

No. 3

MINISTRY OF IRRIGATION, POWER AND ENERGY
THE GOVERNMENT OF THE DEMOCRATIC
SOCIALIST REPUBLIC OF SRI LANKA

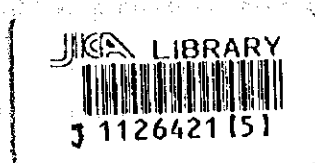
JAPAN INTERNATIONAL
COOPERATION AGENCY

**THE FEASIBILITY STUDY ON
THE REHABILITATION OF
IRRIGATION AND DRAINAGE SYSTEMS IN
THE RIVER BASINS OF SOUTHERN SRI LANKA**

VOLUME I

MAIN REPORT

SEPTEMBER 1996



CHUO KAIHATSU CORPORATION
AERO ASAHI CORPORATION

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PREFACE

In response to a request from the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to carry out a Study comprising (i) a Master Plan Study of irrigation and drainage schemes to be rehabilitated in southern Sri Lanka (Phase I), and (ii) a Feasibility Study of candidate schemes chosen for their viability at the Master Plan Study stage (Phase II). The said Study was entrusted to the Japan International Cooperation Agency (JICA).

JICA subsequently dispatched a Study Team headed by Mr. Masamitsu Fujioka, Chuo Kaihatsu Corporation, 2 times between January 1995 and April 1996.

The Team held discussions with the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka, and conducted field surveys in the Study area. After the Team returned to Japan, further studies were made and the present Report was prepared.

It is my sincere hope that this Report will contribute to the promotion of the Project and to the enhancement of the friendly relations between our two countries.

In closing, I wish to express my deepest gratitude to the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the Study Team.

September 1996



Kumio Fujita
President
Japan International Cooperation Agency

Mr. Kimio Fujita
President,
Japan International Cooperation Agency
Tokyo, Japan

September 1996

LETTER OF TRANSMITTAL

Dear Sir,

We have the pleasure of submitting the Final Report on the Rehabilitation of Irrigation and Drainage Systems in the River Basins of Southern Sri Lanka in accordance with the Scope of Work agreed upon between the Ministry of Irrigation, Power and Energy and the Japan International Cooperation Agency (JICA).


The subject Study was carried out over a 19 month period from July 1995 to August 1996. Under the Study, an extensive field survey was conducted in the Study area lying within the 3 districts of Kalutara, Matara and Hambantota in southern Sri Lanka, on the basis of which a Master Plan for rehabilitation of irrigation and drainage systems was formulated with (i) primary focus on upgrading the agricultural sector and improving the living standards of the rural population, and (ii) with careful attention to the preservation of the environment within the target river basins. Subsequent to the foregoing Master Plan Study (Phase I), a Feasibility Study (Phase II) was then carried out on candidate schemes selected during Phase I.

The Master Plan Study and Feasibility Study for the Project emphasize the establishment of sustainable agricultural production and enhancement of the daily living environment of area farmers. Towards this end, the following 3 elements have been incorporated into Project planning:

- 1) Strengthening of institutional and O&M capabilities of the existing farmer organizations,
- 2) Improvement of agricultural production infrastructure based on an appropriate farm management plan under existing irrigation and drainage systems with finite water resources, and
- 3) Introduction of an effective monitoring program for Project implementation and post-execution management.

We wish to express our extreme gratitude to the personnel concerned of the Japan International Cooperation Agency, the Ministry of Irrigation, Power and Energy of the Government of the Democratic Socialist Republic of Sri Lanka, the Embassy of Japan in Colombo, and the JICA Sri Lanka Office for the courtesies and cooperation extended to us during our field surveys and studies. We would particularly wish to indicate our deep appreciation to the officials and personnel of the Government of Sri Lanka who participated in the work shop during the Study, for their most helpful and insightful comments and recommendations with regards to the Project.

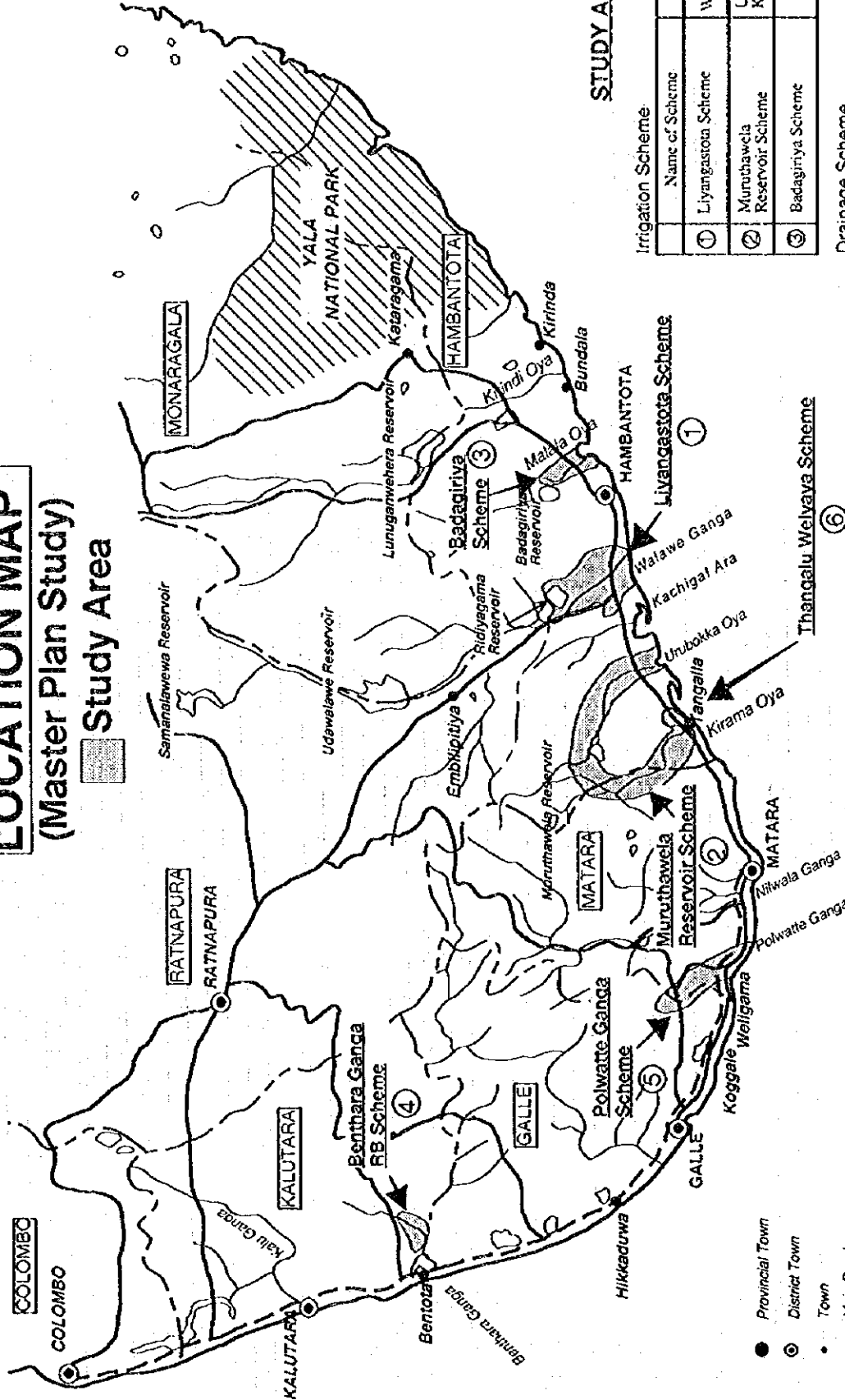
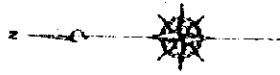
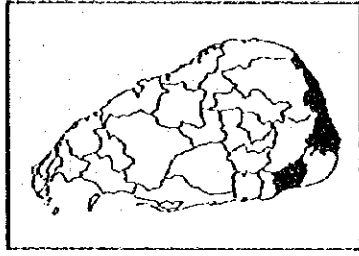
It is our sincere hope that this Report will serve to promote the realization of this very important Project.

A handwritten signature in cursive script, reading "M. Fujioka".

Masamitsu Fujioka,
Leader for the Study Team for the Rehabilitation
of Irrigation and Drainage Systems in the River
Basins of Southern Sri Lanka

LOCATION MAP (Master Plan Study)

Study Area



STUDY AREA

Irrigation Scheme		River Basin	District
①	Liyanagastota Scheme	Walawe Ganga	Hambantota
②	Muruthawela Reservoir Scheme	Urubokka Oya Kirama Oya	Hambantota
③	Badagiriya Scheme	Malala Oya	Hambantota

Drainage Scheme		
④	Benthara Ganga RB Scheme	Benthara Ganga
⑤	Polwatte Ganga Scheme	Polwatte Ganga
⑥	Thangalu Weliyaya Scheme	Kirama Oya



Scale : 1:1,000,000

- Provincial Town
- District Town
- Town
- Main Road
- - - District Boundary
- - - Railway
- Lagoon or Reservoir
- ~ River

INDIAN OCEAN

EXECUTIVE SUMMARY FOR PART I: MASTER PLAN STUDY

1. Introduction

This report comprises the Final Report of the Master Plan Study to select candidate schemes for feasibility study under the Rehabilitation of Irrigation and Drainage Systems in the River Basins of Southern Sri Lanka.

In line with the Scope of Work agreed to between the Ministry of Irrigation, Power and Energy of the Democratic Socialist Republic of Sri Lanka and the Japan International Cooperation Agency, this report was prepared in July 1996 based on the results of field work carried out during January-April 1995.

2. Need for a Rehabilitation Project

In the mid 1980's, Sri Lankan agriculture essentially achieved self-sufficiency in domestic rice production through such large scale irrigation projects such as the Accelerated Mahaweli Development Project, and the Uda Walawe and Kirindi oya projects implemented near the Study area. In addition to this irrigation development, rice production was encouraged through a continuous increase in the purchase price by the government of paddy, as well as retail price and farmer subsidies.

However, the foregoing policy of subsidies which applied to the entire 560,000 ha of irrigated farmland in the country placed a heavy burden on government finances, leading to a shift of agricultural development policy away from new irrigation and drainage projects requiring a large initial investment from the national budget, to rehabilitation programs for existing irrigation and drainage facilities aimed at improving the productivity of farmland already under cultivation.

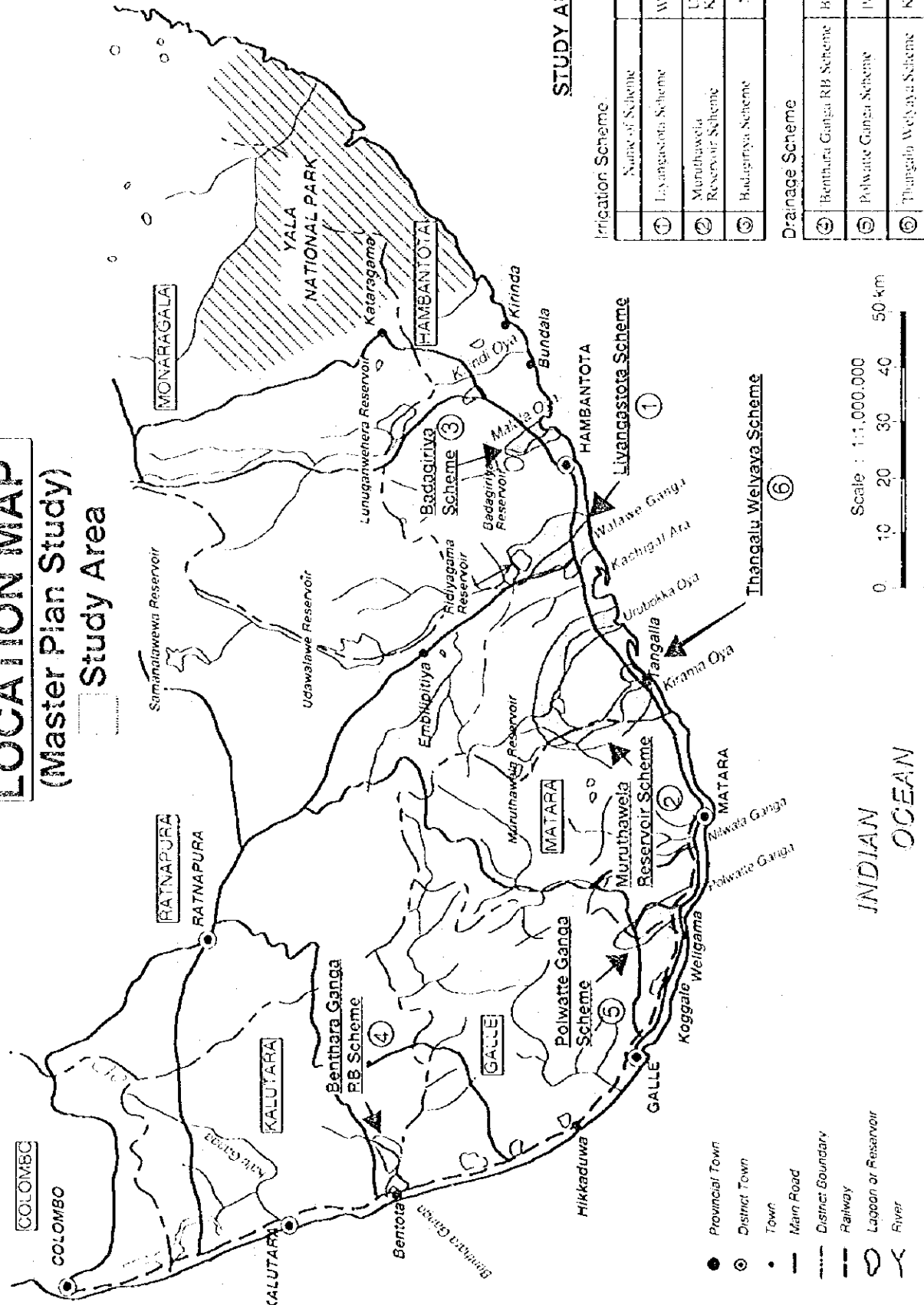
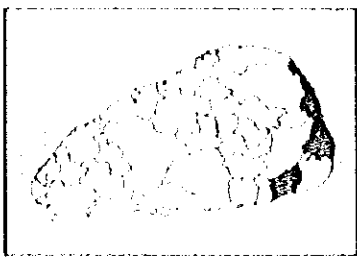
Reflecting the above, the Sri Lankan government issued a new and modified agricultural development policy in December 1994. Under this new policy, government controls, regulations and subsidy programs with regard to agriculture were loosened, to encourage self sufficiency and self incentive on the part of the farmer and promote a greater shift from traditional monoculture farming centered on paddy production to diversified farming under an export oriented agricultural structure.

