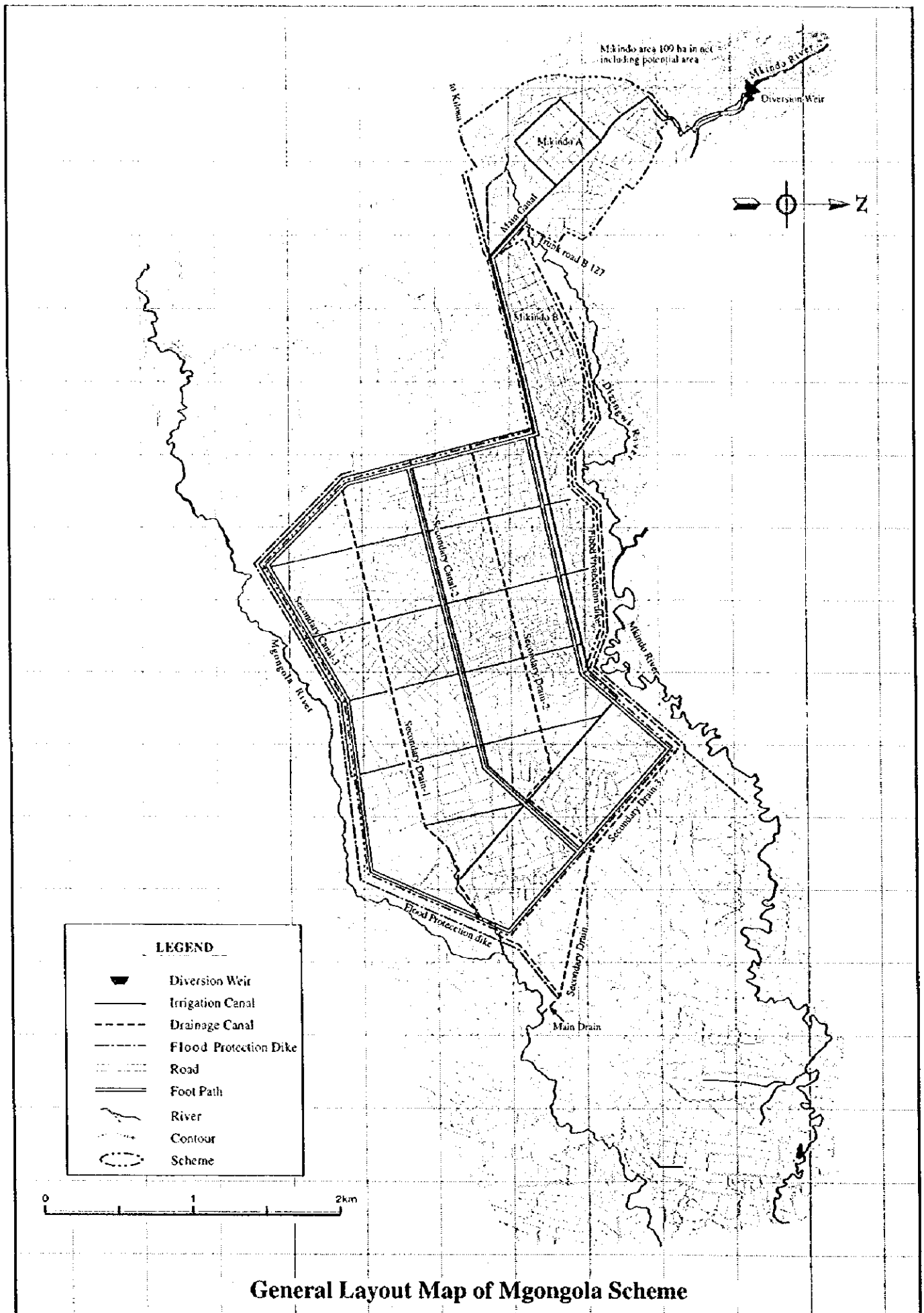


DIVISION - III

***DEVELOPMENT PLAN OF MGONGOLA SCHEME
MOROGORO DISTRICT***



General Layout Map of Mgongola Scheme

DIVISION - III.

**FEASIBILITY STUDY
ON
THE SMALLHOLDER IRRIGATION PROJECTS
IN
CENTRAL WAMI RIVER BASIN**

MGONGOLA SCHEME

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CHAPTER I. PRESENT CONDITIONS OF THE SCHEME AREA

1.1 Physical Nature of the Study Area

1.1.1 Location

Mgongola scheme area is located in Morogoro District, Morogoro Region (See Location Map). It is a part of the extensive Mkata Flood Plain which is drained to the east by the Wami river and its tributaries. The project area lies north of Morogoro city and accessible by an all-weather road via Mvomero (80 km) and by the dry season a short cut road via Dakawa (65 km). The area is situated between the Dizingwi - Mkindo river in the north and the Mgongola river in the south in a range from 345 m to 365 m above sea level, and between latitudes 37°32' E and 37°36' E and longitudes 6°16' S and 6°18' S.

1.1.2 Topography

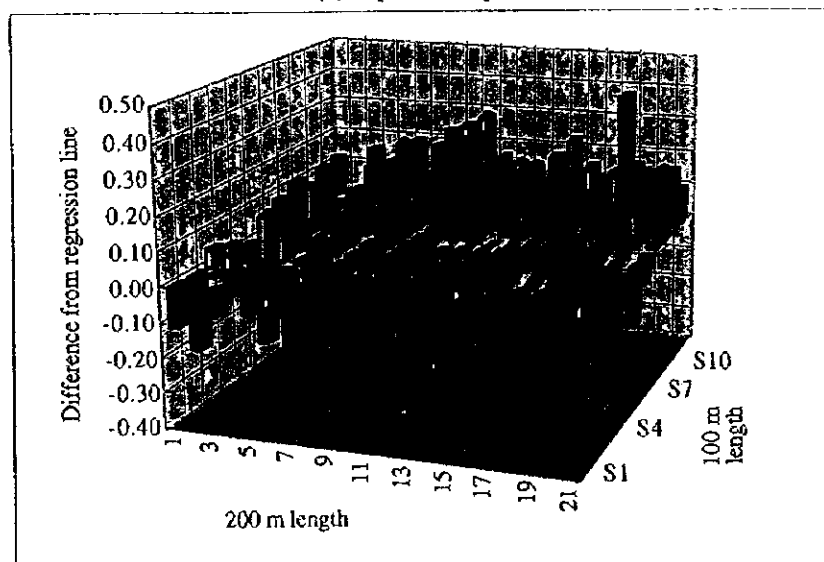
(1) Topography

The topography of the project area is flat with an overall slope of 1 / 200 to 1 / 500 to the east.

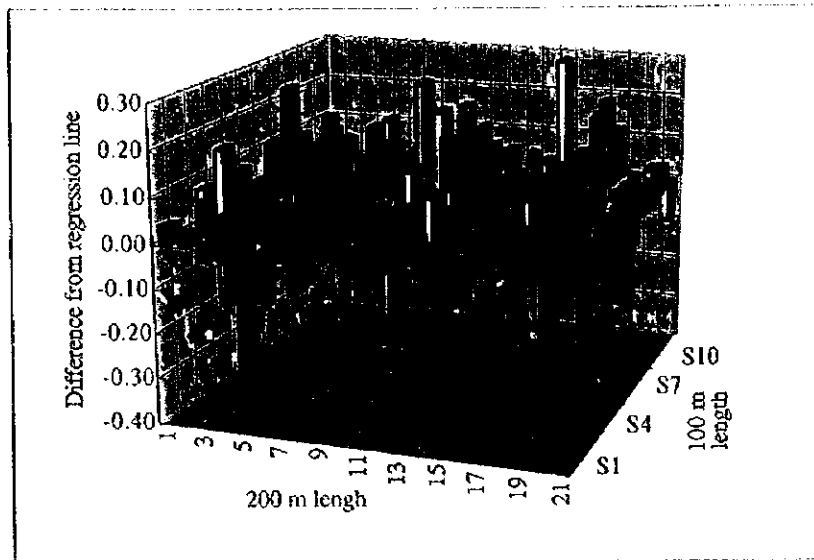
Offset survey was carried out at 10 m grid interval at two points; one selected at the upstream and the other selected at the downstream in the project area. Each area is a rectangular area of 100 m x 200 m. According to the survey, micro undulations are observed in both plots as shown in the following figures. These figures are developed in the following way ; (1) a regression slope and elevation are calculated along the main sloping direction, while the other direction is level and then (2) the difference between the surveyed elevation and the regression elevation is calculated at every grid points . The overall slope is 1 / 290 at the upstream plot and 1 / 460 at the downstream plot. Maximum difference between the highest and the lowest is 75 cm in the upstream plot and 64 cm in the downstream plot.

Micro Undulations in Mgongola Area

(a) Upstream plot



(b) Downstream plot



(2) River system

There are three rivers related to the Mgongola scheme.

- Mkindo river

The Mkindo river is a water source of the existing Mkindo irrigation scheme and expected to be that for Mgongola scheme as well. It flows eastward and joins to the Wami river. It seasonally overflows its banks into the plain in which prospective development area of Mgongola scheme lies. The flooding water depth is 0.3 m in the upstream and 0.5 m in the downstream area along the river at the peak according to hearing survey to inhabitants. There are no water users other than those in the Mkindo scheme.

- Dizingwi river

The Dizingwi river is a tributary of the Mkindo river. It is perennial. Its water is always stagnant in the Mkindo area due to insufficient carrying capacity caused by shallow bottom of the river.

- Mgongola river

Mgongola river runs south edge of Mgongola scheme area to the east. It habitually inundates the Mgongola area in the rainy season. The flooding depth is 0.8 m to 1.0 m in the upstream of Mgongola scheme area and 0.5 m in the downstream area along the river at the peak according to the interview survey with farmers.

1.1.3 Meteorology and Hydrology

(1) Meteorology

(a) Rainfall

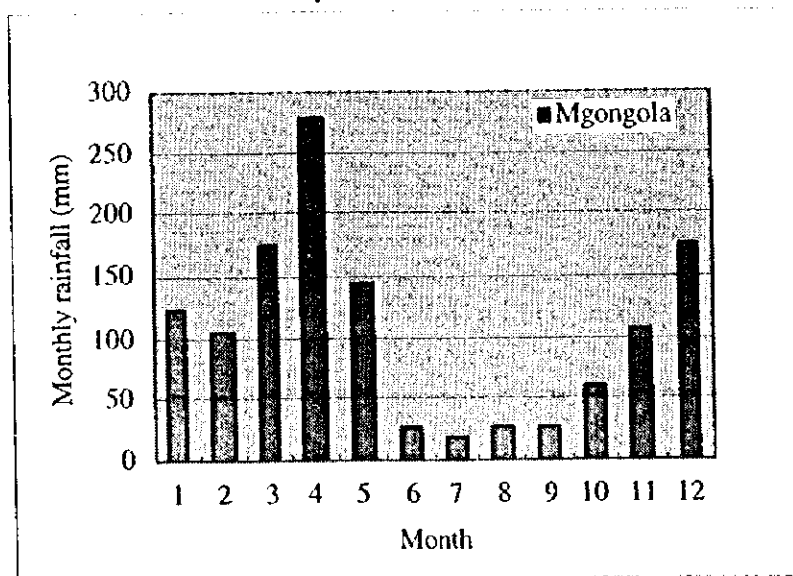
Annual rainfall in Mgongola scheme is 1,300 mm on an average. The rainy season

is usually from October to May and the dry season is from June to September. Peak rainy season is April.

