THE REPUBLIC OF MALAWI
MINISTRY OF AGRICULTURE

JAPAN INTERNATIONAL
COOPERATION AGENCY

FEASIBILITY STUDY
ON
BWANJE VALLEY SMALLHOLDER IRRIGATION DEVELOPMENT PROJECT

VOLUME I

MAIN REPORT

FEBRUARY 1994

NIPPON KOEI CO., LTD.
PACIFIC CONSULTANTS INTERNATIONAL

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LIST OF REPORTS

Volume One **Main Report**

Volume Two **Annexes**

I. ASSESSMENT OF DEVELOPMENT POTENTIAL

II. FEASIBILITY STUDY FOR SELECTED PROJECTS

PREFACE

In response to the request of the Government of the Republic of Malawi, the Government of Japan decided to conduct the Feasibility Study on Bwanje Valley Smallholder Irrigation Development Project and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA dispatched to Malawi a Study Team headed by Mr. Kenjiro Onaka, Nippon Koei Co., Ltd., twice from September 1992 to December 1992 for a Phase I study and June 1993 to September 1993 for a Phase II study.

The Team exchanged views with the officials concerned of the Government of the Republic of Malawi and conducted a field survey in close cooperation with the Malawian officials concerned. After the Team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Malawi for their close cooperation extended to the Team.

February 1994

Kensuke YANAGIYA
President
Japan International Cooperation Agency

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Sir,

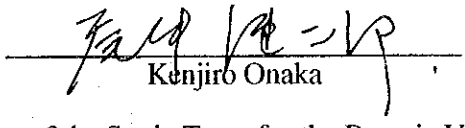
We have the pleasure of submitting the feasibility study report on the Bwanje Valley Smallholder Irrigation Development Project in the Republic of Malawi, in accordance with the terms of reference issued by your Agency.

The Study was carried out for a total period of 17 months from September 1992 to February 1994. The project was basically formulated with the principal aim of the increase of agricultural production and the improvement of farmers' living standards in the three irrigation development areas of 1,570 hectares through (i) exploitation of irrigation water from the Nadzipulu, Namikokwe and Livulezi rivers, (ii) strengthening the supporting activities for agricultural development, and (iii) the consolidation of primary rural infrastructure.

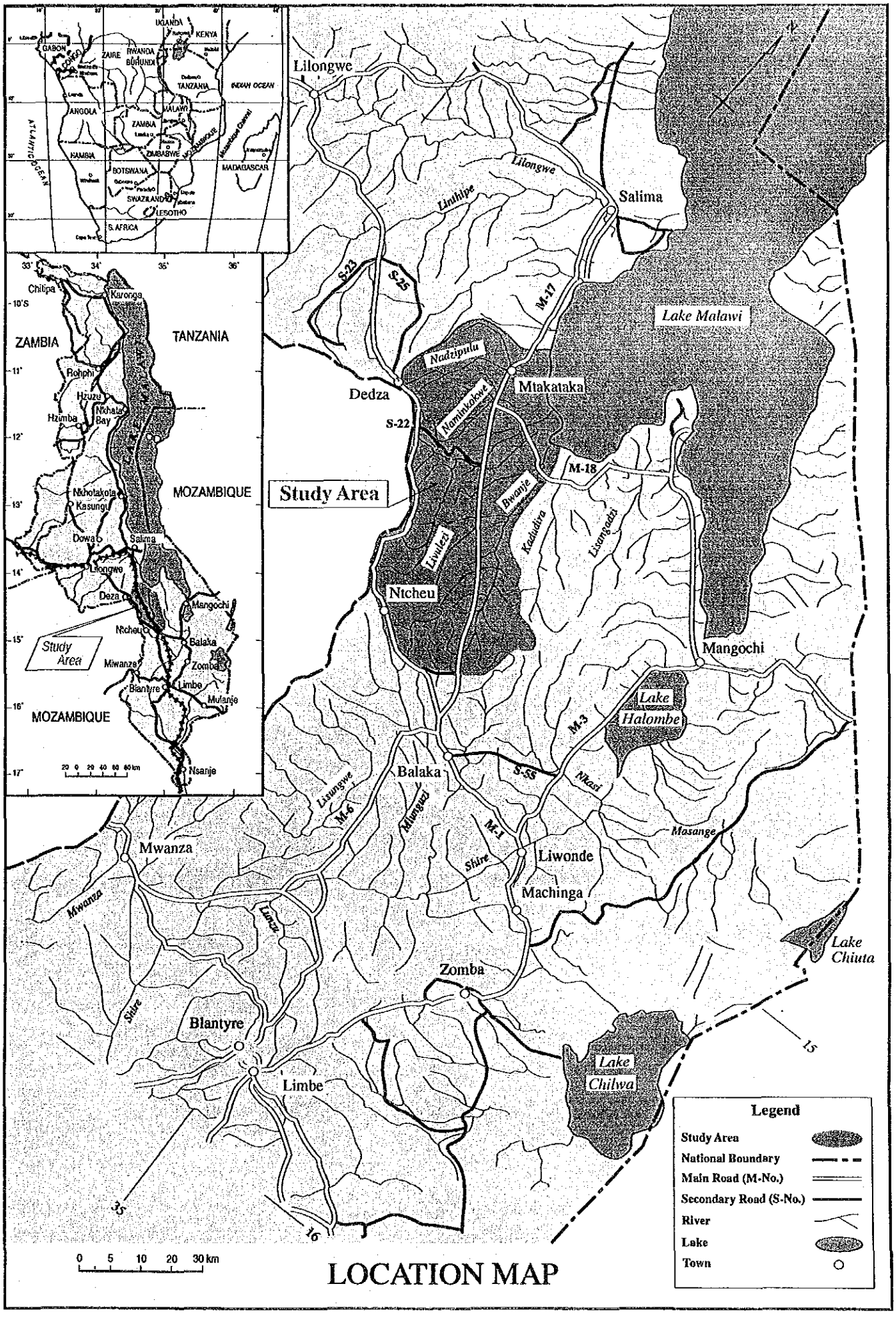
After the implementation of the project, the increase in the agricultural production would substantially contribute to the national economy as well as the regional economy in the project areas. Moreover, the improvement of the rural road networks and village water supply systems would also contribute social welfare of the local people in the project areas. We would recommend that the project will be soon implemented in line with the conclusions presented in this report.

We wish to express our deep appreciation and gratitude to the personnel concerned of your Agency, your Malawi Office, the Embassy of Japan in the Republic of Zambia and the Authorities concerned of the Government of Malawi for the courtesies and cooperation extended us during our field surveys and studies.

Very truly yours,



Kenjiro Onaka
Leader of the Study Team for the Bwanje Valley
Smallholder Irrigation Development Project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Lake Malawi
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Dedza
Mtakataka
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S-22
M-18
Study Area
Bwanje
Kadudiva
Lisongadzi
Livulezi
Ntcheu
Mangochi
Lake Halombe
M-3
Balaka
S-55
Nkasi
Lisungwe
M-6
Mwanza
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Mlunguzi
M-1
Shire
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Lunzu
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MOZAMBIQUE
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Salima
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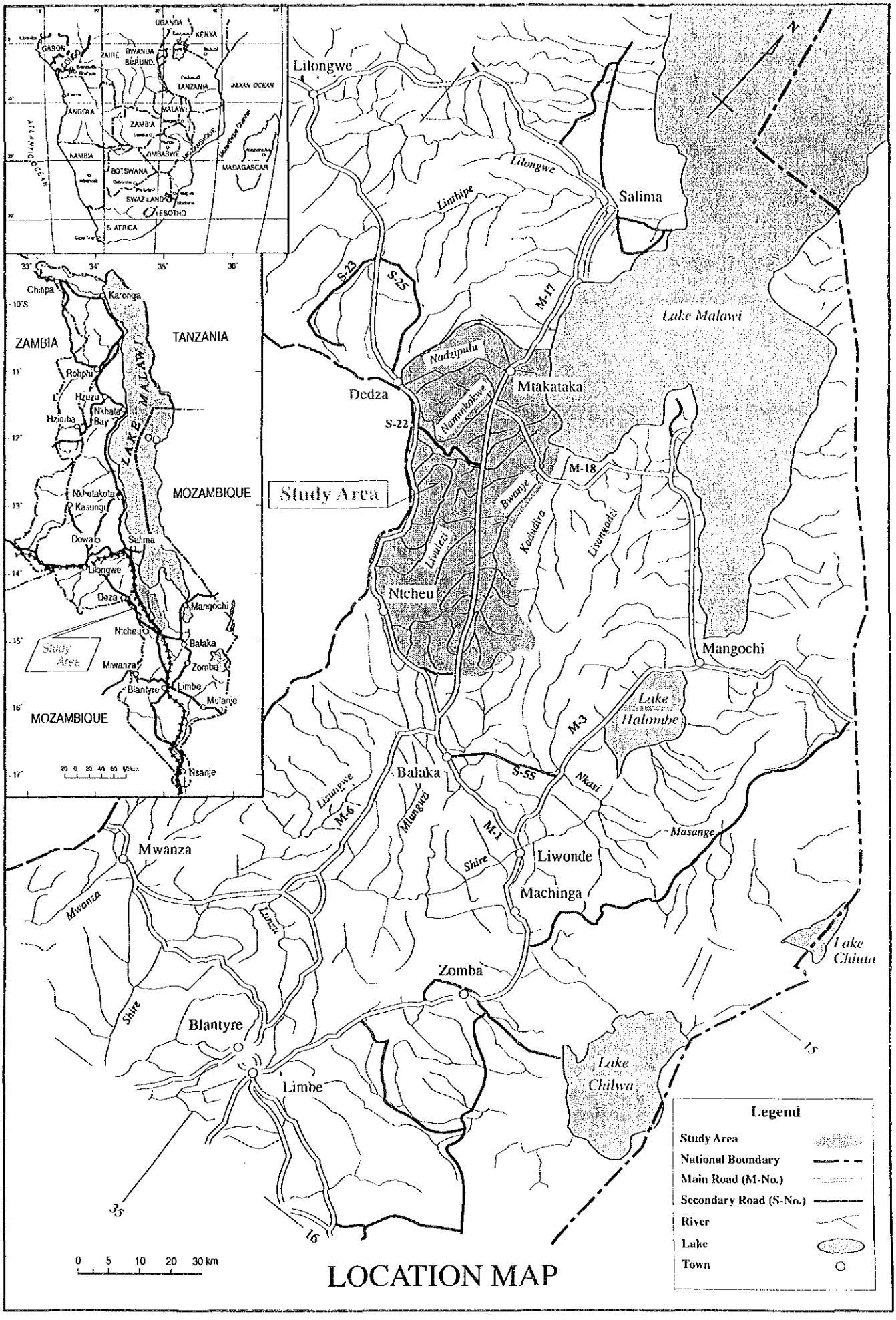
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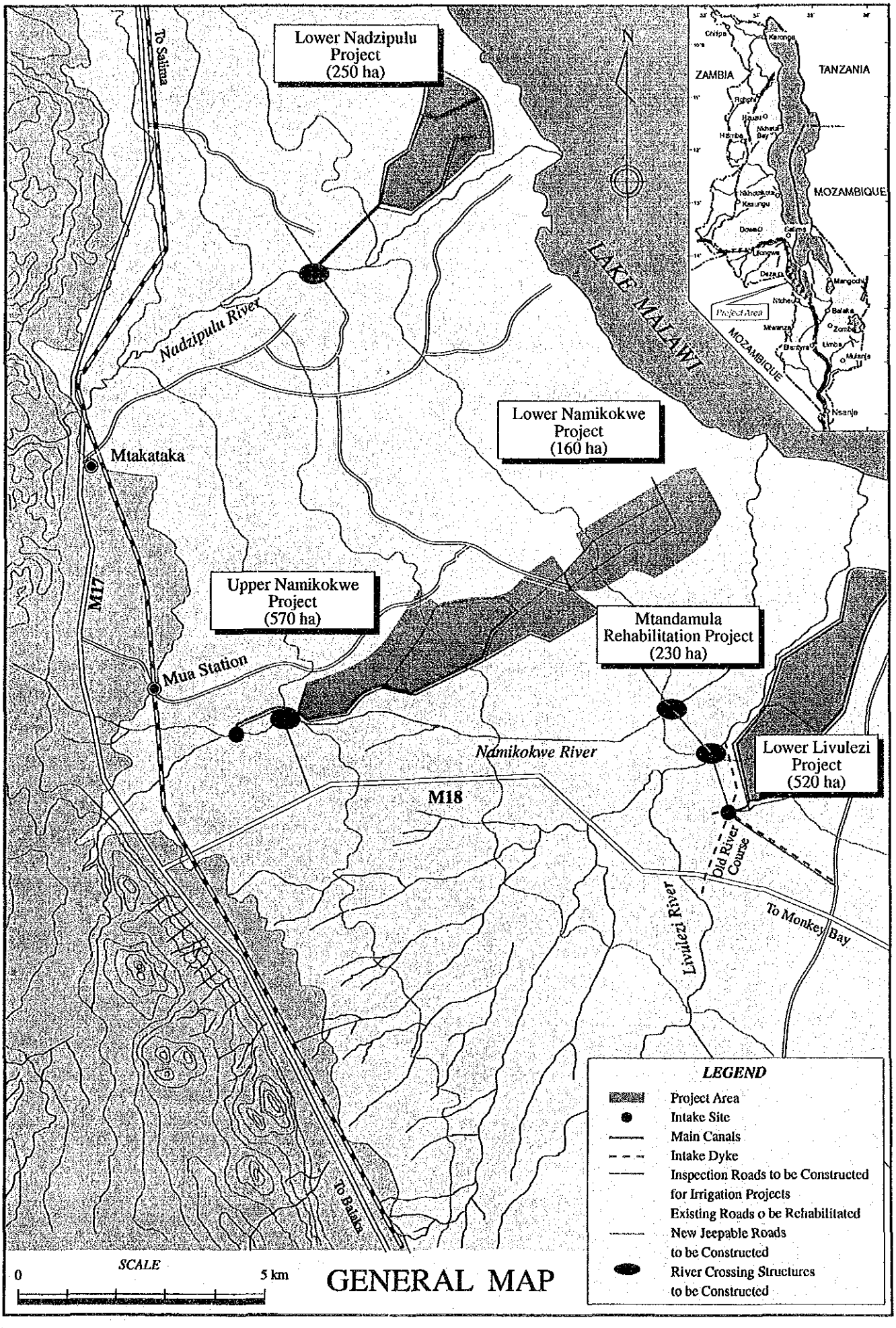
Lower Nadzipulu Project (250 ha)
To Salima
Nadzipulu River
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Project Area
Lower Namikokwe Project (160 ha)
Mtakataka
M17
Upper Namikokwe Project (570 ha)
Mtandamula Rehabilitation Project (230 ha)
Mua Station
Namikokwe River
Lower Livulezi Project (520 ha)
M18
Old River Course
Livulezi River
To Monkey Bay
To Balaka
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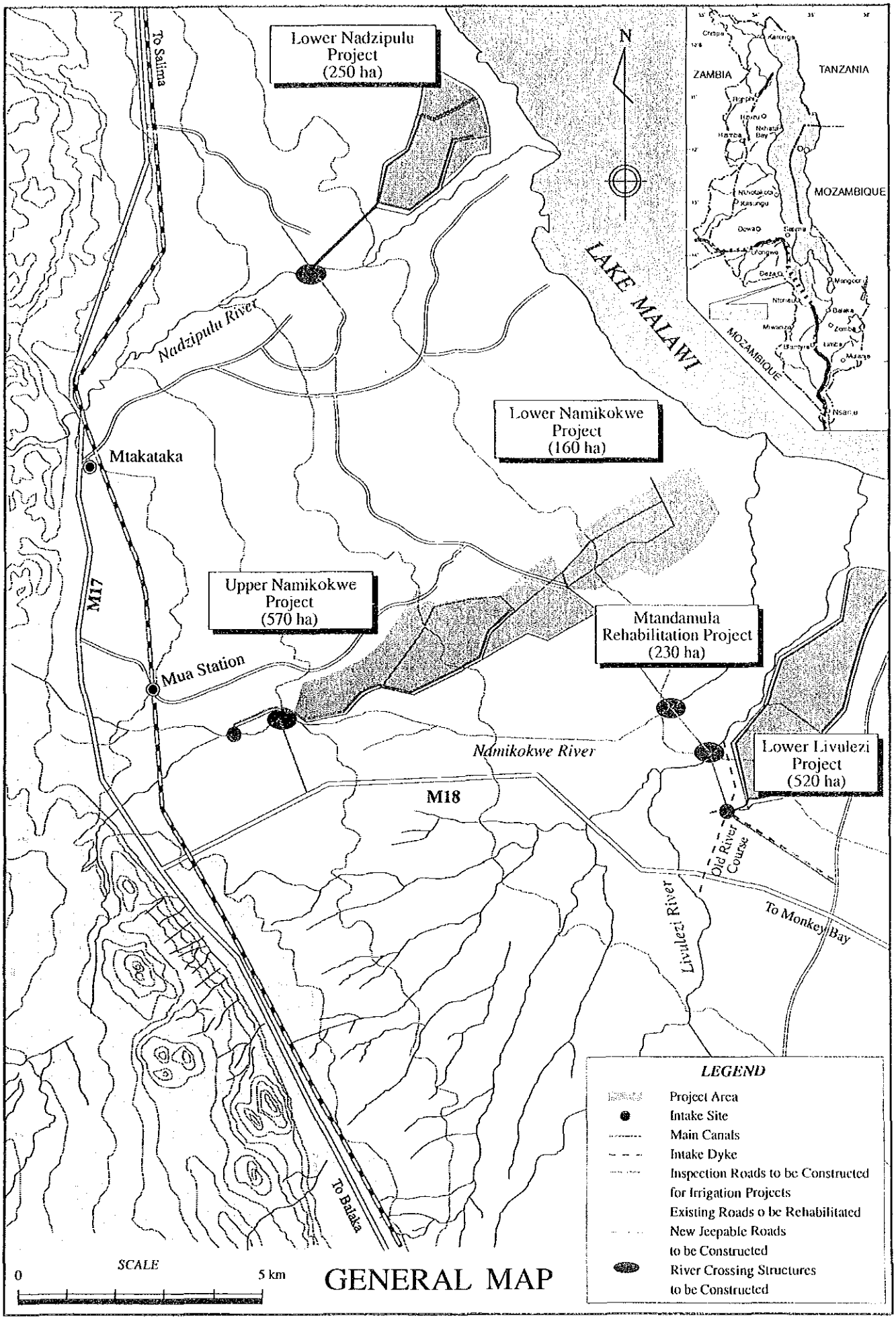
GENERAL MAP
LEGEND
Project Area
Intake Site
Main Canals
Intake Dyke
Inspection Roads to be Constructed for Irrigation Projects
Existing Roads o be Rehabilitated
New Jeepable Roads to be Constructed
River Crossing Structures to be Constructed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SUMMARY

