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APPRAISAL OF THE

MAHAWELI GANGA PROJECT, STAGE II, PART I

SRI LANKA

December 12, 1975

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CURRENCY EQUIVALENTS

The Sri Lanka Rupee is officially pegged to the Pound Sterling at a parity rate of £ 1 = Rs 15.60. The Pound floats relative to the US Dollar and consequently the Rupee, US Dollar rate is subject to change. The rate below has been used throughout this report, except where stated to the contrary. 1/

US$1	=	Rs 7.5
Rs 1	=	US$0.133
Rs 1 million	=	US$133,333

WEIGHTS AND MEASURES

1 long ton = 2,240 lb	=	1.016 metric tons
1 hundredweight (cwt) = 50.8 kg	=	112 lb
1 bushel (bu) of paddy	=	45 lb
1 pint	=	0.57 liters
1 acre (ac)	=	0.405 hectare (ha)
1 ac ft	=	1,233 cubic meters
1 million ac-ft (MAF)	=	1,233 million cubic meters
1 mile (mi)	=	1.609 kilometers (km)
1 square mile (sq mi)	=	640 ac (259 ha)
1 foot (ft)	=	30.5 centimeters (cm)

1/ Through the sale and purchase of Foreign Exchange Entitlement Certificates (FEECs), Sri Lanka effectively practices a dual exchange rate. Most non-foodgrain imports have to pay a surcharge of 65% through the purchase of FEECs. Most non-traditional exports receive a 65% premium over the official rate through the sale of FEECs.

PRINCIPAL ABBREVIATIONS AND ACRONYMS USED

ADB	-	Asian Development Bank
AI	-	Agricultural Instructor
AO	-	Agricultural Officer
APC	-	Agricultural Productivity Committee
BG	-	Batalagoda (a new improved HYV)
CAD	-	Command Area Development
CC	-	Cultivation Committee
CFC	-	Ceylon Fertilizer Corporation
CP	-	Cooperative Program
DA	-	Department of Agriculture
DAEO	-	District Agricultural Extension Officer
DDA	-	Deputy Director of Agriculture
DME	-	Department of Machinery and Equipment
DRI	-	Director Rural Institutions
FAO	-	Foreign Agricultural Organization
FEEC	-	Foreign Exchange Entitlement Certificate
GA	-	Government Agent
GDP	-	Gross Domestic Product
GNP	-	Gross National Product
GOSL	-	Government of Sri Lanka
ICB	-	International Competitive Bidding
ID	-	Irrigation Department
IRRI	-	International Rice Research Institute
KVS	-	Village level worker (Krushikarma Viyaptha Sevaka)
LHG	-	Low Humic Gley Soils
M	-	Million
MAL	-	Ministry of Agriculture and Lands
MDB	-	Mahaweli Development Board
MIPH	-	Ministry of Irrigation, Power and Highways
MPC	-	Multi-Purpose Cooperatives
MPCS	-	Multi-Purpose Cooperative Societies
MW	-	Megawatt
O & M	-	Operation and Maintenance
PMB	-	Paddy Marketing Board
RBE	-	Reddish Brown Earth
RVDB	-	River Valley Development Board
SAI	-	Senior Agricultural Instructor
SDCC	-	State Development and Construction Corporation
SLTC	-	Sri Lanka Tractor Corporation
SMS	-	Subject Matter Specialist
TCEO	-	Territorial Civil Engineering Organization
USBR	-	United States Bureau of Reclamation

GLOSSARY

chena	-	slash and burn or "shifting" agriculture
dhal	-	pulse crop (pigeon peas)
District	-	The first subdivision in the country for Government administrative purposes. There are 22 Districts.
ganga	-	major river
jaggery	-	unrefined sugar
maha	-	northeast monsoon season (October to January)
mammotie	-	hoe -- an implement with a thin blade on a long handle used for cultivating, weeding, or loosening the earth around plants
manioc	-	cassava - the plant from which tapioca is made
oya	-	minor river
paddy	-	the unhusked grain, obtained after the threshing of the rice crop or the actual rice (Oryza sativa) crop itself.
rice	-	the husked rice, ready for cooking (also referred to as "milled rice").
wewa	-	tank
yala	-	southwest monsoon season (April to July)
kurakkan	-	finger millet

FISCAL YEAR

January 1 - December 31

SRI LANKA

APPRAISAL OF THE MAHAWELI GANGA PROJECT, STAGE II, PART I

TABLE OF CONTENTS

Page No.

SUMMARY AND CONCLUSIONS .....

I. INTRODUCTION .....

II. BACKGROUND .....

General .....
The Economy .....
The Agricultural Sector .....
Irrigation .....
Mahaweli Ganga Development .....
Project Formulation .....

III. THE PROJECT AREAS .....

General .....
Climate .....
Topography and Soils .....
Population, Farm Size and Land Tenure .....
Agricultural Production .....
Agricultural Supporting Services .....

IV. THE PROJECT .....

General .....
Project Components .....
Water Supply, Demand and Quality .....
Implementation Schedule .....
Cost Estimates .....
Financing .....
Procurement .....
Disbursements .....
Accounts and Audit .....
Environmental Effects of the Project .....

This report is based on the findings of an appraisal mission including: Messrs. R. Morton; M. Fireman; P. Garg; J. Karl Lee, and A. Seager (IDA), and R. Shukle, Z. Matmor, and D. Benor (Consultants) who visited the project area in April and May, 1975. During part of the time, persons representing prospective donor nations accompanied the mission. They were: Messrs. R. Bailey (Canada); W. Franklin (UK); R. Glazner (Netherlands), and J. Coles, R. Perry and J. Watson (USA).

Page No.

V. ORGANIZATION AND MANAGEMENT .....

Project Implementation .....
Technical Assistance .....
Operation and Maintenance .....
Monitoring Project Performance .....

VI. PRODUCTION, MARKETING, PRICES AND FARM INCOMES .....

Production .....
Market Prospects .....
Prices .....
Farm Incomes .....
Cost Recovery .....

VII. BENEFITS AND JUSTIFICATION .....

VIII. RECOMMENDATIONS .....

ANNEXES

1. Climatic Data

2. Topography and Soils

3. Cultivation Practices, Cropping Patterns and Yields

4. Agricultural Supporting Services

5. Civil Works

6. Equipment List

7. Land Allocation, Settler Selection and Community Development

8. Water Supply, Demand and Quality

9. Implementation Schedule

10. Cost Estimates

11. Schedule of Expenditure, Proposed Credit Allocation and Schedule of Disbursements

12. Operation and Maintenance

13. Prices for Economic and Financial Analysis

14. Crop Inputs and Farm Budgets

15. Economic Analysis

MAPS

11751 - Project Location

11908 - Sub-Service Areas

SRI LANKA

APPRAISAL OF THE MAHAWELI GANGA PROJECT STAGE II, PART I

SUMMARY AND CONCLUSIONS

i. Agriculture dominates the economy of Sri Lanka. It accounts for about one-third of the GNP, more than one-half of all employment, about four-fifths of export earnings and much of the Government revenues. However, Sri Lanka imports about 40% of its foodgrain requirements. Historically, the country has depended upon the export earnings from tree crops -- tea, rubber and coconuts -- to provide for the import of foodgrains and other goods. The worsening terms of trade, particularly during the last few years, have prompted a reexamination of the past strategy. Increased food self-sufficiency is a major objective of the Government's current agricultural policies. Better utilization of existing irrigation facilities and the development of new irrigation potential are the two most important elements in the Government's strategy for increasing increased self-sufficiency.

ii. The Mahaweli Ganga is the largest river in Sri Lanka and drains an area of about 4,000 sq mi. It is the principal source of water available for diversion to the dry zone. During 1965-68, UNDP/FAO undertook a thorough study of the development potential and formulated a Master Plan, to be implemented in three phases over a 30 year period, for 900,000 ac of irrigation and 970 MW of hydropower. The first phase of the Plan envisaged benefiting 231,000 ac -- 127,000 ac of existing irrigated land and 104,000 ac of new land. In addition, it provided for a 40 MW of hydropower generating capacity. Implementation of Stage I of the first phase, comprising the major works for the whole phase, and improvement of water supply to 127,000 ac of existing irrigated land, started, with Bank Group assistance, in 1972 and is expected to be completed by 1976. The proposed project would cover part of the areas to be developed in Stage II.

iii. The project would cover two non-contiguous areas with a total irrigable area of 26,000 ac. The project would include: (a) clearing the jungle into levelled fields and settling some 10,000 families on them; (b) constructing the irrigation, drainage, and road network and rehabilitating the existing irrigation infra-structure for integration into the new

system; (c) providing the social infra-structure for the new communities; and (d) providing the necessary agricultural supporting services to complement the investments in physical facilities.

iv. Total project costs are estimated at US$82.0 million equivalent, including about US$21.0 million in import taxes and duties. The foreign exchange component is estimated at US$23.4 million or about 38% of the total net of taxes and duties. The major elements in the cost estimates are: civil works (US$26.3 M); construction equipment and vehicles (US$14.0 M); agricultural equipment and vehicles (US$4.8 M); technical assistance (US$0.5 M) and engineering and administration (US$3.9 M) -- making the base project cost US$60.0 M. Physical contingencies of US$5.3 M and price contingencies (US$16.7 M) raise the total project cost to US$82.0 M.

v. Project implementation would take four years. The Mahaweli Development Board, an autonomous agency, under the Ministry of Irrigation, Power and Highways would be responsible for implementation, and initial operation and maintenance of the civil works proposed under the project. The Department of Agriculture in the Ministry of Agriculture and Lands would be responsible for the reorganization and strengthening of the extension service. The Sri Lanka Tractor Corporation would be responsible for the procurement and distribution of farm equipment to the project area farmers. Provision of social infra-structure would be the responsibility of the concerned ministries and agencies of the GOSL. A Project Co-ordination Committee would be established to provide inter-agency co-ordination. The committee would be chaired by the Director, External Resources Division (Ministry of Planning and Economic Affairs) and would include heads of the various participating agencies.

vi. Equipment, vehicles and office supplies would be procured through international competitive bidding in accordance with IDA guidelines. Civil

works, proposed under the project, would be simple, labor intensive, individually small, scattered over large areas and restricted to seasonal construction. They would be unsuitable for international competitive bidding and would be carried out instead on the basis of local competitive bidding or through unit cost contracts to local farmers.

vii. At full development by 1986, annual foodgrain production in the project areas as a result of the project is expected to reach 37,900 tons compared to the current 3,000 tons and a projected 6,500 tons under "without project" conditions. The project related increase of 31,400 tons would represent an annual net foreign exchange savings of about US$5.5 million.

viii. The project would directly benefit some 10,000 families who, at present, are landless or practice subsistence agriculture on small holdings. Their present income levels are substantially below the national average; at full development, the project would raise their incomes to the national level. The civil works and village infra-structural works proposed under the project would provide a total of 10 M man-days of employment during implementation. The increased cropped area and the more intensive cultivation envisaged under the project would generate an annual employment of 1.6 M man-days in on-farm works. Also, there would be a substantial increase in secondary employment in activities such as marketing, processing, and supply of farm inputs. The increased employment would help to relieve somewhat the large unemployment and underemployment prevailing in and around the project areas.

ix. At the projected 1985 world market prices, the project's economic rate of return would be 13%. Sensitivity tests indicate that except for a combination of highly unlikely adverse assumptions, the project remains economically viable.

x. Subject to appropriate assurances to be obtained from the Government, the proposed project is suitable for an IDA/co-financing countries credit of US$30 million. The credit would cover all foreign exchange costs and some local currency costs, or about 49% of the total project costs net of taxes and duties. The Borrower would be the Republic of Sri Lanka.

SRI LANKA

APPRAISAL OF THE MAHAWELI GANGA PROJECT, STAGE II, PART I

I. INTRODUCTION

1.01 The Government of Sri Lanka (GOSL) has requested IDA assistance in financing part of the Stage II works under the Mahaweli Ganga Project. Stage I of the project, supported by the Bank Group through Credit 174-CE (US$14.5 M) and Loan 653-CE (US$14.5 M) is expected to be completed in 1976. It includes works that would divert Mahaweli Ganga water in order to improve the water supply to 127,000 ac of existing irrigated land, and to provide irrigation to 104,000 ac of new land in north central Sri Lanka. 1/ The second stage of the project involves the development of 71,000 ac of new land to use, partially, the additional irrigation potential created by Stage I. The proposed project would cover 26,000 ac of the areas earmarked for Stage II development.

1.02 Since the beginning of its operation in Sri Lanka in 1954, the Bank Group has made seven loans and extended eight credits, totalling US$127.6 M. This would be the Bank Group's fifth project in support of the country's efforts in water resources development. In addition to supporting the Mahaweli Ganga, Stage I project, the Bank Group has been involved in a Lift Irrigation Project (Credit 121-CE) and a Drainage and Reclamation Project (Credit 168-CE). A Tank Irrigation Modernization Project, prepared and appraised concurrently with this project, is now being processed.

1.03 The feasibility study for Stage II, provided for under the Loan/Credit Agreements for Stage I, was prepared by the consulting firm SOGREAH of France. In addition, an FAO/IBRD Cooperative Program (CP) mission visited Sri Lanka in early 1975 to prepare this project. The findings and recommendations of the CP mission are presented in Report No. 17/75 CEY. 7 dated April 25, 1975. The project was apparaised in April/May, 1975 by a Bank Group mission comprising Messrs. R. Morton, M. Fireman, P. Garg, J.K. Lee, and A. Seager (IDA) and R. Shukle, Z. Matmor and D. Benor (Consultants).

1/ In addition it includes the installation of a 40 MW hydropower plant and on-farm rehabilitation and development of 4,000 ac of land under sugarcane cultivation.

The mission was accompanied by representatives of four prospective co-financing countries: Messrs. R. Bailey (Canada); R. Glazner (The Netherlands); W. Franklin (UK), and J. Coles, R. Perry and J. Watson (USA). This report, based on the findings and recommendations of the appraisal mission, was prepared by Messrs. J.K. Lee and P. Garg.

II. BACKGROUND

General

2.01 The Republic of Sri Lanka is a tropical island in the Indian Ocean with an estimated current population of about 13.5 million, 80% of which is rural. Of the total land area of 16.2 million ac (about 25,300 sq mi), about 5 million ac are used for agriculture, 9.3 million ac are under forests, and the remaining 1.9 million ac are water bodies, urban areas or under other uses. About half of the forest land is potentially suitable for agricultural development.

2.02 The island's climate is characterized by nearly constant temperatures but with large variations in rainfall. Based on precipitation, the island can be divided into two distinct zones: the wet zone (average annual rainfall over 75 inches), situated in the southwest quadrant and covering about 30% of the land area, and the dry zone (average annual rainfall 35 to 75 inches) covering the remainder of the island. The wet zone supports more than three-quarters of the total population and accounts for about 70% of the cultivated land.

The Economy

2.03 Per capita income levels (US$110 in 1973) are low. Since 1970, growth in national income has averaged 2.5% a year, only slightly higher than the population growth rate of 2%. A large part of the labor force, perhaps about one quarter, is unemployed or underemployed, and indications are that the employment situation has been worsening for some years. During

the last few years, Sri Lanka has been severely affected by rapid deterioration in its terms of trade -- prices of its major imports, foodgrains, fertilizers and petroleum products have shot up, while price increases for its main exports tea, coconuts and rubber have been relatively moderate.

2.04 Past Government programs have emphasized social welfare and equitable income distribution. On the positive side, this has meant an increasingly egalitarian income distribution, a rather well-developed system of health care and other public services, a high literacy rate, and an absence of the extreme poverty. These developments, however, have not been accompanied by a satisfactory growth in output, mainly because of inadequate investment in productive sectors. Much of the capital stock of the economy is obsolete and requires replacement and modernization. The country faces a severe foreign exchange gap, and the budgetary resources of the Government are barely adequate to cover its current expenditure, leaving most capital formation to the vagaries of external assistance. The Government is aware of the problems confronting the economy and has been gradually shifting the emphasis towards production oriented investments, particularly those for increasing food production.

The Agricultural Sector 1/

2.05 Agriculture contributes about one-third of the gross national product (GNP), more than one-half of all employment, over four-fifths of export earnings and much of the Government revenues. Dominance of the sector gives it a pivotal role in influencing the economic activity and the course of development in the country.

2.06 Sri Lanka's climate is suitable for year-round crop production. The major constraint is water; in the wet zone there is sometimes too much while in the dry zone there is often too little. The variations in precipitation and elevation make it possible to grow a wide range of crops including

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1/ A detailed analysis of the various constraints to agricultural development in Sri Lanka is given in the Bank Group Report No. 579-a-CE. Republic of Sri Lanka, Agricultural Policy and Program Review, dated February 19, 1975.

tea, rubber, coconuts, paddy, manioc, chillies, maize, potatoes and millets. About half of the total cultivated area of 5.0 million ac is under tree crops -- primarily tea, rubber and coconuts. The other half is under field crops, the major ones being paddy (1.3 M ac), manioc (0.2 M ac) and chillies, maize, potatoes and millets (about 0.1 M ac each). Where sufficient water is available, it is the common practice to produce two or more crops a year. The cropping intensity on paddy lands ranges from about 185% in the wet zone to about 110% in the dry zone, the average for the whole country being about 150%.

2.07 In the decade ending in 1973 (the last "normal" year), agricultural output increased by about 25%, i.e. at an annual rate of only 2.3%; on a per capita basis the rate of increase was insignificant. While foodgrain production increased by about 36% over this period (3.1% annually), output in the tree crop sector increased by only 13%. Paddy production, under favorable weather conditions, reached 77 M bu in 1970 and that level is still to be surpassed. In 1974, the dry zone experienced a severe drought; both the maha and yala crops harvested in 1975 were much below normal. Tentative estimates of the 1975 paddy crop place it at about 47 M bu -- only about two-thirds of the 1970 production.

2.08 The slow growth of agricultural production despite considerable potential for higher output levels may be attributed to a number of factors. The sluggish performance of the tree crop sector is largely a result of inadequate investment due to poor financial returns and uncertain investment climate. Production of field crops has suffered from poor water management, scarcity of farm inputs, lack of adequate farm power for tillage, inadequate attention to extension, marketing and credit facilities and the system of controls and subsidies which works to reduce incentives to the farmer.

2.09 The Government is concerned about the stagnation in agricultural production. Among the measures recently taken to increase field crop output are: increases in guaranteed support prices and elimination of compulsory paddy procurement to provide production incentives; reduction in free and

subsidized rations; import restriction on subsidiary crops such as chillies, onions, potatoes and pulses to promote domestic production; establishment of Agricultural Productivity Committees (APCs) to improve the supply of farm inputs and supporting services, and most importantly an increased emphasis on efficient water utilization and management.

Irrigation

2.10 Agriculture in the dry zone depends entirely upon irrigation during the yala season and because of erratic monsoons, supplementary irrigation is necessary even during the maha season.

2.11 Irrigation in Sri Lanka dates back to about 600 B.C. when an extensive network of irrigation tanks (reservoirs) was developed in the northern part. Over the last century, many of these facilities have been reconditioned and incorporated into new irrigation systems. Currently, they irrigate about 900,000 ac and efforts are continuing to expand this acreage further.

2.12 In addition to reconditioning the ancient tank network, the Government has undertaken a number of multi-purpose water development projects--among them are Gal Oya, Uda Walowe and Mahaweli Ganga projects. With the completion of the ongoing works by 1985, the total irrigated acreage would increase by about 200,000 ac.

2.13 Farmers in Sri Lanka follow the traditional methods of irrigating paddy; they let water run continuously, ponding it on the fields. In addition to meeting the consumptive use requirements of the crop, this method has the advantage of assisting in weed control. However, it is highly wasteful in the use of water, particularly on soils with high permeability.

Mahaweli Ganga Development

2.14 The Mahaweli Ganga is the largest river on the island and is the principal source of water available for diversion to the dry zone. It drains an area of about 4,000 sq mi with a rainfall varying from about 50 inches in the lower reaches to over 200 inches at the head of the catchment. The mean annual discharge near the mouth is about 7 million ac-ft (MAF).

2.15 Early investigations of the irrigation and hydropower potential of the Mahaweli Ganga River were undertaken by the United States Operations Mission (now USAID) during 1958-61 and the Irrigation Department (ID) of the Ministry of Irrigation, Power and Highways (MIPH). During 1965-68, UNDP/FAO undertook a thorough study of the development potential and formulated a Master Plan, to be implemented in three phases over a 30 year period, for 900,000 ac of irrigation and 970 MW of hydropower. The first phase envisaged benefiting 231,000 ac -- 127,000 ac of already irrigated land and 104,000 ac of new land. In addition, it provided for a 40 MW of hydropower generating capacity. Due to the magnitude of the task and the need for further investigations, after discussions with the Bank Group, the Government decided to implement the first phase in three stages. Implementation of Stage I, comprising the major works for the whole phase, and improvement of water supply to 127,000 ac of existing irrigated land, started in 1972 and is expected to be completed by 1976. Stages II and III would involve, primarily, the on-farm development of existing irrigated lands and reclamation and development of new lands to be served by irrigation potential created under Stage I.

Project Formulation

2.16 The 71,000 ac included in the Stage II development have been divided into six sub-areas, labelled as: H_1 (6,000 ac); H_2 (12,000); H_4 (23,500 ac); H_5 (15,500 ac); H_7 (8,000 ac), and H_9 (6,000 ac) as shown in Map 11908. Three other sub-areas: H_3 (23,000 ac), H_6 (2,000 ac) and H_8 (2,000 ac) cover lands which are already developed and served from existing tanks -- area H_3 from the Kala Wewa tank and areas H_6 and H_8 from the Kandalama tank. Water supplies to these three sub-areas would also be supplemented by Stage I of the project.

2.17 The GOSL has already undertaken the development of sub-area H_1. The proposed project would include the development of H_2, H_7 and H_9.

These three areas are adjacent to lands already developed or under development and hence constitute the logical next step. Exclusion of sub-areas H_4 and H_5 was due to the constraints on implementation capacity. At some future date, they would be developed as a contiguous unit by extension of the right bank Kalawewa canal.

III. THE PROJECT AREAS

General

3.01 The proposed project includes 26,000 ac of irrigable land in two non-contiguous areas in Anuradhapura and Kurunegala Districts. Except for some 5,000 ac partially irrigated from small village tanks, the project areas are covered by brush and scrub timber. The areas are sparsely populated; the estimated current total population being about 15,000. The settlements are mostly purana (old) villages with the traditional pattern of clustered homesteads around village tanks. In recent years, a considerable number of migrants in expectation of impending development have moved into this area and squatted on public lands.

Climate

3.02 The climate in the project areas is tropical with mean monthly temperatures ranging from 76°F to 86°F, making it suitable for year round cropping. The mean annual rainfall is about 55 inches and about two-thirds of that occurs during the maha season (October to January). Mean relative humidity varies from 69% to 80% and average daily sunshine, from about four hours in December to nine hours during February through April (Annex 1).

3.03 The rainfall pattern is highly erratic. The onset of the monsoon may vary as much as six weeks from year to year. The amount of rainfall received also varies considerably from year to year. Precipitation amounting to 6 to 8 inches per week as well as dry periods extending for 2 to 3 weeks are not uncommon during the maha season. The unpredictability of the rainfall makes irrigation necessary even during the maha season.

Topography and Soils

3.04 The north central region in which the project areas are located is a large plain sloping gently from south to north. The soils are lateritic and derived from coarse grained granites. They are unusually low in silt content and therefore are very hard when dry. They have high permeability and low waterholding capcities. The warm winds that regularly blow over the northern part of the island during the yala season dry the soils out quickly and, therefore, they require frequent irrigation.

3.05 In addition to the general slope, there is local undulation in surface relief which is related to the stream pattern. Generally, three soil types are found: (1) reddish-brown, moderately coarse, highly permeable soils, located on uplands with elevated rolling topography; (2) slightly darker, slightly finer, less permeable soils with fair drainage, located mostly on the gentle slopes below the uplands, and (3) brown to grey-brown, slightly finer, impermeable, poorly drained bottom land soils. All the soils are slightly acidic.

3.06 Because of the coarser structure and higher permeability of the reddish brown soils they are best suited for the production of upland crops, while the bottom soils are ideal for paddy production. Even though the soils on the uplands and intermediate slopes are better suited to crops other than paddy, they are officially described by GOSL as "paddy soils". Paddy is uniformly grown on them during the maha season (Annex 2).

Population, Farm Size and Land Tenure

3.07 Rough estimates indicate a total of about 3,000 households in the project areas -- about one-quarter of them recent migrants, mostly from nearby areas. Socio-economic surveys conducted during project preparation indicate: (a) an average of five persons per household; (b) 55% of the population in the 15 to 60 year age group; (c) a literacy rate of about 70%, and (d) about 80% of the households are agricultural.