Annual Rainfall in Mgongola Scheme Area

Name of Scheme	Rainfall Station	Code Number	Annual Rainfall (mm)
Mgongola scheme	Maskati station	963710	1,313

Mean Monthly Rainfall at Maskati station



(b) Other Climate Parameters

Meteorological data for Mgongola scheme is available in Morogoro meteorological station and Ilonga meteorological station. This data is summarized in the following Table.

Summary of Meteorological Data (1/2)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
I. Morogoro Meteorological Station													
(1) Mean Maximum Temperature (oC)	31.6	32.1	31.6	29.6	28.4	27.6	27.2	27.8	29.8	31.4	32.0	31.8	30.1
(2) Mean Minimum Temperature (C)	21.1	21.1	21.1	20.6	18.9	16.0	15.1	15.4	16.7	18.1	19.9	20.6	18.7
(3) Mean Temperature (C)	26.4	26.7	26.4	25.1	23.7	21.9	21.2	21.6	23.3	24.8	25.9	26.2	24.4
(4) Relative Humidity (%)	80.2	80.5	82.7	89.2	89.4	86.0	85.2	82.8	78.0	73.8	72.7	75.9	81.3
(5) Sunshine Duration (hr/day)	7.5	7.6	7.4	5.4	5.4	6.6	6.5	6.4	6.8	7.7	8.2	7.8	7.0
(6) Solar Radiation (I/day)	16.8	18.4	15.5	13.9	12.6	12.8	12.7	12.9	15.1	15.9	17.5	16.8	15.1
(7) Wind Velocity (m/s)	2.5	2.2	1.7	1.0	0.9	1.0	1.3	1.7	2.1	2.4	2.5	2.7	1.8
(8) Evaporation (mm/day)	5.8	6.7	5.6	3.9	3.1	3.1	3.4	4.1	5.6	6.3	6.7	6.3	5.1
Meteorological data except evaporation are available for recent 24 years.													

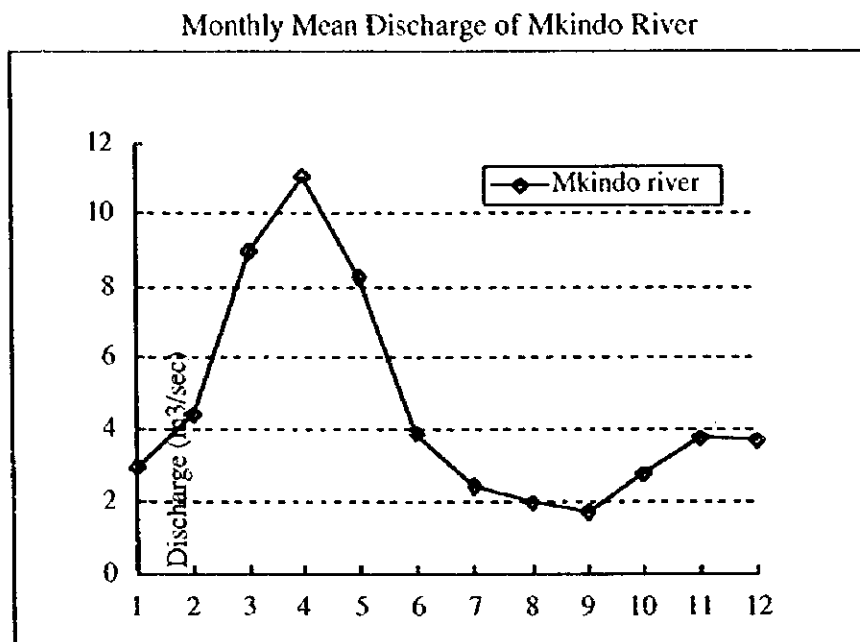
Summary of Meteorological Data (2/2)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
2. Ilonga Meteorological Station													
(1) Mean Maximum Temperature (C)	31.4	31.4	31.5	29.8	28.4	27.4	27.7	28.4	30.2	31.6	32.6	31.9	30.2
(2) Mean Minimum Temperature (C)	20.7	20.6	20.8	20.2	18.7	15.7	15.1	16.2	18.0	19.9	20.7	21.0	18.7
(3) Mean Temperature (C)	26.0	26.0	26.1	25.0	23.5	21.5	21.4	22.3	24.1	25.8	26.7	26.5	24.4
(4) Relative Humidity (%)	83.4	83.2	84.3	84.7	81.8	74.9	73.2	74.4	73.1	72.9	74.1	78.0	78.2
(5) Sunshine Duration (hr/day)	6.8	7.0	7.1	6.3	6.5	7.8	7.5	6.8	6.9	7.8	8.1	7.5	7.2
(6) Wind Velocity (m/s)	1.2	1.2	1.0	0.9	0.9	1.1	1.2	1.3	1.5	1.8	1.7	1.5	1.3
(7) Evaporation (mm/day)	5.7	6.7	5.5	4.0	3.1	3.1	3.4	4.0	5.6	6.4	6.7	6.2	5.0
Data available for 19 years.													

Mgongola scheme closely follows the rainfall patterns of Morogoro station and lays at the same altitude (500 m) as Morogoro and Ilonga stations.

(2) Hydrology

Estimated monthly mean discharges of the Mkindo river are shown in the following figure.



In the mid rainy season from March to April, the river flow is more than 8 m³/sec on the monthly average, and is the lowest of 1.9 m³/sec in September.

Flood discharge of the Mkindo river at the intake point is estimated as follows:

Return Period	Probability Flood Discharge (m ³ /sec) Mkindo River
10 year	74.3
20 year	90.3
50 year	112.4

1.1.4 Soils and Vegetation

The soil survey was carried out aiming at the soil classification as well as clarification-cum-assessment of the land suitability for the subjected irrigation development of Mgongola scheme. The field investigation and soil classification was carried out as follows:

- Review of all the results of the reconnaissance soil survey which had been carried out by JICA Study Team for the master planning study in 1996,
- Interpretation of the aerial photographs on a scale at 1/10,000 that has also been prepared by the JICA Study Team in 1997,
- Clarification and identification of the essential soil groups and those proportional distribution using the detailed topographic maps (1/5,000), and
- Field confirmation and classification of the soil groups at the semi-detailed basis.

According to the FAO/UNESCO Soil Classification System (refer to the Soil Map of the World), the soils of Mgongola scheme are classified into three essential units, *i.e.* Eutric Cambisols (mapping unit Mgl-1), Eutric Fluvisols (mapping unit Mgl-2) and Eutric Fluvisols associated with Eutric Gleysols (mapping unit Mgl-3). Each soil is characterized by the physiographical features, textures and water resume. The soil map of the scheme area is as illustrated in Drawing No.301 in Drawings. The soil morphological characteristics and extent of each soil unit are shown in Table below:

Mapping Unit	Mgl-1	Mgl-2	Mgl-3
Area (ha)	515	25	190
Soil Unit	Eutric Cambisols	Eutric Fluvisols	Eutric Fluvisols associated Eutric Gleysols
Pysiography	Alluvial Plain	Old natural levees	River plain/natural levees
Topography	Flat	Flat - almost flat	Flat - almost flat
Parent Material	Alluvium	Alluvium	Alluvium
Soil characteristics			
Texture	CL/C/C	SL~SCL/SCL/C	SCL~SLA/SL
Depth	> 150 cm	> 150 cm	> 150 cm
Fertility	High	High	High
Drainability	Imperfect	Well	Poor
Depth of groundwater			
Rainy season	Flooding	30 - 100 cm	Flooding
Dry season	> 150 cm	> 150 cm	50 - 150 cm
Land Use	Paddy	Grassland	Paddy, Grassland

The soils of Mgl-1 extend over the flat alluvial plain. These soils are the most predominant that have a proportional extent of 515 ha or 71% of the total scheme area. The land with these soils is generally affected by the seasonal flooding of the Mgongola river during the rainy season. In contrast in the dry season, the land is dried up so seriously, and hence, the soils are cracked rather deeply in the surface profile. The soils have relatively high inherent fertility, fine texture (clay to clay loam) and deep enough soil depth for

reclamation of paddy field. At present, most of the land is extensively utilized for paddy cultivation in the rainy season as much as using the seasonal flood-water while no land use in the dry season.

The soils of Mgl-2 are found on an higher position of alluvial plain lying in the western part of the Scheme area, that is to say the old natural levees formed by the Dizingwi river. The proportional extent of these soils is estimated to be 25 ha or 3% of the gross Scheme area. Generally, the land is free from the seasonal flooding, and accordingly, no land use is practiced even in the rainy season. Dense tall grasses with scarce bushes are grow in this land. The surface soil having 30 to 50 cm depth is moderately fertility and sandy loam to sandy clay foam texture. The sub-soils having clayey textures are deeply underlying without any distinct layers/horizons formation.

The soils of Mgl-3 developed over the meso- and micro-relief complexes, which are composing of the natural levees and depressions extended along the Mgongola, Mkindo and Dizingwi rivers. The proportional extent of these soils is estimated to be 190 ha or 26% of the Scheme area. The existing Mkindo scheme (40 ha), a pilot scheme for irrigated paddy cultivation, developed on this soil unit. The irrigation facilities of the Mkindo scheme are functioning well, and cultivated with paddy twice a year. Other land is also extensively cultivated with paddy under rainfed conditions as much as using seasonal flood-water in the rainy season. A drainability of these soils is poor due mainly to shallow depth of groundwater. The soils have relatively high inherent fertility while medium soil texture in deep soil profile.

The chemical properties and physical natures of the above soils are as shown in Table below. There are no alkaline and/or saline soils.

Physical Natures and Chemical Properties of Soils

Soil Mapping Unit	Soil Sample No.	Horizon Name	Depth cm	EC mS/cm	pH (1:2.5)		Particle Size			Soil Texture	Bulk Density g/cm ³
					H ₂ O	KCl	Clay %	Silt %	Sand %		
Mgl-2	1	Ap	0-14	0.03	6.6	5.0	24	11	65	SCL	1.22
	2	A1	14-28	0.02	6.6	4.8	44	7	49	SC	1.13
	3	AB	28-53	0.03	6.8	5.1	66	5	29	C	1.10
	4	B2	53-80	0.08	6.9	5.5	64	3	33	C	1.22
Mgl-1	5	Ap	0-20	0.08	6.7	5.6	34	17	49	SCL	1.33
	6	A1	20-43	0.05	6.3	5.4	68	5	27	C	1.17
	7	B2	43-75	0.05	6.9	5.6	58	11	31	C	1.07
Mgl-3	8	Ap	0-18	0.02	6.3	5.4	36	17	47	SC	1.13
	9	A1	18-45	0.03	6.1	5.2	38	19	43	CL	1.09
Mgl-3	10	Ap	0-15	0.06	6.9	5.6	16	13	71	SL	1.33

Soil Mapping Unit	Soil Sample No.	Total N %	Organic C %	C/N Ratio	CEC me/100g	Exchangeable Cations					Satur. Ratio %
						Ca	Mg	K	Na	Total	
Mgl-2	1	0.07	0.85	12.1	9.0	2.72	1.83	0.19	0.26	5.00	56
	2	0.08	0.66	8.2	17.0	4.60	4.29	0.44	0.92	10.25	60
	3	0.09	0.73	8.1	22.0	6.77	6.17	0.30	1.72	14.96	68
	4	0.05	0.42	8.3	21.2	7.96	7.20	0.36	2.11	17.63	83
Mgl-1	5	0.10	1.86	18.6	21.0	6.66	3.36	1.16	0.28	11.46	55
	6	0.06	0.50	8.4	23.0	9.94	6.67	0.19	0.70	17.50	76
	7	0.06	0.43	7.1	20.0	10.05	7.54	0.40	1.17	19.16	96
Mgl-3	8	0.09	0.89	9.9	15.4	6.34	3.32	0.14	0.29	10.09	66
	9	0.17	2.10	12.4	20.8	8.76	3.91	0.15	0.21	13.03	63
Mgl-3	10	0.05	0.25	5.0	6.0	2.74	1.06	0.23	0.68	4.71	79

