3.4.2 TEMPERATURE

There are two (2) meteo-stations in Ntcheu and Dedza which record temperature in the study area. The stations are situated at El. 1,277 m and El. 1,615 m on the plateau near the western fringe of the study area. There are no other stations on the lakeshore in the study area. Although Salima and Monkey Bay stations are located outside of the study area, their temperature records are applicable for irrigation planning along the lakeshore. Table 3.4.1 gives mean monthly maximum and minimum temperatures at those stations. Mean monthly temperature is about 24°C over the year, while mean monthly maximum temperature is over 31°C occurring in October and November and mean monthly minimum is about 16°C in June and July

3.4.3 RELATIVE HUMIDITY

The mean monthly relative humidity of the Monkey Bay and the Salima stations is about 65 %, with the minimum ranging from 52 to 53 % in October and the maximum ranging from 80 to 82 % in February.

3.4.4 EVAPORATION

Only the Ntcheu station obverses evaporation within the study area. Its annual evaporation record is lower than that in the lakeshore due to its high altitude. The evaporation data of the lakeshore are available at two (2) stations located in the lakeshore, i.e. Chipoka and Monkey Bay stations. These stations have observed evaporation by using American class "A" type pans since 1952. The annual evaporation at these stations is about 2,100 mm or 5.8 mm/day. The mean monthly maximum evaporation occurs in October and the mean monthly minimum evaporation in February.

3.4.5 WIND VELOCITY

The mean monthly wind speed in the lakeshore is about 4.4 m/sec. There is no big variation in wind velocity throughout the year, while that in the plateau is 4.5 to 4.7 m/sec.

3.4.6 SUNSHINE HOURS

The mean monthly sunshine hours in the lakeshore are considerably long, being about 8.5 hrs/day. The longest months are in September and October with about 10 hours/day, while the shortest are in July with 6 to 6.5 hrs/day during the winter season. The mean monthly sunshine hours at Dedza is 7.3 hrs/day.

3.5 HYDROLOGY

3.5.1 RIVER SYSTEMS AND RIVER CHARACTERISTICS

The major rivers in the study area are the Nadzipulu, Nakaingwa (a tributary of the Nadzipulu), Namikokwe, Nadzipokwe (a tributary of the Namikokwe), Livulezi, Bwanje and Liwadzi rivers (a tributary of the Bwanje). The river system is illustrated on **Figure 3.5.1** and the principal features of the rivers are summarized below.

River	Point	Drainage area (km^2)	Length (km)	Mean width (km)	Shape** factor	C*** (km)	Com-**** pactness	Remarks
Nakaingwa	3.F.2	63.4	20.0	3.2	0.2	48.0	1.51	registered
Nadzipulu	3.F.3	224.0	32.7	6.9	0.2	83.0	1.62	registered
Nadzipokwe	3.E.1	30.1	12.5	2.4	0.2	26.5	1.55	registered
Namikokwe	3.E.5	44.2						
	3.E.2	129.0	27.8	4.6	0.2	48.0	1.45	registered
NGS1		138.0	30.8	4.5	0.1	52.0	1.35	measured point
Livulezi	3.E.3	452.0	50.3	9.0	0.3	118.5	1.50	registered
Liwandzi	*	117.2	29.5	4.0	0.1	66.3	1.30	measured point
Bwanje	*	628.9	50.5	12.5	0.2	114.2	1.76	measured point

* : point is shown in Figure 3.5.1
** : Average width of river/length of the river
*** : Circumference of basin(km)
**** :Compactness of basins are calculated by the following formula.
Compactness=$\{2*\sqrt{(\pi*A)}\}/C$
where, A : Drainage area (km^2)
C : Circumference of basin(km)

3.5.2 HYDROLOGICAL DATA

(1) Rainfall

There are thirteen (13) rain gauging stations in the Study Area. Their locations are shown in **Figure 3.5.1.** A list of names of these stations and data availability is shown in the table below. In addition to the data at these other stations, data at three important rain gauging stations located outside the study area has been collected at Nakumba, Salima and Monkey Bay stations.

No.	Name of Station	Registered No.	Available data period
1.	Mua Mission	14342002	1952-1978
2.	Bilila	14344010	1972-1989
3.	Dedza Meteo.	14341008	1957-1990
4.	Golomoti Agric.	14342009	1980-1990
5.	Mlangeni-Njolomole	14344000	1960-1990
6.	Bwanje MYP Base	14343010	1986-1990
7.	Dedza Boma	14341000	1960-1978
8.	Mtakataka Agric.	14342001	1960-64/1980-90
9.	Mvai Forest No.3	14344009	1977-1985
10.	Mua Livulezi(Sosolo)	14341006	1960-1989
11.	Mtakataka Airwing	14342012	1980-1990
12.	Ntcheu Boma	14344001	1960-1990
13.	Sharpevale	14344005	1960-1989
14.	Nakumba	14342004	1960-1990
15.	Salima Airport	13344000	1960-1990
16.	Monkey Bay Meteo.	14342006	1960-1978

The mean monthly rainfall at each rain gauging station during the period shown in the above table is given in **Table 3.5.1.** In addition, the rainfall data are available at a new rainfall gauging station with an automatic recorder, which was installed in December, 1992. The rainfall gauging station is located at Mganja primary school along S22 road to Dedza.(S14°24', E34°31')

(2) River Discharge Data

The existing gauging stations in the study area is listed below and their location is illustrated on **Figure 3.5.1.** There are no gauging stations for the Bwanje and Liwandzi rivers.

River	Station Name	Drainage Area(km^2)	Available Data Period
Nakaingawa	3.F.2	63.4	1958-1974
Nadzipulu	3.F.3	224.0	1956-1991
Nadzipokwe	3.E.1	30.1	1953-1991
Namikokwe	3.E.5	44.2	1957-1991
	3.E.2	129.0	1957-1991
	NGS1	138.0	Installed during study period
	NGS2		Installed during study period
Livulezi	3.E.3	452.0	1957-1991
	LVGS		Installed during study period

The river discharge data of each station is reliable for the low and the medium flow seasons but is unreliable for the high flow season. Data is incomplete due to occasional gaps in the gauge record. Mean monthly discharge flow at each gauging station is given in **Table 3.5.2.**

Three (3) gauging stations were installed during this study period, namely NGS1, NGS2 and LVGS. NGS1 and NGS2 are located in the Namikokwe river as shown in **Figure 3.5.1.** NGS1 is a water level recorder type. The other two stations are staff gauges only.

3.6 GEOLOGY

Geological basement of the study area consists of gneisses, schists and other minor igneous rocks including granite and syenite of Precambrian and Cambrian ages. Along the lakeshore, they are masked by recent and sub-recent fluvial deposits and superficial lacustrine deposits. The foothills of the escarpments are covered by unconsolidated colluvium and alluvium which extend and fill the whole Bwanje Valley.

3.7 GROUNDWATER

According to an interview with the Public Health Officer of Salima ADD, the newly installed boreholes under the SLADD Shallow Well Programme are roughly 10 to 20 m deep. The known yield of groundwater in the study area is very limited.

Through the National and Shire Irrigation Study, the groundwater potential for irrigation development was investigated at eight (8) drilling sites in Salima ADD. The drilling confirmed that the thickness of the unconsolidated deposits within the Quaternary basins of Malawi is between 30 and 70 m and that the profiles sometimes contain considerable thick coarse clastic materials. The results of five (5) boreholes located near Salima township and Bwanje Valley are summarized below.

Basin	Borehole No. (µmho/cm)	Drilled Depth (m)	Depth Bedrock (m)	Cased Depth (m)	Drawdown* (m)	Discharge rate (lit/sec)	Specific Capacity (lit/sec/m)	ECx10^6 25 °C
Salima	IS 2	66.0	40.5	53.5	11.65	5.0	0.43	1,500
	IS 3	70.0	70.0+	67.5	11.71	15.0	1.28	390
	IS 7	61.0	61.0+	59.1	5.39	15.0	2.78	420
Bwanje	IS 5	92.0	88.4	79.4	10.98	12.0	1.09	960
	3D60	-	-	58.7	25.32	7.0	0.28	

Remark: *Drawdown = at 72 hours continuous pumping

IS 2 was newly drilled to the west of Salima near basement outcrop, while IS 3 and IS 7 were to the east of Salima near Lake Malawi. IS 5 was constructed at Golomoti and the old well 3D60 located to south of the M18 road at Dimbe was re-developed.

Aquifer constants were analyzed and gave the aquifer transmissivity results ranging from 49 m^2/d at 3D60 to 293 m^2/d at IS 7. Average lateral permeabilities were estimated to be 5 to 10 m/d. The specific capacities of the wells were in the range of about 0.3 to 3 lit/sec/m. The water quality analyses indicated that salinity class of the groundwater in the study area are moderate salinity hazard with EC below 750 µmho/cm to medium-high salinity with high EC (over 1,000 µmho/cm).

3.8 LAND USE

The study area is broadly used for agricultural purposes. Out of 250,000 ha of the total study area, 159,400 ha or 63.7 % are cultivated. More than 98 % of the cultivated land is under rainfed agriculture, while the rest includes wetland, i.e. mainly *dambos*, and irrigated paddy fields. There are forest reserves namely Dedza Forest Reserve and Mua-Livulezi Forest Reserve covering 55,200 ha or 22.1 % of the study area. In terms of water retention and soil conservation, functions of these forests are significant for future irrigation development of the lakeshore zone. With a total coverage of 32,900 ha, grasses and other low vegetation are important grazing sources for local animal husbandry. Between grasslands, villages are located selectively near perennial rivers on slightly higher land which is free from flooding. The present land use conditions are presented in **Table 3.8.1** and **Figure 3.8.1** and summarized below.

Land Use Category	Area (ha)	Prop. Ext.(%)
Agricultural land	159,400	63.7
- Rainfed	(156,400)	
- Wetland	(2,800)	
- 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

3.9 LAND TENURE

There are four types of land tenure in the study area: (i) customary land, (ii) public land, (iii) free hold land and (iv) leasehold land. The land tenure system in the study area has been checked based on the data provided by the Department of Lands and Valuations, the report of Salima Lakeshore projects and the existing topographic maps (1/50,000). The summary is shown in the next page:

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

Customary land is the land under the jurisdiction of the TA and village headman. About 87 % of the study area is under customary tenure. The land is allocated to the head of the household (family) by the village headman or the TA. Land is allocated according to the requirements of the household in general. The land allocated cannot be sold or leased. If some family members move out of the household by marriage or death , the village headman or TA has the right to re-allocate part of the land to other families who need it. The land for firewood, grass for thatching, grazing, grave yard, wells and rivers which the local community needs is owned by the village headman.

Public land is the land that is transferred from the jurisdiction of the TA or village headman to the jurisdiction of a specific official organization and/or the government. The public land in the study area consists of the forest reserve land, fishing landing, police college, veterinary station, Malawi young pioneer schemes and the government estate. Among them, the forest reserve areas are the largest, being composed of four (4) forest reserves such as Mua Livulezi, Bangwe, Mua, and Chirobwe. The total public land amounts to 190 km^2 comprising 183 km^2 of the forest reserves and about 7 km^2 for the rest.

Freehold land is the land to be privately owned subject to the approval of the Minister for land matters under part IV of the Land Act 1965. The free hold land in the study area mostly comprises several estates and mission area. The area is estimated at about 4 km^2.

Leasehold land is the land which is formally leased from the customary land as private estates. In the study area there are 19 formally leased estates having the total area of 138 km^2. These estates are listed in **Table 3.9.1**.

3.10 AGRICULTURAL PRODUCTION AND FARMERS' ECONOMY

3.10.1 CROPS AND CROPPING PATTERNS

The present cropping patterns in Bwanje Valley, Dedza Hills and Ntcheu RDPs are illustrated in **Figures 3.10.1** to **3.10.3**, respectively. The planted areas indicated in these figures were estimated on the basis of a series of crop estimates annually reported by Evaluation Officers of both Salima and Lilongwe ADDs. Further details are described in Section 3.10.2 on Crop Yield and Production.

A cropping season falls between November and May in which more than 90% of precipitation falls. At the onset of the wet season, most crops are sown. They are maintained under rainfed conditions for four to five months and harvested from April to May except for cassava. Although no substantial extent of second (winter) crops is recorded in the ADD's crop estimates, intercropping with early maturing pulses such as beans and chickpeas are practiced to a limited scale.

Maize leads the other crops in both planted area and production. Maize occupies 44,200 ha or 70 % of 62,500 ha of the total planted land in the study area. Crop selection in Bwanje Valley RDP is more complex than in Dedza and Ntcheu RDPs. It is conspicuous that cassava and cotton are major crops only in Bwanje Valley RDP, while proportional extent of pulses is higher in Dedza Hills and Ntcheu RDPs. According to the interview survey with the 120 farm households, the leading crops in their farming in 1991/92 were maize taking 61.3 % of the total land holding, rice 13.5 % and cotton 10.4 % as presented in **Table 3.10.4**.

3.10.2 CROP YIELD AND PRODUCTION

Previous records of the MOA's crop estimates are presented in **Tables 3.10.1** to **3.10.3**. For the RDPs concerned, these are summarized in **Tables 3.10.5** and **3.10.6**. On the basis of these crop estimates, the crop production in the study area was estimated by applying the proportional extent of the study area in each RDP. The planted area, yield and production of crops in the study area are presented in **Table 3.10.7**.

(1) Maize

The total maize production of the study area is 44,200 tons of which 41,500 tons or 94 % is local maize which has white grains. The past trend of maize production in Salima ADD is illustrated in **Figure 3.10.4**. Except for the crop failure in the 1991/92

drought, maize production has increased since 1985/86 as a result of a promotion of hybrid seeds under the seasonal credit by MOA. Hybrid varieties (HM varieties) have been steadily expanded from 1.1 % of the total planted area of maize in 1984/85 to 16.2 % in 1990/91. The overall 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. The yield of hybrid maize is also changed by RDP: 1,372 kg/ha in Bwanje Valley, 2,228 kg/ha in Dedza Hills and 3,342 kg/ha in Ntcheu. Although a large difference in productivity is apparent between varieties, local farmers prefer local variety for their home consumption because of its grain quality more suitable for *Nsima*. MOA directs, therefore, its research effort to breeding of top-cross hybrid maize with white grains, i.e. NSCM 41, MH17, MH18, etc.

The interview survey clarified that maize was cultivated by all the farmers surveyed on the area of 1.08 ha per household with local (90.0 % in nos. of cultivated farmers), hybrid (48.3 %) and composite (2.5 %) varieties. Due to sever drought in the 1991/92 cropping year, harvested farmers were only 78 % of the growers and the averaged yield was 0.83 ton/ha of the harvested area as presented in **Table 3.10.8**.

(2) Rice

Rice is the second most important cereal in Malawi as well as the study area. Under the favourable price conditions, rice is currently more important as cash crop than as diet for smallholders. In the study area, rice is planted only in Bwanje Valley RDP with a total area of 478 ha and a production of 585 tons, which give the average yield of 1,220 kg/ha. Out of 478 ha of rice field, 230 ha or 48 % are irrigated under the Mtandamula self-help irrigation scheme, while the rest is located in the *dambos*. Among the variety alternatives, Faya 14-M-69 is the most popular variety covering 416 ha with a total production of 527 tons. It is followed by local varieties similar to Faya, IET 4094 (*Senga*), Blue Bonnet and IR 1561-250-2-2 (*Changu*).

The interview survey verified that rice was grown by 65 % of the farmers for average planted area of 0.33 ha per farmer with such varieties as Faya 14-M-69 (61.3 % in nos. of cases), Kota-Kota (10.7 %), Mixed Faya (5.3 %), Blue Bonnet (2.7 %), Karonga (2.7 %) and Manda (2.7 %). as presented in **Tables 3.10.8** and **3.10.9.**

(3) Grain legumes

Grain legumes in the study area are represented by groundnuts, which are followed by cowpeas, pigeon peas, beans, soya beans, ground beans and grams. Groundnuts covers 1,167 ha or 70 % of the total planted area for grain legumes producing 2,386 tons. The

main variety is Mawanga, which is produced for oil pressing, covering about 50 % of the total planted area with groundnuts. The other varieties are Chalimbana for confectionery and Manipintar for oil pressing.

Cowpeas and pigeon peas are the main pulses in the Bwanje Valley RDP. They are tolerant to heat and dry climate conditions, and suitable for a wide range of soils. The peas contain high quality of protein to supplement animal protein supply to local people and contribute to soil fertility improvement by nitrogen fixation in crop rotation. Pulses are more important in Dedza Hills and Ntcheu RDPs occupying 6,645 ha combined.

Among the farmers contacted through the interview survey, beans/pulses was cultivated by 15 % of the farmers on an area of 0.25 ha per grower and 56 % of the growers had the yield of 0.82 ton/ha. While groundnuts was cultivated by 12.5 % of the farmers surveyed on the area of 0.31 ha per grower and 67 % of the growers had an averaged yield of 0.57 ton/ha in 1991/92 crop season as presented in **Table 3.10.8.**

(4) Root Crops

The root crops are cassava and sweet potatoes in Bwanje Valley and Irish potatoes in Dedza Hills and Ntcheu. They are produced as security crop and cash crop. Among them, cassava is the most important root crop in the study area with a total coverage of 3,300 ha.

(5) Cotton

Cotton is a valuable cash crop for smallholders in Malawi and one of the most important cash crop in Bwanje Valley RDP. Encouraged by seasonal credit and firm marketing channels under ADMARC' monopoly, its planted area has steadily increased from 1,100 ha in 1987/88 to 7,500 ha in 1991/92. The yield and production of seed cotton in the study area are 740 kg/ha and 1,371 ton on average. According to the interview survey, 30.8 % of the farmers cultivated cassava on 0.59 ha per grower and 92 % of the farmers had an average yield of 0.81 ton/ha.

3.10.3 FARMING PRACTICES

The MOA publishes the Guide to Agricultural Production before every crop season. The Guide introduces recommendable farm inputs and appropriate crop husbandry techniques. Its essential parts are summarized in **Tables 3.10.10** and **3.10.11.** Although their application is nationwidely promoted by expansion of the MOA's

extension activities and SACA, the farming practices prevailing in the study area are still traditional with a limited use of agricultural implements. According to the hearing survey, all the households (119 nos) use small hoes, but only 3.4 % and 2.5 % own plows and ridgers as presented in **Table 3.10.12**.

The farming practices for upland crops are initiated by dibbling and sowing after the first rain. Fertilizers are applied only to 20 % of the total cropped area concentrating on hybrid maize and cotton. Weeding is the main practice during the crop season, but it is not sufficiently done. In addition, spraying is important practice for cotton farmers. Out of 119 respondents obtained through the hearing survey, however, only 11 own knapsack-type sprayers procured through medium term credit. Crops are harvested by axes, hatchets and/or sickle. The hearing survey revealed 60 to 80 % of households own those implements.

The farming practices for paddy are more labour intensive than that for upland crops. Oxen-plow is applied to the limited extent, while most of paddy fields are prepared by hands. The Mtandamula irrigation scheme applies mainly transplanting method, but direct seedling is partly practiced where sufficient labour force is not available. Nursery is raised in November to December. Without dosage of fertilizers, seedlings of 35 to 40-day old are transplanted with input of hired labours. Sickle is a common implement for harvesting. Hills slashed are kept on the paddy field for one to two weeks for drying. Grains are threshed on mats and bagged after winnowing.

Although smallholders believe that transplanting is more productive method, this practice is not applied in rainfed paddy fields in *dambos*. Direct seeding method is more prevailing there. After ploughing by hand, dry seeds are directly broadcasted either on wet soils or under flooded conditions. Low germination and seedling establishment percentages do not allow obtaining proper yields.

Through the hearing survey for 120 farmers, the main farming practices and their labour requirement for maize and rice cultivation were verified as presented in **Tables 3.10.9, 3.10.13** and **3.10.14**. For both crops, land preparation and weeding require more work force. It should be noted that labour requirement for disease and pest control for rice is remarkably high.

It was also verified through the hearing survey that local smallholders practice crop rotation, intercropping and mixed cropping to control weeds, maintain soil fertility and utilization of soil moisture retained during the wet season. Among various crops, maize and cotton are main rotation crops. Mixed cropping with pumpkin, cow peas,

groundnuts, pigeon peas, millet, sorghum and vegetables are also practiced. In order to improve soil fertility, mixing with pulses is also prevailing in the study area.

On the basis of the above-mentioned facts, the technical constraints encountered in the study area can be summarized as follows.

(1) Preference for grain qualities and predominance of local varieties

Use of modern farming techniques with improved varieties and fertilizers is still limited. Over 85 % of maize varieties are local flint, of which yields are considerably lower than improved varieties. It is apparent that expansion of improved varieties is indispensable and most effective for their increased production. The said traditional varieties, however, are more suited to Malawian food preference. In fact, local farmers are more encouraged to produce local maize for better *Nsima*.

Variety selection for rice is more crucial. In view of higher marketability, sweet-scented rice grains of Faya are more profitable for farmers. Currently, 90 % of rice is Faya Either new varieties or new strains of Faya is highly required to ensure the further substantial expansion of improved rice varieties. Farmers are conservative in variety selection unless good harvest is secured. In line with a long term strategy, improved varieties has to be expanded under the government support.

(2) Limited use of fertilizers

Successful yields of maize and rice can be achieved not only by introduction of improved varieties but also more use of fertilizers. In this regard, the crop package system under SACA provides smallholders opportunities to select optimum amounts of improved seeds as well as fertilizers among a wide range of alternatives. It is, however, reported that fertilizers are not applied to rice but hybrid maize although rice farmers can obtain fertilizers with improved rice seeds in a credit package. This fact indicates that rice yield is not secured under the current conditions of irrigation water supply. Rice farmers will be more encouraged to apply fertilizers for better yield if their irrigation scheme functions well as farmers expect.

(3) Weed infestation due to insufficient land husbandry

Weed control is an important farming practice during initial weeks after emergence. In particular, it is extremely important to keep cotton free from weeds up to flowering stage. The predominant weeds is Witchweed (*Striga asiatica*). Although

farmers are recommend to uproot weeds before their flowering, this practice is not sufficiently done.

Control of weed in wetland paddy, e.g. Nadanga weed, (*Echinochloa crusgalli*), is more crucial. In this regard, work quality of levelling and puddling is a keen issue. As well, puddling is an essential practice not only for loosing soil clods to facilitate transplanting but also weed control of lowland paddy. Lack of animal power and implements does not allow to practice puddling properly as mentioned above. Weed control is more crucial when directly sowing method is applied.

(4) Soil erosion

As aforementioned, the soils of the study area can be characterized by their hard consistency when dry and pan formation of topsoils. Splash erosion is not negligible taking strong rains in the study area into consideration. To avoid soil erosion, deep ploughing is effective to enhance penetration of rain water and retain capacity of soil moisture. In addition, the soil conservation practices are required more in the study area.

(5) Release from hard work and re-allocate of their manpower

Although oxen-plow is partly available in the study area, land preparation is generally practiced by farmers In addition, post-harvesting practices, in particular threshing, winnowing and milling are manually done. They force the farmers to devote much hours and are burden especially for village women. From the viewpoint of effective allocation of manpower resources, appropriate mechanization level for post-harvest activities has to be considered. By being released from such heavy and intensive housework, farmers will be able to allocate their labour forces to other income activities.

(6) Crop damages by birds and wildlife attacks

Crop damages by birds and rodents are the most serious for rice in the study area. Bird scaring especially for rice is essential during maturing period. The smallholders cultivating on the lakeshore suffer from attack by hippo. The necessary wildlife control such as farm fence will be an important aspect in the study area.

3.10.4 FARMERS' ECONOMY

The farmers' economic survey has been undertaken to identify present agricultural conditions and farmers' economy of the farmers in the study area.

Prior to commencement of the farmers' economic survey, reconnaissance in the study area and preliminary analyses of the existing data have been made. Based on the results of the above, the farmers in the study area could be globally classified by two farmers' groups ; (i) the farmers living on agriculture only and (ii) the farmers living on agriculture and fisheries. The farmers of the type (i) are further subdivided into four types taking into consideration (a) land use pattern and (b) kind of heads of the household. As a result, the farmers in the study area have been classified into four typical farmers' groups as follows:

No. of Type	Description of the typical farmers
(i)	Male headed farmers who own only upland and live on only agriculture for it
(ii)	Male headed farmers who own upland and lowland, and live on only agriculture for them
(iii)	Female headed farmers who own only upland and live on only agriculture for it.
(iv)	Female headed farmers who own upland and lowland, and live on only agriculture for them
(v)	Farmers living on agriculture and fisheries

Due to limited time and limited budget of the farmers' economic survey, sampling of the farmers has not been carried out at random but purposefully. The total sample number are 120. The sampling has been undertaken in the flat land areas where extend between the lake Malawi and the escarpment, and may become the potential lands for irrigation development. The sampling was done taking into consideration (i) an access to the farmers, (ii) the distribution of the farmers in the study area and (iii) ratio of female headed farmers for the total farmers.

