INTERIM COMMITTEE
FOR CO-ORDINATION OF
INVESTIGATIONS OF
THE LOWER MEKONG BASIN

(Lao People’s Democratic Republic,
      Kingdom of Thailand,
      Socialist Republic of Viet Nam)

ANNUAL REPORT 1988
INTERIM COMMITTEE FOR
CO-ORDINATION OF
INVESTIGATIONS OF THE
LOWER MEKONG BASIN

1988 Annual Report

(Lao People's Democratic Republic,
Kingdom of Thailand
and Socialist Republic of Viet Nam)
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PREFACE

This report contains information about progress made in 1988 in the water resources development and related projects in the lower Mekong basin that are included in the Work Programme of the Interim Mekong Committee.

Progress has been made in the various sectors of the Committee's Work Programme. Of special importance was the completion, in 1987, of the updating of the Indicative Basin Plan. This was an intensive exercise to clarify the Committee's priorities and define a realistic framework for the development of the water resources of the lower Mekong basin.

While mainstream construction is still held in abeyance, pending the resolution of problems in the region, efforts have been made to re-establish a greater emphasis on basin-wide projects. The formulation of projects which are regional in nature is in accordance with the purpose for which the Committee was established. It constitutes a vitally important approach in promoting regional co-operation and as such receives active support from co-operating countries.

With events in the region showing an increasingly positive turn, the Committee is looking forward to strengthening its legitimate regional development role and is preparing for an increased and intensified programme for the whole of the lower Mekong basin, leading to improved living conditions for the people of this region with its large but still largely unexploited potential.
Climate

4. The climate of the lower Mekong basin is tropical and is governed by two monsoons, steady winds that blow alternately from the north-east and the south-west, each for about six months of the year.

5. The south-west monsoon begins in May and continues until late September/October; then, following a brief period of instability, it is replaced by a reverse air stream, the north-east monsoon, from November to mid-March. During March and April, winds become light and variable.

Wet-season

6. The south-west monsoon passes over warm equatorial seas and is consequently heavily laden with moisture. The period in which it blows, called the wet season, is characterized by heavy and frequent precipitation, high humidity, maximum cloudiness and tropical temperatures. A short dry period of one to two weeks is normally experienced between June and July due to the influence of high altitude anticyclonic circulation. After the dry period, rainfall becomes more frequent, and heavy rainfall is experienced in tropical storms and typhoons which frequently enter the Mekong basin from the east during the wet season. Flooding usually occurs when two or more of these tropical disturbances occur in rapid succession or when the Equatorial Trough Zone (ETZ), which is the forward edge of the south-west monsoon, has passed into one of its more active stages and a tropical storm follows shortly thereafter.

Dry season

7. The air of the north-east monsoon, which originates in the cold air masses occurring in the winter in China and the polar region, is relatively dry. During the period when this monsoon blows, called the dry season (November to mid-March), very little precipitation occurs, humidity is low, the sky is clear and temperatures are relatively low.

Rainfall

8. The mean annual rainfall ranges from 1,000 mm near the centre of NE Thailand, to 4,000 mm in the Annamite mountain range lying between the Lao PDR and Viet Nam. Between 80 per cent and 90 per cent of the precipitation occurs in the wet season. In that season the dew-point of the atmosphere is only a few degrees below the air temperature and a moderate uplift of the air caused by topography or convection is sufficient to induce precipitation.

9. The effect of the topography is clearly seen in the rainfall distribution over the basin and adjacent areas. Rainfall is highest on the windward side of mountain ranges lying across the path of the south-west monsoon, such as the Cardamom range, which runs along the coast of Kampuchea and south-east Thailand, and the Annamite range which runs across the Lao PDR, eastern Kampuchea and adjacent areas in Viet Nam.
year, as is the case in most of the agricultural areas in the basin, paddy yields are about half the yield possible with an adequate water supply.

Flow

12. Each year about 475,000 million cu m of water empties into the ocean off the delta. At Pakse, where the drainage area accounts for 69 per cent of the total area, the maximum discharge (57,800 cu m/sec) is more than 50 times the minimum discharge (1,060 cu m/sec).

13. The flow of the Mekong and its tributaries is closely related to the rainfall pattern. The water level starts to rise at the onset of the wet season (April-May), reaching a peak in August, September or October. It then falls rapidly until December, and afterward recedes slowly during the dry period of the year (dry season), to reach its lowest level in March/April, just before the onset of the monsoon.

14. The Mekong carries an enormous volume of excess water during the wet season, resulting in severe flooding and substantial damage almost every year in the fertile floodplains along the mainstream, the major tributaries, as well as the vast floodplains of the delta. In contrast, during the dry season a serious reduction in flow often leads to drought in many areas, with a resultant shortage of water for domestic use and agricultural development. The most seriously-affected area during the dry season is the coastal plain of the Mekong delta, where the low flow not only creates a shortage of water for human consumption and agricultural development, but also results in deep intrusion of salt water into the delta. An area of some 2.1 million ha is normally affected by the intrusion of salt water.
15. The Great Lake (Tonle Sap) in Kampuchea attenuates the flows in the delta downstream of Phnom Penh considerably by storing a part of the flood flow in July, August and September and releasing it in the period October-April. During the flood season, the Mekong rises faster than the Tonle Sap (Great Lake) and feeds water into it through the Tonle Sap river thus storing part of its flood volume in some 70 billion cu m of natural storage of the Great Lake. When the Mekong water level goes down, the flow in the Tonle Sap reverses and the Great Lake releases water into the Mekong - both stored Mekong flood water and the yield of its own catchment area.

16. The seasonal flood of the Mekong comes chiefly from the tributaries that join the mainstream along its lower course. At a flood peak, there is generally extensive flooding in lowland areas which can cause considerable damage to crops and property. The lack of water during the dry season imposes severe constraints upon crop production and also limits the navigable depth in the mainstream.

17. The Mekong finally distributes its waters through eight branches in the delta, in Viet Nam, into the ocean. Tidal influence contributes significantly to the extent of salinity intrusion; tidal range varies from 2-4 m. The role of tidal forces is more prominent during the dry season when the river discharge is normally about 2,000 cu m/sec.

18. Acidity of water is normally high (pH is low) at the beginning of the rainy season when the first rain storms leach the highly acid soil. When rain becomes more and more regular, the soils become more permanently saturated and thus less subject to oxidation and less acid, and the water becomes less acidic. However, the acidity of water may vary rapidly along the course of the river depending on the soil conditions of each reach and local inflow and is therefore sometimes difficult to monitor.

The basin’s water resources development potential

19. The amount of water that each year flows down through the lower Mekong basin and into the ocean is vast (475,000 million cu m). If this water was used to generate power, the resources of the lower Mekong basin could supply electricity (505,000 GWh per year) to all the countries in South-east Asia, and possibly beyond, through an interconnected grid. There is also the possibility of using the water to irrigate some 6,000,000 ha of cultivable land for rice and other crops and raising agricultural production in general. Ancillary work associated with the development of these water resources, includes flood control and the improvement of navigation.

The need to develop

20. While the water resources potential of the lower Mekong basin is immense, the river runs through one of the poorest regions of the world. Annual per capita income in most basin areas is in the neighbourhood of US$140-440.

21. It was as a result of efforts made by the Economic and Social Commission for Asia and the Pacific (ESCAP then ECAFE), in the period 1951-1956, to encourage the governments of the riparian countries of the lower Mekong to co-operate in developing the large water resources to improve living standards that the Committee for Co-ordination of Investigations of the Lower Mekong Basin came into being.

The Mekong Committee

Establishment

22. The Committee for Co-ordination of Investigations of the Lower Mekong Basin (Mekong Committee) was set up in 1957, as an intergovernmental organization with plenipotentiary representatives, by the
governments of Cambodia, Laos, Thailand and the Republic of Viet-Nam (the participating governments) during the 13th session of the Economic and Social Commission for Asia and the Pacific (ESCAP then ECAFE). The participating governments had expressed the wish to continue the studies related to the development of the lower Mekong basin, jointly, assisted by international experts.

The Interim Mekong Committee

28. The Interim Committee for Coordination of Investigations of the Lower Mekong Basin (Interim Mekong Committee), was formally established by the declaration signed, in 1978, by representatives of the Lao People’s Democratic Republic, the Kingdom of Thailand and the Socialist Republic of Viet Nam.

Purpose

24. The Committee aims to develop the water and related land resources of the lower Mekong basin to generate social and economic benefits for the people in the riparian countries through the active cooperation of the participating governments in the development of hydropower, irrigation, flood control, drainage, navigation improvement, watershed management and water supply.

Activities

25. To attain its aims the Committee may...

i. prepare and submit to participating governments plans for carrying out coordinated research, study and investigation;

ii. make requests on behalf of the participating governments for special financial and technical assistance and receive and administer separately such financial and technical assistance, and take title to such property as may be offered under the technical assistance programme of the United Nations, the specialized agencies and co-operating governments, or other organizations;

iii. draw up and recommend to participating governments criteria for the use of the water of the main river for the purpose of water resources development;

iv. employ on behalf of the participating governments, personnel to assist the Committee in the performance of its functions.

Organization

26. The Committee has provided an appropriate institutional framework for planning and managing the basin’s integrated development which requires the kind of expertise and know-how not available at present in the member countries. Apart from providing support through the services of international experts and consultants, the Committee provides a framework for the equitable sharing of the water resources of this international river.

27. Each participating government appoints one member with plenipotentiary authority and such alternates, experts and advisers as it desires. Chairmanship is assumed in turn by the members of the Committee, in the alphabetical order of the countries, each member holding office for one year. The Committee’s statute also provides for the adoption of its own rules of procedure. Meetings are to be attended by all participating governments and decisions are to be unanimous.

Co-operation

28. The establishment of the Committee has helped to develop and maintain regional co-operation among the member countries. Efforts are made to implement joint projects with a regional emphasis and activities aimed
at strengthening such co-operation on a long-term basis. Through participation in the Committee the member states have a channel of communication through which they are able to consult each other. This can contribute to better economic co-operation, the resolution of potential conflicts of interest and improved regional understanding. The spirit of co-operation among the member states has prevailed since the early days and with it the hope that the Committee will continue its efforts to attain the long-term development objectives.

**Links with United Nations**

29. Throughout its existence, the Committee has enjoyed the indispensable support of the United Nations Organization and its agencies, in particular the United Nations Development Programme (UNDP), and the Economic and Social Commission for Asia and the Pacific (ESCAP) through which it has established and maintains close relations with the international community of nations that have provided crucial support to the Committee’s development programme.

**Secretariat**

30. The Committee established an independent secretariat, in 1963, headed by an Executive Agent, to plan, direct and coordinate the studies, investigations and other activities included in its development programme. As the member countries could not themselves bear the costs of supporting the Mekong Secretariat, support was provided by the United Nations Organization, through the United Nations Development Programme, which, with its world-wide interest in supporting projects of regional co-operation, its development-oriented international assistance programme and its access to international sources of support, was able to provide institutional support to the Committee from 1964 to 1986.