1.2 Present Conditions of Socio-economy in the Study Area

1.2.1 Administrative Divisions, Public Administration and Demographic Data

(1) Administrative Division

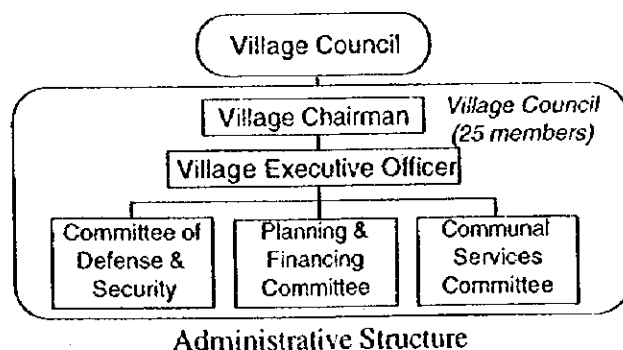
SCHEME	DISTRICT	DIVISION	WARD	VILLAGE
Mgongola	Morogoro Rural	Mvomero	Hembeti	Mkindo
		Mvomero	Hembeti	Dihombo
		Mvomero	Hembeti	Hembeti

(2) Public Administration

1) Administrative Structure

The village is the smallest unit of organization in the administrative structure. Within the village, the following administrative structure can be found:

Members of the Village Council include the Village Chairman and members of the Committees. The villagers elect all members of the Village Council, except the Village Executive Officer. The Village Executive Officer, who is selected among the villagers, is hired by the Village Council and is in charge of administrative works.



To facilitate the work of communication and co-ordination between the villagers and the village government, a number of villagers' clusters are formed. Each cluster has a chairman who is also a member of one of the village committees.

After the Village Council unit, the next level of administrative unit is the Ward Committee integrated by a Ward

Councilor, a Ward Executive Officer, and an assorted number of professionals in charge of evaluating proposals elevated to them by the village government. The Ward Councilor is elected from the different political parties in the ward. The Ward Councilor is supposed to attend the village meetings and represent the villages at the District level. The next administrative level is the Division level. The Divisional Secretariat unit deals specifically with security and defense matters. At the District level, all District Council matters are conducted by a specific board known as Local Government Civil Service Commission. The highest authority is the District Commissioner.

2) Rules Formulation, Approval and Enforcement

Rules Formulation

Village rules, under the form of by-laws, are formulated by the villagers and their leaders. The need to formulate the by-laws comes from either the villagers or the leaders. A meeting is organized by the village government to discuss the proposed

by-laws; the meeting involves the following members:

- All members of the Village Council;
- Village Executive Officer as secretary to this meeting;
- Clusters' chairmen;
- Representatives of different political parties;
- Other special members selected by the villagers.

In the meeting, a proposed by-law to regulate or legislate on problems encountered in the village is discussed. When the by-law has been formulated, the villagers are informed through posting the proposed by-law in the public information board for one month so that if there is any comment or objection, it can be put forward in advance. If there is no objection, the Village Council, through the Ward Councilor, elevates the by-law proposal to the District Council for its approval.

At the District level, the Full Council, which is the body that reviews and approves or rejects the by-law proposed by the Village, has the following members:

- District Executive Director;
- All department heads in the District Council;
- Ward Councilor from all villages concerned with the proposed by-law.

The by-law is scrutinized and, if approved, sent back to the village for its enactment. It must be noted that there is a specific time based on a yearly schedule set by the District Council for approval of all by-laws proposed by the villages within the District.

Enforcement

Enforcement of the by-laws is carried-out by the village government, especially by the Village Chairman and Village Executive Officer. Violation of the by-laws is considered as an offence and punishments/penalties are imposed as an immediate action.

The money amount to be paid as penalties, punishments or fines is set by the village government, based on the existing by-laws. Not fulfilling the conditions set by the punishment is a greater offence, which may lead the culprit to be sent to the court. The collected money goes to the Village Council.

3) Conflict Resolution Framework

When a conflict can not be settled up between the parties involved, they can decide either to let the problem be solved by the village government or settle it by a legal court.

When the problem is to be reviewed by the village government, the parties must accept the final decision adopted by it. However, if the village government fails to solve the conflict, other higher level administrative bodies, e.g., district office, regional office up to the ministry level are in charge of solving it.

(3) Population and Households

The Table below provides information on population and households.

Administrative Division and Population (1996)

Scheme	District	Division	Ward	Village	Population	Household
Mgongola	Morogoro Rural	Mvomero	Hembeti	Mkindo	4,220	844
				Dhombo	1,850	370
				Hembeti	2,400	480

Source : Data from Ward Executive Officers, Village Executive Officers, Village Extension Officers

(4) Population Composition

To be used as a reference and indicative information on the demographic trends, the Table below gives information on the age composition for Mgongola scheme.

Age Composition of the Villages' Population

Scheme	Village	Total Population	0-6 Years	7-14 Years	15-45 Years	46-55 Years	56 Years and Above
Mgongola	Mkindo	4,222	816	1,890	797	363	356
	Dihombo	1,850	390	460	776	205	19
	Hembeti	2,401	561	384	970	220	266

The population composition data for the village can be further classified using the following categories:

- Pre-school age : 0-6 years
- School age : 7-14 years
- Working age : 15-55 years
- Old age : 56 years and above

The Table shows population composition in terms of the ratio between each population category shown above and total population.

Classification of Population According to Activity in Percentage Terms

Scheme	Village	Pre-school Age Pop./Total Pop.	School Age Pop./Total Pop.	Working Age Pop./Total Pop.	Old Age Pop./Total Pop.
Mgongola	Mkindo	19	44	28	9
	Dihombo	21	25	53	1
	Hembeti	23	16	50	11

The data above shows that the ratio working population/total population is high. However, in the case of Mkindo village, if this tendency continues, the low ratio would mean a deep dependence on labor outside the village for farming purposes. This would be a constraint for development of the area.

1.2.2 Rural Infrastructure

(1) Roads

Access by a trunk road from the main road Iringa-Dar-es-Salaam is about 27 km. Access to this scheme is characterized by an alluvial muddy road surface without pavement or embankment. During the mid-rainy season from February to March, it is often submerged with flooding water and the roads are frequently muddy. The scheme becomes often becomes isolated during the flooding season.

(2) Basic Services

The Table below shows the situation of basic services at village level.

Basic Services at Village Level

Scheme	Village	Electricity	Water Supply
Mgongola	Mkindo	Available for not more than 20 houses	River water
	Dihombo	Available for only 3 houses	Limited piped water/river water
	Hembeti	Available only for 10 houses	Limited piped water/river water

Source : Data from Ward Executive, Village Executive Officer

(3) Social Infrastructure

The Table below shows the situation of social infrastructure at village level.

Social Infrastructure in the Villages

Scheme	Village	School	Dispensary	Church	Mosque
Mgongola	Mkindo	1	1	1	2
	Dihombo	1	-	1	1
	Hembeti	1	1	1	1

Source : Data from Ward Executive, Village Executive Officer

The staff of the dispensary consists of a medical assistant and a registered nurse. For cases requiring a better equipment and staff, the patient must be taken to an urban center to be attended there.

(4) Agricultural Facilities

The Table below shows the situation of agricultural facilities at village level.

Agricultural Facilities in the Villages

Scheme	Village	Storage Facility	Rice Mill	Maize Mill	Mill (Rice+Mill)
Mgongola	Mkindo	1	-	2	4
	Dihombo	-	-	-	-
	Hembeti	1	-	-	1

1.2.3 Economic Activities

Agriculture is the main economic activity in the village. There are no industries in the scheme.

Processing activities for agricultural products are mostly centered on two main activities: milling of basic grains and local brew preparation from maize. The former activity is carried out at small-scale mills, which are aimed to satisfy local demand for milling; there is no big-scale milling facility. The latter activity is usually carried out at a domestic level and usually women are in charge of it; this activity is, on one hand, an important off-farm source of income for some families, and on the other hand, it is a stable source of income for the village authorities.

Other off-farm income sources are: petty business, raising of poultry, pigs, and goats for sale, hiring themselves as labor to third parties.

1.3 Present Conditions of Agriculture

1.3.1 Present Land Use

The present land use is classified into four units, i.e. 1) cultivated land; 2) forest/wood land including tree plantation; 3) grassland including scarce bushes and shrubs; and 4) settlement area including right of ways such as roads and canals. The cultivated land is further classified into two sub-types, i.e. 1-a) paddy field and 1-b) upland field.

The land use survey was carried out through interpretation of the aerial photographs (1/10,000), field visual survey and interview with villagers. The present land use of the scheme area is then compiled using the detailed topographic map on a scale of 1/5,000, and the shortened map is attached as shown in Drawing No. 302 in the Drawings. The extent area by land units is summarized as follows:

Land Use Type	Area (ha)
Cultivated Land	580
Paddy Field	580
Upland Field	-
Grassland	130
Forest & Wood Land	-
Settlement/Right of Ways	20
Total	730

Out of 730 ha in gross of the scheme area, 580 ha or 79% of the land has been used for paddy cultivation either under irrigated or rainfed conditions. The existing Mkindo irrigation scheme, which was developed as a pilot scheme for promoting an intensive practice of paddy production, covers some 60 ha and being cultivated paddy twice a year under fully irrigated conditions. The remaining 520 ha land is extensively cultivated with paddy only in the rainy season using the seasonal flood-water from the rivers. In the dry season, these lands are left fallow from any crop cultivation, and used for cattle grazing. In some small plots where the land is free from the seasonal flooding, such upland crops as maize and vegetables are also grown in the rainy season, however, these are of a negligibly small extent.

Grasslands including scarce bushes and shrubs are patchy dispersed in relatively elevated land where the soils are coarse texture, well drained and free from the flooding. The total coverage accumulated is about 130 ha or 18% of the scheme area. The wild-grasses are used for cattle grazing in common. The land used for settlement of the infrastructure is mostly the right of ways of canals in the Mkindo pilot scheme and the existing farm road itself. The total extent shared into this land use unit is estimated to be 20 ha or 3% of the total scheme area.

1.3.2 Land Ownership and Tenure System

The tenure system in the Study Area is generally based on traditional inheritance, land allocation by village council, land purchasing, land borrowing or renting. The most common tenure regime in the scheme is the one based on "customary tenure", where land rights are transferred according to an ancestral tenure of land and/or the traditional inheritance accepted by the village council. The JICA Study Team has estimated that the average landholding size per farm household for Mgongola is 1.62 ha (rainfed plus irrigated areas). It has been estimated that 0.36 ha is within the irrigated area.

Landholding Size

Basic Information	
Number of households	1,694
Cultivated Area (ha)	
Wet Season	2,750
Dry Season	620
Holding Size (ha)	
In the whole village	1.62
In the Study Area	0.36

1.3.3 Present Agricultural Production and Farming Practices

Agricultural activities in the Mgongola scheme predominantly contain cultivation of paddy. That is, double cropping of paddy a year is carried out under fully irrigated condition in the existing the Mkindo pilot irrigation area which covers around 60 ha at the upper reach of the Mgongola scheme.

