



# BDP

The MRC Basin Development Plan

**Sub-area Report**

**Chiang Rai Sub-area (SA2T)**

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Mekong River Commission

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# Acronyms and Abbreviations

BDP	:	Basin Development Plan
DWR	:	Department of Water Resources
EGAT	:	Electricity Generating Authority of Thailand
FYP	:	Five Year Plan
GPP	:	Gross Provincial Product
GMS	:	Greater Mekong Sub-region
Kw	:	Kilowatt
Kwh	:	Kilowatt-hour
MCM	:	Million Cubic Metter
MRC	:	Mekong River Commission
MSL	:	Mean Sea Level
MW	:	Megawatt
PWA	:	Provincial Waterworks Authority
RBC	:	River Basin Sub-committee
RBO	:	River Basin Organization
RWO	:	Regional Water works Office
RID	:	Royal Irrigation Department
SA	:	Sub-area
SAWG	:	Sub-area Working Group
TNMC	:	Thai National Mekong Committee
WHO	:	World Health Organization

# EXECUTIVE SUMMARY

## BACKGROUND

The Basin Development Plan (BDP) formulation started on 1<sup>st</sup> October 2001, as one of the three core programmes of the Mekong River Commission (MRC). The formulation involves the National Mekong Committees (NMCs) in each country, national planning and line agencies, and a wide range of other government, private sector and civil society actors. The work is supervised by the MRC Joint Committee and by National Sub-Committees.

The BDP seeks to develop both an *initial plan* as a framework for the basin-wide water and water-related resources development and a sustainable *planning process* in the four member states of the MRC, including Cambodia, Lao PDR, Thailand and Vietnam.

The BDP team in each country has been initiating studies and analysis in a number of Sub-areas making up the Lower Mekong Basin (LMB). This is the first stage of the BDP development process. Five Sub-areas have been delineated in the Cambodian part of the Mekong Basin (MB).

In Thailand, the Thai National Mekong Committee (TNMC) is leading the efforts on the BDP. The overall process involves reviewing, collecting, analyzing relevant data and information and conducting forums at regional, national and provincial levels. Background study is being finalized at national level through sub/sectoral reviews by Technical Officials from line agencies involved.

The work in the Sub-areas is being divided into two components as following:

- **Component A: Review and Analysis**
  - + Review of provincial and sector plans/data and insight collection; and
  - + Analysis.
- **Component B: Scenario and Strategy Development**
  - + Scenario development; and
  - + Strategy development.

The Sub-area review and analysis will provide the basis for formulating the scenarios and strategies for water use in the Sub-areas and subsequently in the region. It will therefore be essential that *the level of detail be tailored and targeted to facilitate macro thinking and analysis and the promotion of suitable oversight and vision in the subsequent stages*. The outcomes for each Sub-area analysis will therefore be:

- Summary of present conditions and context for development;
- Summary of water availability, ecological demands and present water uses;

- Identification of opportunities, concerns and risks; and
- Formulation of development objectives.

## PROCESS OF SUB-AREA STUDY AND ANALYSIS

Sub-area studies involve:

- ***Preliminary review:*** Review of available information at regional, national and Sub-area levels to provide overviews of keys issues, review of development plans/programmes (either already prepared or under preparation) and preparation of GIS and related information from MRC data sets;
- ***Identification of key issues and sectors;***
- ***Information collection:*** Identify information gaps, collate or collect required information (particularly from national and provincial agencies);
- ***Analysis:*** Identify Sub-area development objectives, formulate scenarios and strategies and identify potential projects/programmes; and
- ***Public consultation:*** Include local knowledge and opinions.

It is proposed that the process of Sub-area study and analysis should be orientated around two forums. The process can then be broken down into a number of steps as follows:

- ***Review:*** Mainly through activities coordinated at MRC Secretariat;
- ***Forum 1:*** A multi-stakeholder forum within the Sub-area to consider Sub-area information, identify key issues and information gaps, and prepare a work plan for further study and analysis;
- ***Implementation of work plan:*** Mainly collection of further information as defined at Forum 1; and
- ***Forum 2:*** A second multi-stakeholder forum to agree on Sub-area development objectives, scenarios and strategies and to identify potential projects/programmes.

## DEVELOPMENT OF SCENARIOS AND STRATEGIES

According to the BDP, scenarios are not about predicting the future; rather they are about perceiving the future in the present. A scenario is a hypothetical combination of events and physical conditions, describing a possible future situation. Development scenarios will be formulated in order to illustrate anticipated limits to the long-term basin development, as well as the significance of external driving forces and uncertainties about applied key assumptions.

Development strategies will be drafted as a tool for identification and assessment of development projects and programmes. Development and management strategies will be



formulated for each Sub-area and each relevant water related sector. This will be done in a close dialogue with the stakeholders, and drawing on related MRC programmes.

The strategies need to be justified in terms of: (i) socio-economic implications; (ii) environmental implications; (iii) human resources development implications; and (iv) national priorities, strategies and plans.

## **IMPORTANCE OF THE REPORT**

The report might also be useful for governmental institutions, external support agencies, project evaluation teams, investors and technical specialists in helping them understand:

- The current condition of various development sectors at provincial levels around Chiang Rai Sub-area;
- The trends within and future plans of the sectors within Chiang Rai Sub-area;
- The linkages between one sector and another;
- The cross-cutting themes: socio-economic, environment, public participation and human resources aspects; and
- The trans-boundary issues within Chiang Rai Sub-area.

## **OVERVIEW OF THE SUB-AREA 2T**

### ***Introduction***

The Basin Development Plan (BDP) is one of the four core programmes of the Mekong River Commission (MRC) with the following principal concepts and process.

- A development plan with emphasis on stakeholders' participation in the formulation process in accordance with the specified and well-accepted five stages.
  - Sub-area Study and Analysis;
  - Formulation of development scenarios;
  - Preparation of integrated development strategies;
  - Compilation of a long list of projects and programmes; and
  - Preparation of a short list of priority projects and programmes.
- The Lower Mekong Basin (LMB) is divided into 10 sub-areas (SA) based on the hydrological conditions and country boundary. The Mekong Basin's part in Thailand includes SA-2T (covering Kok and Mekong river basins in the North), SA-3T (Mekong River Basin in the Northeast), SA-5T (Chi and Mun river basins), and SA-9T (Tonle Sap sub-basin).

- Three activities were simultaneously undertaken: (i) formulation of development plan; (ii) public consultation and participation; and (iii) capacity building of the institutions and stakeholders involved in this plan.

Activities accomplished in April 2004 encompass the preparation of Integrated National Sector Overview which presents an overview at country level of eight sectors related to the Basin Development Plan, namely, watershed management, irrigated agriculture, water supply for domestic and industrial uses, hydropower, flood management, fisheries, navigation, and tourism. This report gives details SA-2T with focus on major sectors.

### ***Context and Scope***

- To analyze the present situation of each sector under the BDP in the sub-areas;
- To serve as a sub-area situation report for other member countries, with some important data to be used in formulating more specific regional development scenarios and strategies;
- To provide preliminary data for trans-boundary meetings; and
- To support the first stage of BDP collaborative learning approach and to be the starting point of the process.

### ***Baseline Description***

Chiang Rai Sub-area (SA-2T) covers Kok River Basin and Mekong River Basin (MRB) Part 1. The Mekong River meanders along the Thai-Lao border. The topography is mainly characterized by high ridges with elevation ranging between 400-2,000 m MSL. The highest peak of 2,285 m in height is Doi Pha Hom Pok, located in Fang district, Chiang Mai province. Most areas are under forest cover, with some flat terrains on the valley floor. This SA covers areas of three provinces, i.e. parts of three districts in Chiang Mai province, namely, Chai Prakan, Fang, and Mae Ai districts; 16 districts and 2 sub-districts of Chiang Rai province; and 5 districts and 2 sub-districts of Phayao province.

The Ninth National Economic and Social Development Plan stipulates that an efficient use of water resources is supported to ensure sustainable and equitable benefits. The present government's policies delivered to the National Assembly on 26 February 2001 have embraced natural resources and environment issues as follows:

- To manage the environment, natural resources and biodiversity in an integrated manner;
- To promote and encourage participation;
- To support the notion of taking social costs into consideration;
- To promote technological research and development with a view to increasing Thailand's capacity to manage, conserve and restore the environment;
- To set national environmental standards; and
- To set standards for controlling the importation of chemical, toxic and hazardous substances.

Thailand has adopted a new concept of regional administration - a bureaucratic system that can efficiently respond to the Government's strategic management. For effective management, provinces have to be grouped together. Provincial water resources management plans will be in line with these strategies. SA-2T extends over 3 provinces, i.e. Chiang Rai, Phayao, and Chiang Mai (some part). They are classified as the Upper North Strategic Group (Lanna Group consists of Chiang Mai, Chiang Rai, Lampang, Lamphun, Phayao, Phrae, Nan, and Mae Hong Son). Three main strategies were formulated for this sub-area:

- Proactive Strategy: To build a new economic base;
- Improvement Strategy: To create value added of the existing economic base; and
- Sustainable Development Strategy: To ensure sustainability of existing and new economic bases

SA-2T is dominated by tropical monsoon or tropical savanna climate. The rainy season occurs during May-October and is influenced by the Southwest monsoon from the Andaman Sea as well as typhoons and depressions from the South China Sea. Rains scatter widely over the whole area with a peak in August. Winter lasts from October to February. The summer is between February and mid May with maximum mean temperature in April. The mean annual rainfall of SA-2T varies from 900 mm to 2,900 mm. The mean annual runoff totals 6,559 million m<sup>3</sup>.

The total population of SA-2T is 1,803,496 persons. Per capita Gross Provincial Product (GPP) income/year in the sub-areas is based on one-year data, i.e. the year 2000, from National Economic and Social Development Board. Per capita GPP income/year of Chiang Mai province is nearly doubles that of Phayao province.

