275
Nakhon Ratchasima	1,678	829	4,437	4,685	1,306	12,935
Buri Ram	487	243	3,620	1,584	370	6,304
Surin	351	117	3,977	798	263	5,506
Si Sa Ket	723	117	3,069	988	628	5,525
Ubon Ratchathani	3,266	506	2,890	2,409	2,965	12,036
Yasothon	290	30	1,268	682	287	2,557
Mukdahan	1,105	349	259	633	254	2,600
Total	9,902	2,738	22,133	13,685	7,604	56,062

Source : GIS Analysis of present study

**Table 2 Characterization of Major Urban Centers and Clustering (1/2)**

Major Urban Centers	Characterization and Priority	Other Urban Centers
Nakhon Ratchasima	Regional center with multiple functions; location of labour-intensive, footloose industry; secondary tourism center; priority includes urban infrastructure to serve industries, urban land use plan and water resources development/management	Pak Chong, Sikhiu, Sung Noen, Chok Chai, Pak Thong Chai (Bua Yai) Phimai
Ubun Ratchathani  Si Sa Ket	Sub-regional center with multiple functions; future location of teleport; development of its hinterlands is the key  Secondary agro-industrial center complementing Ubun Ratchathani specialized in livestock	Warin Chamrap, Det Udom, Phibun Mangsahan Amnat Charoen  Kantarak
Surin  Buri Ram	Community urban growth center; center of handicrafts and rural industries; priority includes the link with the ESB and water resources development for diversified agriculture  Community urban growth center; future tourism center; priority includes better water management and beautification of the city, tourism areas and their access roads	Prasat  Prakhon Chai, Nang Rong, Satuk

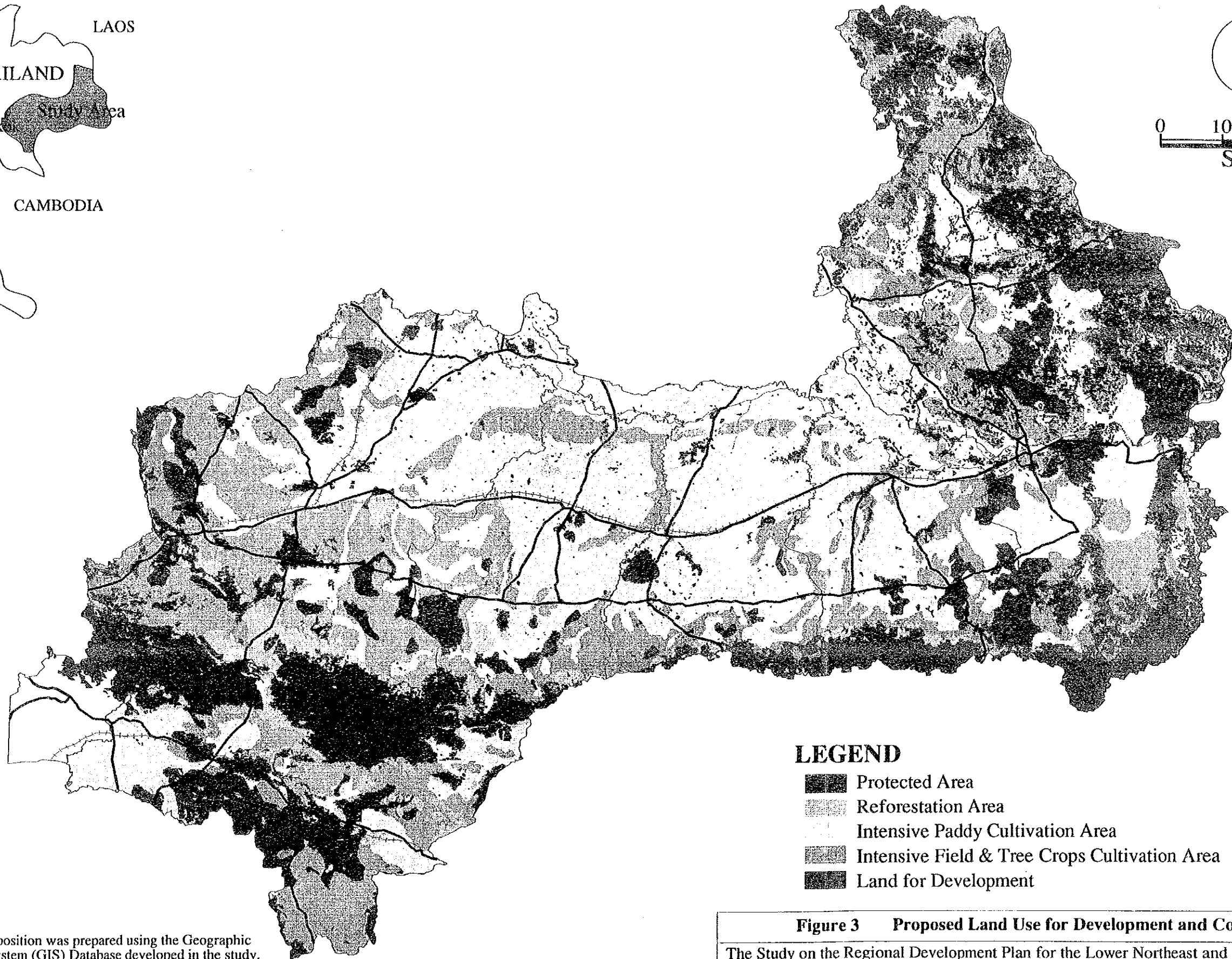
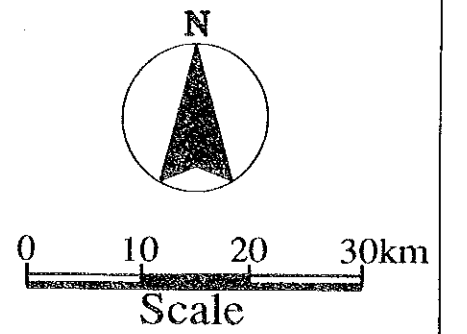
**Table 2 Characterization of Major Urban Centers and Clustering (2/2)**

Major Urban Centers	Characterization and Priority	Other Urban Centers
Prachin Buri	Community urban growth center; alternative site for industries to be relocated from the BMA; center for fruits and vegetable processing; priority includes flood control and increased water supply	Kabin Buri
Nakhon Nayok	Controlled urban growth center; future science and technology center; priority includes flood control, enhancement of urban functions and effective land use control	
Aranyaprathet	Controlled urban growth center; center for border trade and base for Indochina tourism; priority includes urban infrastructure and water supply	
Sa Kaeo	Secondary trade center located on the crossroads complementary to Aranyaprathet	
Mukdahan	Border trade center; future connection to Laos and Vietnam through a new bridge over the Mekong; priority includes improvement of transport infrastructure	
Yasothon	Secondary trade center located on the crossroads; aquaculture center; priority includes the improvement of road links with its hinterland	







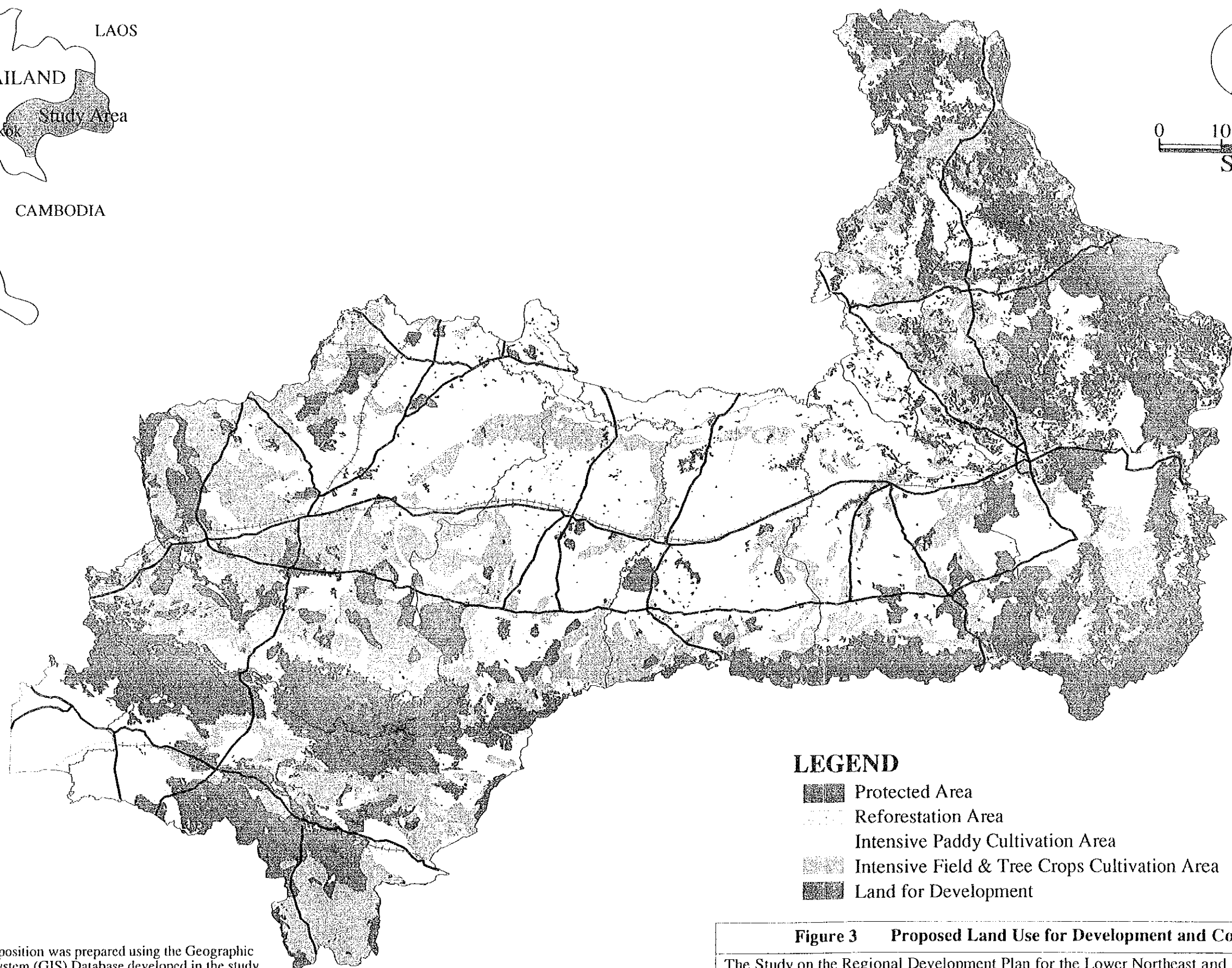
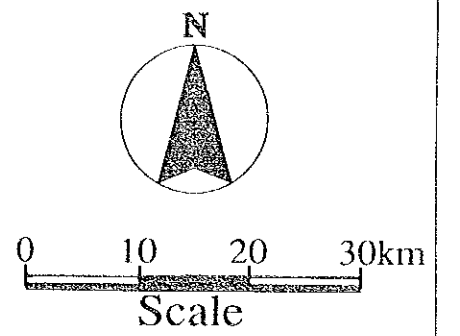


**LEGEND**

- Protected Area
- Reforestation Area
- Intensive Paddy Cultivation Area
- Intensive Field & Tree Crops Cultivation Area
- Land for Development

Note : This map composition was prepared using the Geographic Information System (GIS) Database developed in the study.