**Indicative Basin Plan**

31. To pursue its goal in an effective manner, the Committee published, in 1970, an Indicative Basin Plan, which presented possible mainstream and tributary projects and a full spectrum of ancillary activities. Serving as a comprehensive inventory and providing a framework and guidelines for the development of the lower Mekong basin’s water resources, the Indicative Basin Plan has also been used by the Committee as a basis for selecting projects for funding and implementation.

32. Updated in 1987, the Indicative Basin Plan now includes a framework for projects that could be required in the more distant future. The updated Indicative Basin Plan, entitled *Perspectives for Mekong Development*, was approved by the Committee in April 1988.

**Work Programme**

33. The Committee’s Work Programme is an active file of priority projects (basin-wide, mainstream and tributary projects) that have been formulated to increase food production and hydropower generation, improve navigation and carry out other ancillary works, within the broad and flexible framework of the Indicative Basin Plan.
Some of the Committee’s achievements to date

34. As part of its basin-wide activities, the Committee has set up an extensive network of hydrological and meteorological stations spanning a large part of the lower Mekong basin to collect basic field data. Readings from key stations in the network are relayed by radio to the Secretariat, during the flood season and dry season, for flood and low-flow forecasting. Daily records are kept and subsequently transmitted to the Secretariat for storage and use in support of project planning throughout the basin.

35. Data, which have been collected over almost 30 years and stored in an information system, have been used to prepare an inventory of lower Mekong basin water resources which is stored in a computerized information system. This system is an effective tool for programme planning, project formulation and revision of the Indicative Basin Plan.

36. Studies of the environmental impact of water resources development have included a basin-wide Survey of water-borne diseases to identify changes in environmental parameters engendered by water resources development that could foster the growth of certain disease vectors and add new vectors to the existing mass. Changes in basin-wide water quality and water balance are being assessed and monitoring systems set up. Surveys, aerial photographs and satellite imagery have all been used to prepare land use, crop suitability and pedo-geomorphological maps (issued in 1975) which have added to the Committee’s knowledge of the basin and its river system. Thematic mapping activities are being intensified with the use of remotely sensed images coming from SPOT, a high-resolution satellite, launched in 1986. An effort is also being made to assess the impact on the Indicative Basin Plan of development projects and the availability of new data.

37. On the mainstream, investigations have so far led to the identification of a number of possible projects which have been the subject of studies, in terms of their potential, with respect to power generation, irrigation, flood control, navigation improvement and low-flow augmentation. Dikes have been built to provide flood protection in the Vientiane plain; problems of salinity intrusion in the delta, in Viet Nam, have been tackled by carrying out operational studies, including those on salinity intrusion and environmental investigations of its water and land resources; the ongoing Huong My water control project in the delta has been supplemented by work on Tam Phuong; the main ferry channel at the crucial Nong Khai/Thanaleng crossing and the expansion and equipping of the ports at Thanaleng, Lak Si and Keng Kabao, in the Lao PDR, have enhanced transit capability on the Mekong mainstream.

38. As far as tributary development is concerned, the largest single investment has been for the Nam Ngum hydropower dam (capacity 150 MW) in the Lao PDR. An interconnected power grid has, for some years, enhanced regional co-operation by enabling...
surplus power from Nam Ngum to be exported from the Lao PDR to Thailand. Construction of a similar export-oriented dam, with up to 1,200 MW of installed capacity, is being investigated on the Nam Theun (Lao PDR). Feasibility studies, for Nam Ngou and Nam Khan in Luang Prabang and Xieng Khouang provinces, in the Lao PDR, and an appraisal of the Yali Falls project, in Viet Nam, have been undertaken. The work on Huai Mong and preparations for Nam Songkhram will eventually result in the elimination or reduction of flooding of a substantial area in NE Thailand and the introduction of intensive irrigation on an even larger area especially after the proposed Huai Mong on-farm development has been launched.

39. Several projects for fishery development, including pilot fish farms at Nong Teng and at Tha Ngone (Lao PDR), at Lam Pao (Thailand) and a prawn hatchery in Viet Nam, have been implemented to launch aquaculture (fish farming) to compensate for losses caused by dam construction and intensive irrigation. A fishery station, on the Nam Ngum reservoir, was constructed in 1978-82, as part of the Nam Ngum fishery management project.

40. The completed Phase I of the water management support programme in NE Thailand should help to enhance the efficiency of pump irrigation schemes on tributaries of the Mekong there and elsewhere in the basin. The seed multiplication project, the Pak Cheng agricultural development project and the watershed management project in the Lao PDR have helped to make more crop seeds available and to develop watershed management. At Nam Souang and Nam Houm, in the Lao PDR, the construction of irrigation systems to utilize water from the reservoirs created by two completed dams will enhance their utility.

41. Co-operating countries and organizations have given much support to the Committee's programme of training for riparian personnel, and this support of human resource development parallels the financial and technical assistance provided to the Committee's water resources development programme and is regarded as a crucial part of their regional assistance programmes. Thus, through the Committee, the member governments have been able to upgrade the skills and knowledge of riparian technicians and to facilitate the transfer of appropriate technology in water resources development. The training programme, including seminars, workshops and training courses, meets both the specific needs of the Committee as well as those of the individual member countries.
THE MEKONG DEVELOPMENT PROGRAMME

The Committee's Work Programme describes the current status of the priority projects and defines the needs in the region as delineated in the overall strategy for the integrated development of the basin's resources presented in the Indicative Basin Plan.

The Work Programme is prepared by the Mekong Secretariat with the collaboration of the national Mekong committees and agencies concerned in the member countries. It serves as a plan of operations for the timely and co-ordinated implementation of activities at the pre-investment stage, such as planning, data collection, surveys and feasibility studies, and at the investment level, such as the construction of dams, port and ferry facilities, irrigation works, training centres and other infrastructure, as well as other public works.

<table>
<thead>
<tr>
<th>Programme funding</th>
<th>(in US$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>required</td>
</tr>
<tr>
<td>a. core activities (basin planning):</td>
<td>$4</td>
</tr>
<tr>
<td>b. information system (data collection):</td>
<td>5.0</td>
</tr>
<tr>
<td>c. studies:</td>
<td>15.6</td>
</tr>
<tr>
<td>d. detailed designs and construction:</td>
<td>127.9</td>
</tr>
<tr>
<td>Total:</td>
<td>163.9</td>
</tr>
</tbody>
</table>

Programme activities

ongoing projects: $3
planned projects (awaiting funds): $8
Total: $1
BASIN PLANNING

Integrated basin planning studies

42. The Committee provides an effective and co-ordinated planning function that facilitates the development of the lower Mekong basin’s resources in response to present and future needs. It is a flexible planning capability that can incorporate new data and information into the whole programme as these become available. It also provides advice and guidance to the member countries in establishing priorities in their development efforts that will ensure maximum benefits at minimum cost.

43. The growing demand for increased food and power production makes it essential to co-ordinate planning efforts to develop the water resources of the lower Mekong basin. In addition to planning for the use of water in irrigation and hydropower generation, plans have also been formulated to improve navigation and develop fisheries and forest management.

Potential

44. The revised Indicative Basin Plan (1987) assessed the hydropower potential in the lower Mekong basin at 37,000 MW and 150,000-180,000 GWh/year. Some 51 per cent of this potential is in the Lao PDR, which has a small power market. The countries with substantial power markets (Thailand and to an extent Viet Nam) have only limited potential. If developed, the basin’s hydropower potential could easily meet projected demand over the coming decades.

45. Several proposed projects of international consequence have been reviewed: four on the mainstream, three on major tributaries. Three were selected for closer analysis: Low Pa Mong, on the mainstream, and Nam Theun 2 and Nam Ngum on major tributaries.

46. In 1986 the total energy demand in the three member countries was estimated at 30,949 GWh/year. Markets for the basin’s energy are Thailand - 88 per cent (basin area 12 per cent), Viet Nam - 11 per cent, and the Lao PDR - 1 per cent. Total energy demand is expected to grow to 71,986 GWh by the year 2000 and then to 126,475 GWh by 2010.

47. The demand for water and water management for rice production differs from country to country. While the Lao PDR is moving towards self-sufficiency in rice production, Viet Nam has a deficit of 10-20 per cent or 1.5-3.0 million tons. Thailand, though one of the world’s largest rice exporters, needs to raise the standard of living in the north-east (one of the aims of the Government of Thailand’s Green Esarn project) which lags behind the rest of the country.

48. In the Lao PDR water needed for irrigation projects will mostly be satisfied by pump irrigation schemes or diversion. In NE Thailand, water is the most important physical constraint on efforts to increase rice production. There is an urgent need to use water from the Mekong to meet the need for water for irrigation both during the dry season and during dry spells that occur during the rainy season as well as for domestic supply. Viet Nam seeks self-sufficiency in rice production through the development of the delta which may need some 2,000-3,000 cu m/
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sec of fresh water during the dry season to manage acid-sulphate soils, counter sea water intrusion and irrigate crops. The fresh water demand may be met in several ways, including engineering measures in the delta, the construction of large storage reservoirs on the Mekong mainstream, which could provide up to 3,500-4,500 cu m/sec, and a barrage on the Tonle Sap, which could provide an additional 2,500-2,700 cu m/sec by modifying the natural storage regime of the Great Lake.

Revison of the Indicative Basin Plan

49. The Committee’s Indicative Basin Plan was revised in 1987 by an international consortium of consultants, engaged and supervised by the Committee’s Secretariat. Assistance was also provided by a team of international experts who were invited to participate in a special workshop, held in Bangkok, in September 1987. Comprehensive discussions were held with the governments of the member countries who were consulted about the revision at every stage of the process.

50. The revised plan perspectives for Mekong Development, was approved by the Committee at a special session in Bangkok in April 1988. The updated plan reassessed needs, in terms of flood control and energy requirements, re-estimated the basin’s potential and formulated an investment plan for the period 1988-2000. It also included the development of two international or common works projects: the Low Pa Mong and the Nam Theun 2 (for which investment will be required beyond the year 2000), a number of national projects, and a proposal on the reinforcement of the Mekong Secretariat to cope with the envisaged future work load.

51. The plan included recommendations on further investigations aimed at filling data gaps in the short term project possibilities, and on required studies that could be started in the next 5-10 years to permit implementation of projects in the more distant future. It was also recommended that the Indicative Basin Plan be regularly updated (which is envisaged in the near future) to take into account anticipated social and political developments in the region.

52. Following the recommendations a number of activities and studies have been initiated, including the Prerequisites for common works hydropower projects, namely Pa Mong and Nam Theun 2 (see section on Multi-purpose development), the Preliminary study on long-term sequential dam and reservoir configuration, and preparatory works related to funding arrangements with UNDP (Hanoi) for the Delta master plan study, initiation of a Study on water resources development plan for NE Thailand, and an Agricultural diversification study.

Preliminary study on long-term sequential dam and reservoir configuration

53. The project activities started in September 1988 with a review of all previous geological studies, a review and analysis of hydrological data, and the identification of irrigation requirements.