The results from cross cutting issues are presented by sectors as follows:

- **Watershed Management:** SA-2T has the highest ratio of forest cover to the total basin areas, compared to other sub-areas in Thailand. At present, there are threats from the expanding demand for agricultural land. Legal measures alone will not be adequate and should be integrated with the other sectors.
- Irrigated Agriculture: Presently, monoculture areas are on the rise. This has affected the water demand in the existing agricultural areas. Besides, chemical use has negative impacts on water resources and the people. To solve problem and promote strength point of SA-2T which flora diversity is much in evidence relate to sustainable development. Hence, researches and development of bio-diversity are carried out in combination with the adoption of organic agriculture. The existing irrigation demand (1996) is 581.3 MCM/year and the future demand (2046) is 1,057.6 MCM/year.
- **Water supply for domestic and industrial consumption:** SA-2T becomes a centre linking with Greater Mekong Sub-region (GMS). Watershed conservation will be significantly beneficial for preserving, quantitatively and qualitatively, water sources for consumption. There is a future trend of rising water requirement for consumption. The existing demand (1996) is 58.6 MCM/year and the future demand (2046) is 164.6 MCM/year.
- **Hydropower:** Large-scale hydropower development in the SA will be difficult due to the necessity of watershed conservation and impacts on the people and society. However,

development of small-scale hydropower may be necessary for remote areas where construction of grid system will require high investment.

- **Flood Management:** Flood problems in SA-2T are relatively less severe, compared to other sub-areas. They are mainly flash floods or over-bank flooding near the confluence with the Mekong River. Structural development should take into account the flow direction and volume, use of wetlands as water retardation areas, watershed conservation, and reforestation to help slow down the stream flows to downstream areas.
- **Fisheries:** SA-2T is a unique fishermen community of the Mekong River, with a local custom of catching giant catfish. Riverside communities' livelihoods are still dependent on the vegetation and fish of the Mekong River. The increasing development activities together with explosion of rapids and shoals, and chemical use for monoculture have impacts on fish species and people's way of living. Researches and dialogues should be jointly held to formulate preventive measures and solutions to any subsequent problems. Researches should also be carried out on other marine life apart from the giant catfish to maintain the diversity of fishery resources in the Mekong River.
- **Navigation:** This sector creates great impacts in various aspects on SA-2T including riverside communities. For example, large vessels generate waves that affect small boats of the local people. Erosion or import of cheaper agricultural products also adversely affects the SA. However, the river-borne transport help promote travels within the sub-region.
- **Tourism:** There are great potentials for tourism development in SA-2T compared to the former times. This results from better transportation network and development of tourism resources in various aspects including history, archaeology, and rich natural resources. Strategies of provinces and groups of provinces also reflect the significance of this sector. To achieve sustainable tourism development, preservation of arts, culture and the environment has to be concurrently undertaken. Towards this end, the conservation efforts must not concentrate only on patterns, but public awareness has to be instilled.

Major water and related resources projects:

- Lancang-Mekong River Navigation Improvement for Commercial Navigation Project;
- Construction of the Second Chiang Saen River Port;
- Construction of the 3-Nation Cable Car Project; and
- Construction of Mekong River-Crossing Bridge at Chiang Khong District.

# 1. Overview of National Sector Development

## 1.1. Irrigated Agriculture

More than 22,300 irrigation projects have already been developed and constructed in the Mekong Basin's part of Thailand, with the total benefited area of over 8.84 million rai. Nevertheless, the irrigated area is small compared to the existing agricultural lands in total. Moreover, large-scale irrigation projects are located mainly in sub-areas 3T and 5T; for instance, Ubon Ratana Dam, Sirindhorn Dam and Lam Pao Dam. In sub-areas 2T and 9T, most of the projects are of small- to medium-scale with a limited storage capacity. Others are electrical pumping stations that do not have structures for storing water.

Problems relating to irrigation in Thailand include lacking of a "unity" in water management work which normally performed by many government departments and agencies, particularly before the implementation of bureaucratic reform. Others problems are the "free access" to and the lack of "effective allocation measure" for water. These have resulted in uneconomic, ineffective and unjust water utilization, leading eventually to the problems of conflict and competition among water users. Additionally, there are such problems as the lack of demand-side-management measures, limited knowledge on the basin's ecology, and unavailability of appropriate management pattern and no participation of the water users.

Relevant policies to help solve the problems include establishment of a unified water management system, enactment of law and improvement of regulations related to water resource, public/people's participation in water management, decentralization of authority from the Central to regions through the establishment of so-called "river basin sub-committee (RBC)". Certain roles of the Royal Irrigation Department (RID), for example, would be delegated to local authorities. Other supplementary measures include public relations activities, involvement of private sector in doing operation and maintenance work, collection of fees to cover recurrent cost and/or application of cost-sharing principle for constructing irrigation systems.

## 1.2. Integrated Watershed Management

In the Mekong Basin's part of Thailand, lands classified as classes 1 and 2 that are important watershed of river-basins, are very limited in general. For the Mun basin, area of these two categories is only 3.4% (of total basin's area). For the Chi and the Kok basins, they are 13.3% and 36%, respectively.

Management of forest/watershed upstream is a part of "river basin management" which normally covers various activities, including allocation of water (quantitatively and qualitatively) among different economic sectors within a basin. It represents, however, one of the most important work/tasks of the MRC.

The national FYPs, since the 3rd one of 1972-1976, and especially the Cabinet resolution of October 2000 on National Water Policy have set forth important directives for managing watershed and water resources of the country.

As an effort to solve the problem of water shortage during the dry season which is critical in every part of the Mekong Basin, to undertake a comprehensive study and to plan for utilization of underground water within the basin. In the longer term perspective, measures may include diversion of water from nearby basins, taking fully into consideration physical feasibility and possible impacts thereof.

### 1.3. Fisheries

Fisheries are important to both consumption-life of the people as well as economics of the country. Because fisheries are also important natural resources of the Mekong Basin that are shared and owned commonly by the riparian countries and peoples living within therein, development of fisheries constitutes one of the most important and key activities of MRC.

National policies related to the development of fisheries (2002-2006) include those for the development of fishermen and related institutions, a policy for managing fishery resources and environment, a policy for the development of fish culture and a policy for the development of fishery industries and business which emphasize people's participation in the management of fisheries that will eventually lead to a sustainable development in this sector.

Apart from the Department of Fisheries, there are several other responsible agencies, e.g., the Royal Forest Department which is responsible for forest areas including the mangrove necessary for spawning and raising young fish/fingerings, the Department of River-borne and Maritime Transportation which is responsible for registering fishing boats, RID and EGAT which play important roles in managing fisheries in both the reservoirs and rivers, DWR which is responsible for overall management and allocation of water, the Pollution Control Department which is responsible for protecting and solving the problems related to water pollution caused by such things as urban growth, industries and untreated polluted water from agriculture.

There are many important factors that cause problems and threat to the well-being of fishery resources, e.g., waste from industries which tend to reduce the quantity of solute oxygen, salinity water caused by underground salt, dam construction which obstruct fish migration, out-law fishing or the use of too powerful fishing-gear to destroy fish, cross-breeding of imported/alien fish species, etc.

To increase fishery resources enough for meeting the future demand, several measures for solving the above-mentioned problems are necessary. These may include rehabilitation of water resources, the release of more fingerling to public water bodies, setting up of conservation areas for flora and fauna, restricted areas for fisheries, etc.

### 1.4. Hydropower

Under the Context of the Mekong Committee (1957-1995) and the MRC (1995-present), Thailand has been promoting studies of potential hydropower development within the Mekong River Basin. A large number of potential projects

has already been studied and developed. Several others are still have to be studied further, although the chance for such the development become limited, due to the exhaust of appropriate development sites for large-scale dam construction and opposition of NGOs, domestically and internationally, against construction of dams.

The key agencies responsible for hydropower development in Thailand include Electricity Generating Authority of Thailand (EGAT), the Department of Alternative Energy Promotion and Energy Conservation, the Provincial Electricity Authority, the Royal Irrigation Department, etc. Up to the present, some 1,022 units of hydropower related projects have already been developed in the Basin's part of Thailand. Of these, 12 projects have been installed with electricity generators, with a combined capacity of 241 MW. This constitutes about 8% of all the hydropower plants' capacity (2,939 MW) but, just 1% of the total power generating capacity of the country (25,638 MW).

Taking power demand in sub-areas 3T and 5T as an example, the peak demand is estimated at 2,006 MW or 7.8% of the total country demand (figure of May 2003), while the total energy consumption is 10,387 million units per year, or 8.9% of the country. This means that on the average, per capita power demand of the people in the basin is only 0.091 kW, with an average energy consumption of 472 KWh/head/year. These figures represent only 31% and 25%, respectively of the national averages. Forecasting figures for the power demand and power consumption of the people in the Basin's area of Thailand in the next 10 year are 2,717 MW and 19,886 million units, respectively.

## 1.5. Navigation, Transportation and River Works

Water-borne transportation on the Mekong and in particular, the Mekong tributaries in Thailand have rapidly lost its importance due to the relatively fast development of road and highway networks in the country. Nevertheless, the use of the Mekong by Thailand and her neighboring MRC member countries for transportation of goods and tourism (river-based tourism) purposes is still significant.

National policies related to the river-borne transportation/navigation on the Mekong river include the development of maritime/trading system to support export business of the country by means of, for example, the development of commercial fleets and strengthening of related industries, construction and management of harbors and deep seaports and cooperation in the establishment of communication and transportation networks and safety measures for inland navigation that link to her neighboring countries.

Important problems related to water-borne transportation are bank erosion caused by nature or human act (e.g., sand dredging, construction of buildings in the river, etc.) and sedimentation which make river channels shallow.

Long-term development in this particular Sector of Thailand concentrates mainly on the improvement of the aforesaid river-ports at Chiang Saen and Chiang Khong, to meet the increasing demand for transporting goods and tourism on the



Mekong. Others include small-scale development and construction of bank protection work, particularly in the areas where problems are most acute to the people and public properties.

