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STAFF APPRAISAL REPORT

SOCIALIST REPUBLIC OF VIET NAM

IRRIGATION REHABILITATION PROJECT

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Agriculture and Environment Operations Division
Country Department I
East Asia and Pacific Regional Office

CURRENCY EQUIVALENTS

March 31, 1995
Currency Unit = Vietnamese Dong
US$1.00 = Dong 11,005

FISCAL YEAR (FY)

Government: January 1 - December 31
IDA: July 1 - June 30

WEIGHTS AND MEASURES

Metric System

ACRONYMS

ADB	-	Asian Development Bank
CIF	-	Cost, Insurance and Freight
CMD	-	Construction Management Department
CPO	-	Central Project Office
DAO	-	District Agricultural Office
ERR	-	Economic Rate of Return
FAO	-	Food and Agriculture Organization of the United Nations
FAOCP	-	FAO/World Bank Cooperative Program
GOV	-	Government of Viet Nam
HCMC	-	Ho Chi Minh City
HIDEC2	-	Hydraulic Investigation and Design Corporation No. 2
HMNBC	-	Hoc Mon/North Binh Chanh Subproject
IBRD	-	International Bank for Reconstruction and Development
ICB	-	International Competitive Bidding
ICD	-	International Cooperation Department (of MWR)
IDA	-	International Development Association
IDF	-	Institutional Development Fund
IMC	-	Irrigation Management Company
LCB	-	Local Competitive Bidding
MAFI	-	Ministry of Agriculture and Food Industries
M&E	-	Monitoring and Evaluation
MC	-	Ministry of Construction
MESCO1	-	Material and Equipment Supply Company
MOF	-	Ministry of Finance
MWR	-	Ministry of Water Resources
O&M	-	Operation and Maintenance
PAS	-	Provincial Agricultural Service
PMB	-	Project Management Board
PMU	-	Project Management Unit
PPC	-	Provincial People's Committee
PWRS	-	Provincial Water Resources Service
RAP	-	Resettlement Action Plan
SIO	-	Subproject Implementation Office
SIP	-	Subproject Implementation Plan
SOE	-	Statement of Expenditure
SPC	-	State Planning Committee
SPU	-	Subproject Management Unit
UNCDF	-	United Nations Capital Development Fund
UNDP	-	United Nations Development Program
VBA	-	Viet Nam Bank for Agriculture
VIHID	-	Viet Nam Hydraulic Investigation and Design Company

SOCIALIST REPUBLIC OF VIET NAM

IRRIGATION REHABILITATION PROJECT

Contents

This report is based on the findings of an appraisal mission of October 1994. It was led by Mr. Frank Byamugisha (EA1AE) and included Messrs./Mmes. M. Mulatu, M. Pennell (EA1AE); L.C. Lund and M. Gill (ASTHR); C. Escudero (LEGEA); E. Jimenez (ASTTP); L. Blanchetti, R. Paterson (FAO/CP); and I. Naor (Consultant). Work on the environment and irrigation management was done on earlier missions by Messrs. R. Crooks and G. Spencer (ASTEN) Messrs. L.S. Tay (EA2AG), G. Morgan (ASTEN), and Ms. K. McPhail (OEDD1) were peer reviewers. The Division Chief was Mr. J. Gutman and the Director was Mr. C. Madavo. Secretarial support was provided by Mmes. S. Wilkinson and S. Sundaram (EA1AE).

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CHARTS

MAP: IBRD 25753

SOCIALIST REPUBLIC OF VIET NAM

IRRIGATION REHABILITATION PROJECT

CREDIT AND PROJECT SUMMARY

Borrower:	Socialist Republic of Viet Nam
Implementing Agency:	Ministry of Water Resources
Beneficiary:	Not applicable.
Poverty:	Program of Targeted Intervention. The project has a significant impact on poverty reduction because it increases incomes of farmers mainly in central and northern regions of Viet Nam which have a higher incidence of poverty (50 percent) than urban areas (27 percent) and a significant proportion of rural areas where the average incidence of poverty is 57 percent. The impact on poverty was one of the criteria used in selecting the seven subprojects from a list of twenty five.
Amount:	SDR 67.0 million (US$100.0 million equivalent)
Terms:	Standard IDA terms with 40 years maturity
Commitment Fee:	0.50% on undisbursed credit balances, beginning 60 days after signing, less any waiver.
Financing Plan:	See para. 3.42.
Economic Rate of Return:	17 percent
Map:	IBRD No. 25753

SOCIALIST REPUBLIC OF VIET NAM

IRRIGATION REHABILITATION PROJECT

I. THE AGRICULTURAL SECTOR

Agriculture in the Economy

1.1 Introduction. Viet Nam is one of the poorest countries in East Asia with a per capita income of less than US$200 equivalent (1992). The economy is predominantly agrarian and is based on rice production for domestic consumption. In 1992, farming provided jobs for some 65 percent of workers and generated 40 percent of GDP and almost 50 percent of exports. For an agrarian society with few alternative income opportunities, the cultivated area per capita of only 0.1 ha is very low. Farm sizes are small and holdings, particularly in the north, are fragmented. The average area per actively engaged farm worker is about 0.24 ha in the north and 0.46 ha in the south. Employment conditions in agriculture have deteriorated in recent years as the sector has had to absorb most of the more than 1 million demobilized military personnel and former state employees released by civil service reductions.

1.2 The agricultural sector has played the lead role in the transition to a market economy. Economic liberalization began with the realization that with a population growing faster than food production and national income, Viet Nam would soon be in a position where it could not guarantee the food supply. With the liberalization of production and markets, not only has the food supply become adequate but a surplus has become available for export, propelling Viet Nam from being a net importer of rice to being one of the top three exporters in the world. However, the production response so far has been limited mostly to rice and mostly to the Mekong Delta. Elsewhere, agricultural performance remains constrained mainly by small farm size, aging irrigation systems, limited savings for on-farm investment and insufficient credit and other support services. In addition, the relentless pressure on natural resources has led to an overall deterioration in the production and conservation environment. This coupled with continuing population growth calls into question the sustainability of the food surplus and, for the longer run, basic food security.

1.3 Production. The most important crop is rice, mainly grown with irrigation. Of the total land area of 33 million ha, about 7 million ha (21 percent) is cultivated with 2.1 million ha served by irrigation facilities for multiple cropping. The area cultivated for paddy is about 4.5 million ha and is cropped at an intensity of 140 percent annually. Average paddy yields per ha are around 3.5 ton per ha per crop. Other major food crops are maize, sweet potatoes and cassava. In 1992, production of food crops was estimated at about 24 million tons (paddy equivalent), up from 14 million tons in 1980. Paddy production accounted for about 22 million tons of the output and almost all the growth. Rubber, peanuts, jute, sugarcane, soybeans, coconut, coffee, tea and mulberry for sericulture are the most important industrial crops.

1.4 Growth. The value of agricultural output at constant prices grew at an annual average of 6.3 percent during the Third Plan period (1981-85), then fell to only 2.2 percent during the Fourth Plan period (1986-90), probably less than the growth rate in population estimated at well above 2 percent per year and well below the growth rate in the rural labor force. In the final years of the Fourth Plan, the gross value of sectoral output rebounded in response to accelerated paddy production. Over the long-run the sectoral trend has been for steady output growth for paddy emanating mainly from yield improvements and to a lesser extent from irrigated area expansion, while for other crops yield growth has been slow and planted area growth often negative as better lands were switched to paddy. The major limits to aggregate growth in the past were low level of

investment in the sector and lack of production incentives. Shortages of fertilizers, other inputs and farm credit have in the past constrained response to other measures to increase yields, such as use of high yielding varieties of rice. Chemical fertilizer consumption for example averages around 60 kg per cropped hectare, about one-third the expected amount. Faced with the problem of slow growth relative to need and potential, the Government is implementing a program of far reaching reforms in the sector. Response to the changes has been marked with a 30 percent increase in paddy output from 17 million tons in 1988 to 22 million tons in 1992, and Viet Nam switched from importing around 500,000 tons of rice per year in the mid-eighties to exporting an average of 1.5 million tons of rice per year over the period 1989-92. This trend is continuing.

1.5 Agricultural Policy. Viet Nam's economic policy was substantially reoriented in 1989 and agricultural policy underwent fundamental change. Key farm policy objectives remain to ensure food security, provide additional income and employment opportunities to eliminate poverty and to generate foreign and domestic savings to finance modernization of the economy. Until the recent changes, key policy instruments used to achieve plan targets were collectivized organization of production, state-owned marketing monopolies, and price administration. Following worsening food supply problems in 1986, the Sixth Party Congress introduced a series of fundamental reforms ending price control and re-establishing the farm household as the basic unit of production (Decree No. 10, 1988). New land tenure regulations guaranteed farmers 20 years of occupancy for short-term crops and 30 - 50 years for tree crops. Compulsory sale of farm produce to the state ended in 1987 together with the other product marketing controls. Since then, further reforms have ended state monopoly over price and supply of inputs and a new land law has been promulgated [1].

Sector Strategy

1.6 The policy objective is to increase sustainable production and broaden its base while improving rural incomes. The key focus of Government's agricultural strategy is the transformation of institutions supplying services to smallholders. Liberalization of decision making and freeing markets proved to be relatively quick and simple and produced a remarkable adjustment response. Translating this into long-run growth will require sustained irrigation and on-farm investment, increased availability of credit and adapted technology, and improved information flow to farmers.

1.7 With such a large proportion of households dependent on agriculture, the Government attaches high priority to farm income stabilization, particularly through reduction of weather-related and market risks. In 1991, a major drought in the north reduced paddy production by 15 percent and, in 1992, a bumper crop in the south caused a 20 percent drop in prices. Strategies to reduce risk include irrigation rehabilitation and development, crop diversification and downstream processing. At the national level, policy attention is being given to the need to diversify agricultural export income, particularly through rehabilitation and expansion of existing perennial crops. The Government gives high priority also to the reduction of poverty in a country where 51% of the population is below the poverty line with the incidence of poverty standing at 57% in rural areas (27% in urban areas). A key instrument to reducing poverty is the targeting of projects to the development of rural areas which account for 90 percent of the country's poor people.[2]

1/ For a full treatment of economic changes, see Viet Nam: Transition to the Market, An Economic Report, World Bank, September 15, 1993, Report No. 11902-VN.

2/ For a full treatment of the measurement, magnitude and distribution of poverty, see Viet Nam: Poverty Assessment and Strategy, World Bank, January 23, 1995, No. 13442-VN.

II. THE IRRIGATION SUBSECTOR

A. Water Resources and Irrigation

Water Resources

2.1 Viet Nam's surface water resources are provided by 15 major rivers with basins exceeding 3,000 km^2 and numerous other rivers with relatively smaller catchments draining east from the central highlands to the South China Sea. The largest river is the Mekong whose delta lies in the southern part of the country. Of its catchment area of 795,000 km^2, 72,300 km^2 lies in Viet Nam. Most of the Mekong River flow originates in the four countries in its lower basin: Lao P.D.R., Thailand, Cambodia and Viet Nam. The second major international water course is the Red River in the north with a catchment area of 169,000 km^2, of which 86,700 km^2 are within Viet Nam. The Saigon, Ma and Ca Rivers in the south and center of the country originate in neighboring Cambodia and Laos. Other major rivers have their catchment areas entirely within Viet Nam, and therefore they are not subject to possible upstream developments outside Viet Nam.

2.2 Groundwater from shallow wells is primarily used for rural and domestic supply, and it is used for irrigation only on a minor scale.

2.3 Average annual runoffs are fairly stable, but there are considerable seasonal variations in river flows. Peak monthly flows of 20 to 30 percent of the annual average occur in the August-November period, depending on geographical location. Minimum flows of 0.5 to 3 percent occur in March-April. These considerable variations in river flows give rise to floods during the wet season and water shortages in dry periods. In coastal areas, particularly in the Red River Delta (RRD), pumping is required to evacuate floods in the rainy season, and in many areas pumping for irrigation is also needed in the dry season. Furthermore, as water levels drop below sea level in the dry season, sea water intrudes into river and man-made water courses, which makes construction of sluices indispensable for maintaining adequate water quality for rice cultivation.

Irrigation and Drainage Systems

2.4 About 2.1 million ha are under controlled irrigation from multipurpose or dedicated irrigation systems in Viet Nam. Of this area, about 28 percent (580,000 ha) lies in the Mekong River Delta (MRD), 37 percent (785,000 ha) in the Red River Delta and the remaining 35 percent (735,000) are scattered around the country, predominately in the coastal plains. Practically all irrigated land is under paddy, with limited areas in tobacco, potatoes, sugar cane, yams, beans peanuts and legumes. The overall cropping intensity is about 200 percent, and around 1 percent of the irrigated land is tripled cropped with vegetables. Cropping intensity and crop yields vary from region to region in accordance with soil, climate and other local conditions. Irrigation improvements and new developments in the MRD and RRD will be considered within the framework of respective Master Plans currently in preparation, financed by UNDP and executed by the World Bank through consultants.

2.5 Central Coastal Plain. The project would focus on the rehabilitation and completion of irrigation schemes in the Central Coastal Plain (CCP) which, together with the highlands comprise

56 percent of the total land area and have about 40 percent of the population. Food production does not meet demand and poverty and malnutrition are common in these areas. A good portion of the highlands are classified as forest lands, but large portions are barren due to shifting and inadequate cultivation on steep terrain. Priorities for the highlands are reforestation of barren lands and the rehabilitation of watersheds to increase productivity and prevent floods in the central plain. The CCP, is a narrow strip containing scattered small and medium irrigation schemes comprising about 634,000 ha. Water in the coastal areas is generally plentiful but unevenly distributed, which makes storage frequently necessary for irrigation. Because of high cost and environmental concerns development of new irrigation for rice cultivation depending on dams for storage may not be viable. Rehabilitation, completion and improved operation of deteriorated and incomplete schemes, on the other hand, would yield higher and faster return on investments from sustained production and increased crop areas and yields.

2.6 In the CCP most of the irrigation systems dating back to colonial times have outlived their economic life and deteriorated considerably. Inadequate maintenance funding has further contributed to deterioration and disrepair. A large proportion of canals, structures, pumping and electrical equipment is in urgent need of repair or replacement. In addition, recently initiated systems are only partially complete and require construction of distribution and tertiary canals in order to achieve full utilization of existing works. The FAO has estimated that some 700,000 ha of irrigated area could be added nationwide by rehabilitation and expansion of the existing systems.

B. Institutional Framework

2.7 The Ministry of Water Resources (MWR) is in charge of development policy and planning of water resources at the national level. The Ministry of Energy (ME), the Ministry of Transport (MT) and the Ministry of Construction (MC) are responsible for hydropower development, navigation, domestic supply, etc. MWR's primary responsibilities are planning, design, construction and finance of irrigation headworks and main and distribution canals down to 150-ha command area. The provinces carry out construction of canals serving less than 150 ha, sometimes with State financial assistance and often using beneficiaries' labor. The provinces are also responsible for O&M of the main irrigation and drainage systems, through the Provincial Water Resources Services (PWRS) and Irrigation Management Companies (IMCs), while water users operate and maintain tertiary systems.

2.8 As several ministries and government agencies are involved in water management with considerable overlapping and conflict, GOV is processing a comprehensive Water Law and with donor assistance, reviewing the water resources sector. The review of the water sector, which was initiated in 1994 as part of the Bank's Economic and Sector Work is expected to produce a strategy which would address, among other things, inter-agency conflict and overlap in water management. The draft law includes provisions on water rights, water use and disposal, water quality, construction and maintenance of water works and water resources management. On water management, the draft law introduces the River Basin Management concept and proposes the establishment of a National Council on Water Resources.

Ministry of Water Resources

2.9 The Ministry of Water Resources is organized in four functional divisions; Administration, Planning and Budget, and Technical and Construction sectors, as shown in Chart 1. Each division is under the supervision of a vice-minister and operates through specialized departments and semi-autonomous institutes, companies and enterprises. The International Cooperation Department (ICD) is responsible for overall relations with multilateral and bilateral assistance institutions, other foreign institutions and private companies. As the economy is in the process of liberalization, MWR's companies and enterprises are in a transitional period from total government control towards commercial operation and financial autonomy. An important step was the passage of a bankruptcy law on December 30, 1993, applying to all public and private enterprises, whose implementation regulation was issued on December 23, 1994 (decree no. 189/CP).

2.10 Engineering Planning and Design. Engineering planning and design of irrigation and drainage works in the northern and central part of the country are the responsibility of the Institute for Water Resources Planning and Management and the Hydraulic Investigation and Design Company (VIHID) in Hanoi. Similarly, the Hydraulic Investigation and Design Corporation No 2 (HIDEC2) in Ho Chi Minh City (HCMC) carries out engineering planning and design of irrigation and drainage works in the southern part, particularly the Mekong Delta. In addition, there is a VIHID subsidiary company in Nha Trang and about 40 autonomous provincial design and investigation companies. VIHID, its subsidiary and HIDEC2 are well established institutions employing around 1,000 highly experienced and qualified engineers and technicians. Engineering designs are generally prepared in accordance with sound criteria and standards which, however, have not kept pace with state-of-the-art technology. There is little doubt that given appropriate technical assistance, MWR's planning and design capacity can be rapidly updated to modern standards.

2.11 Procurement and Construction. MWR's Construction Management Department (CMD) is responsible for developing procurement and construction management policies and procedures, approving major construction designs and drawings, preparing and costing construction plans, and for bidding, contracting and construction supervision of headworks, main, primary and distribution canals down to 150-ha command areas. CMD manages construction through resident Project Management Boards (PMBs). Provincial authorities are responsible for construction of minor irrigation and on-farm works serving blocks under 150 ha through PWRS and IMCs.

2.12 Currently, MWR assigns construction contracts to one of its own 14 regional construction enterprises or provincial companies under well established procedures. Contracts are based on fixed regional unit rates determined annually by MWR. GOV plans to gradually introduce competitive bidding. MWR issued in May 1994 Provisional Regulations for the Competitive Bidding of the Construction of Hydraulic Works but the administrative framework is still to be developed. An IDF grant to assist the government in developing such a framework, procurement procedures and tender documents has been approved. Systematic construction supervision and quality control are minimal due to insufficient technical staff and lack of laboratory testing and other equipment. Construction quality is therefore low, and there is an urgent need for improved contract management, construction standards and construction supervision practices, which would be attempted under the proposed project.

2.13 The three largest MWR construction enterprises have had extensive experience in construction of dams, canals and hydraulic structures, including construction projects in neighboring Laos and Cambodia. In line with Government policy, construction companies are in transition towards independent entities comparable to private contractors in a market economy, but their legal status is still unclear. Also, some companies are affected by debt burden, insufficient working capital, staff tenure regulations and obsolete and inefficient equipment, which affect operational efficiency. However, as credit is being made available, these companies are modernizing their plant and equipment, improving their management and initiating joint ventures with foreign companies.

2.14 The Material and Equipment Supply Company (MESCO 1) is MWR's procurement agency for equipment and materials, for which it charges MWR a 3 percent (CIF delivery) to 5 percent (CIF plus inland transport) fee. MESCO has experience in international procurement procedures and trade practices. Its staff includes 20 mechanical engineers involved in preparing technical specifications and bidding documents.

Irrigation Management Companies (IMCs)

2.15 After construction of the main system down to canals serving more than 150 ha, the Central Government transfers the responsibility for the management of irrigation and drainage projects to the provinces for completion of minor canals and for operation and maintenance by IMCs. IMCs are provincial enterprises under full administrative and financial control of the Provincial Peoples Committees (PPCs) through the PWRS. IMCs do not have the institutional and financial autonomy needed to operate independently of the PWRS, to set levels of service desired by farmers and prices, and to control costs of those services.

2.16 The organization and management, including financial management, varies between companies. Their financial position depends on the level of water fees and the amount actually collected. Typically, IMCs are attached to PWRSs, headed by a director and organized along functional lines, including departments of finance and administration, planning and technical services, O&M field units and workshops. Steering committees consisting of representatives of the PWRSs and Provincial Agricultural Services (PAS), Peoples District Committees and the Director oversee IMCs' operations, approve and submit annual budgets and irrigation calendars to PPCs and arbitrate in case of water use conflicts. IMCs lack adequate funding for routine system maintenance, in part because they devote a large portion of their revenues to major repairs. Also, IMCs have limited amounts of plant, vehicles and equipment, most of which are old and worn out.

2.17 IMCs' annual budgets are prepared in consultation with the Cooperatives and other water users. The accounts are approved by PPCs, which, in case of shortfall, finance the gap between expenditures and revenues from water fees. IMC accounts, which are kept manually in accordance with national standards established by the Viet Nam Accounts and Auditing Company (VACO), record operation and maintenance costs down to the canal station level. Financial reports based on VACO principles are issued monthly, quarterly and annually. Annual financial statements, which include balance sheet and P&L statements, are approved by PPCs after receiving comments from water users. IMC management would be enhanced by training of staff in management, accounting and O&M practices, and by computerization of financial and administrative processes.

Water User Organizations (Cooperatives)

2.18 Intense farmer participation is a prominent feature in the construction of minor works and O&M of irrigation facilities in Viet Nam. Such participation has been possible through cooperative organization. While the predominant role of cooperatives in other aspects of production, such as provision of inputs, credit and marketing is being phased out, these organizations still play a key role in water management, serving as solid links between individual farmers and IMCs. Each irrigation scheme comprises one or more cooperatives organized around the canal system. Cooperatives usually group from a few hundred to several thousand hectares, comprising a membership as large as four farm families per ha. Membership is voluntary, but it would be almost impossible for a farmer to operate independently within an irrigation district. Cooperatives are reportedly autonomous. They have their own management, administration structure, and staff (including manager, accountant, field operators, etc.) which is periodically elected by the membership. Operating costs of the cooperatives are financed out of a 2.5 percent cooperative fee on the value of production.

2.19 The main activities of cooperatives include: preparation of irrigation schedules, O&M of tertiary canals, and collection of water fees and agricultural taxes on behalf of IMCs and provinces. The liberalization of agricultural services and the introduction of individual land leases under the 1993 Land Law encourage individual initiative and development of markets; this could and has already started to weaken the cooperatives including those in water management. Should cooperatives continue to weaken, alternative water-user organizations would be supported under the project to ensure farmer participation and efficient operation of irrigation schemes.

Agricultural Support Services

2.20 The Ministry of Agriculture and Food Industries (MAFI) is responsible for national agricultural planning and policy implementation, sector regulation and provision of extension, research and other services. At the local level, Provincial Agricultural Services (PAS) are responsible for research and extension through District Agricultural Offices (DAO) and the cooperatives. However, with the decline of cooperatives, their responsibilities for agricultural extension at farm level are being transferred to DAO staff. PWRS and PAS usually report to the same PPC deputy chairman, thus ensuring good coordination between agricultural production and irrigation activities.

2.21 Seed and other farm inputs are provided by MAFI and PAS through cooperatives and marketing companies. Seed is readily available, but quality is not always good. Fertilizer is in common use and appears to be freely available both from supply companies and private traders. However, the levels of nutrients applied are insufficient to achieve potential yields. Farmers have not increased the use of fertilizer because they lack cash and are reluctant to use credit. Crop protection services are organized through district agricultural services in conjunction with the supply and promotion of pesticides. Integrated Pest Management (IPM) is expanding rapidly.

2.22 Agricultural credit is available through the Viet Nam Bank for Agriculture (VBA), which recently shifted its policies to include lending to private farmers. In 1991 VBA lent only US$33.5 million to private smallholders; in 1992 this figure increased to US$236 million and the total loans outstanding to production households rose to US$407 million in late 1993. In 1993, VBA

reached about 1.4 million smallholder households, about 13 percent of the 10.3 million farm households in the country.

C. Operation and Maintenance of Irrigation Works

Operation

2.23 Irrigation operations are planned from the bottom up with active participation of the cooperatives. IMCs prepare operation plans and water delivery schedules on the basis of consolidated water requirements from the cooperatives. Based on those schedules, IMCs and cooperatives sign annual contracts specifying their mutual obligations including crop areas, irrigation schedules, water fees and other requirements. IMCs and cooperatives jointly update irrigation plans and water delivery schedules when necessary.

2.24 System operation is constrained by limited capacity of conveyance due to canal siltation, insufficient pumping capacity and frequent breakdowns of electro-mechanical equipment and power supplies. Other problems affecting operation are loss of water due to leakage from canals and structures and seepage where unlined canals pass through porous soils, and a lack of effective water measurement and control structures. There is also lack of communications and transport equipment. The level of service has gradually deteriorated as the backlog of deferred maintenance and rehabilitation has mounted.

Maintenance

2.25 Routine maintenance operations are usually carried out during short periods between the winter and spring-summer seasons. As systems have gradually deteriorated, maintenance has gone beyond routine work (often including replacement of embankments, canal lining and overhaul of pumps), but little work has been done in repairing or replacing concrete structures, gates, electrical controls and the like. While resources are limited, maintenance work is usually well organized with specific responsibilities cascading from headworks and main canals to farm level. Desilting and canal repair usually involves intensive use of labor provided by the beneficiaries (up to 20 days/year). Bigger tasks are carried out with IMC resources making use of minor plant and tools. Major repairs are contracted with small local construction companies.

O&M Financing, Water Pricing and Taxation

2.26 Regular O&M is entirely financed by the provinces through water charges and limited budgetary support. State grants are occasionally given for extraordinary repairs arising from damage by typhoons or other natural disasters. PPCs levy water rates on the basis of MWR's national guidelines. Until the recent new pricing guidelines, water fees were set annually as a percentage of production (6-10%) by crop, season and type of service, i.e., gravity or pumped. Crop production, for water charges and taxation purposes, was assessed on the basis of land capability and average crop yield for the past five years. IMCs would then collect water fees through cooperatives in kind (paddy equivalent) or cash at market value, at the convenience of beneficiaries.

2.27 Below is a table (Table 2.1) which summarizes MWR's new water pricing guidelines that are contained in a regulation issued on February 28, 1994. Water pricing is now based not on

production but on area. IMCs would continue to collect the fees through cooperatives either in kind (paddy equivalent) or in cash, depending on the preference of beneficiaries.

Table 2.1. National Water Pricing Guidelines
(kg of paddy/ha)

	Direct Irrigation & Drainage			
	Spring-Winter Crops	Summer-Fall Crops	Summer Crops	Indirect Irrigation
Irrigation & drainage by pumping	350	320	260	170
Irrigation & drainage by reservoir, dam & canal	280	255	210	130
Irrigation & drainage by pumps & reservoirs, dams or canals	315	290	235	150

2.28 In addition to water fees, farmers pay out of their production a 10 percent land tax (until recently agricultural production tax), a 3 percent Social Security Fund (SSF) tax, a 2.5 percent cooperative charge, and a 3 percent to 4 percent tertiary canals maintenance fee, the latter usually in the form of labor.

2.29 Revenues from water charges often fall short of O&M expenses particularly when the irrigation systems rely on pumping rather than gravity, resulting in inadequate maintenance and deterioration of the systems. Nationally, only about 57 percent of farmers of irrigated areas pay water fees. Performance in water fee collection varies significantly from area to area being best in central Viet Nam and poorest in the Mekong delta area. In well established and maintained systems water fees collections are usually high and close to 100 percent of assessment. In new service areas with incomplete distribution systems and in deteriorated schemes, farmers are reluctant to sign irrigation contracts and pay water fees because of the unsatisfactory services they receive; thus collection rates in such areas could be lower than 70 percent of assessments. Farmers are usually able to pay water fees associated with gravity schemes, but are often unable to pay the full additional cost of pumping for irrigation and/or drainage, thus relying on subsidies.

2.30 The above notwithstanding, national water fee collections grew from 169,000 ton (paddy equivalent) in 1991 to 174,000 ton in 1992 and to 250,000 tons in 1993, a 48 percent increase in two

years. This is an average collection of 119 kg-paddy/ha over a 2.1 million total irrigated area vs. about an expected collection of 180 kg/ha per crop (assuming a yield of 3.0 ton/ha).

2.31 Rehabilitation and urgent repairs due to natural disasters and replacement of equipment and infrastructure will require substantial and continued funding by GOV. MWR's 1993 budget for these works ranges between 5 and 7 billion Dong, which is only 2.6 percent to 3.7 percent of water fees collected in 1991.

2.32 MWR is committed to revising the structure of irrigation fees and the financing of IMCs to ensure full O&M cost recovery. Preliminary estimates indicate that this objective could be largely achieved through the production impact if water fees, now based on irrigated areas, are increased in line with project-related production increases in order to maintain their share in production at least for gravity systems. For the other schemes, water fees would have to be raised to capture a higher percentage of production to cover at least the costs of O&M. While subsidies had been given by provincial and district governments to cover such costs in the past, current government policy requires IMCs to terminate their reliance on subsidies. Under the project, a financial management strategy would be developed for each subproject. It would examine the current revenues from all customer groups and the costs associated with the provision of services to each group (cost allocation). It would include a plan that maps out the steps necessary to bridge the gap between revenue and costs and to move IMCs to a position of financial autonomy over the life of the project.

D. Government's Irrigation Subsector Strategy

2.33 GOV's strategy on irrigation and drainage includes economizing on new investments, improving efficiency and achieving financial self sufficiency of irrigation schemes by: (a) achieving full utilization of existing schemes through rehabilitation and replacement of deteriorated works and equipment and construction of secondary and tertiary canals in areas already served by main distribution systems; (b) increasing cropping intensity and yields by improving water use and introducing high yielding varieties; (c) giving priority to small- and medium-scale works making use of provincial capital and labor over construction of large-scale works; (d) expanding multiple cropping in the Mekong and Red River Deltas; and (e) revising the structure of irrigation water charges to levels sufficient to cover at least O&M expenses in accordance with type and level of service and the farmers' ability to pay.

E. Lessons from Previous IDA Involvement

2.34 IDA has made two credits for agricultural development in Viet Nam, the Dau Tieng Irrigation Project (Cr. 845-VN) approved in August 1978 and closed in 1986 [3], and the Agricultural Rehabilitation Project (Cr. 2561-VN) approved in January 1994. A Project Completion Report (PCR) and an Audit Report (AR) have been issued for the first project while the second project is still in its early stages of implementation. The AR rated as satisfactory the Dau Tieng Irrigation Project. Two of the lessons highlighted by the PCR and AR are that: (i) adequate design of the project's major works prior to project implementation is essential for smooth project implementation;

3/ Project Completion Report No. 8239, December 11, 1989. PPAR No. 9993, October 16, 1991.

and (ii) external technical assistance in procurement and construction supervision is essential to overcome problems of inexperience in international procedures faced by new Borrowers. At least four additional lessons are highlighted also in a 1994 study by the Bank's Operations Evaluation Department (OED) entitled "A Review of World Bank Experience in Irrigation": (i) project size is strongly associated with results, with high economic returns derived from large command areas; (ii) low unit costs (investment costs per irrigated area) are significantly related to project success; (iii) construction quality and land acquisition are important implementation problems that require increased attention from supervision missions; and (iv) satisfactory O&M is usually associated with financial autonomy of user groups or public water service units that are directly funded by farmers.

2.35 The above six lessons have guided the design of the proposed project and its implementation plan in several ways. First, the two lessons drawn from implementation of the Dau Tieng project have influenced project design through advance preparation of engineering designs, development of procurement procedures and tender documentation before project negotiations, and provision for IDA financing of technical assistance to support project implementation. Second, the first two lessons from the OED study have influenced project design to focus on rehabilitation geared to maximizing the irrigable command area with limited investments while the third lesson has influenced the design of the project's supervision plan to include specialists in irrigation construction and resettlement in Bank supervision missions. The fourth lesson from the OED study has influenced project design to include support for strengthening the financial autonomy of Irrigation Management Companies.

F. Involvement of Other Donors

2.36 While various donors have been involved in irrigation, the main ones have been the Asian Development Bank (ADB) and the United Nations Capital Development Fund (UNCDF). The former is financing an Irrigation and Flood Protection Rehabilitation Project (about one and one half years old) in Hanoi, Thanh Hao Province and Nghe An Province while the latter has also been financing an Irrigation Rehabilitation Project (3 years old) in Quang Nam/Da Nang Province.

III. THE PROJECT

A. Project Background and Rationale for IDA Involvement

3.1 The 1989 FAO-IBRD Agricultural and Food Production Review determined that on the basis of technical and economic viability and poverty alleviation considerations, rehabilitation, repair and upgrading of existing irrigation schemes in the northern and central regions have the highest priority in the irrigation and drainage subsector, followed by the completion of schemes in the Mekong Delta. This is also a GOV priority supported by the Country Assistance Strategy (CAS) which was discussed by the Bank's Board of Executive Directors on October 25, 1994. The main components of the CAS include targeted efforts to reduce poverty through projects supporting rural development. The project and subproject selection process supports this strategy. The project would complete and rehabilitate existing irrigation schemes and contribute to raising rural incomes on schemes located mainly in the poor central and northern region of Viet Nam. In addition, the project would provide technical inputs to enhance planning, design and construction of irrigation systems, and improve O&M through strengthening of irrigation management companies, water user groups and cost recovery mechanisms. The project would also contribute to the Bank's dialogue on water resources, irrigated agriculture and sustainable development in Viet Nam.

B. Project Objectives and Components

3.2 The project aims to restore or establish sustainable irrigation service by rehabilitation and completion of infrastructure and improvement of operation and maintenance in selected irrigation schemes. The objectives of the project therefore are to increase agricultural production (primarily of rice for food), and farmer incomes, and reduce poverty in selected rural areas of Viet Nam.

3.3 The project would include:

(a) rehabilitation and completion of seven irrigation schemes comprising a gross area of around 130,000 ha located in the south, central and northern regions of Viet Nam. The main works would be rehabilitation of diversion and head-works, main canals, structures and pumping stations, and completing construction of main, secondary and tertiary canals and on-farm works (US$123.6 million);

(b) institutional development through: (i) the transfer of technology for engineering design, procurement and construction of irrigation works through technical assistance and on the job training; (ii) the improvement of operation and maintenance practices and cost recovery mechanisms; (iii) the strengthening of irrigation management companies and farmer user groups through training; and (iv) support for accounting and auditing (US$4.5 million); and

(c) resettlement and rehabilitation of families whose land and/or assets are acquired by the state for the project (US$7.4 million).

C. Detailed Project Features

Irrigation and Rehabilitation Works

3.4 Details of physical characteristics, current situation of irrigation works and agricultural production, and proposed improvements for the seven subprojects are given in Annexes 1 through 7 and summarized in Table 3.1. Geographical location is shown in map IBRD 25753. The seven subprojects were selected after a detailed screening of 25 schemes proposed by MWR. The main criteria for subproject selection were adequate land and water resources, technical and economic viability and availability of data and engineering plans and poverty impact. Priority was given to rehabilitation over construction of new works. New irrigation canals would be constructed only to complete earlier initiated systems. The seven subprojects include gravity and pumped irrigation. Subprojects in the MRD and RRD were not included because specific projects would be developed later on the basis of recommendations from the UNDP financed master plans. The following provides a brief description of each subproject and of the main rehabilitation/completion works included:

3.5 Cam Thuy Subproject, Thanh Hoa Province (Annex 1). The project would rehabilitate one gravity and six minor pumping irrigation schemes to increase irrigated area from 760 ha to 1,919 ha. Main works include rehabilitation of the Thung Bang dam (18.7 m high; 3 million m^3 live storage), replacement of six pumping stations and rehabilitation of the canal network and structures.