54. A geological reconnaissance of the proposed dam sites and reservoirs was carried out on the Mekong mainstream by a team comprising engineers from the Lao PDR, Thailand and Viet Nam, and an international consultant (engineering geologist), in November/December 1988.

55. A related activity included a review of existing and projected irrigation areas, planned by the Committee’s member countries, and the determination of those areas which could be supplied with water from the mainstream projects. The results of these activities, together with power demand in the basin, will be used for the reservoir operation study. Further studies proposed include load demand forecasts, preliminary engineering
designs/studies and economic analysis to determine the economic potential of the Mekong mainstream. It is planned to complete all activities under this study in 1989.

**Delta master plan study**

56. In Viet Nam there is an urgent need to increase food production. This applies particularly to rice production which must be increased to meet the needs of a growing population. In the Mekong delta, which has a total area of 3.9 million ha, there is substantial scope for agricultural development. At present only 2.4 million ha are cultivated; only one crop is grown on 75 per cent of the cultivated area.

57. The proposed master plan aims at the integrated development of the Mekong delta and the formulation of scenarios to implement projects in the short to medium term (before upstream storage works are constructed) and for a long-term perspective based on the future increase in low flow.

58. A project formulation mission, comprising UNDP, the World Bank and the Mekong Secretariat, visited Viet Nam in August/September 1988, and prepared the draft *Project Formulation Framework*. The terms of reference for the plan were then revised after consultations with the Government of Viet Nam and the World Bank (proposed as the Executing Agency). Discussions were also held with UNDP (Hanoi) on the funding of the study and on the organizational set-up for its implementation. The Mekong Secretariat was proposed as the Associated Agency.

**Study on water resources development plan for NE Thailand**

59. The study aims to provide more complete and up-to-date information about the demand for mainstream water in NE Thailand, which is the poorest part of the country, and about the effects of development (intensive irrigation, construction works, etc.) on the downstream areas. The main focus of the study will be on planning small-scale water resources projects in rainfed areas that cannot be covered by medium and large-scale projects. Another of its aims will be the preparation of an inventory of past and ongoing projects and an assessment of the need for future studies of water resources development.

**Agricultural diversification study**

60. Preparatory studies for an agricultural diversification study for the lower Mekong basin were initiated in 1988, following discussions with the member countries and a consultant. The proposed study would identify suitable crops, having high economic and nutritious value, to substitute for the traditional main crop of rice which is affected by low prices on the international market. As farm practices
change they will probably affect future water resources development and this project would therefore provide useful feedback in any master plan.

Economic and social studies

Project appraisal and evaluation

61. Two main activities were carried out during the year: a terminal evaluation of the Mun-Chi pump irrigation project in NE Thailand, and a baseline survey for the Nam Houm irrigation project in the Lao PDR to facilitate future evaluation. Other activities included the analysis of baseline data for the Tam Phuong water control project in Viet Nam, planning and preparation for a terminal evaluation of the Pak Cheng agricultural development project, and a baseline survey of the Nam Ngum fishermen’s communities project also in the Lao PDR.

62. Standardization of data collection procedures was initiated early in the year to help the evaluation and appraisal process. Impact assessment that goes beyond the scope of individual projects requires access to aggregated socio-economic data reflecting a variety of performance indicators, and efforts were therefore made to partially integrate the project evaluation procedures with the development of the Lower Mekong Basin Information System, and in particular the socio-economic data base.

Environmental impact assessment and planning

Co-ordination of environmental planning

63. In planning the Committee’s development activities, great care is taken to ensure that adverse effects on the environment are minimized. Development activities are very often the source of significant side effects which may far outweigh the benefits hoped for.

64. The project, Co-ordination of environmental planning, was therefore formulated as an umbrella project, funded by UNDP, to integrate environmental parameters into the Committee’s development programme. As part of this approach, pilot projects were planned to demonstrate measures that could be implemented to offset adverse side effects while enhancing benefits. The component activities of the project are shown below.

Collection and analysis of data on environmental resources

65. Existing projects indicate that most environmental problems in the basin result from mismatching resource capabilities and resource uses. Sustainable development can only be achieved if the potential and constraints of the resources to be developed are taken into account during the planning stage. A lot of data and information relating to the quantity, quality and location of available water and land resources, the suitability of these resources for various uses, their present uses, existing problems and influencing factors, such as climate, topography, and population density, already exist, but are scattered in the published and unpublished records of governments, institutions and private-industry.

66. To provide background information for environmentally-sound resource use planning and management, data and information were collected from various sources, and stored so that they could be easily retrieved for use in a desired context. Related activities initiated in 1988 are described below.

Selection of information system and software

67. To determine the type of data and information needed, and how it was to be evaluated, it was decided to establish a data base of the GIS (geographic information
system) type. This database makes it possible to store, retrieve and combine data on the basis of geographic units (areas, points or vectors), and facilitate the use of information contained in maps directly.

68. A software package (ARC/INFO), which is also used by UNEP for the GRID-project, was selected and installed in January 1988. This software has good data manipulation/evaluation possibilities, and can store and combine attribute information for geographic units together with map information. The ARC/INFO software can also be operated on PC's.

Data collection

69. In Thailand and Viet Nam, national coordinators organized and supervised data collection from various institutions. This activity was completed while the computer facilities for data input were being installed. In the Lao PDR, however, data collection did not start, but maps and other relevant information available at the Mekong Secretariat in Bangkok, were compiled and entered into the data base.

Screening and storage of data

70. The accuracy of the existing data and maps collected from the various sources was dependent on the purpose for which they were originally intended. In many cases, they presented derived information, i.e., the original data had already undergone evaluation and the criteria for this evaluation were not known. In some cases, different sources of information presented different pictures of the same aspects. A consultant was therefore engaged for a period of four months, to screen and organize the collected material.

71. Data, for a selected test area in NE Thailand, were screened in this way before being fed into the data base. The accuracy of the information obtained was then determined by comparing the results with information obtained through field checks.

Identification of users

72. The intended users of this information include the national institutions, which already supply data and information to the data base, and planners at the Mekong Secretariat. Co-operation between these institutions is essential to maintain and update the data base, and efforts are therefore being made to establish and maintain contacts from the earliest possible stage.

73. In Viet Nam, the Study for integrated development planning of the Quan Loi Phung Hiep project was selected as the first case study to demonstrate the use of the data base.

Identification of problems and information gaps

74. This activity, which commenced in June 1987, as scheduled, was continued in 1988 and is based on an analysis of the information/data collected in this and other projects of the Committee. Major environmental problems identified in the basin so far include the following:

i. improper or destructive practices affecting watershed management and which result in accelerated sedimentation of dams, for example Se Done, Nam Dong and Nam Ngum, in the Lao PDR;

ii. acidification of soils in the delta as a result of land reclamation;

iii. soil salinization as a result of irrigation in the Korat plateau;

iv. adverse effects of inundation control on fisheries;
spread of water-borne diseases, particularly opisthiorchiasis, schistosomiasis and malaria;

vi. toxic biocidal levels in edible organisms;

vii. lack of potable water supply in problem (saline and acid) areas;

viii. problem soils - danger of desertification as a result of their improper use.

75. Following the identification of these problems, project proposals were prepared to investigate the mechanisms of problem development, and pilot projects were set up to demonstrate ways of combating the problems. Some of these proposals have already received funds from co-operating countries and are under implementation.

Formulating environmentally-sound resource development programmes

76. Projects were formulated for the ecologically-sound development of two 1,000-ha pilot areas, for an acid sulphate soil area, and a saline acid soil area, in the Mekong delta, in Viet Nam. A multi-disciplinary team of seven scientists (including experts in fisheries, forestry, agronomy, modelling, ecology, etc.) are participating in the project activities.

77. A Secretariat Mission conducted a "preliminary environmental assessment" of the Quan Lo/Phung Hiep area, in the Ca Mau peninsula, in order to formulate an ecologically-sound development programme for the area.

Co-ordination of project operations

78. To ensure the effective integration of environmental aspects into Mekong resource development projects, a project proposal, Ecologically-sound development of water and land resources in the Mekong delta, Phase I (Viet Nam), was prepared by the Mekong Secretariat and approved by the Committee at its 27th session.

79. A workshop on problem soils in the basin was held in Bangkok, from 16-19 November 1987, to discuss the subject and to prepare a project document.

80. An identification mission from Belgium had visited various locations in the basin to evaluate the project Study of water-borne diseases, Phase II, in December 1987.

Environmental impact assessment (EIA)

81. Comprehensive environmental data collection was initiated in February 1988 by the Mekong Secretariat, in collaboration with the national agencies concerned, in Viet Nam and NE Thailand as a preliminary step to conducting environmental impact assessments of the Committee’s projects.

Water quality monitoring network (Phase I)

82. The Water Quality Monitoring Network project, which commenced in 1985, with external financial assistance of (SEK 12,890,000 = US$1.6 million) provided by the Government of Sweden through the Swedish International Development Authority (SIDA). Phase I of the project was completed in September 1988.

83. During the project period, from January 1985 - September 1988, three regional laboratories were established, one in each country, and staff were trained to analyse twenty water quality parameters, including those that relate to salt transport, eutrophication and pollution. The laboratories are also equipped with atomic absorption spectrometers to analyse trace metals. Another project, to measure the sediment
transport, in the Lao PDR, is incorporated in the project. Equipment was procured and on-site training was given by a consultant from Uppsala University, Sweden.

84. The preliminary monitoring programme to analyse pesticide levels was initiated in 1988 for the Lao PDR and Thailand, and it is envisioned that the programme will become a regular activity once the technicians are fully trained. Data and information produced by regular monitoring and campaigns have been used in the formulation of projects for sustainable land use development in the basin.

85. Besides this, the data collected are being used regularly by the national agencies and by the Mekong Secretariat as an input for development projects. The laboratories are routinely undertaking analysis for aid agencies. These activities are encouraged even though they are not part of the regular monitoring network.

86. During the implementation of the project, technicians working on the Water Quality Monitoring Network project were trained in Sweden and at the project site by personnel from the Swedish Environmental Protection Board.

87. The basin-wide monitoring network conducts regular sampling at thirty-nine stations in the basin. Biological monitoring was launched in 1987 for bottom fauna sampling, carried out twice a year, and monthly determinations are made of faecal bacteria at thirty stations.

88. In addition to the regular monitoring operation, sampling campaigns are conducted during the period May-September to study acidification in the Mekong delta and salt mobilization in NE Thailand.

89. Several workshops have been conducted, in connection with the project, to provide training in the evaluation of data collected. The latest was in September 1988, when a workshop was organized in Ho Chi Minh City, to summarize the results of the monitoring activities and provide recommendations for future work. Several consultants were invited to participate in the workshop and their recommendations have been incorporated in the proposed Phase II of the project.