## 1.6. Tourism and Recreation

Tourism has become one of the most important economic sectors of Thailand. Compared to revenue from other export-goods, tourism can generate income and bring in the largest amount of foreign currency to the country, contributing to stabilization of balance of payment and solving many critical problems of the country. However, activities related to tourism are least developed in the context of MRC work, which concentrate principally on the river-based and eco-tourism. Role of the MRC in this particular sector is therefore still very limited and, needs to be performed in conjunction with other development sectors, such as, navigation, conservation of river ecology, environmental protection, etc.

National policy and plan for 2004-2006 reflect a strategy for the development of tourism sector in the long-term perspectives. These include the expansion of tourist area to cover a wider Region with Thailand as the center of the network, the shifting of emphasis from quantity to quality, the increase in management roles of local institutions, the importance being placed on the development and rehabilitation of natural resources, etc.

Recently, six countries in the Greater Mekong Sub-region comprising Cambodia, China, Lao PDR, Myanmar, Thailand and Vietnam have agreed to jointly develop tourism in the Mekong River Basin aiming at a sustainable benefit, reduction of development cost, a full satisfaction of tourists and, an increase in capacity for competition in the market which in the future, is to become a “single tourism market”, with the Mekong River as a selling point. Thailand has a clear role of being a gateway to the Region. Other countries have also been constructing various infrastructures that make a network linking to the Mekong.

## 1.7. Domestic Water Supply and Sanitation

In quantitative terms, the demand for water for domestic uses comprising home consumption and industrial use represents the 2<sup>nd</sup> largest of all. However, it was only recently that MRC has taken this into consideration under the BDP context. Apart from an effort to meet the demand, development of water for domestic uses could contribute to improvement of quality of life of the people living within the basin and enhance sustainable development in the longer term.

PWA is considered the main agency. As a policy, it places an emphasis on quality of the water, following the standards established by the World Health Organization (WHO). Its target is to make waterworks available to rural areas at the rate of 400 villages a year. Priority is to be given to projects where the people are most suffered with shortage of water for home consumption. PWA has also a target to increase its service areas of “potable water” for at least 10 places a year. By 2023, it is expected that all the service areas will be able to provide potable water from tab.

## 1.8. Flood Control and Management

The Mekong River Basin is subject to frequent flooding. Within the Basin's part of Thailand and particularly in the wet season, the rising water level of the Mekong River often overtops the riverbanks in Nong Khai, Nakhon Phnom and Mukdahan provinces. Sub-basins where flood occurs frequently are Nam Song-khram and Nam Kam sub-basins, due to their topographical locations which are relatively low and, lack of effective protection schemes and measures. Currently, Flood Mitigation and Management constitutes another key programme of the MRC, comprising various new components in addition to the "flood forecasting" which has been implemented continuously in the past.

Important policy related to flood and following the resolution of the Cabinet of 31 October 2000 stipulated that the plans for mitigating flood and drought problems should be formulated for areas. Flood forecast, flood mitigation methods and restoration of flood damage should be implemented effectively and justly, taking fully into account the land-use and natural resources involved.

In addition, there is a set of policies of the Ministry of Natural Resources and Environment that influences either directly or indirectly flood mitigation activities in the country. They include the policy for reserving, developing and conserving natural resources and the one for resource utilization to meet the various demands to the maximum potentials while sustaining the benefits.

In view of the fact that flood problems could be caused by both natural-geographical factors and human acts: economic growth coupled with construction of infrastructures, expansion of urban areas, destruction of swamp/flood plains, forest and watershed areas, etc., flood protection/mitigation measures should therefore comprise of those of engineering and non-engineering structures. They include, for example, improvement of rule/operation curve for managing the existing reservoirs, installation of flood forecast system, construction of natural flood plains, excavation of culverts/diversion routes, expansion of waterways, construction of large-scale projects specifically for flood protection purpose, etc.

## 2. Baseline Description of the Sub-area

## 2.1. Development Objectives, Plans and Policies

The Ninth National Economic and Social Development Plan stipulates that an efficient use of water resources is supported to ensure sustainable and equitable benefits by the following objectives:

- To manage the existing water resources and bring them for use to the maximum potential for agriculture, production, and consumption including change of agricultural production system by shifting to less water consuming crops as well as increase in water use efficiency;
- To manage multi-purpose water resources by means of people's participation process from project preparation and allowing the beneficiaries to involve in investment;
- To study ways and means to manage groundwater, quantitatively and qualitatively, in accordance with its potential as well as to investigate and monitor the land subsidence to proclaim areas of underground water control and to solve the decrease of underground water;
- To enable collection of service fees on raw water being used for industries, commerce and water works together with campaigns and building the public awareness of conservation of water quality and efficient water use;
- To develop water forecast system to improve the management efficiency so as to mitigate water shortage, flood, and water supply problems; and
- To formulate a master plan for integrated water management at basin level, emphasizing management of water quality and critical basins as well as participation of the people and communities in the implementation.

The present government's policies delivered to the National Assembly on 26 February 2001 have embraced natural resources and environment issues as follows:

- To manage the environment, natural resources and biodiversity in an integrated manner by upholding the principles of good governance and popular participation by the people and the local community;
- To promote and encourage participation by the people and the community in waste control and waste disposal, both of which affect the health, welfare and quality of life of the people;
- To support the notion of taking social costs into consideration when conducting project evaluations of repercussions on the environment and natural resources. In managing the environment and natural resources, the Government supports the principle that whoever causes pollution shall also bear the costs as well as the system of joint rights;
- To promote technological research and development with a view to increasing Thailand's capacity to manage, conserve and restore the

environment. Support the beneficial use of natural resources from all sources, including the recycling of waste and other used materials;

- To set national environmental standards that are suitable for and compatible with Thailand's level of development in the scientific, economic and social spheres. At the same time, such standards should be in tandem with international environmental standards dealing with international trade;
- To set standards for controlling the importation of chemical, toxic and hazardous substances in accordance with the international standards set by developed countries with a view to preventing Thailand from becoming a test site or commercial site for hazardous substances and materials that are sub-standard.

Thailand has adopted a new concept of regional administration - a bureaucratic system that can efficiently respond to the Government's strategic management. This can be achieved through an integrated management system, emphasizing the use of shared resources as well as clearly defined implementation strategies and goals. For effective management, provinces have to be grouped together. Provincial water resources management plans will be in line with these strategies.

SA 2T extends over 3 provinces, i.e. Chiang Rai, Phayao, and Chiang Mai (some part). They are classified as the Upper North Strategic Group (Lanna Group consists of Chiang Mai, Chiang Rai, Lampang, Lamphun, Phayao, Phrae, Nan, and Mae Hong Son). Three main strategies were formulated for this sub-area, which are presented as follows:

- ***Proactive Strategy:*** To build a new economic base
  - 1st strategy: To develop and promote the sub-area as an economic centre linking with Greater Mekong Sub-region (GMS) and South Asia;
  - 2nd strategy: To develop an economic gateway for trading and tourism with neighboring countries; and
  - 3rd strategy: To build a new economic base on the basis of culture and knowledge-based economy.
- ***Improvement Strategy:*** To create value added of the existing economic base
  - 1st strategy: To promote handicrafts that are unique and of internationally accepted excellence for niche markets by embracing the Lanna culture to create the identity and legend, thus resulting in value-added commodities;
  - 2nd strategy: To encourage tourism network to create new attractions out of the tourism resources within groups of provinces as well as linkage with GMS countries; and

- 3rd strategy: To improve the efficiency in agricultural production by creating diversity and new management concept.
- ***Sustainable Development Strategy:*** To ensure sustainability of existing and new economic bases
  - 1st strategy: To preserve the Lanna cultural base;
  - 2nd strategy: To uphold its status of natural resources base through rehabilitation and sustainable management of natural resources;
  - 3rd strategy: To build security in border areas as well as safety of life and properties of people and tourists; and
  - 4th strategy: To develop human resources.

## 2.2. Institutional Capacity

In Thailand, the BDP Unit established under the Thai National Mekong Committee (TNMC) leads the efforts. The Unit manages day-to-day activities on BDP and as an organ at the national level, coordinates the work with other key stakeholders within the country. Within the Unit, in addition to the Unit Head, there are other key staff, including the BDP Coordinator who is assisted by a full-time BDP National Specialist (a local and external consultant). BDP within the Thai context is steered by a multi-agency BDP National Working Group (NWG) comprising of members from TNMC member ministries/line-agencies.

In the case of Thailand, as an example, the national water policy has been in place since October 2000, in which among others, public participation in water resources planning has been heavily emphasized. Institutional framework for the peoples' network has also been established and expanded for quite some time. On the side of the Government, 25 major river basins have been identified for planning and management purposes. Moreover, 29 RBCs have been established in all these river basins. The terms "sub-area (SA)" defined by BDP are basically similar to the "river basin" defined by the Thai authorities. Some, such as the Kok river basin, are the same and therefore, without adequate and proper explanations to the local stakeholders, establishment of new SAWG(s) over the existing RBC(s) in the same SA/river basin could lead to confusion.

For the BDP Unit, efforts and time were required much more than anticipated, in order to have all the necessary explanations made to the local people and institutional set-up formalized. This, as a matter of fact, was one of the practical problems experienced by the Unit during the early stage of implementation of the BDP process in Thailand.

BDP activities in Thailand used the real stakeholders who know their needs and sub-area well. All BDP working groups were selected from RBCs by themselves relate to 8 sectors of BDP (Watershed Management, Irrigated Agriculture, Water Supply, Hydropower, Flood Management, Fisheries, Navigation and Tourism) but

not all sectors depend on sub-area characteristic and activities. The members of RBCs comprise with 4 main groups of stakeholder in sub-area as follows:

- Related government official representatives;
- Water user representatives;
- Academics, local wise persons; and
- Non government organization representatives.

Sub-area 2T working group is the first official establishment by Chairman of Kok and Khong River Part I RBC on May 2004.