At the same time, under the nation's National Conservation Strategy (1988), emphasis is placed on responding to the need to increase food production to meet population growth not by further dependence on exploitation of natural resources (development of new farmland, etc.) but rather by application of modern technologies to upgrade the productivity of existing land. Accordingly, rehabilitation projects for agricultural facilities have been given priority under this policy.

LOCATION MAP

(Master Plan Study)

Study Area



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③	Badagiriya Scheme	Madala Oya	Hambantota

Drainage Scheme		River Basin	District
④	Bentara Ganga RB Scheme	Bentara Ganga	Kalutara
⑤	Polwatta Ganga Scheme	Polwatta Ganga	Matara
⑥	Thangalu Welwava Scheme	Kirama Oya	Hambantota

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At the same time, under the nation's National Conservation Strategy (1988), emphasis is placed on responding to the need to increase food production to meet population growth not by further dependence on exploitation of natural resources (development of new farmland, etc.) but rather by application of modern technologies to upgrade the productivity of existing land. Accordingly, rehabilitation projects for agricultural facilities have been given priority under this policy.

Against the above development philosophy and shift in government polity, strengthening of agricultural production infrastructure through rehabilitation projects has become urgently necessary in southern Sri Lanka to complement the rural development and farmer financial support programs being carried out in the region aimed at increasing yields and generating employment opportunities. This strengthening of the agricultural sector, which is the mainstay of the southern Sri Lankan economy, is expected to accelerate growth of the regional economy, expand economic production activities, maximize efficient utilization of available resources, and contribute to rectifying skewed levels of development between development sectors and between regions.

3. Study Background and Study Period

The agricultural sector in Sri Lanka accounts for 25% of the nation's GDP and 40% of the employed labor force (70% of the population reside in rural area). During the period 1970 to 1991, irrigated farmland sharply grew from 240,000 ha to 535,000 ha under agricultural development policy of the government which included such large scale programs as the Mahaweli development project. Irrigated agriculture has played a major role in Sri Lanka achieving self-sufficiency in food production.

However, inadequate maintenance and outdated operational methods have hastened the deterioration of existing irrigation facilities, to the point where irrigation systems no longer adequately fulfill their intended functions. Under the Mahaweli development program, NIRP (National Irrigation Rehabilitation Program), etc., various new construction and rehabilitation of irrigation and drainage facilities is being carried out; however, this activity has centered on the central and northern regions of the country with only limited programs being implemented in southern Sri Lanka.

To address this situation, the Sri Lankan government requested cooperation from the Japanese government in July 1993 in the execution of a feasibility study on rehabilitation of existing irrigation and drainage facilities (5 irrigation schemes totaling 14,000 ha, and 10 drainage schemes totaling 10,766 ha) and saline exclusion in 13 basins of southern Sri Lanka where facility deterioration is most severe and urgently warrants rehabilitation, and the potential for increased agricultural productivity through rehabilitation of said facilities is considered high.

In response to this request, the Japanese government in September 1994 dispatched a Preliminary Study Mission for Scope of Work discussions to confirm the request background and envisioned study content. The findings of the mission indicated that (i) of the above 10 drainage schemes under the original request, 7 were subject to the Southern Province Rural Development Project currently in progress with ADB funding, and (ii) that a portion of the benefit area under the irrigation schemes required modification. It was ultimately agreed between the concerned parties that the target area under the subject study would comprise 4 irrigation schemes totaling 17,000 ha and 3 drainage schemes totaling 3,000 ha, and the Scope of Work for the Study was signed between the Sri Lankan and Japanese governments in September

1994. The executing agency for the Study is the Ministry of Irrigation, Power and Energy.

Availing itself of the close cooperation of the MIPE, the JICA Study Team carried out its field survey during the following periods:

Phase I survey : January~April 1995 (master plan study)
Phase II survey : January~April 1996 (feasibility study)

4. Master Plan Study Area

At the end of Phase I field survey in April 1995, the JICA Study Team and the Irrigation Department agreed to exclude the Kachigala Ara scheme, one of the 4 irrigation schemes under the request, from the study as it is included as one part of the upstream Uda Walawe development project

On the basis of the results of field survey and discussions with the Irrigation Department, it was agreed that the Study area would comprise 3 irrigation schemes totaling 12,973 ha and 3 drainage schemes totaling 1,920 ha, for a grand total Study area of 14,893 ha.

5. Basic Study Strategy

Drawing on experience and lessons learned from past major irrigation and drainage projects, and participatory type operation and management programs for irrigation systems carried out to date in Sri Lanka, Study strategy was formulated to aim at (i) establishing a participatory system O&M structure through strengthening of farmer organizations, (ii) a rehabilitation plan sustainable after completion of construction works, and (iii) ultimate transfer of scheme jurisdiction to the farmer organizations.

6. Description of Study Area

Natural conditions including hydrology and meteorology

The Study area is located in the 3 districts of Kalutara, Matara and Hambantota in southern Sri Lanka. The drainage schemes are situated in wet zone with annual mean rainfall of 2,500~4,500 mm. The remainder of the schemes are in dry zone with annual mean rainfall of 1,100~1,800 mm. Topography of drainage scheme areas comprises gently undulating terrain and flatland. Soil is classified into 2 groups, i.e. red-yellow podzolic soils in the wet zone and reddish brown earth in the dry zone.

Annual mean temperature is 26~28°; humidity is 70~80%; annual evapotranspiration is 1,500~1,800 mm; and annual daylight hours are 2,000~2,500.

Agriculture

Total farm households in the Study area are 16,000, with average land holdings of 0.6~1.1 ha per household. Rice yield is 2.5~3.0 t/ha, with annual cropping rate of

126~155% in irrigation scheme areas and 60~120% in drainage scheme areas. Agriculture production centers on paddy farming supported by animal husbandry (cattle, water buffalo, goat) and coconut cultivation.

Farmer organizations, and operation and maintenance

There are 184 farmer organizations in the Study area. These can be classified into 3 types: those covered under (i) the INMAS (Integrated Management of Major Systems) program, (ii) the MANIS (Management of Irrigation Systems) program, and (iii) not covered by either of the foregoing programs.

The Project Management Committees established under the INMAS and MANIS programs function as the decision making entities for the farmer organizations. These committees primarily determine timing for start of cultivation activities, cropping patterns for a particular season, issues related to system O&M throughout the year, and activities and rules of the farmer organizations.

The Irrigation Department is responsible for the INMAS and MANIS programs, while drainage schemes fall under the jurisdiction of the Department of Agrarian Services.

Existing irrigation and drainage facilities

The 3 irrigation schemes under the Study are comprised of 6 sub-schemes, of which 4 have tanks as their water source and 2 divert water directly from rivers. Method of irrigation in all cases is by gravity.

Age of facilities of these schemes since construction range 25~100 years, and all require rehabilitation to some degree. Tanks, intake canals, main canals, and branch canals fall under the jurisdiction of the Irrigation Department, while field channels are the responsibility of the farmer organizations. There are 2 cropping seasons in a year (Yala and Maha), with each primarily comprising a 4.5 month irrigation period (including 1 month transplanting); however, cropping adjustment under the rotation system has been introduced into a portion of the area. Effective water distribution to the field level is hindered by deteriorated diversion, storage and conveyance facilities, metering equipment which is out of order, and leakage along canals and farm channels. Also, deteriorated field roads in the area are an obstacle to canal repair and maintenance, and the transport of farm products.

In the case of the 3 drainage schemes, natural drainage during high tide is impossible due to tidal levels. Furthermore, there are no mechanical drainage facilities. Deteriorated steel flap gates and wooden sluice gates have been established at the field level; however, these instead only aggravate saline intrusion and rainy season inundation in the scheme areas. These drainage scheme facilities were constructed during 1940's and 50's, and their utility life spans have expired.

Environment

In terms of soil and water quality, there is no problem under the 3 irrigation schemes. The downstream area of the Badagriya scheme comprises the Bundala National Park which is a registered area under the Ramsar treaty, and home to various rare species of water fowl and other wildlife.

In the case of the drainage schemes, steady abandonment of farmland has occurred due to transformation into marsh as a result of poor drainage caused by seawater intrusion, lack of properly functioning drainage facilities, and blockage of estuary outlets to the sea by sedimentation. Although mangrove forests are present at estuary areas, rare species of wildlife are few and overall biodiversity is low.

In Sri Lanka, rehabilitation projects as well are subject to environmental procedures prescribed by law. In the case of this Study, there are no precedents with regards to procedures under environmental laws and regulations. (The Central Environmental Authority has indicated its opinion that no environmental legal procedures need be taken at the Master Plan level; however, the Feasibility Study would be subject to an environmental evaluation.)

7. Objectives and Scope of Master Plan Study

The objective of the Study is to carry out a master plan level study for a total of six schemes (3 irrigation schemes and 3 drainage schemes), formulate a basic plan for rehabilitation of the irrigation and drainage facilities under each of the 6 schemes, and select the candidate schemes to be subject to feasibility study.

Scope of each scheme is as follows:

- (1) Irrigation and drainage facility rehabilitation plan
- (2) Agricultural development plan
- (3) Operation and maintenance plan
- (4) Environmental conservation plan

Note 1: The Kachigala Ara scheme, covered in the original request, has been excluded from the Master Plan Study under agreement with the Irrigation Department.

Note 2: Cost for strengthening O&M organizations (procurement cost of O&M equipment, training costs, and monitoring costs) is considered as common to all schemes, and has not been included in project cost under the basic scheme plan.

8. Basic Plan for Rehabilitation of Irrigation and Drainage Systems

The basic plan for facility rehabilitation was formulated in line with the fundamental concepts given below, based on analysis of experience and lessons learned from past irrigation and drainage projects carried out by the Sri Lankan government.

- Project planning and formulation under the participatory method.
- Farmer organizations to be strengthened to enable sustained operation and maintenance of facilities by the farmer organizations after completion of rehabilitation works.
- Optimum balance between project costs and project benefits.

(1) Irrigation and Drainage Facility Plan

Irrigation Schemes

The irrigation plan aims at expansion of effectively irrigated area through (i) rational utilization of tank facilities, (ii) improved irrigation rate, and (iii) economy of water use through introduction of other field crops in addition to paddy.

Main facilities targeted for rehabilitation under the plan are tanks, gauging facilities, main canals, branch canals (D-canals), regulating gates (anicut) and field roads. Rehabilitation of field channels (F-canals) is to be the responsibility of the farmers themselves. The elimination of F-canals from the scope of the Study was done in agreement with the Irrigation Department.

Total benefit area under the irrigation schemes is 12,901 ha. Total construction cost for rehabilitation is Rs 1,010,000,000 (¥ 2,020,000,000). Project cost per ha is US\$ 1,560. A total canal length of 294 km and roughly 2,870 locations of canal appurtenant structures would be rehabilitated under the Project.

Drainage schemes

Having considered the experience and lessons drawn from the drainage projects (Gin Ganga Regulation Project, Nilwala Ganga Flood Protection Scheme) currently being implemented in the southern region, as well as the impacts on fishing activities and ecosystems in the downstream basins, the drainage plan gives priority to natural drainage over pump drainage.

All 3 schemes are affected by outside (tidal) water levels. Utilizing the differential between inside and outside water levels, main drainage canal gates, etc. will be rehabilitated under the plan to accommodate a drainage volume with a 10 year return period. In cases where the tidal water level is high or where flood discharge exceeds that with a 10 year return period, as in the past, inundation of the project area would be allowed to occur.

The salvage value of existing structures would be maximized, and rehabilitation carried out to upgrade the function of the same to the design level under the plan. Structure design would be such as to facilitate operation and maintenance by farmer groups after completion of rehabilitation works.

Total benefit area under the drainage schemes is 1,920 ha. Total construction cost for rehabilitation is Rs 455,000,000 (¥ 910,000,000). Project cost per ha is US\$ 4,670. A total main and branch drainage canal length of 60 km, embankment length of 19.5 km and gate drainage facility structures at 41 locations would be rehabilitated under the Project.

(2) Agricultural Development Plan

Land use

Currently cropped area in the design irrigated area is 20,349 ha (138% cropping rate). Under the plan, this would be upgraded to 27,900 ha (189% cropping rate)

(unit: ha)

Scheme	At present	With Project
Liyangastota	9458 (155%)	12242 (200%)
Muruthawela	8141 (132%)	11390 (185%)
Badagiriya	866 (126%)	1406 (200%)
Benthara Ganga	650 (67%)	1303 (135%)
Polwatte Ganga	560 (100%)	868 (155%)
Tangalu Welyaya	474 (120%)	691 (175%)
Total	20149 ha (138%)	27900 ha (189%)

Design cropping system

The design cropping system is to comprise paddy (3.5 month variety), OFC's (chili, onion, etc.), sedge, etc.

Scheme	Yala season	Maha season
Liyangastota	paddy + OFC	paddy
Muruthawela	paddy + OFC	paddy
Badagiriya	paddy + OFC	paddy + OFC
Benthara Ganga	paddy + sedge	paddy + sedge
Polwatte Ganga	paddy + sedge	paddy + sedge
Tangalu Welyaya	paddy + sedge	paddy + sedge

Crop yield

Target paddy yield 5.5 t/ha under the irrigation schemes and 5.0 t/ha under the drainage schemes. Target yield for OFC's (chili, onion etc.) is 1,000 kg/ha, and 4,000 kg/ha for sedge.

(unit: t)

Scheme	At present	With Project
Liyangastota	27,494	64,577
Muruthawela	24,362	57,785
Badagiriya	2,616	5,834
Benthara Ganga	1,458	6,467
Polwatte Ganga	1,436	4,312
Tangalu Welyaya	1,215	3,435
Total	58,581	142,410

Agricultural support

Under the new integrated rural financial plan aimed at the upgrading of agricultural production, a financial system has been developed by which funding is extended for paddy and food crop production subsidies by a combination of national and private sector banks. However, as the major part of financial assistance to farmers is in the form of lending from the private sector, the present status quo will not be altered under the Project.