90. Phase II of the project (October 1988-September 1991) commenced in October 1988 with a total funding of SEK 11,200,000 (US$1.72 million). The objectives of Phase II are to develop a comprehensive water quality policy and establish systems for early recognition of water quality problems arising from current and future development
activities, and to develop predictive tools and ameliorative strategies for complex, water related environmental problems of natural and anthropogenic origin in the lower Mekong basin.

Ecologically-sound development of water and land resources in the Mekong delta

91. This project was formulated, in December 1987, in response to a request to determine ways of increasing production (agricultural, aquacultural and silvicultural), on a sustainable basis, in the ecologically-sensitive acid sulphate soils of the delta. The United Nations Environment Programme (UNEP) provided financial assistance (US$979,500) for the execution of the project by the Mekong Secretariat in collaboration with the national authorities concerned and UNEP/COM.

92. Project activities, which started in January 1988, included a training course on Organization of ecological investigations dealing with water, soil and resources development, held in the USSR, in March 1988. The participants included ten Vietnamese technicians involved in project operations, and Soviet resource persons. A meeting of the project advisory group (representatives of UNEP, UNEP/COM and the Mekong Secretariat) was also held at that time to review and revise the work plan of the project.

93. A project office was established in Ho Chi Minh City, at the National Sub-Institute of Agricultural Planning and Projection (NIAP). Two 1,000-ha pilot areas were selected, one in an acid sulphate soil area and one in a saline acid soil area, to carry out field trials in ecologically-sound methods of development.

94. Among the project personnel appointed were a project co-ordinator, and a multi-disciplinary team of experts to assist in carrying out surveys and studies and plan project operations. The team comprised specialists in agro-ecology, soil sciences, water quality, hydraulics, fisheries and modelling. Missions visited areas of interest in the delta, in August and again in November/December 1988, including the proposed pilot stations, and collected data/information required for detailed planning of activities. The information was analysed and the results are expected to be submitted in January 1989.

95. A second training workshop on Intensive rice culture in problem areas was held in Krasnodar (USSR), in September/October 1988, in which 12 national counterpart technicians participated.

Study of water-borne diseases (Phase II)

96. Following the recommendations of an evaluation mission, the Belgian Administration for Development Cooperation (BADC) agreed to provide financial assistance of US$890,000, and an agreement is expected to be signed in early 1989, for the Study of water-borne diseases. Phase II, project. The Phase II proposal is a sequel to a reconnaissance survey carried out by the Mekong Secretariat to identify and assess the endemcity of water-borne and vector-borne diseases in the lower Mekong basin. The survey indicated that there are three categories of water-related diseases endemic in the basin. These are the following:

Water-borne diseases or water-transmitted diseases in which man or animal is the source of infection and the main reservoir. The disease-causing agent is discharged into the water with human or animal faeces or urine. Water is the vehicle for infective agents: bacteria, viruses or parasites. Examples: a variety of diarrhoeal diseases, enterotoxic, Escherichia coli infections, shigellosis, salmonellosis, cholera, rotavirus infections, typhoid and paratyphoid, virus hepatitis A, amoebic dysentery, giardiasis, leptospirosis, etc.
ii. Water-transmitted helminthic diseases with involvement of an intermediate host or hosts living in the water. Examples: schistosomiasis, opisthorchiasis and paragonimiasis. Snails are the first intermediate host for parasite development and fishes, crabs and plants the second intermediate host for certain parasites. Humans become infected through direct water contact (schistosomiasis) or by eating the intermediate hosts raw.

iii. Vector-borne diseases where water constitutes the breeding place for the vectors. Examples: malaria, filariasis and Japanese B encephalitis.

Environmental study of the Xeset hydropower project

97. The Xeset hydropower project is located in the southern part of the Lao PDR, in the province of Saravane, about 90 km from the town of Pakse. The Xeset river is a tributary of the Se Done river which joins the Mekong at Pakse.

98. Studies and investigations of the project have been ongoing since 1983, financed by the Asian Development Bank (ADB).

99. The decision to implement the Xeset hydropower project was made by the Government of the Lao PDR in 1987. Financing of the project is to be provided jointly under an agreement co-signed by the ADB, the Swedish International Development Authority (SIDA), the World Bank and the United Nations Development Programme (UNDP). The total project cost is about US$40 million.

100. The co-operating countries emphasized the importance of developing a technically and economically sound project, but with due consideration of the natural and social environment. They therefore commissioned the Mekong Secretariat to carry out an environmental impact assessment and socio-economic study for the project. The study is being financed by SIDA.

101. The Mekong Secretariat appointed a consultant to carry out the work which was completed in the last quarter of 1988. The interim findings of the Consultant show that the project would cause only minor environmental problems. Proposals on how to provide adequate protection and to enhance the surrounding areas are to be presented in the final report due in February 1989.

Study for integrated planning of the Quan Loi/Phung Hiep project

102. On the basis of earlier recommendations, made by a Netherlands consultant, in 1979, the Government of Viet Nam requested the Mekong Secretariat to formulate a project to develop the Quan Loi/Phung Hiep area for intensive, irrigated agriculture. The area covers some 453,000 ha in Hau Giang and Minh Hai provinces, in the Mekong delta.

103. Although the Mekong delta is the most important rice producing area in Viet Nam, development of the project area has progressed very slowly due to several constraints: a) shortage of fresh water during the dry season and severe salinity intrusion; b) flooding during the rainy season; and c) the existence of large areas of acid sulphate soils.

104. Double cropping of rice is currently possible only in some lands located close to the Bassac river, or bordering major canals which bring fresh water from the river. The major part of the project area sustains only one crop of rainfed paddy. In the remaining part of the project area there are large stretches of acid sulphate soils which lie fallow under a natural vegetation cover of reeds.

105. A preliminary environmental assessment of the proposed development was carried out in January/February 1988 to gain a better understanding of the problems affecting development and to propose an ecologically- and economically-sound development plan.
106. The need to increase food production in Viet Nam requires the utilization of all available land, including those areas of the delta classified as problem soils. A system of water control structures was proposed for the Quan Lo/Phung Hiep project area to make full agricultural use of it by preventing salinity intrusion, and to provide drainage and fresh water for irrigation during the dry season.

107. However, such measures adversely affect the prawn and shrimp populations (fresh-water prawn, Macrobrachium rosenbergi and the brackish-water shrimps, Penaeus indicus, P. monodon and other species). These species are caught in canals and cultured in the fields. At present they provide the main source of income to many farmers and fishermen, often in combination with rice. As shrimp and prawn command a high price (US$8-12 a kilo) on the international market, export of these products can constitute a source of substantial foreign exchange earnings—especially if the natural production is augmented by intensive culture. The prevention of sea water intrusion would eliminate this development possibility.

108. In view of the foregoing, a “small-scale” water control scheme was suggested. However, a final decision on its implementation cannot be made unless the exact potential of the area for shrimp production is known, and the areas where salinity intrusion is desirable for the protection of shrimp fisheries are clearly delineated. Furthermore, the high potential for fishery production is by no means the only desirable function of salinity intrusion, although it is the most important one. Under present conditions, marine sediments provide most of the nutrient input to the fields and reduce the need for fertilizers. Saline water has also been successfully used to reclaim acid sulphate soils—a function which cannot be taken over completely by fresh water. Saline water provides ion-exchange and successful leaching of the toxic products of pyrite oxidation, and has historically been used to reclaim acid sulphate lands initially for shrimp culture and, after some years of alternate leaching by saline water and rain, for combined rice and shrimp culture.
109. Besides agriculture and fisheries, forests constitute another major resource likely to be affected by water control schemes, including salinity control, drainage and irrigation, in the project area. Mangrove forests along the coast protect the shore against erosion. *Maleleuca leucodendron* forests are, at present, the only suitable type of land use on severely acid sulphate soils which have to be kept submerged. Both types of forest provide a habitat for economically important wildlife (fish, snakes, birds, etc.), besides providing fuel-wood and timber.

110. The implementation of large-scale water control projects was planned to prevent salinity intrusion and provide fresh water, and also to limit flooding and waterlogging. However, in much the same way as salt water intrusion, *inundation* /flooding is a natural ecological function which acts to prevent acidification of potential acid soils and provides for fisheries exploitation. Also, significant lowering of the water level in the canal system would render navigation, which is at present the most important means of transportation in the area, very difficult, if not impossible.

111. A development strategy has to take into consideration the diverse ecological functions of the area and the conflicting requirements of different resource uses. For this reason, careful consideration is given to the planning of the construction of water control structures and their location.
INFORMATION SYSTEM

112. One of the vital functions of the Committee is the collection, storage and analysis of both basic and specific data on hydrology, meteorology, hydrography, topography, and land use, as well as economic and social data for use in planning and operating projects in the lower Mekong basin, in such fields as hydropower, irrigation/agriculture, navigation and water supply.

113. Data, and the information generated from them, guide the preparation and management of the Committee’s projects. Pilot schemes are implemented to provide additional data for planning activities in such areas as watershed management, erosion control and soil conservation, fishery rehabilitation and integrated soil/water management.

114. The Information System constitutes the Committee’s infrastructure in the lower Mekong basin. The Information System comprises networks and related data collection activities which have been implemented to gather essentially, but not exclusively, basic data. These data may be subjected to “primary processing” in the field and in laboratories in the member countries, before being communicated to the Mekong Secretariat where they are fed into the data bases of the Information System and stored for use in planning projects which fall within the scope of the Committee’s endeavour, and also in other applications, such as the production of the Committee’s Hydrologic Yearbook, hydrographs, maps, and the Hydrographic Atlas.

Development of the information system

115. In 1988, development of the Information System continued and the progress made is described below.

Data bases

Hydrological and meteorological data base

116. Data entry, storage, retrieval, and presentation activities were all fully operational in 1988. The data base was improved to provide menu-driven/user-friendly operations for these functions on a multi-user system. To date, more than 11,000 station-years of data records have been stored in the data base. A link was developed between the data base and the graphics system to present the time-series data in various graphic forms.
117. The data base has provided essential data to various activities of the Committee through the use of mathematical models, such as the Hydro System Seasonal Regulation (HYSSR) model and the MIT River Basin Simulation (MITSIM) model for the preliminary study of long-term sequential dam and reservoir configuration, the Streamflow Synthesis and Reservoir Regulation (SSARR) model and the DELTA model for river forecasting and the HYDATA package for water balance studies.

**Socio-economic data base**

118. Macro-economic data, for member countries, were being stored in the system using a data base management software for microcomputers. The completion of this task will make it possible for the data to be retrieved by Mekong Secretariat staff and consultants for economic analysis and evaluation of projects in the lower Mekong basin. To date, macro-economic data for Thailand (with 215 variables) have been stored. Data for the Lao PDR and Viet Nam were still being collected.

119. On the micro level, data on agricultural development have been obtained for 17 provinces in NE Thailand, from the Ministry of Agriculture, Thailand. These data are being entered into the data base. Other micro-economic data and socio-economic data, related to projects in the lower Mekong basin, will be systematically collected and stored in the data base.

120. On the application side, a simulation model for economic analysis was installed at the Secretariat, using a mathematical software called KEOPS. Economic data for Thailand have been used in the model.

