JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF AGRICULTURE
REPUBLIC OF ZIMBABWE

THE MASTER PLAN STUDY ON THE LOWER MUNYATI BASIN AGRICULTURAL DEVELOPMENT

FINAL REPORT
MAIN TEXT

OCTOBER 1995

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PREFACE

In response to a request from the Government of the Republic of Zimbabwe, the Government of Japan decided to conduct a Master Plan Study on the Lower Munyati Basin Agricultural Development and entrusted the study to the Japan International Cooperation Agency (JICA).

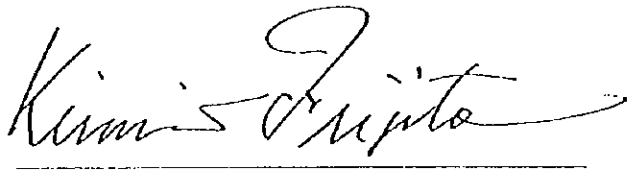
JICA sent to Zimbabwe a study team headed by Mr. Yoshitomo Miyanishi, Sanyu Consultants Inc., three times between December 1994 and August 1995.

The team held discussions with the officials concerned of the Government of Zimbabwe, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Zimbabwe for their close cooperation extended to the team.

October, 1995



Kimio Fujita
President
Japan International Cooperation Agency

October, 1995

Mr. Kimio Fujita
President
Japan International Cooperation Agency (JICA)
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are, herewith, pleased to submit the Final Report for the Master Plan Study on the Lower Munyati Basin Agricultural Development in the Republic of Zimbabwe, upon completion of the study works.

The Report, which describes the fundamental framework for an agricultural development in the area, is compiled in reflecting the advices and suggestions for the formulation of development plan by the authorities concerned of the Government of Japan and your Agency as well as comments made by the Inter-Ministerial Committee of Zimbabwean side.

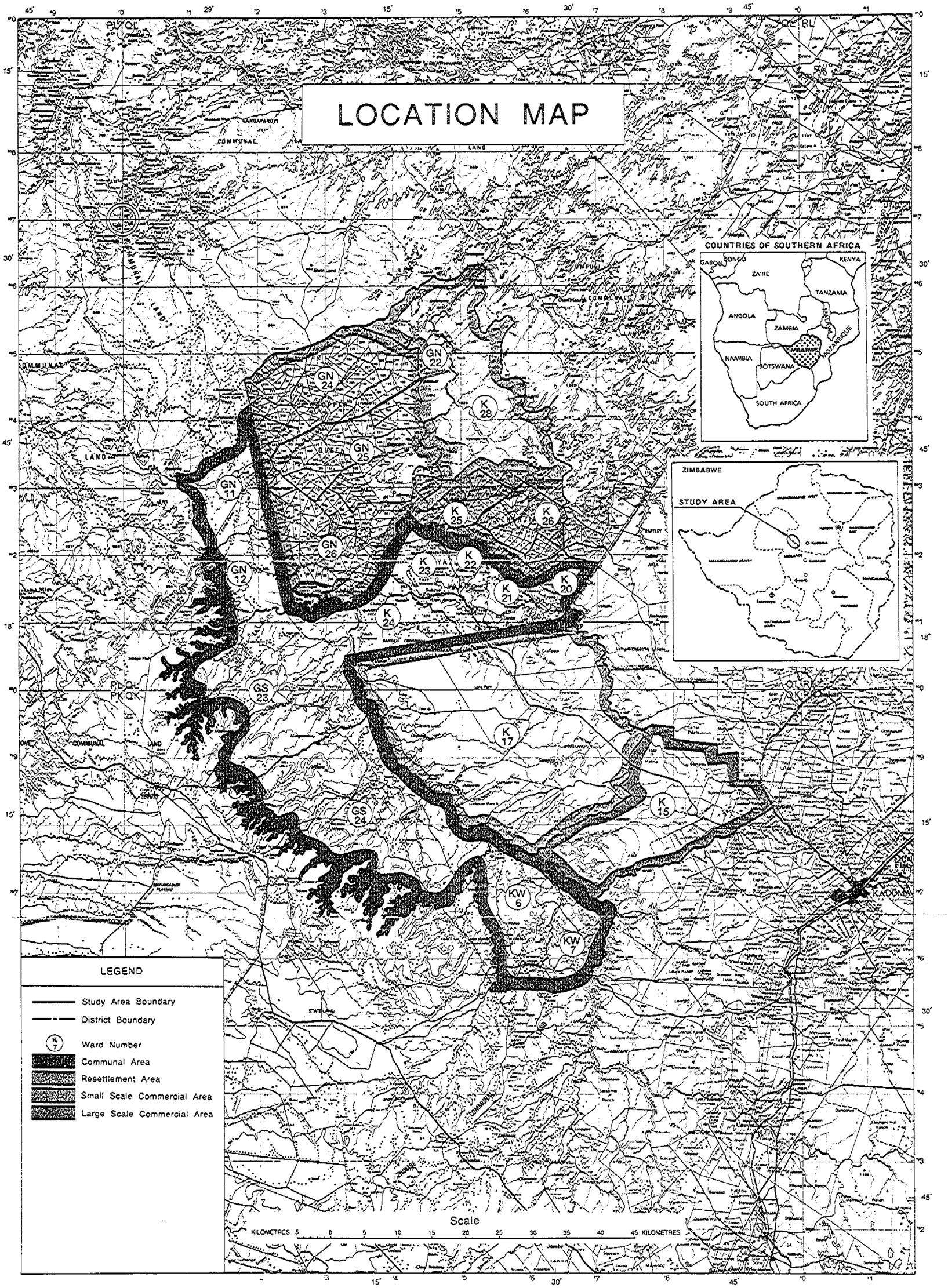
As the result of the study, it is concluded that the development scenario which aims bottom-up of smallholder farmers in the communal and resettlement areas through an irrigated agricultural development as a core including construction of Kudu Dam in the Munyati River basin, is the best alternative, taking into consideration the changes in the governmental agricultural policy putting more attention onto smallholder farmers. However, it is considered a prerequisite to conduct a feasibility study because the said development plan still involves such various issues to be solved as establishment and extension of irrigated farming technology, regulation of various interest groups, displacement of people and regional environmental management, project execution system and procurement of development fund, and so on.

Finally, we take this opportunity to express our sincere gratitude to AGRITEX, and Ministry of Foreign Affairs, Ministry of Agriculture, Forestry and Fishery of the Government of Japan, and Japan International Cooperation Agency, especially for Advisory Committee which gave valuable and useful advice and suggestion as well as close cooperation to the study team from time to time so as to smoothen the study works.

Respectfully yours,

Yoshitomo Miyanishi
Team Leader of Study Team

LOCATION MAP



SUMMARY

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1. Background

1.1 Zimbabwean Economy

National Economy and Structural Adjustment Programme

Zimbabwe is situated in the southern part of the African continent having its total area of 390,757 sq.km and total population of about 12.3 million, showing annual population increase of 4.9 percent over 10 years from 1982. Zimbabwe is bordered by Zambia, Mozambique, South-Africa and Botswana, and is completely land-locked.

Since its independence in 1980, Zimbabwe has achieved considerable progress in the area of social development such as education, health and population control. In spite of this social achievement, the economic growth had been modest throughout 1980s, indicating the average GDP growth rate of only 3.4%, which barely matched the population growth rate during the same period. In addition, the internal/external macro-economic imbalances had become closed up as the debt servicing payments drastically increased and the subsidy to parastatals deteriorated the central Government's fiscal position.

In response to these modest economic performance and macro-economic imbalances, the Government of Zimbabwe, under the assistance of IMF/World Bank, launched a comprehensive Structural Adjustment Program (SAP) in 1991, of which basic strategies are: 1) fiscal deficit reduction together with rationalization of parastatals; 2) prudent monetary policy including tightening money supply; 3) trade liberalization coupled with devaluation of the currency; and 4)domestic deregulation including decontrolling agricultural products by parastatals.

In spite of the comprehensive economic reform program, macro-economic balances were deteriorated immediately after the introduction of SAP in 1991, due partly to exogenous factors such as poor agricultural seasons and world recession. At the latest moment in the fiscal year 1994/1995, however, although the inflation rate still stood at about 20%, the Government estimated that the real GDP growth rate achieved more than 4.4% and the rate of the central Government's deficit to GDP reduced down to less than 5.0%, respectively, which are both in line with the targets

of SAP. In this way, the overall economic policy under SAP is ready to be on the right truck. In fact, the Government of Zimbabwe and the World Bank agreed on the introduction of the successive SAP at the end of January, 1995.

Second Five-Year National Development Plan

In response to the poor performance of the previous plans, the Second Five-Year National Development Plan was formulated under the framework of SAP. Out of 12 main objectives of the Second Five-Year Plan, the most critical objectives are improvement in living conditions, reduction of poverty and economic growth with the increase in investment and employment opportunities. In order to achieve these objectives, the following strategies are set up: (a) increasing the rate of savings and channeling these into productive investment; (b) achieving expansion of trade; and (c) encouraging the operation of market forces.

Specifically, in the agricultural sector, the main objective of the sector is the production of enough food for the population. The plan identified the major constraints for the agricultural production as water shortage and drought. In order to remove these constraints and attain this objective, the investment program including the acceleration of the construction of dams as well as drilling of boreholes, especially in communal and resettlement areas, was proposed. The average percentages of investment on agriculture and water sectors during 1991-1995 are the second and the third largest, respectively. In addition to the economic aspect of the agricultural sector, the social aspect was emphasised in the rural development sector, committing itself to enhance the basic needs of communal and resettlement farmers.

1.2 Issues in Zimbabwean Agricultural

Role of Agricultural Sector

The sector contributes around 12 percent of GDP and over 50 percent of the raw materials required by the manufacturing sector. Its contributions to exports, allowing for the influence of climate, have usually been about 40 percent since 1981. The sector provides employment for approximately 70 percent of the population and 80 percent of population is depending on the sector for securing their livelihood.

Natural Region and Land Holding System

On the basis of annual rainfall, Zimbabwe is divided into five natural regions (NRs). Farming in each NRs is categorized as specialized and/or diversified farming, intensive one, semi-intensive, semi-extensive and extensive in order of NR I to V. On the other hand, an important characteristic of the sector is the existence of four major sub-sectors (a) communal land, (b) resettlement land, (3) small-scale commercial farm (S.S.C.F.) and (d) large-scale commercial farm (L.S.C.F.). Distribution of acreage by these sub-sectors is shown below:

(Unit: 1,000 ha)

Natural Region	Communal	Resettlement	S.S.C.F.	L.S.C.F.	Total
I and II	1,410	620	250	3,890	6,170
III	2,820	1,240	530	2,410	7,000
IV	7,340	810	500	2,430	11,080
V	4,780	620	100	2,490	7,990
Total	16,350	3,290	1,380	11,220	32,240

L.S.C.F. occupies almost 63 percent of NRs I and II with high potential land and only 10 percent of communal and resettlement land is categorized in NRs I and II. This highly skewed land distribution pattern brings about several problems in the agricultural sector.

Drought Damage

83 percent of Zimbabwe is located in so-called semi-arid area having annual rainfall of 650 mm or less, and extensive rainfed farming and animal husbandry are being practised. Farming in these areas is easily damaged by droughts, due to unstable rainfall pattern. Since it independence, several droughts occurred in 1981/82 - 83/84, 1986/87 and 1991/92, badly damaged smallholder farmers in the communal and resettlement land, in which irrigation development had been hardly promoted. In order to supplement decreased farm income from crop cultivation failure, farmers were obliged to sell their cattle which plays a vital role in farming practices, and hence their financial foundation became further deteriorated. This fact makes farmers' access to the current agricultural financing system more difficult.

1.3 Water Resources Sector

Future Plan

On the basis of average annual rainfall and runoff reported by DWD, the potential of 8,445 MCM could actually be exploited under the risk

level of 10%. Out of the exploited water resources, 4,900 MCM including granted water rights and ministerial agreements are currently committed, a balance of 3,545 MCM is the potential for water use. The major and medium sized urban water supply development is proposed at 16 places with total water requirement of 464 MCM. As to dams for possible major irrigation development, construction of 13 dams is planned including Kudu Dam in the Study Area.

Problems

In the dam projects previously implemented, most of medium size dam projects or similar sized ones are constructed together with irrigation facilities simultaneously. In recent, the Zimbabwean government has changed its policy to partly include smallholder farmers in communal and resettlement areas into a beneficiary of the large-scale dam projects. However, in such large projects as Osborn Dam, Tokwe Mukorsi Dam etc., irrigation for these farmers could not be attained due partly lack of fund as well as not completion of facility design works. Since Kudu Dam project should put more significance on smallholder farmers than the above projects, it is a prerequisite to pay special attention on simultaneous construction of dam and irrigation facilities.

Kudu Dam

The plan of Kudu Dam existed before the independence. As part of nation-wide water resource development plan, DWD has carried out necessary feasibility study and detailed design including selection of dam site and geological survey for Kudu Dam. Environmental study on dam itself was completed in 1992, and the revised report on detailed design was prepared in 1993.

1.4 The Lower Munyati Basin Agricultural Development

Zimbabwean Request and Issue

Zimbabwean government has considered the construction of the Kudu Dam for agricultural development purposes, in Munyati river which flows at the middle part of the country. Feasibility study and detailed design for the dam itself were carried out by Zimbabwean budget and resources. However, the required study on irrigation planning has not been undertaken. The Zimbabwean government then made a request to the Japanese government, which includes plan formulation and feasibility

study for irrigated agricultural development including the construction of the Kudu Dam.

In Zimbabwe, water resource development are usually executed, mainly for large scale commercial farms. Generally, they have enough know-how and technology for irrigated agriculture, and hence, the government only concentrate its efforts on the construction of storage dam and main irrigation facilities. However, for the planned Kudu Dam project, smallholder farmers are given more priority as a beneficiary. These farmers might not have enough financial and organizational background as well as a know-how and technology related to water utilization, and operation and maintenance of facilities. In addition, there would arise a problem on land holding system with the implementation of the project.

Under such circumstances, JICA has recognized and concluded that the proposed Study should not only focus on a feasibility study for the Kudu Dam project as requested by the Zimbabwean government, but firstly, from viewpoint of development of Munyati river basin, development needs in the basin should be grasped, and development potential and constraints should be reviewed and analysed in considering natural, social and administrative condition in the basin. Secondly, on the basis of results from the above analysis, it is desirable to carefully study the necessity, priority and possibility in management, operation and maintenance of the proposed Kudu Dam Irrigation Study, through the formulation of a master plan as a basic agricultural development plan for the basin. Eventually, JICA recommended said considerations to the Zimbabwean government, and both sides have agreed.