AUTHORITY

This is the final report for the Feasibility Study on Bwanje Valley Smallholder Irrigation Development Project prepared in accordance with the Scope of Works agreed upon between the Government of Malawi (GOM) through the Ministry of Agriculture (MOA) and the Japan International Cooperation Agency (JICA) on 14th April 1992.

THE STUDY AREA AND THE OBJECTIVES OF THE STUDY

The Study area covers an aggregate basin area of 2,500 km^2 consisting of the Nadzipulu river, Namikokwe river, Livulezi river, and Bwanje river basins. The objectives of the Study is to formulate an optimum irrigation agricultural development project (the Project) in the Study area and appraise and verify its technical and economic feasibility.

PERFORMANCE OF THE STUDY

The Study was scheduled to be carried out in two phases for a total period of 17 months. The Phase I Study was carried out from September 1992 to March 1993. In this period, assessment for the present conditions in the Study area, selection of the potential areas, and a preliminary plan formulation for the potential areas were carried out. The Phase II Study was conducted from June 1993 to February 1994. In this period, the detailed surveys for the potential areas and the feasibility study for the said areas were carried out.

BACKGROUND

Malawi is a long, narrow, landlocked country. The national population was 7,950,000. A rapidly increasing population by migration from the neighbouring countries accelerated the population pressure in the 1980s. This has pressed Malawis' economy, especially in regard to the food security.

Agriculture plays a dominant role in Malawis' economy as a whole, contributing about 30 % of GDP and about 85 % of the total employment. The exports of Malawi are largely derived from the agricultural sector. Malawi recently suffered from crop failures

caused by recurrent droughts. Sharply increasing transportation costs of traded commodities by the internal conflict in Mozambique reduced the international competitive power of Malawi's exports.

Staple crops are produced by smallholders, these account for 70 to 80 % of the total crop production. They are mostly planted by traditional methods under rainfed conditions. Therefore, the crop production levels of Malawi have largely fluctuated.

The GOM launched the Statement of Development Policies 1986-1996, in which the highest priority is given to agricultural development, paying with particular attention to food production by smallholders. The GOM has realized that the agricultural development projects should be in line with the Statement. The following national projects and programmes were implemented: (i) smallholder agriculture credit administration (SACA), (ii) agricultural research and extension, (iii) national livestock development project, (iv) national rural development programme, and (v) rehabilitation of smallholder irrigation schemes.

The irrigation sector in Malawi adopted the following development strategies: (i) rehabilitation of the existing rice irrigation schemes, (ii) a full feasibility study of the irrigation development in the lower Shire Valley, covering a total extent area of about 20,000 ha, (iii) development of smallholder irrigation schemes in which full-cost recovery will be expected, and (iv) institutional arrangements for planning and support services in this sector.

PRESENT CONDITONS IN THE STUDY AREA

The soils of the Study area are classified into 7 soil groups according to the modification of the FAO legend (Soil Map of the World, 1988). They are: Eutric-fersialic soil group, Fluvic soil group, Gleyic soil group, Mopanic soil group, Paralilthic soil group, Vertic soil group, and Eutric-ferralic soil group. Land suitability for irrigation development was assessed for both paddy and upland crops according to the FAO's framework of land evaluation. As a result, 19 % and 29 % of the Study area is suitable for rice and upland crops under irrigation farming, respectively.

Climatic conditions in the Study area promise favourable agricultural production except rainfall. Annual mean rainfall is small, being 970 mm. There is a considerable variation in annual rainfall. Ninety-nine % of the annual rainfall falls in the rainy season (6 months).

There are 6 main rivers in the Study area, namely the Nadzipulu, Nakaingawa (a tributary of the Nadzipulu), Namikokwe, Nadzipokwe (a tributary of the Namikokwe), Livulezi, and Bwanje rivers. The features of river discharge are shown in the following table.

River	Tributary	Catchment area (km^2)	Station	Annual mean discharge (m^3/sec)	Range of annual discharge (m^3/sec)
Nadzipulu		224	3F3	2.81	0.26-7.35
	Nakaingwa	63	confluence	0.44	0.04-1.57
Namikokwe		129	3E2	1.49	0.16-5.29
	Nadzipokwe	30	confluence	0.62	0.05-2.16
Livulezi		452	3E3	3.34	0.45-14.1
Bwanje*		629		-	-

* There is no hydrological station and record available.

In accordance with the analysis of the water of the Nadzipulu, Namikokwe, and Livulezi rivers, the water quality of all the rivers is favorable for irrigation.

There seems a potential for groundwater in the Study area. Since the known yield of groundwater in the Study area is very limited, detailed investigation and study is required to assess groundwater potential.

About 64 % of the Study area is the agricultural land. Of them more than 99 % is under rainfed agriculture. The land in the Study area is categorized into: (i) customary land, (ii) public land, (iii) freehold land, and (iv) leasehold land. About 87 % falls in customary land. The customary land is the land under the jurisdiction of the traditional authority (TA) and village headman.

The Study area is under the jurisdiction of 3 districts, namely Dedza and Ntcheu Districts of the South Region, and Mangochi District of the Central Region, which are further divided into 10 TAs. The population of the Study area is estimated to be 294,000 in 1987. The societies are mostly matrilineal with matrilocal marriages.

The main crop in the Study area is maize, followed by rice, groundnuts, pulses, and cotton. Most of the crops are cultivated under rainfed conditions. Maize occupies 70 % of the total planted land in the Study area. The farming practices prevailing in the Study area are still traditional with limited use of farm inputs. The crop yields in the Study area are generally low.

The annual income and the living expenditure of the farmers in the Study area is low. The expenditure for food accounts for about 60 % of the total living expenditure. Most of the farmers in the Study area remain at the subsistence level of living.

In the Study area there are no government run irrigation schemes, but there are 2 farmers' self-help irrigation schemes; the Mtandamula and Mwalawoyera schemes, which are presently operating. In the schemes, a farmer's participation was carried out through the construction of the irrigation schemes. These schemes are managed by farmers' themselves through the farmers' irrigation scheme committee under the guidance of the Salima ADD staff. The technical constraints encountered in these 2 schemes are: (i) unstable irrigation water permanent structures, (ii) insufficient functioning of the irrigation facilities due to their deterioration, and (iii) improper water distribution due to insufficient land levelling.

Farm inputs and outputs are traded through 3 marketing channels, namely: the Agricultural Development & Marketing Corporation (ADMARC), private traders, and estate sector marketing bodies. Most of the marketed maize are distributed through ADMARC channel. Since the marketability of rice as a cash crop rises following the increase in rice demand in recent years, the private traders carry out rice marketing considerably. Inputs supply is operated in connection with the seasonal credit scheme by ADDs with the financial assistance of the IBRD, EDF, Germany, etc. The credit amount is limited.