**Mekong bibliographic data base**

121. The computerization of the Centre’s holdings was in progress during 1988. The Mekong Bibliographic Data Base by the end of the year held 4,500 records and these were transferred to the Secretariat’s VAX computer. Access to the data may be made by the Secretariat’s staff and other users through a terminal or a PC, by means of a multi-user version of UNESCO’s CDS/ISIS software package.

122. Most of the data entry work, including new acquisitions, was completed, and the computerization exercise was then focused on improving and refining the data base. In this connection, the keyword search field of every data record was revised to confine the search language to the “Authoritative List of Terms (keywords)” issued previously by the Centre. Similar work was started on the title field of the reference to trim down the inverted file dictionary of the data base so that the storage requirement of the data base and the machine time in updating the file and in making a search could be reduced.
123. Documents and files in the Centre were rearranged to facilitate their retrieval, to keep the number of reference copies to a minimum, and to assign a call number to each document in accordance with its location.

Modelling and related activities

Improvement of hydro-meteorology and mathematical modelling

124. On 22 September 1988, the Government of the Netherlands agreed to provide financial assistance amounting to Dfl. 1.4 million (US$667,000), over a 3-year period (1988-90), to the project Scientific and technical assistance for hydro-meteorology and mathematical modelling. The project started in October 1988.

125. There are three main components in the project: i) the improvement and streamlining of the present network; ii) the development of data base management and data processing; and iii) mathematical modelling. Technical consultancy services were provided by a Netherlands consultant to develop and improve the hydro-meteorological data base at the Mekong Secretariat and at agencies in the riparian countries.

126. Within the framework of the project, a master model for the lower Mekong river will be developed and installed at the Secretariat by consultants from the Netherlands, to evaluate the consequences of planning alternatives for flows, salinity intrusion and water quality.

127. The first meeting of Chief Hydrologists of the Interim Mekong Committee was held, from 14-16 September, and was attended by 17 participants. The meeting provided an opportunity to review the achievements of the hydro-meteorological network operation in 1987 and progress made in 1988, and to formulate a long-term plan to optimize the network.

Data collection

Meteorological and hydrological data collection

128. Under the 3-year (1987-1989) project Development and maintenance of the hydrological and meteorological network, further improvement and development of the network continued during the year. At the end of 1988, 11 stations out of the planned 13 hydrological stations were rehabilitated; 13 out of 20 new stations planned were installed.

129. Discharge measurements continued as planned at 6 key stations on the mainstream. For tributary stations, discharge measurements were resumed at 23 stations on major tributaries in the critical left bank area, in the Lao PDR, where data are most needed. In Thailand discharge measurements continued at 74 hydrological stations, and in Viet Nam at 8 stations. The water level was observed at all hydrological stations, sediment and water samples were collected and analysed.

Discharge measurement on Mekong tributary

Updating of the hydrographic atlas

130. In December 1987, the Government of Finland granted FIM 3.3 million (US$800,000) to the Committee to carry out hydrographic surveys on the Mekong from Luang Prabang to Savannakhet in the upper reach and in the delta area in the lower reach.
131. In March 1988, at a meeting of officials from the Lao PDR, Thailand and the Mekong Secretariat, held in Nong Khai, a work plan was finalized for the river stretch between Vientiane/Nong Khai and Savannakhet/Mukdahan. Project activities started with the arrival of an expert on ground control in April 1988. Joint Lao/Thai survey teams, under the supervision of the expert, began to establish ground control networks in the Vientiane/Nong Khai area, in May 1988. A ground control survey of the stretch from Vientiane/Nong Khai to Savannakhet/Mukdahan was completed in December 1988.

132. A hydrographic survey expert arrived at the project site in October 1988 and the cross-river soundings commenced in November 1988 under his supervision.

133. On-the-job training in the use of electronic distance measuring equipment and other instruments was given to surveyors in the joint Lao/Thai survey teams, while the ground control surveys were taking place, to enable the riparian survey teams to continue the survey works after the departure of the ground control expert.

Economic and social data collection

Surveys of water-borne transport

134. In 1985 the Mekong Secretariat reactivated its programme to survey water-borne transport on the river. For this activity, the Secretariat required a great deal of supporting data and information and a project was presented to carry out surveys in the member countries on inland water-borne transport. The last water-borne transport survey on the Mekong was carried out in 1973, from the Burma border down to the Lao/Kampuchean border.
135. The Government of Switzerland provided financial assistance for the first stage of this project, for which survey work was completed in 1987. The results of the surveys were compiled and published in statistical form and distributed to the government agencies concerned and the Government of Switzerland during the second half of 1988. A similar survey of water-borne transport in the Mekong delta, was being carried out by the national survey team in Viet Nam, under the supervision of the Mekong Secretariat, with financial assistance provided by UNDP under its assistance to the development of the Secretariat’s information system.

**Thematic mapping programme**

136. Topographic and thematic maps are important tools in planning the development of the resources of the lower Mekong basin. In the relatively new field of remote sensing/thematic mapping, the Committee has been keen to develop a programme based on information needs and past experiences. An expert was therefore engaged in 1988 to prepare such a programme to guide its mapping activities over the next decade. The draft programme will be submitted to the Committee and recommended for adoption at the Committee’s 28th session.

**Thematic mapping**

137. The Committee’s activities in this field in 1988, which were financed by the United Nations Development Programme (UNDP), the Economic and Social Commission for Asia and the Pacific (ESCAP), the Government of France and the Government of Sweden (through the Swedish International Development Authority) comprised the following components: a) map compilation; b) map synthesis; c) training in remote sensing and thematic mapping.

**Map compilation**

138. Land use and agro-ecological maps of the Xe Champhon basin were produced on a scale of 1:100,000, based on the interpretation of SPOT images acquired in 1987 and aerial photographs acquired in 1981. Five hundred copies of each of the maps are available at the Secretariat.
139. Land use and agro-ecological maps are being prepared on a scale of 1:100,000 for the Bolovens plateau. The maps are based on the interpretation of aerial photography and SPOT images.

140. Land use mapping, focussing on deforestation, was carried out for the Luang Prabang watershed area. Based on the interpretation of SPOT imagery and aerial photographs, a land use map was produced on a scale of 1:100,000.

141. A case study of the environmental effects of salinity protection was carried out for selected coastal areas in the Mekong delta.

142. Based on the interpretation of remote sensing data acquired at different times, a set of thematic maps was produced, on a scale of 1:100,000, showing changes in land use, the extent of salinity intrusion, and the drainage condition of three pilot areas: i) in an area without protection, ii) in an area where salinity protection is under construction, and iii) in an area already protected.

143. A map, on a scale of 1:100,000, was prepared from SPOT imagery for each entrance in the project Preliminary study of situlation at the Bassac and Mekong entrances. The maps show qualitatively different concentrations of suspended sedimentation at the entrances. The information is to be used in the development of navigation in the Mekong delta.

144. Agro-ecological mapping on a scale of 1:100,000 for the Ban Me Thuot area, was carried out in the Central Highlands, and the An Giang province in the Mekong delta. Following up on the agro-ecological mapping on a scale of 1:250,000 for the whole of the Mekong delta, a map on a larger scale is needed for detailed planning of agriculture. A project was formulated and commenced on producing an agro-ecological map on a scale of 1:100,000 for the above-mentioned areas.

Map synthesis

145. A first experiment was performed to assemble a land suitability map using PC-ARC/INFO. A part of the original agro-ecology map of the Mekong delta, on a scale of 1:250,000, was digitized into land use, soil, geomorphology and inundation. A land suitability map has been created. The project, which started in November 1988, will be completed in eight months.

Training in remote sensing and thematic mapping

146. A one-month training course on the fundamentals of remote sensing and thematic mapping (Séminaire de Teledetection spatiale et d’utilisation des images SPOT) was held in Vientiane, Lao PDR, from 23 May to 16 June 1988. The course, sponsored jointly by the Government of France and the Mekong Committee, was conducted by experts from the Secretariat and the Remote Sensing Laboratory at the Asian Institute of Technology (AIT). Twenty-three technicians working in the field of natural resources participated in the training.

147. Two technicians from the Lao PDR received on-the-job training for six weeks at the Mekong Secretariat in connection with the mapping of the Bolovens plateau.

Applied hydrology

River forecasting

148. River forecasting operations are carried out annually as an interim measure (pending more substantial development measures, such as mainstream dam construction) to provide warnings about impending floods, drought and salinity intrusion.
Low flow forecasting

149. Annual low flow forecasting activities, which indicate how low the water level is likely to reach in the dry season, were carried out during the critical period (between February and May) at four key stations in the Mekong delta.

150. The records show that 1988 was another very dry year, drier, in fact, than 1987. All hydrological stations reported that water levels throughout the basin were well below the mean levels and close to the minimum recorded levels, particularly at Pakse and in the Mekong delta. A hydrograph, showing the streamflow at Vientiane during the period July to October 1988, is shown below with its maximum, minimum and mean.

151. Factors influencing this situation included the fact that the monsoon trough was weak during the wet season, and only one tropical depression approached the coast of Viet Nam during the flood season, on 1 October. Normally 3-5 storms would be expected during this period (July-September). The storm only slightly affected the middle and lower reaches of the basin where water levels rose at a minimum rate.

Flood forecasting

153. The Mekong Secretariat carried out its annual flood forecasting operation in 1988, from 18 July to 7 October, for 13 key stations on the mainstream, and continued to 11 November for four stations in the delta.

154. Forecasts were issued five days in advance for daily water levels and disseminated to the Lao PDR and Viet Nam through the Mekong radio network and by hand to the Thai authorities concerned.

Water balance study (Phase III)

155. The Government of the United Kingdom provided assistance of USS134,000, in 1988, to cover the costs of 11 man months of consultancy services, and computer equipment, for Phase III of the Water balance study (1987-1989).
156. The study, which was carried out by consultants from the United Kingdom from January to July 1988, reviewed gauging at ten stations on the Mekong mainstream and updated the rating curves using the gauging data.

157. The final report on the study, which was submitted to the Secretariat in December, found in a regional study of the dry season flow, using data from 44 stations, that there was, in general, an increase in dry season flow attributable to the regulation on the tributaries. A simple time series and a regresional model were developed by the consultants to estimate inflow into the delta based on the daily flow at Pakse and the storage in the Tonle Sap (Great Lake).

158. The study also revealed that there had been no significant change, in terms of the total annual rainfall, in the lower Mekong basin since 1950.

**Delta salinity intrusion forecasting (Stage I)**

159. The Government of Viet Nam is currently making efforts to increase agricultural production in the Mekong delta to meet the rising food demand created by the rapidly increasing population. However, these efforts are hampered by the intrusion of sea water into agricultural land that could be used to boost production if the salt water could be held at bay.

160. The Co Chien branch of the Mekong river was selected as an experimental zone for Stage I of the salinity intrusion forecasting programme to maximize the benefits of two water control projects: Tam Phuong and Huong My. A network of four reference stations was established at the beginning of the 1988 dry season and forecasting operations started on 1 April and ended on 15 June 1988.

