MKG / 106

COMMITTEE FOR COORDINATION OF INVESTIGATIONS
OF THE LOWER MEKONG BASIN

ANNUAL REPORT
1983

P R E F A C E

This report is prepared in accordance with Article 10 of the Interim Mekong Committee's Rules of Procedure which, in reaffirming the provisions of Article 6 of the Mekong Committee's Statute, requires, inter alia, the submission of an annual report of its activities to the participating Governments as well as to the Economic Commission for Asia and the Far East (ECAFE), renamed the Economic and Social Commission for Asia and the Pacific (ESCAP) in 1974. The above Article, in conformity with provisions of the Mekong Committee's Statute, also authorizes the release, with the Committee's concurrence, of such reports or their summaries to other Governments and international organizations.

Following the submission of the Annual Report to ESCAP, a brief description of the Committee's activities as reflected in the Report for the relevant year is incorporated with ESCAP's Annual Report to the United Nations Economic and Social Council (ECOSOC) in accordance with paragraph 15 of ESCAP's terms of reference.

Submisaion of the Annual Report to ESCAP also served in the past to meet the Committee's obligation to prepare a report of its activities each year, in line with the administrative requirement of the United Nations Development Programme (UNDP), for its Project for Institutional Support to the Committee, and to the United Nations while the latter was acting as executing agency for the UNDP Project. However, since the beginning of direct execntion of the project by the participating Governments themselves in 1979, this requirement has been replaced by that of reporting direct to UNDP on a semi-annual basis.

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Chapter 1

THE COMMITTEE AND BASIN PLANNING

THE POTENTIAL OF THE LOWER MEKONG BASIN

1. The Mekong, one of the world's largest rivers, may be considered as Southeast Asia's most substantial single natural resource. Until major developments on the mainstream take place, each year an average of more than 475,000 million cubic metres of water flows, almost completely unutilized, through the mouths of the Mekong delta into the sea. The drainage basin of the lower Mekong, with the development of which the Committee for Coordination of Investigations of the Lower Mekong Basin (Mekong Committee) is concerned, covers more than 600,000 square kilometres - and comprises almost the whole of the Lao People's Democratic Republic and Kampuchea, one-third of the Kingdom of Thailand and two-fifths of the Socialist Republic of Viet Nam. It is inhabited by a population of some 40 million, representing just over one-third of the total population of these countries.

2. The hydrologic regime of the lower Mekong is not markedly affected by conditions in the upper basin but mainly reflects the alternating dry and wet monsoon climate of the lower basin. The river begins to rise each year in May and reaches its highest elevation in August or September, which marks the end of the southwest monsoon season. Then, during the dry northeast monsoon season, it falls until May. The magnitude of difference between flows during the dry and wet seasons can be indicated by measurements at Kratie, where the average low flow can be as little as 1,800 cubic metres/second, compared to an average flood flow which can be as high as 52,000 cubic metres/second and an average flow of 14,000 cubic metres/second. This seasonal flood of the Mekong is largely drawn from the tributaries that join the mainstream along its nearly 2,400 km-long lower course. At a flood peak, there is generally extensive flooding in the lowlands which can cause considerable damage to crops and property in contrast to the moisture deficiency of the dry season, which imposes severe destruction upon crop production and also limits the navigable depth in the mainstream. Thus, the two obvious natural problems presented by the lower Mekong are the control of the annual flood and the alleviation of dry-season moisture deficiency.

3. By comparison with most other Asian river basins, that of the lower Mekong is not, at present, densely populated so that resources of land, forest and water are still relatively plentiful. Such natural resources may also be considered abundant in relation to the need for their utilization at the present stages of development of the regions in the basin. For instance, food production has not only kept pace with the rapidly increasing population but has also provided an exportable surplus for regions outside the basin.

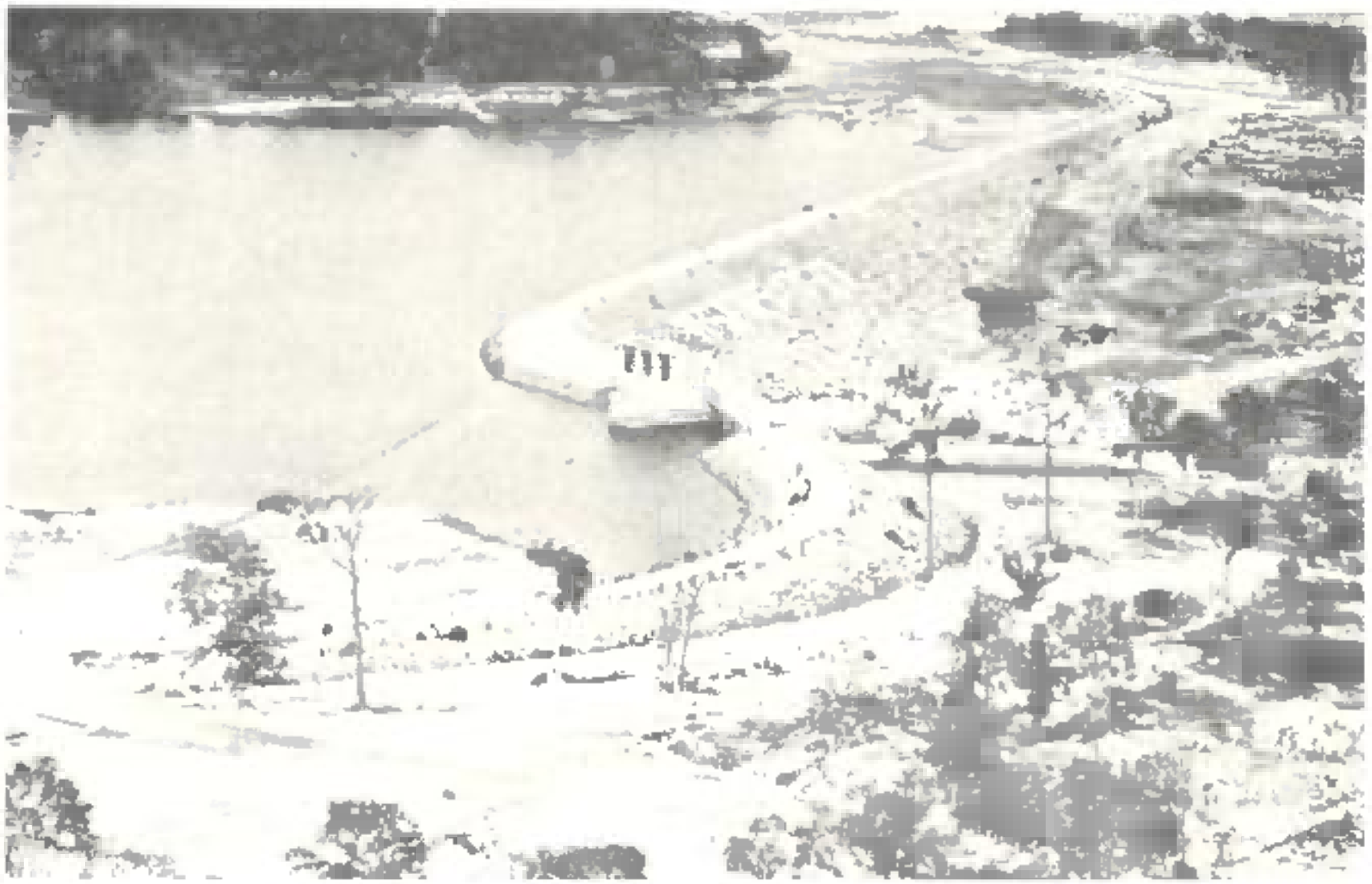
4. Indeed, the basin's natural resources will remain relatively plentiful for some time to come so long as their utilization is rationalized. The traditional process of achieving growth in agricultural output by the expansion of the cultivated area will, sooner or later, reach its practical limits, and use will have to be made of more intensive cultivation and improvement of land productivity by means of wet-season water control to avoid losses and dry-season irrigation to combat moisture deficiency. At the same time, while the countries in the basin display dominantly agricultural economies in which the production of a simple wet-season rice crop is the staple element, they are making a determined effort to develop an industrial sector, initially based on the processing and manufacture of agricultural products, more of which will be required for industrial development. This new industrial sector will also contribute to the need for greater output of cheap energy occasioned by development.

5 Studies sponsored by the Mekong Committee have confirmed that such demands could be met out of the basin's vast potential. It has been estimated that, even with unchanged agricultural technology, there will be enough irrigation water to provide food for 140 million people, the population the riparian countries can expect to have in seven years' time if it grows at the projected rate of 2.5 per cent per annum. It has also been determined that the economic electric energy potential of the lower Mekong basin is in the order of 150 billion kilowatt-hours per year or six times the current demand for electric power in the riparian countries. Over the long run, such demand is expected to grow at the average rate of 8 per cent annually, and it will take at least 23 years for it to catch up with the basin's potential.

6 Quite apart from the possibilities of irrigation and water control for the benefit of more intensive agriculture and hydropower production for the developing industries at a cost far below that of thermal power, the vast potential of the Mekong River and its tributaries also affords excellent opportunities for rural electrification, fisheries, navigation and other useful activities in the riparian countries.

THE INDICATIVE BASIN PLAN

7. The first comprehensive effort to assess the vast potential of the lower Mekong basin was the preparation of an 'Indicative Basin Plan' (1970-2000), which, in a sense, is something of an inventory of water resources in the lower Mekong basin. On the basis of data collected from field research and pre-investment investigations on the part of experts from some 30 countries over a period of more than a decade, and at the cost of some US$60 million, the Indicative Basin Plan was completed in 1970 after four years of preparation. As an inventory of resources, the Plan reveals the possible width of the Mekong Committee's activities and includes 16 possible mainstream and 180 possible tributary projects on top of a full spectrum of ancillary activities. As an inventory of resources and possible projects, it also provides essential direction for the



The Sirindhorn dam (above) on the Lam Dom Noi and the Chulaphorn dam (below) on the Nam Phrom in northeast Thailand are among the major dams which have been constructed in the lower Mekong basin with assistance from the Committee

continued expansion and refinement of investigations of those projects for which sufficient basic data were not available at the time the Plan was prepared.

8. In purporting to serve as a planning tool of major importance to the lower Mekong basin, the document describes an indicative framework for the lower Mekong basin's development over the following 30 years and ways of improving the quality of life of the 30 million people living in the basin at the time. As such it is a sectoral plan and is destined to provide essential guidance to the countries in developing their general economic and social development programmes by pointing out the possibilities afforded, and limitations imposed, by the available water and related resources. It slso points to the opportunities, through co-operative development of joint water resources, for co-ordination and harmonization of the development activities of the riparian countries.

9. In particular, it emphasizes the orderly development of the water and related resources of the basin to provide the infrastructure and services including flood control, irrigation and drainage for increased agricultural production, and electrical power for industrial and other uses as well as some improvement in water supply and navigation,

10. A general emphasis is placed on the improvement and expansion of agricultural production as they are regarded as indispensable to: the betterment of the economic and social status of the rural population of the riparian countries, the production of adequate food to satisfy the existing and growing future demands of the total population and the provision of essential raw materials for industry and export. With this aim in view, the Plan envisages the progressive development of facilities for providing adequate flood control, water storage, irrigation, drainage and water management, needed for full potential agricultural production, and also provides a programme of the associated activities which are essential to enable the farmers to improve their agricultural practices and really achieve the production level of which the area is capable.

11. In view largely of the dependence of industrial development on the availability of adequate amounts of electrical power at a reasonable cost, the Plan has also been devised to satisfy such demands. In anticipation of this it contemplates the installation of hydropower generating facilities, transmission lines and, in some instances, complementary thermal generation up to the year 2000.

12. Incidental to serving the primary purposes of agricultural production, industrial development, flood control and power generation, the facilities envisaged in the Indicative Basin Plan are also meant to provide industrial and domestic water supplies, and improved navigation and fisheries.

13. With its collaborative approach the Indicative Basin Plan points to the overwhelming advantages of integrated development of the basin over any possible separate development of the component parts on a purely national basis. As a sequential investment plan for the basin's integrated development, it sketches possibilities for:

(a) A short-range plan (1971-1980), costing US$1,428 million and involving mainly tributary projects that could be developed independently of one another;

(b) A long-range plan (1981-2000), costing US$7,494 million and involving mainly mainstream projects, mostly interdependent and aimed at meeting national and regional needs;

(c) A complementary programme costing US$2,965.3 million and covering all ancillary activities required to bring out the full benefits of these projects, both in the short-range and long-range plans.

14. However, this estimated total sum of US$11,887.3 million represents only direct investment. When account is also taken of indirect investment, in the form of outlays designed to permit the full utilization of power and water to be made available for planned projects, as well as of the cost of serving various other industrial and agricultural developments, the total investment is envisaged at US$40,000 million (at 1970 prices). When a moderate annual rate of inflation of 10 per cent is assumed, other things being equal, the total investment cost contemplated by the Indicative Basin Plan would stand, in 1983, at US$138,080 million.

15. During the 14 years of the Mekong Committee's existence up to the time of the Plan's completion, out of 180 possible tributary projects identified in the Plan, nine had already been completed under its sponsorship, at a cost of some US$77 million. By 1983, 14 such tributary projects had been completed at an investment cost in the order of US$225 million, spread over a number of years and, since the Committee's inception, by 1983 some US$520 million had been committed for the Work Programme as a whole. Moreover, rapid changes occurred in water resources management and land use in the intervening years, especially in the upper and middle reaches of the Mekong River. For instance, deforestation and introduction of new agricultural practices could have affected runoff and low-flow characteristics of the Mekong. Of course, the exact nature and impact of these changes on the regime of the river and its basin await findings from ongoing studies.

16. The essential data forming the basis of the Indicative Basin Plan cannot be assumed to have remained unchanged. Such changes that have occurred globally as well as within the riparian countries, together with the outcome of the Secretariat's data collection activities since the Plan's completion, have rendered it imperative that the Plan be revised. Indeed, the Plan itself has constantly been subject to review; partial revision has been started with the reviewing and updating of such data including those on topography, meteorology, hydrology, soils, land use, agriculture, power, minerals, transport, and economic and social factors.

17. On account of such periodic updating and review work, the Indicative Basin Plan has become a broad and flexible framework for planning studies and investigations of the basin. While accepting that harnessing the Mekong mainstream will yield immense benefits in terms of flow regula-

tion, energy production, irrigation, flood control and navigation, it has been the Plan's basic development strategy - which seems to have stood the test of time so far - that mainstream development cannot be attempted unless and until such requisite experience and data that have been accumulated from relatively modest tributary development can be brought to bear by the Committee on planning and managing the construction of large-scale projects on the mainstream.

THE ROLE OF THE COMMITTEE AND ITS SECRETARIAT

18 The lower Mekong basin's vast resource potential, as revealed by studies leading up to the Indicative Basin Plan, had, until the establishment of the Mekong Committee, been left largely untouched for lack of necessary conditions. The establishment of the Mekong Committee has significantly helped to create these conditions. Twenty-five years of basic data collection under the auspices of the Mekong Committee have gone some way towards meeting the long-felt need for basic data. Moreover, as the resource potential is shared by the riparian countries, assistance and support by international consultations and co-operation are therefore indispensable; the Mekong Commitee has provided the necessary framework for these essential processes. Finally, in the Mekong Committee is found an organization which can ensure that the development of the basin keeps pace with its perceived needs.

19. For more than a quarter of a century, water resources development in the lower Mekong basin has been fostered by the Mekong Committee, which was established in 1957 by the Governments concerned in response to a recommendation adopted by what was then ECAFE at its 13th session in March 1957.

20. The goal of the Mekong Committee, as laid down in its Statute, is the comprehensive development of water resources and related resources of the lower Mekong basin -- including the mainstream and its tributaries -- for hydro-electric power, irrigation, flood control, drainage, navigation improvement, watershed management, water supply and related development. The attainment of this goal is predicated on the realization that, only through genuine and active co-operation between the riparian states can the truly enormous potential of the Mekong River system be harnessed and exploited to meet the needs of their population. Continuous in nature, the consultations between the member states are believed to contribute to better economic co-operation, the resolution of potential conflicts of interest, and improved international understanding.

21. The Mekong Committee met 69 times in the period between 1957 and 1975, the Chairmanship rotating annually among the four riparian countries. However, following important political changes in the region in 1975, no meetings of the full Committee were held in 1976.

22. Convinced of the urgent need for the joint development of the water resources of the lower Mekong basin, representatives of the Lao PDR, Thailand and Viet Nam met in Bangkok in April 1977 and reached agreement on the steps to be taken to proceed with new water resources development activities, pending resumption of participation by the fourth riparian

country in the work of the Mekong Committee. This was followed by a Declaration formally establishing the Interim Committee for Coordination of Investigations of the Lower Mekong Basin (Interim Mekong Committee) which was signed by representatives of the Lao PDR, Thailand and Viet Nam on 5 January 1978. It, inter alia, reaffirmed the mandate of the Mekong Committee and placed special emphasis on the development of water resources in the basin for increasing agricultural and power production, in order to meet the growing needs of reconstruction and development of the Lao PDR and Viet Nam and the widening economic development needs of Thailand.

23. The Interim Mekong Committee held its first meeting in Hanoi in February 1978. Since then, the Committee has met regularly with the venue rotating between the member countries, as had been the case with the full Mekong Committee.

24. In 1983 the Committee held three sessions under the chairmanship of Mr. Prapath Premmani, Member for Thailand and Committee Chairman for 1983. The first (sixteenth) session, which was a "plenary" in the sense that representatives of co-operating countries and agencies were invited to attend, was convened in Vientiane from 13 to 19 January 1983. The seventeenth session was held at Bangkok from 2 to 4 June 1983 and the eighteenth session at Ho Chi Minh City from 8 to 15 September 1983. During 1983 the following Members represented their respective countries on the Interim Mekong Committee: the Lao PDR - Dr. SomPhavan Inthavong, Vice-Minister, National Planning Committee; Thailand - Mr. Prapath Premmani, Secretary-General, National Energy Administration; and Viet Nam - Mr. Dinh Gia Khanh, Vice-Minister of Water Resources.

25. It is through such sessions that the Mekong Committee has been able to work together, within the flexible framework of the Indicative Basin Plan and on the basis of the annual Work Programme, and with the support of the Secretariat. Along with the constant pursuit of the long-term planning activities aimed at ensuring that major projects which require many years of preparatory work will be ready at the time when they are needed, other projects are developed on a collaborative basis. The Committee identifies and develops basinwide, mainstream and tributary projects; even those projects located within national boundaries, whether they are in the field of watershed management, agricultural experimentation, navigation training or agro-industrial development, are, because of their basinwide relevance, jointly planned and managed by the Committee.

26. At its eighteenth session, the Committee decided to alter its annual session structure, and the number of annual sessions has been reduced from a minimum of three, as required by its Rules of Procedure, to two with a view to achieving economies in the expenditure of resources and time and to improving overall efficiency of operations. With this new structure, a plenary session will be held each January, following the time-honoured principle of rotation among the member countries. At the plenary session the Committee will meet with the representatives of co-operating countries and agencies to engage in an open dialogue with them. It will also be an occasion for the Committee to review the actual status of Work Programme implementation, take stock of progress made as

well as of problems encountered in the implementation of projects sponsored by the Committee, mobilize resources on the part of co-operating countries and agencies in support of selected projects and examine issues relating to overall policy.

27. On the other hand, an ordinary working session will normally be held in June at the Committee's headquarters in Bangkok, to allow the Committee to delve into the details of project implementation and Work Programme planning as well as internal management questions. It is understood, of course, that the Committee is free at any time to convene special meetings, above and beyond the mandatory minimum of two per annum, at the request of any one or more of its Members.

28. Ar the national level, the three participating Governments have all established a National Mekong Committee, which is normally headed by the Member for that country, to ensure that all important questions scheduled for consideration by the Committee are carefully examined in advance and that the work and the decisions of the Committee are made known to all those who are or should be involved in their execution. National Mekong Committees thus help to follow up decisions made by the Mekong Committee and serve to co-ordinate activities at the national level.

29. In performing its functions, in conjunction with the National Mekong Committee, of fostering co-operation in international river basin development and promoting the spirit of mutual support for development efforts in the riparian states, the Committee realized at an early stage of development the value of having a permanent Secretariat. The need for international support for such a Secretariat arose when, in 1963, it became evident that the Mekong Committee, having gained in strength after five years of activity, needed a substantial and capable Secretariat to plan, direct and co-ordinate the many studies investigations and other activities included in the annual Work Programme. It was found that UNDP, with its development-oriented assistance programme, its world-wide interest in supporting projects of regional co-operation and its available resources, was in the best position to make a sustained contribution in support of a basic establishment such as the Secretariat.

30. The first phase of institutional support from UNDP (at that time known as the United Nations Special Fund), as envisaged, began in 1964. Five phases have since elapsed, the current phase (Phase VI) for US$6,610,000 (together with US$650,000 of cash contributions from riparian member governments) having started in April 1982 to cover a three-year period.

31. In approving Phase V of the Institutional Support project, UNDP agreed, in 1979, that the project should be government-executed (an extremely important step in the process of assisting the Committee to achieve greater autonomy and self-reliance) so that eventually it might be able to assume, on the basis of continuing international support, the status of an independent inter-governmental body with its own legal framework.

32. Following the initiation of government execution of the inatitutional support project, another crucial development in UNDP's support to the Committee occurred in the period covered by its current phase (Phase VI) of inatitutional support. In 1980, when elaborating its inter-country programme for Asia and the Pacific, UNDP felt that the time had come to move away from pure institutional support to the Committee, with some of the Phase VI funds being made available for the support of specific action-oriented projecrs under the Committee's Work Programme. As a consequence, and concurrently with Phase VI of the institutional support to the Committee, UNDP in 1982 begsn a separate project of programme support, amounting to US$1.4 million for planning, data collection and pre-investment projects sponsored by the Committee.

33. Tripartite monitoring reviews and technical reviews were instituted by UNDP, and both the institutional and programme support projects have been subject to periodic review in accordance with UNDP's established policies and procedures for monitoring project and programme implementation. To monitor and evaluate the utilization and impact of UNDP's inputs for institutional and programme support, the Administrator of UNDP established a Monitoring Committee which has been meeting on an annual basis and has had full access to the semi-annual progress reports, financial statements, auditor's reports and all other such documentation concerning the Secretariat's activities as deemed necessary for the monitoring process.

34. In the course of its last meeting held in April 1983 the Monitoring Committee reviewed the work performed by various Secretariat bodies set up to deal with such matters as appointments, promotion, contracts and property surveys, as well as the semi-annual progress reports to UNDP and expenditure reports for the year ending 31 December 1982. It also considered the developments with regard to the project identification and selection process carried out within the framework of the Indicative Basin Plan. In particular, it pointed to UNDP's new policy emphasis on programme support while maintaining institutional support to the Interim Mekong Committee. A joint meeting was also held with the Members of the Interim Mekong Committee to impress upon the latter the changed emphasis in UNDP's policy.

35. Through the provision of such institutional and programme support on the part of UNDP and co-operating countries and agencies, the two latter groups having made available expert services, fellowships and other assistance, both in cash and in kind, the Secretariat has been able to carry out its three main functions:

(a) Co-ordinating studies undertaken by or on behalf of riparian authorities or the Committee, as well as its own studies made on behalf of the Committee. In this function it is supported by the existence of basic data, especially those relating to hydrology, climate, hydrology, topography, pedology, transport and demography, which have been collected over the past two decades for the purposes of Project preparation and long-term planning. Such studies

may include surveys, feasibility studies, economic studies and system analysis required for identification and development of projects for the Committee's approval prior to fund-raising.