## 2.3. Socio-economic Description and Information on Resources Users

### 2.3.1. Population<sup>1</sup>

The total population of SA-2T is 1,803,496, consisting of 899,833 men and 903,663 women.

### 2.3.2. Income

Per capita Gross Provincial Product (GPP) income/year in the sub-areas is based on one-year data, i.e. the year 2000, from National Economic and Social Development Board. The study of people's income in rural areas, villages, and tambon within the sub-areas reveals that the structure of household income in the rural areas is mainly based on agricultural activities.

*Table 1: Income of the people in 2T-SA*

Province	Per capita GPP (baht/person/year)
Chiang Rai	30,710
Phayao	29,110
Chiang Mai	55,846

Per capita GPP income/year of Chiang Mai province is nearly doubles that of Phayao province. This is because most inhabitants of Phayao are engaged in the agriculture sector, while the service sector generates high income for Chiang Mai province. When considering only the districts in Chiang Mai, which are located

<sup>1</sup> Chiang Mai Province, Data from Chiang Mai Provincial Office on 31 January 2000

Chiang Rai Province, Data from Chiang Rai Provincial Office in 2003

Phayao Province, Data from Phayao Provincial Office on 1 August 2003

within the SA, i.e. Fang, Chai Prakan, and Mae Ai, the average income/person/year is lower.

## 2.4. Inventory of Physical Features and Water Resources

### 2.4.1. Geography

SA 2T covers Kok River Basin and Mekong River Basin (MRB) Part 1. The Mekong River meanders along the Thai-Lao border. Some of its tributaries flow into Ing River, e.g. Nam Phung, Nam Lao, and Nam Mae Ngao, while some joining Kok River, namely, Fang and Lao rivers, and some directly discharging into the Mekong River, namely, Nam Ma, Nam Kham, and Nam Ruak.

The topography is mainly characterized by high ridges with elevation ranging between 400-2,000 m MSL. The highest peak of 2,285 m in height is Doi Pha Hom Pok, located in Fang district, Chiang Mai province. Most areas are under forest cover, with some flat terrains on the valley floor. This SA covers areas of three provinces, i.e. parts of three districts in Chiang Mai province, namely, Chai Prakan, Fang, and Mae Ai districts; 16 districts and 2 sub-districts of Chiang Rai province; and 5 districts and 2 sub-districts of Phayao province.

### 2.4.2. Climate

SA-2T is dominated by tropical monsoon or tropical savanna climate. The rainy season occurs during May-October and is influenced by the Southwest monsoon from the Andaman Sea as well as typhoons and depressions from the South China Sea. Rains scatter widely over the whole area with a peak in August.

Winter lasts from October to February. The area is subject to the influence of the Northeast monsoon, which brings cold and dry weather from China, thus causing low temperatures over the area. The mean minimum temperature in January is 11.9 °C and 13.7 °C in Chiang Rai and Chiang Mai, respectively.

The summer is between February and mid May with maximum mean temperature in April, i.e. 34.9 °C and 36.1 °C in Chiang Rai and Chiang Mai, respectively.

#### ***Rainfall:***

Rainfalls of SA 2T were derived from the average rainfall in the area as mentioned in the Report of Kok<sup>2</sup> and Ing<sup>3</sup> River Basins Study. The mean annual rainfall of SA

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<sup>2</sup> Kok River Basin – Pilot Study for Water Resources and Environment Management (Basinwide), October 2000

<sup>3</sup> Feasibility Study and EIA of Ing People's Irrigation Project, Phayao Province, Royal Irrigation Department, Ministry of Agriculture and Cooperatives, January 2002



2T varies from 900 mm to 2,900 mm, while the mean annual rainfall of the entire SA is 1,221 mm.

Table 2: Mean Monthly Rainfall of SA-2T (mm)

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
7	9	16	71	162	142	212	239	198	111	40	14	1,221

### **Runoff:**

The runoff data of SA-2T was compiled from the Report of Kok and Ing River Basins Study. The mean annual runoff totals 6,559 million m<sup>3</sup>.

Table 3: Summary of Mean Monthly Run (million m<sup>3</sup>)

Basin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Kok	189	115	95	87	147	227	415	795	844	606	399	258	4,177
Ing	33	15	9	11	45	88	212	559	679	444	212	76	2,382
<b>Total</b>	<b>222</b>	<b>130</b>	<b>104</b>	<b>98</b>	<b>192</b>	<b>315</b>	<b>627</b>	<b>1,354</b>	<b>1,523</b>	<b>1,050</b>	<b>611</b>	<b>334</b>	<b>6,559</b>

### 2.4.3. Soil and Land Use

#### **Soil:**

Soils in SA 2T are mainly composed of alluvial deposits or floodplain alluvium. Recent alluvium is found on river levees along the channel. They are sandy loam or clay or the two types intermittently interbedded. In the depressions of the flood plains, soils are clayish, deep, and poorly drained. Soil fertility is moderate with moderate composition of organic matters and low content of Phosphorus, which is useful for plant, thus making the area very suitable for rice farming. Moreover, it is suitable for upland crops and vegetables after the rice harvest, but not suitable for perennial tree crops or other trees with deep root systems due to the poor drainage and water logging. On the lower river terrace, alluvium is also observed and the land is rather flat and composed of sandy loam. The middle terrace is undulating land and composed of strongly acid, well-drained sandy loam. This area is suitable for fruit tree crops or pasture.

#### **Land Use:**

The predominant land use in SA 2T is lowland paddy fields, i.e. 19% of the total area 3,550 km<sup>2</sup>. Other areas are upland where other agricultural land is much less than paddy field. In the aspect of land cover, various types of forest are found in the greatest extent. This indicates that the land use in the lowlands of SA 2T is quite constant, while that on the upland is not constant. It is likely that land use may be changed more easily in this area than in the lowlands.

#### 2.4.4. Forest Resources

The collected data on forest cover in SA 2T<sup>4</sup> only concentrates on Kok and Ing river basins. Forest areas in Kok and Ing river basin are 6,191 km<sup>2</sup> and 4,098 km<sup>2</sup>, respectively, thus totaling 10,289 km<sup>2</sup>. Dry dipterocarp forests are observed around the mountain base up to the mountain top where laterite is found. Mixed forests are observed near the mountain base and watercourses. Primary forests are found on high elevations of more than 800 m MSL on average, including pine forests.

#### 2.4.5. Wetland

Wetland is an ecological system which is diversified, linking lands and water bodies. It is a productive area where people may utilize for various purposes. Many countries do recognize the value and importance of wetlands that are located worldwide and accordingly, did agree on 13 September 1998, an agreement for conservation of wetlands known as Ramsar Convention in which Thailand was also a member country.

Wetland of SA 2T<sup>5</sup> is important at two levels, i.e., international and national levels, see the table below.

Table 4: Levels of Wetland in SA-2T

Wetland	Types	Location	Area (km <sup>2</sup> )	No. of Varieties	
				Bird	Fish
<b>Internationally</b>					
Aeng-Chiang Saen	Floodable low land, swamp areas where water is available all year-round or in some seasons	Chiang Saen and Mae Chan Districts, Chiang Rai province	62.40	121	143
Nong Leng Sai	Swamps where water is available in some seasons. There are some water plants too.	Tambon Pa-Faek and Charoen Raj, Mar Jai District, Phayao province	9.60	56	24
Kwan Phayao	Originally, it was a swamp with some water. After the construction of a weir across the Ing river, it has become a big reservoir largest in size in the upper part, northern Thailand	Muang Phayao District,			

<sup>4</sup> Feasibility Study and EIA of Kok-Ing-Nan, Chiang Rai, Phayao and Nan provinces, Royal Irrigation Department, Ministry of Agriculture and Cooperatives, January 2002

<sup>5</sup> Thailand's Wetlands Document, Vol. 2, Northern Wetlands, Office of Environmental Policy and Planning, DANCED, 1999

Wetland	Types	Location	Area (km <sup>2</sup> )	No. of Varieties	
				Bird	Fish
<i>Nationally</i>					
Nong Arng	Water is available all year round. Some parts became shallow and water is only available in the wet season. Water plants are seen generally.	Phan District, Chiang Rai	2.79	3	16
Nong Luang	Originally, it was a small swamp. Became a big water resource after the construction of a weir at the Mae-Sakeun river mouth.	Wiang Chai District, Chiang Rai	14.71	4	25
Phru-ya Ta-ton	A lowland with floods covering both banks of the Kok and Mae-Fang rivers.	Mae-Ai District, Chiang Mai Province	59.36	15	15

## 2.5. Economic Sectors

### 2.5.1. Irrigated Agriculture

#### ***General Condition:***

The principal crop in SA 2T is rice, particularly glutinous rice. Upland crops include maize and fruit-trees, such as, mango, longan litchi, tamarind and orange/citrus. Vegetables include garlic, onion, chili, ginger, lettuce and cabbage. Others include soil-bean, mung-bean and groundnut. Rice is grown basically in the wet season or in a place where water is stored. In highlands, upland rice is some time grown too. During the dry season, upland crops, including tobacco will be grown. In irrigation area, rice, particularly glutinous rice, will be grown due to the fact that people in the north consume glutinous rice.

#### ***Irrigation:***

Water resources development projects of various sizes have already been constructed in the area. Basic definitions of projects of different scales can be briefly introduced hereunder.

- Large scale projects mean those with reservoir capacity of more than 100 MCM or, with reservoir area of more than 15 km<sup>2</sup> or, with irrigation area of more than 80,000 rai (12,800 ha).
- Medium scale projects means those with reservoir capacity of less than 100 MCM but more than 2 MCM or, with reservoir area of less than 15 km<sup>2</sup> or,

with irrigation area of less than 80,000 rai (12,800 ha) but greater than 3,000 rai (480 ha).