Likewise, the present system whereby agricultural inputs are distributed or lent to the farmer via the farmer organizations, which receive the same from the Agrarian Services Centers and Multipurpose Co-operative Societies will continue.

Agricultural extension is presently carried out by agricultural instructors (AI). However, since the extension area under the responsibility of each such instructor is 2,000 ha, it is proposed under the Project that permanent extension staff be assigned to each scheme.

(3) Operation and Maintenance Plan

For the purpose of operation and maintenance activities in the Study area, it is planned that the farmer organizations in each scheme area be strengthened in accordance with mid to long term goals indicated below.

Mid-term goals

The activities of farmer organizations in each of the scheme areas have been evaluated according to 5 levels of organizational maturity, and it is the target of the Project to upgrade the capability of each of the subject organizations to level 1. The time period for accomplishing this is 3~5 years beginning from just before the start of the Project. Classification of scheme by level of development, and design targets are given in the table below.

Level of farmer organization development	Scheme	Design targets
1.	No corresponding scheme	1) Farmer participation in the organization is 90% or more 2) Entire scheme area is covered by farmer organization activity 3) Farmer organization is officially registered 4) PMC has been set up and is active 5) Farmer organization procures agricultural production inputs and markets farm products on behalf of the farmers
2.	Badagiriya	1) Strengthening of financial base of farmer organization 2) Official transfer of branch canals (D-canals) to the jurisdiction of the farmer organization 3) Upgrade to level 1
3.	Muruthawela (I/B main) and Liyangastota (I/B, R/B)	1) Establishment of joint PMC for all 3 sub-schemes of Muruthawela 2) Establishment of joint PMC for entire Liyangastota scheme (I/B, R/B) 3) Strengthening of finances of farmer organization according to PMC mid-term plan 4) Upgrade to level 2 5) Unofficial transfer of branch canals (D-canals) to the jurisdiction of the farmer organization
4.	Uruhokka Oya and Kirama Oya sub-schemes under Muruthawela	1) Establishment of PMC for the sub-schemes 2) Promote participation in the MANIS program 3) Upgrade to level 3
5.	All 3 drainage schemes	1) Creation of farmer organizations for each scheme 2) Planning and implementation by the government of joint management program 3) Upgrade to level 4

Long-term objectives

- 1) Capacity building for O&M activities of the Irrigation Department
- 2) Establishment of district-wise management units (for procurement of repair and maintenance equipment, deployment of manpower, etc.)
- 3) Operation of management units by the farmer organizations

(4) Environmental Conservation Plan

Basic strategy

The environmental conservation plan was formulated in accordance with the following basic strategy:

1) Alleviation of poverty in the Project area

Alleviation of poverty and upgrading of the daily living environment by effective incorporation into schemes of areas heretofore unable to be included due to various social and natural conditions prevailing in the said areas.

2) Preservation of biodiversity

- Strict protection of areas registered under the Ramsar Treaty, and national parks

- In the case of drainage schemes, protection of the ecosystems in downstream basin areas by avoidance of forced (pump) drainage schemes

- Protection of ecosystems through the promotion of appropriate use of agro-chemicals, chemical fertilizers and herbicides

3) Effective use of land resources

- Rather than development of new land, application of modern farming technology to upgrade the productivity of land already under cultivation (through rotation irrigation, economy of water use by introduction of OFC's, etc.) and thereby conserving land resources

4) Active encouragement of farmer participation in the Project, and deepening the awareness of the rural population regarding the importance of environmental conservation

- By encouraging women's participation in farmer organizations, expanding the female role in the regional socio-economy and upgrading the social living environment

- By promoting farmer participation in rehabilitation efforts, deepening farmer awareness of the importance of maintaining daily living environment infrastructure

Environmental conservation plan

The following environmental conservation plan would be reflected in the Project.

Scheme	Environmental conservation plan
Liyangastota	· Conservation of the socio-economic environment through the rehabilitation of deteriorated canal facilities (this applies to all the schemes)
Muruthawela	· Improvement of the socioenvironment through official incorporation into the scheme of areas which heretofore have not been able to be included, due to various social and environmental conditions prevailing therein
Badagiriya	· Monitoring of environmental impacts to Bundala Park in the downstream basin area · Improvement of the socioenvironment through incorporation into the scheme of abandoned farmland in the downstream basin area
Benthara Ganga	· Preservation of ecosystems through avoidance of forced (pump) drainage schemes · Preservation of ecosystems through introduction of alternative, salt-resistant crops
Polwatte Ganga	same as above
Tangalu Welyaya	same as above

IEE (Initial Environmental Examination)

In accordance with National Environmental Act No. 47 and the regulations with regards to IEE and EIA of the CEA, and IEE by the ADB and WB checklist method was carried out. As a result, it was determined that a detailed IEE is required at the feasibility study level for all schemes.

9. Preliminary Project Cost Estimate

Preliminary cost estimate for the 6 schemes is as per below.

Scheme	Preliminary construction cost estimate
Liyangastota	Rs 473,000,000 (¥ 950,000,000)
Muruthawela	Rs 484,000,000 (¥ 970,000,000)
Badagiriya	Rs 53,000,000 (¥ 110,000,000)
Benthara Ganga	Rs 174,000,000 (¥ 350,000,000)
Polwatte Ganga	Rs 163,000,000 (¥ 330,000,000)
Tangalu Welyaya	Rs 118,000,000 (¥ 240,000,000)
Total	Rs 1,465,000,000 (¥ 2,950,000,000)

Note 1: Includes direct construction cost, land acquisition cost, general administration cost, price escalation (10%), etc.

Note 2: Costs for personnel training, monitoring and O&M equipment are not included.

10. Project Evaluation

Project evaluation was done by computing the economic internal rate of return (EIRR) and the benefit cost ratio (B-C) applying criteria of project cost, operation and maintenance cost, a project evaluation period of 25 years (including a 5 year construction period, and decrease in agricultural productivity with deterioration of the rehabilitated facilities over time. Evaluation results showed an EIRR of over 20% for the irrigation schemes, indicating their economic viability. In contrast, the EIRR for the 3 drainage schemes was under 10%, indicating less economic robustness.

11. Selection of Candidate Schemes for Feasibility Study

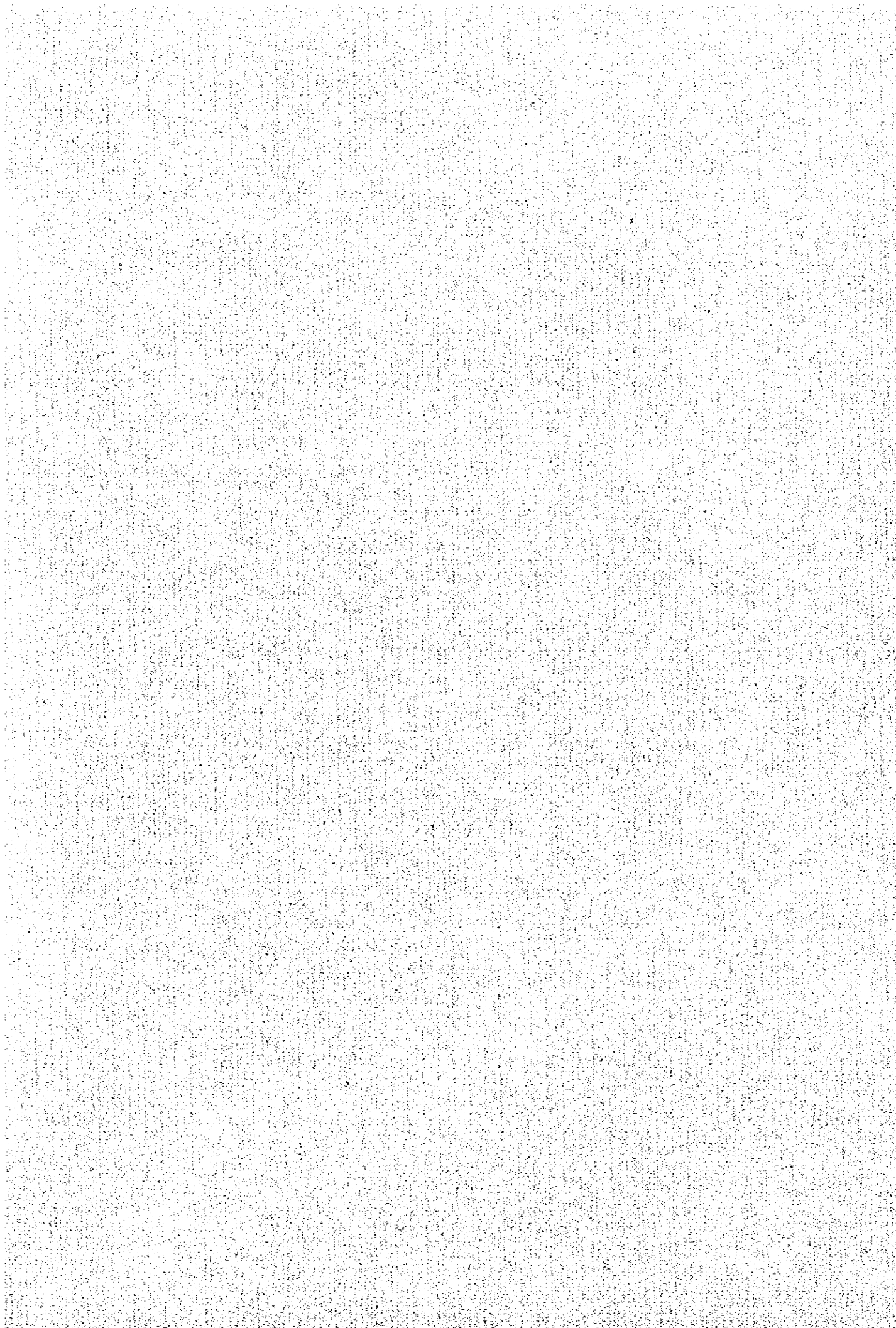
The 3 irrigation schemes indicated below were selected as candidates for feasibility study on the basis of the 3 criteria of (i) maturity of existing farmer organization development, (ii) economic viability and (iii) project scale (size of benefit area).

Scheme	Benefit area (ha)	Level of farmer organization development	EIRR (%)	Construction cost (Rs '000,000)
Badagiriya	703	level 2	32	53
Liyangastota	6,121	level 3-4	24	473
Muruthawela	6,149	level 3-4	22	484
Total	12,973			1,010

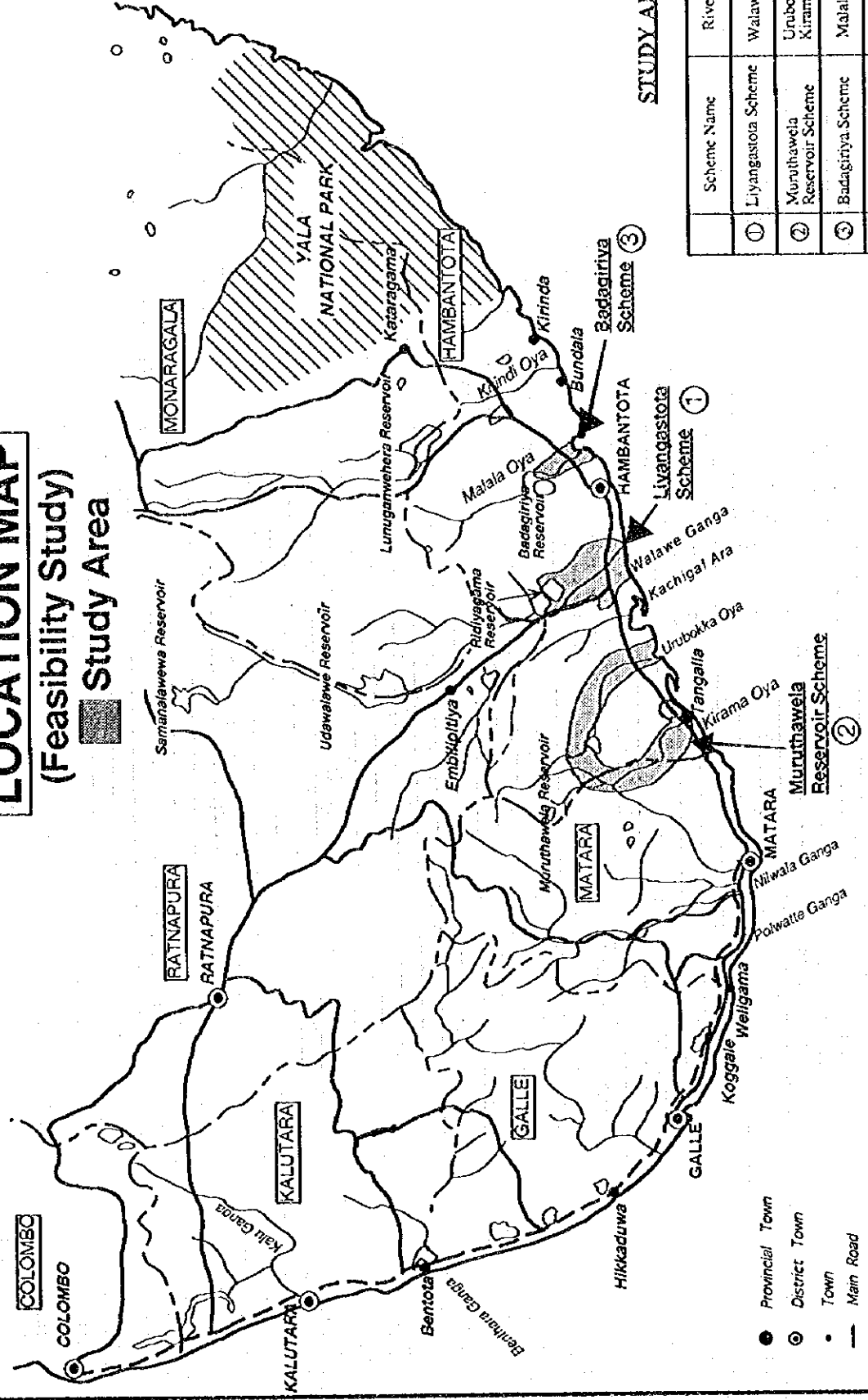
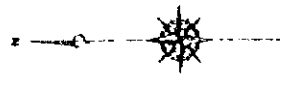
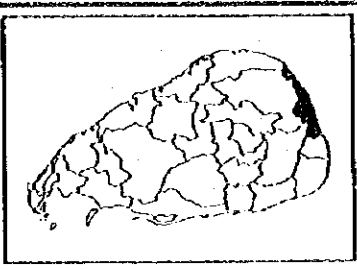
12. Conclusion and Recommendations

- (1) The Study area has the potential to play a major role in the modernization of the agricultural sector in southern Sri Lanka. The accelerated regional economic growth and expanded production activities that would result from the Project can be expected to contribute significantly to rectifying skewed levels of development between sectors and regions, and to the alleviation of poverty of the area.
- (2) 25-100 years have elapsed since construction of the irrigation and drainage facilities in the Study area, during which period the Sri Lanka government has undertaken to operate and maintain the same. However, against the background of a trend, not only in Sri Lanka but world-wide as well, to cut back on agricultural subsidies and encourage the beneficiaries themselves of agricultural development projects to bear an increasing share of the cost and responsibility for the success of such projects, it is necessary to strengthen the function of the 180 farmer organizations in the Study area, and instill a spirit of self-help and self-reliance in the farmers towards achieving sustainable and stable agriculture in the area.