(b) Mobilizing resources, on behalf of the Committee, to finance activities and projects sponsored by the Committee. Such projects may have originated as studies co-ordinated or undertaken by the Secretariat. In its effort to mobilize resources in support of projects, the Secretariat identifies and develops a proper mechanism for the transfer of external resources. For instance, with its general purpose funds the Secretariat can envisage such modalities as joint and parallel financing.

(c) Executing projects, supervising their execution or reporting on their execution.

36. Admittedly, these functions do overlap and constitute essential elements of the characteristics of the Secretariat's activities.

37 In view of the substantial resources devoted to them, the Secretariat'a executory and aupervisory functions have gained in importance. With respect to field projects and special activities requiring funding, the Sectetariat, acting on behalf of the Committee, serves in some cases as the donor's executing agency and provides all the agreed external inputs with funds channelled through its accounts. The projects so executed have recently come to be loosely termed as "Mekong-administered projects". In other cases the Mekong Secretariat, acting again on behalf of the Committee, performs controlling supervisory or reporting functions in a variety of forms, the exact nature of which depends on the requirements of the donors and recipient riparian countries concerned. In the latter category, loosely termed as "Mekong-supervised projects", cash resources in the form of outright grants or loans are given directly to the recipient riparian countries concerned and expenditures out of these grants and loans are therefore neither channelled through, nor controlled by the Secretariat.

38. Institutional support to the Secretariat and support for the Work Programme from various sources make up the Committee's total resources. In 1983 additions in cash and in kind, in the form of pledges for and contributions to institutional support and resources for projects in the Work Programme approved by the Interim Mekong Committee, totalled US$15,743,114. The cumulative total of resources in cash and in kind actually contributed or pledged to the Mekong Committee and the Interim Mekong Committee, or to projects sponsored by the Committee, from 1957 to the end of 1983 amounted to US$520 million, of which US$391 million (75 per cent) was for investment for construction and US$129 million (25 per cent) for pre-investment investigations and planning. The sources from which these resoutces are detived are shown in Annex I.

Chapter 2

PROGRAMME PLANNING AND IMPLEMENTATION

BACKGROUND

39. The Work Programme for 1983, as in previous years, continued to follow the general framework laid down in the Indicative Basin Plan and served as a broad basis for implementation of projects sponsored by the Committee during the year. It comprised six sectoral programmes hydrology and meteorology, basin planning, land and water resources development, navigation improvement, agriculture and fisheries, and power, industry and minerals. These sectoral programmes were further divided into 20 sub-programmes, which were, in turn, sub-divided into 106 separate project activities.

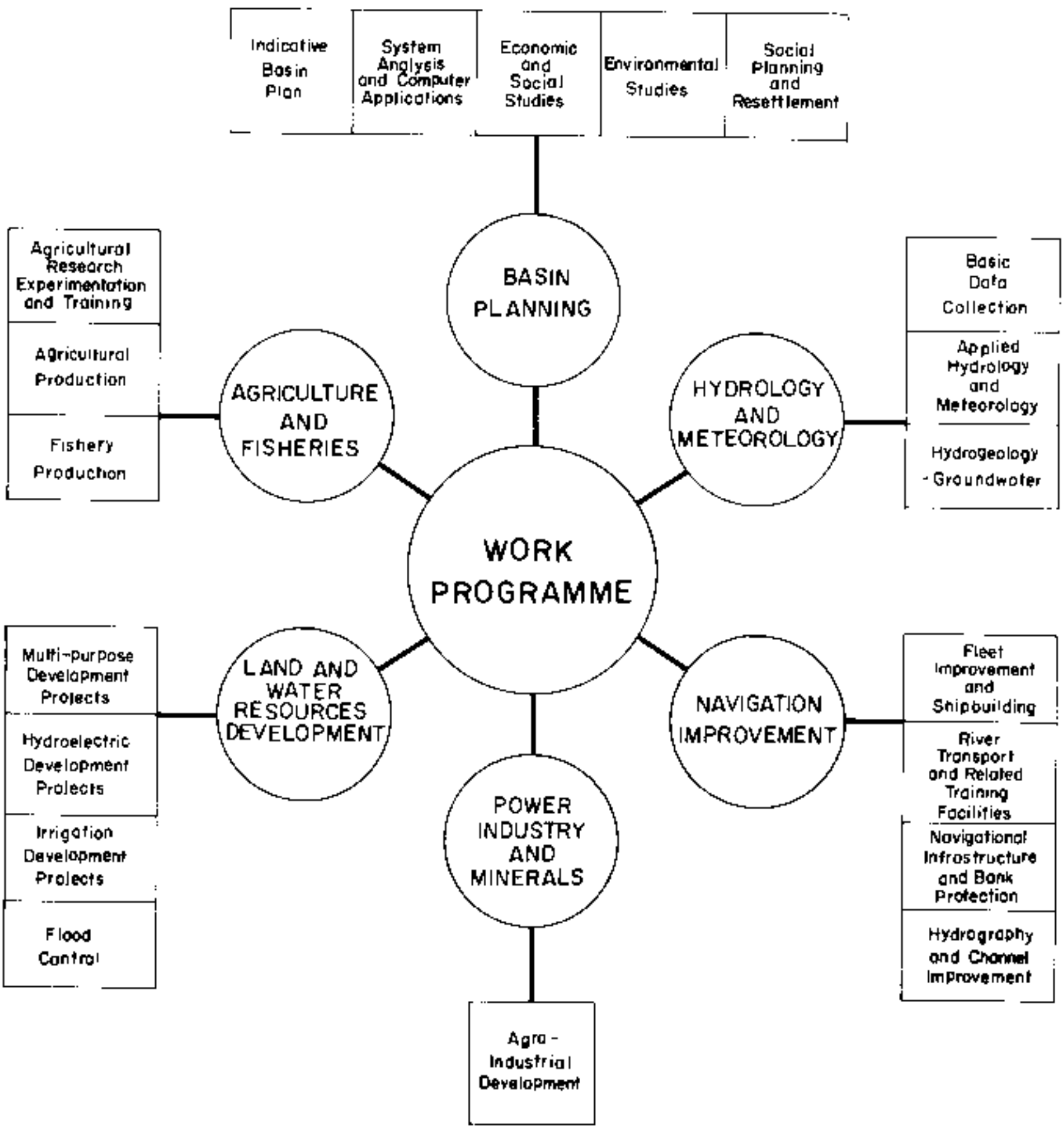
40. The Work Programme for 1984 has the same structure as that for 1983, and contains 110 project activities, of which 13 are new. Nine of the projects listed for 1983 are no longer in the Work Programme for 1984, because of completion or for other reasons. However, a number of projects are of a continuing nature and as such have been brought forward from 1983.

41. The contents of the Work Programme reflect the close consultations which the Secretariat has had with the National Mekong Committees prior to their formal adoption at an appropriate Committee session. In 1983, for the first time, these consultations took the form of programming missions fielded by the Secretariat to the member countries before the formal adoption of the Work Programme for 1984 at the eighteenth session of the Committee.

42 The Work Programme is so organized that, for ease of identification and reference, a programme sector, a sub-programme, and a project are given separate code numbers. Thus, under the programme sector of hydrology and meteorology (1), 1.1 stands for the sub-programme of basic data collection and 1.1.01 for the project 'Maintenance of the hydrologic and meteorologic network'.

43 On paper, complete implementation of the 106 activities contained in the Work Programme for 1983 would have required US$157 million worth of manpower and other resources, while something in the order of US$215 million is required for the manpower and other resources needed by the 110 activities contained in the Work Programme for 1984. However, costing cannot always be consistently complete. In other words, projects included in the Work Programme are at various stages of planning and development. More is known about some projects than others, and the funding requirements listed in the Work Programme are, in several instances, only tentative in nature. With improvements in project planning and programming, the total funding requirements of the Work Programme should better reflect actual needs in Work Programme implementation.

WORK PROGRAMME STRUCTURE
(Programmes and Sub – programmes)



44. In this chapter the thrust of the Committee's work will be examined with the help of observed work trends. Such trends of Work Programme implementation, as could be discerned in 1983, will be treated under a quaternary division into basinwide activities, mainstream development and related studies, tributary development and training, and also in accordance with the order of sectoral groupings as defined in paragraph 39. This should serve as the perspective in which full details of project implementation, given in Chapter 3, can be viewed.

CONCEPTUAL DESIGN OF THE WORK PROGRAMME

45. The Work Programme for 1983 and 1984, as outlined above, typifies the kind of work that the Committee has been pursuing over the past two decades. Such a Work Programme has been designed to reflect both the functions which an international river basin authority, faced with the peculiarities of a given river system, is expected to perform and, through water resources development, the special development needs of the member countries that it must meet. It has continued to include provision for both pre-investment activities like planning and data collection, and investment activities like the construction of dams and improvement of navigation channels. Nevertheless, projects drawn up have not necessarily fallen neatly into two water-tight compartments, since several of them encompass final construction phases as well as initial phases of pre-investment studies. As the Work Programme represents a means of achieving certain ends, it cannot be understood without reference to such objectives as have underlain the Committee's Work Programme throughout its history of operation.

46. The basic aim of the hydrology and meteorology programme sector is to develop a system for securing, by means of basic data collection through a network of hydrologic and meteorologic stations placed at strategic points in the basin as well as by other means, a comprehensive and detailed knowledge of hydrology (surface and groundwater) and prevailing meteorological conditions in the basin, and to apply this knowledge to short-term and long-term water resources planning and such operational activities as systems of flood, low-flow, in-flow and salinity forecasting developed by the Secretariat. Such a network needs to be constantly serviced, maintained and expanded in order to improve accuracy and fill the gaps in the system of data collection, particularly since the fields of sedimentology and seismology are also involved.

47. The sector on basin planning, taken in its broadest sense, includes appraisal and formulation of individual projects. It is aimed at developing, with the help of a computer-supported information system, system analysis and modelling, a comprehensive framework for the integrated development of the water and related resources of the lower Mekong basin to meet the long-term collective needs of the riparian countries. Socio-economic and physical data, derived from national sources and basinwide surveys and projections, are constantly being analysed to constitute a statistical base permitting the continuing refinements of projects.

48 The type of basin planning being developed is geared towards ensuring that social and environmental concerns are, by means of such methods as case studies of completed projects, bench-mark surveys and the establishment of a monitoring system, incorporated in the planning and implementation of projects so that benefits may be maximized and adverse social and environmental effects minimized. The outputs of this programme sector are typically represented by satellite-based basinwide maps (showing optimum methods of water supply and drainage, the basin's ecosystem, land use, pedo-geomorphology and crop suitability) and refinements to the Indicative Basin Plan.

49. The overall aim of the land and water resources development sector is the integrated development of potential irrigable land and storage projects on the Mekong mainstream and its tributaries, in an effort to meet regional food and energy demand at minimum costs. In the sub-programme of hydroelectric development, an attempt is made to co-ordinate hydroelectric power development in the basin and to promote co-operation in the exchange of power through the construction of inter-connected transmission lines among member countries. Projects so far identified under this sub-programme range from large (such as Nam Theun in the Lao PDR) to very small (such as those in northern Thailand).

50. In the irrigation sub-programme the main target is the efficient planning and development of pumping and other types of irrigation in the lower Mekong basin, with particular emphasis on the preparation of overall plans for certain priority areas and on the enhancement of land utilization. Finally, the flood control sub-programme aims at studying and providing, for certain priority areas including urban and agriculturally fertile land, short-term flood-control measures which are compatible with long-term mainstream regulation, considered to be the most effective means of flood control for the middle reaches of the river.

51 The objectives of the sector of navigation improvement for long-haul as well as cross-haul river transport are: to make the Mekong River and its tributaries a waterway system on which, with constant improvements of navigation channels, repeated topo-hydrographic surveys -- particularly of difficult passages -- and timely dredging and installation of navigation aids, ships can navigate safely; supply it with shore facilities -- which will be constantly improved and maintained as well as safeguarded by bank protection works -- such as agglomerations and cargo assembly points at ports along the river, making the use of the river system economically attractive; and provide the riparian countries with modern river fleets capable of replacing obsolescent river craft and taking advantage of the potential thus opened up.

52. Along with fleet modernization comes training in shipbuilding and navigation-related trades to enable navigation personnel in the member countries to keep up with new equipment and facilities. Of course, the overall need to plan projects in the navigation improvement sector calls for periodic traffic surveys which are expected to yield information on the volume and categories of cargo transported by place of shipment and destination.

53. Activities in the agriculture and fisheries sector are aimed mainly at solving, by means of the development of these two areas the prevalent problems of lowland productivity and rural poverty in the riparian countries. With rainfed agriculture prevailing in the Lao PDR and northeastern Thailand, and flood-adaptive cultivation predominantly in the Mekong delta, the riparian countries are now confronted with the introduction of irrigation, drainage and other water-control measures; research is therefore required to optimize the benefits of these measures. Agricultural research and experimentation concentrate on enhancing the theoretical potential by establishing a number of research stations, together with experimentation and demonstration farms, to carry out trials related to significant aspects of agriculture in each region of the basin, such as soil conservation, multiple cropping and water distribution, and to disseminate the results from such studies to local farmers with special recommendations. In addition, the training component in the sub-programme is aimed at providing technicians from the member riparian countries with opportunities of absorbing and becoming familiar with new knowledge and techniques in agriculture and related fields.

54 The sub-programme of agricultural production lays special emphasis on how to increase agricultural production by planning and launching agricultural development and pioneer projects in each member country, along with such related activities as introduction of new economic crops and improvement in marketing techniques. The final sub-programme of fisheries attempts to enhance the benefits and offset the adverse effects of water resources development on fisheries resources of the basin.

55 In the last sector covering power, industry and minerals, attention is concentrated on the sub-programme of agro-industrial development which can play an important role in the various stages of the development process. Technologically speaking, agro-industries are relatively simple to develop and the factor endowment of the member countries, where unskilled labour is plentiful and capital scarce, cortesponds to their requirements. Since such industries depend on widely-spread agricultural inputs they need not be concentrated in industrial centres, but can instead be dispersed throughout a country and therefore help to stimulate development and employment in rural areas. The agro-industrial development sub-programme at present is concentrating on studies and surveys to identify agro-industrial investment opportunities and pre-feasibility studies for specific industries, preparatory to investment promotion.

BASINWIDE ACTIVITIES

56. Under its sectoral programme on hydrology and meteorology the Committee sponsors and helps to operate and maintain a basinwide network of stations (1.1.01), which supplies basic hydrologic and climatic data on a year-round basis. Data collection has continued to widen the Committee's knowledge of the lower basin. Within the framework of the hydrology and meteorology programme sector, and on the basis of data transmitted to the Secretariat from the network during the high-water season, a flood forecasting operation (1.2.02) has been mounted annually. Meanwhile, in

an effort to reinforce the collection of discharge data on the Mekong mainstream, a preliminary study was also carried out in 1983, under the hydrology and meteorology programme sector, in order to determine the technical feasibility of applying the velocity index method to streamflow measurements along the Mekong, and the Committee recommended that the study first be conducted on a pilot basis. Under the same programme sector, an experimental low-flow forecasting operation for the delta (1.2.03) was continued for the prediction of flows during the critical low-flow period. New hydrologic and meteorologic stations are being added to the network in the member countries under a continuing expansion programme (1.1.05) as well as the rehabilitation of some existing stations under the same programme. The basic data supplied by the network of stations relate to river levels, current velocities, discharge, sediment loads, evaporation rate, salinity, and rainfall, and are essential for operations as well as for the short-term and long-term planning of water resources projects. The data received from the hydrologic network are processed by the Secretariat and published in the form of a hydrologic yearbook, and its 1981 issue was prepared for publication in early 1984.

57. In the basinwide water balance study (1.2.06), the Committee has felt the need for a method for systematically reviewing the water balance in the basin to identify, record and analyze the rapid changes in water resources management and land use over the last 30 years,especially in the upper and middle reaches of the lower Mekong. Phase I of the study, which was completed in 1982 with assistance of the United Kingdom and its Institute of Hydrology at Wallingford, indicated that there had been no changes in low-flow characteristics of the Mekong in recent years. With similar arrangements, Phase II of the study was launched in 1983 in order to develop a network-routing model which will provide a framework within which the effects of the various developments on downstream flows can be asssessed and enable estimates of areal rainfall to be made from point records.

58. While a great deal is known about surface water, the lack of data on groundwater within the lower Mekong basin has been a constraining factor with regard to the future management of water resources within the basin. In addition, it is feared that interaction between surface water and groundwater may change the quality of water utilized in ongoing Projects and in turn may adversely affect the efficiency of these projects. To ascertain the actual groundwater situation (1.3.01), Stage I of the investigations was initiated in 1983 with financial assistance from UNESCO. It is expected that further work in this area will consist of the preparation of more detailed investigations in areas to be selected by the Committee.

59. Since its inception the Mekong Committee has placed great emphasis, within the basin planning programme sector, on the systematic collection of accurate basinwide information and data relating to potential development, in order to be able to assist in planning integrated development of the basin. Activities have continued in the Secretariat in updating essential data series and verifying assumptions on which the Indicative Basin Plan (2.1.01) has been based. The Committee

has also participated in the NASA Earth Resources Technology Satellite (LANDSAT) programme, and three thematic maps on a scale of 1:1,000,000 have been prepared and published with assistance from France to depict soil types, land use and crop suitability. Further work in ecosystem mapping (2.1.03) will be carried out on a regional basis with a view to producing a report recommending measures for improving land use and Productivity within each region of the basin, taken as an ecosystem.

60. In the course of the Committee's more than 20 years of continuous investigations and operations a wealth of data, including those embodied in the Indicative Basin Plan and in the basin's ecosystem maps, have been collected and it has long been felt that there is a need for assembling the existing components into a data bank (2.1.05) to cope with collection, processing, rapid retrieval and storage. Computer support (2.7.02) and programming services have been maintained for the various components of the data bank, as well as for system planning activities and general data-processing applications. After a review in 1982 and 1983 of its electronic data processing (EDP) requirements, as a pre-requisite to upgrading its computer facilities, the Committee approved the purchase of a computer system to replace the system which had been rented for the previous five years.

61. In 1982, UNDP agreed to provide financial assistance for the data bank and, in 1983, with assistance from the United Nations Department of Technical Co-operation for Development (UNDTCD) a draft plan of operation was prepared for a 'Lower Mekong Information System' (2.1.05) — (a broader concept than a data bank). Along the same lines, with financial assistance from the Netherlands, a study was initiated in 1983 with the aim of establishing, as another component of the lower Mekong information system, the lower Mekong water resources inventory (2.1.06), a computerized summary presentation of economic information and known data on potential development projects in each sub-basin.

62. Basinwide environmental studies (2.9) have been pursued, within the framework of the basin planning programme sector, in collaboration with the United Nations Environment Programme (UNDP). Such studies include ecological multidisciplinary studies to assess the effects of selected development projects on the environment as a whole, with a view to evolving appropriate, environmentally sound management measures. The project for establishing a basinwide water quality monitoring network (2.4.03) is one example of the work being carried out in this area. The project was formulated with the help of UNDP, and in 1983 Sweden agreed to finance it. The project is expected to give a comprehensive assessment of current water quality and should furnish the material for predicting changes in water quality likely to be brought about by various development activities and the effects of those changes. The study could eventually lead to the preparation of a water quality policy for the basin. Similarly, with a project for watershed management (2.9.07) to be launched with financial assistance from EEC, it is hoped to solve, as far as possible, the problem of deforestation arising mainly out of shifting agriculture, especially in the more hilly parts of the Lao PDR. The project is designed to provide a basinwide alternative of a less

exploitative means of earning a livelihood for shifting cultivators and also to begin the process of reafforestation in the affected areas.

65. Sectoral studies on selected economically or socially important resources likely to be, or known to be, affected by water resource development have also been included in the basinwide environmental studies. In the public health field, changes in environmental parameters engendered by resource development could foster the growth of certain disease vectors and add new vectors to the existing mass. This could be accentuated by the current general health and nutritional status of the inhabitants. Following a pioneering four-year study of schistosomiasis, completed by the Committee in 1974, a preliminary survey of the basinwide waterborne disease situation in the basin (2.9.08) began in 1983, in Thailand.

64 In the land and water resources development programme sector, a Project of basinwide relevance and importance contemplates research into the application of hydraulic rams and turbines (4.3.03). In view of the probable future shortage of energy and of its high cost, special attention has been paid to small-scale water resources development projects and the efficient use of water power in recent years. It is believed that hydraulic rams and turbines can economically meet the needs of the basin, especially in mountainous areas in the Lao PDR and the delta in Viet Nam where tidal turbines may be applicable. It is planned to identify applicable sites by field reconnaissante and desk studies, and the feasibility of applying such technology will be carefully examined. The final objective will be to manufacture, on the basis of locally available labour material inputs, standardized hydraulic rams, turbines and related components.

65. In the sector of agriculture and fisheries, the Committee has felt that an agronomic approach is essential for agricultural development of the lower Mekong basin, where rainfed agriculture (Lao PDR and northeast Thailand) and flood-adaptive cultivation (Mekong delta) are dominant. An example of this approach can be found in the proposed establishment of a research and development farm in a kenaf fibre-producing area of northeast Thailand (8.2.05). The proposed farm will accommodate retting facilities, a selected seed production area, research and development facilites, demonstration plots, and other facilities. It will be located in the vicinity of an irrigation project to ensure that an adequate supply of retting water is available. The project will address itself principally to research and development in providing farmers with selected seeds, improved fibre retting techniques, supply fertilizers and insecticides, technical system and credit. It wll also assist them in improving grading, bailing and marketing.

66. Similar in nature is the seed multiplication farms in the Lao PDR (8.2.04) supported by EEC. Apart from producing and multiplying a continuing supply of good-quality, true-to-type seeds for distribution to farmers, potentially suitable new and improved varieties will be made and trials carried out.

67. Existing crops need to be improved and new ones introduced through continuous agricultural research and experimentation, no matter how far irrigation, drainage, flood control, salinity control and other such engineering measures have been taken in an effort to improve the basin area. A prime objective of the Committee has therefore been the strengthening of agricultural research and experimentation and dissemination of the results to farmers. Within such a framework, the introduction of ley farming (8.1.04) into upland areas of northeast Thailand commenced in 1980 and continued in 1983. An extension stage for resting the applicability of small-scale dairying on legume leys has also been launched. The basinwide significance of the ley-farming project in northeast Thailand is borne out by the fact that the findings from it have been successfully applied in the Pak Cheng agricultural development project (2.4.03), where the evacuees from the Nam Ngum dam in the Lao PDR have been resettled.

68. Another prime objective of the sector on agriculture and fisheries has been to conduct research into irrigation efficiency and ways of improving it. In line with this objective, another agricultural research project of basinwide significance has been designed to study water management support in northeast Thailand (8.1.05), pump irrigation being prevalent in various parts of the basin.

69. Of equal relevance in terms of their basinwide importance have been fishery projects typified by the pilot fish farms at Tha Ngone (the Lao PDR) (8.4.04) and at the Lam Pao dam (Thailand) (8.4.05), constructed to establish the feasibility of farm fisheries development in irrigation areas and to serve as experimental and demonstration centres, which can be duplicated, conditions permitting, elsewhere in the basin. These projects offer interesting possibilities of developing non-arable land and fallow water areas, particularly within the irrigation service areas of different projects, for intensive fish culture as a means of maximizing project benefits, as well as saving, rehabilitating and propagating endangered species of fish. Feasibility studies of three similar farms, one in Thailand at Lam Dam Noi for freshwater fish (8.4.10) and two in Viet Nam for brackish water fish and marine shrimps (8.4.06) have been completed, and funds are being sought to enable their early implementation.