**Figure 3 Proposed Land Use for Development and Conservation**  
The Study on the Regional Development Plan for the Lower Northeast and Upper East Regions  
in the Kingdom of Thailand



**LEGEND**

- Protected Area
- Reforestation Area
- Intensive Paddy Cultivation Area
- Intensive Field & Tree Crops Cultivation Area
- Land for Development

**Figure 3 Proposed Land Use for Development and Conservation**

The Study on the Regional Development Plan for the Lower Northeast and Upper East Regions in the Kingdom of Thailand

Note : This map composition was prepared using the Geographic Information System (GIS) Database developed in the study.





#### 4. LNE-UE DEVELOPMENT SCENARIO WITH PHASING

LNE-UE regional development will be realized in steps, as the resource base and the financial capacity expand to support the development and related institutional development takes place over time. To plan for the regional development accordingly, the planning period is broadly divided into three phases: Phase I up to 1996 (the end of the Seventh Five Year Plan), Phase II for 1997 - 2001 (the Eighth Five Year Plan), and Phase III for 2002 - 2010. Characterization of each phase is summarized in Table 4.

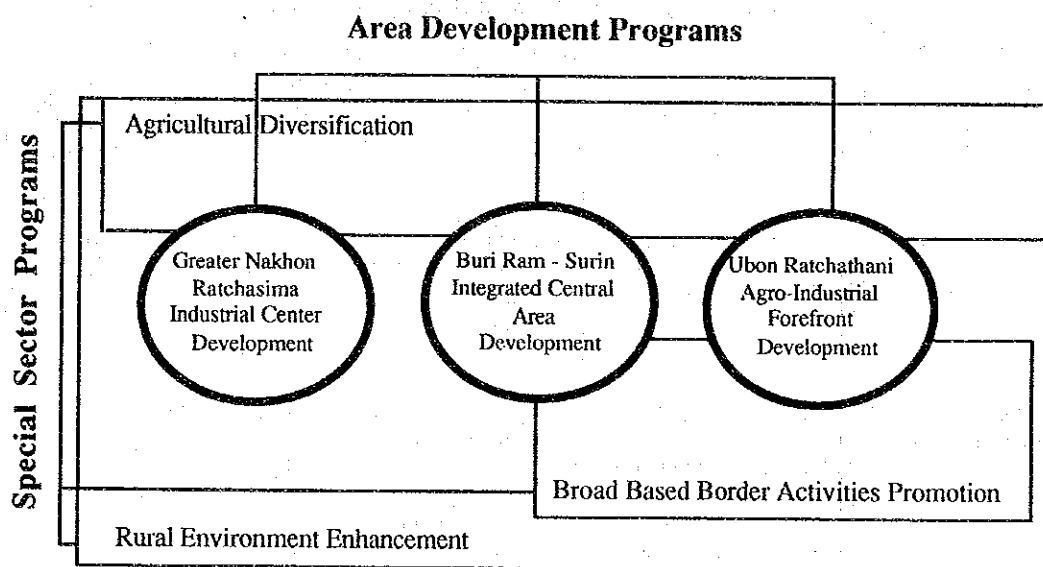
**Table 4 Development Phasing - Characterization of Each Phase**

	Phase I ~ 1996	Phase II 1997 ~ 2001	Phase III 2002 ~ 2010
Aim for Economic Development	Preparation for take-off	Take-off by the end of the century	Realization of economic structure for self-sustained growth
Physical/Economic Links	Restructuring within the Study Area and initial links with the ESB	Strengthened links with the ESB and initial international links	Establishment of international links
Government/Private Sector Partnership	Preferential treatment by the Government for implementation of new land policies, industrial location, and investment into key infrastructure	Strong private sector initiative for all the economic activities supported by coordinated government efforts	Private sector participation in the provision of some infrastructure and social services
Driving Forces (key economic activities)	Mixed farming of various forms  Footloose industries  Domestic tourism Agriculture induced services	Crop diversification (fruits and vegetables, oil crops, flowers etc.)  Car and rolling stock assembly New agro-processing  Industry induced services Border trade related services	Integrated farming Drip irrigation for high value-added crops  Machinery and engineering Automobile manufacturing  International tourism Borderless services
Growth Rates	5 ~ 8% p.a.	8 ~ 12% p.a.	~ 9% p.a.

## 5. LNE-UE REGIONAL DEVELOPMENT MASTER PLAN

The LNE-UE regional development master plan consists of development projects and institutional measures to complement the project implementation. Core projects have been designated, which would be essential to realize the planned development. They can be classified into regional/inter-regional projects that are instrumental for transforming the development structure of LNE-UE and local projects. Most local projects are packaged into three area development programs and three special sector programs combining also project specific institutional measures. The structure of the Master Plan is illustrated in Figure 4.

**Figure 4 Three Area Development Programs and Three Special Sector Programs**



The three area development programs, emphasizing explicitly the urban sector and industrial and related service activities, will provide the driving force for the development of the entire LNE-UE regions. Two special sector programs will ensure the enhancement of productivity and living standards in rural areas, and the third one will contribute to the diversification of the regional economy.

### 5.1 Regional/Inter-Regional Projects

Nine regional/inter-regional projects have been designated. Three of them are completely new, formulated through master planning: regional artery establishment (or new Indochina gateway road), local air services network development, and small pumping reservoirs development. Four projects represent extension of on-going efforts: railway improvement, route no.24 improvement, Lam Thakong pumped storage power generation, and Pak Mun hydropower.

The remaining two have been planned by implementing agencies and endorsed by the master plan: Second Mekong bridge, and Phanom Dong Rek water resources development. Implementation phasing of these projects is given in Table 5. Figure 5 shows locations of these projects.



Table 5 Implementation Phasing of Regional/Inter-Regional Projects

No.	Core Project	Phase I (~ 1996)	Phase II (1997 ~ 2001)	Phase III (2002 ~ 2010)
R.1	Regional artery establishment (New Indochina gateway road)	<ul style="list-style-type: none"> <li>• Sa Kao - Buri Ram/Surin link</li> <li>• Route no.2169</li> </ul>	<ul style="list-style-type: none"> <li>• Extension to the ESB</li> <li>• Improvement of other sections</li> </ul>	<ul style="list-style-type: none"> <li>• Further improvement of other sections</li> <li>• High speed train - Stage I</li> </ul>
R.2	Railway improvement	<ul style="list-style-type: none"> <li>• D/D and initial implementation of Bangkok - Nakhon Ratchasima double tracking</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of double tracking, improved signaling and telecom.</li> <li>• Inland container depot</li> </ul>	<ul style="list-style-type: none"> <li>• Upgrading to higher standards</li> </ul>
R.3	Route no.24 improvement	<ul style="list-style-type: none"> <li>• Improvement of sections as planned by DOH</li> </ul>	<ul style="list-style-type: none"> <li>• Improvement of other sections</li> </ul>	<ul style="list-style-type: none"> <li>• Completion</li> </ul>
R.4	Second Mekong bridge	<ul style="list-style-type: none"> <li>• F/S</li> </ul>	<ul style="list-style-type: none"> <li>• D/D and initial implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Completion</li> </ul>
R.5	Local air services network development	<ul style="list-style-type: none"> <li>• Establishment of network within LNE-UE</li> </ul>	<ul style="list-style-type: none"> <li>• Links to the Indochina</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of implementation</li> </ul>
R.6	Small pumping reservoirs development	<ul style="list-style-type: none"> <li>• Implementation of identified schemes</li> <li>• River basin studies to identify more sites</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of river basin studies and implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of implementation</li> </ul>
R.7	Phanom Dong Rek water resources development	<ul style="list-style-type: none"> <li>• Completion of 1st stage</li> <li>• Initiation of 2nd stage</li> </ul>	<ul style="list-style-type: none"> <li>• Completion of 2nd stage</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of implementation</li> </ul>
R.8	Lam Thakong pumped storage power generation	<ul style="list-style-type: none"> <li>• Stage I implementation (250 MW)</li> </ul>	<ul style="list-style-type: none"> <li>• State II implementation (250 MW x 3)</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of implementation</li> </ul>
R.9	Pak Mun hydropower	<ul style="list-style-type: none"> <li>• Implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Completion</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of implementation</li> </ul>