3.08 On the average, agricultural households own about 2 ac of tank irrigated paddy land, 1.5 ac of unirrigated high land and 1 ac of chena land. There are considerable variations from the average -- most of the paddy land belongs to the old settlers -- the new settlers generally have highland and chena land only. Practically all farms are owner operated. However, the new settlers do not have any tenancy rights to the lands cultivated by them.

Agricultural Production

3.09 As most of the project areas are forests the present agricultural production is rather small (para 3.01). Paddy is the most widely cultivated crop in the tank irrigated areas. Sowing of the maha paddy starts in October/November, after the tanks have been filled to a level deemed adequate to ensure the water requirements of the crop until maturity. Because of inadequate farm power for land preparation and the priority given to chena cultivation, the sowing is extended into late January. The crop is harvested between February and April. Subject to the water availability in the tanks, a second paddy crop, yala paddy, is broadcast during March/April for harvest in June/July.

3.10 Maha paddy is grown on some 4,500 ac and yala on 500 ac. Due to chronic water shortages, the yields are low -- about 0.7 and 0.6 tons/ac, respectively. Farmers prefer broadcasting to transplanting despite the latter's potential for higher yields. Recently, row seeding which allows easier weed control, has become popular. Cultivation is by manual labor, except for land preparation which is done by tractors and buffaloes.

3.11 Crops such as kurakkan (finger millet), maize, sorghum, pulses and chillies are grown under rainfed conditions on about 1,500 ac of high lands. Some coconuts, bananas and vegetables are grown on household garden plots. On chena lands, farmers grow millets, pulses, sesamum, and other drought-resistant crops. The total production is about 3,500 tons of paddy and about 500 tons of pulses, cereals and other crops. Present cultivation

practices, cropping patterns, yields and production levels are detailed in Annex 3.

Agricultural Supporting Services

3.12 As the project areas are largely undeveloped, there is only a minimal social or economic infrasructure in the areas. Essentially, the project farmers practice subsistence agriculture using few purchased inputs and marketing only a small fraction of the produce. For the limited commercial links, and for the supply of services such as extension and inputs, the project areas depend upon the nearby more developed areas (primarily sub-areas H_3, H_6 and H_8). Annex 4 describes the general set up of agricultural supporting services in Sri Lanka.

IV. THE PROJECT

General

4.01 The project would develop about 26,000 ac of irrigable land for using part of the irrigation potential created under Stage I of the Mahaweli Ganga project. Except for some 5,000 ac, the areas to be developed are forests, covered by brush and scrub timber. The proposed project would include:

- clearing the forests into leveled fields;
- constructing the irrigation, drainage, and road network, and rehabilitating the existing irrigation infrastructure for integration into the new system;
- selecting some 10,000 families for settlement into about 100 hamlets in the areas to be developed and providing the hamlets with the necessary social infra-structure; and
- providing the agricultural supporting services to complement the investments in physical facilities.

Project Components

4.02 The main components of the project would be:

Civil Works (Annex 5)

(a) rehabilitating and enlarging the two existing sluices on the Kandalama tank to deliver 250 cfs and 200 cfs to the right bank (RB) and left bank (LB) main canals, respectively;

(b) rehabilitating, enlarging and extending the RB main canal from the Kandalama tank. The canal would be about 22 mi long and would terminate in Mankadawala tank. It would carry 250 cfs for the first 7 mi, 210 cfs for the next 6 mi, and 100 cfs for the rest. Three village tanks, located along the canal, would be integrated into the canal by providing appropriate control structures. A 3 mi long branch canal would leave the main RB canal after about 12 mi;

(c) rehabilitating, enlarging and extending the LB main canal from the Kandalama tank. The canal would be 14 mi long and would terminate in Ranawa tank. It would carry 200 cfs for the first 5 mi and 170 cfs for the rest. An earthen dam would be built on the Dambulu Oya, to enable the canal to cross that waterway. Two branch canals, one 3 mi long and the other 2 mi long, would take off from the Ranawa tank, the terminal point for the LB main canal;

(d) extending the LB main canal from the Kala Wewa tank by about 3.5 mi. It would carry about 160 cfs and would feed two branch canals, one 7 mi long and the other 10 mi long;

(e) constructing distributaries and field channels in the service area to carry water from the main and branch canals to the individual farms;

(f) constructing field drains, secondary drains and main drains for removing excess surface water from the fields. Design capacity of the drainage system would provide for removal of 0.125 cfs per ac for farm drains, 0.105 cfs per ac for secondary drains, and 0.90 cfs per ac for main drains;

(g) constructing 12 ft wide unpaved roads along the field channels, 16 ft wide paved roads along distributaries and branch canals, and 20 ft wide paved roads along main canals; and

(h) clearing the vegetative cover and stumps from the forests and levelling the land into 2.5 ac - sized farm units.

Construction Equipment and Vehicles (Annex 6)

(a) provision of equipment and vehicles (base cif cost about US$6.4 M) for use in the construction program. After project completion, leftover usable equipment would be used either for the O & M of the completed system or would be deposited in the equipment pool of the Department of Machinery and Equipment (DME), Ministry of Irrigation, Power and Highways (MIPH).

Agricultural Equipment and Supporting Services (Annex 6)

(a) provision of 150 four-wheel and 570 two-wheel farm tractors, all with necessary attachments and equipment for use in land preparation. In addition, the project would provide 150 sprayers for applying pesticides and herbicides;

(b) provision of buildings, vehicles and equipment for strengthening the extension services, and

(c) provision of equipment and supplies to the Maha Illupalama Research Station for continuing its program in irrigated agriculture.

Land Settlement and Social Infra-Structure (Annex 7)

(a) selection of some 10,000 landless/small holder families from in and around the project areas for settlement on the newly developed lands; and

(b) provision of social infra-structure such as schools, health clinics, markets, community centers, post offices and banks to serve the settlers.

Technical Assistance

(a) provision of a hydrologist/water resource specialist for 1 to 2 years to assist the Mahaweli Development Board (MDB) in analyzing the water availability from the Mahaweli project, particularly the potential for further expansion of the service area. A water management/on-farm development specialist would assist in designing on-farm works and preparing project operating plans at the field level. The project would also provide an construction engineer to assist the Mahaweli Development Board (MDB) in planning, scheduling and management of the project implementation (para 5.06).

Water Supply, Demand and Quality (Annex 8)

4.03 Water Supply: The water supply for the project areas would come from two sources: from the Mahaweli Ganga diversion via the Bowatenna tunnel and from the existing tanks fed by the local catchments. For a total irrigable area of about 125,000 ac, of which the project areas are a part, it is expected that the diversion from the Mahaweli Ganga would average 540,000 ac-ft per year, and the yield from the local tanks, about 400,000 ac-ft per year. Together, the two sources would provide an average of 7.5 ac-ft of water per acre per year.

4.04 Water Demand: For the proposed full development cropping intensity of 160%, the average annual water requirements are estimated at about 6 ac ft per ac. Under the proposed project, the irrigation deliveries to the paddy fields would be restricted to daylight hours and as a result, overall irrigation efficiencies are expected to be about 40% compared to 20% or less achieved under traditional irrigation in similar other areas of the country. A simulation study covering the total irrigable area of 125,000 ac, cultivated at the proposed cropping intensity of 160%, indicated that over a 24 year period (1945-68), the supplies would have been fully adequate except in one extremely dry year (1947/48). Even then the shortage would have been less than 15%.

4.05 Until the development of all of 125,000 ac, the proposed project areas would have abundant water supplies. Even after completion of the whole development, supplies are expected to be fully adequate. It is proposed, however, that before starting the remainder of Stage II development, a thorough updating of the water supplies and requirements for the entire Mahaweli Ganga project be undertaken.

4.06 Water Quality: The water available for the whole of the Mahaweli Ganga project is of good quality and fully satisfactory for irrigation.

Implementation Schedule

4.07 The project implementation would take four years (Annex 9). Tender documents for construction equipment would be prepared and issued so that deliveries would start in August 1976 and would be completed by June 1977. Using the machinery and equipment already with the Mahaweli Development Board (MDB), some preliminary works would begin in January 1976. However, the progress is expected to be slow until the arrival of the new equipment. It is expected that about 10% of the construction work would be completed in 1976, and 30% each year in the following three years. Selection and settlement of the new families into the developed areas and the strengthening of the supporting services would proceed concurrently with the implementation of the physical works, and it is expected that by December 31, 1979 the project would be fully implemented.

4.08 To minimize interference with crop production in existing tank areas and also to take advantage of the favorable construction weather, most of the field work would be performed during the nine month periods from January through September. Many of the farmers from the project areas and from the surrounding areas could be employed on project works.

Cost Estimates

4.09 Total project costs are estimated at US$82.0 million equivalent, including about US$21.0 million in import taxes and duties. The foreign exchange component is estimated at US$23.4 million or about 38% of the total net of taxes and duties. Estimates are based on preliminary design, with unit prices at January 1976 levels. The major elements included in the cost estimates are: civil works (US$26.3 M); construction equipment and vehicles (US$14.0 M); agricultural equipment and vehicles (US$4.8 M); social infra-structure (US$10.5 M); technical assistance (US$0.5 M), and engineering and administration (US$3.9 M), making the base project cost US$60.0 M. To this cost, physical contingencies of US$5.3 M (20% of civil works costs)

and price contingencies 1/ of US$16.7 M (26% of the base cost plus physical contingencies) are added to arrive at the total project cost of US$82.0 M. Estimated project costs, presented in greater detail in Annex 10 are summarized below:

1/ Price contingencies have been calculated assuming the following inflation rates:

	Year			
Rate of Inflation (%)	1976	1977	1978	1979
Civil works	14	12	12	12
Equipment & Vehicles	10	8	8	8

Item	Local	Foreign	Total /a	Local	Foreign	Total	% of Total
	------(Rs Million)-----			-----(US$ Million)---			
I. Civil Works							
Kandalama tank	6.1	1.5	7.6	0.8	0.2	1.00	1
Main and branch canal /b	49.9	17.3	67.2	6.7	2.3	9.0	11
Distributary canals	26.0	1.5	27.5	3.5	0.2	3.7	5
Main and secondary drains	5.1	1.5	6.6	0.7	0.2	0.9	1
Field channels and drains	26.4	2.2	28.6	3.5	0.3	3.8	5
Land clearing	16.7	7.5	24.2	2.2	1.0	3.2	4
Land preparation	10.2	3.0	13.2	1.4	0.4	1.8	2
Roads	16.0	6.0	22.0	2.1	0.8	2.9	4
Subtotal	156.4	40.5	196.9	20.9	5.4	26.3	32
II. Construction equipment and vehicles	57.0	48.0	105.0	7.6	6.4	14.0	17
III. Agricultural equipment and vehicles							
Farming equipment	15.0	17.3	32.3	2.0	2.3	4.3	5
Extension vehicles and supplies /c	1.5	0.8	2.3	0.2	0.1	0.3	-
Research equipment and supplies	0.8	0.7	1.5	0.1	0.1	0.2	-
Subtotal	17.3	18.8	36.1	2.3	2.5	4.8	6
IV. Social Infrastructure	63.0	15.8	78.8	8.4	2.1	10.5	13
V. Technical Assistance	1.5	2.3	3.8	0.2	0.3	0.5	1
VI. Engineering management and administration	29.5	-	29.5	3.9	-	3.9	5
Basic project cost	324.7	125.4	450.1	43.3	16.7	60.0	73
VII. Physical contingencies	31.3	8.1	39.4	4.2	1.1	5.3	6
Subtotal	356.0	133.5	489.5	47.5	17.8	65.3	80
VIII. Expected price increase	83.5	42.0	125.5	11.1	5.6	16.7	20
Total project cost	439.5	175.5	615.0	58.6	23.4	82.0	100

/a Due to rounding, the figures may not exactly agree.

/b Includes the costs of Damulu Oya reservoir and village tank improvements.

/c Includes the costs of bicycles and motorcycles purchased for resale to Extension staff.

Financing

4.10 The proposed contribution of US$30.0 million by IDA and the co-financing countries would finance the full foreign exchange costs and some local costs, or about 49% of the total project cost net of taxes and duties. Commercial banks and the buyers of the farm equipment (tractors and sprayers) would provide about US$5.0 M for financing the farm equipment. The Government would contribute the remaining US$47.0 M through annual budgetary appropriation. Net of receipts from taxes and duties on imported project items, the Government's contribution would be about US$26.0 M, or about one-third of the net project cost. Assurances would be obtained from the Government that it would make adequate budgetary provisions to the agencies concerned to cover all project costs and that it would furnish to IDA not later than November 1 each year a detailed plan for the implementation of the project with related financial requirements for the following fiscal year.

4.11 Assurances would also be sought from GOSL that after the construction phase is completed, such parts of the construction equipment as needed and agreed with IDA would be retained by the MDB for the O & M of the project works (Annex 6, Table 1).

Procurement

4.12 All equipment and vehicles would be procured through International Competitive Bidding (ICB) procedures in accordance with Bank Group Guidelines. Small off-the-shelf items costing less than US$10,000 each, which are not practical for international tendering, would be purchased through normal Government procurement procedures which are satisfactory to IDA. Such purchases would however, be limited to an aggregate total of US$500,000.

4.13 Because most of the civil works (base cost US$26.3 M) would be simple, individually very small, labor intensive, scattered over a wide area, restricted to seasonal construction, and could not be grouped into large contracts, they are unsuitable for international competitive bidding. Work such as excavation of field and collector drains, and enlargement of

distributaries and field channels, would be done through contracts with villagers/day laborers on a unit-cost basis. The construction of other works would be done by public or private contracting firms, selected through local competitive bidding according to procedures satisfactory to IDA.

Disbursements

4.14 Disbursement from the proposed credit would be made for (a) 100% of the foreign expenditures for directly imported equipment, vehicles and spares; (b) 50% of local expenditures for locally procured, equipment, vehicles and spares; (c) 100% of foreign expenditures for technical assistance; and (d) 50% of the cost of civil works performed under local competitive bidding and under day laborer contracts. Applications for disbursements would be fully documented. It is expected that disbursements would be completed by June 30, 1980, approximately six months after the end of a five year implementation period. An estimated schedule of expenditures of the project, a semi-annual disbursement schedule and the proposed allocation of the proceeds of the credit are shown in Annex 11. Upon completion of the project, any funds remaining in the credit account may be used at the Association's discretion, for project related expenditures.

Accounts and Audits

4.15 The organizations responsible for carrying out any part of the project would be required to prepare and maintain separate project accounts and financial statements in accordance with sound accounting practices and to have such accounts and financial statements audited annually by independent auditors acceptable to IDA. Certified copies of the audited accounts and the auditor's reports would be sent to IDA within six months of the close of each fiscal year.

Environmental Effects of the Project

4.16 The only known water-related disease in the area is malaria. Schistosomiasis and other similar diseases common in some tropical parts

of the world do not occur in Sri Lanka. At one time malaria was practically eliminated, but in recent years the incidence of the disease has been increasing. The implementation of the project would extend the time during which storage water would be held in the tanks and run in the canals and thus would increase the breeding potential for the mosquitoes. On the other hand, the opening of the natural drains would remove the tailwater from the fields which stagnates in borrow areas and low spots. As a precautionary measure, the Government would be asked to institute a malaria monitoring system, and if, necessary, to take appropriate remedial measures in the project area. Assurances to this effect would be sought from the Government.

V. ORGANIZATION AND MANAGEMENT

Project Implementation

5.01 Civil Works: The MDB would have the overall responsibility for project implementation. It would prepare final plans and designs, prepare specifications and tenders for construction equipment and vehicles, award construction contracts, and supervise the implementation. The Board would be supported by the Irrigation Department (ID) in the Ministry of Power, Irrigation and Highways (MIPH) in the preparation of plans and designs, and by the Department of Machinery and Equipment (DME) in MIPH for the procurement and maintenance of the major construction equipment.

5.02 The MDB, an autonomous agency under the MIPH, was established in 1970 to oversee the development of the water resources of the Mahaweli Ganga River. The Board makes its own rules and regulations, recruits its own staff, and is financed by regular budgetary appropriations by the Government. The Board is well staffed with experienced technical personnel. Currently, the Board is in charge of implementing the Stage I of the Mahaweli Ganga project. It is also involved in the development of some Stage II areas (sub-area H_1). Its future work program includes the development of remaining Stage II areas (sub-areas H_4 and H_5), Stage III areas, and Phases II and III

of the Mahaweli Master Plan. In view of its limited implementation capacity in land development works, it would be necessary that until completion, the Board restrict its attention to the development of the areas proposed under this project. Assurances to this effect would be obtained from the GOSL during negotiation.

5.03 Agricultural Extension and Supporting Services. The Department of Agriculture (DA) under the Ministry of Agriculture and Lands (MAL), would be responsible for the reorganization and strengthening of the extension service and for the procurement of vehicles, equipment and supplies for the extension service. The motorcycles and bicycles to be used by the extension staff would be sold to the staff by the DA on terms and conditions which are satisfactory to IDA. The MDB would be responsible for procuring the equipment and supplies for the Maha Illupalama research station. The Sri Lanka Tractor Corporation (SLTC) would be responsible for the procurement of the farm tractors and equipment and for their allocation to the dealers for resale to project area farmers and APCs. For farm tractors, a condition of resale would be that the buyers would agree to engage in custom operations within the project area for at least 40 days per year. The PMB would be responsible for improving marketing, processing and storage facilities. The Bank of Ceylon and the People's Bank would provide credit to the eligible project farmers.

5.04 Social Infra-structure. The concerned Government agencies and departments, co-ordinated by the Land Settlement Division of the MDB would be responsible for settler selection, hamlet and village design and for providing the necessary social infra-structure.

5.05 A project Co-ordination Committee would be established to provide inter-agency co-ordination. The committee would be chaired by the Director, External Resources Division (Ministry of Planning and Economic Affairs) and would include the heads of the various participating agencies. The establishment of the committee would be a condition of Board presentation.

Technical Assistance

5.06 The MDB would employ the following specialists for assistance in project implementation: (a) a well-qualified on-farm development/water management specialist to advise on the design and layout of the irrigation network and on the operating criteria for the system. The specialist would also work in the field with the extension service and the project operating personnel to effect a viable water management plan compatible with the proposed rotational irrigation; (b) a hydrologist/water resources specialist to assess the water availability in the Mahaweli development, and (c) a construction engineer to assist in planning, scheduling and management. Draft terms of reference for the three specialists are given in Annex 5. The appointment of the three experienced specialists, with qualifications acceptable to IDA, would be a condition of credit effectiveness.

Operation and Maintenance (Annex 12)

5.07 Principal Irrigation Works. The MDB would be responsible for the O & M of the major project works (estimated costs Rs 75/ac/yr) until five years after completion of the project. Thereafter, the responsibility for O & M would belong to the Territorial Civil Engineering Organization (TCEO) in the MIPH. Assurances would be sought that the Government would provide sufficient funds for the proper O & M of the project facilities.

5.08 Field Channels: The Cultivation Committees (CCs) acting under the general supervision of the Agricultural Productivity Committees (APCs) and advised by Irrigation Engineers and Agricultural Extension Officers, would be responsible for the maintenance of the field channels and for the distribution of water among the various users on each field channel (Annex 4). The MDB/TCEO would oversee the maintenance operations of the CCs, and would report any deficiencies to the APCs or other higher authorities. In case remedial action is not taken, authority would be given to the MDB/ TCEO to take over the maintenance of the field channels and assess the costs against the water users with such charges to be collected by the Government

Agent (GA). Assurances that such arrangements would be established would be sought from GOSL.

5.09 Water Management: It is anticipated that under the project, the CCs would make recommendations to the MDB/TCEO with respect to cropping calendars and the water issue periods. The CCs would also recommend minimum flows for domestic purposes and livestock. With this information, the MDB/TCEO would then establish the operating calendars for the various canals and distributaries which would be strictly followed. The success of this program would require complete cooperation of the CCs and the APCs in the adopted water management plans.

5.10 Agricultural Equipment and Services. Adequate repair facilities and workshops exist in the private sector in nearby areas to provide maintenance services for the farm eequipment. It is expected that with the settlement of the project areas, private entrepreneurs would move into these areas as well. Accordingly, no problem is foreseen regarding the availability of maintenance services for farm equipment. The maintenance of motorcycles and bicycles to be sold to the extension staff would also be done through private workshops. The DA would provide a mileage allowance to the staff for the operation and maintenance of these vehicles. The maintenance of the extension equipment and other vehicles would be the responsibility of the DA. Funds for such maintenance as well as for fuel, personnel and operating supplies would be provided through the annual budget of the DA. Assurances would be obtained that the GOSL would continue to make available adequate funds and personnel for the agricultural extension services in the project area.

Monitoring Project Performance

5.11 The MDB would establish a small unit to monitor the operation of the project. The unit would record: the water releases through the Bowatenna Tunnel; the amount of water released from the storage tanks, and its distribution to the branch canals, distributaries and field channels; canal and distributary conveyance efficiencies; field channel conveyance efficiencies; the number of families settled; cropping patterns and yields

during both the maha and yala seasons, and O & M costs. Such reports would be submitted to IDA annually on September first. Assurances that such a monitoring program would be implemented would be sought from GOSL.

VI. PRODUCTION, MARKETING, PRICES AND FARM INCOMES

Production

6.01 Development of the newly irrigated lands and strengthening of the supporting services would lead to increased cropped area and higher crop yields. It is estimated that at full development in Year 11, the cropped area would increase from about 6,500 ac at present to about 42,000 ac. Similarly, the average paddy yield is expected to increase from the present 0.7 tons/ac to about 1.4 tons/ac. It is projected that even "without" the project, there would be some increase in the cropped area because of the increased water availability from Stage I of the Mahaweli project. Similarly, it is expected that the yields in the presently cultivated areas would become similar to those in surrounding areas. The estimated present and projected future cropping patterns and production levels for project areas are summarized below:

	Area Cultivated (thousand ac)			Production (thousand tons)		
Crop	Present	Future Without Project	Future With Project	Present	Future Without Project	Future With Project
Maha Season						
Paddy	4.5	4.5	24.5	3.2	4.5	34.3
Cereals	-	0.5	1.5	-	0.4	1.5
Pulses	-	-	-	-	-	-
Yala Season						
Paddy	0.5	3.0	9.0	0.3	2.7	11.7
Cereals	1.0	1.0	3.0	0.6	0.8	3.8
Pulses	0.5	1.0	4.0	0.2	0.5	2.8
Total	6.5	10.0	42.0			
Cropping Intensity (%)	25	38	162			

The projected "with project" cropping intensity would be about 160%. Annex 3 gives the details of projected cultivation practices, cropping patterns, yields and production.

Market Prospects

6.02 Sri Lanka currently imports about 45% of its estimated annual foodgrain requirements of about 1.6 million tons. Despite the Government's emphasis on food self-sufficiency, it is likely that Sri Lanka would continue to be an importer for the foreseeable future. Accordingly, the project related increase of about 38,800 tons of paddy (equivalent to 25,200 tons of rice) and about 3,900 tons of cereals would be readily absorbed into the domestic market. 1/ No problem is foreseen in marketing the increased production of pulses. Before the import ban by the Government in 1970, the per capita consumption was over four times the current level of 1.5 kgs. The projected annual increase of 2,300 tons would amount to a mere 10% increase over the present production in the country.

6.03 The proposed improvements in transportation network and marketing channels would reduce the problems of any localized surpluses. The existing processing and storage facilities around the project areas, augmented by the PMB's planned expansion, would be adequate to handle the additional production. The recent decision to allow private trading in paddy would also be helpful in handling the increased production.

6.04 To ensure farmer incentive and confidence, it would be necessary that before each crop season, the Government should set the guaranteed support prices for the various crops at reasonable levels and then procure all the supplies offered at those prices. The Government should take particular care not to lower the guaranteed support price in the middle of a procurement season.

1/ Maize and sorghum, somewhat inferior substitutes to rice and wheat flour, would be consumed directly or mixed with wheat flour. The Oils and Fats Corporation would also be a likely buyer of these cereals for use as animal feed.

Prices

6.05 For rice and cereals, the estimated future farm gate prices are derived from the Bank's projected 1985 World Market prices expressed in 1976 constant prices. Prices for pulses, for which no projections are available, are based on the historical ratios between their prices and the rice prices. On this basis, the estimated future farm gate prices, appropriately adjusted for freight, handling and processing are: US$180 per ton for paddy, US$140 for cereals, and US$270 for pulses.

6.06 For economic analysis, the official exchange rate of US$1 = Rs 7.50 has been adjusted to a shadow exchange rate of US$1 = Rs 12.00 (roughly equal to the FEEC exchange rate) to reflect the foreign exchange scarcity in Sri Lanka's economy. For farm budgets, the local farm gate prices have been based on the official exchange rate, but with a 20% premium to reflect the Government's emphasis on food self-sufficiency. 1/ To isolate the project effects from the effects of unusually high foodgrain prices prevailing at present, the projected 1985 farm gate prices are used even for the present situation. The various price assumptions are discussed in more detail in Annex 13.