70. Closely related to agricultural development has been agro-industrial planning undertaken by the Committee in the programme sector of power, industry and minerals. Following completion of a pre-feasibility study on kenaf for paper pulp, with assistance from the United States in 1975, private investment has resulted in a major pulp mill based on kenaf grown in northeast Thailand, where the supply of such raw material has helped to provide employment to something like 20,000 farming families. Moreover, when account is taken of government policies and socio-economic constraints in regard to the industrialization of the outlying regions of the riparian countries, it has been felt that not only should selected agricultural processing plants be established in rural areas but also that the growth of more comprehensive industrial systems in those areas should be encouraged. Plans have therefore been made, with assistance from Belgium, for a pre-feasibility study, to be undertaken in

1984, of an integrated vegetable oil/livestock processing agro-industrial complex (9.1.01) which would appreciably raise the profitability of the various production components by taking advantage of all the various linkages.

MAINSTREAM DEVELOPMENT

71. Since agriculture in the Mekong delta is to a large extent inhibited by the predominance of saline water intrusion, at varying degrees and with seasonal variations according to the distance from the river mouth and the river stage, the Committee has felt it necessary to use the hydrology and meteorology programme sector to solve this practical problem. Within the framework of this programme sector, delta salinity studies (1.2.05) have been undertaken to improve the Committee knowledge of the interrelationship among the factors involved. The outcome of the studies should go some way towards providing the Committee with a sound basis for deriving a rational method of utilizing water resources in the Mekong delta.

72. Construction of a mainstream dam could cause environmental changes beyond narrow tolerable limits. There is therefore a danger that such environmental features as natural flooding that trigger the pattern of fish migration forming part and parcel of normal life cycles of fish species may be lost. This would result in failure to spawn and possible decline or even collapse of all the fisheries of those species. If the species so affected contribute significantly to the fishery sector, the economic losses would be considerable. More work along these lines under environmental studies, within the framework of the basin planning programme sector, will be carried out in the course of 1984 (2.9.09 and 2.9.10).

73. Since the Mekong Committee's inception, it has become increasingly evident that an important key to the economic development of the basin lies in harnessing the Mekong River itself. Within the framework of the land and water resources development programme sector, when attention is concentrated on production of electric power it has been the belief that all tributary projects together will not be able to contribute more than a small portion of the total future power needs of the region. The choice will therefore be either utilization of Mekong mainstream power or heavy reliance on thermal power with its high recurring fuel costs. Again, it is believed that the irrigation needed to increase agricultural production to meet a growing demand for food in the next two decades cannot come from tributary projects alone. Moreover, since large areas in all riparian member countries suffer damage caused directly or indirectly by Mekong flood flows, irrigation development in those areas cannot be envisaged without flood control resulting from mainstream regulation.

74. Mainstream investigations, in the land and water resources development programme sector, have so far led to the identification of 16 possible mainstream projects in the lower Mekong basin including alternatives, and these 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. Investigations have advanced to various stages, from preliminary desk studies and site investigations to comprehensive feasibility studies, for example, in the case of Pa Mong.

75. Technical and economic studies have been pursued on Pa Mong for 25 years and at a considerable investment costs, and these have culminated in a report on the organization and financing of the project submitted in 1982. The Committee feels, however, that certain aspects of the project need to be reviewed along with a further assessment of its effects on upstream areas. In 1983 a study of planned irrigation alternatives of Pa Mong examined the various possibilities for irrigation development and presented detailed information aimed at facilitating decision-making in relation to the scheme's full supply levels at 230, 240 and 250 MSL, including the Nam Lik/Nam Mong exclusion schemes. However, further in-depth studies are required and will be undertaken to determine comparative merits of alternative Pa Mong options as well as the upstream and downstream impact of the project on such things as the navigation channel and navigation infrastructure.

76. Environmental studies (2.9) of an ecological multidisciplinary nature have continued. Following a mission fielded by UNEP in 1980, and the issue of its report in 1981, a joint UNEP/Mekong mission was fielded again in 1983 as part of Phase II of the environmental survey in the delta, in order to prepare a research and pilot development project with a view to ensuring that development objectives are achieved without affecting the delta environment and its resources. The latter's report recommended, for the Committee's consideration, projects to assess the environmental impact of agricultural development on the delta and to develop, on a pilot basis, utilization of acid sulphate and saline acid sulphate soils.

77. In the same programme sector of land and water resources development, irrigation and flood control activities have been undertaken along the mainstream. The project for Mekong Pump irrigation in the Vientiane Plain, Lao PDR (4.3.04), in operation since 1978 under a grant provided by the Netherlands, is a case in point. It consists of 11 pump stations installed with 32 electric pumps along the Mekong River, downstream of Vientiane, and its long-term goal is to provide all-year-round irrigation water for about 3,000 ha of existing paddy fields. This project is similar in nature to the activities being undertaken along the mainstream in Thailand, within the framework of the pump irrigation project on the Mun/Chi (4.3.06).

78. Another project of a wider scope is flood protection and swamp reclamation in the Vientiane Plain report (4.4.02), under implementation with a grant from EEC. It has been designed, as part of the overall plan for the agricultural development of the Vientiane Plain, to protect large areas of cultivated land along the Mekong from flood damage and to reclaim swamp and marshland in the That Luang/Salakham area near Vientiane. The Committee has completed a technical study on the reclamation of the swamp

area, which includes the engineering aspects of reclamation as well as a reconnaissance survey with reference to the environmental and fisheries aspects.

79. In the same sector of land and water resources development, several studies for the purpose of project identification would conform to an overall model for the type of future irrigation and flood control development of the basin that would depend on mainstream regulation. Under such development, it is believed that substantial flood control could be achieved, especially over an extensive area of lowlands in the middle reach of the Mekong, both in the Lao PDR and Thailand. Mainstream regulation could, given favourable conditions, also improve drainage conditions in the Vietnamese part of the delta, facilitate salinity control in the coastal belt and ensure the availability of fresh water for dry-season irrigation of the entire delta. Moreover, water from the Mekong might also be available for irrigating the lowlands adjacent to the Mekong in the Lao PDR and Thailand and the flat lowlands and some of the low terraces in the Mun/Chi basin in northeast Thailand.

80. Out of such studies have emerged projects like Huai Mong (4.4.03) for flood control and irrigation in the Pa Mong Stage I area. With assistance from EEC and equipment donated by Belgium, work on it has started as a pioneer project consisting of a regulator at the mouth of the Huai Mong (at its confluence with the Mekong), dikes and electric pump stations for drainage as well as flood control and distribution systems. The Huai Mong project could serve as the model for other projects like Nam Suai and Nam Songkhram in other sub-basins of the lower Mekong basin.

81. Another project of this nature is the Huong My water control project (4.3.09) destined to control salinity intrusion into, and supply irrigation water to, potentially productive land in the Mekong delta.

82. From the standpoint of the navigation improvement programme sector, the Mekong mainstream can be seen as a waterway which provides an excellent means of transporting goods and passengers. Unfortunately, it cannot be navigated throughout its whole length owing to the presence of various obstacles and its navigational potential cannot be fully utilized for lack of shore facilities. Moreover, owing to the strong current and widely fluctuating water level, bank erosion occurs in many places, especially in the upper part of the river running between Thailand and the Lao PDR. This is aggravated by the meandering nature of the river which leads to erosion at different locations in an unpredictable pattern. Over the years, a number of projects have been implemented by the Committee for the purposes of improving the navigability of the Mekong and facilitating haulage of goods and passengers. These include ramp construction in Thailand and the Lao PDR, beaconing upstream of Vientiane and rock-blasting at Keng Kabao in the Lao PDR the creation of a boat-building industry training centre at Nong Khai, northeast Thailand, and improvement of the river fleet in the Lao PDR.

83. To create an infrastructure which can efficiently handle waterborne passenger and cargo traffic, ports have been built within the

framework of the navigation improvement programme sector. In 1983 further headway was made with the establishment of a transit port at Keng Kabao (6.2.04), comprising the construction of infrastructural facilities. In anticipation of the sizable increase in cargo volumes upstream as a result of the scheduled completion of the Keng Kabao transit port, a solution has also been found for coping with future traffic at the Lao PDR ports of Thanaleng and Lak Si (6.2.03). In this continuing effort to foster infrastructural development in support of navigation, other ports have also been planned on other parts of the mainstream. These included ports at Luang Prabang, Tha Deua and Pak Khone in the Lao PDR and at My Tho, Vinh Long, Can Tho and Long Xuyen in the delta, Viet Nam.

84. Work in bank protection (which, together with navigational infrastructure, constitutes a sub-programme within the navigation improvement programme sector) has been undertaken to safeguard valuable infrastructure as well as property. In this respect, the Committee, with the help of heavy earth-moving equipment donated by the Netherlands, has carried out works in critical places with methods which have differed from place to place as account is taken of such factors as the angle of attack by the current, current velocity, soil composition, and local availability of protecting materials. In more recent years special attention has been focussed on a major scheme for the Nong Khai/Vientiane area for flood protection as well as erosion control, and it is hoped that more substantial work on this can proceed in 1984.

TRIBUTARY DEVELOPMENT

85. In the hydrology and meteorology programme sector, and on the basis of data transmitted to the Secretariat from the recording stations during the high-water season, an experimental flood forecasting operation for the lower Nam Ngum (1.2.04) was continued during the flood season of 1983.

86. One of the major tributary activities undertaken by the Secretariat, under the programme sector of basin planning and within the framework of environmental studies, has been the three-phased Nam Pong environmental management research project. Implemented with funds provided by the Ford Foundation and UNEP, the three phases of the study included a simulation model formulated for the Nam Pong system.

87. Other major activities in tributary development have been undertaken under the programme sector of land and water resources development. Up to 1983, 14 tributary dams (four in the Lao PDR, nine in Thailand and one in Viet Nam) have been completed on tributaries in the lower Mekong basin. Some of these dams could be classified under the sub-programme of hydroelectric development (4.2) since, initially, they have been operated mainly for the production of hydroelectric power, with irrigation to be provided later on. On the other hand, other projects could be classified under the sub-programme of irrigation development (4.3), since they have been meant exclusively for providing irrigation water. A small minority, like Nam Pong and Lam Dom Noi in Thailand, could be classified under a sub-programme of multipurpose development (4.1), since they have been providing both hydropower and irrigation water.

88. Expansion has been planned on some of the completed tributary dams in order to exploit their full potential. One of these, the Nam Ngum, since its completion in 1971 has been exporting something like 850 GWh (approximately 80 per cent) of its production of power to Thailand, from which about 90 GWh (about 10 per cent) of the surplus power has been re-exported to southern Lao PDR via the Thai transmission system. The Lao PDR has undertaken Phase III of the dam's expansion, with assistance from IDA and the OPEC Fund, and contracts have been awarded for the installation of a fifth turbine-generator unit of 40 MW, which will add to the existing total generating capacity of 110 MW; installation work is expected to be completed in 1984. Another tributary project, for which expansion has been recommended by a study financed by Japan, is Drayling in Viet Nam, and it is hoped that financial support will be forthcoming to increase its existing capacity of 480 kW to 12,000 kW. The project also has the potential to irrigate 13,000 ha of farm land.

89. Apart from completed tributary dams, 11 projects either to provide hydroelectric power or to provide irrigation or water control in the Lao PDR and Thailand are under construction. One of these, Huai Mong (4.4.03), has been mentioned in connexion with mainstream development because of the interesting possibilities it offers in combination with mainstream regulation. In another activity, the Se Bang Fai flood control and irrigation project (4.4.05) in the Lao PDR, construction work has continued with funds provided by UNDP. Finally, the four dams on the Nam Cheng, Nam Souang, Nam Houm and Nam Moun (4.3.01) form part of a project to develop irrigation in the Vientiane Plain. These projects are excellent examples of the kind of work pursued by the Committee in developing the tributaries for hydropower, irrigation and flood control.

90. Apart from tributary dams in operation and under construction, a number of studies have been conducted by the Secretariat for the purpose of identifying promising tributary projects for hydropower development, flood control and irrigation. So far, data on 144 such projects, out of the total 188 identified by the Indicative Basin Plan, have been compiled.

91. Prominent among such projects under investigation are Nam Theun (4.2.01) and Houay Phaling (4.4.07) in the Lao PDR, Nam Mae Kham (4.1.03) and Lower Mun Basin (4.3.07) in Thailand, Yali Falls (4.2.04) and Quan Lo - Phung Hiep (4.3.11) in Viet Nam, along with three other projects modelled after Huai Mong in northeast Thailand.

92. A desk study was carried out in 1970 on a possible dam on the Nam Theun (4.2.01) in the Lao PDR, intended as an export-oriented hydropower plant in addition to the existing Nam Ngum No.1. The pre-feasibility study was started by the Secretariat in November 1983.

93. A preliminary study of the Houay Phaling project (4.4.07) to explore possibilities of installing a flood control regulator at the tributary's confluence with the Mekong, along the same lines as Huai Mong in Thailand, combined with low-lift pumping was completed in 1981. Funding is being sought for a study to prepare the detailed engineering designs as

well as appraise pump irrigation possibilities on the basis of electricity supplied from the Selabam hydropower station in the Lao PDR or the Lam Dom Noi station in Thailand.

94. Following a request from the Government of Viet Nam, the Secretariat has approached the Government of Sweden for assistance in appraising and updating the feasibility study of the Yali Falls hydropower project (4.2.04). The terms of reference for an appraisal mission were prepared and forwarded to the Government of Sweden, which has approved the proposal and work is expected to start soon.

95. The Quan Lo - Phung Hiep (4.3.11) project area is located on the southeastern side of the Quan Lo - Phung Hiep canal (the freshwater supply canal) and is part of the extended Rach My Thanh drainage area in Viet Nam. The implementation schedule foresees a five-year construction period. The final objective is to create water control conditions with 9-10 months of fresh water, allowing two rice crops to be grown yearly on a large scale.

96 A preliminary study of hydropower potential was made by a consulting firm for the Thai Government in 1978 of the Nam Mae Kham project on the largest tributary in the Nam Mae Chan sub-basin in northern Thailand. The survey indicated possible development by means of a rock-fill storage dam and recommends further investigations up to the feasibility level. The project is multipurpose in nature and consists of hydroelectric power generation (from a 20 MW installed capacity) of 40 million kWh per annum, irrigation for some 5,000 hectares, flood control and fisheries development. The National Energy Administration (NEA) of Thailand has already carried out several investigative studies, including topographic surveys of the dam site and reservoir area, and a preliminary geological survey of the project site. In view of the increasing demand for electric power in Thailand, NEA has recommended that priority be given to carrying out further investigations of the proposed Nam Mae Kham hydroelectric project up to the feasibility level (4.1.03).

97. A feasibility study on development of the lower Mun basin (4.3.07), financed by the Netherlands, was completed in 1982. The study indicated that irrigation development would provide a good rate of return. Similarly, a feasibility study was completed in 1981, with assistance of Switzerland, on the proposed flood control and irrigation project in the Nam Suai basin (4.4.04), one of three projects (Nam Suai, Nam Kam and Nam Songkhram in northeast Thailand) modelled after Huai Mong, currently under construction. Work on the detailed engineering designs and tender specifications is awaiting an investment commitment. The objectives of the project, as in the case of Huai Mong, are to eliminate or reduce flooding on some 15,000 ha and to introduce irrigation on some 17,750 ha through the construction of a regulator with gates at its confluence with the Mekong, 33 pump stations around the reaervoir formed by the regulator, and irrigation and drainage systems including on-farm development.

98. A feasibility study for the Nam Kam basin, northeast Thailand, is being conducted with bilateral financial assistance from the Federal

Republic of Germany. The objective of the study, expected to be completed in early 1984, is to provide irrigation for 15,000 ha by means of a barrage at the river mouth which will form a reservoir along the river channel, and irrigation pumps and a canal system. The reservoir supply will be supplemented by pumping from the Mekong. The feasibility study will also include a proposal for the development of the lower Nam Pung and the area around the Nong Han Lake.

99. Following preparatory work on a mathematical model, a topographic survey and an archaeological survey, based on a proposal for a pre-feasibility study on irrigation and flood control in the Nam Songkhram basin (4.4.06), were completed in March 1983 and plans have been prepared for the full feasibility study.

100 In parallel with relatively large projects under study, several smaller tributary projects are at various stages of investigations in the sector of land and water resources development. These include the Huai Pa Thao multipurpose project (4.1.02) for hydropower production and irrigation development in northeast Thailand. Again, a reconnaissance study of micro-hydropower projects (4.2.06) in the Thai part of the northern sub-basin of the Mekong has shown that the Nam Mae Slong, Nam Mae Kon and Huai Pong Nam Ron projects, with maximum installed capacity of 100 kW, are economically feasible and that they can usefully supply electricity to the remote villages in Chiang Rai Province. The use of isolated diesel generators or, alternatively, extension of power lines has been found to be more expensive.

101 Within the framework of the development of small water resources projects and rural electrification (4.2.02) Sweden has agreed to finance the feasibility and design studies for two small water resources projects in Xieng Khouang and Luang Prabang, Lao PDR. Field investigations have also been carried out for five mini-hydro power projects: Nam Yuan, Nam Mae Suai, Nam Mae Pun Luang, Huai Krai and Upper Fang in Thailand. Similarly, the Committee, in co-operation with the Vietnamese Government, has carried out a reconnaissance survey of small-scale hydroelectric projects in the Central Highlands of Viet Nam (4.2.03), including the Ia Drang I, Ia Drang II and Krong K'Mar projects.

102. Quite apart from projects to build dams, barrages and regulators on tributaries, another project type includes pump irrigation projects which have multiplied on tributaries. Almost 300 pump stations have been either constructed or planned for 16 northeastern provinces of Thailand. Of the total number of pump stations constructed so far, about 80 per cent are concentrated on the Mekong as well as the Chi and Mun tributaries. In the Mun and Chi project (4.3.06), Stage I, installation of electrical pump units, coupled with the distribution systems along both rivers has been completed. Assistance was received in 1983 from the Netherlands for Stage II of the project.

103. In the programme sector of agriculture and fisheries, tributary development has typically involved creation of productive fisheries on a substainable basis in irrigation reservoirs, including those on the Nam

Houm and Nam Souang as well as on the Nam Ngum (8.4.01 and 8.4.02). While other fisheries projects have been planned on the Nam Houm and Nam Souang reservoirs, the one on the Nam Ngum is now in operation.

104. Among the most important beneficial effects of dam construction is the creation of large, relatively stable water bodies, which, under certain conditions, can produce large quantities of fish. In order to take full advantage of this opportunity and to achieve maximum sustained yields of fish, it is however necessary to institute appropriate fishery development and management measures. The Nam Ngum fishery development and management project in the Nam Ngum reservoir, Lao PDR, implemented with support from the Netherlands, was the first of several projects of this nature.

105. Tributary development activities undertaken in the navigation improvement programme sector have included improvement of river transport facilities. It is appreciated that inter-village passenger transport serves to facilitate local commerce and afford villagers an opportunity to visit the larger centres for medical treatment, purchase of basic provisions, and other purposes. As air transport is expensive and only possible between principal towns, regular services by boats are necessary. Thus, under the project to improve river transport in the Lao PDR (6.4.01), a regular and improved service for transport and cargo and passengers has been envisaged, and the first three standard vessels built, with the help of UNDP, as prototypes. Similarly, to enable inhabitants living on the shore of tributary reservoirs to travel, ferry services have been envisaged for the Nam Ngum (6.4.04) and Champassac.

TRAINING

106. Training in the context of the Committee's work has been aimed at enhancing the absorptive capacity of the riparian member countries and at facilitating the transfer of modern technology in disciplines related to water resources development. A variety of training programmes have been organized to meet the specific needs of the Committee as well as those of the riparian member countries.

107. The first type of training is pre-feasibility and essentially long-term in nature. A scholarship programme has been carried out, with assistance from co-operating countries and agencies, since 1971. It has been organized in support of the explicit objective of the Committee to enhance the technical capacity of the Secretariat by means of progressively increasing the proportion of riparian personnel working in it. This programme began by being part of a plan, approved by the Committee in 1970, to train the best candidates from a pool of talent, for the Mekong Cadre to ensure that qualified staff would be available to the Secretariat in all the disciplines needed. In carrying out this training, the principle of an equitable distribution of posts among nations of the riparian countries has been taken into consideration to the extent possible. Suitably qualified riparian candidates other than those actually working in the Secretariat are trained at institutions of higher learning and at the end of their academic programmes, which are limited to

disciplines required by the Secretariat's functions, the successful candidates are given first consideration for employment in vacant posts.

108. The scholarship programme has not only helped the Secretariat to recruit qualified staff from the riparian pool but also helped to enhance the technical capability of the riparian member countries in water resources planning. During the last 11 years, 47 riparian students have pursued studies under these Mekong scholarships in areas including engineering, hydrography, port management, hydrology, business administration, geology, statistics, economics, rural and urban planning, environment, and remote sensing. Of those, eight have been recruited by the Secretariat after completion of their studies, while others have returned to work for their Governments.

109. Another type of training, funded from the UNDP institutional support budget, is on-the-job training for riparian personnel. This essentially short-term programme is meant to develop a stock of expertise in water resources development from which the riparian member countries can draw as required. Under this scheme, incumbents in a number of established positions in the Secretariat are seconded from government service and serve for a period of one to three years with a monthly stipend. The seconded riparians are thus afforded an opportunity to become acquainted with the work of the Secretariat in addition to gaining more expertise in the field of their specialization. Since 1971, 77 government officials from the riparian countries have been selected to work in the Secretariat for various periods. At the end of their secondment, they usually return to their government posts. The National Mekong Commitees are then invited to nominate replacements for selection by the Committee's Appointments Panel as seconded riparian personnel, with account again being taken in the selection process, to the extent possible, of the principle of equal representation of riparian countries.

110. In addition to the above two types of formal training, several groups or individuals from the riparian countries have been invited to participate in a variety of short-term training programmes, financed from project funds or from allocations using contributions from co-operating countries, either at the Secretariat or in the region's governmental and private organizations. These training programmes have concentrated on such areas of interest to the riparian Governments as remote sensing technology, flood forecasting, fisheries development and underwater demolition technology. During the last 11 years, a total of 249 participants have benefited from this type of training and returned to their government positions to apply the knowledge acquired.

111. Such short-term informal training has been a built-in element in all sectoral projects where new technology is being implanted, and this has also involved a great deal of institutional development, with the Committee's help, in the riparian member countries themselves. This type of training, being programme-related, is meant to meet the specific requirements of work programme implementation by national authorities. Specific instances follow.

112. Under the programme sector of hydrology and meteorology, a national training centre for hydrologists and meteorologists in Vientiane (1.1.06) has been proposed. The expansion and development of the hydrologic and meteorologic network in the Lao PDR has progressed steadily but there has been no corresponding increase in the training of technical personnel to take care of the newly established stations. In fact, the number of technical personnel has gradually decreased through attrition, and a critical stage has been reached as insufficient qualified technical personnel are available to effectively operate the stations. The main objective of the project will therefore be to establish a permanent national training centre for hydrologists, meteorologists, streamflow measurement operators and technicians in such related fields as sediment and water-quality laboratory techniques and topographic surveys. The period of training will be one year and will cover both the theoretical and practical aspects of the disciplines involved as well as the operation and maintenance of hydrological and meteorologic equipment.

113. In the same programme sector, under the training component of the rehabilitation and expansion of the hydrologic and meteorologic network activity (1.1.05), and in co-operation with the Lao National Mekong Committee and the World Meteorological Organization (WMO), the Committee organized a seminar on 'Seasonal Streamflow Forecasting' in Vientiane, in 1983 to consider various methods of forecasting the long-term variation of streamflow and to serve as a forum where riparian engineers could exchange views on the various technical problems encountered. A number of international lecturers, Mekong staff members and participants from the Lao PDR, Thailand, Viet Nam, Burma and Pakistan took part in the seminar.