2. PRESENT CONDITION OF THE STUDY AREA

2.1 Natural Condition

Topography and Geology

The Study Area is located at north-west of Kadoma town. The area covers 5,052 sq.km., administratively extending from Kadoma District of Mashonaland West Province to South and North Gokwe District as well as the northern portion of Kwekwe District of Midlands Province. Elevation in the Study Area extends from 800 to 1,000 meters. Munyati river flows from the south to north through the central part of the Study Area. The catchment area of Munyati river is about 17,250 sq.km at the site of

proposed Kudu Dam, and main tributaries are Mazoe, Umsweswe, Zhombe, Sezhombi and Sebakwe. The Study Area is composed of basement complex of granites gneisses, and schists with folding and metamorphism.

Soils and Land Use

The soil condition in the area is generally divided four groups: Lithosol group (108,300 ha) have a depth less than 25cm and are not arable in general; Vertisol group (9,900 ha) are often called as the Black Cotton Soils, which form some of the best irrigable land; Siallitic group (108,200 ha) have very high agricultural potential, the main limitation is the aridity of the environments in which they occur. Thus, where water is available for irrigation, some very high levels of productivity would be achieved; Fersiallitic group (278,000 ha) are further divided into several different sub-groups and wide range of properties and moderate fertility suitable for various crops.

The basic land use pattern is cultivated land, grazing land and forest in the area. Out of total area of 505,200 ha, cultivated land occupies around 101,140 ha, mainly under rainfed condition. Cropped area, therefore, varies from year to year according to water availability. A part of the cultivated land is irrigated by boreholes or small dams covering only small areas. The vegetation of grazing and forest lands predominantly consists of mixed savannah woodland.

2.2 Meteorology and Hydrology

In the area, mean maximum and minimum temperature are 26.6 and 14.2 ℃, and mean annual rainfall is ranging 650 to 700 mm on the average for the last 30 years. The beginning of first rainfall as well as annual rainfall amount fluctuate widely, and the latter shows decreasing tendency recently.

Annual discharge recorded in the three main rivers (Umsweswe, Munyati and Sebakwe) was about 603 MCM for the last 30 years' average, only 55 percent or 336 MCM is recorded in the last 10 years' average. In the gauging station C-8, annual minimum and maximum discharge were 3.5 MCM and 1,260 MCM, respectively. Similar to rainfall, the river discharges also shows declining tendency.

For these river discharges, total of 18.6 MCM as present water right are fixed by mining companies, railway, commercial farms and government.

According to the field investigation, there exist no problematic water quality. In addition there are 338 wells mainly for domestic purpose and for livestock, some of which need rehabilitation.

2.3 Present Agriculture

In the Study Area of which 84 percent belongs to NR III, and rainfed farming is practised under annual rainfall of 650 mm or less. In any land holding system, maize and cotton are main crops followed by sunflower and groundnuts, and sorghum and millet are also grown in small scale. Recently, all these crops show similar tendency in their production, namely, once cropped area and yield decreased drastically due to most severe drought in 1991/92, and recovered the previous level of the 1991/92 drought in 1993/94.

In terms of crop productivity, most of crops show the lowest in communal and resettlement land and the highest in the large-scale commercial farms. In large-scale commercial farms, irrigation system which enables supplemental irrigation is provided. On the contrary, major reasons for low productivity in the communal and resettlement land are: (a) limited suitability of current farming technologies for Natural Region III and IV where the bulk of the crop is grown; (b) low level in dosage of chemical fertilizers; and (c) due to lack of necessary resources such as cash, labor, animal and mechanical power, timely implementation of key husbandry practices such as planting and weed control as well as harvesting are hardly practised.

Farming Labour

Almost all cultivation in the Study Area is done using draught animal power (DAP) because of the limited numbers of tractors available even among small scale commercial farmers. Some tractor contracting is practiced but the availability is not widespread, the services erratic and comparatively expensive. District Development Fund rental services are not widely used either. Most of the small scale commercial farms employ some permanent labour, the average being about two units per farm. In the communal and resettlement areas the majority of farmers do not employ permanent labour.

Animal Husbandry

While it is ecologically and environmentally undesirable in NR III,

extensive livestock breeding is being introduced as a part of farm management, and it is, for the most, part an economic necessity in areas of low and erratic rainfall and low soil fertility. In this area, cattle are by far the most important because of the many roles they play in the farming systems of the area. Communal grazing system in the communal and resettlement lands is an important feature of livestock production in these areas.

2.4 Irrigation and Drainage

Existing Irrigation Facilities

In the Study Area, two schemes, namely, the Takavingwa (8 ha) and Ngondoma (44 ha) in the communal land, several schemes in the large-scale commercial farms and one scheme in the small-scale commercial farm are presently being operated. In the communal land, furrow irrigation is mainly adopted. After conveying water from a reservoir to a night storage, irrigation water is supplied to fields through open canals, and rotational irrigation is carried out regularly. In the commercial farms, irrigation water is mainly depending on the borehole, and a sprinkler irrigation method is adopted with rotational irrigation.

Drainage System

There is no particular drainage facility in the Study Area. Generally speaking, detained surface water flows down through lower parts of field or small valleys into pools or rivers. Although most of run-off water flowing downstream could be hardly utilized effectively, some amount of water is utilized for livestock by storing in pools or reservoirs that are established in the rivers.

Operation and Maintenance

A storage dam is under the control of the DWD. Practically, a Provincial Water Engineer is directly responsible for the operation of the dam. And generally, each dam has a designated post for a Water Bailiff and some subordinate staffs who are employed by DWD, and responsible for operation and maintenance of the dam and main canal in practice. Irrigation systems on-farm level are operated and maintained by AGRITEX and Irrigation Management Committee.

Most of irrigation schemes in the Study Area has organized an

Irrigation Management Committee. This organization is composed of about 7 members and its responsibilities are (a) operation of water distribution in the scheme; (b) maintenance of irrigation facilities; (c) collection of maintenance fees; (d) setting up of local rules and regulations; and (e) continuous training of irrigators.

2.5 Socio-Economic Condition

Local Administration

The Study Area consists of four districts belonging to Mashonaland West and Midland provinces and include twenty wards. These twenty wards can be divided into communal land (eleven wards), resettlement land (three wards), small-scale commercial land (five wards), and large-scale commercial land (one ward). The number of these wards belonging to each district is as follows: ten wards in Kadoma district of Mashonaland West province, two wards in Kwekwe district of Midland province, two wards in South Gokwe district, and six wards in North Gokwe district.

Each province has a provincial office of each department under the governor who is being appointed by the government and conducts administration with a certain extent of autonomy. District-level administration is entrusted to district administrators and the district office of each department. There still remains the chief system in the communal land, where one chief is stationed for one to three wards. The chief has the rights to maintain public order, to arbitrate, and to judge. There are a number of villages under the ward. Several neighboring villages form a village development committee (VIDCO), which also is an autonomous organization and the terminal organization of local administration. There is no chief system in the resettlement land, where the VIDCO is the only local administrative organization. The commercial land has a farm owners' committee called the intensive conservation area (ICA), where ICA is both the autonomous organization and the terminal organization of administration.

Social infrastructure

The drinking water in the Study Area depends mainly on deep wells. In the rainy season, surface water or shallow wells can supplement it. As a whole, water amount is absolutely insufficient during the dry season. Especially water for animals is lacking, and thus death of animals by epidemic diseases or drop of the amount of milk to suck occurs. In some

districts, during the dry season, since deep wells are generally not functioning because of the draw-down of groundwater table, and sometimes people has to fetch water from deep wells located far from where they live.

Asphalt paved roads stretch by linking the central locations in the district and many roads connecting the business centers of villages are paved with gravel. However most of the roads connecting the villages are not paved, which cause traffic difficulty by becoming muddy after the rain fall. In many cases, a bus service is being operated one or two times a day between business centers. In the Study Area, there are cargo collection and temporary storage facilities of cotton and maize, where the farmers bring and sell their products. However because the number of these facilities are few, and road network as well as condition are insufficient, farmers are obliged to use more labour and to bear more expenses.

Presently, the damage of tsetse flies is rarely seen. Instead, malaria is widespread, followed by diarrhea and dysentery. In order to cope with these diseases, the Ministry of Health has established one clinic in each ward. At the center of the district, there exists a national hospital or the hospital operated by religious groups.

Almost all the wards have several open spaces called business centers, where there are groceries, restaurants, bus terminal, or vegetable and fruit markets. In some cases, schools are build close to these locations. The reason for establishing the business center is literally to establish the business center for the scatteredly located farm houses. Therefore the business centers are constructed extremely artificially compared with the naturally formed cities or commercial districts. However, by establishing facilities and giving them some relationship with the daily living of residents, business centers can be developed to the central locations of farming villages.

3. BASIC AGRICULTURAL DEVELOPMENT POLICY

3.1 Development Objective

In this master plan, it aims as major objective of the regional development to bottom up smallholder farmers especially in the communal and resettlement lands in the Study Area, and further to develop and

promote the regional economy through self-support of them. Zimbabwean government put its priority to the communal and resettlement lands, the small scale commercial farms and then the large scale commercial farms in order for allocation of Kudu Dam water. Hence, the master plan will be formulated by thoroughly examining efficient use of the limited water from technical, economical, social and environmental viewpoints.

3.2 Development Needs, Potential and Constraints

Development Needs

In the Study Area, most of farmers cultivates their land under rainfed condition, and their productivity is quite low and unstable because amount and pattern of rainfall fluctuates widely year by year. The foundation of farm management in the communal and resettlement lands are quite weak due to the frequent drought damages. In addition to lack of water for farming, it is rather difficult to secure drinking water for dwellers and animals both in quality and quantity throughout a year. In this connection, it is urgent subject to secure stable water resources in the Study Area.

Development Potential

The development potential in the Study Area is composed of (a) human resources, (b) land resources, (c) water resources and (d) socio-economic resources.

In the study Area, the total number of population and household are presently estimated at 105,268 and 17,613, respectively, out of which about 90 to 95 percent are a farmer. In four Districts of the Study Area, there are 15 Agricultural Extension Officers as well as 120 Agricultural Extension Workers. In addition, there are Cotton Research Institute and training staffs in Cotton Training Center in Kadoma, and several NGOs are working.

As the land resources, taking water retentivity of soils, slope, vegetation density, and the potential of soil erosion hazard into consideration, suitability of land for irrigation was assessed. 78 percent of the area is identified as little to no restricted area in which most of existing cultivated land is included.

Water resources available in the area are surface water in Munyati and its tributaries and groundwater, and the survey on groundwater for irrigation purpose was not carried out in this Study. When comparing 10 years' average for the last 30 years, annual discharge of Munyati river fluctuates 505, 950 and 330 MCM. In the main stream of Munyati, DWD has completed the detailed design for Kudu Dam in 1993, of which purpose is supply of irrigation water to lowland in mainly Sanyati, Copper Queen, Chenjiri and Gokwe as well as urban water supply to Kadoma and Kwekwe including industrial uses. The dam site is located about 70 km westward from Kadoma, and 1.5 km upstream from the conjunction point of Munyati and Ngondoma rivers. Main feature of Kudu Dam are indicated in the following:

Design of dam

- Dam type	Rockfill
- Dam Height	72.7 m
- Dam Length	860 m
- Saddle Dam Length	875 m
- Designed flood	12,122 cu.m/s
- Embankment Volume	8.005 MCM

Design of Reservoir

- Catchment Area	17,520 sq.km
- Surface Area at FSL	7,800 ha
- Total Storage	1,551.4 MCM
- Full Capacity	1,491.4 MCM
- Live capacity	1,426.9 MCM
- 10 % yield	380.0 MCM
- FSL	947.0 m
- Outlet EL	approx. 905.0 m

According to the existing feasibility studies for medium size dams in the Study Area, one for Mashonaland West Province and seven for Midlands provinces were identified. However, most of them has insufficient potential for water source, because although each dam has a big storage capacity, its catchment area is too small. Storage capacity and irrigable area are ranging from 0.17 to 4.1 MCM and four to 105 ha, respectively. Out of the eight dams, only Sanyati-2 and Mtange dams seem to be feasible.

As for socio-economic resources, (a) Financial resources, (b) marketing resources and (c) agricultural input, are listed up. The supply of credit by AFC for the purchase of agricultural input and assets is one of important socio-economic resources. In AFC, there are short-term loan scheme for procurement of input materials and medium-term loan scheme for purchase of equipment and machinery. On the other hand, under the strategies of Structural Adjustment Program (SAP), the commercialization and deregulation of marketing and prices accelerated competition between parastatals/ex-parastatals companies and private buyers. As a result, this competition is expected to benefit smallholder farmers by offsetting the price differentials in agricultural products between producer's

prices and open market prices. In addition, according to AGRITEX, it is estimated that the factors affecting yield of maize are: a) fertilizer (61.5%); b) high-yield variety seed (13.8%); c) chemicals for weed control and pest control (12.3%); and d) others (12.4%). In this connection, input materials would be properly supplied to small holder farmers, there are enough socio-economic potentialities to improve the level of crop yield.

Development Constraints

Against promotion of an agricultural development in the Study Area, the following five items are identified as development constraints:

(1) Physical issues

In the communal and resettlement land, respective farm area with size between two to six hectare scatters with distance ranging several ten to hundred meters and topography between one plot to another is rather undulating. Therefore, it is considered quite difficult to convey irrigation water to each plot from viewpoints of huge cost to be required for construction of irrigation canal network as well as complicated water management by such canal network. It is, therefore, inevitable to relocate and integrate the existing farming plots. It is considered more advantageous taking into consideration future infrastructure development that irrigation command area shall be distributed along or near the main/secondary canals, and new community development shall be made around the irrigation command area.

(2) Technological Issues

Most of all people in the communal and resettlement land do not have neither experience or knowledge about an irrigated agriculture. On the other hand, a sprinkler irrigation is introduced and practiced in the cotton research institute and the large scale commercial farms near Kadoma town, but knowledge or knowhow on fundamental terms such as unit water requirement of crop and irrigation interval, are not well recognized.

(3) Socio-Economic Issues

The AFC's short-term and medium-term loan schemes involve several constraints: (a) the financial sources for smallholder farmers are

extremely limited; (b) although the interest rate is favorable for communal and resettlement farmers, it is still high for repayment; and (c) almost all farmers complained that the medium-term loan to buy machinery is not available without sufficient collateral. Although the commercialization and deregulation of marketing and prices were expected to accelerate competition between parastatals/ex-parastatals companies and private buyers, the fact is that the prices offered by these private buyers are reported to be well below the official prices by GMB, COTTCO, DBZ and CSC due to lack of transportation in isolated areas and lack of alternative outlets. In addition, small holder farmers, especially, communal farmers had low-level amount of input materials. The reason that they have not enough financial resources to procure such input and farmers are not willing to use such input as far as they can not secure stable water for cultivation.