### Area Development Programs

#### Greater Nakhon Ratchasima Industrial Center

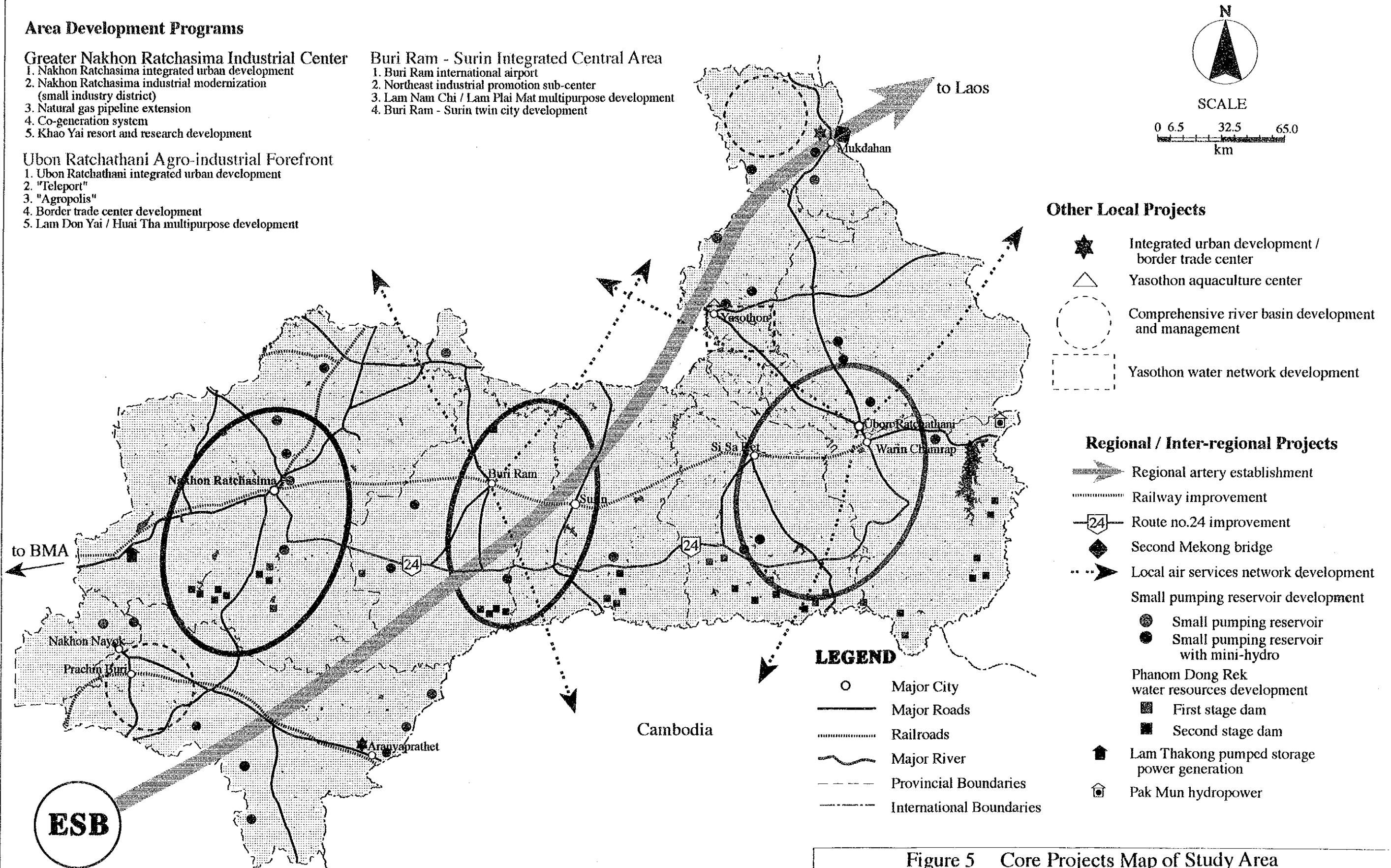
1. Nakhon Ratchasima integrated urban development
2. Nakhon Ratchasima industrial modernization (small industry district)
3. Natural gas pipeline extension
4. Co-generation system
5. Khao Yai resort and research development

#### Ubon Ratchathani Agro-industrial Forefront

1. Ubon Ratchathani integrated urban development
2. "Teleport"
3. "Agropolis"
4. Border trade center development
5. Lam Don Yai / Huai Tha multipurpose development

#### Buri Ram - Surin Integrated Central Area

1. Buri Ram international airport
2. Northeast industrial promotion sub-center
3. Lam Nam Chi / Lam Plai Mat multipurpose development
4. Buri Ram - Surin twin city development



- #### Other Local Projects
- ★ Integrated urban development / border trade center
  - △ Yasothon aquaculture center
  - Comprehensive river basin development and management
  - Yasothon water network development

- #### Regional / Inter-regional Projects
- Regional artery establishment
  - ⋯⋯⋯ Railway improvement
  - 24 Route no.24 improvement
  - ◆ Second Mekong bridge
  - ⋯⋯ Local air services network development
  - Small pumping reservoir development
  - Small pumping reservoir with mini-hydro
  - Phanom Dong Rek water resources development
  - First stage dam
  - Second stage dam
  - ⬆ Lam Thakong pumped storage power generation
  - ⬆ Pak Mun hydropower

- #### LEGEND
- Major City
  - Major Roads
  - ⋯⋯⋯ Railroads
  - ~ Major River
  - - - Provincial Boundaries
  - - - - International Boundaries

**ESB**

Note : Basic elements of this map composition were derived from the Geographic Information System (GIS) Database developed in the study.

Figure 5 Core Projects Map of Study Area  
The Study on the Regional Development Plan for the Lower Northeast and the Upper East Regions in the Kingdom of Thailand





## 5.2 Area Development Programs

### (1) Greater Nakhon Ratchasima Industrial Center Development

#### Objectives

Objective of this area development program are the following.

- 1) To strengthen the functions of the Nakhon Ratchasima city as the major growth center and the regional industrial and trade center;
- 2) To make the Greater Nakhon Ratchasima Area large enough to counter-balance the agglomeration of the BMA with the development of secondary urban centers to complement the functions of the capital city; and
- 3) To induce the development of hinterland rural areas by improving productive as well as physical links between the urban centers and the rural areas.

#### Core projects

Five core projects formulated in different sectors will support the industrial development of this area development program. Phasing of implementation is indicated in Table 6.

#### Implementation plan

Those projects already planned by implementing agencies should be implemented in the nearest future. They are the natural gas pipeline extension and regional truck terminal as well as various urban projects and road projects.

The Nakhon Ratchasima integrated urban development project should be formulated in Phase I for subsequent implementation during Phases I through III. Important components include water supply, electricity, telecommunications, sewerage and solid waste management. As Nakhon Ratchasima is foreseen to face the most serious water shortage, water resources need to be fully explored and developed efficiently, including groundwater. Also reduction of losses and cost recovery by proper user charges should be part of this project. The latter would provide an opportunity to improve the municipal management, including development funding and financial management. Project planning and implementation monitoring would be other important functions not only of Nakhon Ratchasima but of any major municipalities. This project may serve as a model case for planning and implementing such integrated urban development projects under a new project planning and funding system.

### (2) Ubon Ratchathani Agro-Industrial Forefront Development

#### Objectives

Objectives of this area development program are defined as follows.

- 1) To strengthen the functions of the Ubon Ratchathani city as another growth center of LNE-UE; and

**Table 6 Implementation Phasing of Greater Nakhon Ratchasima Industrial Center Development**

No.	Core Project	Phase I (~ 1996)	Phase II (1997 - 2003)	Phase III (2002 - 2019)
1.1	Nakhon Ratchasima integrated urban development - Regional truck terminal - Commerce and industry plaza complex - Automobile test course	<ul style="list-style-type: none"> <li>• Plan formulation and initial implementation (drainage, sewerage etc.)</li> <li>• Implementation</li> <li>• Implementing arrangement by public-private partnership</li> </ul>	<ul style="list-style-type: none"> <li>• Full scale implementation (water supply expansion, new by-pass, solid waste etc.)</li> <li>• Implementation</li> <li>• Implementing arrangement by public-private partnership</li> </ul>	<ul style="list-style-type: none"> <li>• Continued implementation and plan reformulation</li> <li>• Implementation</li> </ul>
1.2	Nakhon Ratchasima industrial modernization (small industry district)	<ul style="list-style-type: none"> <li>• Initial establishment following plan for project no.1.1.1</li> </ul>	<ul style="list-style-type: none"> <li>• Expansion</li> </ul>	
1.3	Natural gas pipeline extension	<ul style="list-style-type: none"> <li>• Implementation</li> </ul>		
1.4	Co-generation system	<ul style="list-style-type: none"> <li>• F/S and D/D</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation</li> </ul>	
1.5	Khao Yai resort and research development	<ul style="list-style-type: none"> <li>• Plan formulation and implementing arrangement</li> </ul>	<ul style="list-style-type: none"> <li>• Initial implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Expansion</li> </ul>



- 2) To develop the Ubon Ratchathani and surrounding areas as a forefront of various agro-industrial activities that are emerging as economic interactions increase with the Indochina countries.

#### Core projects

New agricultural activities in rural areas will be supported by the Agricultural Diversification Program and the Rural Environment Enhancement Program described in Section 5.3, complementary to this area development program. This program itself contains five core projects. Development phasing of each one project is indicated in Table 7.

#### Implementation plan

Several road projects and various urban projects already planned by implementing agencies and contained in the development programs for the Seventh Five Year Plan should be implemented without delay. The same applies to the Pak Mun dam and hydropower development.

The Ubon Ratchathani integrated urban development project is a key project for this area development program. It will be formulated during Phase I for subsequent implementation through Phase III. Important components include water supply and sewerage, electricity, telecommunications, urban roads and drainage, municipal slaughterhouse, cold storage and solid waste disposal.

A comprehensive study should be carried out in Phase I for water resources development in the Lam Don Yai and the Huai Tha river basins. It will include feasibility studies of priority multipurpose projects. Implementation of these projects will follow in Phase II as well as feasibility studies of other projects newly formulated.

Other core projects should also be studied in Phase I for implementation in Phase II. A plan for the border trade center will be prepared, clarifying functions and facilities to be included. Detailed system configurations will be determined for the "Teleport". The telecommunication component of the Ubon Ratchathani integrated urban development project should be consistent with such system configurations.

A development plan for the "Agropolis" may be worked out by a private enterprise, but its implementation will be by a public-private partnership. The local government may offer land for the project site, and establish and operate a quality control center under the direction of the central government.

- (3) Buri Ram - Surin Integrated Central Area Development

#### Objectives

This area development program has the following three objectives.