The existing storage capacity in the Study area is estimated at about 64,000 tons. In addition, 49,000 m^3 of sheds are available. Storage capacity might not be a constraint in the Study area.

The Study area is favourably located with traffic linkages by the following main roads:

Road	Road sections in and around the Study area	Remarks
M17	Salima - Balaka	62 km from Salima - Mua is under rehabilitation (to be completed by the end of 1994)
M14	Salima - Lilongwe	103 km under rehabilitation
M18	(Salima -) Mtakataka - Mangochi	
M1	Lilongwe - Dedza - Ntcheu - Blantyre	
M8	Balaka - Liwonde	

After completion of both rehabilitation works, accessibility in both directions, to Lilongwe and Blantyre, will be remarkably improved. Apart from the primary network in and around the Study area, the lack of a feeder system is crucial.

Salima ADD is the most important agricultural support organization in the Study area. The total staff in the Salima ADD is 476 as of the end of 1991. The staff comprises 5- senior staff, 41- middle level staff, and 430- low level staff. The present constraints of Salima ADD are: (i) lack of trained staff, (ii) shortage of transportation means for the staff, and (iii) shortage of budget.

The farmers' club is the spontaneous farmers' organization. It has played an important role as a parent receiver of agricultural credit from Salima ADD. About 1,000 farmers clubs have been instituted in the Study area and only about 20 % of the total farmers attend these farmers clubs.

The farmers' expectation in the Study area ranked first concentrates on the construction of irrigation facilities, followed by the construction of drainage facilities, expansion of land to be cultivated, supply of farm inputs reinforcement of extensions, and credit services. For rural development, the construction of wells, hospitals, and mills are the most important expectations.

DEVELOPMENT POTENTIAL AND DELINEATION OF THE DEVELOPMENT AREAS

The land resources were evaluated from the standpoint of irrigation development with both paddy and upland crops. The soil study indicates that 47,500 ha of land or 19 % of the Study area is suitable for paddy cultivation and 71,800 ha or 29 % is suitable for upland crop cultivation.

There are 4 kinds of water resources for irrigation development in the Study area: (i) surface water of rivers, (ii) river water regulated by dam, (iii) Lake Malawi, and (iv) groundwater. The major rivers in the Study area are the Nadzipulu, Namikokwe, Livulezi, and Bwanje rivers. Of the 4 rivers, the Bwanje river was excluded as a water source for irrigation because of: (i) no hydrological record and no study results on the river runoff mechanism and floods, (ii) an unstable river course due to floods, (iii) extremely limited river flow during the dry season, and (iv) no suitable dam site.

There are possible dam sites in the upper basins of the Nadzipulu and Livulezi rivers, while no suitable dam site is available on the Namikokwe river. Since the technical, economic, and social viabilities would be low, the usage of regulated water by the construction of dams will be excluded from the water resources study for irrigation development.

To use water from Lake Malawi for irrigation, irrigation water has to be elevated by a pump(s). Despite the fact that Lake Malawi has the most stable and inexhaustible water resource, it is excluded because of low economic viability.

The groundwater yield data are too limited to ensure the technical assessment for irrigation development. The present Study excludes groundwater as the water resource for irrigation.

It is considered that the water resources for irrigation development in the Study area are the surface water of the Nadzipulu, Namikokwe, and Livulezi rivers. The river flow discharge in 1969/70 with a 5-year return period, design year as shown below:

	River discharge		
Nadzipulu Month	Namikokwe river (m3/s)	Livulezi river (m3/s)	river (m3/s)
Nov.	0.31	0.13	0.17
Dec.	0.58	0.80	0.27
Jan.	5.25	1.83	6.66
Feb.	2.85	1.60	3.63
Mar.	5.71	3.68	8.77
Apr.	2.50	1.79	3.34
May	1.17	0.73	1.22
Jun.	0.91	0.52	0.90
Jul.	0.67	0.35	0.64
Aug.	0.46	0.23	0.36
Sep..	0.31	0.15	0.20
Oct.	0.18	0.09	0.11

MAXIMUM POTENTIAL AREA FOR IRRIGATION DEVELOPMENT

In order to estimate the maximum potential area for irrigation development, a water balance study was carried out using the available water and irrigation water demand for a 5-year return period. The result is shown below:

River	Maximum potential in the rainy season (ha)	Maximum potential in the dry season (ha)
Nadzipulu	1,658	224
Namikokwe	1,104	123
Livulezi	946	239
Total	3,708	586

IDENTIFICATION OF THE DEVELOPMENT AREAS

The irrigation development area in each river basin was identified based on the following conditions: (i) application of gravity irrigation using river water flow without any regulation, (ii) land suitability for irrigation farming, and (iii) required measures for protecting the areas and facilities from flood damage. The following 5 irrigation development areas in 3 river basins were identified.

River Basin	Irrigation Development Area	Area in ha	Note
Nadzipulu	The Lower Nadzipulu Area	250	newly developed
Namikokwe	The Upper Namikokwe Area	570	newly developed
	The Mtandamula Area	230	rehabilitated
	The Lower Namikokwe Area	160	newly developed
Livulezi	The Lower Livulezi Area	520	newly developed
Total		1,730	

PRESENT CONDITIONS IN THE IRRIGATION DEVELOPMENT AREAS

The 5 irrigation development areas come under the jurisdiction of the Kachindamoto Traditional Authority (TA). There are 42 villages in and around the areas with a total population of 15,800 and total households of 3,780, thus there are 4.2 persons per household on average. The female headed households account for about 40 % of the total households. Over 90 % of the societies in the areas are matrilineal with matrilocal marriages.

The development areas are extensively used for agricultural purposes. About 42 % of the total area is cultivated and about 10 % is irrigated. The present land use is summarised below:

(unit: ha)

Land Use Category	Irrigation Development Area					Total
	Upper Namikokwe	Mtandamula Area	Lower Namikokwe	Lower Livulezi	Lower Nadzipulu	
Agricultural land	300	230	110	190	80	910
Irrigated rice	0	230	0	0	0	230
Rainfed rice	150	0	110	0	80	340
Upland crops	150	0	110	0	80	340
Non-agricult. land	350	0	180	560	190	1,280
Total area	650	230	290	750	270	2,190
Net irrigable area	570	230	160	520	250	1,730

Crop production in the development areas is under rainfed conditions except that for irrigated rice in the Mtandamula Area. The main crops are maize and rice. About 90

% of the total cultivated lands are covered by both crops. Single cropping of maize or rice prevails, while double cropping is practised only to a limited extent. Most of the crops are planted at the onset of the rains. Farming activities, from land preparation to harvesting are carried out manually. Farming practices are traditional with limited use of farm inputs.

Crop yields are low. Maize yield in the areas is about 1 ton/ha for local varieties and 1 to 2 tons/ha for hybrid varieties. Paddy yield is about 1 to 1.5 tons/ha for rainfed land and about 2.7 tons/ha under irrigated conditions. Limited use of improved varieties and fertilizers is one of the major factors depressing maize yield. The main causes of the low yield of paddy are considered to be : (i) low quality of paddy seeds, (ii) poor land levelling of paddy fields, (iii) shortage of irrigation water, (iv) poor drainage of excess water, (v) weed infestation, and (vi) crop damage by wild animals. The poor land levelling of paddy fields most seriously affects the current productivity of rice.

The roads in and around the development areas are still poor. The density of jeepable roads or all weather roads is less than 0.3 km/km^2. Moreover, the traffic in the rainy season between villages has been frequently impeded by river floods. The drinking water supply conditions are also poor. The densities are 3.4 boreholes and 1.1 shallow wells per 1,000 households. Water is often exhausted in the dry season.

Under such above agricultural conditions, the farmers in the areas remain at the subsistence level of living. Capacity to pay of the typical farmers in the irrigation development area is about MK 300/year for the irrigation area and minus MK50/year for the rainfed area.

Women in the development areas have a very heavy work load for undertaking the majority of all daily activities. In addition, housewives have to perform many traditional kinds of daily work. Especially the work for fetching drinking water and milling is important owing to the shortage of boreholes and wells and mills.

The results of the questionnaire survey for the farmers indicate that most of the farmers willingly contribute labor to the construction and maintenance of the irrigation facilities and stated that management of the irrigation system should be undertaken by Salima ADD at the initial stage and by the farmers' association in the full stage of the project. They will pay water charges in the form of O&M of the irrigation scheme.

BASIC DEVELOPMENT CONCEPT

The overall objectives of the Project are to generate more farm income and improve social welfare in the development areas. The basic concepts of the Project are:(i) maximum exploitation of land and water resources for irrigation purposes, (ii) enhancement of crop yields by the introduction of improved farming techniques, (iii) strengthening the supporting organization for irrigation and agricultural development, and (iv) improvement of primary rural infrastructure.

In view of the high demand for rice on the domestic market, irrigated paddy will be a main crop grown in the development areas. Crops with a low water requirement other than paddy, such as maize and vegetables will be also grown by utilizing supplemental irrigation supply.

The crop productivity can be enhanced not only by irrigation water supply but also through improved farming practices. The introduction of improved farming techniques is essential to increase crop yields. For this purpose, institutional support should be strengthened, particularly in: (i) research and demonstration work and (ii) training of the government staff and key farmers.

The Study emphasizes the rationalized use of human resources to ensure adequate development of the regional economy. Improvement of primary rural infrastructure was strategically incorporated in the Project with a specific objective. The components concerned are (i) boreholes, (ii) rice mills, and (iii) rural roads. The installation of more boreholes and the introduction of rice mills will mitigate work load of farmers' daily housework. Improvement of rural access is another central issue in rural infrastructure development. Expansion of the rural road network is envisaged to ensure the smooth operation of the irrigation and agricultural activities.

AGRICULTURAL DEVELOPMENT PLAN

Suitable land within the areas will be developed for irrigation purposes according to the following principles: (i) All the existing rainfed paddy fields and upland fields located within the development areas will be changed to irrigated paddy fields. (ii) In addition, suitable land which is currently covered by natural vegetation will become irrigated paddy fields. (iii) Part of the project areas will be occupied by the irrigation and agricultural works such as canals, farm road networks, and other farming facilities. The future land use of the 5 development areas in the 3 river basins is shown in the next page:

(Unit : ha)

River Basin / Irrigation Development Area	Wet Seaon Irrigated Paddy	Dry Seaon Irrigated Maize	Dry Seaon Irrigated Vegetables
Nadzipulu basin			
The Lower Nadzipulu Area	250	205	19
Namikokwe basin			
The Upper Namikokwe Area	570	80	43
The Mtandamula Area	230	106	17
The Lower Namikokwe Area	160	111	12
Livulezi basin			
The Lower Livulezi Area	520	200	39

Selection of the main crops for the development areas was carried out taking account of the following conditions: (i) plant physiological features for climatic conditions and soil conditions, (ii) marketability and profitability of crops, (iii) yield response by irrigation water supply, (iv) farmers' labor requirement and the availability of a work force in and around the development areas, (v) farmers' familiarity with crop cultivation, and (vi) easy storing and processing.

It is proposed that paddy with Faya rice varieties be grown in the wet season. The introduction of early maturing maize and vegetables that have a less than 90 days growth period is proposed to be grown in the dry season.

It is proposed that farming using an appropriate farming practice along with the development and strengthening of institutional support be carried out.

The future crop yields are targeted to be 4.5 ton/ha for paddy, 2 ton/ha for maize, and about 10 ton/ha for vegetables under the with-project condition. The production under the with- and without-project conditions are estimated below.

(unit: ton)

Development Area	With-project Rice	With-project Maize	With-project Vegetables	Without-project Rice	Without-project Maize
1. Lower Nadzipulu Area	1,130	220	190	0	80
2. Namikokwe River Basin	4,320	120	720	980	260
- Upper Namikokwe Area	(2,565)			(360)	(150)
- Existing Mtandamula Area	(1,035)			(620)	(0)
- Lower Namikokwe Area	(720)			(0)	(100)
3. Lower Livulezi Area	2,340	240	390	290	0
Total	7,790	580	1,300	1,270	340

In order to increase the value-added price of rice produced under the projects, sets of post harvest facilities will be provided at each irrigation project. The required sets of post harvest facilities are 2 sets for the Lower Nadzipulu Irrigation Project, 5 sets for the Namikokwe Integrated Irrigation Project and 3 sets for the Lower Livulezi Irrigation Project.