- Small scale projects means those with reservoir capacity of less than 2 MCM or, with irrigation area of less than 3,000 rai (480 ha). Most of them are projects constructed by RID.
- Pumping irrigation schemes are those projects that do not have reservoirs. They rely on water from natural rivers/streams that would be pumped up and delivered to beneficiary areas.

In SA 2T, considering only the Kok and the Ing sub-basins, there are some 210 projects of those four categories (1998 figure). Total irrigation area is 198,400 ha (1.24 million rai) or, 10.52% of the basin's area.

### 2.5.2. Watershed Management

The Cabinet has endorsed on 27 July 1992, classification of watershed in Thailand that was divided into five (5) classes in accordance with their respective hydrology and natural resources and for effective management of the basins, with the following details.

Class 1 area is further divided into two: Classes 1A and 1B. Class 1A is to be preserved as upstream watershed of a river and therefore, all activities that could affect conditions of the forest therein are strictly prohibited.

For watershed Class 1B, if unavoidable, responsible agencies are required to conduct EIA of the project and to report the outcome to the National Environment Committee (NEC) for consideration prior to the implementation. In the case where road or mining is to be constructed/implemented in the area, the agencies are required to make a proper control over soil erosion that could be caused by such the activity.

Class 2 area is meant to be conserved basically for forestry and mining purposes, with a restricted rule over "land-use" in the area. The use of land for agricultural purpose is to be avoided.

Class 3 area can be used for activities related to forestry, mining, agriculture and other purposes, with some specific rules to be observed for land and water conservation.

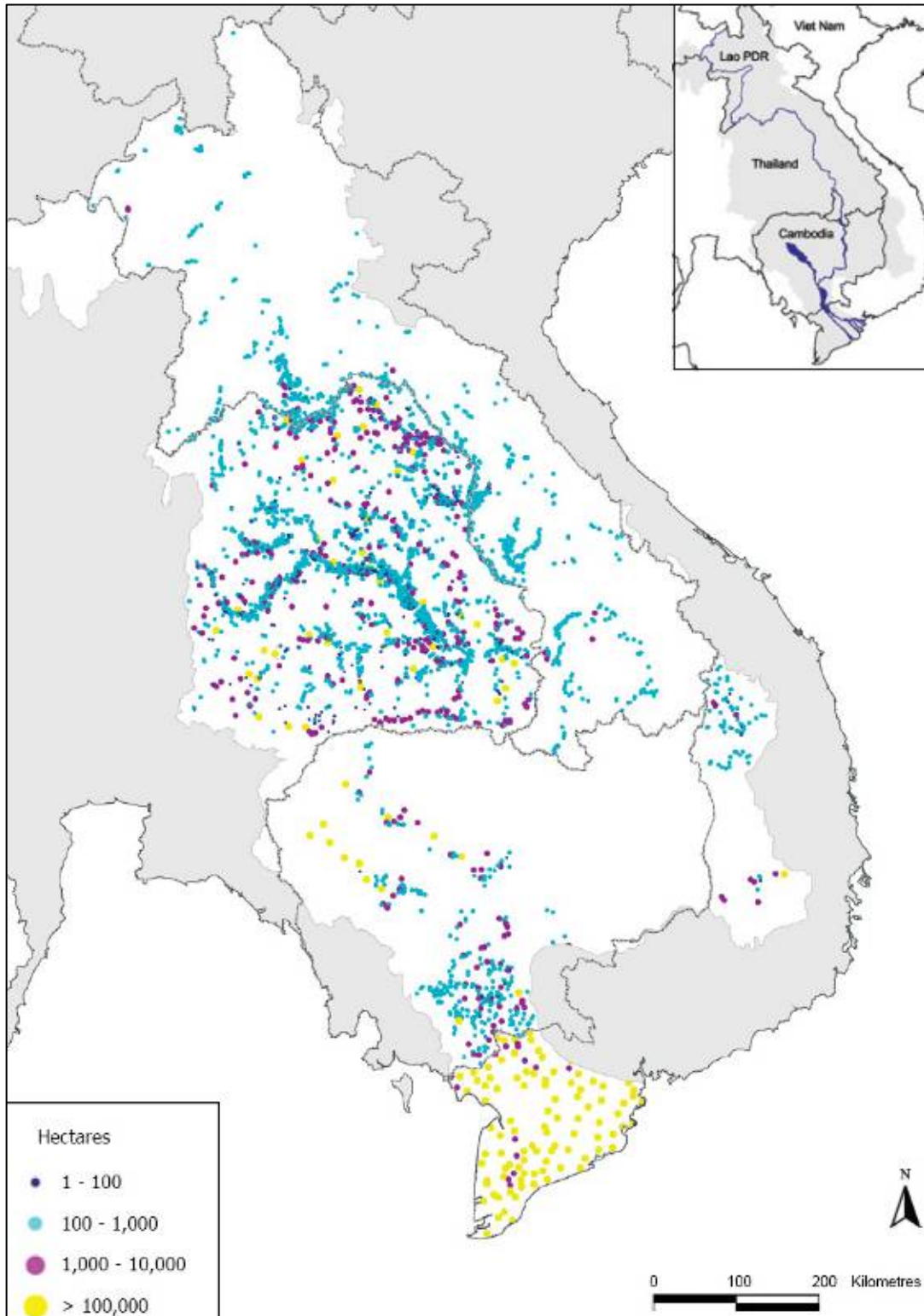
Class 4 area can be used for all activities. For agricultural use, however, slope of the area should not exceed 28% and, there is a need for land-use planning in accordance with land and water conservation.

Lastly, for Class 5 area, it can be used for all activities.

For this present stage of study, only a summarized picture of the Kok river basin, excluding sub-area Mekong part 1, is to be presented. In SA 2T, Class 1A area constitutes as high as 36%, the highest one compared to other sub-areas with the LMB in Thailand. Forest area also constitutes as high as 54.55 of the total area of

SA-2T. This, however, is only a figure in quantitative term without classifying it yet into such terms as forest being deteriorated or encroached.

Figure 1: Size of Irrigation in the LMB



River Basin	Area by Classes of Watershed (%)			
	1A	1B	2	3-5
Kok	36.0	4.0	16.0	44.0

### 2.5.3. Fisheries

#### *Types of Fisheries:*

Fisheries in SA 2T can be classified into the following:

- Fishing from natural water resources;
- Fish culture in natural ponds; and
- Commercial fish culture by means of constructed fish-ponds and/or fish-cage.

It requires an intensive care and use of feedstuff. However, commercial fish culture often faces such problems as expensive feedstuff, fingerings, disease and unstable fish prices. Important data on fisheries in SA 2T is given in the Table below.

Table 5: Fisheries in the Kok and Ing basins, 1994

Basin/Province	Farming Household (HH)	Production (t/HH)	
		Natural Fishing	Fish Culture
1. Kok			
Chiang Mai	14,473	0.04	0.17
Chiang Rai	28,077	1.88	1.35
Average	-	0.96	0.76
2. Ing			
Chiang Rai	20,873	1.40	1.09
Phayao	22,816	3.37	0.80
Average	-	2.38	0.94

#### *Fish Resources:*

During the feasibility and environmental impact study on Kok-Ing-Nan project by RID, surveys of flora and fauna in the area were conducted for at least three times, i.e. prior to wet season of 1996 (26-29 May), wet season of 1996 (6-9 September) and dry season of 1997 (8-10 February). Some 33 fish species were found in the Kok River, while in the Lao and Ing rivers, the figures were 46 and 51, respectively. Fish productions in the three (3) rivers were similar, i.e., in the range of 27.44-30.93 kgs/ha.

In addition, Ratchaphat University<sup>6</sup> in Chiang Rai undertook a study on biodiversity, including fishes in the Mekong river, during December 2003 and January 2004. During the process of collecting water samplings from the river, they interviewed some fishermen who reported that the following fish species (as called locally) could be found in the Mekong: Pla-Beuk (Giant Catfish), Pla Khae, Pla-Kang, Pla-Phia and Pla Mong.

Every year, during April and May, it is known to be the season for fishing the Mekong giant Catfish (Pla Beuk). Fishermen will get together around Ban Had-khrai of Chiang Khong district. However, the fish could hardly be caught during 2001-2003 due to the huge drop of water level in the Mekong. The situation was a bit better in April 2004 when the water level increased with some sediment. It was reported that some seven (7) Catfish were caught. It is also known that this time of the year is a spawning period for the giant Catfish and for this reason, the Fisheries Station at Nong-luang of Chiang Rai province has been trying to do artificial breeding, using the Catfish just caught.

#### 2.5.4. Hydropower

Construction of large- and medium scale hydropower plants in SA 2T becomes more and more difficult due to its possible impacts over watershed area and communities. It requires therefore a lot of time, involving public participation process. For those potential projects of a smaller scale, the construction should depend on outcome of their studies and needs of the local people.