Farm Incomes

6.07 Since the farm sizes, cropping patterns and cultivation methods would be the same in all the areas to be developed under the project, the future farm incomes would essentially be uniform. Accordingly, only one farm model was analyzed -- a 2.5 ac irrigated farm with cropping patterns and yields representative of the project areas as a whole. It is estimated that at full project development in 1986, the annual net farm income 2/ including the imputed value of the farm produce consumed at home would be about Rs 6,000 (in 1976 currency values) (Annex 14).

1/ Financial farmgate prices arrived at in this manner are quite similar to the current official procurement prices.

2/ Before paying any water charges.

6.08 For the families' currently in the project areas, the present net farm income on the same basis is estimated at Rs 1,900, which would increase to about Rs 3,000 in 1986 under "without project" conditions. Thus, as a result of the project at full development, their income would be doubled.

6.09 For the new settlers who would be mostly landless families from surrounding areas, the present income levels are unknown. However, they are unlikely to be above those for the farmers currently in the project areas. Furthermore, it is unlikely that without the project their incomes would experience any significant increase. Thus the gains for the new settlers would be even larger than those for the existing farmers.

Cost Recovery

6.10 At a discount rate of 10% per annum, the present value of the project investments (in economic terms) is estimated to be about Rs 285 million or about Rs 11,000 per ac. In addition, the O & M of the irrigation system would require an annual expenditure of about Rs 75 per acre. Assuming that the water charges were introduced in phase with the construction schedule, but with a two year grace period, it would require an average annual charge of Rs 2,000 per ac [1/] -- Rs 1,925 for recovery of capital costs and Rs 75 for O & M costs -- to recover fully all the expenditures on this project. For the families currently in the project areas, these charges would exceed, their net incremental farm incomes (before accounting for family labor, even at full development.

6.11 Analysis of the farmers' ability to repay the project indicates a "project rent" of about Rs 740 per ac (Annex 14, Table 4). In theory this is the maximum charge compatible with leaving adequate incentives to the farmers. It would be better however, to set the charges at a somewhat lower level because of (a) below average income levels of the project area farmers; (b) absence of any water charges in other areas of the country;

1/ In constant 1976 prices.

and (c) indirect recovery by the Government of about half of the project cost through differentials between the crop procurement prices and their "economic" prices. Tentatively, an average water charge of about Rs 300 1/ per ac, equivalent to about 25% of the net incremental farm income (before accounting for family labor) or about 40% of the project rent would be most appropriate. This level of charges would recover all O & M costs and about 15% of the capital cost, not counting the "indirect" recovery by the Government. Inclusion of the indirect recovery would imply a cost recovery index of about 65%.

6.12 In the near future, the Government is planning to enact a Land Betterment Tax Legislation. This would permit the Government to impose taxes on increases in land values resulting from public projects, and water charges based on factors such as amount and dependability of water supplies, increases in agricultural production, cropping intensity, capital costs, and project O & M costs. The legislation would permit the imposition of adequate charges to recover a reasonable proportion of investment costs for this project.

6.13 Under the Mahaweli Ganga Stage I project (Credit 174-CE and Loan 653-CE), soon to be completed, the Government is committed to impose water charges in that area to cover the full O & M costs and a reasonable proportion of the capital costs. Submission of a detailed implementation plan as stipulated under that project would be a condition of negotiations for this project. Actual implementation of that plan would be a condition of effectiveness for this project. Assurances would be obtained that within two years of the credit effectiveness, the Government would submit to IDA, for implementation after IDA concurrence, a study indicating the appropriate level of charges as well as the administrative mechanism to be used for collecting such charges. Following the initial implementation, the Government, in consultation with IDA, would review and revise the level of charges at intervals of not more than three years.

1/ In constant 1976 prices.

VII. BENEFITS AND JUSTIFICATION

7.01 Sri Lanka presently imports about one half of its foodgrain requirements. These imports put a severe strain on the balance of payment situation of Sri Lanka. Accordingly, the primary national benefit from the project would be the increased foodgrain production and the resulting foreign exchange savings.

7.02 The project would develop and settle about 26,000 ac, most of which is forest land and only sparingly used for crop production. At full development, the project related increase of about 31,400 tons in foodgrain production (rice, 25,200 tons; cereals 3,900 tons and pulses 2,300 tons) would represent an annual gross foreign exchange savings of US$7.6 million. Allowing for the added imports of fuel, fertilizers, agrochemicals and farm equipment this would represent an annual net foreign exchange savings of US$5.5 million.

7.03 The labor intensive civil works and village infra-structural works proposed under the project would provide a total of 10 million man-days of employment during project implementation. The increased cropped area and the more intensive cultivation envisaged under the project would generate an annual employment of 1.6 M man-days in on-farm works. Also, there would be a substantial increase in secondary employment in activities such as marketing, processing, and supply of farm inputs. All this would help to relieve somewhat the large unemployment and underemployment prevailing in the area.

7.04 The primary project beneficiaries would be some 10,000 families who at present, are landless or practice subsistence agriculture on small holdings. Their present income levels are substantially below the national average. At full development, the project would bring their incomes to the national level.

7.05 Based on the following assumptions, the project's economic rate of return is estimated to be about 13% (Annex 15):

(a) a four year project implementation and a 50 year project life;

(b) full agricultural development six years after project completion;

(c) projected 1985 World Market prices in terms of 1976 dollars for crops, fuel, fertilizers and pesticides;

(d) allowance for the shortage of foreign exchange by using a shadow rate of US$1 = Rs 12;

(e) all farm labor valued at about 70% of the average market wage rate of Rs 8 per man-day (see Annex 15) and construction labor at the market wage;

(f) only the project related increase in crop production is included in the benefits. Benefits from improved farm roads, and strengthened extension service in the rest of Anuradhapura District are not included in the analysis, and

(g) inclusion of all project costs except price contingencies, taxes and duties, cost of farm equipment (tractors and sprayers) and cost of social infrastructure. The cost of farm equipment is included as a recurrent cost in crop budgets.

7.06 Tests made to determine the sensitivity of the ROR estimate to various alternative assumptions about costs and benefits, indicate that the project remains viable except under an unlikely combination of highly adverse assumptions. Results from some of the important tests are given below:

	Alternative	Rate of Return
(i)	Basic case	13%
(ii)	Foreign exchange valued at US$1.00 = Rs 9.00	11%
(iii)	Foreign exchange valued at US$1.00 = Rs 15.00	15%
(iv)	Farm labor valued at the market wage rate of Rs 8.00 per man-day	12%

(v)	A decrease of 25% in net incremental benefits	10%
(vi)	An increase of 25% in project investment costs	11%
(vii)	A two year delay in realizing the full project benefits	12%
(viii)	Combination of (v) and (vi)	8%
(ix)	Combination of (vi) and (vii)	10%
(x)	Combination of (v), (vi) and (vii)	7%

7.07 The results from the sensitivity test emphasizesthe need to carefully monitor and control the project costs and to ensure the realization of the full project benefits.

VIII. RECOMMENDATIONS

8.01 Conditions of negotiation would be that:

(a) the Government has submitted a detailed implementation plan for land settlement and for the provision of social infra-structure to the project areas, and

(b) the Government has submitted a detailed implementation plan for cost recovery, as stipulated under the Mahaweli Ganga Stage I Project (Credit 174-CE and Loan 653-CE) (para 6.13).

8.02 Assurances should be sought from GOSL that:

(a) the Government would make adequate budgetary provisions to cover all project costs and that it would furnish to IDA not later than November 1 each year a detailed plan for the implementation of the project with related financial requirements for the following fiscal year (para 4.10);

(b) after the construction phase is completed, such parts of the construction equipment as needed and agreed with IDA would be retained by the Mahaweli Development Board (MDB) for the O & M of the project (para 4.11);

(c) the MDB and other organizations responsible for carrying out any part of the project would prepare and maintain separate project accounts and financial statements in accordance with sound accounting practices. Such accounts and financial statements would be audited annually, by independent auditors acceptable to IDA. Certified copies of the audited accounts and the auditor's reports would be sent to IDA within six months of the close of each fiscal year (para 4.15);

(d) the Government would institute a system to monitor the incidence of malaria in the project area and if necessary, it would take appropriate remedial measures (para 4.16);

(e) until the completion of the project, the MDB would not undertake any other major development works (para 5.02);

(f) the Government would provide adequate funds for O & M of the project facilities (para 5.07);

(g) the Government would make such arrangements for the maintenance of field channels as would be acceptable to IDA (para 5.08);

(h) the Government would make available adequate funds and personnel for the agricultural extension services in the project areas (para 5.10);

(i) the Government would establish a unit to monitor the project progress, and would send to IDA every September 1, annual progress reports (para 5.11); and

(j) within two years of the credit effectiveness, the Government would submit to IDA, for implementation after IDA concurrence, a study indicating the appropriate level of charges as well as the administrative mechanism to be used for collecting such charges. Following the initial implementation, the Government, in consultation with IDA, would review and revise the level of charges at intervals of not more than three years (para 6.14).

8.03 Conditions of Board Presentation would be that:

(a) the Government has established a Project Co-ordination Committee acceptable to IDA (para 5.05).

8.04 Conditions of Credit Effectiveness would be that:

(a) the MDB has appointed a qualified and experienced on-farm development/water management specialist, a hydrologist/ water resources specialists and a construction engineer acceptable to IDA (para 5.06); and

(b) the cost recovery plan as stipulated under the Mahaweli Ganga Stage I Project (Credit 174-CE and Loan 653-CE) has been implemented (para 6.13).

8.05 With the above assurances obtained, the proposed project would be suitable for an IDA/co-financing countries' credit of US$30 million under standard IDA terms. The Borrower would be the Republic of Sri Lanka.

December 12, 1975

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Climatic Data

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature (F°) 1/												
Monthly mean maximum	83.5	87.2	91.7	91.7	90.9	90.0	90.0	91.4	92.2	89.3	85.8	83.3
Monthly mean	76	78	82	86	84	83	83	83	84	78	78	77
Monthly mean minimum	69.2	69.3	71.5	74.4	76.3	76.4	75.8	75.5	75.2	73.6	71.5	70.3
Relative Humidity (%)												
Anuradapura	77	70	65	70	71	67	64	64	62	72	79	80
Maha-Illuppallama	74	68	67	70	66	62	62	60	65	75	74	76
Wind mileage (mi/day) 2/												
Mean daily	107	106	94	88	180	245	235	236	227	131	82	98
Sunshine (% daylight hours)												
Mean daily	72	86	77	79	88	89	74	71	71	58	69	57
Pan evaporation (inches)												
Kalawea tank	4.75	4.69	6.08	5.93	7.05	7.15	7.44	8.05	8.17	6.21	4.70	4.58
Precipitation (inches)												
Anuradapura (98 year mean)	4.8	2.1	3.9	7.4	3.9	0.5	1.2	1.8	2.7	9.2	9.8	9.5

1/ Anuradapura station

2/ Maha-Illuppallama

ANNEX 1
Page 1

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Topography and Soils

1. The project areas are located in the "dry zone" in north central Sri Lanka which is characterized by rolling topography with rough, eroded water catchment areas above the more or less flat lands commanded by the tanks.

2. The soils are residual (i.e. were developed in place), derived from and underlain at relatively shallow depths by granites, and are unusually low in silt content. As a result, infiltration and permeability rates are high, water holding capacities are low and the soils are quite hard when dry. Erosion in the uplands has resulted in the lowlands soils being somewhat finer in texture and lower, but not low, in permeability.

3. Land classifications of the commanded areas, done somewhat along the lines of the United States Bureau of Reclamation method, indicated that there are no Class I soils; that most of the high lands comprising about half those considered irrigable are Class II and III; and the bottom lands, because they are suitable only for paddy, are in Class IVR which is considered excellent for paddy.

4. The soils of the areas are similar in most respects and are composed almost entirely of three types: (1) well-drained, dark brown to reddish brown soils (Reddish Brown Earths or Alfisols) on the crests and upper slopes of the undulating landscapes, (2) imperfectly drained, slightly darker and usually slightly finer brown to reddish brown soils (Haplustalf sub-group of Alfisols), and (3) poorly drained, finer, dark brown to dark grey soils with pseudo-gley and gley horizons (Low Humic Gley, Aqualf sub-order of Alfisols).

5. The most important characteristics of the soils of the project areas, with regard to development and use, are: (1) high infiltration and

permeability rates, (from a low of 0.17 to more than 3 inches per hour) (2) low available moisture holding capacities (1.2 to 1.6 inches per foot of soil), (3) high bulk densities (mostly 1.6 to 1.7 gram/cm^3) and (4) very low silt contents. The soil clays are mostly of the non-expanding type (illitic and kaolinitic), the pH ranges from 6 to 7, the exchange complex is 80 to 90% base saturated, the silica: sequioxide ratio is about 3, the exchange capacity is 0.5 to 0.6 meq per gram of clay and the exchange capacities range from 4 to 20 meq/100 grams. There are some salt and alkali accumulations in low spots where the drainage is completely blocked. The organic matter content of the surface layer ranges from 1 to 5% and averages about 2%. Nitrogen and available phosphorous are low and potash is moderate.

6. The infiltration rates of the upland soils are above an inch an hour and of the Low Humic Gley soils, 0.1 to 1 inch per hour. Thus, water-logged conditions can exist in these soils only where the drainage outlets are blocked. Since the soils retain a relatively small amount of water that is available for plant growth (13 to 16% by volume) and the rooting depth of most crops apparently is restricted, a few irrigations will be required in the wet season, and more often in the dry season. Because of their unusually low silt content, these soils are very soft when wet and very hard when dry and the period when they can be effectively worked for seed-bed preparation is very short. Hence, it will be necessary to provide mechanical equipment for timely land preparation.

7. As implied above, the Reddish Brown Earths (i.e. uplands) are best suited for the production of upland crops such as cereals, pulses, chillies, maize, etc, whereas the Low Humic Gley (bottomlands) are suitable <u>only</u> (in the absence of drainage) for paddy. Even though the upland soils, because of their high permeabilities, are not well suited for flooded paddy culture, they are almost entirely used for paddy simply because it is by far the most profitable crop that can be grown. Since only a few supplemental irrigations would be required to <u>ensure</u> a good paddy crop in the maha (wet) season, the

fact that a high proportion of this supplemental water would be lost is not inconsistent with the objective of making effective use of available irrigation supplies in the wet season. No paddy would be grown in the uplands in the dry season.

December 1975

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Cultivation Practices, Cropping Patterns and Yields

1. Paddy is the main irrigated crop grown in the project areas. There are two seasons -- maha and yala. Maha paddy is broadcast, row-drilled or transplanted during October-January, for harvest during January-April. Yala paddy is planted between February and April and harvested during May-July. Cultivation is by hand labor with draft power for plowing, tilling and leveling supplied by buffaloes and 2-wheel and 4-wheel tractors. Harvesting and threshing are not mechanized. Despite higher yield potential and easier weed control, transplanted paddy is not popular with farmers. Broadcasting is most favored but row seeding, which allows weed control by rotary weeders is spreading.

2. Considerable amounts of water are used in field preparation (saturation and leveling) and thereafter to maintain at least a 2 inch depth of water to help control weeds, reduce labor and animal draft demand, and to enable continuous irrigation to be practiced. Because land preparation usually does not begin until the tanks are sufficiently full to ensure a crop, the maha planting season is delayed and insufficient use is made of rainfall.

3. Chena cultivation. An important reason for the extended paddy sowing periods is the practice of slash and burn (chena) agriculture in nearby jungle areas. The slashing begins when the yala rains cease in April-May; the cuttings are burned in August. To make maximum use of the maha rainfall and to enable the crop to keep ahead of the regenerating weeds, planting of the chena lands takes place as soon as it begins to rain. Most farmers look upon it as their major source of food other than paddy, consider chena cultivation dependable and are reluctant to give it up. Only

when the chena lands are secured does the farmer and his family transfer attention to rice lands where, in the meantime, much of the rainfall and often a significant amount of the irrigation water released from storage for those who sowed earlier has been wasted. Yala plantings are delayed partly by the delays in starting the maha crop and partly by the need to harvest maha cereal and pulse crop in the chena lands and to replant them, usually with sesamum, before starting the yala crop on the irrigated lands.

4. The cereal crops consist of finger millet, maize and sorghum. The former is almost entirely a chena crop because of its great sensitivity to weed competition. Of the others, sorghum has recently been expanding because some good varieties have become available from India and these ratoon well in Sri Lanka. Maize has always been grown, although not to a large extent, in the northern dry area. Neither sorghum nor maize are grown on irrigated lands at present, but investigations in Maha Illupalama show that they can both be grown successfully under irrigation, especially on the more permeable soils.

5. The pulse crops. Cowpeas, green and black gram, and pigeon peas would appear to present good prospects for the future. Very little is grown under irrigation at present, but a start has been made to grow them after rice on the irrigable lands. Elsewhere in the country, farmers have grown some under irrigation. Maha Illupalama has good varieties and encouraging field data to support pulse growing on irrigated lands.

6. Fruits and vegetables. Tree crops such as jack fruit, mango, coconuts, guavas together with some vegetables are grown in home gardens.

7. Present yields. Information on present paddy (unhusked rice) yields comes from a socio-economic survey conducted by the MDB in January 1975 in sub-areas H_7 and H_9. The survey indicated an average yield of about 0.75 tons per ac for maha paddy. No reliable yield information is available for sub-area H_2, but it is considered to be lower than in H_7 and H_9. Accordingly, the average for the three areas is assumed to be 0.7 tons per ac. In yala season, the water supplies are more unreliable and yields are somewhat lower --

perhaps about 0.6 tons per ac. For cereals and pulses, the estimated present yields are based on observations of field crops as well as on discussions with farmers and extension and research workers.

The Future Without the Project

8. It is projected that even "without" the project, there would be some increase in the cropped area because of the increased water availability from Stage I of the Mahaweli Project. Also, the paddy yields are expected to increase faster than at the historic average rate of about 2% per annum. However, the yield would remain somewhat below those in the surrounding areas, because agricultural inputs and supporting services would not be as readily available. Yields of other crops would increase at the rate of about 2% per annum compounded. Cropping intensities would increase from about 25% at present to 38% under without project conditions.

Projected Cropping Patterns and Yields

9. The main factors contributing to increased yields under the project would be the much improved and reliable irrigation supply, the provision of drainage, better cultivation practices with the help of a reorganized extension service and improved supply of inputs such as agricultural machinery, seeds and fertilizers. Cropping intensities in the project area would increase primarily because of land clearing and irrigation development.

10. Research station yields at Maha Illupalama between 1970 and 1974 indicate that if sufficient water is available, the paddy yields in both the maha and yala seasons are about equal. However, in the case of maize, sorghum and pulses (given sufficient water), the yields during the yala season will exceed those secured during the maha. The difference is due, in part, to more hours of effective sunshine.

11. Considering the above information as well as farmer practices and the findings of surveys by the Agricultural Research and Training Institute, it has been concluded that approximately five years after the completion of project works (assuming a strengthened extension service), average yields would be of the following order:

	Maha	Yala
	---tons/ac---	
rice (broadcast)	1.40	1.30
Pulses		
Dhal	.66	.66
Green gram	.66	.66
Black gram	.55	.60
Cowpea	.70	.75
Groundnuts	.80	.85
Average pulses	.59	.65
Maize	1.00	1.20
Sorghum /a	0.90	1.20
Average cereals	0.90	1.20

/a Including ratoon.

12. The proper management of irrigation deliveries would permit early pre-season preparati .. of maha paddy in September and the introduction of intermittent irrigation would conserve water for the yala crops. Maha sowing would be from late September through October for harvesting in January and early February. Yala sowing would be in February and early March for harvesting in late May through June. The principal agronomic changes would be:

(a) Under the project, irrigation to paddy fields would be restricted to daylight hours while the other crops would be irrigated on a 4 to 5 day rotation. Also, it is expected that a significant portion of the lands would be prepared while dry and others just after the first rain. The practicability of this has been demonstrated at Maha Illupalama, at IRRI and on two operating projects in Sri Lanka. However, it has not been tried on a farm basis in the northern dry zone and therefore its extensive demonstration must be the first priority of the reorganized extension service.

(b) The seedbed for the entire service area of a given unit would be prepared with mechanical power within a short time — preferably a significant portion of it while dry or following the first monsoon rains. This would decrease the demands on stored water for pre-irrigation to soften the soil.

(c) Firm irrigation seasons during which stored water would be released would be established. This would enable shortened crop cycles over the whole service area, but would require much greater discipline of farm operation than at present.

(d) To secure the results anticipated it would also be necessary for farmers to grow other crops such as maize, sorghum, pulses, millet and sesamum on the "paddy" lands during the yala season and perhaps even during the maha season.

As the above practices imply many techniques that are new to the project areas, the Maha Illupalama Research Station must, at the earliest, devote its attention to the potential problems and provide the extension staff with the relevant technical information.

13. The present and estimated future production under the project for paddy rice, cereals, and pulses crops in each of the five tanks is given in Table 1.

December 1975

Table 1

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Present & Estimated Future Production[1/]

All Project Areas (26,000 ac)

	Area (thousand ac)			Yield (tons/ac)			Production (thousand tons)		
	P[2/]	$\overline{W}$[2/]	W[2/]	P	$\overline{W}$	W	P	$\overline{W}$	W
Maha paddy rice	4.5	4.5	24.5	0.7	1.0	1.4	3.2	4.5	[illegible]
cereals	-	0.5	1.5	-	0.8	1.0	-	0.4	[illegible]
pulses	-	-	-	-	-	-	-	-	-
Subtotal	4.5	5.0	26.0	-	-	-	-	-	-
Maha intensity	17%	19%	100%	-	-	-	-	-	-
Yala paddy rice	0.5	3.0	9.0	0.6	0.9	1.3	0.3	2.7	1.7
cereals	1.0	1.0	3.0	0.6	0.8	1.2	0.6	0.8	3.6
pulses	0.5	1.0	4.0	0.4	0.5	0.7	0.2	0.5	2.8
Subtotal	2.0	5.0	16.0	-	-	-	-	-	-
Yala intensity	8%	19%	62%	-	-	-	-	-	-
TOTAL	6.5	10.0	42.0	-	-	-	-	-	-
TOTAL INTENSITY	25%	38%	162%	-	-	-	-	-	-

1/ In the net cultivable project area of 26,000 ac.

2/ P = Present, $\overline{W}$ = Future Without Project, W = Future With Project

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Agricultural Supporting Services

A. Organization of Agricultural Production

1. The Ministry of Agriculture and Lands (MAL) is responsible for the supervision of agricultural production and mobilization of inputs. The Ministry of Irrigation, Power and Highways (MIPH) is responsible for irrigation and land drainage. Recently, Sri Lanka reorganized field supervision of agricultural production by setting up Agricultural Productivity Committees (APCs) to oversee the Cultivation Committees (CCs), as well as Agricultural Tribunals. The Government also proposes to set up District Agriculture and Irrigation Advisory Committees. Four new laws governing agriculture productivity, agriculture insurance, tenancy rights and rent, and sale of State lands, respectively, have been enacted during 1972-1975. Draft legislation for control of irrigation activities and for recovering land betterment costs are due to be presented to the Legislature in the near future. The betterment charges bill is significant in that it would enable recovery of irrigation capital and O & M costs.

2. Agricultural Productivity Committees (APCs) are set up under the Agricultural Productivity Law (APL) which makes it mandatory for all owners and occupiers of agricultural land to use it to the maximum benefit of the country, in a manner prescribed from time to time by the APC. The law deals with all agricultural and livestock production. The duties of the owner and occupier are defined and the processes of enforcement and supervision are also described in the APL. If compliance is not forthcoming, defaulters can be dispossessed. The APCs are to become the principal regulatory bodies for all agricultural activities. About 530 APCs are planned of which about 430 had been set up at time of appraisal. Its members are nominees of the

Minister, MAL. At village level, the Cultivation Committees (CCs) are the agents of the APCs and are subject to their direction and control. The Minister may empower APC to act on all sections of the APL. The proposed Irrigation Bill would give further powers to the APCs.

3. The APC functions are to:

(a) direct and control the CC. If necessary, the APC may delegate this responsibility to any concerned Government official (i.e., Engineer, Agriculturist or Administrator);

(b) promote and coordinate agricultural development;

(c) assist formulation of crop and livestock production programs;

(d) supplement the Minister, MAL's regulations for:

-- the cultivation of irrigated crops;

-- the enforcement of "established customs" in this respect;

-- distribution of water at farm level;

-- the appointment and remuneration of executive agents for the foregoing, and

-- farmers' contributions, in cash or labor, to the irrigation structures for which they are responsible.

(e) regulate repossession by a landlord when a tenant dies intestate.