IRRIGATION AND DRAINAGE PLAN

Irrigation plan was formulated in view of maximum use of land and water resources, topographic conditions of the irrigation development areas, and the characteristics of the rivers as water source, being paid special attention to the following points: (i) selection of a stable intake site, (ii) keeping a certain area for passing floods, (iii) prevention the project area from flood intrusion by construction flood protection dikes which will be used as the inspection roads, (iv) drainage of runoff water from the outside of the project area, (v) improvement of land leveling, (vi) installation of the road network in the development areas, and (vii) safe construction and construction method of the project facilities. On the basis of the results of investigations and studies, the 5 irrigation project in the 3 river basins were identified as follows:

The Nadzipulu River Basin
- (i) The Lower Nadzipulu Irrigation Project

The Namikokwe River Basin
- (i) The Upper Namikokwe Irrigation Project
- (ii) The Mtandamula Rehabilitation Project
- (iii) The Lower Namikokwe Irrigation Project

The Livulezi River Basin
- (i) The Lower Livulezi Irrigation Project

In order to optimize the scale of the irrigation development, alternative plans for irrigation were formulated in view of (i) the intake site/construction method, (ii) the alignment of the irrigation and drainage system, (iii) construction cost, and (iv) the scale of the irrigation development area. The formulated plans were evaluated by the 4 factors: (i) economic viability, (ii) technical soundness, (iii) maximum use of natural resources and (iv) availability of labor in and around of the project area. The alternatives are summarized below:

Alternatives of irr. project	Irrigation area (ha)	FIRR (%)	Factors of alternative studies
Nadzipulu river basin			
(a) the Lower Nadzipulu Irri. Project	250	5.5	intake site, construction method
Namikokwe river basin			
(b) the Upper Namikokwe Irr. Project	570	11.6	intake site, construction method
(c) the Mtandamula Rehab. Project	230	1.7	intake site, construction method
(d) the Lower Namikokwe Irr. Project	160	2.1	intake site, construction method
(e) Integrated Irr. Project-1 (b+c)	800	11.9	integration of the project (b+c)
(f) Integrated Irr. Project-2 (c+d)	730	10.2	integration of the project (b+d)
(g)Integrated Irr. Project-3 (b+c+d)	960	10.2	integration of the project (b+c+d)
Livulezi river basin			
(h) the Lower Livulezi Irr. Project (alternative-1)	520	7.6	river improvement and road structures
(i) the Lower Livulezi Irr. Project (alternative-2)	380	6.9	river improvement and road structure

As a result of the evaluation, the Lower Nadzipulu Irrigation Project in the Nadzipulu basin, the Integrated Irrigation Project-1 in the Namikokwe basin, and the Lower Livulezi Irrigation Project (alternative-1) in the Livulezi basin were selected as proposed irrigation projects.

The diversion irrigation water requirement and the drainage water requirement for design of the project facilities are estimated as shown below:

Diversion irrigation water requirement	Paddy:	1.42 lit/sec/ha
	Upland crops:	0.88 lit/sec/ha
Drainage water requirement	Paddy fields:	1.42 lit/sec/ha
	Upland fields:	16.01 lit/sec/ha

The irrigation system consists of a headworks, main and branch canals, and tertiary canals. The design capacities of the intake and the main and branch canals are determined on the basis of 24 hour continuous water supply at the peak demand period in the design year. The design capacity of tertiary canals is determined on the rotational irrigation method within the certain rotational block. The 10-day rotation of water supply to rotational irrigation blocks (8 ha of lands) is applied.

The main features of the proposed irrigation project in each river basin are shown below:

River Basin	The Nadzipulu	The Namikokwe	The Livulezi
Irigtion Project	The Lower Nadzipulu I	The Integated I	The Lower Livulezi
- Irigtion area	250 ha	800 ha	520 ha
- Project facilities			
- Headworks	1 site	1 site	1 site
- Main irrigtion canals	7.0km	6.7km	11.1km
- Branch canal	0.6km	8.3km	1.0km
- Tertiary canals	18.4km	55.7km	38.3km
- Drainage canals	5.2 km	12.2km	13.7km
- Inspection roads	7.9km	12.8km	8.5km
- Road/flood protection dikes	4.5km	7.0km	6.1km
- Connecting road	2.0km	2.4km	2.5km
- Rehabiltaion of river crossings tructures			required
- River dredging			1.0km

RURAL INFRASTRUCTURE DEVELOPMENT PLAN

In order to improve the poor roads and road network conditions in the irrigation development areas, the road network development plan was formulated: The salient features of the proposed routes are shown below:

Route A : - M-18 - Njoka village - The Lower Nadzipulu Irrigation Project site - Chatala
- Rehabilitation works : 6.5 km
- Construction works : 2.5 km

Route B : - Mtakataka (M-17) - Chatala - Chitula
- Rehabilitation works : 13.0 km
- Construction works : 2.5 km

Route C : - Mua station (M-17) - Mwasinja
- Rehabilitation works : 12.0 km

Route D.: - Chatala - Mwasinja - Mtembanji (The Namikokwe Integrated Irrigation Project, Mtandamula portion)
- Rehabilitation works : 9.0 km

Route E : - Mtembanji (The Namikokwe Integrated Irrigation Project, Mtandamula portion) - The Lower Livulezi Irrigation Project site
- Construction works : 10.0 km

In order to improve the above situation, the village water supply development plan was formulated. The plan comprises the construction of a total of 29 boreholes with manual pumping equipment.

SUPPORTING ACTIVITIES FOR IRRIGATION AND AGRICULTURAL DEVELOPMENT

In order to ensure the expected irrigation/agricultural benefits and maintain the high project sustainability of the proposed irrigation projects over their useful life, agricultural supporting activities are required. A supporting plan, comprising (i) a short / medium-term component and (ii) a long-term component, was formulated as follows:

(a) Short / medium-term component

- Improvement of facilities concerning the supporting activities
  - to rehabilitate and improve the field office (EPA office) of Salima ADD
  - to construct site offices for the proposed irrigation projects,
  - to provide vehicles for the O & M works of the proposed irrigation projects, and
  - to provide office equipment for the field office and site offices.

- Training of the government staff and key farmers
  - to train government staff in irrigation practices, water management, irrigation farming, and post harvest works through training courses abroad,
  - to inspect irrigation projects which are successfully managed in neighbouring countries,
  - to train the key farmers on irrigation farming and O & M of on-farm facilities.

- Support of the present research activities
  - to provide equipment and tools for research and testing,
  - to provide seed and fertilizer, and
  - to prepare the primary research fields required.

(b) Long-term component

- Establishment of a development center with the objectives of training the government staff and farmers, extension of the advanced irrigation farming techniques, and agricultural research works.
  - to construct the facilities of the development center,
  - to construct an experimental farm, and
  - to provide the required equipment and machinery.

- Consecutive training of the government staff and farmers.

OPERATION AND MAINTENANCE PLAN

The proposed O/M plan for the irrigation development component recommends the step-by-step O/M plan. The plan comprises 2 steps: Step-1 for the initial period and Step-2 for the full development stage, as described in the next page:

Step-1: The government will execute all the O/M works in the initial period of about 5 years after completion of the project implementation. The government will carry out the training of the farmers and assist in organizing the farmers' association. The beneficiary farmers will supply participate labor for the O/M works, as required.

Step-2: The O/M works will be handed over to the newly organized farmers' association. The government will carry out the training of the farmers continuously.

The O/M works for the post harvest facilities will be carried out by the beneficiary farmers. In the initial stage, the farmers will handle the management and O/M works of the facilities through the existing village organization and/or the temporary organization established by the farmers only for the agricultural development facilities. In the full stage of the Project, the management and O/M works will be handed over to the farmers' association which will be established.

The O/M works for the rural road networks will be carried out by MOW. The water supply system will be handed over to the administrative unit at the village level. The O/M works will be executed by the village administrative unit.

IMPLEMENTATION PLAN AND ORGANIZATION

As for the implementation of the development components, 4 packages were formulated to realize the development goals as follows: The packages include the irrigation project as a core, agricultural development plan, and social infrastructure development components. It is proposed that these development components will be

implemented on a package-by-package basis in accordance with the priority order for implementation of the irrigation project.

(a) First Package
  (i) The Namikokwe Integrated Irrigation Development Project
    - Construction of the irrigation and drainage system
  (ii) Agricultural development plan
    - Construction of the rice mills and related facilities (5 sites),
  (iii) Construction and installation of the village water supply system
  (iv) Improvement of the rural road networks: route C and part of D
  (v) Supporting activities
    - Short / medium-term plan

(b) Second Package
  (i) The Lower Livulezi Irrigation Development Project
    - Construction of the irrigation and drainage system
  (ii) Agricultural development plan
    - Construction of the rice mills and related facilities (3 sites),
  (iii) Improvement of the rural road networks: Route A, B and part of D

(c) Third Package
  (i) The Lower Namikokwe Irrigation Project
    - Construction of the irrigation and drainage system
  (ii) Agricultural development plan
    - Construction of the rice mills and related facilities (2 sites),
  (iii) Improvement of the rural road networks: Route E

(d) Fourth Package
  (i) Supporting activities component
    - Long-term plan

The project works for irrigation are to be implemented within 3 years, including 1 year for the project preparatory works. All construction work and procurement works will be carried out on a contract basis.

Implementation of the social infrastructure development plan and short / medium-term plan of the supporting activities will be in the same way as that for the irrigation and agricultural development components.

As regarding the long-term plan, GOM will carry out the preparatory works for the establishment of the center as well as for the training of the government staff and farmers during the period of construction of the irrigation and agricultural development components. The actual implementation of the long-term plan of the supporting activities will begin depending on the progress of the short / medium-term plan and implementation of the irrigation / agricultural development components.

DOI, MOA shall be primarily responsible for implementation of all the development components under the project. As for the actual execution of the construction works, the Construction Office under DOI will be established at the site. It will be responsible for the design of the construction works and supervision of the project facilities. The

Construction Committee in conjunction with the relevant ministries and agencies will be organized for the management of the implementation of the rural road improvement and village water supply component.

DOI shall be responsible for O/M of the irrigation and agricultural development components in the initial stage. The Project Committee headed by the representative of DOI will be organized. The Committee in conjunction with the local administrations and farmers' representatives shall be responsible for all the O/M works. After a certain period, the O/M works will be handed over to the farmers' organization established by the beneficiaries. DOI will act as the consultancy for technical and administrative matters concerning the O/M works.

As for the development center in the long-term plan of the supporting activities, DOI shall be responsible for all the O/M works.

COST ESTIMATE AND BENEFIT

The construction cost of the irrigaiton projects comprises the construction cost, procurement cost of equipment and machinery, land compensation cost, engineering services cost, administration cost, and contingencies. The total cost of the proposed irrigation and drainage projects in the Study is summarized below:

(Unit: 1,000)

Irrigation project	Local Currency (MK)	Foreign Currency (J.Yen)	Total (J.Yen)
Lower Nadzipulu Irrigation Project	16,492	517,132	912,932
Namikokwe Integrated Irrigation Project	27,523	849,990	1,510,553
Lower Livulezi Irrigation Project	28,547	860,348	1,545,467

The construction costs for the improvement of the rural road networks and village water supply were estimated on the direct cost basis. The costs are summarized below:

Route of Road	Local Currency (1,000 MK)	Foreign Currency (1,000 J.Yen)	Total (1,000 J.Yen)
(Rural road networks)			
Route A	1,375	56,315	89,324
Route B	2,235	91,512	145,152
Route C	2,321	95,032	159,735
Route D	1,547	63,354	100,490
Route E	1,719	79,393	111,656
(Rural water supply; boreholes and equipment)			
29 villages	1,330	0	31,900

The costs of the supporting activities for irrigation / agricultural development are shown below:

Items	Local Currency (1,000 MK)	Foreign Currency (1,000 J.Yen)	Total Currency (1,000 J.Yen)
(a) Short / medium-term plan			
- Improvement of supporting facilities	630	34,600	49,700
- improvement of field and site offices	630	14,700	29,800
- procurement of vehicles for O/M works	0	12,700	12,700
- procurement of office equipment	0	7,200	7,200
- Training of government staff and key farmers	0	35,000	35,000
- training under overseas training courses	0	22,600	22,600
- inspection of irrigation projects in neighbouring countries/training of key farmers	0	12,400	12,400
- Support of present research activities			
- procurement of tools and equipment	0	6,100	6,100
(b) Long-term plan			
- *Establishment of the development center*	6,200	167,700	316,100
- construction of facilities	6,200	125,900	274,300
- procurement of equipment and machinery	0	41,800	41,800

The O/M cost comprises the administration cost, equipment cost, and O/M cost of the irrigation system. The annual O/M cost in the full operation stage for the respective irrigation projects is summarized below:

(1,000 MK)

Project	Administration Cost	O/M Equipment	Maintenance of Facilities	Total
The Lower Nadzipulu Irri. Project	300	167	72	539
The Namikokwe Integrated Irri. Project	310	204	126	640
The Lower Livulezi Irri. Project	307	183	134	624

The metal works of the irrigation facilities and rice mill equipment will be replaced periodically. The O&M equipment and gates should be replaced 20 years after commencement of the Project. The replacement cost for the respective irrigation projects is summarized below:

(1,000 MK)

Project	Metal Works	Rice mill Equipment	Total
The Lower Nadzipulu Irri. Project	337	577	914
The Namikokwe Integrated Irri. Project	719	1,442	2,161
The Lower Livulezi Irri. Project	578	865	1,443

The irrigation benefit in the full development stage was estimated as below:

(unit: 1,000 MK)

Project	Annual irrigation benefit
The Lower Nadzipulu Irri. Project	3,176
The Namikokwe Integrated Irri. Project	8,633
The Lower Livulezi Irri. Project	6,229

PROJECT EVALUATION

The project were evaluated in view of their internal rate of return, the farm budget, and impact of the projects.