- 1) To establish a new core of development in the least developed central part of the Lower Northeast;

Table 7 Implementation Phasing of Ubon Ratchathani Agro-Industrial Forefront Development

No.	Core Project	Phase I (~ 1996)	Phase II (1997 - 2001)	Phase III (2002 - 2010)
2.1	Ubon Ratchathani integrated urban development - Regional truck terminal - Commerce and industry plaza complex	<ul style="list-style-type: none"> <li>Plan formulation and initial implementation (urban roads, drainage etc.)</li> <li>F/S</li> <li>Implementing arrangement by public-private partnership</li> </ul>	<ul style="list-style-type: none"> <li>Full scale implementation (water supply, sewerage etc.)</li> <li>Implementation</li> <li>Implementation</li> </ul>	<ul style="list-style-type: none"> <li>Continued implementation and plan reformulation</li> </ul>
2.2	"Teleport"	<ul style="list-style-type: none"> <li>Determination of detailed configurations and establishment of base station</li> </ul>	<ul style="list-style-type: none"> <li>Installation of satellite gateway</li> </ul>	<ul style="list-style-type: none"> <li>Full establishment of "Teleport"</li> </ul>
2.3	"Agropolis"	<ul style="list-style-type: none"> <li>Planning and implementing arrangement by public-private partnership</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of "Agropolis"</li> </ul>	<ul style="list-style-type: none"> <li>Expansion and full-scale operation</li> </ul>
2.4	Border trade center development	<ul style="list-style-type: none"> <li>Planning and initial implementation</li> </ul>	<ul style="list-style-type: none"> <li>Expansion with full functions</li> </ul>	
2.5	Lam Don Yai/Huai Tha multi-purpose development	<ul style="list-style-type: none"> <li>Master planning and F/S of priority projects</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of priority projects and F/S of others</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of other projects</li> </ul>

- 2) To create a large number of employment opportunities in various rural industries and related services throughout the area to increase income levels of rural populace and thus minimize the drift of rural people into larger cities; and
- 3) To enhance the land and water environment of the generally dry central part of the Lower Northeast.

#### Core projects

Four core projects constitute this area development program together with the regional/inter-regional projects. Rural industries and related services will be supported also by the Rural Environment Enhancement Program described in Section 5.3. Implementation phasing of each core project is shown in Table 8.

#### Implementation plan

Implementation of on-going projects planned by implementing agencies should be expedited. They include the Buri Ram international airport, Khmer ruins restoration program, urban projects in Buri Ram and Surin, and small road projects.

A comprehensive study should be carried out in Phase I for the Lam Nam Chi and the Lam Plai Mat multipurpose development project. Additional sites for water storage in large scale are practically non-existent in these river basins. Therefore, the small pumping reservoir projects formulated at this time should be elaborated on and additional sites identified. Groundwater exploration will also be part of the study. Implementation of these projects will start also in Phase I and continue through Phases II and III.

Areas suitable for reforestation and economic forests will also be identified through this basin study as well as site for the new elephant park. Implementation of the "Green wedge" development project will follow immediately and the elephant park establishment project in Phase II. Buri Ram - Surin twin city development should be planned in Phase I and implemented through Phase III.

The Northeast industrial promotion sub-center will be planned for initial implementation in Phase I to serve the Study Area. It will be expanded in stages to serve Laos and Cambodia.

### **5.3 Special Sector Programs**

- (1) Agricultural Diversification Program (ADIP)

#### Objectives

Objectives of this program are expressed as follows.

- 1) To increase farm incomes by increasing agricultural productivity, through crop diversification in favour of high value-added crops, and livestock improvement supported by coordinated services provision through integrated implementation of key project/programs; and

**Table 8 Implementation Phasing of Buri Ram - Surin Integrated Central Area Development**

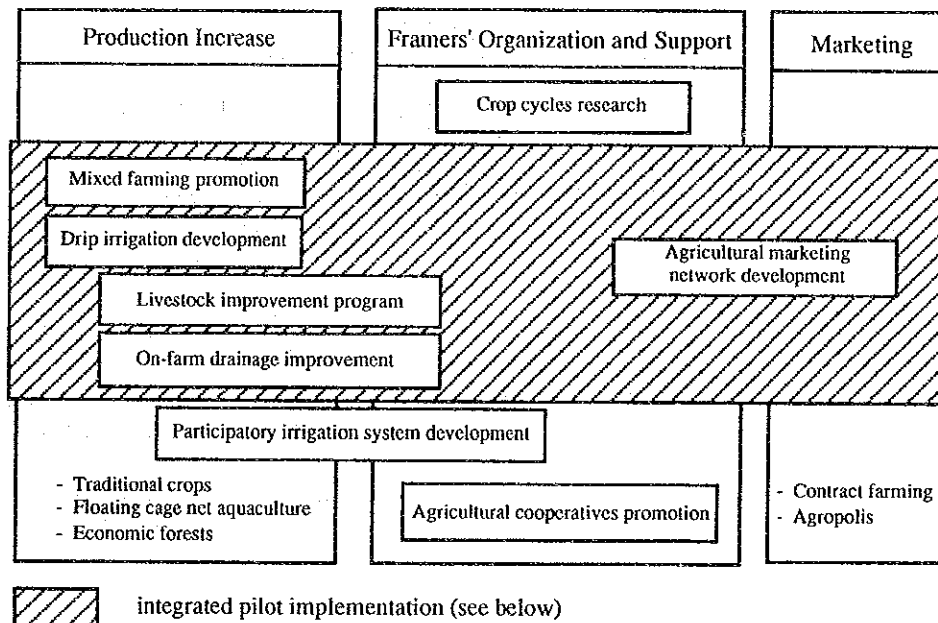
No.	Core Project	Phase I (~1996)	Phase II (1997 ~ 2001)	Phase III (2002 ~ 2010)
3.1	Buri Ram international airport	<ul style="list-style-type: none"> <li>• Implementation as a local airport</li> </ul>	<ul style="list-style-type: none"> <li>• Expansion to an international airport</li> </ul>	
3.2	Northeast industrial promotion sub-center	<ul style="list-style-type: none"> <li>• Plan formulation and initial implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Expansion to serve the Indochina</li> </ul>	
3.3	Lam Nam Chi/Lam Plai Mat multi-purpose development	<ul style="list-style-type: none"> <li>• Master planning and F/S of priority projects</li> <li>• Implementation of identified small pumping reservoirs</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of priority projects</li> <li>• F/S of other projects</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of other projects</li> </ul>
3.4	<ul style="list-style-type: none"> <li>- "Green wedge" development</li> <li>- Elephant park establishment</li> <li>- Khmer ruins upgrading</li> </ul>	<ul style="list-style-type: none"> <li>• Reforestation following M/P</li> <li>• Identification of site by M/P</li> <li>• Continuation of restoration and tree planing</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation</li> <li>• Implementation</li> <li>• Khmer heritage museum</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation</li> </ul>
3.4	Buri Ram - Surin twin city development	<ul style="list-style-type: none"> <li>• Plan formulation including water supply expansion</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation</li> </ul>

- 2) To encourage farmers' participation in changing the agricultural structure through cooperatives, contract farming and other schemes.

### Components and structure

This program contains several components related to production increase, farmers' organization and support, and marketing. The structure of the program is illustrated in Figure 6.

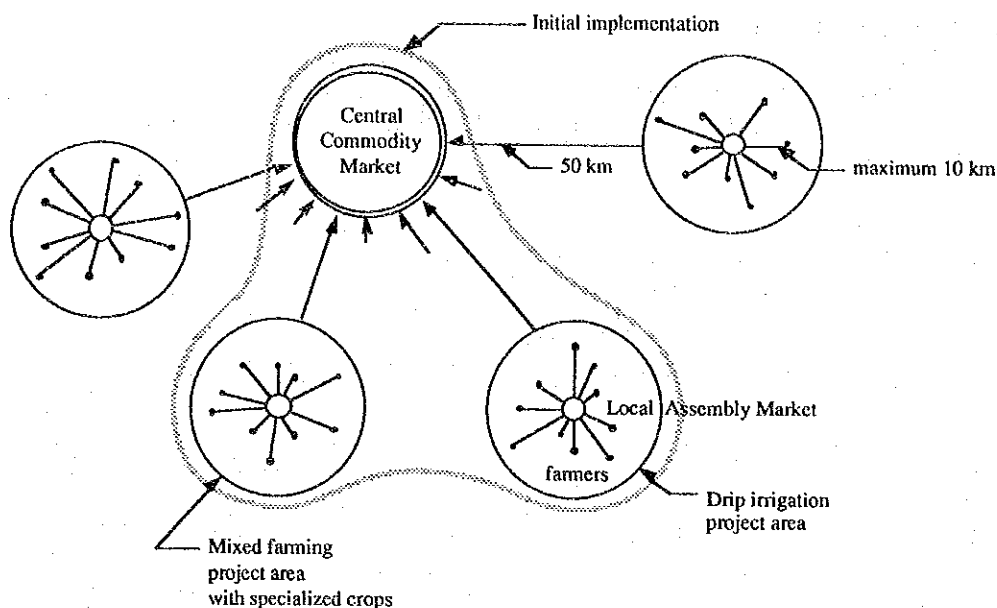
**Figure 6 Components of Agricultural Diversification Program**



### Implementing arrangements

Production projects will be used as a core activity to implement this program. Local assembly markets will be established associated with the production projects, but once established will be used for other products as well. This new marketing outlet would provide farmers a motivation to enter into new production activities. Support measures will be provided by the respective production projects. Only a few local assembly markets may be established initially. At least one of them would better be established on a cooperative basis. In this case, support services would be channelled more effectively through the cooperative. A central commodity market will be established in one of the provincial capitals initially to serve the local assembly markets as well as other individual farmers. The concept of this initial implementation is illustrated in Figure 7.

**Figure 7 Concept of Agricultural Diversification Program Implementation**



The program will be expanded in steps to cover more local assembly markets. They will be established increasingly more on a cooperative basis capitalizing on the agricultural cooperatives promotion project. Results of the crop cycles research project will be put to field application under this program. Eventually, central commodity markets will be established in all the provincial capitals.