3.6 South Nghe An Subproject, Nghe An Province (Annex 2). The project would rehabilitate existing irrigation and drainage works to increase the irrigated area from about 15,300 ha to 25,500 ha. The main works include rehabilitation of two sluices at Nam Dan and Ben Thuy, completion of construction of a new sluice at Quang Ngai, dredging of main canals (Thap and Gai) and the Vinh River, rehabilitation of 79 small pumping stations and 70 km of canals, and construction of two new pumping stations and irrigation structures to serve 6000 ha.

3.7 Linh Cam Subproject, Ha Tinh Province (Annex 3). The project would include rehabilitation of pump houses and replacement of mechanical and electrical equipment in two major pumping stations (Linh Cam and Cau Cao), rehabilitation of three sluices on the La river, dredging of the May 19 canal (8 km) and Nghe River (12 km) and rehabilitation of the irrigation network for an area of 14,600 ha.

3.8 An Trach Subproject, Quang Nam Da Nang Province (Annex 4). The project would rehabilitate existing irrigation works to provide reliable water supply to 9,715 ha currently partially irrigated. The main works include rehabilitation of three weirs, main secondary and tertiary canals.

3.9 Thach Nham Subproject, Quang Ngai Province (Annex 5). The project would rehabilitate and complete construction of main canals and distribution works to increase the irrigated area from 18,900 ha to about 45,500 ha [4]. The main works include completion of earthworks for about 20 km of main canals, structures for most of the 65 km of main canals, construction of about 50 km of primary canals and about 350 km of secondary and tertiary canals, and on-farm works.

4/ Construction of 13 pumping stations was excluded from MWR proposal at preappraisal because they were not considered economically viable.

3.10 Dong Cam Subproject, Phu Yen Province (Annex 6). The project would rehabilitate and improve existing irrigation works and restore the irrigated area from about 17,000 ha to 19,800 ha. The main works include repair of the diversion wire, replacement of old structures, river bank protection, desilting and lining of canals, dredging of drains and reconstruction of canals for some 2,800 ha.

3.11 Hoc/Mon North Binh Chanh Subproject, Ho Chi Minh City (Annex 7). The project would include construction of sluices to prevent saline intrusion, drains and irrigation canals and structures for reclamation of about 13,300 ha of low lands, of which only 300 ha are currently irrigated. The main works include construction of seven sluices and 10 km of a new Link canal, dredging of 24 km of interceptor drains and canals, and construction of secondary and tertiary canals and on-farm works [5].

3.12 Rehabilitation works aim at restoring the systems to their original design capacity, while modernizing and improving their operation, water management control and safety features. The rehabilitation of weirs and sluices would primarily consist of repairing structural damage, replacing deteriorated gates and mechanisms, and providing electrical motors and measuring devices to facilitate operation. Rehabilitation of canals would include reconstruction of eroded sections, desilting, lining, rehabilitation and construction of new control and measurement structures, access and service roads and related works. Rehabilitation should result in lower O&M costs, improved water management and water availability, and expansion of irrigated and cropped areas.

Engineering Design and Construction Improvements

3.13 The project would strengthen central and provincial government staff capacity in engineering design, and construction management. During implementation, special attention would be given to the transfer of state-of-the-art technology on design of economically efficient water control structures and electro-mechanical equipment, for better operation and management of the irrigation systems. The project would also assist MWR in the updating of construction specifications and developing internal competitive bidding, construction quality and contract management procedures. At the subproject/provincial level, the project would aim at improving construction quality by strengthening the operation of PMBs and enhancing day-to-day construction supervision of project works. These goals would be attained through the strengthening of MWR's CMD, technical assistance, staff training and provision of vehicles, office and testing materials equipment.

5/ Rehabilitation of drainage pumping stations was excluded from the project at preappraisal because their effectiveness was not apparent.

Table 3.1 Summary of Subprojects

Subproject Province		Cam Thuy Thanh Hoa	S. Nghe An Nghe An	Linh Cam Ha Tinh	An Trach Da Nang	Thach Nham Quang Ngai	Dong Cam Phu Yen	HMNBC HCMC	Total
Irrigated area wo	ha	760	15,285	5,300	9,715	18,900	17,400	300	67,660
Irrigated area w	ha	1,919	25,535	14,600	9,715	45,500	19,784	13,300	130,353
Farm families	no	6,251	63,838	37,330	16,700	113,750	58,000	16,835	312,892
Cropped area wo	ha	3,160	46,238	29,200	23,125	95,620	41,700	13,000	252,043
Cropped area w	ha	4,038	55,070	29,200	26,785	102,530	41,684	23,380	282,687
Rehabilitation works									
Dam/weirs	no	1	0	0	1	1	1	0	4
Sluices	no	0	2	3	0	0	0	0	5
Main canals	km	0	70	37	3	0	10	54	174
Primary canals	km	0	0	98	0	0	0	0	98
Secondary canals	km	85	0	217	0	0	0	210	512
Tertiary canals	ha	0	19,535	14,600	0	0	0	7,000	41,135
Dredging	m3	0	0	740,000	0	0	0	0	740,000
Pumping stations	no	6	79	12	0	0	0	0	97
New Works									
Sluices	no	0	1	0	0	0	0	13	14
Main canals	km	0	0	0	0	12	0	1.8	13.8
Primary canals	km	0	0	0	0	94	0	0	94
Secondary canals	km	0	0	0	0	300	0	40	340
Tertiary canals	ha	0	0	0	0	25,000	2,400	6,300	33,700
Pumping stations	no	0	2	0	0	0	0	1	3
Resettlement	family	3	NYK	0	NYK	45	NYK	130	178

w = with project wo = without project
NYK = Not Yet Known

Improvement of Operation and Maintenance of Irrigation Works

3.14 Improved management, O&M and financing of irrigation schemes would be achieved by: (a) Strengthening program management capabilities and processes; (b) Strengthening program delivery capabilities; (c) Moving over time to price water services at cost; and (d) Promoting greater farmer participation in decision making.

3.15 Strengthening of Management Capability. Strengthening of the IMCs capacity to effectively manage and deliver O&M programs under their responsibility is a key part of this component. The project will include the development of subproject-specific Plans for Operations and Maintenance (POMs), the introduction of modern management systems in the areas of planning, programming and budgeting, monitoring and recording, and asset maintenance and replacement management. The financial and administrative management capability at IMC level will be strengthened by the introduction of modern computerized financial management systems for cost accounting and cost allocation and upgrading of office equipment.

3.16 Strengthening the Capability for Service Delivery. Operational activities would be strengthened by improving mobility and communications in order to increase the responsiveness of system operations, to increase safety and to reduce costs. Likewise, IMCs' maintenance abilities would be enhanced primarily by the provision of vehicles, trucks, wheeled tractors and small construction equipment like air compressors, welders and concrete mixers.

3.17 Pricing Services at Cost. The objective of the GOV's pricing policy is to recover the full cost of O&M and administration, and a part of the replacement costs of distribution works below 150 ha. After rehabilitation, it is estimated that O&M cost will be reduced as a result of replacement of obsolete and inefficient pumps, introduction of better management and control of water, and more cost effective management and maintenance methods.

3.18 For the gravity irrigation schemes, it is expected that water fee collections from farmers would be able to cover the costs of O&M if current water rates (based on irrigated area) are raised in line with project-related production increases in order to maintain their share in production. However, for the schemes that rely on pumping, revenues would fall short of the costs of O&M even after the water charges are adjusted to maintain their share in production. Water fees would have to be raised to capture a higher percentage of production if government policy on O&M is to be met. The current government policy requires IMCs to trade their way out of subsidies and cover the full costs of O&M, administration and major repairs through increased water fees. Under the project, a financial management strategy would be developed for each subproject. It would examine the current revenues from all customer groups and the costs associated with the provision of services to each group (cost allocation). It would include a plan that maps out the steps necessary to bridge the gap between revenues and costs and to move IMCs to a position of financial autonomy over the life of the project. For the subprojects that are currently receiving subsidies, their financial management strategies would include details about the magnitude of the subsidy and the timeframe for phasing it out. During negotiations, assurances were obtained that a time-bound financial management plan, acceptable to IDA, would be prepared for each subproject and its implementation reviewed with IDA during the mid-term review of the project, March 15, 1998. The Plan would aim at covering the costs of O&M of

irrigation systems by beneficiaries consistent with the Government's regulations on water fees issued on February 28, 1994.

3.19 Farmers Participation in IMCs Management. Currently, farmers' concerns about the management of irrigation systems are expressed through their Water User Groups to the IMCs directly or through the Peoples' Committees. It is necessary to increase direct participation of farmers in irrigation management. During negotiations, assurances were obtained that by December 31, 1996, the Government would prepare and furnish to IDA for its review and comments a proposal to enhance farmers' participation in the management of the IMCs and thereafter, taking into account IDA's comments, implement such a proposal.

3.20 The O&M strengthening aspects of the project would be assisted by an O&M specialist who would advise and train the staff of the Irrigation and Drainage Department and IMCs on all aspects of system maintenance, operation, and water management. The Specialist would also assist the IMCs with the preparation of POMs for each subproject. The specialist would have an important liaison role with the design and construction programs to ensure that the future requirements of O&M are taken into account and that appropriate "hand over" procedures from construction to O&M are developed.

Farmers and Staff Training

3.21 The project would provide on the job and formal technical training to MWR, Provincial, IMC staff and farmers covering a wide range of subjects as detailed in Annex 8. On the job training to be provided by the consultants would be in the areas of project management, monitoring, evaluation, reporting and financial management, engineering design, procurement, contract management, construction and O&M. The project would also provide short term training specialists to design the training program and training modules and for identification and training of trainers.

3.22 Training courses for IMC staff and farmers would include: Management for Senior IMC Managers (21 participants); Financial Management, including budgeting and cost accounting/cost allocation (35); O&M (35); Computerized Project Management (10); and Computers (70). Also included is English language training for selected staff within the MWR, PWRS and IMCs. Farmer training would include pre-season, mid-year and post-season workshops and seminar-field days concentrating on technology transfer using trial/demonstration sites. Cooperatives and water user groups would be trained in O&M and water management.

Consulting Services for Project Preparation and Implementation

3.23 To assist in the operation of the Central Project Office (CPO) (para. 4.4), the preparation of detailed technical designs for the last three years of project implementation, the implementation of the above mentioned improvements, staff training and auditing of project accounts, the project would provide some 194 staff-months (sm) of long and short term consulting services as follows: (i) Team Leader (38 sm), Agriculturalist (3 sm), Monitoring and Evaluation Specialist (3 sm) and Environmental Specialist (4 sm) attached to the CPO; (ii) Irrigation Design Engineer (8 sm) and Electro-mechanical Engineer (6 sm) attached to VIHID and HIDEC2; (iii) Construction/Procurement Specialist attached to the Construction Management

Department (18 sm); (iv) Irrigation O&M Specialist attached to the Irrigation and Drainage Department (18 mm); (v) three Construction Specialists, for 30 sm each, attached to CMD and respectively stationed at Vinh, Thach Nham and Ho Chi Minh City; (vi) training and other short term specialists as required during implementation (3 sm); and (vii) services of an auditing company. Terms of reference for the Consultants are presented in Annex 9.

Equipment and Vehicles

3.24 The project would provide for the acquisition of vehicles, motorbikes, light construction equipment for O&M, equipment for testing materials, survey, and office equipment for the various project components, as listed in Annex 8.

D. Environmental Impact

Environmental Category

3.25 Since the project will be primarily concerned with rehabilitation of existing irrigation projects, rather than the construction of new ones, the environmental impacts were generally expected to be positive in that farm incomes will rise, employment will be created and quality of farmers' lives will improve. Adverse impacts will be limited, and mainly restricted to the construction phase. However, it was anticipated that the project would also provide an opportunity to review operational environmental issues and, as required, include provisions to address these.

3.26 Following field inspections during early project preparation, a number of more substantial environmental issues were identified in connection with the Hoc Mon/North Binh Chanh (HMNBC) component including: (a) its proximity to Ho Chi Minh City and the existence of plans for extending urban developments over part of the area; (b) the extensive disposal of industrial liquid effluent and domestic garbage into the area; and, (c) potential impacts due to the release of acids and, possibly, increased levels of aluminum and iron, due to disturbance of acid sulphate soils during drainage operations.

3.27 Consequently, the HMNBC subproject component was classified as a Category A, requiring a full environmental impact assessment (EIA). All other subprojects were classified as Category B, although they too were subject of environmental review to define construction and operational environmental management and monitoring requirements as necessary. The EIA was completed in May 1994 and its summary distributed to the Board on June 27, 1994. Annex 10 details potential environmental impacts and proposed mitigation actions by subproject.

Findings of Environmental Studies

3.28 Hoc Mon/North Binh Chanh EIA. During the course of subproject preparation several of the environmental concerns were addressed through changes in project design. In particular: (a) areas potentially subject to urban development were excluded from the project; (b) measures to deal with the solid waste disposal issue will not be part of the project since these issues concern only the excluded area; and (c) the water pollution problem was avoided by the

decision to install sluice gates to separate the scheme from the polluted Ba Hom Creek, which had the corollary benefit of excluding polluted flows from the development area.

3.29 The remaining issue of substance was the downstream physico-chemical and socio-economic effects of acid leachates from acid sulphate soils exposed during drainage and land rehabilitation works. The environmental management plan proposes steps to handle these problems including careful control of construction, proper disposal of construction material, and improved drainage and discharge of acid waters.

3.30 Other Subprojects. The Dong Cam, Thach Nham, Cam Thuy and Linh Cam subprojects were subject of environmental review based on field inspections to evaluate both construction and operational phase environmental issues. Issues which were subject of special consideration included: (a) control of construction impacts such as disposal of excavated materials, waste oils and greases, concrete and other construction materials; (b) in-river activities relating to weir rehabilitation, river bank reinforcement, siphon construction etc., which could impact on fish and other important aquatic organisms; (c) disposal of coolant oils from electrical transformers; and (d) disturbance of sites having cultural or historical importance.

3.31 Operational issues considered included: (a) potential fertilizer and pesticide pollution; (b) potential health impacts (potential for increased incidence of vector-borne and water borne diseases as a result of changing environmental conditions); (c) the potential for salt water intrusion due to hydrological changes; (d) catchment management requirements; and (e) the potential for increasing pollution from industries processing the products of the irrigation systems.

Environmental Action Plans

3.32 Environmental action plans have been prepared to provide for the mitigation of any significant impacts identified as a result of the environmental investigations. The procedures recommended to mitigate the construction impacts will form part of the construction specifications. It is anticipated that specifications will be prepared covering: (a) site stabilization and reclamation; (b) procedures for the collection and disposal of leachates from acid sulphate soils; and, (c) construction site management procedures to ensure the safe disposal of wastes and the health and safety of workers. Where there is construction in rivers and potential for significant impacts on aquatic ecosystems, appropriate mitigative measures will be specified. The locations of the relevant clauses in the construction specifications will be cross referenced in the environmental action plan. The locations of any sites of cultural or historical value will be identified together with the actions proposed for the protection of these. During negotiations, assurances were obtained that the environmental action plans would be furnished to IDA for review, and implemented by Government after incorporating IDA's comments. This would be a condition of disbursement against expenditures incurred under each subproject.

E. Involuntary Resettlement

3.33 As the main thrust of the project will be rehabilitation of existing works, the use of farm land for construction will be limited, and land acquisition will affect most individual

holdings only marginally. However, in Thach Nham and HMNBC, construction of new canals will take farm and homestead land, and will require resettlement of a limited number of families. The subproject preparation teams working in close cooperation with the provincial authorities have carried out inventories and socio-economic assessments of affected households. These show that about 1,125 farm plots have already been affected and 455 households have already been resettled in the Thach Nham subproject. In future, an additional 1,500 farm plots will be affected and 45 households will have to be resettled due to project-supported construction of primary canals in Thach Nham. About 1,934 farm plots will be affected and 130 households resettled due to project-related construction in HMNBC subproject.

3.34 For Linh Cam, An Trach and Cam Thuy subprojects, surveys have been carried out, assessing the extent of impact on people and their productive assets; the surveys have been based on the current level of subproject design which, in the case of An Trach, is preliminary and incomplete. For Linh Cam Subproject, it has been established that no household will have to be relocated or will lose more than 20 percent of its land; 3,736 farm plots will be marginally affected by realignment/dredging of canals. In the Cam Thuy subproject, 3 houses will be relocated due to international safety requirements for the Thung Bang Reservoir. In Dong Cam and South Nghe An subprojects, the resettlement impact is unknown because the technical designs on which to base resettlement assessments are not yet done in the case of South Nghe An, and are incomplete in the case of Dong Cam.

Resettlement Action Plans (RAPs)

3.35 During the Bank mission to Viet Nam in July 1994, draft RAPs for Thach Nham and HMNBC were presented to the mission by the project preparation teams. Although the inventories and surveys were largely completed, the RAPs still needed improvements in order to meet the requirements of O.D. 4.30. In order to complete and improve the RAPs, a two step approach (Part 1 and Part 2) was adopted. Part 1 or the general RAP was to be prepared for the project as a whole, laying down the policy, principles and procedures applying to all subprojects. This has been completed and submitted by the Project Preparation Teams to the Government and the Bank. It has been found to be in conformity with the Bank's resettlement policy and has been accepted by the MWR. It was subsequently approved by the Government before negotiations. (See Annex 11 for a summary of the RAPs.) RAP Part 2 was to consist of subproject specific RAPs.

3.36 Based on the information available on the number of project-affected families and the impact on farm land and other household assets, subproject specific RAPs Part II will not be required for Linh Cam, An Trach and Cam Thuy subprojects because the project-affected families are few and below the threshold for RAPs Part II (sub-project-specific RAPs Part II would be prepared only if there are more than 20 families affected, either by losing more than 20 percent of their productive land or having to relocate their houses). Nevertheless, compensation arrangements described in Part 1 of the RAP would apply in these three sub-projects.

3.37 RAP Part II drafts were prepared for Thach Nham and HMNBC sub-projects and submitted to the Government and the Bank. The drafts were found to be incomplete and inadequate. The appraisal mission worked with the Government to complete and review them. For the remaining two subprojects (South Nghe An and Dong Cam), since a lack of complete

technical designs cannot permit a resettlement impact assessment to be made, RAP Part II will be prepared at least 6 months before the start of construction activities. The RAP would include a timetable for implementation and completion prior to start-up of construction activities. It is estimated that implementation of the RAP would take six months.6/ An independent agency would be hired to undertake regular monitoring and evaluation studies; the agency would during the first year of implementation also undertake a survey to assess the resettlement and rehabilitation of families already affected by project construction prior to project approval in order to determine whether they have regained their livelihood or whether additional measures need to be taken. During negotiations, assurances were obtained that the required RAP Part II for each of these subprojects (and for the Thach Nham and HMNBC subprojects) acceptable to IDA, would be furnished to IDA and implemented, before disbursement is made against civil works and goods of each subproject. In addition, assurances were obtained that RAPs Part I and Part II would be implemented in a manner satisfactory to IDA. By November 1, 1995, the Government would hire independent consultants to carry out the monitoring of the resettlement actions under the project. The qualifications, experience, staffing and terms of reference of the consultants would be acceptable to IDA.

3.38 The Government's resettlement policy is based on a land for land compensation. The only exception is for the HMNBC subproject where people losing less than 20 percent of their holdings (as many as 78 percent of the project-affected people) would be given an option of cash compensation in cases where suitable land with which to compensate them is unavailable within close proximity. Any replacement land located distant from the main land holding would be difficult to manage by the compensated families. That is why the provincial authorities at the HMNBC subproject preferred to have a cash compensation option. The cash compensation is acceptable because: (i) the people in the project area have a diversified source of livelihood including self-employment and employment in the city; (ii) the amount of land lost does not severely affect the standard of living, particularly since the productivity of the remaining land would increase with project-supported irrigation; and (iii) the proximity to the city allows for non-agricultural investments to be made with the cash compensation. Cash compensation would be made available at replacement cost.

F. Dam Safety

3.39 Flows from the Dau Tieng reservoir, construction of which was financed under Credit 845-VN (para. 2.34), would be the main source of water for salinity control and irrigation in the HMNBC subproject. Construction of this dam was carried out in accordance with IDA dam safety procedures, including the establishment of an independent panel of experts. Another dam, the Thung Bang, serving one of the schemes in the Cam Thuy subproject, has been damaged. The project includes rehabilitation of the dam (para. 3.5). Two other dams - Ayun, under construction with Kuwait Fund financing, and Hinh, under construction by the Ministry of Energy - are not part of the project, but are located upstream of the Dong Cam subproject. In June and July 1994, an independent review of dam safety features was carried out for Dau Tieng, Thung Bang and Ayun dams; it confirmed the need for repair work on the Thung Bang dam. To ensure safety, the Thung Bang, Dau Tieng, Ayun and Hinh dams would be inspected by a panel of experts with professional independence, qualifications and experience in dam safety satisfactory to IDA, during design, construction or repair and thereafter in accordance with sound

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6/ For Details on the RAPs, see Annex 11.

engineering practice in order to determine whether there are any deficiencies in the design and construction of the dams or in their condition or in the quality and adequacy of maintenance, or in their methods of operation which may endanger their safety. During negotiations, assurances were obtained that the Government would, by June 30, 1996 submit to IDA for approval a list of experts with professional independence, qualifications, and experience in dam safety satisfactory to IDA, together with a description of their qualifications and experience, their terms of reference and a time-bound plan of dam inspections to be undertaken during design, construction or repair and maintenance of the four dams; and would implement the proposal upon receiving a "no objection" from IDA.

G. International Waters

3.40 The sources of water for the Cam Thuy, South Nghe An and Hoc Mon/North Binh Chanh subprojects respectively are the Ma, Ca and Saigon international waterways with headwaters in Laos (Ca and Ma Rivers) and Cambodia (Saigon River). Implementation of the project would not have any impacts in the upstream riparian countries. Also, since upstream flows in the riparian countries are not significant, their potential use in those countries would not have negative impacts on the Viet Nam subprojects. On behalf of GOV, IDA in June 1994 informed the Government of Cambodia and requested the Executive Director representing Laos on IDA's Board to inform the Government of Laos of GOV's intention to rehabilitate these subprojects, November 30, 1994 was indicated as the deadline for the riparian countries to provide their comments on the project. No objection has been received from the authorities of each of the countries.

H. Project Cost and Financing

Costs

3.41 Project costs totaling US$135.7 million, are summarized in Tables 3.2 and 3.3 below and detailed in Annex 9. The foreign exchange component is US$75.1 million or 55 percent. Base costs are estimated at US$112.7 million; physical and price contingencies at US$16.8 million (14.9 percent) and US$6.2 million (5 percent) respectively; and local taxes at US$7.0 million. Base costs were estimated in US dollars on the basis of mid-1994 prices adjusted for 3 percent inflation between 1994 and 1995. Physical contingencies for civil works and equipment averaging 17 percent were estimated on the basis of the status of engineering design. No physical contingencies were allowed for consulting services. Price contingencies for the period 1995-1999 have been estimated as 2.2 percent per annum, the average annual international inflation rate as specified in OP 6.50 Annex B of October 1994.

Table 3.2. Project Cost Summary by Components
(US$ millions)

	Local	Foreign	Total	% Foreign Exchange	% Total Base Costs
Subprojects					
Cam Thuy	1.1	1.6	2.7	58	2
South Nghe An	7.5	11.1	18.6	60	17
Linh Cam	4.1	7.5	11.5 a/	65	10
An Trach	1.8	2.6	4.4	59	4
Thach Nham	15.7	13.8	29.5	47	26
Dong Cam	4.5	5.7	10.2	56	9
Hoc Mon/North Binh Chanh	14.9	16.2	31.1	52	28
Subtotal:	49.6	58.5	108.1	54	96
Consultants and Training					
Technical Advice	0.2	1.5	1.7	88	2
Project Administration	0.5	2.4	2.9	84	3
Subtotal:	0.7	3.9	4.6	85	4
Total Baseline Costs	50.3	62.4	112.7	55	100
Physical Contingencies	7.7	9.4	16.8	55	15
Price Contingencies	2.7	3.6	6.2	57	5
Total Project Costs	60.6	75.1	135.7	55	120
Taxes and Duties	7.0	0.0	7.0		
Total Costs Net of Taxes and Duties	53.6	75.1	128.7		

a/ Numbers do not add up because of rounding off.

Table 3.3. Project Cost Summary by Type of Expenditures
(US$ million)

	Local	Foreign	Total
Civil works	45.7	62.9	111.3
Equipment and Vehicles	3.1	7.7	10.9
Consultants	0.2	3.6	3.8
Training	0.4	0.3	0.7
Resettlement/Environment Mitigation	7.6	0.3	7.9
Engineering/Administration	3.4	0.0	3.4
Other expenditures	0.1	0.2	0.2
Total	60.6	75.1	135.7

Financing

3.42 The proposed IDA Credit of SDR 67.0 million (US$100 million equivalent) on standard terms would be made to Socialist Republic of Viet Nam, and would finance about 78 percent of total project costs, net of taxes and duties. The Credit would cover 97 percent of the foreign exchange cost, US$72.7 million, plus US$27.3 million of local costs (51 percent of local costs). The Central Government would finance US$7.2 million equivalent (5.6 percent of the total cost) plus US$6.4 million equivalent of taxes, the Provincial Government US$7.3 million (5.7 percent) and farmers would contribute US$14.3 million or 10.9 percent plus taxes of US$0.6 million.

3.43 In accordance with Government policy, construction of "minor works" serving areas under 150 ha would be the responsibility of the provinces and beneficiaries. Because of lack of a revenue base for the provincial governments (other than charging water fees) and given the need to ensure that this does not delay rehabilitation of tertiary irrigation systems and divert water fees from covering the costs of O&M, IDA financing would be provided to in lieu financial contributions from provinces and beneficiaries for funding construction of water control structures serving less than 150 ha. During negotiations, assurances were obtained that investments in the construction or rehabilitation of water control structures for areas less than 150 ha would be recovered from provincial authorities and farmers according to a cost recovery plan, acceptable to IDA, that would be worked out by the mid-term review of the project and would be consistent with the overall financial management plan for each subproject. The cost recovery plan would be consistent with the financial management plans for O&M prepared for each subproject.

Table 3.4. Financing Plan
(US$ million)

	Local a/	Foreign a/	Total a/	%	Taxes
IDA	27.3	72.7	100.0	78.0	--
Viet Nam					
Central Government	7.2	0.0	7.2	5.6	6.4
Provincial Government	7.2	0.1	7.3	5.7	0.0
Farmers	11.8	2.2	14.0	10.9	0.6
Total:	**53.6**	**75.1**	**128.7**	**100.0**	**7.0**

a/ Without taxes and duties estimated at US$7.0 million.

I. Procurement

3.44 The draft Country Procurement Assessment Report for Viet Nam indicates that no agency of the GOV had, in recent years, undertaken international or local procurement procedures that would be considered acceptable to IDA. Moreover, basic laws and regulations establishing acceptable procurement procedures had only been put in effect recently. IDA has provided an IDF grant to assist GOV to establish appropriate legal basis for the government procurement.

3.45 Civil Works. Based on the experience with a UNCDF project in Quang Nam and Da Nang Provinces, it is likely that foreign contractors would be interested in bidding for contracts valued at US$2.0 million or even less. MWR subsidiary construction companies, while underfunded and lacking equipment, have considerable experience and should be capable of carrying out rehabilitation and construction of new works as they have been doing. These companies may participate in IDA-financed procurement if they can establish that they are legally and financially autonomous, and operate under commercial law. Their financial strength would be enhanced if they enter into joint ventures with foreign contractors, which some are already planning to do. On this basis, civil works contracts for construction of irrigation and drainage works and major structures with a value of US$2.0 million or more per contract would be procured through ICB procedures following prequalification of bidders, and the Bank's Standard Bidding Documents (SBD). This threshold would be reviewed and, if necessary, revised on the basis of the response from foreign contractors to contract bidding in the first two years of project implementation. Qualified domestic contractors participating in ICB procedures would be eligible for a margin of preference of 7.5 percent in bid evaluation. Civil works, in individual contracts valued at less than US$2.0 million and in an aggregated amount up to US$37.2 million would be procured following prequalification and LCB procedures acceptable to IDA. The US$37.2 million aggregate limit for LCB may be subject to change after completion of detailed technical designs of subprojects and upon request by the Government. During negotiations, agreement was reached on the LCB procedures to be followed. Other smaller works, scattered and in isolated areas, in aggregated amount up to US$5.0 million may be procured through force account. Prequalification would be in the form of continuous registration on the basis of thresholds that indicate the available performance capacity of the contractors. To encourage foreign participation, the LCB bidding documents would be modeled after the Bank's SBDs for Smaller Works and would be available both in English and Vietnamese languages. Earth works for canals serving less than 150 ha would be carried out by beneficiaries through their labor contributions up to an amount estimated at US$13.6 million not financed by IDA.

Table 3.5. Procurement Arrangements
(US$ million)

	ICB	LCB	Other a/	N.I.F.	Total
Civil Works					
Major Civil Works	55.0 (50.0)	30.0 (27.1)	-	-	85.0 (77.1)
Minor CW - Earthworks	-	-	-	13.6 (-)	13.6 (-)
Minor CW - Structures	-	6.5 (5.5)	5.0 (5.0)	-	11.5 (10.5)
Minor CW - Buildings	-	0.7 (0.6)	-	-	0.7 (0.6)
Goods					
Equipment and vehicles	9.1 (7.0)	- -	0.5 (0.5)	-	9.6 (7.5)
Consultants and Training					
Consultants		-	3.6 (3.6)	0.2 (-)	3.8 (3.6)
Training	-	-	0.7 (0.7)	-	0.7 (0.7)
Engineering/Administration	-	-	-	3.4 (-)	3.4 (-)
Resettlement/Environ. Mitigation	-	-	-	7.3 (-)	7.3 (-)
TOTAL	64.1 (57.0)	37.2 (33.2)	9.8 (9.8)	24.5 (-)	135.7 b/ (100.0)

Note: Figures in parentheses are the respective amounts financed by IDA.
N.I.F. (Not IDA financed) items are primarily civil works on irrigation systems serving less than 150 hectares, plus costs of resettlement. These would be financed by provincial governments and through the labor contributions of beneficiaries.

a/ Other: Includes local and international shopping, force account, hiring of consultants and expenditures in training activities following administrative procedures.

b/ Numbers do not add up because of rounding off.

3.46 Goods. All contracts for pumps, electro-mechanical equipment, vehicles and other major equipment in an aggregated value of US$9.1 million would be procured centrally on the basis of ICB procedures in accordance with IDA Guidelines. The Bank's SBD for goods would be used for procurement of goods under ICB. Domestic manufacturers participating in ICB

would be eligible for a margin of preference of 15 percent, or the import duty, whichever is lower. Minor supply contracts, including supply of light construction equipment, vehicles, motor bikes, equipment for testing materials and office equipment, with an estimated value of US$50,000 or less with an aggregated value not to exceed US$500,000 may be procured through the UN Inter-Agency Procurement Services Office (for urgently needed supplies), direct contracting or on the basis of international or local shopping obtaining at least three price quotations from qualified local or international suppliers eligible under IDA Guidelines; the procedures followed would have to be acceptable to IDA. The US$500,000 aggregate limit for such procurement may be subject to change after completion of detailed technical designs of subprojects and upon request by the Government.

3.47 Consultants' Services and Training. Consultants' services totaling 194 staff months and estimated to cost US$3.6 million would be procured on the basis of IDA Guidelines for the Use of Consultants. IDA guidelines would also be used for procurement of training estimated at a total cost of US$0.7 million. At negotiations, the Government furnished to IDA for review a draft general procurement notice, a draft standard letter of invitation and draft standard contracts for hiring of consultants. These were reviewed by IDA and found satisfactory.

IDA Prior Review

3.48 For all contracts with a value of US$200,000 equivalent or more per contract for civil works and goods, each set of bid documents would be subject to prior review by IDA before issuing to bidders, and evaluation reports would be reviewed by IDA before award of the contract. This would cover about 80 percent of the value of goods contracts and about 75 percent of civil works contracts. All other contracts of goods and civil works would be subject to IDA post review procedures. All consultancy contracts with firms valued at the equivalent of US$100,000 or more will be subject to IDA prior review procedures; so would contracts with individuals valued at the equivalent of US$50,000 or more. Prior review procedures would apply regardless of the value of contracts with respect to draft letters of invitation and contracts, terms of reference, qualification criteria, evaluation reports, award proposals and final contracts when substantial differences to the original draft are made. For individual consultants, simplified review procedures would apply as per IDA Guidelines. All post review contracts for goods, civil works and consultants would be subject to sample review. In order to ensure timely award of contracts, the CPO would ensure all required information is provided to IDA promptly, and evaluation and contract award proposals are also submitted to IDA in a timely manner.

J. Disbursements

3.49 The proposed IDA Credit of SDR 67.0 million (US$100 million equivalent) would finance about 78 percent of the total project costs net of taxes. The project would be physically completed by December 31, 2000 and the closing date of the Credit would be December 31, 2001. An estimated schedule of disbursements is presented in Annex 13. Disbursement would be as follows:

(a) Civil works. 91 percent of expenditures;

(b) Goods. 100 percent of foreign expenditures; 100 percent of local expenditures (ex-factory cost) of locally manufactured items and 80 percent of local expenditures for other items procured locally; and

(c) Consultant Services and Training. 100 percent of total expenditures.

3.50 Implementation of RAPs Part II and environmental action plans and establishment of SIOs would be conditions of disbursement for each subproject (see paras. 3.32, 3.37 and 4.10). Full documentation would be required for disbursements against all contracts for civil works and goods above US$200,000, consulting firms above US$100,000 and individual consultant contracts above US$50,000. Disbursements for all contracts below these levels, including training expenditures would be made against SOEs prepared by the CPO. Documentation supporting the SOEs would be retained by the executing units and made available for review by IDA supervision missions. Retroactive financing up to US$10.0 million would be allowed for expenditures in urgent repair works carried out after August 1, 1994. Retroactive financing would apply only for contracts whose procurement procedures are acceptable to IDA.

3.51 Special Account. In order to facilitate timely payments of project expenditures, a Special Account will be established in a bank acceptable to IDA and on terms and conditions satisfactory to IDA. The account would be established in US currency with an authorized allocation of US$5 million equivalent. The account would be replenished monthly or when it is drawn down by 30 percent of the initial deposit, whichever occurs first.

3.52 Disbursement Profile. As there is no recent disbursement profile available for IDA projects in Viet Nam, the project disbursements schedule has been developed on the basis of the project implementation plan taking into consideration all procurement, implementation and disbursement steps. Disbursements are expected to be completed in about seven years as opposed to eight years which is the average for the agricultural projects in East Asia and Pacific Region. A schedule of estimated disbursements is given in Annex 13.

K. Accounts and Audits

3.53 During negotiations, assurances were obtained from the GOV that: (a) Subproject Implementation Offices (SIO) would keep separate project accounts for their respective project components and report to CPO on monthly basis, while consolidated project accounts would be maintained by the CPO; (b) the project accounts, including documentation for SOEs, would be audited annually by independent auditors acceptable to IDA, with the audit including a separate opinion on use of the SOEs as well as the status of audit compliance; and (c) the detailed audit reports would be submitted to IDA within nine months of the closing of the government's fiscal year. During negotiations, it was confirmed that four new Vietnamese companies located in Viet Nam, in addition to MOF's Accounting and Auditing Company (VACO), would be considered to provide auditing services whose costs would be financed out of the proceeds of the Credit; procurement of the auditing services would be in accordance with the World Bank Guidelines for Use of Consultants.