(f) appoint tenants for land not cultivated for two seasons;

(g) decide seasonal cropping pattern subject to the Government Agent's (GA) approval; Minister, MIPH has the final decision in respect of water releases implied by any specific cropping pattern;

(h) permit the cultivation of crops other than paddy (the 1958 Paddy Lands Act has been repealed);

(i) act as an Agricultural Leasehold Society to take over or lease its members' land subject to appeal to the Minister, MAL only as to the rent payable;

(j) determine the rent payable by tenant to landlord, within the provisions of the law, subject to adjudication of dispute by the Agricultural Tribunal;

(k) determine, for rent purposes, the degree of crop failure;

(l) control water distribution below the 50 ac level (or on canals under 0.5 mi length) subject to the direction of the Engineer assigned by the MIPH;

(m) organize, through the CC, the cultivators to maintain the works associated with (i).

4. The Agricultural Tribunal (AT) acting under the Agricultural Land Law (ALL) is the guardian of tenants' rights, has final ruling powers on inheritance disputes and adjudicates rent payable. Rent is fixed by the Minister, MAL, but may not exceed 15 bu per ac or one quarter of the crop, or the customary rent, whichever is the lowest. The APC's levy of Rs 6/ac is payable by the landlord. The AT members are appointed by the cabinet on the advice of the Judicial Services Advisory Board. The AT is the highest authority to whom orders of dispossession are referred and its rulings may only be referred to the Supreme Court on points of law. The ALL: recognizes continued occupancy by the tenant and his legal or nominated successor; recognizes rotational occupancy; ensures continuing tenants' rights or change of ownership, and regulates transfer of tenancy to the landlord. Land may be mortgaged, or a charge raised against it, either by the owner or the occupier. Non-payment of principal or interest becomes a first charge on crops or livestock, if their raising was the purpose of the loans. The rights of the prescribed banks to recover confirmed debts are unalienable and not negotiable under the previous law.

5. The Agricultural Insurance Law No. 27 has been enacted to operate a comprehensive agricultural insurance scheme in respect of the paddy crop and of such other crops as may be specified by the Minister to indemnify the farmers against loss. The Board consists of a Chairman appointed by the Minister, MAL, with representatives from the People's Bank and the Bank of Ceylon, the Ceylon Insurance Corporation and the Paddy Marketing Board (PMB). Insurance is compulsory for every person having an interest in the paddy crop,

be ne the owner, tenant or sharecropper. The premium, which is determined by the Board, is shared according to the interest an "insured person" has in the crop. Crops other than paddy may be insured, as determined by executive order. The law does not state for what causes of loss a claim may be preferred, only that it must be filed within seven days of its occurrence. The premium is also not stated but is, at present, around Rs 30 per ac, depending on the location in the country.

6. The Sale of State Lands (Special Provisions) Law empowers the Land Commissioner (LC) acting on a report by the District Government Agent (GA) to determine state land sales conditions. Potential purchasers are selected according to regulations made under the Law and the price is set by the LC. The successful purchasers may elect to pay cash and receive a land grant or pay in installments with interest and receive a use-permit (cancellable on non-payment of installments) to be converted to a land grant when fully paid. The Law prohibits unapproved disposal of land, subdivision and co-ownership. With the wide powers of the Law, the Minister, MAL may make regulations to control land operation and use. The law specifically declares it to be an offense to encroach on land that has been alienated and makes ejection of the encroacher mandatory.

7. The draft Irrigation Bill is understood to have received Cabinet approval in principle and was to have been presented to the Legislative Assembly. Its May 1975 draft provides for establishing a District Irrigation Committee with the GA and an Advisory Committee for each major irrigation work or group of works. The law controls both interference with canals and water wasteage; it determines the area to be irrigated in each command in that season and fixes the water charges.

8. The Land Betterment Charges Bill drafted but not yet enacted, defines "benefited areas" where the productivity of agricultural lands has improved or is likely to improve as a result of the construction of an irrigation, drainage or flood protection project in such area. Annual charges would be levied, (after making due allowance for whole or partial crop failure) either as a fixed sum per acre, or as a fixed sum for a fixed amount of water and an additional charge for supplies in excess of the minimum, or as a charge based on the water supplied. The charges would be determined on the basis of the following criteria;

(a) capital expenditure and expected life of the works;

(b) operation and maintenance costs;

(c) water availability;

(d) its regularity;

(e) the extent to which the land has benefited;

(f) the likely increase of production due to the project; and

(g) other matters, to be prescribed.

B. Research and Extension

Agricultural Research

9. Organization. Agricultural Research is headed by the Deputy Director of Agriculture (DDA), Research, who is based at the Central Agricultural Research Station at Peradiniya, near Kandy. He has a staff of 67 Research Officers of whom 20 are Ph. Ds. Some 15 of the Research Officers were abroad for training at the time of appraisal. There are 16 outstations, two of which are significant to the project--Batalagoda, where almost all the paddy breeding is being done and Maha Illupalama where irrigated agriculture is being studied.

10. Rice Research. Sri Lanka has always had a good rice breeding program. During the 1950s and 1960s, the H series of locally bred varieties replaced most of the traditional varieties. Since the advent of high yielding varieties (HYV), Sri Lanka has successfully incorporated the IRRI strains to produce HYVs suitable to its conditions. The most notable feature of the new varieties is a shorter growing season. Of the varieties released BG (Batalagoda) 11/11, 34/4 and 34/2 are outstanding. All are resistant to blast, intermediate in stature (80-90 cm high) and have leaves that become erect as they develop. Most take about 3-1/2 months from seed to seed, a desirable feature for the maximum utilization of rainfall on the yala crop.

11. Research on Other Crops. Research on other crops for the dry zone is concentrated at Maha Illupalama, where irrigation studies are also carried out. Considerable progress has been made in introducing and developing new varieties of chillies, green gram, black gram, pigeon peas (dhal) and cowpeas.

Agricultural Extension (Reference 1)

12. All extension activities are under the control of the DDA, Extension. He is assisted at his headquarters by five graduate Subject Matter Specialists (SMSs) and by a District Agricultural Extension Officer (DAEO) in each of the 22 administrative Districts. The DAEO, in his turn, may have an additional (i.e. deputy) DAEO and always some SMSs, who are not necessarily graduates. The field staff consists of Agricultural Instructors (AIs) who hold agricultural diplomas and Village Level Workers (KVS) who are the actual contacts with the cultivators. In addition to the regular line department, other groups are doing extension work for special projects like irrigation developments or the fostering of specified crop production programmes. At the time of appraisal, MDB was doing the extension work on the part of their project area that was already functioning. However, the areas to be covered under this project were under the District Agricultural Extension Organizations. The Maha Illupalama station provides the technical backstopping as well as the periodical in-service training for the extension staff.

13. Factors impeding efficiency of the extension service are:

(a) lack of formal and regular exposure to up-to-date research findings;

(b) lack of clearly defined areas of responsibility and consequent gaps in support;

(c) a serious lack of transport for all levels of staff, militating against regular field visits, and

(d) lack of accommodation which prevents the positioning of key staff at essential locations.

14. Under the project, it is proposed to organize the whole Mahaweli Stage II area into a separate extension District, making a total of 23 units in the country instead of the present 22. As sections of the Stage II areas are taken up for land clearing, canal construction and settlement, so would they be taken over from the District agricultural administration's control. The 6,000 ac already irrigated would be transferred immediately, along with the 26,000 ac of the present project. Staff numbers would be built up according to needs. The officer in charge would be a Project Agricultural Extension Officer (PAEO), reporting to DDA Extension, but he would maintain continuous and close contact with the concerned District agricultural and administrative authorities. He would have as deputy an Additional PAEO. SMSs would be required for farm machinery maintenance and operation; water management and irrigation practices; extension methods; farm management; rice culture; maize and sorghum agronomy; other upland crops, and plant protection. At the field level there would be KVSs, reporting to AIs who would be supervised by Senior AIs. They would eventually be replaced by graduate Agricultural Officers (AOs). At full development, the following staffing pattern is envisaged:

PAEO	1	KVS - Field	70
APAEO	1	KVS - Assistant to AI	18
SMS/SAI/AO	8	Drivers	10
SAI/AO	2	Clerks, etc.	10
AI	18		
Totals: Supervisory staff	30	Executive staff	108

A key factor of the new system would be continuing intensive training programs that would embrace all levels of staff and the contact farmers through whom the KVSs would be expected to work.

15. Under the project, suitable transport would be provided. Motorcycles and bicycles to be used by the extension staff would be sold to the staff by the DA on credit. Appropriate mileage allowances would be provided to the staff for O & M and the amortization of the vehicles. Housing, or a rent allowance where suitable premises are available, would be provided. All project staff would receive 15% project allowance, on top of their regular salary. Equipment and vehicles required for the extension service, and the estimated costs are detailed in Annex 6, Table 2.

C. Agricultural Inputs

Farm Power and Equipment

16. Farm power for the developed parts of the project area is provided by working buffaloes and 2-wheel and 4-wheel tractors. Working buffaloes are few and it is not expected that, even if priority is given in selection of settlers to those owning buffaloes (Annex ..) enough can be found. Therefore it is expected that the bulk of the primary and secondary tillage will be done by tractors.

17. The mechanization of tillage operations has a history of at least 25 years, especially in the dry zone. In the two Districts to which the main parts of the project area extend, a survey by the Ministry of Agriculture has found that preparation was carried out, respectively, on 66% and 77% of the land.

18. The tractors in use are a combination of 4-wheel and 2-wheel machines. The 4-wheel tractors, most of them in the 35-40 hp class, use mainly a tined cultivator (tiller) and only occasionally, under dry conditions, a

disk plough. The 2-wheel tractors use a reversible mouldboard plough and a rotary cultivator. The buffaloes use a barpoint plough with a long sole which helps to seal the surface on which it travels, thereby impeding percolation and assisting with water conservation. Of the three, farmers expressed unequivocal preference to the work performed by the buffaloes and gave as their second choice the rotary cultivator. This is much in keeping with experience in other countries in the preparation of rice lands. It would, therefore, appear necessary to examine the use of implements with a view of emulating more closely the work of the local plough, and investigate the possibility of using the rotary cultivator, a disk harrow or another puddling implement like the rib roller behind the 4-wheel tractors to achieve a land preparation that would reduce water losses through percolation.

19. Under project conditions, most of the land preparation would take place under non-flooded conditions and therefore the following outputs can be expected:

Primary tillage by 4-wheel tractors	2 hrs/ac
Secondary tillage by 2-wheel tractors	7 hrs/ac

It is expected that most of the primary tillage would be done by 4-wheel tractors, with the 2-wheelers doing a minor share; for secondary tillage, the roles would be reversed. This is a feasible division of labor as unde project conditions the two tasks would take place within a week or so of each other. Tractors already move around between areas making use of the differing calendar of operations to extend their working season. It can be expected that 30% of the need for 4-wheel tractors, and 10% of the need for 2-wheel tractors, will be so met. It may further be assumed that:

(a) the few existing units in the area will have completed their useful life before project completion and will need to be replaced;

(b) time available for primary and secondary tillate is 40 days; a tractor works continuously for eight hours per day.

Therefore, 150 4-wheel tractors and 570 2-wheel tractors are required to complete the work in the given time in the maha, the busier of the two seasons.

20. Seeds. Farmers at present obtain their seeds via the extension service and the Multi-Purpose Cooperative Societies (MPCS), which get them from Government farms and from seed growers. There is a great deal of farmer-to-farmer exchange and also growers saving their own seed, especially paddy seed. There is no seeds legislation. The seed testing laboratory at Peradiniya works only in an advisory capacity. The system works well enough for paddy with a rapid spread of any good variety when released. It would be necessary to introduce statutory controls and standards on pulse seed quality. Pulses usually present serious storage and quality control problems, with rapidly decreasing germination rate and vigor over time. The GOSL is being advised by a team from FAO on legislative and quality control measures. Pending the legislation, an unofficial certification scheme for paddy seed is operating, which is similar to that of the International Seed Testing Association in relation to standards, and recognizes foundation, registered and certified seed. The first two are always grown on Government farms; certified seed is partly produced by certified growers. Inspection in the field and supervision of threshing floor is done by the AIs. In 1974, 400,000 bu, enough to plant about 200,000 ac, were certified. These are sold on consignment by the MPCSs which, in turn, distribute them to farmers.

21. Fertilizers. All fertilizers are imported. The sole importer is the Ceylon Fertilizer Corporation (CFC) which also acts as wholesaler to the dealers selling to the growers. The CFC operates a blending plant that produces NPK blends recommended as basal dressings prior to planting. For top dressings, urea is normally used.

22. Fertilizers are subsidized for paddy and other field crops (onions and chillies do not receive subsidized fertilizers). Prices are reviewed every six months on the basis of the landed costs by handling charges. At

the time of appraisal unsubsidized price for the basal paddy mixture containing 3-30-13 NPK was Rs 86 per cwt. Certificates of entitlement are issued by the APCs. Other products, besides the basal blends, are sulphate of ammonia, triple super phosphate (TSP), rock phosphate, diamonium phosphate (DAP) and mono ammonium phosphate (MAP). Sulphate of potash is used for tobacco only. The estimated fertilizer consumption for field crops in Sri Lanka during 1974/75 (a low rainfall year) was as follows:

Fertilizer	Total	Paddy	Other Field Crops
	('000 t)		
N	57	30.5	5.6
P_2O_5	23	12.3	3.1
K_2O	31	10.3	5.7
Total Nutrient Used	111	53.1	14.4

23. The CFC sells the subsidized fertilizers for paddy production wholesale to the Director of Rural Institutions (RI) and charges Rs 45 per ton for transport to any point in the country. Before new orders are filled, RI must pay CFC for the previous consignment. The RI sell to APCs, CCs and MPCSs, charging Rs 20 per ton markup. Transport costs of Rs 5 plus a 5% margin may also be added. The final sellers are allowed a margin of 5% on what they actually pay but some are charging their customers less, to attract business. Farmers may buy directly from RI stores if they have Certificates of Entitlement from the APCs and they must have the purchase recorded in their Identity Document to avoid leakage to other crops. If the purchase was from RI stores, they get the same terms as the retail buyers, but must pay cash. Thus, the attraction to go to a retail outlet is that they may buy against credit vouchers. Nevertheless, RI stores sell about 25% of their throughput directly to farmers.

24. The lines of the distribution chain are well arranged and CFC and RI management good. Upcountry stores that work on little more than a single turnover per year are underutilized--a situation that will continue until import scheduling can be better controlled.

25. Present fertilizer use on paddy is about 30% of the recommended dosage, due to the recent increase in fertilizer prices and water supply uncertainties. The recommended application, 60-40-30 NPK, is modest by comparison to the standards of other countries growing dwarf paddy varieties. It can be expected, therefore, that under project conditions, by 1986 the recommended amount equivalent to 1.5 cwt urea and 1 cwt of the basic paddy mixture per acre, may be applied.

26. Plant Protection Chemicals. Active ingredients and emulsifiers for all pesticides are imported; most of the formulation takes place in Sri Lanka. Locally established representatives of two major companies have access to proprietary products; most of the non-proprietaries are handled by the Ceylon Petroleum Corporation which is also the only importer for solvents. The range of pesticides available is comprehensive and adequate, and packaging is good. The flow of product is from the formulator to the distributors who receive a 20% commission which is shared with the final seller. Within this margin, the farmer has a fair range to buy the most suitable product at relatively competitive prices. The retail price which includes the 20% margin, and a transport allowance, is determined by the GOSL. The kind of products that may be marketed are controlled by the GOSL and permission to market them is only given after the product has been field tested. However, there is no statutory control over storage conditions, or shelf life, nor is there an administrative means of sampling the products actually offered to the farmer.

27. All formulations are liquid, therefore, they must be applied through sprayers. The weed killers are systemic, and are effective if put on the leaves of the weeds growing in water or on any part of the weed if there is not standing water. Insecticides, especially for plant hoppers must be applied in small droplets and very uniformly. Many of the sprayers seen would not appear to be of a design that would ensure this. Also, there is some shortage of units. The MPC rent sprayers to their members at Rs 0.50 per hour. However, for full project benefits to be realized it would be necessary to have more and better designed sprayers available, possibly even some tractor mounted models.

28. Under project conditions, the cost of pesticides and hired sprayers used by farmers will amount to about Rs 35 per ac for paddy and Rs 20 for the other crops.

29. Sprayers for hire would have to be made readily available. Under project conditions, motorized knapsacks would provide a useful supplement to the hand sprayers that are available. Their output is about 10 ac per day and the maximum interval between spraying may be a fortnight. Therefore, 225 sprayers would be needed. However, since hand sprayers are available in the area and simultaneous use is unlikely the number of sprayers to be purchased under the project would be 150 units. If locally procured, these could be phased over the Years Two, Three and Four as the project develops. However, if they are purchased abroad, for purposes of convenience, they should all be included in a single tender.

30. Agricultural Credit. Evaluation Study No. 2 by GOSL, entitled "A Short History on Credit for Peasant Agriculture in Sri Lanka", May 1974, briefly outlines the history of credit to peasant cultivators from its inception in 1911 until 1947 and gives full details on credit since that time. Historically, the following points are outstanding:

(a) institutional sources never met more than 30% of the rural credit needs; the present figure is just under 16%;

(b) repayment was always dependent on a good harvest but there were always at least 15% defaulters;

(c) about 1960 when, concurrent with a drive to increase lending, and the write-off of defaults began, the repayment record worsened considerably and the default rate exceeded 30%;

(d) there has never been close supervision on credit use and such control, as was exercised initially, has declined since the mid-1960s. An increase in the rate of defaulters can be traced to this relaxation, and

(e) interest, while charged, was not shown separately in the statements. If included, the default rate would be considerably higher than shown.

31. Recent legislation would improve past problems. Loans would be given by the Bank of Ceylon only to farmers and for purposes approved by the APCs. Coordination is ensured by the bank which has its offices in the APC Building. While there is still no provision for the bank to supervise the use of the loan, their association with and the designated functions of the APCs introduces a substantial element of control. The Agricultural Insurance Law would compensate for crop failures and as it makes the claims of a recognized credit organization the first charge on the payment, this cause for defaults will disappear. A further factor is that under the project, production will be enhanced and generate a cash surplus in excess of living costs.

32. The procedure for applying for credit is set out in the relevant legislation. Applications must be made to the APC who assess its justification either directly or through the extension staff attached to it. Whenever feasible, credit is supplied in kind, in the form of purchasing vouchers. The APC, through the CCs and the extension staff, ensure its proper use within the framework of their general supervisory duties.

D. Storage, Marketing and Processing

33. Paddy. Until recently, the Paddy Marketing Board (PMB) had a monopoly over paddy purchase. Even with the removal of restrictions on private traders, it is expected however, that the PMB would continue to play an important role in paddy marketing and milling. The Board buys from farmers at a fixed price (presently Rs 35/bu) through a vast network of purchasing points run by the cooperative societies. Since the price is fixed and does not vary throughout the year, it is to the farmer's advantage to sell as soon as possible and thus avoid the risks associated with farm storage. Because of this, most farmers keep only paddy needed for home consumption and seed. They normally have a small storage room

built as part of their house. The PMB is legally required to purchase all paddy offered at the set price.

34. The Village Level Cooperatives get a commission of 75¢ per bushel from PMB for grading, weighing, and sacking. Grading is normally done according to the following standards:

	Grade I	Grade II
Chaff (by volume)	6%	12%
Foreign matter	1%	2%
Other varieties	10%	10%
Moisture content:	16%	16%

The difference in price is 2¢ per lb in favor of Grade I. Because the purchase centers are not equipped to test for quality variations, they base prices on judgement and experience.

35. The periods of purchase are between March and July inclusive, and again between August and October. The peak period is between March and May, when transport is sometimes a bottleneck which results in accumulation of produce at the purchasing centers and temporary suspension of purchases.

36. At present in the project area, there are very few purchasing points. As the settlement clusters and the villages are developed (Annex 7), premises would also be provided for the MPCS for all their activities, including that of purchasing for the PMB. Once in the hands of PMB, arrangements for safe storage and processing are either adequate or under development by various bilateral agencies working with GOSL and no bottlenecks on this account are anticipated.

37 Maize and Sorghum. The quantities produced are small and the bulk of the harvest takes place in a relatively dry period. Marketing of surpluses is mostly through private channels. The GOSL, through the Oils

and Fats Corporation, and PMB, which acts for the Flour Milling Corporation, has entered the market, but its purchases are low and erratic. Prices during the last season varied between Rs 2,000 and Rs 1,500/ton, due mainly to the limited market for feeds; the Oils and Fats Corporation prefers the much cheaper coconut cake and rice bran. The cooperatives are buyers only up to the extent of recovering outstanding debts. The Flour Milling Corporation uses maize and sorghum for blending with imported wheat flour, on an ad hoc basis.

38. Pulses. Consumption has fallen to about one third of the amount used before imports were banned in 1971. Since 1973, prices have increased considerably and this has encouraged production. Although there are a few local marketing difficulties, total consumption is still much below pre-1971 levels. The crop is potentially profitable even at prices below present levels, and no major long-term problem in organizing a profitable and effective marketing system is anticipated.

39. Paddy Storage and Marketing Requirements Under the Project. As planting and, therefore, harvesting would be concentrated into a short season, deliveries to the PMB would also have high peaks and would take place over a short time span. Therefore adequate facilities for storage and re-bagging must be provided in the settlement complexes to handle the peak (maha) procurement in about four weeks, at the rate of about 40 tons per day. Each collection point would require about 150 tons of storage and working space for a simple auger-fed bagging shute or about 1,500 sq ft of floor space. The building should have large doors at both ends and a loading dock at the end opposite the bagging unit. A moisture tester capable of giving instantaneous reading should be available. Samples above 16% moisture would be accepted at a discounted price and then only if they could be delivered to a drier the same day. A total of about 30 collection centers would be required at full development.

40. Processing. The milling of produce purchased by PMB is adequately handled by facilities in existence or planned under the PMB and Oils and Fats Corporation development projects. Custom milling in villages is expected to be developed by private enterprise in premises set aside for them by the settlement village development plans (Annex 7).

December 1975

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Civil Works

General

1. The project will provide irrigation service for 26,000 ac with enlarged existing facilities and new facilities that will use water accruing in the basin and supplemental water imported into the basin via the Bowatenna tunnel. Two project units are proposed, namely, the:

(a) Kandalama tank unit serving 14,000 ac (8,000 ac on the right bank and 6,000 ac on the left bank);

(b) Kalawewa tank unit, located on Kala Oya immediately downstream from the Kandalama tank and service area, serving 12,000 ac on the left bank.

Kandalama Unit

2. The main project items of the Kandalama unit comprise the Kandalama tank, Dambulu reservoir and integrated village tanks that store and regulate local inflows and Bowatenna tunnel imports; main, branch, and distributary canals and field channels with related structures to deliver water to the land; main and secondary drains to remove surface water from the land, service roads; land clearing, and farm land preparation.

3. Kandalama Tank: The project will rehabilitate and enlarge the two existing tank sluices to deliver 250 cusecs to the right bank (RB) main canal and 200 cusecs to the left bank (LB) main.

4. Dambulu Reservoir: The project will construct this reservoir on Dambulu Oya as an alternative to an inverted siphon for the left bank main canal crossing of the Dambulu. The structure proposed is a homogeneous rolled earthfill 5,475 ft long with a top width of 24 ft, a height of 40 ft, 3:1

side slopes on the upstream and 2.5:1 on the downstream. The active reservoir capacity is 7,500 ac-ft. A gated spillway 100 ft long with four 20 ft x 20 ft radial gates and one 20 ft x 10 ft automatic radial gate is proposed and will be capable of discharging 29,000 cusecs (100 year design flood). A sluice tower with a double barrel sluice is proposed on the left bank (design capacity 250 cusecs).

5. Integrated Village Tanks: Three village tanks are along and part of the right bank (RB) main canal. The first tank, Randenawewa, is about 7 mi downstream on the canal from Kandalama. The second, Mahawewa, is 18 mi downstream; and Makandawala, 22 mi downstream, is the RB canal terminus. Regulating gate structures to control canal flows entering and leaving each tank are proposed for construction.

6. Main and Branch Canals: The proposed project canals are unlined except in special cases where excessive seepage would occur (e.g. weathered rock areas). The earth section is a normal trapezoid in moderate cut and fill. Designs are based on Manning's formula with a roughness coefficient of 0.025 for earth and 0.017 for concrete lining. To avoid erosion average velocities are less than 3 ft/sec. Depths of water in the canal were held to about 4.0 ft to minimize seepage and to facilitate maintenance. Side slopes of the earth section are 2:1 and 1:4 in the deep cut lined sections in rock. The canal embankments carry 12 to 20 ft wide roadways depending on the canal size and the road classification. Checks regulate flow in the canals. Discharges to the main canals and from the main canals are measured using parshall flumes. Orifices are used to measure releases from the distributaries and field channels. Given below are the specific details of the two main canals proposed for the Kandalama unit:

(a) Right bank main canal. The project RB canal follows the existing canal for 9 mi then continues northward for a total of 22 mi terminating in the Makandawala tank. The canal passes through Randeniwewa tank at about mile 7 and Mahawewa tank at about mile 15. In the first 7 mi the canal carries 250 cusecs in a section having a bed width of 20 ft and a depth of 4.4 ft. The capacity is reduced at 210 cusecs between mile 7 and 13. From mile

13 to the terminous, the canal flows at 100 cusecs in a section having a 4.0 feet depth and 18 feet of bottom width. One short branch canal about 3 mi long leaves the main at about mile 12. The principal structures related to the canal are 5 tank sluices (village tanks), 4 parshall flumes, 10 regulating weirs, 33 turnouts, 17 drainage culverts and 10 road bridges, 1 spillway and 1 siphon.