Since insufficient data are available, the conversion factors for the adjustment of financial and economic evaluation. Instead of the economic internal rate of return, a financial internal rate of return (FIRR) was calculated. The FIRR is 5.5 % for the Lower Nadzipulu Irrigation Project, 11.9 % for the Namikokwe Integrated Irrigation Project and 7.6 % for the Lower Livulezi Irrigation Project.

The farm budget analysis was carried out on the typical farmers in the Mtandamula irrigation scheme and the rainfed area. The results are summarized below:

Description	unit	Mtandamula irrigation scheme		Rainfed area	
		With project condition	Without project condition	With project condition	Without project condition
Farm size	person	4.0	4.0	4.3	4.3
Total income	MK	4,094	2,281	3,805	705
Total expenditure	MK	2,493	1,979	2,680	756
Capacity to pay	MK	1,601	302	1,125	-51

The typical farmers in both Mtandamula scheme and rainfed area will be able to afford to pay for the O/M cost in the full stage. The farm economy, after sharing the O/M cost of the with-project condition under the 3 proposed irrigation projects, is shown in the following table:

(unit: MK)

	O/M Cost		Surplus	
	share / ha	share/ household	before sharing	after sharing
Lower Nadzipulu Irri. Project				
- rainfed area	1,176	470	1,125	655
Namikokwe Integrated Irri. Project				
- rainfed area	480	192	1,125	933
- Mtandamula	480	192	1,601	1,409
Lower Livulezi Irri. Project				
- rainfed area	713	285	1,125	840

The table shows that the farmers in the project areas will have a financial surplus after sharing the O/M cost of the with-project condition.

In addition to the direct benefits counted in the project evaluation, various secondary and intangible benefits and/or favourable socioeconomic impacts are expected under the project: (i) Increase in employment opportunity, (ii) Demonstration effects, (iii) Improvement of local transportation, (iv) Improvement of farm products, (v) Increased feed sources to animals, (vi) Improvement of the nutritional status of the rural population, (vii) Improvement of the present water supply condition and (viii) Improvement of womens' works

Bilharzia is recognized as a significant health problem in the small holder irrigation schemes in Malawi. The survey indicates that the risk of contracting Bilharzia is much higher in relation to irrigation development. It is expected that such risk will occur after the implementation of the projects.

No deforestation will be included in the irrigation development and the area where the specific animals and birds inhabit will not be touched under the Project. It is judged, therefore, that few effects on the ecological environment will occur under the Project.

In accordance with the results of the economic evaluation, the maximum use of natural resources and improvement of farm economy, the irrigation projects were synthetically evaluated and its project priority sequence was determined as follows:

			FIRR value (%)
1 st. priority	:	The Namikokwe Integrated Irrigation Project	11.9
2 nd. priority	:	The Lower Livulezi Irrigation Project	7.6
3 rd. priority	:	The Lower Nadzipulu Irrigation Project	5.5

On the basis of the priority order for the implementation of the irrigation projects, the priority for the implementation of the proposed development packages is set out as shown below:

1 st. priority : Package 1

- The Namikokwe Integrated Irrigation Project including construction of post harvest facilities
- Consolidation of the village water supply system (100%)
- Improvement of the rural road networks (C route and a part of D route)
- Supporting activities for irrigation / agricultural development (Short medium-term plan)

2 nd. priority : Package 2

- The Lower Livulezi Irrigation Project including construction of post harvest facilities
- Improvement of the rural road networks (A,B routes and a part of D route)

3 rd. priority : Package 3

- The Lower Nadzipulu Irrigation Project including construction of post harvest facilities
- Improvement of the rural road networks (E route)

CONCLUSIONS AND RECOMMENDATIONS

The Namikokwe Integrated Irrigation Project has the highest economic viability of the proposed irrigation projects. The project is technically sound and achieves the maximum use of land and water resources. The project aims at the improvement of the farm economy and social welfare. Since the project includes the rehabilitation of the existing Mtandamula irrigation scheme where the farmers are familiar with irrigated agriculture, it is expected that the earlier project effects can be realized.

The improvement and construction of the rural road aim at raising the welfare of the local people and marketability of the farm products from the Project.The consolidation of the village water supply system aims at alleviating the heavy work load of women.

In order to ensure the expected benefits from the implementation of the Project and maintain the high sustainability of the Project, the supporting activities, such as rehabilitation / construction of the field/ site office of Salima ADD, training of government staff and key farmers, and support of the present research works, are essential.

On the basis of the above, it can be strongly recommended that Package 1 should be implemented as soon as possible. The project cost for the implementation of Package 1 is 1,861 million J.Yen

The basic concepts for management, operation, and maintenance of the project facilities will be carried out by the beneficiary farmers. In order to smoothly hand over the management and O/M works to the farmers' association in the full development stage of the Project, a detailed plan and preparation for establishment of the farmers' association will be required.

For the irrigation / agricultural development in the Study area, reinforcement of the government staff, especially irrigation engineers and farmers in the Project, is

necessary by means of training. Also adaptive research works and their dissemination to the farmers are necessary. For this purpose, the Development Center will be established in terms of the long-term plan. It is recommended that GOM should proceed with the preparatory works for the establishment of the Development Center.

Since sand sedimentation coupled with floods is crucial in the proposed irrigation projects in the Study area, land and water conservation in the upper watershed area is required for maintaining project sustainability. It is recommended that the watershed management plan comprising afforestation, reforestation, soil conservation of the upland crop fields, and protection works for riverbank erosion be formulated and implemented.

It is recommended that groundwater potential in the Study area be assessed for the purpose of irrigated agricultural development as well as drinking water.

In the full development stage of the irrigation project, it seems that Bilharzia will become a significant health problem for the farmers. In order to take appropriate measures against Bilharzia, it is recommended that the Bilharzia monitoring system be established in close cooperation with the authorities concerned.

FEASIBILITY STUDY
ON
BWANJE VALLEY SMALLHOLDER IRRIGATION DEVELOPMENT PROJECT

VOLUME I

MAIN REPORT

CONTENTS

		page
CHAPTER 1	**INTRODUCTION**	1
1.1	Authority	1
1.2	Project History	1
1.3	Outline of the Scope of Works	2
1.4	Performance of the Study	3
CHAPTER 2	**BACKGROUND**	4
2.1	National Economy	4
2.2	Agriculture in Malawi	5
2.3	Agricultural Development Policy and Plans	5
2.4	Irrigation Development in Malawi	6
CHAPTER 3	**PRESENT CONDITIONS IN THE STUDY AREA**	8
3.1	Physiography	8
3.2	Soils and Land Suitability	8
3.3	Agro-Climate	9
3.4	Hydrology	9
3.4.1	Rivers in The Study Area and River Discharge	9
3.4.2	Flood Discharge	11
3.4.3	Water Quality and Water Right	12
3.5	Groundwater	12
3.6	Land Use	13
3.7	Land Tenure	13
3.8	Administration and Demography	14

page

3.9 Crop Production 14
3.10 Livestock 15
3.11 Famers' Economy 15
3.12 Irrigation Schemes in the Study Area 16
3.13 Marketing 16
3.14 Agro-Industries and Marketing Facilities 17
3.15 Rural Infrastructure 17
3.16 Agricultural Support System 18
3.17 Farmers' Association 19
3.18 Farmers' Expectation 19

CHAPTER 4 DEVELOPMENT POTENTIAL AND DELINEATION OF THE DEVELOPMENT AREAS 20
4.1 Land Resources 20
4.2 Water Resources 20
4.3 Maximum potential for Irrigation Development 22
4.4 Identification of the Development Areas 23
4.5 Present Conditions in the Irrigation Development Areas 23

CHAPTER 5 THE PROJECT 28
5.1 Basic Development Concept 28
5.2 Agricultural Development Plan 29
5.2.1 Proposed Land Use 29
5.2.2 Proposed Cropping Pattern 29
5.2.3 Proposed Farming Practices 32
5.2.4 Anticipated Yields and Production 33
5.2.5 Farm Inputs 33
5.2.6 Labor requirement 34
5.2.7 Post Harvest 35
5.3 Irrigation and Drainage Plan 35
5.3.1 Project Optimization 35
(1) The Nadzipulu river basin 36
(2) The Namikokwe river basin 37
(3) The Livulezi river basin 42
5.3.2 Proposed Irrigation Project 43
(1) Irrigation water requirement 43
(2) Drainage water requirement 44
(3) Basic plan of irrigation facilities 45

page

(4) Project works 47

5.4 Rural Infrastructure Development Plan 47

5.4.1 Rural Road Network 47

5.4.2 Village Water Supply 48

5.5 Supporting Activities for Irrigation and Agricultural Development 49

5.6 Operation and Maintenance Plan 51

5.6.1 Irrigation Development Component 51

5.6.2 Agricultural Development Component 52

5.6.3 Social Infrastructure Development Component 52

CHAPTER 6 IMPLEMENTATION PLAN AND ORGANIZATION 53

6.1 Implementation 53

6.1.1 Principle Approach to the Project Implementation 53

6.1.2 Implementation Schedule 54

6.2 Organisation and Management 55

6.2.1 Organisation in the Construction Stage 55

6.2.2 Organisation in the Operation and Maintenance Stage 56

CHAPTER 7 COST ESTIMATE 58

7.1 Conditions for the Cost Estimate 58

7.2 Cost Estimate for the Irrigation and Drainage Projects 58

7.2.1 Project Cost 58

7.2.2 Operation and Maintenance Cost 59

7.2.3 Replacement Cost 59

7.3 Cost Estimate for the Improvement of Social Infrastructures 59

7.4 Cost Estimate for the Supporting Activities 60

CHAPTER 8 PROJECT EVALUATION 61

8.1 Objectives 61

8.2 Economic Evaluation 61

8.2.1 Basic Assumption 61

8.2.2 Price Setting 62

8.2.3 Project Benefit 62

8.2.4 Project Cost 62

8.2.5 Internal Rate of Return (IRR) 63

8.3 Financial Analysis 64

8.4 Social Impacts 65

page

8.5 Influence on the Environment of the Project Implementation 67

8.6 Evaluation Results 67

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS 69

LIST OF TABLES

			page
Table	1.4.1	Member List of JICA Study Team and Counterpart Personnel	T - 1
Table	1.4.2	List of Data and Information Collected	T - 2
Table	3.4.1	Recorded Maximum Flood Discharge at Gauging Station	T - 3
Table	3.9.1	Planted Area and Production of Major Crops in RDPs Concerned ...	T - 4
Table	5.2.1	Farm Labour Balance under With and Without Project Conditions ..	T - 5
Table	5.2.2	Required Capacity and Numbers of Rice Mill	T - 6
Table	5.3.1	Alternative Plan for Irrigation Development Projects	T - 7
Table	7.2.1	Project Cost for the Irrigation Projects	T - 9
Table	8.2.1	Primary profit from Crops	T - 11
Table	8.2.2	Irrigation Benefit at Full Development Stage	T - 12

LIST OF FIGURES

			page
Figure	3.4.1	Location of Meteo- and Hydro- Observation Stations	F - 1
Figure	3.9.1	Present Cropping Pattens of the Study Area	F - 2
Figure	5.2.1	Proposed Cropping Pattern	F - 5
Figure	5.3.1	Proposed Layout for the Lower Nadzipulu Irrigation Project	F - 6
Figure	5.3.2	Proposed Layout for Projects in the Namikokwe River Basin	F - 7
Figure	5.3.3	Proposed Layout for the Lower Livulezi Irrigation Project	F - 8
Figure	5.4.1	Proposed Plan for Improvement of Rural Road Network	F - 9
Figure	6.1.1	Implementation Schedule of the Proposed Irrigation Projects	F - 10
Figure	6.1.2	Implementation Schedule of development Packages	F - 11
Figure	6.1.3	Flow Chart of Implementation of whole Development Works	F - 12
Figure	6.2.1	Organization Chart for Construction Stage	F - 13
Figure	6.2.2	Organization Chart for O/ M Works of Irrigation Projects	F - 14
Figure	6.2.3	Organization Chart for Development Center	F - 15