IV. PROJECT IMPLEMENTATION

A. Status of Project Preparation

Status of Project Preparation

4.1 Subproject identification and initial preparation were carried out by the FAO/World Bank Cooperative Program. Preparation reports Nos 118/93 CP-VIE.10 of August 6, 1993 and 1/94 CP.VIE 12 WPS of January 5, 1994 (Irrigation Subsector Project) are in project files. VIHID, HIDEC2 and provincial survey and design companies assisted by two consulting firms, financed under Canadian and Italian bilateral assistance grants, have assisted in planning and preparing implementation plans, environmental assessments, resettlement plans and designs for works to be constructed during the first two years of project implementation (about 40 percent of the total works in terms of costs) for five of the seven subprojects (Cam Thuy, Linh Cam, Thach Nham, Dong Cam and HMNBC). Preparation work on the other two subprojects (South Nghe An and An Trach) was initiated in February 1995 and is expected to be completed by August 1995; the consultants who are doing this work will also support the completion of preparation work on the Dong Cam subproject.

4.2 Preparation of the remaining work (the last three years of project implementation) for the seven subprojects would be carried out during project implementation. Consultants to be provided under the project would assist MWR in this endeavor.

B. Project Organization and Management

4.3 Overall project implementation would be the responsibility of the MWR through its departments and subsidiary agencies, with active participation of the provincial authorities concerned. In order to coordinate the activities of different ministries, provinces and state committees concerned with the implementation of the project, a steering committee would be established, which would be in charge of policy decisions regarding project implementation, and would consist of members at the level of Vice-Minister from MWR, SPC, Ministry of Finance, Ministry of Construction, State Bank of Viet Nam and chairmen/vice-chairmen of PPCs of provinces in which the subprojects are located.

Central Project Office (CPO)

4.4 MWR would establish a Central Project Office (CPO) to administer and coordinate the day-to-day implementation of the IDA project. The CPO would be headed by a Project Manager, who would be a senior MWR official (holding the rank of Director or Deputy Director) reporting to a Vice-Minister (Project Director). Other staff would include irrigation engineers, accountants, planning and monitoring specialists, interpreters, clerical staff and other experienced specialists as required. A team of consultants to be employed under the project (para. 3.23) would assist the CPO, MWR departments and the provinces in project implementation in accordance with terms of reference included in Annex 9. The consultant's

team leader would be the counterpart to the Project Manager and assist him/her in the fulfillment of his/her responsibilities and in the operation of the CPO.

4.5 CPO's responsibilities would include planning, procurement of major contracts, coordination of implementation, monitoring and reporting project physical and financial progress, processing disbursement applications and statements of expenditure, facilitating and coordinating technical assistance services and ensuring that the project is implemented in accordance with the agreements between GOV and IDA. Implementation of the various project components would be the responsibility of Subproject Implementation Offices, specialized departments and provincial services. For an optimal utilization of local staff and technical assistance, the CPO would work in close collaboration with other MWR units responsible for implementation of projects financed by ADB and other international agencies and would share common expertise. During negotiations, assurances were obtained for the establishment of the CPO and the appointment of the Project Manager, whose qualifications and experience are acceptable to IDA, before the credit is effective.

Subproject Implementation Offices (SIOs)

4.6 MWR would also establish seven SIOs, responsible for implementation of individual subprojects. Each SIO would be headed by a senior staff member of MWR as Subproject Manager and an official from PWRS as Deputy Subproject Manager. Each SIO would consist of technical and administrative staff from MWR, PWRS and PAS as required. SIOs' responsibilities, organization and staffing would reflect and complement those of the CPO. An organization chart for a typical subproject is shown in Chart 2 of the Annex.

C. Details of Project Implementation

Engineering Planning and Design

4.7 The CPO would oversee engineering planning, design, procurement and construction of project works at the central level. VIHID and HIDEC2 would prepare designs of major engineering works under contract with CPO or SIO; provincial survey and design companies would prepare engineering designs of minor irrigation and on-farm works under the guidance and supervision of VIHID and HIDEC2. The consultant irrigation engineer and other short term specialists would assist MWR and the survey and design companies in updating design parameters, carrying out operational studies and completing detailed designs.

Works Procurement and Construction

4.8 The CPO, assisted by consultants recruited under the project, would, in collaboration with MWR's Planning Department and Department of Construction Management: (a) review and update construction specifications; (b) complete preparation of MWR's competitive bidding procedures; (c) make procurement and construction plans, and prepare bidding documents, advertise and evaluate bids for project works; (d) strengthen the organization, staffing and operation of SIOs; and (e) monitor project works construction. CPO staff would be provided with on-the-job training and courses in contract management and construction quality control.

The construction and procurement specialist to be hired under the project would assist in this. MESCO 1 would procure all project equipment assisted by the electro-mechanical specialist to be hired under the project.

4.9 Awarding Committee. An Awarding Committee, chaired by a Vice Minister of Water Resources and comprising the Project Director and the Directors of the concerned Departments would review CPO's and MESCO's bid evaluation reports and make recommendations on contract awards.

4.10 Subproject Implementation Offices. Responsibility for day-to-day contract administration and quality control of civil works and electro-mechanical equipment contracts would rest with resident SIOs. These were formerly known as Construction Management Boards and would be strengthened under the project. Depending on the scope of construction works, each SIO would establish one or more contract management and supervision teams comprising a Resident and one or two Assistant Engineers (for earth and concrete works), inspectors of works and testing materials technicians, and a survey team. SIOs would also be provided with vehicles, survey, computer, materials-testing and other equipment necessary for the performance of their functions. Three resident Construction Specialists (para. 3.23) would assist in strengthening the organization of SIOs, provide on-the-job training of staff and day-to-day construction supervision for the first three years of project implementation with part-time inputs thereafter. The three specialists would be based at Vinh for Cam Thuy, South Nghe An and Linh Cam Subprojects; Quang Ngai for An Trach and Thach Nham Subprojects; and HCMC for Dong Cam and Hoc Mon/North Binh Chanh Subprojects. During negotiations, assurances were obtained that satisfactory establishment of each subproject's SIO would be done before disbursement is made for the subprojects.

Training

4.11 The CPO would coordinate preparation and implementation of the training program. MWR specialized institutes and departments would implement the program assisted by the project consultants, who would provide on-the-job training and lectures in their respective fields of expertise. Training courses would be primarily conducted in the subproject areas. Additional implementation details of the training program are included in Annex 8. During negotiations, assurances were obtained that the Government would provide to IDA for review by November 30 of each year, beginning on November 30, 1995, a proposed training program for the MWR and provincial level staff; upon receiving and incorporating comments from IDA, the Government would implement the program.

Monitoring and Evaluation, Reporting

4.12 The CPO would monitor, evaluate and report project physical and financial progress based on information provided by MWR Departments, SIOs, PWRS, PAS and IMCs. On the basis of baseline information and key indicators to be identified in Subproject Implementation Plans (SIP) the CPO would develop and implement a computerized monitoring, evaluation and reporting system (M&E). The M&E would focus on progress and impact of works construction, implementation of resettlement and environmental action plans; O&M costs and irrigation fees, water use and efficiency, crop areas, yields and production and farmer incomes would be

monitored. The information would be collected at the provincial level and processed by the CPO. A short-term specialist with experience in computerized project management would assist the CPO in the establishment of the project M&E system, would train the staff and would periodically follow up implementation for a total time of 4 months (para. 3.23). The SIO and CPO would prepare progress reports for the steering committee. These would be consolidated by CPO and submitted to IDA semi-annually. In addition the CPO would arrange for a mid-term review of the project and would contribute to the preparation of an Implementation Completion Report. For the mid-term review of the project, the Government would prepare and submit to IDA an assessment of progress made in achieving project objectives, the performance of technical assistance and the need to adjust project design, if required; and the Government would also prepare a program of action to address any deficiencies in project implementation identified in the assessment. The Bank would conduct semi-annual project supervision missions; a supervision plan is presented in Annex 15. During negotiations, assurances were obtained on the establishment and implementation of adequate M&E and reporting systems by December 31, 1995, the furnishing to IDA of semi-annual project progress reports by March 1 and September 1 of each year beginning March 1, 1996, preparation of documentation for a mid-term review of the project by March 15, 1998 and preparation of an Implementation Completion Report within six months of the credit closing.

Beneficiary Participation

4.13 The beneficiaries (farmers) would participate in the implementation of the project in at least three ways: (a) contributing labor to the rehabilitation and completion of tertiary irrigation canals; (b) getting involved, through their water user groups, in the collection of water fees for financing of O&M costs, and in the management of irrigation water services through their representation on Water Management Boards; and (c) continuing to be closely involved in resettlement planning and implementation. During project design, farmers were involved in resettlement planning.

V. PROJECT BENEFITS AND COSTS

Crop Areas and Cropping Intensities

5.1 Information on irrigated and cropped areas, cropping intensities and production with and without the project is included in Annexes 1 through 7 and summarized in Table 5.

5.2 The project would rehabilitate and modernize existing systems and complete construction of partially built systems. This would enable reliable delivery of irrigation water to an aggregate area of over 130,000 ha including areas that at present do not receive irrigation water and to areas that receive supplies which are unreliable for the reasons described in para. 2.24 and, particularly for small pumping systems at South Nghe An, Linh Cam and Thach Nham, due to scarcity of water at the source. It has been assumed that no new crops would be grown and that there would be no major changes in the cropping pattern due to the project. The project area will continue to be cropped predominantly with paddy (195,000 ha out of 270,000 ha, or 72 percent). Other crops will continue to include sweet potatoes (8 percent), sugarcane (5 percent), maize (4 percent), and groundnuts (2.5 percent). The total cropped area in the seven subprojects would increase from about 239,000 ha to about 270,000 ha and the average cropping intensity would increase from 193 percent to 219 percent.

Yields and Production

5.3 Average paddy yields per season currently range from 2.0 ton/ha at Cam Thuy to 3.9 ton/ha at Dong Cam. As a result of increased irrigation, inputs, credit and extension, these yields would rise to 3.2 ton/ha to 4.5 ton ha. Other crop yields are also expected to rise correspondingly. Total annual paddy production would increase by about 54 percent from about 518,000 tons to 800,000 tons. Using byproducts from rice and other crops, farmers raise cattle and poultry which are important sources of protein and income to them. Increased production of meat and other animal products, while not calculated in detail, is expected to increase in a similar proportion to that of crop production.

Marketing

5.4 As the subprojects are located in rice deficit areas where farm holdings are very small (0.31 to 0.79 ha), farmers would consume most of the net incremental production of paddy and other crops. Minor farm surpluses would be marketed locally. Meat production from cattle and poultry not consumed by farmers would be sold locally in nearby towns and villages.

Table 5.1. Crop Areas, Yield, Production, Cropping Intensities

Subproject and Crop	Without Project				With Project				Incremental Production ton
	Crop	Yield	Production ton	Cropping Intensity	Crop Area ha	Yield ton/ha	Production ton	Cropping Intensity	
Cam Thuy (1,900 ha)									
Rice	2,300	2.0	4,612		3,166	3.3	10,290		5,678
Corn	860	1.2	1,032		872	2.5	2,180		1,148
Total	3,160		5,644	1.6	4,038		12,470	2.1	
South Nghe An (25,000 ha)									
Rice	31,540	2.3	72,542		37,774	3.3	124,654		52,112
Sweet Potatoes	7,492	4.5	33,714		7,189	7.1	51,042		17,328
Peanuts	5,253	1.3	6,829		6,102	1.6	9,763		2,934
Corn					3,999	2.5	9,998		9,998
Total	44,285		113,085	1.8	55,064		195,457	2.2	
Linh Cam (14,600)									
Rice	27,440	2.4	66,233		29,200	4.5	130,660		64,427
Mungbeans	1,760	0.4	762						-762
Total	29,200		66,995	2.0	29,200		130,660	2.0	
Anh Trach (9,700 ha)									
Rice	17,105	3.3	56,748		22,065	3.9	85,319		28,571
Sweet Potato	6,020	5.0	30,100		4,720	8.0	37,760		7,660
Total	23,125		86,848	2.4	26,785		123,079	2.8	
Thach Nham (45,500 ha)									
Rice	50,794	3.0	152,382		50,788	4.3	218,388		66,006
Sweet Potatoes	25,245	7.0	176,715		24,396	10.0	243,960		67,245
Corn					6,038	4.5	27,171		27,171
Sugar Cane	8,575	41.8	358,435		9,491	70.0	664,370		305,935
Total	84,614		687,532	2.1	90,713		1,153,889	2.3	
Dong Cam (19,800 ha)									
Rice	38,000	3.9	149,650		38,000	4.5	171,000		21,350
Soy Beans	3,300	0.7	2,300		3,300	0.8	2,495		195
Sugar Cane	400	30.5	12,200		384	34.9	13,400		1,200
Total	41,700		164,150	2.1	41,684		186,895	2.1	
HMNBC (13,300 ha)									
Rice	5,570	3.1	17,181		14,122	4.4	62,230		45,055
Peanuts	41	2.3	94		1,087	2.6	2,826		2,732
Sugar Cane	2,308	18.0	41,544		4,065	30.0	121,950		80,406
Other	5,083	28.0	14,364		4,103	18.3	75,085		60,721
Total	13,002		73,183	1.0	23,377		262,091	1.8	
Total Project (129,800 ha)									
Rice	172,749	3.0	518,247		195,115	4.1	799,972		281,725
Sweet Potatoes	38,757	6.1	236,418		36,305	9.2	334,006		97,588
Corn	860	1.2	1,032		9,970	3.6	35,892		34,860
Peanuts	5,294	1.3	6,882		7,189	1.6	11,502		4,620
Mungbeans	1,760	0.4	704		0		0		-704
Soybeans	3,300	0.7	2,310		3,300	0.8	2,640		330
Sugar Cane	11,283	36.4	410,701		13,940	64.6	900,524		489,823
Other	5,083	10.0	50,830		4,103	20.0	82,060		31,230
Total	239,086		1,227,124	1.9	270,861		2,166,596	2.2	

Project Benefits

5.5 The proposed project would contribute to food security and poverty alleviation of some 312,000 rural families, many living below the poverty line. The main benefits derived from rehabilitation and improved O&M would be restoring the irrigation systems to their original design capacity and securing their sustainability, which in turn would increase water availability, crop area, yields and production over an area of 130,000 ha. Average cropping intensity would rise from 1.9 to 2.2 and rice production would increase by about 282,000 ton per year in the seven subprojects. The project would also strengthen the role of cooperatives and other water user groups in water management, improve the management and financial position of IMCs, and contribute to enhancing MWR's design, procurement and construction capacity.

Financial Analysis

5.6 Farmers' Incomes. The impact of the project on farmers' incomes were determined on the basis of crop budgets and subproject production models prepared for each subproject. The outcome is contained in Annexes 1-7 and details are available in the project file. Increases in farmers' incomes related to the project would range from US$9 per year for an average farm size of 0.34 ha in the Dong Cam subproject to US$87 per year for an average farm size of 0.45 ha for the Thach Nham subproject, representing increases of 10 to 32 percent in farm incomes.

5.7 Beneficiaries' Capacity to Pay is addressed in Annex 8 taking into consideration the new water pricing guidelines contained in a regulation which was issued on February 28, 1994 as well as the impact of the project on farm incomes. The main conclusion is that, for the gravity irrigation schemes, farmers would be able to cover the costs of O&M if current water rates are increased in line with project-related production increases in order to maintain their share in production. However, for the schemes that rely on pumping, there would be a need to increase water fees to capture a higher percentage of production although the increase would be minimal since rehabilitation of irrigation systems is expected to significantly reduce O&M costs. Therefore the farmers would still be better off with the project despite some increase in water charges.

5.8 Cost Recovery, and IMCs' Financing. Increases are expected in water fee collections by IMCs resulting from higher production, and reduced O&M and repair costs, provided the new structure of water fees, based on irrigated area, is adequately adjusted to maintain its share in production. An analysis of this can be found in Annex 8. For three of the seven schemes, it is expected that O&M costs would be covered without a need to increase the percentage of water fees in relation to production. For the rest of the schemes, the percentage of water fees in production would need to be raised but the magnitude of the raise would be determined in the context of a financial management plan for each subproject which would take into account the expected reductions in the costs of O&M due to cost efficiencies related to rehabilitation and improvements in management.

Economic Analysis

5.9 The combined economic rate of return (ERR) for the seven subprojects is estimated at 17 percent. Individual subprojects' ERRs are: Cam Thuy: 16 percent; South Nghe An: 12 percent; Linh Cam: 21 percent; An Trach: 27 percent; Thach Nham: 24 percent; Dong Cam: 12 percent; and Hoc Mon/North Binh Chanh: 12 percent (see Table 5.2 below). Three of the seven

schemes have marginal ERRs at 12 percent. Two of the three schemes (Dong Cam and Hoc Mon/North Binh Chanh) involve predominantly new construction as opposed to rehabilitation. As for South Nghe An (the other scheme with marginal ERR), the main investment is a major rehabilitation of pumping stations which are usually low return investments compared to gravity irrigation systems. These shortcomings notwithstanding, the overall net returns are expected to be higher since the ERR calculations have not taken into account the benefits related to the supply of fresh water for domestic and industrial purposes.

Table 5.2. Economic Rates of Return

		Sensitivity Analysis	
Sub-project	ERR (%)	20% decline or 2 year delay in benefits	20% increase in costs
Cam Thuy	16.0	13.0	13.9
South Nghe An	12.0	10.0	9.6
Linh Cam	21.0	17.0	19.0
An Trach	27.0	23.1	23.4
Thach Nham	24.0	18.3	20.7
Dong Cam	12.0	9.6	9.8
Hoc Mon/North Binh Chanh	12.0	9.5	9.6

5.10 As the table above shows, the project overall remains quite robust even with assumptions of declines in benefits or increases in cost. For the three subprojects whose ERRs decline to 10% (under pessimistic assumptions), they are still worth the investment given the additional (unaccounted for) benefits which include supply of fresh water for domestic and industrial use, positive environmental interventions and improved safety for the dams and irrigation systems.

Risks

5.11 Since the project involves rehabilitation and improvement of irrigation works, it does not face major risks. The main risks related to implementation include: (i) lack of experience in implementation of externally financed projects and competitive bidding in Viet Nam, which could delay contracting and construction of project works; (ii) inadequate construction quality which would reduce the life of project works; (iii) failure to provide adequate funding for O&M, which would result in deterioration of the irrigation systems; and (iv) delays related to government acquisition of land for the project and compensating affected people. Consulting services to assist in project implementation would help to minimize the technical risks including procurement problems. Increased agricultural production and higher water fees will enhance IMCs' revenues for O&M, while O&M costs would be reduced by rehabilitation. Since the key RAPs were prepared and approved before negotiations, the risk of delays in resettlement will be minimized.

VI. AGREEMENTS REACHED AND RECOMMENDATION

6.1 The conditions of credit effectiveness and disbursement as well as the agreements obtained during negotiations are as follows:

Agreements Obtained During Negotiations

(a) the Government would prepare for each subproject a time-bound financial management plan, acceptable to IDA, and its implementation would be reviewed with IDA during the mid-term review of the project (March 15, 1998). The Plan would aim at covering the costs of O&M of irrigation systems by beneficiaries consistent with the Government's regulations on water fees issued on February 28, 1994 (para. 3.18);

(b) by December 31, 1996, the Government would prepare and submit to IDA, for its review and comments, a proposal to enhance farmers' participation in the management of the IMCs and thereafter taking into account IDA's comments, implement such a proposal (para. 3.19);

(c) the Government would ensure that the environmental action plans satisfactory to IDA are implemented (para. 3.32);

(d) the Government would carry out the resettlement of the project-affected people consistent with the provisions of RAP Part I and RAPs Part II in a manner satisfactory to IDA. By November 1, 1995, the Government would hire an independent entity to carry out the monitoring of the resettlement actions under the project (para. 3.37);

(e) the Government would, by June 30, 1996, submit to IDA for review a proposal for dam inspection which would include a list of experts with professional independence, qualifications and experience in dam safety satisfactory to IDA, together with a description of their qualifications and experience, their terms of reference and a time-bound plan of dam inspections to be undertaken during design, construction or repair and maintenance of the four dams associated with the project; and would implement the proposal upon receiving a "no objection" from IDA (para. 3.39);

(f) the Government would, by mid-term review of the project (March 15, 1998), prepare and provide to IDA for review a plan to recover from the provincial authorities and project beneficiaries funds invested in the construction or rehabilitation of water control structures serving 150 ha or less of land; the plan shall be consistent with the financial management plans for O&M for each subproject (para 3.43).

(g) the Government would ensure that consolidated project accounts are maintained by the CPO; the project accounts, including documentation for SOEs, would be audited

annually by independent auditors acceptable to IDA, with the audit including a separate opinion on use of the SOEs as well as the status of audit compliance; and detailed audit reports would be submitted to IDA within nine months of the closing of the government's fiscal year (para. 3.53);

(h) the Government would provide to IDA for review by November 30 of each year beginning on November 30, 1995, a proposed training program for the MWR and provincial level staff; upon receiving and incorporating the comments from IDA, the Government would implement the program (para 4.11);

(i) the Government would ensure the establishment, by December 31, 1995, of adequate M&E and reporting systems, furnishing to IDA of semi-annual progress reports by March 1 and September 1 of each year beginning March 1, 1996, preparation of documentation for a mid-term review of the project by March 15, 1998 and preparation of an Implementation Completion Report within six months of the credit closing (para. 4.12);

Conditions for Credit Effectiveness

(j) the Government would establish a CPO and appoint a Project Manager whose qualifications and experience are acceptable to IDA (para. 4.5);

(k) a legal opinion would be furnished to IDA indicating that the approved RAP Phase I is legally enforceable in Viet Nam;

Conditions of Disbursement

(l) the Government would approve and furnish to IDA a RAP Part II that is acceptable to IDA and implement such RAP Part II before disbursement is made against civil works and goods of each subproject that requires RAP Part II to be prepared (para. 3.50);

(m) the Government would establish the SIO of each subproject before disbursement can be made on the subproject (para. 4.10); and

(n) the Government would adopt an environmental action plan, satisfactory to IDA, for each subproject before disbursement can be made in each subproject (para. 3.32).

Recommendation

6.2 Subject to the above agreements and conditions, the project is suitable for a Credit to the Government of Viet Nam in the amount of SDR 67.0 million (US$100 million equivalent), on standard IDA terms with 40 years maturity.

CAM THUY SUBPROJECT

I. Background

General

1. The subproject comprises rehabilitation of seven small schemes with a cultivable area of 1,919 ha in the Cam Thuy District of Thanh Hoa Province in a hilly region, located on both banks of the Ma River, about 80 km from Thanh Hoa Town (Figure 1). The elevation of the subproject ranges between 19 m MSL (meters above Mean Sea Level) and 30 MSL. Approximately 6,250 households with a total population of about 30,000 live in the subproject area, about 98% of whom are engaged in agriculture. The average farmholding within the subproject area is about 0.31 ha per family.

Water Resources

2. There are several small streams flowing in the subproject region but the major source of water is the Ma River. This river originates in Lai Chau Province at an elevation of about 1,000 m MSL, passes through Song La and Laos before re-entering Vietnam in the northwest of Thanh Hoa Province and drains into the South China Sea. The total catchment area of the Ma River is about 28,000 km^2, 17,800 km^2 above Cam Thuy. About 10,000 km^2 of the western part of the catchment are located in Laos. The river's mean annual flow is 10,300 million m^3 (MCM), (10.3 BCM) and with this flow the potentially irrigable area in the plains of Vietnam is estimated to be 117,000 ha, including some 50,000 ha on the Chu River, a tributary of the Lower Ma. Overall, water resources are therefore not considered to be a constraint to irrigation development in the basin.

Irrigation System

3. The seven irrigation schemes, which would be rehabilitated under the project, supply water to seven communes, in them 15 cooperatives which comprise about 40% of the irrigated area in the Cam Thuy District. Amongst the seven schemes are six pump-lift schemes on the Ma River and one gravitational scheme on the Thung Bang, a tributary of the Ma. Water of the Thung Bang is stored in a small reservoir before being released for irrigation of 471 ha. (Figure 1). The catchment area above this reservoir is about 13 km^2 and the reservoir's live storage capacity is about 3 MCM. The earth dam forming the reservoir is 18.7 m high and has a crest length of 505 m, at elevation 48.7 m MSL. This crest has recently been damaged by overtopping waves. Also the intake gate has been damaged and canals, supplying water to the service area, have silted up and their banks have been damaged.

4. Existing irrigation installations at Cam Thuy comprise the following:

	Present Situation		
	Pumps	**Design Area (ha)**	**Actual Area (ha)**
Cam Giang I Pumping Station	1 x 540 m^3/h	100	50
Cam Giang II Pumping Station			50
Cam Than Pumping Station 1/	2 x 1000 m^3/h	218	115
Cam Binh Pumping Station	2 x 540 m^3/h	150	100
Cam Son Pumping Station 1/	2 x 540 m^3/h	100	77
Cam Van Pumping Station	4 x 1000 m^3/h	393	150
Thung Bang Reservoir		471	135
Total 2/		**1,432**	**677**
1/ Pumps placed in series.			
2/ In addition, 16 ha are irrigated from temporary weirs which are rebuilt each year.			

5. Existing pumping installations and canals are in poor condition and pumps, operating at low efficiencies, are not able to meet water demands. Because pumpsets are of a horizontal, centrifugal type with an effective suction lift limited to 6-7 meters, the electric motors are at low level and have to be disconnected and removed seasonally during high river stages to avoid submergence. Frequent removal and replacement is not only time consuming and disruptive to irrigation supplies, but also increases wear and tear.

6. Discussions with CTIMC staff indicate that electric supply to the subproject, a constraint to continuous pumping in the past, may not be a constraint in the future as the area is served by both 35 kV and 10 kV lines from the national grid. Nevertheless, disruptions in electricity supply have been common and, combined with a desire to avoid pumping during peak periods of electric power demand, an allowance has been made in sizing pumping capacities to avoid pumping during 8 hours of peak power demand except during land preparation and during exceptional dry periods.

Agriculture

7. Transplanted rice is the most important crop in the area. Because of traditional rice shortage in the district, cooperatives have promoted rice cultivation in preference to other crops. As a result, this crop benefits mostly from irrigation and is double cropped wherever conditions are suitable . Maize which is grown in uplands supplements rice for human consumption and for fodder. Despite current inadequate water supplies, the overall cropping intensity is high, reaching 160%, most likely due to small farm holdings (0.31 ha per household) and limited off-farm employment opportunities.

8. During the Winter-Spring season (January to June) a total of about 1,250 ha are cropped: 640 ha to partially irrigated rice, 100 ha to rainfed rice and 500 ha to rainfed maize. During the Summer-Autumn season (July to October) a total of about 1,910 ha are cropped: 1,560 ha to partially irrigated and rainfed rice and 350 ha to rainfed maize.

Constraints to Crop Production

9. The major constraints to crop production in this area are inadequate water supplies, caused by the deteriorated condition of the irrigation systems, and high cost of transportfor agricultural inputs and produce caused by the area's relative isolation. These inhibit farmers from applying optimal production inputs and as a result paddy yields are relatively low, ranging between 1.4 and 2.5 t/ha. Adequate water supply and availability of production credit will provide an incentive to farmers to increase the production of all crops grown in the area.

II. Subproject Description

10. Proposed works under the subproject comprise:

(a) Rehabilitation, improvement and expansion of the Thung Bang dam, six pumping installations and associated irrigation systems for:

	Area
- Thung Bang System	471
- Cam Tan pumps and system	218
- Cam Van pumps and system	393
- Cam Giang I pumps and system	206
- Cam Giang II pumps and system	123
- Cam Binh pumps and system	293
- Cam Son pumps and system	215
Total	**1,919**

(b) Provision of buildings, equipment and materials for agricultural extension, trials and demonstration plots.

(c) Technical assistance and training for IMC staff; provision of vehicles and equipment for construction supervision, operation and maintenance of completed works.

Irrigation Works

11. Proposed main irrigation works are as follows:

	Thung Bang Reservoir	Cam Tan	Cam Van	Cam Giang I	Cam Giang II	Cam Binh	Cam Son	Total
Irrigable area (ha)	471	218	393	206	123	293	215	1,919
Required pump design discharge (cu.m/h)[1]	N.A.	2,684	4,839	2,536	1,514	3,607	2,654	
Required Pumps (incl. standby):								
Number		2+2	4+2	2+2	3	2+3	2+2	26
Capacity m^3/h		1,000;800	1,000;800	1,000;800	800	1,000;800	1,000;800	
Static head (m)		12.7	12.8	12.4	10.6	12.5	11.7	
Discharge pipes (m)		54	90	42	26	65	38	315
Transformers (kVA)		320	560	320	250	400	320	6
10 kV Transmission lines (km)			2.4	2.0	2.0	7.5	1.3	15.2
400 V Transmission lines (km)		0.1		0.4	0.2	0.2	0.15	1.05
Electric hoists		1	1	1	1	1		5
Conveyance and distribution canals (km)	14.9	7.6	19.0	11.7	9.6	13.9	8.5	85.2
of which lined (km)	7.4	5.6	5.9	6.2	3.3	5.8	5.2	39.5
Structures								
Drop structures							3	3
Road bridges	11	6	9	3	2	14	9	54
Checks (Regulators)	13	2	17	1	1	2	6	42
Aqueducts & cross drains	12	4	1	1	3	1	4	26
Intakes	6	15		7	8	14	9	59
Flumes	3	1			1	1		6
Total Structures	45	28	27	12	15	32	31	190

12. The crest of Thung Bang dam will be repaired and a 0.6m high wall will be provided to deflect waves and to prevent overtopping and damage to the crest. The damaged spillway will be repaired and its capacity of 176 m^3/s corresponding to the routed outflow of a 1/1000 year flood, restored. The capacity is considered safe for this location with the proposed relocation of three houses from downstream of the spillway . Alternatively, had these houses not been removed and had there been any potential danger to human lives, the capacity of the spillway would have had to be

1/ Based on a continuously supplied irrigation duty of 2 l/sec/ha increased to 3.42 l/sec/ha to allow for pumpage during 14 off-peak hours. Only during exceptionally high demand periods will pumpage during peak-power demand periods be required.

increased commensurately [2]. In addition to repairing the crest and the spillway, the intake and other minor damage will also be repaired.

13. Irrigation distribution systems will be improved and extended. Canals will be reshaped and will be lined where they pass through porous or highly erodible soils and villages; bridges, cross-drainage structures, turnouts and other control structures will be constructed as needed and existing structures will be rehabilitated.

III. Production and Benefits

14. Following the completion of the irrigation systems, it is expected that two fully irrigated rice crops would be grown annually together with maize and possibly some sweet potatoes primarily for fodder. A small pilot area of hybrid maize would be introduced as a third crop after the double rice crop to test the feasibility of maize cultivation under the planned, tight, planting schedule.

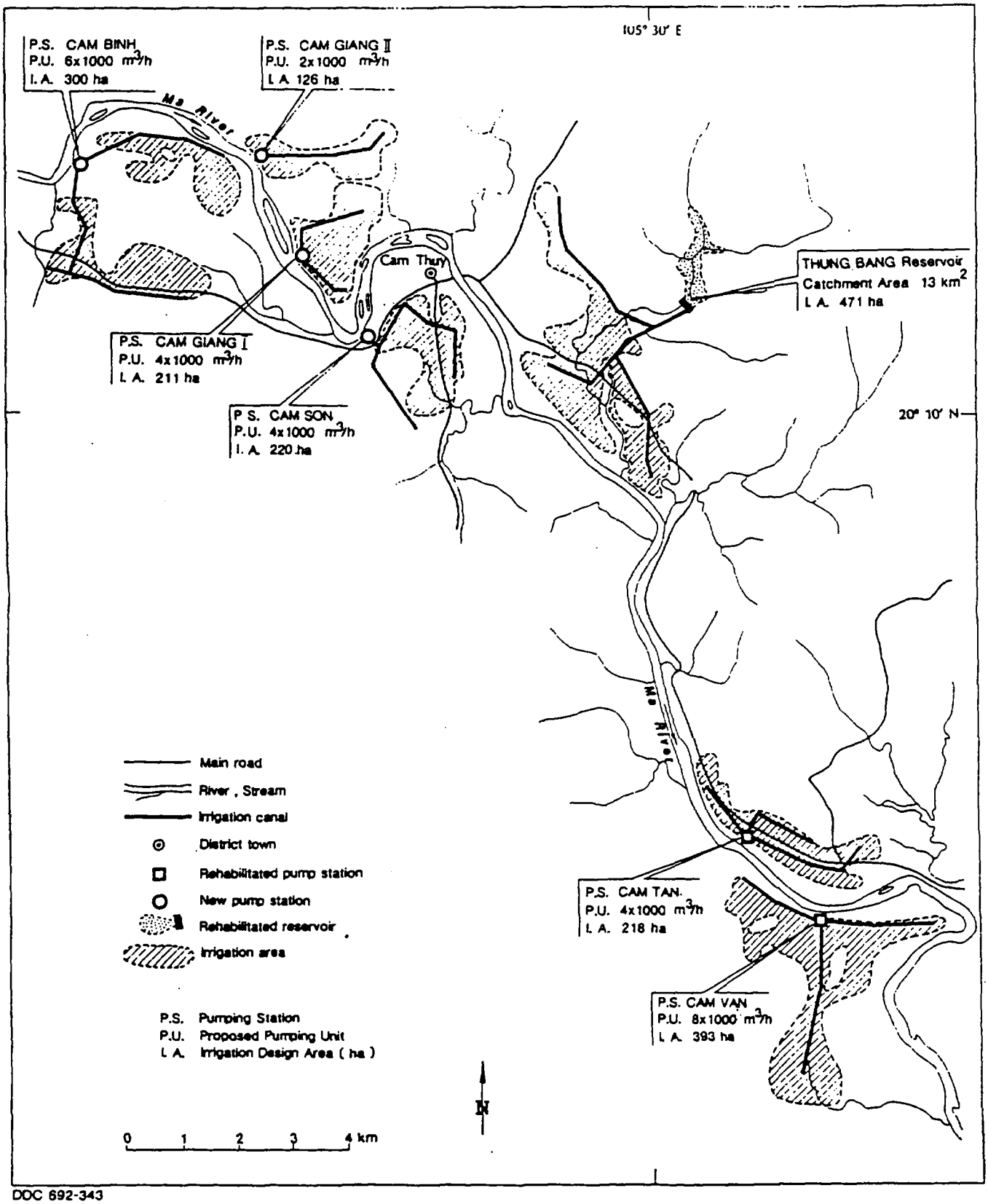
15. The increase in annual agricultural production five years after completion of the subproject (full development) has been estimated to include about 5,700 tons/year of paddy and about 1,200 tons of maize. The estimated benefits are based on the assumptions that cropping intensity would increase from the present 160% to 210% at full development and yields would increase due to the availability of irrigation water and increased use of agricultural inputs. Based on an average farm size of 0.31 ha, estimated net annual farm income from crops would increase from US$22 per year at present to US$57 per year with the project at full development. The economic rate of return has been estimated to be 16%.