(b) Left bank main canal. The project enlarges the existing canal from Kandalama to Dambulu to a section having a 16 ft bed width, 4.4 ft of depth and 200 cusecs of capacity. The canal then extends for 2.5 mi to discharge into Dambulu reservoir. The canal continues from the left bank of the reservoir for 4 mi with a capacity of 170 cusecs to Nammillewa where it discharges into a natural waterway. The discharge flows down the waterway for about two miles to Ranawa tank. The project provides a 3 mi branch canal from the tank along the right bank and a 2 mi branch extending from the tank along the left bank. The main canal structures include 5 tank sluices, 5 parshall flumes, 4 regulating weirs, 12 turnouts, 1 spillway, 10 drainage culverts, 3 road bridges and 2 siphons.

7. Distributaries: The distributaries take off from the main and branch canals and command from 250 to 500 ac. Discharges from the distributaries issue to the field channels through orifice measuring devices. Flow within the distributaries is controlled by regulating weirs.

8. Field Channels: The project field channels receive water from the distributary and deliver it to the farm. Generally each field channel serves twenty 2.5 ac farms or a total of 50 ac.

9. Drainage Facilities: The project will provide facilities to remove excess surface water from the farm fields. The surface drainage will be removed from the farms by field drains that discharge into secondary drains. Water from the secondary drains will discharge into mains which in turn will release their flows into the major natural drains of the area. Design capacity of the drainage system provide for removal of 0.124 cusecs per acre for farm drains, 0.105 cusecs per acre for secondary drains and 0.088 cusecs per acre for the mains.

10. Roads: The project will provide Class C roads (20 ft roadway), and Class D roads (16 ft roadway) to service the area. The Class C road will provide for the through travel and major access to the area. The Class D road will connect with and serve villages. Tracks (12 roadway) will provide access to the farms. The tracks will parallel field channels. Roadways along distributaries and branch canals generally will be equivalent to Class D. Roadways along the main canal will be 20 ft wide.

11. Farm Units: The construction of the individual irrigated farm units of the project are included as project works. The work involved has been separated into two categories, namely: Land Clearing and Farm Land Preparation.

(a) Land Clearing. The new lands under the project are wooded with jungle bush and timber growths. The project construction program using heavy equipment will remove the vegetative cover and stumps and rough level the land.

(b) Farm land preparation. Following rough leveling the project will prepare topographic maps of the land and paper layouts of the proposed farm units. The farms will average 2-1/2 ac (one hectare). The upland farms will be developed to use furrow irrigation. The lowland paddy farms will be under basin or flood irrigation. To the extent possible, farm sizes will be regular and will not exceed 600 ft in length in the direction of irrigation.

The upland farms will be terraced with land leveling generally along the contours. Final slopes in the direction of irrigation will not exceed 0.5% and slopes normal to the irrigation direction will be at less than 1.0%. Figure 1 illustrates the general layout of upland farms with conservation bunds ,farm ditches and drains.

The lowland farms will be leveled when ground slopes exceed 0.5%. The depth of cut will not exceed three inches and the length of each liyadda will not exceed 100 feet. Figure 2 illustrates typical farm layout for two lowland paddy farms.

Kalawewa Tank Unit

12. The Kalawewa tank unit is located on the left bank of the Kala Oya downstream from the tank. Water exiting from Kandalama tank and service

area enters Kalawewa tank. Field inspection, review of topographic maps and the feasibility study for Stage II of Mahaweli Ganga Development of September 1972, and discussions with the staff of the Mahaweli Development Board indicate sufficient comparability between the Kandalama and Kalawewa units. In general, the unit works will be similar, the areas are comparable, and the lowland and uplands fall in the same general pattern. Because of the general comparability the unit cost of project works per acre of the Kandalama unit reasonably can be used to project the cost of building the Kalawewa unit.

Technical Assistance

13. The project would provide one hydrologist/water resources specialist to assist the MDB in preparing a water supply analysis and operation program for the Mahaweli Ganga Project to establish the ability of the project to serve its existing lands and the potential for expansion. The study would take between one and two years. It would be a "from scratch" study based on all currently available data and would not be an update of any earlier study. Draft terms of reference for the specialist are presented as Appendix 1.

14. The project will provide for a water management and irrigation system specialist during part of the project period to assist in implementing, at field level, the construction of an effective irrigation system, and to assist in preparation of effective project operating plans. Appendix 2 presents the draft terms of reference.

15. Also the project will provide for construction engineer to assist the Chairman, MDB. The specialist will provide guidance in overall project implementation, scheduling and direction necessary to meet completion goals (see Appendix 3).

December 1975

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Hydrologist/Water Resources Specialist

Terms of Reference

1. The project will provide a specialist to work with the Mahaweli Development Board to prepare a new evaluation of the Mahaweli Ganga project water supply. The study will include all project features, plans and operations and will establish the water supply available for Stages II and III of the project and the supply available for future development.

2. The specialist should have:

(a) broad experience in river hydrology, water supply, irrigation and hydropower and in preparing project water and power operation studies and programs, and

(b) experience in monsoon environments.

3. The specialist working with the Board will direct the preparation of a project operation study that will:

(a) establish water supplies available to each project unit and sub-area;

(b) establish procedures for allocation of water between power and irrigation use when conflicts occur;

(c) establish the limits of irrigation development permitted by project water resources, and

(d) complete the operation study and evaluation in approximately one but not more than two years.

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Water Management On-farm Development Specialist

Terms of Reference

1. The project will provide technical assistance to the Mahaweli Development Board in irrigation management including on farm system development, criteria for layout and design of control and conveyance facilities, irrigation operation practices and system maintenance procedures.

2. The specialist should:

(a) be experienced in irrigation system design, construction and operation;

(b) have experience in monsoon area irrigation;

(c) have managed, operated and maintained an irrigation project;

(d) be able to provide details and criteria and layout advice for all features of an irrigation conveyance system and supporting facilities.

3. The specialist will:

(a) assist the Board with criteria for design of the project conveyance system, including measuring and control features extending from the tank to the farm delivery turnout;

(b) assist and train project personnel in developing tank operating programs to meet projected crop demands;

(c) assist and train project personnel in operating the conveyance system to provide satisfactory and efficient deliveries to the land;

(d) assist and train project personnel in scheduling and executing maintenance routines, preventive maintenance and repairs;

(e) with and assisting project personnel work with and train farmer groups to carry out rotational irrigation along the field channels and to maintain the field channels and related structure to assure excellent performance;

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(f) develop a cadre of project personnel and farmers who in turn can train others in the details and routines of project operation and maintenance.

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Construction Engineer

Terms of Reference

1. During the implementation period, the project will provide for a specialist to assist the Chairman of the Mahaweli Development Board on programs, schedules and implementation problems. The specialist will serve as a special advisor to the Chairman and provide assistance as required to complete the project in an effective and timely manner.

2. The specialist should:

(a) have broad construction experience on similar irrigation and power projects, and

(b) have experience in monsoon areas.

3. The specialist will:

(a) serve as a special advisor to the Board Chairman on all matters related to implementation of the project;

(b) assist in the preparation of programs and schedules;

(c) review progress and furnish advice on actions related to progress maintenance;

(d) provide advice on handling special construction problems; and

(e) provide advice and assistance to bring the project to completion on schedule.

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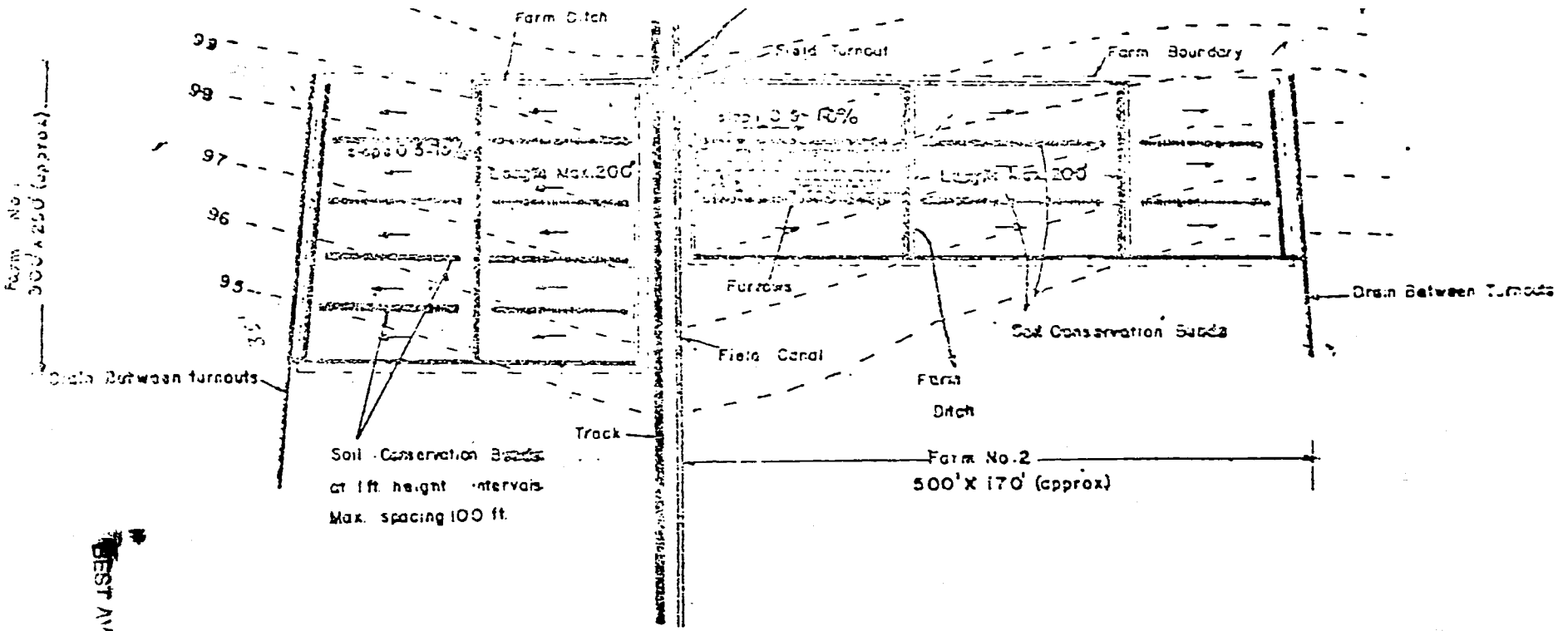

LEGEND

- Field Canal
- Track
- Farm Ditch
- Drain
- Farm Boundary
- Contours
- Soil Conservation Bunds
- Step Drain

ANNEX 5
Figure 1

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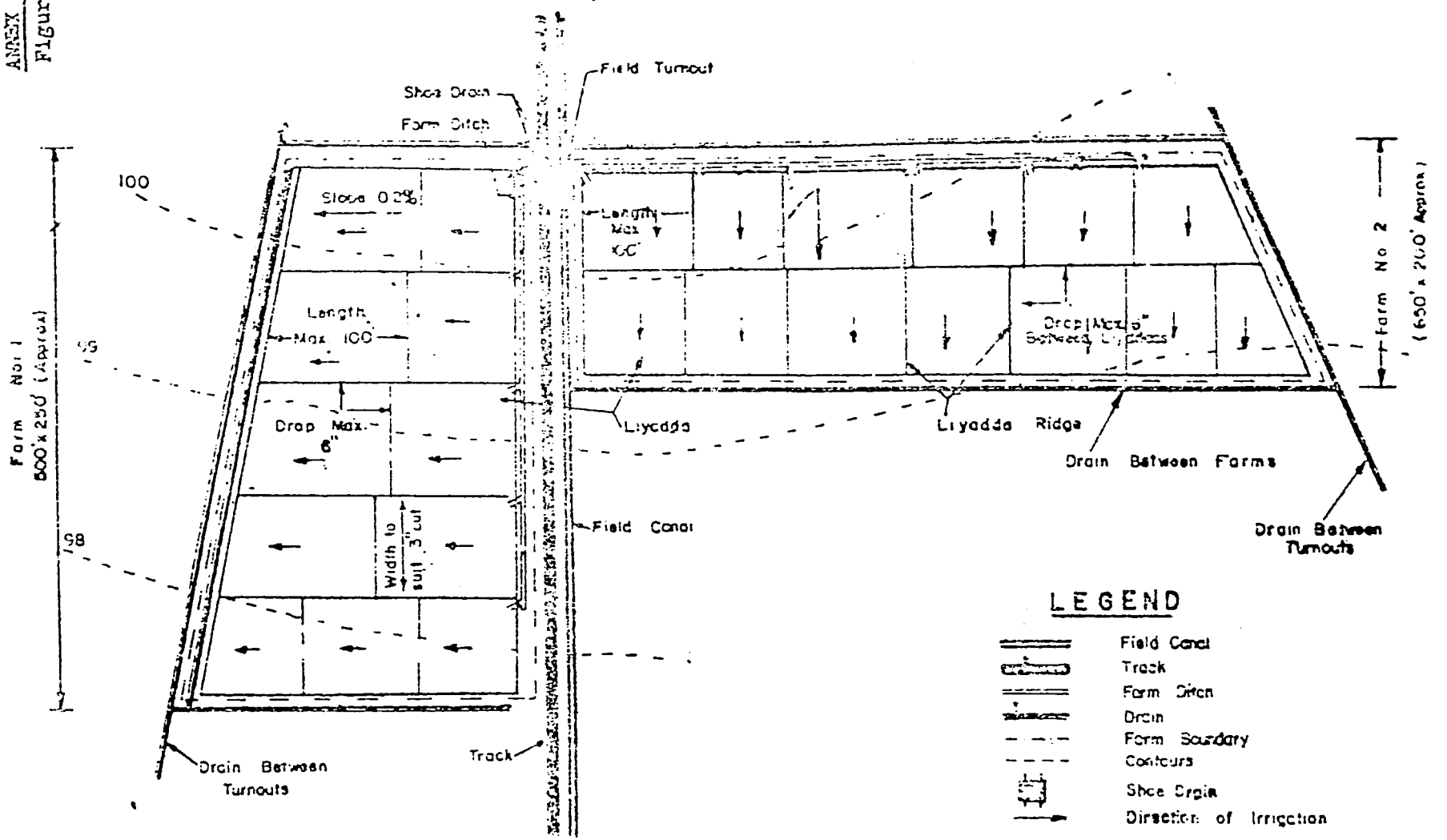
ANNEX 5
Figure 2

TYPICAL PADDY FARM 3 Acs.

(Existing Ground Slope Approx. 0.5%)



ANNEX 5
Figure 2

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Equipment List

Equipment and Vehicles for Construction

Item	Quantity	Estimated Unit Cost (cif Colombo)	Total Cost
		---------(US$'000)----------	
I. Canal Construction Unit			
Elevating motor scrapers (14 cu yd)	4	125	500
Track type tractors (180 hp)	1	100	100
Track type tractors (120 hp)	2	80	160
Dump trucks (3-5 cu yd)	3	20	60
Motor grader	1	30	30
Wheeled farm tractors	2	15	30
Motorized sheepfoot rollers 1/	2	15	30
V-ditcher	1	20	20
Water trucks	2	20	40
Fuel and lubrication trucks	2	25	50
Sub-total			1.020
II. Land Clearing - Leveling Unit			
Track type tractor (235 hp)	1	135	135
Track type tractors with ripper and special root and tree pusher attachments (180 hp)	3	110	330
Blade and brush forks	3	30	90
Land planes	3	15	45
Sub-total			600
III. Road Unit			
Track type tractors (120 hp)	2	80	160
Motor rollers	2	35	70
Motor graders	2	30	60
Water trucks	2	20	40
Fuel and lubrication trucks	1	25	25
Motorized sheepfoot roller	1	15	15
Sub-total			370

1/ Or specially designed canal compactors.

Item	Quantity	Estimated Unit Cost (cif Colombo)	Total Cost
		----------(US$'000)--------	
IV. Tank-Dam Unit			
Motor scrapers 1/ (14 cu yd)	6	125	750
Track type tractors (180 hp)	2	100	200
Truck type tractors (120 hp)	3	80	240
Motorized sheepfoot roller (vibrating)	4	15	60
Motor graders	2	30	60
Water trucks	3	20	60
Fuel and lubrication trucks	2	25	50
Sub-total			1,180
V. Equipment Support Pool			
Dump trucks (5 cu yd)	16	18	288
Front end loader (1.5 cu yd)	5	40	200
Back hoe (1 cu yd)	I	100	100
Dragline (1.5-2.0 cu yd)	1	250	250
Botton dump trailers (10 cu yd)	4	30	120
Track type tractor with rippers(120 hp)	1	165	165
Track type tractor (180 hp)	1	100	100
Track type tractors 2/ (120 hp)	4	95	380
Motor graders	3	30	90
Fuel and lubrication trucks	2	25	50
Sub-total			1,743
VI. Miscellaneous Equipment			
Surveying and mapping equipment	Lump Sum	-	30
Concrete Equipment			
Mixers	5	6	30
Transit mixers	2	40	80
Highway spreaders	2	10	20
Logging Equipment	Lump Sum	-	10
Chain Saw	10	1	10
4-wheel drive field cars	5	6	30
Tools	Lump Sum	-	10
Sub-total			220
Total			5,133
Spare Parts (25%)			1,283
GRAND TOTAL			6,416
		(Say US$6.4 million)	

1/ 8 push pull type and 4 elevator type
2/ 2 with land planes.

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Equipment List

Equipment and Vehicles for Extension Service

Item	Quantity	Estimated Unit Cost (cif Colombo)	Total Cost
		----------(US$'000)----------	
4-wheel drive field cars	10	6.0	60.0
Motorcycle	20	0.5	10.0
Bicycle	50	0.1	5.0
Mini bus	1	5.0	5.0
Teaching Aids and equipment	Lump Sum	-	20.0
Sub-total			100.0
Spare Parts (25%)			25.0
Total			125.0

ANNEX 6
Table 3

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Equipment List

Farm Equipment

Item	Quantity	Estimated Unit Cost (cif Colombo)	Total Cost
		--------(US$'000)--------	
4-wheel tractors	150	5.0	750
Heavy duty cultivators	150	0.5	75
Disc plough	15	0.7	10
Offset disc Harrows	15	0.7	10
Trailers	150	0.6	90
Spare parts	-	LS	150
Sub-total			1,085
2-wheel tractors	570	0.80	455
Rotary cultivators	570	0.30	170
Ploughs	400	0.25	100
Trailers	570	0.40	230
Spare parts	-	LS	150
Sub-total			1,105
Equipment for repair and maintenance facilitities	-	LS	75
Sprayers	-	LS	60
Total			2,325

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Land Allocation, Settler Selection and Community Development

Farm Size and Allocation

1. Settlers would be allocated 2.5 ac (one hectare) of irrigated crop land and a houseplot of 1/2 ac which would not be irrigated, and would be used for fruit trees and vegetables. The irrigated crop land would be allocated in two parcels, according to the land inventory of the settlement unit. It was noted (Annex 2) that the two major soil types, low humic gley (LHG) suitable for two rice crops and red brown earth (RBE), which would not be able to produce rice in the yala without unacceptably high water application rates, are present in an approximately 2:3 ratio. Therefore, each settler would receive approximately 1 ac of LHG land and 1.5 ac of RBE land, in much the same manner as it has been done before under earlier settlement projects. This will enable every settler to have an annual cropping intensity of about 160%, divided as follows (see also Annex 3, Table 1):

	Maha	Yala
Rice	95	35
Cereals	5	12
Pulses	-	15
Total	100	62

This cropping pattern would give a net farm income of about Rs 6,000 per family.

2. The alternative of giving each settler either LHG or RBE lands would enable the former to grow two crops of rice and the latter only one. Further, their respective farming intensities and therefore net incomes would also be different, as shown below:

	LHG farms	RBE farms
Maha		
Rice	95%	95%
Cereals	5%	5%
Yala		
Rice	87.5%	-
Cereals	-	45%
Total	187.5%	145%
Farm incomes (Rs)	8,000	5,000

Clearly, such potential difference in the physical assets allocated to the individual settlers would be unacceptable and therefore the inconvenience of a split holding, successfully overcome by the settlers in the major tank areas, is to be introduced also in this project.

The Settler Communities

3. The settlers would live in hamlets, made as compact as the size of the home plots would allow. The homesteads would surround a village center which would contain the school, trading and commercial facilities, administrative and advisory services and a dispensary. Each hamlet would house no more than 100 farming families and there would be four or five hamlets serviced by the village center; that is to say, one unit for every 1,200 ac of commanded land, or about 20-23 settlement clusters within the project area. The hamlets and villages would be located on non-irrigable land. A lower density of clusters and/or larger hamlets would make distance between homestead and farms most inconvenient.

Selection and Establishing of Settlers

4. The total number of settler families, for whom land is available, using the criteria set out in para 1 is between 10,000 and 11,000. Of those, GOSL estimates that some 2,500 to 3,000 are already in the project area; it

is likely that the number is in fact higher. There are basically three groups: the original inhabitants of the area based on, and often living in, villages named after the ancient tanks (the "purana" villagers), the "colonists," brought in over the last 25 to 30 years, in the wake of major or minor tank rehabilitation and improvement schemes ,and the "encroachers" who came on their own initiative and are squatting on, usually, unirrigated land. These are the most enterprising and many of them are successful mixed farmers. As a group they own the least rice land and are the least communally integrated and organized.

5. The GOSL has decided that farming families already in the area will have priority as participants under the project. New recruits will be, preferably, the landless members of farming families from nearby areas, 30 to 39 years of age, married with no more than two children and with practical experience in farming. Those owning working animals will have preference.

6. The developed lands, houses and home plots will be alienated and a compensation paid for growing crops. Present residents who own houses in places designated as hamlets or villages will be allowed to retain them with a home plot of 1/2 ac. Plots in excess of this area will be allocated to fit into the proposed village or hamlet layout pattern. The village and hamlet sites selected will, as far as possible, coincide with the already established settlements. Due regard will be paid to established connections and affinities in assembling the hamlets. The farm lands will be allocated on request if workable, by ballot, if, otherwise, a dispute is likely. Each settler will receive a grant of Rs 300 towards materials for a new house and, if he requires it, a loan for a permanent dwelling after 1-1/2 to 2 years. Facilities will be provided to obtain the standard parts such as bricks, doors, window frames, roof trusses, etc. by fabricating them locally. Apart from personal efforts and labor, the cash cost of a house is estimated to be between Rs 10,000 and Rs 30,000.

7. The settlers would pay an annual charge for their land as determined by the proposed Land Betterment Charges Law and have the security of

tenure guaranteed by the Agricultural Lands Law. This latter would be subject to a probationary period of a duration yet to be determined.

8. No settler should be expected to earn his living off a holding that was not handed to him in a condition where only normal farming practices would be required to produce an irrigated crop. Thus, he would not be expected to do any bush clearing, stumping and major levelling; he may be called upon to do so as a force account or contract employee of MDB even though working on a holding that will eventually be his. It is expected that with the levelling required and its attendant disturbance of the soil, especially on farms situated on the RBE soils, yield potential for the first few years will be below that ultimately attainable. Therefore, the extra burden imposed by having to cultivate unlevelled and uncleared land may well discourage a settler and must not be imposed on him.

Settlement Management and Administration

9. All matter pertaining to the selection, establishment and welfare of the settlers will be under the overall charge of an Assistant General Manager (AGM) of the MDB, who reports to the General Manager (GM). This officer is also a Deputy Land Commissioner. At present, he and his staff work only in Area H1 dealing with 2,400 potential settlers and allocating 6,000 ac of irrigated land. Therefore, his present staff is only indicative; its strengthening must depend on the rate of settlement actually achieved. Thus, at present, there are three District Land Officers reporting to him, to whom, in turn, six Settlement Officers report. All these cadres are arts graduates with previous experience in the Land Settlement Department commensurate with their grades. A similar organization exists under the GA of the Districts, with whom close liaison on settler selection is being maintained. Once a village cluster is established, it will be the task of the settlement staff to maintain close contacts with the settlers, establish councils and organizations that will adequately represent them and will be in a position authoritatively to discuss current and long-term problems with the authorities and ensure a rapid and fair hearing of these problems.

10. Provisions would be made for all community infrastructural facilities like schools, dispensaries, police posts, etc. These will be designed, erected and staffed by the Ministries concerned. The budget for the capital items would be allocated to MDB who, as the investment becomes necessary would pass them on to the Ministry concerned. The following would be required:

(a) In the hamlets: an elementary school, cooperative depot/produce purchasing point and post box and the sale of postage stamps on an agency basis.