(4) Local Administrative and Institutional Issues

The Study Area belongs to the Mashonaland West and Midlands provinces. There seems to be so-called bureaucratic atmosphere or a sectionalism in various ministerial agencies in Zimbabwe. In addition, there exist difference in level of institutional set-up as well as level of recognition on the proposed project among local offices of the concerned ministry and provincial offices as well. Therefore, to work out a consistent policy in relation to implementation, management, operation and maintenance of project facilities, it may require well coordination among governmental agencies concerned at the central and local levels not only horizontally but also vertically. On the other hand, number of agricultural extension staff is absolutely not sufficient. In fact, taking an example of Kadoma District, some Wards do not have their own agricultural extension worker. Also, it can be pointed out their mobility is not enough due to low level of mobile and communication tools. In addition, in the Study Area, solidarity in a community is rather weak and there exist none of wide range farmers' organization, especially in the communal and the resettlement lands. It is prerequisite for successful implementation of the project to organize beneficial farmers as a member of a water user group and an agricultural cooperative who has rather individualistic tendency, in relation to several activities such as operation and maintenance of project facilities, acceptance of agricultural extension, request for agricultural credit and guarantee for loan, collective purchase of farm input as well as sale of farm products, namely, an agricultural

cooperative activities.

(5) Issues on Data and Information

In this study, it lacks detailed topographic information. The topographic map with scale of 1/50,000 and contour interval of 20 meters, is presently available. Although an aerial photograph is available, which was taken in 1986, it is considered that physical condition has changed during the recent 10 years after taking the photos. In addition, it is recognized that more reliable and precise hydrological data should be required, especially, such data on discharge of major tributaries of Munyati river.

3.4 Development Scenario

Basic Concept

The development scenario presently formulated would include cases with Kudu Dam (Scenario A) and without it. The latter is further divided into a case with consideration of any water resources development (Scenario B-1) and without it (Scenario B-2).

Scenario Code	A	B-1	B-2
Alt.-1: Kudu Dam	With	Without	Without
Alt.-2: Other Water Source	-	With	Without
Development Purpose	Agricultural & Rural Development thru Wide Area Irrigated Agriculture	Agricultural & Rural Development thru Spot Irrigated Agriculture	Agricultural & Rural Development without Irrigation
Development Term	Long	Middle	Short

Development Framework

(1) Scenario A (with Kudu Dam)

After completion of the Master Plan Study, it would take about five years for a feasibility study and a detailed design, and 10 years for construction works, and thus the target year for this scenario is being set at year 2010. During the period, the present number of farmers including those employed in the large scale commercial farms will increase from 16,870 to 26,794.

Based on the land resources potential, the study area was roughly divided into two different land categories; namely preservation area and utilization area, in which most of the cultivable area currently lies in the latter area.

After allocating urban/industrial water of 60 MCM for Kadoma and Kwekwe from water to be developed by Kudu Dam (380 MCM at 10% Risk Level), the remaining could be utilized as irrigation water. In accordance with AGRITEX's guideline, allocation of water should be based on the following:

Utilization	Amount (MCM)	Allocation (%)
Urban/Industrial Use	60.0	15.8
Irrigation Use		
- Communal/Resettlment	188.2	49.5
- S.S.C.F.	75.3	19.8
- L.S.C.F.	56.5	14.9
- Sub-total	320.0	84.2
Total	380.0	100.0

On the basis of available amount of water, proposed cropping pattern and other necessary factor on irrigation planning, irrigable area has been calculated as follows:

Risk Level	Irrigable Area
25 %	35,000 ha
10 %	25,000 ha

Coping with Zimbabwean governmental policy, each farmer within the irrigation command area could be allocated with one hectare of irrigable area, aiming full-time irrigation. In order to secure the irrigation beneficiaries of 14,700 farms, it is necessary to voluntarily relocate about 5,000 farms into the irrigation command area. On the other hand, existing farms are secured to keep the same farm size at present. In case that the size is below 4.0 ha as well as for newly increased farmer, farm size of 4.0 ha is also secured.

It is estimated that total of about 1,000 household should be relocated, taking into consideration people to be included in the buffer zone as a national park designated by DNPWLM. In order to sufficiently compensate those peoples to be relocated, it is planned

to locate them inside a proposed irrigation command area.

(2) Scenario B-1 (Medium size dams)

In this scenario, an agricultural development will be promoted by constructing several medium size dams in the tributaries of Munyati river. The target year of this scenario is being set in year 2005 in considering the required period of 10 years for a feasibility study, a detailed design and construction works. Fundamentally, same planning with Scenario A would be applied for land use planning as well as allocation of farmland.

(3) Scenario B-2 (No Dam)

The scenario is fundamentally aiming the regional development not depending on an irrigated agriculture, and the target year is being set in year 2000, taking into consideration five years for the further study and implementation. Land use planning will be same as Scenario A. And allocation of farmland is same as the non-irrigated farms in Scenario A.

Development Impact

In Scenarios B-1 and B-2, it is considered necessary to convert about 30,000 to 35,000 ha of presently grazing/bush lands into cultivated land in order to secure farming plot for newly increased farmers. On the other hand, in Scenario A, it would be able to convert about 24,000 ha of the presently rainfed cultivated land into grazing land or forest land. Even in case of 1/10 probability analysis in the water balance study, about 10,300 ha of land in both the small and the large scale commercial farms could be irrigated after providing the required irrigation water for the communal and the resettlement areas (14,700 ha).

Issues and Necessary Measures

On the basis of the basic agricultural development concept, the following issues should be taken into consideration for formulation of the master plan: (a) Realization of dam component from viewpoint of management, operation & maintenance; (b) Establishment of new set-up for overall project planning, implementation and management; (c)(d) Financial examination on allocated farm size under irrigated and rainfed condition; (e)(f) Reviewing role & activities of existing research institution for

irrigated and rainfed agriculture; (g) Farmers training and set-up of farmers' organization; (h) Due attention on people to be relocated from reservoir area; (i) Measures to create farm economic surplus especially under rainfed condition; (j) Due attention on both economic and social approach for promotion of proposed project; (k) Introduction of staged development approach; (l) Preparation of countermeasures for water-born diseases including malaria; (m) Preparation of detailed topo-map and hydrological data; (n) Implementation of feasibility study; and (o) Procurement of development fund (Refer to Table 4-8 of Chapter 4).

Furthermore,ten items of the project component have been selected towards solving the said problems of issues, which are: (a) research, experiment and extension of regional farming technology; (b) strengthening of agricultural extension services; (c) marketing development; (d) activation and establishment of farmers organization; (e) farmers' participation; (f) improvement and strengthening of agricultural crediting system; (g) rural infrastructure development; (h) water resource and irrigation development; (i) land reclamation and soil conservation; and (j) management, O & M of project facilities (Refer to Table 4-9 of Chapter 4).

4. BASIC AGRICULTURAL DEVELOPMENT PLAN

4.1 Basic Concept

For the 10 items of project component identified in the above, (a) land use plan, (b) proposed cropping pattern and farming plan, (c) water resource development and utilization plan, (d) irrigation and drainage plan (except for Scenario B-2), (e) rural infrastructure development plan, (f) farmers' supporting service, (g) marketing plan and (h) plan for regional farming technology center were formulated in each development scenario, with respective cost estimation.

4.2 Scenario B-2

Land Use Plan

The prevention of soil erosion, efficient control of grazing land and fodder conservation contribute considerably to support farmers' economy especially in times of drought. In addition to introduction of drought resistant field crops or varieties, it is necessary to promote

livestock production through introduction and enhancement of sylvo-pastoral system, which is one of the agroforestry systems.

Cropping Pattern and Farming Plan

In this scenario, the present cropping pattern will unchange because rainfed farming will be continuously practised in about 117,000 ha. On the other hand, crop yield of maize and cotton as major crop will be improved (20 - 65%) due to efforts on research, experiment and extension on rainfed farming technology applicable to Natural Region III.

Water Resource Development and Utilization

Annual discharge of Munyati river is quite unstable, and existing water rights have been fixed by mining companies, railroad, commercial farms and government. In addition, due to the declining tendency in the recent river discharges, the available water resource is limited at 11.8 MCM including existing water rights amounting to 10.1 MCM in the Study Area only, without considering any water use facility including dam.

According to Local Water Supply and Sanitation Plan, it aims supply population of 250 per one well, based on which about 43 new wells with water of about 0.6 MCM per year will be required in the Study Area. Judging from production capacity per well (2.6 - 8.6 ㎥/hour), these wells should be solely used for drinking water of both human being and animal.

Rural Infrastructure Development

(1) Improvement of Road Network

- Existing trucks of 279 km which connect villages with main and secondary road will be upgraded to gravel road with 3 m width;
- 35 km of gravel road with 3 m width will be newly constructed from Chenjiri camp to conjunction point of Munyati and Mufri rivers;
- A part of ring road of 70 km connecting Sanyati, Copper Queen and Gokwe will be upgraded to asphalt road;
- New bridge over Munyati river between Umsweswe resettlement land and Chisina communal land will be constructed.

By these road improvement, local people could enjoy easier access to local governmental and medical services and reduction of vehicle

operating cost.

(2) Drinking Water

In accordance with the government standard, 43 new wells will be constructed and 60 out of the existing 338 wells will be rehabilitated.

(3) Community Center

It is proposed to construct a community center in which local government can positively approach to local people, and farmers training will take place, in such wards of Sidakeni, Umsweswe, Chisina I & II, and Sanyati.

Farmers Supporting Services

(1) Research and Extension on Regional Farming Technology

In this scenario, it is very important point how to alleviate drought damage under rainfed condition. It is necessary to carry out research, experiment and extension on drought resistance crops and variety and on improved variety of animal and effective utilization of grazing land.

(2) Reinforcement of Agricultural Extension

At present, farming level of smallholder farmers in communal and resettlement land remains low, and hence it is very important factor for successful implementation and management of the project to strengthen agricultural extension activities for these farmers. Therefore, AGRITEX should make effort to secure necessary budget for retraining AGRITEX's extension officer/worker as well as farmers training in the AGRITEX district offices and by Training and Visit system. Especially, guiding and training AGRITEX's extension staff on improved farming technology in semi-arid areas, is one of key roles.

(3) Activation of Farmers Organization

In order to activate existing crop production groups and livelihood cooperatives, a ward level crop production group (mainly maize and

cotton) and livestock production group (mainly beef cattle) should be organized, through which members are able to enjoy privilege of tax exemption for input materials and aiming to increase bargaining power by collective marketing and purchasing. In future, these production groups will be gradually united towards establishment of an agricultural cooperative, which could give its strong effect in scopes of marketing and crediting. In the unification activities, it is necessary to guide and train AGRITEX extension staffs and then farmers.

(4) Strengthening of Agricultural Credit

It is quite difficult to escape any drought damage under rainfed condition. In this connection, in order to improve accessibility to the current crediting system by smallholder farmers, (a) introduction of crop insurance system, (b) to soften conditions in AFC's group lending scheme, and (c) reinforcement of subsidy to AFC for the purpose to use AFC's tie-up schemes, are to be required. In addition, in order to improve the accessibility, establishment of new AFC liaison offices and introduction of depositing operation in AFC should be taken into consideration in future.

Marketing Plan

(1) Road Network Development

It could be expected that transportation cost for farm products and farm input will be reduced by using the road network improvement planned in the rural infrastructure development. In addition, through establishment of collection points for farm products as mentioned below, it is expected opportunity of more small and medium transporter's participation will increase.

(2) Collection Point

For the purpose to strengthen the existing marketing channel for maize and cotton, one depot in Gokwe and six collection points of COTTCO, as well as five collection points of GMB shall be established. These collection points could be used as a temporary shed for purchased farm input.

Regional Farming Technology Center (RFTC)

In order to research and experiment on improved rainfed farming technology, and to extend the results to farmers, it is proposed to establish "Regional Farming Technology Center" in each side of Munyati river. In this center, research and experiment shall be carried out on drought resistance crop and variety applicable to NR III and effective use of grazing land including sylvo-pastoral system. The center also collect and analyse such information on marketing farm products including internal and external demand. Furthermore, results obtained in the center shall be transmitted to farmers in the area through guidance and training for AGRITEX extension staff.

4.3 Scenario B-1

Land Use Plan

Although the irrigated agriculture will be introduced in this scenario, the total irrigable area is only 331 ha, and then most of the area will be left under rainfed condition. Therefore, except the irrigable area of 331 ha, the same land use plan for Scenario B-2 is applicable.

Cropping Pattern and Farming Plan

In the irrigable area, cropping pattern based on maize and cotton in rainy season and wheat and vegetables in dry season would be introduced. In addition, every effort should be made in RFTC to develop irrigated farming technology so as to realize the target crop yield through training farmers by existing extension activities. In the rainfed area of about 115,000 ha, same farming as Scenario B-2 would be practised.

Water Resource Development and Utilization

Since there is no possibility to construct any diversion work in Munyati river, only medium-size dams in the tributaries are available of which developed water is estimated at about 4.3 MCM to be mainly utilized for irrigation purpose, and then drinking water in schools, clinics nearby the dams.

Irrigation and Drainage Plan

(1) Design Discharge

Irrigable area and design discharge in medium-size dams are ranging from 4 ha to 105 ha and 0.005 cu.m/sec to 0.131 cu.m/sec.

(2) Irrigation Method

In order to reduce cost burden for beneficial farmers through reduction of O & M cost, a gravity system and a furrow irrigation method on-farm would be applied. Main irrigation facilities are as follows:

- Water Source: Medium-size Dam
- Water Conveyance: Open Canal (Main Canal)
- Regulation: Farmpond
- On-Farm: Open Canal (Irrigation/Drainage) and Road

(3) Design Standard

Basically, the design standard used by DWD and AGRITEX is applied including measures for schistosomiasis.

Rural Infrastructure Development

In this scenario, rainfed agriculture will be playing important role similar with Scenario B-2, except 331 ha of irrigable area by medium-size dams. Therefore, the following rural infrastructure will be developed for the purpose to uplift farmers' living standard and to give impact on producing farm economic surplus:

(1) Road Network Development: same as Scenario B-2.

(2) Drinking Water: same as Scenario B-2.

(3) Community Center: same as Scenario B-2.

Farmers Supporting Services

(1) Research and Extension on Regional Farming Technology

Irrigable area of this scenario is only 331 ha, and most of the area remains under rainfed condition. Therefore, same contents of Scenario B-2 would be deployed with research, experiment and extension of irrigated agriculture.

(2) Reinforcement of Agricultural Extension

Same contents of Scenario B-2 would be deployed, and it is necessary for AGRITEX to provide training for beneficial farmers on irrigated farming technology with collaboration of RFTC.

(3) Activation of Farmers Organization

Same contents of Scenario B-2 would be deployed, it is planned to establish water user group in each medium-dam. Composition and activity of the group should follow those of the existing Irrigation Management Committee.