- (3) A facility rehabilitation project fits well within the context of the Sri Lankan government's environmental strategy in that it is aimed at upgrading the productivity of existing land under cultivation through the application of modern agricultural technologies rather than the exploitation of new water and land resources. This contributes to the avoidance of sacrificing additional natural resources to meet increased food consumption as a result of population growth.
- (4) With regard to the 3 drainage schemes under the Master Plan which were not taken up for feasibility study, it is considered appropriate that these would be incorporated into the Shared Control of Resources (SCOR) program targeted at all the basins of the country.

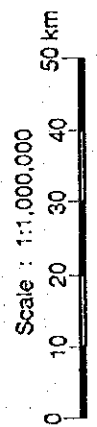


LOCATION MAP (Feasibility Study) Study Area



STUDY AREA

- Provincial Town
- ⊙ District Town
- Town
- Main Road
- - - District Boundary
- Railway
- ⊖ Lagoon or Reservoir
- Y River



INDIAN OCEAN

EXECUTIVE SUMMARY FOR PART 2: FEASIBILITY STUDY

Introduction

This Report comprises the Final Report for the Feasibility Study on the 3 target schemes selected under the Master Plan Study for the Rehabilitation of Irrigation and Drainage Systems in the River Basins of Southern Sri Lanka. It presents the results of feasibility study (Phase II, January ~ April 1996) carried out subsequent to the master plan study (Phase I, January ~ April 1995), based on the Scope of Works agreed to by the Ministry of Irrigation, Power and Energy of the Democratic Socialist Republic of Sri Lanka, and the Japan International Cooperation Agency.

1. Outline of Phase II Study, and Size of Project Area

All three of the schemes targeted for feasibility study are located in Hambantota district. Total benefit area is 11,166 ha. Of the 3 schemes, 2 schemes are comprised of 2~3 sub-schemes. An outline of the Phase II study and the size of the Project area are given below.

Study Period	Phase II study components
Field survey (January-April 1996)	(1) Irrigation and drainage facility survey, (2) Agricultural sector survey, (3) Farm economy survey, (4) Operation and maintenance survey, (5) Environmental survey
Home office works (May-July 1996)	(1) Rehabilitation plan for irrigation and drainage related facilities, (2) Operation and maintenance plan, (3) Agricultural development plan, (4) Environmental conservation plan, (5) Project implementation plan, (6) Project monitoring and impact evaluation plan

– Size of Project Area –

Scheme	Sub-scheme	Area (ha)
1) Liyangastota	Walawe RB	2,454.0
	Walawe LB	2,553.4
	Sub-total	5,007.4
2) Muruthawela Reservoir	Left Bank	1,700.1
	Urubokka Oya	2,261.9
	Kirama Oya	1,510.5
	Sub-total	5,472.5
3) Badagiriya		686.0
Total		11,165.9

2. Study Background

(1) Agricultural Sector

The agricultural sector is a mainstay of the nation's economy and accounts for 20.9% of the GDP (1993), 22.9% of exports, and 38.5% of employed labor. Under the Policy Framework formulated on the basis of the macro-economic indicator targets and structural adjustment plan in collaboration with the World Bank and IMF, the following policy is being pursued in the agricultural sector: ① elimination of subsidies for production of rice and milled wheat, ② privatization of agro-related public firms, ③ lowering of tariff rates for agricultural produce, ④ promotion of private sector participation in the distribution market for rice, fertilizer and milled wheat. The Five-year Public Investment Plan (1995-99) incorporates a major emphasis on the World Bank - IMF structural adjustment plan and new agricultural development strategy aimed at loosening of the various government controls and regulations affecting the agricultural sector to encourage independent spirit and creative energy among farmers, and promote a shift from monoculture to a more diverse, export-oriented agricultural structure.

(2) Irrigation Sector

Against the background of a shift in agricultural policy from monoculture farming to an export oriented agricultural structure, the fact that development of new farm land has essentially approached its critical limit, and the fact that there are severe constraints on government capacity to make outlays for construction of new irrigation facilities which require a large initial investment, there has been a likewise shift away from the construction of new irrigation facilities to facility rehabilitation in order to upgrade the irrigation efficiency of obsolete irrigation facilities and increase the productivity and cropping intensity of existing cultivated land. In order to achieve this, institutional and organizational aspects affecting irrigation system operation have been given priority, and the need to introduce an operation and maintenance system based on the participation of beneficiary farmers has been recognized. This is a major theme of this feasibility study as well, under which it is planned to hand over responsibility for D-canals and below to the farmers after rehabilitation. In the future, it is planned that the official role in the management of systems will be reduced to advice on technical and institutional matters, and O&M of anicut facilities in the case of major irrigation schemes. Based on this policy, the INMAS (Integrated Management of Settlements) Program with emphasis on institutional aspects, and the IMPAS (Irrigation Management Policy Support Activity) program with focus on irrigation management policy aspects have been launched. With regards to ④④institutional reorganization, the Agrarian Services Act was revised in 1990, and the Irrigation Ordinance was likewise amended such that the Project Management Committees (PMC) were legally empowered to carry out their duties. Under policy reform, establishment of a National Water Resources Policy Planning Body has been recommended.

(3) Environmental Sector

Under the National Environmental Act. No. 47 of 1980, the Central Environmental Authority (CEA) was created. The agency has established procedures and guidelines to be adhered to in the course of pursuing development projects. Under environmental policy of the nation, forest destruction and soil erosion are considered priority issues. Also, policy cites the importance of irrigation system rehabilitation, improvement of water management, and review of the land ownership system as crucial to establishing sustainable agricultural development. The District Environmental Agency (DEA) is the central organization in Hambantota district in the study of environmental impact mitigation measures within its sphere of jurisdiction which includes the areas of the 3 schemes. Of particular concern in the case of all the schemes under the Project are ① appropriate use of agro-chemicals and chemical fertilizer to prevent adverse impacts in lower basin areas, and ② through improved management of irrigation systems, the prevention of inundation and still water bodies which foster water borne or originating diseases including malaria, etc.

(4) Administrative Agencies related to the Schemes

In the case of major and medium irrigation schemes, the agency responsible for attaining the targeted agricultural production is the relevant department within the Ministry of Irrigation, Power and Energy (MIPE), and the Ministry of Agriculture (MOA).

Area of responsibility	Relevant administrative agency
Management of major schemes	Irrigation Department (ID), Irrigation Management Division (IMD), Agrarian Services Department (ASD), Paddy Marketing Board (PMB)
Irrigation and irrigation management	ID, IMD
Agricultural support services	<agricultural extension and research> Department of Agriculture (DOA), Department of Agrarian Services (DAS), Rice Research Station, Regional Agricultural Research Center, Government Seed Farms <marketing and rural credit> Paddy Marketing Board, Multi-purpose Cooperative Societies, Co-operative Wholesale Establishment, Ceylon Fertilizer Co., Ltd., Ceylon Petroleum Corporation, Central Bank of Sri Lanka
Environment	<government> Central Environmental Authority, District Environmental Committee, Agricultural Research Center of the Wildlife Department, District Agricultural Office, Coast Conservation Department, Department of Fisheries and Aquatic Resources, Divisional Malaria Office <NGO> Women's Development Federation Sarvodaya

(5) Development of Policy for Participatory Type Management of Irrigation Systems

Up until partial amendment of the Irrigation Ordinance in 1994, participatory type management of irrigation systems had developed as follows. Under this process, ① management rights of government agencies, ② management rights, functions and responsibilities of FOs, and ③ management rights, functions and responsibilities of PMCs were clarified.

Background	Description
1) Prior to emergence of participatory type management	Management under the Irrigation Ordinance of 1968
2) Confirmation of deterioration of irrigation schemes	Latter half of 1970s
3) Participatory type system management model	Minipe major irrigation scheme in 1978, ARTI program to organize farmers under the Gal Oya Water Management Project in 1981
4) Launching of the INMAS program	1984
5) Establishment of IMD	Established by ID in 1984
6) INMAS program	First participatory type management of major irrigation scheme
7) MANIS program	Commenced in 1986 (aimed at small-medium scale projects)
8) Collection of water use tariffs	Commenced in 1984 (targeted at major schemes)
9) Promotion of participatory type system management policy	Adopted as official government policy in December 1986
10) Amendment of relevant law	Agrarian Services Act, Irrigation Ordinance (May 1994)

3. Experience and Lessons Related to Rehabilitation

Experience and lessons gleaned from the following projects and programs were applied to planning under the Study.

(1) Irrigation Rehabilitation Projects

Project	Irrigated area (ha)	Implementation period	Donor agency
(1) TIMP: Tank Irrigation Modernization Project	12,753	1976-1982	World Bank
(2) Gal Oya Water Management Project	23,000	commenced in 1985	USAID
(3) MIRP: Major Irrigation Rehabilitation Project	46,240	1985-1992	joint funding by IDB, CIDA, SDC
(4) Uda Walawe Rehabilitation Project	17,000	commenced in 1985	ADB

(2) Participatory Type System Management Programs

- 1) INMAS (Integrated Management of Major Irrigation Systems) program
- 2) MANIS (Management of Irrigation Systems) program
- 3) ISMP (Irrigation Systems Management Project) program

(3) NIRP (National Irrigation Rehabilitation Project)

<Lessons learned>

Lessons learned from the above programs and project with applicability to the Study area are as follows:

- 1) Beneficiary farmer participation should occur from the initial stages of project formulation.
- 2) Programs need to be effected which strengthen the activities of FOs and promote their participation in facility O&M.
- 3) Rehabilitation should be pragmatic and cost effective.
- 4) Full cooperation of the Sri Lankan government is necessary in ensuring the effective function and coordination of the related executing agencies.

4. Study Approach and Execution Strategy

Based on lessons learned from past irrigation rehabilitation projects, demarcation of FO boundaries, benefit areas and irrigation and drainage systems was done on topomapping (S = 1/5,000) prepared in the course of the Study. This demarcation was done jointly by the Team over a 1 month period with the cooperation of around 1,500 farmers and ID staff in charge of the 3 schemes, and represents the first such survey approach applied in Sri Lanka. On the basis of this map-top data, a rapid rural appraisal (RRA) including baseline survey and participatory rural appraisal (PRA), and a diagnostic analysis of present status (DAPS) were carried out. Upon completion of the foregoing survey, a workshop was held in Colombo. The workshop provided a vehicle for further deepening the understanding of concerned personnel and decision making level officials regarding the content of the Study.

5. Present Conditions in the Study Area

(1) Socio-economy

Number of beneficiary farm households in the 3 scheme areas is 19,190, with total population of 105,200. Approximately 50% of the farmers are tenants, with average land holdings of 3.1 ac per household. Average unemployment rate is 30%, which is well above the district-wide average for Hambantota of 15.5%. Recipients under the

Samurdhi Programme are estimated to comprise 12.6 % in the Liyangastota scheme area and a high of 39.2% of the population in the Muruthawela Reservoir scheme area.

(2) Agro-economy

In the case of the scheme benefit areas, purchase by private marketing agents is the dominant marketing route for paddy. Other purchasing agents comprise the Paddy Marketing Board (PMB) and the Multi-purpose Co-operative Societies (MPCS). Purchase price for white rice is Rs 8~9 / kg, and that for red rice is Rs 9~10 / kg. In the case of dried chilies as well, marketing is mainly by private marketing agents. Purchase price is Rs 10 / kg.

Farm inputs are supplied to the farmers via the Agrarian Services Centres, multi-purpose cooperative societies and private merchants. These inputs are originally obtained from the following sources: paddy seed from the Bata-ata seed farm, fertilizer from the Ceylon Fertilizer Co., Ltd., and agro-chemicals from the Ceylon Petroleum Corporation. Cultivation loans are extended mainly by the Regional Rural Development Bank and the Bank of Ceylon, and use rate by farmers reaches 68~76%. Interest on the loans is 16% p.a.; however, lending banks suffer from a poor loan recovery rate.

(3) Irrigation and Drainage

Total benefit area for the 3 schemes is 11,116 ha, with total canal length of 355 km. Two of the 3 schemes are comprised of a total of 5 sub-schemes, making in effect 6 schemes targeted under the Project. The unlined canals which comprise the major irrigation and drainage facilities under the schemes have experienced 25 ~ over 100 years since construction, and are widely damaged and deteriorated due to expiry of their effective utility lives. Paddy is the main crop under all 3 schemes. Both sub-schemes of the Liyangastota scheme, and the Kirama Oya and Urubokka Oya sub-schemes under the Muruthawela Reservoir scheme divert water directly from river sources. In the case of the remaining 2 sub-schemes, water source is by reservoir. In terms of available water volume, only the Liyangastota scheme is without problem. The other 2 schemes suffer water shortage requiring a combination of facility rehabilitation and upland crop introduction in order to expand irrigated area.