114 In 1983, in addition to this seminar, and again in the same programme sector, the Secretariat, together with the regional office of the United Nations Food and Agriculture Organization (FAO) and the Canadian International Development Agency (CIDA), supported a regional seminar on 'Field Investigations and Modelling for Water Management in Estuaries and Deltas' which was jointly convened by the Asian Institute of Technology (AIT) and WMO.

115. As part of the programme of delta salinity studies (1.2.05), two riparian engineers have undergone three months' training in mathematical modelling of salinity intrusion in the Ca Mau peninsula of the delta in Viet Nam.

116. Under the programme sector of land and water resources development, an effort is being made to produce standardized hydraulic rams and turbines (4.3.03), especially for mountainous areas in the Lao PDR and delta in Viet Nam, where tidal turbines may be applicable. Pilot projects will be conducted and riparian personnel will be trained in the application of such hydraulic rams and turbines.

117. Short-term training for two Lao engineers was also organized at the Secretariat in the methodology for the identification and evaluation of hydroelectric, irrigation and flood-control projects.

118. In the sector of navigation improvement, a typical project has been the Boat-Building Training Centre (6.3.02) at Nong Khai, which was established in 1970 with assistance from the United Kingdom and, later, the Federal Republic of Germany. Several hundred Thai trainees, as well as students from other riparian countries, have been trained in several trades connected with the boat-building industry.

119. Such navigation training facilities have also been envisaged for the Lao PDR and Viet Nam. The Lao Government has attached great importance to the improvement of its inland water transport system and, in line with this, it wishes to centralize all training connected with inland navigation at one establishment to ensure unified management and the optimum utilization of qualified personnel and facilities at minimum cost. To achieve this objective, construction of a permanent training centre has been completed in Vientiane with financial assistance from UNDP.

120. In Viet Nam, there is a need to organize training courses for crews meant for new inland-waterway fleet units, as well as refresher courses to upgrade present skippers and engineers and enhance their ability to handle modern craft. The main objective is to establish a navigation training centre (6.3.04), capable of training a sufficient number of crew members and shore staff to run and maintain a modern inland waterway fleet. On another front, to meet the need for basic hydrographic information, Viet Nam has also envisaged the process of turning out well-qualified hydrographic surveyors at a school in Ho Chi Minh City (6.3.05).

121. In the programme sector of agriculture and fisheries, training in agriculture has been designed to meet the needs of technological advances. It has been felt by the Committee that such advances can have an adverse effect in cases where training and familiarization fail to keep pace. It is therefore felt that relatively short courses of a practical, rather than academic, nature in technological advances in specific areas of agriculture, including agricultural planning and land use, should be organized for riparian technicians. Thus, in 1983, within the framework of the project for agricultural training (8.1.06), three riparian technicians underwent a four-month training course on remote-sensing techniques held at AIT. Again, in connexion with the activities of the Tha Ngone fish culture training and extension centre (8.4.03), 35 mid-level trainees in 1983 completed a course of classroom lectures, practical demonstrations and field training in principles and management practices of aquaculture, including fish seed production.

Chapter 3

PROGRAMME ACTIVITIES IN 1983

BASINWIDE ACTIVITIES

HYDROLOGY AND METEOROLOGY

Basic data collection - hydrologic and meteorologic network

122. The major portion of the Committee's work in the field of hydrology and meteorology involves the operation and maintenance of a basinwide network of stations (1.1.01) in the Lao PDR, Thailand and Viet Nam, which provides year-round basic hydrologic and climatic data. Assistance for the network's activities is given by the riparian countries and the resulting data are collected from the stations by the National Mekong Committees and forwarded to the Secretariat for processing. These data, which relate to river levels, current velocities, discharge, sediment concentration, evaporation rates, salinity and rainfall, play an essential role in the Committee's planning work on water resources projects.

123. A four-month preliminary study, aimed at reinforcing the collection of discharge data on the Mekong River, was carried out to determine the technical feasibility of applying the velocity index method of streamflow measurement at some locations along the mainstream. Subsequently, at its eighteenth session, the Committee recommended that a pilot programme of discharge measurement, using this method, be conducted at two stations to verify the results of the preliminary study. The results of this pilot programme, which will require total funds of US$25,000, will be submitted to the Committee for consideration of the possible extension of this method to cover other locations. The duration of the pilot programme will be two years.

124. The basinwide hydrologic and meteorologic network, which was initiated in 1960 with 40 hydrologic stations and 48 meteorologic stations, consisted at the end of 1983 of 356 hydrologic stations and 327 meteorologic stations. Developments with regard to the network in each of the member countries were as follows:

(a) Lao PDR: Under the programme for "Improvement of the hydrologic network in the Lao PDR" (1.1.04), expansion of the network was continued using equipment procured with a grant of US$265,000 from the Government of the Netherlands. Seven hydrologic stations and three meteorologic stations were added to the network, bringing the total to 113 hydrologic stations and 104 meteorologic stations. Work was continued for installing additional stations, equipped with radio-transceivers, in the upper Nam Ngum to provide input for flood forecasting in the Nam Ngum area. In connexion with the network of hydrologic and meteorologic station, const-

ruction of the National Training Centre for hydrologists and hydro-meteorologists in Vientiane (1.1.06) was started, and the first building, housing the classroom and a sediment laboratory, was completed. The construction was financed under a programme activity allocation of US$25,000 and with government counterpart funds of Kip 1.1 million (approximately US$31,500). An additional US$160,000 was being sought to enable the project to be completed.

(b) Thailand: Five hydrologic stations and six meteorologic stations were added to the network, bringing the total to 175 hydrologic stations and 187 meteorologic stations. A total of US$23,000 was made available to Thailand, under a programme activity allocation, for the purchase of various items of hydrologic equipment and spare parts to facilitate the hydrologic data collection programme.

(c) Viet Nam: As part of the project "Rehabilitation and expansion of the lower Mekong basin hydrologic and meteorologic network" (1.1.05), 13 items of equipment were procured, while the Secretariat continued to provide technical assistance. The General Department of Meteorology and Hydrology completed the rehabilitation of 17 hydrologic stations and, in co-operation with the Ministry of Water Resources, installed 26 new hydrologic stations. This brought the total number to 68 hydrologic stations. Three new meteorologic stations were added to the network, bringing the total to 36.

125. Discharge measurements on the Mekong mainstream were continued by a joint measurement team of technicians from the Lao PDR and Thailand at Nong Khai. Meanwhile, discharge measurements at Savannakhet by another joint team were started in May. The resumption of discharge measurements at other key stations on the mainstream is the next target.

126. Radio communications between certain key stations and the Secretariat continued regularly throughout the year, particularly during the flood forecasting period from June to October and the low-flow forecasting period from March to May. Flood warnings were issued when necessary, while reports were provided on water levels, rainfall data and basinwide water level forecast. The radio network was also used to facilitate the transmission of routine messages.

127 The basic data collected from the hydrologic network were analyzed for application to flood and low-flow forecasting (see the next section, 'Applied hydrology and meteorology'). The data were also processed for publication in the Lower Mekong Hydrologic Yearbook -- Volume I (hydrologic data) and Volume II (meteorologic data). Final preparations were completed for the 1981 edition of the Yearbook, which will be published in early 1984. Financial assistance for the publication of the 1979, 1980 and 1981 editions was being provided by the Government of New Zealand.

128. During the year, Secretariat staff visited stations in many parts of the network to inspect the condition and performance of the hydrologic, meteorologic and communications equipment, particularly at the newly installed stations in Viet Nam.

APPLIED HYDROLOGY AND METEOROLOGY

Climatic conditions

129. The start of the wet season was rather late and the climatic conditions for 1983 made it one of the driest in the lower Mekong basin. On 26 June, the first tropical storm, "Sarah", entered the basin at Lat. 17°N and moved westward through northeast Thailand, causing widespread heavy rainfall along its path. Three months later, a second depression entered the basin on 4 October at Lat. 19°N, producing moderate to heavy rainfall from Vientiane southwards. A third storm, "Herbert", entered and affected only the lower part of the basin at Lat. 13°N on 10 October.

130 The monsoon trough was rather weak during July-September and only two storms affected the upper part of the basin, one in June and other in October. Consequently, the amount of rainfall at various stations in the basin was below normal, although rainfall distribution was considered average. In general, rainfall over the basin was 20 to 40 per cent lower than normal.

Flood conditions

131. In 1983 the lower Mekong basin also experienced one of its driest years, with regard to flooding. At the start of the flood season, water levels at all key stations on the Mekong were well below average. The effect was more pronounced for the middle reach, from Thakhek/Nakhon Phanom to Pakse, and the lower reach in the Mekong delta.

132. Three distinct peaks were observed for the upper reach, from Chiang Saen to Vientiane/Nong Khai. The first peak, which was the highest of the year, occurred during the first week of August, the second at the end of August and the third during the third week of September. Water levels remained below the mean except during the peak periods. In the middle reach from Thakhek/Nakhon Phanom to Pakse, a distinct peak was only observed at the end of August. Apart from this, water levels were below the mean for this reach. In the lower reach water levels remained below the mean throughout the flood season. The total runoff was 20 to 40 per cent lower than average.

Flood forecasting

133. The flood forecasting operation (1.2.02) was first undertaken by the Secretariat in 1970, on an annual basis. The first official forecast for 1983 was disseminated to the riparian member countries on 28 July. The

operation was concluded on 20 October for the upper and middle reaches of the Mekong, and on 1 November for the delta. The forecasts covered 13 key stations: Chiang Saen and Nong Khai (Thailand), and Luang Prabang and Vientiane (Lao PDR) in the upper reach; Thakhek, Savannakhet and Pakse (Lao PDR) and Nakhon Phanom and Mukdahan (Thailand) in the middle reach; and, in the delta in Viet Nam, Tan Chau and My Thuan on the Mekong, and Chau Doc and Can Tho on the Bassac.

134. The Streamflow Synthesis and Reservoir Regulation (SSARR) model which was introduced two decades ago, was again applied between July and October in preparing the forecasts for the upper and middle reaches, while the modified version of the Delta model was applied for the delta area. This enabled forecasts of mainstream levels to be issued to the riparian member countries for the two maximum water levels at the My Thuan and Can Tho stations on a daily basis from 5 to 14 days in advance.

Groundwater investigation programme

135. A consultant groundwater engineer was engaged with financial assistance, totalling US$19,500 from UNESCO to carry out stage I of the groundwater investigation programme (1.3) which includes the collection, review and evaluation of available data concerning groundwater within the lower Mekong basin, the provision of information on areas where the lack of hydrogeologic data could be critical to future development, and the preparation of an indicative map of information on groundwater. The consultant held several discussions with the national agencies concerned in the Lao PDR, Thailand and Viet Nam and undertook field visits to several areas of interest. His report was expected to be submitted to the Secretariat and UNESCO for evaluation by the end of December.

Low-flow conditions

136. In general, flows during the dry season of 1983 were slightly lower than those in 1982, although they showed some improvement compared with the general conditions for the last four years. At Pakse, which is the principal source of data on in-flow into the delta, the lowest monthly flow rate was some 21 per cent higher than the corresponding average. A minimum discharge of 1,860 cubic metres/sec at Pakse was recorded on 23 April.

Low-flow forecasting

137. The experimental low-flow forecasting operation in the delta (1.2.03), which was started in 1979, was continued in 1983 using the Delta and Tidal models. The operation began on 1 March with the first official forecast being issued on 11 March for four stations in the Mekong delta. Daily forecasts were issued to Viet Nam one week in advance for the two maximum and two minimum levels, and for the average daily discharge at Tan Chau and My Thuan (Mekong), and Chau Doc and Can Tho (Bassac). In addition, the harmonic analysis method was used to countercheck the results obtained from the Delta and Tidal models. Forecasting was concluded on 9 June.

Water quality and sediment analyses

138. In 1983, field work for the water quality and sediment analyses programme was carried out in Thailand. The programme included: (a) water pollution control testing carried out for northeast Thailand; (b) monthly sediment sampling and analysis undertaken for selected stations during discharge measurement activities; and (c) conductivity, salinity and temperature measurements in the delta. The resulting data are also published annually in the Hydrologic Yearbook. These activities are serving as a supporting base for the basinwide water quality monitoring network project (2.9.03) -- (see section on Environmental Studies, page 37).

Basinwide water balance study

139. Phase I of the 'Basinwide water balance study' (1.2.06) was initiated in October 1981 to investigate whether land-use changes, particularly with regard to the Mekong's right-bank tributaries, had changed the low-flow characteristics of the mainstream. The study included a comprehensive review of the available data, carrying out water balance studies of selected tributary basins and investigating the variability of flows in the upstream portion of the delta. The study was conducted by a team of specialists from the Institute of Hydrology, Wallingford, with a grant from the United Kingdom, while the Secretariat provided a system analyst and computer facilities. The study, which was completed in November 1982, reached the significant conclusion that there was no evidence of change in the low-flow characteristics.

140. Under similar arrangements, phase II of the study was launched in February 1983, covering two areas:

(a) The development of a network-routing model;

(b) A study of the assessment of areal rainfall from point records.

141. The primary objective of the network-routing model will be to provide a framework within which the effects of various developments on downstream flows can be assessed. The model will be used for long-term planning of the basin's water resources development.

142. With regard to (b), the objectives of the rainfall study are to define the accuracy of areal rainfall estimates for different areas and time periods, through the application of direct statistical methods, and to identify any strong regional patterns in these estimates. The implications of these findings on the effectiveness of rainfall-runoff models, such as the SSARR and other simpler models are being assessed. At the end of these studies it should be possible to determine the density of rain gauges necessary for providing adequate estimates of areal rainfall for current purposes.

BASIN PLANNING

Establishment of the Lower Mekong Basin Information System

143. With the continually growing need for a more organized system of collection, processing, rapid-retrieval and storage of qualitative and quantitative socio-economic information relevant to lower Mekong basin development, and to meet the demands of basin planning and project analysis, the establishment of a data bank (2.1.05) has assumed ever greater importance during the last few years. As a first step to undertaking this major task the Mekong Secretariat, in 1972, undertook a general study on Mekong information storage and retrieval needs. Towards the partial fulfilment of the above goal, a documentation specialist was provided in March 1975 by France for a period of two years, and work began on planning a comprehensive documentation system to be introduced in stages over the next few years.

144. In February 1982, UNDP agreed to provide financial assistance in the form of programme support to the Committee, a project entitled 'Development of the Lower Mekong Basin" under which US$240,000 was earmarked for the formal establishment of a data bank on the basis of existing components. The Committee requested assistance from UNDTCD and the services of a United Nations Inter-regional Adviser were provided in September-October 1983 for the preparation of a detailed plan of operation, taking into account the capabilities of the new computer facilities to be installed at the Secretariat. In line with the expert's recommendations the project was renamed the 'Lower Mekong Basin Information System' due to its broader scope; the following proposed activities were then incorporated into a revised project document, which was to be presented to the Committee for its consideration at its nineteenth session in January 1984:

(a) A hydrologic and meteorologic data base;

(b) A water quality data base;

(c) Optimization of simulation models;

(d) A groundwater data base;

(e) An integrated data base;

(f) A computer graphic subsystem;

(g) A computerized documentation centre.

145. In 1983, a major portion of the data development activities was devoted to simulation studies for mini-hydro projects, including a month-by-month simulated operation of reservoirs for optimum power outputs over an extended period of 10 to 20 years. Computer facilities and programming services were also maintained in support of system planning activities and general data-processing applications within the Secreta-

riat. In systematizing data for the information system the conclusions reached in the review of the Indicative Basin Plan (2.1.01) -- (see paragraphs 145 to 150) -- should be borne in mind, not only concerning basic data but also project and programme data, which may have become obsolete because of technological or socio-economic changes.

146. However, due to the growing need for more extensive and sophisticated computer services to assist in the development of data bases the Secretariat decided to undertake a review of its electronic data processing (EDP) requirements as a prerequisite to upgrading the computer facilities.

147. On the basis of a document prepared in February 1982, outlining and defining the needs for a lower Mekong basin data bank, a United Nations Regional Adviser was provided on a short-term basis in November 1982, through UNDTCD, to assist in determining the preferred data structure in terms of data base management systems, and which hardware and software system would be most suited to the Secretariat's overall requirements. The Committee reviewed the Secretariat's EDP requirements at its sixteenth session in January 1983 and subsequently approved the purchase of a computer syatem as tecommended by the expert, using the general purpose funds donated by, and with the concurrence of, the Australian Government. It was expected that the new system would be installed early in January 1984.

Review and revision of essential data for the Indicative Basin Plan

148. The Working Group set up within the Secretariat and entrusted with the initial task of critically examining key sections of the Indicative Basin Plan issued in 1971, continued to meet at regular intervals to revise and review the basic data (2.1.01) on which the Plan was based.

149. In particular, it continued to take account of ongoing work in the relevant areas which had brought forth further hydrological and meteorological, and other physical data on subjects such as soil composition, minerals, infrastructure, and social and economic data. The Working Group also reviewed the importance, for planning purposes, of the following components of the Work Programme: (a) the basinwide data which are published in the Hydrologic and Meteorologic Yearbook; (b) the monitoring of the water balance in the basin; (c) the preparation on a regional basis of ecosystem maps; (d) the interpretation of imagery and information provided by LANDSAT-3; (e) socio-economic benchmark studies; and (f) the updating of technical and economic project data.

150. In view of the growing mass of data the Working Group stressed the need for the systematic development of the data base as a permanent component of the Secretariat's annual Work Programme. A convenient data storage and retrieval system will be provided through the establishment of the 'Lower Mekong Basin Information System'. The Working Group also endorsed the establishment of the 'Lower Mekong Water Resources Inventory' (2.1.06) as a significant step towards the implementation of sub-basin development planning.

151. In the course of its deliberations the Working Group also assessed the implementation status of the Indicative Basin Plan. Approximately 10 per cent of the overall Plan requirements, in monetary terms, has actually been invested; however, this amount is far below what was anticipated in the Plan. This can be partly attributed to the constraints created by relatively recent events in the region. It is important to note that while fundamental studies, as outlined above, were carried out at a basinwide level, many of the investment/production projects called for under the Plan were carried out within national boundaries. For example, a number of hydropower stations and irrigation projects have been constructed; fish production is increasing through Mekong fish seed production; and navigation on the Mekong has been improved through rockblasting and port construction.

152. Fundamentally it was the impression of the Working Group that the bases of the Indicative Basin Plan remained valid, and that it should continue to be used as the long-term framework for development planning of the lower Mekong basin.

153. Following its deliberations, the Working Group also suggested that, parallel to the continuing preparations for the mainstream development programme, a supplementary programming approach for Mekong development might be considered in order to accelerate the process of project implementation. The group devoted some effort to the question and has suggested that programme be undertaken, based on the principle of ensuring the complementarity between national and regional projects to satisfy the development needs of the riparian countries.

Lower Mekong Water Resources Inventory

154. The first comprehensive reconnaissance study of potential hydropower projects on major tributaries in the lower Mekong basin was carried out by a Japanese team during 1959-1961. Subsequently, large quantities of hydrologic data were collected and practically the whole lower basin was mapped at a scale of 1:50,000 at 20-metre intervals. After additional data became available, the Secretariat in 1969 undertook a desk study of possible developments in the Mekong tributaries, on a country-by-country basis. Although the study was only preliminary in nature and had to be carried out without the advantage of complete geologic information and/or site investigations, a large number of promising projects were identified.

155. These data are being expanded and updated to serve as a basis on which will be established the comprehensive inventory of water resources in the lower Mekong basin (2.1.06), approved by the Committee in June 1983. This project involves a 10-month study, to be undertaken with financial assistance from the Netherlands. The study, initiated in late October, was aimed at establishing, as a component of the 'Lower Mekong Information System', a computerized summary of economic information and known data on potential development projects in each sub-basin. Once the data format has been developed, a first base-line report will be prepared,

providing physical data relating to each sub-basin and information on the salient features of projects, including investment costs and expected benefits. The report is expected to be completed by the end of 1984 and will comprise approximately 10 major sub-divisions, which will include mainstream sections and some 50 tributary sub-basins, with maps.

Analysis of LANDSAT imagery

156. Within the framework of ecosystem mapping (2.1.03) the Secretariat continued to collect and update data/information on various aspects of the lower Mekong basin such as land use and flood areas. The data were supplied primarily by the ground receiving station in Bangkok. The Government of France also continued to provide assistance in the form of funds with regard to the production of a geomorphological map of the Korat Plateau in northeast Thailand which was completed in early 1983.

ECONOMIC AND SOCIAL STUDIES

Energy surveys and projections

157. In July 1980, NEA began an 18-month study, aimed at developing an Energy Master Plan (EMP) for Thailand, which will identify viable investment opportunities for expanding domestic energy supplies, formulate growth-oriented and efficient energy pricing and demand management policies and recommend appropriate institutional changes. Pending the official release of the Energy Master Plan, which was completed in 1983, the basinwide findings from a 1977 survey of rural households, conducted within the framework of the EMP study, can be considered indicative of the current supply structure in Thailand. According to the survey, the share of energy derived from the imported petroleum products was found to be 66.3 per cent and that for indigenous resources 33.7 per cent (including 6.9 per cent for hydroelectric power). For the purpose of the planned basinwide study (2.3.01), energy survey plans were also discussed with the authorities concerned in the Lao PDR during the Secretariat programming mission, which took place in June 1983 and to which a positive reaction was received.

ENVIRONMENTAL STUDIES

Establishment of a water quality monitoring network

158. The first phase of the project entitled 'Basinwide water quality studies' was concluded in August 1982 after 12 months of intensive data gathering and reconnaissance studies, with funds totalling US$79,000 provided by UNDP. A brief summary of the studies' results was presented in the Annual Report for 1982.

159. Following the completion and based on the results of the first phase, a detailed plan of operation and programme of work for the establishment of a basinwide water quality monitoring network was prepared. Following the approval of the plan of operation by the Committee at its 15th session, and subsequent exploratory efforts by the Secretariat

to seek funds from donor countries, the Swedish International Development Authority (SIDA) approved a grant of US$1.1 million for the implementation of the project in November 1983.

160. Activities proposed under the project 'Water quality monitoring network in the lower Mekong basin' (2.9.03) can be categorized into two groups: (a) the establishment of a permanent monitoring network; and (b) problem-oriented sampling. The proposed monitoring network will include 38 sampling locations: 11 on the mainstream, 20 on tributaries; and seven on canals in the acid sulphate soil region. The expected outputs of the project are many and the more important ones are listed below:

(a) Establishment of the first-ever basinwide water quality monitoring network, which is basically non-existent at present;

(b) Development of a functional data storage, retrieval and management system, so that users will have prompt access to data, in the manner in which they are mostly required;

(c) Training of personnel in the countries concerned in the sampling operations, analyses of water samples and management of data (this type of expertise is currently not available at an adequate level);

(d) Identification of present and future potential point and non-point sources of water pollution;

(e) Development of a regulatory framework within which water pollution control can be successfully achieved on a long-term basis;

(f) Development of an integrated approach to resources management by considering water-land-biota inter-relationships simultaneously, rather than considering one resource at a time, which is the case at present. This is an urgent necessity for the acid sulphate region of the Mekong delta, areas along the coast suffering from salt-water intrusion, and parts of northeast Thailand and the Lao PDR where maintaining a salt-water balance in the soil is a serious problem;

(g) Construction of water quality management models to explore policy options for appropriate development of the regions;

(h) Preparation of a series of reports and other publications on the problems of the region;

(i) Training and developing indigenous expertise to use modern techniques such as systems analysis and remote sensing;

(j) Facilitating communications and establishing technical co-operation among member countries of the Committee in maintaining water quality of the river at an acceptable level for downstream users.