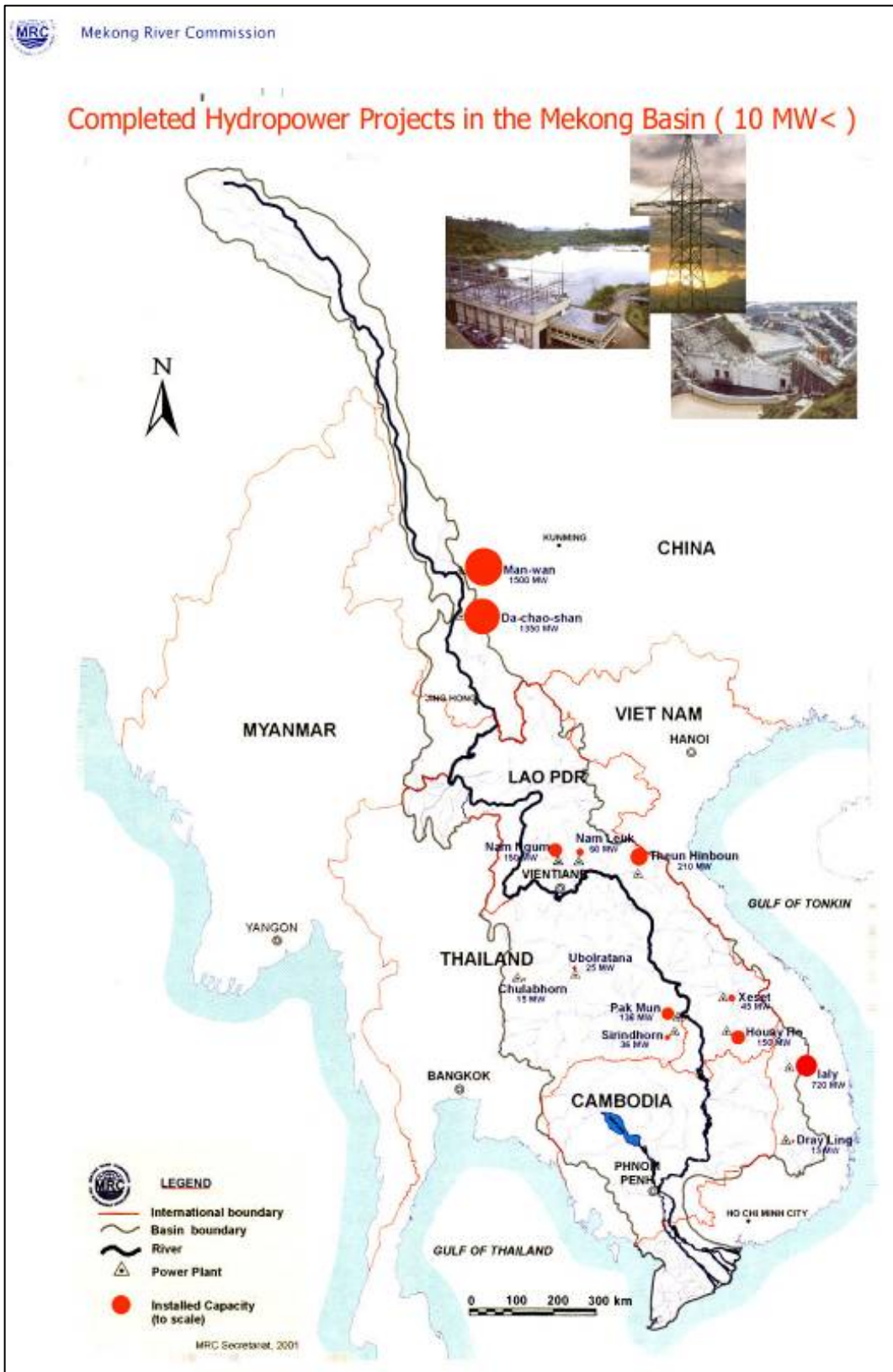
Table 6: Important Hydropower Projects that have already been Implemented in SA 2T

Project	Location	Watershed Area (km <sup>2</sup> )	Reservoir Capacity (MCM)	Generating Capacity (Kw)	Production (Gwh)	Year of Construction
Mae Keum Luang	T. Mae Sao, Mae Ai District, Chaingmai	56		2*1,600	15.62	Dec. 1981
Mae Mao	T. San Sai, Fang District, Chiang Mai	61	20.6	1*2,300	9.14	
Mae Jai	T. Mon Pin, Fang District, Chiang Mai			1*875	4.8	Jan. 1985
Huai Nam Khun	Mae Sa-ruai District, Chiang Mai	36.4		1*1,800	8.988	

Source: Electricity Generating Authority of Thailand (EGAT)

<sup>6</sup> Minutes of Workshop on Efficiency Increase in Water Resources Management in the Mekong River Basin, Part 1 and Kok River Basin, 15-16 July 2004, by Mekong River Commission, Part 1 and Kok River Basin, Water Resources Office Region 1, Department of Water Resources, Ministry of Natural Resource and Environment, in cooperation with Biodiversity Centre, Technical Service Office, Rajabhat University Chiang Rai

Figure 2: Completed Hydropower Projects in the Mekong Basin





### 2.5.5. Tourism and Recreation

Statistics of tourists who visited the provinces in SA 2T, including Chiang Rai, Phayao and Chiang Mai during 2002-2003 are given in Annex A.

It could be observed that numbers of the tourists visited particularly Chiang Mai and Chiang Rai in 2003 were less than those in 2002. The decrease could be attributable to the spread of SARS epidemic. However, number of the Thai tourists during the same period increased due perhaps to the continued and big campaigns launched by the Government.

In relative terms, the tourists stay in Phayao longer than in both Chiang Mai and Chiang Rai. Although per capita expense of the tourist did not change much during the 2-year study period, the combined total figure of revenue from tourism of these three provinces has indicated an increase of about 2%.

### 2.5.6. Water Supply and Sanitation

The rate of domestic water use by households varies from place to place, depending on availability of water resources in each area. Generally, the demand of households for domestic water use is not high when compared to that of the agricultural and industrial sectors. However, it requires quality water, particularly potable water that needs to be good of taste and without bacteria.

The demand of households for domestic water use can be divided into two major areas: urban and rural ones. In urban area, most households need water from waterworks. It is the water from natural resources that was duly purified prior to distribution through water tap to consumers. In rural areas, however, most households would use water that is obtained directly from the natural resources. It is therefore more convenient for the households in urban area to consume more water than those in the rural area. According to the estimate of the Regional Waterworks Office (RWO), water consumption of the people in urban area is about 120-160 liters/head/day (l/h/d). A study by the Department of Hygiene disclosed, however, that the corresponding figure for the people in rural area is only 50 l/h/d.

Table 7: Water Demand for Domestic and industry

Unit: MCM/Year

Purposes of Water Use	Kok Basin		Ing Basin	
	Present (1996)	Future (2046)	Present (1996)	Future (2046)
Domestic uses	22.9	64.0	25.0	59.1
Tourism	3.1	18.7	1.5	5.8
Industries	4.3	12.5	1.8	3.5
<b>Total</b>	<b>30.3</b>	<b>95.2</b>	<b>28.3</b>	<b>68.4</b>

On the other hand, the demand of industrial sector for water is considered “high”. Again, in accordance the criteria provided by the RWO, industries are those that consume water more than 101 cubic meters per day (CM/d). A general rate being

applied per factory/plant is 10 CM/d (Ref. Study on Potential Development of the Kok River Basin, by the Faculty of Engineering, Chiang Mai University 1994).

For tourism, water consumption is also high in the areas where tourism has been developed. From the same Study by the Chiang Mai University referred to above, it was found that in an area where many first class hotels are located, water consumption of a tourist could be as high as 615 l/h/d.

#### 2.5.7. Flood Control and Management

In SA 2T, there are at least two following areas where flood occurs frequently due to drainage problem and in particular, when the water level in the Mekong is high. They are as follows:

- In the middle reach of the Fang river which is a tributary of the Kok. Agricultural lands in the area will be occasionally flooded in the wet season when heavy rains come. In the lower reach from Chiang Rai city to the Mekong, the agricultural lands will be affected even more frequently due to back-water from the Mekong into the Kok river.
- It is the confluence where the Lao river flows into the Ing river in the northern part of Thoeng District. Another site is where the Ing flows into the Mekong River.

## 2.6. Environmental Issues

### 2.6.1. Irrigated Agriculture

- Compared to needs, inadequate sources of water resource. Most water is used for agriculture;
- Lack of appropriate management measures for water; and
- Heavy use chemical substance in agriculture and poor soils.

### 2.6.2. Watershed Management

- Damage to the existing weirs caused by soil erosion in the upstream where slash-and-burn cultivation, orchard, deforestation and mono-culture are practiced;
- Encroachment of public land and lands for conservation;
- Decreasing water quantity due to mono culture and deforestation; and
- Water pollution due to garbage and waste from households as well as chemical substance from industrial and agricultural sectors.

### 2.6.3. Fisheries

- Deteriorating quality of water, causing the decrease in fish productivity;

- Construction of infrastructures across the river that altered the ecological condition and became hindrance to fish migration; and
- General low productivity of 19-25 kg/ha compared to the national average of 94 kg/ha.

#### 2.6.4. Water supply for domestic and industrial consumption

- Scarcity of raw water for waterworks, particularly in the dry season;
- Quality of raw water which is affected by chemical substance from agricultural;
- lands, waste from communities and sedimentation; and
- Inefficient management and utilization of water.

#### 2.6.5. Flood Management

- The change in land-use and encroachment of forest area has caused the problem of frequent flooding;
- The lack of proper city/urban planning and accordingly, newly constructed infrastructures often became obstacles to flow passages; and
- The lack of watershed management and disaster warning system.



## 3. Sub-area Analysis

## 3.1. Development Opportunities and Needs

### 3.1.1. Irrigated Agricultures

In sub-area 2T, soil fertility particularly of those poor soils need to improved, by means of conservative or sustainable agricultural practices to reduce the harmful chemical residue in both the soils and water that will cause impacts to the environment and water resources. Local communities should play a key role in this respect, with technical support from the government sector.

Irrigation demand in sub-area 2T trend to be double in 2046 compare to 1996 then rehabilitation of watershed and identification of new water resources to be supplied sufficiently in the future also, existing water resources need to be improved efficiency.

### 3.1.2. Watershed Management

The watershed management is stipulated, now, in order to encourage public awareness to concern on environment and conserving water source forest. This issue has been raised continuously by government policy and communities as the forest planting campaign in the area of head water and establishing community forests. However, these activities did not spread to all areas; it is depending on their potential and readiness.

Thus, to achieve this goal, the supporting tool should be improved by local and laws, e.g., Water Resources Act that related to Communities' Forest, to enable public participation in managing natural resources, recognize human's right and encourage peoples' participation in all stages of development activities. Also, improving the EIA processes for projects and activities, following a high and technical standard, encouraging peoples' participation in all stages of project's formulation, through the local administration and people's institution a focal point for receiving/voicing views from the public on the project prior to its implementation and on the issues related to environmental impact. Lastly, the strengthening capacity of RBC is required.