2/ Thung Bang Dam and Reservoir, Report of the Result of a Safety Inspection, ELC-ElectroConsult, Milan, June 1994.

ANNEX 1
Figure 1

VIET NAM
THANH HOA PROVINCE
IRRIGATION SUBSECTOR PROJECT

CAM THUY SUBPROJECT LAYOUT



DOC 692-343

SOUTH NGHE AN SUBPROJECT

I. Background

General

1. The subproject comprises rehabilitation and extension of an irrigation system supplied by gravity diversion from the Ca river and comprising a large number of pumping installations serving 25,535 ha in the Nghi Loc, Hung Nguyen, Nam Dan districts of the Nghe An province and in part of the town of Vinh (Figure 1). There are about 63,800 households in the subproject with an average farm holding of 0.4 ha.

Water Resources

2. The subproject area is bounded by two rivers, the Cam in the North and the Ca in the South. The Ca is also known as the Lam in its lower reaches. The Cam, a local river with a catchment area of 287 km^2, contributes relatively little water to the subproject before discharging into the South China Sea near the port of Cua Lo. In addition there are other small streams and springs in the subproject area. The main source of water is the Ca river, originating in Laos and a major river in the north-central part of Vietnam whose mean annual flow is 13,248 MCM. Both the Ca and the Cam are tidal with a water level range of about 2 m, which reverses the direction of flow in the lower reaches of the rivers and, depending on the residual outflow, cause salinity intrusion into the mouths of the two rivers.

Irrigation System

3. The main source of water for irrigation is the Ca River from which water is diverted into the Thap canal through a sluiced intake at Nam Dan, located at the west end of the subproject area (Figure 1). From the intake, water flows through the Thap canal eastward to the Gai canal and then northwards to the Cam river. The Thap and Gai convey water to numerous distribution canals and 19 pumping installations. The currently partly-irrigated area in the winter-spring season (January to May) is about 20,000 ha and in the summer/autumn about 11,000 ha. However, for much of this area the irrigation is unreliable due to insufficient water reaching the pumping stations.

4. The Nam Dan sluice, which was built between 1936 and 1941, has four 2 m wide gates and a 5 m wide navigation lock and is designed for a maximum flow of 33.7 m^3/s. The sluice has been damaged by war, floods and normal wear and tear and suffers from leakage, siltation, a damaged stilling basin floor and damaged gates and operating mechanisms.

5. The 35 km long Thap canal, is the subproject's main canal for irrigation and drainage. Over most of its length silt has been deposited and as a result of deferred maintenance, accumulated to a depth ranging now between 0.5 m and 1.2 m. Additionally, canal banks have slipped into the

canal prism constraining the flow of water. The 20 km long Gai canal and the 15 km long Hoang Can canal are in a similar condition.

6. The canal system supplies water to a total of 113 pumping installations including individual pump sets. Thirty-two of these pumping stations were built during the 1960's and 81 since 1980. About 6,000 ha will be developed for irrigation east of Highway 1 and will be supplied through the Thap, Gai and additional canals. An additional 28 pumping installations pumping directly from the Lam river and 15 small reservoirs designed to irrigate 3,742 ha but only irrigating 1,421 ha, are not included in the subproject.

Drainage System

7. During the rainy season, the irrigation system conveys excess surface runoff from fields through the Thap and Gai canals into the sea through Ben Thuy and Cua Lo sluices. Land to the east of Highway 1A, north of Vinh and in Nghi Loc district, drains into Thong Xa and Nghi canals and discharges to the sea at Cua Lo and through the Rao Dung sluices, at Cua Hoi. A sluice is under construction at Nghi Quang to control salt water intrusion into the Cam river.

8. The Ben Thuy sluice, which was built between 1936 and 1941, consists of eight 4 m wide vertically hinged concrete gates, one 5 m wide radial gate and one 5 m wide navigation lock. The sluice has been damaged and repaired many times. The concrete gates have been recently replaced (1988 to 1990) but are already corroding; the radial gate is corroded and with damaged mechanical hoists and is difficult to operate. Other drainage sluices and mechanical and electrical equipment of five drainage pumping installations, two of which discharge into the Ca river and three into canals, are reportedly in a similar poor state of repair.

Flood Protection

9. A 32.5 km dike along the Ca River between Nam Dan and Ben Thuy and another 12.1 km dike downstream of Ben Thuy protect adjacent lands and the city of Vinh against floods from the river. The height of these river dikes is adequate for flood protection, but their thickness is not and in certain reaches the dikes need to be widened. The Thap and Gai canals and the Vinh River are diked by 150 km long embankments to prevent flooding of adjacent lands during flood stages. These dikes are not sufficiently high and can not protect adjacent lands during peak floods.

10. A 33.7 km long sea dike was built to protect coastal lands from sea water intrusion during high tides and typhoons. The dike, however, is not high enough and sea water intrudes to the detriment of some 430 ha which are rendered uncultivable, and some 600 ha on which crop yields have decreased.

Agriculture

11. The annual cropped area now is about 46,240 ha which, for the subproject area of 25,535 ha represents an overall cropping intensity of 181%. It is believed that this relatively high

cropping intensity is achieved due to prevailing small farm holdings, averaging 0.4 ha, and an availability of labor with limited off-farm employment opportunities.

12. The principal crop currently grown at South Nghe An is transplanted rice. About 31,541 ha are grown annually under partial irrigation and rainfed condition as follows: From February to May (winter-spring season) a total of 15,170 ha (48 % of the annual) of which 10,423 ha are partially irrigated and 4,747 ha are rainfed. From May to August (summer season) a total of 9019 ha (29 % of the annual total) of which 6197 ha are partially irrigated and 2,822 ha are rainfed. From June to October (autumn season) a total 7352 ha (23 % of the annual total) of which 5051 ha are partially irrigated and 2301 ha are rainfed. Partially irrigated paddy yields vary between 2.2 t/ha and 3.1 t/ha , and those of rainfed paddy between 1.2 t/ha and 1.6 t/ha. The relatively highest yield is achieved during the summer season, the lowest during the autumn season.

13. During the winter-spring season the dominant upland crop is ground nuts (about 5,200 ha) followed by sweet potatoes (about 4,300 ha). Both are partly irrigated during this season. During the autumn season rainfed sweet potatoes on, about, 5140 ha, is the dominant upland crop.

Constraints to Crop Production

14. Insufficient water supply is a key factor constraining agricultural production. Adequate and timely water supply would facilitate an increase in cropping intensity and increasing crop yields. By providing adequate and timely water and drainage, partially irrigated rice will be fully irrigated, and its yield will increase as farmers will have an incentive to use optimal dosages of inputs.

II. Subproject Description

Description

15. The proposed subproject will include:

(a) Rehabilitation of the Nam Dan sluice and the construction of an additional sluice near Nam Dan.

(b) Completion of construction of Nghi Quang sluice.

(c) Rehabilitation of the Ben Thuy sluice.

(d) Desilting of the Thap and Gai canals and of the Vinh river.

(e) Rehabilitation of 79 pumping stations and their pump sets, pumping installations and distribution network serving 19,535 ha.

(f) Construction of Tho Son and Hung Dong pumping stations and distribution networks for 6,000ha of mainly new irrigation.

(g) Distribution canals and on-farm development for areas to be newly irrigated.

(h) Provision of buildings, equipment and materials for agricultural extension, trials and demonstration plots.

(i) Technical assistance and training for IMC staff; vehicles and equipment for construction supervision, operation and maintenance of the completed works.

16. Nam Dan Sluice. The intake sluice at Nam Dan will be rehabilitated and its capacity restored to 33.7 m^3/s. To cope with peak water demand of the service area of 25,535 ha, a new sluice with two 2 m wide gates with a design capacity of 10 m^3/s will be constructed about 1,600 m downstream of the existing sluice. The existing channel linking the new sluice and the Thap canal will be widened.

17. Ben Thuy Sluice. Mechanical and structural components of the sluice will be rehabilitated.

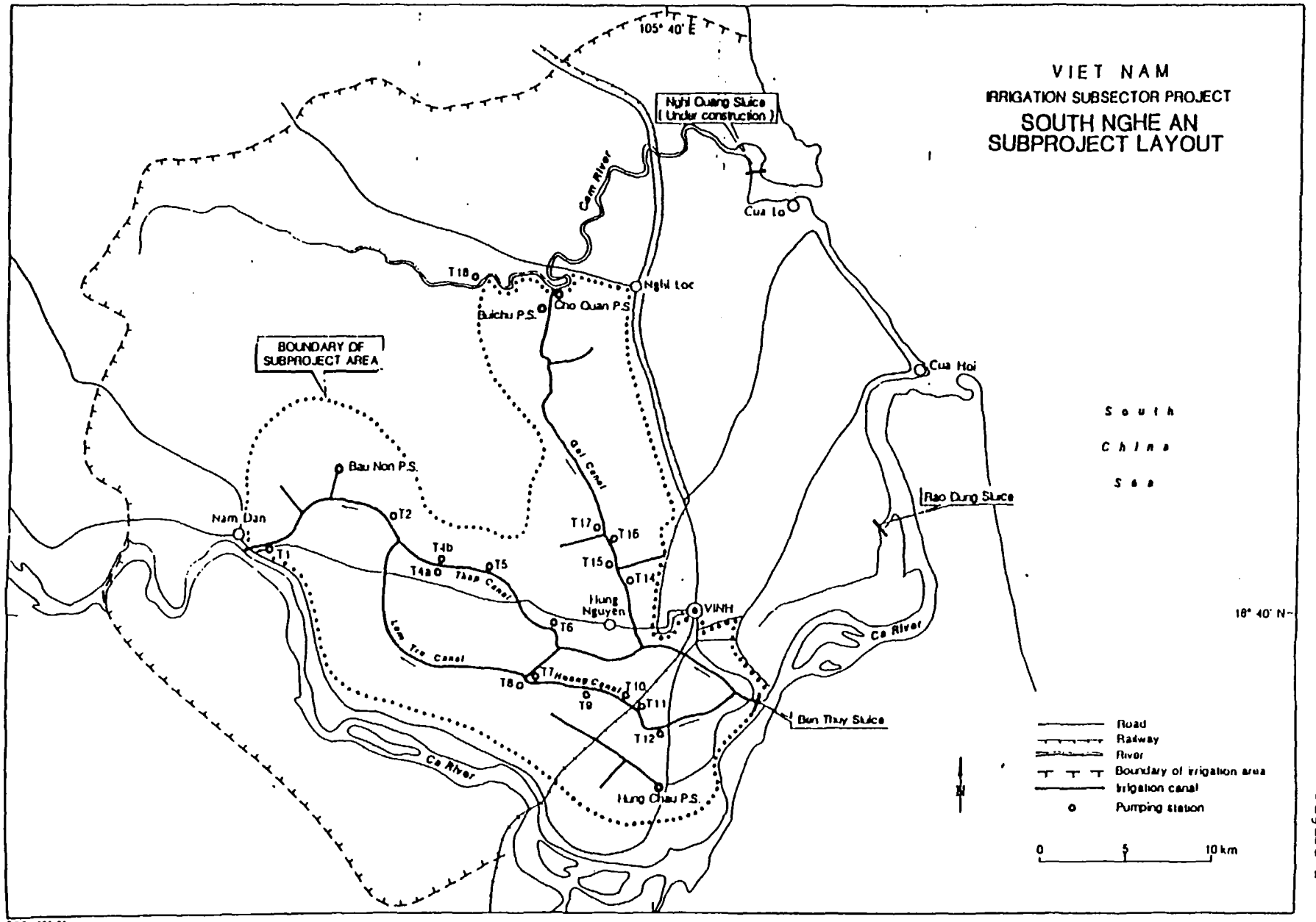
18. Canal Improvement. The Thap and Gai canals and the Vinh river will be desilted, reshaped and their bed width increased to increase conveyance capacities. The bed width of the Thap and of the Vinh River will be increased to 25 m and that of the Gai to 20 m. The quantity of excavation and dredging is estimated to be about 1,300,000 m^3.

19. Rehabilitation of Pumping Installations. The older pumping installations have been in service longer than 30 years, the equipment has mostly outlived its economic life, is worn out and is either not operational or operates at low efficiency. It is proposed under the Project to replace equipment that cannot be economically repaired. Conveyance and distribution canals will be rehabilitated, structures and gates repaired or replaced, depending on conditions.

20. Buildings, miscellaneous equipment and a telecommunication system for the operation of the system will be provided with stations located at the headquarters of the IMC, at Nam Dan, Nghi Quang, Ben Thuy and at main pumping installations.

III. Production and Benefits

21. Infrastructural improvements to be provided under the project will facilitate adequate and timely water supply to fully irrigate the service area of 25,535 ha, which does not at present receive a full irrigation supply. This will lead to intensified land use and to increased yields as, with adequate water for irrigation, farmers will have an incentive to increase current suboptimal dosages of inputs. The increase in annual agricultural production five years after completion of the subproject (full development) has been estimated to include about 51,000 tons of paddy, about 9,000 tons of sweet potatoes and about 3,000 tons of groundnuts. The estimated benefits are based on the assumptions that the cropping intensity would increase from 181% at present to 216% at full development and crop yields would increase due to availability of irrigation water and increased use of agricultural inputs. Based on an average farm size of 0.4 ha, the estimated net annual farm income from crops would increase from US$84 at present to US$156 at full development of the subproject. The economic rate of return has been estimated to be 12%.



ANNEX 2
Figure 1

LINH CAM SUBPROJECT

I. Background

General

1. The subproject comprises the rehabilitation of pumped irrigation systems, including two major pumping stations, 11 minor pumping stations and an irrigation and drainage network and ancillary structures for 14,600 ha.

2. The subproject area is located in the coastal plain of Ha Tinh Province on the south bank of the La River at an elevation ranging between 0.5 m MSL and 5.0 m MSL (Figure 1). The subproject area is in Duc Tho and Can Loc districts, comprising 69 communes and 3 small towns with a total population of 158,200. Approximately 37,330 farming families live in the subproject area with an average holding of about 0.39 ha per family. In addition, there are some families which are engaged in salt harvesting and fishing.

Water Resources

3. There are several small streams flowing into the subproject from hills to the north and to the south but the main source of water to the area is the La River. Recorded discharges in the river during 25 years indicate that there is adequate water to supply Linh Cam's planned water requirements throughout the year. The discharges of the La vary considerably between seasons; in a year of 75% excedence probability, the maximum average monthly discharge of 539 m^3/sec in October is over nine times the minimum average monthly discharge of 58.4 m^3/sec in May. As a result, flood stages occur during the peak of the rainy season while salinity from the sea intrudes into the river's estuary during dry seasons.

4. The characteristic morphology of the subproject is that of a flat deltaic flood plain. The main stream, the La, carrying large flows from high-precipitation mountainous areas in the West to the sea would normally inundate the entire plain. As the plain has been converted to agriculture, the river has been diked along its entire length in the subproject area. While this prevents floods, it would also inhibit gravity drainage of accumulated surface inflows from higher-lying areas (the Tra Son hills to the south and the Hong Linh hills to the north) and from excess rainfall on the area at times of relatively low river stages were it not for a number of sluices constructed in the river dikes to provide for gravity drainage during such stages. During high stages drainage is only possible by pumping (into the La) or by gravity flow through secondary rivers like the Nghen and its tributaries whose capacity is constrained by topography and by tidal fluctuations. As a result, low lying parts of the subproject are periodically inundated.

5. Due to relatively low discharges in all rivers during the dry season salinity intrudes periodically, unless checked by means of river sluices. Such intrusion in the La and the Nghen Rivers affects an estimated 10% of the area during the peak of the dry season.

Existing Irrigation Systems

6. The Linh Cam Irrigation System, was constructed in 1966 to irrigate about 17,200 ha and comprised the following :

(a) a main pumping plant on the right bank of the La River with six pumps, each designed to deliver 10,000 m^3/hr(2.78m^3/sec);

(b) a main canal on the right bank of the La, about 31 km long, about 58 km of primary canals, about 23 km of secondary canals and about 370 km of tertiary canals;

(c) a multi-purpose[1] 11 km long "May Nineteenth Canal", connecting the La River, at the Duc Xa sluice, to the Nghen River; and

(d) an embankment along the right bank of the La River and the Dohao Channel and three sluices[2] and two salinity-intrusion control sluices in the lower reaches of the Nghen River.

7. In 1984, an additional pumping plant was constructed at Cau Cao, on the Nghen River near Dong Hue to irrigate about 3,500 ha to the northeast of the Nghen River which are out of command of the Linh Cam system. However, due to shortage of water supply at this plant[3] of an originally specified 13 pumps of 1,000 m^3 per hour capacity each (3.6 m^3/sec total) only six pumps were installed and as this equipment was allowed to deteriorate and there are high seepage losses in the canal system, only about 300 ha can be irrigated presently by this plant. Pumpage has been affected in the past by frequent power outages but this constraint is expected to be removed with the commissioning of additional hydro-power generating capacity at Hoa Binh.

1/ Navigation, drainage and, as of lately, also irrigation.

2/ The MWR's Dept. of Flood Control and Dike Management is responsible for the maintenance of the embankment and the three sluices. These sluices, which are critical for flood control of Linh Cam currently being repaired under funds provided by GOV.

3/ Water to the Cau Cao plant was to be delivered through (a) the Gia Canal, a branch of Linh Cam's system, and a siphon across the Nghen River, and (b) the Nghen River itself. However water from Linh Cam never reached Cau Cao and the flow in the Nghen during the dry season is too small to supply Cau Cao's water requirements.

8. There are 11 small pumping installations lifting water for the partial irrigation of about 2,500 ha from May Nineteenth Canal, the Nghen River and other small rivers and creeks. These installations, whose equipment is generally old and run down, are being operated by agricultural cooperatives. Replacement of the equipment and rehabilitation of the ancillary canals will improve the performance of these installations, increase water deliveries and lead to increased crop yields.

9. Following completion of the Ke Go reservoir, some 25 km southeast of Linh Cam, it was found that some 2,600 ha, which were to be irrigated from this reservoir, were out of its gravity command. It was therefore decided to substitute 2,600 ha at the southeast end of the Linh Cam main canal for the uncommanded area of Ke Go. This reduced the area of the Linh Cam subproject from 17,200 ha to 14,600 ha. A plan of the irrigation system is given in Figure 1.

10. Linh Cam's main pumping plant serves currently only 5,400 ha of its potential command area of 8,570 ha. The Plant, which appears to be totally neglected by its owners, the Linh Cam Irrigation Management Company (LCIMC) is in a very poor state of repair. The pumping station contains six vertical-axis pumps, motors and electrical controls, which suffer from a lack of maintenance and, as a result, only four or less pumps can be operated simultaneously, and at low efficiency. Similarly, the efficiency of conveyance and distribution canals is low due to a lack of adequate maintenance, a lack of effectively operating gates and high conveyance and operation losses.

Agriculture

11. Where irrigation water is available it is used for the cultivation of rice production. From February to May, the winter-spring season, the entire area of 14,600 ha is reportedly cropped: 11,030 ha to fully or partially irrigated rice, 2,410 to rainfed rice and 1,160 ha to rainfed mungbeans. Yields have been reported to range between 1.8 and 2.8 tons/ha.

12. From June to September, the rainy summer-autumn season, all arable land within the subproject area is cropped: 11,000 ha under fully or partially irrigated rice, 3,000 ha under rainfed rice and 600 ha under rainfed mungbeans. Due to the risk of typhoons and associated floods, farmers attempt to plant the crop as early as possible.

Constraints to Crop Production

13. Because of the inadequate water supply from Linh Cam's main pumping plant during the winter-spring crop and the risk of typhoons and floods during the summer-autumn crop, farmers use only moderate levels of inputs and consequently crop yields are relatively low. Assured irrigation supplies would eliminate risks for the winter-spring crop and reduce risks for the summer-autumn crop. This would give farmers an incentive to increase the use of inputs, particularly fertilizer, to achieve higher crop yields.

II. Subproject Description

14. The objective of proposed works is to increase the fully irrigated area to 14,600 ha, to increase yields, farm incomes and nutrition levels.

15. The scope of proposed works is as follows:

(i) Civil Works:

a. the rehabilitation of the Linh Cam and the Cau Cao pumping plants;

b. repairs of sluices on the main canal and on the Nghen River[4].

c. the rehabilitation of 11 minor pumping stations[5];

d. the rehabilitation and modernisation of the irrigation network for 14,600 ha;

e. desilting of the Nghen River and of the May Nineteenth Canal to improve drainage, navigation and water supply water to Cau Cao and to other minor pumping stations;

(ii) Agricultural support. Provision of buildings, equipment and material for agricultural extension, trials and demonstration plots.

(iii) Technical assistance and training for IMC staff; vehicles and equipment for construction supervision, operation and maintenance of completed works.

Irrigation Works

The subproject will be operated as three distinct subdivision: Linh Cam, Cao Cao and minor pumping installations.

16. The Linh Cam Pumping Plant will be rehabilitated and equipped with new pumps, motors and electric controls to lift irrigation water from the La River for irrigation of 8,570 ha. Six new pumps of 3 m^3/sec each pumping against an average total dynamic head (TDH) of 6.2 m

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4/ This in addition to Duc Xa and Trung Luong sluices currently under repair by the MWR's Dept. of Flood Control and Dike Management whose cost is not included in this Project.

5/ To be funded by the Provincial Government

(max. 6.5 m) will be provided to meet peak requirements of about 15 m^3/sec. The plant will be rehabilitated, its exterior and interior architecture will be properly finished and upgraded, and suction-fan ventilation, floor finish (tiles), sanitary facilities, lighting, etc. will be furnished.

17. The Cau Cao Pumping Plant will be rehabilitated and equipped with three new pumps of 2.2 m^3/sec, motors and electric controls each to meet peak requirement of (about) 6 m^3/sec at a TDH of about 5.8 m, for 3,500 ha. The source of water is the La River whose water will be conveyed to Cau Cao through the May Nineteenth Canal and the Nghen River. Two sluices , one on the main canal at km 0+273 to prevent flooding of the main canal by the river and one on the Nghen River near Dong Hue to prevent salinity intrusion to Cau Cao will be rehabilitated under the Project. Old, deteriorated gates will be replaced, motorized lifting devices will be installed and damaged structural parts will be repaired or reconstructed.

18. Eleven minor pumping installations , serving a total area of about 2,530 ha and related canals and structures will be rehabilitated under the Project and an, approximately 18 km long electric power line will be installed.[6]

19. The irrigation network in the areas served by Linh Cam and Cau Cao pumping stations will be rehabilitated, reshaped and lined (as required) to reduce seepage losses and stabilize side slopes. The Nghen River, the May Nineteenth Canal and intake channels to the main pumping stations will be desilted. A reach of 5.6 km of Cao Cau's main canal, which traverses porous soils, will be lined to reduce seepage losses.

20. A new communication system with a total of 17 stations will be provided to the LCIMC to cover the subproject area and nearby irrigation systems. Central control will be at the IMC headquarters at the Linh Cam pumping station and there will be stations at Duc Tho and Chan Loc pumping plants and management offices, at the Trung Luong, Duc Xa, Cau Khong, and Cau Nguc sluices and at 10 control units within the subproject area.

III. Production and Benefits

21. The provision of assured irrigation supplies will increase the cropping intensity by enabling double-cropping throughout the entire subproject area in the winter-spring and summer-autumn seasons. Adequate water will provide the basis for an increased use of fertilizers and the achievement of higher yields. While the dominant crop, at least for the time being, is expected to remain paddy there are options for crop diversification during dry seasons primarily in lighter soils, as found in the Cau Cao area. Though not quantified here, other crops may be more attractive than paddy and increase farmers' incentives. The increase in annual agricultural production five years after the completion of the subproject (full development) has been estimated to include about 38,000

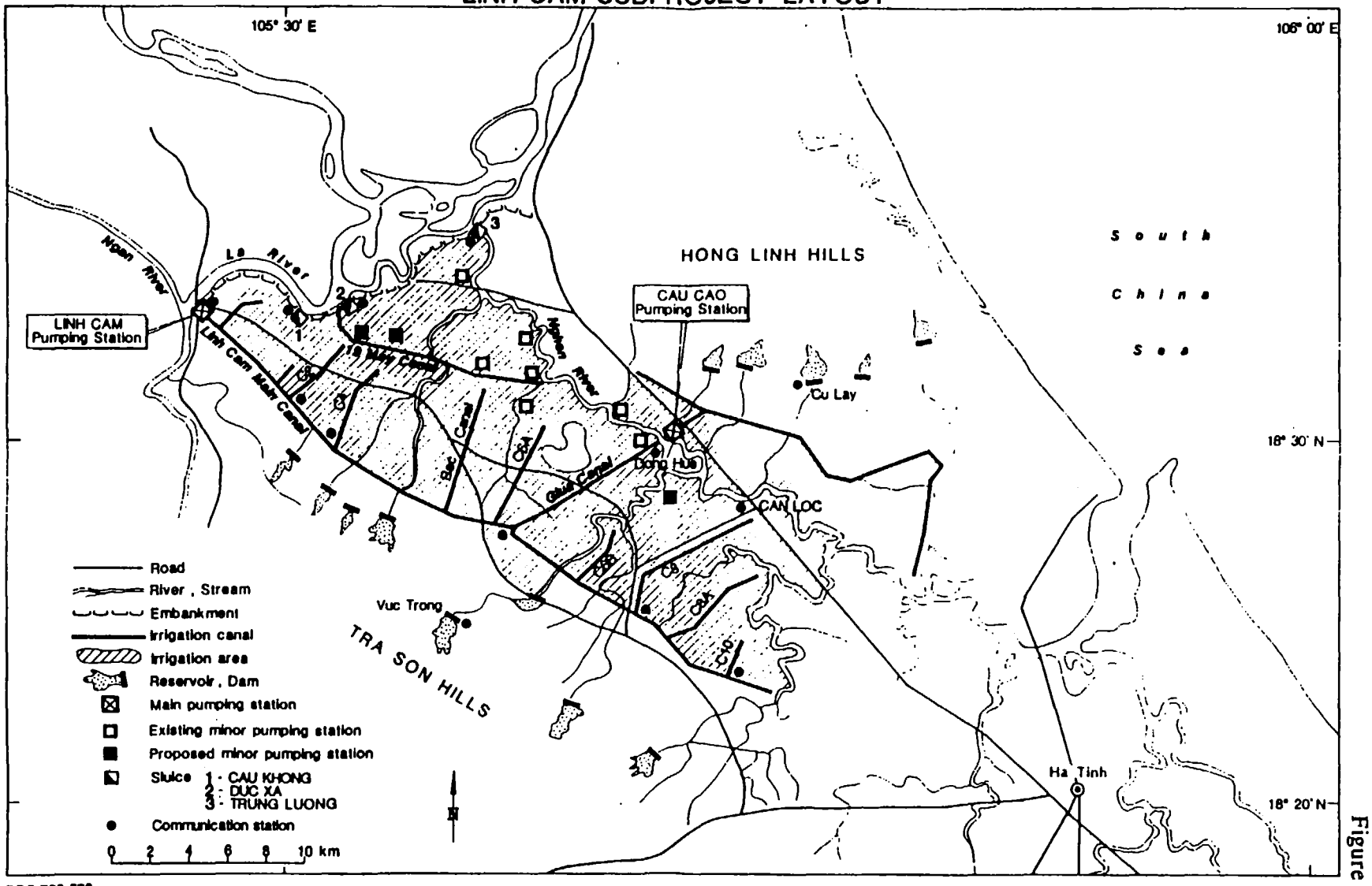
6/ As pointed out above, these works will be financed by Provincial Government.

tons of paddy offset by a decrease of about 760 tons of mung beans. The estimated benefits are based on the assumptions that the cropping intensity would remain at 200% and crop yields would increase due to the improved availability of irrigation water and increased use of agricultural inputs. Based on an average farm size of 0.39 ha, the estimated net annual farm income from crops would increase from US$95 at present to US$164 at full development of the subproject. The economic rate of return has been estimated to be 21%.

VIET NAM

IRRIGATION SUBSECTOR PROJECT

LINH CAM SUBPROJECT LAYOUT



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ANNEX 3
Figure 1

AN TRACH SUBPROJECT

I. Background

General

1. The subproject would involve the construction of two new weirs to replace existing damaged structures, rehabilitation of another weir and canals serving an aggregate area of 9,715 ha. The total number of expected beneficiary households is 16,700 with an average farm size of 0.58 ha.

2. The subproject area is in Quang Nam Da Nang Province, about 12 km south of the town of Danang. It is located between the Thu Bon river in the south and the Cau Do river in the north and comprises about 32% of the cultivable land of Hoa Vang, Dien Ban and Dai Loc districts. The An Trach area is largely comprised of medium textured silty clays formed from past alluvial deposits interlaced with pockets of coarse alluvium. Whilst 9,715 ha are partly irrigated for rice in the winter/spring, only 8,210 ha are irrigated in the summer/autumn and about 5,200 ha receive supplementary irrigation in the winter.

Water Resources

3. Two rivers provide the main sources of water to the subproject area(Figure 1). The major source is the Vugia river, which originates in the hills to the south and west of Quang Nam Danang province (where it is called the Cai and the Bung), and has a catchment area of about 5,600 km^2 above Ai Nghia (near the southwest corner of the subproject area). The Thu Bon, a smaller river, forms the southern boundary of the subproject area.

4. The Vugia bifurcates into the Yen and the Lac Thanh. The Lac Thanh bifurcates into the Bau Xau, which flows to Ha Thanh and Bau Nit weirs, and the La Thu which meets the Thu Bon upstream of Than Quit weir. The Vugia catchment has an average rainfall of 2,760 mm per year. The mean annual discharge at Ai Nghia is 9,050 million m^3/year (287 m^3/s), more than sufficient to irrigate 9,715 ha. During the peak of the rainy season flooding of lower-lying areas is a frequent occurrence.

Irrigation System

5. The An Trach system consists of four weirs, 10 pumping plants and ancillary conveyance and distribution canals built to irrigate 9,215 ha and 500 ha of gravity irrigation (Figure 2).

6. The 70 m long An Trach weir on the Yen river, built of concrete between 1933 and 1938, has been damaged by floods and partially repaired by gabion and dumped rock. However, the crest level is now about 1.5 m lower than the previous crest level (+1.1 m MSL vs. +2.6 m MSL) which increases the pumping lift of Phu Son, Thai Son and Chai Son pumping plants.

7. The 30 m long Than Quit weir was built at the same time as An Trach weir but was later destroyed. It was rebuilt in 1987 with assistance from an NGO and is in satisfactory condition. Six automatically controlled gates, which can also be mechanically operated, maintain the upstream water level at about +2.0 m MSL.

8. The 40 m long Ha Thanh weir was built in 1954. The weir's crest is at +2.47 m MSL and the water level is manually controlled by stoplogs, which are however difficult to remove at the onset of floods. Excepting damage to the downstream stilling basin, the weir is otherwise in satisfactory condition.

9. The Bau Nit weir, also built in 1954, has collapsed due to foundation failure. Steel sheet piles and dumped rubble are used at a road bridge, just upstream of the weir site, to raise the water level in the river.

10. The Yenne canal was supplied in the past by the Yen river upstream of An Trach weir but because the water level in the Yen River has dropped (para 6) the canal can no longer be used.

11. The Lac Thanh canal takes water diverted by Ha Thanh weir to irrigate 500 ha by gravity.

Agriculture

12. The annually cropped area in the subproject area is about 23,125 ha yielding a cropping intensity of 238%. This cropping intensity is most likely the result of small farm holdings and limited off-farm opportunities for the area's relative large labor force.

13. Rice is still the principal crop and about 17,000 ha are cultivated annually under partial irrigation, 6,700 ha during winter/spring (December to April), about 5,200 ha during summer/autumn (May to September) and an equal area during autumn (August to November). The autumn crop is irrigated in early September and then receives water from monsoonal rains. Most paddy is directly sown and only in relatively small areas is paddy transplanted. Average paddy yields are between 3.2 and 3.5 t/ha and main varieties are IR64 and 13/2 with smaller areas of IR5203, IR19743 and IR9129. Crops are fertilized and the use of pesticides is generally well accepted but application rates are suboptimal due to uncertain water supplies.

14. The main upland crops are sweet potatoes, cassava, groundnuts and green beans. In both the winter/spring and autumn about 3,000 ha are grown under partial irrigation.

Constraints to Crop Production

15. The soils in the An Trach area are generally suited to intensive crop production but the ability to optimize production is constrained by water shortages and shortages of operating capital. By improving water availability, timing of irrigation and proper drainage and working capital (affordable credit), farmers would have the necessary incentives to apply appropriate rates of fertilizers and pesticides to increase production.

II. Subproject Description

Irrigation

16. The proposed subproject will include:

(a) Survey, investigation and design of the subproject works;

(b) Construction of two new weirs at An Trach and Bau Nit to replace existing structures;

(c) Rehabilitation and improvement of Ha Thanh weir;

(d) Rehabilitation and improvement of Lac Thanh canal;

(e) Rehabilitation and improvement of distribution canals from ten existing pumping plants;

(f) Construction and improvement of access roads and buildings for O&M;

(g) Provision of vehicles and equipment for construction supervision and for O&M of completed works, including a communication system.

(h) Agricultural support; provision of buildings, equipment and materials for agricultural extension, trial and demonstration plots.

(i) Technical assistance and training for IMC staff.

17. An Trach weir will be built of concrete. It will be about 80 m wide and gated to maintain the requisite upstream water level when the gates are closed and to allow free passage of flood flows by opening the gates. The main weir structure will be supported by concrete piles driven through silty sand into clay and protected against percolation by an upstream steel sheet-pile cutoff wall. Due to the unstable foundation it will be necessary to support the stilling basin on piles.

18. The Bau Nit weir will be built of concrete. It will be about 35 m wide and similar to the An Trach weir.

19. At the Ha Thanh weir the existing seven bays of stoplogs will be replaced by gates similar to those proposed for An Trach and Bau Nit weirs. This will require structural modifications, including the construction of a bridge and of an operating platform.