Basinwide survey of waterborne diseases

161. One of the major scourges associated with water resource development is the spread of waterborne and vectorborne diseases. Some changes in environmental parameters engendered by resource development either favour the growth of certain disease vectors or bestow vector competence on other previously innocuous, potential vectors.

162. For example, the quiet, sheltered, weed-infested aquatic habitat of man-made lakes is highly conducive to the proliferation of some species of snail vectors of schistosomiasis and mosquito vectors of malaria. Irrigation of large land areas for agriculture has apparently increased the hazard of infestation by such parasites as the blood fluke Schistosoma spp. in Africa, and a species of liver fluke, Opisthorchis viverrini, which has an, as yet, unknown snail vector in Thailand. Rapidly flowing tailrace waters at dams are known to have favoured the spread of the fly vector, Simulum damnosum, of river blindness (Onchocerciasis) and to increase the nuisance value of other members of the same genus.

163. The danger of waterborne/vectorborne diseases spreading in the lower Mekong basin is increased by the current levels general health and nutrition of the resident populations, reported to be lower than that in other areas of the riparian countries.

164. Many waterborne and water-associated diseases, besides malaria and schistosomiasis, are already known to occur in the lower Mekong basin. Examples of such diseases are Opistharchiasis, Paragonimiasis, Echnostomiasis, Angiostronglyliasis, Faciolopsiasic and Gnathostomiasis. However, very little is known either about their incidence in different areas or the exact impact the various resource development projects would have on their proliferation.

165. It is therefore essential that health planning is built into water resources development programmes from their inception -- long before any dam is built -- and continued long after, until the health provisions are fully incorporated into the public health structure of the country concerned. To be able to achieve this objective, a basinwide reconnaissance survey of waterborne and water-associated diseases (2.9.08) was initiated in May 1983 with a grant totalling US$60,000 from Switzerland.

166. The objective of the survey, which constitutes Phase I of the project, is to determine the present state of knowledge and to identify gapa in this knowledge with particular reference to the following:

(a) Identification of various types of diseases, their occurrence and prevalence;

(b) Identification of high-risk populations and their socio-anthropological attitudes and practices;

(c) Collection of information available on the patho-biology of various vectorborne diseases;

(d) Preparation of a report on the current status of knowledge on water associated and waterborne diseases, based on available literature and reconnaissance surveys;

(e) Formulation of a programme of detailed studies which will focus on health hazards, disease prevention, disease and vector monitoring and its cost effectiveness, and on the collection of base-line data on the public health and nutritional status of people in communities likely to be affected by water resource development activities.

167. A preliminary survey of the waterborne disease situation in the basin in Thailand and a review of existing information on the subject were completed in August 1983. On the basis of this survey it was concluded that a reconnaissance survey should be conducted in Thailand to select the methods for carrying out a basinwide survey. It was also proposed that, at the conclusion of the survey, a programming or organizing workshop be conducted for specialists from all member countries of the Committee to evolve standard methodology for detailed basinwide surveys to be conducted in Phase II of the project.

Nam Pong model

168. Following the completion of the 'Nam Pong environmental management research project' (2.9.02) in northeast Thailand, the environmental simulation model of the Nam Pong basin, which was formulated as part of the project, two Apple II computers and related peripheral hard and software were handed over to the Office of Water Resource Development (OWRD) at Khon Kaen University, together with the unexpended balance of US$25,000 from the project budget. OWRD undertook to carry out follow-up activities, in collaboration with the Committee, leading to the implementation of the improvements generated by the model and recommended for management of the basin. However, the Secretariat is continuing to monitor the progress of the project.

169. The project was implemented by the Secretariat with grants amounting to US$387,000 from the Ford Foundation and US$58,000 from UNEP. The objectives of the project are to evaluate the effects of the Nam Pong water resource development project 15 years after its implementation so that the model may be improved and to recommend environmentally sound methods of managing the natural and developed resources. Such efforts will eventually be applied in the other riparian member countries, thus benefiting the population of the lower Mekong basin.

AGRICULTURE RESEARCH AND PRODUCTION

Introduction of ley farming, northeast Thailand

170. Following the Committee's approval at its fifteenth session in March 1979, pilot research project to introduce ley farming into upland

The joint Lao-Thai team prepares to start another day of discharge measurements on the Mekong River near Nong Khai, northeast Thailand

A duckbill weir in operation at the site of the water management support programme project in northeast Thailand. This type of weir allows more effective control of the flow and volume of water in an irrigation canal.

One of the Lao counterpart staff members at work in the water analysis laboratory of the Tha Ngone pilot fish farm in the Lao PDR

Ducks being raised over ponds,in integrated duck-cum-fish culture at the Lam Pao pilot fish farm, northeast Thailand

areas of northeast Thailand (8.1.04) was started in 1980. Research was continued in 1983 with a grant equivalent of US$430,000 from the Netherlands. The main objective of the project is to develop a stable, low cash-input system of ley farming by integrating ley pastures with cash cropping and livestock which will in future be applicable to other areas in the lower Mekong basin. During the continuous trials rotational cropping with legume leys was carried out at the project site, 70 km north of Khon Kaen provincial capital, and the results are gradually being analyzed. In addition, to test the applicabity of small-scale dairying on the legume pastures, most activities in 1983 were centred around the establishment of a small dairy project in which five local farming families were participating. The participants were given on credit, by the project, a total of 11 mature cows, while training was provided in basic livestock and farm management, under the guidance of the project experts. The results of the research and experimental work by the dairy component during 1983 were satisfactory. To further expand the experimental work in 1984, another group of five farming families was to be selected and trained before the end of 1983.

Water management support programme, northeast Thailand

171. The first stage of the pilot research project of the water management support programme (8.1.05), which was approved by the Committee at its seventh session in 1980 and started the same year with a grant of US$123,500 from the Netherlands, ended in December 1983. The project was located in Maha Sarakham province, northeast Thailand, where a great number of pumping stations under the supervision of NEA are sited. In an attempt to formulate guidelines for improving the management of pump irrigation systems and evolving more efficient methods for the use of available water supplies during the dry season, the planning of more effective water delivery scheduling and the measurement and control of water conveyance losses was continued. Alterations and improvements of a pump irrigation schemes were also carried out which, together with better supply management techniques, resulted in greatly improved and more efficient water utilization. The findings and recommendations regarding Stage I will be summarized and published in early 1984. In Stage II it is planned to apply and demonstrate these findings in the field.

Seed multiplication farms, Lao PDR

172 The implementation stage of this pilot project (8.2.04), aimed at producing seed of improved quality and characteristics and testing the suitability of new varieties for widespread introduction in the Lao PDR, was approved by the Committee at its sixth session in 1979 and started in September 1983. EEC, which is providing a grant totalling some US$1.9 million for the project, released the first 20 per cent of the total expected costs for Phase I to the Secretariat for procurement of the necessary machinery and materials. The first two seed multiplication farms will be established in Savannakhet and Champassac provinces in southern Lao PDR. The Government of the Lao PDR has allocated Kip 800,000 (approximately US$23,000) for the preparatory works at the two farm sites, including land-clearing and levelling. Some initial crop trials have also

been conducted at the sites by the Lao authorities. In addition, the Hat Dok Keo experimental station in Vientiane will be rehabilitated as a project base and trials centre. Construction work was expected to commence during the 1983/84 dry season. Initially, the project will concentrate on trials and multiplication of good-quality maize seeds, groundnuts, mung beans and soya beans. Seeds of other types of crops will be subject to trials and multiplication as and when the need arises.

Watershed management: Fruit and tree propagation and planting project, Lao PDR

173. Formulated by the Secretariat in 1982, this activity (2.9.07) is designed as a pilot project to test the applicability of re-afforestation on steeply-sloping hillsides in an area close to Luang Prabang province, where the majority of the forest cover has been destroyed by the 'slash and burn' type of shifting agriculture. The main components of the project include the rehabilitation and extension of fruit and forest tree nurseries, both in Vientiane and Luang Prabang, and the establishment of a communal fruit orchard in Luang Prabang. Following approval of the project by the Interim Mekong Committee at its fifteenth session in 1982, EEC approved a grant of some US$230,000 to finance implementation in August 1983. The duration of the project will be two years (1984-1985). An expert (nurseryman/project co-ordinator) was expected to be recruited by the end of 1983.

FISHERIES

Tha Ngone Fish Culture Training and Extension Centre

174. This project (8.4.03), initiated in 1981, was initially terminated in June 1983. However, on the recommendation of the tripartite review committee in October 1982, a further grant of US$60,000 was approved and the services of the expatriate expert extended until 31 December 1983 by the Netherlands to ensure continuation of project activities until June 1984.

175. Details of the various activities which were undertaken during the year are given below.

176. The construction of dormitories for students was completed. This considerably facilitated the progress of the training course.

177 Although limited in scope, extension work under the project achieved impressive results. A record rate of fish production (7,000 kg/ha/year) was achieved in one fish farmer's pond. A number of parties, including the FAO fisheries project in the Lao PDR, were assisted through the provision of technical advice and demonstrations.

178 The project laboratory was used extensively in detecting and correcting crucial chemical deficiencies in the water at the fish farm and in other areas surveyed.

179. Good progress was made in the preparation of a practical guidebook for fishery workers with regard to carrying out water analysis, and interpreting and using the results. This will be helpful to future training programmes.

180. Training courses, including lectures and field work, were provided (see section on 'Training').

181. The Tha Ngone pilot fish farm project was initiated in 1978, with a grant equivalent of US$1.25 million from the Netherlands. On the completion of some ponds and farm buildings in 1981 fish culture activities, such as fish breeding and rearing to market size, were started. On completion of 90 per cent of the farm ponds and of all the project buildings, the farm was inaugurated on 15 January 1983. Secretariat aquacultural specialists stationed in the Lao PDR continued to provide technical assistance during the year.

182 The divergent nature of construction activities during the post-breeding season of 1982 and early 1983, involving extensive cleaning, construction and draining of all nursery, rearing and production ponds, and in-flow and out-flow channels, hampered the maximization of farm production during 1983. Inadequate supplies of water from irrigation pumps also caused difficulties early in the year with regard to the proper planning and execution of fish culture operations. These problems were, however, resolved and a continuous water supply was restored.

183. A new expatriate expert joined the project in May 1983. With provision of permanent physical facilities at the farm, and the availability of constant expert guidance, the farm is now being operated with increasing efficiency and production is being stepped up on a permanent and dependable basis. An intensive effort to place farm operations on an even keel, in order to obtain maximum benefits, was started.

184. Breeding of Chinese and Indian carps, big-head carp (Aristichthys nobilis), silver carp (Hypophthalmichthys molitrix), mrigal (Cirrhinus mrigala), rohu (Labeo rohita), catla (Catla catla), grass carp (Ctenopharyngodon idella) and tawes (Puntius gonionotus), was continued and about 1.1 million fry were produced during the year. About 400,000 fry were distributed to private ponds for raising large fingerlings and marketable size fish. The fish-breeding work was mainly entrusted to the local counterparts and the trainees under the general guidance of the expert.

185. During 1984 attention will focus mainly on upgrading management capabilities of the national staff and on putting the project on a financially autonomous basis.

Pilot fish farm at Lam Pao, northeast Thailand

186 The construction of the pilot fish farm (8.4.05) at Lam Pao, Kalasin province in northeast Thailand, utilizing a grant equivalent to US$1 million from the Netherlands, was completed and the farm brought into operation in 1982. During 1983 construction of 11 more houses for staff and 10 more concrete tanks of 50 square metres each was completed.

187. Large-scale breeding of six species of fish -- rohu (Labeo rohita), mrigal (Cirrhinus mrigala), big head-carp (Aristichthys nobilis), Thai silver carp (Puntius gonionotus), common carp (Cyprinus carpio) and nile tilapia (Oreochromis niloticus) -- was undertaken during 1983 and over 13 million fingerlings were produced. These were sold to fish farmers, distributed to schools and village community ponds and stocked in natural waters.

188. Experimental trials were initiated during 1983 to demonstrate the possibility of profitably integrating fish culture with raising livestock, ducks and pigs. Duck-cum-fish culture was undertaken in three ponds of two-rai (0.32 ha) size each and the result obtained so far has been encouraging with respect to fish production. Though the fish were not given any supplementary feeding, production from these ponds ranged from 1,183 to 1,320 kg per pond during a rearing period lasting 8 to 10 months. This equals a production figure of 4,400 to 6,200 kg/ha/year.

189. In pig-cum-fish culture, pigs were raised in sties constructed over ponds. The ponds were stocked with five species of fish -- big-head carp, rohu, mrigal, nile tilapia and Thai silver carp. No supplementary feeding was given to the fish and their growth was monitored. Over 10 tons of fish have so far been harvested from production ponds in Lam Pao and sold to local villagers and fish markets.

190. To demonstrate the feasibility of culturing fish in cages installed in reservoirs, six cages of 48 cubic metres each, made of bamboo and nylon mesh, were installed in the Huai Si Thon reservoir and each stocked with 500 big-head carp. The growth of the fish, which were subsisting on natural food supplies in the reservoir, was monitored at monthly intervals.

191. Three theoretical and practical training courses were conducted in fish culture and fish breeding. The duration of the courses varied from 17 to 35 days. Thirty-seven students from the Kalasin Agricultural School and eight from the Nakorn Srithammaraj Agricultural School took part in the training. Two students from Wageningen University in the Netherlands also received training at the farm in various aspects of Asiatic carp breeding and culture for six months. Extension workers from the project visited farmers and provided advice on fish culture.

Agro-industrial development, northeast Thailand

192. Preparations for the pre-feasibility study of an integrated vegetable oil-cum-livestock processing industry in northeast Thailand (9.1.01) were initiated following the approval of the project by the Committee at its twelfth session in 1981 and the provision of a grant by the Belgian Government, totalling US$119,000, in 1983. Discussions were held between the Secretariat and the Agriculture and Co-operatives Ministry -- which serves as the country co-ordinating agency -- concerning arrangements for administration and the existence of counterpart facilities, and agreement was secured for the provision of counterpart funds.

193. The findings of the study will identify possibilities for investment, either in the public or private sectors, in this field. The output of a fully-established vegetable oil-cum-livestock industry, based on the market demand for vegetable oil and livestock products, could progressively be widened to cover the processing of oil seeds into vegetable oil products, the utilization of oil cake for compounded fodder and the processing of meat and by-products, including the recycling of offal into animal feed. Once established, this pilot project could be duplicated elsewhere in the basin, conditions permitting.

MAINSTREAM DEVELOPMENT

HYDROLOGY AND METEOROLOGY

Salinity studies in the Mekong delta

194. The programme of salinity intrusion studies in the Mekong delta (1.2.07) consists of two phases, which are being carried out from 1981 to 1986. Phase I, which will be concluded in 1984, deals with the Ca Mau peninsula as a priority study area. Phase II, approved by the Committee at its sixteenth session in 1983, will deal with the main tributaries of the Mekong delta for which financial assistance is being sought. The studies are based on the Tidal mathematical model, prepared in the early 1970's in support of delta development planning, and the Mekong salinity model (MEKSAL) which is a modified version of the Tidal model.

195. In March and June 1983, under Phase I, two major measurement campaigns covering the most important canals and rivers in the Ca Mau peninsula were carried out. The measurement network is shown in Map 1. The first measurement campaign, from 27 March to 1 April, was aimed at providing necessary data for simulating the conditions which exist during the driest month. The second measurement campaign, from 10 to 15 June, covered the effect of rainfall on salinity intrusion. Besides the two measurement campaigns, a detailed measurement campaign was also undertaken in April to investigate the possible stratification of flow in some parts of the peninsula.

196. The data collected during the three measurement campaigns were processed and a preliminary mathematical model formulated. To provide the necessary asistance for this effort, the services of two Vietnamese engineers were made available to the Secretariat for the final calibration of the model, which was expected to be completed by December.

197. The contribution by the Government of Viet Nam to the programme included meeting the costs incurred in the measurement campaigns, data processing and verification, model calibration and computer programme refinement, and some 10 tons of fuel. The total cost of these contributions was estimated at Dong 850,000 (approximately US$73,000). The Secretariat allocated a total of US$21,500 as support for the programme.

MULTIPURPOSE DEVELOPMENT

The Pa Mong Scheme

198. The Pa Mong comparative study (4.1.01) of irrigation development at alternative reservoir elevations undertaken by the Secretariat in 1981, was completed in August 1983 and approved by the Committee at its eighteenth session in September 1983. The study examined the various possibilities of irrigation development in the case of smaller Pa Mong schemes. It presented detailed information aimed at facilitating decision-making in relation to full supply levels at 230, 240 and 250 m above MSL, including the Nam Lik/Nam Mong exclusion schemes. The potential irrigable areas for the Pa Mong alternatives 230, 240 and 250 m MSL with and without exclusion schemes are presented in table 1.

Table 1: Potential irrigable areas (with and without exclusion schemes)

	Pumping (ha)	Gravity (ha)	Additional (ha)	Total (ha)
Pa Mong 230	123,000	272,000	320,000	715,000
Pa Mong 240	88,000	307,000	870,000	1,265,000
Pa Mong 250	403,000	524,000	770,000	1,697,000

199. Compared with other studies completed so far, substantial additional irrigable areas have been identified as follows:

(a) For Pa Mong 230 - 240 - 250

(i)	Nam Ngum left bank area	20,000 ha
(ii)	Nam Songkhram area	100,000 ha
(iii)	Lam Pao-Chi area	150,000 ha

(b) For Pa Mong 240- 250 in addition to (a)

Mun - Chi area	500,000 ha

200. The main advantage, from an irrigation point of view, of Pa Mong 240 over Pa Mong 230 is clearly the inclusion of the Mun-Chi area. Irrigation water for a large portion of this area would be channelled through the Nam Pong reservoir, which in the case of Pa Mong 230 cannot be supplied from the Pa Mong reservoir due to its lower offtake level. The main difference in irrigable areas between Pa Mong 240 and Pa Mong 250 is the inclusion in the latter of areas west of Khon Kaen, although largely through pump irrigation. Inclusion under Pa Mong 240 of these areas would lead to high-head pump irrigation supply.

GULF OF THAILAND

Loc Ninh
Dong Yen
Vinh Phuoc
Cau Dut
Song Cai
Ngo Ba Dinh
Tro Al
Phung Hiep
Bung Tau
Son Mat
Nam Roy
Hong Dan
Ngo Nam
Tran Soc
Kien Long
Ninh Quoi
Thanh Phu
Cai Tac
Thanh Tri
Phuoc Long
My Thanh
Phu Sinh
That Binh
Tan Long
Chu Chi
Vinh Hy
Soc Lieu
Tho Phuoc
Duc Hoa
Co Mau
Rach Trang
Muong Dieu
Binh Hoa
SEA
BASSAC

LOCATION MAP
PLAN DE SITUATION

LEGEND

- **Stations for water level and salinity data.**
  Stations fournissant des données sur le niveau d'eau et la salinité
- **Stations for water level salinity and discharge data.**
  Stations fournissant des données de niveau d'eau, de salinité et de débit
- **Seasonal salinity monitoring stations**
  (Samples are taken during spring tides throughout the year)
  Stations de contrôle de la salinité saisonnière
  (Des échantillons sont prélevés toute l'année durant les grandes marées)

MAP. I. LOCATION OF SAMPLING STATIONS IN THE CA MAU PENINSULA IN 1983

CARTE I. EMPLACEMENT DES STATIONS D'ECHANTILLONNAGE DANS LA PÉNINSULE DE CA MAU EN 1983

Concrete piling being prepared for the construction of the Huong My regulator

201. The various Pa Mong alternatives described in the study may be summarized as follows:

(a) The Pa Mong 230 option has the merit of relatively simpler and faster project implementation, but the disadvantage of less potential for hydropower and irrigation development; a smaller area at higher development cost, as well as operational cost, per ha;

(b) The Pa Mong 240 option appears to be the best in respect of irrigation development. The economic rate of return is the highest at the full development stage, whereas Pa Mong 230 will cost more in relation to the area commanded by the reservoir, while Pa Mong 250 is likely to encounter longer delays before implementation through serving a much larger area. The unit costs and potential of Pa Mong 240, for both irrigation and hydropower development, lie between the other two options in both respects;

(c) Elevation 250 m above MSL has the merit of possessing the largest potential at the most economic cost for irrigation and hydropower development, but is less likely to be implemented at an early date;

(d) All options present major problems of population resettlement, although these are somewhat less intractable at the 230 - 240 elevation.

IRRIGATION DEVELOPMENT

Mekong pump irrigation, Vientiane plain

202. The project (4.3.03), which commenced in 1978 and is expected to end in 1985, is being financed by a grant from the Netherlands totalling the equivalent of US$1,160,000. This assistance covers the provision of 32 electric pump for 11 pump stations, accessories and spare parts. All 32 pumps were installed and in operation in 1983, irrigating a total of some 3,000 ha of the project area. The Lao PDR was continuing its efforts to complete the irrigation systems at all 11 pump stations. The Secretariat was assisting in monitoring the project implementation and operation and maintenance activities of the local project staff, to ensure that the project equipment/materials were kept in good condition. Assistance for the operation and maintenance activities will be extended until the end of 1985 through the services of a mechanical engineer, provided under the United Nations Volunteers programme.

203. Some 1,400 ha of paddy fields were irrigated by the pumps during the dry season of 1982/1983. The results of an informal survey indicated that the rice crop harvested from the area served by the pump scheme was as high as 3,520 tons. In 1983, further efforts were made to extend on-farm irrigation facilities so that larger areas could benefit from this

project. A number of ancillary activities were also undertaken with a view to increasing the capability of the operation and maintenance team in performing future tasks.

204. With the extension of electricity supplies along the Mekong River, additional pumps are to be installed to complete the supply of irrigation water to other areas, as previously planned under this project.

Huong My water control project, Viet Nam

205. The objective of the project (4.3.09), which is located in the Mekong delts, is to control salinity intrusion and to supply irrigation water to an area of high productive potential, and in particular to the land between the Co Chien and Ham Luong rivers. The first stage involves the provision of partial salinity intrusion control and irrigation for 3,840 ha, with peripheral diking and a sluice gate for a much larger area.

206. In January 1982, the Netherlands approved a grant equivalent to US$2.5 million to finance the purchase of machinery, equipment, spare parts, lubricants and some construction materials for the implementation of Stage I of the project. The Secretariat assisted in the procurement and delivery of these items to the project site and, on behalf of the donor country, carried out regular monitoring exercises of the project's progress. In 1983, Viet Nam undertook all design and construction work, while meeting the costs involved, which were provisionally estimated to amount to some Dong 34 million (approximately US$2.9 million). An agreement for the construction of the Vam Don regulator, the main feature of Stage I, was also signed in May 1983. All the required equipment and materials were procured and delivered to the project site, and the main construction phase started in September 1983. Meanwhile, the following major preliminary works were undertaken: (a) the preparation of the site at Vam Don gate; (b) the construction of a workers' camp; and (c) casting of concrete piles for the regulator gate structure.

FLOOD CONTROL

Flood protection and swamp reclamation in the Vientiane Plain, Lao PDR

207. The Secretariat is continuing to provide technical assistance to the project (4.4.02), which is designed to protect large areas of cultivated land along the Mekong River from flood damage, and to reclaim swamp and marshland in the That Luang/Salakham area near Vientiane. In 1983, all the equipment ordered under the EEC grant equivalent of US$2.5 million for the first phase of this project was received and put into operation. Following discussions between the Lao PDR and EEC, it was decided to purchase a cutter suction dredger, the procurement of which would be undertaken after the completion of the technical and economic studies relating to the swamp reclamation component of the project. In-depth technical and economic studies, aimed at asaessing the feasibility of reclaiming the That Luang/Salakham area, were being carried out by the Secretariat and an interim report outlining the various

reclamation alternatives, including aquaculture, and assessed costs and economic returns was submitted to the Lao authorities in January 1983.