The analysis of the farmers' economy for the male headed farmers has furthermore been done for the farmers classified into the farmers who live in TA Kachindamoto and in TAs other than TA Kachindamoto. The results of the farmers' economic survey are summarized below;

(1) Balance

The 1991/92 year was such serious drought year that the harvested area drastically decreased and yield of crops also became low. The survey results indicated that the rate of harvested crops is 78 % for maize, 76 % for rice, 92 % for cotton, 56 % for beans and 0 to 67 % for other crops. The yield of the main crops is 0.7 ton/ha for local maize, 1.6 tons/ha for hybridmaize, about 1.5 ton/ha for rice, 0.8 ton/ha for cotton and 0.8 ton/ha for beans. Under such situation, a balance of the farm budget for most of the farmers is red as shown in **Table 3.10.15**.

According to the hearing survey, the crop production per household was 1,160 kg in the 1991/92 crop season. Its production value was estimated at MK 526. Out of this value, 86 % was derived from three crops such as maize (46 %), rice (23 %) and cotton (17 %). The products corresponding to MK 339 or 65 % of MK 526 were allocated to home consumption and the rest was sold.

The main income is the farm incomes from sale of products of crops and livestock. The farmers get some non-farm income but it is very small except the farmers living on agriculture and fisheries. The annual farm income per family is quite different depending on the type of farmers, ranging from MK 100 to MK 1,680. The farmers having the high farm income obtain main incomes from sale of livestock. It is ,however, assumed that the drought in 1991/92 forces the farmers to sell livestock because of shortage of grass to feed livestock. It is characterized in the farm income that the farm income for the female headed farmers is very small. The cause of such low income may result in (i) small farm land size, (ii) low active labour force due to small family size.

(2) Living Expenditure

As shown in **Table 3.10.16,** the living expenditure of the farmers is different on the type of the farmers, ranging from about MK 430 to MK 780 per year except farmers living on agriculture and fisheries. The expenditure spent for food (except food produced by themselves) occupies about 60 % of the total living expenditure. The living expenditure except food is as small as about MK 130 to MK 590 per annum per family that means that the expenditure per capita per annum is only MK 23 to MK 70. It is also characterized that such expenditure is the lowest in the female headed farmers.

An analysis has also been made for the pattern of the living expenditures. The summary is shown in **Table 3.10.17**. The main expenditures are for clothing/footwear, followed by furniture/household utensils, medical care, education and cost for transportation and communication. The expenditure for clothing/footwear occupies 47 % of the total expenditure except food expenditure.

It may be concluded that most of the farmers in the study area remain in the subsistence level of living. Among them, the living standard for the female headed farmers is lowest and very serious.

3.11 LIVESTOCK AND INLAND FISHERY

3.11.1 ANIMAL HUSBANDRY

(1) Animal Population

Animal husbandry is prevailing throughout the country. Its distribution pattern is governed highly by availability of grazing sources and agro-climatic conditions: more populated in cooler plateaus with higher rainfalls such as Lilongwe, Kasungu and Mzuzu ADDs. The animal population in 1990 is summarized below.

Animal	Malawi		Salima ADD		Lilongwe ADD	
	Head	(%)	Head	(%)	Head	(%)
Cattle	835,600	(100)	65,500	(7.8)	188,700	(22.6)
Sheep	85,200	(100)	11,100	(13.0)	10,500	(12.3)
Goats	853,300	(100)	102,400	(12.0)	228,500	(26.8)
Pigs	233,100	(100)	12,800	(5.5)	81,400	(34.9)
Poultry	3,124,400	(100)	244,000	(7.8)	956,200	(30.6)

Cattle and goats are the most important animals for smallholders in the study area as sources of both cash income and animal power. The past trends of animal population are presented in **Table 3.11.1** for Salima ADD in the period from 1985 to 1991 and **Table 3.11.2** for Lilongwe ADD in the period from 1985/86 to 1989/90. On the basis of these records and proportional extent of RDPs concerned in the study area, the animal population in the study area was estimated as presented in **Table 3.11.3**. This correspond to 0.42 head of cattle and 0.74 head of sheep/goats (smallstock) per average household.

The animals raised in Salima ADD are in principle locally consumed and not traded to the other areas. Although cattle in Bwanje Valley RDP are occasionally sold to the southern ADDs, its number is negligible, i.e. less than 1,000 heads or 2 % of the total cattle.

The prevailing cattle breed is Malawian Zebu. This breed is characterized by low productivity but highly tolerant to heat and dry climate as well as diseases. In order to improve the productivity of local animals, Salima ADD carries out a cattle improving programme in Kitu ranch. This ranch has a total area of 3,040 ha located 6 km west of Salima township. The main purpose of the ranch is to raise and distribute the improved breed called Brahman introduced from South Africa. Currently 1,400 heads of this improved breed is raised. Salima ADD also manages the Lifidzi Goat Breeding Centre for introduction of improved goat breeds to smallholders.

(2) Animal Products and Marketing

Animal products are meat, milk, eggs, hides and skins. Their annual production in Salima ADD was estimated as presented in **Table 3.11.4**. The parameters used for the estimate are extracted from the official statistics of Salima ADD such as Annual Livestock Census (1985 to 1991), Annual Report on Department of Animal Health and Industry (1989 to 1991), records of slaughter houses and meet inspection, and information given by Animal Husbandry Officer. The herd composition was assessed as presented in **Table 3.11.5** in order to estimate number of cow in lactation period and milk production.

The estimated meat production in Salima ADD amounts to 1,388 tons per year consisting of 1,095 tons (79 %) of beef, 149 tons of goats/sheep meat and 144 tons of chicken meet, which is equivalent to 2.5 kg/capita/year. In addition to the meat production tangible through analyses of the official records by slaughter houses, most of pigs and some of smallstock are also slaughtered in villages and consumed by local people.

Cattle and smallstock are sold to butchermen who transport those animals from cattle markets to slaughter house or slabs. As of November, 1992, an average cattle with a total liveweight of 300 kg is sold to butchermen at MK 400. There are 13 market slaughter houses and slabs in Salima ADD, i.e. two in Bwanje Valley RDP, five in Salima RDP and six in Nkhotakota RDP, of which Salima Slaughter House owned by the Salima town council is the largest. In Bwanje Valley RDP, there are slaughter slabs in Mtakataka and Sharpevale, but their output is very limited. The total slaughtered animals in Mtakataka was 439 heads of cattle and 289 heads of goats in 1991, which account only for 4 % and 7 % of the total slaughtered cattle and goats in Salima ADD. The slaughter fee is MK 3 to 5 per head paid by butchermen to slaughter houses. After slaughtered, carcass is checked by a meet inspector who is authorized by Veterinary Department of MOA. Liver flukes is the predominant reason of rejection.

Number of market slaughter shows a large seasonal fluctuation as illustrated in **Figure 3.11.1**. This is highly related to availability of grazing sources and financial situations of smallholders. During the wet season from November to May, uplands covered by natural grasses and shrubs provide sufficient grazing sources to cattle and smallstock. In the late wet season, cattle herds are forced to enter lowlands along the lakeshore in order to consume crop residues left on farmland after harvesting and graze along the fringe of *dambos* by following gradually receding inundation. At this time smallholders can sell their animals to local butchermen at the most favourable prices because animals are healthy and fat in this period. The peak season of slaughter,

therefore, always appear in and after the end of the wet season. Moreover, the financial situations of smallholders are worsened during the dry season without crops for sale. In spite of such financial conditions, most of the farm families need to pay school fees in September to October.

Due to lack of stable marketing channels of milk and transporting facilities, the smallholders' incentive to milk production is low. Assuming annual lactation yield at 300 kg/year, the annul milk production in Salima ADD is estimated to be 4,000 tons of which about a half is fed to calves and the rest is for home consumption including a limited quantity for sale.

(3) Animal Sanitation and Institutional Supports

Within the Salima ADD, the Divisional Veterinary Branch is set up. The Divisional Veterinary Officer is responsible for all the activities related to animal sanitation and livestock industry in the ADD. Under this officer, three (3) Project Veterinary Officers are posted to deploy all the veterinary services in their RDPs. The total staff members of this Veterinary Branch are 97, of which 33 are allocated to Bwanje Valley RDP.

The prevailing cattle diseases are Trypanosominasis and Black quarter, while chicken diseases are represented by new castle disease. Dipping is the one of the major activities in Salima ADD. The other supporting services include vaccination, clinical treatment, and castration. The ADD's veterinary officers are also responsible for control of rabies.

3.11.2 INLAND FISHERY

Inland fishery in Malawi plays an important role as a supplier of animal protein to local people and an income earner for farmers. The national total of fish capture amounts to about 50,000 tons per annum, of which 30,000 tons are derived from Lake Malawi.

Department of Fisheries is responsible for all the activities including fish pond culture in the country. The Department was previously attached to MOA and its regional offices were established in ADDs. Currently the Department belongs to the Ministry of Forestry and Natural Resources. The Regional Fishery Office of Central Region is still located in the offices of Salima ADD. Its main tasks are to issue fishing license (right) to local fishermen and to monitor and evaluate the fishing activities in the Central Region. Commercial fishing is under the control of the headquarters of the Department.

Fishermen are officially recognized by issuance of fishing license. The total fishermen in Salima ADD amounts to 7,325: 2,089 from Mtakataka to Domira Bay and 5,236 in Nkhotakota. Out of 7,325, only 1,262 or 17% are full-time fishermen, while the rest are of part-time or their assistants.

In Salima ADD, there are nine (9) fishing zones, which is called "minor stratum". The monthly fish capture by minor stratum is presented for the period from January 1990 to December 1991 in **Table 3.11.6.** Among nine strata, Chipoka is the largest stratum yielding 6,000 tons or 27 % of the total fish capture in the said period.

The prevailing fish species are Utaka (*Haplochromis spp.*), Usipa (*Eungrcyrris Sardella*) and Mpasa (*Opsiridium Microlepis*). Chambo (*Oveochroris spp.*) is less common along the northern lakeshore in the above-mentioned stratum, but more predominant along southern lakeshore in Mangochi.

Neither official marketing channels nor institution are established in Malawi. There are no cold storage and no ice plants in Salima. Therefore, most of fish is sold on beach after landing or processed to dry fish for local consumption. A very limited amount of fresh fish is transported to Lilongwe.

In Salima ADD, 2,207 crafts are used for fish capture, of which 1,720 (78 %) are either dugout or canoes. Engine driven boats are not common, i.e. 123 units. (6 %) of the total crafts. A wide range of gears are used. They are gill nets, gear chilimira, mosquito nets, fish traps, hand line, scoop nets, cast nets, long line, and Kambuzi nets. Among them, gill nets are most prevailing. Spearing and bow & arrow are rarely used.

No specific regulation is issued for mesh sizes of fishnets for local fishermen, while strictly controlled for commercial fishing to avoid overfishing. To maintain Chambo population in the region, the Regional Fishery Office recently directed to local farmers that Chambo with total length of less six (6) inches should be released to the lake.

3.12 IRRIGATION SCHEMES

3.12.1 EXISTING IRRIGATION SCHEMES

In the study area there is no government run irrigation scheme, but there are 2 self-help irrigation schemes, the Mtandamula and Mwalawoyera schemes, which are presently operating.

(1) Mtandamula self-help irrigation scheme

The Mtandamula self-help irrigation scheme is located 10 km east of Mtakataka. It was constructed in 1987. Irrigation water is supplied by gravity system taking surface water from the Namikokwe river diverted at Mthembanji village. Irrigable area of the scheme is 230 ha, divided into 20 field lots. Each field lot has 20 to 37 plots. The plot size is 0.4 ha. There is a diversion bank at the south-west end of the scheme for dual propose of flood protection and reservoir. The unlined main canal starts from the diversion bank and run to the direction of the Lake Malawi. The main canal is 3,480 m long with 20 lateral outlet and drop structures.

Construction was carried out by using of EEC fund and both the Government (Salima ADD) and farmers participated. The Government contributed planning, design and all necessary heavy equipments and materials, and the farmers contributed their labour force to dig out irrigation and drainage canals.

From the viewpoint of an effective water utilization and water management of the scheme, the technical constraints encountered in the Mtandamula scheme can be summarized below;

(i) Unstable water intake due to no permanent structures at the point of the Namikokwe diversion,
(ii) Insufficient functioning of the canals and canal structures due to erosion of side slope of canal in many places and scouring at the drop structures, and
(iii) Improper water distribution due to insufficient land levelling.

These issues may accelerate the deterioration of the whole scheme in the near future. Rehabilitation of canals, construction of intake structure, improvement of lateral outlet and drop structures, and re-levelling of the fields are urgently needed.

(2) Mwalawoyera self-help irrigation scheme

The Mwalawoyera self-help irrigation scheme is located about 5 km east of Mwalawoyera on the road M17. The scheme is still under construction as of November 1992. Irrigation method is gravity taking surface water from the Bwanje river diversion weir which is under construction, about 400 m upstream of the site. Irrigable area of the scheme is 110 ha. Construction is being carried out by using of EEC fund. The Government contributed planning, design, and all necessary heavy equipment and

operators, materials and skilled worker for construction of the intake weir, canal brick lining and structures. The farmers are contributing labour force to dig out irrigation canal and drainage canals .

3.12.2 IRRIGATION SCHEMES IDENTIFIED BY EC GROUP

The study on the self-help irrigation communities throughout the country has been performed by the EC-fund since 1990. To date the results of the study were compiled into the draft reports titled " Multicriterion Analysis Report", "Self-help Irrigation Master Plan" and "Implementation of Self-help Irrigation Schemes in Malawi".

These reports identify five self-help irrigation communities in the study area which constitute opportunities to enhance the production of staple food crops. The identified schemes and their salient features are summarized below and location of these schemes are illustrated on **Figure 3.12.1.**

Name of system	Irrigable area (ha)	Water source	Proposed crops
Gosyeni	585	Livulezi	Rice/maize
Namikokwe	330	Namikokwe	Rice/maize
Zalengela/Kayiya	25	Stream	Sugarcane
Nadzipulu		Nadzipulu	Rice
Chitenje	65	Namikokwe	Rice

3.13 SOCIAL INFRASTRUCTURE

3.13.1 TRANSPORTATION

In traffic terms, the study area is favourably located by being linked by the following main roads.

Road	Road sections in and around the study area	Remarks
M17	Salima - Balaka	62 km of Salima - Mua is under rehabilitation (to be completed by end 1994)
M14	Salima - Lilongwe	103 km under rehabilitation (to be completed by early 1993)
M18	(Salima -) Mtakataka - Mangochi	
M1	Lilongwe - Dedza - Ntcheu - Blantyre	
M8	Balaka - Liwonde	

Among the above-listed roads, the two north-south parallel routes, i.e. M1 and M17, play a important roll in passenger and commodity flow within the study area as well as inter-region traffic. Road Department of MOWS is currently undertaking the rehabilitation of Salima - Mua section (62 km) of the M17 road of which bitumenising will be completed by end 1994. Its rehabilitation is scheduled to be extended up to Balaka.. The M14 road connecting Salima and Lilongwe is also under rehabilitation. After completion of both rehabilitation works, accessibility to both directions to Lilongwe and Blantyre will be remarkably improved. Apart from the primary network in and around the study area, lack of feeder system is crucial. The feeder system to M17 and M18 is particularly important to ensure the region's agricultural activities, e.g. agricultural extension, farm input distribution and transport of products to ADMARC markets.

ADMARC deals with the largest freight in the study area. During June and September, about 8,000 tons of crops purchased at the four (4) parent markets of ADMARC in the study area are transported to either Salima depot or Balaka depot through the M17 road. In this connection, the M18 road is a main access for transporting products which are collected at Kapiri market from the farmland expanding over the southern lakeshore.

Rural transport services are undertaken by United Transport of Malawi (UT (M)). According to the hearing survey to its Salima office, UT (M) operates long-distance coaches from Salima to seven (7) destinations, i.e. Lilongwe, Balaka, Dwambazi, Dwangowa, Nkhotakota, Mangochi, and Monkey Bay. It is estimated that about 250,000 passengers utilize UT (M) buses annually.

The other transportation modes include rail, lake and air. Malawi Railways Ltd. (MRL) operates one round trip a day (up and down) between Lilongwe and Blantyre via Salima. According to the hearing survey to the Salima station-master, passengers using the Salima station amount to 50 to 100 a day. Their destinations are mainly Lilongwe and Blantyre. In addition to both large cities, passenger movement from Salima to Chipoka shows the peaks on Tuesday and Friday for connection to lake freight traffic departing at Chipoka. One ship a week is operated by MRL along the route of Karonga - Nkhotakota - Chipoka - Makanjila - Monkey Bay - Chilinda. Air freight is limited. There are airfields in Salima and Mtakataka; the former is under Ministry of Transport and Communications and the latter is the police air-base. No scheduled flights are currently operated, but two to four crafts a month land at Salima airfield mainly for filling fuel.

3.13.2 MEDICAL SERVICES AND SANITATION

In Salima ADD, there are two (2) district hospitals at Salima and Nkhotakota, one (1) rural hospital at Dwambazi, 36 health centres and five (5) PHA hospitals and clinics. Their location is indicated in **Figure 3.13.1**. The most frequent causes of out-patients visits are Malaria, respiratory infections, diarrhoeal diseases, etc. According to the Public Health Officer of Salima ADD, the average health centre is equipped with 10 maternity beds and two or three in-patient beds. The average bed occupancy ratio is 400 %.

Outbreak of water-related epidemic diseases is often reported in and around the study area. In the period from January to July, 1992, a total of 2,587 cases of bloody diarrhoea with 136 deaths (case fatality rate: 5.2 %) was reported in the Central Region. As a result of drought which has hit the country in 1991/92, protected water sources were dry up and consequently domestic hygiene became unsafe and scarce. In Salima, the problem started in May, 1992 and 300 to 400 cases a month have been reported.

The Regional Health Office of MOH emphasizes the intensification of the health promotion and education activities by formation and activation of the village health community committees so as to improve personal and environmental hygiene, improve latrine coverage, and sensitize people to seek health care promptly once they are sick. In addition to rodent and vector control, expansion of latrine coverage is the main aspect of rural sanitation. As of 1987, its coverage reached at 60 to 70 % level as presented in **Table 3.13.1** and more expansion is expected under Health Education and Sanitation Promotion Programme (HESP).

3.13.3 MUNICIPAL WATER SUPPLY

Water supply is under the responsibility of Water Department of MOWS. Water Supply Branch of Water Department services a population of 12,000 of Salima township with 770 cubic meters a day from three (3) borcholes of 45 m deep. Currently, water supply to Salima is operated for 9.5 hrs a day. The per capita daily water availability in Salima township is as low as 64 liters, while ones in Lilongwe and Blantyre area 200 liters and 167 liters, respectively.

As seen in **Table 3.13.2**, 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 4 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 assistance of the ODA/UK. In parallel, the EC financed ADDfood project installs shallow wells at selected villages. Under this project, cement, tools and a direct action water pump for every 100 household are provided to local communities, and wells are constructed with technical assistance from agricultural field staff and, where necessary, staff from Water Department. 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. of shallow wells in Salima ADD of which about 60 % are under working conditions. Therefore, the average density of pump is roughly 150 to 200 households per pump [153,000 households ÷ (1,690 pumps x 60 %)].

3.13.4 RURAL ELECTRICITY SUPPLY

Electricity supply and distribution is under the responsibility of the Electricity Supply Commission of Malawi (ESCOM), a parastatal organization. Electricity in Salima is supplied by 132 kV transmission line connecting Lilongwe and by diesel generator of 600 kW of the install capacity. So far here are no plan to extend a national grid to the study area.

The rural electrification programme has been underway for some years, linking district centres to the interconnected system, but most of the rural population are not connected to it. Fuelwood is still primary energy source in Malawi with a total consumption of 9.2 million cubic meters in 1985, of which rural and urban households consumed 72 % of the total and the tobacco industry 23 %. Over-consumption of fuelwood is crucial. The annual supply of wood is estimated to be 2.75 million cubic meters against the consumption of 9.2 million cubic meters. The Government through Forestry Department has encouraged individuals, smallholders, estate owners and institutions to plant trees by providing a variety of technical services and tree seedlings.

3.13.5 EDUCATION

The number of enroled children in the districts concerned, namely Dedza, Ntcheu and Mangochi, are presented in **Table 3.13.3**. The population of school age group over 5 years old was 1,040,400 in 1987, of which 637,200 or 61.2 % are not given primary education, while 54.8 % in the the country. This reflects lower literacy rates, i.e. 23.3 % in Mangochi and 30 % in Dedza compared to 41.6 % in the country. Furthermore, the ratios of the children who are not given the primary education is higher in the TAs falling

in the study area. This implies that literacy rate in the study area is much lower than the above-mentioned district averages.

3.13.6 COMMUNICATION

Communications are responsibility of the Department of Postal and Telecommunications under the Ministry of Transport and Communications. As of December, 1992, the exchange capacity in Salima township is limited to 286, which correspond only to 0.9 % of 33,500 of the total connections in the country.

The postal service has been expanding rapidly in recent years both by increasing post offices and post agencies and by offering a range of services. By 1986, there were 141 post offices and 128 postal agencies: each services 27,000 persons and 350 km^2 on average. The postal services in Salima ADD are operated by the East Post Division Office's service network: the senior executive post offices at Salima and Nkhotakota, the senior clerical post offices at Chipoka, Mtakataka, Golomoti and Kasinje, and the post agency at Bwanje.

3.14 MARKETING

3.14.1 MARKETING SYSTEM AND AMOUNTS

The study area is covered by the ADMARC's market network under three (3) Divisional Offices, namely Salima, Balaka and Nathenje Divisional Office, as illustrated in **Figure 3.14.1**. Salima Divisional Office controls one (1) depot, seven (7) parent markets, and 30 unit markets as presented in **Figure 3.14.2**, of which Mtakataka Area Office (parent market) covers the northern part of the study area. The southern part of the study area is covered by Balaka Divisional Office. It operates two (2) depots, eight (8) parent markets, and 25 unit markets as illustrated in **Figure 3.14.3**, of which Bilila and Nanyangu (Sharpevale) Area Offices are concerned to the study area. Nathenje Divisional Office covers only the northwestern corner of the study area and ADMARC's activities might be limited compared to other two Offices.

The marketing channels of the major smallholder crops in Salima ADD are summarized in **Table 3.14.1** and their flow is illustrated in **Figure 3.14.4**. Smallholders can bring any amounts of their products into any of parent markets, unit markets and seasonal markets. ADMARC markets are located so as to enable smallholders to access easily within a 10 km distance. Products collected at markets are basically transported to the Salima Depot through parent markets. Smallholders can also sell their products to the

Salima Depot at higher prices than official prices if lot sizes are larger than one (1) ton. No products are for sale for local consumers at the Salima Depot and ADMARC markets.

The crop purchase by ADMARC in Malawi (1982/83 - 1991/92) is presented in **Table 3.14.2**. Ones in Salima and Balaka are 10,931 tons and 31,251 tons in the period from 1989/90 to 1991/92 as presented in **Tables 3.14.2** to **4**. Out of the total purchase by Salima Divisional Office, such crops as cotton, maize and paddy occupy 10,150 tons or 93 %, of which 7,778 tons or 71 % are cotton. Maize is the most predominant in Balaka. Out of the total purchase by Balaka Divisional Office, 78 % are occupied by maize followed by cotton.

Purchased amounts by private traders are not officially recorded, but estimated for major crops by MOA. In 1990/91, private traders purchased 26,000 tons of maize and 4,600 tons of paddy in the country which account for 10 % and 156 % of ADMARC purchased amounts. This fact implies that involvement of private traders is more important in rice markets in Malawi than maize.

Salima ADD has released the license to private traders 16 nos. in 1990/91, 11 in 1991/92 and 14 in 1992/93 as presented in **Table 3.14.5**. These traders originate not only from Salima but also from Lilongwe and Blantyre. Although their purchase amounts have no limitation, private traders inform their expected purchase amounts to Salima ADD when they apply licences. For 1992/93, 11 traders out of 14 plan to purchase 9,585 tons of major crops such as cotton, maize and paddy.

3.14.2 FARM INPUTS

Input supply is operated in connection with seasonal credit scheme by ADDs given the financial assistance from IBRD, EDF, Germany, etc. Smallholders can avail those credits through farmers club. Inputs can also be bought in cash. The amounts of farm inputs released by Salima ADD in 1991/92 are presented in **Table 3.14.6**.

Prior to crop season, farmers club apply seasonal credit to Salima ADD. If applicants have sufficient capacity to repay and are satisfied with conditions to non-defaulters of any previous loans by either ADD or any governmental organization, Salima ADD takes them up for seasonal credit. Firstly Salima ADD issues L.P.O. (local purchasing order/A-form) to ADMARC to release farm inputs to farmers club. In response to the L.P.O., ADMARC supplies farm inputs to farmers club. After harvesting, farmers repay to Salima ADD. ADMARC claims to Salima ADD with all the bills. Salima ADD pays to ADMARC and a loan cycle in completed.

According to the standard fertilization rates recommended in the Guide to Agricultural Production, fertilizers supplied to Salima ADD were applicable for basal dressing for maize up to 15,000 ha and top-dressing for 14,600 ha in 1991/92. This means that about 20 % of 72,000 ha of the total maize field in Salima ADD were able to be fertilized. Seeds of hybrid maize sold amounted to 289,000 kg in 1991/92 which could be sown to 12,000 ha or 17 % of 72,000 ha of the total maize field. Pesticides sold to smallholders were applicable to 19,500 ha of cotton field. Since the actual planted area of cotton was 18,700 ha, pesticides might be fully applied to all the cotton fields.