Scheme-wise benefit area and canal length area as follows:

Scheme	Sub-scheme	Benefit area (ha)	Feeder canal ~ main canal ~ branch canal length (km)	D-canal length (km)
Liyangastota	WRB, WLB	5,007	79.9	74.6
Muruthawela Reservoir	Left Bank, Urubokka, Kirama Oya	5,473	14.4	165.2
Badagiriya	-	686	16.2	4.8
Total	6	11,166	110.5	244.6

(4) Agriculture

Present agricultural conditions area summarized scheme-wise below:

Item	Liyangastota	Muruthawela Reservoir		Badagiriya
		Muruthawela I.B	Urubekka Oya and Kirama Oya	
1. No. of farm households and land ownership	Total no. of households: 8,700, of which 2,400 are landowners, 3,300 are tenants and 3,000 are landless. Paddy area: 5,000 ha. Average paddy field per household: 0.57 ha.	Total no. of households: 2,128, of which almost all are settlers. Paddy area: 1,700 ha. Average paddy field per household: 0.80 ha.	Total no. of households for both sub-schemes: 7,800. Paddy area: 3,773 ha. Average paddy field per household: 0.48 ha.	Total no. of households: 686, of which 686 are landowners. Paddy area: 686 ha. Average paddy field per household: 1.0 ha. Total upland field area: 270 ha.
2. Land use and cropping pattern	Almost all paddy. Cropping intensity: 191%	Almost all paddy. Cropping intensity: 130%	Almost all paddy. Cropping intensity: 160%	Average paddy cropping intensity: 138%. Upland crops are mainly green gram, cowpea, maize and peanut
3. Paddy unit yield and production amount	Maha season: 3.8 t/ha Yala season: 3.5 t/ha Production: 36,700 t/year	Maha season: 3.9 t/ha Yala season: 3.8 t/ha Production: 7,000 t/year	Maha season: 3.2 t/ha Yala season: 3.1 t/ha Production: 19,000 t/year	Maha season: 3.6 t/ha Yala season: 3.0 t/ha Production: 3,030 t/year
4. Average annual income from agriculture	Landowner: Rs 34,200 Tenant: Rs 19,000 Landless: Rs 11,400	Rs 21,300	Rs 14,800	Rs 23,700
5. Farmer support structure	ASC, cooperatives, DOA	INMAS since 1987, other services same as for Ridiyagama scheme.	ASC, cooperatives, DOA	Kirindi Oya Project Office, ASC, cooperatives, DOA, regional agricultural research center
6. Desire on part of farmers to introduce OFCs	Extremely low	Low	Low	Low
7. Problem issues	Water shortage; fragmented farm scale; landless farmers	Illegal diversion at Tract-I resulting in water shortage downstream.	Inadequate extension activities for farm technology; FOs are weak	Water shortages at downstream extremity of scheme; lack of good paddy seed; lack of coordination among agricultural support services.

(5) Farmer Organization

A total of 129 FOs have been confirmed in the scheme areas, all of which were formed under the INMAS and MANIS programs. Almost all of the FOs have been registered as of the early 1990s under the Agrarian Services Act. FO units are demarcated along command area boundaries, and average unit size is less than the nation-wide average of 500 ac. Membership registration rate in the FOs is over 60%, however, membership fee payment and group activities differ depending on the FO and in general not sufficiently organized for adequate accumulation of physical and financial assets.

The FOs of each scheme were evaluated by the Study Team applying marking criteria of (i) membership rate, (ii) level of member participation in FO activities, (iii) O&M and support services, (iv) physical assets, (v) financial assets and (vi) management

capacity. On the basis of these, in descending order of superior organization, the schemes were ranked as follows: Badagiriya, LB Main, WLB, and WRB.

Scheme	Sub-scheme	No. of FOs	Program	Agency
1) Liyangastota	Walawe RB	24	INMAS	Irrigation Management Division (IMD)
	Walawe LB	30	MANIS	Irrigation Department (ID)
2) Muruthawela Reservoir	Muruthawela LB	27	INMAS	IMD
	Urubokka Oya	22	MANIS	ID
	Kirama Oya	22	MANIS	ID
3) Badagiriya	--	4	INMAS	IMD

(6) Operation and Maintenance

Average annual O&M outlay by the government (ID and IMD) for the target scheme areas over the past 3 years (1993-95) is approximately Rs 500 /ha; however, this is in a decreasing trend due to fiscal constraints. O&M activities of the ID are performed in the field by a total of 87 permanent laborers assigned to the 3 scheme areas, each with a fixed area of responsibility for facility maintenance. Area size per laborer averages 125 ha / person, with scope of responsibilities including anicuts, gates, and canals. However, work efficiency is poor due to the fact that all works are performed primarily by hand, and laborers often live at considerable distance from their work sites. ID administrative staff with jurisdiction over the scheme areas total 35 persons, including 18 persons for the Muruthawela Reservoir scheme, 11 for the Liyangastota scheme, and 6 for the Badagiriya scheme. In some sectors of the scheme areas, O&M works for D-canal and below are performed by the farmers themselves. Nevertheless, rate of farmer participation varies greatly depending on the scheme and the system.

(7) Environment

According to the District Environmental Committee, of particular concern in terms of negative environmental impact from the 3 target schemes are ① water borne diseases, and ② impact from agro-chemical use. Under ① above, malaria is cited in the case of the subject schemes, and is the disease with which farmers are afflicted the most. The rate of malaria occurrence in the Badagiriya scheme area is 2 fold that in the other 2 scheme areas. The District Environmental Committee recommends the prevention of inundation due to leakage from canals, and the release of an appropriate maintenance discharge in the canals as measures to help control the disease. With regards to ② above, the Integrated Pest Control program was launched in 1984 as a part of the national environmental action plan to promote proper timing and application amounts for agro-chemical use. There are no existing guidelines for environmental assessment procedures for an irrigation rehabilitation project, as this Project is the first such to come under the jurisdiction of the Central Environmental Authority; however, in discussions with the CEA it indicated that it would not be necessary to carry out an

IEE (Initial Environmental Evaluation) nor and EIA (Environmental Impact Assessment) under the Study in this case.

6. Formulation of Rehabilitation Plan

(1) Confirmation of Necessity and Need for Rehabilitation

The necessity, urgency and appropriateness of the Project is confirmed from the standpoints (i) government policy background, (ii) utility life of facilities (project life), (iii) sustainable and upgraded agricultural activity, and (iv) sustaining and conserving the environment.

(2) Plan Formulation Strategy

The Study Team drew on the valuable body of experience and lessons learned from other irrigation rehabilitation projects carried out in Sri Lanka, and applied this to formulation of the Project plan. These experience and lessons can be summarized as follows:

- Adoption of a participatory type project wherein beneficiary farmers (the users) actively participate in the project from its incipient planning stage.
- Rehabilitation plan for irrigation facilities must be pragmatic and cost-effective.
- Formulation of a project which can readily obtain the coordinated and integrated support, cooperation and collaboration of the concerned higher government agencies (provincial and national level) in achieving design targets.

Basic strategy under each project component is as follows based on the above.

- 1) Rehabilitation plan for irrigation facilities: to recover system function.
- 2) Agricultural development plan: to clearly set priorities for agricultural development within the framework of an irrigation rehabilitation project.
- 3) Environmental conservation plan: to carry out monitoring during execution of the project during the three stages of design, implementation, and operation to prevent adverse impacts to the environment.
- 4) Operation and maintenance plan: to clarify problem issues through "logical frame" analysis, and to formulate specific scenarios for target achievement through clear-cut goal analysis.

(3) Agricultural Development Plan

1) Introduction of OFCs

Under the national agricultural development policy, principal focus is placed on increased paddy production in major irrigation areas, and instead OFC is recommended for introduction to rainfed upland fields. Approximately 5~10% of cropped area is planned for OFCs in the case of the Muruthawela LB sub-scheme and the Badagiriya scheme. Selected OFCs are chilies and banana.

2) Anticipated Harvest

On the basis of data available from adjacent major irrigation schemes, and the rice research station facilities within the Project area, anticipated yield for paddy is set at 5.5 t/ha for both rainy and dry seasons, and 15 t/ha for OFCs (chilies and banana).

3) Fertilizer Application

Design fertilizer application amount for paddy is 450 kg/ha of compound fertilizer. In the case of OFCs, application of organic fertilizer is planned at 900 kg/ha for chilies, and 250 kg/ha for banana in the first year to be followed by 500 kg/ha from the second year on for a total application of 2,000 kg/ha per year of organic fertilizer.

4) Design Crops and Cropping Intensities

On the basis of the above, design crops and cropping intensities are as follows:

Scheme	Sub-scheme	Annual cropping intensity (%)				Remarks
		Present		Design		
		Paddy	OFC	Paddy	OFC	
1) Liyangastota	WRB, WLB	190	--	200	--	Paddy, 4.5 month variety
2) Muruthawela Reservoir	LB Main	112	19	127	30	Paddy, 3.5 month variety
	Urubokka Oya	168	--	185	--	Paddy, 3.5 month variety
	Kirama Oya	147	--	175	--	Paddy, 3.5 month variety
	Overall	145	6	153	18	
3) Badagiriya	--	132	6	150	20	Paddy, 3.5 month variety

(4) Irrigation and Drainage Plan

1) Basic Strategy for the Irrigation Plan

As available discharge is sufficient for the Liyangastota scheme, effort under the Project will focus on rehabilitating the deteriorated state of irrigation facilities. Due to water shortage in the case of the Muruthawela scheme, strategy under this scheme is focused on study and analysis of water source, mitigation measures for water shortage, legalization of Tract I participation in the scheme, and improvement of system efficiency. Since ample discharge is available in the case of the Badagiriya scheme, strategy for this scheme will be aimed at study and analysis of water source, mitigation measures for any possible water shortage, measures to prevent seepage along feeder and main canals, and system rehabilitation.

2) Basic Strategy for Drainage Plan

Almost all of the canals in the Project area are unlined drainage cum irrigation canals which exhibit progressive deterioration and cross-section deformation. As a result, entire canal length is to be subject to rehabilitation. With regard to the drainage situation in the extreme downstream of the basin, excepting the most downstream portion of the Kirama Oya sub-scheme, there is no serious drainage damage occurring in the scheme areas. Accordingly, rehabilitation works for embankment, gate and drainage canal cross-section, etc. will be done only at the extreme downstream area (Kirama Oya sub-scheme).

3) Basic Strategy for the Rehabilitation Plan

Level of facility rehabilitation is to be as follows in light of the primary objective of recovery of overall system function under the Project.

Tanks:

As the Study is aimed at the recovery of the function of existing facilities through rehabilitation, neither diversion from new water sources nor increasing the storage capacity of tanks (embankment raising, etc.) are considered under the rehabilitation plan.

Discharge gauging facilities:

The existing and deteriorated facilities are to be completely rehabilitated as they are crucial to overall system management. In addition, new such facilities are to be installed at the start point of distribution canals.

Main canals:

Segments of canals where discharge carrying cross-section is insufficient and slope collapse has occurred, and turnout facilities which have experienced severe

deterioration will be rehabilitated. Canal lining method will in principal be a combination of unlined, and lining with stone masonry.

Distribution canals:

D-canals and equivalent branch canals will be rehabilitated to include appropriate O&M roads along the canals. Lining method is to be stone masonry or standard section unlined canal.

F-canals:

In the case of F-canals (field canals), metal and concrete works at turnout facilities and cross-section transition points, etc. will be targeted under the Project. Cross-section improvement works, etc. for the canals themselves are to be the responsibility of the farmers, and thus will be outside the scope of rehabilitation works under the Project.

Anicuts:

As anicuts constructed on rivers are presently in relatively good condition despite the fact that they have exceeded their design utility lives, rehabilitation will mainly comprise replacing gates and repair of seriously damaged embankment protection works upstream and downstream of the structures.

4) Facility Rehabilitation and Expansion of Irrigated Area

Present cropping intensity in the Liyangastota scheme which has ample water resources is 95% (Maha / Yala). Under facility rehabilitation and scheme improvement, cropped area is to be increased to 100%. In the case of the other 2 schemes (Muruthawela Reservoir and Badagiriya) for which shortage of water resources has been identified, rehabilitation of facilities alone will not achieve 100 percent irrigation of the scheme areas. As a result, increase of irrigated area would be achieved through economy of irrigation discharge use by introducing upland crops.

5) Irrigation and Drainage Facility Rehabilitation Plan

Components of the irrigation and drainage facility plan under the Project are as follows:

Scheme	No. of sub-schemes	Design area (ha)	Canal rehabilitation (km)		Appurtenant works		
			Masonry lined	Unlined	Canal structures	Intake weir	Farm road (new) (km)
1) Liyangastota	2	5,007	71.7	85.9	720	1	25
2) Muruthawela Reservoir	3	5,473	125.5	86.8	1,844	26	38
3) Badagiriya	--	686	16.2	2.3	341		
Total		11,166	213.4	175.0	2,905	27	63

(5) Plan to Strengthen Farmer Organizations

1) Restructuring of FOs and PMCs

Existing FOs are in operation under the INMAS and MANIS programs. PMCs (Project Management Committees) have been established in the case of schemes under the INMAS program; however, they have been not set up in the case of the MANIS program. PMCs would be established under the Project in line with the restructuring of FOs as set out below. From the standpoint of facilitating future transfer of responsibilities for system O&M to FOs, more equitable selection of farmer representatives, upgrading efficiency of PMC operations, this restructuring is aimed at effective integration and strengthening of the present FO units in line with true canal command areas. Number of FOs would be restructured from the present 129 to 64 under the Project.

No. of FOs

Scheme	Present	Design	Remarks
1) Liyangastota	54	29	
2) Muruthawela Reservoir	71	31	
3) Badagiriya	4	4	same as present
Total	129	64	

2) Plan to Strengthen and Support FOs

The continuation and promotion of the ongoing INMAS and MANIS programs is the base of the government policy towards support of FO activities. In this line, the following facilities and equipment are included under the Project to foster greater farmer initiated activity.

Scheme	Building construction works			Equipment deployment		
	Conference room	Fertilizer, seed storage	Garage	2 wheel tractor	Motorbike	Office equipment
1. Liyangastota	6 buildings	6 buildings	6 buildings	12 nos.	6 nos.	1 set
2. Muruthawela Reservoir	9 buildings	9 buildings	9 buildings	18 nos.	18 nos.	1 set
3. Badagiriya	1 building	1 building	1 building	2 nos.	2 nos.	1 set
Total	16 buildings	16 buildings	16 buildings	32 nos.	26 nos.	3 set

3) Training and Human Resources Development

The Irrigation Management Department is carrying out a nationwide farmer training program. The training program is targeted at FO representatives and administrative staff of the FOs, and encompasses O&M, financial management, agricultural development, basin conservation, farmer exchange, etc. However, since the Irrigation Management Section lacks instructors, it is planned under the Project to augment instructional staff from NGOs and the private sector. In addition, a supplemental training program would be established under the Project in this regard aimed at farmers and staff of concerned government agencies to further develop human resources.