161. The forecasts were sent to the Hydrological and Meteorological Centre, in Ho Chi Minh City, for distribution to specialized agencies in the two provinces bordering the Co Chien branch and then transmitted by radio to farmers in the area.

162. A workshop to conclude Stage I of the salinity forecasting programme was held in Ho Chi Minh City, in December 1988, when the achievements were assessed, and the use of forecasts was discussed with the project authorities and other users.
163. Stage II of the programme, which involves the expansion of the network to 12 stations, is scheduled to commence in early January 1989.

**Delta salinity intrusion studies**

*(Phase III)*

164. Phase III of the *Delta salinity intrusion studies*, covering all areas affected by salinity intrusion in the Mekong delta, started in May 1988, with a grant of US$420,000 provided by the Government of Australia over a four-year period (1988 to 1991).

165. Existing data on salinity intrusion were collected, compiled and analysed. During the dry season of 1988, salinity data were also collected at 12 stations along the northern branch of the Mekong river and basic dry season discharge was monitored on the upper reaches, at Tan Chau and Chau Doc.

166. Refinement of *MEKSYAL* model was completed in September 1988 and installed on computers at the Mekong Secretariat. The refined model can incorporate hydraulic structures and flood plains of the Mekong delta.

167. In February 1988, a Vietnamese engineer received training on communications between computers and transfer of data, at the Asian Institute of Technology (AIT). A hydraulic engineer from the project also completed a Master's degree course at the Asian Institute of Technology (AIT), under the framework of co-operation between AIT and the Secretariat. A thesis was submitted entitled *Characteristics of flow and salinity intrusion in the Mekong delta*. 
RESOURCES DEVELOPMENT

Hydropower development

*Standardization of micro-hydropower components*

168. Micro-hydropower is an important and renewable small-scale energy source that is particularly appropriate for people living in small communities in remote areas. It is also an important component of integrated rural development and merits a place in the formulation of development policies.

169. In May 1988, a mission, comprising a consultant and Mekong Secretariat staff, visited the three riparian countries to assess manufacturing facilities and capabilities, and inspect existing plants and proposed project sites. The mission also held discussions with the national agencies concerned about standardizing micro-hydropower equipment.

170. In August 1988, a study was completed, with financial assistance of US$30,000 provided by the Government of New Zealand, for the project: *Standardization of micro-hydropower components in the lower Mekong basin*.

171. The Government of New Zealand also provided US$27,500 for the organization of a workshop in Bangkok, from 24 to 27 October 1988, attended by fourteen riparian engineers, the Consultant who prepared the standardization report, Secretariat staff and a number of invited specialists experienced in planning, design, construction and operation of micro-hydropower schemes.

172. The workshop discussed the standardization report and adopted its recommendations for application in the Mekong basin. It also discussed the proposed local manufacture of equipment and closer technical co-operation among member countries. The University of Auckland donated a 60-kW electronic load controller to the Committee and arranged a demonstration during the workshop. It is planned to install the load controller at an existing station (Pong Nam Ron, Chiang Rai, Thailand) on an experimental basis.

173. For implementation of these pilot projects, the three member countries would contribute a total amount of US$569,000 while external assistance of US$340,000 would be required over a period of two years. These pilot projects will provide an opportunity for riparian technicians to receive training in micro-hydropower development and, in the long term, more skilled manpower will be available for further development efforts by the countries themselves.

*Feasibility study of improvements to Selabam power-station*

174. The Mekong Secretariat carried out field investigations and technical studies as part of a feasibility study to find ways to improve operations at Selabam power-station. The study, which was completed in September, was carried out under a sub-contract with UNDP's Office for Project Services (OPS), over a two-year period, financed (US$132,000) by UNDP, and resulted in a number of recommendations to improve the hydraulic conditions at Selabam.

175. One of the main recommendations was to construct an additional concrete overflow weir, to reduce flood water diversion into the tail-race area downstream of the power-station, and divert more flow into an adjacent branch of the river. Measures were also recommended to reduce the amount of sediment being deposited in the intake channel.
176. Engineering and construction work, which could start as soon as approval is obtained, could be carried out as part of the proposed extension of the power-plant being studied by the World Bank.

**Feasibility study of Nam Ngum-Luang Prabang transmission line**

177. A feasibility study of the project to construct a transmission line linking Nam Ngum and Luang Prabang, Lao PDR, indicated that significant benefits would derive from the implementation of the project. The results of the feasibility study of this project, completed in December 1987, were accepted by the Asian Development Bank (ADB) which expressed interest in providing financial assistance to the Government of the Lao PDR for the implementation of this project. The estimated cost would be some US$10 million.

178. The transmission line would provide the town of Luang Prabang with a reliable source of electricity. A planned cement factory at Vang Vieng, which is along the proposed route of the transmission line, would also be supplied with power. When constructed, the line would support industrial and agricultural developments in Luang Prabang and, by further extensions of the distribution system, also provide electrification to nearby centres of population.

179. The choice of the capacity of the line will be determined by the necessity to accommodate future connections with Sayaboury and Xieng Khouang provinces. The project is therefore expected to serve as the first stage in efforts to establish an interconnected transmission grid in the Lao PDR.

**Irrigation and drainage**

*Mekong Irrigation Programme*

180. On 1 November 1988, the *Mekong Irrigation Programme* was launched. This programme incorporates pump irrigation projects of the Committee on the Korat plateau, covering NE Thailand and the Vientiane plain in the Lao PDR, which share similar characteristics. The programme also serves to promote the exchange of experience between the two countries and provide training in irrigation and water management.

181. The Government of the Netherlands contributed US$3.3 million of the total investment (US$4.3 million) required to implement the 2.5-year project (November 1988-May 1991) which comprises five components: two in the Lao PDR (the *Mekong pump irrigation project, Phase II*, and follow-up support to the *Pak Cheng agricultural development project*) and three in NE Thailand (the *Water management support programme, Stage II, the Study on investment support and credit facilities for irrigated agriculture*, and the *Study on a water resources development plan for NE Thailand*).
182. The programme focuses on improving water management, operation and maintenance practices, strengthening farmers’ organizations, and assessing credit and marketing facilities, and represents a shift in approach from the earlier emphasis on design and construction.

183. A Netherlands consultant, in association with Thai and Lao consultants and government agencies, will implement the programme.

Construction of Tam Phuong water control project

184. Construction work on Phase I of the Tam Phuong water control project, in the Mekong delta, continued in 1988. The project, when complete, will make it possible to cultivate two paddy crops per year and to increase agricultural (specifically food) production in general by improving drainage and providing salinity intrusion control to some 5,900 ha of cultivable land.

185. During the year, work continued on the construction of the Da Loc sluice, and the on-farm system in 1988. Some 31 secondary canals were excavated, and 29 secondary sluices were built. Construction work on the Lo Cong bridge, on the O-Xay canal, was completed and the access roads were being improved.
186. Australian consultants provided training courses, in Viet Nam, throughout the year for the project personnel and technical agencies concerned, on project management, construction quality control, design of sluice gates, foundation design, energy dissipator design, and project operation and maintenance.

187. To improve the efficiency of agricultural production in the project area, an agricultural development plan was prepared and implemented in February by the project authorities. A report was also prepared on the agricultural and social development component for the project by an Australian agricultural expert.

188. During monitoring of the project in May, the drainage facility was observed to be operating effectively to alleviate the problem of waterlogging that had existed earlier.

189. An annual review mission visited the project site in November 1988 and observed that construction work on the project’s main features (main canals and sluices) was on schedule, but delays in construction of the on-farm works could be expected due to the inflation in the Vietnamese economy. The mission recommended that increased attention be given to agricultural extension services and training.

**Technical assistance to agriculture support facilities**

190. This project, which was financed by a loan from the Asian Development Bank (ADB), was formulated to provide irrigation for an area of 1,270 ha through the construction of three pump irrigation schemes, one in Khammouane province and two in Champassak province. At the request of the Asian Development Bank, the Mekong Secretariat provided technical assistance to the project throughout the year.

**Multi-purpose development**

*Prerequisites for common works hydropower projects in the lower Mekong basin*

191. Financed by the Swedish International Development Authority (SIDA), a study was formulated, to look into the organizational, financial and legal aspects on co-operation between the riparian countries in joint hydropower development. This includes a case study for the Low Pa Mong project on the mainstream and the Nam Theun 2 project located in Lao PDR. Important elements in the study are the appraisal of the potential power markets for the projects, and a comprehensive survey of international reference projects, from which vital information can be collected.

192. The main objective of the study is not only to highlight the possibilities and advantages inherent in joint developments of the Mekong hydropower resources, but also to make an inventory and analyse the different sets of preconditions, which will need thorough attention and satisfactory solutions, before the projects can be realized.

193. The study will also assess the possibilities of setting up a joint Lao-Thai power company in the future which, under governmental concessions, could be given the right and responsibility to construct these power projects. The financial and legal requirements for such arrangements will also be examined.

**Final design of the Huai Pa Thao multi-purpose project**

194. The project is located on the Huai Pa Thao river (a tributary of Nam Chi) in Chaiyaphum province, NE Thailand, and comprises the design of two earth dams and appurtenant structures, a power waterway,
water tunnel, penstock, power-house, tail-race channel, irrigation network, specifications for the supply and installation of electro-mechanical equipment, two transmission lines of 22-kV capacity with a total length of 20 km, and a 13-km raw water pipeline. Half of the water of the basin will be stored behind the upper dam, and then will be diverted to an adjacent basin (Kaeng Khlo district) where the power-house is located. Downstream, this water will be used to irrigate 2,400 ha of farm land. The other half of the water will be stored behind the lower dam and be used to irrigate some 1,800 ha in the main basin and supply drinking water to Chaiyaphum City, the provincial capital.

195. The final design, comprising the preparation of construction drawings and tender documents, was carried out from July 1987 to June 1988 by a Thai consultant and supervised by an international consultant from Switzerland.

196. The Huai Pa Thao multi-purpose project, which will produce about 18.4 GWh per year on average and be capable of generating peak power of 4.6 MW, will also help to increase agricultural production in Chaiyaphum province. Increases in the present level of crop production are expected to generate an additional annual income and the project is expected to create more job opportunities for the rural poor in the irrigated areas. The project will also provide water supply to some 160,000 people.

197. The study was financed by a grant of US$453,000 provided by the Government of Switzerland. The Government of Thailand contributed US$100,000 for geological investigations and mapping surveys.

Flood control and bank protection

Stage II of Mekong basin-wide bank protection

198. The plan for this project was revised this year and now focuses on the top-priority activities. Only one priority zone in each of three pilot areas (one in each of the riparian countries) in which bank protection works are to be constructed have been selected. The morphological studies are now oriented towards providing early warning to populated areas that remain unprotected. A meeting was held in Nong Khai, in March 1988, between the Lao, Thai and Secretariat project personnel, and another meeting was held in April 1988, between the Vietnamese and Secretariat project staff during a mission to the Mekong delta to discuss the revision and related matters.