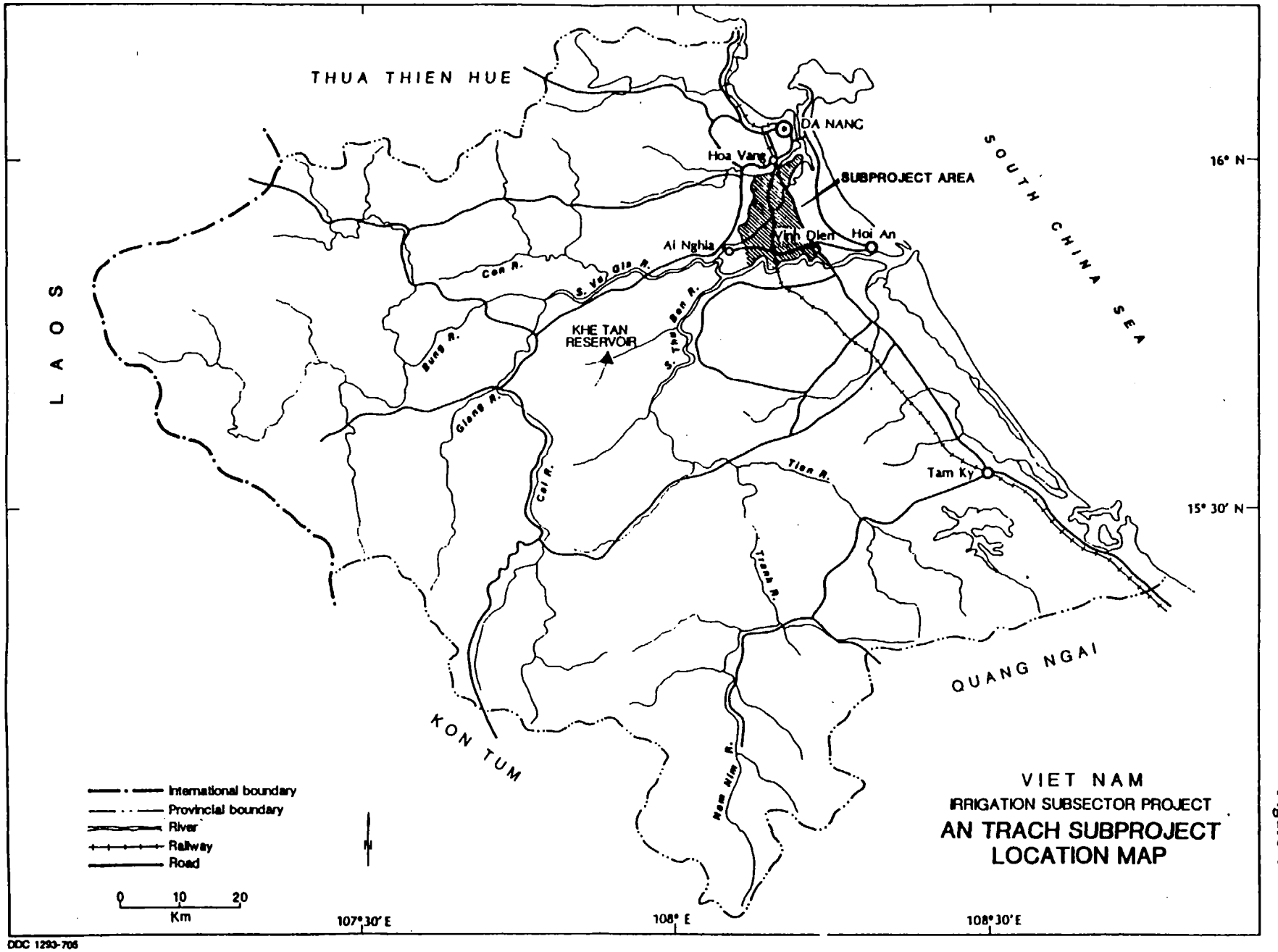
20. The existing Lac Thanh canal will be restored to its design shape to irrigate 500 ha by gravity upstream of the Ha Thanh weir. The 2.6 km long canal includes 9 structures.

21. Secondary distribution and tertiary canals of each system will be reshaped, lined where necessary and embankments will be regraded. Control gates will be installed.

22. Five access roads with a total length of about 15 km will be upgraded, about 11 km with 5.5m wide pavement and about 4 km with 3.5 m wide pavement.

III. Production and Benefits

23. The increase in annual agricultural production at full development, assumed to be five years after completion of the subproject, has been estimated to include about 29,000 tons of paddy (about 50% of present production) and about 8,000 tons of sweet potatoes (25% of present production). The estimated benefits are based on the assumptions that the cropping intensity would increase from 240% to 280%, and crop yields would increase due to an improved supply of water and some increase in the use of agricultural inputs. Based on an average farm size of 0.58 ha, estimated net annual farm income from crops would increase from the present $179 to about $263 at full development. The economic rate of return has been estimated to be 27%.



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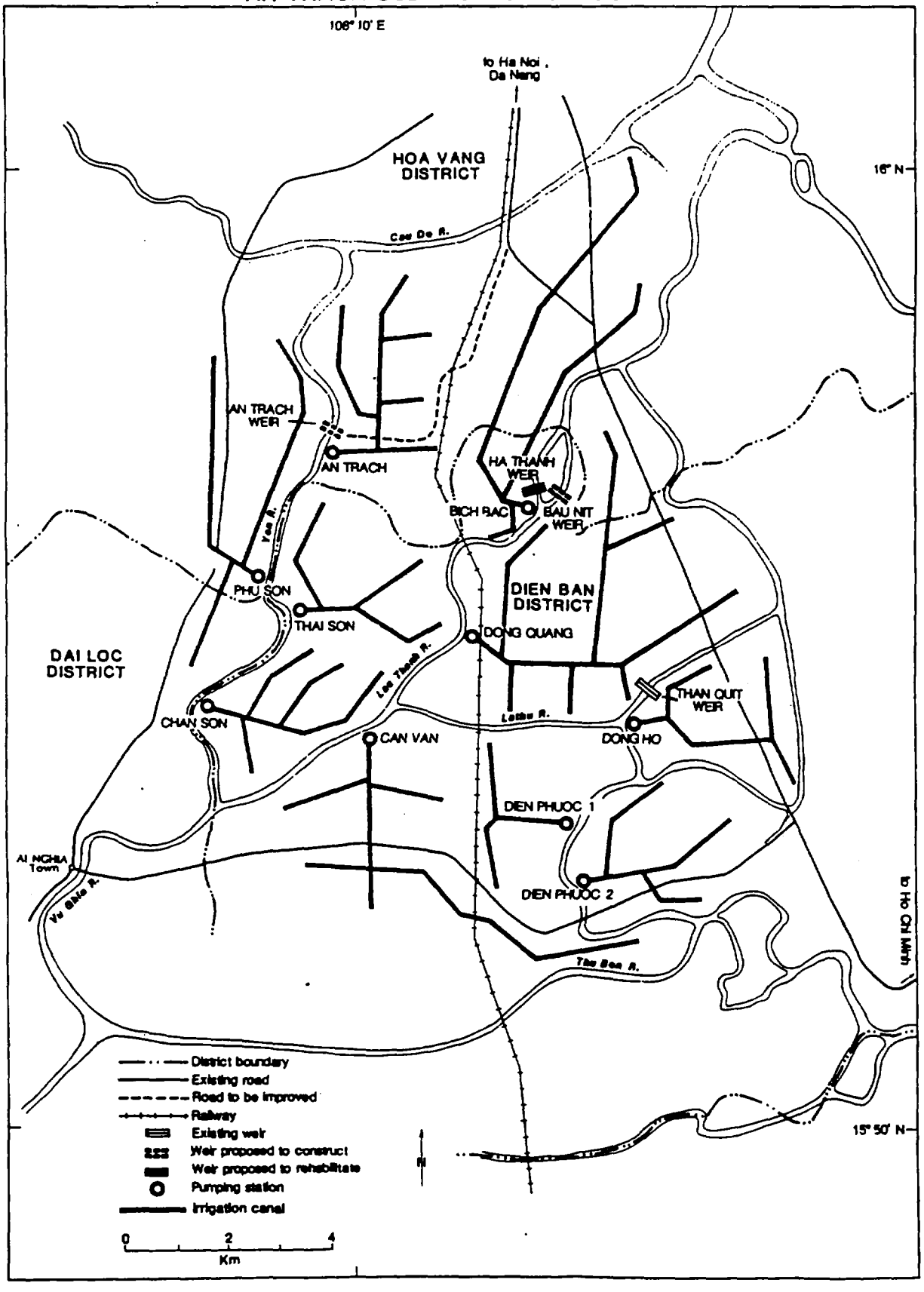
ANNEX 4
Figure 1

VIET NAM

IRRIGATION SUBSECTOR PROJECT

ANNEX 4
Figure 2

AN TRACH SUBPROJECT LAYOUT



THACH NHAM SUBPROJECT

I. Background

General

1. The subproject involves the completion of construction of irrigation systems for an irrigated area of about 45,500 ha of which about 18,900 ha are already (May 1993) irrigated. The subproject is located in the Quang Ngai Province in the plains of the lower basins of the Tra Khuc, Tra Bong and Ve Rivers as shown in Figure 1, covering six districts and one town. The total population in the subproject area in 1979 was 788,000 and most of the people are engaged in agriculture. Approximately 101,000 farming families live in the subproject area with an average holding of about 0.45 ha per family. Soils in the area are generally moderately fine-textured and poorly-drained soils with a slight to strong acid reaction.

Water Resources

2. There are several rivers flowing in the subproject region but the main source of water is the Tra Khuc River, which originates in the western mountains bordering Laos and flows 108 km before arriving at the Thach Nham Weir where water is diverted for irrigation to both banks of the river. The river's catchment of 2,836 km^2 at the weir is in a high rainfall zone with annual rainfall of more than 2,500 mm. High discharges from October to January cause temporary flooding of low-lying areas, while from February to September discharges average only about 200 MCM per month, with lowest discharge of 167 MCM in April. Thach Nham's irrigation requirements range between a low of 2% of Tra Khuc's 75% probable flows in December to about 80% during March-July. Accordingly, water resources do not constrain irrigation of the subproject area under planned (or similar) crops.

Irrigation System

3. Development of Thach Nham's irrigation system began in the 1970s with financial assistance from IFAD and technical support from FAO for soils surveys and engineering studies by foreign consultants, which were carried out through the mid-1980s. Since then GOV has been constructing the irrigation system but, due to GOV's policy of thinly spreading investments over a large number of projects, the project has not yet been completed. GOV has assigned high priority to the early completion of this scheme and has applied to the World Bank/IDA for financial assistance.

4. The Thach Nham subproject, as designed by GOV to irrigate about 50,000 ha, comprises following components:

(a) a diversion weir between 10-14 m high and 200 m long across the Tra Khuc River near Son Nham Village in Son Ha District;

(b) an intake on the north bank with a capacity of 23.5 m^3/s for the irrigation of 22,500 ha (1.04 l/sec/ha);

(c) an intake on the south bank with a capacity of 31.5 m^3/s for the irrigation of 27,500 ha (1.15 l/sec/ha), including about 11,000 ha south of the Ve river;

(d) a 30.3 km long North Main Canal (NMC) with 127 structures;

(e) a 35 km long South Main Canal (SMC) with 153 structures including a large siphon crossing of the Ve River;

(f) primary canals with a total length of 180 km, secondary canals with a length of 355 km and tertiary canals;

(g) thirteen pumping stations and associated irrigation systems to serve about 4,500 ha (not included in the IDA-financed subproject).

5. At present, the diversion weir, the north and south intakes and scouring sluices have been completed by GOV. The NMC has been constructed up to about km 25 (about 83% of the total earthwork) and the SMC up to about km 21 (about 60% of the total earthwork). Structural work is still incomplete on turnouts, checks, gates, etc. Progress of work is slow due to insufficient fund allocations. About 50% of the primary canals branching off the NMC have been completed, including the construction of a major siphon crossing of the Tra Bong River (on primary B3) and about 66% of primary canals branching off the SMC have been completed. As in the case of the main canals, construction of structures lags behind and many turnouts and checks have yet to be built and gates have yet to be installed.

6. Because of the need for irrigation during the dry season, farmers have sought a variety of sources to irrigate their land. These include the Tra Khuc River, various creeks, small artificial reservoirs and shallow wells from which water is pumped, usually by groups of farmers, often using old and inefficient pumps and motors. In order to alleviate water shortages, irrigation authorities have authorized water releases into canal reaches in which earthworks had been completed even before the completion of regulation and control structures. While this policy had obvious short-term benefits, it also creates potential problems for the future as farmers have been receiving uncontrolled flows by gravity from the incomplete canal system or have pumped from canals using their own pumping equipment, often exceeding the amount of water their fields and crops would normally require.

7. In November 1992 the newly established Thach Nham Irrigation Management Company (TNIMC) assumed responsibility from the Construction Management Organization Company for the operation and maintenance (O&M) of the headworks and for some reaches of nearly completed canals. However the TNIMC has no experience in O&M, no equipment or facilities and there has

been no formal 'handing over' of the concerned infrastructural components by the Construction Management Organization.

Agriculture

8. Rice is by far the most important crop grown in the area, followed by sweet potatoes and sugarcane. Almost all the rice produced is consumed locally by the producer. The sweet potatoes and maize are important animal feedstuffs, mainly used for fattening pigs. The present overall cropping intensity is high, at about 210%. This high intensity is possible because of the small farm holdings (about 0.45 ha on average) together with very little off-farm employment opportunities in the area.

9. Within the project area, practically all available irrigation water is used to cultivate paddy which is grown by broadcasting the seed. During November to March, the 'winter-spring' season, the entire area of 50,000 ha is cropped: 18,900 ha (40%) to fully or partially irrigated rice, 12,180 ha (24%) to rainfed rice, 8,350 ha (17%) to rainfed sweet potatoes and cassava. The remaining 10,570 ha are permanently under sugarcane.

10. Between March and July, the 'summer-autumn' season, available water supply limits the cultivation of paddy to about 10,500 ha and also limits the cultivation of other crops (mainly sweet potatoes). With unreliable and little rain, rainfed cultivation is risky and varies considerably from season to season.

11. From July to November, a third crop is grown, including about 10,500 ha is irrigated paddy and rainfed crops of sweet potatoes, cassava and maize. With little rain expected during the establishment period of the upland crops, the cultivated area and yields are highly variable.

Constraints to Crop Production

12. The main constraint to increased crop production is the lack of reliable and adequate water supply. Other constraints are inadequate extension and farmer's reluctance to use optimal dosages of fertilizers. The limited capacity of the sugar factory (1,500 tons of cut cane per day) constrains the production of rainfed sugar cane as it matures during four months. With irrigation, it should be possible to lengthen the harvesting period and increase the capacity of the mill to handle about 12,000 ha of sugarcane annually. Also, in addition to the present mill, whose capacity has been increased to 2,000 t/day, a second 2,000t/day mill will be constructed in 1995 which will facilitate a further increase in the area under sugarcane in the future.

II. Subproject Description

13. The proposed subproject comprises the completion of irrigation and drainage systems for an area of 45,500 ha. The proposed subproject also includes institutional strengthening of the newly established irrigation management company and provision of agricultural services, technical assistance and training.

Irrigation Works

14. The proposed subproject will include:

(a) upgrading of headworks by providing electric motors for gate hoists; upgrading the access road and rehabilitating the low-level river crossing downstream of the weir.

(b) completing the North Main Canal and the South Main Canal and all structures to the Ve River crossing;

(c) construction of primary canals KB-1,B-2, B-5, B-5A, B-7, B-10 and completion of B-6 and B-8 branching off the NMC;

(d) construction of an inverted syphon under the Ve river and rehabilitation, modernization and extension of the canal system for about 11,000 ha south of the Ve river.

(e) construction of primary canals N-14, N-16 and completion of N-6, N-8, N-10 and N-12 branching off the SMC;

(f) widening and shaping of main drains;

(g) construction of secondary and tertiary canals;

(h) construction and improvement of access and canal roads;

(i) provision of a telecommunication system with a central station, six district irrigation stations and three stations at the headworks, the North main canal and South main canal;

(j) provision of buildings, equipment and materials for agricultural extension, trials and demonstration plots;

(k) technical assistance and training for IMC staff and vehicles and equipment for construction supervision, operation and maintenance of the completed works.

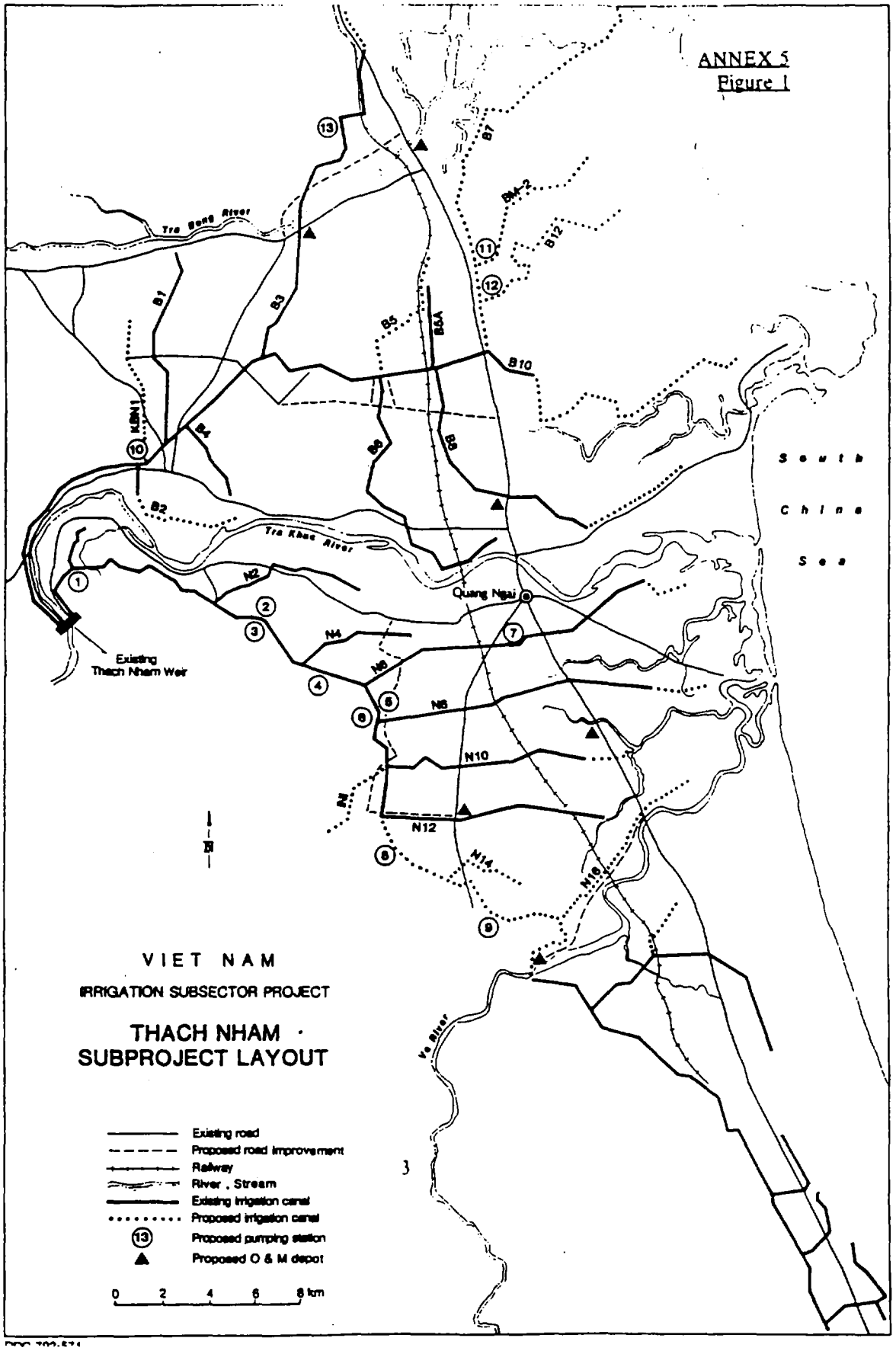
Resettlement

15. New canals to be built under the proposed project will require about 292 ha of land and it is estimated that about 70 families will have to relocate their homesteads: a total of 2296 families will be affected. Land lost will be replaced with land and compensation will be paid for loss of other physical assets.

III Production and Benefits

16. Following the completion of the irrigation system, it is expected that three irrigated crops would be grown annually that will include paddy and other crops mainly for fodder. Also, the area permanently under sugarcane will increase as milling capacity increases. As a result of the recent introduction of high-yielding hybrid maize varieties in the project area, it is expected that the rainfed sweet potatoes currently grown in the summer-autumn season will be replaced by maize. The increase in annual agricultural production at full development (assumed to be five years after completion of construction) has been estimated to include about 76,000 tons of paddy, 35,000 tons of sweet potatoes and other crops and 50,000 tons of sugarcane. The estimated benefits are based on the assumption that the cropping intensity would increase from the present 210% to 226% at full development and crop yields would increase due to the availability of irrigation water and increased use of agricultural inputs. Based on an average farm size of 0.45 ha, estimated average net annual farm income from crops would increase from the current US$273 per year to about US$360 at full development. The economic rate of return has been estimated to be 24%.

ANNEX 5
Figure 1



DONG CAM SUBPROJECT

I. Background

General

1. The subproject comprises the rehabilitation of an irrigation scheme, which is more than 60 years old, and restoring the area irrigated from about 17,000 ha to 19,784 ha. The subproject area is located in Phu Yen Province to the west of Tuy Hoa town on both banks of the Da Rang river (Figure 1). The gross area of the subproject is about 31,200 ha and the cultivable area 19,800 ha, lying between 18.0 and 2.5 m MSL. Approximately 370,000 people live in the subproject area including about 59,000 farm families. The average farm holding is about 0.34 ha per farm family.

Water Resources

2. The main source of water for the Dong Cam subproject is the Ba river. Downstream of Dong Cam weir, the river is called the Da Rang. At the Dong Cam weir, the catchment area is 12,830 km^2 with an estimated mean annual flow of 7,537 Mm^3. The 75% reliable flow has been estimated to be 5,648 Mm^3/year. There is adequate water for irrigation of the 19,800 ha of the fully developed subproject excepting a short period in April during land preparation for the second (summer) crop. While this deficiency will be removed after completion of the Ayun reservoir and the Hinh river hydropower reservoir (both of which will control river flows), there may be a need to slightly extend the time for land preparation if the subproject develops prior to the completion of these upstream reservoirs. This is not considered a serious issue as a two-week extension of land preparation, and a similar delay in harvesting, would balance supply and demand without causing significant loss of yield.

Soils and Land Suitability for Irrigation

3. Soils in the subproject area are predominantly alluvial with a high percentage of clay, and slightly acidic with a pH (in KCl) ranging between 5.0 and 6.0. They are suitable soils for paddy and have been used for paddy cultivation for many years. Due to their tight structure however, these soils are less suitable for dry-footed crops.

Irrigation System

4. The Dong Cam irrigation system was constructed between 1924 and 1932 and has in the past provided irrigation for up to 19,800 ha. The headworks consist of a masonry weir 590 m long, between 3 and 10 m high, and intakes on each bank, which divert water to north and south main canals, and scouring sluices. The layout of the scheme is shown in Figure 1. The north canal is 97.3 km long and the south canal 100.8 km long. Canals are generally unlined and have suffered erosion in some places and siltation in other places. Most of the 1,119 canal structures are built of masonry but there are also concrete structures (checks, flumes and siphons). Some minor structures

have been partly rehabilitated but most major structures have been left untouched for many years. There has been a gradual accumulation of silt in the system, in part due to poor functioning of the SMC's desilting sluice. As a result, the irrigated area decreased from 19,800 ha to about 17,000 ha and is expected to continue decreasing unless the system's operational capability is improved and maintained in an improved condition. Inadequate maintenance has led to a gradual deterioration of the irrigation system. In addition, in October 1993 a flood with an estimated return period of 1,000 years caused extensive damage to the canal systems, washing out entire sections of canals, and damaging structures. The most serious damage to headworks, river dikes, canals and major structures has been repaired but, due to extremely limited time in which repairs were made and financial constraints, some earthwork and some structural repairs are considered temporary. The state of some of the system's major components may be summarized as follows:[1]

- The main diversion weir, where a 20 m long and 2 m deep section was washed out in October 1993, was satisfactorily repaired during February and March, 1994.

- The gates of headworks of both main canals require repair and hoists require replacement by motorized hoists.

- The gates of the silt trap at the headworks of the South Main Canal (SMC) require repair and the connecting cut and cover section, broken during the flood, has to be rehabilitated.

- Embankments along the NMC km 0-18 and SMC km 0-9, in part washed out and reconstructed after the flood, are poorly compacted and as a result have failed (or are failing) and are unsuitable as a base for canal lining. In reaches where leakage has been observed or where lining has failed, embankments will have to be reconstructed and compacted and lining placed.

- While many of the system's structures have outlived their economic life, there is no need or justification for the replacement at this time of all the structures unless they are structurally unsafe and/or can not be rehabilitated to function as needed[2]. In the upper reaches of the main canals many cross-drains, whose outlets are too short and abrupt can be used for many more years by remodelling and improving the outlets; similarly, check structures can be improved by remodelling their stilling basins.

1/ Due to the topography of the subproject area, the river diversion and headworks are relatively far from irrigated areas and hence this subproject comprises more structures than other subprojects.

2/ For example: Leaking siphons on main canals could be repaired at a considerable saving compared to reconstruction by using either dry pack concrete, thermo-setting plastic (epoxy) bonding agent or grout.

- There is a need to supplement control structures in the distribution system. These structures which had not been incorporated in the system as built, are needed to control water levels to facilitate an equitable distribution of water.

Agriculture

5. Rice is the most important crop grown in the project area, followed by soyabeans. Due a risk of floods in late October and November and one month of canal maintenance, only two crops of rice are grown each year. Three crops of quick-maturing rice were grown some years ago, but farmers now prefer to grow two high yielding crops using medium-maturity rice varieties and broadcasting the seed. In the higher-lying areas, not prone to flooding, soyabeans and sugarcane are grown. The present overall cropping intensity is about 210% annually. This is a result of the small farm size averaging 0.34 ha and limited off-farm employment opportunities in the area. Yields of fully irrigated rice are quite high, ranging between 4.0 and 4.5 tons/ha.

6. The main constraint to crop production is lack of water.

II. Subproject Description

7. The subproject would comprise the rehabilitation of existing irrigation canals and structures, construction of new canals and structures for about 2,050 ha (restoring the service area from its contracted size of 17,750 ha to 19,800 ha), agricultural support service and institutional strengthening. Main work components of the subproject are:

Review of outline designs, survey, investigation and detailed design of selected works, which are expected to include:

South Main Canal (SMC)

- Provide a river groin to guide flow and reconstruct inlet invert at headworks to same elevation as NMC;

- Provide trashracks, repair gates and motorize hoists;

- Rehabilitate cut and cover section of main canal near the headworks;

- Rehabilitate scouring sluice and repair its gates;

- Reconstruct compacted river-side embankments where unstable or where seepage occurs notably along the initial 10 km where the SMC runs parallel to the river;

- Intercept and dispose of hill-side cross drainage in reach km 5+000 to km 6+500;

- Desilt and rehabilitate the SMC, provide (or rehabilitate) gates on checks/drops and turnouts to primaries, calibrate flows and provide appropriate stilling basins on check/drops and cross drains;

- Desilt and rehabilitate the distribution system, provide additional calibrated control structures and gated turnouts;

North Main Canal (NMC)

- Repair gates and motorize hoists;

- Desilt and rehabilitate unstable or seeping reaches of the NMC (notably from km 0+000 to km 18+000 where the NMC runs parallel to the river);

- Rehabilitate cross drains and provide stilling basins;

- Rehabilitate checks, check/drops, provide (or repair) gates, provide stilling basins and calibrated gates on turnouts to primaries;

- Desilt and rehabilitate the distribution system, provide additional calibrated control structures and gated turnouts;

8. Details of new irrigation systems required to restore irrigation to areas where the previous system has largely disappeared are:

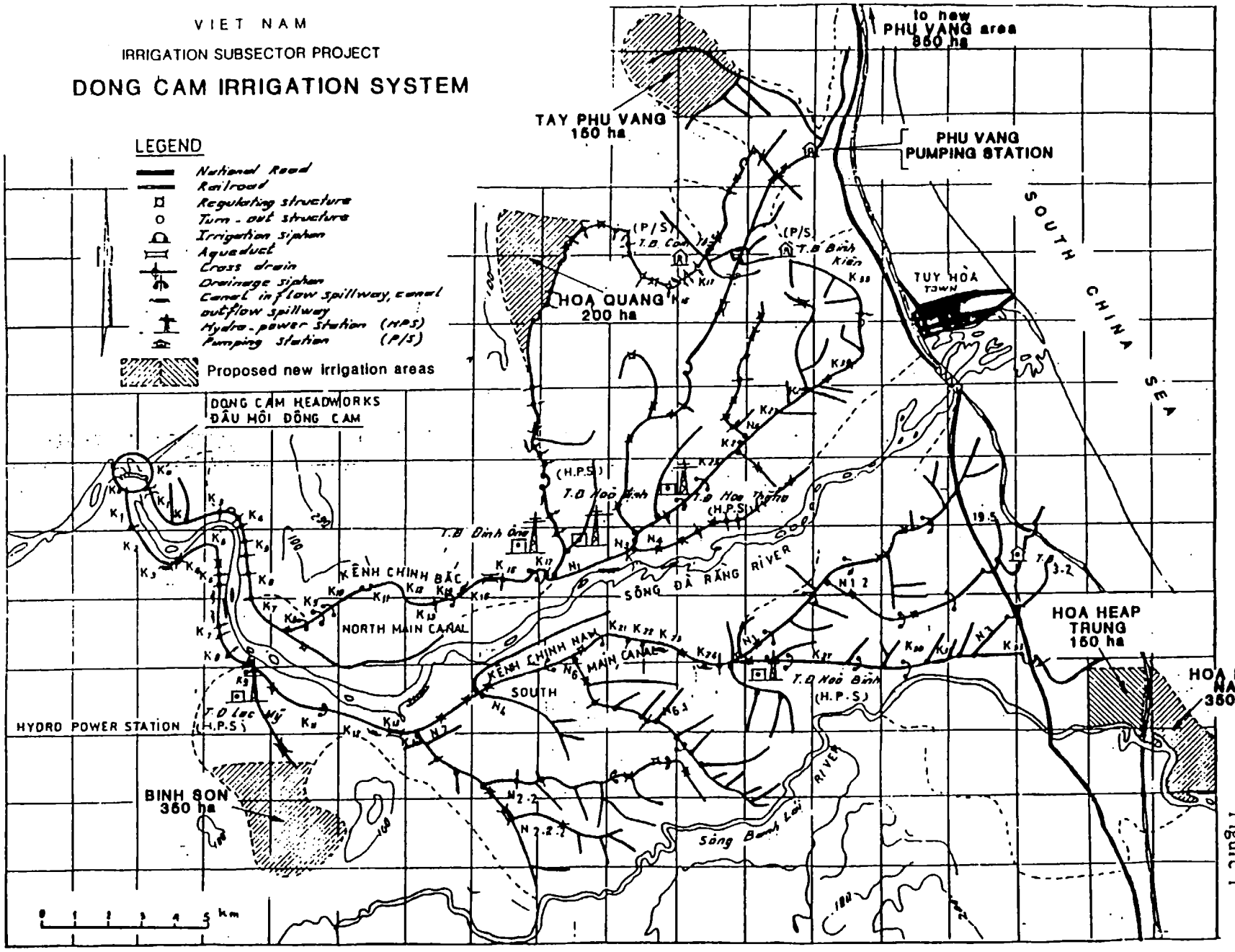
	Area (ha)	Canal Length (km)	Design Flow (m^3/s)	Source of Water
North				
- Hao Quang	200	1.25	0.24	Canal N1
- Phu Vang	850	5.25	1.23	Pumped from Canal N3
- Tay Phu Vang	150	2.50	0.17	Pumped from Canal N3
South				
- Binh Son	350	2.00	0.45	Binh Son Canal
- Hoa Hiep	500	4.60	0.68	South Main Canal
Total	**2,050**	**15.60**		

9. Buildings, equipment and materials for agricultural extension, trials and demonstration plots will be provided.

10. Technical assistance and training for IMC staff and vehicles, and equipment for construction supervision, operation and maintenance of the completed workswill be provided.

III. Production and Benefits

11. The main benefits would be: (a) improving irrigation to 1,400 ha that at present does not receive a reliable supply by removing obstructions to flow and by making more efficient use of water at times when the supply only just matches demand; (b) providing irrigation to 2,050 ha of unirrigated land; (c) preventing a reduction in the service area; and (d) preventing failure of the system. Following the completion of rehabilitation of the irrigation system it is expected that two fully irrigated rice crops would be grown annually with average yields increasing to between 4.25 and 4.75 tons/ha. A third,mostly soyabean crop would continue to be grown on about 2,500 ha during the monsoon period on higher-lying areas not prone to flooding. About 400 ha of sugarcane would continue to be grown. The increase in annual agricultural production at full development (assumed to be five years after completion of construction) has been estimated to include about 21,000 tons of paddy, about 200 tons of soyabeans and other crops and about 1200 tons of sugarcane. The estimated benefits are based on the assumption that the cropping intensity would remain at 211% and crop yields would increase due to the availability of irrigation water and increased use of agricultural inputs. Based on an average farm size of 0.34 ha, estimated average net annual farm income from crops would increase from the current US$95 per year to about US$104 at full development. The economic rate of return has been estimated to be 12%.



ANNEX 6
Figure 1

HOC MON/NORTH BINH CHANH SUBPROJECT

I. Background

General

1. The subproject lies mainly within the administrative boundaries of Hoc Mon and North Binh Chanh Districts which are part of HCMC and extends into Long An Province. The subproject would be confined to very flat land with elevations in the range of 0.5 to 0.8 m.a.s.l. About 13,300 farm families live in the subproject area. The present average farm holding is about 1.0 ha per farm family.

Water Resources

2. The source of water for the subproject area is mainly the Saigon river with some water also from the Vam Co Dong river. In the vicinity of the proposed subproject, both rivers are influenced by tidal water level fluctuations. An existing reservoir on the Saigon River at Dau Tieng has a live storage volume of 1,056 million m^3 and the mean annual inflow from the catchment area of 2,700 km^2 is about 1,870 million m^3/year. Dau Tieng reservoir supplies irrigation water to an area of about 52,000 ha; the return flows from most of this area drain into the Vam Co Dong. Because Dau Tieng's full irrigation potential[1] has not yet been developed, Dau Tieng has at this time surplus water, some used to over-irrigate the served area while about 25 m^3/sec is released from the reservoir to repulse salinity intrusion into the Saigon River and to provide some 3 m^3/sec for municipal and industrial use in HCMC.

3. The Saigon river is a tributary of the Dong Nai river, the main river in the area (Figure 1), joining it at the southern edge of HCMC. There is a reservoir at Tri An on the Dong Nai, with a catchment area of 14,890 km^2 and a live storage of 2,640 million m^3. A third reservoir, Thac Mo, with a catchment area of 2,200 km^2 and a live storage of 502 million m^3, is under construction on the Be river, another tributary of the Dong Nai, and three more reservoirs have been planned for future construction on the same river. Prior to the construction of Dau Tieng and Tri An reservoirs, salinity of 2,000 mg/l intruded during low flow seasons into the Saigon river to near the takeoff of the Rach Tra canal, the principal freshwater conveyance canal to the proposed subproject. Since these two reservoirs have been in operation with Tri An releasing about 200 m^3/s and Dau Tieng releasing about 25 m^3/s in the dry season, salinity intrusion has retreated about 20 km in the Saigon river to Phu An, about 8 km upstream of the confluence with the Dong Nai. However salinity intrudes into the subproject from the saline portion of the Saigon river through the Cho Dem river and also from the Vam Co Dong, whose salinity level reaches 4,000 mg/l (the maximum salinity tolerated by paddy) during 5 months of the year (January to May), and which is connected to the subproject area through the Ben Luc river, An Ha and Xang canals (Figure 2). Drinking water in much of the subproject area is brought by tanker or other means during the dry season and is very expensive.

1/ Estimated to be 72,000 ha in the SAR.