(4) Strengthening of Agricultural Credit: Same as Scenario B-2

Marketing Plan : Same as Scenario B-2

Regional Farming Technology Center (RFTC)

Similar to Scenario B-2, it is proposed to establish "Regional FArming Technology Center", in which irrigated farming technology (optimum cropping pattern, farming practice and water management) will be researched, experimented, and extended to farmers. In addition, same contents of Scenario B-2 will be carried out.

4.4 Scenario A

Land Use Plan

According to the field survey, the existing cultivated land is amounting to 101,140 ha, 20 percent of total area of 505,200 ha. In this Scenario, irrigated land will increase to about 25,000 ha by constructing Kudu and medium-size dams. In case of converting existing grazing land to cultivated land, it is inevitable to carry out soil erosion control measures. In this scenario, considerable acreage remains under rainfed, it is necessary to promote livestock production through introduction of sylvo-pastoral system.

Cropping Pattern and Farming Plan

By Kudu Dam, about 25,000 ha under 10 percent risk level will be irrigable. The area will be distributed to 14,700 ha for the communal and resettlement land, 5,900 ha for S.S.C.F. and 4,400 ha for L.S.C.F. in accordance with AGRITEX guideline.

In the communal and resettlement land, a cropping pattern based on maize and cotton in rainy season and wheat and vegetables in dry season, will be introduced. In addition, every effort should be made in RFTC to develop irrigated farming technology so as to realize the target crop yield through training farmers by existing extension activities. On the other hand, sprinkler irrigation will be practised on the basis of cropping pattern of cotton in rainy season and vegetables in dry season, in both commercial lands.

Apart from these irrigated farmers, about 22,000 ha of existing 3,600 farms and 20,000 ha of new 5,100 farms remain rainfed, for which same contents of Scenario B-2 will be practised.

Water Resource Development and Utilization

Based on water balance study for Kudu Dam, available water resources at 10 percent risk level is estimated at 380 MCM, which will be distributed irrigation, urban water supply and industrial purposes. On the other hand, Mtange and Sanyati-2 dams having higher economical and technical feasibility, will be utilized for RFTC's activities. Medium-size dams of Sanyati-2 and one planned in Mdzongwe river will be functioning as a regulating reservoir within the Kudu irrigation system.

Irrigation and Drainage Plan

(1) Design Discharge

- Design discharge for irrigation planning is estimated at 5.4 mm/day.
- This discharge is maximum throughout a year in the fourth 5-days interval of February, and calculated as 24 hours continuous flow.

(2) Irrigation Method

Similar to Scenario B-1, gravity and furrow irrigation will be introduced. Main facilities are as follows:

- Water Source: Kudu DAm
- Water Conveyance: Open (Main and Secondary Canal)
- Regulation: Regulating Reservoir and FArmpond
- On-Farm: Farm Ditch and Drain and Road

(3) Design Standard: Same as Scenario B-1

Rural Infrastructure Development

In this scenario, a large irrigation system covering wide area will be managed. And although its magnitude will decrease gradually, still about 42,000 ha remain rainfed.

(1) Road Network

Same contents of Scenario B-2 are planned. In addition, maintenance road with total length of 296 km along main and secondary canals will contribute for improvement of transportation network.

(2) Drinking Water: Same as Scenario B-2

(3) Community Center: Same as Scenario B-2

Farmers Supporting Services

(1) Research and Extension on Regional Farming Technology

In this scenario, 14,700 ha in the communal and resettlement land will be irrigated, and it is inevitable to research, experiment and extend an irrigated farming technology to the farmers. On the other hand, efforts to improve the rainfed farming technology should be continued for the rainfed area of about 42,000 ha.

(2) Reinforcement of Extension Services

Same contents of Scenario B-2 would be deployed, and it is necessary for AGRITEX to provide training for beneficial farmers on irrigated farming technology (selection and farming practice for appropriate crops, method of irrigation, water management and so on) with collaboration of RFTC.

(3) Activation of Farmers Organization

Same contents of Scenario B-2 would be deployed, it is planned to establish water user group in every farmpond (approx. 100 ha). Composition and activity of the group are almost same as Scenario B-1, but it is planned to establish water user's association in each secondary canal.

Marketing Plan : Same as Scenario B-2

Regional Farming Technology Center (RFTC) and Model Project

(1) RFTC

Similar to Scenario B-1, it is proposed to establish two numbers of "Regional Farming Technology Center", in which irrigated farming technology (optimum cropping pattern, farming practice and water management) will be researched, experimented and extended to farmers. In addition, same contents of Scenario B-2 will be carried out.

(2) Model Project

In order that farmers who have no experience of irrigation will be able to immediately commence irrigated farming upon completion of the construction of a large scale irrigation system, including crop cultivation as well as water management, it is proposed that a model project should be implemented in parallel with construction of irrigation facilities so as to educate and train both AGRITEX extension workers and beneficial farmers by using RFTC as its core. Especially, due attention should be paid for AGRITEX and its staff, because they shall play a very vital role of an interface between main facilities and farmponds. In this connection, by utilizing water developed by the two medium-size dams, training on water management and O & M of facilities shall be extended not only to farmers but also to AGRITEX extension staff.

4.5 Preliminary Cost Estimate

The required cost for the said agricultural basic development plan is summarized in the following (without price escalation):

(Unit: 1,000 Z$)

	Scenario B-2	Scenario B-1	Scenario A
Initial Cost	378,700	474,800	2,598,500
O & M Cost	8,353	10,399	31,628

(Exchange Rate: US$1.00 = Z$8.3871 = JYE106.40, as of Jan. 1995)

5. IMPLEMENTATION PROGRAMME

5.1 Implementing Organization

Since the specific feature of the master plan is, generally, to cover various component, AGRITEX could not solely handle all the component including implementation, management, and O & M. It is, therefore, planned to establish a project coordinating committee at three levels of the government, namely, Project Executive Committee (P.E.C.), Project Coordinating Committee (P.C.C.) and Project Working Committee (P.W.C.). With the directive and guidance of these coordinating committees, AGRITEX shall be in charge of supervising progress of project implementation.

Under the P.E.C., AGRITEX shall appoint a project director and become direct executing body of the project. The project director will act as secretary of P.E.C. as well as a chairman of P.C.C. Under the project director, AGRITEX shall appoint a project manager, who will be chairman of P.W.C., and supervise respective role of agency allocated by the project component.

5.2 Implementation Schedule

In order to compare three scenario at same level, implementing schedule up to year 2010 was prepared. This schedule includes the required period for feasibility study and detailed design. Construction period varies from two years to 13 years at longest (Refer to Figures 6-1 to 6-3 of Chapter 6).

5.3 Organization for Project O & M

Responsible Agency

Basically, the implementing agency will be continuously in charge of operation and maintenance of facilities, except the following component: (a) Regional Farming Technology Center (Min. of Public Construction and

Houses to AGRITEX); (b) Land Reclamation and Soil Conservation (AGRITEX to farmers group); (c) Farm ditch and on-farm facilities (AGRITEX to farmers group).

O & M for Irrigation System

Role of farmers group especially in the communal and resettlement land is quite important in management, O & M of irrigation facilities and dominate sustainability of the project. Therefore, it is prerequisite for farmers organization to take initiative to operate and maintain the irrigation facilities as well as to collect water charges.

6. ENVIRONMENTAL MANAGEMENT PLAN

In 1994, the Ministry of Environment and Tourism (MET) published guidelines for Environmental Impact Assessment (EIA) for application to development projects likely to have significant environmental consequences. According to the new policy, the purpose of EIA "is to ensure that the environmental and socio-economic costs and benefits of economic development projects are properly accounted for, that unwarranted negative impacts are avoided or mitigated, and that potential benefits are realized".

The present environmental concerns in the Study Area are: (a) Population and resettlement, including displacement and relocation, compensation and cultural and historical sites; (b) Environmental health issues including water-borne and water-related diseases, use of agrochemicals, domestic water supplies and health, and sexually transmitted diseases; (c) Woody vegetation clearance; (d) Monitoring of mining activities; and (e) soil deterioration. Judging from the present environmental condition in the Study Area, out of these concerns, the water-born diseases of malaria and schistosomiasis, the involuntary relocation of people, the change in woody vegetation, the application of agricultural chemicals under irrigated condition, and displacement of cultural and historical sites, seem to be more serious through implementation of the project. Therefore, detailed EIA study under the succeeding feasibility study will seek to:

- to identify and quantify total number of households that will be displaced by the project facilities and to estimate the amount of compensation to be required for immovables, and to secure possible areas for the resettlement of the displaced households

within the Study Area.

- to investigate on ways of protecting the Mabura Cave and on procedures for the exhumation and reburial of the remains of the late Chief Samambwa.

- to identify areas and estimate the numbers of people that will be at risk of water-borne or water-related diseases due to the siting of the irrigation works and to prepare appropriate mitigatory measures.

- to identify the areas and numbers of households where safe water supplies will need to be developed in order to ensure that the inhabitants do not resort to using unsafe irrigation water.

- to investigate the current uses of woodland resources in communal and resettlement areas and to identify the areas of woodland that will be lost through the development works, the amount of such lost vegetation as a proportion of the current woodland area, and the plant species and their significance for biodiversity.

- to the quantities and variety of agrochemicals that are likely to be used in irrigation agriculture and to prepare the most appropriate methods for their use, storage and disposal.

7. PROJECT EVALUATION AND PRIORITIZATION

7.1 Basic Concept

In order to evaluate and prioritize the formulated basic agricultural development plans under three scenarios, from economic, financial, engineering, organizational, social and environmental aspects, respective index for the evaluation aspects is selected with calculation of numerical value where possible. Selected indices are:(a) economic internal rate of return (EIRR) and total value added in terms of economic prices in the economic aspect; (b) financial internal rate of return (FIRR) in the financial aspect; (c) relative difficulty of construction works in engineering aspect; (d) relative difficulty of project implementation and management in organizational aspect; (e) increase in average crop income per farm and social internal rate of return (SIRR) in social aspect; and (f) involuntary relocation of people, change in woody vegetation and fear for outbreak of water-born diseases in environmental aspect. In items (c), (d) and (f), qualitative analysis has been applied. Reference is made to those approach and values used by the World Bank

have been made in the calculation of economic price of project input and output.

7.2 Project Benefit

Project benefit arising from the project to be valued in monetary terms is consisting of: (a) increased crop production from both rainfed and irrigated agriculture; (b) road improvement effect valued at reduction in vehicle operating cost; (c) industrial water supply (willingness to pay); (d) drinking water supply by wells (willingness to pay); and (e) increase and/or decrease in livestock production through conversion of present land use. The full benefit of each items is summarized below:

(Unit: 1,000Z$)

Benefit	Scenario B-2	Scenario B-1	Scenario A
Economic Price			
- Crop	63,257	64,758	226,565
- Road	483	483	483
- Industrial Water	-	-	10,434
- Drinking Water	221	221	221
- Livestock	-6,525	-6,219	11,107
Total	57,436	59,063	227,942
Financial Price			
- Crop	18,829	20,873	208,228
- Road	710	710	710
- Industrial Water	-	-	12,000
- Drinking Water	260	260	260
- Livestock	-7,688	-7,308	13,052
Total	12,111	14,535	210,250

7.3 Evaluation

Each index for various evaluation aspect and respective ranking are presented in the following:

Comprehensive Evaluation of Development Scenarios

Aspect	Index	Unit	Index Value B-2	Index Value B-1	Index Value A	Ranking B-2	Ranking B-1	Ranking A
1. Economic								
- National	EIRR	%	7.5	6.1	8.3	B	C	A
- Regional	Value added	10^6Z$	44.9	42.1	167.7	B	C	A
2. Financial	FIRR	%	-10.1	-8.3	3.5	C	B	A
3. Engineering	Rel. Difficulty	-	small	medium	large	A	B	C
4. Organization	Rel. Difficulty	-	small	medium	large	A	B	C
5. Social								
- Poverty	Crop income	Z$	243	261	4,189	C	B	A
- For Weak	SIRR	%	10.9	9.5	10.4	A	C	B
6. Environment								
- Health	W.B. disease	-	small	medium	large	A	B	C
- Relocation	No. of people	-	small	medium	large	A	B	C
- Vegetation	Grazing area *1	-	(1)	(2)	(3)	C	B	A

*1 (1) Largely decreased, (2) Fairly decreased, (3) Increased

(1) Scenario B-2

In this scenario, the rank-A is given to five indices, in engineering, organizational and environmental aspects as well as SIRR. In addition, the scenario has the rank-B in two indices and the rank-C in three indices. Judging from these ranking, the scenario could possess similar significance with Scenario A, magnitude of economic, financial and social impact for smallholder farmers is rather small in comparison to Scenario A. Therefore, Scenario B-2 is evaluated as medium ranking among the three scenarios. Furthermore, it is necessary to keep in mind that this Scenario would play an important role for improvement of the rainfed farming technology of those farmers who could not enjoy any benefit arising from the proposed water resource development.

(2) Scenario B-1

Scenario B-1 has no rank-A, but the rank-B in seven indices and the rank-C in three indices. Especially, out of five indices having numerical value, three indices are ranked as C. This is because the proposed medium-size dams would not contribute to irrigation

development in comparison of required cost and expected benefit, due to topography and available river discharge at the point where these dams locate. Eventually, Scenario B-1 is given with the lowest ranking.

(3) Scenario A

In this scenario A, the fact that the scenario obtains the rank-A in all indices having numerical value except SIRR, indicates that economic, financial and social impact for the smallholders is bigger than the other two scenarios. Therefore, Scenario A is evaluated as the highest ranking, taking into consideration the Zimbabwean governmental policy which aims bottom up of smallholder farmers. However, the rank-C is given in four indices having qualitative aspect consisting of two indices in the engineering and the organizational aspects and two indices in the environmental aspect, because not only AGRITEX who will be a direct implementing body of the project, but also smallholder farmers in the communal and resettlement land are facing lack of experience and know-how on a large scale irrigation development, and such large scale water resource and irrigation development project will have high possibility to bring about various environmental issues. And hence, Scenario A should have highest number of items and issues to be solved in future among three scenarios.

8. Conclusion and Recommendation

8.1 Conclusion

In order to prepare a master plan for an agricultural development in the Lower Munyati basin, three independent development scenarios as a basic agricultural development concept, were formulated through comprehensive examination on development needs, potentials and constraints in the Study Area. In addition, a basic agricultural development plan for each development scenario was formulated, and each scenario was evaluated from economic, financial, engineering, organizational, social and environmental viewpoints through estimation of project cost and benefit.