## (2) Rural Environment Enhancement Program (REEP)

### Objectives

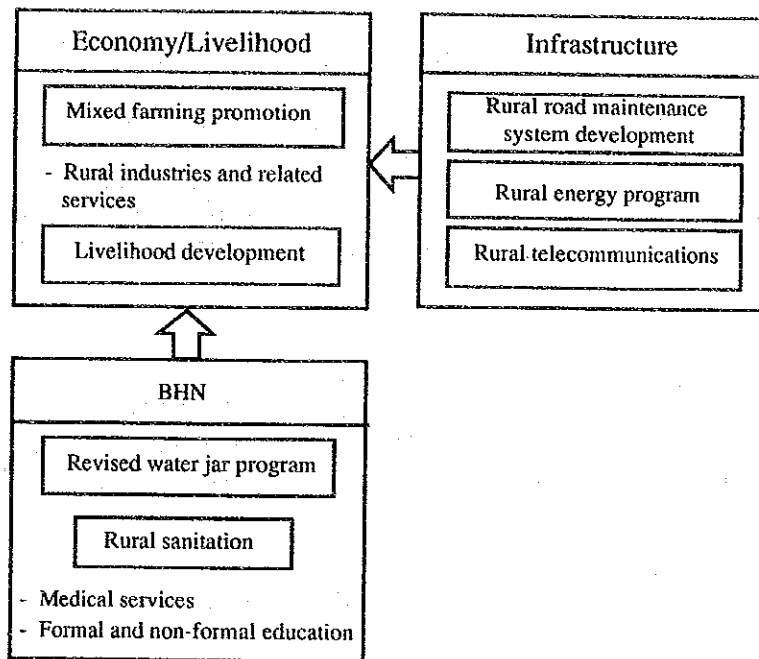
This program has the following two objectives related to basic human needs (BHN) and needs for production increase.

- 1) To alleviate poverty and associated problems in rural areas as the basic human needs to improve moral sanitation of people and prepare a better base for market-oriented economic activities; and
- 2) To expand agricultural and related processing and service activities by improving the provision of infrastructure and other support services.

### Components and structure

This program consists of projects for economic and livelihood development activities, and infrastructure and BHN projects to support them. The structure of the program is illustrated in Figure 8.

**Figure 8 Structure of Rural Environment Enhancement Program**



Implementing arrangements

Most of the component projects/programs may be implemented by respective line agencies. For coordinated implementation, however, the existing institution for rural development should be effectively utilized. In particular, the Tambon Rural Development Committees would be instrumental in working out implementation programs. Representatives of farmers in respective subject villages should be involved in program formulation.

Biomass and biogas components of the rural energy program should be integrated with the mixed farming promotion projects. Solar PV component may find application in the rural telecommunications project.

A community based rural road maintenance system should be established, and in some rural areas, linked to project areas of mixed farming promotion. This would contribute to the marketing of new agricultural products by allowing more effective and timely repair services for rural access roads.

Mixed farming promotion in various forms will create opportunities for additional means of livelihood in services and simple processing. Support to these activities should be part of the program.

### (3) Broad Based Border Activities Promotion Program

#### Objectives

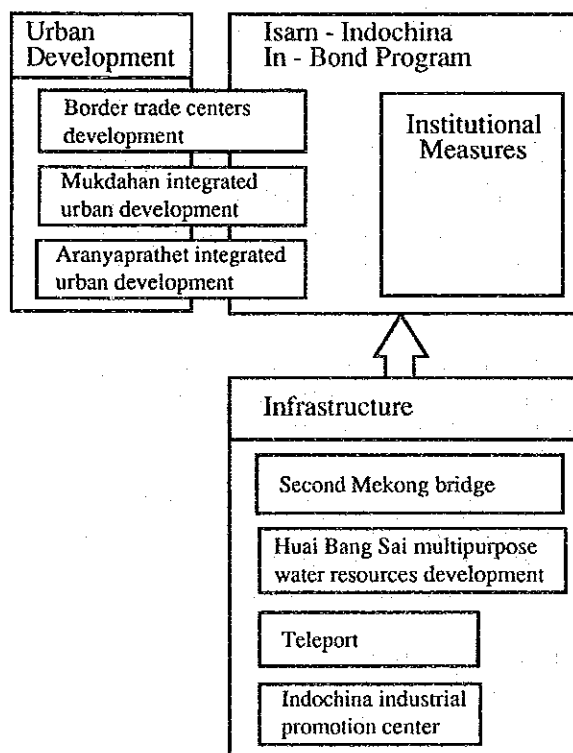
Objectives of this program are expressed as follows.

- 1) To encourage border trade and related production and services activities by introducing a new institution of support package; and
- 2) To improve urban services to local communities through the improvement of urban infrastructure and utilities to support these border related activities.

#### Components and structure

The Isarn - Indochina In - Bond (III-B) program is the center piece of this special sector program. It combines the institutional measures to support broad based border activities and the projects to improve urban infrastructure in selected urban centers. It will be supported by other infrastructure projects. The structure of the program is illustrated in Figure 9.

**Figure 9 Structure of Broad Based Border Activities Promotion Program**



#### Implementing arrangements

Institutional mechanism should be developed in Phase I for the Isarn-Indochina In-Bond program, including legislative measures and custom services both in Thailand in the Indochina countries. Plans for urban and infrastructure



development should be prepared initially for selected urban centers and presented to the Laos and the Cambodian governments to convince them of the advantages of the scheme and to demonstrate Thai government commitment.

Prospective Thai investors shall be widely invited to participate in the program by clarifying special features and incentives to be provided. Initial establishments will be made by joint efforts of the government and private enterprises. The Indochina industrial promotion center to be established in Phase I will be expanded to support the program by meeting requirements for technology development and skill training. Border trade and distribution centers to be established within the Study Area will facilitate the marketing of products to the BMA, the ESB and export markets as well as other domestic markets.

#### **5.4 Other Regional and Local Projects**

There are other projects formulated in different sectors, which are not included explicitly in any program described above but nevertheless are important on their own merits. They are categorized broadly in four sectors: environment, water resources, agro-related, and new energy.

##### **(1) Environmental projects**

Environmental management is critically important in the LNE-UE regions having generally vulnerable land and water environment. While urban-based environmental problems are addressed by individual control measures, a different approach is necessary to deal with rural-based problems. The following projects are instrumental:

- Regional environmental monitoring,
- Fragrant wood reforestation program, and
- Problem soil management and soil erosion prevention.

##### **(2) Water resources projects**

To serve areas not covered by any area development program, the following water resources projects are proposed:

- Nakhon Nayok river basin multipurpose water resources development,
- Yasothon water network development, and
- Groundwater exploration program.

##### **(3) Agro-related projects**

To promote aquaculture for improving nutritional conditions of local people and providing an opportunity to earn extra cash income, the following projects are recommended:

- Floating cage net aquaculture development, and
- Yasothon aquaculture center.

To safeguard future options, the following projects are proposed:

- Rice products development, and
- Goat bank development.

(4) New energy application promotion (NEAP) program

In addition to co-generation for Nakhon Ratchasima and the biomass, biogas and mini-hydro components of the rural energy program contained in the Rural Environment Enhancement Program, the following should be pursued under this program:

- Solar PV application,
- Rick husk power generation, and
- Solar water heater application program.

**5.5 Indivative Investment Schedule**

An indicative investment schedule of the LNE-UE regional development is shown in Table 9. Steps for implementation of the core projects are shown in Table 10.

**Table 9 Indicative Investment Schedule for LNE-UE Regional Development (1/2)**

(Unit : million baht)

Sector/Projects	Agency	Status	Phase I (-1996)	Phase II (1997-2001)	Phase III (2002-2010)	Total	(%)
<b>1. Agriculture and Water Resources</b>			<b>21,296</b>	<b>36,194</b>	<b>102,178</b>	<b>159,667</b>	<b>25</b>
1.1 Agricultural Diversification Program (ADIP)	Inter-agency	New	800	2,500			
1.2 Drip Irrigation Development & Drainage	RID, etc.	"	2,300	10,500			
1.3 Small Pumping Reservoirs Development	Inter-agency	"	2,700	6,500			
1.4 Lam Don Yai / Huai Tha Multipurpose	"	"	100	*			
1.5 Lam Nam Chi / Lam Plai Mat Multipurpose	"	"	100	*			
1.6 Huai Bang Sai Multipurpose	"	"	50	*			
1.7 Nakhon Nayok/Prachin Buri Multipurpose	"	"	50	*			
1.8 Yathoton Water Network	"	"	100	*			
1.9 Revised Water Jar	"	"	*	*			
1.10 Groundwater Exploration	"	Extension	*	*			
1.11 Phanom Dong Rck Water Resources Dev.	RID	On-going	1,400	700			
1.12 Others			13,696	15,994			
- Implementation of 1.4, 1.5, 1.6, 1.7, 1.8 & 1.9							
<b>2. Energy</b>			<b>14,481</b>	<b>24,612</b>	<b>69,481</b>	<b>108,573</b>	<b>17</b>
2.1 Lam Takong Pumped Hydropower	EGAT	On-going	5,300	12,000			
2.2 Pak Mun Hydropower	"	"	*	*			
2.3 Natural Gas Pipeline Extension	PTT	Planned	*				
2.4 Co-generation System	EGAT	"	100	*			
2.5 Others			9,081	12,612			
- Power Transmission & Distribution	EGAT	Extension	*	*			
- Rural Energy Program	Inter-agency	New	*	*			
- Joint Hydropower Development with Laos	"	Planned		*			
<b>3. Transportation and Communications</b>			<b>21,296</b>	<b>36,194</b>	<b>102,178</b>	<b>159,667</b>	<b>25</b>
3.1 Regional Artery Establishmant	DOH	New	1,700	6,900			
3.2 Railway Improvement	SRT	Extension	100	2,200			
3.3 Route No.24 Improvement	DOH	"	500	2,200			
3.4 Second Mekong Bridge	MOTC	Planned	100	700			
3.5 Buri Ram International Airport	AAT	New	100	400			
3.6 Local Air Services Network	"	"	100	100			
3.7 Provincial Roads and Highways	MOTC	Extension	*	5,035			
3.8 Other Transport Projects			18,696	18,659			
- Ubon Ratchathani Airport	AAT	Extension					
- Mukdahan Local Airport	"	New					
- Nakhon Ratchasima Airport	"	Planned					
- Regional Truck Terminals	MOTC	New	50	50			
- Rural Road Maintenance System	"	"	*	*			
- Inland Waterways, etc.	"	"					
3.11 TOT Rural Long Distance Telephones	TOT	Extension	5,000	10,000			
- Rural Telecommunications		New					
- Others							
3.12 Teleport	MOTC	New	200	800			
3.13 Other Communication Projects	"		4,800	9,200			

**Table 9 Indicative Investment Schedule for LNE-UE Regional Development (2/2)**

(Unit : million baht)