Soils

4. Of a total surveyed area of 19,930 ha, which includes 4,000 ha now proposed for urban development, heavy textured lowland soils comprise about 14,230 ha, of which 4,400 ha are classified as acid-sulphate and affected by salinity intrusion; 5,000 ha are classified as acid-sulphate; and 4,830 ha are classified as saline soils (non-acid sulphate). The balance of the area (5,700 ha) is comprised of well-drained, light-textured soils suitable for upland crops, but only marginally suitable for irrigated rice. In about 2,000 ha of the 9,400 ha acid-sulphate soils, pyritic layers are less than 80 cm below ground level and in about 7,000 ha jerosites are less than 50 cm below ground. This means that topsoil layers are acidic or potentially acidic and would have to be repeatedly flushed. Soils below root depths of about 30-40 cm would have to be continuously maintained in a reduced (wet) state by careful water management to prevent further oxidation and acidification. Water would be controlled to avoid continuous acid effluent by introducing closely spaced ditches, which would enable farmers to maintain an appropriate high water table.

Irrigation and Drainage

5. The tidal flow regime in the subproject area and the bordering rivers has been simulated in a mathematical model by the MWR but because of the complexity of simulating flows through distribution networks, the results of model tests are applicable only to water levels (and flows) in main canals. Most of the subproject area can be drained, but often more slowly than the rate of accumulation. Pumped drainage is therefore used to accelerate the rate of drainage. Tides being the dominant hydraulic driving force in this subproject, capacity requirements (and shapes) of irrigation and drainage canals and related structures will be governed by the results of tidal simulation studies.

6. The area has a network of multi-purpose waterways serving navigation, drainage and irrigation. There is a need to increase the drainage capacity as part of the area is flooded during the rainy season, and to provide effective gated structures to enable a high water table to be maintained in acid-sulphate soils. The irrigation and drainage network is incomplete and silted up in parts. There is a lack of sluices to prevent salinity intrusion and permit tidal irrigation and drainage; Canal C has no structures; turnouts, bridges, improvement of the road on the canal embankment and construction of laterals are needed. Most of the control gates on turn-outs from Canal A are not operable. Tertiaries have no turnouts nor water level control structures and require clearing, reshaping and rehabilitation. The southwestern part of the subproject area is currently subject to salinity intrusion during the dry season.

Agriculture

7. Rice is the most important crop grown in the subproject area, followed by sugarcane. Some 5,600 ha of mostly local varieties of rice are grown under rainfed conditions on the heavy wetland soils, mainly during the monsoon, yielding about 3 tons/ha. On land subject to flooding, rice is transplanted, but where a degree of water control is possible direct seeding is practised. Little fertilizer is used. Along some of the drainage canals, farmers have reclaimed acid-sulphate soils by making alternate broad, raised beds interspersed with broad furrows. Sugarcane and pineapples are grown on these beds. About 2,300 ha of sugarcane is grown for local processing (by pan

evaporation) or is transported to a sugar mill in Song Be Province. Average cane yields are low at about 18 tons/ha.

Phasing of Development

8. Insufficient water is available now for the full irrigation of the originally proposed subproject area of 16,200 ha, which would require up to 15 m^3/s in the dry season. If this amount of water was to be abstracted from the Saigon river, saltwater would intrude up the river reducing the area that can be irrigated. Preliminary mathematical model tests at SIWRPM[2] have examined the extent of saltwater intrusion with various residual flows. The results, which are inconclusive and require verification and refinement, indicate that only a small part of the Hoc Mon/North Binh Chanh area (about 7,000 ha) could be developed from incremental releases from Dau Tieng. Further development would require additional water control, such as would be provided by Thac Mo reservoir, completion of which is expected within two years, and which is expected to release a minimum flow of 55 m^3/sec into the Dong Nai for salt water exclusion. In that case, Hoc Mon/North Binh Chanh could divert the water released at Dau Tieng which would enable the supply of adequate water for the irrigation of up to about 13,000 ha during the dry season and for the entire area during the wet season. Further development of HM/NBC would require development of additional water resources such as Phuoc Hoa which is expected to release a minimum flow of 42 m^3/sec but whose viability is not certain at this time.

Subproject Rationale

9. Agricultural development of the area is constrained by a lack of freshwater, by a potential acidification of soils and by an incomplete irrigation and drainage infrastructure. The provision of protection against salinity intrusion, the rehabilitation of the existing infrastructure, the improvement of freshwater supply and surface drainage have been given high priority by GOV to enable farmers to raise agricultural production and income. Employment would be created for local people and the availability of freshwater would enhance urban settlement in the subproject area. Due to shortage of funds, GOV is unable to complete the required facilities in the near future and has requested IDA's financial assistance to accelerate the development of the subproject. This would improve reclamation and development of acid-sulphate soils, reduce the duration and degree of toxic effluent and avoid environmental damage.

II. Subproject Description

10. The proposed subproject would include:

(a) construction of 11 major sluices along the main canals to prevent salt water intrusion and to control the discharge of drainage water;

(b) dredging and reshaping about 53 km of existing main canals (A, B, C, link canal and Tan Kien creek);

2/ Subinstitute of Water Resources Planning and Management.

(c) dredging and reshaping 210 km of existing secondary canals and construction of about 40 km of new secondary canals;

(d) dredging and reshaping of about 210 km of existing tertiary canals and construction of about 188 km of new tertiary canal;

(e) construction of 9 minor sluices along the main canals to prevent salt water intrusion and to control the discharge of drainage water;

(f) construction of west canal and bridges;

(g) construction of about 100 control gates on secondary canals to control irrigation and drainage;

(h) construction of about 60 stoplog gates on secondary canals to allow two-way flow for irrigation and drainage and to prevent acid water entering the system;

(i) construction of 500 stoplog structures 1 m wide and 173 0.6m wide at the head of each tertiary unit;

(j) on-farm development for 13,300ha;

(k) construction of 4 major bridges, 3 vehicle bridges and 80 footbridges along main and secondary canals;

(l) construction of about 43km of embankments for salt water and flood control purposes.

11. The works would be designed and built to withstand a hostile soil and water environment, which has high levels of acidity, sulphates and salinity. Care would be taken with the design and construction of structures to ensure that concrete, steel and other materials used were able to withstand adequately the conditions in which they would operate; measures taken would include use of sulphate-resistant cement, high quality concrete with large cover to reinforcement (say 100 mm), allowance for corrosion on steel structures and extensive protective coatings.

12. Buildings, materials and equipment would be provided for agricultural extension, trials and demonstration plots.

13. Vehicles and equipment would be provided for supervision of construction and for the use of IMC following completion of the project.

14. Project works will require about 20 ha of land and it is estimated that about 130 families will be relocated. About 2080 families will lose some land. the project will compensate for all lost physical assets. Land will be replaced by land except wherethe amount lost is less than 20% of the holding, in which case cash will be paid for productive investments.

III. Production and Benefits

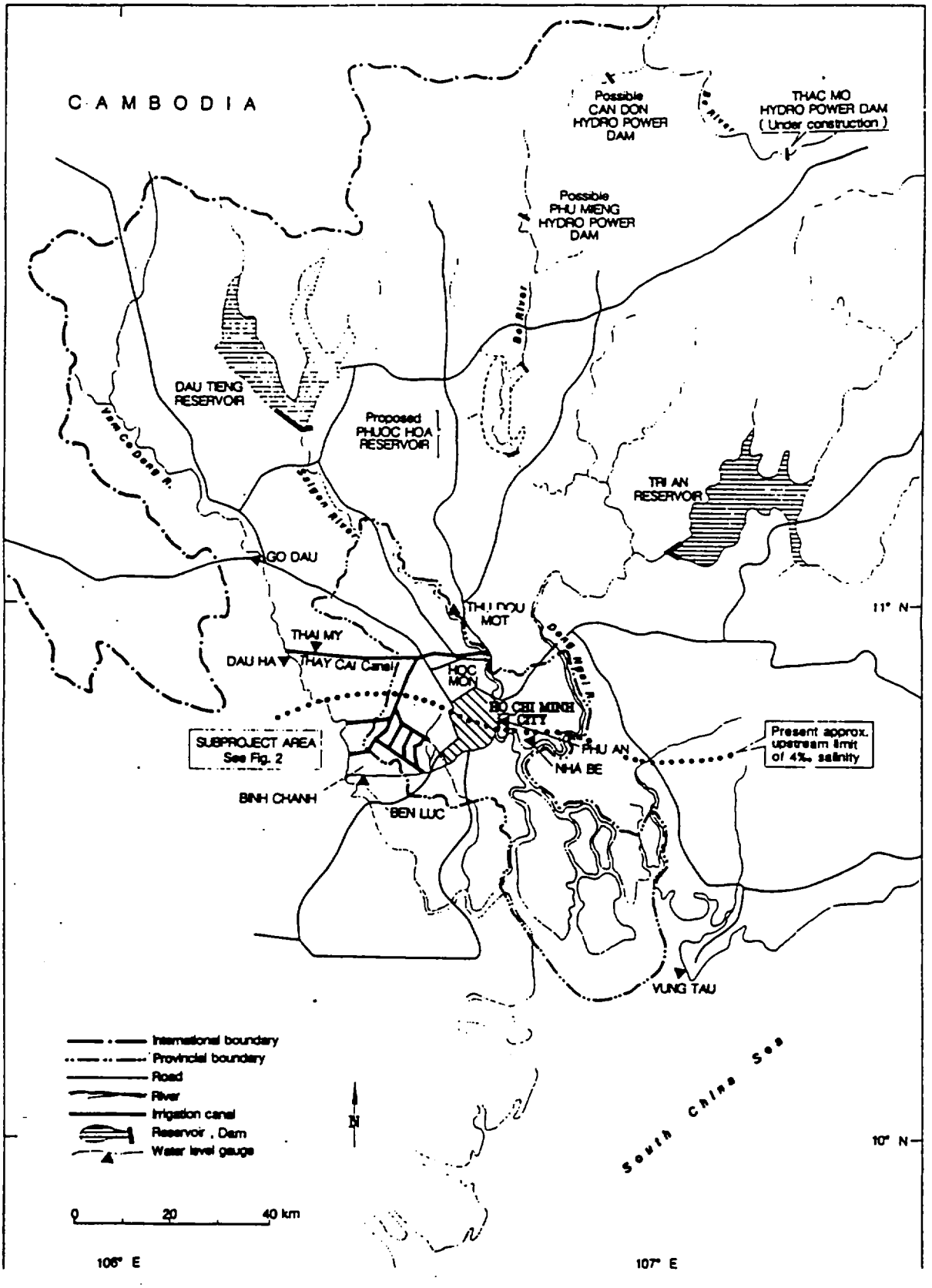
15. The increase in annual agricultural production at full development has been estimated to include about 45,000 tons of paddy, about 2,700 tons of groundnuts, about 47,000 tons of vegetables and about 80,000 tons of sugarcane. The estimated benefits are based on the assumption that cropping intensity would increase from about 98% at present to about 176% at full development, there would be a shift to higher value crops and crop yields would increase due to the improved soil and water conditions, availability of irrigation water and increased use of agricultural inputs. Since the scheme is close to HCMC, it is likely that some farmers would diversify into horticulture or floriculture. This would produce higher benefits but has not been taken into account in the economic evaluation of the subproject. The economic rate of return is estimated to be 12%.

VIET NAM

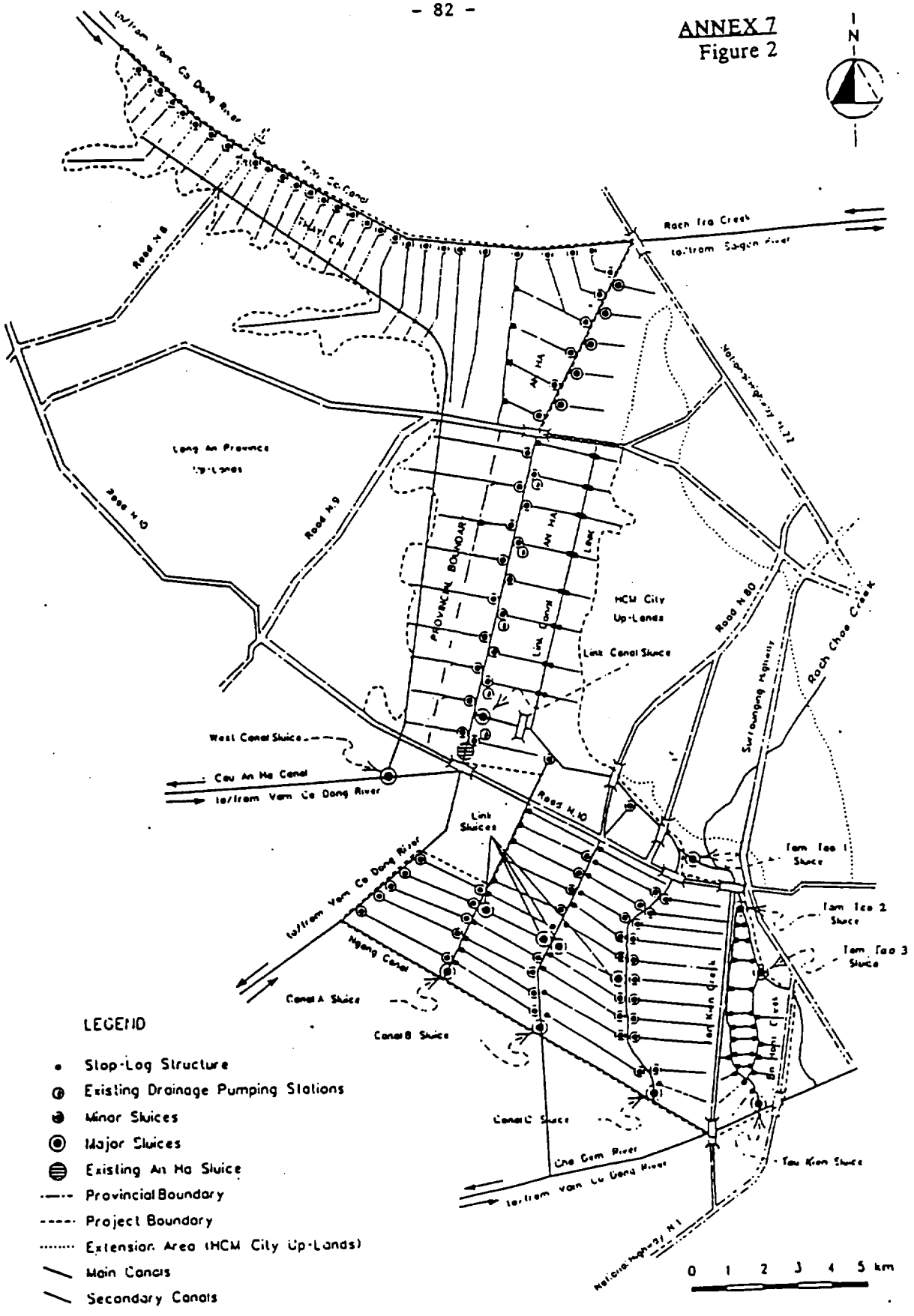
IRRIGATION SUBSECTOR PROJECT

ANNEX 7
Figure 1

HOC MON / NORTH BINH CHANH SUBPROJECT LOCATION



ANNEX 7
Figure 2



Hoc Mon - North Binh Chanh

OPERATIONS AND MAINTENANCE

Background

1. The investment in rehabilitation, modernization and scheme completions under the project will bring about considerable improvements in system performance and will result in increased agricultural production. However, the return on this investment will be quickly eroded if the subproject infrastructure is allowed to deteriorate through lack of adequate maintenance and sound operational management to the point where systems will not deliver the services for which they were designed. Efficient operations and effective maintenance is therefore essential to safeguard the investment and to sustain the irrigation systems in perpetuity. The O&M component of the project therefore has as its overriding objective the improvement and sustainability of performance of water service delivery of the subproject systems, primarily for irrigation and drainage. The project will serve to strengthen the linkages between sound operations and maintenance that lead to reliable and equitable water services, water fees that cover the cost of adequate O&M and administration and participative management by farmers in the subprojects. The component will address these issues through:

(a) Reorganized institutional and participative management arrangements;

(b) Strengthening program management capabilities and processes;

(c) Provision of equipment and training to enhance O&M program delivery capability;

(d) Moving over time to pricing water at cost;

(e) Full funding of maintenance programs on a needs basis; and

(f) Moving Irrigation Management Companies (IMCs) to a position of financial autonomy;

Management Responsibilities and Farmer Participation

2. Generally irrigation schemes that have been built with central government funding are handed over to be operated and maintained by provincial level IMCs supplying water to farmer cooperatives and other users. Oversight is by provincial Water Resource Services agencies accountable to the Peoples Committee of each province. Management at IMC level has responsibility for the primary and secondary levels of the system and the cooperatives have responsibility at the tertiary level. The involvement by customers in decision-making at various levels below IMC level of management is a strong feature. However, at the peak decision-making level there is no direct representation of customer groups with oversight responsibilities. It is proposed under the project to strengthen steering committees that oversee IMC by the addition of farmer representatives on the committee and to increase the Committee's powers and duties. It proposed to redefine the steering committee as a Board of Management (BOM).

(a) BOM Membership. Since, at least in the medium term, companies will remain as state-owned enterprises under the People's Committee of the province, it will be essential for them to have a Board of Management that would report to the PPC through PWRS. The BOM would develop the independence of companies and move them over time to become capable of providing direction to the company, providing greater participatory decisionmaking including farmers, and in particular overseeing and improving the effectiveness and efficiency of its operation. Board membership would include:

- PC representative (1);
- PWRS representative (1);
- PAS representative (1);
- Farmer beneficiary members (3);
- Director of the company.

3. The Board would elect its own chairman, ideally on a three-year rotational basis. The Director would not be eligible for election. Board members (apart from the Director and Deputy Director) would not receive any salary from the company but would be paid justifiable expenses at agreed rates. Additional work undertaken by Board members at the request of the Board could be paid for as agreed by the Board. All such cases should be reported in the annual report of the company indicating the name of the Board member, the task undertaken, days worked and remuneration received. A typical organization chart is at Appendix 2 to this annex.

(a) Responsibilities of BOM. The Board would not become involved in day-to-day management of the company, which would rest with the Director and his staff. The main areas of the Board's responsibility would be to review and take decisions on:

(i) Policy - including:

- Levels of service;
- Staffing and emoluments;
- Organizational structure; and
- Financial management including pricing and cost recovery, budgets, and costs of services.

In consultation with government, determination of policy on continuing subsidies for recurrent cost and arrangements for financial assistance in the event of natural disasters on the company.

(ii) Plans and Programs - including:

- Forward planning at 5 and 10 year horizons;
- Annual total budget;
- Annual operations and maintenance plans;
- Proposed irrigation and cropping programs for each season;
- Plans for special activities, e.g., cooperation in rice variety trials;
- Setting annual prices for services.

(iii) Monitoring and Accountability - including:

- Receive and review reports on the physical and financial performance of the company and be accountable to the government;
- Any special reports, e.g., natural disasters or other particular problems;
- Present the annual report of the company to government and the beneficiaries.

(b) Responsibilities of Director IMC. The Director of the company would report to the Board and would be responsible for the day-to-day management of the company in accordance with the direction given by the BOM.

(c) Responsibilities of Staff. The main staff responsibilities are:

- To provide quality water services of supply, drainage, and flood control where appropriate, which satisfy customers needs at a minimum unit and overall cost;
- To earn revenue from water fees equal to the cost of services, including the cost of management, operations, maintenance and some replacement costs;
- To deliver annual programs of operations and maintenance within budgets;
- To collaborate with beneficiaries in promoting improved water management;
- To collaborate with beneficiaries and agricultural support services on measures to intensify crop production within the command area and to sustain incremental production levels;

(d) Staffing Requirements. The above suggested changes in management, organization, and operations of the companies will require redefinition of staff responsibilities and functions.

Based on the list of staff responsibilities defined, job profiles should be developed and numbers of staff required to give acceptable efficiency should be estimated. Company activities could be grouped to provide suitable spans of control for Deputy Directors. Such a division of responsibilities between Deputy Directors will be by separation into the following four functional areas of management:

- Planning, finance, administration, and personnel;
- Pumping stations operation and maintenance;
- Canal system operation and maintenance;
- Irrigation scheduling, water management, and customer services.

4. The organization and management, including financial management, varies between IMCs. Their financial position depends on the ability of farmers to pay water fees. Typically, IMCs are headed by a director and organized along functional lines, including departments of finance and administration, planning and technical services, O&M field units, and workshops.
However, in Hoc Mon/North Binh Chanh and Thach Nam subproject the IMCs need to be reorganized along functional lines to better reflect the management responsibilities of these agencies

in carrying out their future role as providers of rural water services. Organization charts for these subprojects are shown in Appendices 3 and 4 respectively.

Management Capacity

5. Strengthening of IMCs' capacity to effectively manage the delivery of recurrent as well as future rehabilitation and construction programs forms an important part of this component. It will include the introduction of computer aided management systems to assist IMCs with forward planning, programming and budgeting, scheduling of activities, monitoring and recording, and financial management. The introduction of these systems will be supported by an extensive training program.

Operations and Maintenance Issues

6. The significant operational issues in the subproject areas are poor access, poor communications, lack of mobility, lack of water flow control and measurement, and the lack of some basic equipment. The maintenance issues are lack of mobility, lack of communications, training, maintenance work planning and scheduling, and lack of some key equipment to support core maintenance activities at each subproject.

Program for Sustainable Operations and Maintenance

7. To ensure the sustained O&M, each subproject will develop Plans of Operations and Maintenance (POM) which will result in a set of documents, that vary in extent and detail depending on the complexities and characteristics of each subproject. The preparation of the POM should start as early as possible in the project life and incorporate the design and modifications proposed under rehabilitation/modernization and completions. The output will be a comprehensive document that will detail the operating concept of the system and the procedure for all operations actions from the point of diversion of supply through to the coordination with cooperatives and other bulk supplied customers. It should document seasonal schedules and incorporate standard operating procedures as well as special instructions for structures and equipment such as pumping stations. Likewise the POM would contain maintenance procedures, schedules, and records for the major types of maintenance on the facilities. The document would also include such things as maps, drawings, and design and construction data, organization and staffing levels, responsibilities of functional groups, and mandatory staff training requirements.

Operations and Maintenance Programs

8. A key component of the project is the planning, organizing, scheduling and funding of maintenance, operations, and repair programs on a recurring basis to ensure that the performance of subproject systems will be sustained in perpetuity and that IMC services are provided in an equitable, reliable, and cost effective manner. Specifically, activities would include:

(a) Operational Management. Improved effectiveness of operations to meet service objectives by the enhancement of operator mobility and communications; incorporation

in the design for remodelling/modernization provision for more control and measuring structures to improve system responsiveness and increase system operating efficiency; and improved monitoring and reporting.

(b) Maintenance Management. Improved planning prioritization and scheduling of maintenance and construction programs and activities through the introduction of project management software; enhancement of program delivery by the procurement of key tools and equipment for maintenance and repairs.

(c) Training. Training of staff to support the O&M program including courses in the areas of computers; basic maintenance including earthworks, concrete, formwork, structures, pumps mechanical and electrical, trades, and heavy equipment usage. In the operations area training will include basic hydraulics, canal operations, water measurement and regulation.

Financial Management of IMCs

9. O&M activities of IMCs in the past has been subsidized by provincial and district governments. The current government policy now requires IMCs to trade their way out of subsidies and cover the full cost of O&M, administration and major repairs through increased water fees. Any revenue in excess of costs would be used to fund future rehabilitation. Under the project, a financial management strategy for each subproject will be developed that will examine the current revenues from all customer groups and costs associated with the provision of services to each group (cost allocation). The plan would encompass the steps necessary to bridge the gap between revenue and costs and move IMCs to a position of financial autonomy over the life of the project.

10. Table 1 sets out the costs of full O&M of the IMCs under each sub-project while Table 2 shows the estimated revenue projections, based on project-related increased production, compared with the total costs of O&M. The revenue projections are based on existing water fee percentages applied to projected production levels. For such revenue to materialize, the water pricing structure (introduced in March 1994), which is based on area as opposed to production, would have to be increased in order to generate more revenue associated with project-related production increases. As Table 2 shows, the potential exists for some of the IMCs to move towards full cost recovery including funding of replacements (in 3 of the 7 subprojects) provided the area-based water rates are increased to capture part of the production increases in order to maintain the share of water fees relative to production. For the other four subprojects, water rates would have to be increased over and above what is required to maintain the share of water fees relative to production in order to fully cover the costs of O&M.

Table 1. Estimated Future O&M Costs of Projects

Sub Project	Area ha total	$/ha O&M *[1]	$/ha[2] Pumping O&M	Area (ha) Pumped	Cost of Gravity	Cost of Pumped	Total Costs of O&M
Cam Thuy	1,919	15	47	1,470	28,785	69,000	97,785
Linh Cam	14,600	20	39	14,600	292,000	569,400	861,400
Thach Nham	50,000	25	31	4,500	1,250,000	139,500	1,389,500
Dong Cam	19,800	22	42	1,000	435,600	42,000	477,600
Hoc Mon/ North Binh Chanh	12,700	20	30	3,610	254,000	108,300	362,300
South Nghe An	19,500	22	31	19,500	429,000	604,500	1,033,500
An Trach	9,715	23	38	9,215	223,445	350,170	573615

1/ Includes O&M and Management costs of all headworks and canals.

2/ Includes energy and pump O&M.

Table 2. Estimated Revenue and O&M

Subproject	Revenue (US$)	Total Cost of O&M (US$)
Cam Thuy	77,640	97,875
Linh Cam	645,430	861,400
Thach Nam	3,354,760	1,389,500
Dong Cam	1,050,420	477,600
Hoc Mon/North Binh Chanh	575,650	362,300
South Nghe An	389,869	1,033,500
An Trach	565,000	573,615

Vehicles and Equipment Procurement

11. The capacity to deliver the O&M program will be increased by the procurement of selected maintenance equipment that would improve the productivity and effectiveness of some of the core maintenance activities. The mobility of both canal operations staff as well as construction and maintenance staff would be enhanced with the provision of motor cars, jeeps, and motorcycles. The effectiveness of use of both the mobile equipment and the vehicles would be enhanced by having them fitted with two-way radios.

Vietnam Irrigation Rehabilitation Project
Agricultural Support

	Number	Unit Cost US$	Amount US$'000	Remarks
INVESTMENT COSTS				
Civil Works				
District extension centres, incl furniture	20	15000	300	300m2 x $50/m2
Equipment				
White boards	20	50	1	one per district extension centre
Photocopiers	20	3000	60	one per district extension centre
Amplifier/loudspeaker	20	2000	40	one per district extension centre
Camera	20	250	5	one per district extension centre
Overhead projector	20	750	15	one per district extension centre
Typewriter	20	250	5	one per district extension centre
Equip.,tools for trials & demos	20	1000	20	one per district extension centre
Subtotal			146	
Training				
Pre-season 5-day workshops	80	875	70	25 attenders/district x $7/manday x 4 years
Mid-year 2-day workshops	80	350	28	25 attenders/district x $7/manday x 4 years
Post-season 5-day workshops	80	875	70	25 attenders/district x $7/manday x 4 years
Farmer 1-day training seminars	1600	60	96	20 seminars/district x 30 attenders x $2/day x
Subtotal			264	
Technical assistance				
Irrigation extension adviser in CPO	3	15000	45	3 months @ $15000/month
RECURRENT COSTS				
O&M of equipment	4	7300	29.2	5% of investment cost/year x 4 years
Training & info material	80	500	40	$500/district/year
Verification trials	160	200	32	2 trials/district/year x 4 years
On-farm demo plots	5008	20	100.16	1 plot/500 families(=626 plots) x 2 trials/yr x 4
Subtotal			201.36	
TOTAL			956.36	

Subproject	Province	No. of Districts
Cam Thuy	Tanh Hoa	1
South Nghe An	Nghe An	3
Linh Cam	Ha Tinh	2
An Trach	QN Da Nang	3
Thach Nham	Quang Ngai	6
Dong Cam	Phu Yen	2
Hoc Mon/N.Binh Chanh	HCMC/Long An	3
Total		20

INDICATIVE TERMS OF REFERENCE FOR CONSULTANTS

Objective, Scope and General Description of Services

1. The objective and scope of consulting services for the Irrigation Rehabilitation Project is to assist, advise the MWR (IMC and others, as applicable) and train staff in:

a. Reviewing and, as required, upgrading and improving project design criteria and in completing designing the seven subprojects included under this Project;

b. Preparing technical specifications for civil works and equipment;

c. Procuring civil works and equipment in accordance with Bank guidelines;

d. Effectively managing and monitoring the implementation of the Project;

e. Preparing appropriate operation plans and procedures for each subproject to ensure effective water management: timely, quantified, equitable, irrigation supplies and their monitoring, and providing guidance and training to IMCs staff in appropriately operating each irrigation system;

f. Preparing appropriate routine and preventive maintenance plans and procedures for canals systems, structures and gates for each subproject and providing guidance and training to IMCs staff in appropriately maintaining each irrigation system;

g. Preparing technical specifications for pumping and ancillary equipment and overseeing the installation and testing of pumps and ancillary electrical/mechanical equipment, preparing O&M plans and procedures for electrical/mechanical equipment, training IMC staff and others concerned in properly operating it and in performing routine and preventive maintenance, monitoring pump performance and keeping appropriate records;

h. Establishing a base-line survey concerning environmental conditions in each subproject and in monitoring environmental impacts in rehabilitated irrigation/drainage systems.

i. Managing and supervising construction with special attention to compliance to terms of contracts, specifications, quality control, cost-effectiveness and timeliness.

Location of Services

2. Consulting services under these terms of reference shall comprise (a) six international consultants, visiting international specialists and six national experts assigned to the Central Project

Office (CPO) in Hanoi, who will provide services specified under 1.1 to 1.8 above; (b) three long-term international and three long-term national construction specialists who will each be assigned to a group of subprojects within one region and who will provide services under (1.9) above.

Job Description and Required Expertise of International Experts.

3. Consultants assigned to the Central Project Office shall comprise:

a. Team Leader. The Team Leader (TL) shall be the Consultant's Chief Technical Officer (CTO) who shall represent the Consultant in all matters and obligations pertaining to this Project. The TL shall closely collaborate with MWR's National Project Director (NPD) and his deputy in managing the Project and in coordinating the work of individual consultants and GOV counterparts. The TL shall have overall responsibility for directing, organizing and coordinating the work of individual consultants and of ensuring that the Project is executed timely, cost effectively and in accordance with pertinent IBRD/IDA requirements (para.1.4) The TL. shall be a civil engineer with at least 20 years of experience, at least 12 years of which shall have been related to design and construction of irrigation/drainage systems. The TL shall have at least 4 years of executive positions in overseas irrigation projects and shall have assisted and trained national counterparts in managing the implementation of at least one large irrigation/drainage project. Fluency of speaking and writing English is essential.

b. Procurement Specialist. The Specialist shall assist, guide and train MWR in preparing technical specifications for civil works (particularly earthwork and concrete structures), in packaging procurement for works and equipment, in preparing ICB and LCB bidding and contract documents and in procuring works and equipment by ICB and LCB in accordance with Bank guidelines (para.1.2,1.3). The Specialist shall be a qualified civil engineer with at least 10 years experience in procurement and in construction of civil works including construction of canals and hydraulic structures, be thoroughly familiar with earthwork construction, with modern concrete technology and with ICB and LCB procedures, documentation and processing. Fluency of speaking and writing English is essential.

c. Irrigation Engineer. The Irrigation Engineer shall assist, guide and train MWR and concerned survey and design institutes in updating design criteria (where required), in completing designing the seven subprojects (para.1.1) and, in collaboration with the O&M Engineer --shall assist, guide and train IMC and other concerned staff in appropriate water management in preparing detailed plans for effective use of water and systems operation. The Irrigation Engineer shall guide the installation of flow-measuring devices at suitable control points on each system (e.g.turnouts of primaries, main, primary and secondary checks), guide, assist and train operation staff in controlling quantified water deliveries. The Irrigation Engineer shall have at least 15 years of experience in planning and designing irrigation and drainage systems of which at least five shall have been connected with work in developing countries with climatic and cropping conditions similar to those in Vietnam. The Engineer shall be thoroughly

familiar with the operation of gravity supplied and pump-lift irrigation for predominantly rice growing systems and shall have worked closely with national counterparts and engaged in training. Speaking and writing proficiency in English is essential.

d. O&M Engineer. In collaboration with the Irrigation Engineer the O&M Engineer shall assist and guide IMC and other concerned staff in preparing detailed plans of operation for each subproject, train staff in implementing them[1] and in monitoring and recording measured water deliveries. The O&M Engineer shall assist and guide IMC staff of each subproject in preparing maintenance and repair manuals for canals and structures, specifying work that should be done manually or mechanically during shut-down periods and throughout the year. The O&M Engineer shall assist and guide IMC management in cost-effective O&M procedures and train IMC staff and water users in appropriate maintenance. The O&M Engineer shall be a qualified civil engineer with at least 15 years experience in operation and maintenance of gravity and pump-lift irrigation and drainage systems, and shall have worked on I&D projects in developing countries with climatic conditions similar to those in Vietnam. The O&M Engineer shall be thoroughly familiar planning and implementing rotational-supply systems and in training O&M staff and water users in collaborative water management. Speaking and writing proficiency in English is essential.

e. Environmental Expert. The Environmental Expert shall assist and guide MWR, IMC and other concerned central or provincial agencies in preparing an environmental base-line survey of water resources and public health in the subproject areas that will be used to determine any potential changes after rehabilitation of the irrigation and drainage infrastructure (para.1.8). The Expert shall also assist and guide concerned agencies in setting up a monitoring system to periodically monitor the quality of water resources and public health and alert provincial and/or central authorities to detrimental quality changes, if any. The Expert shall have at least 7 years of experience in environmental impact assessments related to water-resource developments and shall have carried out, guided and assisted base-line studies and monitoring. Speaking and writing proficiency in English is essential.

f. Mechanical Engineering Specialist. The Mechanical Engineering Specialist shall assist MWR and IMC in carrying out duties specified in para.1.7 above. Specifically, the Specialist shall guide and assist in preparing technical specifications for pumps and ancillary electrical and control equipment, advise MWR's procurement award committee on technical matters, guide and oversee the installation and testing of pumps and ancillary mechanical/electrical equipment and assist in preparing O&M plans and

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1/ Plans shall be drawn up for short-term (10-day) intervals, respond to land preparation and crop-irrigation requirements, shall be for both routine and applicable emergency operation (e.g. floods, typhoons) and, in the case of pump-lift systems, address system specific operational features and constraints (e.g. planning pumping so as to take full advantage of off-peak power rates).

procedures for such equipment. The Specialist shall further guide and train IMC staff and other concerned personnel in operating the equipment and in performing routine and preventive maintenance, in monitoring performance, in keeping appropriate records and in taking requisite action should a deterioration in performance be indicated. The Mechanical Engineering Specialist will be a qualified mechanical engineer with at least 10 years of experience in mechanical engineering design, operation and maintenance and be familiar with the various types pumps, motors, controls and ancillaries. The Specialist shall be experienced in preparing specifications for pumps, motors and ancillaries, and in installing and testing pumps and motors. Speaking and writing proficiency in English is essential.

g. Visiting Specialists. The Consultant shall provide visiting, short-term specialists in specific technical disciplines as may be required during the implementation of the Project. Job descriptions, required expertise and schedules of Visiting Specialists will be specified by the Project Director in consultation with the Consultant's Team Leader.

h. Construction Specialists. Construction Specialists , one based in Vinh for Cam Thuy, South Nghe An and Linh Cam, one based in Quang Ngai for Thach Nham and An Trach and one based in Ho Chi Minh City for Hoc Mon/North Binh Chanh, shall assist, guide and train MWR and other concerned construction supervision staff in constructing works specified in the project's loan agreement in strict conformity with applicable technical specifications, materials and construction standards and by employing cost-effective construction methods procedures (para 1.9). The Specialists will be qualified construction engineers with at least 15 years of experience in construction of canals and hydraulic structures, materials and construction quality testing, and will have been in construction supervisory positions for at least 7 years, including supervising construction of similar works in developing countries. The Engineers will have worked with and trained national counterparts in construction supervision and management. Speaking and writing proficiency in English is essential.