Bank Protection Workshop, Nong Khai, Thailand
19 March – 2 April 1988
Opened by Deputy Governor of Nong Khai

199. Regular monitoring of the river morphology was continued for the priority sites in the Vientiane/Nong Khai reach and the four major affected sites in the Mekong delta. During the month of August, 358 bed material samples were collected along the longitudinal profile during the high flow period in the Vientiane/Nong Khai reach and these have been analysed. Equipment has been procured for long-term monitoring of populated areas not yet protected to provide warnings of
possible disaster in the three riparian countries. In February 1988, at Tan Chau, in Viet Nam, part of the river bank collapsed and 15 people died when some 50 houses fell into the river.

200. The construction of pilot bank protection works has been delayed as the funds available are limited. Other sources of funding are being sought to undertake these works in the coming dry season of 1989. Meanwhile, continuous monitoring is in progress to provide data to review the original plans as well as to update the construction costs.

201. Activities to date include compiling records of past experience available in the three riparian countries and collecting reference materials. A working document will be prepared using these materials.

**Construction of flood protection and reclamation of swamp and marshland in the Vientiane plain**

202. Work continued in 1988 on the construction of flood protection dikes and the reclamation of swamp and marshland in the Vientiane plain (Lao PDR). Construction work on the project started in 1982 with a grant from the European Communities (EC) of ECU 2 million.

203. Additional funds of ECU 0.4 million were approved by EC, in January 1988, to cover the cost of increasing the volume of earthfill work. This was required because the dike design and its alignment were modified to avoid bank erosion in places where the dike was too close to the Mekong.

204. Earthfill work (56,000 cu m) was carried out in 1988 by Lao construction companies. By December, some 80 per cent of the earthfill work had been completed on the main project component - raising the existing road-dikes along a 26-km stretch near the city of Vientiane. The dikes, which will be completed by the end of 1989, will protect some 3,000 ha of rice-farming land from damage by floods.

**Agriculture, watershed management and agro-industry**

**Seed multiplication farms (Phase I)**

205. In 1988, the seed multiplication farm at Hat Dok Keo produced and distributed more seed and a greater variety of seed thus enabling farmers to grow new crops on a larger area. The increased demand for seed is reflected in higher recorded sales of seed this year. The distribution of the seed now extends beyond Vientiane prefecture and Vientiane province and demand has been in excess of production.
206. Total revenue accruing to the Hat Dok Keo seed multiplication farm from sales in 1988 was Kip 1,790,400. The total value of production (including seed retained) was estimated at more than Kip 2 million.

207. At Ban Phone Ngam, near Pakse, construction work for the on-farm development of facilities and an irrigation distribution system and other related structures were completed in May, and some 20 ha were sown with maize, mung beans, soya beans and rice. Irrigation canals and concrete structures damaged by the rains have been repaired and upgraded.

208. At Thasano seed farm, near Savannakhet, construction work for the on-farm development was completed in October. Work on the installation of an irrigation pump system, including a pipeline, stilling basin and spillways was completed and the system is now operational.

Pak Cheng agricultural development (Phase II)

209. After harvesting the 1987 wet season crop, in early January 1988, maintenance work was carried out on the irrigation distribution systems and other related structures. A number of irrigation canals had been partially washed out by the 1987 rains. Repair work was carried out on several checkgates, division boxes, turn-outs and slide gates. To ensure adequate supply of water to fields located far from the existing canals, farmers constructed farm ditches.

210. In August 1988, the Pak Cheng bridge over the Nam Cheng was completed. A steel deck was installed instead of wood as originally planned. Abutment protection for the bridge remains to be completed.

Study of sandy soils for development and conservation

211. The Government of the United Kingdom provided financial assistance (US$294,000), through the South-east Asia Development Division (SEADD), for the initial stage of the Study of sandy soils for development and conservation which is to cover areas in NE Thailand. A short-term consultant, recruited in September 1988, prepared detailed terms of reference for the study for a team of experts specializing in soil science, land-uses and other related fields, who will carry out the work starting in 1989. The time-frame of the project is three years (1988-1991).

Lam Dom Noi land settlement

212. In August 1988, a draft final report was completed on the integrated development plan for the Project formulation and detailed design for the integrated development for the Lam Dom Noi land settlement, in NE
Thailand. The Government of Australia provided external funds (US$269,000), in March 1986, to enable the Committee to carry out the project. The Government of Thailand provided US$22,000 (in cash and kind).

213. The report deals with the proposed integrated development plan and sub-projects, with respect to the following subjects: water supply and infrastructure, public health, forestry, socio-economics, agriculture, aquaculture and fishery, livestock promotion, and other income-generating activities, and economic analysis.

214. During the year, the Department of Public Welfare completed the topographic and related survey work. Detailed designs and the final report are expected to be completed in March 1989.

**Study of small-scale agro-industries**

215. A preliminary study of the technical, economic and financial aspects of establishing small-scale agro-industries in the lower Mekong basin, carried out by the United Nations Development Programme (UNDP), ESCAP/UNIDO, and the Mekong Secretariat, was completed in October 1988.

216. The results of the study, which was initiated in 1987 with financial assistance provided by UNDP, indicated that rice bran, groundnuts, eucalyptus (as well as other fast-growing trees) and sugar-cane are some of the major agricultural crops/products of the lower Mekong basin which have potential for further local processing through the establishment of small-scale agro-industries.

**Fisheries**

**Development of fishermen communities in the Nam Ngum basin**

217. Activities on the project Development of fishermen communities, started in March 1988, with financial assistance of US$175,000 provided by the Government of Switzerland. The project aims to encourage the people living in communities around the Nam Ngum reservoir, who were relocated as a result of the construction of the Nam Ngum dam and reservoir, to adopt new techniques and improve existing ones to exploit the fish stocks at the maximum sustainable level.
218. Project activities that have been initiated in 1988 comprise: (a) planning of appropriate fishery management measures to maximize catch and improve fish stock; (b) reorganizing co-operatives to ensure the full participation of fishermen in the exploitation of the reservoir, collection and marketing of fish; and (c) providing health care, schooling facilities and drinking water facilities in the fishermen villages.

Construction of the NE Thailand fish, seed production centre

219. This project, the Fish seed production centre, was formulated to supply fish fry to replace natural stocks whose numbers have declined due to the development of irrigated agriculture in flood plains which are the natural breeding and nursery grounds for various species of river fish. The Government of the Netherlands has provided US$1.4 million in support of this project.

220. Land clearing activities in the project area, started in October 1988 at Yasothon, NE Thailand, to allow construction work to be commenced on the centre in January 1989.

221. Ecological studies will be carried out in January 1989 to provide further inputs for the project's implementation.

Inland navigation

Study on Mekong channel marking

222. Arrangements were being made to carry out the study on the Mekong mainstream channel marking for stretches of the river between Luang Prabang-Vientiane and Vientiane-Savannakhet, as well as in the Mekong delta. The study is expected to be completed during the first half of 1989 based on up-to-date hydrographic data and a field survey of the difficult passages. The report will provide guidance to the national agencies concerned on the requirements of navigation aids and for the low-cost installation of channel markers.

Study of siltation and channel maintenance at the Mekong and Bassac entrances

223. The preliminary study, which started in 1986, was completed in October 1988. Using satellite images and remote sensing techniques, this study delineated the minimum area required for detailed investigations in order to reduce the overall costs of the project.

224. In May 1988, the third field measurement campaign was conducted to provide ground-truth data for satellite interpretation and supplementary information for analysis of the major factors influencing the formation and extent of shoals on these important navigation routes.

225. The preliminary study revealed that the alignment of the navigation channel is more stable on the Mekong than on the Bassac, although the rate of land intrusion into the sea is higher on the Mekong than on the Bassac. Also, although it is difficult to assess the relative importance of marine sedimentation in relation to river sedimentation for each of the entrances, due to the limited number of data available, it is clear that the effects of marine sedimentation on the Bassac are more prominent than on the Mekong. This fact would make the development of the Mekong entrance for navigation purposes more economically attractive than the Bassac.

226. A detailed study is now proposed to focus on the Mekong entrance. It is estimated that the detailed study will be completed in three years.

Construction of ports at Tha Deua/Pak Khone and Luang Prabang

227. Project activities, including site investigation and survey, were carried out by an Australian consultant in July 1986, with
financial support (US$2.2 million) provided by the Government of Australia, and the construction designs were subsequently prepared. Construction work was started during the second quarter of 1987 when equipment and construction materials procured by the Secretariat were delivered to the project sites.

228. At Tha Deua, construction of the vehicular ferry ramp and three loading piers, including a transit warehouse and other related facilities, was completed during the third quarter of 1988. At Pak Khone, opposite Tha Deua, the construction of a vehicular ferry ramp was completed at the end of 1987.

229. The construction of a concrete ramp at Luang Prabang was started in May and completed in August 1988. Cargo-handling equipment, including a mobile crane and forklift trucks together with utility vehicles, were provided to facilitate port operations. Work on the three ports will be completed in the first quarter of 1989.

Improvement of Thanaleng cargo-handling facilities

230. With funds provided by the United Nations Capital Development Fund (US$2.5 million), work on the rehabilitation and expansion of Thanaleng port, the only river port handling imports and exports of the Lao PDR, was completed in November 1988.

231. Existing warehouses have been rehabilitated and new ones built, drainage and fire-fighting systems have been completed, and a cold storage plant erected and commissioned, as part of the project carried out under the supervision of the Mekong Secretariat.

Nong Khai Industrial and Boat-building Training Centre

232. The Boat-building Training Centre was established under the aegis of the Mekong Committee at Nong Khai, NE Thailand, in 1970, with assistance provided by the Government of the United Kingdom. Several hundred Thai trainees, and students from the other riparian countries, have been trained in trades connected with boat-building and related industries.

233. As the need for more skilled manpower in boat-building and related industries has grown in the region, a project was formulated in 1988 to upgrade the Centre’s training facilities. The Senior Expert Services (SES) of the Federal Republic of Germany formulated a new curriculum for the Centre which was approved by the Ministry of Education in late 1988. The Centre plans to introduce the new curriculum in 1989 and to increase the intake of trainees from its present level of about 200 a year.
Improvement of navigation channel

234. Navigation on the Mekong between Vientiane and Keng Kabao port during the dry season is only possible for small river craft or larger vessels with partial loads.

235. In 1987, the Government of the Federal Republic of Germany provided technical assistance to carry out a study on channel improvement on the Mekong between Vientiane and Keng Kabao. The study, which was completed in February 1988, recommended that dredging should be carried out to ensure efficient and safe navigation all the year round.
FINANCE AND ADMINISTRATION

Financial information

Income

236. The Committee’s total income for 1988 amounted to $10,063,064. Of the sum, contributions paid in by donors to the Interim Mekong Committee’s programme during 1988 amounted to US$9,306,453. The Committee continues to operate on a fully funded basis where all project commitments are covered by firm undertakings by the governments of co-operating countries.