208. The first phase includes: (a) raising the road-dike from Chinaimo to Nong Heo (25 km) slong the Casier Sud, in order to protect some 3,500 ha (including existing paddy land) from flooding; (b) the reinforcement of critical sections of temporary dikes downtream of Nong Heo; (c) the rehabilitation of existing flood control structures along the Mekong; and (d) the construction of a drainage system to reclaim 2,000 ha of swamp and marshland. The main activities during the year included the construction of the cofferdam at the Houei Mak Hiao regulator; the strengthening of the existing dike near Ban Mak Nao, amounting to a total of 5,000 cubic metres of concrete fill; and rehabilitation work at six structures (principally comprising the repair and installation of gates). Construction work on the 25 km road-dike from Chinaimo to Nong Heo was started in July 1983.

ENVIRONMENTAL STUDIES

Environmental survey of the delta (Phase II)

209. In 1980, after consultations with the Mekong Committee, the United Nations Environment Programme (UNEP) fielded a mission to the delta, comprising three experts. The mission's report, entitled 'Environmental aspects of water resources developmeot in the Mekong delta', covered a wide area, with particular reference to the general environmental situation in the basin and the work conducted up to that time. However, the Committee was of the opinion that a second mission was necessary to formulate a well-defined project on the basis of the background information provided in the report of the first mission.

210. Following consultations between UNEP and the Secretariat in January 1983, a joint UNEP/Secretariat mission, comprising four technical specialists in fields such as hydrology, soil sciences, fisheries and environment, and irrigation engineering, was fielded in September-October 1983. One of the specialists was seconded by UNEP and the remainder by the Secretariat. The goal of the mission was to prepare a research and pilot development project in the delta with a view to ensuring environmentally compatible development of water and land resources in the area; i.e. achieving development objectives in a manner that will not adversely affect the delta environment and its resources.

211. Following a rapid reconnaissance survey of the delta (2.9.04), intensive data collection and interpretation, and extensive consultations with riparian specialists, the mission prepared a report entitled 'Environmental investigation of the development of water and land resources in the Mekong delta, Viet Nam'. The report, besides elaborating on the environmental problems of the delra, proposed a pilot reearch-cum-development project consisting of the three activities indicated below:

(a) A preliminary assessment of the environmental effects of agricultural development in the delta;

(b) Pilot development and demonstration projects for the utilization of acid sulphate and saline-acid sulphate soils;

(c) Environmental monitoring of selected agricultural development projects.

212. The objective of the first activity is to understand the environmental relationships within the entire ecosystem of the delta, through an analysis of available data characterizing the water regime, soil conditions and flora and fauna, at a computerized data centre to be established under the project. After supplementing the available data with further information, a preliminary assessment will be made of the delta ecosystem. This assessment is necessary for the location of the pilot areas and essential for the determination of development strategies. The data will also be valuable with regard to development planning for the whole region.

213. Under the second activity, it is planned to establish two pilot and demonstration farms, each with an area of 1,000 ha. The location of one farm is proposed in the Plain of Reeds, where conditions correspond to medium-shallow flooded terrain, covered by acid sulphate soil, outside the flood-transport zone and suitable for the construction of irrigation systems receiving water from the Mekong. The second farm is proposed in Thanh Tri district, where the acid sulphate soil comes under the influence of saline water. The detailed designs will be prepared after the execution of the preliminary assessment and the selection of specific areas. Besides land-use aspects, efforts will also be made to identify socio-economic problems such as domestic water supply, housing and sanitation.

214. The third project activity is detailed environmental monitoring to determine the appropriate agricultural development policies for large-scale utilization of land and water resources in the delta area. This will be carried out within and around the two pilot farms, as well as within the Huong My project currently under implementation. The evaluation of these observations is expected to throw considerable light on environmentally sound measures to be taken within the framework of agricultural development.

215. In 1983 UNEP expressed interest in supporting a project of this nature, the implementation costs of which are estimated to be US$2.85 million. Some of the problems which the project will help to alleviate are detailed below.

Environmental problem areas of the Mekong delta

Problem area 1: The obvious need to increase food production, in conjuction with the shortage of additional land for areal extension of agriculture, necessitates the intensification of agricultural practices to achieve the needed food production increases. However, the following constraints hamper such intensification efforts: (a) vast tracts of acid sulphate soils; (b) low elevation of delta lands (above MSL) which hinders

Part of the flood protection and reclamation of swamp and marshland in the Vientiane Plain involves the rehabilitation of flood control structures. Above, the Houei Mak Hiao regulator is shown after rehabilitation of the damaged trash racks and gates. Below, the Houei Van Vard flood control structure is shown following the installation of new flap gates

LAO PDR

THAILAND

SOCIALIST REPUBLIC OF VIET NAM

HANOI

LUANG PRABANG PORT
PORT LUANG PRABANG

LUANG PRABANG

THA DEUA R
RAMPE D'ACCOSTAGE
THA DEUA

SAYABOURI

CHIANG KHONG

BAN HOUEI SAI

HUEI SAI PORT
PORT HOUEI SAI

CHIANG SAEN

VIENTIANE

VIENTIANE SHIPYARD
CHANTIER NAVAL VIENTIANE

CHANNEL MARKERS
BALISAGE

PORT / RAMP
PORT / RAMPE D'ACCOSTAGE

HYDROGRAPHIC SURVEY
LEVE HYDROGRAPHIQUE

PROTECTION WORKS
OUVRAGES DE PROTECTION

NONG KHAI / VIENTIANE BRIDGE
PONT NONG KHAI / VIENTIANE

NONG KHAI BOAT BUILDING TRAINING CENTRE
NONG KHAI
CENTRE DE CONSTRUCTION NAVALE

FLEET REHABILITATION
REHABILITATION DE LA FLOTTE

THAKHEK

NAKHON PHANOM

PAKSANE PORT
PORT DE PAKSANE

DIRECTORATE PORT SERVICES
DIRECTION PORT SERVICES DE BAC

MUKDAHAN

SHIPS UP TO 80 TONS
BATEAUX PLUS DE 80 TONNES

VERY LIMITED SEASONAL NAVIGATION
NAVIGATION SAISONNIERE TRES LIMITEE

SHIPS UP TO 50 TONS
BATEAUX PLUS DE 50 TONNES

PAKSE

PAKSE PORT
PORT DE PAKSE

FERRY SERVICES
SERVICES DE BAC

PAKSE BRIDGE
PONT DE PAKSE

BANGKOK

GREAT LAKE
GRAND LAC

GULF OF THAILAND
GOLFE DE THAILANDE

CAMPONG CHAM

TONLE SAP

PHNOM PENH

KOMPONG CHAM

NAVIGATION TRAINING CENTRE
CENTRE DE FORMATION A LA NAVIGATION

HO CHI MINH VILLE

MY THUAN BRIDGE
PONT DE MY THUAN

HATIEN

TO NAVIGATION
AIDES A LA NAVIGATION

TRAFFIC SURVEY
ENQUETES SUR LES TRANSPORTS FLUVIAUX

EROSION CONTROL
CONTROLE DES BERGES

HYDROGRAPHIC SURVEY
LEVE HYDROGRAPHIQUE

ROUTINE WORKS
TRAVAUX RHUTINIER

ON GOING ACTIVITIES
ACTIVITES EN COURS

PROJECTS REQUIRING FUNDS
PROJET A RECHERCHER FONDS

CA MAU

LEGEND

- FRONTIERE
- CAPITALE
- VILLE
- LIMITE DU BASSIN VERSANT DU MEKONG
- AMENAGEMENT ACHEVE OU EN COURS DE CONSTRUCTION
- PORT EXISTANT OU EN COURS DE CONSTRUCTION
- (R) RAMPE D'ACCOSTAGE EXISTANTE OU EN COURS DE CONSTRUCTION
- (T) CENTRE DE CONSTRUCTION NAVALE OU DE FORMATION A LA NAVIGATION EXISTANT OU PREVU
- CANAL PRINCIPAL DU DELTA
- (B) BALISAGE VIENTIANE - LUANG PRABANG
- (S) CHANTIER NAVAL PROPOSE
- (B) PROTECTION DE BERGES
- (R) SAUTAGE DE ROCHES
- PONT PREVU

LEGEND

- COUNTRY BOUNDARY
- CAPITAL
- TOWN
- MEKONG BASIN WATERSHED BOUNDARY
- RESERVOIR COMPLETED OR UNDER CONSTRUCTION
- HARBOUR EXISTING OR UNDER CONSTRUCTION
- (R) RAMP EXISTING OR UNDER CONSTRUCTION
- (T) BOAT BUILDING OR NAVIGATION TRAINING CENTRE EXISTING OR UNDER CONSIDERATION
- MAJOR DELTA CANAL
- (B) BEACONING "VIENTIANE - LUANG PRABANG"
- (S) PROPOSED SHIPYARD
- (B) BANK PROTECTION
- (R) ROCK BLASTING
- BRIDGE UNDER CONSIDERATION

SCALE ECHELLE

0 100 200 500KM

THE BOUNDARIES SHOWN IN THIS MAP DO NOT REFLECT OFFICIAL ENDORSEMENT OR ACCEPTANCE BY THE UNITED NATIONS.

LES LIMITES INDIQUEES SUR CETTE CARTE NE REFLETENT PAS L'APPROBATION OFFICIELLE OU L'ACCEPTATION PAR LES NATIONS UNIES.

MAP 2 — CARTE 2

LOCATION OF NAVIGATION AND TRANSPORTATION PROJECTS
EMPLACEMENT DES OUVRAGES DE NAVIGATION ET DE TRANSPORT

diversion of drainage water, especially during high tide; (c) inundation of lands by floods; (d) intrusion of salt and acid waters from the sea and acid sulphate areas respectively; (e) inadequate discharge in the Mekong for irrigation withdrawal during low-flow periods; and (f) irregular rainfall, even during the wet season, which causes either dry spells or over-abundance of water, thereby adversely affecting plant growth.

Problem area 2: Implementation of development activities in the delta will, in itself, affect other resources; for instance, the development of modern intensive agriculture will affect fishery and forest resources.

Problem area 3: Drainage and inundation water from acid lands affects agriculture and fisheries in adjacent areas.

Problem area 4: Productive utilization of acid sulphate soils. The needs in respect of problem areas 2, 3 and 4 are: (a) to ascertain the exact nature and magnitude of detrimental effects and evolve solutions to alleviate the situation; and (b) to design and implement pilot projects to demonstrate the effectiveness of suggested solutions.

Problem area 5: Enhancement and protection of the environment in the face of rapid development; in this context, issues to be considered are: (a) the establishment of bird sanctuaries; (b) the conservation and development of mangroves; and (c) the development of fisheries and aquaculture.

NAVIGATION IMPROVEMENT -- HYDROGRAPHY AND CHANNEL IMPROVEMENT

Hydrographic surveys and related activities

216. During the dry season of 1982-1983, two hydrographic surveys (6.1.01) of scale 1:2,500 were carried out by joint Lao/Thai survey teams. The first survey concerning the study of the formation of sand-bars which impede the ferry crossing during low-water periods, was carried out at the Nong Khai/Thanaleng river crossing. The second survey, to identify the navigation channel between the vehicular ferry ramps at this crossing, was conducted at the Mukdahan/Savannakhet crossing.

217. A meeting between the authorities concerned in the Lao PDR and Thailand was organized by the Secretariat from 5 to 8 January 1983 in Nong Khai province. The discussions during the meeting were based on the result of the previous meeting held at Mukdahan in 1982. It was agreed by both sides that a master plan for hydrographic surveys and dredging would have to be prepared for the maintenance of the navigation channels during the dry season at the Nong Khai/Thanaleng and Savannakhet/Mukdahan river crossings. Permanent shore-marks for surveying and dredging would also have to be installed with technical and financial support from the Secretariat.

Improvement of the main ferry channel

218. Based on the results of the hydrographic surveys which located the best channel alignment, a joint Lao/Thai dredging team carried out dredging operations (6.1.03) at the Nong Khai/Thanaleng river crossing from January to April 1983. Two small dredgers were in operation. Unfortunately, mechanical problems developed in one of the dredgers, which was donated by the Australia five years ago, and the necessary spare parts could not be made available in time. Therefore maintenance of the ferry channel could not be carried out as planned, resulting in some delay to the cross-river traffic.

Channel marking

219. Navigation safety depends largely on channel marking (6.1.05). In 1983, the Lao PDR placed priority on the river stretch between Vientiane and Savannakhet. Studies of channel marking on this river stretch were carried out by the Secretariat. However, accurate and economic marking has to be based on up-to-date hydrographic information. Only certain portions of the river stretch where large-scale hydrographic surveys have been done recently, such as at Keng Kapung and Keng Kabao, can be improved at present.

220. Temporary channel marking between Luang Prabang/Vientiane and Vientiane/Savannakhet was carried out by the Lao PDR on a routine basis, using bamboo floats. This undertaking has considerably improved navigation safety for the small river craft plying the river during the low-flow season.

Supply of hydrographic equipment

221. Following the provision of the first batch of hydrographic equipment (6.1.06) in 1982, several other necessary items (an echo sounder, recording papers and a vehicle) were delivered to Viet Nam. The equipment is being used in carrying out hydrographic surveys for the designs of four river ports in the delta at Can Tho, My Tho, Vinh Long and Long Xuyen, as well as for providing necessary data for channel improvement between ports.

222. In 1983, the Vietnamese Government proposed that the equipment provided in 1982 be used for training 10-15 hydrographers at Ho Chi Minh City. A work plan for the training course is being prepared by the Secretariat in consultation with the authorities concerned in Hanoi.

NAVIGATION INFRASTRUCTURE AND BANK PROTECTION

Transit port at Keng Kabao, Lao PDR

223. The construction of the Keng Kabao port (6.2.04) office building, dining hall, canteen workshop, fire-station, communication building and the customs/police offices was completed. The construction of two water towers and a dormitory for port workers, the cargo stacking area and

vehicle parking area was nearing completion at the end of the year. Bank protection work for berths 1, 2 and 3 was also completed.

224. Tenders for the supply, delivery and erection of a transit shed, pontoons, gangways and cargo handling cranes were opened on 26 July 1983. Offers were selected from several bidders and contracts were awarded in late 1983. After completion in late 1984, the transit port at Keng Kabao will have one manual cargo handling berth and two mechanical cargo handling berths.

Ports at Lak Si and Thanaleng, Lao PDR

225. Lak Si and Thanaleng (6.2.03) are both important ports of Vientiane. Thanaleng is used mainly for cross-haul service to Nong Khai in Thailand, through which the bulk of imports to the Lao PDR are channelled. However, it is also being used increasingly as a long-haul port. Lak Si, a typical long-haul port, does not have the facilities to satisfactorily handle both incoming and outgoing cargo. With the completion of the Keng Kabao transit port a sizeable increase in cargo volumes can be expected, and it is essential that an immediate solution be found for coping with any future increase in traffic. In 1983 the United Nations Capital Development Fund (UNDCF) provided financial assistance totalling US$2.5 million to the Lao PDR to improve the cargo-handling facilities at the Thanaleng port. Additional support, in the form of a grant equivalent of US$370,000 from the Netherlands, was provided for procuring additional cargo handling equipment for both Lak Si and Thanaleng ports. The Secretariat was supervising the implementation of the two projects and providing technical assistance.

Bank protection work along the mainstream

226. Bank erosion is a normal phenomenon, occurring in all alluvial rivers flowing under natural conditions. Tackling this phenomenon is generally a very costly undertaking and occasionally, from an economic point of view, unfeasible. In any case, the cost of bank protection has to be weighed against potential losses which will occur if no preventive measures are taken.

227. Located along the river stretch between Vientiane and Nong Khai are the cities of Vientiane and Tha Deua (the Lao PDR), Vientiane airport, Sri Chiangmai and Nong Khai (Thailand), and land where the execution of agricultural development projects such as Huai Mong are being undertaken or planned. Therefore this area needs to be protected through the construction of diking for flood protection. In view of the high priority attached to bank protection work in this area by the Committee, the Secretariat has prepared a programme for erosion control on the river stretch between Vientiane and Nong Khai (6.2.06). Further studies of the most economic and suitable methods to counter this problem were initiated by the Secretariat in 1983, while a plan was being formulated for solving bank erosion at the My Thuan ferry crossing in Viet Nam.

RIVER TRANSPORT AND RELATED ACTIVITIES

Survey of waterborne transport

228. The waterborne survey (6.3.01) to be undertaken in the Lao PDR and Thailand, with a grant from Switzerland totalling US$23,000, had to be postponed from 1983 to 1984 due to unforeseen circumstances. Meanwhile, preparations for the waterborne transport survey in the Mekong delta were completed, and it was expected that the two surveys would be carried out in 1984 by the national authorities concerned, with assistance from the Secretariat.

FLEET IMPROVEMENT AND SHIPBUILDING

Improvement of river transport in the Lao PDR

229. In 1983, the Lao PDR received four self-propelled barges of about 80 tons capacity each from Viet Nam. The barges were put into service transporting cargo on the river stretches between Vientiane/Luang Prabang and Vientiane/Savannakhet.

230. The Lao PDR, on its own initiative, rehabilitated and converted an old river steamer of about 250 tons capacity into a passenger-cum-cargo vessel. This craft is now running on a regular schedule between Vientiane and Savannakhet. These five vessels, in addition to a unit provided by UNDP under its assistance programme to least developed countries, have enabled the Lao PDR to greatly ease its waterborne transport problems (6.4.01) on the Mekong.

Ferry services at the Nong Khai/Thanaleng river crossing

231. A ferry, built for the Lao PDR with a grant of DM 2 Million from the Federal Republic of Germany in 1982, has been in regular and continuous operation at the Nong Khai/Thanaleng river crossing (6.4.03) and is now in need of an overhaul and general repairs. The Secretariat, in consultation with the German Agency for Technical Co-operation, prepared work plans for the envisaged programme in 1984 for the repair and maintenance of the ferry. Meanwhile, a proposal to provide a second ferry for this river crossing was accepted by the Federal Republic of Germany for consideration.

TRIBUTARY DEVELOPMENT

HYDROLOGY AND METEOROLOGY

Experimental flood forecasting for the lower Nam Ngum

232. An experimental flood forecasting operation for the lower Nam Ngum, at Ban Tha Ngone in the Vientiane Plain (Lao PDR), was continued during the flood season. The installation of additional hydrologic

stations in the upper Nam Ngum is being carried out and the data collected by these srations will be used in calibrating the flood model to be used in forecasting the inflow into the Nam Ngum reservoir.

HYDROPOWER DEVELOPMENT

Nam Theun hydropower project, Lao PDR

233. Following the submission of a document, 'Selection of the most promising hydropower sites in the Lao PDR' to the Committee at its eighteenth session, it was recommended that the proposed pre-feasibility report should concentrate on three potential sites of one tributary, the Nam Theun (4.2.01), so as to be able to identify the best site. For this purpose, the Committee requested the Secretariat to implement the hydrological, topographical and geological work in close collaboration with the Lao authorities. The pre-feasibility study was undertaken in November 1983 by the Secretariat. The initial results, evaluated on the basis of an earlier Nam Ngum project, show that electricity from such a source will be cheaper than all the projected thermal stations, and that the project also carried none of the possible environmental hazards of the latter type of projects. Additional benefits in terms of irrigation, fisheries, flood control, timber extraction and possible effects of reservoir regulation (such as dry-season releases) on downstream flows, will be assessed after the ongoing geological and hydrological field studies are completed.

Huai Pa Thao

234. The Huai Pa Thao River originates in the Phetchabun mountain range, which lies in northeast Thailand and forms the watershed boundary separating the Mekong and the Nam Pa Sak rivers. The major portion of its 300 square-kilometre watershed area lies high in the mountains at an elevation of between 350-800 m MSL in two districts of Chaiyaphum province. The river flows down to the plain at the elevation of 220 m MSL, some 20 km north of Chaiyaphum, and joins the Nam Chi in the southwest of the province.

235. In view of the increasing demand for electric power in Thailand, NEA has recommended that high priority be given to carrying out investigations of the proposed Huai Pa Thao multipurpose project up to feasibility level. In response to a request by Thailand, the Secretariat prepared a project data sheet (MKG/R,408), including the terms of reference for the feasibility study (4.1.02), which was approved by the Committee at its seventeenth session.

236. Most of the studies will be conducted by the Secretariat, while the topographical and geological surveys and drilling will be carried out by NEA.

Yali Falls hydropower project (4.2.04)

237. Following a request from the Government of Viet Nam, the Secretariat approached the Government of Sweden for assistance in appraising and

updating the feasibility study of the Yali Falls hydropower project (4.2.04). The terms of reference for an appraisal mission were prepared and forwarded to SIDA, and formal approval for a grant of US$170,000 was given by the Government of Sweden in November. Work was expected to start in February 1984.

Power development

238. Examination and evaluation, within a system framework of alternative project combinations and the timely implementation of projects to meet the demand of each of the riparian countries represent a continuing activity of the Secretariat. In this connexion, in 1982, the Secretariat, with assistance from the Vietnamese Ministry of Energy, carried out a review of power development in the southern region of Viet Nam as part of its data collection activities, in order to provide up-to-date information for basin planning.

239. The report, completed in December 1982 and submitted to the Committee in January 1983 at its sixteenth session, indicated that present power supplies were inadequate to meet increasing demand for agricultural and industrial development in that region as set forth in the five-year State Development Plan (1982-1985). To meet this demand the construction of four power stations has been planned, with a total installed capacity of almost 900 MW, but none of these projects will be completed before the end of 1987.

240. Available information and current technology suitable for the development of energy resources in the southern region of Viet Nam were also reviewed. However, unlike the Central Highlands, in the southern region all the indigenous hydroelectric resources, amounting to some 2,000 MW, are located outside the lower Mekong basin. Some of these projects have been developed, while some are at the planning stage.

Small-scale water resources projects and rural electrification

241. A grant of US$510,000 was given formal approval in November by the Government of Sweden, through SIDA, for the feasibility study and detailed engineering design of two small water resources projects in the Lao PDR, the Nam Ngiou and Nam Pa (4.2.02). The Secretariat will act as the executing agency for SIDA.

242 The Nam Ngiou project is located on the Nam Ngiou, a tributary of the Nam Nhiep, about 2 km southwest of Xieng Khouang. This is a run-of-the-river type project with an installed capacity of 2,700 kW, to generate and supply electric power for supply to Xieng Khouang and Phonsavanh towns. It will also provide electricity for the National Co-operative at Latsene and will encourage the development of local industry and the community, as well as provide energy for pump irrigation. The project will cost US$3.89 million at 1979 price levels and will yield an annual benefit of US$490,000 which gives an internal rate of return, at constant prices, of 12 per cent.

243. The Nam Pa project, located 15 km from Luang Prabang, is proposed for a low-head (20-m high) dam for multipurpose development. The project will have an installed capacity of 900 kW. Energy from this project will be supplied to Luang Prabang, thus helping to solve its problem of power shortage. The project will irrigate 500 ha, from a total cultivable area of about 7,450 ha in Luang Prabang province. The irrigation development of the Nam Pa project will also contribute to solving the problem of food shortage in this northern province. The project will cost US$4.5 million at 1979 price levels and yield an annual benefit of US$410,000, which gives an internal rate of return of 9 per cent.

244. The projects are to be conducted in two phases -- a basic data collection programme which will take five months, and a second phase entailing a feasibility study and detailed design studies which will require another six months to complete.

245. In phase I, investigation equipment and facilities are to be provided from the project funds. During this phase, expatriate personnel will perform field investigations to collect and compile sufficient data for the feasibility and detailed design studies. Co-ordination of the work, including the supervision of the field investigations in this phase, as well as in phase II, will be the responsibility of the team leader of the consultant firm which will contracted at the start of the project.