In upstream area, which is sources of water in the watershed requires construction of weirs to retard water flow in dry season and collect erosion to the river.

### 3.1.3. Fisheries

Reduction of chemical uses in agriculture that would affect the quality of water in consequence of toxic cumulate in aquatic life, the systematic data collection is required.

New researches for the development of fish culture should be promoted and link with local fish species conservation.

#### 3.1.4. Water Supplies

Some parts of sub-area 2T will be promoted for industrial estate area and some parts have high potential which can be developed to be a new tourism area thus, water supply should be readiness for supporting this activities. Sustainable development of industries by keeping the balance between the development, environmental protection and society hence, waste water will be concerned with water supply demand.

The development of water supplies relate to potential water resources not only quantity but also quality hence, improvement of water quality to a standard level, with people's participation in protecting the source of water resources are required with efficient utilization and management of water.

#### 3.1.5. Flood Management

Flood problems in sub-area 2T trend to severe when the urban area is expanded and decrease of forest area in the upstream, for sustainable development flood management should be rehabilitated and conserved watershed upstream for retarding the river flow and, enhance the use of wetlands in the area. Data establishment/preparation on flooding and monitor its situation should be supporting tools. A master plan for integrated water resources management and management of critical sub-basins will be prepared with an emphasis being placed on public/people participation in the implementation.

### 3.2. Development Constraints

#### 3.2.1. Watershed Management

Supporting institutional network local administration and peoples' volunteer groups to help monitor activities related to the management and utilization of natural resources and environment, e.g., monitoring of activities that would generate water pollution, encroachment of public/conserved lands and water resources are still in place but will be strengthen and expanded to all stakeholders in basin.

#### 3.2.2. Fisheries

Conservation of wetland areas, spawning grounds for fishes is encroached by the development of residential/agricultural area consequence to natural fish species and products.

### 3.3. Potential Social, Environmental and Economic Impacts of Development

#### 3.3.1. Navigation

Compared to other sub-areas, SA 2T is significant in that it is a center for regional navigation for countries in the upper Mekong basin which link to proactive strategy of provincial group to build a new economic base. Potential in increasing the volume of trade in this respect is also high after Thailand has agreed to establish a Free Trade Area (FTA) with China.

The case study of SA 2T was undertaken during November 2003 and January 2004, focusing on the study of environmental impact from the improvement of river channel for commercial navigation between Lancang-Mekong. The study process involved the people in three (3) districts of Chiang Rai, namely, Chiang Saen, Chiang Khong and Wiang Kaen. To define the project's objectives, framework and work plan, local people were invited to participate in consultation meetings for at least nine (9) times and public hearing for three (3) times. The peoples were asked to give/share their views on potential impacts from the development initiatives on the environment, on their lives, their ways of living, health conditions of the communities, security to their lives and properties, international relations and economics, etc.

It may however be added that outcome of the study has shown that the local people did not totally agree to the initiatives to improve the river's channel for commercial navigation on the Lancang-Mekong.

Some advice from the study:

- To use land-transportation instead, following the route from China through Myanmar to Thailand or, the route from China through Lao PDR to Thailand. For the latter, it was also recommended that a bridge across the Mekong be constructed at Chiang Khong.
- Environmental impact study should involve all the parties concerned in all stages.
- The problem related to border line between Lao PDR and Thailand, which was an outcome of the Agreement concluded in the previous days, should firstly be settled prior to implementation of any new initiatives.
- A complete set of data and information on the improvement of Lancang-Mekong river project should be disclosed to public.
- Data/information on EIA obtained from the various forum and meetings must be made known to the local people again.
- Mitigation measures to protect the environment and other problems from the channel improvement must be in place prior to the implementation.



### 3.3.2. Tourism

Important tourism network in the Mekong Sub-region is known as the “network of five (5) Chiang” in four countries, namely, Chiang Rai and Chiang Mai (Thailand), Chiang Thong (Lao PDR), Chiang Tung (Myanmar) and Chiang Rung (or, Jinghong in China). River-borne transportation starting from Jinghong via the Mekong river to Chiang Rai and Luang Phrabang could be operational all-year-round. However, during the dry season, only the vessels of less than 50 t may navigate. In the wet season, the vessels of up to 150 can be operated on the Mekong. In addition, there are tourist boats that could house about 40 passengers running between Jinghong and Chiang Saen in about 8 hours (and 12 hours if against the tide).

## 3.4. Potential Trans-boundary/Cross Regional Issues and Impacts

### 3.4.1. Irrigated Agriculture

Presently, monoculture areas, e.g. orange, etc., are on the rise, especially in Fang and Chai Prakan districts, Chiang Mai province. This has affected the water demand in the existing agricultural areas. Besides, chemical use has negative impacts on water resources and the people. Non-governmental organizations (NGOs) and governmental agencies have launched campaigns to reduce the utilization of chemical fertilizer and pesticide as well as to encourage the use of environmentally friendly organic fertilizer.

Flora diversity is much in evidence in SA 2T. If researches and development of bio-diversity are carried out in combination with the adoption of organic agriculture, it will be of great benefit. If direction and targets of the development are well defined with target groups accurately identified, this will add great value to crops and deter the import of agricultural products under the Free Market.

### 3.4.2. Watershed Management

SA 2T has the highest ratio of forest cover to the total basin areas, compared to other sub-areas in Thailand. It significantly serves as the watershed for other areas. At present, there are threats from the expanding demand for agricultural land. To preserve forest conditions, public participation is very essential for watershed conservation. Legal measures alone will not be adequate because people's livelihoods have been long interwoven with forests. Forest conservation results in adequate water for agriculture, consumption, hydropower generation, and flood mitigation. Moreover, flood flows to downstream areas will be retarded, and sediment volume and erosion will be reduced.

### 3.4.3. Water Supply for Domestic and Industrial Consumption

Watershed conservation will be significantly beneficial for preserving, quantitatively and qualitatively, water sources for consumption. There is a future trend of rising water requirement for consumption when SA 2T becomes a centre linking with

Greater Mekong Sub-region (GMS). More people will move into the area because of greater job opportunities. The number of tourists will increase as well. Consequently, raw water sources need to be provided for water supply to support such growth. Apparently, it is necessary to conserve water sources and improve water quality. Furthermore, attention should be given to municipal wastewater treatment system so as to cope with town expansion in the future.

#### 3.4.4. Hydropower

Large-scale hydropower development in the SA will be difficult due to the necessity of watershed conservation and impacts on the people and society. However, development of small-scale hydropower may be necessary for remote areas where construction of grid system will require high investment. Power demand is likely to rise in the future along with the SA development. Improvement of existing power plants may be needed to raise their efficiency. There is a possibility of collaboration with neighbouring countries in hydropower development in the future.

#### 3.4.5. Flood Management

Flood problems in SA 2T are relatively less severe, compared to other sub-areas. They are mainly flash floods or over-bank flooding near the confluence with the Mekong River. Structural development should take into account the flow direction and volume, use of wetlands as water retardation areas, watershed conservation, and reforestation to help slow down the streamflows to downstream areas.

#### 3.4.6. Fisheries

SA 2T is a unique fishermen community of the Mekong River, with a local custom of catching giant catfish. Riverside communities' livelihoods are still dependent on the vegetation and fish of the Mekong River. The increasing development activities together with explosion of rapids and shoals, and chemical use for monoculture have impacts on fish species and people's way of living. Researches and dialogues should be jointly held to formulate preventive measures and solutions to any subsequent problems. Researches should also be carried out on other marine life apart from the giant catfish to maintain the diversity of fishery resources in the Mekong River.

#### 3.4.7. Navigation

This sector creates great impacts in various aspects on SA 2T including riverside communities. For example, large vessels generate waves that affect small boats of the local people. Erosion or import of cheaper agricultural products also adversely affects the SA. However, the river-borne transport help promote travels within the sub-region.

#### 3.4.8. Tourism

There are great potentials for tourism development in SA 2T compared to the former times. This results from better transportation network and development of tourism resources in various aspects including history, archaeology, and rich natural resources. Strategies of provinces and groups of provinces also reflect the significance of this sector. To achieve sustainable tourism development, preservation of arts, culture and the environment has to be concurrently

undertaken. Towards this end, the conservation efforts must not concentrate only on patterns, but public awareness has to be instilled.

The tourism sector in SA 2T is directly related to watershed management because many natural tourism resources are located within national parks. Other potential tourism resources include agro-tourism, and the long-upheld custom of catching giant catfish at Ban Hat Khrai, Chiang Khong district, which is pertinent to the fisheries sector. In addition, the opening of GMS river-borne transport will certainly have a direct impact on tourism.

### 3.5. Major Water and related Resources Projects in the Mekong River Basin

#### 3.5.1. Lancang-Mekong River Navigation Improvement for Commercial Navigation Project

In the past, river-borne transport on the Mekong River between Chiang Saen and Sip Song Pan Na was constrained by 12 rapids, i.e. Kaeng Tang Ok (tang means rapids), Pa Hin Tam Nam, Kaeng Nam Lo, Kaeng Sam Sao, Kaeng Saen Phi, Kaeng Chiang Dao, Kaeng Tang Pang Lang, Kaeng Tang Pang, Kaeng Tang Salam, Kaeng Long Chom, Kaeng Khlai, and Hat Pa Laeo Lang. At some rapids, channels were S-shaped, while some were steplike. At rapids in certain areas due to the flow velocity, certain boats need the high speed to pass through. In certain areas, the stream channel was so narrow that people on the boat may extend their hands to touch rock outcrops. After the improvement of navigation channel, an international navigation aid, i.e. sound signal, has been used. Besides, physical obstacles at each rapid have been reduced. Navigation aids were installed at 77 locations.