3.14.3 AGRO-INDUSTRIES, POST-HARVEST AND MARKETING FACILITIES

(1) Agro-industries

There are agro-industries and post-harvesting activities in and around Salima ADD, i.e. ADMARC cotton ginnery in Balaka and Chigonamikango Ltd. in Salima, flour milling by Tiyese Ltd. in Nkhotakota and rice milling by the National Oil Industries (NOIL) in Nkhotakota. As mentioned above, products except for maize are finally purchased by the agro-industries located mainly in Blantyre and Lilongwe. The following agro-industries are mainly concerned to the smallholder crop production in Salima ADD although they are not located within Salima ADD.

Maize milling

Maize purchased by ADMARC is generally sold to local millers such as Grain & Millers Ltd. and Tiyese Ltd. in Nkhotakota for flouring. Only in good harvests, this crop is sold to other ADDs depots, e.g. Lower Shire Valley. Apart from the large-scale agro-industries, flour mills are also operated by private millers at village-level. The milling charge is around MK. 4 per bag (90 kg), where electricity is available, and MK 8 per bag by engine-driven mills in 1991/92.

Rice milling

Rice miller in Malawi is represented by National Oil Industries Ltd. (NOIL). Its total milling capacity is 36,500 tons per year, while actual paddy receiving is only 12,000 tons giving low utilization rate of its rice mill plant at 33 %. With lower producer prices of paddy, ADMARC can purchase only 22 % of the national paddy production of 36,000 tons.

Cotton ginnery

There exist cotton ginneries in Salima ADD, i.e. ADMARC ginnery in Balaka and Chigonamikango Ltd. in Salima. After sorting into three grades, cotton lint is sold to David & Whitehead Ltd. and cotton seeds are to oil pressing factories mentioned below.

Oil pressing

Since Salima ADD produces cotton as well as a diversity of oil seeds such as groundnuts, castor seeds, sunflower, sesame, etc., the existing oil pressing factories are taken into consideration in future crop production plan. Oil processing is done by NOIL, Lever Brothers and Kukomo Ltd. NOIL extracts cotton seed oil by oil crusher with installed capacity of 25,000 tons per year. The average utilization rate is about 30 to 40 %. This plant can press other oil seeds, but not utilized for them yet. Unrefined oil is sold to Lever Brothers to refine. Lever Brothers also process sunflower seeds.

Spice processing

Two varieties of chilies are produced in Salima ADD, i.e. birdseye and capsicum, of which the former is small type for export and the latter is large one for domestic consumption. Their processing is carried out by many small processors throughout the country. These small scale processors are favourable for responding quickly to any change in prices and demand/supply balance.

The above-mentioned companies were mostly under the management of ADMARC. In line with the Structural Adjustment Programme, the privatization of these companies has been carried out since 1985 under the committee organized by Ministry of Finance, Ministry of Agriculture, Ministry of Commerce and Tourism and ADMARC. The companies concerned are ADMARC Canning, National Seed Company, MALDECO Fisheries Ltd., Cattle Feed Plot, Grain & Milling, David Whitehead (textile), NOIL, Cold Storage, SUCOMA, Auction Holding Ltd., United Transport Malawi Ltd. and 25 estates including Kavuji/Mzenga Tea Estate, Tung/Coffee Estate, and Sugar Estate.

(2) Storage

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 as presented in **Table 3.14.7.** In addition, 49,000 m^3 of sheds are available at parent and unit markets in Salima ADD. Mini-silo is simple structured with steel frames and sheets with 500 tons storage capacity, which have been introduced since 1990. The ADMARC Balaka Divisional Office has the warehouse in Balaka town with a total capacity of 16,000 tons and 12 mini-silos with 6,000 tons as presented in **Table 3.14.8.**

As presented in **Tables 3.14.2** and 3, Mtakataka Area Office deals with about 1,530 tons of crop purchase, while Nanyangu and Bilila Area Offices purchase crops of 2,080 tons and 1,160 tons 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.

3.14.4 CEREAL BALANCE OF THE STUDY AREA

In line with the principles and unit rates being applied to the NEWS, the analysis was made on the demand and supply balance of cereals in the study area as presented in **Table 3.14.9.** It is estimated that a total population of the study area is 235,915 demanding 50,179 tons of cereals in 1992/93. A total production of 44,026 is the average in the period from 1984/85 to 1991/92. This gives 87.7 % of self-sufficiency ratio of cereals for the entire study area.

A high self-sufficiency ratio is gained for maize, i.e. 91.5 %, although in-balance is recognized within the study area. The self-sufficiency ratio of maize in Bwanje Valley RDP is significantly lower than ones in Dedza Hills and Ntcheu RDPs. In contrast, rice is not locally produced in Dedza Hills and Ntcheu, while Bwanje Valley is a net exporter of rice giving self sufficiency ratio of 111.7 %. The self-sufficiency ratios as well as production for wheat and sorghum/millet are lower than ones for maize and rice.

3.15 AGRICULTURE SUPPORT SYSTEM

3.15.1 THE SALIMA AGRICULTURAL DEVELOPMENT DIVISION (ADD)

Salima ADD is one of the eight ADDs under the Department of Agricultural Extension and Training, Ministry of Agriculture in Lilongwe. It will become the most important agricultural support organization when the Bwanje Valley Small holder Irrigation Development Project is realized. It is located at Senga Bay in Salima. The organizational structure of this ADD is illustrated on **Figure 3.15.1.**

The Programme Manager (PM) is fully responsible for an overall management of the Salima ADD. Under PM, there are four supporting section /branches such as (i) Adaptive research branch, (ii) Evaluation section, (iii) Health branch and (iv) Irrigation branch. There are also eight supporting branches. These are (i) Veterinary branch, (ii) Finance branch, (iii) Personnel and administration branch, (iv) Project offices, (v) Computer branch, (vi) Food and nutrition, (vii) Land husbandry branch and (viii) Credit branch. These section/branches are technically and administratively linked with the each related Department of Ministry of Agriculture in Lilongwe at present.

The PM direct manages the agricultural branch headed by principal agriculture officer who technically directs all activities on extension and training through the Regional Development Project (RDP) in the Project offices to the farmers. In Salima ADD, there are three RDPs such as Salima, Bwanje Valley and Nkhotakota of which overall management is performed by Project officers. Under each DRP, Extension planning areas (EPAs) headed by development officers are instituted and the total number of EPAs is 14 in Salima ADD. The EPAs are further divided into Sections, the low level of subordinate unit in the field offices and totals 137. The chart of these organization is illustrated on **Figure 3.15.2**.

The total staff in Salima ADD was estimated to be 476 as of the end of 1991. The component of staff is shown below;

	Senior staff	Middle level staff	Lower level staff	Total
1. Establishment	8	63	438	509
2. Vacancy	3	26	43	72
3. Over-establishment	0	4	35	39
4. Actual staff	5	41	430	476

Among the total staff, the field staff such as the field assistants and field home assistants amounts to 164 and 22, respectively. The total number of senior field assistants and senior home assistants are 15 and 3, respectively. Veterinary assistants amount to 32.

The annual budget of Salima ADD was about MK 6.36 million in 1991/92 fiscal year as shown in **Table 3.15.1**. The cost allocated to personnel and administration sector was MK 2.19 million or 34 % of the total budget.

3.15.2 SEED MULTIPLICATION

As mentioned in section 2.4 (e) seed multiplication sector, the Ministry of Agriculture has performed seed multiplication for only rice. The Lifuwu sub-research station is the one of the stations to breed new varieties of rice and supply the pre-basic seeds to each ADD.

In Salima ADD, seed multiplication officer (SMD) in crops section is responsible for this work. The seed multiplication officer receives the pre-basic seeds, and plans and supervises multiplication of rice both for basic seeds and certified seeds.

The results of the seed multiplication in Salima ADD in the 1991/92 fiscal year are shown in **Table 3.15.2.**

All the seed multiplication work have been entrusted to the farmers under supervision of SMD in the government run irrigation scheme and/or the self-help irrigation schemes in the Salima ADD. Basic seed multiplication has been performed for three rice varieties of (i) Faya, (ii) IET 4094 and (iii) IR1561-250-2-2 in the area of about 15 ha at the Lifuwu government run scheme. The certified seed multiplication has been two rice varieties of (i) Faya and (ii) IET 4094 at the area of about 70 ha in the Llfuwu, Bua and Kastu irrigation schemes. The total certified rice seed produced in the 1991/92 fiscal year is about 285 tons.

The ADMARC direct purchases rice seed from seed production farmers.

3.15.3 RESEARCH AND EXTENSION WORK

(1) Adaptive Research in Salima ADD

The Adaptive Research Branch headed by Adaptive Research Officer (ARO) is in charge of all research work in Salima ADD. The ARO receives information on research work from the Adaptive Research National Coordinator (ARNC) in the Department of Agricultural Research in the headquarters in Lilongwe. The ARO should work out the research work plan to be fit to the local conditions in Salima ADD area.

The ARO should make the adaptive research program to solve the present problems in agricultural production in coordination with all supporting sections/branches in Salima ADD. The present objectives of the adaptive research program are : (i) to improve a linkage between research and extension, (ii) to undertake more research

recommendations to suit local conditions, (iii) to expand farming technology and (iv) to focus the research work adaptable for the present capability of the farmers

Based on the above objectives, the following adaptive research work (on-farm trials) in Salima ADD has been carried out in the fiscal year of 1991/92.

(i) Inter cropping system test on hybrid maize and grain legume
(ii) Inter cropping system test on cassava and maize
(iii) Fertilizer test for maize in the lakeshore area and
(iv) Fertilizer test for cotton

These adaptive research work are carried out for the area of 50 m^2 with 4 replication for each trial item.

The ARO has made plan and design of the above research work. The ARO has entrusted these research experiments to the farmers to undertake them and supervised the farmers on farming practices. The ARO has analyzed all data collected. The results of trials are discussed and authorized as new technology in the annual Technical Services Meeting of Salima ADD.

All results obtained in the Technical Services Meeting are transferred to the ARNCs in the headquarters in Lilongwe, Project officers and technical officers in RDPs and Development Officers in EPAs. The EPAs officers demonstrate new technology in the field plots to disseminate it to the farmers.

The present constraints in the research work are summarized below: (i) lack of trained staff, (ii) shortage of transportation means of the staff, (iii) design of the research work being obliged to be simple owing to a low technical level of the entrusted farmers and (iv) insufficient budget allocated to adaptive research work (only MK 60,000 in 1991/92 budget).

(2) Extension Work in Salima ADD

The extension work is the channel to transfer the new technology form the adaptive research work to the farmers. A good communication between extension and adaptive e research work is essential to increase agricultural production.

The Agricultural Branch headed by principal Agriculture Officer (PAO) technically supports extension work in Salima ADD. Under this branch, there is

extension section which is further sub-divided into 5 sections and one unit as shown in **Figure 3.15.1.** These are (i) training section, (ii) women's programmer's section, (iii) farm mechanization section, (iv) rural industries section, (v) crops section and (vi) visual aids unit.

Administratively, extension work in Salima ADD is performed through 3 RDP (headed by Project officer) such as Bwanje Valley RDP, Nkhotakota RDP and Salima RDP under control of the PM. Each RDP is divided into EPAs (headed by Development officer) and each EPA is further divided into Section (Field Assistant). The area under Section is divided into several blocks for a Field Assistant's periodical filed visit to farmers and Farmers Clubs. The organizational chart of the field offices is illustrated on **Figure 3.15.2.**

Extension staff consist of Principal Agriculture Officer, Senior Agriculture Extension Officer in Extension section and Subject Matter Specialist (SMSs) in ADD, RDP and EPA, and Field Assistants (FAs, extension workers) in section. The total number of the field assistants is shown in **Table 3.15.3.** Each FA covers 800 to 1,000 farmers with extension work activity.

The details of activities on extension work in Salima ADD are shown in **Table 3.15.4** and are summarized below;

(i) Field demonstration consisting of on farm demonstration, mini-plots, block demonstration, block garden and EPA field
(ii) Field visit by FAs
(iii) Film show: one to two times a year, produced by the MOA
(iv) Annual agricultural show
(v) Monthly meeting and block meeting

Location	Frequency of meeting	Chairman of meeting	Participant
ADD	monthly	PM	POs, SMSs of ADD
RDP	monthly	PO	Asst. PO, SMSs of RDP
EPA	fortnightly	DO	Asst. DO, SMSs of EPA
Block	fortnightly	FAs	Farmers

Remarks:
PM: Program manager of Salima ADD
PO: Project officer
SMS: Subject Matter Specialist
DO: Development office
FA: Field assistant

(vi) Publication

- agricultural extension and training policy (once every 2 year, MOA in Lilongwe)
- farmers news letter (monthly, MOA in Lilongwe)
- extension companion (4 times a year, Salima ADD)

The present main constraints in extension work are : (i) lack of trained staff, (ii) shortage of transportation means for staff and (iii) shortage of budget allocated to the extension sector (about MK 19,800 in the 1991/92 fiscal year).

3.15.4 TRAINING IN SALIMA ADD

Under the PAO in Agriculture Branch, there is Training Section headed by Training Officer that is responsible for training to the farmers and staff of Salima ADD. The training section has two organizations of Nkhotakota Residential Training Centre and Chitala Farm Institute. Training staff totals 14 consisting of 2 in Senga Bay headquarters of Salima ADD, 7 in the Chitala Farm Institute and 5 Nkhotakota Residential Training Centre as shown in **Table 3.15.5**.

The Training Officer is responsible for preparation of the annual training programs based on request from RDP and the training program are authorized by the meeting to which all Project Officers in Salima ADD attend.

There are two types of the training courses both for the farmers and Salima ADD staff: One is day training course conducted in EPA and the other is residential training course undertaken in Nkhotakota Residential Training Centre, Chitala Farm Institute and the conference room in Salima ADD headquarters. The outline of these training courses are summarized in **Table 3.15.6**.

In addition, in-service training is often carried out for the high ranked officers who are engaged in the new job fields such as horticulture, rice culture, land husbandry and irrigation. Further farmers' mobile courses, not a training course, have performed.

The training activities of Salima ADD in the 1991/92 fiscal year are described in **Table 3.15.7** and summarized below:

Activity	No. of course	No. of participant
Farmers' day training	233	7,965
Farmers' residential training	23	438
Staff day training	295	3,185
Staff residential training	35	302

The present constraints in training work in Salima ADD are (i) lower rate of farmers' attendance to the training course, (ii) shortage of budget allocated to the training sector (MK 7,200 in the 1991/92 fiscal year), (iii) shortage of transportation means such as bus and (iv) shortage of trained trainers. Especially improvement of transportation means will be essential to increase women's attendance to the training courses.

3.15.5 CREDIT IN SALIMA ADD

The credit for the farmers in Salima ADD is available through farmers clubs from SACA. Individual loans should only be considered in exceptional cases.

The Credit branch headed by Agricultural and Marketing Officer fully supports the credit works to the farmers in Salima ADD. Every EPA establishes a Loan Committee of which members comprise Development officer (chairman), Credit/Marketing Assistant (secretary), the relevant Field Assistant (member) and at least two farmer representatives (member). An accurate farm input requirement is collected from the farmers club and assessed by the committee. The Credit/Marketing Assistant is responsible for all arrangement work needed for credit supply in the field level.

In Salima ADD there are two kinds of credit such as short term loans and medium term loans. The short term loans are mainly applied to the seasonal crops such as maize, rice and cotton in the ADD, medium loans to livestock, farm tools, etc. The interest rate of these loans is 18 % per annum for short term and 20 % for the medium term. Both loans are provided to the farmers in kind through the form of approved credit packages. In the 1991/92 fiscal year, there are 10 packages for maize cultivation , 3 packages for rice and 4 packages for cotton as shown in **Table 3.15.8**. At present it is estimated that about 20 % of the farmers in Salima ADD receive these loans.

The loan amount and repayment condition for short term credit package in the recent years in Salima ADD is shown in **Table 3.15.9** and medium credit package in **Table 3.15.10**. The loan amount of medium term credit is as small as 3 % of the short term credit.

The loan amount with short term loans has remarkably increased for the last six years except 1991/92 when a great drought occurred. The total loan amounts in 1991/92 have become about 5 times of that in 1986/87. Also the number of participant farmers in 1991/92 become about 2 times of that in 1986/87.

With respect to recovery of the loans, the recovery rate has exceeded 85 % except the recent two years of 1990/91 and 1991/92. The low recovery rate in 1990/91 year seems that the farmers could not perform repayment due to low purchased prices of agricultural products of ADMARC and the one in 1991/92 due to crop damages caused by the drought.

The Salima ADD considers to increase 20 % of the present farmers' participant ratio to 35 % by the 1994/95 fiscal year through the following strategy;

(i) To encourage women to participate as independents borrowers by joining the existing mixed farmers clubs or forming pure stand women's clubs,
(ii) To diversify the credit packages to the off-farm activities such as mat making, tin smith and other related agro-business (e.g. milling equipment), and
(iii) To increase credit fund.

3.16 FARMERS' ORGANIZATION

3.16.1 FARMERS CLUBS

Principally the basic concept of the farmers club was formulated early 1960's to cut down administrative and servicing costs necessary for the credit services to the small holder farmers.

The farmers club is the spontaneous farmers' organization having no legal basis, however, is traditionally recognized as development agency. It has played an important role in (i) a parent receiver of agricultural credit from SACA, (ii) an unit to manage resources in local community and (iii) an unit to conserve its catchment area.

At present, there are two type of the farmers clubs in Salima ADD: (i) Mixed farmers club and (ii) women's farmers club. Before 1983 only the type of mixed farmers clubs were available. Since 1983, the Ministry of Agriculture has made every endeavour to make up the women's clubs which bring women into the mainstream credit program as independent borrowers. The number of women's clubs and women's participants has

increased year by year, becoming 21 times for women's club and 5 times for women's participant during the period of 6 years from 1986/87 to 1991/92.

Table 3.16.1 indicates number of farmers clubs instituted and participants from 1986/87 to 1991/92 in Salima ADD. At present about 1,000 farmers clubs are instituted and about 24,000 farmers attend these farmers clubs. It turns out that about 20 % of the total farmers in Salima ADD enter for these farmers clubs. With regard to women's attendance, about 30 % of the total membership and 25 % of the total farmers clubs are occupied by women.

The organization of the typical farmers club in Salima ADD is illustrated on **Figure 3.16.1.** The main committee headed by chairman comprises 10 members in general who are chairman, Secretary, Treasurer, their vices and 4 committee members. Under the main committee, the sub-committee has 4 committees such as finance, agriculture, discipline and credit.

The farmers clubs have their constitution and the rules. Based on the constitution and the rules, management for the farmers club is performed.

3.16.2 FARMERS' IRRIGATION SCHEME COMMITTEE

The government has promoted realization of irrigation schemes since the middle of 1960's in Malawi. There are two types of irrigation schemes of (i) the government run type and (ii) farmers' self-help type. There are only farmers' self-help irrigation schemes in the study area. These are (i) Mtandamula scheme (about 230 ha) and (ii) Mwalawoyrea scheme (110 ha). The basic information of these schemes are shown in **Table 3.16.2.**

In these schemes, a farmers' participatory approach has been made in the construction of the irrigation schemes and management of the scheme has been undertaken by the farmers themselves through the scheme committee. The plan and design of the schemes have been carried out by Salima ADD. The construction of the facilities has been done both Salima ADD and the farmers involved in the schemes. The materials and equipment for construction have been owed by Salima ADD, and labour necessary for construction of canals and related works has been contributed by the farmers. The scheme committee for operation and maintenance of the scheme has been made up by farmers themselves under guidance and help of Salima ADD. After construction, the scheme manager, staff of Salima ADD has fully support management of the schemes technically and administratively.

At present the number of participant farmers are 472 in the Mtandamula and 198 in Mwalawoyera.

The scheme committees of both schemes were established in August, 1990 for the Mwalawoyera and 1885/86 for the Mtandamula. These scheme committees have no legal basis.

The scheme committee is composed of 4 committees such as (i) Land allocation, (ii) Scheme management, (iii) Block and (iv) Farmers club. Land allocation committee is composed of one chairman, one secretary and 8 committee members. And the committees other than land allocation committee is organized by one chairman, one vice chairman, one secretary, one vice secretary, one treasurer and 4 committee members.

The chairman of Land allocation committee is nominated by the group village headman of the villages involved in the scheme. The chairmen and the main posts of another committees are elected by all the participant farmers. The service period of the chairman and the posts are tree years and they work voluntarily without salaries.

The general assembly meeting is held once a year and the periodical meeting is held twice a month.

The main function of the land allocation committee is to allocate land to the farmers and solve disputes about land. The scheme management committee conducts overall daily routine work in the field mainly with respect to irrigation water delivery and land use condition. The block committee mainly controls irrigation water delivery and farming within the irrigation blocks. The farmers credit club committee covers the work of credit from SACA.

With regard to financial management of the committee, the main revenues are crop incomes from the communal garden, some due, etc. and outgoes are costs for stationary and sundry.

The present constraints encountered in the scheme is summarized in **Table 3.16.2.**

3.17 FARMERS' EXPECTATIONS FOR FUTURE AGRICULTURAL AND RURAL DEVELOPMENT

Along with farmer' economic survey, farmers' expectation for future agricultural and rural development were investigated by questioning 120 farmers in the study area.

Ten items for agricultural development and seven items for rural development have been checked upon.

(1) Agricultural Development

The results of the investigation are shown in **Table 3.17.1**. The expectation ranked first concentrates on the construction of irrigation facilities, followed by construction of drainage facilities, reinforcement of extension services, improvement of marketing system, and reinforcement of credit services.

(2) Rural Development

The results of the investigation are shown in **Table 3.17.2**. In this study, the farmers' expectations for future rural development is analyzed based on the farmers' categories such as the male headed farmers , the female headed farmers and the farmers living on both crops and fisheries. Generally the construction of wells, hospitals, and mills are the mostimportant expectations of the farmers in the study area. Some different perception for future rural development, however, appears as follows:

(i) In the expectations of the farmers living on both crops and fisheries, the construction of wells ranks first, the construction of market second, and the construction of hospital third. These farmers live by lake Malawi and have to take a long time to go the hospitals located in Mtakataka. They have to take lake water with less water quality for drinking due to shortage of wells.

(ii) In the female headed farmers with no husband, the well construction ranks first, followed by the construction of mill and provision of hospital. The female headed farmers have to be engaged in farming activities by themselves and further they have to undertake fetching water and milling corn/paddy and health care of which activities are very hard in workload. This expectation for the rural development is considered to be keen and serious for women.

4. ASSESSMENT OF DEVELOPMENT POTENTIAL FOR IRRIGATION

4.1 LAND RESOURCES FOR IRRIGATION DEVELOPMENT

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. The suitable land is mostly located on the rift valley floor extending between Lake Malawi and the escarpments as presented below:

Name of river	Total catchment area of river (ha)	Suitable land area			
		Paddy		Upland crops	
		TA (ha)	DOE (ha)	TA (ha)	DOE (ha)
Nadzipulu	36,100	2,630	2,630	4,210	4,210
Namikokwe	35,700	5,000	4,790	6,790	6,790
Livulezi	70,200	11,670	9,680	20,150	15,270
Bwanje	108,000	28,210	26,860	40,640	39,290
Total	250,000	47,510	43,960	71,790	65,560
% of total catchment area		19	18	29	26

Note: TA : Suitable lands within the whole catchment area
DOE: Suitable lands within the catchment area of the river lying between Lake Malawi and the escarpments

4..2 WATER RESOURCES

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) the Lake Malawi, and (iv) groundwater. The major rivers in the Study area are the Nadipulu, 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. A dam site on the Nadzipulu river is located near Chilasamongo village on the Mwachikula river, a

tributary of the Nadzipulu river, and has a catchment area of about 45 km^2. The possible reservoir capacity is estimated at 25,000,000 m^3. A dam site on the Livulezi river is located near Thondoya village and has a catchment area of about 320 km^2. The possible reservoir capacity is 12,000,000 m^3. There will be constraints with the design and construction of the dams on the above 2 rivers. The constraints are: (i) large-scale dam and reservoir capacity which should include the dead water capacity for huge sedimentation, (ii) large construction cost; 1 billion Japanese Yen for the dam embankment of 500,000 m^3, and (iii) compensation for the inhabitants in and around the reservoir area. Since the technical, economic, and social viabilities would be low in accordance with the above constraints, 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), first to a distribution pond to be located at a higher point than the proposed development area for applying gravity irrigation systems. The development area should be extended along the lakeshore to minimize both the construction and operation costs of irrigation using pumped lake water. Despite the fact that Lake Malawi has the most stable and inexhaustible water resource, it is excluded because of: (i) unfavourable soil conditions along the lakeshore areas, (ii) unsuitable topographic conditions: no favourable areas for the distribution pond, and (iii) difficulty in purchasing the spare parts for the pump equipment in Malawi.

The groundwater yield data are too limited to ensure the technical assessment for irrigation development. Although some possibility for groundwater irrigation was identified through the same investigation, further investigation is required to confirm its potential. Taking such groundwater development conditions in the Study area into consideration, the present Study excludes groundwater as the water resource for the Bwanje Valley Irrigation Project.

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, design year as shown hereinafter, is given on the next page.

Month	River discharge		
	Nadzipulu river (m3/s)	Namikokwe river (m3/s)	Livulezi 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

4.3 MAXIMUM POTENTIAL AREA FOR IRRIGATION DEVELOPMENT

In order to estimate the maximum potential area for irrigation development, a preliminary water balance study was carried out using the available water and irrigation water demand for the design year. The design year is defined as the year with an annual rainfall depth of a 5-year return period. The design year is 1969/70 with a rainfall depth of 750 mm.