In Scenario B-2, its main component is an agricultural development through improvement of rainfed farming technology, and hence it requires

relatively small amount of investment resulted in shorter development period and quicker realization of project effects. The scenario shall be applicable not only to those people who could not enjoy a benefit arising from a water resource development scheme in other two scenarios, but also for the period until the other two scenarios would be realized. However, due to its partial investment, economic, financial and social impact by this scenario would be rather limited from viewpoint of the regional development in the Lower Munyati basin as well as the Zimbabwean governmental policy aiming bottom up of smallholder farmers. For the purpose of avoiding the phenomenon that increased population in future in the area would transmigrate to urban area for seeking their employment opportunity, it requires conversion of considerable acreage of existing grazing land into cultivated land in order to secure new farmland. This would badly affect supply of feedstuff which is presently placed under almost marginal condition.

Basically, Scenario B-1 has similar characteristics as Scenario B-2. It is clear that an irrigated agricultural development would provide some scale of impact on the limited irrigation beneficiaries, which could be realized through construction of medium-size dams in the tributaries of Munyati river. The expected irrigation command area is, however, quite limited at 331 ha in comparison to the required cost to develop the proposed medium-size dams, resulted in the lower economic feasibility. Furthermore, similar situation as Scenario B-2 would happen in conversion of grazing land into cultivated land.

In Scenario A, by introducing a large-scale irrigated agriculture in communal and resettlement land for which Zimbabwean government considers main beneficiary of the development project, overall impact on the regional economy would be absolutely enough through a big scale of project benefit due to drastic improvement in crop yield and cropping intensity, resulted in increase in farm income. When comparing with other two scenarios, this scenario would contribute to supply of urban and industrial water, and promotion of livestock production as multi-sided effect, in addition to the effects arising from improvement of rainfed agriculture as well as introduction of irrigated agriculture. In other words, Scenario A is considered best among the three scenarios in terms of efficient utilization of resource potentiality available in the Study Area. On the contrary, the scenario includes various unknown factors as well as issues to be solved in future, because the proposed Kudu Dam project including irrigation facilities would require a quite huge investment and long development period, and also because it is one of

large scale irrigation development project to be firstly introduced in communal and resettlement land in Zimbabwe. For example, most of farmers in communal and resettlement land has no or insufficient experience and know-how on irrigated agriculture. And also it is the first case for AGRITEX as a direct executing body, to construct a large-scale irrigation scheme and to allocate irrigation water covering very wide area in communal and resettlement area. In addition, there exists several problems such as displacement of people to be submerged by Kudu Dam and outbreak of water-born diseases through water resource development.

Through comprehensive evaluation of the basic agricultural development plans, it is considered justifiable that Scenario A shall be deployed for the agricultural development in the Lower Munyati River Basin, subject to execution of a feasibility study.

8.2 Recommendation

As concluded in the above, although Scenario A which fully covers the ten items of project component formulated under the basic agricultural development concept in Chapter 4 of this report, is considered a best alternative among three scenarios so far comprehensively examined, in order to promote the agricultural development in the Lower Munyati River Basin in realistic and sustainable shape on the basis of Scenario A, due attention should be carefully considered on the following items:

(1) Project Execution System

The proposed large-scale irrigation development which places highest emphasis on smallholder farmers in the communal and resettlement land, is the first case in Zimbabwe. AGRITEX who should play an important role as an interface (hard/soft) between the dam and main irrigation facilities maintained by DWD and irrigation facilities after farmpond maintained by beneficial farmers, has not sufficient experience in planning/design/implementaion/O & M. It is necessary to jointly work with DWD who has enough experience and knowhow, especially in scope of hardware.

(2) Farmers Participation

Important factors to realize successful implementation of the project and its sustainability include positive participation of farmers in the project promotion and management. As far as beneficial farmers do

not recognize project facilities as their own property, it is rather difficult for those farmers to voluntarily operate and maintain the facilities as well as to bear the required cost. Therefore, it is quite important to promote the project by considering farmers' opinion and by farmers' regulation on conflicts for especially relocation and/or consolidation of present cultivated land, focussing on future farmers' organization (i.e. water user group, etc) from initial stage of investigation and planning.

(3) Regulation of Interests

The Study Area extends Mashonaland West and Midlands Provinces, and involves four type of land holding system, forming various interest groups, and hence it will happen various and complicated conflicts among these groups, especially on allocation of developed water and project budget. Therefore, it is prerequisite to establish three level committee as proposed in Chapter 6 "Implementation Programme" of this report.

(4) Environmental Issues

By construction of Kudu Dam, not only about 1,000 households including those to be submerged by the dam and those located buffer zone to be designated by DNPWLM, should be removed, but also outbreak of water-born diseases such as malaria and schistosomiasis would be in fear through utilization of annual amount of 380 MCM for irrigation purpose, together with altitude where the Study Area is extending. Furthermore, soil erosion might become problem in progress of construction of large irrigation system and irrigated agriculture. In this connection, appropriate measures should be thoroughly studied and formulated in the succeeding feasibility study.

(5) Advanced Implementation of Model Project

As described already, beneficial farmers in communal and resettlement land has no experience and knowhow on irrigated agriculture. Therefore, it is recommended to promote a model project in advance, in which necessary technology on irrigated agriculture applicable to technical level of smallholder farmers, including operation and maintenance of facilities, selection of crop, irrigation method, farmers' organization. Through implementation of the proposed model project, it could be expected that smallholder farmers could start

their irrigated farming upon completion of the construction of facilities. It is desirable to promote the model project by using the proposed "Regional Farming Technology Center" as its core.

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ABBREVIATION

AFC	Agricultural Finance Corporation
AGRITEX	Dept. of Agricultural, Technical and Extension Services, MOA
CMB	Cotton Marketing Board
COTTCO	Cotton Company of Zimbabwe
CSC	Cold Storage Company (Commission)
CSO	Central Statistical Office
DAEO	District Agricultural Extension Office
DBZ	Dairyboard of Zimbabwe
DDF	District Development Fund
DMB	Dairy Products Marketing Baoard
DNPWLM	Department of National Parks and Wild Life Management
DNR	Department of Natural Resources, MOET
DR&SS	Department of Research and Specialist Services, MOA
DWD	Department of Water Development, MLWR
EC	European Community
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
GDP	Gross Domestic Products
GMB	Grain Marketing Board
GOJ	Government of Japan
GOZ	Government of Zimbabwe
HYV	High Yielding Variety
IA	Irrigator's Association
ICA	Intensive Conservation Area
IEE	Initial Environmental Examination
IMF	International Monetary Fund
JICA	Japan international Cooperation Agency
LSCF	Large Scale Commercial Farm
M/M	Minutes of Meeting
MLGRUD	Ministry of Local Government, Rural and Urban Development
MLWR	Ministry of Lands and Water Ressources
MET	Ministry of Environment and Tourism
MOA	Ministry of Agriculture
MOF	Ministry of Finance
NEPC	National Economic Planning Commission
NGO	Non-governmental Organisation
NR	Natural Region
NRB	Natural Resources Board, MET
O & M	Operation and Maintenance
PIE	Project Impact Evaluation
RBZ	Reserve Bank of Zimbabwe
RRA	Rapid Rural Appraisal
S/W	Scope of Works
SSCF	Small Scale Commercial Farm
USDA	United States Department of Agriculture
VIDCO	Village Development Committee
WADCO	Ward Development Committee
WUG	Water User's Group
ZESA	Zimbabwe Electricity Supply Authority

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 General

The Scope of Works (S/W) for the Master Plan Study on the Lower Munyati Basin Agricultural Development in the Republic of Zimbabwe (hereinafter referred to as "the Study"), and the Minutes of Meetings for the said S/W were agreed upon and signed between the Japan International Cooperation Agency and the Ministry of Land, Agriculture and Water Development (until April, 1995) on 20th April, 1994.

The Study was commenced on 22nd November, 1994 as the domestic preparatory works in Japan, in which the Inception Report was prepared. And then, the first group of the Study Team arrived in Harare on 2nd December, 1994 and commenced the field works in Zimbabwe. On 6th December, the joint meeting on the Inception Report was held among the Inter-Ministerial Committee, JICA's Study Team and Advisory Committee members, and contents of the Inception Report were basically agreed to and accepted by the concerned personnel.

The Study Team used Kadoma as its base, and carried out various field investigation works in the area, such as collection of data and information at various points including the capital Harare, soil sampling and analysis, interview survey for farmers and women and so on. The team prepared its progress report and a joint meeting was held with Zimbabwean governmental officials concerned on 8th February, 1995. The field works were completed on 13th February, 1995.

Upon completion of the field works in Zimbabwe, the Study Team carried out the home office analytical works, in which development scenarios were formulated through analysing the data and information collected in the field works as well as identifying development needs, potential and constraints in the Study Area. On the basis of the said works, the Interim Report was prepared, for which explanation and discussion was held with Zimbabwean governmental officials concerned from May 17 to May 31, 1995.

During the period for the discussion on the Interim Report, it was confirmed in relation to the separation of the former Ministry of Land, Agriculture and Water Development into Ministry of Agriculture and Ministry of Land and Water Resources in April, 1995 that Ministry of Agriculture is successively taking chairmanship of the Inter-Ministerial Committee for this Study.

On the basis of the discussion on the Interim Report, respective basic agricultural development plan under the three scenarios have been formulated, and preliminary cost estimation, implementation programming, and evaluation and prioritization on each scenario were carried out in the home office work in Japan. Contents of the Draft Final Report which contains the results of the said works were discussed with Zimbabwean governmental officials concerned from 1st to 12th August, 1995.

This Final Report is prepared by incorporating various comments on the Draft Final Report raised both by the Zimbabwean side and the Advisory Committee for this Study.

1.2 Background of the Study

The Zimbabwean government wishes to embark on the construction of the Kudu Dam for agricultural development purposes, on the Munyati river which flows through the middle part of the country. A feasibility study and detailed design for the dam itself were carried out using Zimbabwean budget and resources. However, the required study on irrigation planning has not been undertaken. The Zimbabwean government therefore made a request to the Japanese government to carry out this Study, which includes plan formulation and feasibility study for irrigated agricultural development including the construction of the Kudu Dam.

In Zimbabwe, the development of water resource was usually carried out mainly for large scale commercial farms. Generally, these farmers have enough know-how and technology for irrigated agriculture, and hence, the government only concentrates its efforts on the construction of the storage dam and main irrigation facilities. However, for the planned Kudu Dam project, smallholder farmers will be given more priority as the beneficiary. These farmers might not have enough financial and

organizational background as well as the know-how and technology related to water utilization, and the operation and maintenance of facilities. In addition, problems may arise regarding the land holding system or land tenure with the implementation of the project.

Under such circumstances, JICA has recognized and concluded that the proposed Study should not only focus on a feasibility study for the Kudu Dam project as requested by the Zimbabwean government, but firstly, from the viewpoint of development of Munyati river basin, development needs in the basin should be grasped, and development potential and constraints should be reviewed and analysed in considering the natural, social and administrative condition in the basin. Secondly, on the basis of results from the above analysis, it is desirable to carefully study the necessity, priority and possibility in management, operation and maintenance of the proposed Kudu Dam Irrigation Project, through the formulation of a master plan as a basic agricultural development plan for the basin. Eventually, JICA recommended said considerations to the Zimbabwean government, and both sides have agreed.

1.3 Purpose of the Study

The primary purpose of the Study is to formulate a master plan for the agricultural development on the Lower Munyati river basin, extending to the two provinces of Mashonaland West and Midlands in Zimbabwe. Especially, possibility of implementing feasibility study of the Kudu Dam project shall be examined from viewpoints of necessity, priority and sustainable operation and maintenance of the project. In addition, technology transfer on the study method, basic concept and process of project planning shall be carried out for Zimbabwean counterparts.

CHAPTER 2

BACKGROUND OF THE STUDY

CHAPTER 2 BACKGROUND OF THE STUDY

2.1 National Economy

2.1.1 General Description

Zimbabwe is situated in the southern part of the African continent between latitude 15° 30' and 22° 30' South of the Equator and between longitude 15° 30' and 22° 30' East of the Greenwich Meridian, having its total area of 390,757 sq.km. According to the 1992 census, the total population is about 12.3 million, showing population density of 31.5 per sq.km, and an annual population increase of 4.9 percent over 10 years from 1982. It is bordered by Zambia to the North and North-west, Mozambique to the East, South-Africa to the South, and Botswana to the West. Zimbabwe is completely land-locked.

Zimbabwe is administratively divided into eight provinces, of which the smallest is Mashonaland Central Province with an area of 28,347 sq.km, while the biggest is Matabeleland North Province with 75,025 sq.km. Harare, capital of the country, has a population of about 1.5 million and is located in Mashonaland East Province. Bulawayo, the second biggest city with population of 620 thousand, is located in Matabeleland North Province.

Although Zimbabwe lies wholly within the Tropics, the normal tropical continental climate is considerably modified by altitude, especially on the central plateau where temperatures are lower than at sea level in the same latitude. The year falls roughly into three seasons: a dry winter, covering the months from April to August, with cool temperatures especially at night when frost is sometimes experienced; a hot season with temperatures building up to a maximum in October or early November; and a wet season in which the main rains usually come around mid-November and continue until March.

2.1.2 Review on the National Economy in 1980s

Since its independence in 1980, Zimbabwe has achieved considerable

progress in the area of social development such as education, health and population control. Primary school enrollments skyrocketed from 1.2 million children in 1980 to 2.2 million in 1989. Infant mortality has significantly declined from 86 to 61 per 1,000 births, and the population growth rate has fallen to 2.8 percent per annum in 1989.

In spite of this achievement, the economic growth had been modest throughout 1980s, except for 1988 and 1989 which enjoyed the favourable weather conditions following the drought in 1987 and leading to 25% increase in agricultural production in 1988. Table 2-1 indicates that the average GDP growth rate during 1980s was only 3.4%.

As shown in Table 2-2, while exports increased by 4.3% per annum in real terms between 1980 and 1990, imports were stagnant in the same period, due mainly to the debt servicing payments which drastically increased from 4% of export earnings in 1980 to 37% in 1987.

As for the fiscal balance, Table 2-3 indicates the public sector deficit in 1980-1988, showing that the central Government's fiscal deficit was in excess of 10% of GDP in 1980s, and the subsidy to parastatals contributed to 42.1% of the fiscal deficit in 1988.

With regard to the monetary balance, inflation has averaged around 15% per annum in 1980s. Nominal interest rates in 1980s have averaged 12% with the result that real interest rate had been negative.

2.1.3 Economic Structural Adjustment Program

In response to these modest economic performance and macro-economic imbalances in 1980s, the Government of Zimbabwe, under the assistance of IMF/World Bank, launched a comprehensive Economic Structural Adjustment Program (ESAP) in 1991. This program was called "A Framework for Economic Reform: 1991-1995". The basic strategy of SAP is to transform direct controls of the economy by the Government into efficient allocation of resources by market forces.

There are mainly four components of the policy package in ESAP: 1) fiscal deficit reduction together with rationalization of parastatals; 2)

prudent monetary policy including tightening money supply; 3) trade liberalization coupled with devaluation of the currency; and 4)domestic deregulation including decontrolling agricultural products by parastatals.