246. For phase II, once the necessary basic data have been collected, the consultant firm will undertake the feasibility studies and, if the proejcts are found to be feasible, detailed design studies will be carried out. The feasibility study will be prepared to such standards as to enable the projects to be considered for financing. Detailed designs will then be completed, and will include the preparation of tender documents for the construction of civil works and the procurement of the required project components.

247. The Secretariat also continued its reconnaissance studies of small-scale potential hydroelectric projects on the tributaries of the Mekong River, in northern Thailand. Field investigations of five mini-hydropower projects, Nam Yuan, Nam Mae Suai, Nam Mae Pun Luang, Huai Krai and Upper Fang, have been carried out since November 1982. Based on a preliminary study, it was concluded that the Huai Krai and Upper Fang projects were not suitable for development due to relatively high investment costs that would be incurred in relocating the national highways and by resettlement problems. The studies of the other projects were under review and the report was expected to be completed by the end of 1983.

248. Owing to the favourable topographic and climatic conditions in the Central Highlands of Viet Nam the potential for many small and medium-scale hydropower projects exist. Much of the population in this area is still without electricity supplies and the Government of Viet Nam has therefore placed high priority on the implementation of small-scale hydroelectric projects for rural electrification, in an effort to accelerate economic development in the Central Highlands.

249. With this in mind the Secretariat, in co-operation with the Vietnamese authorities concerned, undertook a reconnaissance survey during March and April 1983 of small-scale hydroelectric projects in the Central Highlands, including the Ia Drang I, Ia Drang II and Krong K'Mar projects. The results of the study showed that the first two projects were economically feasible. The Committee, during its eighteenth session, approved both projects as recommended by the Secretariat and requested that funds be sought for their implementation.

IRRIGATION DEVELOPMENT

Construction of four dams on the Vientiane plain

250. Originally, four dams were to be constructed on the Nam Cheng, Nam Souang, Nam Houm and Nam Moun tributaries (4.3.05). However, the irrigable area of the Nam Moun dam has been included in the integrated Kao Liao (western Vientiane) irrigation scheme now under construction with bilateral assistance from Australia. Therefore the construction of the Nam Moun dam is no longer necessary. The remaining three dams are of the earth-fill type, with an intake conduit installed in the dam body and an overflow chute spillway. On completion, they will irrigate a total 10,000 ha of existing paddy fields and reclaimable land in the-western part of the Vientiane Plain. The construction phase of the project commenced in 1978, with OPEC, Sweden and Japan as the main co-operating countries/agencies. So far, a total of more than US$7 million in foreign exchange has been invested in the construction work. However, considerable work remains to be done. The Secretariat, on behalf of the OPEC Fund, which is the main financing agency for the project having provided total loans of US$6.5 million, has been assisting the project with the procurement and delivery of equipment, machines and spare parts.

251. Much of the progress in 1983 was made at the Nam Houm dam. The work was concentrated on the construction of the upper portion and both slopes of the dam, excavarion and trimming of both banks of the spillway and a number of outlets to the secondary canal. The dam structure and the bridge over the spillway were completed, while raincuts on both slopes were refilled. Work on both banks downstream of the spillways was in the final stage, with a concrete catch-drain being constructed on the right bank to prevent erosion of the slope surface. With regard to the other two dams the following activities were carried out in 1983:

(a) Nam Souang dam -- Phase I, including the dam structure, was completed in 1982. It was proposed to complete the construction of the main and lateral canal systems under Secretariat supervision during the 1984/1985 dry season, with equipment provided on a bilateral basis by SIDA, and a Lao Government budget allocation was expected in 1984;

(b) Nam Cheng dam -- Based on plans and designs, which are still under preparation, the start of construction at the Nam Cheng site has provisionally been scheduled for the 1984/1985 dry season, subject to the availability of funds.

Se Bang Fai flood control and irrigation project

252. The proposal to conduct a pre-feasibility study on a floodway for the Se Bang Fai River was approved by the Committee in 1978. On the basis of available data, studies of the flood regime for different project alternatives were complered and a pre-feasibility report on the floodway was finalized in December 1983. The study was financed by UNDP as a part of a four-year programme being executed by the World Bank, which sub-contracted the study to the Secretariat. Although the electrification study was completed in July 1980, the construction programme and survey activities have encountered prolonged delays due to security problems in the area; owing to this situation the World Bank withdrew from the project in late 1981. However, the pre-feasibility study on flood control was completed by the Secretariat in December 1983 and will be submitted to UNDP/OPE in early 1984.

253. UNDP/OPE retained the services of the Secretariat with a view to completing the project (4.4.05). The Secretariat administered the disbursement of the balance of funds made available under the former project budget, following the liquidation of all obligations incurred by the World Bank as executing agency for the project. The balance of US$75,711 and an additional amount of US$3,000 for an earth auger constituted the budget of the project as of January 1982. It was planned to complete the project on 30 June 1983 and a site engineer was recruited to render technical assistance to the Lao authorities in implementing the project. By the end of June 1983, the construction of the pumping station at Ban Hat Xieng Di was 90 per cent completed by the Lao authorities with assistance from the Secretariat, while preparations were undertaken for the construction of the second pumping station at Ban Ton Hene and the Houei Sok Bo flood control structure.

254. During the dry season of 1983, some 30 ha was irrigated by diesel pumps, and this is the third consecutive dry season that paddy cultivation has been carried out in this area. Under a programme drawn up in 1983, the Lao authorities will be responsible for the remaining construction work in 1984, for which the necessary equipment and materials have been purchased by the Secretariat and delivered to the Lao PDR.

Pak Cheng agricultural development project, Lao PDR

255. Following a recommendation made in 1981 by a joint Netherlands/Mekong Secretariat mission, a project (2.4.03) was formulated for developing 400 ha of lowland for rice-growing by newly resettled farming families displaced by the construction of the Nam Ngum dam. The Netherlands agreed in November of the same year to provide a grant equivalent of over US$1.2 million for implementing the project, the main components of which included: (a) rural electrification and provision of two pump stations; (b) transformation of newly-cleared land into paddy fields and the provision of irrigation and drainage facilities; and (c) the introduction of double cropping and development of animal husbandry. Two bilateral experts (under the technical assistance component from the Netherlands), were stationed

in Vientiane to provide assistance, in close co-operation with Secretariat's experts, to the project staff and farmers in the community.

256. In 1983, following the completion of the topographical survey covering some 700 ha in the northern part of the project area, the survey of another 360 ha in the area south of the Nam Cheng was continued and was nearing completion at the year's end. Hydraulic calculations and designs for many of the irrigation canals, up to the quarternary laterals, were completed. The foundations for a pump station were completed and construction materials were delivered to the project site. Meanwhile, electrification work at the project site, in conjunction with the Asian Development Bank (ADB) project to extend the power line from the Nam Ngum dam, was nearing completion. Construction of the office, warehouse and the drying floor were completed.

257. A sociological survey was also completed in April. Crop trials for maize, soybeans, groundnuts and cowpeas were carried out during the wet season, while experiments were carried out in August on farmers' fields in the upland area with regard to both permanent and ley pasture provision in the future.

Lower Mun basin development, northeast Thailand

258. A total grant equivalent of US$2 million from the Netherlands was invested in a feasibility study of the lower Mun basin (4.3.07) between September 1980 and April 1982. The study, which was undertaken by the Netherlands Engineering Consultants (NEDECO) and covered a total area of 400,000 ha along the middle and lower reaches of the Nam Mun, indicated an irrigation development potential of some 45,000 ha which are particularly prone to drought. It recommended that a project be formulated for the construction of a gated barrage across the Mun River near Si Sa Ket province, which would create a 490-million-cubic metre storage reservoir, and the construction of five pumping stations and a distribution system at the reservoir. The reservoir will, in turn, store in-flow during the wet season for irrigation purposes during the dry season, while some benefit will be provided downstream with regard to the alleviation of flooding. The study also indicated that the resulting dry-season flow would be higher than under present conditions. Thus the project would provide a positive year-round effect on downstream river flows. In 1983, the Secretariat began seeking additional funds for mapping and the detailed designs.

Pump irrigation on the Mun/Chi, northeast Thailand

259. Stage I of the project (4.3.06), which consisted of the installation of 26 electric pumps on the Mun and the Chi rivers, was completed in early 1983. The project was started in 1979 when the Netherlands approved a total grant equivalent of US$680,000 to finance the project. On completion, all 26 pumps had been installed at 18 pumping stations located in four provinces of northeast Thailand. The pumps are now supplying irrigation water to 7,810 ha in the wet season (supplementary irrigation). In the dry season of 1982/1983, however, they are only able to irrigate

An aerial view of the proposed No 1-2 dam site on the Nam Theun River in the Lao PDR

Preparation of the foundations for lining one of the main canals of the Huai Mong project, northeast Thailand, gets underway

The Seminar on Seasonal Streamflow Forecasting held between 20-27 October 1983, gets underway in Vientiane

1,525 ha of the total project area. This is attributable mainly to the inadequacy of the distribution systems. Thailand is going to carry out further construction work of on-farm ditches to enable the degree of cropping intensity of be increased to the desired level. The Secretariat will, however, continue its role of monitoring the development of Stage I.

260. Stage II of this project involves the delivery of another batch of 40 pumps for installation along the Mun, the Chi and the Mekong rivers. Of the 40 pumps, nine will be installed on the Mekong River, four in Nakhon Phanom province and the remainder in Nong Khai province. The Netherlands approved a second grant equivalent of US$890,000 to finance Stage II, and the project agreement was signed in September 1983 with the Secretariat again actiog as project superviser. The procurement of the 40 pumps was underway and the construction phase of the project was scheduled to start in the dry season of 1983/1984.

Huai Mong project, northeast Thailand

261. This project (4.4.03), which was initiated in October 1981, will provide flood control, drainage and irrigation on completion in 1985 for an area of 8,630 ha. Construction continued at a satisfactory pace during the year and earthworks on dikes and canals showed good progress, with the dikes being 90 per cent completed and canals about 50 per cent completed. Work also started on the main structures including the regular pumphouse and the smaller pump stations. Manufacture of the pumps and control systems was also initiated.

262. The total cost of the project, which is being supervised by the Secretariat, is esrimsted at US$25 million with a contribution from EEC in the form of a grant equivalent of some US$13 million and with pumps to a value equivalent to US$6 million being provided by Belgium. The remainder of the costs, equivalent to US$6 million, are being borne by Thailand. The main components of the project are a regulator at the river mouth of the Huai Mong, dikes and nine electric pump stations and their distribution systems.

On-farm development for the Huai Mong project

263. Following the implementation of flood control and irrigation in the Huai Mong project, which commenced in February 1982, the Secretariat undertook a study of on-farm development in the same project area in July 1982. A proposal for implementing this part of the project (4.3.08) was approved by the Committee at its fifteenth session. At the request of the counterpart agency, NEA, the proposal was modified and completed by the Secretariat in February 1983.

264. Stage I of the project is ultimately aimed at up-grading and maximizing the efficiency of water delivery and use in pump irrigation schemes throughout the whole project area (8,630 ha). The initial on-farm development plot, however, covers two selected areas, totalling some 500 ha, located in two of the nine pump schemes of the Huai Mong project. The main components of the project include: (a) construction of tertiary

and/or quaternary irrigation and drainage laterals; (b) construction of farm roads alongside the irrigation canals to improve accessibility to farmers' fields; (c) partial re-arrangement of farm plots; and (d) clearing and (if necessary) levelling of cultivable land to improve the on-field water control. The required costs for this project were estimated at US$360,000, of which US$220,000 was being sought from co-operating countries and organizations for project implementation.

Flood control and irrigation development, Nam Songkhram basin, northeast Thailand

265. A preliminary study on flood control and irrigation development for the Nam Songkhram basin (4.4.06) was initiated by the Secretariat in 1980, aimed at alleviating the regular occurrence of severe flooding in the wet season as well as providing more irrigation water in both the wet and dry seasons. Preparatory work for a pre-feasibility study was completed in mid-1982 with a grant equivalent of US$248,000 provided by the Netherlands. Another grant equivalent of US$254,000, again from the Netherlands, was provided for the pre-feasibility study itself which was undertaken in September 1982 and completed in March 1983.

266. The study report provides a master plan for the development of the basin, i.e., to alleviate annual flooding over about 70,000 ha, and to provide irrigation to some 20,000 farming households on 35,000 ha. The project components considered include: (a) a regulator near the confluence of the Nam Songkhram with the Mekong; (b) an upstream reservoir; (c) road-dikes enclosing some areas located between the Nam Songkhram and its tributaries, with the aim of providing flood protection and irrigation; and (d) irrigation and drainage systems, including pump stations to be installed around the main reservoir. Based on these recommendations, a programme for upgrading the study to the feasibility level was prepared. In this connexion, it was planned to map some 50,000 ha of the priority area during the 1983/1984 dry season.

Nam Ngum fishery development and management, Lao PDR

267. This project (8.4.02), was undertaken in May 1978 and completed in March 1983, utilizing a grant equivalent of US$1.4 million provided by the Netherlands. The project has resulted in the establishment of a sound base for a fishing industry in the Nam Ngum reservoir and in the enhancement of fish production. For example, prior to the start of the project, the average annual fish catch from the lake was some 350 tons, whereas the total annual catch in 1983 was estimated to be 2,800 tons.

268. The results of the project are summarized below:

(a) Infrastructure facilities necessary for conducting fishery operations, such as roads, a fish-landing platform, an ice factory, a workshop for maintenance of fishing craft and gear, and a well-equipped laboratory building were completed in 1982. Equipment and supplies for the capture and transportation of fish to markets, such as fishing nets, outboard engines and an insulated van, were provided;

(b) Fishermen were trained in modern fishing techniques and in the care and maintenance of fishing craft and gear;

(c) Improvements were effected in traditional fishing gear, resulting in increased efficiency, while improved techniques in fish preservation, transportation and quality grading, and statistically sound methods for estimating fish harvests and species' composition of catches, were demonstrated;

(d) The economics of fishing activities was studied, the cost of production of fish was estimated and equitable selling prices were estimated;

(e) On-going research, which includes biological studies through the regular collection and analysis of water samples from 10 locations has already provided some understanding of the limnology of the lake and the biological aspects of the fishery resource. Other research has been carried out through the collection of samples of fish scales and guts, and measurements of length frequency and distribution of various species in catches from the reservoir.

TRAINING

HYDROLOGY AND METEOROLOGY

Seminar on seasonal streamflow forecasting

269. Co-operation with WMO was continued during the year, particularly in relation to the Hydrological Operational Multipurpose Sub-programme (HOMS/WMO). A HOMS Focal Point was set up at the Secretariat to co-ordinate HOMS activities relating to the riparian countries. In March, WMO made available the services of an expert to review available methods for seasonal streamflow forecasting and to install selected methods at the Secretariat.

270. As an important adjunct to the WMO/HOMS sub-project, the Secretariat proposed a seminar on seasonal streamflow forecasting, in co-operation with WMO, as an effective means of technology transfer. The seminar, held in Vientiane from 20 to 27 October 1983, was organized under the training component of the project, 'Rehabilitation and expansion of the lower Mekong basin hydrologic and meteorologic network' (1.1.05), for which financial assistance is being provided by UNDP within the framework of its programme support to the Committee. The training component is aimed at improving the efficiency of the network operation as well as promoting the effective application of hydrologic data.

271. The main objective of the seminar was to provide a means, either simple or relatively sophisticated, of forecasting long-term variations in streamflow, an essential prerequisite to improved use and management of water resources projects, such as the operation of reservoirs (man-made or

natural) and water management for irrigation or salinity and acidity control. The second objective of the seminar was to provide a forum for riparian engineers with various technical responsibilities -- e.g. hydrologists in charge of network operations and analysis -- to exchange views on the technical problems encountered in this field, to facilitate efforts towards achieving optimum conditions for the development and operation of hydrologic networks. To further enhance this objective Secretariat staff and international lecturers also attended the seminar to inject new ideas and provide details of the latest developments in the application of hydrologic data to seasonal forecasting.

272. The number of participants totalled 24 -- 10 from the Lao PDR, five from Thailand, six from Viet Nam, one each from Burma and Pakistan and an observer from the Danish Hydraulic Institute (DHI). Three participants from Burma, Pakistan and Viet Nam were sponsored under the WMO/HOMS Project. The number of papers submitted totalled 18. Each country submitted a paper on national hydrologic activities and papers on the operational models/methods used in seasonal streamflow forecasting.

273. Great interest was expressed in the computer models for seasonal streamflow forecasting as described in the papers and the Secretariat was requested to transfer its available computer programmes to the participating countries. The Secretariat agreed in principle to supply the programmes to the member countries of the Committee, but in the case of Burma and Pakistan, it was pointed out that the request should be made through WMO headquarters in Geneva.

274. It was also recommended that the next seminar would cover data processing, estimation of streamflow for an ungauged basin or a basin with inadequate data and network design. Alrhough a definite title was to be determined at a later date, it was agreed that the seminar would be linked to WMO/HOMS to enable WMO to continue providing technical assistance in this field.

Regional seminar on field investigations and modelling for water management in estuaries and deltas

275. As part of the studies carried out by the Secretariat since 1981 on delta salinity intrusion, and as a follow-up activity to the seminar held at Ho Chi Minh City in October 1982 on 'Tidal hydraulics and salinity intrusion in the Mekong delta', a regional seminar on 'Field investigations and modelling for water management in estuaries and deltas' was held from 21 to 25 November at AIT, in Bangkok.

276. The seminar, which was attended by 21 participants, was organized jointly by AIT and WMO, with support from the Secretariat, the regional office of the United Nations Food and Agriculture Organization (FAO) and the Canadian International Development Agency. One of the main objectives of the seminar was to review the results of data compilation, processing and analysis undertaken for modelling of salinity intrusion in the Ca Mau peninsula of Viet Nam. Another objective was to review work carried out on discharge measurements in the Mekong estuarine system.

277. As part of its support for the seminar, the Secretariat sponsored the participation of 12 engineers of whom two were from the Lao PDR, four from Thailand and four from Viet Nam; the two additional Vietnamese engineers were sponsored by the Secretariat to present technical notes, one on the modelling and management activities in the Ca Mau Peninsula and the other on discharge measurements, by the moving boat method, in the Mekong eatuarine system. The Secretariat also provided the services of two staff members to assist in the organization of the seminar and to present a technical note on the modelling activities of the Secretariat. Other lectures were delivered by staff of AIT, WMO and FAO.

NAVIGATION TRAINING FACILITIES

Nong Khai Industrial and Boat-Building Training Centre

278. The Centre (6.3.02) was established at Nong Khai in 1970, the costs of which were shared equally between the United Kingdom and Thailand. Technical assistance from the United Kingdom was phased out in 1976; however, further assistance was granted in 1981 and 1982 by the Federal Republic of Germany in the form of equipment and expert services, in conjunction with a project to supply a modern ferry boat to the Lao PDR. At present the Centre is operating a full-time one-year course in steel, non-ferrous, wood and GRP boat-building for 120 trainees. A part-time training scheme, of one to three months duration and covering the areas of welding, auto-mechanics, machine shop, electricity/electronics and building construction, has also been run for 256 trainees.

279. In 1983, Thailand laid out plans to upgrade the training facilities at the Centre, under which the present one-year course will be phased out in 1984 and replaced with a three-year training programme in 1985. In addition, the intake of trainees will be increased gradually to approximately 1,000 by 1987. During the latter part of 1983, the Secretariat, in collaboration with the International Labour Organization (ILO) in Bangkok, assisted the Centre in preparing a detailed schedule for the three-year training programme.

Navigation Training Centre in Vientiane

280. The Centre (6.3.04) was established in 1979 as part of the Committee's navigation training programme with financial support from UNDP. Project supervision was undertaken by UNDP; however, assistance in procuring training materials and equipment and the preparation of the training programme, which started in 1980, was provided by the Secretariat. In 1983, 50 trainees were enrolled in a three-year hydrography course which was initiated in 1982. The Secretariat also prepared a programme for further assistance to the Centre, following the termination of UNDP support in 1983.

SCHOLARSHIPS, ON-THE-JOB AND SHORT-TERM TRAINING

Scholarships

281. As part of the follow-up activities of the seminar on 'Tidal hydraulics and salinity intrusion in the Mekong delta' AIT agreed to provide scholarships for two Vietnamese engineers to take a Master degree programme in the field of coastal engineering, for the purpose of further research into salinity intrusion and analysis of hydrologic data in estuarine systems. Other co-operation between AIT and the Secretariat included co-ordinated research work in the field of hydraulics and hydrology in the Mekong basin.

On-the-job training

282. Two Vietnamese engineers underwent on-the-job training for three months at the Secretariat from 19 September to 19 December, in connexion with the Secretariat's delta salinity studies (1.2.05). The training included work on mathematical modelling of salinity intrusion in the Ca Mau peninsula. Their work produced some very useful data for the most critical period of the low-flow season in the peninsula. These data were presented to the regional seminar on 'Field investigations and modelling for water management in estuaries and deltas'. Further refinement of the model was being carried out.

283. Two Lao engineers underwent a six-month on-the-job training course at the Secretariat, in connexion with the prepsration of an inventory of promising water resources projects in the Lao PDR. After being trained on the methodology used in identifying and evaluating water resources projects, the trainees prepared an inventory of 26 promising projects, with a total installed capacity of 512.3 MW and an irrigation area of 3,600 ha. The result of the study was forwarded to the Lao authorities for consideration before preparing a programme for further necessary investigations and the collection of the more basic data.

284. In connexion with the activities of the Tha Ngone Fish Culture Training and Extension Centre (8.4.03), 35 mid-level trainees completed a course of classroom lectures (200 hours), practical demonstrations and field training in the principles and management practices of aquaculture, including fish seed production. Some of the key lectures were translated into the Lao language and distributed to the students and counterparts. Three of the latter group had higher level academic backgrounds and were therefore associated in laboratory and extension field activities.

Short-term training in remote sensing technology

285. In 1983, the Secretariat sponsored the participation of three technicians -- one from Thailand and two from Viet Nam -- on a four-month training course on remote sensing technology at AIT. The objectives of the training were to assist the riparian countries in upgrading the capabilities of their technicians in the use of remote sensing technology

and to enhance the co-operation between their respective institutions and the Secretariat in evaluating remote sensing data through various programmes to be established by the Secretariat. At the same time, the training was aimed at the transfer of remote sensing technology to developing countries in Asia. The course provided training in remote sensing theory and applications, with emphasis on both computer and visual analyses of remotely sensed data. Similar training will be organized for technicians from the Lao PDR in 1984.

Chapter 4

RELATIONS WITH CO-OPERATING COUNTRIES AND AGENCIES

BACKGROUND

286. Over the years, 26 countries[1/] and 16 United Nations agencies and related organizations[2/] have been associated with the work of the Committee. In addition, close working relations have continued with inter-governmental organizations outside the United Nations system such as EEC and the OPEC Fund.

287. Four foundations -- the Asia Foundation, the Ford Foundation, the US Natural Science Foundation and the Ramon Magsaysay Award Foundation -- have also provided assistance on a number of occasions to the Committee, together with the International Rice Research Institute and other non-profit institutions and business organizations.

288. The functions of the Secretariat in co-ordinating studies, mobilizing resources and executing projects have already been touched upon in paragraphs 35 - 37 of Chapter 1. It is important to note that co-operating countries and organizations have given sustained support to the Secretariat in its performance of these functions and in its implementation of the Committee's Work Programme. Contributions in cash and in kind from co-operating countries and organizations amounted to US$524,403,924 from its inception to the end of 1983 (Annex I), enabling the Committee to engage in water resources development in the lower Mekong basin, which has helped to improve the living standards of the inhabitants in the region.