(b) In the village clusters: there would also be a junior secondary school, a full MPCS depot, clinic, post office, community center, and housing, offices and depot for the KVS.

(c) In the urbanized centers: there would, in addition, be a senior secondary school, a bank, a cottage hospital, and a project administrative office.

The planning of these facilities must be inclusive of the housing appropriate for the staff expected to reside in the settlements.

11. The plans must include shopping and service centers that will be constructed and eventually sold to private potential shopkeepers, artisans and businessmen for trading premises. Plans must include the appropriate religious buildings, to be created by community efforts in cash or kind. It is necessary that budgetary provisions, for investment and continuing operation, be forthcoming and that staff of a suitable high calibre, fit to cope with the problems likely to occur in a heterogeneous, new community, be posted.

12. Past experience has shown that new settlers tend to be reckless in their spending habits and then they rely on the Government to tide them through until the next harvest. Those who are unable to obtain this form of relief assistance in adequate amounts commit their land to third parties and become, if not in law then in fact, tenants ,sharecroppers or even laborers on what may well remain nominally their own land. No legislative action can prevent

this from happening, only careful counselling, coupled with the ready availability of institutional credit so that at least all legitimate needs either for cases of genuine hardship or development can be expeditiously met.

December 1975

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Water Demand, Supply and Quality

Water Demand

1. The estimated monthly and seasonal crop water requirements, developed using a modified Penmen method, are shown in Table 1. Based on these estimates and the proposed cropping pattern (Annex 3, Table 1) the ross irrigation requirements for the 26,000 ac project areas would be about 73 000 ac-ft during the Maha season and 80,000 ac-ft during the Yala season, or bout 153,000 ac-ft annually. The annual demand would be equivalent to an average of about 6 ac-ft of water per ac.

2. The main sources of water supply for crop production in the 26,000 ac project area (part of the total Kal Oya, including also area II, irrigation service area of 124,900 ac, Table 1) are rainfall and the flow of the Kal Oya river system regulated by the Kandalama and Kalawewa tank storages. The Kal Oya river is supplemented at its head by diversions, from the Mahaweli Ganga River, now coming on stream as a result of Mahaweli Ganga Stage I project. The Mahaweli Ganga supplies are partly diverted at Pogolla dam and conveyed by the improved Amban Ganga river course to Bowatenna Dam and or partly diverted by the Bowatenna tunnel to the Kal Oya headwaters The Bowatenna complex divides the Amban Ganga flows between Kal Oya out he downstream Amban Ganga irrigation service areas (99,000 ac 1/) which are supplied via the Elahera diversion weir and canal (Map 11908).

3. Water balance studies carried out by the MDB assisted successivel by the consulting engineering companies ECI (USA) and SOGEREAH (France) determined the various inflows, tank(reservoir) regulated storages and probable tank yields available for irrigation supplies as follows:

(a) Locally available river supplies

Tank	Capacity	Annual Inflow
	----------000 ac-ft	----------
Kandalama	25.6	25.1
Kala Wewa	72.7	166.6
Kattiyawa, Maha Illupalama	6.7	12.3
Angamuwa	12.4	33.0
Usgala Siyabalangamuwa	20.7	61.7
Rajangana	76.5	103.0

The average yield of the tanks is estimated at 250,000 acre-feet. In a dry year the tank will yield about 150,000 acre-feet. In wet years the tanks can furnish 300,000 acre-feet of water to meet irrigation demands.

(b) Mahawali Gange supplies diverted at Bowatenna

Supply	Low	Average	High
	----------000 ac-ft		--------
Mahawali	730	1020	1300
Amban-Mahaweli at Bowatenna	1060	1420	1810
Release to downstream AG including Elahera	640	980	1160
Diversion to Kal Oya	420	540	650

(c) Summary of total water supplies available in Kal Oya

Source	Low	Average	High
	000 ac-ft		
Bowatenna imports	420	542	650
Local tank supply	150	250	300
Salvaged return flow	100	160	190
	680	952	1,140

4. The studies indicated that there would be sufficient water available from these sources to supply the active Ganga Stage II areas (Kal Oya including also Area IH), the existing Amban irrigation service areas, and to provide for extension of the Amban Ganga service areas in Stage III of the Mahaweli project. The supplies available in Kal Oya would be sufficient to sustain [illegible] a 160% cropping intensity at a high level of reliability, presently estimated from the 24 year record to be about 75%. (shortfall of about 15% once in 24 years).

5. Before the development of the remaining Kal Oya areas and well before Stage III is implemented MDB proposes to update the hydrological and reservoir operation studies, and together with the irrigation water use experience gained, refine the water balances.

Water Quality

6. The waters of the Mahaweli and Amban Ganga are of excellent quality. The water supplies of the project area tanks are also good. The waters can be used satisfactorily for irrigation purpose.

December 1975

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Crop Water Demand Per Ac

	Maha						Yala					
	Sept.	Oct.	Nov.	Dec.	Jan.	Total	Feb.	Mar.	Apr.	May	June	Total
Paddy												
Evapo-transpiration (in)	6.7	5.2	4.1	4.3	4.5		5.5	6.7	6.5	7.9	4.2	
Crop factor	-	1.00	1.15	1.20	0.90		-	1.00	1.15	1.20	0.90	
Consumptive use (in)	-	5.2	4.7	5.2	4.1	19.2	-	6.7	7.5	9.5	3.8	27.5
Land preparation (in)	4.0	2.0	-	-	-	6.0	4.0	2.0	-	-	-	6.0
Total water requirements (in)	4.0	7.2	4.7	5.2	4.1	25.2	4.0	8.7	7.5	9.5	3.8	33.5
Effective rainfall 1/ (in)	0.5	3.5	3.4	3.0	0.8	11.2	0.4	1.3	2.5	1.1	-	5.3
Net irrigation requirements (in)	3.5	3.7	1.3	2.2	3.3	14.0	3.6	7.4	5.0	8.4	3.8	28.2
Gross requirements at 40% overall efficiency (in)	8.8	9.2	3.3	5.5	8.2	35.0	9.0	18.5	12.5	21.0	9.5	70.5
Field Crops												
Evapo-transpiration (in)	6.7	5.2	4.1	4.3	4.5		5.5	6.7	6.5	7.9	6.2	
Crop factor	-	0.4	0.8	0.9	0.6		-	0.4	0.8	0.9	0.6	
Consumptive use (in)	-	2.1	3.3	3.9	2.7	12.0	-	2.8	4.9	7.1	2.6	17.4
Land preparation (in)	4.0	2.0	-	-	-	6.0	4.0	2.0	-	-	-	6.0
Total water requirements (in)	4.0	4.1	3.3	3.9	2.7	18.0	4.0	4.8	4.9	7.1	2.6	23.4
Effective rainfall 1/ (in)	0.5	3.5	3.4	3.0	0.8	11.2	0.4	1.3	2.5	1.1	-	5.3
Net irrigation requirements (in)	3.5	0.6	-	0.9	1.9	6.9	3.6	3.5	2.4	6.0	2.6	18.1
Gross requirements at 40% overall efficiency (in)	8.8	1.5	-	2.3	4.7	17.2	9.0	8.8	6.0	15.0	6.5	45.3

1/ [illegible] ...cy.

ANNEX 8
Table 1

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Kal Oya Service Areas

Location	Existing Area (ac)	New Area (ac)
Kandalama	4,000	14,000 a/
Kala Wewa) Kattiyawa) Maha Illupalama)	13,000	57,000 a/
Rajangana) Angamuwa)	17,000	-
Usgala Siyabalangamuwa	1,500	-
Nachachaduwa & City tanks	10,000	-
Hurulu Wewa	8,400	-
	53,900	71,000

a/ Include the proposed project areas.

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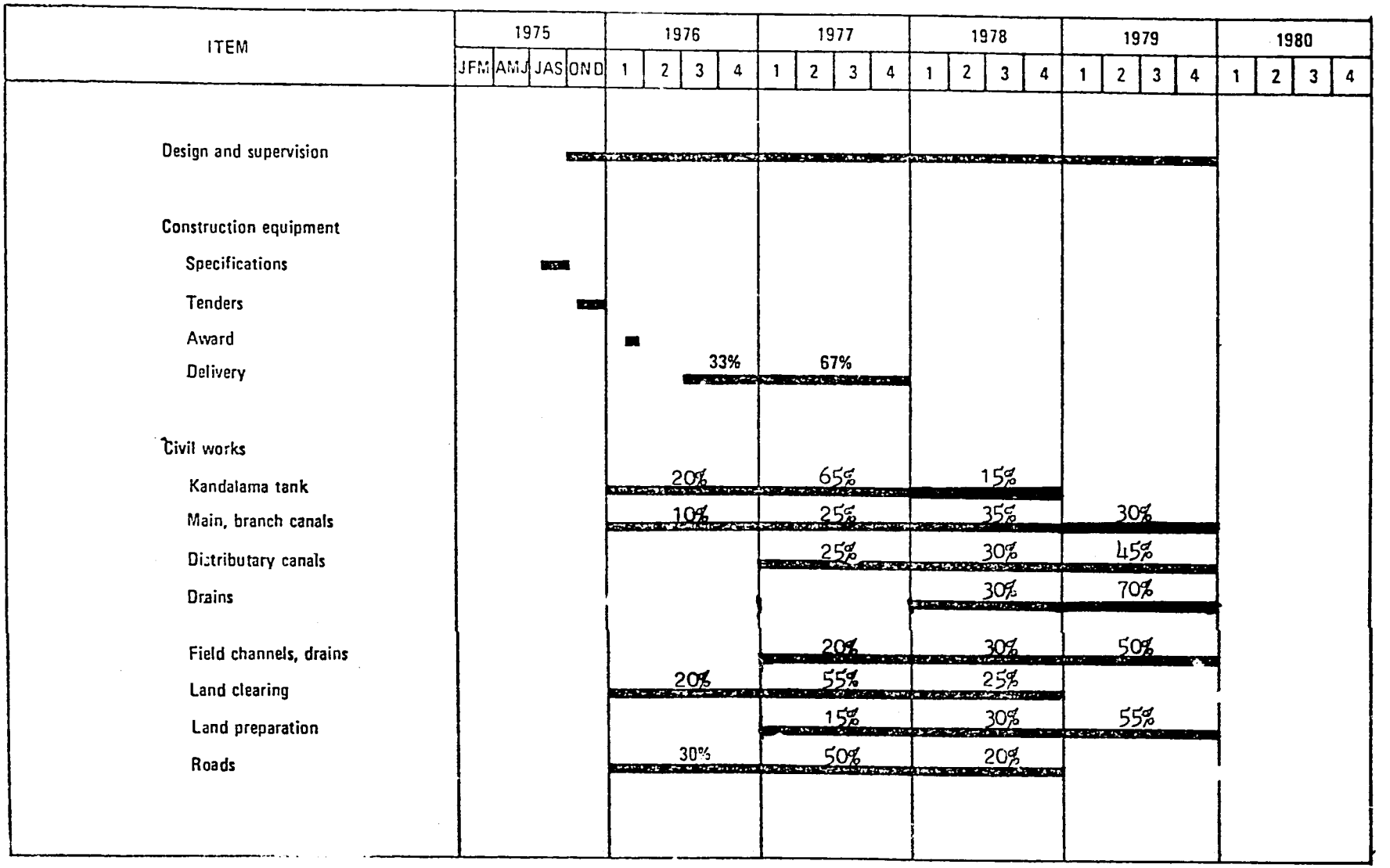
MAHAWELI GANGA PROJECT, STAGE II, PART I
Implementation Schedule



ANNEX 9
Table 1

World Bank—15220

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Cost Estimates

Civil Works

1. The project costs for 26,000 ac were based on the cost per acre developed for the Kandalama unit (14,000 ac). Similarities, terrain, structures required and projected farm sizes and irrigation use provided a reasonable basis for using Kandalama costs. The costs for the Kandalama unit were developed by the MDB staff. Some of the costs are based on detailed engineering estimates, others are based on analyses of cost of facilities for a sample area.

2. The costs prepared by the Board engineering staff were increased by 30% to obtain January 1976 costs. This action was taken following review of and discussion of the basis of the cost estimates with the management and cost estimates of the Government's largest construction organization, the State Engineering Corporation. This agency indicated that its bid on the project would be based on unit costs 30% greater than those used by the MDB in preparing estimates of the project cost.

3. The cost estimates for repair of the Kandalama tank and for enlargement of the existing main canals were based on design cost estimates. The Dambulu Oya dam and reservoir costs were drawn from the feasibility report on the unit prepared by the MDB. Costs of the other project components rely greatly on the 1972 feasibility study for Stage II of the Mahaweli Ganga Development. The general layout of irrigation system and farms, typical structures, service roads, land clearing and farm land preparation and procedures in the feasibility report provide the base upon which the MDG engineering staff estimates of quantities were drawn. The unit costs applied to quantities determined by the engineering staff to obtain project costs were

obtained from "Data for Works and Standard Rates for Basic Item of Construction," Sept. 1974, prepared by the Engineering Studies Organization of the MDB.

Equipment and Vehicles

4. The estimated equipment and vehicle requirements for construction, farm operations and the extension services are listed in Annex 6, Tables 1 to 3. The tables also give the estimated cif Colombo unit costs. In addition, provision has been made for covering FEEC charges, appropriate import taxes and duties, and administrative and handling costs.

December 1975

ANNEX 10
Table 1

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MAHAWELI GANGA, STAGE II, PART I

Cost Estimates

Item	Local	Foreign	Total 1/	Local	Foreign	Total	% of Total
	------(Rs million)---			----(US$ million)----			
I. Civil works							
Kandalama tank	6.1	1.5	7.6	0.8	0.2	1.00	1
Main and branch canals 2/	49.9	17.3	67.2	6.7	2.3	9.0	11
Distributary canals	26.0	1.5	27.5	3.5	0.2	3.7	5
Main and secondary drains	5.1	1.5	6.6	0.7	0.2	0.9	1
Field channels and drains	26.4	2.2	28.6	3.5	0.3	3.8	5
Land clearing	16.7	7.5	24.2	2.2	1.0	3.2	4
Land prepration	10.2	3.0	13.2	1.4	0.4	1.8	2
Roads	16.0	6.0	22.0	2.1	0.8	2.9	4
Subtotal	156.4	40.5	196.9	20.9	5.4	26.3	32
II. Construction equipment and vehicles	57.0	48.0	105.0	7.6	6.4	14.0	17
III. Agricultural equipment and vehicles							
Farming equipment	15.0	17.3	32.3	2.0	2.3	4.3	5
Extension vehicles and supplies	1.5	0.8	2.3	0.2	0.1	0.3	-
Research equipment and supplies	0.8	0.7	1.5	0.1	0.1	0.2	-
Subtotal	17.3	18.8	36.1	2.3	2.5	4.8	6
IV. Village Infra-structure	63.0	15.8	78.8	8.4	2.1	10.5	13
V. Technical Assistance	1.5	2.3	3.8	0.2	0.3	0.5	1
VI. Engineering management and administration	29.5	-	29.5	3.9	-	3.9	5
Basic project cost	324.7	125.4	450.1	43.3	16.7	60.0	73
VII. Physical contingencies	31.3	8.1	39.4	4.2	1.1	5.3	6
Subtotal	356.0	133.5	489.5	47.5	17.8	65.3	80
VIII. Expected price increases	83.5	42.0	125.5	11.1	5.6	16.7	20
Total project cost	439.5	175.5	615.0	58.6	23.4	82.0	100

1/ Due to rounding, the figures may not agree exactly.

2/ Includes the costs of Danulu Oya reservoir and village tank improvements.

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Schedule of Expenditures

	Total Cost	Years 1976	1977	1978	1979
	(Rs Million)				
1. Civil Works					
Base cost	196.9	19.7	59.1	59.1	59.0
Physical contingencies	39.4	3.9	11.9	11.8	11.8
Subtotal	236.3	23.6	71.0	70.9	70.8
Expected price increases	75.3	1.6	14.2	24.1	35.4
Subtotal	311.6	25.3	85.2	95.0	106.2
2. Construction Equipment and Vehicles					
Base cost	105.0	35.0	70.0	-	-
Expected price increases	11.2	2.3	8.9	-	-
Subtotal	116.2	37.3	78.9	-	-
3. Agricultural Equipment and Vehicles					
Base cost	36.1	3.7	10.8	10.8	10.8
Expected price increases	7.3	0.2	1.4	2.3	3.4
Subtotal	43.4	3.9	12.2	13.1	14.2
4. Village Infra-structure					
Base cost	78.8	7.8	23.6	23.6	23.8
Price contingencies	25.1	0.5	4.7	8.0	11.9
Subtotal	103.9	8.3	28.3	31.6	35.7
5. Technical Assistance					
Base cost	3.8	0.5	1.2	1.3	0.7
Price contingencies	0.9	-	0.2	0.4	0.3
Subtotal	4.7	0.5	1.4	1.7	1.0
6. Engineering Management and Administration					
Base Cost	29.5	4.5	9.0	8.0	8.0
Expected price increases	5.7	0.2	1.2	1.8	2.5
Subtotal	35.2	4.7	10.2	9.8	10.5
7. Total Project Cost					
Rupees (million)	615.0	80.0	216.2	151.2	167.6
US$ (million)	82.0	10.7	28.8	20.2	22.3

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Proposed Credit Allocation

Category	Amount Allocated (US$ million)	% of Expenditure to be financed
(i) Civil Works (including construction materials procured locally)	15.0	50%
(ii) Equipment, Vehicles and spares	10.0	
(a) Directly Imported		100% of foreign expenditure
(b) Locally Procured		50% of local expenditure
(iii) Technical Assistance	0.3	100% of foreign expenditure
(iv) Unallocated	4.7	
Total	30.0	

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Schedule of Disbursement

IDA Fiscal Year and Semester	Accumulated Disbursements (US$ million)
1977	
1st	2.0
2nd	8.0
1978	
1st	12.0
2nd	16.0
1979	
1st	20.0
2nd	24.0
1980	
1st	2[illegible].0
2nd	30.0

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Operation and Maintenance

General

1. The system of operation must reconcile two major objectives: the requirements for power generation at the point of diversion from the Mahaweli Ganga river and to meet the water requirements of the crops the farmers are expected to grow, at the time and in quantities that ensure optimum yields. Deliveries to the fields will be timed to take place during daylight to enable the farmers to handle the flow with the least difficulty. Flow rates through a pipe will be approximately one cusec and its command area approximately 40 acres.

Operation Schedule

2. Annex 8, Table 1 shows the monthly irrigation requirements of the two classes of crops taking into consideration the expected effective monthly rainfall. The irrigation requirements of the service area are shown in Table 1. The figures show that there is a great deal of flexibility in the system. Only in May would it appear necessary for each field carrying a crop to be irrigated every day. In the other months irrigation of each field may either cease after a few hours or every farmer would not have to irrigate every day nor would the pipe have to be opened every day and still meet water requirements. The latter method should be encouraged both for operational ease and to enable fertilizing, weeding and spraying to be carried out more efficiently.

3. Operation and maintenance organization. During the construction period and for five years following, the MDB will control the utilization of water on the project area. A Water Management Panel is proposed consisting of the:

Chairman, Mahaweli Development Board

Director of Irrigation

Director of Agriculture

Chairman, Ceylon Electricity Board

Resident Project Manager Kalawewa

Resident Project Manager Minneriya

Head, Water Management Division (secretary)

Area Representative (Kalawewa)

Area Representative (Minneriya)

4. The panel will direct the Water Management Division and the Resident Project Managers in the management and control of the irrigation system. Figure 1 shows the project organization and a suggested organization for the Kandalama unit. Area Representatives will be the channel of communications with the Board on issues involving the farmers. Each committe of farmers will have a Board technical officer to assist and guide their activities.

5. The farmers on each field channel will elect a distributor for the area who will be responsible for deliveries to each farm and for reporting on the maintenance of the field channel to the Cultivation Committee. The rotation plan for the field channel will be developed by the distributor.

6. A Maintenance Overseer (Jala Palana Sevaka - JPS) will distribute water from the distributaries to the field channels and have control of the distributary intake from the main canal. Each JPS will be responsible for about 500 ac.

7. An engineering assistant will be in charge of water distribution and irrigation system maintenance for about 2,000 to 3,000 ac. He will supervise 4 to 6 JPS. He will be under the direction of the Resident Project Manager who will have technical support by the engineering staff of the Water Management Unit. During the project construction period and ten years following, the engineering assistant also will be responsible for overseeing the adequacy of field channel maintenance.

8. Operation and maintenance costs. Estimated equipment and personnel requirements for a typical 6,000 ac module area are shown in Table 2. The total operation and maintenance cost of the project irrigation features exclusive of field channels is estimated at about Rs 75 per acre per year.

December 1975

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Monthly Water Requirements (ac-ft)

	Maha						Yala					
	Sept	Oct	Nov	Dec	Jan	Total	Feb	Mar	Apr	May	Jun	Total
	24,700 ac						9,100 ac					
Paddy	18,010	19,040	6,690	11,321	16,981	72,042	6,825	14,029	9,479	15,925	7,204	53,462
	1,300 ac						7,020 ac					
Dry crop	948	162	-	244	515	1,869	5,265	5,119	3,510	8,775	3,803	26,472
TOTAL	18,958	19,202	6,690	11,565	17,496	73,911	12,090	19,148	12,989	24,700	11,007	79,934
Per 40 ac Pipe 1/	22	22	8	13	20	85	14	22	15	28	13	92

1/ Allowing for 25% loss in the main conveyance system.

ANNEX 4
Table 1

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART

OPERATION AND MAINTENANCE

Staff Requirements for a 6,000 ac Module Area

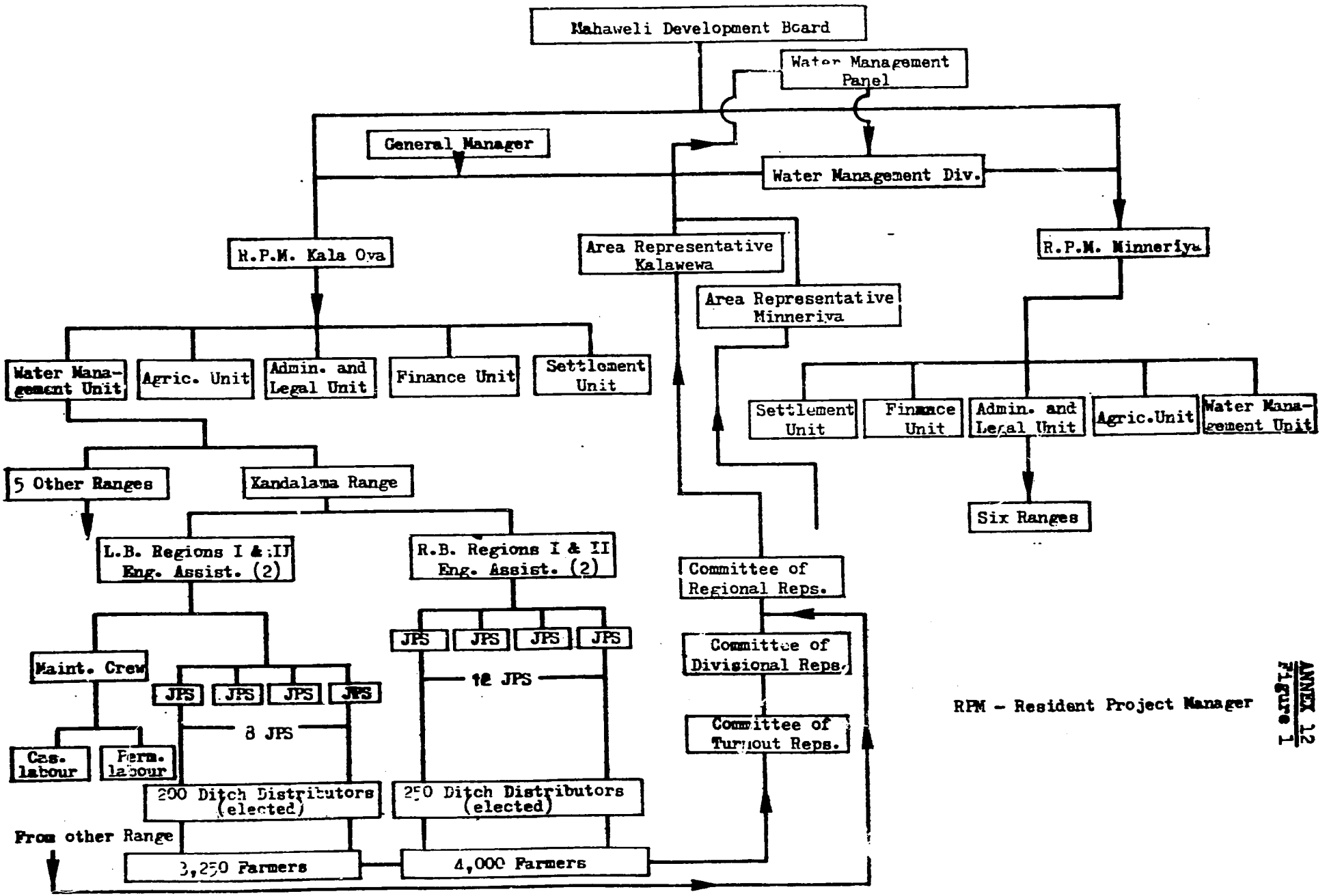
Staff Position	No.	Salary/yr (Rs)	Total Cos (Rs)
Engineer	1	12,000	12,000
Technical Assistant	2	6,000	12,000
Maintenance Overseer (JPS)	4	3,500	14,000
Maintenance Laborer	40	2,500	100,000
Driver	5	3,000	15,000
Store Keeper	1	2,000	2,000
Clerk	1	2,000	2,000
Sub-total			157,000
Leave and Travel 20%			31,000
Total			188,000

Equipment Requirements for a 6,000 ac Module Area

Item	No.	Hrs/year	Cost/hr (Rs)	Total Annual Operating Cost (Rs)
5-ton Truck	1	1,000	40	40,000
Agricultural Tractor	1	1,000	35	35,000
Dump Truck	2	1,000	20	40,000
4-wheel Drive Field Car	1	2,000	25	50,000
Motorcycle	4	2,000	6	48,000
Pedestrian Roller	1	1,000	10	10,000
Total Annual Operating Cost				223,000
Contingencies 10%				22,000
GRAND TOTAL				43[illegible],000

Say Rs 450,0[illegible]

or Rs 75/ac



RPM - Resident Project Manager

ANNEX 12
Figure 1

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Prices for Economic and Financial Analyses

General

1. The estimated future farm gate price of rice, maize, sorghum and agricultural inputs are derived from projected 1985 world market prices in 1976 currency values with appropriate adjustments for freight, handling and processing. Production of crops such as pulses is relatively small and most of the output is consumed locally. Projected farm gate prices for these products are based on the typical ratio between their prices and the price of rice.