Sector/Projects	Agency	Status	Phase I (-1996)	Phase II (1997-2001)	Phase III (2002-2010)	Total	(%)
<b>4. Urban Development</b>			<b>7,666</b>	<b>13,030</b>	<b>36,784</b>	<b>57,480</b>	<b>9</b>
4.1 Nakhon Ratchasima Integrated Urban Dev.	Inter-agency	New	800	1,800			
4.2 Ubon Ratchathani Integrated Urban Dev.	"	"	400	2,000			
4.3 Mukdahan Integrated Urban Dev.	"	"	200	1,000			
4.4 Aranyaprathet Integrated Urban Dev.	"	Extension	200	1,000			
4.5 Buri Ram / Surin Twin City Development	"	"	200	1,600			
4.6 Others	"	"	5,866	5,630			
- Secondary Town Development		Extension					
- Rural Centers Development		"					
<b>5. Environment</b>							
5.1 Northeast Industry Promotion Sub-Center	MOID	New	50	250			
5.2 Khao Yai Resort and Research Development	TAT & MOE	"	100	1,400			
5.3 Agropolis	Inter-agency	"	50	150			
5.4 Nakhon Ratchasima Industrial Modernization	MOID	"	50	100			
5.5 Others			2,305	2,443			
<b>6. Education</b>			<b>5,963</b>	<b>10,134</b>	<b>28,610</b>	<b>44,707</b>	<b>7</b>
6.1 Si Sa Ket Agriculture Training Center	MOIT	New	30	*			
6.2 Korat Skill Training Center	MOAC	On-going	540	*			
6.3 Thai-Vietnam Culture Bridge Project	"	New	20	*			
6.4 Yasothon Aquaculture Center	"	"	19	*			
6.5 Thai-Khmer Culture Bridge Project	TAT	"	*	20			
6.6 Thai-Cambodia Skill Development Center	MOID	"	*	120			
6.7 Others			5,354	9,994			
- Buri Ram Provincial Training Center	MOIT	New					
<b>7. Public Health</b>			<b>4,259</b>	<b>7,239</b>	<b>20,436</b>	<b>31,933</b>	<b>5</b>
7.1 Tambon Health Care Center Expansion	MOPH	New	1,344	1,680			
7.2 Others (conventional programs)	"	Extension	2,915	5,559			
- Village Health Care Center Dev. Program							
<b>8. Social Development</b>			<b>7,666</b>	<b>13,030</b>	<b>36,784</b>	<b>57,480</b>	<b>9</b>
8.1 Rural Enviro'tal Enhancement Program [REEP]	MOIT	New	2,000	5,000			
8.2 Others			5,666	8,030			
<b>Public Fund Availability (Total)</b>			<b>85,183</b>	<b>144,774</b>	<b>408,710</b>	<b>638,667</b>	<b>100</b>

\* Costs to be incurred but not estimated; some costs included in other projects.

**Table 10 Steps for Implementation of Core Projects**

◊ study, design, implementing arrangement, review etc.  
● implementation

Project	Phase I (~1996)	Phase II (1997~2001)	Phase III (2002~2010)
R.1 Regional Artery establishment (New Indochina gateway road)	●	●	
R.2 Railway improvement	◊ ●	●	●
R.3 Route no.24 improvement	●	●	●
R.4 Second Mekong bridge	◊	◊ ●	●
R.5 Local air services network development	●	●	
R.6 Small pumping reservoirs development	● ◊	● ◊	●
R.7 Phanom Dong Rek water resources development	●	●	
R.8 Lam Thakong pumped storage generation	●	●	
R.9 Pak Mun hydropower	●	●	
1.1 Nakhon Ratchasima integrated urban development - Regional truck terminal - Commerce and industry plaza - Automobile test course	◊ ● ◊ ● ◊	● ● ● ◊	● ◊ ● ●
1.2 Nakhon Ratchasima Industrial Modernization (Small industry district)	●	●	
1.3 Natural gas pipeling extension	●		
1.4 Co-generation system	◊	●	
1.5 Khao Yai resort and research development	◊	●	●
2.1 Ubon Ratchathani integrated urban development - Regional truck terminal - Commerce and Industry plaza	◊ ● ◊ ◊	● ● ●	
2.2 Teleport	◊ ●	●	●
2.3 "Agropolis"	◊	●	●
2.4 Border trade center development	◊ ●	●	
2.5 Lam Don Yai/Huai Tha multi-purpose development	◊	● ◊	●
3.1 Buri Ram International airport	●	●	
3.2 Northeast industrial promotion sub-center	◊ ●	●	
3.3 Lam Nam Chi/Lam Plai Mat multi-purpose development • Green wedge development • Elephant park establishment • Khmer ruins upgrading	◊ ● ● ◊ ●	● ◊ ● ● ●	● ●
3.4 Buri Ram - Surin twin city development	◊	●	●

## 6. STRATEGY AND PROJECTS BY SECTOR

The following part presents a summary of development strategy and projects proposed for each sector. They are fully described in the Main Report and respective sector reports.

### 6.1 Economic Sectors

#### (1) Agriculture

##### Strategy

- (a) Achieving higher productivity through crop diversification in favor of high value added crops for export and processing in the LNE-UE Regions.
- (b) Establishment of proper crop cycles.
- (c) Improvement of farm practices in soil improvement, selection of crops and timing for planting.
- (d) Improvement in marketing of agriculture produce by establishing assembly markets and encouraging joint marketing through cooperatives and farmers' organizations.
- (e) Promotion of contract farming coupled with enhancement of farmers' organization.
- (f) Promotion of mixed farming supported by improved provision of agricultural inputs.
- (g) Effective water management for maximum utilization of limited water resources.
- (h) Expansion of livestock sector capitalizing on various favorable conditions such as rapidly growing demands, availability of agricultural by-products for feed and hot and dry climate.

##### Projects

- (a) Mixed farming promotion program
- (b) Livestock improvement program
- (c) Crop cycles research
- (e) Agricultural marketing network program
- (f) Agricultural cooperatives promotion
- (g) Floating cage net aquaculture development
- (h) Yasothon aquaculture center
- (i) Drip irrigation development

- (j) Participatory irrigation system improvement
- (k) On-farm drainage improvement

(2) Industry

Strategy

- (a) Further promotion and diversification of agro-industries as a backbone industry through crop diversification, integrated farming and contract farming with processors.
- (b) Development of metal working and machinery industries including electrical and transport equipment as another backbone industry.
- (c) Promotion of labor intensive, footloose industries and local culture based handicraft industries in rural areas to absorb the new workforce and those shifted from agriculture.

Projects

- (a) Complete cycle projects
- (b) Khao Yai resort and research development
- (c) Commerce and industry plaza complex
- (d) Northeast industrial promotion sub-center
- (e) Automobile test course
- (f) Nakhon Ratchasima industrial modernization

(3) Tourism

Strategy

- (a) Full realization of the LNE-UE Regions' major tourism potential, its proximity to Cambodia, Laos and Vietnam with the medium to long-term perspective through improved links between these countries and the LNE-UE Regions.
- (b) Upgrading of the tourism resources and improvement of tourism infrastructure capitalizing on domestic tourists as the short to medium term strategy.

Projects

- (a) Khmer ruins restoration program
- (b) Elephant park establishment

- (c) "Green wedge" development
- (4) Trade, distribution and other services

#### Strategy

- (a) Improvement of market access for agricultural products through improvements in transport and information, marketing outlets in rural market centers and institutional measures to promote competition among traders.
- (b) Reduction of farmers' dependence on middlemen and seasonal price fluctuations and improvement in farmers' access to institutional credit.
- (c) Increased support for input delivery system, both private and public.
- (d) Promotion of inter-regional trade through establishment of transport facilities such as regional truck terminal and storage and handling facilities.
- (e) Introduction of a new institution to encourage broad based border trade including commodity trade as well as processing, financial transactions and skill training.

#### Projects

- (a) Agropolis
- (b) Border trade centers development
- (c) Isan Indochina In-Bond program

### **6.2 Natural Resources and Infrastructure Sectors**

- (1) Land and environment

#### Strategy

- (a) Establishment of an appropriate land use control system to resolve emerging conflicts over land use and realize potential land use identified.
- (b) Preservation of existing forests and reforestation with active involvement of local people and encouragement of on-farm tree planting by farmers.
- (c) An appropriate soil management by the improved management of land use and application of organic fertilizer.
- (d) Application of a river basin approach for multipurpose water resources development.



### Projects

- (a) Problem soil management and soil erosion control
- (b) Fragrant wood afforestation program
- (c) Regional environmental monitoring
- (d) Economic reforestation program
- (e) Protected area buffer zone program
- (f) Land information system development

### (2) Water resources

#### Strategy

- (a) Planning and implementation of storage of rain water from a viewpoint of river basins or sub-basins and including proper arrangements for the management of the integrated facilities.
- (b) Provision of three to five water jars per household to bridge the water availability gap due to extended drought.
- (c) Intensified exploration of groundwater for drinking water supply in rural areas which are not served by rivers or storage reservoirs and identified as promising in groundwater potential.

#### Projects

- (a) Small pumping reservoirs development
- (b) Lam Nam Chi/Lam Plai Mat multipurpose water resources development
- (c) Nakhon Nayok/Prachin Buri river basins multi-purpose water resources development
- (d) Yasothon water network development
- (e) Revised water jar program
- (f) Huai Bang Sai multipurpose water resources development
- (g) Lam Dom Yai/Huai Tha multipurpose water resources development
- (h) Groundwater exploration

(3) Power and energy

Strategy

- (a) Expanded use of abundant agricultural and animal wastes as new energy sources such as biogas, biomass and rice husk.
- (b) Wider application of solar energy.
- (c) Promotion of co-generation depending on the natural gas pipeline extended to Nakhon Ratchasima or extended power transmission and distribution system.
- (d) Promotion of a joint effort with the neighboring countries such as Laos in the development of power transmission and distribution facilities as well as power generation facilities.
- (e) Improvement of power supply stability and reliability by replacement of equipment.

Projects

- (a) Lam Takhong pumped storage power generation
- (b) Natural gas pipeline extension
- (c) Rural energy program
- (d) Solar PV application
- (e) Rice husk power generation
- (f) Co-generation system
- (g) Solar water heater application program

(4) Telecommunications

Strategy

- (a) Increase of subscriber lines per system applying the multiple access subscriber system (MASS).
- (b) Establishment of a "Teleport" as a base for comprehensive telecommunication services and information exchanges to support higher levels of economic activities.
- (c) Introduction of integrated services digital network (ISDN) to provide all the advanced telecommunication services.