(6) Operation and Maintenance Improvement Plan

Under the Project a Range Management Unit (1 location) to oversee O&M operations for the entire Project area would be established, as well as Operation Units (3 locations) for each scheme to be under the jurisdiction of the RMU. Necessary equipment for maintenance would be procured and deployed at the units to upgrade the O&M activities currently carried out by less efficient manual labor by the ID labor staff at its branch offices under the Irrigation Department Hambantota Range. O&M equipment (total of 112 units) and facilities envisioned for the RMU and OUs are as follows.

Item	Qty.	Building facilities				Equipment	
		Work shop (300 m ²)	Office (150 m ²)	Garage (300 m ²)	Management office (96 m ²)	Drag line, motor grader, trailer lorry, etc.	Dozer, backhoe, trailer, compactor, etc.
1. Equipment procurement	Total 14 types, 112 units	--	--	--	--	1 unit each of 4 types: total of 4 units	10 types, total of 108 units
2. RMU construction	1 location	1 building	1 building	1 building	1 building	Deployment of 4 units of above	--
3. OU construction	3 locations	--	1 building	1 building	--	--	Deployment of above total of 108 units

With the above equipment procurement, and construction of RMU and OU facilities, it is envisioned that it will be necessary to employ 45 new O&M staff, to be deployed as follows.

Scheme	Existing	Design			Total
	Existing permanent laborers	System operators	Equipment operators	New ID laborers	
1) Liyangastota	36	6	3	--	9
2) Muruthawela Reservoir	45	6	3	--	9
3) Badagiriya	6	2	2	--	4
RMU	--	9	4	10	23
Total	87	23	12	10	45

(7) Environmental Conservation Plan

Based on the National Environmental Action Plan, the following environmental conservation plan will be carried out under the Project: ① plan to mitigate impacts from agro-chemicals, ② plan to contain malarial infection, ③ green belt plan and ④ environmental educational program. The foregoing would be carried out under the guidance of the Hambantota District Environmental Agency (DEA).

(8) Project Monitoring and Environmental Impact Assessment Plan

Monitoring under the Project would cover the 3 areas of irrigation system efficiency, agricultural production and environment related aspects. Observation and data recording in this regard would begin during the project implementation stage.

7. Project Plan

(1) Project Components

The Project comprises the following 3 plans and 2 programs.

<Plans>

- 1) Rehabilitation plan for existing irrigation / drainage systems
- 2) Plan to strengthen operational and maintenance capability
- 3) Plan to strengthen and support farmer organizations

<Programs>

- 1) Program to strengthen participatory management system
- 2) Monitoring and environmental impact assessment program

(2) Implementation Plan

Completion of preparatory works including tendering procedures is targeted for June 1998, with construction to last for 3.5 years from July 1998 to 2001.

(3) Project Executing Agency, and Project Management

The executing agency for the Project is the Irrigation Department under the Ministry of Irrigation, Power and Energy. Actual project management will be performed from the Hambantota regional irrigation office and the Kirindi Oya settlement project regional office.

(4) Project Cost

Total Project cost is estimated at Rs 1.953 billion (US\$ 37.6 million), equivalent to a per hectare project cost of Rs 175,000 (US\$ 3,300).

8. *Project Evaluation*

(1) Economic Evaluation

Economic evaluation of the Project was carried out by computing economic internal rate of return (EIRR), benefit cost ratio (B/C) and net present value (NPV) based on project implementation cost, O&M cost and economic benefit for a 25 year flow period. EIRR for the 3 schemes respectively is 13.7% for Liyangastota, 14.7 for Muruthawela Reservoir, and 15.3 for Badagiriya. These figures indicate a good economic viability for the Project.

(2) Farm Economy Analysis and Collection of Water Use Tariffs

In the case of landowner farmers, the present overall net income will increase 1.1~3.2 fold, and the net income increase for the tenant farmer will be 1.9~9.1 fold with the Project. If it is assumed that in the future all beneficiary farmers will pay a flat water use tariff of Rs 440/ha, this would be equivalent to 0.9~1.4% of the net income increment in the case of landholder farmers, and 0.8~1.5% in the case of tenant farmers. This is judged to be within the capacity to pay of the farmers.

(3) Employment Generation

Implementation of the Project can be expected to generate approx. 55,200 man-days of labor opportunity in the case of the Liyangastota scheme, and 42,000 man-days of

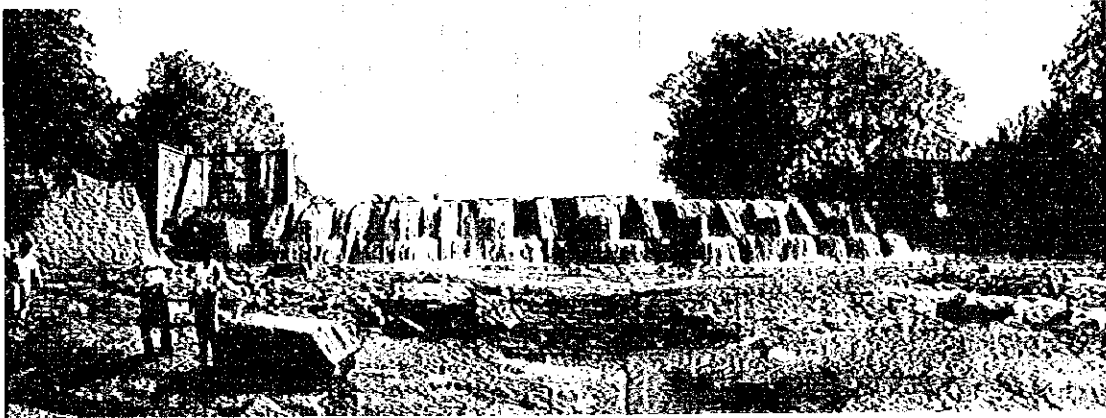
the same in the case of the Muruthawela Reservoir scheme, and 14,000 man-days in the case of the Badagiriya scheme.

9. Conclusion and Recommendation

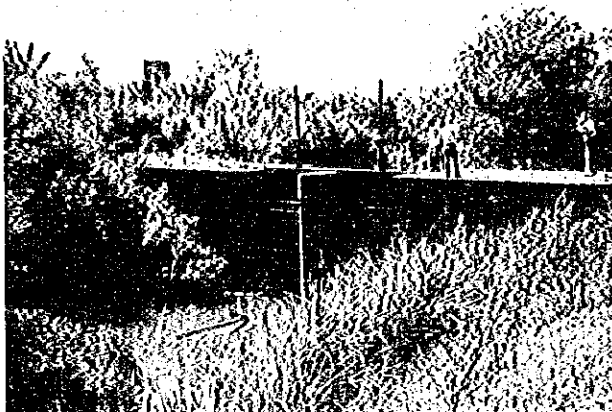
- (1) Learning from lessons and experience of past irrigation projects carried out in the country, the participation of farmers was obtained from the very outset of the Study. As a result, farmers in the scheme areas show a high degree of interest in the Project. Furthermore, locations and areal scope of particular problems afflicting the schemes over the past decades were identified and confirmed on topomapping (S = 1,5000), and it was concluded that a preparatory structure on the beneficiary side is in place for Project implementation.
- (2) With implementation of the Project, it will be possible to increase the average household income in the 3 scheme areas from the present Rs 19,600 to Rs 40,000. It is thus recommended that the Project be implemented at the earliest possible date in order to improve the living standards of the area farmers.
- (3) The 2 programs (program to strengthen participatory management system, and monitoring and environmental impact assessment program) are scheduled to start either in advance of or simultaneous to the rehabilitation construction works. This is an aspect which should be given high priority by the Sri Lankan government in arranging the planned implementation schedule.
- (4) It is planned that FOs be contracted to the extent possible for participation in the Project construction works. This will provide supplemental income to offset the unavoidable cessation of a portion of cultivation in the scheme areas due to construction activities during implementation. Accordingly, the 2 programs under the Project are key factors to its success and it is recommended that these be effectively carried out in advance or simultaneous to the actual construction works under the Project.

Site Photos

① LIYANGASTOTA SCHEME



Liyangastota Anicut

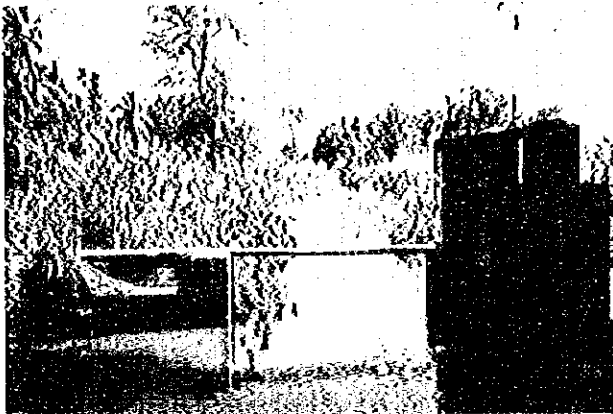


LB Feeder Canal Diversion Structure

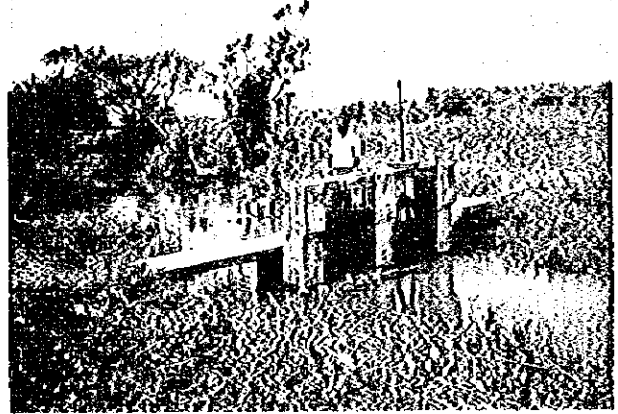


LB Feeder Canal

①-1 WALawe RB SUB-SCHEME



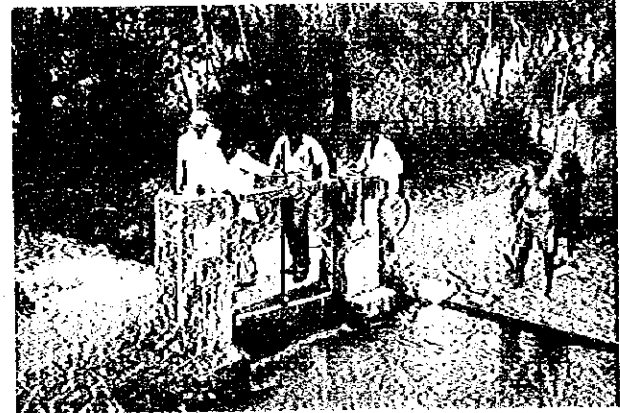
RB Main Canal (Sta.1+170)



RB Main Canal (Sta.13+000)

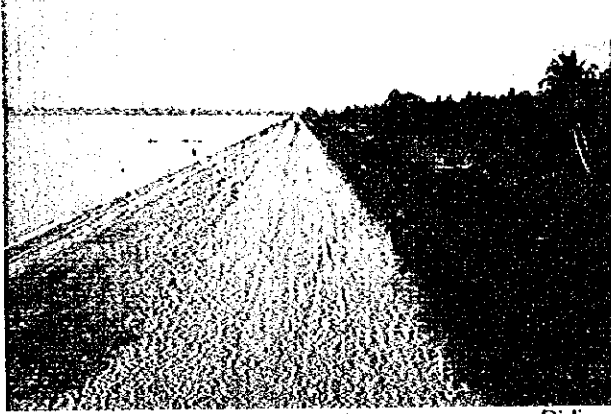


Jansegama Canal

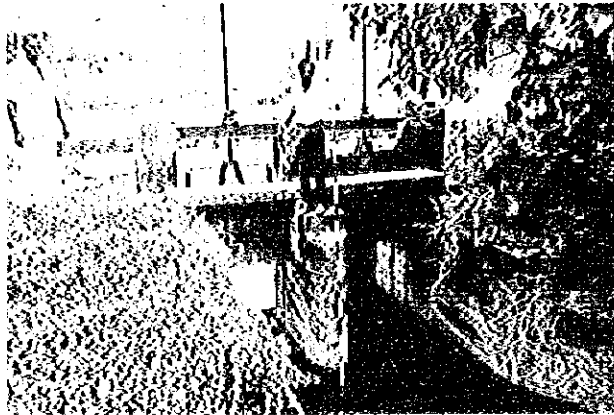


D-1 Canal

①-2 WALAWE LB SUB-SCHEME



Ridiyagama Tank



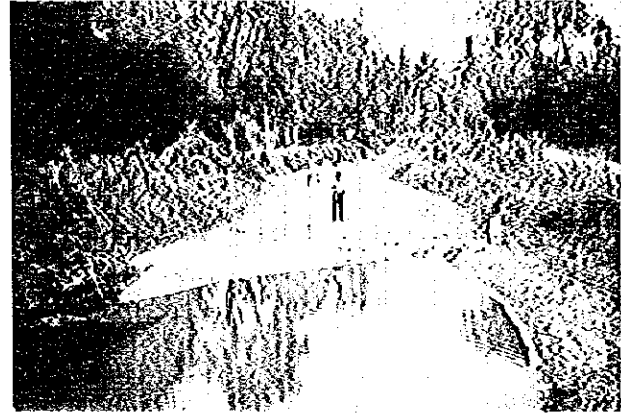
LB Main Canal Diversion Structure



LB Main Canal (Sta. 1+900)