The target of the fiscal deficit reduction under ESAP is that the central Government's deficit must be reduced from 10.7% of GDP in 1990 to 5% in 1993 in order to avoid crowding out private investment and to maintain sustainable external and domestic debt positions. However, due to Zimbabwe's relatively high tax ratio and the need for the infrastructure investment, this target can be achieved mainly by reducing parastatal deficits and rationalizing public sector employment.

There has been a substantial tightening of monetary and credit policy in 1991 through the use of increased reserve requirements and the Reserve Bank selling off government bonds. This monetary and credit policy aimed at reducing the rate of inflation to less than 10% by 1994.

The Government committed itself to a phased program of trade liberalization to move from the foreign exchange allocation system before the introduction of SAP to a market-based system by 1995. This program includes expanding the Open General Import License (OGIL) and the Export Retention Systems (ERS), tariff reform, supportive exchange rate policy and improved export incentives.

Extensive intervention by the Government in domestic markets has caused distortions in the allocation of resources and helped sustain an inefficient and high cost structure of production which is not in line with the comparative advantage of Zimbabwe. In order to avoid this situation, the Government especially committed itself to a program of liberalization of agricultural pricing and marketing.

By the introduction of these policy reforms, the target of the real GDP growth rates for 1991, 1992 and 1993-1995 were projected at 3.5%, 4.0% and 5.0%, respectively. In other words, the real growth rate of GDP should rise from 3.4% during 1980s to a sustainable 5% per annum by 1995.

2.1.4 Latest Economic Trend in 1990s

In spite of the comprehensive economic reform program, macro-economic balances were deteriorated immediately after the introduction of the program in 1991, due partly to exogenous factors such as poor agricultural seasons and world recession. In fact, there has been a significant deterioration in the current account deficit of the balance of payments, from 4.7% of GDP in 1990 to an estimated 12% of GDP in 1991, and the real GDP growth rate in 1992 was minus 6.2%.

At the latest moment in the fiscal year 1994/1995, however, although the inflation rate still stood at about 20%, the Government estimated that the real GDP growth rate achieved more than 4.4% and the rate of the central Government's budget to GDP reduced down to less than 5.0%, respectively, which are both in line with the targets of ESAP. In this way, the overall economic policy under ESAP is ready to be on the right track. In fact, the Government of Zimbabwe and the World Bank agreed on the introduction of the successive ESAP at the end of January, 1995.

2.2 National Development Plan

2.2.1 Performance of the Previous Plans

Since its independence, the government of Zimbabwe started development planning as a major instrument for attaining socio-economic development. In 1982, the government launched the Transitional National Development Plan (1983-1985), followed by the First Five-Year National Development Plan (1986-1990).

As mentioned in the former section, the economic performance in the 1980s under these previous plans was not so satisfactory. In particular, the agricultural sector is often regarded as not having fulfilled its potential during 1980s. The growth rate of agricultural output in constant prices between 1980 and 1988 was 2.2%, well below the estimated population growth of over 3.0% during the same period.

2.2.2 Second Five-Year National Development Plan

In response to the poor performance of the previous plans, the Second Five-Year National Development Plan was formulated under the framework of ESAP. Out of 12 main objectives of the Second Five-Year Plan, the most critical objectives are: (a)improvement in living conditions; (b)reduction of poverty; and (c)economic growth with increases in investment and employment opportunities. In order to achieve these objectives, the following strategies were formulated:

(1) increasing the rate of savings and channeling these into productive investment;

(2) achieving expansion of trade; and

(3) encouraging the operation of market forces.

2.2.3 Agricultural Sector in the Second Five-Year Plan

Specifically, in the agricultural sector, the main objective of the sector is the production of enough food for the population. The plan identified the major constraints for the agricultural production as water shortage and drought.

In order to remove these constraints and attain this objective, the investment program amounting to Z$ 2,373 million for 1991-1995, includes the acceleration of the construction of dams as well as drilling of boreholes, especially in communal and resettlement areas, was proposed. Table 2-4 indicates the public sector investment program by different sector under the Second Five-Year Plan, illustrating that the average percentages of investment on agriculture and water sectors during 1991-1995 are the second and the third largest, respectively.

In addition to the economic aspect of the agricultural sector, the social aspect of the Second Five-Year Plan was emphasised in the rural development sector, the Plan committed itself to enhance the basic needs of communal and resettlement farmers.

This Master Plan Study which promotes the regional development of the Lower Munyati river basin through water resources development mainly

for the benefit of smallholder farmers, especially in the communal and resettlement areas, is completely in line with both the economic and social objectives of the Second Five-Year Plan.

2.3 Agricultural Sector

2.3.1 General Description

(1) Overview

The agricultural sector is regarded as the main engine for national economic growth and development in Zimbabwe. This is because of the sector's strategic importance in the provision of food for the population, raw materials for the manufacturing sector, generation of foreign exchange, and the provision of employment to the majority of the country's population.

More specifically, it is estimated that up to 80 percent of the country's population is dependent, one way or another, on agriculture for their livelihood. The sector contributes around 12 percent of GDP and over 50 percent of the raw materials required by the manufacturing sector. Its contributions to exports, allowing for the influence of climate, have usually been about 40 percent since 1981.

With respect to agricultural exports, the majority of these are accounted for by two crops namely, tobacco and cotton. In some years these two crops have accounted for nearly three-quarters of total agricultural exports and one-third of total exports since 1981. Other export commodities include: maize; tea and coffee; sugar; horticultural produce; frozen beef; dairy products; and poultry. Maize exports vary according to each year's level of production as influenced by the weather pattern. Since maize is the main staple food in Zimbabwe, exports only take place if surpluses are available. Apart from cotton and maize, almost all the produce destined for export is produced by the large scale commercial sector.

A further important feature is that the agricultural sector provides employment for approximately 70 percent of the population either through

wage labour or self-employment. In 1991, before the great drought, the large scale commercial sector employed about 298,000 permanent and casual workers accounting for about 30 percent of formal employment. The ability of the agricultural sector to provide employment is therefore crucial to the economic development of the country even though agriculture is often not the preferred option for job seekers.

(2) Policy and Development Objective

The importance of the agricultural sector is also highlighted and emphasized in both the First and Second Year National Development Plans. In the second plan, the need to implement the National Land Policy was emphasized. One of the objectives of this policy is to promote agricultural development in the sub-sectors of agriculture. In promoting agricultural development the following measures were to be taken: (a)land redistribution; (b)acceleration of the development of irrigation facilities; (c)intensification of agricultural research and development; and (d)training of communal and resettlement farmers in agricultural and managerial skills. More specifically, the development objectives of the agricultural sector can be summarized as follows:

(a) To produce the food required by the population of Zimbabwe in both rural and urban areas;

(b) To supply raw materials for local manufacturing industries in Zimbabwe;

(c) To create and sustain employment in agriculture;

(d) To contribute towards the improvement of the balance of payments both through increasing export earnings and generating import substitutions; and

(v) To improve the living standards of farmers and their families, particularly those in communal, resettlement and small scale commercial farming areas.

2.3.2 Agro-Ecological Zone

In order to gain a fuller understanding of the roles of agriculture in the economy, however, it is important that the structure of the sector is also understood. On the basis of annual rainfall, Zimbabwe is divided

into five natural regions (NRs). Farming in each NRs is categorized as specialized and/or diversified farming, intensive one, semi-intensive, semi-extensive and extensive in order of NR I through V. On the other hand, an important characteristic of the sector is the existence of four major sub-sectors (a) communal land, (b) resettlement land, (3) small-scale commercial farms (S.S.C.F.) and (d) large-scale commercial farms (L.S.C.F.). Distribution of hectarage by these sub-sectors is shown below:

(Unit: 1,000 ha)

Natural Region	Communal	Resettlement	S.S.C.F.	L.S.C.F.	Total
I and II	1,410	620	250	3,890	6,170
III	2,820	1,240	530	2,410	7,000
IV	7,340	810	500	2,430	11,080
V	4,780	620	100	2,490	7,990
Total	16,350	3,290	1,380	11,220	32,240

Overall, only 19 percent of Zimbabwe's farmland is in NRs (Natural Region) I and II and almost 63 percent of this high potential land is in the large scale commercial areas. This highly skewed land distribution pattern highlights two factors:

- Zimbabwe, generally, has limited agricultural potential with the major limiting factor being rainfall; and
- the large scale commercial areas have an inherently higher agricultural potential than the other three farming sectors.

2.4 Water Resources Sector

2.4.1 Surface Water Resources

According to the report of "Present Surface Water Resources Utilization in Zimbabwe" prepared by DWD in 1994, the long term mean annual rainfall is estimated at 674.5 mm/year (259,100 MCM) throughout the country, of which only 7.7 % or 51.8 mm (19,900 MCM) is available as runoff.

The theoretical yield of the total surface water resources is 11,260 MCM under the risk level of 10%. Due to absence of dam sites to store the water or absence of proper use for the dammed water, 25% of the

available surface water resources is not usable and 75% of the potential or 8,445 MCM could actually be exploited.

Out of the exploited water resources, 4,900 MCM including granted water rights and ministerial agreements are currently committed, balance of 3,545 MCM is therefore the potential for water use. If 80% of this figure is used for irrigation and the balance is used for other sectors, then 2,836 MCM would be available for irrigation. This amount could irrigate up to approximately 250,000 ha at acceptable levels of water use efficiency of 1,100 mm/ha/year.

2.4.2 Future Water Development Projects

Future dams for possible major irrigation development and major and medium sized urban water supplies development up to year 2005 are summarized in Tables 2-5 and 2-6, respectively.

Based on these figure, the major and medium sized urban water supply development is proposed at 16 places with total water requirement of 464 MCM. With respect to dams for possible major irrigation development, construction of 13 dams is planned including Kudu Dam in the Study Area.

After completion of these projects, usable water of 1,373 MCM and an irrigable area of 93,000 ha would be developed.

2.5 Regional Economy and Development Policy

2.5.1 Mashonaland West Province

(1) Population and Area

According to the 1992 census, the population of the area was about 1.12 million. The annual average population growth is estimated to be about 2.7 percent. Population densities are higher in urban areas than in communal areas. There is considerable migration to urban areas namely Chegutu, Chinhoyi, Kadoma and Kariba where the rate of unemployment is high and rising. The total area of the province is 57,441 sq.km.

(2) Natural Resources

The Province has about 44 different types of minerals. Some of the minerals are asbestos, antimony, marble, quartz, mercury, mica, molybdenum, copper, dolomite, iron, kaolin, limestone, nickel, platinum, pyrites, tin, coal and gold.

The Province falls in Natural Regions II, III, IV and V. Natural Region II has enough rainfall for agricultural activities and is suitable for intensive farming. Natural Region III is suitable for semi-intensive farming, while Natural Region IV and V are for extensive farming. The province is part of the catchment area of the Zambezi River, hence besides the Zambezi with large quantities of water there are other big perennial rivers such as Ruya, Musengezi, Hoya, Manyame, Angwa and Kadzi. Most of these rivers can potentially be dammed. The Province has also a number of designated wildlife areas including the Dande and Mupfurudzi Safari areas. There is also plenty of wildlife in the Kariba area. At present oil exploration activities are going on in the Zambezi Valley.

(3) Review of Economic and Social Sectors

Agriculture plays a leading role in the Province. There is both extensive and intensive farming. In large commercial farming areas, virginia and burley tobacco, maize, cotton, wheat, barley and groundnuts are grown. Cotton and maize are the main crops produced by communal farmers. The Province is also engaged in livestock production, especially dairy and beef cattle. Fishing is carried on in Lake Kariba.

Agricultural production in the Province is faced with problems such as low productivity, especially in communal areas, overgrazing, due to shortage of grazing land, soil erosion and lack of draught power in the Zambezi Valley due to the presence of tsetsefly.

Although the Province is rich in mineral deposits, the mining sector is not as developed as the agricultural sector. There is mining of nickel and gold ores in the province and platinum mining has commenced near Chegutu.

The manufacturing industries of the Province are located in the four towns of Norton, Chegutu, Kadoma and Chinhoyi. The main products are textiles, dairy products, paper, plastic and glass. Tourism is another sector which is growing with Kariba and its environment being the major attractive centres.

Over the last ten years, there has been some remarkable socio-economic infrastructural developments. The Province had seen 8 pre-schools, 73 primary and 27 secondary schools and the Chinhoyi Teachers College built during the period. New rural health centres were built. Five districts hospitals were upgraded. The construction of Chinhoyi Provincial and Kutama Hospitals is in progress.

New large dams, including Mazvikadei, Cliflon, Manyame, Claw-Gates, Ngezi and Mhondoro have been constructed. Additionally, 26 small and medium sized dams were constructed.

(4) Development Strategy (Under 2nd 5-Year Plan)

The development strategy is based on the exploitation of the natural resources of the Province. The province has great potential for the development of agriculture, mining, tourism as well as mineral and agro-based manufacturing industries. Over 44 different minerals of the Province form a robust base for mining and manufacturing industries. Good rainfall in Natural Region II and the catchment area of the Zambezi river as well as perennial rivers such as Mazowe, Ruya, etc make it possible for the construction of dams whose water can be used for irrigation. Lake Kariba has a great potential for the development of the fish industry and the beautiful Kariba area with its abundant wildlife offers great opportunities for the expansion of the tourist industry.

During the plan period, efforts will be made to further develop agriculture, tourism, mining as well as mineral and agro-based manufacturing industries. Economic and social infrastructure to facilitate the development of the above industries will be strengthened. The development of these sectors will create job opportunities, absorb the surplus population from communal areas and reduce environmental degradation.

The local private sector and Non-Governmental Organizations will be expected to play a leading role in the economic and social development of the Province. Government will formulate specific policy measures to facilitate their participation and the Provincial development planning system will be strengthened.

2.5.2 Midlands Province

(1) Population and Area

According to the 1992 census, the population of the Midlands Province was estimated at 1.30 million, growing at an average rate of 1.7 percent per annum. The total land area of the Province is 49,166 sq.km, and the population density is 26.5 per sq.km. About 17 percent of the people in the province live in urban areas, with the majority concentrated in Gweru. The population of Gokwe and Kwekwe are growing at an average rate of 6 to 7 percent per annum largely due to rural-urban influx. The Province has a young age structure. The provincial economy has been growing much more slowly compared to the population growth. This has resulted in high and rising unemployment, particularly among the youth.

(2) Natural Resources

The Provinces lies in Natural Regions III, IV and V. The mean annual rainfall is about 481 mm. However, the river systems of Shangani, Munyati and Sanyati have some potential for water resources development. The total potential water yield is about 23,650 MCM. There are about 11 dam sites in the Province. The Province has about 37 different types of minerals. Some of the minerals are soapstone, platinum, emeralds, antimony, arsenic, asbestos, barytes, beryl, chromium, limestone, lithium, gold, coal clay, cobalt, copper, diamonds, corundum, iron, lead, kaolin, nickel, pyrite, silver and molybdenum.