While the proposed Mgongola scheme area covers 520 ha at the lower reaches of Mgongola scheme and is regularly inundated by the seasonally habitual flooding during the period from March and April in the rainy season. In this proposed area, single cropping of paddy is extensively conducted by smallholder farmers who come from the surrounding villages that is Mkindo, Dihombo, and Hembeti villages. On the other, rainfed maize is cultivated in some part of upland area which is not flooded during the rain season.

(1) Cropping Pattern

As mentioned above, in the existing Mkindo pilot irrigation area, double cropping of paddy a year is generally carried out. That is, first cropping of paddy is carried out in the rainy season during the period from January to June, following land preparation which is completed in December. Second cropping is started from middle of June and completed in beginning of December.

Regarding single cropping in the proposed Mgongola area, sowing is conducted during the period from December to January, depending on the availability of rainfall. Harvesting is mainly completed in May and June.

Present cropping pattern in the scheme including the existing Mkindo pilot area and proposed Mgongola area is shown in Figure 1.3.1.

(2) Paddy Cultivation in the Mkindo Pilot Area

The relatively intensive farming practices is carried out for paddy cultivation in the area. Cultivar which are applied is "Line 88" which is a high yielding variety and crossed between "Supa India" and "KM 87 of North Korean high yielding variety" and will be expected to be officially released in November of this year. Seeds have been multiplied by farmers themselves, not renewed to the certified seeds so far.

In this area, farmers have been supported technically by the Special Programme of Food and Agriculture Organization (FAO). The objectives of this Programme is to increase production of maize and paddy, in order to meet the future food demand of Tanzania. 21 farmers out of 97 farmers in the Mkindo pilot area have participated in this Programme. Under the programme, participated farmers have been instructed irrigated farming practices

of paddy cultivation. Major farming practices are summarized in Table 1.3.1 and elaborated as follows;

1) Land preparation of the main field

Land preparation is manually done by using tractor or hand hoe. Concerning draught cattle, it is not available in the area as farmers have not kept cattle. At present, two hand tractors are adopted for ploughing and puddling. However, one-third out of all farmers have received the benefit, while two-third of them are forced to conduct land preparation manually.

Ploughing is carried out 3 to 4 weeks before transplanting. That is, land preparation for the main field is commenced when nursery beds are prepared in a part of the main field. After ploughing, puddling is consequently conducted over the nursery period depending on the availability of hand tractors. This point is elaborated in Section 2.3.6 of constraints and problems.

2) Nursery preparation

Nursery bed is prepared in a part of the main field. Seed amount for the nursery is estimated at 15 to 20 kg for one acre of the main field and bed size is instructed to be 250 m² for one acre. No soaking seed is common. Nursery period is estimated at around 3 to 4 weeks. Urea of 2 kg per one bed of 250 m² is applied around two weeks after sowing.

3) Transplanting

One to two seedlings per hill are transplanted with range between 10 cm x 10 cm and 10 cm x 20 cm, using line marker which were introduced by the Indonesian farmers who trained the Mkindo farmers. It is common to carry out gap filling for missing paddy seedlings. No broadcasting is conducted in the area.

4) Application of fertilizer and agro-chemicals

Basal fertilizer is applied two weeks after transplanting, or 50 kg of Urea in one acre (125 kg per ha). Almost all farmers participated in the Special Programme - FAO apply basal fertilizer, while majority of non-participated farmers to the programme do not apply fertilizer, due to lack of capital. Furthermore, top-dressing 60 to 70 days after sowing, or the stage of panicle formation stage, is recommended under the Programme. However, no top-dressing is common in the area.

5) Plant protection

Regarding diseases, blast, sheath rot, etc. are mainly identified in the area, while stalk eyed sheath fly, stem borer, etc. are major insects. However, those diseases and insects are not so serious. Normally, no application of agro-chemicals for them is common in the area. On ripening stage, bird scaring is the main activity.

6) Weeding

Concerning weeds, Special Programme - FAO has instructed to adopt rotary weeder instead of application of herbicide and manual weeding. However, farmers prefer to conduct manual weeding instead of adoption of rotary weeder, due to low efficiency of this tool. On the other hand, some farmers, especially participating

farmers in the Special Programme - FAO apply 2,4-D of herbicide.

7) Water management

Basically, irrigation is commenced on preparing nursery beds in a part of the main field. Consequently, puddling is carried out under shallow water. Irrigation is generally conducted once a week until around 20 days before harvesting. Further, when soil is hard for ploughing by hand tractors, there is some cases to impound shallow water to the field in order to soften the soil condition.

8) Harvesting and post-harvesting activities

Growth period of "Line 88" is estimated at around 120 to 130 days in the area. Harvesting work is commenced during the period from the beginning of November to beginning of December when around two-third of panicle from the top side is changed to yellowish color. Drying activity after reaping is not so common. After reaping, paddy grains are consequently threshed, winnowed, and bagged immediately in the field. Bags of harvested paddy are carried to farmers house by themselves or hired persons, using bicycle or manpower. Harvested paddy is soon sold whenever traders are available.

(2) Farming Practices in the Proposed Mgongola Area

Paddy cultivation in the area is relatively extensive farming practices with broadcasting method. No fertilizer and agro-chemicals are applied to a large extent. Cultivar which are applied is "Supa India" which is a common local variety in Tanzania. Seeds are multiplied by farmers themselves, not renewed to the certified seeds. Major farming practices are summarized in Table 1.3.1 and elaborated as follows;

1) Land preparation of the main field

Ploughing and harrowing by hired tractors is predominant in land preparation. It is estimated that about 10 tractors are hired in contract base of the individual farmers concerned. Quality of such land preparation as ploughing and harrowing is quite rough. Tractor availability is low and hence some farmers are forced to carry out land preparation manually by using hand hoe which is a laborious work. This point is elaborated in Section 2.3.6 of constraints and problems. Labour for land preparation is arranged from family, while hired labours are also expected to make up for the lack of man-power of family labour. Ridge formation in the main field is not common because farmers themselves are not aware of the efficiency and hereby they have not striven to prepare ridges to keep flooded water for a certain period.

2) Planting

Concerning planting way, broadcasting is mostly common in the proposed Mgongola area. This activity is conducted after plowing by means of tractor or hand hoe. Dry seed of paddy is broadcasted before harrowing by tractor or hand hoe. Soaking is not common and hence rainfall is expected for germination. Accordingly, this broadcasting should be done at the right time of commencement of the rainy season. Depending on the rainfall pattern, sowing time might be shifted year by year. It is noted that paddy cultivation is affected by unreliable seasonal flooding which is not controlled by farmers.

3) Application of fertilizer and agro-chemicals

Application of fertilizer is not so effective due to no ridge formation in the area and utilization of seasonal flooding by which fertilizer to be applied is washed away. No application of fertilizer and agro-chemicals are common in the area. In some part of the area which is not flooded continuously, serious outbreak by army worm is reported, but not every year. It is recommended to apply Diptex, Sevin, Thiodan, etc. for the protection. However, those agro-chemicals are not easily available.

4) Maintenance activities in the main field

Due to the extensive farming of paddy cultivation under the seasonal flooding, sufficient maintenance is not expected. Weeding is not common, although this activity is done in the case of serious condition, by using 2,4-D or hand weeding.

Bird scaring is main activities during the ripening stage of paddy. Generally, one child or female is deployed each plot.

5) Harvesting

Growth period of "Supa India" is estimated at around 150 days in the area. Harvesting work is flexibly commenced during the period from May to June depending on the occurrence of seasonal flooding on sowing. Drying activity after reaping is not so common. After reaping, paddy grains are consequently threshed, winnowed, and bagged immediately in the field. Bags of harvested paddy are carried to farmers house by themselves or hired persons, using bicycle or manpower. Harvested paddy is marketed as early as traders are available.

(3) Crop Production

Unit yield of major crops in the Mgongola scheme is confirmed based on the result of Master Plan study last year and field investigation this years.

As for paddy cultivation in the proposed Mgongola area, no application of fertilizer and agro-chemicals is common in the area. As for seeds, farmers do seed multiplication by themselves rather than purchase of qualified expensive seeds.

In the Mkindo pilot scheme, participated farmers in Special Programme - FAO have gained relatively high yield, that is 4.0 to 5.0 ton/ha, as shown in Table 1.3.2. This means that impact of irrigation has been come out and unit yield has been jumped up at even the initial stage. Moreover, proposed farming practices have been disseminated to non-participating farmers, since the commencement of the programme. As a result, they have striven to apply fertilizer and agro-chemicals, resulting in the increment of paddy yield. Actual data on paddy production of the non-participatory farmers in the programme is not available, so that the existing paddy yield of the non-participated farmers is estimated to be slightly lower than that of the participated farmers. While it seems that unit yield of paddy in the Mgongola area is still in low level due to extensive practices under the seasonal habitual flooding.

The present cultivated area and production of paddy in the scheme is estimated as follows:

Present Crop Cultivation in Mgongola Scheme

	Cultivated Area (ha)		Unit Yield (ton/ha)	Crop Production (ton)		
	RS*1	DS*2		RS	DS	Total
Mkindo pilot scheme	40	40	3.8	152	152	304
Mgongola area	540	-	1.6	864	-	864
Total	580	40		1,016	152	1,168

*1 RS : Rainy season (January to June) *2 DS : Dry season (July to December)

Based on the situation mentioned above, crop budget in the present condition is prepared as shown in Table 1.3.3.

(4) Livestock and Inland Fishery

It is revealed that cattle grazing is not common for farmers concerned in the Project area. Such small livestock as chicken, goats, etc. are raised for home consumption. Inland fishery is not available in the Project area.

1.3.4 Activities of Agricultural Supporting Services

(1) Extension Services Concerned in 1996/97 for Morogoro District

During the first fiscal year of 1996/97 for NAEP II, it was expected that the major thrust of activities during the first and second quarters to be to smoothen the transition between NALERP and NAEP-II, while during the third and fourth quarters, the project was expected to concentrate on initiating and strengthening some new features which respond to the lessons learned in Phase I. Also an appropriate arrangement for other providers were considered to be included in the extension services to participate in extension dissemination activities, steps for great district focus, providing communication support, emphasizing farmers' group approach instead of individual contact, and further introducing additional means for enhancing farmer - extension - research linkages.

It is reported that the implementation of the 1996/97 extension programme has remained stagnant due to several factors, that is i) sporadic allocation of budget, ii) re-trenchment exercise, iii) delay of deployment of staff to the districts and rural area (Annual Work Programme for 1997/98, Morogoro Region).

12 Monthly Training Sessions (MTSs) in Morogoro District were expected to be held for improvement and enhancement of knowledge and technique of DIVEOs and VEOs, as shown in Table 1.3.4, however only one or two of MTSs were held in each District as shown in Table 1.3.5. While Bi-Monthly Workshops (BMWs) were held hardly once.

Aiming at increasing skills of VEOs concerning both livestock and crop production aspects, they have the obligation to attend retraining programme. Currently, 131 of VEOs are available in 215 villages of the whole Morogoro District. Out of 131 VEOs, 57 VEOs attended retraining programme of crop production or livestock by 1996/97. Moreover, during this fiscal year of 1997/98, 45 VEOs are required to attend the programme. Remaining 29 VEOs would attend the programme in 1998/99 onward. Progress of the retraining programme in Morogoro Region by District is shown in Table 1.3.6.