Irrigation water demand includes crop water consumption, water losses in the conveyance of water and irrigation activities (water requirement; shown in Annex II.3.3), and river maintenance water. The required river maintenance flow water discharge is the minimum flow discharge in 1969/70 in each river. The available water is the river flow and precipitation in 1969/70. The results of the preliminary water balance study are shown below:

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

4.4 PRELIMINARY LAYOUT OF THE IRRIGATION PROJECTS

A preliminary irrigation plan was carried out to select the irrigation area in the study area based on the results of land and water resources in the study area. A preliminary layout of the irrigation plan is undertaken by using the existing topographic map on a scale of 1/50,000 with 50 feet contour interval.

4.4.1 NADZIPULU RIVER BASIN

Based on the aerial photos taken on August 1992 and the existing 1/50,000 map prepared in 1971, the river course is relatively stable between railway bridge and Mathemba village. However, the river course changed drastically east direction at Mathemba village.

The proposed site lies in the left bank of the moved Nadzipulu river. The irrigable area (Lower Nadzipulu Irrigation area) is about 270 ha as shown in **Figure 4.3.1.** A diversion weir at Kachindamoto village is considered. The water intake at this weir will be conveyed by a main canal which acts as a flood protection dike to the northward. The main canal will be extended up to the north end of the irrigable area. The project site should be reclaimed with gentle slope towards to the river direction so as to make easy drain to the river.

The preliminary irrigation plan will be further scrutinized with respect to intake site on the Nadzipulu river, sediment and flood control.

4.4.2 NAMIKOKWE RIVER BASIN

The upper stream catchment area of the Namikokwe river is covered with Mua-Livulezi forest reserve. Comparing with other rivers, sediment is lesser. New two irrigation projects were formulated. One, the upper Namikokwe Irrigation area is the dambo area of 650 ha extending on the left bank of the Namikokwe river. It starts about one Km south east of Mlongoti village and stretches to eastward. The other, the Lower Namikokwe Irrigation area, lies parallel with the Mtandamula self-help irrigation scheme. It extends about 290 ha along the north boundary. Sites of the projects are shown in **Figure 4.3.1** . In addition to two projects, the Mtandamula self-help irrigation scheme is considered to involve the project for rehabilitation.

The total irrigable area including the existing Mtandamula self-help scheme (230 ha) is about 1,170 ha. In order to get stable irrigation water, an intake structure

should be constructed before the Escarpment. Diversion canal will pass several villages such as Bwanali, Nankumba, and turn north at Msolo village. The Namikokwe river will be shifted to north direction near Mlongoti village because diversion canal will act as flood protection dike by crossing the present river course. Since the river shifted to the northward, a flood protection dike should be constructed along the north boundary of the project. Irrigation water conveyed by diversion canal will be distributed to the field by the main canal which will run the south boundary of the project. Irrigation water to Mtandamula scheme and its neighbouring area will be distributed through this canal.

According to the results of the water assessment for the Namikokwe river, only 1,104 ha out of 1,170 ha could be developed. Issues still remain such as intake site of irrigation water, sediment, route of the diversion and main canal, flood control and topographic condition.

4.4.3 LIVULEZI RIVER BASIN

The upper stream catchment area of Livulezi river shows almost platform and has been cultivated for upland crops mainly maize. The river course is stable up to the Escarpment. However, after the Escarpment, especially downstream the railway crossing, the river course is very unstable and much sedimentation could be recognized. In the mid of 1970s, the river course changed drastically to the east direction.

The irrigation area, the Lower Livulezi Irrigation area, was delineated in this river basin. It is the dambo area of about 750 ha extended downstream M18 road in between New road (connecting Kbulika II village with Stolo village) and D81 road which is not used at present as shown in **Figure 4.3.1.** According to the results of water assessment of the Livulezi river, only 946 ha could be developed. The area used to be affected by the flood overflowed M18 road, however recently M18 road has been risen up. As a result of this, the road may act as flood protection dike of the proposed area. About 2 km of the dike will be constructed at about one km downstream of the M18 for the purpose of reservoir so as to prolong irrigation period during the rainy season. The constraint of he area is water resources in the dry season. It might be impossible to intake water direct from the Livulezi river because the Livulezi river has little water in the dry season and its discharge does not reach the M18 road. Further study on water resource and drainage is required.

Based on the results of assessment of development potential for irrigation, it may be concluded that the total areas (about 2,200 ha) of the following five areas are delineated for irrigation development.

(i) Lower Nadzipulu Irrigation area (270 ha)
(ii) Lower Namikokwe Irrigation area (290 ha)
(iii) The existing Mtandamula scheme (230 ha)
(iv) UpperNamikokwe Irrigation area (650 ha) and
(v) Lower Livulezi Irrigation area (750 ha)

ANNEX I
ASSEEMENT OF DEVELOPMENT POTENTIAL

Tables

Table 2.3.1 SMALLHOLDER (PRODUCER) PRICES BY ADMARC

Unit: MK/kg

Crop	1988/89	1989/90	1990/91	1991/92	1992/93*	Change 91/2-92/3
Maize	24.00	26.00	27.00	29.70	43.00	44.8
Paddy						
Grade I	300.00	350.00	370.00	390.00	470.00	20.5
Grade II	100.00	100.00	110.00	120.00	150.00	25.0
Groudnuts						
Shelled	63.00	77.00	85.00	84.00	105.00	25.0
Unshelled	42.00	51.00	53.00	58.00	65.00	12.1
Tobacco						
NDDF						
Grade C1	240.00	275.00	275.00	335.00	335.00	0.0
Grade C2	233.00	165.00	165.00	325.00	325.00	0.0
Grade G1	190.00	200.00	250.00	275.00	275.00	0.0
Grade G2	121.00	165.00	165.00	165.00	165.00	0.0
SDDF						
Grade S1	207.00	330.00	330.00	330.00	330.00	0.0
Grade S2	198.00	245.00	300.00	300.00	300.00	0.0
Grade T1	124.00	220.00	255.00	255.00	255.00	0.0
Grade T2	87.00	125.00	160.00	160.00	160.00	0.0
Grade X	23.00	35.00	42.00	42.00	42.00	0.0
Sun Air						
Grade C1	218.00	300.00	300.00	300.00	300.00	0.0
Grade C2	209.00	250.00	250.00	250.00	250.00	0.0
Grade G1	182.00	215.00	215.00	215.00	215.00	0.0
Grade G2	102.00	150.00	150.00	150.00	150.00	0.0
Oriental						
Top Grade	285.00	327.00	343.00	330.00	382.00	15.8
Grade B1	106.00	111.00	122.00	210.00	240.00	14.3
Grade Kapp	50.00	50.00	53.00	40.00	40.00	0.0
Cotton						
Grade A	77.00	81.00	81.00	90.00	92.00	2.2
Grade B	37.00	39.00	39.00	45.00	45.00	0.0
Pulses						
Soybeans	47.00	60.00	65.00	65.00	65.00	0.0
Guar Beans	25.00	30.00	33.00	33.00	41.00	24.2
Beans	40.00	55.00	60.00	60.00	60.00	0.0
Sugar beans	48.00	60.00	70.00	70.00	70.00	0.0
Cowpea	30.00	35.00	37.50	37.50	37.50	0.0
Sesame	45.00	60.00	80.00	80.00	80.00	0.0
Oil Seeds						
Sunflower	31.00	50.00	55.50	55.50	55.50	0.0
Caster seeds	33.00	35.00	35.00	35.00	35.00	0.0
Cashew Nuts						
Grade I	100.00	150.00	155.00	175.00	220.00	25.7
Grade II	35.00	50.00	50.00	65.00	82.00	26.2
Wheat	50.00	55.00	55.00	55.00	55.00	0.0
Cassava	10.00	12.00	15.00	15.00	15.00	0.0
Chili	200.00	400.00	400.00	400.00	400.00	0.0

Source: ADMARC
Remarks: *; effective on April 1, 1993

Table 2.3.2 INPUT PRICES BY ADMARC

Crop	1991/92	1992/93*	Change (%) 91/2-92/3
SEED (Tambala/kg)			
Maize			
MH12/16	250.00	365.00	46.0
MH17/18	250.00	327.00	30.8
NSCM41	250.00	335.00	34.0
UCA & CCA	200.00	298.00	49.0
Paddy	70.00	98.00	40.0
Groudnuts			
Shelled	150.80	157.00	4.1
Unshelled	98.50	102.00	3.6
Tobacco (Tambala/gram)			
Dark western	93.00	106.00	14.0
Oriental	93.00	106.00	14.0
Burley	109.00	125.00	14.7
Cotton (Tambala/gram)	20.00	30.00	50.0
Pulses			
Beans pure type	146.00	146.00	0.0
Soybeans	90.00	105.00	16.7
Cowpea	64.00	68.00	6.3
Pigeon peas	64.00	72.00	12.5
Sunflower			
Selected seed	80.00	84.00	5.0
Hybrid seed	80.00	120.00	50.0
Sorghum	90.00	92.00	2.2
Wheat	105.00	115.00	9.5
FERTILIZERS (MK/50kg)			
Urea	45.00	60.80	35.1
DAP	49.00	66.15	35.0
CAN	48.00	69.00	43.8
23:21:0+4S	50.00	70.00	40.0
SA	42.00	49.80	18.6
"S"	55.00	69.00	25.5
"B"	65.00	97.20	49.5
"C"	56.00	73.60	31.4
"D"	58.00	93.20	60.7

Source: ADMARC
Remarks: *; effective on October 1, 1992

Table 2.3.3 CEREAL BALANCE FOR THE 1992/93 MARKETING YEAR, SEPTEMBER 30, 1992
(NEWS - NATIONAL EARLY WARNINGSYSTEM FOR FOOD SECURITY)

Item	Maize	Rice	Wheat	Millet/ Sorghum	Total Cereal	Remark
A. Total Domestic Availability (A1+A	906.2	20.4	6.8	8.2	941.6	Opening stocks plus gross domestic production
A.1 Opening Stocks on April 1, 1992	249.5	0.2	5.5	0.8	256.0	Carryover stocks of commodities held by ADMARC and the National Strategic Grain Researves (SGR) on April 1, 1992 at the beginning of the marketing year in Malawi
A.2 Gross Production	656.7	20.2	1.3	7.4	685.6	Estimated or forecasted harvested production
B. Total Requirement (B.1+B.2+B.3)	1,740.0	32.0	44.0	29.0	1,845.0	Gross consumption requirements plus closing stock requirements plus expected exports
B.1 Consumption Requirements	1,620.0	30.0	44.0	29.0	1,723.0	Aggregated domestic consumption requirements (food and non food) over the full marketing year
B.2 Closing Stock Requirements on March 31, 1992	90.0	2.0	0.0	0.0	92.0	The sum of ADMARC working stocks and the Strategic Grain Researve (SGR) on March 31 at the end of the marketing year in Malawi
B.3 Current "Export" Commitmen	*30.0*	*0.0*	*0.0*	*0.0*	30.0	*Forecast level of exports over full marketing yea* including intra SADCC trade. Exports refer to a contract entered into between ADMARC and WFP to sell maize to WFP in order to feed the population of refugees from Mazambique living in Malawi and whose requirements are not catered in the above Table.
C. Domestic Balance (A-B)	-833.8	-11.6	-37.2	-20.8	-903.4	Total domestic availability less total requirement
D. Commodity Cross Substitution	20.8	0.0	0.0	-20.8	0.0	Required substitutions between different cereals owing to non-availability of specific cereals.
E. Shortfall (-) / Surplus (+)	-854.6	-11.6	-37.2	0.0	-903.4	Domestic balance after taking account of *commodity cross substitutins. Under normal* circumstances, a shortfall (negative domestic balance) indicates an import requirment, while a surplus (positive domestic balance) indicates amounts availabile over and above currently foreseen requirements.
F. Current Imports Being Planned	735.0	0.0	37.2	0.0	772.2	Sum of imports (commercial and aid) so far planned bu not yet received.
G. Uncovered Shortfall (-) / Unallocated Surplus (+) (E+F)	-119.6	-11.6	0.0	0.0	-131.2	Shortfall/Surplus plus current import arrangements
H. Estimated Closing Stock on *March 31, 1992*	0.0	0.0	0.0	0.0	0.0	Projected end of marketing year national cereal *stocks on the basis of surrent imports/exports* arrangements.
I. Current Stock Level on September 30, 1992	163.4	0.2	1.0	0.6	165.2	Stocks of commodities held by ADMARC and the strategic Grain Reserve on september 30, 1992.

Source: Second Quarterly Bulletin for the 1992-93 marketing Year - Position at September 30, 1992
Planning Division, Ministry of Agriculture

Table 2.3.4 MAIZE PRODUCTION AND REQUIREMENTS BY RDP

	ADD/RDP	No. Farm Families (nos.)	Ave.Famil. Members (persons)	Total population (persons)	Maize * Requirement (ton)	Production a/o Apr.2 '92 (ton)	Balance (ton)	Surplus/ Deficit (%)
I.	NGABU							
	1. Nsanje	60,290	5.00	301,450	54,261	30	-54,231	-100
	2. Chikwawa	39,635	5.00	198,175	35,672	212	-35,460	-99
II.	BLANTYRE							
	3. Mwanza	26,308	4.50	118,386	21,309	1,717	-19,592	-92
	4. Shire Highlands	217,410	4.50	978,345	176,102	27,045	-149,057	-85
	5. Mulanje	94,437	4.50	424,967	76,494	40,239	-36,255	-47
	6. Phalombe	49,301	4.50	221,855	39,934	13,752	-26,182	-66
III.	LIWONDE							
	7. Mangochi	75,716	4.50	340,857	61,354	661	-60,693	-99
	8. Namwera	60,201	4.50	270,906	48,763	19,238	-29,525	-61
	9. Balaka	57,081	4.50	256,865	46,236	205	-46,031	-100
	10. Kawinga	66,069	4.50	297,311	53,516	8,978	-44,538	-83
	11. Zomba	123,512	4.50	555,801	100,044	20,370	-79,674	-80
IV.	SALIMA							
	12. Bwanje	41,301	4.80	198,245	35,684	6,586	-29,098	-82
	13. Salima	42,701	4.90	209,235	37,662	6,862	-30,800	-82
	14. Nkhotakota	31,706	5.00	158,530	28,535	6,989	-21,546	-76
V.	LILONGWE							
	15. Nichew	58,771	4.50	264,470	47,605	13,617	-33,988	-71
	16. Dedza Hills	44,629	4.50	200,831	36,150	40,799	4,649	13
	17. Thiwi Lifidzi	45,096	4.50	202,932	36,528	44,572	8,044	22
	18. Lilongwe East	84,643	4.50	380,891	68,560	30,468	-38,092	-56
	19. Lilongwe West	114,401	4.50	514,805	92,665	101,668	9,003	10
VI.	KASUNGU							
	20. Kasungu	62,723	5.00	313,645	56,456	69,797	13,341	24
	21. Mchinji	69,641	5.00	348,205	62,677	25,235	-37,442	-60
	22. Dowa West	45,431	5.00	227,155	40,888	45,531	4,643	11
	23. Dowa East	33,274	5.00	166,370	29,947	24,699	-5,248	-18
	24. Ntchisi	24,425	5.00	122,125	21,983	37,040	15,058	68
VII.	MZUZU							
	25. Rumphi/N.Mz.	33,617	5.00	168,235	30,282	17,678	-12,604	-42
	26. C. Mzimba	37,802	5.00	189,010	34,022	46,981	12,959	38
	27. S. Mzimba	25,368	5.00	126,810	22,826	30,089	7,263	32
	28. Nkhata Bay	30,715	5.00	153,575	27,644	1,512	-26,132	-95
VIII.	KARONGA							
	29. Karonga	22,404	5.00	112,020	20,164	1,530	-18,634	-92
	30. Chitipa	13,771	5.00	68,855	12,394	7,906	-4,488	-36
	Total	1,732,379	4.67	8,090,862	1,456,355	692,006	-764,349	-52

Remark: *; per capita comsumption at 180 kg/person/year

Source: Ministry of Agriculture

TABLE 2.4.1 RESEARCH STATIONS IN THE CENTRAL REGION

Name of station	Location	No. of researcher	Duty
(A) Main research station			
Chitedze	Lilongwe (upland)	30	Basic research work on upland crops such as maize, groundnuts, agro-forestry, cassava, sunflower:, Research areas : breeding, pathology, crop storage, seed services, farm mechanization and soil laboratory
(B) Sub research station			
(1) Lifuwu	Salima (low land)	3	Basic research on rice: Research areas such as seed services of rice, agronomy on winter grain legumes (soybeans, phaseolus beans, cowpeas)
(2) Chitala	Salima (low land)	0	Basic research work on upland crops in low land, objective crops and research areas areas same as in the Chitedze station Planning and design are sent by the Chitedze station and the results of research work to the Chitedze station
(C) Trial sites			
(1) Dembeke	Dedza (upland)	0	Basic research crops:, maize, wheat and temperate fruits Research areas:, breeding and agronomy Planning and design of maize and wheat are made by the Chitedze station, Temperate fruits by the Bvumbwe main research station
(2)Tsangano	Ntcheu	0	Basic research crops:, maize wheat, Irish potato and temperate fruits Research areas:, agronomy and crop storage Planning and design for maize and wheat are made by the Chitadze station and Irish potato by the Bvumbwe station

TABLE 3.1.1 (1/3) BASIC DEMOGRAPHIC DATA IN THE STUDY AREA

Administration	Area (Km2)	Total population			Population growth rate	Total population classified by sex in 1987		Sex ratio for male (%)	Total number of household in 1987	Average farm size in 1987	Population density 1987 (persons/ Km2)
		1987	1977	1966	1977-87	male	female				
(A) whole Malawi	94,276	7,988,507	5,547,460	4,039,583	1.44	3,867,136	4,121,371	48	1,859,572	4.3	85
(B) Central Region	35,592	3,110,986	2,143,716	1,474,952	1.45	1,521,234	1,589,752	49	716,648	4.3	87
(C) Southern Region	31,753	3,965,734	2,754,891	2,067,140	1.44	1,904,612	2,061,122	48	952,641	4.2	125
(D) Related Districts to the Study Area											
(1) Dedza district (all)	3,624	411,787	298,190	230,715	1.38	189,950	221,837	46	95,404	4.3	114
Traditional administrations(TAs) in Dedza district related to the Study Area											
1. T.A.Kasumbu	565	42,209	30,888	23,169	1.37	19,538	22,671	46	10,128	4.2	75
2. T.A.Kachindamoto	622	50,836	38,312	28,073	1.33	24,232	26,604	48	11,757	4.3	82
3. S.T.A. Kamenya Gwaza	174	21,937	14,623	11,001	1.50	10,131	11,806	46	4,979	4.4	126
4. Dedza city	18	16,735	5,578	2,318	3.00	7,902	8,833	47	3,670	4.6	930
sub-total	1,379	131,717	89,401	64,561	1.47	61,803	69,914	47	30,534	4.3	96
(2) Ntcheu district (all)	3,424	358,767	226,454	164,685	1.58	164,870	193,897	46	81,006	4.4	105
Traditional administrations(TAs) in Ntcheu district related to the Study Area											
1. T.A. Kwataine	220	30,690	23,584	20,406	1.30	14,072	16,618	46	6,973	4.4	140
2. S.T.A. Makwangwala	531	61,674	45,471		1.36	28,538	33,136	46	14,462	4.3	116
3. T.A. Njolomole	251	57,723	30,485	24,015	1.89	25,878	31,845	45	13,420	4.3	230
4. T.A. Chakhumbira	168	28,790	12,137		2.37	12,610	16,180	44	6,690	4.3	171
5. S.T.A. Goodson Ganya	850	68,136	49,950		1.36	32,268	35,868	47	15,576	4.4	80
6. T.A. Masasa	210	18,733	9,746		1.92	8,808	9,925	47	4,923	3.8	89
sub-total	2,230	265,746	171,373	44,421	1.55	122,174	143,572	46	62,044	4.3	119
(3) Mangochi district	6,273	496,578	302,341	232,692	1.64	234,592	261,986	47	122,930	4.0	79
Traditional administrations(TAs) in Mangochi district related to the Study Area											
1. T.A. Mponda	422	42,358	21,769	17,653	1.95	19,627	22,731	46	10,590	4.0	100
Total for the related TAs	4,031	439,821	282,543	126,635	1.56	203,604	236,217	46	103,168	4.3	109
(E) Estimate for the Study Are	2,500	293,767	183,050		1.60	136,068	157,700	46	68,402	4.3	118

TABLE 3.1.1 (2/3) BASIC DEMOGRAPHIC DATA IN THE STUDY AREA

Administration		Population classified by age 1987				Population classified by age 1977			
		0 to 4	5 to 14	15 to 64	over 65	0 to 4	5 to 14	15 to 64	over 65
(A) whole Malawi		1,393,950	2,286,954	3,968,987	338,611	1,080,116	1,395,961	2,813,879	257,504
	(%)	17	29	50	4	19	25	51	5
(B) Central Region		569,483	878,394	1,539,629	123,480	433,823	525,582	1,090,139	94,172
	(%)	18	28	49	4	20	25	51	4
(C) Southern Region		664,002	1,148,453	1,977,333	175,946	524,672	693,284	1,405,031	131,904
	(%)	17	29	50	4	19	25	51	5
(D) Related districts to the Study Area									
(1) Dedza district (all)		77,887	120,939	193,331	19,630	63,326	72,900	146,300	15,664
	(%)	19	29	47	5	21	24	49	5
Traditional administrations(TAs) in Dedza district related to the Study Area									
1. T.A.Kasumbu		8,797	12,258	19,467	1,687	6,938	7,358	15,064	1,528
2. T.A.Kachindamoto		9,079	14,919	24,660	2,178	7,554	9,239	19,174	2,345
3. S.T.A. Kamenya Gwaza		3,992	7,038	9,955	952	3,110	4,077	6,656	780
4. Dedza city		3,095	5,084	8,159	397	1,095	1,397	2,939	150
sub-total		24,963	39,299	62,241	5,214	18,697	22,071	43,833	4,803
	(%)	19	30	47	4	21	25	49	5
(2) Ntcheu(all)		63,940	107,645	169,067	18,115	42,866	59,538	111,914	12,136
	(%)	18	30	47	5	19	491	49	5
Traditional administrations(TAs) in Ntcheu district related to the Study Area									
1. T.A. Kwataine		5,121	9,083	14,811	1,675	4,477	6,103	11,471	1,523
2. S.T.A. Makwangwala		10,506	18,028	29,602	3,538	8,263	11,477	23,054	2,677
3. T.A. Njolomole		10,771	17,437	26,445	3,070	5,751	8,280	14,736	1,718
4. T.A. Chakhumbira		5,438	9,109	13,091	1,152	2,356	3,433	5,773	575
5. S.T.A. Goodson Ganya		11,860	20,555	32,485	3,236	9,319	12,768	25,333	2,530
6. T.A. Masasa		3,501	5,748	8,618	866	1,990	2,558	4,760	438
sub-total		47,197	79,960	125,052	13,537	32,156	44,619	85,127	9,461
	(%)	18	30	47	5	19	26	50	6
(3) Mangochi district (all)		84,896	137,859	250,279	23,544	57,639	73,348	152,340	19,014
	(%)	17	28	50	5	19	24	50	6
Traditional administrations(TAs) in Mangochi district related to the Study Area									
1. T.A. Mpando		8,202	12,985	19,529	1,642	4,378	6,101	10,270	1,020
	(%)	19	31	46	4	20	28	47	5
Total of all the related TAs in 3 districts		80,362	132,244	206,822	20,393	55,231	72,791	139,230	15,284
	(%)	18	30	47	5	20	26	49	5
(E) Estimate for the Study Area		53,501	88,956	137,960	13,350				
	(%)	18	30	47	5				

Data source: Malawi population and housing census 1987, Preliminary report
Malawi population and housing census 1987, summary of final results
Malawi population census 1977, final report
Malawi population census 1966, final report

TABLE 3.1.1 (3/3) BASIC DEMOGRAPHIC DATA IN THE STUDY AREA

Administration	Crude birth rate	Crude death rate	Infant mortality rate
(A) Whole Malawi	41.2	14.1	159
(B) Region			
-Central	44.9	15.3	171
-Northern	42.4	14.7	133
-Southern	38	13	156
(C) Related districts to the Study Area			
-Dedza	45.4	16	167
-Ntcheu	40.7	17.3	162
-Mangochi	39.3	16.2	169

Data source: Malawi population and housing census 1987
summary of final results , Volume 1

Remarks:

(1) Crude birth rate is the number of births in a given one year period for every 1,000 persons

(2) Crude death rate is the number of deaths in a given on year period for every 1,000 persons

(3) The infant mortality rates have been obtained by using indirect demographic estmation techniques.