ACRONYMS

ACLCO	Land Resources and Conservation Branch
ADB	African Development Bank
ADD	Agricultural Development Division
ADMARC	Agricultural Development and Marketing Corporation
ARNC	Adaptive Research National Coordinator
ARO	Adaptive Research Officer
CAARO	Department of Agricultural Research
CAETO	Department of Agricultural Extension and Training
CAN	Calcium Ammonium Nitrate
CAS-NRDP	Controller of agricultural services
CAS-I	Controller of agricultural services
CDC	Common Wealth Devilment Corporation
CEC	Cation Exchange Capacity
CIF	Cost, Insurance and Freight
CONGOMA	Council for Non-Government Organizations in Malawi
CVO	Department of Animal Health and Industry
CIO	Department of Irrigation
DANIDA	Danish International Development Agency
DAP	Di-Ammonium Phosphate
DAR	Department of Agricultural Research
DET	Department of Agricultural Extension and Training
DO	Development Office
DOI	Department of Irrigation
EC	European Community
EC	Electric Conductivity
EPA	Extension Project Areas
EPD	Economic Planning and Development
ESCOM	Electricity Supply Commission of Malawi
ETo	Evapotranspiration
EXST	Estate Extension Services Trust
FA	Field Assistant
FAO	Food and Agricultural Organization of the United Nations
FES	Farming Equipment and Engineering Services
FHA	Farm Home Assistants
FHH	Female Headed Households
GDP	Gross Domestic Product
HESP	Health Education and Sanitation Promotion Programme
JICA	Japan International Cooperation Agency
Kc	Crop coefficient
MK	Malawi Kwacha
MOA	Ministry of Agriculture
MOH	Ministry of Health
MOWS	Ministry of Works and Supplies
MRL	Malawi Railways Ltd.
NEWS	National Early Warning System
NGO	Non-governmental Organization
NOIL	National Oil Industries
NRC	national research coordinators
NSCM	National Seed Company of Malawi
NVRC	National Variety Release Committee
O&M	operation and maintenance
OPC	Office of the President and Cabinet
PFNO	Food and Nutrition Unit
PHA	Private Hospital Association
PM	Programme Manager
PO	Project Officer

RDP	Regional Development Project
SA	Sulphate of Ammonium
SACA	Smallholder Agricultural Credit Association
SADCC	Southern African Development Coordination Conference
SCF	Save the Children Fund
SFFRFM	Smallholder Farmers' Fertilizer Revolving Fund of Malawi
SFHA	Senior Farm Home Assistants
SLADD	Salima Agricultural Development Division
SMO	Seed Multiplication Officer
SMS	Subject Matter Specialists
STWPC	Seed Technology Working Party Committee
SUCOMA	Sugar Company of Malawi
TA	Traditional Authority
UNDP	United Nations Development Program
USAID	United States
UT (M)	United Transport of Malawi
WFP	World Food Program

STANDARD ABBREVIATIONS

m^3	Cubic metre
m^3/sec	Cubic metre per second
d	Day
°C	Degrees Celsius
El.	Elevation above mean sea-level
ha	Hectare
kg	Kilogram
km	Kilometre
lit	Litre
lit/sec	Litre per second
m	Metre
mm	Millimetre
m^2	Square metre
ton	Tonne

CURRENCY EQUIVALENTS

US$ 1 = MK 4.33 = Japanese Yen (¥) 104

MK 1 = ¥ 24

as of 1993

CHAPTER 1 INTRODUCTION

1.1 AUTHORITY

This report was prepared in accordance with the "Scope of Works for the Feasibility Study on Bwanje Valley Smallholder Irrigation Development Project", agreed upon between the Government of Malawi (GOM) through the Ministry of Agriculture (MOA) and the Japan International Cooperation Agency (JICA) on 14th April 1992.

The Feasibility Study was commenced in September 1992 and the following reports were submitted to MOA:

(1)	Inception Report:	September 1992
(2)	Progress Report I:	December 1992
(3)	Interim Report:	March 1993
(4)	Progress Report II:	September 1993
(5)	Draft Final Report:	November 1993

This report was prepared on the basis of the outcomes obtained throughout the study course and a series of discussions between JICA and MOA on the above-mentioned reports.

1.2 PROJECT HISTORY

The GOM has placed a great emphasis on the increased production of export-oriented cash crops such as tobacco, tea, and sugar, which are produced mainly by estate farmers, in line with the national policies for the improvement and modernisation of Malawi's economic structure since the beginning of the 1980s. Given the government support, production of these estate crops steadily increased and attained 90% of total exports by the beginning of the 1990s.

In contrast, the smallholder farmers were left at the subsistence level with limited support. The budgetary allocation to credit schemes and other institutional supports for the smallholders was reduced. Besides, the fertiliser subsidy programme for smallholders was abolished. Consequently, smallholders' food production was discouraged and its growth remained far below GOM's expectations. Further, national food security conditions changed to be more unstable under recurrent droughts.

Due to its particular condition as a landlocked country, Malawi's national economy has been seriously affected by the internal conflict which broke out in Mozambique in the early 1980s. This resulted in increased transportation prices and insurance costs of traded commodities including farm inputs and exported crops. Within the international economic recession in the 1980s, the said adverse circumstances hindered the development of the agricultural sector as well as the national economy as a whole.

GOM launched the Statement of Development Policies (1987-1996) and embarked on the adjustment strategy plan for the agricultural sector in 1987, its first action programme. In the Statement, first priority was attached to the improvement of food production by smallholders through every development effort.

The Bwanje Valley area is one of the most economically depressed areas in Malawi. The area is broadly used for extensive rainfed agriculture by smallholder farmers. The annual rainfall of the area is limited to 600 - 900 mm and erratic with considerable yearly variation. Therefore, crop production is highly susceptible to drought compared to other regions.

The development idea for the Bwanje Valley area was firstly identified by the nationwide development study conducted by JICA in October 1992. GOM requested that the Government of Japan extend the technical cooperation programme to cover the execution of a Feasibility Study for the Bwanje Valley Smallholder Irrigation Development Project in August 1991. JICA responded to this request by dispatching a preparatory study team in April 1992 to confirm GOM's request. The Scope of Works was agreed upon between the MOA and JICA on 14th April 1992.

1.3 OUTLINE OF THE SCOPE OF WORKS

The objectives of the Study are:

(1) to formulate an optimum irrigation agricultural development project (the Project) and appraise and verify its technical and economic feasibility, and
(2) to undertake on-the-job training of Malawian counterpart personnel in the course of the Study.

The Study area covers an aggregate basin area of 2,500 km^2 consisting of the Nadzipulu river, Namikokwe river, Livulezi river, and Bwanje river basins, from which potential irrigation areas would be selected for development.

The Study was scheduled to be carried out in two phases for a total period of 17 months with the following objectives.

Phase I : Overall Basin Study and Preparation of the Project Concept
Phase II : Project Design and Analysis

1.4 PERFORMANCE OF THE STUDY

The Phase I Study was carried out in Malawi from September to December 1992, and in Japan from January to February 1993. In this period the JICA Study Team (the Team) identified the constraints of agricultural development in the Study area, assessed land and water resources, selected five irrigation potential areas, and formulated a preliminary plan formulation for the potential areas.

The Phase II Study was conducted in Malawi from June to September, 1993 and in Japan from September 1933 to March 1994. In this period the Team conducted the detailed surveys for the five irrigation potential areas selected in the Phase I Study by applying the newly prepared 1 : 5,000 topo-maps, formulated the plan, and undertook the feasibility study for the said areas.

In principle, the Study was carried out by the joint efforts of the Team and the counterpart personnel assigned from Salima Agricultural Development Division (ADD). The Team transferred technical knowledge to the counterpart personnel through the day-to-day operation of the Study in the field. Throughout the study course, a series of regular meetings were held every second Monday at the office of the Programme Manager of Salima ADD. The biweekly meeting was a good opportunity for both the Team and Salima ADD to exchange views on the Project. The member list for the Team and counterpart personnel is presented in **Table 1.4.1** and the data and information collected throughout the Study are listed in **Table 1.4.2**.

CHAPTER 2 BACKGROUND

2.1 NATIONAL ECONOMY

Malawi is a long, narrow, landlocked country located between latitudes 9°22' and 17°03' S and longitudes 33°40' and 35°55' E with a total territory of 119,140 km^2, of which 24,000 km^2 or 21 % are lakes.

According to the latest population census, in 1987, the national population was 7,950,000 and the annual growth rate was 3.7 % in the period from 1977 to 1987. The population density of the country was 85 persons/km^2. About 50 % of the total population was concentrated in the southern region, giving a higher density of 125 persons/km^2. A rapidly increasing population by migration from the neighbouring countries accelerated the population pressure in the 1980s. In 1989 of about 800,000 Mozambican refugees in 1989 accounted for nearly 10 % of the national population and this has pressed Malawi's economy, especially in regard to the food security.

Gross Domestic Product (GDP) has shown a real growth rate of 3.6 % in the second half of the 1980s. By 1990 the GDP growth rate had increased and reached 4.8 %. The real GDP registered record growth of 7.8 % in 1991 and 7.9 % in 1992. GDP in 1991 was MK 6,100 million at current market prices. Agriculture plays a dominant role in Malawi's economy as a whole, contributing about 30 % of GDP and about 85 % of the total employment. The exports of Malawi are largely derived from the agricultural sector. In 1992 the total export value was MK 1,427 million, of which 94 % was derived from the agricultural sector.

In the 1980s exports were seriously affected due to unfavourable prices on the international market of certain products. Malawi recently suffered from crop failures caused by recurrent droughts and sharply increasing transportation costs of traded commodities. As a result of the internal conflict in Mozambique, international trade was carried out through Durban (3,500 km from Malawi) in South Africa and Dar-es-Salaam (2,500 km) in Tanzania, instead of through harbours in Mozambique, i.e. Beira (360 km) and Nacala (615 km). Thus transportation costs for imports soared by over 40 % of the CIF margin, which reduced the international competitive power of Malawi's exports.

2.2 AGRICULTURE IN MALAWI

Agricultural activities occupy 20,143 km^2 (21.4 %) of land, of which 13,833 km^2 or 69 % are cultivated by smallholder farmers and 6,310 km^2 are managed by estate farmers. Smallholders mainly depend on customary land for cultivation under the control of local administrations.

Staple crops are produced by smallholders, these account for 70 to 80 % of the total crop production. They are mostly planted by traditional methods under rainfed conditions. Therefore, the crop production levels of Malawi have largely fluctuated. Except for crop failures in drought years, food production has been adequate to meet domestic food demand although the nutritional value still remains low.

Sugarcane and tobacco are mainly produced by the estate farmers. The production of sugar has always exceeded domestic demand in the past decade and the surplus has been exported to EC and U.S.A. In recent years, however, sugar export levels have declined due to unfavourable price setting on the international market and sharply increasing international transportation costs. Tobacco earns the most foreign currency for Malawi, i.e. over 70 % of the total export value.

2.3 AGRICULTURAL DEVELOPMENT POLICY AND PLANS

The economy of Malawi had successfully developed till the end of the 1970s. Since the beginning of the 1980s, its economy has declined. The GOM has performed a series of structural adjustment programmes with the World Bank and International Monetary Fund (IMF) since 1981. These programmes made it possible to postpone payment of her debt and invest financial development funds in the estate sector. The GOM encouraged the export of the estate-oriented crops such as tobacco, tea, and sugar. As a result, the economy of Malawi has considerably recovered.

However, such government efforts adversely affected the smallholder sector. Firstly, the lending conditions of agricultural credit become more severe for the smallholders. Secondly, the smallholders government subsidy for fertilizer supply was abolished. Under such conditions, smallholders' food production could not meet the increasing domestic demand and it remained at a crucial level in regard to the food balance. Facing serious drought in the mid-1980s, food security became a concern.

The GOM launched the Statement of Development Policies 1986-1996, in which the highest priority is given to agricultural development, paying with particular attention to food production by smallholders. Its overall objective is to enhance the social welfare and income of the agricultural community and the prosperity and stability of the nation as a whole by both improving food self-sufficiency and expanding and diversifying export receipts from agricultural produce. The Statement emphasizes the improvement and development of irrigation facilities, agricultural research, marketing, livestock, and agro-industry.

The GOM has realized that the agricultural development projects should be in line with the Statement. It allocated MK 64 million to the agricultural sector in 1991/92 and the following national projects and programmes were implemented: (i) smallholder agriculture credit administration (SACA), (ii) agricultural research and extension, (iii) national livestock development project, (iv) national rural development programme, and (v) rehabilitation of smallholder irrigation schemes.

2.4 IRRIGATION DEVELOPMENT IN MALAWI

There are about 22,000 ha of irrigated land in Malawi or about 10 % of the total potential irrigation area. The estate irrigation schemes cover 18,000 ha in total, consisting of (i) 15,000 ha of sugar estates and (ii) 3,000 ha for tea, tobacco, and wheat estates. The smallholder irrigation schemes cover about 4,500 ha in total. There are 16 government support schemes with a total coverage of 3,500 ha, while the remaining 1,000 ha are covered by 8 self-help schemes.