(2) Extension Services in the Village Concerned

Agricultural supporting services in the village concerned are not attractive, although extension services are disseminated to farmers concerned by means of adoption plots,

regular training, etc. as shown in Figure 1.3.2.

In the villages concerned, there is no programme by means of management of adoption plots for agricultural activities except for the promotion of Special Programme - FAO. This Special Programme has been commenced in the selected villages since 1995/96. The Programme consists of two phases, that is i) a Pilot Phase for 2 to 3 years and ii) an Expansion Phase. This year of 1997/98 is a third year of the programme and the pilot phase will be completed next year. It is said that the objectives of the Programme are i) to demonstrate the potential of available improved technologies for a significant increase of paddy and maize production, ii) participatory identification of limiting factors to widespread adoption by farmers of available improved production technologies and identification of sustainable solutions, and iii) participatory formulation of a realistic programme of policy action, capacity building and investment to be implemented during the Expansion Phase.

Farmers in Mkindo and Hembeti villages, who independently participated in the Special Programme, organized groups to promote improvement of farming practices concerning rainfed maize and paddy in Hembeti and irrigated paddy in Mkindo village. The Programme will disseminate each farmers' group a series of technical assistance concerning on farming practices and group management.

Special Programme Team (SPT) is headed by a senior official of the Agriculture and Livestock Division in Ministry of Agriculture and Cooperative, and further plan and manage the Special Programme activities and resources. The SPT organized the area-level Special Programme team consisting of the regional Agriculture and Livestock Development Officer (RALDO) as team leader and representatives of research, extension, training, and input and marketing. VEO is designated as extension worker of the Programme under the supervision of District Special Programme Action Officer.

Through the special programme, each farmers group for paddy and maize cultivation is granted the following equipment, in order to carry out the smooth operation.

for paddy

- Seed (quality seed, that is Line 88, TXD 85 , etc.)
- Space marker
- Rotary weeder
- Foot driven paddy thresher
- Ox puddler
- Hand tractor (only for Mkindo village)

for maize

- Seed (Staha) : foundation seed
- Fertilizer
- Insecticide for seed dressing
- Sisal bundle

1.3.5 Marketing and Credits

(I) Marketing System of Agricultural Production

At present, the marketing of agricultural production is being done under a free market system. It means that there is no governmental intervention in the marketing process.

For the case of Mgongola scheme, where paddy and maize are the main crops, traders go to the villages and pick up the products already bagged or packed. The traders usually set up the price and the farmers usually have to accept them due to lack of market power. The traders take advantage of the lack of solidarity among the farmers to force them to accept their prices; the traders know that if a farmer does not accept the proposed price, there will be another farmer who will accept it.

(2) Rural Credit

1) Banking Institutions

At present the two main banks operating in the Morogoro region, the National Bank of Commerce (NBC) and the CRDB (1996) Limited face restriction on agricultural loans' granting. However, both banks are not granting loans to small scale farmers within the scheme.

The NBC stopped granting soft loans due to the poor performance of the loans granted to small-scale farmers; the NBC is in the middle of a restructuring process which also creates uncertainty on the present and future policy to be adopted for loans to small-scale farmers.

The CRDB (1996) Limited started operations just in July 1996. It inherited the infrastructure of the old CRDB that went bankrupt opening the way for its privatization. At the beginning of its operations, the CRDB (1996) was ordered by the Bank of Tanzania not to grant new rural loans, but to only renew the old loans given by the old CRDB. It is only since April 1997 that it has started to grant new loans but mostly are commerce and services sectors' loans. The bank faces infrastructure and staff constraints which difficult the approach to the farmers for credit promotion.

2) FAO Special Program on Food Production

This program started in 1995 with the objective of increasing production of maize and paddy in order to meet the future food demand of the country. The relevant village to the special program in the Study Area is Mkindo and Hembeti villages.

One feature of the special program is to provide inputs to organized farmers' groups involved in the program at the beginning of the farming season and allow them to pay part of the costs after harvesting. Mkindo village has 2 farmers groups with a total of 25 members and use 25 acres for cultivation of paddy. Hembeti village has 4 farmers groups with a total of 52 members and use 63 acres for cultivation of paddy and maize. The program works as follows:

- (a) The program puts in contact stockists and farmers groups for purchase of agricultural inputs under credit conditions. The stockists are selected by the District Local Team constituted by the DALDO, District Crop Officer, the District Extension Officer, and the District Action Officer for the programmed; the last officer is the liaison and field coordinator of the program.
- (b) The farmers groups to be benefited by the program must be legally organized and registered with the Ministry of Home Affairs. The number of members is usually varies from 10 to 20 members. The managing board of each farmers' group is constituted by a chairman, a secretary, a treasurer, and other selected members from the farmers. In order to become a member of the farmers group. The farmer must have a permanent farming land and regularly pay the fees to the group.

- (c) Before the beginning of the farming season, the District Action Officer collects price lists of inputs from the selected stockists and presents them to the farmers groups of the program. The farmers select the inputs they wish and an order for those inputs are put forward with the stockists who make an agreement for delivery to the village.
- (d) The farmers are supposed to pay half of the cost of the inputs when receiving them and half after harvesting time. In practice, most of the farmers' groups pay after harvesting time. If the group decide to pay after harvesting time, the interest rate charged for the credit is as follows:

<u>Credit period</u>	<u>Interest rate</u>
3-months	5%
6-months	10%
9-months	15%
12-months	20%

Collateral is provided by the farmers' group. It means that the farmers group is collectively responsible for each loan. The distribution and collection of repayment of the loans are done by the treasurer of the farmers group. The repayment money is given to the Village Extension Officer to be kept until the stockist, with the witnessing of the District Action Officer collects the money.

The program has been achieving a good degree of success but its influence area is limited.

1.4 Present Conditions of Irrigation Development

1.4.1 Existing Irrigation Schemes

Mgongola scheme is a new scheme currently producing rice under rainfed condition. It has no irrigation facilities at present. As already explained in Section 1.1.2, the area lies between the Dizingwi-Mkindo river and the Mgongola river and is habitually inundated with flooding water from both Mkindo and Mgongola rivers. Mgongola scheme is to be extended from Mkindo scheme, which is a pilot scheme as one of model areas for smallholder irrigation-based paddy production.

Mkindo pilot scheme started in 1982/83 with an aid from Netherlands Government. This project was implemented in two phases. In Phase-I, an intake and a 1.5 km main canal was constructed by funds from Netherlands Government in 1985. This activity was followed by on-farm development including 17 ha land leveling and paddy ridge formation. These works were completed in 1988. The Phase-I comprised 42 families on 17 ha irrigable paddy fields. Phase-II involved another batch of 50 families with 20 ha. The major task of Phase II was an extension of the main canal with construction of a siphon across Dizingwi river and on-farm development of 20 ha land.

Mkindo pilot scheme is currently under operation with double-cropping of paddy a year. At present, the planted area reaches about 60 ha a little extended to the area surrounding the original development area according to the aerial photographs taken in latter crop season of 1996.

Irrigation water is diverted from the Mkindo river at just upstream of a natural fall which is located at about 2 km upstream from the bridge of trunk road B127 across the

Mkindo river. There is a concrete-made intake equipped with two slide gates and two spillway cum sand-flushing gates. Just after the intake gates, a side overflow spillway has been provided to drain excess water to the Mkindo river. The structure is still intact, but seems to be insufficient capacity against the river flood. All the gates are not working well due to poor maintenance and probably inherent insufficient strength on the gate leaves and spindles. Thus it hardly possible to control diversion discharge.

Water is conveyed to the Mkindo area through a main canal passing a very steep slope in the upstream reaches of about 250 m long, in which the flow carrying capacity is estimated only around 50 litre/sec. Its amount corresponds to only 0.8 litre/sec/ha. The main canal is of concrete flume type in the upstream reaches of 250 m in length, then after is of earthen canal type. Its length is about 2 km in total. On the way to the Mkindo phase-II area, it crosses the Dizingwi river by a siphon structure and the trunk road B127 by a pipe culvert. Offtakes on the main canal is simply a bank cutting in the Phase-I area and concrete-made division boxes in the Phase-II area, from which water is delivered to the paddy plots through earth-made branch canals. All the canals are not maintained well. The canal cross sectional shape is irregular in most of all the reaches and leakage can be seen in some reaches where the canal banks are thin. The crest height of the main canal banks is insufficient against the flood water level of the Dizingwi river at the main canal-crossing point by the siphon.

The paddy plot was originally planned to be 1 acre size rectangular, but the plot have been divided into 4 to 8 smaller rectangular plots to solve the micro relief problem.

The Dizingwi river flows eastward along the downstream border of the Phase-I paddy field and joins to the Mkindo river. The river has insufficient drainage capacity and causes water stagnancy in the downstream area of the Phase-I paddy fields just before the bridge of the road B127. An old intake weir, which exists just at the downstream of the bridge of the road B127 across the river aggravates the water stagnancy by the back-water effect.

1.4.2 Access Road

The trunk road B127 is an access road to Mkindo village in which the Mgongola scheme exists. It is easily accessible from Morogoro city via Mvomero throughout a year or through a short cut road via Dakawa in the dry season. From the B127, a road is available to the existing Mkindo intake. The road has a length of 2.3 km, runs in low-lying basin through the Mkindo village with no embankment in the most of whole sections and then rather rough surface hilly area in last 300 m near the existing Mkindo intake. In the rainy season, the road usually suffers from wet surfaces in the rainy season in the low-lying reaches which renders vehicle traffic impassable.

1.4.3 O&M Activities in Mkindo Scheme

An irrigation meeting is held by the water users' group chaired by the village agricultural extension officer for deciding a planting schedule, an irrigation commencement date, matters concerning maintenance works of irrigation facilities, etc. twice a year about 1.5 month before planting paddy. In accordance with this schedule, irrigation water supply is practiced. Actually once the intake gates are opened, these gates are usually left as they are without any regulations until the gates are closed at the harvesting time of paddy. That is to say, the water supply is simply commenced and stopped at the fixed dates. Non water supply period is usually twice a year about 20 days for each between harvesting of matured paddy and planting new paddy.

As for the irrigation water distribution, throughout the irrigation season except for the peak season, farmers freely take and distribute water from the main canal, although the phase-I area is divided into seven blocks and water is supposed to be distributed to each of the blocks at a seven-day interval, and also the Phase-II area is divided into three blocks by three branch canals and the each block is supposed to be served irrigation water at a three-day interval. These rotational irrigation is only practiced at the peak irrigation water requirement season.

In the above-mentioned non-water supply period, the maintenance works of the intake structures and the main canal ought to be carried out by farmers through communal works. Also all canals should be kept clean by de-silting, reshaping, and weeds removal by all the farmers in the canal reaches leading and bordering to their plots according to farmers interview. However the canals seem not to be maintained well as explained in Section 1.4.1.

1.5 Community Development and Activities

1.5.1 Organization of Village Community

Mgongola scheme covers three villages; Mkindo, Dihombo and Hembeti villages. Table shown below presents social community and infrastructure of three villages. These villages in the project area have a well matured community with a good social norms of life, even though the village's population consists of various tribes such as Luguru and Nguu. Most of the troubles and/or problems among the farmers have been solved by the community according to their traditional norms. If it is difficult to settle them up within the community, the village government takes the initiative to do it. Almost no problem among tribes was found in all villages of the project area, with the exception of some conflicts between Masai and other tribes.