SRB Canal Diversion Structure



SRB Canal



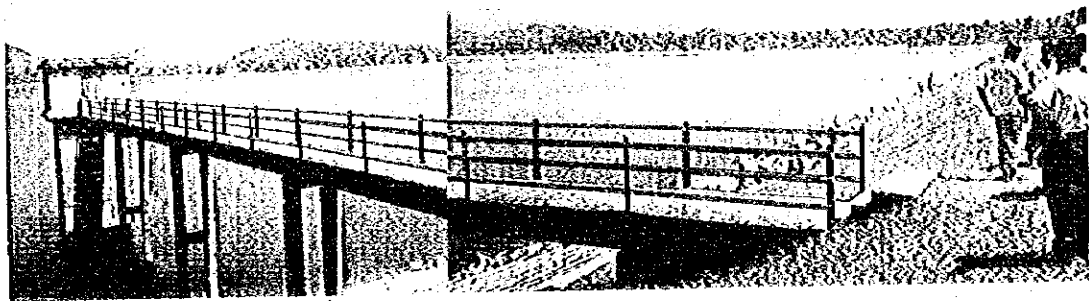
Control Pipe Outlet



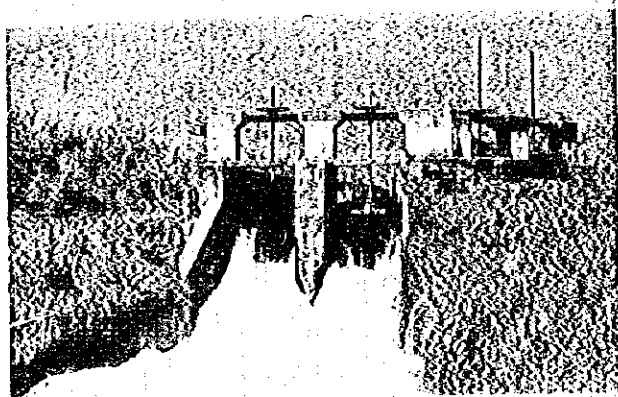
Karagaha Ara Drainage Canal

② MURUTHAWELA RESERVOIR SCHEME

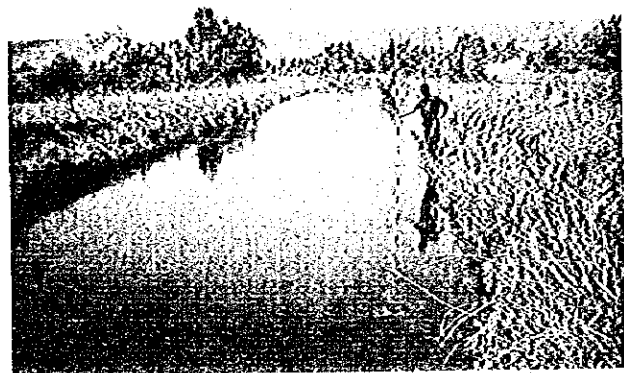
②-1 MURUTHAWELA LB SUB-SCHEME



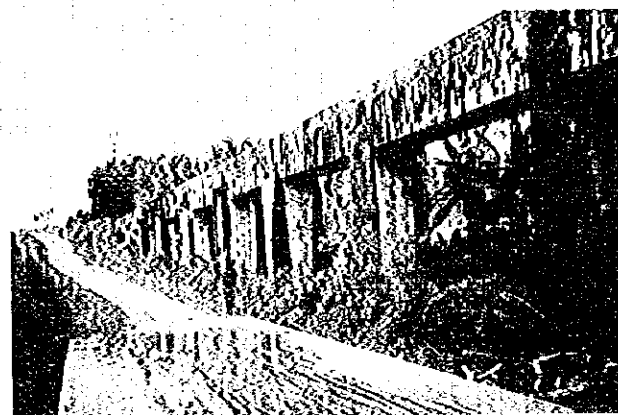
Muruthawela Reservoir



LB Main Canal Diversion Structure



LB Main Canal (Sta.0+200)



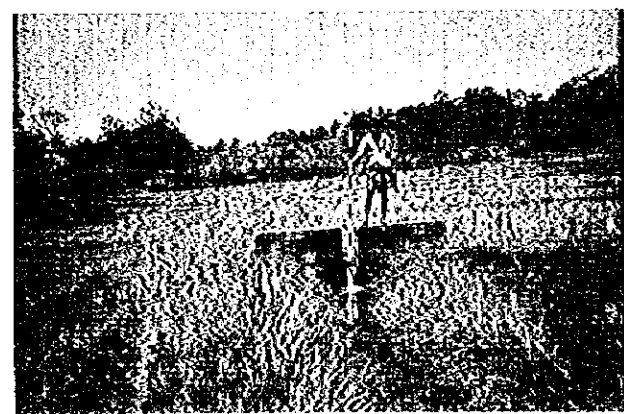
LB Main Canal Aqueduct (Sta.0+970)



LB Main Canal (Sta.6+100)



D-1 Canal in Tract II

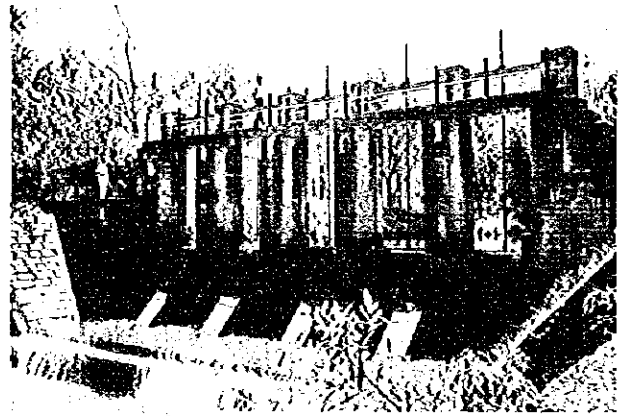


Field Canal in Tract II

②-2 URUBOKKA OYA SUB-SCHEME



Wakamulla Anicut (upstream)



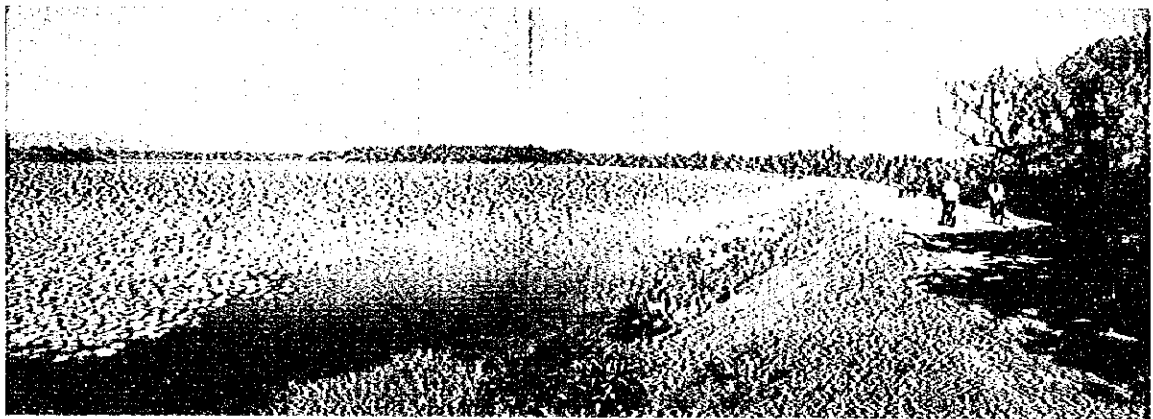
(downstream)



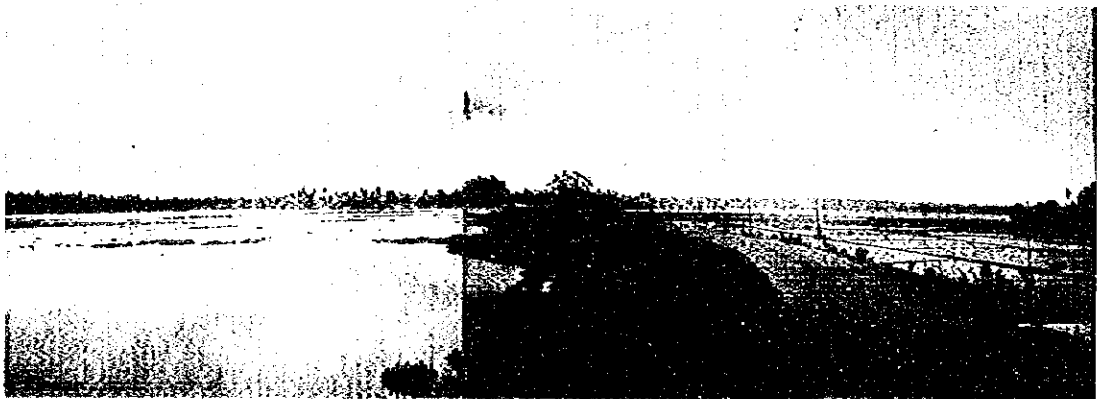
Wakamulla LB Intake



Land Preparation in the Scheme



Udukiliwila Tank

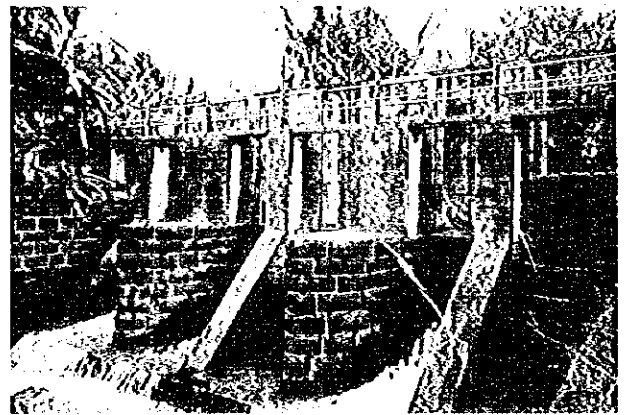


Pattiyapola Tank

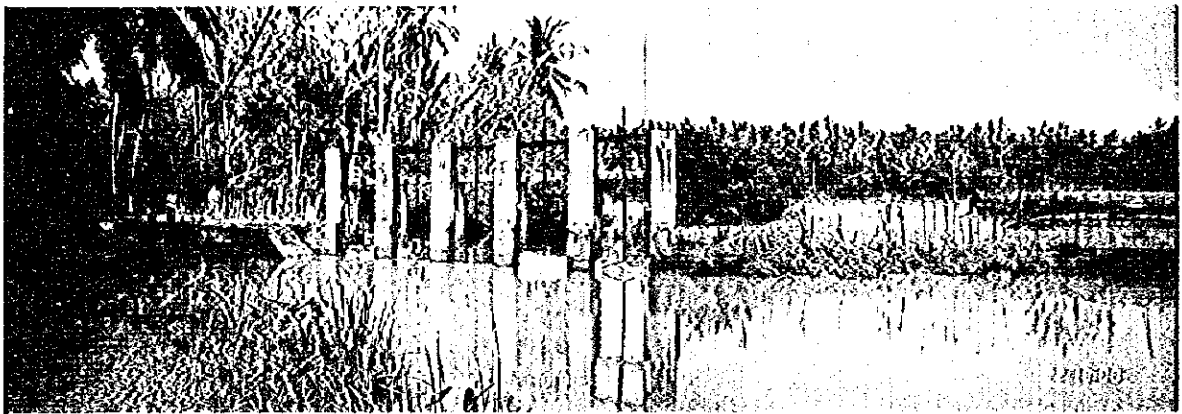
②-3 KIRAMA OYA SUB-SCHEME



Hambumandiya Anicut (upstream)



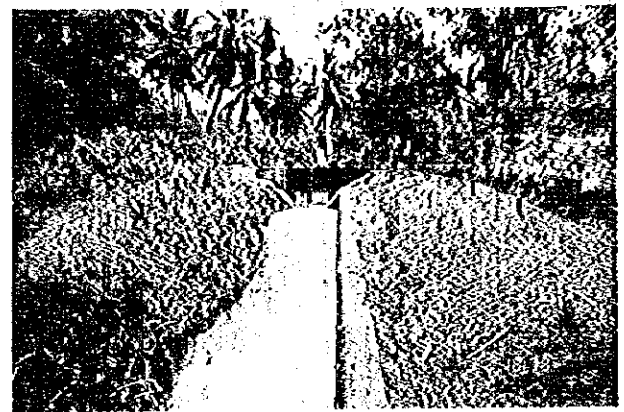
(downstream)



Palliyawela Anicut (upstream)



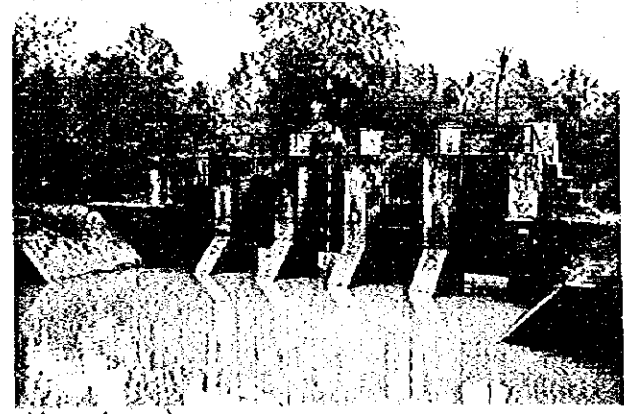
Palliyawela LB Intake



Palliyawela RB Intake

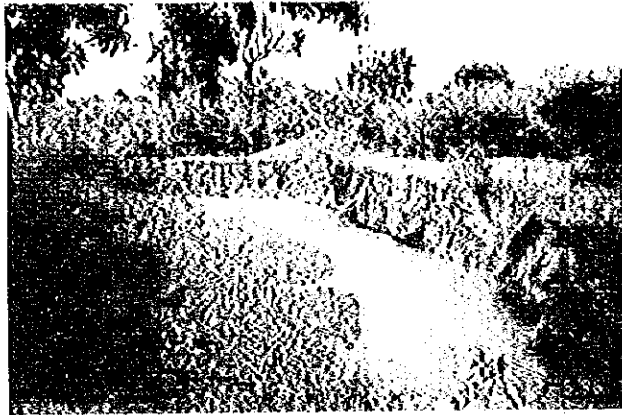


Danketiya Anicut (upstream)

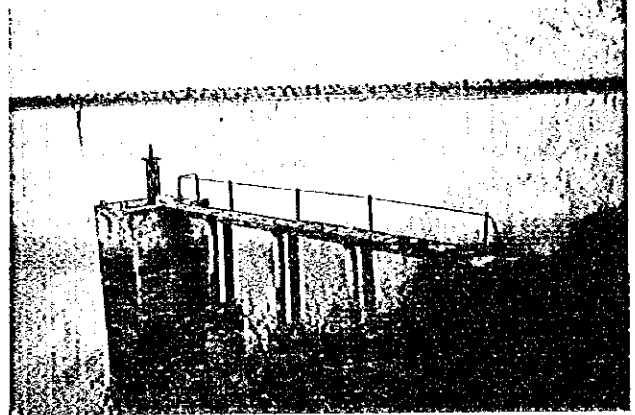


(downstream)