Projects

- (a) Rural telecommunications

- (b) Mobile telephone system
- (c) Telephone services upgrading
- (d) Satellite gateway
- (e) Teleport
- (f) Border links establishment

(5) Transportation

Strategy

- (a) Establishment of a new regional artery linking the Eastern Seaboard with the central area of the LNE-UE Regions and Mukdahan.
- (b) Enhancement of the gateways to the LNE-UE Regions such as Nakhon Ratchasima as the main gateway, Buri Ram as the tourism gateway and border trade centers such as Mukdahan and Aranyaprathet.
- (c) Improvement of rural access by construction of new rural roads and maintenance by self-help efforts of local people.
- (d) Effective utilization of the existing development axes such as the east-west axis and the north-south axis to develop urban centers along these axes for designated functions.

Projects

- (a) Regional artery establishment (New Indochina gateway road)
- (b) Route no. 24 improvement
- (c) Rural road maintenance system
- (d) International airport establishment
- (e) Motorway network development
- (f) Regional truck terminals
- (g) Railway improvement
- (h) Local air services network development
- (i) New Mekong bridge

(6) Urban system

Strategy

- (a) Adoption of "regional network approach".
- (b) Promotion of a balanced distribution pattern of urban centers by effectively linking transportation and urban development.
- (c) Enhancement of the functions of cities to stimulate economic activities in hinterland rural areas.
- (d) Development and upgrading of urban infrastructure and utility facilities to create an attractive and efficient urban environment.
- (e) Creation of a desirable urban land use pattern by incentive and regulatory measures in combination with infrastructure development.

Projects

- (a) Integrated urban development
- (b) Local planning and management

**6.3 Human Development (Education, skill training and public health)**

Strategy

- (a) Enhancement and expansion of skill training programs as the short-term measure and those of basic education as the medium to long term measure for improving the educational level of the population.
- (b) Flexible adjustments of educational resources allocation among various ministries and departments to efficiently meet rapidly growing demands for educational and skill training programs.
- (c) Enhanced role of provincial governments to tailor educational and skill training programs to local needs.
- (d) Allowing a greater role of the private sector as the provider of education from primary school level to higher education and skill training levels.
- (e) Enhancement and expansion of primary health care services to upgrade overall health condition of the rural population.
- (f) Expansion of health insurance system to cover a larger portion of the population as a measure to get rid of financial constraint to receive medical and health care services.

Projects

- (a) Thai-Khmer Culture Bridge Project

- (b) Thai-Vietnam Culture Bridge Project
- (c) Si Sa Ket Agriculture Training Center
- (d) Khorat Skill Training Center
- (e) Yasothon Aquaculture Training Center
- (f) Thai-Cambodia Skill Training Center
- (g) Tambon Health Care Center Expansion Program

## **7. ACTION PLAN**

Four kinds of activities should be undertaken, subsequent to the submission of the LNE-UE Master Plan. They are (1) adoption of the Master Plan, (2) promotion of the Master Plan (3) project formulation studies of some core projects, and (4) implementation of other core projects.

### **7.1 Master Plan Adoption and Promotion**

The bulk of development projects and related measures proposed by the LNE-UE Master Plan can be implemented within the competence and policies of sector agencies. However, the coordination of various development efforts by many agencies and timely implementation of core projects will have to be assured. For this purpose, Master Plan proposals will have to be discussed first among related agencies, sectoral concerns and conflicts resolved, and the Master Plan formally adopted, if necessary with addenda.

Initial steps to be taken, immediately following the Master Plan submission are shown in Table 9. In these steps, NESDB should play key roles as shown. In particular, the establishment of a Project Management Unit (PMU) based on the two regional centers of NESDB is proposed to facilitate the regional/provincial level coordination and to provide technical assistance to local administrations for plan/project formulation.

In parallel with these steps, the Master Plan proposals should be disseminated widely to facilitate implementation and to cultivate public acceptance. The following may be particularly effective:

- 1) implementation of orientation seminars to convey the Master Plan proposals to a wide range of people such as politicians, local government officials, prospective investors, NGO's, environmentalists and researchers as well as general public,
- 2) preparation of publicity materials such as brochures and videos,
- 3) drafting of promotion materials for selected priority projects/programs,
- 4) launching of a series of TV programs combining video presentation, plan schematics and commentaries by various people, and
- 5) organization of international donors meetings and an investment promotion committee by public-private cooperation.

**Table 11 Initial Steps in the Action Plan for LNE-UE Master Plan Implementation**

Step	Action	By whom
1	Prepare a policy document recommending adoption of the Master Plan objectives and strategy in principle and requesting approval	NESDB NESDC
2	Adopt the Master Plan objectives and strategy in principle as a national policy	Prime Minister (Cabinet)
3	Convene National Regional Development Committee to resolve sectoral concerns and conflicts related to Master Plan proposals	Chairman (Prime Minister)
4	Take legislative measures necessary for the streamlining of NESDB functions and the establishment of PMU	Prime Minister
5	Appoint the Director of PMU	Secretary General of NESDB
6	Establish PMU and organize it with key staff	Director of PMU
7	Organize LNE-UE Council and resolve fundamental issues related to Master Plan implementation	Director of PMU
8	Establish local support and advisory base	PMU

## 7.2 Core Projects Formulation and Implementation

### (1) Regional/inter-regional projects

All the regional/inter-regional projects designated by the Master Plan as the core projects can be implemented by relevant sector agencies, following the implementation phasing indicated by the Master Plan (Table 5). For most of them, project formulation including feasibility studies and design can be conducted also by the sector agencies.

For the regional artery establishment and the small pumping reservoirs development, pre-feasibility level analyses have been conducted as part of the master planning. Further project development can be undertaken by sector agencies in line with these preliminary analyses. A feasibility study needs to be carried out for the Second Mekong bridge within the framework of the Master Plan. Stage-wise development of local air services network may be clarified first by NESDB and other related agencies before its implementation.

For the railway improvement and the route no.24 improvement, existing programs should be reviewed in the light of the Master Plan to fix the implementation schedule as well as design. Other projects should be implemented as already planned by respective sector agencies.

(2) Area development programs

Greater Nakhon Ratchasima Industrial Center Development

The Nakhon Ratchasima integrated urban development has been formulated at preliminary level as part of the master planning. Each component project should be further developed and immediately implemented by relevant sector agencies in cooperation with the CAO and the municipality.

Existing program for the natural gas pipeline extension and the co-generation system should be reviewed in the light of the Master Plan. A feasibility study and design should be completed in Phase I for the co-generation system.

A feasibility study should be carried out by either NESDB or the Ministry of Industry for the Nakhon Ratchasima industrial modernization (or small industry district). NESDB, in cooperation with other related agencies, should take the initiative to invite the private sector to prepare jointly a plan for the Khao Yai resort and research development and to work out implementing arrangements.

Ubon Ratchathani Agro-Industrial Forefront Development

For the Ubon Ratchathani integrated urban development and the border trade center development, NESDB should provide technical assistance to the provincial government for project formulation. For the Lam Don Yai/Huai Tha multipurpose development, NESDB should take the initiative for a comprehensive development and management study, coordinate activities of related agencies, and monitor the implementation.

The "Teleport" can be implemented by TOT within the framework of the Master Plan, possibly in cooperation with a foreign corporation. The private sector initiative to establish the "Agropolis" may be assisted by provincial governments and NESDB for planning and implementing arrangements.

Buri Ram-Surin Integrated Central Area Development

The Buri Ram international airport and the Northeast industrial promotion sub-center should be further elaborated respectively by AAT and the Ministry of Industry (Department of Industrial Promotion) in line with the Master Plan. For the Lam Nam Chi/Lam Plai Mat multipurpose development, NESDB should take the initiative to conduct first a comprehensive development and management study. For the Buri Ram-Surin twin city development, NESDB should provide technical assistance to the provincial governments and the municipalities for project formulation.

(3) Special sector programs

Agricultural Diversification Program (ADIP)

An inter-agency task force should be formed with NESDB for program formation based on the Master Plan. The drip irrigation project has been studied at preliminary level as part of the master planning. A joint public-private committee should be established in each province with the initiative of the provincial governments supported by NESDB to identify project area with implementing



arrangements. For the crop cycle research, subject matter institutes should be designated and research programs prepared based on the Master Plan.

#### Rural Environment Enhancement Program (REEP)

Implementation programs should be worked out by the Tambon Rural Development Committees with participation of farmers' representatives. They would be reviewed at provincial level. In this review, NESDB would be in a position to ensure that component projects are consistent mutually and with other related projects such as those in the ADIP. Component projects will be programmed by relevant sector agencies for implementation.

#### Broad Based Border Activities Promotion Program

An inter-agency task force should be formed with NESDB to draft the Isarn-Indochina in-bond program. This would provide the basis for negotiations with neighboring countries. For other projects, NESDB should extend technical assistance to the relevant municipalities for the preparation of development plans.

### **7.3 Immediate Actions and Phase I Budget**

Immediate actions to be taken for all the core projects are summarized in Table 12 together with budget allocation during Phase I. For those projects to be implemented during Phase I, the budget allocation covers initial investment as well as further project formulation. For other projects for which only studies are recommended for Phase I, only indicative allocation is given. The outlines of the selected priority projects for which pre-feasibility analyses were carried out are presented in Table 13.

The total investment requirements for all the core projects are 19,950 million bahts during Phase I, corresponding to 23% of the projected total public investment allocation to LNE-UE. Early implementation of those projects would be essential to transform the development structure of the LNE-UE regions.