(As of September 1996)

Administrative Division	- District - Division - Ward - Village	Morogoro		
		Mkindo	Dihombo	Hembeti
Population		4,220	1,850	2,400
Household		840	370	480
Tribes		Luguru 80% Nguu 15% Others 5%	Luguru 90% Nguu 10%	Nguu 75% Luguru 25%
Village Extension Officer		1	1	1
Irrigation Technician		1	-	-
Electric Supply		Available	Part	Available
Domestic Water Supply		River/Well	P. Water/River	P. Water/Well/River
Fuel for Cooking		Wood/Charcoal	Fuel Wood	Fuel Wood

Source: Information and data obtained from ward executive officer, village executive officer, village extension officer and farmers.

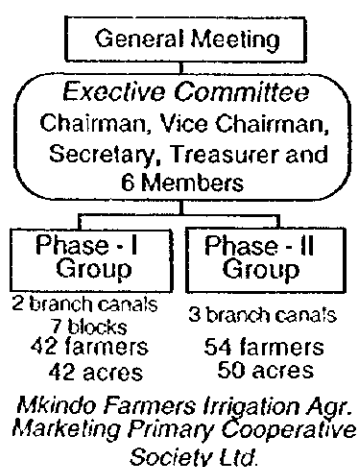
Each village has an administrative organization which is organized as the smallest unit of the administrative structure. The organizational structure of this village government is shown in the figure in Sub-section 1.2.1 (2). Under a village council, the village government consists of a chairman, a village executive officer and three committees including a committee of defence and security, planning and financing committee, communal services committee, etc. Members of the council and the village chairman are elected by the

village people. A village executive officer who is in charge of administrative work and has a relatively higher educational level, is employed after being selected from the village people. It can be said that the village communities and governments have functioned well, and have enough capacity to settle troubles and problems occurring in their villages.

1.5.2 Water Users' Group

The Mkindo irrigation area in Mgongola scheme has been operated and maintained by a farmers' cooperative which has registered name of "Mkindo Farmers Irrigation Agr. Marketing Primary Cooperative Society Ltd" (see Table 1.5.1). This cooperative was initially organized by the farmers of Phase-I in 1984, and the farmers in Phase-II area joined to the Cooperative in 1986. The numbers of farmers total up to 96 as of August 1997. In April 1997, the cooperative was registered to the Ministry of Agriculture and Cooperatives. The organizational structure is presented in the following figure.

The Mkindo Cooperative Society has an executive committee consisting of 10 committee members under the general meeting. The farmers are divided into two groups; Phase-I and Phase-II groups. Each group has no group leader.



The Phase-I group consists of 7 irrigation blocks, and each block takes water for one day. It means that water is distributed to individual farmer at 7-day intervals. The Phase-II group has three branch canals, and each canal takes water for one day. Namely, a farmer in this group can take water at 3-day intervals. For maintenance of irrigation facilities, the Cooperative has managed the communal work twice a year (before every season) and one week per time. The Cooperative punishes absentees according to the following process: (i) 1st. - warning to absentees, (ii) 2nd. - fine with Tsh. 500, and (iii) 3rd - the Cooperative stop water distribution to absentees during the one season. The secretary of the Cooperative said that almost all farmers have joined to this communal work.

The Mkindo Cooperative commenced to collect ISC of Tsh. 1,000/year/acre from the 1994/95 season. Out of 96 farmers, 85 farmers paid its charge to the Cooperative as of August 1997. Those collected amount has been deposited into the Cooperative's bank account (NBC Morogoro) for funds of maintenance. In 1997, the Cooperative has a plan for changing of its payment system and rate from "cash" to "in kind" amounting to one paddy bag (70kg) /year/acre.

The Mkindo Cooperative has a written by-laws. This by-laws were prepared on the basis of the standard one for agricultural cooperatives made by the Cooperative Office, and has no articles for operation and maintenance of irrigation facilities. A punishment rule applied when shirking communal works and evading payment of water charge mentioned earlier should be enacted in the by-laws.

The Mkindo Cooperative was registered at MAC in April 1997, under the supporting services of the irrigation technician attached to the Mkindo irrigation system. The registered cooperatives should have auditing by an authorized organization once a year. In addition, the cooperatives should submit their final accounting books to an authorized auditing organization within 3 months from the end of the budget year. The Cooperative Audit and Supervision Corporation (COASCO) has provided these services to the regis-

tered cooperatives.

The Regional Water Engineer is responsible for registration of the water right under the Act No.42 of 1974. With exception of the Mkindo Cooperative, all existing WUGs in the irrigation schemes have no official water rights, because they are not legally authorized yet. The Mkindo Cooperative in Mgongola scheme has actually held water right for irrigation before the registration, and the official holder is RAIDO on behalf of this Cooperative.

The Mkindo irrigation system has following several problems, (i) water leakage from canals, inappropriate design of canal profile, and weeds along the canals. For the Cooperative activity itself, it has functioned well and farmers has no water dispute among them. However, there are some water disputes with the outside farmers who steal water from upstream main canal. In the last season (1996/97), the Cooperative encountered 2 times on such problems, though these were settled by the village government.

1.5.3 Farmers' Co-operatives Society

In the project area, there is only one (2) primary cooperative societies as shown in the following table.

Existing Farmer's Cooperatives in Mgongola Schemes

Schemes	Villages	Population	No. of Coop.	Year established	No. of farmer	Remarks
Dizingwi Rural Cooperative Society Ltd.						
	Mkindo	4,220	1	1991	14	Dizingwi Cooperative covers three villages of Mkindo, Dihombo and Hembeti Mainly marketing of cotton
	Dihombo	1,850			6	
	Hembeti	2,400			15	

Source: Information and data obtained from ward executive officer, village executive officer, village extension officer and farmers.

The Dizingwi Cooperative Society has been registered as authorized organizations under the Co-operative Act. No.15, 1991. This Society consists of about 40 members in three villages of Mkindo, Dihombo and Hembeti. The Society was organized for the purposes of marketing services to the farmers on farm inputs and all storable crops including rice, maize, cotton, etc., but their actual activities are concentrated on the marketing of cotton. At present, this cooperative has almost no activity because of inactive cotton cultivation in three villages.

The society has the following management problems; lack of funds for marketing of crops, lack of storage facilities, etc.

1.5.4 Other Societies

In Mgongola scheme, there are several farmers' groups which are being organized under the special program for food production especially maize and rice, assisted by FAO, as shown below. This program provides farm inputs' loan with technical guidance for crop cultivation to those groups.

Farmers' Groups for FAO Special Program (as of Sept. 1996)

	No. of Group	Total Members	Crops cultivated
Morogoro Scheme			
Mkindo Village	2	27	Paddy
Hembeti Village	4	Over 30	Paddy + Maize

Source: Information obtained from village executive officers

1.5.5 Role of Women and Gender Groups in Farming and Community Activities

(1) Women's Group

In Mgongola schemes, there are 4 women's groups organized under foreign aid assistance programmes or with the guidance of village governments and/or by women themselves. The membership of a group is not larger than 20 women. Their activities are mostly crop cultivation in the rainy season and production of local beer in the off season. The table below provides information on the existing women's groups in Mgongola scheme.

Existing Women's Groups in the Irrigation Schemes

Schemes	Village	Popula- tion	No. of group	Year established	Supporting Agencies*2	Total members	Activities
Mgongola	Mkindo	4,220	1	1994		10	Paddy cultivation (1 acre)
	Dihombo	1,850	1	1976		20	Production of local beer
	Hembeti	2,400	2	1995 & 1996		10	Paddy cultivation (10 acres)

Source: Information and data obtained from ward executive officer, village executive officer, village extension officer and farmers.

(2) Role of Women in Farming and Living

The Table below shows the everyday and farming activities that women carry out in the villages:

In most cases, transportation of water and collecting of fuel wood are entrusted to women, while land clearing and spraying of chemical are carried out by men. Other farm works are done by both men and women. It may be said that women play an important role in farming and everyday activities.

One important fact is that men are usually who control the household finance. All proceeds from farming activities are held by the male head of the household making women financially dependent on him. It is important that women should be empowered, not only by increasing their participation in the decisions governing the village but also by increasing the opportunities to become financially independent.

Role of Women in Farming and Everyday Activities

		Mgongola
(1) Role of women in farming		
- Land preparation		Both
- Seeding		Both
- Transplanting		-
- Weeding		Both
- Fertilizing		Both
- Spraying of chemicals		Male
- Irrigating		-
- Drying/bagging of products		Both
- Harvesting		Both
(Heavy work)		(Male)
- Selling of products		Male
(2) Transportation of water		
- Distance	(km)	0.3
- Frequency	(times/day)	4
(3) Collecting of fuel food		
- Distance	(hrs.)	3
- Frequency	(times/week)	2

Source: Interview survey to farmers, village executive officers and village extension officers.

1.6 Assessment of Environmental Aspects

1.6.1 Natural Environment

(1) Water Resources and Water Quality

A number of rivers and streams are found within Mgongola scheme. Many of the villagers in Mgongola Scheme, who are located at low lying plains use water from streams. As the results of the field survey, no constraint of water quality is found for drinking purpose except long distance to water sources.

(2) Vegetation

Vegetation in Mgongola scheme could be classified as Bushland. Cultivated lands and scattered settlements (Bushland [other land]) and Bushland [Bushed Grassland] widely cover most of land within the proposed scheme area. While grassland communities appeared to be the dominant vegetation in the Mgongola area, only "island" of woodlands and/or wooded grasslands are left. Woodland and Wooded Grassland could be commonly found in the surroundings, having rolling to hilly terrain, of villages in the Project Areas. However, the distance to Woodland from villages has been continuously increased because of woodland degradation.

(3) Wildlife

The wildlife is dominated as "generalist". They are mainly vermin species i.e. ba-boons, monkeys, wild pigs, and birds. The "specialist" species are not found in the scheme area.

1.6.2 Socio-economic Environment

As summarized in the following table, it is obvious that the health service facilities in the Mgongola area fall short of WHO recommended minimum requirement sets.

Health Service Facilities and Medical Staff

VILLAGE	
	Dihombo
	Mkindo
	Hembeti
HEALTH UNIT	
Mkindo Gov. Dispensary	
Assistant Clinical Officer	1 person
Material Child Health	1 person
Nurse Auxiliary	2 persons
Nurse Attendant	3 persons
Hembeti Gov. Dispensary	
Assistant Clinical Officer	1 person
Health Assistant	1 person
Material Child Health	1 person
Nurse Auxiliary	1 person
Nurse Attendant	2 persons

Under the said health-environment in this scheme area, a high morbidity has been reported by the concerned village dispensary. The following Table shows estimated morbidity in the villages in this scheme.