237. Additionally, the three member states each contributed US$90,000 during the year making a total contribution of US$270,000 for the Committee’s activities. Other income, consisting of interest earned and income from the disposal of property and sale of documents, amounted to US$486,611.

Expenditures

238. Total expenditures during 1988 amounted to US$7,547,604. The major part of these funds (US$6,588,555) was used for the procurement of goods and services in support of the Committee’s work programme. Administrative expenditures from the Secretariat’s administrative reserve fund amounted to US$959,049. The Secretariat continues to implement cost-cutting measures to maximize its efficiency.

Administration

General

239. The work of the Committee continued to be carried out by the Mekong Secretariat located in Bangkok. In 1988, the Secretariat comprised approximately 96 staff, including 49 professional and 47 general service staff.

Computerization of Secretariat operations

240. The Secretariat’s computerized accounting system which was designed and developed in 1987, became fully operational in 1988. The financial Monitoring System with its on-line capacity at terminals located in offices throughout the Secretariat now allows, among other things, improved capacity of the Secretariat’s decision-makers at all levels to monitor immediately the financial developments related to their projects. This tool is an effective monitoring device for project implementation at both the programme and project levels.

241. Computer hardware was procured as needed and as budgets permitted to support the various needs of the organization. In addition to the computerization of the accounting and financial systems of the organization, the technical applications related to the scientific and socio-economic elements of the Secretariat’s work on the lower Mekong basin were being advanced further.

242. To co-ordinate effectively the Secretariat’s evolution on computer applications, a separate unit within the division of finance and Administration has been created using existing staff. This unit will be responsible for the development of systems related to finance and administration needs of the Secretariat and will also be in charge of ensuring full compatibility of hardware, software, and computer training.
Training

243. The Secretariat continued to place great importance on the training of its staff for ongoing development. A one-week course in December for all project staff focused on the proper design and conceptualization of quality projects. All staff were trained during the year on the new Financial Monitoring System. Other training was provided on various computer applications and on the procurement practices of the Secretariat.

244. Training in preparation of project design was conducted by a UNDP consultant, from 6-9 December, for project/programme staff of the Secretariat. The main emphasis was on the UNDP Project Formulation Framework (PFF). Elements of the PFF approach have been adopted by the Secretariat for use in the preparation of its project proposals.

245. The Consultant has also developed new Secretariat guide-lines for preparation of project proposal documents of the Committee, based on the experience obtained from the training course.

Institutional matters

Meetings

26th Committee session

246. The 26th session of the Committee was held in Bangkok, from 22-24 February 1988, at the premises of the Regional Office for Asia and the Pacific of the Food and Agriculture Organization (FAO). Dr Somphavan Inthavong, Member for the Lao PDR and Committee Chairman for 1988, presided over the meeting. The meeting was also attended by observers from ESCAP and UNDP.

Special Committee session

247. A Special Session was held on 18 April 1988, in Bangkok, when the revised Indicative Basin Plan was unanimously approved by the Committee.

27th Committee session

248. The 27th (plenary) session of the Interim Mekong Committee was held from 8 to 11 June in Vientiane, Lao PDR, and was attended by representatives of 26 countries and 11 international agencies in addition to the member countries of the Committee.
249. The meeting was chaired by Dr Somphavan Inthavong, Chairman of the Committee for 1988, and opened by Mr Saly Vongkhamsoa, Vice-Chairman of the Council of Ministers and Chairman of the State Committee for Economy, Planning and Finances of the Lao PDR.

250. Mr Saly thanked co-operating countries and organizations for their support and expressed the hope that interest in such support would continue to grow in the future and that the full participation of all members of the Committee would soon be restored.

251. Representatives of the co-operating countries and agencies expressed their interest in and support for the revised Indicative Basin Plan, which was presented at the plenary session. The revised plan provides guide-lines for the updating of the Committee’s development work. Several countries stressed the importance of maintaining and developing the regional character of the Committee’s activities and pointed out the importance of receiving information on the progress made in the various projects.

252. The session ended with co-operating countries confirming support to the Committee worth nearly US$36 million for the development of lower Mekong basin resources.

Special meetings

Navigation seminar

253. The Mekong Secretariat organized a Seminar on Navigation Activities in Vientiane, Lao PDR, from 2-5 August 1988, for navigation experts from the Lao PDR, Thailand and Viet Nam. The seminar aimed to refocus attention on the use of the Mekong as a waterway and to assess the planning capabilities of navigation experts in the riparian countries that would enable a long-term plan to be formulated. It also served as a forum for the exchange of ideas for priority projects that accord with the recommendations of the Indicative Basin Plan (1987) that provides a framework for this and other sectors up to the year 2000.

Micro-hydropower workshop

254. A four-day workshop on micro-hydropower development and the standardization of design and manufacture of micro-hydropower equipment was held in Bangkok, from 24-27 October 1988, sponsored by the Mekong Secretariat with the support of the Government of New Zealand.

255. The workshop recommended the implementation of three pilot projects, each with capacity of some 100-200 kW at Huay Salot (Lao PDR), Lam Chang Han (Thailand) and Ea H’leo (Viet Nam). Electricity produced by the projects will be used for domestic uses in rural areas and for small agro-industrial processing and pump irrigation projects.

256. During the workshop a 60-kW electronic load controller was donated by the University of Auckland. The device will be installed in a micro-hydropower station at Pong Nam Ron, Chiang Rai, Thailand.

Chief Hydrologists Meeting

257. The first meeting of Chief Hydrologists was held at the Mekong Secretariat from 14-16 September 1988. The meeting reviewed the achievements of the hydro-meteorological network operations in 1987, the progress of activities in 1988, and the formulation of a long-term plan.

258. The participants also discussed the improvement of data base management and data processing and the optimization of the network. A recommendation was made to reclassify the network to separate national and basin networks to make operations more efficient.
259. The proposed improvements will be carried out with financial assistance provided by UNDP and the Government of the Netherlands which has approved finance of Dfl. 1.4 million (US$700,000), over the period 1988-90, for the project Hydrometeorology and mathematical modelling.

**Principal missions and visits**

**Netherlands mission**

260. The Deputy Director-General of the Department of Development Co-operation in the Netherlands, Mr. L. Hanrath, visited the Mekong Secretariat on 4 May 1988, and was briefed on the history and activities of the Mekong Committee.

261. Assistance provided by the Government of the Netherlands has been chiefly in support of irrigation and water management projects, but has also included major fisheries projects in Thailand and the Lao PDR, and river bank protection work.

**SIDA mission**

262. The Director-General of the Swedish International Development Authority (SIDA), Mr. C. Tham, visited the Mekong Secretariat on 10 May 1988. During his visit he was able to confirm the pledges (amounting to US$5.4 million for the period 1988-1991) made at the Committee’s 27th session.

263. These funds are earmarked for use in several of the Committee’s projects supported by the Government of Sweden, in the field of environmental studies and management, including the Water Quality Monitoring Network project, and feasibility and detailed design studies for small water resources projects in the Lao PDR, as well as hydropower development in Viet Nam.

264. Besides briefing on the work of the Secretariat he was given a presentation on the GIS (Geographic Information System), a software package used in setting up an environmental data base.

**UNDP Accountability Mission**

265. The 1988 Accountability Mission of the United Nations Development Programme to the Mekong Secretariat was headed by the Assistant Administrator of the United Nations Development Programme, Mr Andrew Joseph. The Mission, from 18-20 July, also comprised Mr Sebastian K. Zacharia, Chief, Division for the Regional Programme for Asia and the Pacific, Mr Roger Berthelot, Water Resources Development, Mr Gerhard Rahn, Administration, Management and Finance, and Ms Margaret Carey, Regional Programme Officer.

![UNDP Accountability Mission and Mekong Secretariat staff (July 1988)]

266. UNDP’s assistance to the Mekong Secretariat for the current phase 1987-89 is US$4.6 million (US$952,000 for Basin Planning, US$2.0 million for Data Collection and Information System, and US$1.6 million for other activities). Throughout the existence of the Committee, UNDP has contributed approximately US$44 million. The confidence shown by UNDP in the effectiveness of the Committee’s development programme has served to attract assistance from cooperating countries and agencies totalling some US$600 million.
267. The mission made specific note of the fact that the Mekong Secretariat had some very experienced staff, who had previously worked on Mekong projects in Kampuchea, and since there was a wealth of data and technical information/expertise available, the Committee should play a very important role in the overall rehabilitation and development of Kampuchea once problems were resolved, and could serve as an interface between UNDP and that country.

**AIDAB visit to the Secretariat**

268. The Assistant Director-General, South-east Asia Branch of the Australian International Development Assistance Bureau (AIDAB), Mr Alex Agafonoff, visited the Mekong Secretariat on 15 September 1988. He was briefed on the work of the Committee and informed of the progress made in the Australian supported projects of the Committee.

269. Australia currently provides support to the Committee for studies of salinity intrusion in the delta, a water control project at Tam Phuong, a freshwater prawn hatchery at Vung Tau, a port construction project at Tha Deua/Pak Khone, in the Lao PDR, and the Lam Dom Noi settlement project in NE Thailand.

**Study tour to France**


271. Also included in the programme was a visit to the Service Consultant en Observation de la Terre (SCOT), the SPOT IMAGE Centre in Toulouse, and a number of other institutions and consultant organizations in fields related to the Committee’s work.

**Inter-regional meeting on river and lake basin development**

272. Representing the Chairman of the Committee, Mr Sisouphan Choummalivong, Vice-President of the National Mekong Committee of the Lao PDR, presented a case study: *The development of the lower Mekong river basin*, at the Inter-regional meeting on river and lake basin development organized jointly by the Economic Commission for Africa and the United Nations Department of Technical Co-operation for Development from 10-15 October 1988, in Addis Ababa, Ethiopia.

**ESCAP 44th meeting**

273. The Chairman of the Committee, Dr Somphavan Inthavong, and the Executive Agent, Mr C. Jan Kamp, attended the 44th meeting of the Economic and Social Commission for Asia and the Pacific (ESCAP), held in Jakarta from 11-20 April 1988.
ANNEXES
<table>
<thead>
<tr>
<th>No.</th>
<th>Project</th>
<th>Country</th>
<th>Purpose</th>
<th>Total cost / (US$ million)</th>
<th>Year of Completion/Status</th>
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<td>P</td>
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<td>new project</td>
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Notes:  
L : Lao PDR  
T : Thailand  
V : Viet Nam  
K : Kampuchea  
P : Power  
I : Irrigation  
F : Fisheries  
A : Agriculture  
N : Navigation

a/ Price level at the construction time  
b/ Total estimated
# CASH AND IN-KIND CONTRIBUTIONS RECEIVED
FOR THE PERIOD
1 JANUARY 1984 TO 31 DECEMBER 1988
(in US$)

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<td><strong>TOTAL</strong></td>
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<td><strong>9,504,870</strong></td>
<td><strong>7,589,118</strong></td>
<td><strong>10,195,380</strong></td>
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