RELATIONS WITH CO-OPERATING COUNTRIES

289. The Committee, apart from receiving resources in cash and in kind from co-operating countries, operates in close collaboration with the same nations. In particular, it has benefited from the wide experience gathered by some of these countries in their efforts to deal with the problems involved in harnessing resources and in managing river basin development programmes. Study tours to some of these countries and visits by counterparts from other river basins for the purpose of exchanging experiences in the field of river basin development and management, and also in identifying possibilities of closer collaboration, have therefore taken place on a regular basis. A description of some of the more recent visits is given below.

1/ Australia, Austria, Belgium, Canada, Denmark, Egypt, Finland, France, Germany (Fed. Rep. of), Hong Kong, India, Indonesia, Iran, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Pakistan, Philippines, Sweden, Switzerland, United Kingdom, United States of America and Union of Soviet Socialist Republics.

2/ ADB, ESCAP, FAO, IAEA, IBRD, IFAD, ILO, UNDP, UNDTCD, UNEP, UNESCO, UNICEF, UNIDO, WFP, WHO, WMO.

The Nam Ngum dam, constructed by the Committee in the Lao PDR, has a total generating capacity of 150 MW and supplies more than 750 Gwh of power annually to Thailand.

A stretch of the Mekong River, upstream of Vientiane, the Lao PDR.

During the eighteenth session of the Interim Mekong Committee, held at Ho Chi Minh City, Viet Nam, from 8-15 September 1983, the participants visited the Dau Tieng irrigation project in Tay Ninh province. Among the participants were (above, from right) Mr. Bernt Bernander, out-going Executive Agent, Dr. Somphavan Inthavong, Member for the Lao PDR, Mr. Prapath Premmani, Member for Thailand; Mr. Dinh Gia Khanh, Member for Viet Nam, and Mr. Galal Magdi, incoming Executive Agent.

290. In 1981, a delegation comprising the three Members of the Interim Mekong Committee, the Executive Agent and five other participants from the National Mekong Committees and the Secretariat took part in a study tour in the Union of Soviet Socialist Republics (USSR) from 9 to 22 July 1981. Organized by the Government of the USSR, and funded by UNEP, the study tour focussed on water resources development for irrigation purposes in four different regions of the Uzbek Soviet Socialist Republic: Tashkent, Golodnaya Steppe, Samarkand and the Ferghana Valley.

291. In August 1982 the Secretary-General of the Senegal River Development Organization visited the Secretariat for an exchange of views and a discussion on the possibilities of collaboration. It is interesting to note that the Senegal River Development Organization had helped to organize in Dakar from 5 to 14 May 1981, in conjunction with the United Nations, a meeting of international river organizations at which the Committee was represented by a delegation comprising two representatives each from the Thai and Vietnamese National Mekong Committeea and the Secretariat. It was, therefore, something in the nature of a return visit on the part of the Organization's Secretary-General.

292. A delegation, headed by the Chairman of the Interim Mekong Committee and comprising two participants from each of the riparian countries, the Executive Agent and one other participant from the Secretariat, took part in a study tour of the Snowy Mountains hydroelectric development and the Murrumbidgee irrigation scheme in southeast Australia from 7 to 14 November 1982. The study tour, which was organized and funded by the Government of Australia, focussed on the system development of water resources for power generation and irrigation purposes. The participants visited many of the construction sites in the scheme which includes 16 large dams and many smaller diversion structures, some 50 miles of aqueducta, over 90 miles of tunnels, two pumping stations, and seven surface and underground power stations. Its total generating capacity is 3,740 MW with an annual output of 5,000 million kWh. It also provides almost 2.5 million cubic metre of water each year for irrigation in the semi-arid areas along the Murray and the Murrumbidgee rivers.

293. In November 1983, at the invitation of the Government of India, a delegation of the Committee, comprising two representatives of each member country and two members of the Secretariat, visited India and was able to see a number of Government offices, technical and research institutions and consultancy firms engaged in power and water resources development in India and abroad. The delegation was also able to meet the Secretary of the Ministry of Irrigation, with whom matters of common interest were discussed. The visit resulted in considerable strengthening of the relationship between the various institutions in India and the Committee and provided the Committee with an excellent overall picture of the latest development in science and technology in India. The visit also afforded both the Committee and India an opportunity for exploring future avenues of collaboration.

RELATIONSHIPS WITH CO-OPERATING AGENCIES AND ORGANIZATIONS

294. Assistance, both in cash and in kind, has been received from inter-governmental bodies and non-governmental organizations in the area of pre-investment investigations and planning (see Annex I). This technical assistance has been instrumental in assisting the Secretariat in the implementation of the Committee's Work Programme.

295. The Asian Development Bank (ADB) has been providing both technical assistance and loans for a number of projects sponsored by the Committee. In 1974, in collaboration with the World Bank, ADB identified a number of pioneer agricultural projects in the basin and proceeded to assist the Nong Wai pioneer agriculture project in Thailand. ADB has also extended assistance to the Binh Dinh, Go Cong and Tan An irrigation schemes in Viet Nam. In recent years, in the Lao PDR, ADB has assisted projects in forestry, road improvement, rural electrification and agricultural support services.

296. It was at the thirteenth session of ESCAP, held in March 1957, that a recommendation was made for the establishment of the Committee by the Governments concerned. After having brought the Interim Mekong Committee into being in 1975, ESCAP has continued to collaborate closely with it. From the inception of UNDP'S institutional support to the Committee to the introduction of government execution, ESCAP has played a key role in helping the United Nations, through UNDTCD, to execute the Mekong project. ESCAP has also had a primary role in the development of water resources in the region and was the motive force behind the preparation of the Indicative Basin Plan. Moreover, it has helped to provide technical expertise in various fields and, over the years, staff of both organizations have participated in each other's meetings and other activities. Contributions in kind have also come from ESCAP in the form of physical facilities and administrative back-stopping for the Secretariat's work.

297. Close collaboration has existed between FAO and the Committee, especially in areas connected with agricultural development of the lower basin. Support from FAO has been multi-faceted and varied in nature, and began largely with a survey mission fielded by FAO in 1959 at the request of the Committee, on the basin's agriculture, forestry and fisheries; that survey laid the foundations for subsequent work in these areas. This was followed by an active part in the preparation of the Indicative Basin Plan. Through its World Food Programme (WFP), it also provided support in the form of food for work. More recently, FAO recruited experts to man fish-breeding stations in the Lao PDR and also sent a programming mission to the Lao PDR in 1980.

298. In the field of computer technology and system analysis, the International Atomic Energy Agency (IAEA) has helped in providing expert and material inputs for the Committee's pre-investment investigations. For example, in 1975 it gave the Wien Automatic System Planning Package (WASP) to the Committee, a series of six computer codes designed to find the optimal economic way of expanding the generating capacity of an electrical utility system under any given conditions, and also agreed to train Secretariat staff members in the use of the programme package.

299. In the field of development assistance, the World Bank (IBRD) has been providing technical assistance and loans for a number of projects sponsored by the Committee. In 1969, it fielded a mission to the riparian member countries with a view to making arrangements for the financing and execution of high-priority projects. It acted as administrator for the funding of Phase I of the Nam Ngum hydroelectric project in the Lao PDR (completed in 1971) to which 10 countries contributed support. Subsequently in 1974, in collaboration with ADB, it helped to identify a number of pioneer agricultural projects in the basin. One of these, the Nam Pong irrigation project, was financed by the World Bank loan in 1974. More recently, the current Phase III extension of the Nam Ngum project has been implemented, utilizing World Bank and IDA loans.

300. In the field of agricultural development, the International Fund for Agricultural Development (IFAD) has been providing the Committee with technical assistance and loans for construction works. For example, in 1979 arrangements were made for a technical assistance input as well as a loan from IFAD for the Casier Sud pump irrigation project in the Lao PDR.

301. In the area of manpower development the Committee has been working closely with ILO, which has given expert inputs to pre-investment investigations undertaken by the Secretariat. In 1970 it assisted the Committee in conducting a survey of the basin's manpower requirements. In 1983, it helped to arrange the provision of the services of an expert to define a project for expanding the Nong Khai Industrial and Boat-Building Training Centre, under which the Centre's one-year training course is to be developed into a three-year course, aimed at improving graduates' requirements prospects and upgrading the capabilities of the instructors. It is also envisaged in the project that the number of trainees will be increased, while facilities will be offered for training students from other riparian countries.

302 UNDP has made very substantial contributions in assisting the Committee to perform its functions on a self-sustaining basis. Paragraphs 29 - 34 in Chapter I describe UNDP institutional support to the Committee. In the area of programme support, UNDP has figured among those sources of finance for the supply of hydrologic equipment and spare parts which, between 1957-1983, helped to expand and rehabilitate the hydrologic and meteorologic network in the lower basin. UNDP is also supporting the establishment of the Lower Mekong Basin Information System. Assistance from UNDP has been largely concentrated on pre-investment investigations and planning. Of all the members of the United Nations family, UNDP has so far contributed the largest amount of resources in cash and in kind (see Annex I). In certain cases UNDP has also asked the Secretariat to serve as executing agency for its projects. A recent example is the project for agricultural development of the Se Bang Fai flood plain (Phase I) in the Lao PDR.

303. UNDTCD has played an important role in the development of the Committee by acting for many years as the executing agency for UNDP's institutional support project, prior to direct government execution of the Mekong project. Moreover, UNDTCD has on many occasions provided expertise

for carrying out some of the projects sponsored by the Committee. A recent example is the expert assistance given in 1983 for drafting a plan of operation for the Lower Mekong Basin Information System.

304. As far as the environmental aspects of the Committee's activities are concerned, work has been carried out in close co-operation with UNEP, which has been supporting the Committee with contributions, both in cash and in kind. A cash contribution was received from UNEP for the implementation of the three phases of the Nam Pong environmental management research project, the terminal report of which was published in 1982. Similarly, UNEP also contributed cash for the preparation of 'Environmental Impact Assessment: Guidelines for Application to Tropical River Basin Development', a manual for planners, engineers and developers of tropical river basins, also published in 1982. A joint UNEP/Mekong mission also visited the delta in 1983, with a view to preparing a research and pilot development project to ensure environmentally compatible development of water and land resources in the area.

305. In the area of education and applied science in particular, and development in general, the United Nations Educational, Scientific and Cultural Organization (UNESCO) has played an important role in helping the Committee to undertake pre-investment investigations. In 1968 UNESCO helped to conduct a survey of the need for agricultural extension in the lower Mekong basin. In 1969 the Delta mathematical model for developing further studies of the Mekong delta was prepared under UNESCO's directions. More recently, it helped to launch in 1983 a very important project to investigate groundwater resources of the lower Mekong basin.

306. The United Nations Children's Fund (UNICEF) has helped the Committee largely by providing expert inputs for pre-investment studies. For instance, in 1970, it seconded to the Secretariat a social development consultant to help in compiling a survey of young human resources in the basin.

307. In the area of industrial development, the United Nations Industrial Development Organization (UNIDO) has been assisting the Committee in providing expert inputs for pre-investment investigations. For example, in 1970, it made available the services of an expert to carry out a feasibility study of a ferro-alloys industry in the basin. A feasibility study was also completed in 1980, with the help of a UNIDO expert, on the establishment of a fish feed mill in Viet Nam.

308. In the field of public health, the World Health Organization (WHO) has been working very closely with the Committee by providing it with expert inputs. In 1970 it made available the services of a consultant in malatia control for studies of the malaria situation in tributary project areas in the lower basin. In 1983, it has helped to identify a consultant for the basinwide survey of waterborne diseases, in which WHO wishes to participate at a later date.

309 WMO has engaged in an exchange of expertise and material inputs with the Committee, particularly in relation to HOMS/WMO. Since December 1982 the Secretariat has been a HOMS focal point in the region,

collaborating closely with WMO headquarters in Geneva and with the HOMS national reference centres located in various parts of Asia and the southwest Pacific. This has resulted in an exchange of staff and material inputs. For example, the services of a WMO expert were provided for seasonal streamflow forecasting and in connexion with field investigations and modelling for water management in estuaries and deltas. On the other hand, the Committee has provided the services of staff members for the WMO Programme on mathematical models used for hydrological forecasting and has provided components for inclusion in the HOMS/WMO Reference Manual.

310. EEC has been providing inputs, both in cash and in kind, for projects sponsored by the Committee. For example, it is providing resources for the current implementation of the Huai Mong flood control and irrigation project in northeast Thailand.

311. The OPEC Fund has been providing loans for projects sponsored by the Committee.

FURTHER AVENUES OF CO-OPERATION

312. While such past modalities of collaboration with donor countries and agencies as exchanges of visits and expertise will be continued in future, new avenues of collaboration need to be explored in order to fully meet the specific requirements of co-operating countries and organizations.

313. As far as the Committee's role in the mobilization of financial resources is concerned, it has limited itself in the past to receiving financial aid from co-operating countries and agencies; but, now that the concept of general purpose funds has taken hold, it can contemplate other modalities of mobilizing financial resources on the basis of such funds. General purpose funds are contributed by co-operating countries and organizations for the purpose of promoting activities which have been held up for lack of funds and to support Secretariat activities requiring expenditures for which no other specific funds are available, either in UNDP's institutional and programme support budgets or in other project budgets. In future, on the basis of general purpose funds, the Committee's joint financing of priority projects can be explored with co-operating countries and organizations. Similar arrangements can be envisaged with regard to parallel financing, whereby certain components of a priority project can be financed by the Committee out of general purpose funds, while other components are taken by co-operating countries or organizations.

314. No less important is the role of the Committee and its Secretariat in serving as a catalyst. The Committee has in the past helped to identify and formulate worthwhile projects where opportunities for development of such projects have not previously been perceived. With its long-standing technical expertise in water resources development, this catalytic role should be well-recognized by co-operating countries and agencies. One way in which the Committee can play such a role is to make use of general purpose funds to provide seed money for the identification and formulation of projects, which could be further assisted by co-operating countries and agencies.

315. As part of its efforts to carry out the Work Programme, the Committee has been involved in an active training programme for technology transfer, as explained in paragraphs 106 - 121 in Chapter 2. In this the Committee seeks further modalities of co-operation with co-operating countries and agencies for selecting the technology most appropriate to the level of development and absorptive capacity of riparian member countries. Technology transfer can take place not only from more developed countries but also from developing countries, where the United Nations' Programme for Technical Co-operation among Developing Countries (TCDC) provides a useful framework.

Chapter 5

INSTITUTIONAL DEVELOPMENT

BACKGROUND

316. From the standpoint of staff development, viewed within the broad framework of institutional development, the Committee has, since its inception, laid emphasis on collective self-reliance. The conception of the Mekong Cadre bears witness to this. The Mekong Cadre, instituted in 1972 and supported by the Mekong scholarship programme, was designed to constitute the core of the Secretariat. The Mekong Cadre's salaries and conditions of service are meant to constitute a compromise between prevailing governmental practice in the basin and international practice adopted by inter-governmental organizations. The idea behind this compromise is that it should be possible, on the one hand, to attract highly qualified experts from the riparian member countries because they would work close to home and help to develop the basin as a whole and, on the other hand, build up an international civil service among riparian member countries that would, in the long run, be compatible with and supportive of each national civil service concerned.

317. The Mekong Cadre's salaries and conditions of service have been kept under constant review in order to keep abreast of developments in international practice, and to take account of inflation. Thus, in 1982, the Committee decided to put into effect a revised salary scale along with improved fringe benefits and allowances applicable, to the extent possible, to all riparian staff of the Secretariat.

318. After more than a decade of existence the Mekong Cadre concept, in the sense of the practice of basing the Secretariat on the core of permanent riparian personnel and the philosophy of attracting riparian talent to the Committee's work, is very much alive. The experience so far bears out the hypothesis that excellent staff are available within the riparian member countries and can be attracted to the Secretariat by well-conceived incentives and by the challenge posed by the development of one of the largest river basins in the world.

319. The Secretariat is manned by three categories of staff. The international staff, highly specialized in areas required for the implementation of the Committee's Work Programme, possess expertise which at present is not available within the riparian member countries but which is being actively fostered through training programmes instituted by the Secretariat. They are funded by UNDP, under its institutional support project, other organizations and co-operating countries. The second category of staff is the Mekong Cadre, the core of the Secretariat, who have such background and training as can meet the requirements of the Committee's Work Programme. The Mekong Cadre's posts are funded partly from the UNDP institutional support project and partly by the Governments of the riparian member countries. The third component of staff consists of specialized personnel seconded from riparian member Governments for a

short period of between one to three years. During their assignment with the Secretariat they are paid by their national civil service but, in addition, the Committee provides them with a stipend paid out of UNDP's institutional support. Their presence in the Secretariat is to enable them to undergo training in specialized fields and familiarize themselves with development problems connected with the water resources development of the basin.

THE INSTITUTIONAL DEVELOPMENT OF THE COMMITTEE

320. In view of UNDP's resource situation, its new policy with regard to institutional support to the Committee and as a result of a UNDP Evaluation Mission which visited Bangkok and Vientiane in January 1983, assistance to the Committee is being directed more towards programme support, although institutional support will not be completely cut off.

321. The Committee's institutional budget is financed from three sources. UNDP, through its institutional support project, allocates something like 54 per cent of the budget. Co-operating organizations and countries contribute about 38 per cent, while the riparian member Governments provide about 8 per cent of the budget.

322. Since staff costs account for approximately 83 per cent of UNDP's institutional support to the Committee, expected developments in this area of assistance are likely to have an adverse impact on staff.

323. A strenuous effort has been made by the Committee to reorganize the Secretariat's structure and to streamline administrative procedures, in order to make its operation more economic and cost-effective. In the process, the number of riparian professional posts were cut from 34 in 1982 to 31 in 1983. Similarly the number of international staff posts were cut from 7 in 1982 to 5 in 1983. When the number of posts and the timeframe involved are considered, such curtailment can be considered as substantial.

324. Overall economies achieved by the Secretariat are reflected in the declining trend shown by disbursement figures for 1982 and 1983. Out of the amount of US$1,282,900 allocated by UNDP in its institutional support project to the Committee, disbursements in 1982 came to only US$1,127,470. This represented a reduction of 12 per cent. Moreover, in 1983 initial estimates place expenditures at US$1,449,900 or only 80 per cent of the total US$1,813,900 allocated in UNDP's budgeted institutional support figure for the Committee in 1983.

325. The current level of overall institutional costs can still be considered as economic when account is taken of the volume of work, the diversity of projects in the Work Programme and the functions which the Secretariat is called upon to perform. Paragraphs 35 - 37 in Chapter 1 have already touched on the increasingly important role of the Secretariat in executing projects, in the supervision of project execution and in providing support services to the national authorities in the implementa-

tion of projects sponsored by the Committee. Such services have been rendered to the riparian Governments and the co-operating countries and agencies on a gratuitous basis, the actual costs of inputs involved being charged to the Committee's institutional budget.

326. While in the long run the Committee must subsist on the basis of collective self-reliance, as embodied in the Mekong Cadre concept, in the short run there are no immediate prospects of replacing international inputs entirely. One of the member countries of the Committee has been categorized by the United Nations General Assembly as being among the least developed countries and another as being most seriously affected, and it is only gradually that they can assume the degree of financial responsibility needed to cover in full any possible reduction in institutional funding from international sources. Moreover, such international expertise as the Committee requires for the implementation of its projects is highly specialized and it will take many years to build up a similar pool of human resources in the riparian member countries.

327. The Committee fully appreciates the gravity of the resource situation. At its seventeenth and eighteenth sessions in 1983 it took note of the implications of the expected reductions in the level of UNDP institutional support to the Committee and expressed its concern over the likely impact on the structure and work of the Secretariat, as well as on the statutoty functions of the Committee. While paying strict attention to organizational cost effectiveness in relation to the Work Programme, the Committee reaffirmed its desire to maintain, as far as possible, the present Secretariat organizational structure, so as to ensure that its present functions, technical capabilities and capacity to execute projects do not suffer.

328. With such purpose in mind, the Committee agreed at its eighteenth session that common representation of its concern should be made on the matter to the international community. In fact, this decision was followed up in the form of an appeal made late in 1983 by representatives of ripatian member countries to the United Nations Secretary-General and the Administrator of UNDP for their continued support of the Committee's objectives. It is hoped that a positive outcome of the appeal will be seen in early 1984.

329. In the meantime, a fresh assessment will be made of the current composition of the Secretariat in terms of organizational structure, staffing requirements and procedures. If there is to be reorganization and streamlining of procedures, they will be planned in consultations with the Committee and in the light of findings of the recent UNDP Evaluation Mission's recommendations. In principle, such changes will be aimed at achieving cost-effectiveness in relation to the Committee's Work Programme, while maintaining the Secretariat's functions, technical capabilities and capacity to support such a programme, in line with the wishes expressed by the Committee. Once such a reorganization has been detailed it will be submitted to UNDP, other organizations and co-operating countries for their support.

Annex I

CUMULATIVE CONTRIBUTIONS TO THE COMMITTEE UP TO 31 DECEMBER 1983

	Pre-investment investigations and planning	Investment for construction	Total
	(U S $ e q u i v a l e n t)		
Australia	1,840,827	5,595,996	7,436,823
Austria	111,000		111,000
Belgium	1,126,500	7,940,000	9,066,500
Canada	1,865,000	7,451,000	9,316,000
Denmark	10,000	1,217,725	1,227,725
Egypt	5,000		5,000
Finland	10,000		10,000
France	3,024,588	10,564,811	13,589,399
Germany (Fed. Rep. of)	2,364,367	38,470,000	40,834,367
Hong Kong	20,000		20,000
India	673,340	505,000	1,178,340
Indonesia	60,000		60,000
Iran	434,827		434,827
Israel	317,180	896,800	1,213,980
Italy	102,200	1,000,000	1,102,200
Japan	2,904,856	36,271,189	39,176,045
Netherlands	9,937,186	21,503,367	31,440,553
New Zealand	553,095	1,457,428	1,990,523
Norway	10,000		10,000
Pakistan		250,000	250,000
Philippines	430,957		430,957
Sweden	2,718,900		2,718,900
Switzerland	1,733,075	508,000	2,241,075
United Kingdom	1,646,032	2,478,347	4,124,379
United States	25,845,085	20,514,301	46,359,386
	57,724,015	156,623,964	214,347,979
Lao PDR	6,018,531	7,519,010	13,537,541
Thailand	14,796,118	128,537,869	143,333,987
Viet Nam	5,102,750	16,721,101	21,823,851
Others	5,238,107	9,284,960	14,523,067
	31,155,506	162,062,940	193,218,446

	Pre-investment investigations and planning	Investment for construction	Total
		(U S $ e q u i v a l e n t)	
ESCAP	799,804		799,804
UNDP	34,395,923	2,526,336	36,922,259
UNDTCD*	452,799		452,799
UNEP	530,191		530,191
UNESCO	37,300		37,300
UNICEF	50,000		50,000
UNIDO	86,820		86,820
FAO	140,050		140,050
IAEA	55,650		55,650
ILO	13,104		13,104
WFP	173,083		173,083
WHO	8,277		8,277
WMO	45,300		45,300
	36,787,901	2,526,336	39,314,637
ADB		15,823,000	15,823,000
EEC	1,920,500	17,480,400	19,400,900
IBRD		19,880,000	19,880,000
IFAD		6,410,000	6,410,000
OPEC Fund		10,500,000	10,500,000
	1,920,500	70,093,400	72,013,900
Asia Foundation	35,574		35,574
Ford Foundation	1,155,639		1,155,639
Magsaysay Foundation	10,000		10,000
Others	348,899	67,850	416,749
	1,550,112	67,850	1,617,962
	129,138,034	391,374,490	520,512,924

* Formerly UNOTC.