**Table 12 Immediate Actions to Implement the LNE-UE Master Plan and Phase I Budget (1/3)**

No. Project/Program	Immediate Actions	Phase I Budget (million baht)
<u>Regional/inter-regional projects</u>		
R.1 Regional artery establishment	• Programming of initial link between LNE and UE (Sa Kaeo - Buri Ram/Surin border)	1,700
R.2 Railway improvement	• Review of existing program in light of M/P	100
R.3 Route no.24 improvement	• Review of existing program in light of M/P	500
R.4 Second Mekong bridge	• F/S	100
R.5 Local air services network development	• Study to clarify stage-wise development	100
R.6 Small pumping reservoirs development	• Preparation of I/P for identified schemes followed by implementation	2,700
R.7 Phanom Dong Rek water resources development	• Acceleration of implementation	1,400
R.8 Lam Thakong pumped storage power generation	• Programming of stage 1	5,300
R.9 Pak Mun hydropower	• Programming of stage 1	
	Sub-total	11,900
<u>Area Development Programs</u>		
<u>Greater Nakhon Ratchasima Industrial Center Development</u>		
I.1 Nakhon Ratchasima IUD	• Project elaboration through NESDB technical assistance to local governments based on M/P	800
I.2 Nakhon Ratchasima industrial modernization	• F/S by NESDB/MOI based on M/P to be followed by implementation	50
I.3 Natural gas pipeline extension	• Review of existing program for early implementation	*
I.4 Co-generation system	• Review of existing program and F/S	100
I.5 Khao Yai resort and research development	• Plan formulation and implementing arrangement by public-private partnership with NESDB initiative	100

**Table 12 : Immediate Actions to Implement the LNE-UE Master Plan and Phase I  
Budget (2/3)**

No. Project/Program	Immediate Actions	Phase I Budget (million baht)
<u>Ubon Ratchathani Agro-Industrial Forefront Development</u>		
2.1 Ubon Ratchathani IUD	<ul style="list-style-type: none"> <li>• Project formulation based on M/P through NESDB technical assistance to local governments</li> </ul>	400
2.2 "Teleport"	<ul style="list-style-type: none"> <li>• Detailed planning based on M/P by TOT ( in cooperation with foreign corporation)</li> </ul>	200
2.3 "Agropolis"	<ul style="list-style-type: none"> <li>• Planning by private sector and implementing arrangement assisted by NESDB</li> </ul>	50
2.4 Border trade center development	<ul style="list-style-type: none"> <li>• Project formulation through NESDB technical assistance to local government</li> </ul>	50
2.5 Lam Dam Yai/Huai Tha multipurpose development	<ul style="list-style-type: none"> <li>• Comprehensive development and management study by NESDB</li> </ul>	100
<u>Buri Ram-Surin Integrated Central Area Development</u>		
3.1 Buri Ram international airport	<ul style="list-style-type: none"> <li>• Detailed planning to be followed by implementation as local airport</li> </ul>	100
3.2 Northeast industrial promotion subcenter	<ul style="list-style-type: none"> <li>• Detailed planning by MOI (DIP)</li> </ul>	50
3.3 Lam Nam Chi/Lam Plai Mat multipurpose development	<ul style="list-style-type: none"> <li>• Comprehensive development and management study by NESDB</li> </ul>	100
3.4 Buri Ram-Surin twin city development	<ul style="list-style-type: none"> <li>• Project formulation based on M/P through NESDB technical assistance to local governments</li> </ul>	200
Subtotal		<u>2,300</u>
<u>Special Sector Programs</u>		
Agricultural Diversification Program (ADIP)	<ul style="list-style-type: none"> <li>• Program formation based on M/P by inter-agency task force with NESDB</li> </ul>	800
- Drip irrigation development	<ul style="list-style-type: none"> <li>• Preparation of I/P by public-private committee by province</li> </ul>	2,300
- Crop cycles research	<ul style="list-style-type: none"> <li>• Designation of subject matter institute(s) and research program preparation based on M/P</li> </ul>	

**Table 12 Immediate Actions to Implement the LNE-UE Master Plan and Phase I Budget (3/3)**

No. Project/Program	Immediate Actions	Phase I Budget (million baht)
Rural Environment Enhancement Program (REEP) - Revised water jar program	<ul style="list-style-type: none"> <li>• Preparation of I/P by Tambon Rural Development Committee with farmers' participation</li> <li>• Identification study for problem areas to determine needs for and applicability of larger containers</li> </ul>	2,000
Broad Based Border Activities Promotion Program	<ul style="list-style-type: none"> <li>• Drafting of Isarn-Indochina in-bond program by inter-agency task force with NESDB</li> </ul>	*
	Subtotal	<u>5,100</u>
<u>Other local projects</u>		
Nakhon Nayok/Prachin Buri multipurpose development	<ul style="list-style-type: none"> <li>• Comprehensive development and management study including land use plan</li> </ul>	50
Yasothon water network development	<ul style="list-style-type: none"> <li>• Comprehensive development and management study</li> </ul>	100
Yasothon aquaculture center	<ul style="list-style-type: none"> <li>• Project formulation coordinated with Mekong Secretariat</li> </ul>	50
Groundwater exploration	<ul style="list-style-type: none"> <li>• Review of DMR data to identify more promising areas</li> </ul>	*
Huai Bang Sai multipurpose development	<ul style="list-style-type: none"> <li>• F/S to be followed by initial implementation</li> </ul>	50
Mukdahan IUD/border trade center	<ul style="list-style-type: none"> <li>• Project formulation based on M/P through NESDB technical assistance to local governments</li> </ul>	200
Aranyaprathet IUD/border trade center	<ul style="list-style-type: none"> <li>• Project formulation based on M/P through NESDB technical assistance to local governments</li> </ul>	200
	Subtotal	<u>650</u>
	<b>Total</b>	<b>19,950</b>

\* Costs to be incurred but not estimated; some costs are included in other projects.

**Table 13 Outline of Selected Priority Projects \***

Projects	Objective	Outline	Investment cost (10 <sup>6</sup> Baht)
Regional artery establishment	To establish a regional artery from the northern part of the Upper East region to Mukdahan passing through the poorest central part of the Lower Northeast to promote various economic activities along the route	<ul style="list-style-type: none"> <li>- Forecast traffic volume: 12,000 VT/day in 2000 16,000 VT/day in 2010</li> <li>- Total length : 635.2 km</li> <li>Laem Chabang - Sa Kaeo : 163.3 km</li> <li>Sa Kaeo - Nang Rong : 154.8 km</li> <li>Nang Rong - Suwannaphum : 161.2 km</li> <li>Suwannaphum - Mukdahan : 155.9 km</li> <li>- Economic internal rate of return:</li> <li>- Total : 10.5%</li> <li>- Laem Chabang - Nang Rong section : 10.3%</li> </ul>	Phase I (~1996): 1,700 Phase II (~2001): 6,900 Total : 8,600
Small pumping reservoirs development	To expand the water availability in LNE-UE during the dry season to support various activities in both rural and urban areas by constructing small reservoirs connected to river systems	<ul style="list-style-type: none"> <li>- Number of selected sites:</li> <li>Nakhon Ratchasima : 5</li> <li>Buri Ram : 3</li> <li>Surin : 2</li> <li>Si Sa Ket : 2</li> <li>Ubon Ratchathani : 2</li> <li>Yasothon : 3</li> <li>Mukdahan : 3</li> <li>Nakhon Nayok : 2</li> <li>Prachin Buri : 6</li> <li>Total : 30</li> <li>- Scale of reservoirs</li> <li>- inundation area : 1 to 25 ha</li> <li>- storage capacity : 70,000 to 2,000,000 m<sup>3</sup></li> <li>- Economic internal rate of return : 11.7%</li> </ul>	Phase I (~1996): 2,700 Phase II (~2001): 6,500 Total : 9,200
Integrated urban development program	The following objectives will be pursued in an integrated manner. <ol style="list-style-type: none"> <li>(1) Review and modification of existing land use plans</li> <li>(2) Development and improvement of various urban infrastructure and utility facilities</li> <li>(3) Enhancement of institutional and financial capabilities for better urban management</li> </ol>	<ul style="list-style-type: none"> <li>- An integrated urban development program was prepared for Nakhon Ratchasima at the pre-feasibility analysis level</li> <li>- Population framework : 1 million in 2010</li> <li>- The existing land use plan prepared by DTCP was reviewed and modified in light of the new population framework, anticipated functions of the city in the future and various projects proposed by the master plan.</li> <li>- Individual infrastructure projects</li> <li>water supply: expansion to 140,000 m<sup>3</sup>/day capacity by 2001</li> <li>wastewater-drainage: expansion to 60,000 m<sup>3</sup>/day capacity by 2001</li> <li>solid waste: expansion of garbage collection capacity to 150,000 tons/day and construction of an additional disposal site by 2001</li> </ul>	Phase I (~1996): 800 Phase II (~2001): 1,800 Total : 2,600

Projects	Objective	Outline	Investment cost (10 <sup>6</sup> Baht)
		<p>electricity:            installation of street lights</p> <p>telecommunication:    expansion of telephone network coverage, enhancement of mobile telephone system and improvement in telecommunication services</p> <p>urban roads:            improvement of the existing roads, construction of fly overs, street lighting etc.</p> <p>Other non-infrastructure type projects include industry modernization, regional truck terminal, industry and commerce plaza and agriculture marketing improvement.</p>	
Drip irrigation development	To increase farm income and improve nutrition level of local people through crop diversification centering on oil crops and vegetables applying drip irrigation technology	<p><u>Component / measures</u></p> <p>(1) Development of water sources ... small pond, small pumping reservoir or groundwater,</p> <p>(2) Introduction of drip irrigation system with application device for water, fertilizer and chemicals,</p> <p>(3) Agricultural credit by BAAC,</p> <p>(4) Establishment of a joint public-private committee in each province to plan, implement and manage the project,</p> <p>(5) Farmers' involvement and commitment throughout the project cycle: planning for sub-projects, construction, maintenance, cost recovery, marketing and information exchange through existing or new farmers' organizations</p> <p>(6) Establishment of marketing outlet to traders or processors.</p> <p>Internal rate of return : 14.0%</p>	<p>Phase I (~1996):    2,300</p> <p>Phase II (~2001):    10,500</p> <p>Total :                12,800</p>
Private agro-processing projects	<ul style="list-style-type: none"> <li>- Increase of dairy products production</li> <li>- Increase of processed meat production</li> <li>- Increase of animal feed production</li> </ul>	<ul style="list-style-type: none"> <li>- Production of yogurt and milk from 29,000 tons raw milk at the full operation stage (IRR : 47%)</li> <li>- Production of pork (3,500 tons/year) and beef (4,500 tons/year) at the full operation stage (IRR : 26%)</li> <li>- Production of animal feed at 230,000 tons per year at the full operation stage (IRR : 79%)</li> </ul>	<p>185</p> <p>137</p> <p>104</p>

Note: \* Projects for which pre-feasibility analysis were conducted.



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