(3) Review of Economic and Social Sectors

The leading productive sectors are agriculture and mining. The

Province is mainly engaged in semi-extensive and intensive farming. There are also a number of dams for irrigation purposes. Agricultural activities of the Province include crop and livestock production. The main crops produced are maize, cotton, sorghum, groundnuts and sunflower. Despite frequent seasonal droughts, the Province increased its maize, cotton and sunflower production in the last five years.

The second leading sector in the Province is mining. Some of the main minerals being produced include chromium, iron, asbestos and emeralds. Since independence, the production of minerals has been declining. The decline in production has been caused by a decline in demand on the world market. Prospects for the growth of the mining industry are, however, much brighter than in the past, due to the considerable mineral exploration currently underway.

Although the manufacturing industry is not so developed compared to that of Mashonaland East and Matabeleland North, the Province is the home of strategic industries such as Zimbabwe Iron and Steel Company (ZISCO) which produces iron and steel as well as Sable Chemicals which produces ammonia. In the past, the manufacturing industry experienced a decline in production, due to the lack of new investment.

There has been a general improvement in the quality and accessibility of the telecommunications services. An automatic exchange was built at Gokwe. There has also been some significant improvement in the provision of social infrastructure. Health and educational facilities have been expanded and extended to disadvantaged rural areas.

(4) Development Strategy (Under 2nd 5-Year Plan)

The development strategy is based on further exploitation of the natural resources of the Province. These natural resources provide a potential for the development of mining, irrigation-based agriculture, mineral and agro-based manufacturing industries.

During the Plan period and beyond, efforts will be made to develop water resources for agricultural, mining and industrial purposes. Exploitation of mineral deposits will be undertaken as well as the

development of mineral and agro-based manufacturing industries. The development of the above sectors will create jobs and conditions for improving the quality of life.

During the plan period, the necessary economic and social infrastructure will be constructed so as to facilitate the development of the productive sectors. The local private and non-governmental organizations will be encouraged to play a leading role in the economic and social development of the Province. Government will formulate specific policy measures and incentives to facilitate their participation in the development process of the Province, including the strengthening of the Provincial development planning machinery.

2.6 Similar Projects

In order to recognize problems and/or constraints in the implementation of an agricultural development project and the formulation of a basic water sources development plan, data/information of similar projects which have already been completed and on going or under planning, are collected and summarized in Table 2-7. In most of the medium size projects or similar sized ones, dam and irrigation facilities are constructed simultaneously. On the other hand, the large scale dam projects have been previously implemented for the large scale commercial farm sector. In other words, the sector itself carried out planning, design, fund arrangement and construction for on-farm irrigation facilities with technical advice by the government.

In recent, the Zimbabwean government has changed its agricultural policy towards putting more emphasis on smallholder farmers in communal and resettlement areas, and decided to partly include these farmers in the large scale dam projects as a beneficiary (Osborn, Tokwe-Mukorsi and Manyuchi Dams). With regard to construction of irrigation facilities in these projects, some intake facilities are under construction and/or planning in Osborn Dam, design works are not completed in Tokwe-Mukorsi Dam, and no fund arrangement is made in Manyuchi Dam. As such, there exist no large project in which irrigation activities are currently carried out in the communal and resettlement areas. Under such situation, it is quite a prerequisite to pay special attention on simultaneous

construction of dam and irrigation facilities since the project planning stage in the proposed Kudu Dam Project which should put more significance on smallholder farmers than the other large dam project mentioned above.

Table 2-1 Transition of GDP in 1980-1993

	Nominal		Reai (1980 Constant Price)	
Year	Amount, Z$million	Growth Rate, %	Amount, Z$million	Growth Rate, %
1980	3,224	21.7	3,224	10.7
1981	4,049	25.6	3,537	9.7
1982	4,657	15.0	3,589	1.5
1983	5,432	16.6	3,461	-3.6
1984	5,649	4.0	3,540	2.3
1985	6,503	15.1	3,803	7.4
1986	7,408	13.9	3,881	2.1
1987	8,019	8.2	3,861	-0.5
1988	10,183	27.0	4,143	7.3
1989	12,165	19.5	4,332	4.6
1990	14,165	20.1	4,426	2.2
1991	18,964	29.8	4,615	4.3
1992	22,647	19.4	4,327	-6.2
1993	25,278	11.6	4,339	1.7

Table 2-2 The Transition of Trade Blance, 1985-1992

Table2-2-1 (Unit : Z$ million)

Year	Total Account	Current Account
1985	82.2	-75.7
1986	55.5	6.8
1987	124.5	48.0
1988	101.6	116.6
1989	-46.8	9.3
1990	85.8	-146.8
1991	45.2	-459.8
1992	-194.6	-605.1

Table2-2-2 (Unit : Z$ million)

Year	Total Account	Export	Import
1985	200.6	1119.6	-918.9
1986	311.2	1322.7	-1011.6
1987	381.0	1,452.0	-1,071.0
1988	501.3	1664.9	-1163.6
1989	375.2	1693.5	-1318.3
1990	242.7	1747.9	-1505.2
1991	48.1	1693.8	-1645.7
1992	-254.5	1527.6	-1782.1

Table2-2-3 (Unit : Z$ million)

Year	Ex-Trade Account	Receipt	Payment
1985	-295.9	333.3	-629.2
1986	-336.1	205.4	-541.5
1987	-380.6	197.6	-578.2
1988	-437.1	207.8	-644.9
1989	-425.2	267.9	-693.1
1990	-494.7	287.1	-781.8
1991	-605.7	299.6	905.4
1992	-632.1	331.1	-963.2

Table 2-3 Public Sector Deficit and Financing, 1980-1988

Year	Government Deficit		Net Domestic Borrowing		Net Foreign Borrowing		Subsidy
	Z$ million	% of GDP	Z$ million	% of GDP	Z$ million	% of GDP	% of Deficit
1980	376	10.9	297	8.6	79	2.3	22.5
1981	262	5.9	116	2.6	146	2.3	10.4
1982	545	10.6	414	8.0	132	2.6	25.3
1983	394	6.2	244	3.9	44	0.7	39.8
1984	470	10.1	325	5.1	322	5.0	37.9
1985	513	7.3	295	4.2	488	7.0	58.5
1986	608	7.3	322	3.9	286	3.4	51.6
1987	1015	11.4	847	9.5	167	1.9	39.7
1988	1150	10.8	1016	9.5	133	1.3	42.1

Table 2-4 The Public Sector Investment Program by Sector, 1991/92-1995/96

(Unit : Z$ million)

Sector	Budget Allocations					1991/92 to 1995/96	Share in %
	1991/92	1992/93	1993/94	1994/95	1995/96		
1.Agriculture	427	475	525	600	675	2,702	22.2
2.Mining	10	15	20	25	30	100	0.8
3.Manufacturing	10	30	50	75	100	265	2
4.Energy and Water	405	450	440	480	580	2,355	19.2
5.Transport & Communication	634	600	650	700	710	3,294	26.9
6.Housing and Urban Development	368	270	255	230	210	1,333	10.8
7.Education	100	130	165	180	215	790	6.4
8.Health	48	65	85	100	120	418	3.4
9.Public Administration	90	65	50	40	20	265	2.2
10.Defence	178	80	60	40	20	378	3.1
11.Other Sectors	182	70	50	30	20	352	2.9
Total	2,452	2,250	2,350	2,500	2,700	12,252	100

Table 2-5 COST OF FUTURE MAJOR AND MEDIUM SIZED URBAN WATER SUPPLIES DEVELOPMENT UP TO YEAR 2005

NO.	NAME OF URBAN CENTRE	NEXT SOURCE	4 % YIELD x 10-6. m³	DISTANCE FROM TOWN km	TOTAL PER YEAR x 10-6. m³	COMPLETION BY DATE	COST DAM z$ x 10-6.	COST PIPELINE z$ x 10-6.	*TOTAL COST z$ x 10-6.
1	MUTARE	OSBORNE	12	25	24	1995	—	60	60
2	MARONDERA	ALBANIE	7	10	7	1995	25	13	38
3	BULAWAYO	MTSHABEZI	8	50	8	1996	50	70	120
4	HARARE	NYAGUI	100	50	100	1996	160	215	375
5	GWERU	GWENORO 2	5	35	5	1997	30	—	30
6	CHINHOYI	NYAGUI	10	5	10	1997	20	8	28
7	BINDURA	BINDURA	10	5	7	1997	**14	7	21
8	BULAWAYO	GWAYI/MUGUSA	24	120	24	1998	40	280	320
9	MUTARE	PUNGWE TUNNEL	24	25	24	2000	**18	—	18
10	GWERU	LUBONGO	40	55	20	2000	60	120	180
11	CHEGUTU	MONDORO B	7	12	7	2001	**20	16	36
12	BULAWAYO	GWAYI-SHANGANI	40	320	40	2002	**170	950	1120
13	HARARE	SHAVANHOE	100	50	100	2002	160	215	375
14	MASHAVA	TOKWE-MUKORSI	10	10	50	2002	—	16	16
15	KWEKWE	GREENHAM	14	10	14	2003	50	18	68
16	MASVINGO	TOKWE-MUKORSI	24	15	24	2004	—	35	35
	TOTAL		435	797	464		817	2023	2840

*NOTE: total cost is for delivering raw water to the urban centre,
it does not include the water treatment works, town reservoirs or reticulation

**Part cost

Table 2-6 COST OF FUTURE DAMS FOR POSSIBLE MAJOR IRRIGATION DEVELOPMENT UP TP YEAR 2005

	NAME OF DAM	PROVINCE	RIVER	10 % YIELD x 10-6 m³	MAIN CANAL LENGTH km	IRRIGABLE AREA APPROX. Ha	COMPLETION BY DATE	COST DAM zS x 10-6	COST CANAL zS x 10-6	TOTAL COST zS x 10-6
1	OSBORNE	MANICALAND	ODZI	167	50	20.000	1995	120	50	170
2	BINDURA	MASHONALAND WEST	MAZOE	30	—	2.000	1995	—	—	—
3	ZVOVHE	MATABELELAND SOUTH	MZINGWANI,BUZI	45	—	2.500	1996	60	·	60
4	TOKWE-MUKORSI	MASVINGO	TOKWE	380	**	20.000	1997	310	200	510
5	BIRI	MASHONALAND WEST	MANYAME	111	—	7.000	1997	*100	—	100
6	DANDE	MASHONALAND CENTRAL	DANDE	59	—	4.000	1998	50	—	50
7	MUDA	MASHONALAND EAST	MUPFURE	32	—	2.000	1998	30	—	30
8	MIRROR	MANICALAND	BUZI	14	—	1.000	1998	20	—	20
9	SILVERSTROOM	MASHONALAND CENTRAL	MUSENGEZI	34	—	2.000	1999	75	—	75
10	PUNGWE TUNNEL	MANICALAND	PUNGWE	24	—	1,500	2000	*18	—	18
11	KUDU	MIDLANDS/ MASHONALAND WEST	MUNYATI	360	**	24.000	2000	350	200	550
12	MONDORO "B"	MASHONALAND WEST	MUPFURE	67	—	4.000	2001	*120	—	120
13	GRAYI-SHANGANI	MATABELELAND NORTH	GWAI	50	—	3.000	2002	50	—	50
	TOTAL			1373		93.000		1303	450	1753

** Information not available *Part Cost

Table 2-7 (1) EXAMPLES OF SIMILAR PROJECTS

Project name	Completion year	Province	River	Dam height (m)	Reservoir capacity (MCM)	Purpose of utilization	Conveyance facility	Irrigation area (ha)	Operation & maintenance	Problem	Remarks
Claw dam stage II	1991	Mashonaland	Umsweswe	28	21	-irrigation for L.S.C 3.87 M.C.M/year -water supply for Kadoma 10.26 MCM in 1993 -Mine 400cu.m/day	river/pump pipe pipe	N.A.	DWD	no problems	O/M cost=$150,000/year
Sebakwe Dam stage II	1986	Midlands	Sebakwe	47	266	-irrigation for L.S.C. 57.0 M.C.M/year -water supply to Uarban 40.0 M.C.M/year	river river	N.A.	DWD	outbreak of malaria	water charge -industry $84/1000cu.m -agricul $45/1000cu.m
Medium size dams in Masvingo						irrigation for communal				no problem	Grant-Aid by Japan
Musaverema	1992	Masvingo	Musaverema	12.7	6.6	lands	canal	44	dam to night-		
Magudu	1992		Mmedzi	18.8	5.7		canal	70	storage by DWD		
Chinyamatumuwa	1992		Chinyamatumuwa	18.8	2.3		pump/pipe	50			
Mashoko	1994		Chenyere	18.4	1.5		canal	21	nightstorage		
Mabvute	1994		Musuche	19.3	3.1		pump/pipe	100	to farm by		
Munjanganja	1995		Mutora	18.7	1.8		canal	51	AGRITEX		
Osborn dam	1994	Manicaland	Odzi	66.6	401	-irrigation for L.S.C. and communal area -water supply for urban, industry and mining	river	(1) 1,000 (2) 3,000 (3) 300 (4) 100	DWD, farmers and AGRITEX	distribution water systems: pickup weirs, canals and pumping stations are proposed. (1) and(4) under construction (2)and(3) under planning	Removal of 700 families Relocation of land approx. 9000ha. 70% of the contract cost paid by Italy Government
(1) Musihavanhu	1996										
(2) Mukwada	1996										
(3) Maronge	1996										
(4) Manhowe	1996										
Tokwe-Mukorsi	not known	Masvingo	Tokwe	90	1800	-irrigation for L.S.C. communal & resettlement -hydroelectric power generation 6 MW	river, canal etc.,	20,000 to 25,000	DWD, farmers and AGRITEX	distribution water systems: pickup weirs, canals and pumping stations ate proposed. irrigation fcilities are not designed.	Removal of 1200 families Relocation of land approx. 6000ha.
Manyuchi Dam	1989	Masvingo	Mwenezi	41	319	-irrigation	river, canal etc.,	345 for Commu.	DWD, farmers and AGRITEX	Funds not available after feasibility report. outbreak of malaria	allocation of water communal 10% Large Scale 90%
Zhovhe Dam	to be 1996	Matabeleland south	Mzingwani & Luhani	26	133	-irrigation	not known	2,500 approx.	DWD, farmers and AGRITEX	Free-feasibility report done	Financed by the Gov. of Zimbabwe and Italian Gov. Construction commenced in 1994

Table 2-7(2) EXAMPLES OF SIMILAR PROJECTS

Project name	Completion year	Province	River	Dam height (m)	Reservoir capacity (MCM)	Purpose of utilization	Conveyance facility	Irrigation area (ha)	Operation & maintenance	Problem	Remarks
Rusape Dam L.S.C. Chiware Tikwiri	not known	Manicaland	Rusape	41.2	67	-irrigation for L.S.C. and Communal Areas	river pump/pipe	250 600	DWD AGRITEX Farmers	- Topo survey for Tikwiri produced. -Feasibility for Chiware produced but no funding	-DWD discussing proposed canal with L.S.C. farmers.
Gwaai-Umguza Dam	not known	Matabeleland North	Gwaai-Umguza			-irrigation of Communal lands	river pump/pipe	700	DWD AGRITEX Famers	-Final design for dam to be completed in July 1995 -No fouding yet.	
Marevanyati Dam	not known	Manicaland	Mwerakazi	34	55	-Water supply to Murambinde - irrigation of communal lands	River/canal	1,500	DWD AGRITEX Famers	-Dam design complete. -investigation of irrigation area underway	Dam construction to be financed by Kuwait. Prefeasibility studies in progress
Silverstroom Dam	not known	Mashonaland Central		67	140	-irrigation of L.S.C. farms and communal lands	River/canal or pumping	Communal areas 3,000	DWD AGRITEX Famers	-Dam design complete -Lands for irrigation identified.	Prefeasibility studies in progress Funding of Dam construction from Kuwait
Mwarazi Dam	not known	Manicaland	Mwarazi	27	6.4	-irrigation of resettlement areas. -Some water for domestic use.	River/canal or pumping	400	DWD AGRITEX Famers	-Feasibility studies on irrigation conpleted. -No funds available.	