While impacts of the 4-nation Agreement are to be assessed and problem solving after channel improvement will be implemented, emphasizing the route from the Golden Triangle to Sip Song Pan Na, Thailand carried out an impact assessment of the blasting of rapids. The study concentrated on the improvement of Kaeng Khon Phi Long or Khon Phi Luang which is on the Lao-Thai border between Chiang Saen and Chiang Khong districts, Chiang Rai province, and has not yet been improved. In accordance with the Cabinet's resolution of 8 April 2003, the study was carried out by Office of Natural Resources and Environmental Policy and Planning, Ministry of Natural Resources and Environment.

Presently, China has completed most of the blasting of rapids on the Mekong River. In April 2004 and April 2005, there will be two more explosions within the Lao territory so as to widen the navigation channel.

#### 3.5.2. Construction of the Second Chiang Saen River Port

The present Chiang Saen port 1 is sited on an area of about 9 rai. A 2-lane bitumen road runs behind the port and within the Chiang Saen market area, Tambon Wiang Chiang Saen, Chiang Saen district, Chiang Rai province. Port Authority of Thailand

has managed this port in accordance with the Cabinet's resolution of 25 March 2002 and invested an additional sum of 257 million baht. The port can serve 4 vessels of 100-150 tons at a time or 10 vessel/day on average. Earlier this year, improvement began for the port on the northern side. Loading and unloading of goods in containers can be done now. The problem of this port is its limited area with no possibility for expansion. This is due to the construction being done in the existing area with no long-term plan to handle trading volume on the Mekong River. Truck transport in and out of the port is quite difficult. After the joint effort by the 4 riparian nations (China, Myanmar, Thailand and Lao PDR) in improving the river navigation by blasting the obstructing rapids, 300-ton vessels will be able to use the channel throughout 8 months. It is expected that there will be high growth in trading volume, size of vessels, and new transport modes. Therefore, Marine Department has planned to build the second Chiang Saen port near the confluence of Kok and Mekong rivers or Sop Kok, about 15 km from Chiang Saen towards the direction of Chiang Khong district. The construction will begin in 2006. The Chiang Saen port 1 will be improved to serve as a tourist port in the future.

#### 3.5.3. Construction of the 3-Nation Cable Car Project

The 3-Nation Cable Car Project has been planned for the Golden Triangle. It will start at Ban Sop Ruak, Chiang Saen district, Chiang Rai province, Thailand, and then cross to Tha Khilek province, Myanmar, prior to linking to Muang Ton Phung, Lao PDR. These areas will become new tourist sites for the three countries. The project cost is estimated at about 180 million baht. A feasibility study is currently under way.

#### 3.5.4. Construction of Mekong River-Crossing Bridge at Chiang Khong District

The construction of another Mekong river-crossing bridge at Chiang Khong district aims to provide a link with the Thai-Lao-China road to be constructed under the 3-nation cooperation. This road (R3) starts from Muang Chiang Rung, Sip Song Pan Na, South China, then passes Muang Bo Han-Bo Ten and Bo Keo province, Lao PDR, and ends in Chiang Khong district, Thailand. It will be completed in 2007. Construction of Mekong river-crossing bridge will commence in 2005 and its completion will coincide with that of road construction. The bridge will facilitate transport of goods along the border and encourage cross-border transport of commodities through Chinese-Lao-Thai borders to other place.

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# Annexes

## Annex 1: Number of Households and Population by District

District		Number of Households	Population		
			Male	Female	Total
<b>Chiang Mai Province</b>					
1	Fang	32,050	51,158	49,299	100,457
2	Mae Ai	19,350	30,521	29,369	59,890
3	Chai Prakan	8,837	14,385	13,376	27,761
<b>Total 3 Districts</b>		<b>60,237</b>	<b>96,064</b>	<b>92,044</b>	<b>188,108</b>
<b>Chiang Rai Province</b>					
1	Muang Chiang Rai	80,876	114,119	119,054	233,173
2	Chiang Khong	19,930	33,218	32,702	65,920
3	Wiang Pa Pao	21,108	35,370	35,030	70,400
4	Thoeng	24,512	43,578	43,577	87,155
5	Pa Daet	7,578	13,713	13,572	27,285
6	Phan	41,064	65,714	67,373	133,087
7	Wiang Chai	13,921	22,307	22,706	45,013
8	Mae Chan	34,052	54,634	55,648	110,282
9	Chiang Saen	17,967	28,222	28,880	57,102
10	Mae Sai	33,715	40,871	42,843	83,714
11	Mae Suai	22,109	42,901	41,380	84,281
12	Phaya Mengrai	13,346	25,736	25,365	51,101
13	Wiang Kaen	8,178	17,953	16,822	34,775
14	Khun Tan	7,655	13,877	13,577	27,454
15	Mae Fa Luang	14,747	41,430	39,794	81,224
16	Mae Lao	10,226	15,723	16,097	31,820
17	King Amphoe Wiang Chiang Rung	7,269	13,500	13,189	26,689
18	King Amphoe Doi Luang	6,719	11,588	11,382	22,970
<b>Total 16 Districts 2 King Amphoe</b>		<b>384,972</b>	<b>634,454</b>	<b>638,991</b>	<b>1,273,445</b>
<b>Phayao Province</b>					
1	Muang Phayao	34,961	51,614	53,056	104,670
2	Chun	13,477	21,982	22,934	44,916
3	Chiang Kham	19,659	33,477	33,171	66,648
4	Dok Khamtai	15,416	25,648	26,417	52,065
5	Mae Chai	9,684	15,572	15,909	31,481



6	King Amphoe Phu Sang	9,086	13,465	13,142	26,607
7	King Amphoe Phu Kamyao	4,791	7,557	7,999	15,556
	<b>Total 5 Districts 2 King Amphoe</b>	<b>107,074</b>	<b>169,315</b>	<b>172,628</b>	<b>341,943</b>
	<b>Total 3 Provinces, 24 Districts, 4 King Amphoe</b>	<b>552,283</b>	<b>899,833</b>	<b>903,663</b>	<b>1,803,496</b>

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## Annex 2: Tourist Arrivals in Chiang Rai, Phayao and Chiang Mai Provinces

Item	Chiang Rai 2002			Chiang Rai 2003		
	Thai	Foreigners	Total	Thai	Foreigners	Total
Total visitors	<b>712,512</b>	<b>369,544</b>	<b>1,082,056</b>	<b>759,047</b>	<b>293,544</b>	<b>1,052,591</b>
Tourists	661,370	352,576	1,013,946	708,794	280,195	988,989
Excursionists	51,142	16,968	68,110	50,253	13,349	63,602
Average expense/person/day (baht)	<b>2,501.39</b>	<b>3,007.64</b>	<b>2,674.29</b>	<b>2,550.97</b>	<b>3,018.14</b>	<b>2,681.25</b>
Tourists	2,546.32	3,047.58	2,720.61	2,595.51	3,056.97	2,726.25
Excursionists	1,920.34	2,177.63	2,009.82	1,922.86	2,203.16	2,002.27
Income (million baht)	<b>5,288.12</b>	<b>3,263.55</b>	<b>8,551.67</b>	<b>6,075.62</b>	<b>2,676.14</b>	<b>8,751.76</b>
Tourists	5,189.91	3,226.60	8,416.51	5,978.99	2,646.73	8,625.72
Excursionists	98.21	36.95	135.16	96.63	29.41	126.04
Average length of stay (days)	2.25	2.15	2.19	3.25	3.09	3.20

Item	Phayao 2002			Phayao 2003		
	Thai	Foreigners	Total	Thai	Foreigners	Total
Total visitors	<b>352,732</b>	<b>55,783</b>	<b>408,515</b>	<b>369,309</b>	<b>43,383</b>	<b>412,692</b>
Tourists	184,610	6,754	191,364	188,077	5,792	193,869
Excursionists	168,122	49,029	217,151	181,232	37,591	218,823
Average expense/person/day (baht)	<b>848.65</b>	<b>899.56</b>	<b>855.61</b>	<b>841.06</b>	<b>790.18</b>	<b>835.71</b>
Tourists	959.93	1,199.39	968.38	939.96	1,101.63	944.79
Excursionists	726.45	858.26	731.09	738.45	742.19	738.57
Income (million baht)	<b>413.01</b>	<b>56.48</b>	<b>469.49</b>	<b>446.74</b>	<b>40.47</b>	<b>487.21</b>
Tourists	290.88	14.40	305.28	312.91	12.57	325.48
Excursionists	122.13	42.08	164.21	133.83	27.90	161.73
Average length of stay (days)	4.01	4.68	4.30	4.06	4.11	4.08

Item	Chiang Mai 2002			Chiang Mai 2003		
	Thai	Foreigners	Total	Thai	Foreigners	Total
Total visitors	<b>1,852,168</b>	<b>1,608,718</b>	<b>3,460,886</b>	<b>1,922,059</b>	<b>1,477,847</b>	<b>3,399,906</b>
Tourists	1,639,473	1,558,317	3,197,790	1,714,843	1,431,351	3,146,194
Excursionists	212,695	50,401	263,096	207,216	46,496	253,712
Average expense/person/day (baht)	<b>2,390.56</b>	<b>3,171.12</b>	<b>2,753.39</b>	<b>2,554.41</b>	<b>3,254.65</b>	<b>2,858.79</b>
Tourists	2,482.88	3,202.06	2,833.34	2,658.51	3,284.53	2,943.30
Excursionists	1,678.98	2,214.84	1,940.11	1,693.01	2,334.83	1,985.00
Income (million baht)	<b>16,395.36</b>	<b>21,118.76</b>	<b>37,514.12</b>	<b>18,860.03</b>	<b>19,430.89</b>	<b>38,290.92</b>
Tourists	16,038.25	21,007.13	37,045.38	18,509.21	19,322.33	37,831.54

Excursionists	357.11	111.63	468.74	350.82	108.56	459.38
Average length of stay (days)	1.79	1.99	1.80	1.77	1.97	1.78

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Source: Tourism Authority of Thailand

Remark: Visitors: Tourists and excursionists; tourist: A visitor who stays overnight, excursionist: A visitor who does not stay overnight.