Job Description and Required Expertise of National Experts.

4. Services to be provided under these terms by the Consultant shall also include services of six national experts assigned to the CPO and three experts assigned to work with the Construction Specialists in the North, Center and South, respectively. National Experts will collaborate with international experts in fulfilling their tasks and serve as liaison officers with the MWR, provincial agencies or companies and other GOV agencies. They shall be qualified engineers or scientists and shall have at least 15 years of professional experience in their respective disciplines. They shall have a good command of English and be able to communicate with International Experts on pertinent technical matters. They shall be engaged by the International Consultant at terms and conditions stipulated by him in agreement with GOV. National Experts may overlap and/or complement the expertise furnished by International Experts.

Schedule of Services

	Unit	1995	1996	1997	1998	1999	TOTAL
Consultants with International Expertise							
CPO							
Team Leader	mm	10	10	10	5	3	38
Procurement Specialist	mm	10	8				18
Irrigation Engineer	mm	4	2	2			8
O&M Engineer	mm	6	6	4	2		18
Environmentalist	mm	2		2			4
Mech.Engineer	mm	2	2		2		6
Visiting Specialists	mm	3	3	3			9
Field Construction Specialists							
North	mm	10	10	6	3	2	31
Central	mm	10	10	6	3	2	31
South	mm	10	10	6	3	2	31
Consultants with National Expertise Only							
CPO	mm	72	72	72	72	36	324
Field	mm	36	36	36	36	36	180

ENVIRONMENTAL ASPECTS

Environmental Category

1. Since funding will be directed largely toward the rehabilitation of existing irrigation projects, rather than the construction of new ones, the environmental impacts were generally expected to be limited, and mainly restricted to the construction phase. However, it was anticipated that the project would also provide an opportunity to review operational environmental issues and, as required, include provisions to address these.

2. Following field inspections during early project preparation, a number of more substantial environmental issues were identified in connection with the Hoc Mon/North Binh Chan (HMNBC) component including: (i)its proximity to Ho Chi Minh City; (ii)the existence of plans for extending urban developments over part of the area; (iii)the extensive disposal of industrial liquid effluent and domestic garbage into the area; and, (iv)potential impacts due to the release of acids and, possibly, increased levels of aluminum and iron, due to disturbance of acid sulphate soils during drainage operations.

3. Consequently, the HMNBC component was classified as a Category A development and a full environmental impact assessment was prepared, addressing these issues. All other subprojects were classified as Category B, although they too were subject of environmental review to define construction and operational environmental management and monitoring requirements as necessary.

Findings of Environmental Studies

4. Hoc Mon/North Binh Chanh EIA. During subproject design, several of the environmental issues of initial concern were resolved, at least as far as the project is concerned, through changes in the project concept. In particular: (i)areas subject of potential urban development were excluded from the project since they were included within the boundaries of a proposed environmental study covering all of Ho Chi Minh City and the Ministry of Water Resources did not want to pre-empt any findings and recommendations arising out of that study; (ii)the issue of solid waste disposal was also avoided since it only applied to the excluded area; and, (iii)the water pollution problem was avoided by the decision to install sluice gates to separate the scheme from the polluted Ba Hom Creek, which had the corollary benefit of excluding polluted inflows to the development area.

5. The remaining issue of substance was the downstream physico-chemical and socio-economic effects of acid leachates from acid sulphate soils exposed during drainage and land rehabilitation works. These impacts were analyzed by a simple flow and dilution model which was calibrated against existing and supplementary water quality data which were collated and gathered during the environmental studies program. The analysis showed there would be a localized downstream impact but it would be restricted to areas of alternating salt and fresh water which are

not of high biological productivity and are not heavily fished. There will be no impact below the confluence with the Vam Co Dong River, about five kilometers downstream of the development area.

6. Other Subprojects. The Dong Cam, Thach Nam, Cam Thuy and Linh Cam subprojects were subject of environmental review based on field inspections to evaluate both construction and operational phase environmental issues. Issues which were subject of special consideration included: (i)control of construction impacts such as disposal of waste oils and greases, concrete and other construction materials; (ii)in-river activities relating to weir rehabilitation, river bank reinforcement, siphon construction etc., which could impact on fish and other important aquatic organisms; (iii)disposal of coolant oils from electrical transformers; and, (iv)disturbance of sites having cultural or historical importance.

7. Operational issues considered included: (i)potential fertilizer and pesticide pollution potentials; (ii)potential health impacts (potential for increased incidence of vector-borne and water borne diseases as a result of changing environmental conditions); (iii)the potential for salt water intrusion due to hydrological changes; (iv)catchment management requirements; and, (v)the potential for increasing pollution from industries processing the products of the irrigation systems.

Environmental Monitoring and Management Plan

8. An Environmental Monitoring and Management Plan for the Hoc Mon/North Binh Chanh development has been prepared. The main activities provided for under the plan include: (i)Coordination & Management; (ii)Environmental Monitoring by an independent organization (the Environmental Protection Center); (iii)Spoil Disposal Planning & Management; (iv)Fishery Development and Mitigation; and, (v)Integrated Pest Management as an extension of the Integrated Pest Management Project being carried out under an existing Bank-funded project.

ENVIRONMENTAL MONITORING AND MANAGEMENT PLANS

1. The environmental impact potentials of the proposed project were evaluated in two reports: "Hoc Mon - North Binh Chan Project Preparation: Environmental Impact Assessment (ELC Electroconsult s.p.a. and Hydraulic Survey and Design Company No.2, May, 1994); and, "Environmental Analysis of Dong Cam, Thach Nham, Cam Thuy and Linh Cam Irrigation Subprojects" (Northwest Hydraulic Consultants, Institute of Water Resources Planning, June, 1994).

2. The environmental monitoring and management plans (EMMP) are based on these reports.

EMMP for Hoc Mon/North Binh Chan Subproject

3. The EMMP is summarized in Table 1. Most of the environmental management activities will be implemented by the Construction Management Board of the Provincial Agricultural Services and Construction Management Board No.302. Additional activities for which cost provisions have been made are:

a. Coordination & Management - the responsibility for undertaking these activities would rest with the HCMC and Long An Agricultural Service Representative on the Executive Board who would have the technical support of relevant staff within the Provincial Agricultural Services. Actual monitoring of environmental management in the field would be the responsibility of an independent monitoring institution which would report periodically to the Executive Board;

b. Environmental Monitoring - to be undertaken by the Environmental Protection Center on a contract basis;

c. Spoil Disposal Planning & Management - to be undertaken by the Structural Construction Management Boards of MWR and the Provincial Agricultural Services. The cost provision covers expenses involved in carrying out property assessments and compensation costs for farmers affected by spoil disposal;

d. Integrated Pest Management - to be carried out by the Plant Protection Departments of the Provincial Agricultural Services as an extension of the Integrated Pest Management Project being carried out under the Agricultural Rehabilitation Project.

Other Subprojects

4. The environmental review showed that these subprojects have very limited environmental impact potentials which can be adequately addressed by the inclusion of provisions in the contract specifications covering the following:

a. site preparation, operation and abandonment;

b. construction waste disposal;

c. disposal and stabilization of excavated soils;

d. disposal and stabilization of dredged sediments;

e. stabilization and reclamation of borrow sites and quarries;

f. construction, operation and maintenance of temporary access roads;

g. river bank protection works;

h. site hygiene;

i. enforcement of on-site safety;

j. safe disposal of hazardous substances including waste lubricating oils.

5. The necessary provisions will be included in the contract documents.

TABLE 1 SUMMARY OF ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN - HOC MON/NORTH BINH CHAN SUBPROJECT

ACTIVITY	TASKS	IMPLEMENTATION RESPONSIBILITY	NOTES
1. Coordination & Management	* review annual plans & budgets for Environmental Management * coordination of EMMP * follow-up on monitoring results	HCMC Agricultural Service Representative on the Executive Board <1>	<1> The Executive Board member would have the technical support of relevant staff within the Provincial Agricultural Service such as the Research and Extension Team, the Construction Management Board, the Plant Protection Department and the Fisheries Section, as required.
2. Environmental Monitoring	* monitoring contractor compliance with environmental conditions * monitoring of spoil disposal and rehabilitation effectiveness * water quality monitoring * impact on aquatic ecology <2>	Environmental Protection Center <3>	<2> A suggested Terms of Reference for the independent environmental monitors is attached (Attachment 1) <3> It is proposed that the EPC be commissioned on a sole source basis since it is the only technically qualified and equipped agency capable of doing the work and EPC staff were involved in development of the environmental management and monitoring plan
3. Spoil Disposal Planning & Management	* final assessment of quantities * identification of spoil disposal areas * payment of compensation * supervision of spoil disposal (dike construction, drainage, etc.) * reclamation of soils	Structural Construction Management Boards of MWR and the Provincial Agricultural Services <4>	<4> Prime responsibility would be with the Construction Management Boards but they would be assisted by other technical specialist from within the Provincial Agricultural Services (e.g. Research and Extension Teams) and other participants in the Property Assessment Teams (e.g. Vice Chairman of village, Hamlet representatives, representative of village land manager, representative of Farmer Associations)
4. Integrated Pest Management	* IPM for paddy, fruit trees & vegetables based on existing ARP program - allow for 60 FFS, 200 demonstration plots, extension	Plant Protection Department of Provincial Agriculture Services	

ENVIRONMENTAL MONITORING
SCOPE OF WORK

1. Familiarization

Review of environmental impact assessment report, project design documents, site inspections, planning of monitoring programs.

2. Monitoring of Civil Works

Periodic (monthly) inspections of civil works contractors to ensure compliance with environmental conditions in contracts.

3. Monitoring of Spoil Disposal

Periodic (monthly) inspections of civil works contractors to ensure compliance with environmental conditions in contracts.

4. Water Quality Monitoring

Establish surface water monitoring points to monitor water quality upstream of the development area, within the development area and downstream of the development area.

Location of Sampling Points. The location and number of sampling would need to be determined during the familiarization phase. The cost estimate has been based on 12 sampling sites located as follows:

i) **Upstream (2 sites)** - one on Thai Cai Canal (east of Cau Bong) and on Tra Creek (west of Cau Bong);

ii) **Within the Development Area (6 sites)** - one on An Ha Canal (e.g. at An Ha Sluice), one on An Ha Link Canal, one on West Drainage Canal, one each on Canals A, B and C, one on Ngang Canal downstream of Canal C;

iii) **Downstream of Development Area (4 sites)** - one on An Ha Canal downstream of Ngang Canal, one on Cau An Ha Canal east of Cau Xang, one on Cho Dem River downstream of Ngang Canal and one in Vam Co Dong River downstream of Cho Dem River.

Sampling Frequency and Sampling Time. It is suggested that all sites would be sampled monthly during the first project year and quarterly (every three months) during project years 2 - 4 inclusive. Since the major impact potential arises when water is draining out of the development area (i.e. towards the south), sampling should always be carried out on the falling tide.

Monitoring Parameters - for each sample collected, it is suggested that the following parameters be recorded or analyzed:

PARAMETER	ANALYTICAL OBJECTIVE
sampling date and time flow direction (upstream/downstream)	To establish flow conditions at the time of sampling
pH	To assess the effect of acid leachate from spoil disposal and land reclamation
EC	To determine the presence or absence of saline intrusion at the time of sampling
Total solids	To assess the quantities of sediment flowing through the system
Total N, Total P	To assess any changes in nutrient levels in the system due to agricultural development
Total Fe, Total Al, Pb, Hg	To assess the impact of reduced pH levels on mobilization of heavy metals within the system
COD (permanganate), Total coliforms, Faecal coliforms	To assess the amount of organic pollution in the system due to disposal of human wastes.

To assist in interpretation of results, it would be useful to have a general idea of flow conditions in the area at the time of sampling. Since it will not be practicable to measure flows at the sampling locations, the next best option would be to record the flow at some existing flow monitoring station upstream of the development area (e.g. at Rach Tra) which is likely to be directly proportional to flows within the system.

5. Aquatic Ecology Survey/Fisheries Survey

Aquatic Ecology Survey - survey (four times during first project year and two times during project years 2 - 4 inclusive) of existing acidic zone, transition zone and brackish zone of plankton and fishes in areas downstream of the project area.

Fisheries Survey - fish catch surveys (four times during first project year and two times during project years 2 - 4 inclusive) downstream of project area.

RESETTLEMENT AND REHABILITATION

1. Since the project is mainly rehabilitation of existing irrigation schemes, the scope of resettlement is limited. In five of the seven subprojects, the need for land acquisition is mainly for widening canals, and will only affect individual families marginally. However, two subprojects (Thach Nham and Hoc Mon/North Binh Chanh) are under construction and expansion and are known to involve substantial resettlement. The project is estimated to acquire a total of 582 ha of land, out of which 491 ha are for those two subprojects.

2. A full inventory of properties and families affected by the project is presently available for only two subprojects (Thach Nham and HMNBC). Information for all other subprojects are estimates. Inventories of affected families and properties for these subprojects will be produced upon finalization of detailed design.

3. Table 1 summarizes the available information for each subproject:

Table 1: Estimated Number of Affected Families and Type of Loss

Subproject	Houses Lost	PAFs		
		LS>20%	LS<20%	Total
Cam Thuy	3	0	35	38
S. Nghe An	0	0	150	150
Linh Cam	0	0	3,736	3,736
An Trach*	0	0	0	0
Thach Nham	45	1,062	1,114	2,246
Dong Cam	0	0	200	200
HMNBC	130	201	1,750	2,081
TOTAL	**178**	**1,263**	**6,985**	**8,451**

(LS = Land Loss)

* Preliminary design indicates that no land will be acquired in An Trach subproject, hence no resettlement is envisaged. This is subject to the detailed design being finalized.

**The figures relative to the number of PAFs loosing more and less than 20% of their land are approximated.

4. Since the project is in low lying areas, close to the coast, the vast majority of affected people are Kinh (Vietnamese). In Thach Nham subproject, where 992 families were relocated from 1985 to 1993, because of construction work further upstream, surveys indicate that approximately 13% belonged to the Hre and Cot minorities, living among Kinh people. All families to be affected by the project are from the Kinh etnic group. A study will be conducted to assess the situation of those families already relocated (see para 21).

Resettlement Action Plans

5. The Resettlement Action Plan - Part One (RAP-I), prepared by the Ministry of water Resources, lays out a legal and institutional framework, and the implementation arrangement, to guide the resettlement and rehabilitation of the people that will be adversely affected by the proposed project. The underlying principle is to ensure that all persons affected by the project will be compensated and rehabilitated to improve, or at least maintain, their living conditions and income earning capacity at the pre-project level and will share in project benefits.

6. The principles, legal and institutional framework and implementation procedures will be applied throughout the project. In addition inventories of affected families and their losses will be produced for all subprojects. For subprojects in which at least 25 project affected families will lose houses or more than 20% of their land, RAP-I will be supplemented by detailed documentation of implementation arrangements in an operational Resettlement Action Plan - Part Two (RAP-II).

7. RAP-II, including a socio-economic survey based on a 20% sample of the total number of PAFs, have only been prepared for the two subprojects (Thach Nham and HMNBC) which are known to involve substantial resettlement. Based on the detailed design, it will be determined if more subprojects require the preparation of a RAP-II. In any event, inventories of affected families and lost assets will be carried out in all subprojects.

Resettlement Principles

8. All subprojects will follow the same resettlement and land compensation principles which are listed below:

a. The people (Project Affected Families, PAFs) will be compensated and rehabilitated so as to improve their standard of living or at least maintain their current standards at pre-project level, and to share in the project benefits.

b. The means of resettlement and rehabilitation are: compensation at full replacement cost, land for land of equal productive capacity, replacement of premise land, transfer allowances and transition subsidies, and income restoration, such as vocational training and other assistance for self employment.

c. Both resettlement and land acquisition must be minimized as much as possible.

d. Resettlement distances must be minimized and replacement land should be as close as possible to the land that was lost.

e. The resettlement transition period must be minimized and cash compensation and/or land for land should be provided to the PAF before

the beginning of construction activities, and no later than six month prior to construction.

f. All affected people residing or cultivating land within the subproject boundaries before the cut-off date for PAF identification are entitled to compensation for their losses and/or income rehabilitation. Lack of land use right certificate will not bar the PAF from compensation and/or income restoration.

g. Resettlement and land acquisition plans should have popular acceptance and should be carried out following consultation with the affected population.

h. Resettlement and compensation programs must provide adequate institutional arrangements and funds to ensure effective and timely implementation and proper monitoring.

i. The previous level of community services and resources should be maintained or improved after resettlement.

Legal Framework

9. The overall legal framework for the RAP is provided by the Land Law of 1993 of the Government of Viet Nam. Article 27 states that "when the State recovers land,...,the land user shall be given compensation for the damages". Therefore any eligible (see 18. below) PAF will be entitled to compensation as provided for in RAP-I and in each of the detailed RAP-II.

10. Compensation for land and fixed assets (e.g. houses) is defined by the Government Decree No. 87-CP of the 17th of August 1994, which provides for land for land compensation, cash for land, when land is not available, at rates established by Government.

Eligibility for Compensation, Subsidies, and Income Restoration

11. The PAFs will be divided in four (4) entitlement categories based on the legality of their occupation of affected areas. The cut-off date for each subproject for purposes of entitlement will be the day of the completion of the respective census and inventory of PAFs.

a) Persons who, as of the cut-off date, have certificate of land use rights or of residence in the Commune, land-tax receipts, or any other written document related to land they occupy for economic or residential purposes, will be entitled to full compensation for all their assets affected by the project and other resettlement entitlement, including resettlement allowance during the transition period.

b) Persons who, as of the cut-off date, do not have documentary evidence of their possession of affected lands, but who can prove by any other means that they were occupying affected lands prior to the PAF identification cut-

off date, will be eligible to income rehabilitation corresponding to 60% of the value of the land occupied for economic or residential purposes. In addition, this category of PAFs will be entitled to rehabilitation assistance in kind (subsidy, training, support for self employment, etc.) and in cash (resettlement allowance during the transition period). These PAFs will be entitled to full compensation for losses of house and other structures.

c) Those who start using the affected land for economic or residential purposes, without land use certificate or other legal title after the cut-off date for PAFs identification of the respective subproject, will not be entitled to any compensation.

d) Persons who have leased land and/or rented houses are entitled to compensation in cash: lease holders for the market price of crop loss for the remaining period of the lease and capital investments made by them; and house tenants at the rate of cash equivalent to six months rent.

People's Participation in the Project

12. The affected populations will be publicly informed and consulted of the details of each subproject resettlement and land compensation. Cut-off dates for each subproject, entitlement, definition of eligibility, modes of compensation, complaints and grievances procedures will be made public by means of pamphlets distributed to each affected household in the subproject areas.

13. The actual compensation, representing the replacement value of houses and other fixed assets, will be determined through negotiations with the PAFs, within GOV prescribed rates.

14. For each PAF a protocol will be drawn up delineating the amount of cash compensation and/or the location, amount, and type of land and/or house to be given in substitution for holdings lost. This protocol will be signed both by the PAF and by the RAP management officials when agreement is reached.

Complaints and Grievances

15. Each subproject will provide appropriate mechanisms for addressing Complaints and Grievances. These mechanisms will follow a pattern as close as possible to the existing general practice in the subproject area on these matters, and will involve both administrative officers and representatives of the local communities affected by the project. Complaints and grievances related to any aspect of a subproject will be handled through negotiations aimed at achieving consensus.

Entitlement Policy

16. The following table provides an overview of the compensation and resettlement policy:

Table 2: Compensation and Resettlement Policy

Type of Loss	Entitled Unit	Entitlement
Less than 20% of total agricultural, cultivated land	Households, who can document land use before cut-off date	1) Land of equal or greater productive value, or cash at Government rates plus rehabilitation package, and 2) cash, representing the market price of standing crops and trees
More than 20% of total agricultural, cultivated land	Households, who can document land use before cut-off date	1) Land of equal or greater productive value, and 2) cash, representing the market price of standing crops and trees
More than 75% of total agricultural, cultivated land	Households, who can document land use before cut-off date	1) Land of equal or greater productive value for the land lost, or replacement land for the total holding, and 2) cash, representing the market price of standing crops and trees
Leased agricultural land	Households, who can document lease of the land at the time of the cut-off date.	1) Cash, representing the market price of crop loss for the remaining lease period, and 2) any capital investment made by them
Houses (homes), and residential land	Households, who can document residence before cut-off date	1) Residential land of equal or greater size, and 2) cash, representing the full replacement cost without depreciation, and 3) transition allowance and subsidy
Rented house	Household, occupying the house before the cut-off date	1) Cash, equivalent to six months rent, and 2) transition allowance, and 3) assistance in identifying alternative accommodation
Houses on unauthorized or other's land	Households, who have been residing on that land before cut-off date	1) Cash, 60% of the government prescribed rates, and 2) rehabilitation assistance, and 3) transition allowance and subsidy
Structures, such as barns, stables, ponds, tombs	Households, who have been erecting and/or using such structures prior to the cut-off date	Cash, representing the full replacement cost without depreciation

17. In cases where community infrastructure such as schools, factories, water sources, roads, sewage systems or electrical supply is lost, this will be replaced by GOV at no cost to the community.

Organizational Framework

18. The responsibility for implementing the principles and objectives of this RAP-I are as follows:

a) The Central Project Office (CPO) in the Ministry of Water Resources (MWR) has overall responsibility for resettlement and land acquisition within the project. The CPO will guide, supervise and report on progress in the subprojects, and will handle resettlement issues requiring actions and coordination at the central government level. The CPO has overall control and management of the project resettlement budget;

b) The Subproject Implementation Office (SIO) appointed by the MWR to each subproject will monitor and supervise the implementation of resettlement and land acquisition programs. The SIO will work in close collaboration with the local authorities involved in implementation of resettlement and land compensation. Its functions includes: planning, coordination of implementation, and financial control; information exchange and inter-agency liaison; internal inspection and monitoring.

c) Provincial, District, and Commune People's Committees will carry out the resettlement and land compensation within the areas of their responsibility under the supervision of the SIO. These entities will be in charge of organizing the various tasks implied by the resettlement and land compensation programs, including PAF identification and census, socio-economic surveys, provision of information to PAFs and administration of all compensation-related matters.

Implementation Schedule

19. In each subproject resettlement and land compensation schedules will be coordinated with construction schedules. Resettlement/land compensation programs will be completed before construction activities in a particular area will begin. By that time the new houses will be inhabitable and the agreed compensation has been delivered to the PAFs.

20. Since the building time for houses of the highest category is at least four months, foundation works for the new dwellings need to begin at least six months prior to start of project construction.

Supervision and Monitoring

21. All subprojects will to be regularly supervised and monitored by the CPO of the MWR. Internal monitoring will be carried out quarterly. An agency nominated by CPO will periodically carry out external monitoring and evaluation. Nomination of agencies for this task will be done in close consultation with International Development Agency (IDA) of the World Bank.

22. The external monitoring agency, will in addition to regular monitoring and evaluation studies, undertake a survey, during the first year of implementation, to assess the resettlement and rehabilitation of families already affected by project construction prior to approval of the project, in order to determine whether they have regained their livelihood, or whether additional measures needs to be taken for their rehabilitation.

Cost and Budget

23. The budget is presented below for each subproject, and consolidated for the project as a whole.

Viet Nam - Irrigation Rehabilitation Project: Resettlement
Budget for Land Acquisition, Resettlement and Rehabilitation

Subproject	Province	Area (ha) to be acquired	No. of Affected Families			Estimated Cost of Land, Resettlement and Rehabilitation						(US$)
			Will lose house	Will lose >20% land	Will lose less 20%	Land value 1)	Compensation		Allowance/ Subsidies	Equipment Information	Surveys, M&E	TOTAL
							houses 2)	Crops				
Cam Thuy	Thanh Hoa	20	3	0	35	2500	3200	20000	1000	5000	5000	36700
South Nghe An	Nghe An	40	0	0	150	400000	5000	15000	1500	5000	5000	431500
Linh Cam	Ha Tinh	15	0	0	3736	150000	0	45000	0	5000	5000	205000
An Trach	Da Nang	0	0	0	0	0	0	0	0	0	0	0
Thach Nham	Quang Ngai	295	45	1062	1114	2362000	73000	207000	20000	20000	20000	2702000
Dong Cam	Phu Yen	16	0	0	200	160000	5000	16000	1500	5000	5000	192500
Hoc Mon/N. Binh Chan	HCMC/LAP	196	130	201	1750	1850000	245500	245000	40000	60000	40000	2480500
Total		582	178	1263	6985	4924500	331700	548000	64000	100000	80000	6048200

1) Land value is only a cash transaction in HMNBC for 1750 households loosing less than 20% of their land. In all other situations the transaction is in kind.
2) Includes physical structures like tombs, barns and fishponds.

VIET NAM
Irrigation Rehabilitation Project
Project Components by Year – Base Costs
(US $ Million)

	Base Cost					
	1995	**1996**	**1997**	**1998**	**1999**	**Total**
SUBPROJECTS						
Cam Thuy	0.3	0.9	1.0	0.4	0.0	2.7
South Nghe An	1.5	5.9	6.3	4.2	0.8	18.6
Linh Cam	3.4	2.9	3.7	1.5	0.1	11.5
An Trach	1.3	2.5	0.5	0.1	0.0	4.4
Thach Nham	7.6	5.8	5.4	5.8	4.9	29.5
Dong Cam	1.2	4.0	4.3	0.6	0.1	10.2
Hoc Mon / North Binh Chanh	5.6	8.5	8.4	8.4	0.2	31.1
Subtotal SUBPROJECTS	20.9	30.4	29.7	21.0	6.1	108.1
CONSULTANTS						
Consultants	0.7	0.5	0.3	0.2	0.1	1.7
Central Project Office (CPO)	1.1	0.7	0.5	0.3	0.2	2.9
Subtotal CONSULTANTS	1.8	1.2	0.8	0.5	0.3	4.6
Total BASELINE COSTS	22.7	31.6	30.5	21.4	6.4	112.7
Physical Contingencies	3.2	4.8	4.7	3.2	0.9	16.8
Price Contingencies	0.3	1.2	2.0	2.0	0.8	6.2
Total PROJECT COSTS	26.1	37.6	37.2	26.6	8.1	135.7
Taxes	1.5	2.2	1.8	1.1	0.3	7.0
Foreign Exchange	11.2	22.5	22.0	15.3	4.0	75.1

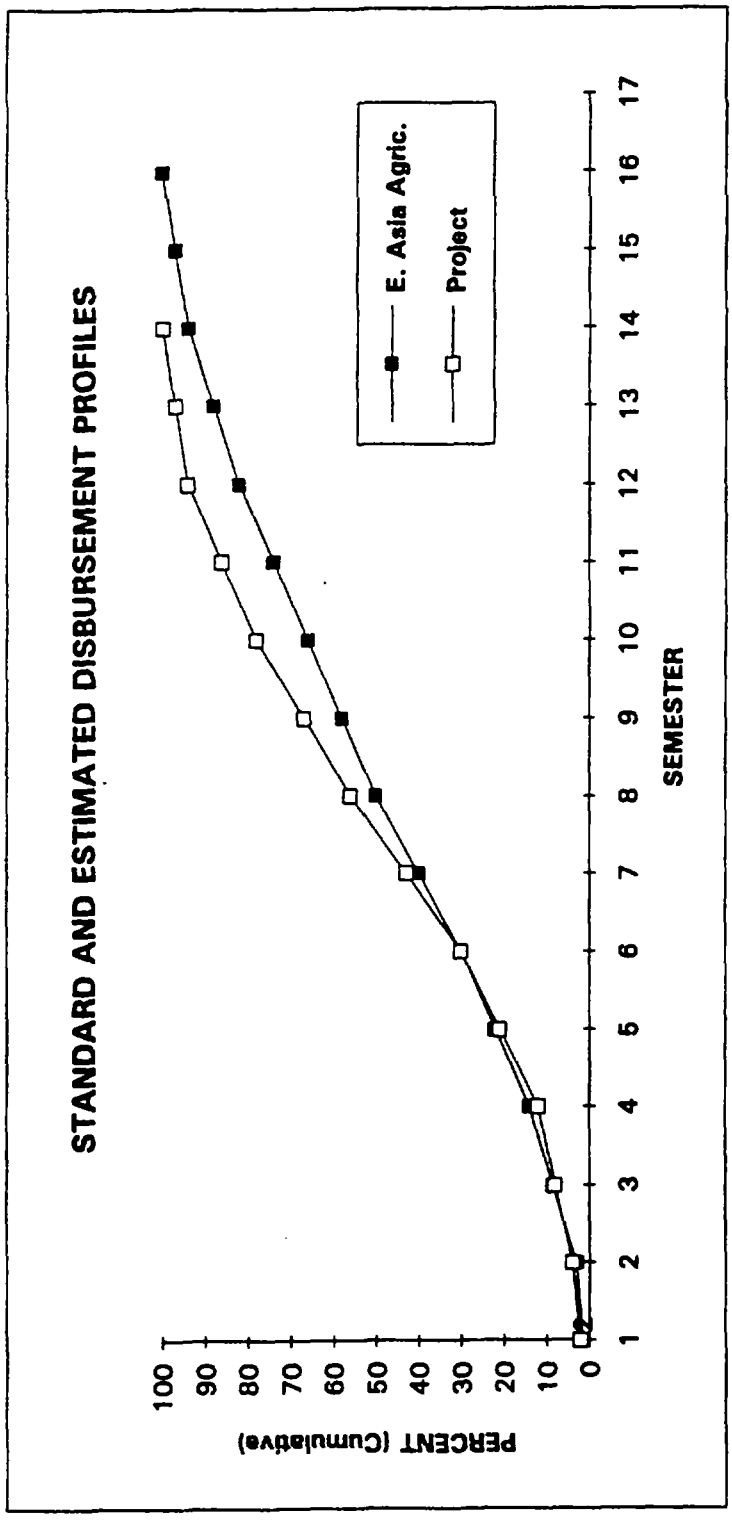
VIET NAM
Irrigation Rehabilitation Project
Expenditure Accounts by Years – Base Costs
(US $ Million)

	Base Cost						Foreign Exchange	
	1995	1996	1997	1998	1999	Total	%	Amount
Investment Costs								
CIVIL WORKS								
Headworks (dams, weirs, sluices)	1.5	7.0	5.0	2.9	0.1	16.5	65.3	10.8
Pumping stations	0.1	0.3	0.8	0.2	0.0	1.5	65.0	1.0
Canals > 150 ha	6.8	12.2	12.5	9.3	3.7	44.4	65.0	28.8
Canals < 150 ha earthwork	1.3	2.5	2.2	1.8	0.5	8.3	20.0	1.7
Canals < 150 ha structures	1.0	3.0	2.7	2.5	0.3	9.5	65.0	6.2
Drainage, dredging	-	0.6	1.6	0.9	-	3.1	65.0	2.0
Roads	0.8	0.6	0.9	0.1	0.0	2.4	35.0	0.8
Buildings	0.2	0.0	0.1	0.3	-	0.6	20.0	0.1
On-farm development	-	0.4	0.7	0.9	0.7	2.8	5.0	0.1
Subtotal CIVIL WORKS	11.6	26.7	26.6	18.9	5.4	89.1	57.9	51.6
RESETTLEMENT/COMPENSATION								
Land Value	5.1	-	-	-	-	5.1	-	-
Compensation	0.9	-	-	-	-	0.9	-	-
Allowances	0.1	-	-	-	-	0.1	-	-
Equipment/Info	0.1	-	-	-	-	0.1	50.0	0.1
Surveys, M&E	0.2	-	-	-	-	0.2	35.0	0.1
Subtotal RESETTLEMENT/COMPENSATION	6.4	-	-	-	-	6.4	2.0	0.1
ENVIRONMENTAL MITIGATION	0.1	0.1	0.1	0.0	-	0.4	35.0	0.1
EQUIPMENT								
Headworks	-	0.5	-	-	-	0.5	90.0	0.4
Pumps & Motors	1.0	0.3	0.6	0.2	0.0	2.1	90.0	1.9
Transformers	0.0	0.3	0.2	0.1	0.0	0.6	90.0	0.5
Transmission Lines	0.0	0.3	0.3	0.2	0.0	0.9	65.0	0.6
O & M vehicles	0.5	0.7	0.4	0.1	-	1.6	30.0	0.5
O & M equipment	0.1	0.1	0.3	0.7	-	1.3	90.0	1.1
Construction, supervision vehicles	0.7	0.4	-	-	-	1.1	30.0	0.3
Construction superv equipmt	0.1	0.0	0.0	0.0	0.0	0.2	90.0	0.2
Project Management Equipment	0.0	0.0	-	-	-	0.0	90.0	0.0
Agric. support equipment	-	0.1	0.3	0.2	-	0.5	90.0	0.5
Telecommunications	0.2	0.3	0.2	-	-	0.6	90.0	0.6
Subtotal EQUIPMENT	2.7	3.0	2.3	1.4	0.0	9.4	70.4	6.6
CONSULTANTS								
International Experts	1.1	1.0	0.6	0.3	0.1	3.1	100.0	3.1
National Experts	0.1	0.1	0.1	0.1	0.0	0.3	25.0	0.1
Local travel expenses	0.1	0.1	0.1	0.0	0.0	0.3	85.0	0.3
Subtotal CONSULTANTS	1.2	1.1	0.8	0.4	0.2	3.7	93.4	3.4
TRAINING								
Staff Training	0.1	0.1	0.1	0.1	0.1	0.4	47.2	0.2
Training for Farmers	0.0	0.0	0.0	0.0	0.0	0.2	26.3	0.0
Materials for trials and demonstrations	-	0.0	0.0	0.0	0.0	0.2	50.0	0.1
Subtotal TRAINING	0.1	0.2	0.2	0.2	0.2	0.7	43.3	0.3
IMPLEMENTATION MANAGEMENT	0.1	-	-	-	-	0.1	85.0	0.0
ENGINEERING AND ADMINISTRATION	0.6	0.6	0.6	0.6	0.6	2.8	-	-
OFFICE COSTS	0.0	0.0	0.0	0.0	0.0	0.2	75.0	0.1
Total BASELINE COSTS	22.7	31.6	30.5	21.4	6.4	112.7	55.4	62.4
Physical Contingencies	3.2	4.8	4.7	3.2	0.9	16.8	54.6	9.2
Price Contingencies	0.3	1.2	2.0	2.0	0.8	6.2	56.8	3.5
Total PROJECT COSTS	26.1	37.6	37.2	26.6	8.1	135.7	55.3	75.1
Taxes	1.5	2.2	1.8	1.1	0.3	7.0	-	-
Foreign Exchange	11.2	22.5	22.0	15.3	4.0	75.1	-	-