2. In recent years, because of severe shortages, foodgrains and fertilizers have commanded unusually high prices in the world markets. In order to isolate the effects of the project from the effects of these temporary fluctuations, projected 1985 prices are used both for present and projected future farm budgets.

Exchange Rate

3. The Sri Lanka Rupee is officially pegged to the Pound Sterling at a parity rate of £ 1 = Rs 15.60 (approximately US$1.00 = Rs 7.50). However, to promote "non-traditional" exports and to cut-down on non-essential imports, the Government practices a dual exchange rate system through the sale and purchase of Foreign Exchange Entitlement Certificates (FEECs). Currently, about 20% of merchandise exports and about 60% of merchandise imports are subject to the FEEC rate of about US$1.00 = Rs 12.40. Despite this, Sri Lanka has faced severe balance of payments problems for the past several years. The country is also experiencing widespread shortages of essential materials, spare parts and capital equipment. In view of these, the official exchange rate clearly understates the real value of foreign exchange to the

Sri Lanka economy. Absence of any economy-wide models and the presence of a complicated system of import restrictions and excise duties makes it difficult to estimate the true opportunity cost of foreign exchange. The unofficial market rate of US$1.00 = Rs 15.00 may be taken as an upper limit, but it partially reflects the demand for luxury imports and for capital flight. A rate of US$1.00 = Rs 12.00 (roughly equal to the current FEEC rate) is perhaps a more reasonable estimate of the value of foreign exchange to the Sri Lanka economy. Accordingly, the economic analysis is based on this assumption. To test the sensitivity of the economic viability of the project to this assumption, the analysis has also been done assuming a 25% error in this estimate.

4. The estimated crop prices for farm budgets are based upon the official exchange rate. However, in view of the Government's emphasis on food self-sufficiency, it is likely that the Government would continue to set the Guaranteed Support Prices at levels which are somewhat higher than the corresponding import prices. Accordingly, a premium of 20% is allowed in estimating the financial farm gate prices for paddy, cereals and pulses.

Crops

5. Rice: The projected 1985 price used as a basis for economic and financial analyses is US$235 per metric ton of low-to-medium quality rice (25% - 35% broken) fob Bangkok. 1/ This represents a sharp decline from the shortage-related prices which have recently averaged more than US$400 per metric ton. Adding shipping and insurance costs results in a projected price of US$265 per metric ton cif Colombo. To this are added the estimated average handling, transportation and marketing costs between Colombo and the likely "deficit areas" resulting in an estimated local market price for milled rice of US$300 per ton. Deducting US$25 per ton as the costs of the

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1/ The Bank's Economic Analysis and Projections Department's latest forecast for 1985 is US$335 (1976 dollars) per metric ton of high quality rice (5% brokens). The price for low-to-medium quality rice is assumed to be 70% of the price for high quality rice.

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Prices for Economic and Financial Analyses

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marketing processing and transportation between the farm and the urban areas close to the project, gives a farm gate price of US$275 per ton rice equivalent. For an estimated milling yield of 65%, 1/ this is equivalent to a paddy farm gate price of about US$180.

6. Cereals (Maize & Sorghum): The 1985 fob Gulf ports prices for maize and sorghum are projected to be about US$110 and US$95 (1976 dollars) per ton, respectively. Assuming a 50-50 mix of the two cereals in project area production and adjusting the fob prices for shipping, insurance handling, marketing and processing, gives an equivalent farm gate price of about US$140 per ton.

7. Pulses: Since pulses are not traded internationally in any appreciable quantity, the Bank Group does not put out a price projection for them. Historical comparisons of rice prices with those for pulses in Sri Lanka and in the neighboring countries indicate that the price ratio remains fairly stable, with pulses commanding a 50-70% premium over the paddy prices. Somewhat conservatively, an average price of US$270 per ton (a 50% premium over paddy price) is assumed in the analysis of this project.

Crop Inputs

8. Fertilizers: It is projected that the 1985 fertilizer prices would be substantially below the unusually high prices experienced during the last few years. The price for nitrogen nutrient (fob Persian Gulf) is expected to decline from about US$650 to US$350 per ton; for phosphate nutrient (fob Morocco) from US$720 to US$470 per ton, and for potassium nutrient (fob Vancouver) from US$120 to US$95 per ton. Shipping, insurance, handling and local marketing would add an average of about US$80 per ton nutrient. Accordingly, the per ton farm gate prices for the three nutrients are estimated to be US$430, US$550 and US$175, respectively. For the

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1/ This is lower than the 70% yield assumed by the PMB since the rice supplied by the PMB has to be reprocessed before consumption.

commonly used basal mixture of 3-30-13 NPK, the price would be about US$200 per ton and for urea (46% N), used as top dressing, the price would be US$160 per ton.

9. Land Preparation: Much of the land preparation work in the area is done on a custom basis. The current rental charges of Rs 60 per hour for 4-wheel tractors, Rs 15 per hour for 2-wheel tractors, and Rs 10 per day for a pair of buffaloes are considered reasonable and are used as such in the farm budget analysis. For economic analysis, the rental charge for two-wheel tractors is increased to Rs 20 per hour as they are imported without the imposition of FEEC charges.

10. Farm Labor: In the farm budget analysis, the prevailing average wage rate of Rs 8 per day is used for all hired labor. However, in view of the unemployment and underemployment situation prevailing in the area, the market wage rate is considered inappropriate for economic analysis. Accordingly, the economic cost of all farm labor (family as well as hired) is based on a seasonally adjusted opportunity cost in terms of output foregone in alternative employment. The details of the analysis are given in Annex 13.

11. Table 1 of this Annex gives a summary of the various economic and financial prices.

December 1975

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Prices for Economic and Financial Analysis

Item	Prices Economic	Prices Financial
Crops		
Paddy (Rs/Ton)	2,150	1,620
Cereals (Rs/Ton)	1,080	1,200
Pulses (Rs/Ton)	3,240	2,430
Fertilizers		
Basal (Rs/Ton) (3-30-13 NPK)	2,400	1,500
Top Dressing (Rs/Ton) (Urea - 46% N)	1,920	1,200
Land Preparation		
4-wheel Tractor (Rs/hr)	60	60
2-wheel Tractor (Rs/hr)	20	15
Buffaloes (Rs/day)	10	10
Farm Labor (Rs/day)	* 1/	8

1/ See Annex 15.

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Crop Inputs and Farm Budgets

General

1. Present agricultural practices in the project area and the expected overall changes in cropping patterns, yields and production due to the project are described in Annex 3. This Annex discusses the impact on the individual farm. The purposes of this micro analysis are:

(i) to estimate the farm incomes for representative farm sizes in order to determine whether the prospective increases in farm income would be sufficient to compensate the farmer and his family for the additional effort and for other production costs they would have to incur;

(ii) to determine the distributional impact of the project and to compare the income levels of the project area farmers with those of farmers in other areas, and

(iii) to analyze the effects of different Government policies regarding water charges.

2. Since the farm sizes, cropping patterns and the cultivation methods would be the same in all the areas to be developed under the project, only one farm model was analyzed -- a 2.5 ac farm with cropping pattern and yields representative of the project areas as a whole. Some further assumptions are as follows:

(a) Crop Input Requirements: Present and projected unit input requirements are given in Tables 1 and 2. The estimated current levels of inputs are based on the agro-economic surveys conducted during project preparation as well as on the information obtained from the local administrations, the Department of Agriculture and several other surveys in similar areas of Sri Lanka. Some improvements in farming practices are assumed for

future "without project" conditions. Future "with project" requirements are based on recommendations by the Department of Agriculture and on observed cultural practices of the progressive farmers of the area. The future estimates assume that land preparation would be fully mechanized under the "with project" conditions.

(b) Prices and Subsidies: The prices used in the analysis are the "financial" farm gate prices discussed in detail in Annex 13. The crop prices are derived on the assumption that to promote food self-sufficiency, the Government would keep the Guaranteed Support Prices at 20% above the corresponding import prices (at the official exchange rate). Crop inputs prices (particularly, the fertilizers) assume the elimination of all subsidies.

(c) Hired Labor: The estimated hired labor requirements (about 20% of the total) are costed at the average market wage rate of Rs 8 per day. No value is put on family labor.

Farm Incomes and Incentives

3. Under the above assumptions the net farm income, including the imputed value of the farm produce consumed at home, is estimated to increase from about Rs 1,900 per year at present to about Rs 3,000 under "without" project conditions and Rs 6,000 1/ under "with" project conditions. Thus, as a result of the project, the farm incomes would be doubled.

4. For the new settlers who would be mostly landless laborers from surrounding areas, the present income levels are unknown. However, they are unlikely to be above those for the farmers currently in the project areas. Furthermore, it is unlikely that without the project their incomes would experience any significant gains. Accordingly, the gains for the new settlers would be even higher than those for the existing farmers. These increases are considered to be sufficient incentives for getting the cooperation and participation of the project area farmers.

1/ Before deducting water charges.

Distributional Impact

5. The landholding pattern in the project area is rather uniform and as a result, the income levels are fairly even. Whatever income disparities do exist, are largely due to the variations in the quality of irrigation facilities utilized by the various farmers. However, even this difference is partially compensated, since the farmers with inadequately irrigated lands divert more effort to chena cultivation, and increase their income from that source. It is projected that the income levels within the project area would become even more uniform "with" the project.

6. In comparing the project area income levels with the average national income, it is necessary to take into account the farmers' income from sources other than irrigated agriculture. Unfortunately, however, there are no reliable data on this. It is generally agreed though, that the farmers do earn substantial incomes perhaps about, Rs 1,500 per year, from 'chena' cultivation and the cultivation of fruits and vegetables in their homestead plots. Furthermore, if one takes into account the imputed value of other goods and services (e.g. rent on homestead) and differentials in purchasing power it is likely that the farm households have a total net annual income of about Rs 4,000, or a per capita annual income of Rs 800. This is about 80% of the national per capita disposable income of about Rs 1,000 per year. Assuming that the income from other sources remains constant, at full development, the average household income in the project area would increase to about Rs 7,000. Taking into account the population increase during the intervening period, this would mean a per capita income of about Rs 1,200. Assuming that the national per capita disposable income increases about 2% annually, at full development, the project area incomes would be approximately the same as the national level.

Recovery of Project Costs

7. At a discount rate of 10% per annum, the present value of the project investments (in economic terms) is estimated to be about Rs 285 million or about Rs 11,000 per ac. In addition, the O & M of the irrigation system would require an annual expenditure of about Rs 75 per ac.

Assuming that the water charges were introduced in phase with the construction schedule, it would require an average annual charge of Rs 1,800 per ac 1/ -- Rs 1,725 for recovery of capital costs and Rs 75 for O & M costs -- to fully recover all the expenditures on this project. These charges would represent about 150% of the net incremental farm income (before accounting for family labor), at full development. During the development period when the production is below the full potential, the proportion would be even higher.

8. For analyzing the farmers' ability and willingness to pay water charges, it is necessary to estimate the 'project rent'. Simply stated, the project rent is the incremental net income when all factors of production except project supplied services have been paid the returns necessary for their cooperation. In the absence of uncertainty (about yields, crop prices), the project rent would be the net incremental farm income less the necessary rewards to family labor and management for their additional effort.

9. Recently, GOSL enacted a crop insurance legislation (Annex 4) and this should largely eliminate the uncertainty about the returns to the farmers. However, it is assumed that a 10% reduction in the expected gross farm income is necessary to arrive at the certainty equivalent.

10. In economic literature, there is a considerable amount of controversy about appropriate returns for family labor and management. Conservatively, in the following analysis, all family labor is valued at the average market wage rate of Rs 8 per day. An additional 10% of the net incremental income is allocated to farm management.

11. On this basis, the project rent for the assumed farm model is estimated to be about Rs 1,850 per year (Table 4). Since these estimates are based on "typical" farms, they do not take into account the variations in land and human resources for the various farms. Allowing a 25% margin

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1/ in constant 1976 prices.

for such variations, a reasonable upper limit for the potential water charges would be about Rs 1,400 per ac.

12. While in theory it should be feasible to recover all the 'project rent', in the overall socio-economic context it may be better to impose somewhat lower charges. This is because (a) the income levels of the project area farmers are somewhat below the national average; (b) traditionally, farmers in Sri Lanka have not been required to pay for irrigation water and an abrupt policy change would be difficult to implement politically;

(c) the project would need to persuade the farmers to adopt the proposed in intermittent irrigation techniques, and

(d) through differentials between the crop procurement prices and their "economic" prices, the Government would, in any case, indirectly regain a large part (perhaps about 50%) of the total project cost. In view of these, water charges at an average rate of Rs 300 per ac, covering full O & M cost and about 15% of the investment costs, would perhaps be more appropriate. A study should be undertaken to determine the appropriate level of charges as well as the mechanism to be used for imposing and collecting such charges.

December 1975

SRI LANKA

MAHAWELI GANGA, STAGE IV, PART I

Crop Input Requirements (per acre)

	Paddy			Cereals			Pulses		
	P	W	W 1/	P	W	W	P	W	W
Land Preparation 2/									
4-wheel tractor (hrs)	2	2	2	1.5	1.5	1.5	1.[illegible]	1.5	1.5
2-wheel tractor (hrs)	-	-	2	-	-	1.5	-	-	2
buffaloes (days)	1	1	-	1	1	-	0.5	1	-
Fertilizers									
basal (lbs)	30	60	120	-	-	60	-	60	120
top dressing (lbs)	60	90	180	-	60	120	-	-	-
Agro-chemicals (Rs)	15	25	35	-	10	20	-	10	20
Seeds (lbs)	90	90	90	20	20	20	35	35	35
Crop insurance (Rs)	30	30	30	-	30	30	-	30	30
Miscellaneous 3/ (Rs)	50	60	80	30	40	50	40	50	60
Manual labor 4/ (days)	55	55	55	33	33	33	33	33	33

1/ P = Present, W = future without project, W = future with project

2/ Project conditions will bring about the replacement of buffaloes by tractors for all land preparation work

3/ Excludes water charges.

4/ Labor requirements for rice and cereals under future situations are expected to remain as at present. There will be reductions in labor as a result of shifting from buffaloes to tractors for seedbed preparation. This is assumed to compensate for the additional labor required for harvesting and threshing resulting from higher yields.

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MAHAWELI GANGA, STAGE II, PART I

Monthly Labor Requirements for Various Crops 1/ 2/

Crop		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Paddy (Maha)	P	5	8	5	2	-	-	-	2	9	12	7	5	55
	W	10	8	5	-	-	-	-	3	15	7	4	3	55
Paddy (Yala)	P	2	10	12	7	5	12	4	3	-	-	-	-	55
	W	3	15	7	4	3	9	8	5	-	-	-	-	54
Cereals (Maha)	P	3	4	5	-	-	-	-	-	4	9	4	4	33
	W	6	5	-	-	-	-	-	3	8	4	4	3	33
Cereals (Yala)	P	4	9	4	4	3	4	5	-	-	-	-	-	33
	W	3	8	4	4	3	6	5	-	-	-	-	-	33
Pulses (Maha)	P	-	-	-	-	-	-	-	-	-	-	-	-	-
	W	9	2	-	-	-	-	-	-	7	5	4	6	33
Pulses (Yala)	P	7	5	4	6	9	2	-	-	-	-	-	-	33
	W	7	5	4	6	9	2	-	-	-	-	-	-	33

1/ P: Present, W: Future with Project

2/ The future labor requirements without the projects are projected to remain as at present.

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Farm Budgets[1/]

	P[2/]	$\bar{W}$	W
Cropped Area (ac)			
Maha - Paddy	2.2	2.2	2.4
- Cereals	-	0.1	0.1
- Pulses	-	-	-
Yala - Paddy	0.1	0.4	0.9
- Cereals	0.2	0.2	0.3
- Pulses	0.1	0.1	0.4
Total	2.6	3.0	4.1
Cropping Intensity (%)	104	120	164
Crop Production (Tons)			
Paddy	1.6	2.6	4.5
Cereals	0.12	0.24	0.46
Pulses	0.04	0.05	0.28
Gross Production Value (Rs)	2,850	4,600	8,550
Production Costs (Rs)			
Non-labor inputs	800	1,300	2,200
Hired labor	150	300	350
Total	950	1,600	2,550
Net Farm Income (Rs)	1,900	3,000	6,000

1/ Present and "without" Project farm models represent the farmers currently in the project area.

2/ P = Present, $\bar{W}$ = Future without Project, W = Future with Project.

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MAHAWELI GANGA PROJECT, STAGE II, PART I

Project Rent for the Assumed Farm Models[1/]

	Item	$\bar{W}$	W
(i)	Expected Gross Production value[2/] (Rs)	4,600	8,550
(ii)	Certainty Equivalent of (i) (Rs)	4,150	7,700
(iii)	Crop Inputs[2/,3/] (Rs)	1,600	2,550
(iv)	Family Labor (Rs)	900	1,400
(v)	Net raturns[4/] (Rs) (ii) - (iii) - (iv)	1,650	3,750
(vi)	Management Fee (Rs)	150	400
(vii)	Net Farm Returns (Rs) (v) - (vi)	1,500	3,350
(viii)	Project Rent (Rs)		1,850
(ix)	Project Rent per acre (Rs)		740
(x)	Rent Recovery Index (%) at Rs 300 per ac		40

1/ $\bar{W}$ = without Project, W = with Project
2/ From Table 3
3/ Excluding family labor and management
4/ Before management fee.

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Economic Analysis

Assumptions

The economic analysis is based on the following assumptions:

(a) Prices: The farm gate prices used in the economic analysis are derived from projected 1985 world market prices expressed in 1976 currency values. Appropriate adjustments have been made for freight, handling and processing. A shadow exchange rate of US$1.00 = Rs 12.00 is used to reflect the scarcity of foreign exchange. The price assumptions are discussed in more detail in Annex 13.

(b) Benefits: The project would have substantial secondary income and employment effects in processing industries and trade and transport. Also, the improvements in the road network would lower the transportation costs. In this analysis, however, only increased crop production due to the project is counted as a project benefit. Expected crop yields, acreages and production are shown in Annex 3, Table 1. The gross benefits are summarized in Table 1 of this Annex.

(c) Crop Production Costs: Per acre crop input requirements are shown in Annex 14, Table 1. Crop production costs are summarized in this Annex on Table 2.

(d) Pricing of Labor: Based on an equivalent of two full time adults per household, working an average of 250 days per year, the total farm labor availability for the 3,000 farm households currently in the project areas, is estimated at about 1.5 million man-days, or an average monthly availability of about 0.12 million man-days. Estimates of the total monthly labor requirements, taking into account the cropping patterns (Annex 3, Table 1) and monthly per acre labor requirements for various crops (Annex 14, Table 2) are shown in Table 3 of this Annex. Thus, presently there is an annual need for about 0.32 million man-days compared to an estimated availability of 1.5 million man-days. Even in the "peak" months of February and October, the monthly

demand is less than 50% of the availability. At full development in 1986, "without" the project the total labor demand would improve somewhat due to the increased cropped area made possible by the Stage I works. However, there would still be a large pool of surplus labor. "With" the project, the annual farm labor demand would increase to about 2.1 million man-days, while the supply augmented by the settlement of 7,000 new families would increase to about 5.0 million man-days. Thus, even with the project there would be a substantial surplus of farm labor. Undoubtedly, cultivation of 'chena' land and upland homestead plots partially relieve the current unemployment pressure. Nevertheless, the prevailing average wage rate of Rs 8 per day is considered to be overstating the economic opportunity cost of farm labor. Accordingly, for the economic analysis, the incremental farm labor requirements were valued at Rs 6 per day for the "peak" months of January, February, March, September and October and Rs 4 per day for rest of the year. On this basis, the total cost of the incremental farm labor requirements of 1.6 million man-days is estimated at Rs 8.8 million or an average of Rs 5.5 per man-day. This rate is about 70% of the prevailing market wage rate of Rs 8 per day. Construction labor has been valued at the market rate.

(e) Investment Costs: All project costs except price contingencies (Rs 175.5 million), cost of farming equipment 1/ (base cost, Rs 32.3 million), cost of social infra-structure (base cost, Rs 78.8 million) and taxes and duties (Rs 80.0 million) 2/ are included in the economic analysis. On this basis, the investment costs are estimated at Rs 298.5 million of which Rs 100.4 million are in foreign exchange (Annex 7, Table 1). Shadow pricing the foreign exchange component results in an estimated "economic" cost of Rs 358.7 million.(say Rs 360 million). Conservatively, no salvage value was assumed for the construction equipment even though some of the equipment is expected to be useable after project completion.

1/ Depreciation and O & M of farm equipment (tractors and sprayers) is included as a recurrent crop production cost.

2/ This figure differs from the one in the text (para 4.09) as taxes and duties in the amount of Rs 67.5 million are included in the price contingencies and the base costs of farm equipment and social infra-structure.

(f) Operation and Maintenance: The annual O & M costs for the irrigation system are estimated to be about Rs 75 per ac with the project, or a total of about Rs 1.9 million. The strengthened extension service would add a further Rs 1.1 million to the operating expenses, leading to a total annual O & M cost of Rs 3.0 million. These costs are used as a cost stream against the project benefits.

(g) Development Phasing: Implementation would be phased over five years. It is assumed that full project benefits would be achieved five years after project implementation. The overall phasing of the benefits is estimated to be as follows:

Year	1	2	3	4	5	6	7	8	9	10	11
Net benefits (% of full development benefits)	0	5	20	40	60	70	80	85	90	95	100

Economic Rate of Return

2. Resulting costs and benefit streams are shown in Table 4. Assuming a 30-year project life, the economic rate of return is estimated to be 13%

Sensitivity Analysis

3. Several tests were made to determine the sensitivity of the rate of return estimates to various alternative assumptions about costs and benefits. The tests indicate the following:

	Alternative	Rate of Return
(i)	Basic case	13%
(ii)	Foreign exchange valued at US$1.00 = Rs 9.00	11%
(iii)	Foreign exchange valued at US$1.00 = Rs 15.00	15%
(iv)	Farm labor valued at the market wage rate of Rs 8.00 per man-day	12%
(v)	A decrease of 25% in net incremental benefits	10%
(vi)	An increase of 25% in project investment costs	11%
(vii)	A slower development of project benefits /a	12%
(viii)	Combination of (v) and (vi)	8%
(ix)	Combination of (vi) and (vii)	10%
(x)	Combination of (v), (vi) and (vii)	7%

/a Assumed phasing of benefits:

Year	1	2	3	4	5	6	7	8	9	10	11	12	13
Net benefits (% of full development benefits)	0	0	15	30	50	60	70	75	80	85	90	95	100

Thus, the project's rate of return is moderately sensitive to changes in costs, benefits and the build up of project benefits. However, ecept in the unlikely event that project costs are 25% higher, net benefits are 25% lower and the build-up of project benefits is considerably slower, the project remains viable.