TABEL 3.1.2 BASIC DATA FOR EDUCATION IN 1987

Administration	Total population above 5	Percentage distribution of education attendance aged 5years and over: Never attended	Primary std1-3	Primary std4-8	Secondary and over	Not stated	Literacy rate (%)(1)
(A) Whole Malawi							
total	6,594,557	54.8	17.5	24.2	3.4	0.1	41.6
Male	3,178,708	44.7	19.7	30.4	5.1	0.1	52.4
Female	3,415,849	64.3	15.5	18.4	1.7	0.1	31.6
(B) Central Region							
total	2,541,503	55.8	18.1	23	3	0.1	41.3
Male	1,240,231	46.3	20	29.1	4.5	0.1	51.5
Female	1,301,272	64.9	16.2	17.3	1.5	0.1	31.6
(C) Related districts to the Study Area							
- Dedza							
total	333,900	67.9	14.6	15.8	1.6	0.1	30
Male	151,628	59	17.7	20.6	2.6	0.1	39.3
Female	182,272	75.3	12.1	11.8	0.7	0.1	22.2
- Ntcheu							
total	294,827	56.7	20.1	21.2	2	0.1	40
Male	133,457	47	22.7	26.9	3.3	0.1	50.6
Female	161,370	64.8	17.9	16.4	0.9	0.1	31.3
- Mangochi							
total	411,682	59.1	16.1	21.4	3.3	0.1	23.3
Male	192,865	47.9	19	27.9	5.1	0.1	33.8
Female	218,817	69.3	13.5	15.3	1.8	0.1	14

	Total population above 5	Never attended	Primary std 1-8	Secondary and over
(D) Traditional administrations(TAs) related to the Study Area				
(1) Dedza district				
- T.A.Kasumbu	33,412	75.7	23.2	1.1
- T.A.Kachindamoto	41,757	65.3	32.5	2.2
- S.T.A Kamenya Gwaza	17,945	54.4	43.2	2.4
- Dedza city	13,640	49.9	43.1	7
(2) Ntcheu district				
- T.A.Kwantaine	25,569	49.8	47.7	2.5
- S.T.A.Makwangwala	51,168	53.2	44.8	2
- T.A.Njolommole	46,952	59.6	38.4	2
- T.A. Chakhumbira	23,095	65.5	33.4	1.1
- S.T.A.Goodson Ganya	56,276	55	43.2	1.8
- T.A.Masasa	15,232	56.9	41.3	1.8
(3) Mangochi district				
- T.A Mpando	34,156	66.6	32.2	1.2
Total of all the related TAs in 3 districts	359,202	59.1	38.7	2.2
(E) Estimate for the Study Area	240,000	59	39	2

Remarks: (1) % of population aged 5 years and over who are able to read and write either Chichewa, English or both.

Data source: *Malawi Population and housing census 1987*

TABLE 3.1.3 SOCIAL LIFE CONDITIONS IN THE STUDY AREA

Items	Male headed household				Female headed household		Household of Fisheries and agriculture	Average
	TA: Kachindamoto		Other TA					
	Upland	Upland/ lowland	Upland	Upland/ lowland	Upland	Upland/ lowland		
(A) Drinking water								
1. Water quality (% for good)	59	85	63	60	80	71	50	71
2. Water quantity (% for enough)	47	46	63	40	60	33	100	47
3. Nos. of household using well (nos/one well)	151	245	180	117	157	236	213	202
(B) Fetching water								
1. Times per day	3.4	4.7	6.8	6.3	3.6	3.1	4	4.3
2. Distance to well (km)	1.1	0.6	0.8	0.6	0.7	3.2	0.9	
(C) Fetching firewood								
1. Times per week	1.6	1.7	1.9	2	1.2	1.5	2.3	1.7
2. Distance (km)	3.5	2.4	3	2.3	2.4	2.9	9.3	3.1
(D) Distance to the market and the shopping center(km)	1.4	0.6	3.3	1.7	1	1.4	8.5	1.7
(E) Medical conditions								
1. Nos of households to go to hospital(times/year)	3.8	2.6	4.1	2.8	4	2.9	8.3	3.4
2. Distance to the nearest hospital	4.9	9.2	5.6	7.2	4.6	10.8	12	8.1
(F) Kinds of diseases local people have taken(%)								
1. Malaria	81	93	71	67	60	88	75	83
2. Cold	31	50	29	67	40	25	0	36
3. Diarrhoea	38	36	29	16	40	31	0	32
4. Headache	25	21	29	0	80	25	50	26

Remarks: (1): The rusults of the interview survey for the local people in the study area in 1992; An available number of sample are 88.

(2): Upland/lowland means the household having both lands.

(3): Other TA: TAs of Masasa, Chimwala and S.C.Goodson Ganya

TABLE 3.1.4 ACHIEVEMENTS TO DATE IN WOMEN'S PROGRAMME SECTION IN SALIMA ADD

Items	1989/90	1990/91	1991/92
(A) Women group for agricultural extension	171	282	310
(B) Number of income generation groups	160	192	262
Income project by type			
(1) Crops			
Number of projects		117	202
Membership		1,232	3,515
(2) Livestock			
Number of projects		22	26
Membership		177	264
(3) Others			
Number of projects		93	38
Membership		1,842	325
(C) Field assistants working with women in blocks		137	149
(D) Field assistants working with women groups		95	99
(E) Number of women groups		167	235
(F) Attendance of women at block meeting	18,316	21,498	49,226

Data source: Salima ADD

Table 3.2.1 Agro-Ecological Zones of the Study Area

Natural Region	Zone Code	Zone Name	Altitude (m asl)	Soil Parent Material	Dominant Soil Groups and Soil Families	LGP (days)	T-mean GP (C)
Bwanje Valley (BWV)	BWV 1	Bwanje Bottomlands	475 - 550	Fluvial and lacustrine deposits	f (Namitalala, Mlangeni) v (Chilwa, Malikopi)	135 - 150	25.0 - 27.5
	BWV 2	Bwanje Lowlands	500 - 700	Fluvial and lacustrine deposits	e (Mikaju, Chipoka, Jombo) f (Mlangeni, Namitalala)	135 - 150	22.5 - 25.0
	BWV 3	Golomoti Footslopes	600 - 700	Fluvial and colluvial deposits	f (Lisungwe, Gweleweta)	135 - 150	22.5 - 25.0
Dedza Escarpment (DE)	DE 1	Lower Dedza Escarpment	550 - 1200	Gneiss	p (Walkers Ferry) e (Neno)	150 - 165	20.0 - 22.5
	DE 2	Upper Dedza Escarpment	700 - 1500	Gneiss	p (Walkers Ferry) e (Neno)	150 - 165	20.0 - 22.5
Ntcheu Foothills (NF)	NF 1	Ntcheu Foothills	600 - 1000	Gneiss	e (Mpili, Neno) p (Walkers Ferry)	150 - 165	20.0 - 25.0
	NF 2	Ntcheu Footslopes	600 - 1000	Fluvial and colluvial deposits	f (Lisungwe) e (Jombo)	150 - 165	20.0 - 22.5
Dedza Highlands (DH)	DH 2	Dedza Hills	1200 - 2200	Syenite, granite, gneiss	e (Neno) x (Nkwepela)	150 - 180	17.5 - 20.0
Ntcheu Highlands (NTH)	NTH 2	Ntcheu Escarpment	900 - 1900	Gneiss	p (Walkers Ferry) e (Neno)	165 - 195	17.5 - 22.5
Phirilongwe Hills (PH)	PH2	West and Central Phirilongwe Hills	600 - 1600	Gneiss	p (Lulwe, Nkungulu, Majete) e (Mbulumbuzi, Neno, Mpili)	150 - 180	20.0 - 25.0
Salima Lakeshore Plain (SL)	SL 1	Salima Lowland Plain	475 - 550	Fluvial, colluvial and lacustrine deposits	e (Mikaju, Jombo, Chipoka) v (Chilwa, Malikopo)	135 - 150	22.5 - 27.5
	SL 3	Salima Foot hills	500 - 800	Basement Complex	x (Nkwepela, Kapalola)) p (Walkers Ferry)	135 - 165	22.5 - 25.0

Remarks : e (eutric-fersialic) , f (fluvic) , p (paralithic) , v (vertic) , x (eutric-ferralic)
LGP ; Length of the growing period (in days)
T - mean GP ; Mean temperature during the LGP

Source : Land Resources Evaluation Project, Malawi 1992

Table 3.3.1 Extent of Soil Groups

(Unit : ha)

Soil Parent Material	Soil Group	Land Slope 1 (0 - 2%)	2 (2 - 6%)	3 (6 - 13%)	4 (13 - 25%)	5 (25 - 55%)	Miscellaneous	Total Area
A Fluvial , colluvial and/or lacustrine sediments	Ae : Eutric-fersialic	27,970	1,390	3,180	-	-		32,540
	Af : Fluvic	34,550	8,870	1,300	-	-		44,720
	Ag : Gleyic	770	-	-	-	-		770
	Am : Mopanic	7,510	-	-	-	-		7,510
	Av : Vertic	17,570	-	-	-	-		17,570
	Ax : Eutric-ferralic	3,450	-	-	-	-		3,450
	Sub - total	91,820	10,260	4,480	0	0		106,560
X Felsic and intermediate igneous and *metamorphic rocks*	Xe : Eutric-fersialic	1,220	17,290	34,450	26,060	-		79,020
	Xp : Paralithic	-	3,910	12,890	17,820	14,470		49,090
	Xx : Eutric-ferralic	-	3,820	-	-	-		3,820
	Sub - total	1,220	25,020	47,340	43,880	14,470		131,930
B Mafic igneous or netamorphic rocks	Bp : Paralithic	-	1,010	-	-	-		1,010
	Sub - total	0	1,010	0	0	0		1,010
Miscellaneous Land								
M : Marshes							1,590	
R : Very shallow soils (<30cm)							4,590	
V : Predominantly very steep slope (>55%)							4,320	
	Sub - total						10,500	10,500
Total		93,040	36,290	51,820	43,880	14,470	10,500	250,000

Table 3.3.2. (1/4) Legend of the Soil Map

Soil Unit	Area (ha)	Soil Family	Soil Classification (FAO, 1988)	Physiographical Properties: Landform	Altitude (m asl)	Drainage	Flooding	Ponding	Erosion	Soil Properties: Soil Depth (cm)	Particle Size: Topsoil (0-30cm)	Particle Size: Subsoil (>30cm)	pH (H2O) (0 - 50cm)	EC (mmhos/cm)	CEC (me/100g soil)	NPK (0 - 50cm)	Surface Stoniness + Rockiness (%)	Dominant Present Land-Use and Vegetation
A - Fluvial, Colluvial and/or Lacustrine Sediments																		
A1 - Flat or almost flat land (0 - 2%)																		
A1e - Eutric-Fersialic soil characteristics																		
A1e2	12,650	Mikaju	Haplic Luvisols	Outwash plains Lake margin plains	600 - 800	mod. well	none	slight	slight	>150 (Very deep)	Loamy sand	Sandy loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	= = v	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A1e3	16	Jombo	Haplic Luvisols Eutric Cambisols	Footslopes Outwash plains	475 - 700	well	none	none	slight	>150 (Very deep)	Sandy loam to Sandy clay loam	Sandy clay loam	5.5 - 7.0	0 - 2 (Non saline)	>10 (medium-very high)	- v +	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A1e8	13,720	Chipoka	Haplic Luvisols	Lake margin plains Outwash plains	475 - 600	mod. well + imperfect	none	none	moderate	>150 (Very deep)	Sandy loam to Sandy clay loam	Sandy clay loam	5.5 - 7.0	0 - 2 (Non saline)	>10 (medium-very high)	- = +	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A1f - Fluvic soil characteristics																		
A1f2	13,090	Namitalala	Eutric Fluvisols Mollic Fluvisols	Flood plains Depressions Outwash plains	475 - 700	poor	frequent	moderate + severe	slight	>150 (Very deep)	Variable	Variable	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- v +	<1	Seasonally wet grassland of floodplains
A1f4	1,180	L. Linjisi	Eutric Fluvisols	Depressions Flood plains	475 - 700	poor + imperfect	frequent	severe	none	>150 (Very deep)	Sandy clay loam to clay	Clay loam to clay	5.5 - 6.5	0 - 2 (Non saline)	>10 (medium-very high)	- v +	<1	Wetland cultivation (rice)
A1f5	12,920	Mlangeni	Eutric Fluvisols	Outwash plains Flood plains	475 - 700	imperfect	exceptional	moderate + severe	none	>150 (Very deep)	Sandy clay loam	Sandy clay loam to clay	5.5 - 6.5	0 - 2 (Non saline)	>10 (medium-very high)	- + +	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A1f6	3,510	Chingalo	Eutric Fluvisols	Outwash plains Lake margin plains	475 - 600	mod. well	none + exceptional	slight + moerate	none	>150 (Very deep)	Sandy clay loam	Sandy clay to clay	5.5 - 6.5	0 - 2 (Non saline)	>10 (medium-very high)	- - +	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A1f7	3,850	Linungwe	Eutric Fluvisols	Lake margin plains Footslopes	475 - 700	mod. well	exceptional	none	none	>150 (Very deep)	Loamy sand to Sandy clay loam	Sandy loam to Sandy clay loam	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	= = +	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A1g - Gleyic soil characteristics																		
A1g8	550	Mpasa	Gleyic Cambisols Eutric Gleysols	Plains Depressions	800 - 1400	poor + imperfect	none + exceptional	moderate	slight	>150 (Very deep)	Sandy loam to Sandy clay loam	Sandy clay loam to clay	5.0 - 6.0	0 - 2 (Non saline)	5 - 10 (low)	- = -	<1	maize, pulses, tobacco, groundnuts (cassava, etc.)
A1g13	210	Tenthema	Eutric Gleysols	Dambo's	1100 - 1400	poor + imperfect	none + exceptional	moderate + severe	moderate	>150 (Very deep)	Sand to Clay	Sand to Clay	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	v = v	<1	Seasonally wet grassland in upland drainage systems
A1m - Mopanic soil characteristics																		
A1m1	7,510	U. Shire	Eutric Planosols Stagnic Luvisols	Alluvial plains	500 - 600	imperfect	none	moderate	slight	>150 (Very deep)	Sandy loam to Sandy clay loam	Sandy clay loam to sandy clay	6.0 - 7.5	0 - 2 (Non saline)	>10 (medium-very high)	- - +	<1	Mopane woodland with Savannas of fertile lowlands
A1v - Vertic soil characteristics																		
A1v1	10,870	Chilwa	Vertic Cambisols Eutric Vertisols	Bottomlands Lake margin plains	600 - 750	poor	frequent	severe	none	>150 (Very deep)	clay	clay	7.0 - 8.0	2 - 4 (slightly)	>10 (medium-very high)	= = +	<1	Seasonally wet grassland of floodplains
A1v2	6,700	Malikopo	Eutric Vertisols Calcic Vertisols	Depressions Bottomlands Lake margin plains	475 - 550	poor + imperfect	none + exceptional	severe	slight	>150 (Very deep)	Sandy clay to Clay	Sandy clay to Clay	7.0 - 8.0	0 - 2 (Non saline)	>10 (medium-very high)	= = +	<1	Seasonally wet grassland of floodplains
A1x - Eutric-Ferralic characteristics																		
A1x1	3,450	Liphala	Haplic Lixisols Ferralic Cambisols	Footslopes Lowland plains	500 - 700	mod. well	none	none	slight	>150 (Very deep)	Sandy loam to Sandy clay loam	Sandy clay loam to sandy clay	5.0 - 6.0	0 - 2 (Non saline)	5 - 10 (low)	- - +	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)

Remarks: N (Nitrogen) = <0.08% (very low); - 0.08 - 0.12% (low); + >0.12% (medium-very high); v very variable. P (Phosphorus) = <6 ppm (very low); - 6 - 18ppm (low); + >18ppm (medium-very high); v very variable. K (Potassium) = <0.1me/100g (very low); - 0.1 - 0.2me/100g (low); + >0.2me/100g (medium-very high); v very variable.

(Continue next page)

Source: Land Resources Evaluation Project, Malawi (1992)

Table 3.3.2. (2/4) Legend of the Soil Map

Soil Unit	Area (ha)	Soil Family	Soil Classification (FAO, 1988)	Physiographical Properties: Landform	Altitude (m asl)	Drainage	Flooding	Ponding	Erosion	Soil Properties: Soil Depth (cm)	Particle Size: Topsoil (0-30cm)	Particle Size: Subsoil (>30cm)	pH (H2O) (0 - 50cm)	EC (mmhos/cm)	CEC (me/100g soil)	NPK (0 - 50cm)	Surface Stoniness + Rockiness (%)	Dominant Present Land-Use and Vegetation
A - Fluvial, Colluvial and/or Lacustrine Sediments																		
A2 - Gently sloping land (2 - 6%)																		
A2e - Eutric-Fersialic soil characteristics																		
A2e2	540	Mikaju	Hapli Luvisols Eutric Cambisols	Footslopes Outwash plains	475 - 700	mod. well + well	none	slight	slight	>150 (Very deep)	Loamy sand to Sandy loam	Sandy clay loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	= = v	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A2e3	850	Jombo	Hapli Luvisols Eutric Cambisols	Footslopes Valleysides	475 - 700	well	none	none	moderate	>150 (Very deep)	Sandy clay loam	Sandy clay loam to sandy clay	5.5 - 7.0	0 - 2 (Non saline)	>10 (medium-very high)	- v +	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A2f - Fluvic soil characteristics																		
A2f7	5,540	Lisungwe	Eutric Fluvisols	Footslopes	600 - 700	mod. well + well	none + exceptional	none	slight	>150 (Very deep)	Loamy sand to Sandy loam	Sandy clay loam	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	= = +	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A2f8	3,330	Gwelewesa	Eutric Fluvisols	Footslopes	600 - 700	imperfect	none + exceptional	slight + moderate	slight	>150 (Very deep)	Sandy loam to Sandy clay loam	Variable	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- v -	<1	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A3 - Sloping land (6 - 13%)																		
A3e - Eutric-Fersialic soil characteristics																		
A3e1	3,180	Jombo	Hapli Luvisols Eutric Cambisols	Footslopes	600 - 800	mod. well + well	none + exceptional	slight	moderate	>150 (Very deep)	Sandy clay loam	Sandy clay loam	5.5 - 7.0	0 - 2 (Non saline)	>10 (medium-very high)	- v +	1 - 15	Rainfed cultivation (maize, pulses, groundnuts, cotton, etc.)
A3f - Fluvic soil characteristics																		
A3f2	1,300	Chiradzulu	Eutric Fluvisols	Footslopes	600 - 1200	well	none + exceptional	none	moderate	>150 (Very deep)	Sandy loam to Sandy clay loam	Sandy loam to Sandy clay loam	5.5 - 7.0	0 - 2 (Non saline)	5 - 10 (low)	= - +	1 - 15	Rainfed cultivation (maize, pulses, groundnuts, cassava)

Remarks : N (Nitrogen) = <0.08% (very low); - 0.08 - 0.12% (low); + >0.12% (medium-very high); v very variable

P (Phosphorus) = <6 ppm (very low); - 6 - 18ppm (low); + >18ppm (medium-very high); v very variable

K (Potassium) = <0.1me/100g (very low); - 0.1 - 0.2me/100g (low); + >0.2me/100g (medium-very high); v very variable

(Continue next page)

Source : Land Resources Evaluation Project, Malawi (1992)

Table 3.3.2. (3/4) Legend of the Soil Map

Soil Unit	Area (ha)	Soil Family	Soil Classification (FAO, 1988)	Physiographical Properties: Landform	Altitude (m asl)	Drainage	Flooding	Ponding	Erosion	Soil Properties: Soil Depth (cm)	Particle Size: Topsoil (0-30cm)	Particle Size: Subsoil (>30cm)	pH (H2O) (0 - 50cm)	EC (mmhos/cm)	CEC (me/100g soil)	NPK (0 - 50cm)	Surface Stoniness + Rockiness (%)	Dominant Present Land-Use and Vegetation
X - Soils derived from Felsic and Intermediate Igneous and Metamorphic Rocks																		
X1 - Flat or almost flat land (0 - 2%)																		
X1e - Eutric-Fersialic soil characteristics																		
X1e2	470	Namilenga	Eutric Cambisols	Footslopes	475 - 550	mod. well	none	none	slight	>150 (Very deep)	Loamy sand to Sandy loam	Sandy cray loam to Sandy clay	5.0 - 6.5	0 - 2 (Non saline)	>10 (medium-very high)	= - +	<1	Rainfed cultivation (maize , pulses , groundnuts , cotton , etc.)
X1e4	220	Mpili	Chromic Luvisols Luvic Phaeozems	Footslopes	600 - 80	well	none	none	slight	>150 (Very deep)	Loamy sand to Sandy loam	Sandy cray loam to Sandy clay	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- - +	<1	Rainfed cultivation (maize , pulses , groundnuts , cotton , etc.)
X1e7	530	Mbulumbuzi	Chromic Luvisols Chromic Cambisolss	Uplands	600 - 80	well	none	none	slight	100-150 (Deep)	Sandy loam to sandy clay loam	Sandy clay loam to sandy clay	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- - +	<1	Rainfed cultivation (maize , pulses , groundnuts , cotton , etc.)
X2 - Gently sloping land (2 - 6%)																		
X2e - Eutric-Fersialic soil characteristics																		
X2e2	9,050	Mpili	Chromic Luvisols Luvic Phaeozems	Upland Footslopes	600 - 1400	well	none	none	slight	>150 (Very deep)	Loamy sand to Sandy loam	Sandy clay loam to sandy clay	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- - +	1 - 15 (Stony/Fairly rocky)	Rainfed cultivation (maize , pulses , groundnuts , cotton , etc.)
X2e3	7,000	Neno	Chromic Luvisols Luvic Phaeozems	Upland	600 - 900	well	none	none	slight	100-150 (Deep)	Sandy loam to sandy clay loam	Sandy clay loam to clay	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	= = +	<1	Rainfed cultivation (maize , pulses , groundnuts , cotton , etc.)
X2e4	1,240	Mbulumbuzi	Chromic Luvisols Chromic Cambisols	Upland Footslopes	600 - 1100	well	none	none	slight	100-150 (Deep)	Sandy loam to sandy clay loam	Sandy clay loam to sandy clay	5.0 - 6.5	0 - 2 (Non saline)	>10 (medium-very high)	- - +	<1	Rainfed cultivation (maize , pulses , groundnuts , cotton , etc.)
X2p - Paralithic soil characteristics																		
X2p1	780	Makanjila	Haplic Luvisols Luvic Phaeozems	Dissected footslopes Uplands	600 - 800	well	none	none	slight + moderate	50-100 (Mod. deep)	Sandy loam	Sandy clay loam	6.0 - 7.0	0 - 2 (Non saline)	>10 (medium-very high)	- - +	1 - 15 (Stony/Fairly rocky)	Mixed low altitude savanna Brachystegia escarpment woodland
X2p2	3,130	Walkers Ferry	Eutric Cambisols Chromic Cambisols	Upland	600 - 1000	well	none	none	slight	50-100 (Mod. deep)	Loamy sand to Sandy loam	Sandy loam to sandy clay loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- = +	1 - 15 (Stony/Fairly rocky)	Brachystegia hill woodland with maize , pulses , groundnuts , finger millet , cassava
X2x - Eutric Ferralic soil characteristics																		
X2x2	3,820	Nkwepola	Haplic Lixisols	Footslopes	600 - 1000	well	none	none	slight	>150 (Very deep)	Loamy sand	Sandy clay loam to sandy clay	5.0 - 6.0	0 - 2 (Non saline)	5 - 10 (low)	= - +	<1	Moist Brachystegia woodland
X3 - Sloping land (6 - 13%)																		
X3e - Eutric-Fersialic soil characteristics																		
X3e1	4,410	Mpili	Chromic Luvisols Luvic Phaeozems	Upland Footslopes	600 - 1000	well	none	none	slight	>150 (Very deep)	Loamy sand to sandy loam	Sandy clay loam to sandy clay	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- - +	<1	Rainfed cultivation (maize , pulses , groundnuts , cotton , etc.)
X3e9	4,830	Neno	Chromic Luvisols Luvic Phaeozems	Upland Lowhills	1000 - 1600	well	none	none	slight + moderate	100-150 (Deep)	Loamy sand to sandy clay loam	Sandy clay loam	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	= = +	<1	maize,pulses,tobacco,groundnuts,cassava etc.
X3e10	25,210	Neno	Chromic Luvisols Chromic Cambisols	Upland Lowhills	600 - 1500	well	none	none	slight + moderate	100-150 (Deep)	Sandy loam to sandy clay loam	Sandy clay loam to clay	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	= = +	1 - 15 (Stony/Fairly rocky)	maize,pulses,tobacco,groundnuts,cassava etc. with Brachystegia hill woodland
X3p - Paralithic soil characteristics																		
X3p1	6,120	Nkungulu	Eutric Cambisols	Upland Footslopes	500 - 1100	well	none	none	moderate	50-100 (Mod. deep)	Sandy loam	Sandy loam	5.0 - 6.0	0 - 2 (Non saline)	>10 (medium-very high)	- = +	15< (Very stony/Rocky)	Mixed low altitude savanna Brachystegia escarpment woodland
X3p2	4,200	Walkers Ferry	Eutric Cambisols Chromic Cambisols	Dissected uplands Ridges , Escarpments	600 - 1100	well	none	none	slight + moderate	50-100 (Mod. deep)	Loamy sand to Sandy loam	Sandy clay loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- = +	15< (Very stony/Rocky)	Rainfed cultivation (maize , pulses , groundnuts , cassava , etc.)
X3p3	2,570	Walkers Ferry	Eutric Cambisols Chromic Cambisols	Upland Escarpments	800 - 1400	well	none	none	slight + moderate	50-100 (Mod. deep)	Loamy sand to Sandy loam	Sandy loam to sandy clay loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- = +	1 - 15 (Stony/Fairly rocky)	Rainfed cultivation (maize , pulses , groundnuts , cotton , etc.)