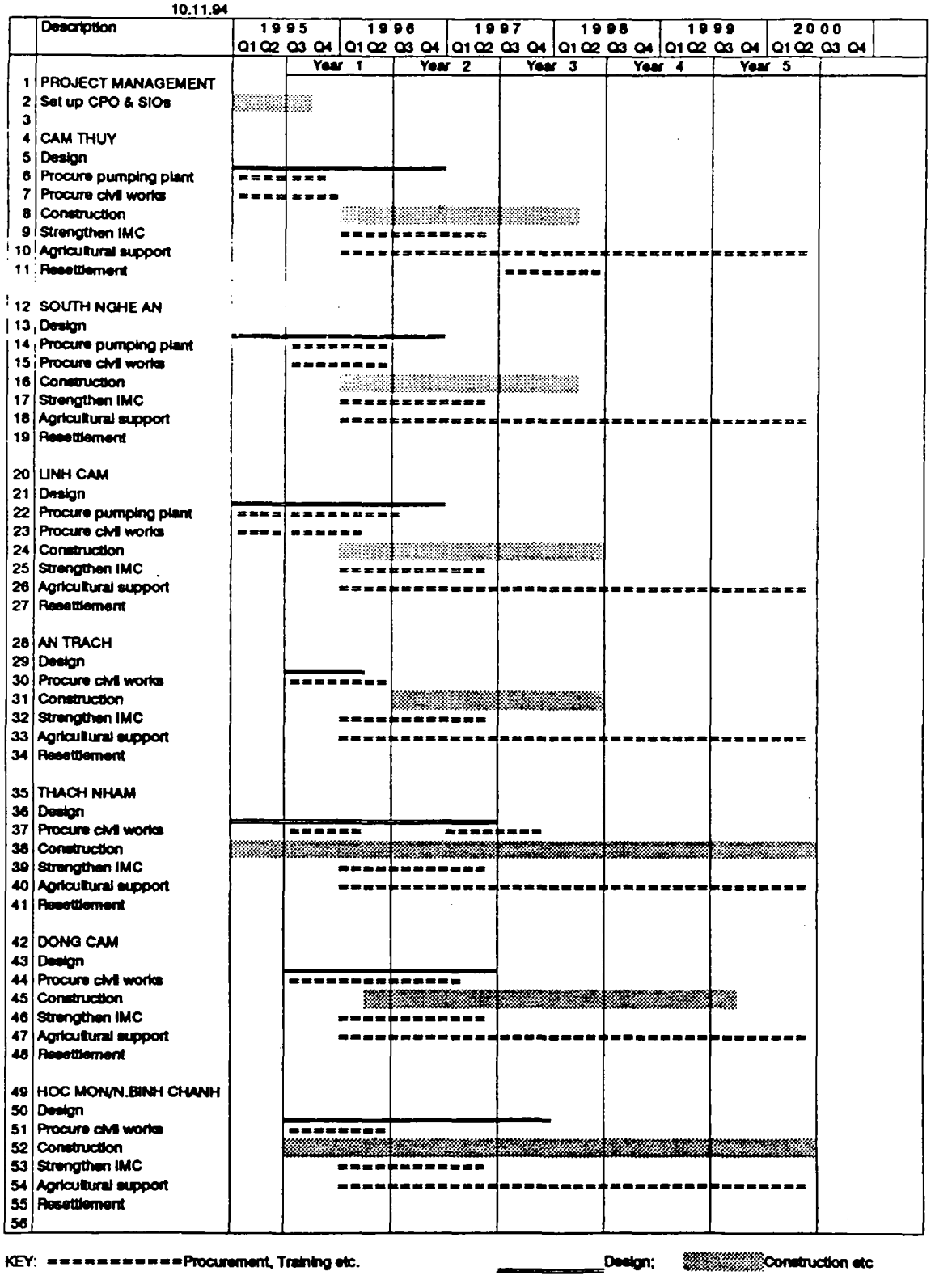
Vietnam Irrigation Rehabilitation Project
Agricultural Support

	Number	Unit Cost US$	Amount US$'000	Remarks
INVESTMENT COSTS				
Civil Works				
District extension centres, incl furniture	20	15000	300	300m2 x $50/m2
Equipment				
White boards	20	50	1	one per district extension centre
Photocopiers	20	3000	60	one per district extension centre
Amplifier/loudspeaker	20	2000	40	one per district extension centre
Camera	20	250	5	one per district extension centre
Overhead projector	20	750	15	one per district extension centre
Typewriter	20	250	5	one per district extension centre
Equip.,tools for trials & demos	20	1000	20	one per district extension centre
Subtotal			146	
Training				
Pre-season 5-day workshops	80	875	70	25 attenders/district x $7/manday x 4 years
Mid-year 2-day workshops	80	350	28	25 attenders/district x $7/manday x 4 years
Post-season 5-day workshops	80	875	70	25 attenders/district x $7/manday x 4 years
Farmer 1-day training seminars	1600	60	96	20 seminars/district x 30 attenders x $2/day x
Subtotal			264	
Technical assistance				
Irrigation extension adviser in CPO	3	15000	45	3 months @ $15000/month
RECURRENT COSTS				
O&M of equipment	4	7300	29.2	5% of investment cost/year x 4 years
Training & info material	80	500	40	$500/district/year
Verification trials	160	200	32	2 trials/district/year x 4 years
On-farm demo plots	5008	20	100.16	1 plot/500 families(=626 plots) x 2 trials/yr x 4
Subtotal			201.36	
TOTAL			956.36	

Subproject	Province	No. of Districts
Cam Thuy	Tanh Hoa	1
South Nghe An	Nghe An	3
Linh Cam	Ha Tinh	2
An Trach	QN Da Nang	3
Thach Nham	Quang Ngai	6
Dong Cam	Phu Yen	2
Hoc Mon/N.Binh Chanh	HCMC/Long An	3
Total		20

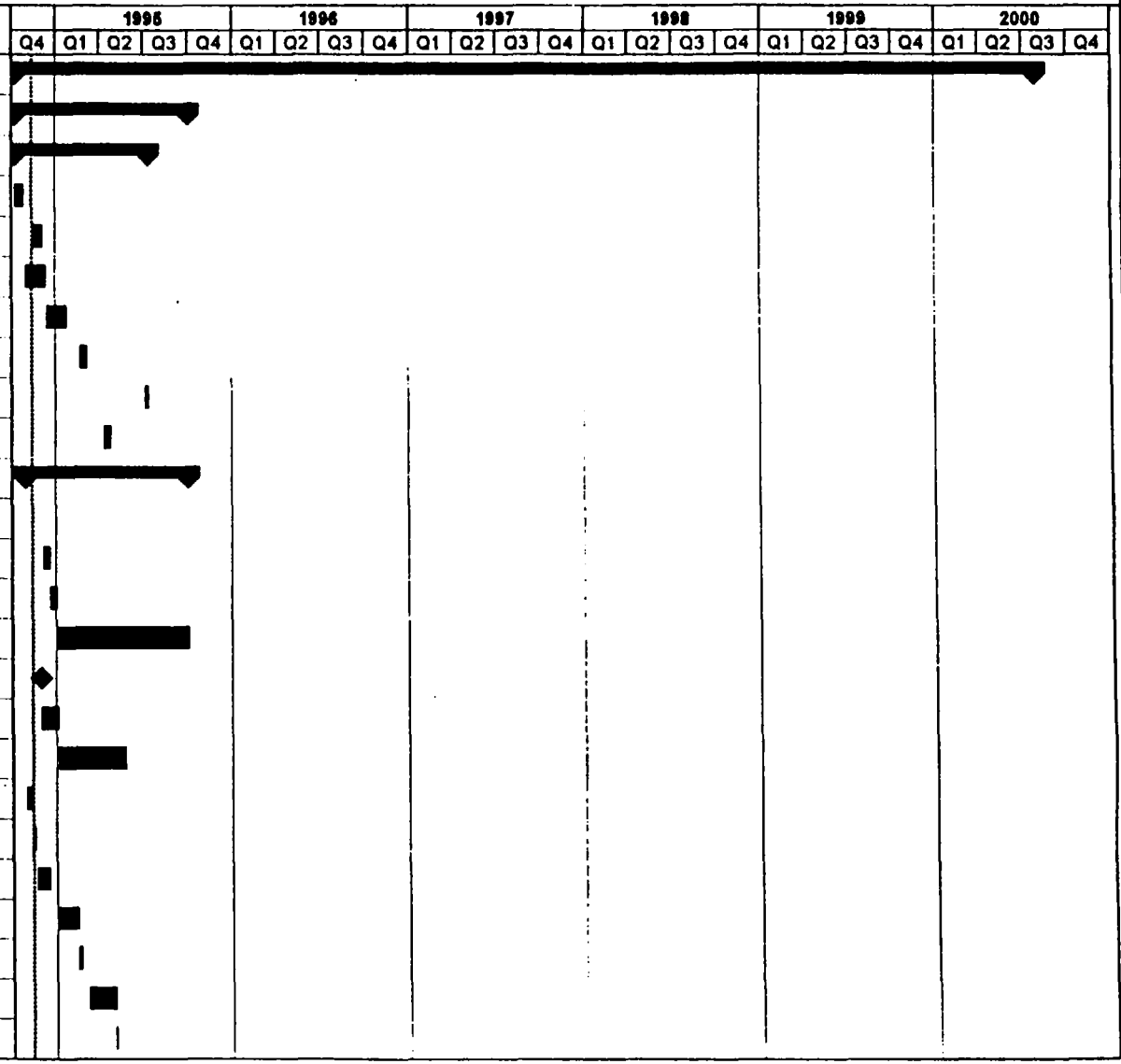

STANDARD AND ESTIMATED DISBURSEMENT PROFILES
E. Asia Agric.
Project
PERCENT (Cumulative)
0
10
20
30
40
50
60
70
80
90
100
SEMESTER
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

Vietnam
Irrigation Rehabilitation Project
Implementation Schedule



VIETNAM IRRIGATION REHABILITATION PROJECT Implementation Schedule a sample

ID	Name
1	VIETNAM IRRIGATION REHABILITATION PROJECT.
2	PREPARATION
3	IDA: Project Preparation
4	Appraisal Mission
5	Process Approval of PPF
6	SAR Preparation
7	YC SAR and MOP Review Process
8	Review of PQ documents
9	Review of PQ Report
10	Review of Standard Bidding Documents
11	MWR: Project Preparation
12	Submit Request for PPF
13	Selection of PPF Consultants
14	Mobilization of PPF Consultants
15	PPF consultants services
16	CIDA: Approve Consultancy Services
17	Mobilization of CIDA Consultants
18	CIDA Consultants' Services
19	Prepare GPN
20	Submit GPN to IDA
21	GPN Advertisement
22	Finalize Prequalification for ICB Works
23	Submit PQ to IDA
24	Prequalification: Advertisement
25	Submission of Applications

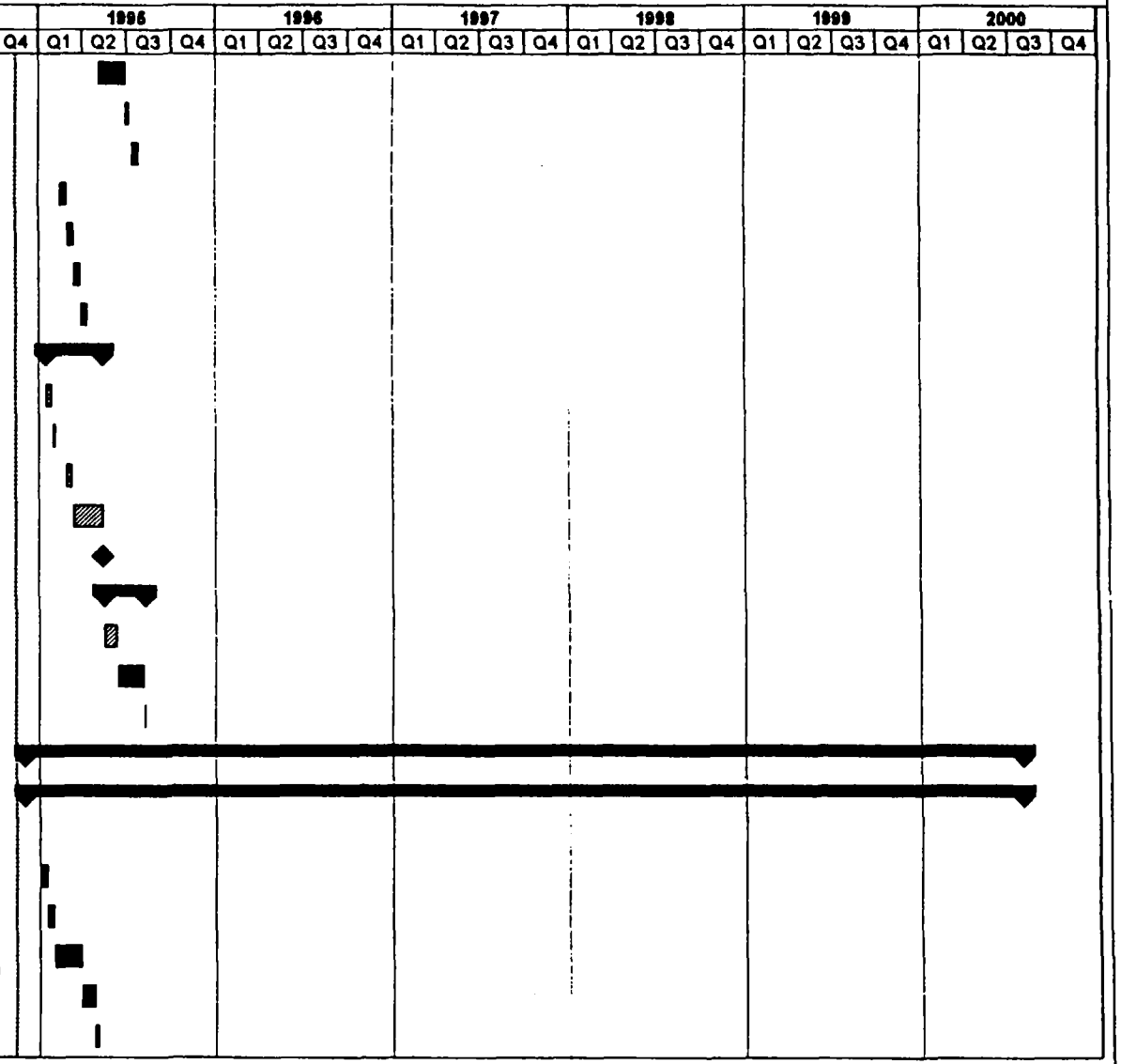


Project: Irrigation Rehabilitation Project
Date: 11/10/94

Critical
Noncritical
Progress
Milestone
Summary
Rolled Up

VIETNAM IRRIGATION REHABILITATION PROJECT Implementation Schedule : a sample

ID	Name
26	Review of Applications
27	Submit Prequalification Report to IDA
28	Notification of Prequalification
29	Preparation of Standard Bidding Documents f
30	Preparation of Standard Bidding Documents f
31	Preparation of Standard Bidding Documents f
32	Submit Standard Bidding Documents to IDA
33	NEGOTIATIONS & BOARD
34	Pre-negotations in Hanoi
35	Notice of Invitation for Negotations
36	Negotations
37	Green Cover and Legal Docs.
38	Board Presentation
39	SIGNING AND EFFECTIVENESS
40	Signing of Credit Agreement
41	Meet Conditions
42	Declare Effectiveness
43	EXECUTION AND SUPERVISION
44	Consultancy Services for Design and Supervision
45	MWR: Approval of TOR for Project Consultan
46	MWR: Draft Letter of Invitation and Prepare S
47	IDA: Review of LOI, TOR and Short List
48	Preparation of Proposals for Project Consultar
49	Evaluation of Proposals and Recommendation
50	IDA: Review Evaluation of Proposals



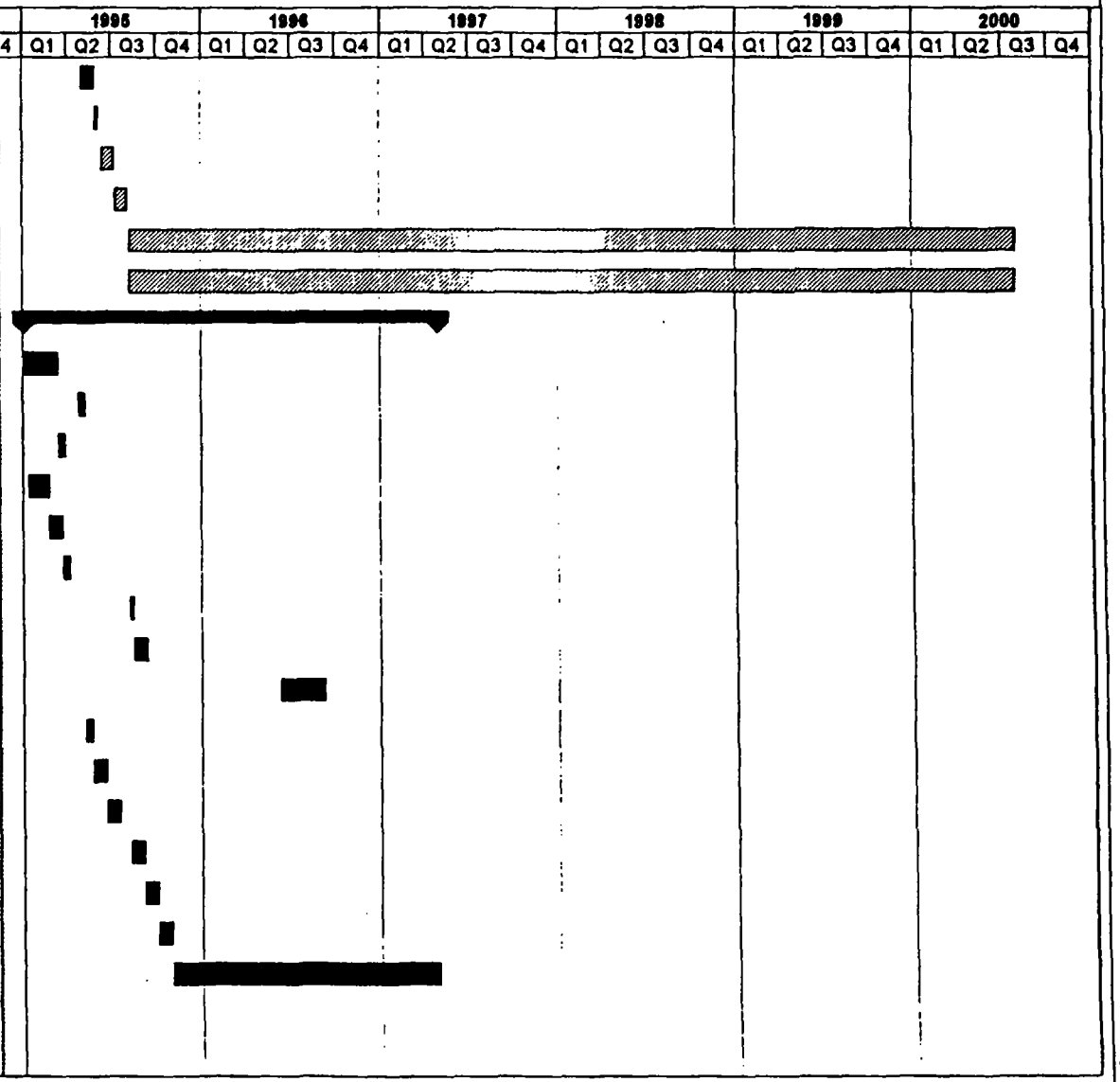
Project: Irrigation Rehabilitation Project
Date: 11/10/94

Critical
Noncritical
Progress
Milestone
Summary
Rolled Up

Page 2

VIETNAM IRRIGATION REHABILITATION PROJECT Implementation Schedule : a sample

ID	Name
51	Negotations of Conditions of Contract
52	IDA: Review of Draft Contract
53	Formaliztion of Contract for Consultancy Servi
54	Mobilization of Project Consultants
55	Consultants services CPO
56	Consultants services Constr s/v
57	Cam Thuy
58	Finalization of Designs
59	Finalization of ICB Docs. for Pumps and Lines
60	IDA review of Bidding Documents
61	Advertisement of ICB Pumps and Transmision
62	Bid Evaluation of ICB Pumps and Lines
63	IDA review of Bid Evaluation Report
64	Award of Pumps and Lines
65	Formalization of Contracts(s) for Pumps and I
66	Delivery of Pumps and Installation of Lines
67	Finalization of LCB Documents for Works
68	Advertisement of LCB Works
69	Bid Evaluation of LCB Works
70	Award of LCB Works
71	Formalization of Contract(s) for LCB Works
72	Mobilization of Contractor(s)
73	Execution of Works
74	
75	



Project: Irrigation Rehabilitation Project
Date: 11/10/94

Critical
Noncritical
Progress
Milestone
Summary
Rolled Up

Page 3

ANNEX 15
Page 1 of 1

SUPERVISION PLAN (based on May 1995 Board Date)

Approximate Date	Activity	Duration Weeks	Skill Requirement	Staff Weeks
Jul.1995	PLW/SPN	2	TM, IE, PS, RR	10
Oct. 1995	AR	2	TM,IE,AG	6
Apr. 1996	SPN	2	TM,IE	4
Oct. 1996	AR	2	TM,IE	4
Apr. 1997	SPN	2	TM,IE	4
Oct. 1997	MTR	2	TM,IE,RR,EC,AG,	10
Apr. 1998	SPN	2	TM,IE	4
Oct. 1998	AR	2	TM,IE	4
Apr. 1999	SPN	2	TM,IE	4
Oct. 1999	AR	2	TM,IE	4
Apr. 2000	PCM	2	IE,EC,AG,	6

Required Skills		Activity	
TM	Task Manager	PLW	Project Launch Workshop
IE	Irrigation Engineer	SPN	Supervision
PS	Procurement Specialist	AR	Annual review
RR	Resettlement Specialist	MTR	Mid-Term review
EC	Economist	PCM	Project Completion Mission
AG	Agriculturalist		

DOCUMENTS AVAILABLE IN THE PROJECT FILE

1. Irrigation Subsector Project Preparation Report; FAO/World Bank Cooperative Program No. 118/93 CP-VIE.10 dated August 6, 1993.

2. Irrigation subsector Project Working Papers 1 to 5; FAO/World Bank Cooperative Program No. 1/94 CP-VIE 12 WPs dated January 5, 1994.

3. Irrigation Rehabilitation Project; Implementation Plans. VIHID, World Bank, Ministry of Water Resources, Northwest Hydraulic Consultants Ltd.

4. a. Cam Thuy Subproject
   b. Linh Cam Subproject
   c. Thach Nham Subproject
   d. Dong Cam Subproject

5. Hoc Mon - North Binh Chanh Irrigation Project Preparation; Implementation Plan. MWR, IBRD, ELC Electroconsult, Hydraulic Survey & Design Company No. 2, dated June 1994.

6. Minutes of Dam Safety Inspections. ELC Electroconsult. June 1994.

7. Thung Bang Dam and Reservoir. Report of the result of a Safety Inspection. ELC Electroconsult. June 1994.

8. Dau Tieng Dam and Reservoir. Report of the Result of a Safety Inspection. ELC Electroconsult, 1994.

9. Environmental Impact Assessment

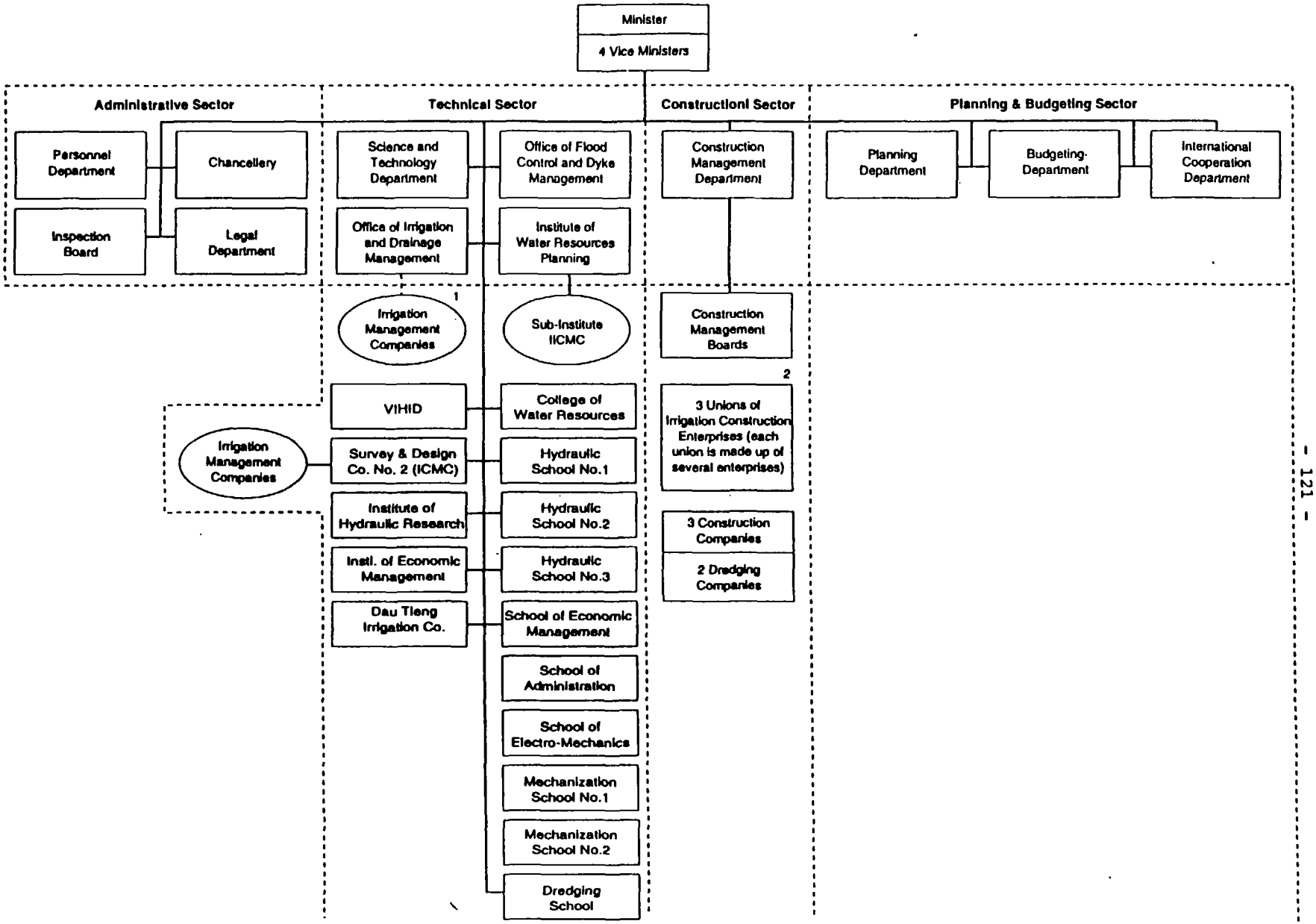
10. Detailed cost tables

11. Procurement schedules.

12. Economic Analysis Tables.

Chart 1

Organization of the Ministry of Water Resources



Source: Interviews with concerned departments in the MWR. Changes from the structure presented in Irrigation Rehabilitation Project SAR (May 1994) are effective July 1994. This draft should be verified with the officials at the MWR.

[1] Most Irrigation Management ?Companies operate under the Provincial People's Committees. However, IMCs which manage large projects are under the Office of Irrigation and Drainage Management, MWR.

[2] Division of authority between the Central and Provincial bodies should be clarified with the Vietnamese authorities concerned.

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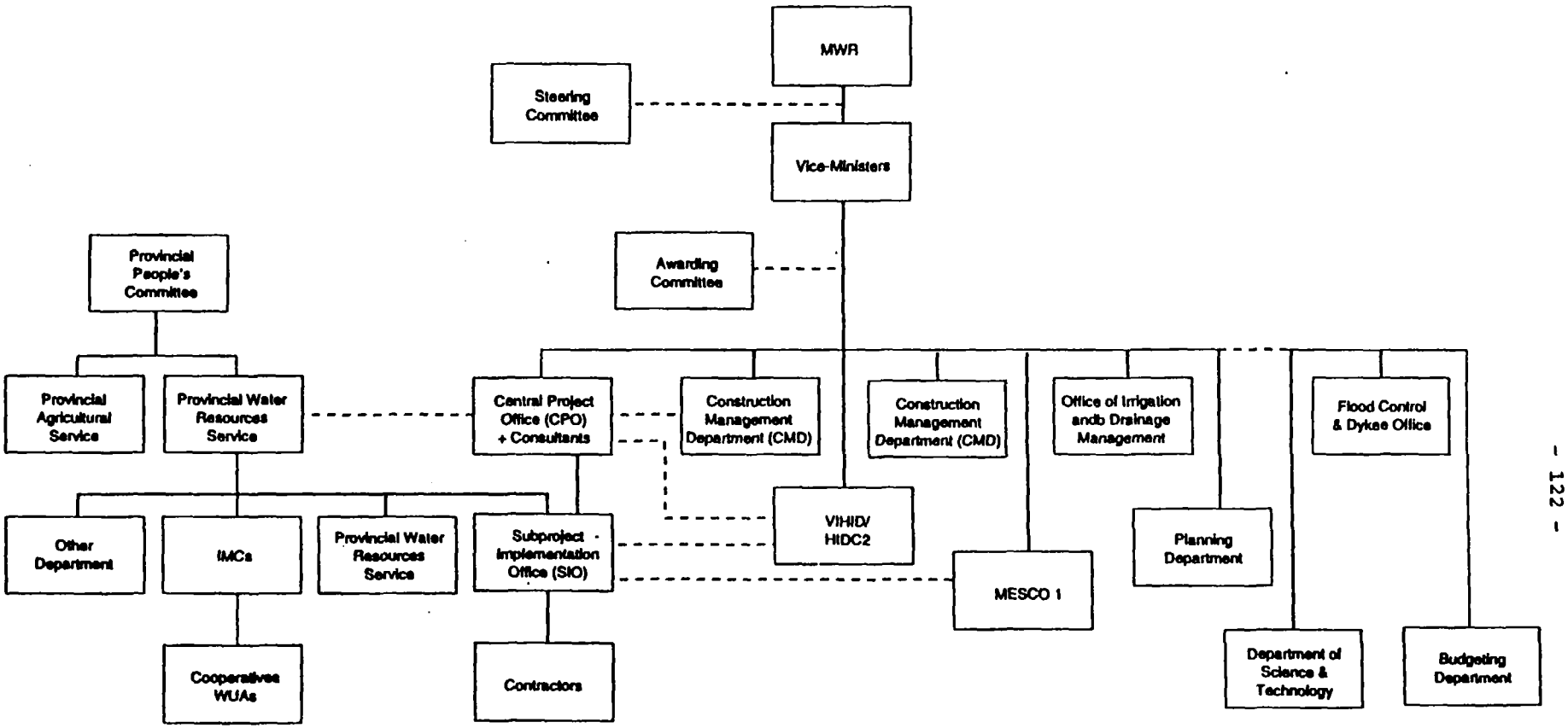
Chart 2
Vietnam Irrigation Rehabilitation Project
Project Organization for a Typical Subproject



MAP SECTION

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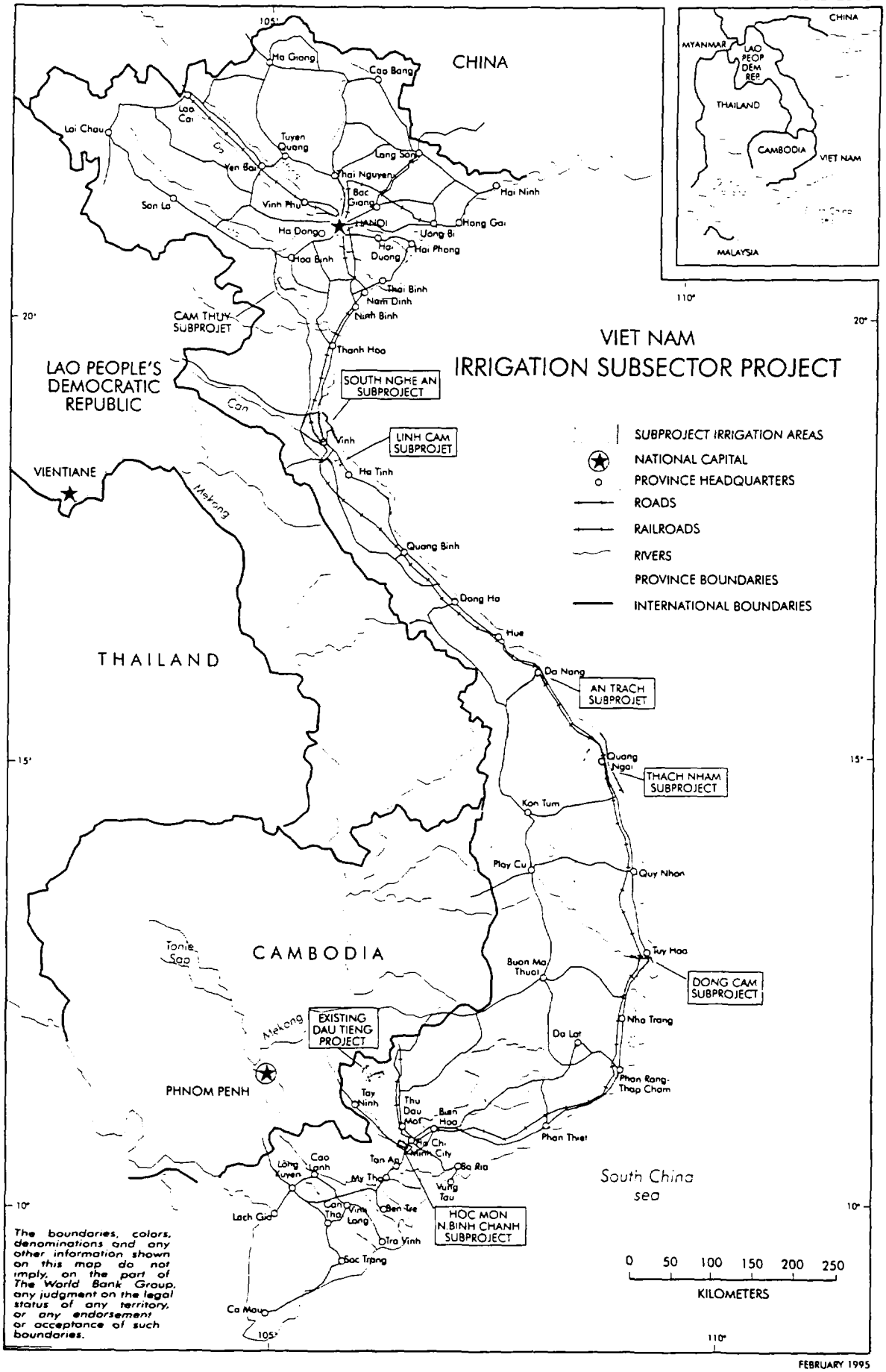

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FEBRUARY 1995