③ BADAGIRIYA SCHEME



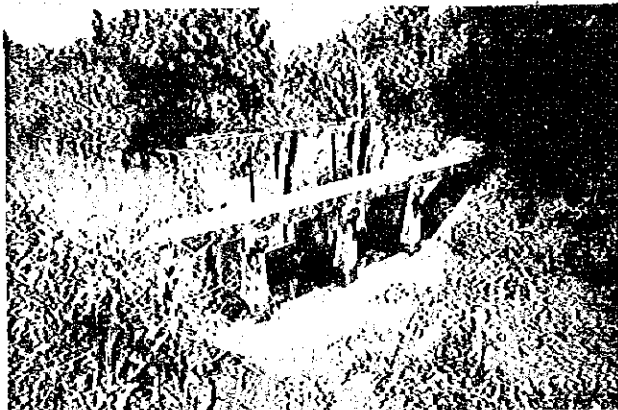
Feeder Canal No.1



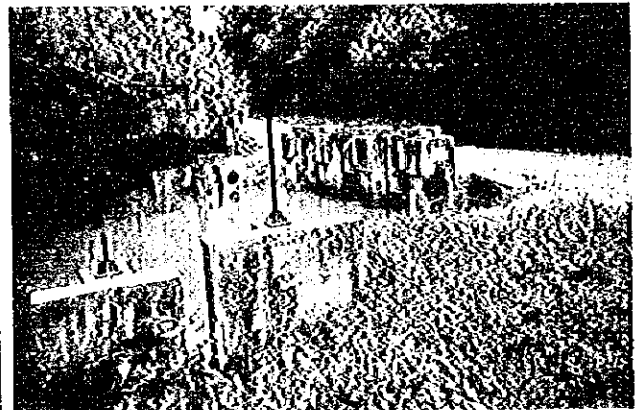
Badagiriya Tank



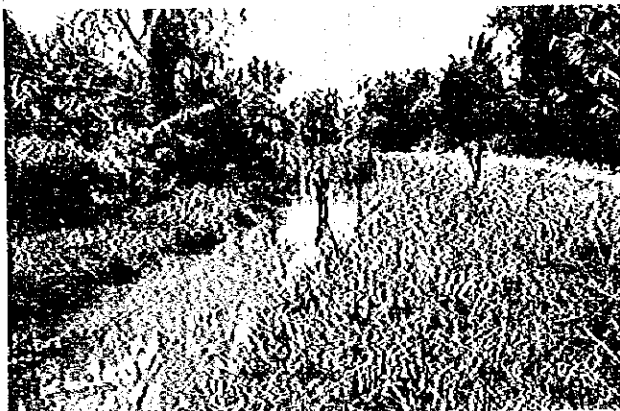
Command Area of Field Canal-1



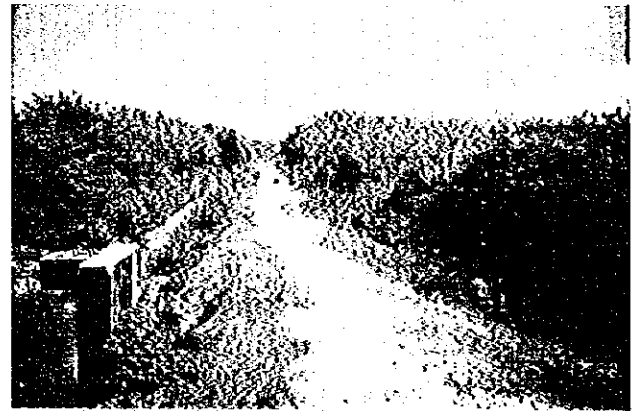
Gate Regulator No.1, Main Canal (Sta.1+630)



Gate Regulator No.4, Main Canal (Sta.5+220)



Main Canal (Sta.6+000)

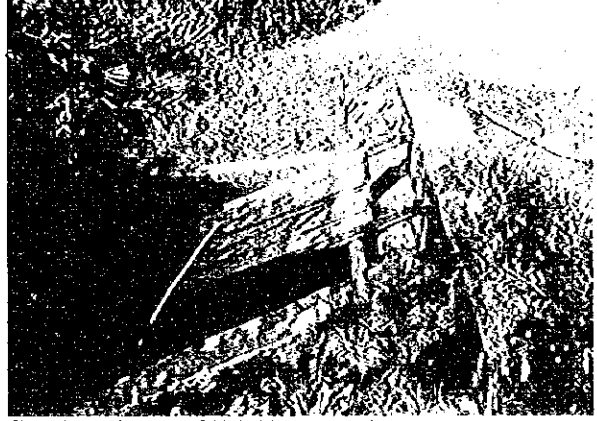


Proposed Area, EP of Main Canal (Sta. 8+600)

④ BENTHARA GANGA RB SCHEME



Dombagaha Ela



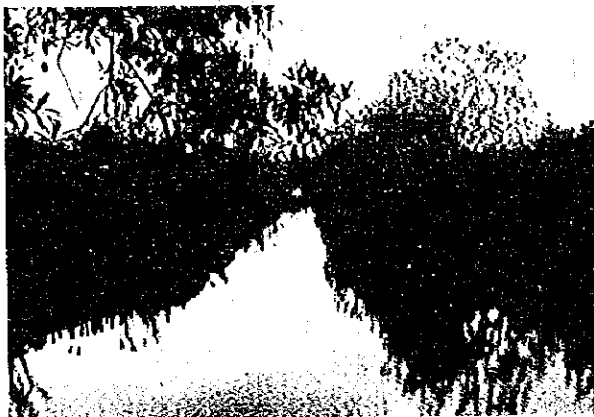
Dombagaha Ela SWE (flap gates)



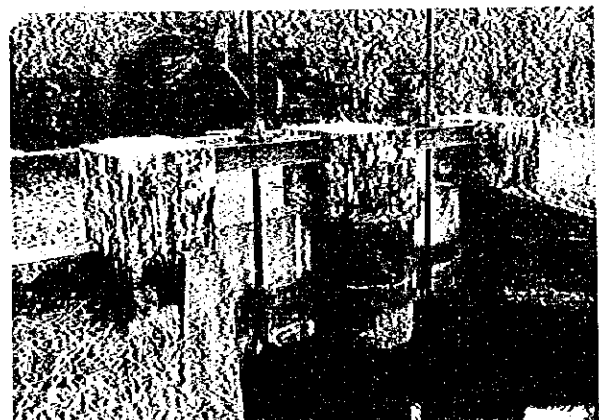
Kaduruwatta Ela



Kaduruwatta Ela SWE (lifting gates)

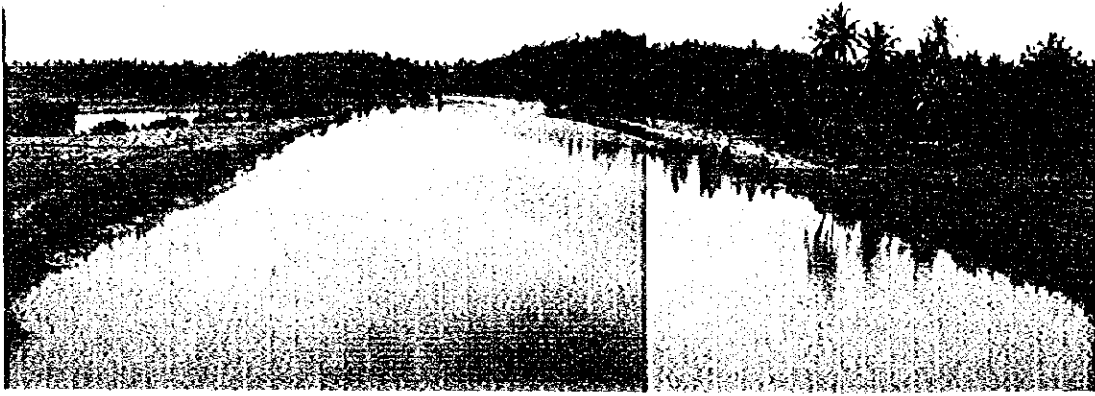


Mahapiyadde Ela

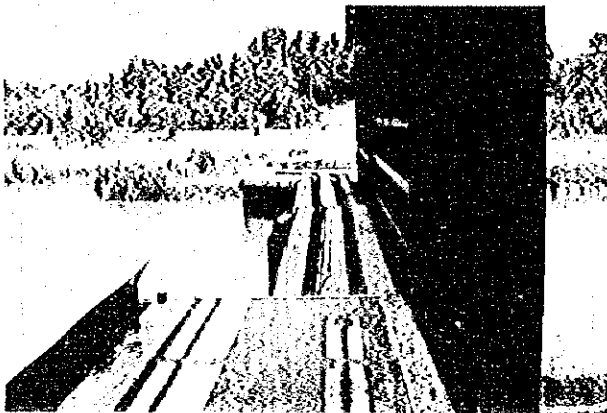


Mahapiyadde Ela SWE (lifting gates)

⑤ POLWATTE GANGA SCHEME



Polwatte Ganga at Ilwatta Anicut



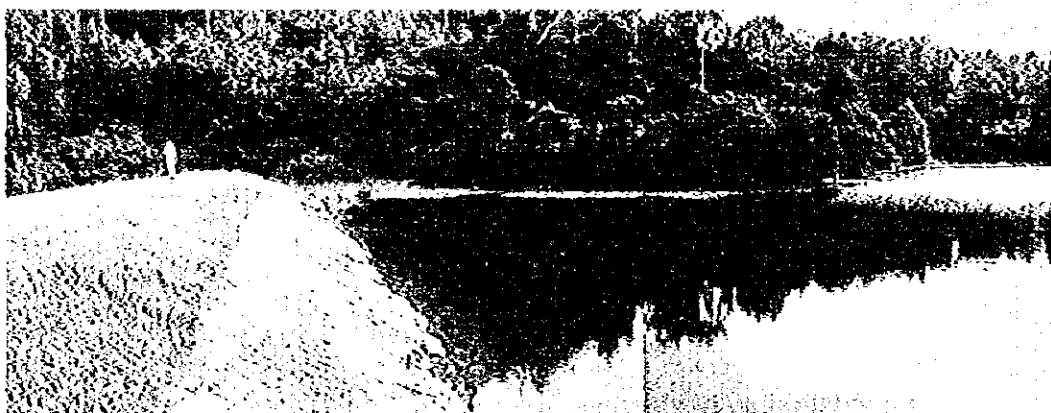
Ilwatta Anicut



Ittawola Anicut (under NIRP)

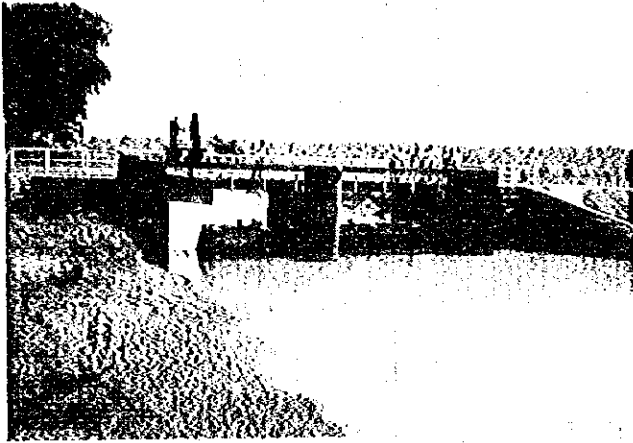


Command Area of Ilwatta Anicut

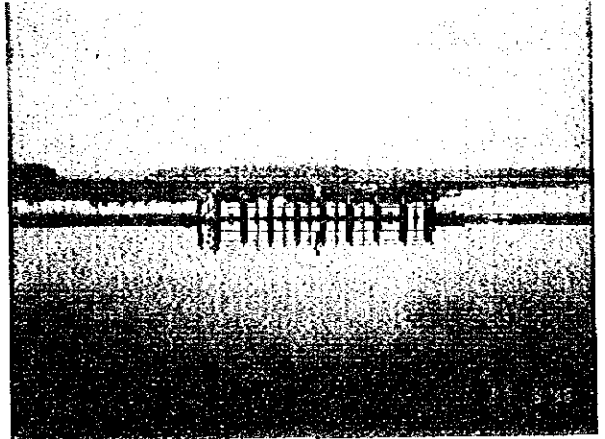


Deegoda Tank (under NIRP)

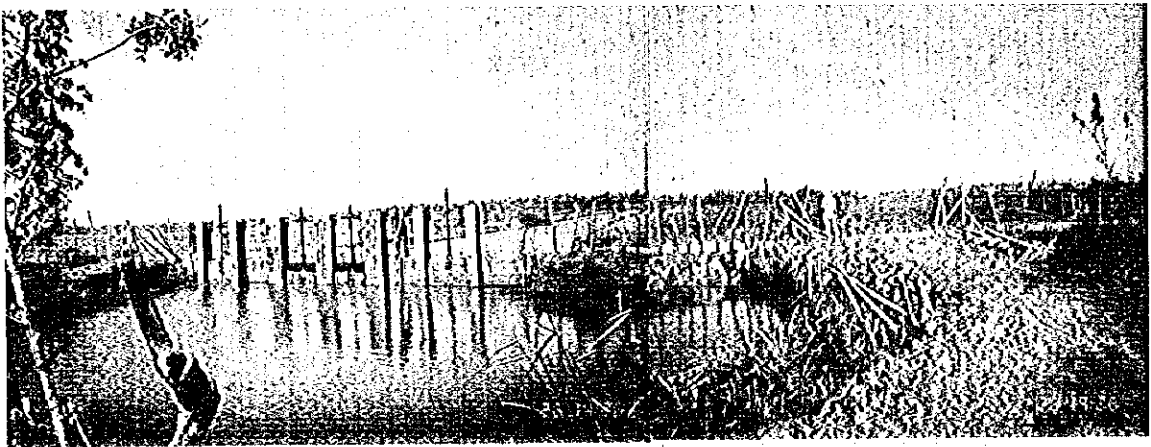
⑥ THANGALU WELYAYA SCHEME



Waladora Anicut



Kariija(W) SWE Structure



Weejetota Anicut



Sea mouth at Rekawa Lagoon

<WORKING LEVEL ADVISORY COMMITTEE (WLAC) MEETINGS>

Liyangastola Scheme, dated on Feb. 01, 1996



Muruthawela Reservoir Scheme, dated on Feb. 02, 1996