Remarks : N (Nitrogen) = <0.08% (very low) - 0.08 - 0.12% (low) + >0.12% (medium-very high) v very variable

P (Phosphorus) = <6 ppm (very low) - 6 - 18ppm (low) + >18ppm (medium-very high) v very variable

K (Potassium) = <0.1me/100g (very low) - 0.1 - 0.2me/100g (low) + >0.2me/100g (medium-very high) v very variable

(Continue next page)

Source : Land Resources Evaluation Project , Malawi (1992)

Table 3.3.2. (4/4) Legend of the Soil Map

Soil Unit	Area (ha)	Soil Family	Soil Classification (FAO, 1988)	Physiographical Properties: Landform	Altitude (m asl)	Drainage	Flooding	Ponding	Erosion	Soil Properties: Soil Depth (cm)	Particle Size: Topsoil (0-30cm)	Particle Size: Subsoil (>30cm)	pH (H2O) (0 - 50cm)	EC (mmhos/cm)	CEC (me/100g soil)	NPK (0 - 50cm)	Surface Stoniness + Rockiness (%)	Dominant Present Land-Use and Vegetation
X - Soils derived from Felsic and Intermediate Igneous and Metamorphic Rocks																		
X4 - Moderately steep land (13 - 25%)																		
X4e - Eutric-Fersialic soil characteristics																		
X4e4	26,060	Neno	Chromic Luvisols Chromic Cambisols	Hillsides	500 - 1200	well	none	none	slight + moderate	100-150 (Deep)	Sandy loam to sandy clay loam	Sandy clay loam to clay	5.0 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	= = +	1 - 15 (Stony/Fairly rocky)	Moist Brachystegia woodland
X4p - Paralithic soil characteristics																		
X4p1	540	Majete	Eutric Cambisols Haplic Phaeozems	Hillsides Mountain sides	600 - 1600	well	none	none	moderate	50-100 (Mod. deep)	Loamy sand to Sandy loam	Sandy loam to sandy clay loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- - +	15< (Very stony/Rocky)	Mixed low altitude savanna Brachystegia escarpment woodland
X4p2	17,280	Walkers Ferry	Eutric Cambisols Chromic Cambisols	Hillsides Dissected escarpments	600 - 1200	well	none	none	moderate	50-100 (Mod. deep)	Loamy sand to Sandy loam	Sandy loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- = +	15< (Very stony/Rocky)	Moist Brachystegia woodland
X5 - Steep land (25 - 55%)																		
X5p - Paralithic soil characteristics																		
X5p2	160	Lulwe	Eutric Cambisols Haplic Phaeozems	Dissected uplands Escarpments	600 - 1600	well + somewhat excessive	none	none	slight + moderate	50-100 (Mod. deep)	Sandy loam to sandy clay loam	Sandy loam to sandy clay loam	5.5 - 7.0	0 - 2 (Non saline)	5 - 10 (low)	+ - +	15< (Very stony/Rocky)	Mixed low altitude savanna Brachystegia escarpment woodland
X5p5	9,030	Walkers Ferry	Eutric Cambisols Chromic Cambisols	Hillsides Escarpments	600 - 1500	well	none	none	slight + moderate	50-100 (Mod. deep)	Loamy sand to Sandy loam	Sandy loam to sandy clay loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- = +	1 - 15 (Stony/Fairly rocky)	Mixed low altitude savanna
X5p6	5,280	Walkers Ferry	Eutric Cambisols Chromic Cambisols	Hillsides Escarpments	600 - 1500	well	none	none	moderate + severe	50-100 (Mod. deep)	Loamy sand to Sandy loam	Sandy loam to sandy clay loam	5.5 - 6.5	0 - 2 (Non saline)	5 - 10 (low)	- = +	1 - 15 (Stony/Fairly rocky)	Maize, pulses, Irish potato, groundnuts Montane grassland with forest remnants
B - Soils derived from Mafic Igneous or Metamorphic Rocks																		
B2 - Gently sloping land (2 - 6%)																		
B2p - Paralithic soil characteristics																		
B2p1	1,010	Chalenthuwa	Eutric Cambisols Haplic Phaeozems	Upland	1000 - 1300	well	none	none	slight	50-100 (Mod. deep)	Sandy loam to loam	Sandy loam to Sandy clay loam	6.5 - 7.5	0 - 2 (Non saline)	>10 (medium-very high)	- = +	1 - 15 (Stony/Fairly rocky)	maize,pulses,tobacco,groundnuts,cassava etc.

Remarks :

N (Nitrogen) = <0.08% (very low); - 0.08 - 0.12% (low); + >0.12% (medium-very high); v very variable

P (Phosphorus) = <6 ppm (very low); - 6 - 18ppm (low); + >18ppm (medium-very high); v very variable

K (Potassium) = <0.1me/100g (very low); - 0.1 - 0.2me/100g (low); + >0.2me/100g (medium-very high); v very variable

Source : Land Resources Evaluation Project, Malawi (1992)

Table 3.3.3 (1/2) Soil Families of the Study Area

Soil Material / Soil Group	Name	Depth	Drainage	Color	Texture Topsoil	Texture Subsoil	Soil Structure Topsoil	Soil Consistency Topsoil	Others	pH (H2O)	CEC	NPK	Organic	others	Soil Classification (FAO, 1988)
A - Fluvial, Colluvial and/or Lacustrine Sediments															
Ae - Eutric-Ferralic	Mikaju	++	mod. well	Brown	LS - SL	SCL	Weak, medium - subangular blocky, Crumb	slight hard (dry) very friable (moist)		5.5 - 6.5	-	= = v	=		Haplic Luvisols
	Joambo	++	well	Brown	SL - SCL	SCL	Weak - moderate subangular blocky	slight hard - hard(dry) very friable (moist)	Clay contents usually increase slightly with depth	5.5 - 7.0	+	- v +	-		Haplic Luvisols Eutric Cambisols
	Chipoka	++	mod. well + imperfect	Yellowish Brown	SL - SCL	SCL	Weak - moderate subangular blocky	slight hard - hard(dry) very friable (moist)		5.5 - 7.0	+	- = +	-		Haplic Luvisols
Af - Fluvic	Namitakula	++	poor		Variable	Variable	Moderate Mid. subangular blocky	hard (dry) friable (moist)	Flooding hazard in several times/year	5.0 - 6.5	-	- v +	-		Eutric/Mollic Fluvisols (inundic phase)
	L. Linjisi	++	poor + imperfect		SCL - C	CL - C			Flooding hazard after heavy rains Ponding commonly	5.5 - 6.5	+	- v +	+		Eutric Fluvisols (inundic phase)
	Mlangeni	++	imperfect	Yellowish greyish brown	SCL	SCL - C			Exceptional flood	5.5 - 6.5	+	- + +	-		Eutric Fluvisols
	Chingale	++	mod. well	Dark brown	SCL	SCL - C	Strong Mid. - coarse subangular blocky	friable to firm (moist)	Exceptional flood	5.5 - 6.5	+	- - +	+		Eutric Fluvisols
	Lisungwe	++	mod. well	Brown - Yellowish brown	LS - SCL	SL - SCL				5.0 - 6.5	-	= = +	=		Eutric/Mollic Fluvisols (sodic phase)
	Gwelewela	++	imperfect	Greyish brown	LS - SCL	Variable	Moderate or weak Mid.or fine subangular blocky	firm (dry) very friable (moist)		5.0 - 6.5	-	- v -	=		Eutric Fluvisols (sodic phase)
	Chiradzulu	++	well	Dark brown	SL - SCL	SL - SCL			Flash flood Surface - topsoil: slightly gravelly	5.5 - 7.0	-	= - +	=		Eutric Fluvisols (rudic phase)
Ag - Gleyic	Mpasa	++	poor + imperfect	Grey	SL - SCL	SCL - C			High groundwater table (rainy season) Mottling (subsoil)	5.0 - 6.0	-	- = -	=		Gleyic Cambisols Eutric Gleysols
	Tenthema	++	poor + imperfect	Grey	S - C (Variable)	S - C (Variable)				5.5 - 6.5	-	v = v	-		Eutric Gleysols (inundic phase)
Am - Mopanic	U. Shire	++	imperfect	Brownish grey	SL - SCL	SCL - SC	Moderate Mid. - coarse subangular blocky	hard (dry) friable (moist)	Mottling (top and subsoil) Very low permiability Lime concretions (subsoil)	6.0 - 7.5	+	- - +	=	High bulk density (1.8 - 1.9g/cu.cm) High ESP (>6%)	Eutric Planosols Stagnic Luvisols
Av - Vertic	Chilwa	++	poor	Black	C	C		firm (moist) very sticky and very plastic (wet)	Exceptional flood	7.0 - 8.0	+	= = +	=	High ESP (>6%) Slightly saline (EC 2-4mmho/cm)	Vertic Cambisols Eutric Vertisols (sodic,inundic phase)
	Malikopo	++	poor + imperfect	Dark grey	SC - C	SC - C	Strong Coarse-subangular blocky to prismatic	extremely firm (moist)	Severely ponding Flash flood	7.0 - 8.0	+	= = +	=	High ESP (20-50%) Slightly saline (EC 2-4mmho/cm)	Calcic/Eutric Vertisols (sodic, inundic phase)
Ax - Eutric-Ferralic	Liphala	++	mod. well	Dark brown	SL - SCL	SCL - SC				5.0 - 6.0	-	- - +	-		Haplic Lixisols Ferralic Cambisols

Depth : ++ Very Deep (>150cm); + Deep (100 - 150cm); - Moderately Deep (50 - 100cm)

Texture : C = Clay; SC = Sandy Clay; SCL = Sandy Clay LOam; SL = Sandy Loam; LS = Loamy Sand

CEC (me/100g soil) : + Medium - very high (>10); - Low (5 - 10)

Organic matter (%) : + High (>2.5%); - Medium (1.5 - 2.5%); = Low (<1.5%)

NPK : N (Ni = <0.08% (very low); - 0.08 - 0.12% (low); + >0.12% (medium-very high); v very variable) P (Phosphorus) = <6 ppm (very low); - 6 - 18ppm (low); + >18ppm (medium-very high); v very variable K (Potassium) = <0.1me/100g (very low); - 0.1 - 0.2me/100g (low); + >0.2me/100g (medium-very high); v very variable

Source : Land Resources Evaluation Project, Malawi

Table 3.3.3 (2/2) Soil Families of the Study Area

Soil Material / Soil Group	Name	Depth	Drainage	Color	Texture Topsoil	Texture Subsoil	Soil Structure Topsoil	Soil Consistency Topsoil	Others	pH (H2O)	CEC	NPK	Organic	Soil Classification (FAO, 1988)
X - Felsic and Intermediate Igneous and Metamorphic Rocks														
Xe - Eutric-Fersialic	Namlenga	++	mod. well	Greyish Brown	LS - SL	SCL - SC			Gravelly throughout with gravel and iron concretions	5.5 - 6.5	-	= = v	=	Eutric/Chromic Cambisols
	Mpili	++	well	Reddish Brown	LS - SL	SCL - SC	Weak	slight hard (dry) friable (wet)	Surface : gravel	5.5 - 7.0	+	- v +	-	Chromic Luvisols Luvic Phaeozems, (rudic phase)
	Mbulumbuzi	+	well	Reddish Brown	SL - SCL	SCL - SC	Moderate, medium - subangular blocky or Crumb	hard (dry) very friable (wet)	Surface : gravel Profile : slight - moderately gravelly Weather rock	5.0 - 6.5	-	- - +	-	Chromic/Haplic Luvisols Chromic Cambisols Luvic Phaeozems, (rudic phase)
	Nemo	+	well	Reddish Brown	SL - SCL	SCL - C	Moderate, medium - subangular blocky or moderate Crumb	slight hard (dry) very friable (wet)	Weather rock	5.0 - 6.5	-	= = +	=	Chromic Luvisols Chromic Cambisols Luvic Phaeozems, (rudic phase)
Xp - Parasilithic	Makanjila	+	well	Yellowish brown	SL	SCL	Weak	slight hard (dry) friable (wet)	Surface : slightly gravel Profile : slight - moderate gravelly Weather rock	6.0 - 7.0	+	- - +	-	Haplic Luvisols Luvic Phaeozems, (rudic phase)
	Walkers Ferry	+	well	Reddish brown Brown	LS - SL	SL - SCL	Weak - moderate, subangular blocky or Crumb	slight hard (dry) very friable (wet)	Surface & Profile : gravel, stone Subsoil : skeital Weather rock	5.5 - 6.5	-	- = +	-	Eutric/Chromic Cambisols (rudic and skeletic phase)
	Nkungulu	-	well	Yellowish brown	SL	SL	Weak	slight hard (dry) very friable (wet)	Surface : common gravel Profile : slight - very gravelly Weather rock	5.0 - 6.0	+	- = +	-	Eutric Cambisols (rudic and skeletic phase)
	Majete	-	well	Brown	LS - SL	SL - SCL	Weak - moderate, subangular blocky (medium-size peds)	slight hard (dry) very friable (wet)	High contents of (quartz) gravel and stones Weather rock	5.5 - 6.5	-	- - +	-	Eutric Cambisols Haplic Phaeozems (rudic and skeletic phase)
	Lulwe	-	well + excessive	Reddish brown	SL - SCL	SL - SCL	Moderate - strong Crumb - subangular blocky	slight hard (dry) very friable (wet)	Surface : gravelly Profile : slight - very gravelly	5.5 - 7.0	-	+ - +	-	Haplic Phaeozems Eutric Cambisols (rudic and skeletic phase)
Xx - Eutric-Ferralic	Nkwepela	++	well	Dark reddish brown	LS	SCL - SC				5.0 - 6.0	-	= - +	-	Haplic Lixisols
B - Mafic Igneous or Metamorphic Rocks														
Xp - Parasilithic	Chalenthuwe	-	well	Brown	SL - L	SL - SCL (Coarse fragment)			Surface : gravelly Weather rock	6.5 - 7.5	+	- = +	-	Eutric Cambisols Haplic Phaeozems (skeltic, rudic phase)

Depth : ++ Very Deep (>150cm); + Deep (100 - 150cm); - Moderately Deep (50 - 100cm)

Texture : C = Clay; SC = Sandy Clay; SCL = Sandy Clay LOam; SL = Sandy Loam; LS = Loamy Sand

CEC (me/100g soil) : + Medium - very high (>10); - Low (5 - 10)

Organic matter (%) : + High (>2.5%); - Medium (1.5 - 2.5%); = Low (<1.5%)

NPK : N (Nitrogen) = <0.08% (very low); - 0.08 - 0.12% (low); + >0.12% (medium-very high); v very variable

P (Phosphorus) = <6 ppm (very low); - 6 - 18ppm (low); + >18ppm (medium-very high); v very variable

K (Potassium) = <0.1me/100g (very low); - 0.1 - 0.2me/100g (low); + >0.2me/100g (medium-very high); v very variable

Source : Land Resources Evaluation Project, Malawi

Table 3.3.4. Criteria for Land Suitability Classification

Land Suitabilitly Class	Land Subclass Limitations
S 1 : Highly Suitable	a : low moisture holding capacity and excessive permeability due to coarse soil texture
S 2 : Moderately Suitable	c : compactness of surface or upper sub-soil leading to difficulties in tillage and excessive run-off, and reducing penetration of water into t
S 3 : Marginally Suitable	f : flooding hazard
N 1 : Currently not Suitable	k : fertility limitation due to low inherentnutrient status of soil
N 2 : Permanently not Suitable	n : sodicity / salinity hazard commonly associated with subsoil compactness and impermeability
	t : topographic limitation associated with steeper slopes and erosion hazard
	v : management difficulties associated with vertisolic soils,extreme physical properties and very slow internal drainage when wet
	x : management difficulties associated with wide variations in soil texture and other properties over short distances

<Upland Crops>

				S1	S2	S3	N1	N2
Soil Factor	Texture	(Vertic)	v		Deep,Dark cracking clay Clay loam - Heavy clay		Finer (poorly cracking) Clay to sandy clay throughout profile Consistence (dry) : Topsoil (hard) , Subsoil (very hard)	
	Alkalinity/Salinity		n	<15% <4mmhos/cm	<15% <4mmhos/cm	<15% <4mmhos/cm	>15% >4mmhos/cm	
	Compactness		c		surface compactness		very compact subsoil	
	Fertility		k	high - moderate	moderate - low			
Topographic	Slope		t	<2%	<2%	<2%	2 - 8%	8%<
	Flood		f	none	none - exceptional Moderately severe	frequent Regular,prolonged wet season flooding and waerlogging	frequent remain flooded or severely waterlogged throughout the wet season	swamp near lakeshore
	Variable		x	none	Variation in short distance			

<Wetland Crop -Paddy->

				S1	S2	S3	N1	N2
Soil Factor	Texture	(Coarse)	a			coarse (Loamy sand)	coarse (Sand) (Rapid permeability)	coarse (Sand) (Very rapid permeability)
		(Vertic)	v		Deep,Dark cracking clay		Finer (poorly cracking) Clay to sandy clay throughout profile Consistence (dry) : Topsoil (hard) , Subsoil (very hard)	
	Alkalinity/Salinity		n	<15% <4mmhos/cm	<15% <4mmhos/cm	<15% <4mmhos/cm	>15% >4mmhos/cm	
	Compactness		c				very compact subsoil	
Topographic	Slope		t	<2%	<2%	<2%	2 - 8%	>8%
	Flood		f	none	none - exceptional Moderately severe			swamp near lakeshore
	Variable		x	none	Variation in short distance			

Remarks :
Fine Texture : SC, SiC, CL Heavy, SiCL Heavy
Medium Texture : SCL, CL, SiCL, L, SiL, Si, S, SL Heayy
Coarse Texture : S, LS, SL Light

Table 3.3.5. (1/2) **Results of Land Suitability Classification**

< Wetland Crops - Paddy->

Classification	Limitating Factor	Area of Each River Basin (ha)						Percentage
		Nadzipulu	(Small River)	Namikokwe	Livulezi	Bwanje	**Total**	(%)
S2 : Moderately Suitable		**1,310**	**470**	**1,140**	**5,100**	**15,960**	**23,980**	**9.6**
F	: Flooding hazard (moderately severe in wet season)	830	120	810	2,050	1,350	5,160	(21.5)
V	: Management difficulties (vertisolic soils)	440	350	20	2,270	6,630	9,710	(40.5)
FV	: Flooding hazard and Management difficulties (vertisolic soils)	40	0	310	780	7,980	9,110	(38.0)
S3 : Marginally Suitable		**1,320**	**820**	**2,570**	**6,570**	**12,250**	**23,530**	**9.4**
AX	: Coarse Texture (loamy sand) and management difficultie (variations)	1,320	760	2,230	5,440	11,820	21,570	(92.0)
XF	: Management difficulties (variations) and Flooding hazard	0	60	340	1,130	430	1,960	(8.0)
N1 : Currently not Suitable		**3,200**	**3,290**	**1,890**	**12,060**	**24,150**	**44,590**	**17.8**
A	: Coarse Texture (sand)	260	30	0	0	600	890	(2.0)
N	: Sodicity / Salinity hazard	1,580	730	780	620	1,340	5,050	(11.0)
T	: Topographic limitation	1,360	1,660	410	9,260	19,350	32,040	(72.0)
C	: Compactness	0	520	630	1,820	1,300	4,270	(10.0)
CV	: Compactness and Management difficulties (vertisolic soils)	0	350	70	360	1,560	2,340	(5.0)
N2 : Permanently not Suitable		**30,290**	**1,200**	**24,360**	**46,480**	**55,630**	**157,900**	**63.2**
F	: Flooding hazard (swamp near lakeshore)	740	70	230	0	550	1,590	(1.0)
T	: Topographic limitation	29,550	1,130	24,070	46,480	55,080	156,310	(99.0)
		36,120	**5,780**	**29,900**	**70,210**	**107,990**	**250,000**	

* Small River is between Nadzipule and Namkokwe

Table 3.3.5. (2/2) **Results of Land Suitability Classification**

< Upland Crops>

Classificatio	Limitating Factor	Area of Each River Basin (ha)						Percentage
		Nadzipulu	(Small River)	Namikokwe	Livulezi	Bwanje	Total	(%)
S2 : Moderately Suitable		**3,950**	**2,890**	**3,470**	**19,020**	**40,210**	**69,540**	**27.8**
F	: Flooding hazard (moderately severe in wet season)	830	120	810	2,050	1,760	5,570	(8.0)
V	: Management difficulties (vertisolic soils)	440	350	20	2,270	6,690	9,770	(14.0)
X	: Management difficulties (wide variations over short distances)	1,320	760	2,230	5,440	11,820	21,570	(31.0)
CK	: Compactness (surface) of and Fertility limitation (moderate)	1,360	1,660	410	9,260	19,940	32,630	(47.0)
S3 : Marginally Suitable		**260**	**90**	**340**	**1,130**	**430**	**2,250**	**0.9**
F	: Flooding hazard (regular, prolonged floooding & waterlogging)	0	60	340	1,130	430	1,960	(87.0)
K	: Fertility limitation (low)	260	30	0	0	0	290	(13.0)
N1 : Currently not Suitable		**1,620**	**1,600**	**1,790**	**3,580**	**11,710**	**20,300**	**8.1**
C	: Compactness (very compact subsoil)	0	520	630	1,820	1,300	4,270	(21.0)
CV	: Compactness and Management difficulties (vertisolic soils)	0	350	70	360	1,560	2,340	(11.5)
F	: Flooding hazard (severely waterlogging throughout the wet season)	40	0	310	780	7,500	8,630	(42.5)
N	: Sodicity/salinity hazard	1,580	730	780	620	1,350	5,060	(25.0)
N2 : Permanently not Suitable		**30,290**	**1,200**	**24,300**	**46,480**	**55,640**	**157,910**	**63.2**
F	: Flooding hazard (swamp near lakeshore)	740	70	230	0	550	1,590	(1.0)
T	: Topographic limitation	29,550	1,130	24,070	46,480	55,090	156,320	(99.0)
		36,120	**5,780**	**29,900**	**70,210**	**107,990**	**250,000**	

* Small River is between Nadzipule and Namkokwe

Table 3.4.1(1/2) Agricultural climate conditions

Mean Monthly Rainfall

(Unit:mm)

Station	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Total	Altitude(m)
Dedza	57.3	210.1	241.8	212.4	139.9	49.8	11.7	3.7	3.1	1.2	2.9	10.9	944.8	1,615.0
Ntcheu	83.7	238.9	285.9	238.4	166.1	50.9	6.4	1.4	1.7	0.6	4.3	25.6	1103.9	1,277.0
Monkey Bay	37.6	161.7	222.2	221.2	115.8	22.6	4.8	3.3	0.3	0	0.3	1.9	791.7	481.0
Salima	42.4	247.4	340.6	278.9	254.4	92.5	10.7	2	0.4	0.4	0.3	6.4	1276.4	512.0

Data source : Meteorological Department

Mean Monthly Temperatures

(Unit:°C)

Station	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean	Altitude(m)
Dedza														
Max.	25.2	23.3	22.7	22.8	22.7	22.4	21.2	19.2	18.8	20.5	22.9	25.0	22.2	1,615.0
Min.	15.8	15.4	15.4	15.6	14.7	13.8	11.7	9.8	9.0	10.6	12.8	15.0	13.3	
Ntcheu														
Max.	27.0	25.2	24.0	23.9	24.3	24.2	22.7	21.1	20.7	22.7	25.0	27.6	24.0	1,277.0
Min.	17.7	17.3	17.2	17.0	16.6	15.7	13.7	12.2	11.6	12.7	14.8	17.1	15.3	
Monkey Bay														
Max.	32.6	30.1	29.7	29.5	30.3	29.7	28.5	26.4	26.3	28.1	31.0	32.3	29.5	481.0
Min.	23.6	22.7	22.2	21.8	21.9	20.6	18.3	16.0	16.0	17.4	19.6	22.4	20.2	
Salima														
Max.	31.8	29.8	29.4	29.0	29.5	28.9	27.8	26.2	25.9	27.8	30.6	32.5	29.1	512.0
Min.	22.3	22.2	21.4	21.3	21.4	20.7	17.9	15.9	15.8	16.9	18.7	21.3	19.7	

Mean Monthly Relative Humidity

(Unit:%)

Station	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean	Altitude(m)
Dedza	55	64	84	85	83	81	72	69	66	61	56	55	69.3	1,615.0
Ntcheu	64	79	85	86	82	78	71	66	61	56	53	51	69.3	1,277.0
Monkey Bay	79	74	79	80	75	70	64	61	58	55	53	53	66.8	481.0
Salima	58	73	80	82	77	72	68	63	60	56	54	52	66.3	512.0

Data source : National Warning System for Food Security (Technical Papaer No.2)
Potential Evapotranspiration Studies in Malawi,October 1989
Food and Agriculture Organization of United Nations

Table 3.4.1(2/2) Agricultural climate conditions

Mean Monthly Pan Evaporation

(Unit:mm)