The government supported schemes were constructed from the late 1960s to the late 1970s mainly by Taiwan and Britain. The implementation and the management of the schemes are directly handled by the government with technical and financial assistance of foreign countries. In most of the schemes, the irrigation facilities have deteriorated due to insufficient operation and maintenance (O&M). Their heavy O&M cost is currently a financial burdens for the GOM.

The self-help schemes have been implemented since the 1980s by the farmers themselves with the government's support, i.e. purchasing a part of the construction materials, design, construction of major structures, and so forth. The O & M works of the self-help schemes have been carried out by the operation committee organized by the farmers. The farmers in the schemes provide the labor for the maintenance works and pay the committee the operation costs. Since the construction and/or maintenance

of the irrigation facilities of the schemes are mainly performed by manpower, the land leveling of paddy fields and on-farm facilities are poor, which causes low productivity.

The irrigation sector in Malawi adopted the following development strategies: (i) rehabilitation of the existing rice irrigation schemes, (ii) a full feasibility study of the irrigation development in the lower Shire Valley, covering a total extent area of about 20,000 ha, (iii) development of smallholder irrigation schemes in which full-cost recovery will be expected, and (iv) institutional arrangements for planning and support services in this sector.

A lack of government staff who can be engaged in the management of the irrigation projects, like irrigation engineers, is one of the most serious constraints of the irrigation sector in Malawi. An increase in number of the government staff, such as irrigation engineers, water management engineers, and O & M experts for irrigation is urgently required for the smooth management, operation, and maintenance of the irrigation projects.

CHAPTER 3 PRESENT CONDITONS IN THE STUDY AREA

3.1 PHYSIOGRAPHY

The Study area is broadly divided into 2 physiographic regions: (i) an undulating to rolling plateau in association with inland valleys and isolated hills and (ii) flat to almost flat alluvial plains of the rift valley floor. Both regions are distinctly separated by fault lines traversing in a N-S direction.

The plateau covers the western part of the Study area and has an elevation of range El. 600 to 1,500 m with isolated hills, e.g. the Dedza Hills, which have peaks of over 2,000 m. The 4 rivers of the Study area originate from this plateau and flow eastward while collecting water from small streams which flow through the scarps and rolling land. The rivers incise the escarpments which are covered by sparse vegetation with scattered trees and rapidly drop to the rift valley floor which gently slopes from EL. 550 to El. 475 m at the water surface level of Lake Malawi. The river courses are subject to change on the rift valley floor. With gradients of 1/200 to 1/500, the rivers continue their incision of the flood plain by connecting to either ephemeral streams or old river courses.

The surface configuration of the rift valley floor is flat to almost flat although irregular meso- and micro-relief has developed. There are seasonally inundated bottom lands called "*dambos*" along the lakeshore.

3.2 SOILS AND LAND SUITABILITY

The soils of the Study area are classified into 7 soil groups according to the modification of the FAO legend (Soil Map of the World, 1988). They are: Eutric-fersialic soil group, Fluvic soil group, Gleyic soil group, Mopanic soil group, Paralilthic soil group, Vertic soil group, and Eutric-ferralic soil group.

Land suitability for irrigation development was assessed for both paddy and upland crops according to the FAO's framework of land evaluation. The land limitations taken into account in the Study include, low moisture holding capacity and excessive permeability, compactness of the surface or upper subsoil, shallow soil depth, flooding hazard, fertility limitation, sodicity/salinity hazard, and topographic limitation. The extent of land suitability class by river basin is summarized on the next page. The details are presented in section 3.3 of Annex I.

Unit: ha (%)

Land Suitability	Nadzipulu	Namikokwe	Livulezi	Bwanje	Total	
Rice						
Suitable	2,630	5,000	11,670	28,120	47,510	(19.0)
Not suitable	33,490	30,680	58,540	79,780	202,490	(81.0)
Upland Crops						
Suitable	4,210	6,790	20,150	40,640	71,790	(28.7)
Not suitable	31,910	28,890	50,060	67,350	178,210	(71.3)
Total Area	36,120	35,680	70,210	107,990	250,000	(100.0)

3.3 AGRO-CLIMATE

The Study area lies in the tropical savannah. Annual mean rainfall is 970 mm. There is a considerable variation in annual rainfall. The rainy season extends over six months, generally from November to April. Ninety-nine % of the annual rainfall falls in the rainy season. The highest mean monthly rainfall generally occurs in December, January, or February and these months account for over 70 % of the annual rainfall.

The average annual temperature is about 25 °C with some seasonal variation throughout the year. The highest temperature month is in November 28.1 °C and the lowest is in June or July 21.2 °C. The maximum mean monthly temperature is over 31 °C and this occurs in September, October, or November and the minimum mean monthly temperature is about 16 °C in June and July. The relative humidity averages 66 %, ranging from a minimum of 53 % in September and October to a maximum of 80 % in February. The mean monthly wind speed is 2.4 m/sec ranging from a minimum of 1.8 m/sec in February to a maximum of 3.0 m/sec in October. The mean monthly sunshine duration is about 8.5 hours/day. The months with the longest sunshine hours are September and October with 9.8 hours/day , while that with the shortest is January with 6.6 hours/day. The annual evaporation is about 2,100 mm or 5.8 mm/day. The maximum mean monthly evaporation is 240 mm/day in October and the minimum is 145 mm/day in June. The details are described in section 3.4 of Annex I. These climatic conditions in the Study area promise favourable agricultural production.

3.4 HYDROLOGY

3.4.1 RIVERS IN THE STUDY AREA AND RIVER DISCHARGE

There are 6 main rivers in the Study area, namely the Nadzipulu, Nakaingawa (a tributary of the Nadzipulu), Namikokwe, Nadzipokwe (a tributary of the

Namikokwe), Livulezi, and Bwanje rivers as shown in **Figure 3.4.1**. Six gauging stations on the above rivers have provided the daily river water level data since the early 1950s. The river flow discharge is mainly estimated by converting the water level data, which is observed at a certain time of the day, to discharge. The estimated river flow discharge is reliable in the low and medium flow seasons when the water level is stable throughout the day. But in the high flow season a flood peak discharge is not always reliable and sometimes missed.

The Nadzipulu river has a catchment area of 224 km^2 at the 3.F.3 station with an mean annual discharge of 2.81 m^3/sec. The Nakaingwa river, a perennial stream, is the main tributary of the Nadzipulu. It has a catchment area of 63.4 km^2 at the confluence with the Nadzipulu at 1 km downstream of the railway bridge. The mean annual river flow discharge of the Nakaingwa is 0.44 m^3/sec, but this declines to 0.04 to 0.20 m^3/sec. in the dry season. The gradient of the river after the confluence of both rivers is about 1/150. The river course is relatively straight and stable with a bank height of 4 m up to Mathemba village or about 4 km downstream of the confluence. Further downstream the river channel capacity becomes smaller (bank height is less than 0.5 m) and the riverbed is apt to increase in size due to sediment deposition.

The Namikokwe river is a perennial stream with a catchment area of 129 km^2 at the 3.E.2 station. The mean annual flow discharge is 1.49 m^3/sec. at the 3.E.2 station, but there is a monthly fluctuation. The Nadzipokwe river is the main tributary of the Namikokwe. It joins with the Namikokwe about 1.5 km downstream of the railway bridge. It has a catchment area of 30.1 km^2 at the confluence and a mean annual discharge of 0.62 m^3/sec. The river course of the Namikokwe is stable up to about 1 km downstream of the confluence of both rivers. Later the river water flows in the upper dambo. In the downstream portion the bank height of the river is less than 0.5 m, the river is 2 to 3 m wide and the channel capacity of the river becomes smaller. The gradient of the river is between 1/200 and 1/300. The Namikokwe has moved rightward and it joins with the old river course of the Livulezi in the low flow season. Floods occur from January to March, spill onto the dambo, and recede for 2 to 3 days in general. Some flood water from the dambo is used as a water source for the existing Mtandamula self-help irrigation scheme. Most flood water is drained out of the old Livulezi river.

The Livulezi river has a catchment area of 452 km^2 at the 3.E.3 station and a river gradient of about 1/300. The mean annual flow discharge is 3.34 m^3/sec. The maximum mean monthly discharge is 14.1 m^3/sec. in February and the minimum is 0.45 m^3/sec. in September. The river is very stable until about 2 km downstream of the

railway bridge where the bank height is about 4 m. From this point, the bank height becomes lower (about 2.0 - 0.5 m). The river carries a lot of sand sediment because the upper catchment area is cultivated for mainly maize and there is no forest reserve. According to the master plan report on national water resources, the sediment transportation rate is over 0.4 kg/m^3.

The Bwanje river has a catchment area of 629 km^2. There is no hydrological record available. The river course is unstable due to flooding and the water flow discharge during the dry season is extremely limited.

The mean monthly discharge of these rivers, except for the Bwanje river, is shown below:

(unit:m3/sec)

Name of station	N	D	J	F	M	A	M	J	J	A	S	O	Mean
Nadzipulu(3F3)	0.34	3.15	5.65	7.35	7.32	3.69	1.89	1.23	0.87	0.64	0.41	0.26	2.81
Nakaingawa(3F2)	0.05	0.28	0.90	1.51	1.57	0.82	0.32	0.23	0.16	0.11	0.07	0.04	0.44
Namikokwe(3E2)	0.28	2.45	3.79	5.29	4.58	2.35	1.12	0.74	0.52	0.36	0.23	0.16	1.49
Namikokwe(3E5)	0.10	0.75	1.04	1.33	1.30	0.69	0.39	0.27	0.20	0.14	0.09	0.07	0.52
Nadzipokwe(3E1)	0.07	0.94	2.03	1.52	2.16	0.80	0.40	0.26	0.18	0.13	0.08	0.05	0.62
Livulezi(3E3)	0.62	5.51	9.16	14.1	10.9	4.51	1.97	1.28	0.92	0.67	0.45	0.49	3.34

3.4..2 FLOOD DISCHARGE

The recorded maximum flood discharge in each observation year at the gauging stations concerned is shown in **Table 3.4.1**. The recorded maximum flood discharge during the whole observation period is shown below. The details are described in section 2.6.2 of Annex II.

Name of River	Drainage Area(km^2)	Maximum Discharge(m^3/sec)	Recorded
Nakaingwa river	63.4	109.0	Feb 79
Nadzipule river	224.0	91.7	Jan 68
Nadzipokwe river	30.1	80.5	Feb 82
Namikokwe river	129.0	130.2	Feb 82
Livulezi river	452.0	372.0	Jan 86

The flood peak discharge, however, is not always reliable, because observations at the gauging stations are only made twice a day: in the morning and evening, and a flood peak discharge is sometimes missed.

The flood discharge of the main rivers was estimated by Drayton's equation. The peak flood discharge for each river is summarised below:

Name of River	Peak flood discharge(m3/s) Return Period(year)				
	5	10	25	30	50
Nakaingwa river	56	74	101	107	123
Nadzipulu river	104	137	186	196	227
Nadzipokwe river	33	43	58	61	71
Namikokwe river	86	113	154	162	188
Livulezi river	171	225	305	322	373

3.4.3 WATER QUALITY AND WATER RIGHT

In accordance with the analysis of the water of the Nadzipulu, Namikokwe, and Livulezi rivers, the water quality of all the rivers is favorable for irrigation.

The existing water right of the rivers is shown below:

Name of River	Water Right (m^3/day)	Purpose
Nakaingwa	200.0	Road Construction
Nadzipule	90.9	Domestic Water
Nadzipule	568.0	Domestic, Power and Irrigation
Namikokwe	200.0	Road Construction
Livulezi	200.0	Road Construction

3.5 GROUNDWATER

The known yield of groundwater in the Study area is very limited. Groundwater potential for irrigation development was investigated at 8 drilling sites in Salima ADD through drilling tests for the National and Shire Irrigation Study. The drilling tests confirmed that the thickness of unconsolidated deposits within the Quaternary basins of Malawi is between 30 and 70 m and that the profiles sometimes contain considerably thick coarse clastic materials. The specific capacities of the wells were in the range of about 0.3 to 3 lit/sec/m. Water quality is moderate saline, EC below 750 µmho/cm, to medium-high saline, high EC (over 1,000 µmho/cm).

3.6 LAND USE

The Study area is extensively used for agricultural purposes. Out of 250,000 ha of the total Study area, 159,400 ha of land or 63.7 % of the total area are cultivated. More than 99 % of the cultivated land, including wetlands of 2,800 ha, is under rainfed agriculture, while the rest includes irrigated paddy fields as presented below. The details are presented in section 2.3.1 of Annex I.