Out of the total cases of the diseases morbidity, "Malaria" is the endemic disease, and the most hazardous in this scheme area. Morbidity of malaria shows 46.4% of the total disease incidence cases in this scheme area. Other than malaria, it is also identified that the water-borne diseases, i.e. "Intestinal Diseases",

"Diarrhoea Diseases", "Bilharzia Schistosomiasis" are also risky endemic diseases in this scheme area. Besides, it is also remarkable that the water-related endemic diseases, i.e. "Upper Respiratory Tract Infection (URTI)", "Pneumonia", "Skin Diseases", "Eye Diseases" also share a large part of the total incidence of diseases. Morbidity of all these endemic diseases is come up more than 90% of the total diseases incidence cases. Major diseases influenced in this scheme area, and those incidence cases as in 1995/96 are summarized in the following Table:

Morbidity by Population in the Villages

	Hembeti	Mkindo
Total Population(persons)	2,217	4,334
Disease incidence(cases)	4,841	6,272
Morbidity (% to population)	218	145

Major Diseases and Incidence Cases by Scheme Area

Major Diseases	Cases	Rate
Water-borne Diseases:		
Malaria	5,688	46.4
Diarrhoea Diseases	992	8.0
Intestinal Diseases	914	7.4
Schistosomiasis	315	2.5
(Sub-total)	7,909	64.3
Water related Disease:		
URTI	1,784	14.5
Pneumonia	390	3.2
Skin Diseases	598	4.9
Eye Diseases	480	3.9
(sub-total)	3,252	26.5
Other Diseases		
Ear Diseases	732	6.0
Anaemia	244	2.0
Gonorrhoea	231	1.9
Mental Diseases	3	nil
Nutritional Disorder	49	0.4
Accident & Wounds	257	2.1
Total	12,262	100.0

1.6.3 On-going Actions/Program of the Environmental Conservation

A few programs for environmental conservation have been conducted and attempted to contribute towards attainment of an integrated sustainable development of agriculture activities through coordinated efforts in the field and to alleviate environmental problems in the Area. Particularly, TIP Program is considered as important components of the actions for the environmental conservation.

1.6.4 Environmental Problems

Considering the present environmental conditions in the Study Area mentioned above, the following overall environmental problems could be listed, as a results of the determinable impacts of this trend.

- Deforestation due to fuel-wood collection, fire and clearance for shifting cultivation and grazing area expansion, clearance for tse-tse fly control etc.
- Pressure on the natural resources generated by farmers due to a steady rising of population
- Pressure to grazing land through alienation and conversion to agricultural land and expansion of settlements
- Trends in diseases and poor sanitary conditions in the Area
- Poor drainage and wet conditions during rainy season
- Sewage discharge from agricultural and rural activities
- Non-legal village demarcation and securing right of land tenure

CHAPTER II. DEVELOPMENT POTENTIAL AND CONSTRAINTS

2.1 Potential for Irrigated Agricultural Development

2.1.1 Land Resources

The land suitability classification for assessment, and then, demarcation of irrigable area was made according to the specific criteria which has been prepared during the master planning stage in 1996 with reference to the "Guidelines: Land Evaluation for Irrigated Agriculture" published by FAO (1985) and the Tanzanian system for paddy irrigation as well as taking into account the land, soil and agricultural conditions in the Central Wami River Basin.

The specific criteria for land classification has been established according to the technical requirements and/or limitations to irrigation development or irrigated farming. The rating parameters are set up according to the four major factors, i.e. agronomic aspect (A), farm management aspects (M); future land development aspects (D); and environmental conservation aspects (E). The climatic and socio-economic factors are not considered herein the rating parameters. Consequently, eleven elemental factors are examined as the essential parameters for rating the land suitability classes. The specific criteria for assessment of the land suitability for both irrigated paddy and upland crop cultivation is as shown in Table 2.1.1. As for the land suitability assessment for irrigated upland farming, maize and vegetables (onion and tomato) are primary taken up as the key crops.

Rating Factors for Irrigation Suitability Assessment

[A] Agronomic Factors	
(r) Conditions of rooting zone:	Soil texture, effective soil depth, drainability, percolation, and water holding capacity.
(n) Soil nutrients:	Organic carbon, total nitrogen, available phosphate, CEC, exchangeable potassium, total cation, and micro nutrients.
(t) Soil toxicity:	EC, sodium absorption ratio, pH, and other toxicity.
(f) Flooding risk:	flooding frequency and inundated period.
[M] Management Factors	
(a) Accessibility to farm:	Distance from village and farm road condition.
(w) On-farm workability:	Slope, micro-relief, stones/rocks, soil consistence, farm size, and easiness of irrigation management.
[D] Land Development Factors (in the future development)	
(l) Grading/leveling and ridging:	Grading/leveling, ridging, land consolidation, and clearing.
(d) Drainage, flood protection:	Drainage and flood protection.
[E] Conservation and Environmental Factors	
(s) Long-term Prevention of salinity:	Salinity/sodicity prevention.
(h) Prevention of groundwater and surface water:	Groundwater, surface water, watershed conservation of upstream.
(e) Soil erosion:	Occurrences of erosion and requirement of erosion control.

There after examination of all the elemental factors, the following "land suitability classes" and/or "sub-classes" are applied to the final judgment of land suitability for irrigation development both for paddy and upland crop production.

Land Suitability Classes and Sub-classes

Order	Class	Sub-class
Suitable (SR, SU)	Higher Suitable (SR1, SU1)	SR1, SU1
	Moderately Suitable (SR2, SU2)	SR2nw, SU2f, etc.
	Marginally Suitable (SR3, SU3)	SR3tw, SU3f, etc.
Not Suitable (NR, NU)	Not Suitable (NR, NU)	NRrn, NUr, etc.

Note: 1) R and U land class indicate paddy rice and upland crops respectively.
 2) Subscripts in subclass indicate the nature of a requirement of limitation: e.g. "n" and "w" for nutrients and on-farm workability.

According to the above land suitability assessment, the land in the scheme area is classified as shown in the table below. Distribution of the land suitability classes is illustrated as shown in Drawing No.303 in Drawings.

Land Class by Irrigation Suitability in Mgongola Scheme Area

Soil Unit	Land Class	Sub-class	[A]				[M]		[D]		[E]			Area (ha)
			(r)	(n)	(t)	(f)	(a)	(w)	(l)	(d)	(s)	(h)	(e)	
(For Paddy Cultivation)														
Mgl-1	SR2	SR2ad	1	1	1	2	3	1	2	3	1	2	1	515
Mgl-2	SR2	SR2a	2	2	1	1	3	1	2	1	1	2	1	25
Mgl-3	SR2	SR2fad	1	1	1	3	3	1	2	3	1	2	1	190
(Total)	SR1: 0 ha, SR2: 730 ha, SR3: 0 ha, NR: 0 ha												730	
(For Upland Crop Cultivation)														
Mgl-1	NU	NUf	2	2	1	4	3	2	2	3	1	2	1	515
Mgl-2	SU3	SU3afd	1	2	1	3	3	1	2	3	1	2	1	25
Mgl-3	NU	NUfd	3	2	1	4	3	2	2	4	1	2	1	190
(Total)	SU1: 0 ha, SU2: 0 ha, SU3: 25 ha, NU: 705 ha												730	

The land of entire Mgongola scheme (730 ha in gross) is recognized as suitable for irrigated paddy cultivation although some marginal factors, i.e. 4 km distance from the village to farm, production risk due to occurrence of the seasonal flooding and poor drainage conditions of soils are subject to improvement. The land, which has been classified into soil units of Mgl-1 and Mgl-3 (total 705 ha in gross), is assessed as unsuitable (NU) for upland crop production especially in the rainy season. This is mainly due to poor drainability of the soils. The soil consistence i.e. extremely firm when dry and sticky when wet, etc. is also marginal factor for upland crop production in the dry season. The land with soil unit Mgl-2 (25 ha in gross) is identified as suitable for cultivation of upland crops under irrigation in the dry season, while marginally suitable for that of the rainy season cropping.

2.1.2 Water Resources

The following table shows the availability of water resources of the Mkindo river on a monthly basis at 2, 5, and 10 year probability of drought. Most of the water resources can be used for the Mgongola scheme, since no water is utilized by any other than the Mkindo scheme. The Dizingwi river, which is a perennial river contributing to the downstream reaches of the Mkindo river, joins the river at the point of about 2 km downstream from the existing Mkindo intake.

The figure below shows the water resources of the Mkindo river and the project irrigation water requirements estimated based on the proposed cropping pattern. The river

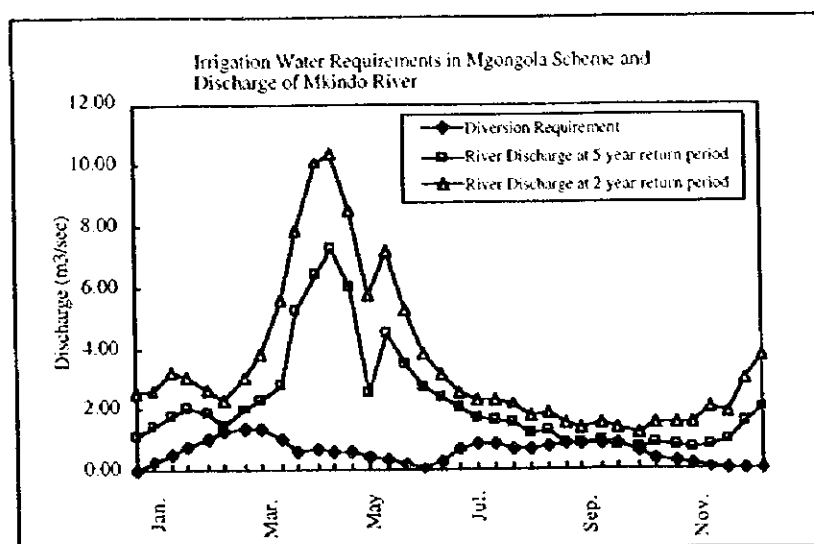
has plenty of water in March and April for the irrigation of the scheme area, but the river discharge gradually decreases from May and reaches its lowest level in September and October. While, the project irrigation water requirements have two peaks in both February and September. September is the most critical season in relation between water supply and demand. The river water resources are enough to the project irrigation water demands in the normal hydrological year and satisfies the demands even at the drought of 5 year return period.

Probability Monthly Discharge of Mkindo River

(Unit : m³/sec)

Return Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10	1.04	1.45	1.75	5.07	3.38	2.37	1.54	1.10	0.69	0.59	0.50	1.03
5	1.46	1.79	2.34	6.27	4.33	2.84	1.79	1.33	0.89	0.78	0.75	1.46
2	2.80	2.65	4.15	9.42	7.12	4.05	2.37	1.93	1.46	1.34	1.67	2.85

Refer to Division -I Master Plan Report



2.1.3 Human Resources

Farming activities by a household are carried out by the husband and wife and supported by all young members above 15 years old. The available family force carries out most of the farm. The Table below gives information on total population, number of households, average household size, average holding size, and working population for Mgongola scheme.

Demographic Data for the Whole Scheme

Scheme	Total Population	No. of Households	Average Household Size	Average Holding Size per Household (ha)	Working Population
Mgongola	8,470	1,690	5	1.62	4,225

Based on the figures shown above it would be possible labor force availability may not be a problem when implementing the irrigation project. However, it will be necessary that in order to promote farming and/or crop diversification under the condition with the

proposed irrigation development, the youth must be organized into working groups either in-household or in-community in the scheme.

It is also essential to up-grade the quality and/or skillfulness of the labor force to accomplish the sustainable irrigation-based agricultural production. At present, there is access to primary schools located in or near the villages. However, the physical conditions are usually not the best and there is a notorious lack of teaching materials. This in turn affects the level and quality of education received by the students. If a student proceeds to secondary school, usually it is not near the village and must live outside the village. In case that the student finishes primary school and wants to receive basic technical education but not to go to formal secondary school, at present there is no possibility, unless he or she goes outside the village. Lack of basic training facilities is a big constraint for the technical education of young people who want to receive it. On the other hand, farmers also need to be advised on cultivation techniques and systems and the extension officers must play that advisory. However, it has been found that most extension officers do not have adequate working conditions or training leading to an unsatisfactory performance from the point of view of the farmers. The government should make efforts to provide facilities for basic technical education for the youth and improve the technical level of the extension officers.