Station	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Annual	Altitude(m)
Chipoka	233	177	139	127	158	160	157	142	157	181	206	248	2085.0	
Ntcheu	180	157	140	104	124	119	122	108	119	142	175	205	1695.0	1,277.0
Mangochi	260	207	179	158	189	189	181	156	170	204	241	296	2430.0	482.0
Monkey Bay	225	187	165	138	167	168	160	145	152	173	194	240	2114.0	481.0
Salima	282.7	204.4	151.8	159.2	180.8	190.2	198.8	179.5	168.6	187.7	232.4	296.1	2432.2	512.0

Mean Monthly Wind Speed

(Unit:m/sec)

Station	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean	Altitude(m)
Dedza	5.4	4.3	3.9	3.8	3.9	4.0	3.8	3.8	4.1	5.0	5.9	6.2	4.5	1,615.0
Ntcheu	5.7	5.1	3.6	3.9	3.9	4.6	4.4	4.5	5.0	5.2	5.7	5.1	4.7	1,277.0
Monkey Bay	2.8	2.4	1.9	1.8	2.0	2.2	2.2	2.4	2.5	2.5	2.6	3.0	2.4	481.0
Salima	4.8	4.7	3.2	3.3	4.0	4.6	4.6	4.9	5.1	4.7	4.4	4.8	4.4	512.0

Mean Monthly Sunshine Hours

(Unit:hour)

Station	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean	Altitude(m)
Dedza	7.7	5.3	4.9	4.9	6.2	7.1	8.2	8	7.7	8.6	9.3	9.8	7.3	1,615.0
Ntcheu														1,277.0
Monkey Bay	9	6.9	6.6	6.8	8.1	8.6	9.4	8.9	8.8	9.6	9.8	9.8	8.5	481.0
Salima	9	6.7	5.9	6.2	7.5	8.8	9.5	9.2	8.9	9.7	9.9	10	8.4	512.0

Data source : National Warning System for Food Security (Technical Papaer No.2)
Potential Evapotranspiration Studies in Malawi,October 1989
Food and Agriculture Organization of United Nations

Table 3.5.1 Monthly Mean Rainfall Data

(Unit : mm)

No.	Station Name	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Total	Period
1	Mua Mission	49.1	210.3	264.8	239.0	155.7	45.1	3.1	2.3	0.7	0.5	2.6	3.3	976.5	1952-1978
2	Bilila	63.7	190.1	188.7	183.9	138.8	41.9	5.3	1.1	2.1	0.1	0.8	19.9	836.5	1972-1989
3	Dedza Meteo.	57.3	210.1	241.8	212.4	139.9	49.8	11.7	3.7	3.1	1.2	2.9	10.9	944.8	1957-1990
4	Golomoti Agric.	62.9	253.6	269.0	296.5	151.7	36.0	4.2	1.1	0.0	0.3	0.7	20.7	1,096.7	1980-1990
5	Mlangeni-Njolomole	74.7	189.7	240.7	223.5	174.2	45.1	8.8	2.8	2.0	1.3	2.2	24.4	989.3	1960-1990
6	Bwanje MYP Base	22.3	197.5	230.3	180.4	155.9	12.3	2.2	0.0	0.0	2.7	0.0	38.5	842.0	1986-1990
7	Dedza Boma	71.9	227.4	278.4	233.9	180.9	67.0	10.6	4.1	3.7	1.3	4.0	11.9	1,095.1	1960-1978
8	Mtakataka Agric.	40.7	177.3	218.6	275.4	101.6	46.9	12.4	5.7	0.4	0.0	0.0	7.4	886.4	1960-64/1980-90
9	Mvai Forest No.3	64.3	267.1	188.2	263.2	166.6	59.6	16.4	4.1	2.4	5.1	5.0	22.1	1,064.1	1977-1985
10	Mua Livulezi(Sosolo)	77.5	282.4	311.2	265.3	192.0	61.5	8.3	2.1	1.5	0.7	1.9	13.4	1,217.9	1960-1989
11	Mtakataka Airwing	57.9	197.6	179.2	214.4	136.2	46.3	13.9	1.7	0.0	0.0	0.0	15.5	862.6	1980-1990
12	Ntcheu Boma	83.7	238.9	285.9	238.4	166.1	50.9	6.4	1.4	1.7	0.6	4.3	25.6	1,103.8	1960-1990
13	Sharpevale	61.9	191.2	188.5	193.4	138.7	39.2	4.5	0.7	0.0	0.8	0.7	18.0	837.7	1960-1990
14	Nakumba	63.4	200.0	199.6	188.9	139.7	36.8	4.8	2.3	0.6	0.3	0.1	11.1	847.4	1960-1990
15	Salima Airport	42.4	247.4	340.6	278.9	254.4	92.5	10.7	2.0	0.4	0.4	0.3	6.4	1,276.4	1960-1990
16	Monkey Bay	37.6	161.7	222.2	221.2	115.8	22.6	4.8	3.3	0.3	0.0	0.3	1.9	791.6	1960-1978

Data source : Department of Meteorology

Table 3.5.2(1/6) Monthly Mean Discharges

River : Nakaingwa at Songwe Catchment Area : 63.40 km2 Station No.: 3.F.2

Unit : m3/sec

Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean (m3/s)
1957/58	0.003	0.174	0.400	1.244	1.192	0.313	0.155	*	0.087	0.043	0.029	0.002	0.33
1958/59	0.015	0.091	0.201	0.976	1.097	0.255	0.143	0.093	0.065	0.042	0.040	0.010	0.25
1959/60	*	0.368	0.374	0.723	1.617	0.463	0.226	0.130	0.075	0.033	0.021	0.001	0.37
1960/61	*	*	0.195	0.744	2.080	0.727	0.321	0.185	0.135	0.072	0.035	0.021	0.45
1961/62	0.033	0.336	1.856	3.038	1.388	0.968	0.463	0.270	0.175	0.168	0.116	0.041	0.74
1962/63	0.048	0.137	0.965	1.985	3.084	1.192	0.602	0.332	0.227	0.168	0.116	0.032	0.74
1963/64	0.187	0.278	1.810	1.470	0.680	0.312	0.207	0.142	0.108	0.071	0.037	0.014	0.44
1964/65	0.011	0.128	0.959	6.675	1.636	0.901	0.383	0.237	0.154	0.093	0.055	0.023	0.94
1965/66	*	0.180	0.434	0.979	1.021	0.270	0.146	0.089	0.052	0.033	0.013	*	0.32
1966/67	0.009	0.216	0.431	1.198	1.190	1.102	0.493	0.323	0.258	0.199	0.144	0.083	0.47
1967/68	0.139	0.132	1.074	0.648	1.289	0.486	0.259	0.191	0.142	0.100	0.076	0.041	0.38
1968/69	0.074	0.639	1.622	2.247	1.291	0.957	0.478	0.288	0.152	0.202	0.122	0.060	0.68
1969/70	0.047	0.504	1.125	2.220	0.560	0.321	0.184	0.136	0.098	0.074	0.043	0.029	0.45
1970/71	0.045	0.901	2.092	9.653	2.958	0.803	0.359	0.208	0.129	0.072	0.047	0.024	1.44
1971/72	0.022	0.206	0.523	0.494	0.808	0.429	0.181	0.085	0.053	0.028	0.013	0.002	0.24
1972/73	*	0.287	0.561	0.499	0.340	0.345	0.202	0.126	0.081	0.054	0.032	0.004	0.23
1973/74	*	*	0.620	*	1.727	1.440	*	0.765	0.510	0.298	0.158	0.086	*
1974/75	0.111	0.427	0.638	0.801	3.386	0.501	0.200	0.135	0.086	0.049	0.023	0.008	0.53
1975/76	0.006	0.398	1.427	5.037	7.640	4.707	2.143	0.899	0.449	0.250	0.131	0.061	1.93
1976/77	0.044	0.303	1.943	1.509	4.072	0.975	0.379	0.203	0.131	0.073	0.031	0.010	0.81
1977/78	0.105	*	3.139	5.715	13.180	4.080	1.718	0.921	0.521	0.294	0.163	0.056	2.72
1978/79	0.071	5.146	0.406	4.963	*	*	*	*	*	*	*	*	*
1979/80	6.428	8.054	9.389	*	*	*	*	*	*	*	*	*	*
1980/81	0.459	4.285	1.096	4.588	*	*	*	*	*	0.225	0.198	0.177	*
1981/82	0.244	0.315	0.765	1.262	0.850	*	*	0.217	0.160	0.117	0.088	0.068	*
1982/83	0.070	*	0.742	*	0.886	0.452	0.271	0.173	0.141	0.091	0.061	0.047	0.29
1983/84	*	0.319	0.230	*	1.273	0.530	0.333	0.213	0.157	0.121	0.067	0.040	0.33
1984/55	0.050	0.493	0.743	2.372	2.295	2.699	1.595	0.980	0.697	*	*	*	
Mean	0.391	1.050	1.310	2.600	2.348	1.083	0.513	0.306	0.198	0.122	0.076	0.041	0.702

Data source : Department of water

Note : * is data missing.

Table 3.5.2(2/6) Monthly Mean Discharges

River : Nadzipulu at Mtakataka Catchment Area : 224.00 km2 Station No.: 3.F.3

Unit : m3/sec

Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean
1956/57	*	*	*	*	*	*	*	*	*	*	0.817	0.479	*
1957/58	0.214	1.080	3.230	5.180	5.573	2.538	1.240	0.996	0.717	0.583	0.427	0.232	1.83
1958/59	0.175	2.675	1.362	6.028	6.529	1.873	0.984	0.650	0.478	0.374	*	0.143	*
1959/60	0.094	2.490	3.726	4.662	8.131	2.836	1.659	1.048	0.731	0.498	0.383	0.194	2.20
1960/61	0.119	0.431	4.253	4.209	13.290	4.624	2.324	1.464	1.021	0.694	0.433	0.334	2.77
1961/62	0.352	2.703	6.045	6.637	5.932	5.243	2.659	1.532	1.121	0.744	0.434	0.245	2.80
1962/63	0.287	0.954	9.102	10.341	8.724	4.433	2.458	1.698	1.325	1.122	0.662	0.368	3.46
1963/64	2.043	3.608	9.067	9.561	4.031	2.027	1.412	0.977	0.771	0.600	0.423	0.239	2.90
1964/65	0.226	0.888	9.126	10.788	9.750	6.238	2.508	1.894	1.241	0.889	0.681	0.276	3.71
1965/66	0.281	2.349	3.411	5.595	4.738	1.711	0.915	0.605	0.451	0.438	0.209	0.115	1.73
1966/67	0.168	0.639	1.540	5.229	12.216	4.606	1.776	1.185	0.835	0.567	0.354	0.185	2.44
1967/68	0.311	0.578	5.249	2.851	5.715	2.495	1.174	0.909	0.670	0.462	0.310	0.183	1.74
1968/69	0.263	5.410	8.972	12.815	10.675	5.805	2.388	1.468	0.886	0.601	0.440	0.235	4.16
1969/70	0.218	2.772	7.672	8.886	3.321	2.603	1.372	0.889	0.544	0.428	0.257	0.214	2.43
1970/71	0.341	4.182	8.635	*	*	*	*	1.275	0.278	0.230	0.221	0.207	*
1971/72	0.254	0.241	8.029	2.304	3.955	2.056	1.180	1.002	0.722	0.536	0.360	0.195	1.74
1972/73	0.335	8.198	5.962	5.030	2.321	4.631	1.729	1.090	0.789	0.595	0.414	0.214	2.61
1973/74	0.102	3.968	9.745	16.045	10.400	5.138	2.118	1.579	1.234	0.890	0.522	0.450	4.35
1974/75	0.346	0.751	2.364	3.517	5.095	*	0.972	0.715	0.546	0.429	0.277	0.160	*
1975/76	0.330	2.011	*	*	*	*	2.995	2.134	1.498	1.100	*	0.577	*
1976/77	0.338	1.257	*	*	*	*	*	1.059	0.856	0.610	0.401	0.242	*
1977/78	0.347	*	*	*	18.304	6.195	3.438	2.140	1.513	1.011	0.692	0.413	*
1978/79	0.393	7.991	5.225	5.889	8.025	4.517	3.572	2.253	1.488	1.007	0.571	0.357	3.44
1979/80	*	*	4.438	5.078	3.910	5.976	2.361	1.488	1.027	0.677	0.428	0.367	*
1980/81	0.140	4.620	3.070	8.650	7.230	2.490	1.320	0.870	0.590	0.410	0.360	0.240	2.50
1981/82	0.120	1.200	10.170	*	*	*	*	*	*	*	1.010	0.470	*
1982/83	1.024	5.207	3.755	8.254	4.973	2.846	2.758	0.862	0.731	0.577	0.323	0.203	2.63
1983/84	0.145	*	1.428	7.072	6.539	2.711	1.612	1.151	0.841	0.639	0.404	0.218	2.07
1984/85	0.272	11.081	4.849	13.187	5.150	5.627	2.809	1.162	1.068	0.742	0.566	0.421	3.91
1985/86	0.650	7.690	12.100	9.680	10.220	6.360	2.790	1.780	1.230	0.870	0.600	0.470	4.54
1986/87	0.534	1.411	4.937	6.859	6.655	2.983	1.701	1.295	1.074	0.875	0.440	*	*
1987/88	0.310	0.955	5.029	7.609	6.268	2.226	1.335	0.838	0.614	0.441	0.302	0.268	2.18
1988/89	0.210	1.290	8.110	14.320	14.020	6.920	3.130	1.890	1.330	0.990	0.650	0.440	4.44
1989/90	0.580	4.130	10.170	6.710	2.410	1.460	2.040	0.810	0.520	0.470	0.390	0.190	2.49
1990/91	0.131	0.214	6.529	7.789	*	1.537	1.348	0.821	0.542	0.388	0.226	0.149	1.79
Mean	0.353	2.999	6.042	7.613	7.383	3.817	2.002	1.258	0.887	0.651	0.454	0.285	2.81

Data source : Department of water

Note : * is data missing.

Table 3.5.2(3/6) Monthly Mean Discharges

River : Nadzipokwe at Mua Mission Catchment Area : 30.10 km2 Staion Number: 3.E.1

Unit : m3/sec

Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean (m3/s)
1953/54	*	0.173	0.559	3.370	1.240	0.662	0.234	0.146	0.093	0.077	0.036	0.007	0.60
1954/55	0.019	0.027	1.147	3.388	2.405	0.834	0.336	0.225	0.146	0.185	0.100	0.036	0.74
1955/56	0.023	0.534	0.601	2.119	1.451	4.284	1.254	0.564	0.352	0.195	0.207	0.135	0.98
1956/57	0.148	0.910	2.577	4.214	2.239	2.841	1.158	0.469	0.239	0.149	0.046	0.016	1.25
1957/58	0.003	0.125	0.690	0.749	1.777	0.542	0.191	0.139	0.077	0.047	0.105	0.013	0.37
1958/59	0.033	0.128	0.249	1.110	0.845	0.397	0.202	0.133	0.072	0.031	0.017	0.001	0.27
1959/60	0.000	0.370	0.539	0.718	1.651	0.639	0.372	0.238	0.169	0.115	0.083	0.003	0.41
1960/61	0.000	0.067	0.951	1.268	4.680	0.994	0.525	0.339	0.254	0.181	0.084	0.057	0.78
1961/62	0.127	0.310	0.794	1.512	0.963	0.969	0.451	0.325	0.230	0.166	0.066	0.008	0.49
1962/63	0.070	0.413	2.024	3.724	1.979	0.893	0.526	0.357	0.269	0.192	0.118	0.069	0.89
1963/64	0.305	0.246	1.364	1.869	0.626	0.392	0.279	0.183	0.107	0.087	0.057	0.028	0.46
1964/65	0.171	0.434	1.156	1.565	1.571	0.942	0.728	0.633	0.561	0.496	0.418	0.316	0.75
1965/66	0.062	0.146	0.413	0.897	0.712	0.274	0.164	0.102	0.082	0.059	0.031	0.011	0.25
1966/67	0.020	0.364	0.458	0.690	0.982	0.410	0.360	0.238	0.164	0.107	0.072	0.032	0.32
1967/68	0.055	0.095	0.641	0.321	1.265	0.455	0.176	0.128	0.092	0.075	0.055	0.032	0.28
1968/69	0.043	1.435	4.108	2.100	1.773	0.928	0.523	0.358	0.250	0.167	0.106	0.068	0.99
1969/70	0.065	3.038	1.887	1.665	0.491	0.390	0.205	0.127	0.087	0.061	0.034	0.019	0.67
1970/71	0.442	2.574	2.424	1.357	0.970	0.463	0.240	0.160	0.097	0.053	0.038	0.036	0.74
1971/72	0.070	0.284	0.733	0.476	0.695	0.500	0.219	0.154	0.112	0.083	0.058	0.055	0.29
1972/73	0.063	1.712	0.465	0.729	0.604	0.963	0.643	0.182	0.116	0.078	0.043	0.026	0.47
1973/74	0.019	0.796	1.510	1.362	1.677	1.048	0.615	0.394	0.268	0.126	0.058	0.026	0.66
1974/75	0.037	0.128	0.333	0.309	1.862	0.338	0.134	0.077	0.053	0.033	0.025	0.022	0.28
1975/76	0.050	0.604	1.365	1.390	*	1.191	0.634	0.428	0.283	0.188	0.107	0.057	*
1976/77	0.041	0.165	0.690	0.496	1.059	0.461	0.251	0.159	0.106	0.064	0.032	*	*
1977/78	*	*	*	*	1.937	1.027	0.653	0.410	0.241	0.170	0.118	0.085	*
1978/79	*	*	*	*	2.050	0.799	0.445	0.311	0.262	0.183	0.093	0.065	*
1979/80	*	*	0.487	0.417	0.307	0.514	0.191	0.098	0.082	0.060	0.040	0.052	*
1980/81	0.039	1.403	0.551	2.183	3.335	0.440	0.257	0.187	0.135	0.105	0.082	0.043	0.73
1981/82	0.017	1.790	4.540	4.462	*	*	*	*	*	*	*	*	*
1982/83	*	0.718	0.600	1.095	0.619	0.303	0.195	0.136	0.112	0.096	0.060	0.038	0.36
1983/84	0.044	1.286	0.366	1.051	0.892	0.373	0.254	0.212	0.148	0.094	0.042	0.021	0.40
1984/85	0.066	1.017	0.827	1.007	1.893	0.773	0.425	0.310	0.259	0.183	0.142	0.098	0.58
1985/86	0.147	3.541	1.576	0.908	0.275	0.612	0.352	0.312	0.225	0.162	0.112	0.083	0.69
1986/87	0.078	0.204	0.994	1.019	0.677	0.496	0.281	0.210	0.155	0.114	0.073	0.061	0.36
1987/88	0.027	0.062	1.131	1.585	1.167	0.461	0.295	0.231	0.165	0.098	0.054	0.052	0.44
1988/89	0.055	0.386	4.548	3.320	3.022	1.027	0.584	0.387	0.286	0.234	0.117	0.056	1.17
1989/90	0.083	1.159	32.295	0.849	28.750	0.333	0.274	0.168	0.114	0.087	0.047	0.029	5.35
1990/91	0.022	0.106	1.314	0.714	0.495	0.278	0.186	0.139	0.119	0.074	0.041	0.031	0.29
Mean	0.074	0.764	2.136	1.556	2.193	0.790	0.400	0.253	0.178	0.126	0.082	0.050	

Data source : Department of water

Note : * is data missing.

Table 3.5 . 2(4/6) Monthly Mean Discharges

River : Namikokwe at Kampanikiza Catchment Area : 44.20 km2 Station No.: 3.B.5
Unit : m3/sec

Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean
1957/58	*	*	*	*	*	0.634	0.264	0.225	0.166	0.117	0.092	0.041	*
1958/59	0.027	0.361	0.316	2.025	2.261	0.571	0.450	0.319	0.226	0.189	0.120	0.079	0.58
1959/60	*	1.206	1.189	2.521	3.058	0.939	0.460	0.329	0.289	0.216	0.124	0.075	*
1960/61	0.048	0.172	0.669	1.269	3.663	1.258	0.675	0.318	0.318	0.232	0.152	0.117	0.74
1961/62	0.152	0.614	2.688	2.125	1.040	1.093	0.709	0.469	0.401	0.295	0.208	0.120	0.83
1962/63	0.150	0.311	1.154	2.382	2.103	1.057	0.611	0.451	0.333	0.190	0.196	0.116	0.75
1963/64	0.292	1.563	1.253	1.558	0.919	0.485	0.333	0.239	0.194	0.147	0.104	0.066	0.60
1964/65	0.177	0.434	1.190	1.620	1.570	0.942	0.751	0.674	0.579	0.496	0.447	0.316	0.77
1965/66	0.217	0.180	0.774	1.991	1.555	0.640	0.394	0.307	0.215	0.151	0.170	0.062	0.55
1966/67	0.079	1.092	1.679	1.412	1.709	1.010	0.547	0.396	0.321	0.225	0.146	0.079	0.72
1967/68	0.081	0.104	1.890	1.158	1.797	0.708	0.410	0.328	0.253	0.185	0.125	0.065	0.59
1968/69	0.176	1.078	2.790	1.633	1.496	1.098	0.556	0.425	0.300	0.220	0.181	0.108	0.84
1969/70	0.091	1.718	1.659	1.996	0.845	0.562	0.269	0.209	0.170	0.121	0.077	0.043	0.65
1970/71	0.345	2.343	4.087	*	*	*	*	0.375	0.290	0.210	0.154	0.106	*
1971/72	0.081	0.663	1.348	1.216	1.333	1.019	0.446	0.307	0.231	0.171	0.116	0.062	0.58
1972/73	0.050	0.929	1.354	2.941	0.817	0.981	0.408	0.299	0.204	0.130	0.089	0.055	0.69
1973/74	0.039	3.124	8.582	6.461	1.748	1.724	0.784	0.455	0.383	0.310	0.228	0.142	2.00
1974/75	0.245	1.111	1.349	1.813	3.391	0.580	0.371	0.291	0.237	0.189	0.143	0.102	0.82
1975/76	0.148	2.129	3.280	6.810	9.467	2.872	0.804	0.443	0.348	0.280	0.210	0.195	2.25
1976/77	0.127	0.326	1.038	0.797	1.372	0.671	0.464	0.353	0.269	0.218	0.150	0.088	0.49
1977/78	0.107	0.872	2.548	5.105	6.034	1.780	1.211	0.565	0.472	0.294	0.195	0.137	1.61
1978/79	0.130	5.084	2.075	3.229	4.277	1.238	0.705	0.431	0.328	0.246	0.156	0.108	1.50
1979/80	0.178	1.443	1.022	0.873	0.546	0.943	0.475	0.315	0.255	0.174	0.115	0.565	0.58
1980/81	0.111	0.979	0.817	1.396	1.060	0.675	0.487	0.339	0.235	0.173	0.114	0.106	0.54
1981/82	0.040	0.172	2.827	2.916	0.882	0.634	0.497	0.312	0.226	0.158	0.105	0.297	0.76
1982/83	0.652	1.688	0.966	1.665	0.945	0.555	0.353	0.242	0.195	0.142	0.084	0.050	0.63
1983/84	0.053	0.245	0.527	2.000	1.862	0.859	0.538	0.376	0.261	0.085	0.019	0.003	0.57
1984/85	0.013	0.238	0.240	0.384	0.434	0.485	0.114	0.088	0.061	0.043	0.028	0.019	0.18
1985/86	0.036	1.807	0.991	0.763	0.810	0.584	0.244	0.159	0.132	0.094	0.055	0.057	0.48
1986/87	0.082	0.138	0.297	0.565	0.553	0.323	0.176	0.223	0.214	0.186	0.116	0.086	0.25
1987/88	0.038	0.268	0.789	1.117	0.957	0.637	0.426	0.287	0.195	0.131	0.087	0.077	0.42
1988/89	0.147	0.647	0.855	2.600	2.885	1.712	0.991	0.694	0.562	0.502	0.419	0.236	1.02
1989/90	0.242	2.944	1.110	1.379	0.744	0.543	0.428	0.284	0.224	0.173	0.130	0.078	0.69
1990/91	0.057	*	3.496	1.970	1.993	0.698	0.405	0.310	0.287	0.132	0.104	0.084	0.87
Mean	0.138	1.124	1.723	2.115	2.004	0.925	0.508	0.348	0.276	0.201	0.146	0.116	0.791

Data source : Department of water
Note : * is data missing.