Land Use Category	Area (ha)	Proportional. Ext.(%)
Agricultural land	159,400	63.7
- Rainfed	(159,200)	
- Irrigated	(200)	
Grasslands including villages	32,900	13.2
Natural forests and woodland	55,200	22.1
Marshes	800	0.3
Bare or sparsely vegetated land	1,700	0.7
Total	250,000	100.0

3.7 LAND TENURE

The land in the Study area is categorized into: (i) customary land, (ii) public land, (iii) freehold land, and (iv) leasehold land. The customary land is the land under the jurisdiction of the traditional authority (TA) and village headman. The land in this category is allocated to the head of the household (family) according to the requirements of the household in general. The land allocated cannot be sold or leased. The land tenure conditions in the Study area are summarized below. The details are explained in section 2.3.3 of Annex I.

Type of tenure	Area (km^2)	Proportional extent (%)
Customary land	2,168	86.7
Public land	190	7.6
Freehold land	4	0.2
Leasehold land	138	5.5
Total	2,500	100.0

3.8 ADMINISTRATION AND DEMOGRAPHY

The Study area is under the jurisdiction of 3 districts, namely Dedza and Ntcheu Districts of the South Region, and Mangochi District of the Central Region, which are further divided into 10 TAs. Within the MOA's administrative structure, for integrated rural development, the Study area falls in 2 ADDs of MOA, i.e. 47 % of the Study area in Salima ADD and 53 % in Lilongwe ADD.

The population of the Study area is estimated to be 294,000 on the basis of the 1987 census. The population density is 118 persons/km^2. The local population increased by 160 % during the 10 years from 1977 to 1987. The total number of households in the study area is estimated at 68,400. The average family has 4.3 persons. The societies are mostly matrilineal with matrilocal marriages. Female headed households cover about 30 to 40 % of the total households in the Study area. The details are presented in section 3.1.1 of Annex I.

3.9 CROP PRODUCTION

The main crop in the Study area is maize, followed by rice, groundnuts, pulses, and cotton. Most of the crops are cultivated under rainfed conditions between November and May. Maize occupies 44,200 ha or 70 % of the total planted land (62,500 ha) in the Study area. Intercropping with early maturing pulses is practiced to a limited extent.

The farming practices prevailing in the Study area are still traditional with limited use of farm inputs. The farming is carried out by man power from seeding to harvesting in general. Fertilizers for upland crops are applied to only 20 % of the total cropped area concentrating on hybrid maize and cotton. No fertilizer is used for paddy. Apart from the Mtandamula scheme, the direct seeding method prevails in the rainfed paddy fields in the *dambos*. Low germination and seedling establishment two of the factors that limit the obtaining of adequate yields.

The maize production of the Study area amounts to 44,200 tons, of which 41,500 tons or 94 % is local maize. The average yield is 977 kg/ha in the Study area: 925 kg/ha for local, 1,187 kg/ha for composite, and 1,882 kg/ha for hybrid. MOA currently directs its research effort to breeding of top-cross hybrid maize with white grains. Over 90 % of the farmers plant local maize, 48.3 % hybrid maize, and 2.5 % composite maize.

In the Study area, rice planting cover a total area of 478 ha of which 230 ha or 48 % are irrigated under the Mtandamula self-help irrigation scheme and the rest is located in the dmbos. Faya 14-M-69 is the most popular variety covering 416 ha. The average yield of paddy in the area is 1,220 kg/ha.

Grain legumes in the Study area are represented by groundnuts followed by cowpeas, pigeon peas, beans, soya beans, ground beans, and grams. Groundnuts cover 1,167 ha of land or 70 % of the total planted area for grain and the average yield is 2.0 ton/ha. Cotton is a valuable cash crop for smallholders. The yield of seed cotton in the Study area is 740 kg/ha on average.

The main causes of low crop yields area considered to be: (i) limited use of improved varieties and farm inputs, (ii) water shortage in the dry season, (iii) insufficient farming facilities, on-farm equipment, and draft animals, (iv) poor drainage condition in the wet season, (v) weed infestation, and (vi) damage by birds and hippopotamuses.

The present cropping patterns of the Study area are illustrated in **Figure 3.9.1**. The planted area, yields, and production of crops in the Study area are presented in **Table 3.9.1.**

3.10 LIVESTOCK

The animal population in 1990 in the Study area was estimated to be 30,200 cattle, 23,300 goats, 2,300 sheep, 114,000 pigs, and 13,200 poultry.

Cattle and goats are the most important animals for smallholders in the Study area, as they are sources of both cash income and draft animal power. It is estimated that an average household in the Study area raises 0.42 head of cattle and 0.74 head of sheep/goats (smallstock) per average household.

3.11 FARMERS' ECONOMY

The socioeconomic survey has clarified that the living standards of the farmers in the Study area are quite low as a result of the very serious drought that occurred in 1991/92. The annual income of the farmers is estimated to be between MK 200 and MK1,900. The annual living expenditure is MK 430 and Mk 780. The expenditure for food accounts for about 60 % of the total living expenditure. The living expenditure, except for food, is as small as MK 130 to MK 590 per family. It may be concluded

that most of the farmers in the Study area remain at the subsistence level of living. The details are presented in section 3.10.4 of Annex I.

3.12 IRRIGATION SCHEMES IN THE STUDY AREA

In the Study area there are no government run irrigation schemes, but there are 2 self-help irrigation schemes; the Mtandamula and Mwalawoyera schemes, which are presently operating. the details of the conditions of these schemes are presented in section 3.12 of Annex I. The technical constraints encountered in these 2 schemes are: (i) unstable irrigation water permanent structures, (ii) insufficient functioning of the irrigation facilities due to their deterioration, and (iii) improper water distribution due to insufficient land levelling.

An assessment survey for future irrigation planning was carried out on the 11 existing irrigation schemes in Salima ADD to clarify the present constraints and problems in view of (i) floods and sedimentation, (ii) irrigation efficiency, (iii) extension of irrigation technology, (iv) O/M expenses, (v) poor quality of land levelling, and (vi) high and stable productivity. The existing irrigation schemes comprise the government support schemes, such as the Bua, Mpamantha, and Lifuwu irrigation schemes and 8 self-help irrigation schemes. The assessment identified significant factors governing successful irrigation projects, namely: (a) optimum engineering plan formulation and design against floods and sedimentation, (b) quality of the irrigation facilities for maximising the irrigation efficiencies, (c) urgent extension of irrigation technology to ensure the appropriate irrigation activities, (d) simplification of O/M works for minimising O/M costs, (e) improving the quality in land levelling of paddy fields to obtain the maximum effect from farm activities, and (f) strengthening the agricultural support services. The details are explained in section 2.8 of Annex II.

3.13 MARKETING

Farm products are traded through 3 marketing channels, namely: the Agricultural Development & Marketing Corporation (ADMARC), private traders, and estate sector marketing bodies. The Study area is covered by ADMARC's market network under 3 Divisional Offices, namely: Salima, Balaka, and Nathenje Divisional Offices. The details are explained in section 3.14 of Annex I.

The crop purchasing amounts in Salima and Balaka were 10,931 tons and 31,251 tons from 1989/90 to 1991/92. Out of the total purchases by the Salima

Divisional Office, such crops as cotton, maize, and paddy account for 10,150 tons or 93%, of which 7,778 tons or 71 % are cotton.

It is estimated by MOA that in 1990/91, private traders purchased 26,000 tons of maize and 4,600 tons of paddy in the country which accounted for 10% and 156% of ADMARC's purchased amounts. Since the marketability of rice as a cash crop rises following the increase in rice demand in recent years, the private traders carry out the major part of rice marketing.

Inputs supply is operated in connection with the seasonal credit scheme by ADDs with the financial assistance of the IBRD, EDF, Germany, etc. Smallholders can avail of these credits through farmers' clubs. The farm inputs supplied by Salima ADD in 1991/92 amounted to 4,960 tons of chemical fertilizer and 4,990 tons of seed.

3.14 AGRO-INDUSTRIES AND MARKETING FACILITIES

There are agro-industries and post-harvesting activities in and around Salima ADD, i.e. the ADMARC cotton ginnery in Balaka and Chigonamikango Ltd. ginnery in Salima, flour milling by Tiyese Ltd. in Nkhotakota, and rice milling by the National Oil Industries (NOIL) in Nkhotakota.

The existing storage capacity of ADMARC in Salima ADD is 34,100 tons consisting of 29,600 tons of conventional warehouse in the Salima Depot and 4,500 tons of mini-silos. In addition, 49,000 m^3 of sheds are available at the parent and unit markets in Salima ADD.

The ADMARC-Mtakataka Area Office deals with about 1,530 tons of crop purchases, while the Nanyangu and Bilila Area Offices purchase 2,080 tons and 1,160 tons of crops, respectively. Since the existing storage capacities are 10,100 tons, 2,900 tons, and 1,950 tons under the said Offices, storage capacity might not be a constraint in the Study area.

3.15 RURAL INFRASTRUCTURE

(a) Transportation

The Study area is favourably located with traffic linkages by the following main roads:

Road	Road sections in and around the Study area	Remarks
M17	Salima - Balaka	62 km from Salima - Mua is under rehabilitation (to be completed by the end of 1994)
M14	Salima - Lilongwe	103 km under rehabilitation
M18	(Salima -) Mtakataka - Mangochi	
M1	Lilongwe - Dedza - Ntcheu - Blantyre	
M8	Balaka - Liwonde	

There are 2 north-south parallel routes, M1 and M17, play an important role in passenger and commodity flow in the Study area as well as in inter-regional traffic. The Road Department of the Ministry of Works is currently undertaking the rehabilitation of the Salima - Mua section (62 km) of the M17 road for Balaka. The M14 road connecting Salima and Lilongwe is also under rehabilitation. After completion of both rehabilitation works, accessibility in both directions, to Lilongwe and Blantyre, will be remarkably improved. Apart from the primary network in and around the Study area, the lack of a feeder system is crucial. The details are explained in section 3.13.1 of Annex I.

(b) Rural water supply

Groundwater is the main drinking water source in the rural area. By pumping water from either boreholes or dug wells, 75% and 53% of the rural population in the Central and Southern Regions utilize groundwater. There are four on-going groundwater development projects in Salima ADD funded by the World Bank, UK, and EC. The existing boreholes are being rehabilitated by both Kampsax with the assistance of the World Bank and Save the Children Fund (SCF) with the assistance of ODA/UK. In parallel, the EC financed ADD food project installs shallow wells at selected villages. Under the SLADD Public Health Shallow Well Programme, 204 shallow wells were protected in Salima ADD. As of December 1992, there were 1,060 boreholes and 630 shallow wells in Salima ADD of which about 60% were under working conditions. Therefore the average density of pumps is roughly 150 to 200 households per pump.

3.16 AGRICULTURAL SUPPORT SYSTEM

Salima ADD is the most important agricultural support organization in the Study area. It manages seed multiplication work, research and extension work, training

works, and credit services. The total staff in the Salima ADD is 476 as of the end of 1991. The staff comprises 5-senior staff, 41- middle level staff, and 430- low level staff. The present constraints of Salima ADD are: (i) lack of trained staff, (ii) shortage of transportation means for the staff, and (iii) shortage of budget. Only 3 professional irrigation engineers are available in Malawi and 1 engineer works in Salima ADD. It is essential to increase the number of irrigation engineers for promoting irrigation projects and managing them. The details are explained in section 3.15 of Annex I.

3.17 FARMERS' ASSOCIATION

The farmers' club is the spontaneous farmers' organization which has no legal basis, but is traditionally recognized as a development agency. It has played an important role as: (i) a parent receiver of agricultural credit from Salima ADD, (ii) a unit to manage resources in the local community, and (iii) a unit to conserve its catchment area. About 1,000 farmers clubs have been instituted in the Study area and about 24,000 farmers or about 20 % of the total farmers attend these farmers clubs. It is a prerequisite to increase the farmers' participation rate in the club for increasing agricultural production through package farm input programs. The details are explained in section 3.16 of Annex I.

In the Study area, there are 2 farmers' self-help irrigation schemes: (i) the Mtandamula scheme and (ii) the Mwalawoyrea scheme. In the schemes, a farmer's participation is carried out through the construction of the irrigation schemes. These schemes are managed by farmers' themselves through the farmers' irrigation scheme committee under the guidance of the Salima ADD staff.

3.18 FARMERS' EXPECTATIONS

The farmers' expectation for future agricultural and rural development were investigated by questioning 120 farmers in the Study area. The results for future agricultural development indicate that the expectation that ranked first concentrates on the construction of irrigation facilities, followed by the construction of drainage facilities, expansion of land to be cultivated, supply of farm inputs reinforcement of extensions, and credit services. For rural development, the construction of wells, hospitals, and mills are the most important expectations. The details are explained in section 3.17 of Annex I.