December 1975

ANNEX 15
Table 1

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Annual Gross Benefits (Economics)[1/]

Item	Price (Tk/Ton)	Production ('000 tons) $\bar{W}$	W	Increment	Gross value (Rs million) $\bar{W}$	W	Increment
Paddy	2,160	7.2	46.0	38.8	15.6	99.4	83.8
Cereals	1,680	1.2	5.1	3.9	2.0	8.6	6.6
Pulses	3,240	0.5	2.8	2.3	1.6	9.1	7.5
Subtotal					19.2	117.1	97.9
Less 5% losses in transport and handling					-1.0	-5.9	-4.9
Annual Total					18.2	111.2	93.0

1/ $\bar{W}$ = Future without project

2/ W = Future with project

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Annual Crop Production Costs (Economic)[1/]

	Price	Quantity Used			Economic Cost		
		$\bar{W}$	W	Increment	$\bar{W}$	W	Increment
					(Rs million)		
Land Preparation							
4-wheel Tractors ('000 hrs)	Rs 60/hr	18.8	79.8	61.0	1.1	4.8	3.7
2-wheel Tractors	Rs 20/hr	-	81.8	81.8	-	1.6	1.6
Buffaloes ('000 days)	Rs 10/day	10.0	-	-10.0	0.1	-	-0.1
Fertilizer (Tons)							
Basal (3-30-13 NPK)	Rs 2,400/Ton	230	2,130	1,900	0.5	5.1	4.6
Urea (46% N)	Rs 1,920/Ton	340	2,930	2,590	0.6	5.6	5.0
Agro-Chemicals		-	-	-	0.2	1.3	1.1
Seeds (Tons)							
Paddy	Rs 2,160/Ton[2/]	300	1,350	1,050	0.6	3.5	2.9
Cereals	Rs 1,680/Ton[2/]	15	40	25	-	0.1	0.
Pulses	Rs 3,240/Ton[2/]	15	60	45	0.1	0.3	0.
Farm Labor (million man-days)	Rs 5.5/day[3/]	0.50	2.11	1.61	2.8	11.6	8.
Miscellaneous	-	-	-	-	0.6	3.1	2.
Total Crop Production Costs					6.6	37.0	30.

Annual Net Benefits = (93.0 - 30.4 = Rs 62.6 Say Rs 63 million

1/ $\bar{W}$ = Future without project,
W = Future with project
Increment = W - $\bar{W}$

2/ For "without" project case. A 20% premium is assumed for "with" project case to account for improved quality.

3/ See para 1 (d) and Table 3 for details.

ANNEX
Table

SRI LANKA

MAHAWELI GANGA PROJECT, STAGE II, PART I

Economic Cost of Farm Labor

Items	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Labor Requirement (million man-days)													
Present	0.03	0.05	0.04	0.02	0.01	0.01	0.01	0.01	0.04	0.05	0.03	0.02	0.32
Future without Project	0.04	0.08	0.07	0.04	0.03	0.04	0.02	0.02	0.04	0.06	0.03	0.03	0.50
Future with Project	0.32	0.38	0.21	0.07	0.07	0.11	0.09	0.12	0.38	0.18	0.10	0.08	2.11
Incremental 1/	0.28	0.30	0.14	0.03	0.04	0.07	0.07	0.10	0.34	0.12	0.07	0.05	1.61
Average Economic Opportunity Cost (Rs/man-day)	6	6	6	4	4	4	4	4	6	6	4	4	5.5
Incremental Economic Cost (Rs million)	1.68	1.80	0.84	0.12	0.16	0.28	0.28	0.40	2.04	0.72	0.28	0.20	8.82

1/ Future "with" over future "without".

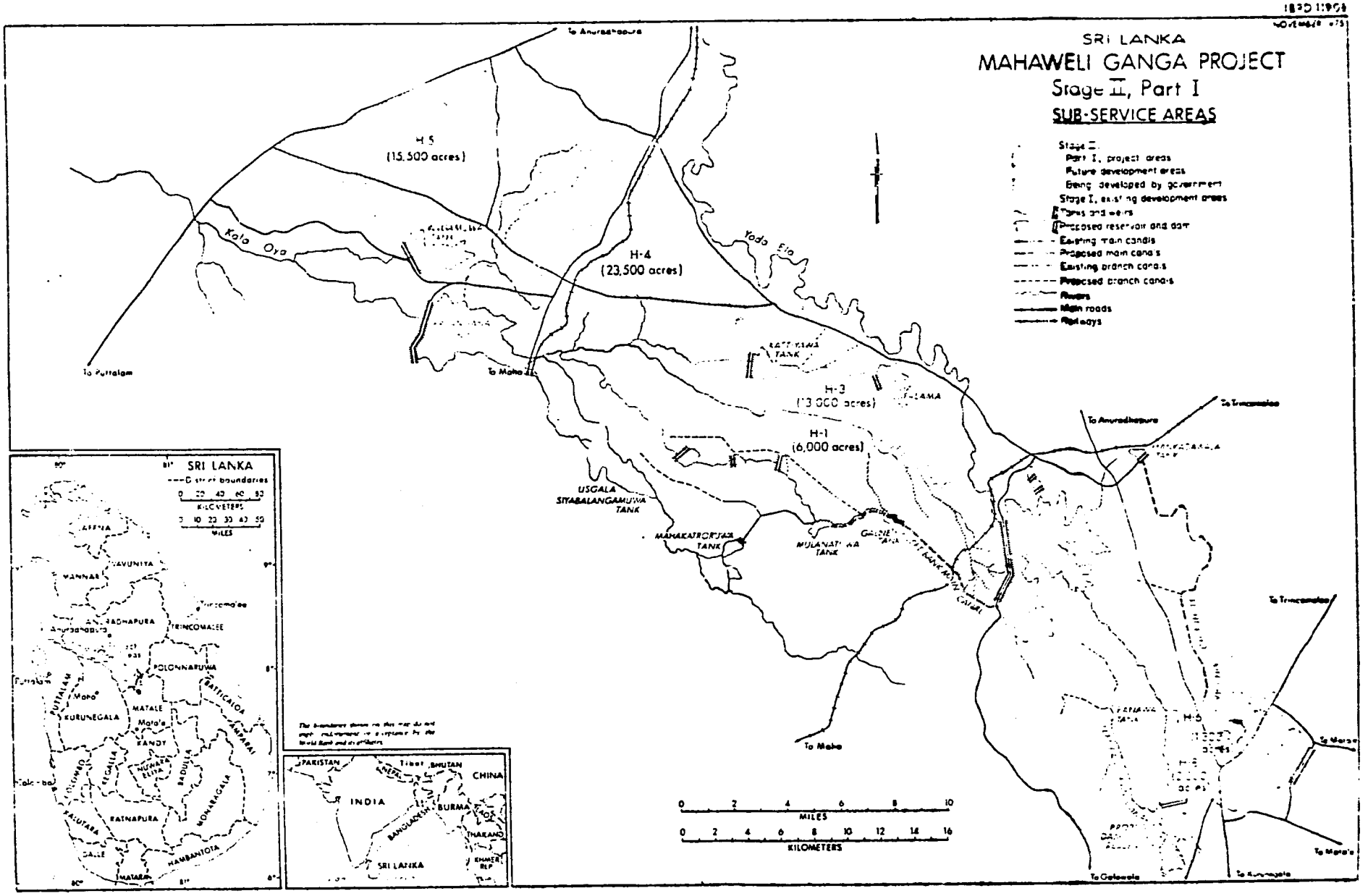
SRI LANKA

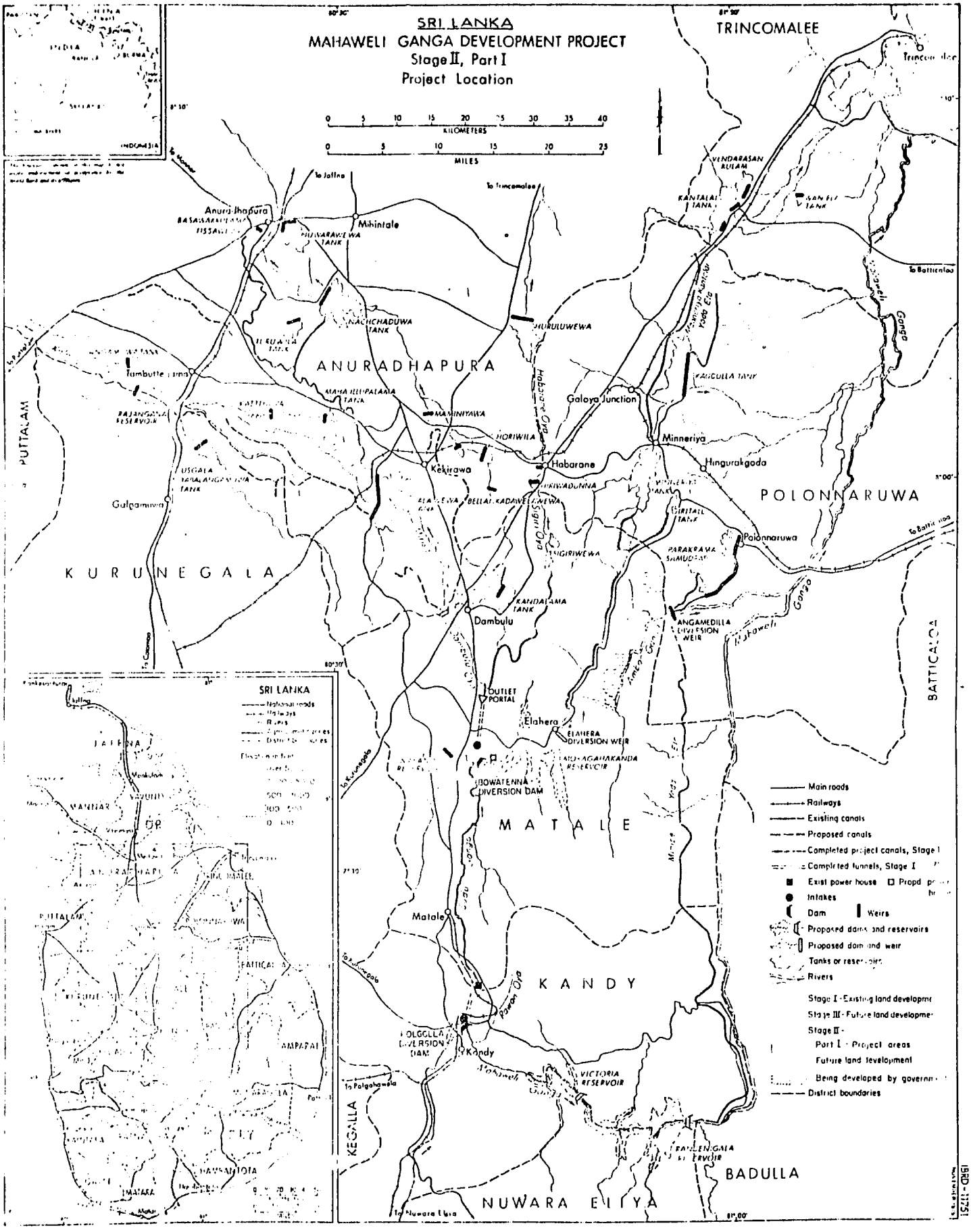
MAHAWELI GANGA PROJECT, STAGE II, PART I

Economic Rate of Return

Year	Investment Costs	O & M Costs	Net Benefits
	(in million Rs)		
1	65.0	0.5	-
2	135.0	1.0	3.2
3	80.0	1.6	12.6
4	80.0	2.3	25.2
5	-	3.0	37.8
6	-	3.0	44.1
7	-	3.0	50.4
8	-	3.0	53.6
9	-	3.0	56.7
10	-	3.0	59.9
11-30	-	3.0	63.0

Economic ROR = 13%


SRI LANKA
MAHAWELI GANGA PROJECT
Stage II, Part I
SUB-SERVICE AREAS
Stage II:
Part I, project areas
Future development areas
Being developed by government
Stage I, existing development areas
Dams and weirs
Proposed reservoir and dam
Existing main canals
Proposed main canals
Existing branch canals
Proposed branch canals
Rivers
Main roads
Railways
H-5
(15,500 acres)
H-4
(23,500 acres)
H-3
(13,000 acres)
H-1
(6,000 acres)
H-6
Kala Oya
Yoda Ela
To Anuradhapura
To Puttalam
To Mahaweli
To Mahaweli
To Trincomalee
To Anuradhapura
To Trincomalee
To Mahaweli
To Galewela
To Kurunegala
To Mahaweli
USGALA
SIYABALANGAMUWA
TANK
MAHAKATRORUWA
TANK
MULANATIVA
TANK
KATTIYAWA
TANK
FLAMA
MAHAKANDALA
TANK
KEPIMAWA
TANK
0 2 4 6 8 10
MILES
0 2 4 6 8 10 12 14 16
KILOMETERS
SRI LANKA
District boundaries
KILOMETERS
MILES
JAFFNA
MANNAR
VAVUNIYA
MUTTUR
TRINCOMALEE
POLONNARUWA
BATTICALOA
AMPARAI
PUTTALAM
KURUNEGALA
MATALE
KANDY
NUWARA ELIYA
BADULLA
MONARAGALA
COLOMBO
KEGALLE
RATNAPURA
KALUTARA
GALLE
HAMBANTOTA
MATARA
PAKISTAN
INDIA
NEPAL
Tibet
BHUTAN
CHINA
BANGLADESH
BURMA
LAOS
THAILAND
KHMER REP
SRI LANKA


SRI LANKA
MAHAWELI GANGA DEVELOPMENT PROJECT
Stage II, Part I
Project Location
KILOMETERS
MILES
TRINCOMALEE
ANURADHAPURA
POLONNARUWA
KURUNEGALA
MATALE
KANDY
BADULLA
NUWARA ELIYA
PUTTALAM
BATTICALOA
KEGALLA
Anuradhapura
Mihintale
Galoya Junction
Minneriya
Habarana
Kekirawa
Hingurakgoda
Polonnaruwa
Dambulu
Elahera
Matale
Kandy
Gulgamuwa
Tambutte
OUTLET PORTAL
ELAHERA DIVERSION WEIR
BOWATENNA DIVERSION DAM
ANGAMEDILLA DIVERSION WEIR
VICTORIA RESERVOIR
KANDALAMA TANK
Main roads
Railways
Existing canals
Proposed canals
Completed project canals, Stage I
Completed tunnels, Stage I
Exist power house
Propd power house
Intakes
Dam
Weirs
Proposed dams and reservoirs
Proposed dam and weir
Tanks or reservoirs
Rivers
Stage I - Existing land development
Stage III - Future land development
Stage II -
Part I - Project areas
Future land development
Being developed by government
District boundaries
SRI LANKA
National roads
Railways
Rivers
JAFFNA
WANNI
PUTTALAM
BATTICALOA
AMPARAI
HAMBANTOTA
MATARA
IBRD - 11251

3830042 (4)
PD-AAD-076

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
American Embassy, Colombo, Sri Lanka.

June 4, 1979

Mr. Douglas Ladduwahetty
Chairman
Mahaweli Development Board
11, Jawatte Road
Colombo 5

Dear Mr. Ladduwahetty:

Subject: Mahaweli Ganga Irrigation
AID Loan No. 383-T-018
Implementation Letter No.9

The purpose of this letter is to advise you that AID approves the inclusion of the following equipment for AID financing under this loan:

Item	Quantity	Estimated Cost U.S.$
Rome Plows	6	120,000
Front End Loaders	3	150,000
Vibratory Rollers (15 - 20 ton)	4	160,000

If you will provide us with a draft invitation for bid (IFB), Commerce Business Daily Notice, and specifications we will act to approve these.

However, before we approve the bid document for this procurement we will want to know that spare parts for equipment already awarded are being ordered.

Yours truly,

John R. Eriksson

John R. Eriksson
Acting Director

3830042 (5)
CONFORMED COPY
PD-AAD-076

A.I.D. Loan Number 383-U-019B
A.I.D. Project Number 383-0043

Amendment Number 1

Dated: August 30, 1979

Between

The Democratic Socialist Republic Of Sri Lanka ("Borrower")

And

The United States Of America, acting through the Agency for International Development ("A.I.D.")

WHEREAS, the Borrower and A.I.D. entered into a Project Loan Agreement for Malaria Control dated February 28, 1978, and

WHEREAS, A.I.D. has agreed to loan additional funds to the Borrower for said Project.

NOW THEREFORE, the Parties agree to amend said Project Loan Agreement as follows:

1. Article 3: Financing, Section 3.1 The Loan. Delete the entire section and insert the following: "To assist the Borrower to meet the costs of carrying out the Project, A.I.D., pursuant to the Foreign Assistance Act of 1961, as amended, agrees to lend the Borrower under the terms of this Agreement not to exceed sixteen million United States (U.S.) Dollars ($16,000,000) ("Loan"). The aggregate amount of disbursements under the Loan is referred to as "Principal".

"The Loan may be used to finance foreign exchange costs, as defined in Section 7.1 and local currency costs, as defined in Section 7.2, of goods and services required for the Project".

2. Article 3 : Financing, Section 3.2 (b) Borrower Resources for the Project. Delete the words "... will be not less than SL/Rs.222,000,000...." and insert the following: ".... will not be less than U.S. $31,853,000 equivalent..."

3. Article 3 : Financing, Section 3.3 (a) Project Assistance Completion Date. Delete the date "June 30, 1982" and insert the following: "October 31, 1984."

4. Article 5 : Conditions Precedent to Disbursement. Insert the following new Section: "Section 5.4 Conditions Precedent for Amendment.
Prior to the first disbursement under the Amendment, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Borrower will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D. an opinion of counsel acceptable to A.I.D. that this Amendment has been duly authorized and/or ratified by, and executed on behalf of, the Borrower, and that it constitutes a valid and legally binding obligation of the Borrower in accordance with all its terms."

5. Article 5 : Conditions Precedent to Disbursement. The previously numbered Section 5.4 shall be renumbered Section 5.5 and Section 5.5 shall be renumbered Section 5.6.

6. Article 7: Procurement Source. Section 7.1 Foreign Exchange Costs. Delete Section 7.1 and insert the following: "Section 7.1 Foreign Exchange Costs." Disbursements pursuant to Section 8.1 will be used exclusively to finance the costs of goods and services required for the Project having their source and origin as follows: The United States (Code 000 of the A.I.D. Geographic Code Book as in effect at the time orders are placedor contracts entered into) for drugs and insecticides and countries in Code 941 of the A.I.D. Geographic Code Book for all other goods and services ("Foreign Exchange Costs"), except as A.I.D. may otherwise agree in writing, and except as provided in the Project Loan Standard Provisions Annex, Section C.1 (b) with respect to marine insurance. Ocean transportation costs will be financed under the Loan only on vessels under the flag registry of the United States or Sri Lanka except as A.I.D. may otherwise agree in writing."

7. Article 7: Procurement Source. Insert the new section as follows: "Section 7.2 Local Currency Costs. Disbursements pursuant to Section 8.2 will be used exclusively to finance the costs of goods and services required for the Project having their source and, except as A.I.D. may otherwise agree in writing, their origin in Sri Lanka ("Local Currency Costs")."

8. Article 8 : Disbursements. Insert the new section as follows: "Section 8.2 Disbursement for Local Currency Costs." (a) After satisfaction of conditions precedent, the Borrower may obtain disbursements of funds under the Loan for Local Currency Costs required for the Project in accordance with the terms of this Agreement, by submitting to A.I.D., with necessary supporting documentation as prescribed in Project Implementation Letters, requests to finance such costs.

"(b) The local currency needed for such disbursement hereunder may be obtained: (1) by acquisition by A.I.D. with U.S. dollars by purchase; or (2) by A.I.D. requesting the Borrower to make available the local currency for such costs, and thereafter reimbursing an amount of U.S. dollars equal to the amount of local currency made available by the Borrower."

9. Article 8 : Disbursements. The previously numbered Section 8.2 shall be renumbered 8.3 and Section 8.3 shall be renumbered 8.4.

10. Annex 1 : Project Description. The Annex 1, attached to this Amendment, is the Project Description revised to include a new financial plan showing the additional funds provided by this amendment and the expanded scope of work.

11. All other terms and conditions of the Loan Agreement for Malaria Control dated February 28, 1978 shall remain in full force and effect.

IN WITNESS WHEREOF, the Borrower and the United States of America, each acting through its duly authorized representative, have caused this Agreement to be signed in their names and delivered as of the day and year first above written.

GOVERNMENT OF THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

BY _____

NAME W.M. Tilakaratna

TITLE Secretary

Ministry of Finance and Planning

GOVERNMENT OF THE UNITED STATES OF AMERICA

BY _____

NAME W. Howard Wriggins

TITLE American Ambassador

Amplified Project Description
Malaria Control Project

1. Plan of Operation

The Plan of Operation prepared by the Anti-Malaria Campaign (AMC) of the Government of Sri Lanka (GSL) with the advice of the World Health Organization (WHO) has been approved by the GSL, AID and WHO. The plan covers the period 1977-1981. The plan takes into account recent failures of the malaria control program in presenting an approach which will help to insure that once malaria is reduced to the stated target of 1.0 API (annual parasite rate) it is further reduced through a consolidation effort of close surveillance, selective spraying and case treatment. Salient features of the present Plan of Operation which are intended to insure long-term success of this program are :

(a) Intensive use of malathion during the initial phase of the program (4 to 5 years) to obtain maximum effect before mosquito resistance develops.

(b) Banning use of malathion as an agricultural insecticide to prolong its effective life as an insecticide for malaria control.

(c) Segregation of the Anti-Malaria Campaign (AMC) from the General Health Services during the Intensive Spraying Phase of the program and to place the field workers under the administrative authority of the AMC headquarters in Colombo rather than the Medical Officers of Health. This will centralize authority and program control during the crucial first years of the program. Integration into the General Health Services will be carried out gradually in phased stages after the Intensive Spraying Phase.

(d) Tenure in the Government Health Service has been granted to Malaria workers thereby reducing insecurity of employment which was found to be a major obstacle to satisfactory performance of former field activities. Promotion channels for malaria workers in the General Health Service are also being opened to clear the way for eventual integration.

(e) Laboratory staff has been increased and seven field laboratories established in addition to the central laboratory at the AMC. At the central laboratory 10 percent of all negative and positive blood films and all P.falciparum are cross checked at the cross checking laboratory to maintain quality control of field laboratory activities.

(f) Formal coordination mechanisms have been established between the AMC, other GSL departments and the target communities.

(g) The Malaria Eradication Training Center has expanded its curriculum to cover training for medical, para-medical and other personnel of the Health Department, medical students, agriculture officers, teachers, and youth volunteers.

(h) The vehicle maintenance facility has been upgraded in 1978 and vehicles, tools and spare parts are being supplied by the British.

This amendment adds a dimension of providing services to the land development and settlement projects of the GSL. The Plan of Operation remains in force and the techniques to be used follow the same technical pattern. The AMC continues to use the 1.0 API as its objective in the program. If supplies and support are available on a timely basis, it will be possible to hold the level of malaria in the settlement areas to the API level.

The amended project is specifically aimed to include a population total of 1,152,000 to be settled on new lands totalling 371,000 acres. The population figures include service populations to be attached to development schemes. The project also aims at the protection of the labor force (estimated at several hundred thousand) to be engaged in the construction of the dams and irrigation channels. These workers represent a serious threat to the on-going malaria effort as they can re-introduce malaria back into their home areas from the labor sites if precautions are not taken to control malaria.

The additional specific activities of the amended project in development areas are as follows:

(a) Indoor spraying of sprayable structure within the area at 2 grams (technical) per square meter of Malathion, 50%, w.d.p. per house at three monthly intervals.

(b) Treatment of all malaria cases with anti-malaria drugs at all medical institutions and voluntary treatment centers set up with the assistance of Development Project authorities.

(c) Regular administration of prophylactic treatment to all GSL personnel in the project area with the help of the project personnel.

(d) Wherever possible, elimination or reduction of the potential breeding places of the mosquito causing malaria.

(e) Fogging with Fenitrothion or Actelic in localities where indoor spraying of insecticides have to be supplemented.

(f) Chemical larviciding when and where feasible using the larvicide "Abate".

(g) Health education to all personnel in the area in order to obtain their cooperation in the malaria control activities.

(h) Assessment and monitoring of incidence of malaria and the impact of control measures in the project area.

2. Financial Plan

The total project costs are estimated at approximately $ 56.6 million of which the GSL is contributing approximately $ 31.8 million equivalent and AID through this project is providing $ 16 million. The balance of approximately $ 8 million is being provided by other donors (e.g. United Kingdom, Netherlands and World Health Organization). The AID assistance will be used to finance the foreign exchange costs of insecticides, anti-malaria drugs, safety/spray equipment, and international training plus local cost support of training center and research activities. The AID budget allocations are as follows :

Description	Original ($ 000)	Amendment ($ 000)	Total AID Contribution ($ 000)
Insecticides	11,900	3,000	14,900
Anti-Malaria Drugs	--	305	305
Training	30	60	90
Local Cost Support	—	200	200
Safety/Spray Equipment	70	35	105
Sub Total	12,000	3,600	15,600
Contingency	—	400	400
Total	12,000	4,000	16,000

NOTE: Individual line items may be adjusted by 20 percent by the Borrower without AID approval