Table 3.5.2(5/6) Monthly Mean Discharges

River : Namikokwe at Mua-Livelezi F.R. Catchment Area : 129.00 km2 Station No. : 3.E.2

Unit : m3/sec

Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean
1957/58	*	0.660	1.390	2.920	2.400	1.260	0.600	0.440	0.320	0.220	0.150	0.040	*
1958/59	0.050	*	*	4.640	3.420	1.190	0.690	0.530	0.370	0.220	0.150	0.090	*
1959/60	0.050	1.410	1.550	3.620	5.040	1.870	0.990	0.670	0.490	0.310	0.160	0.110	1.36
1960/61	0.070	0.260	1.590	3.110	8.690	2.210	1.340	0.930	0.670	0.480	0.300	0.200	1.65
1961/62	0.290	1.470	4.100	6.170	3.480	3.230	1.620	1.130	0.800	0.520	0.290	0.200	1.94
1962/63	0.280	0.700	4.180	9.200	5.520	2.570	1.350	0.880	0.600	0.460	0.320	0.200	2.19
1963/64	0.570	1.230	2.630	4.810	1.710	0.870	0.670	0.550	0.420	0.270	0.140	0.100	1.16
1964/65	0.080	0.540	3.260	4.840	3.280	2.370	1.150	0.740	0.480	0.320	0.260	0.150	1.46
1965/66	0.190	0.490	1.250	5.410	4.640	1.180	0.830	0.490	0.310	0.210	0.140	0.070	1.27
1966/67	0.080	0.870	1.100	2.270	2.820	1.950	0.970	0.650	0.480	0.300	0.180	0.120	0.98
1967/68	0.130	0.800	1.830	1.600	3.680	1.790	0.730	0.520	0.350	0.230	0.150	0.090	0.99
1968/69	0.230	1.940	5.120	5.010	4.390	3.710	1.410	0.900	0.600	0.410	0.290	0.160	2.01
1969/70	0.137	1.714	4.525	5.285	1.772	1.175	0.579	0.389	0.288	0.204	0.104	0.071	1.35
1970/71	0.280	*	*	*	*	*	*	*	*	*	*	*	*
1971/72	*	*	*	*	3.030	*	*	0.680	0.580	0.450	0.240	0.100	*
1972/73	0.110	*	*	*	*	1.450	0.760	0.560	0.370	0.240	0.150	0.100	*
1973/74	0.040	*	*	9.140	13.100	7.470	*	*	*	*	*	*	*
1974/75	*	*	*	*	*	*	*	*	*	*	*	*	*
1975/76	*	*	*	*	*	*	2.380	1.290	0.810	0.610	0.360	0.250	*
1976/77	0.160	0.730	1.830	1.760	3.340	1.930	0.870	0.670	0.520	0.380	0.250	0.120	1.05
1977/78	0.640	0.800	6.230	*	*	*	*	1.270	0.910	0.620	0.370	0.220	*
1978/79	*	3.910	*	*	*	*	*	0.870	0.620	0.480	0.260	0.180	*
1979/80	0.910	3.250	2.430	2.500	1.460	1.780	0.930	0.580	0.420	0.280	0.170	0.200	1.24
1980/81	0.090	6.480	4.440	9.650	4.780	1.980	1.130	0.630	0.470	0.300	0.210	0.110	2.52
1981/82	*	*	*	*	*	*	*	*	*	*	0.179	0.247	*
1982/83	0.675	*	*	8.131	*	*	0.522	0.339	0.242	0.178	0.105	0.078	*
1983/84	0.065	1.219	2.112	*	*	1.860	0.805	0.554	0.391	0.241	0.156	0.103	*
1984/85	0.183	4.393	1.890	6.115	*	3.090	1.332	0.868	0.565	0.394	0.286	0.184	*
1985/86	0.283	13.028	12.951	*	*	3.725	1.720	1.030	0.712	0.490	0.323	0.335	*
1986/87	0.348	*	*	6.947	4.621	2.414	1.041	0.664	0.468	0.328	0.221	0.180	*
1987/88	0.098	0.818	7.345	7.608	5.252	1.995	0.942	0.561	0.384	0.269	0.198	0.229	2.14
1988/89	1.168	1.768	2.760	11.330	11.964	3.972	2.814	1.594	1.025	0.713	0.468	0.286	3.32
1989/90	0.366	6.836	8.399	4.106	2.307	1.597	0.923	0.482	0.354	0.273	0.199	0.117	2.16
1990/91	0.298	2.917	4.217	5.731	4.696	2.524	1.149	0.742	0.516	0.360	0.229	0.161	1.96
Mean	0.281	2.426	3.788	5.496	4.582	2.352	1.120	0.740	0.518	0.359	0.226	0.155	1.709

Data source : Department of water

Note : * is data missing.

Table 3.5 . 2(6/6) Monthly Mean Discharges

River : Livulezi at Khwekhwelele Catchment Area : 452.00 km2 Station No.: 3.B.3
Unit : m3/sec

Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean (m3/s)
1957/58	0.200	2.300	*	*	8.530	*	1.120	0.773	0.525	0.388	0.258	0.106	*
1958/59	0.153	*	*	8.715	7.850	1.367	0.785	0.434	0.318	0.209	0.143	0.080	*
1959/60	*	2.830	2.751	4.081	6.817	2.035	0.917	0.551	0.356	0.290	0.144	0.060	1.89
1960/61	*	1.735	9.394	5.448	17.248	4.220	1.994	1.323	0.917	0.602	0.342	0.150	3.94
1961/62	0.899	4.111	12.503	34.571	17.286	6.898	3.005	1.732	1.141	0.903	0.584	0.276	6.99
1962/63	0.878	1.867	7.941	34.742	16.284	6.059	3.142	2.016	1.469	1.158	0.724	0.774	6.42
1963/64	1.990	4.896	11.935	12.644	4.469	2.060	1.268	0.830	0.835	0.493	0.436	0.334	3.52
1964/65	0.159	0.787	4.629	14.784	9.206	6.783	1.749	1.586	0.992	0.749	0.530	0.365	3.53
1965/66	0.333	0.922	3.599	17.744	7.728	2.318	1.076	0.729	0.532	0.395	0.202	0.107	2.97
1966/67	0.078	0.534	9.473	6.355	8.982	3.675	1.092	0.692	0.543	0.419	0.220	0.121	2.68
1967/68	0.172	0.272	6.661	3.633	8.774	3.338	1.225	0.898	0.640	0.359	0.201	0.105	2.19
1968/69	0.351	8.916	13.539	*	10.809	8.857	2.005	1.339	0.840	0.527	0.323	0.241	*
1969/70	0.129	*	*	*	*	*	1.220	0.840	0.499	*	0.283	0.216	*
1970/71	0.662	*	*	*	9.537	4.908	2.873	2.530	1.129	0.787	0.474	0.240	*
1971/72	0.401	3.279	4.175	4.918	4.865	2.283	1.254	0.674	0.498	0.398	0.242	0.114	1.93
1972/73	0.083	5.229	3.706	5.249	1.785	1.580	0.586	0.313	0.211	0.109	0.045	0.013	1.58
1973/74	0.080	*	4.543	15.352	21.561	10.920	3.838	2.226	1.658	1.143	0.810	0.474	*
1974/75	0.413	1.752	2.660	6.211	13.562	3.441	*	*	*	*	*	*	*
1975/76	*	*	*	*	*	*	4.309	2.476	1.932	1.380	0.876	0.526	*
1976/77	*	*	8.773	4.763	5.528	2.367	1.448	1.090	0.789	0.564	0.426	0.269	*
1977/78	0.325	2.604	3.560	*	*	*	*	2.555	1.643	0.967	0.565	0.408	*
1978/79	0.362	11.241	5.315	6.966	10.845	3.562	2.068	1.284	1.001	0.669	0.389	0.258	3.66
1979/80	1.918	8.045	4.214	6.076	4.514	5.164	1.461	1.052	0.674	0.477	0.304	0.390	2.86
1980/81	0.388	13.245	9.294	23.738	*	*	1.738	1.313	1.071	0.735	0.433	0.430	*
1981/82	1.525	8.437	30.810	*	*	*	*	*	*	*	0.448	0.554	*
1982/83	0.857	8.756	5.499	19.950	3.471	0.854	0.689	0.714	0.702	0.658	0.452	0.326	3.58
1983/84	0.163	6.002	5.911	23.106	17.595	2.982	2.429	0.243	0.631	0.654	0.521	0.439	5.06
1984/85	2.854	18.121	8.374	21.394	25.663	8.370	2.490	1.514	1.069	0.836	0.828	5.056	8.05
1985/86	1.437	20.375	33.644	34.656	24.232	9.148	3.410	2.065	1.414	0.873	0.635	0.598	11.04
1986/87	*	5.133	7.867	8.722	9.128	*	2.614	1.462	0.866	0.626	0.452	0.709	*
1987/88	0.510	3.076	5.940	12.446	10.366	4.823	2.845	1.769	1.251	0.885	0.573	0.954	3.79
1988/89	0.390	2.555	7.698	15.248	14.250	6.619	3.595	2.376	1.639	1.097	0.754	0.620	4.74
1989/90	0.611	6.487	12.596	9.235	4.499	2.655	1.735	1.020	1.072	0.743	0.827	0.598	3.51
1990/91	0.684	0.955	*	*	*	*	*	0.986	0.867	0.527	0.384	0.487	*
Mean	0.655	5.517	8.822	13.875	10.907	4.511	1.999	1.294	0.929	0.665	0.449	0.497	4.18

Data source : Department of water
Note : * is data missing.

Table 3.8.1 Present Land Use Conditions

(Unit : ha)

Land Use Type	Salima ADD	Lilongwe ADD		Study Area
	Bwanje RDP	Dedza Hills RDP	Ntcheu RDP	Total
Agricultural Land	**84,200**	**19,300**	**55,900**	**159,400**
- Rainfed Cultivation	81,200	19,300	55,900	156,400
- Wetland Cultivation	2,800	0	0	2,800
- Irrigated Cultivation	200	0	0	200
Non-Agricultural Land	**33,800**	**33,900**	**22,900**	**90,600**
Grasslands	13,800	10,900	8,200	32,900
Natural Forests and Woodlands	19,200	21,700	14,300	55,200
Marshes	800	0	0	800
Bare or Sparsely Vegetated Rock Out Crops	0	1,300	400	1,700
Total	**118,000**	**53,200**	**78,800**	**250,000**

Source : Land Resource and Evaluation Project FAO/UNDP

Table 3.9.1 Lessee and Extent of Leaseholds in the Study Area

No.	Lessee/Estate	Area (ha)	Deed No.	Sheet No.	Grid Ref.
1.	M.W. Bertleft/Sekwere	672.98	20971	1434 B1	630410
2.	Spearhead 1xC. 64	8,904.00	54263	1434 B3	8120120
3.	F. Jeremiya 80/85	12.40	58063	1434 B3	620226
4.	G.B. Mandele 125/71	27.80	38817	1434 B3	627162
5.	D.R. Katengeza	333.00	47042	1434 B3	785132
6.	Maliwande Estate Ltd.	440.00	51850	1434 B3	790009
7.	*P/H Golomoti*	-	361212	1434 B3	*742060/745070*
8.	Golomoti Public Land	720.00	24176	1434 B3	745060
9.	Seventh Day Adventist	-	31795	1434 D1&C2	675810
10.	Farming (agric) Malawi Council of the Hans Capper	1,025.00	47603	1434 D1&C2	810885
11.	Dedza Vicaniate	-	23805	1434 D1&C2	872843
12.	I. Yasini	179.53	51992	1434 D2	893948
13.	V.G. J.E. Thuwala	40.00	39237	1434 D2	708822
14.	D.J. Matenje O.119/74	159.19	43841	1434 D2	20250
15.	G.M. Musaya (Lamya) 78/77	630.00	47570	1434 D2	30794
16.	P.T. Kwalire 31/80	89.52	51915	1434 D2	38880
17.	I.A.M. Zamaele 216/79	228.25	58347	1434 D2	010795
18.	Chigonamikango 146/81	198.00	53056	1434 D2	758859
19.	C. Maniette 154/81	138.56	53738	1434 D2	775840
	Total	13,798.23			

Source: Regional Office, Department of Lands and Valuation, OPC

Table 3.10.1 Planted Area of Major Smallholder Crops (1982/83 - 1991/92)

Unit: ha

Crop	1982/83	1983/84	1984/85	1985/96	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	Average
Maize	1,169,402	1,173,634	1,145,102	1,193,275	1,182,415	1,215,087	1,270,822	1,343,784	1,391,878	1,368,090	1,245,349
Local	-	1,067,527	1,048,441	1,104,583	1,131,540	1,137,499	1,159,985	1,184,036	1,193,642	1,137,891	1,129,460
Composite	-	26,069	21,477	20,100	13,780	18,698	25,072	24,725	18,878	13,347	20,238
Hybrid	-	89,005	74,935	68,592	37,095	58,890	85,765	135,023	179,358	216,852	105,057
Rice	204	21,917	20,807	22,874	19,076	22,658	25,573	29,042	32,841	17,970	21,296
Local	28,686	3,450	2,912	3,640	2,190	2,760	3,496	3,462	4,135	3,007	5,774
Faya	14,335	14,869	14,204	15,702	13,477	16,142	18,123	21,740	24,851	11,768	16,521
B. bonnet	3,288	3,598	3,691	3,532	2,409	3,756	2,776	1,096	262	120	2,453
IET 4094	0	0	0	0	0	0	1,178	2,144	3,593	3,075	999
Groundnuts	146,314	144,935	135,966	176,293	209,938	175,819	139,691	48,185	69,978	64,135	131,125
Chalimbana	143,606	141,406	131,547	166,759	198,957	164,607	69,236	30,079	37,290	58,896	114,238
Chitenbana	0	0	0	1,149	4,788	3,307	165	10	0	0	942
Manipinta	-	-	-	-	-	-	2,075	908	1,076	588	1,162
Malimba	-	-	-	-	-	-	2,191	2,203	2,885	1,991	2,318
Mawanga	0	0	0	566	2,226	2,617	2,559	1,605	1,905	2,660	1,414
Tobacco	27,587	44,999	46,939	38,045	33,170	24,095	21,446	30,823	33,167	32,605	33,288
NDDF	22,990	36,197	35,332	29,422	27,567	20,186	16,719	24,408	26,700	25,608	26,513
SDDF	2,154	2,768	4,117	3,408	1,718	1,693	1,175	957	835	824	1,965
Sun-air	2,443	5,328	6,309	4,942	3,633	1,833	2,639	4,662	3,720	2,702	3,821
Oriental	0	706	681	273	225	354	903	610	903	1,027	568
Burley	-	-	-	-	27	29	167	186	1,003	2,444	643
Cotton	32,597	51,059	60,824	51,910	34,504	43,642	47,741	48,516	53,691	58,281	48,277
Wheat	2,103	1,980	1,126	1,513	2,525	2,593	2,211	2,119	1,494	1,446	1,911
Sorghum	22,649	21,302	32,725	32,059	30,626	30,099	29,328	30,814	31,035	27,628	28,827
Millet	10,870	15,340	17,413	17,424	18,163	19,439	17,916	19,583	14,979	14,797	16,592
Pulses	82,932	91,322	79,971	113,663	152,076	160,040	149,088	215,301	190,977		137,263
Beans	-	-	-	71,329	86,626	91,345	93,506	96,499	116,268	126,714	97,470
Peas	-	-	-	37,977	60,612	2,256	48,380	113,941	69,314	66,438	56,988
Grams	-	-	-	4,357	4,838	6,439	7,202	4,361	5,465	1,145	4,830
Soya Beans	-	-	-	-	-	760	1,671	5,901	16,255	22,143	9,346

Source: Crop Production Estimate

Table 3.10.2 Unit Yield of Major Smallholder Crops (1982/83 - 1991/92)

Unit: kg/ha

Crop	1982/83	1983/84	1984/85	1985/96	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	Average
Maize	1,171	1,191	1,183	1,085	1,016	1,172	1,188	999	1,142	678	1,083
Local	-	1,037	1,034	958	953	1,094	1,052	813	872	324	904
Composite	-	1,787	1,746	1,729	1,635	1,199	1,760	1,400	1,417	403	1,453
Hybrid	-	2,757	3,111	2,941	2,706	2,667	2,855	2,555	2,908	1,307	2,645
Rice	1,278	1,592	1,647	1,635	1,490	1,426	1,787	1,490	1,764	1,524	1,563
Local	0	1,708	1,475	1,575	1,119	1,218	1,284	965	1,302	618	1,126
Faya	0	1,234	1,434	1,387	1,199	1,129	1,501	1,115	1,522	316	1,084
B. bonnet	0	2,752	2,612	2,804	2,882	2,854	3,024	3,375	2,126	800	2,323
IET 4094	-	-	-	-	-	-	4,759	4,337	3,939	4,361	4,349
Groundnuts	369	378	458	501	420	437	249	385	441	206	384
Chalimbana	0	359	452	492	416	430	260	409	467	170	346
Chitembana	-	-	-	623	429	479	413	500	N/A	N/A	489
Manipinta	-	-	-	-	-	-	395	542	604	182	431
Malimba	-	-	-	-	-	-	368	343	438	258	352
Mawanga	-	-	-	959	672	757	655	514	725	214	642
Tobacco	448	434	437	424	412	383	370	454	552	611	453
NDDF	0	428	452	448	431	381	376	449	541	480	399
SDDF	0	578	486	375	364	468	433	421	439	621	419
Sun-air	0	385	338	316	276	285	196	434	501	325	306
Oriental	-	559	2,937	355	440	503	406	467	465	502	737
Burley	-	-	-	-	2,000	2,207	1,563	1,742	1,204	1,129	1,641
Cotton	403	638	758	698	607	671	735	681	729	234	615
Wheat	0	830	699	851	661	721	670	773	587	424	622
Sorghum	302	670	674	648	475	723	672	501	598	143	541
Millet	149	542	608	547	477	609	624	516	518	233	482
Pulses	217	323	352	344	374	363	338	332	359	202	320
Beans	-	-	-	316	332	307	294	286	333	239	301
Peas	-	-	-	393	434	438	408	376	413	209	382
Grams	-	-	-	372	365	442	431	400	367	158	396
Soya Beans	-	-	-	-	-	409	500	557	801	303	514

Source: Crop Production Estimate

Table 3.10.3 Production of Major Smallholder Crops (1982/83 - 1991/92)

Unit: ton

Crop	1982/83	1983/84	1984/85	1985/96	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	Average
Maize	1,369,403	1,397,948	1,355,202	1,294,564	1,201,757	1,423	1,509,513	1,342,809	1,589,377	657,000	1,171,900
Local	-	1,106,832	1,084,592	1,058,080	1,078,860	1,244,351	1,220,565	963,171	1,041,031	368,282	1,018,418
Composite	-	46,575	37,490	34,755	22,531	22,420	44,123	34,616	26,743	5,377	30,514
Hybrid	-	245,391	233,123	210,729	100,366	157,077	244,825	345,022	521,603	283,341	260,164
Rice	25,948	34,886	34,265	37,407	28,432	32,311	45,690	43,280	57,925	19,032	35,918
Local	-	5,892	4,295	5,733	2,450	3,361	4,488	3,342	5,385	1,806	4,084
Faya	-	19,092	20,365	21,772	16,156	18,232	27,200	24,241	37,829	3,721	20,956
B. bonnet	-	9,902	9,642	9,902	9,826	10,718	8,396	3,699	557	96	6,971
IET 4094	-	0	0	0	0	0	5,606	9,298	14,154	13,409	4,719
Groundnuts	53,991	54,766	62,240	88,297	88,073	76,754	34,752	18,574	30,880	11,198	51,953
Chalimbana	-	50,723	59,481	82,092	82,774	70,824	18,012	12,288	17,418	10,009	44,847
Chitenbana	-	-	-	716	2,056	1,825	69	5	0	0	667
Manipinta	-	-	-	-	-	-	820	492	650	107	517
Malimba	-	-	-	-	-	-	806	755	1,264	513	835
Mawanga	-	-	-	543	1,495	1,980	1,671	825	1,382	569	1,209
Tobacco	12,369	19,545	20,505	16,117	13,650	9,238	7,934	1,400	18,321	16,951	13,603
NDDF	-	15,500	16,182	13,178	11,870	7,631	6,279	10,966	14,457	12,286	12,039
SDDF	-	1,600	2,000	1,279	625	792	509	403	367	512	899
Sun-air	-	2,050	2,133	1,563	1,002	523	517	2,022	1,862	879	1,395
Oriental	-	395	2,000	97	99	178	367	285	420	515	484
Burley	-	-	-	-	54	64	261	324	1,215	2,759	779
Cotton	13,134	32,600	46,106	36,235	20,957	29,286	35,106	33,026	42,800	13,637	30,289
Wheat	-	1,644	787	1,287	1,669	1,869	1,481	1,639	877	613	1,318
Sorghum	6,832	14,271	22,041	20,761	14,542	21,776	20,050	15,452	18,557	4,032	15,831
Millet	1,621	8,316	10,580	9,526	8,666	11,841	11,183	10,113	7,766	3,449	8,306
Pulses	18,026	29,479	28,132	39,099	56,803	58,157	50,390	71,385	68,514		46,665
Beans	-	-	-	22,545	28,725	28,071	27,522	27,638	38,755	30,325	29,083
Peas	-	-	-	14,933	26,311	27,237	19,762	42,814	28,808	13,908	24,825
Grams	-	-	-	1,621	1,767	2,849	3,106	1,945	2,008	181	1,925
Soya Beans	-	-	-	-	-	311	836	3,284	13,020	10,959	5,682
Ground Beans	-	-	-	-	-	109	417	411	382	152	294
Guar Beans	-	2,850	3,600	2,300	1,680	3,150	3,300	1,676	4,861	0	2,602
Cashew	-	40	50	58	67	107	89	7,465	11,723	148	2,194
Macadamia	-	-	-	-	0	0	3	0	3	4	2
Sesame	-	18	19	27	34	139	154	143	215	4	84
Sunflower	-	1,270	1,544	1,705	1,182	1,456	2,192	1,703	5,211	5,053	2,368
Castor seeds	-	2	95	106	144	100	-	107	-	0	79
Coffee	-	-	-	-	8	0	5	0	5	7	4
Chillies	-	-	-	-	278	331	615	1,020	834	353	572
Cassava	143,686	258,693	209,321	218,282	169,403	134,785	154,762	144,760	167,818	128,823	173,033
Sweat Potatoes	-	59,926	81,047	80,003	121,195	101,974	177,424	94,911	176,999	43254	104,081
Irish Potatoes	-	-	-	-	13,180	11,400	11,979	34,200	39,969	49144	26,645

Source: Crop Production Estimate

Table 3.10.4 LAND HOLDING SIZE AND LAND USE PER FARM HOUSEHOLD

		Area (ha)	Percentage of the Land Holding Area
Land holding size		1.63	100.0
Cultivated area		1.56	95.7
Cultivated area by crops:			
Maize	Total	1.00	61.3
	Local	0.67	(41)
	Composite	0.02	(1)
	Hybrid	0.31	(19)
Rice	Total	0.22	13.5
	Upland	0.02	(1)
	Lowland	0.20	12.3
Tobacco		0.01	0.6
Cotton		0.17	10.4
Millet		0.03	1.8
Sorghum		-	-
Groundnuts		0.04	2.6
Beans/Pulses		0.04	2.5
Cassava		0.01	0.6
Sweet potatoes		0.02	1.2
Vegetables		0.02	1.2

Average of 119 farm households (effective samples)

Table 3.10.5 PRODUCTION, PLANTED AREA AND YIELD OF MAJOR CROPS IN SALIMA ADD (1984/85 - 1991/92)

Crop	Planted Area (ha)				Yield (kg/ha)				Production (ton)			
	ADD	RDP			ADD	RDP			ADD	RDP		
	Total	Bwanje	Salima	Nkhotakota	Total	Bwanje	Salima	Nkhotakota	Total	Bwanje	Salima	Nkhotakota
1. Maize												
Local	44,694	24,375	14,621	5,699	1,028	969	1,024	1,250	43,314	22,622	14,117	6,574
Composite	3,497	1,047	1,416	1,034	1,492	1,068	1,209	1,841	4,556	1,243	1,351	1,962
Hybrid	5,694	3,108	1,351	1,235	1,726	1,806	1,502	1,924	9,111	4,263	2,272	2,576
Total	53,885	28,529	17,388	7,968	1,125	1,036	1,091	1,487	56,981	28,129	17,740	11,112
2. Rice	4,107	1,030	1,462	1,616	1,654	1,482	1,587	1,718	6,185	1,261	2,441	2,484
3. Groundnuts	7,400	2,515	3,199	1,687	507	377	571	635	3,792	862	1,904	1,026
4. Sorghum	407	342	65	0	152	162	186	-	104	91	13	0
5. Millet	1,126	1,126	0	1	350	350	-	417	371	370	0	0
6. Cassava	7,114	909	604	5,601	2,473	2,455	1,965	2,541	18,439	2,302	1,281	14,856
7. Sweet Potates	1,163	700	241	222	2,138	2,055	2,050	2,360	2,585	1,604	449	532
8. Beans	991	243	393	355	503	829	540	349	505	181	208	116
9. Ground Beans	145	52	38	56	340	284	282	433	51	15	11	25
10. Pigeon Peas	451	436	11	3	676	683	450	470	308	301	5	2
11. Soy Beans	148	111	28	9	689	636	594	1,156	86	63	13	10
12. Cow Peas	1,036	815	198	22	365	389	283	328	389	317	64	8
13. Green Grams	12	12	0	0	600	600	-	-	8	8	0	0
14. Cotton	12,039	4,006	5,171	2,862	734	800	711	744	8,452	2,956	3,419	2,078
15. Tobacco (sun-air)	76	60	15	1	307	307	-	-	6	6	0	0
16. Cashew nuts*	4,098	1,096	1,244	1,759	2	4	2	2	10	4	2	3
17. Sunflower	31	18	4	9	138	50	100	333	4	1	0	3
18. Chillies	169	164	2	3	448	400	500	300	83	82	1	1
Total**	90,299	41,067	28,817	20,415					98,358	38,553	27,550	32,255

Note: * ; Cashewnuts are indecated by no. of trees instead of hectarage and yield in kg per tree.

** ; Total area does not include panted area of cashewnuts.