2.2 Problems and Constraints to Irrigated Agriculture Development

2.2.1 Social and Institutional Aspects

(1) Weakness of Institutional Service System for Encouragement of WUG

There is one existing WUG (Mkindo Farmers Irrigation Agr. Marketing Primary Cooperative Society Ltd.) which has operated maintained about 40 ha of irrigation area. Although this Cooperative has almost no problem from the standpoint of institutional aspect for O&M of irrigation system. It is however expected to strengthen their activities for improving present agricultural supporting services such as marketing of farm inputs and agricultural credit. In addition, the facilities to be proposed in Mgongola scheme, which covers about 600 ha, will need some advanced O&M techniques. For the activation and enlightenment of present WUG, there are two ways: one is strengthening of institutional function and another is technical strengthening for those services. The executing agency to be responsible for the former is the office of DCO and the latter is DALDO. However, the DCO's office in Morogoro district have a poor experience on WUG, and so far no field staff assigned below district level.

The office of DALDO in Morogoro district is responsible for technical supporting services to the farmers. At present, the DALDO's office has several irrigation officers in charge of those services, and has dispatched one Irrigation Technician to the existing irrigation system having 60 ha of irrigated area. This officer is now powerfully providing supporting services to the farmers and existing WUG.

(2) Inactive Farmers' Cooperatives

The farmers in the Mgongola scheme have confronted with various problems in their activities; i.e., marketing of products, farm inputs supply, purchasing prices of farm inputs, agricultural credits, etc. To solve and/or improve these problems, the farmers' cooperatives should play more active role. However, activities of existing farmers cooperative (Dizingwi Cooperative Society) are mostly concentrated on cotton business, and farmers benefited from the cooperative are limited only to its cultivators. It is also inadequate that this cooperative covers very wide service area over their management capability.

2.2.2 Financial Aspects

(1) Difficulties for Credit Access

Some of the farmers in Mkindo and Hembeti villages are benefited by the FAO Special Food Program which allows them to get inputs first and pay later after the harvesting. However, the great majority of the farmers in the Mgongola scheme, face the following problems related to rural credit:

- i) Small-scale farmers can not easily access formal credit sources as they lack adequate financial and physical collateral acceptable to those sources;
- ii) Lack of awareness of the existence of such formal sources or lack of understanding of the procedures to access credit;
- iii) Lack of financial institutions near the village. The farmers usually have to travel to big urban centers to find a bank or credit institution;
- iv) Lack of an effective agricultural promotion credit policy. The government policy is to encourage the farmers to develop agriculture by them-selves but the lack of a public financial support does not allow them to be provided with adequate and enough financial resources.

(2) Lack of Joint Communal Efforts to Generate Funds

The farmers are not inclined, due to bad experiences in the past with organized groups, to create organized groups for the specific purpose of raising or generating funds. Behind this problem is the fact that leadership is lacking for the promotion of organized efforts for the raising funds among the farmers themselves.

2.2.3 Technical Aspects

(1) Constraints and Problems in Agricultural Activities

1) Low Availability of Tractor and Limiting Factors for Tractor Operation

Tractor operation is required for ploughing work of paddy cultivation in the project area. Demand of tractors is highly concentrated in October and November. Number of tractors which are available in and around the project area is quite limited. Through the interview survey of the study team, it seems that number of tractors which are available in and around the project area for land preparation in October and November are estimated at around less than 20 tractors, or 3 tractors in Mvomero, 5 tractors in Dihombo, 7 tractors in Triani, 1 tractor in Dakawa, respectively.

Additionally, some fleet of tractors are deployed from Morogoro, Dodoma, and other area. For instance, tractors owners in Morogoro area dispatch their tractors in and around the project area before land preparation for upland crops will be commenced in Morogoro area during the period from January to February. Available tractors in Morogoro area is estimated at around 30 to 40 numbers.

Furthermore, there are some negative conditions to restrict the commitment of tractor for land preparation in the surrounding project area as follows:

- a) Paddy fields of farmers are small size and scattered. Considering the cost performance of tractor operation, tractor owners prefer to contract land preparation in the clustered fields.

- b) Soil condition is quite tough for ploughing by tractors, although that condition is suitable for paddy cultivation.
- c) Access from Morogoro area to the surrounding project area is in poor condition.
- d) It is reported that there are some cases which size of the farmers' fields is misrepresented intentionally or accidentally to the tractor owners when land preparation is requested by the farmers. In that case, it is difficult to form a relationship of mutual trust between farmers and tractor owners, causing careless operation for land preparation or misunderstanding of mutual attitude.

Affecting the factors mentioned above, it is difficult for the farmers to expect land preparation in the proper season. Even if land preparation is done, ploughing is generally very shallow and rough because the tractor operators pay much attention to any damage in the tractors and cost performance, not quality of land preparation.

2) Constraints for Land Preparation by Hand Tractors

At present, there are two hand tractors in the project area. One is belong to some individual farmers who attended overseas training under Special Programme - FAO and the maintenance work is carried out by themselves, relying on the service charge from the borrowers. The other is supplied by the grass root fund of the Japanese Government and managed by the water users' association of the Mkindo pilot area. Although major farmers in the area expect to carry out land preparation by hand tractors, the performance of those tractors is low due to frequent break-down. This reason may be caused by no plow pan condition, lack of proper knowledge on trouble shooting, poor technique of tractor operation, etc.

3) Shortage of Certified Seeds of Paddy

Farmers in the Project area select the seeds from their own farms by themselves, in order to secure seeds for the following cropping season. Purchase of certified seeds for those crops are not so common. Farmers prefer to cultivate "Supa India" which indicates high palatability. Currently, Kilangali Foundation Seed Farm, which is a sole seed farm to produce certified seeds of paddy, has produced certified seeds of major improved cultivars, but not "Supa India" and therefore farmers are actually unable to get the qualified seeds. Even improved varieties including "Line 88", it is noted that amount of certified seeds is extremely scarce against the demand. Especially, "Line 88" has not been officially released yet. Accordingly, it is apprehensive that character of "Line 88" will be changed in the farmer's level.

Seed multiplication by farmers themselves is economical and easy way for seed arrangement. However it is strongly required to select the healthy seeds carefully and pay much attention on post-harvesting, otherwise their quality become to be unstable and also variety contamination is most likely occurred. It is urged to improve the system of seed production in order to supply the seeds which are cheap and highly qualified.

4) Unstable Supply of Fertilizer and Agro-Chemicals

As for paddy cultivation, no application of fertilizer and agro-chemicals is common in the area except the Mkindo pilot area. In terms of "Supa India" of local variety, farmers are not so keen to apply fertilizer because application of fertilizer causes

lodging of rice plant during maturing stage and further farmers can not expect any positive effect from them under seasonal flooding condition during the rainy season. On the other, there are no research results concerning the effect of fertilizer application on lodging for "Supa India" which is a common local variety. While, farmers concerned have complains about the expensive price and availability of fertilizer and agro-chemicals in and around the area due to lack of dealers or stockists. Although participated farmers in Special Programme-FAO have connected with stockists, this linkage is still required to strive to ensure the time-liness of supply of such farm inputs as fertilizer and agro-chemicals. That is, stockist which is approved for Farm Input Trust Fund is not stable, but no. of approved stockists has been reduced due to shortage of available loan source.

Even if stockists are available, those stockists are not located near the project area. For instance, three stockists are approved for the Farm Input Trust Fund in Morogoro Region this year, that is one in Morogoro District and two in Kilombero District. Special Programme - FAO has dealt with each one stockist in both Districts. However, it is not so easy to arrange farm inputs from those stockists, because they are not located near the pilot area of the programme.

5) No Application of Fertilizer

As for paddy cultivation, no application of fertilizer is common in the Project area except the Mkindo pilot area. It is mentioned that farmers are not keen to apply fertilizer because application of fertilizer causes lodging of rice plant during maturing stage and further farmers can not expect any positive effect of the application under seasonally habitual flooding condition during the rainy season. Actually, there are no research results concerning the effect of fertilizer application on lodging for "Supa India" which is a common variety in the Project area. As for maize, no application of either fertilizer or agro-chemicals is common in the Project area.

6) No Pre-selection of Seeds before Sowing

As for paddy cultivation, seed soaking is not common practice as a way of pre-selection of seeds, although this activity is recommended in the Special Programme - FAO. As seed selection by either fresh water or salt water is highly effective, seed selection is strongly required to get high rate of germination and healthy seedlings, aiming at the increment of the paddy productivity.

7) High Shattering Rate on Harvesting

It seems that paddy is not harvested at the proper time. The reason might be that farmers themselves are not aware of proper harvesting time or they had some shortage of manpower on harvesting. The delay of harvesting causes high rate of shattering, the increase of cracked grains and decreases the grain quality.

8) No Construction of Field Bund

Current paddy cultivation is relying on seasonal flooding condition. Therefore, it is not easy to drain water from paddy fields and also retain water in paddy fields. In the FAO special programme, preparation of the bund for maximum water harvesting has been disseminated to the farmers concerned in order to improve the productivity of paddy.

(9) Lack of Knowledge on Proper Farming Practices

In the Mukata plain which the Project area is located, farmers had extensively cultivated paddy without any tillage. In the year of 1985, mechanization programme was introduced in Morogoro Region and land preparation by farm machinery have been so common in the plain. Since that time, it has been recognized that land preparation in paddy cultivation should be done by means of farm machinery or hand hoe, while planting by means of broadcasting.

Under this situation, farmers' knowledge have been accumulated, combined with their life style in which they have not kept any cattle. That is, it is very common that land preparation should be carried out by tractor and cattle is not adequate for farming practices, especially in the wet land. They have recognized that best way for land preparation is to adopt farm machinery. Accordingly, even if tractors are not available, they have no choice but to wait until tractors will be available, resulting in the missing of proper cropping timing. Additionally, oxenization project was applied by Sokoine University of Agriculture, but this project failed. Those trials, however, were suspended due to the following constraints;

- i) Structure of some instruments were weak compared with soil condition, while some instruments were heavy for handling.
- ii) Farmers in Mgongola and Mkula have no experience on keeping cattle.
- iii) A part of farmers were not so interested in the oxenization programme. Approach of oxenization were tried in the top-down basis, not bottom-up basis.

Since the year of 1995, Special Programme - FAO has been adopted in the Mkindo pilot area and promoted farm mechanization for land preparation. As a result, they have believed that land preparation by farm machinery is the best way. However, they have to recognize strongly that farm machinery has to be replaced at some future time and they have to arrange some money for replacement.

(2) Problems and constraints from irrigation and drainage points of view

Existing problems and constraints for the present Mkindo scheme are summarized as follows:

- As for the existing intake, two intake gates and two spillway cum sand-flushing gates are not working well due to poor maintenance and probably inherent insufficient strength on the gate leaves and spindles. Thus it hardly possible to control diversion discharge.
- All the canals are not maintained well. The canal cross sectional shape is irregular in most of all the reaches and leakage can be seen in some reaches where the canal banks are thin. The crest height of the main canal banks is insufficient against the flood water level of the Dizingwi river at the main canal-crossing point by the siphon.
- The phase -I paddy fields are suffering from water stagnancy due to the insufficient drainage capacity of the Dizingwi river and the back-water effect of the old weir existing just at the downstream of the bridge of the road B127.

The Mgongola area has no irrigation and drainage facilities. Crops is cultivated only in the rainy season under rainfed condition with flooding water from both Mkindo and Mgongola rivers. Thus the crop yield and production are very unstable and remained at low level.