CHAPTER 3

THE STUDY AREA

CHAPTER 3 THE STUDY AREA

3.1 Location, Topography and Geology

(1) Location

The Study Area is located between the South Latitude 17° 30' and 18° 30' and the East Longitude 28° 55'and 29° 47' at north-west of Kadoma town. The area covers 5,052 sq.km., administratively extending from Kadoma District of Mashonaland West Province to Gokwe South and North Districts as well as the northern portion of Kwekwe District of Midlands Province.

(2) Topography

Elevation in the Study Area extends from 800 to 1,000 meters. Munyati river flows from the south to north through the central part of the Study Area. The right bank of the Munyati river has a gentle slope towards the Munyati river, and it's tributaries which flow from the east to west are almost small except for the Sakungwe river. On the other hand, the left bank is characterized by the Mafungabusi Plateau and Chinwavaenzu Hills which lie between the 1,000 and 1,200 meter contour lines along the west boundary. Compared to the right bank, there are many tributaries from the south west towards the north east which form river bank terraces.

(3) Geology

The Study Area is composed of a basement complex of granites gneisses, and schists with folding and metamorphism. Sediments of Late-Precambrian and deformed rocks of Precambrian overlain these basements. The formations mainly consist of sandstone, grit, marl, and shale. Horizontal sediments of Carboniferous to Jurassic period rest on these formations.

Soils and alluvium materials of Recent Period form the upper layers in Copper Queen, the Karroo bed of clayey shist and conglomerates form in Kadoma and the clayey sandstone and limestone are overlain by red Kalahari

sand of about 75 meters depth in Gokwe.

3.2 Land Tenure System

There are five major categories of land tenure system in the Study Area as described below. It is important to note that only commercial lands have a freehold tenure system while other lands are forms of State ownership.

(1) State land mainly consists of national parks and state farming land. The state farms are operated by ARDA(Agricultural and Rural Development Authority).

(2) Communal land was formerly called Tribal Trust Land before Independence, which can not be given over to inhabitant private ownership.

(3) Resettlement land is a land category introduced after Independence in 1980 to relieve the increasing population pressure in the communal areas. These areas are based on a leasehold tenure system.

(4) Commercial land comprised of large scale commercial farms (formerly European areas) and small scale commercial farms (formerly African Purchased Areas) which are on a freehold tenure system.

Land tenure system of the area is mapped in Figure 3-1. The map shows communal land is the most dominant in the area, which covers 2,173 sq.km (43%). The extent of resettlement, small scale commercial farm, large scale commercial farm and state farm are 1,406 sq.km (28%), 1,053 sq.km (21%), 410 sq.km (8%), and 9.6 sq.km (0.2%), respectively.

3.3 Soil and Land Use

3.3.1 The Characteristics of the Soils

The soils of the Study Area were studied through reviewing existing reports and an additional reconnaissance soil survey by the Study Team. Seven major soil types were found in the area. The provisional soil map of the area is shown in Figure 3-2.

The texture of the soils varies from sand to clay, but clay or silty clay loam is dominant in the area. Sandy or loamy sandy soil also occupies considerable part of the area. In general, pH - $CaCl_2$ of the soils varies from 5.0 to 7.0 while some soils show exceptionally lower pH value. The value of pH - $CaCl_2$ is generally 0.5 - 1.5 units lower than the pH - H_2O, therefore most of the soils of the area are moderately acid to neutral in nature. Soils in the area are generally low in organic carbon content which is less than 1.0%. The result shows the soils will benefit from application of any organic matter. The available phosphorous of surface horizon is mostly less than 10 ppm which is low to medium in the fertility rating.

The principal characteristics of the soils are given in Table 3-2, and the major results of the soil analysis stated above are summarized in Appendix C with explanation of each soil group. Brief explanation on the soil group is presented in the following:

2 (Lithosol group)

The lithosol soils have a depth less than 25cm. Because of their shallowness, these soils are not arable in general. Their most common use is as game reserves and national parks.

3B (Vertisol group)

Vertisols are often called as the Black Cotton Soils. They form some of the best irrigable land. Although these soils are inherently fertile being particularly rich in bases, they require moderate applications of nitrogen fertilizer to ensure economic yields.

4E (Siallitic group)

Siallitic soils have very high agricultural potential, the main limitation is the aridity of the environments in which they occur. Thus, in a number of cases, where water is available for irrigation, some very high levels of productivity have been achieved. In those areas where irrigation water is not readily available, ranching of both cattle and wildlife is an important activity.

5E, 5G, 5M, and 5S (Fersiallitic group)

In general, the fersiallitic soils are the most important single soil group with regard to crop production because of their considerable broad extent, wide range of properties and moderate fertility. Therefore, a very wide range of crops are grown. Since the fersiallitic soils have rather broad criteria, the soils further

divided into several different sub-groups.

3.3.2 Present Land Use

Land use survey was conducted through collecting ward-wise data from the district offices of the area, the review of existing reports and additional ground observations. The SPOT satellite photographs taken in 1986 were also used when ground observations were carried out. The satellite data was then analyzed during the work in Japan. Different land use units of the area were identified as cultivated land (cropped and fallow), grazing land, dense forest land, and others. The delineation for land use units was done on transparent overlays, and the present land use map was prepared (Figure 3-3).

The ward-wise present land use is shown in Table 3-3, based on which the ratio of cultivated area to the total area is remarkably high in communal lands. The ratio is around 31%, 7%, 15%, and 10% in communal lands, resettlement, small scale commercial farms and large scale commercial farms, respectively. Cultivated land of the area occupies around 101,140 ha (20%), which mainly consists of rainfed agriculture land. Cropped area, therefore, varies from year to year according to water availability. A part of the cultivated land is irrigated by boreholes or small dams covering only small areas. The major crops grown in the area are maize, cotton and groundnuts. The vegetation of grazing and forest lands predominantly consists of mixed savannah woodland, which is dominated by Brachystegia, Combretum, Terminalia, Grewia and Acacia species.

3.4 Meteorology and Hydrology

3.4.1 Meteorology

Related data were collected at Gokwe Meteorological Station and Kadoma Cotton Research Institute, respectively with cooperation of both the Department of Meteorological Services and DWD in Harare. Collected data records and location are shown in Table 3-4 and Figure 3-4, of which summaries are shown as below and in Figure 3-5.

(1) Maximum temperature (1951/52 - 1993/95)

(Unit : Deg. C)

Station	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Mean
Gokwe	22.6	25.2	28.9	30.3	29.5	27.5	27.3	26.9	27.4	26.6	24.8	22.6	26.6
Kadoma	24.0	26.7	30.3	32.0	30.5	28.8	28.7	28.3	28.7	28.0	26.2	24.0	28.0

(2) Minimum temperature (1951/52 - 1993/95)

(Unit : Deg. C)

Station	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Mean
Gokwe	8.4	10.4	13.7	16.7	17.5	17.8	17.7	17.3	16.2	14.5	11.4	8.8	14.2
Kadoma	8.6	11.2	14.9	17.4	18.0	17.5	17.6	17.4	16.8	14.9	11.7	8.9	14.6

(3) Relative humidity (1983/84 - 1991/92)

(Unit : %)

Station	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Mean
Gokwe	49.7	42.8	37.1	43.6	51.2	70.8	74.2	75.9	69.7	63.7	55.8	53.0	57.3
Kadoma	No Record												

(4) Wind speed (1959/84 - 1991/92)

(Unit : knots/hr)

Station	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Mean
Gokwe	4.2	4.4	5.0	5.1	4.5	3.8	3.4	3.4	3.8	4.0	3.9	4.0	4.1
Kadoma	5.0	5.4	5.9	6.2	5.5	4.6	3.9	3.6	3.8	4.3	4.4	4.7	4.7

(5) Pan evaporation (1962/63 - 1991/92)

(Unit : mm)

Station	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Mean
Gokwe	4.7	6.1	8.0	8.6	7.3	5.7	5.5	5.2	5.6	5.4	4.9	4.5	6.0
Kadoma	4.8	6.3	8.3	8.8	7.5	5.7	5.6	5.1	5.3	5.2	4.8	4.5	6.0

The monthly values at both stations are almost same. The mean annual evaporations at Gokwe and Kadoma are estimated to be 2,175.7 mm/year and 2,188.1mm/year, respectively.

3.4.2 Rainfall

Five (5) rainfall stations were selected for the Study Area and the mean annual rainfall figures over thirty (30) years between 1964/65 -

1993/94 are summarized as below.

According to the records, the beginning of rainfall and the rainfall amount is different in each year and annual rainfall has shown an inclination to decrease in recent years.

Station	64/65 - 73/74	74/75 - 83/84	84/85 - 93/94	Mean
Marowa	818.5 mm	739.9 mm	634.5 mm	651.6 mm
Sanyati rest camp	686.9	772.3	679.6	699.6
Gokwe	647.9	809.5	681.4	647.9
Ngwenya	721.1	644.7	595.4	651.3
Kadoma	718.2	785.2	718.0	727.2

3.4.3 River Runoff

Rivers flowing into the Study Area are mainly Umsweswe, Munyati and Sebakwe rivers, and recorder stations and their mean annual flow and runoff in relation to the Study Area are as follows:

Station	River	Catchment Area (sq. km)	Mean annual flow (1000 cu.m/year)	runoff (mm/year)
No.C48 Claw Dam D/S	Umsweswe	2,480	99,100	39.97
No.C87 Claw Dam U/S	-do-	1,990	46,900	7.96
No.C 8 Power Station	Munyati	5,890	278,900	47.35
No.C30 Rhodesdale	-do-	2,780	107,000	38.47
No.C18 Dyke G/W	-do-	2,631	217,100	82.53
No.C20 Rhodesdale	Ngesi	1,820	57,748	31.73
No.C88 Copper Qu'n G/W	Munyati	24,400	N.A.	N.A.
No.C36 Lower Zivagwe	Sebakwe	4,170	225,600	54.11
No.C 9 Cactus Port D/S	Kwekwe	1,250	56,700	45.36

Figure 3-6 shows thirty (30) years annual river flow between 1964/65 and 1993/94 at C48 of Umsweswe, C8 of Munyati and C36 of Sebakwe river. According to these records, annual river flow shows wide fluctuation. It is therefore very difficult to predict the amount of water which could be utilized.

3.4.4 Water Quality

Water quality tests of pH, Electrical Conductivity, Dissolved Oxygen, Turbidity and Water Temperature for surface and well water were carried out. According to the results, these were no extraordinary values in each test. Results are shown in Table 3-5.

Because there are some gold mines in the Study Area and upstream of Claw Dam, it will be therefore necessary to examine further the water quality tests for chemicals such as cyanide, mercury etc., in detail.

3.5 Water Source and Utilization

3.5.1 Water sources

(1) Surface water sources

Main surface water sources in the Study Area are Umsweswe, Munyati and Sebakwe rivers which have gauging stations upstream of the Study Area. Using thirty (30) years daily records (1964/65 - 1993/94), river flow of each station is summarized as below. There is a great difference between maximum and minimum flow (See Figure 3-6).

Mean total flow of the latest decade (1984/85 - 1993/94) shows 335.9 million cu.m which is 55% of the total 30 years' mean. This figure could be utilized for the Study.

				mean	(unit million cu.m)		
Station	River	min.	max.	1st decade	2nd decade	3rd decade	30 years
C-48	Umsweswe	0.8	539.1	83.1	181.9	34.4	99.1
C- 8	Munyati	3.5	1,260.7	205.4	364.2	244.4	278.9
C-36	Sebakwe	6.8	1,467.3	216.3	403.5	57.1	225.6
Total				504.8	949.6	335.9	603.6

(2) Water rights

Between each gauging station and Umfuli river confluence, there are many water users with water rights such as mines, railways, agricultural projects and governmental offices, etc. Summary of the water rights are

shown as follows. It is found that total volume of water rights is estimated at 17.6 million cu.m/year and should be taken into consideration for the Study.

Section	River	Water right (1000 cu.m/year)
C48 to Munyati confluence	Umsweswe	2,957.1
C8 to Munyati confluence	Munyati	1,164.7
C36 to Munyati confluence	Sebakwe	4,864.0
Up to Umfuli confluence	Munyati	9,589.1
Total		18,574.9

3.5.2 Existing Water Utilization Project

There are some small ponds in the Study Area whose storage capacities are less than 500,000 cu.m and are mainly used for drinking by livestock. These ponds are always almost dry by the end of April. Only two facilities whose capacity is more than 1 million cu.m are found in the Study Area, namely Ngondoma Dam and Munyati weirs in Sanyati Estate.

(1) Ngondoma dam

Ngondoma dam was constructed in 1967 at upstream of Ngondoma river to supply water to Empress Mine and Ngondoma Irrigation scheme of 44 ha. The dam is of the earthfill type and has 22 meters height. Its capacity is 7.5 million cu.m. Due to the closure of Empress Mine in 1982, to use surplus water, a new irrigation scheme of 150 ha is under planning by AGRITEX.

(2) Munyati weirs in Sanyati Estate

There are two weirs at 28 km upstream and near by Sanyati Estate in the Munyati river. These storage capacities is 520,000 cu.m each. Water is used by pumping for drinking water and irrigation of approximately 200 ha.

(3) Borehole

The Borehole inventory in the communal areas was collected in

cooperation with the DDF. Summary is shown below. According to this, water is used mainly for domestic purposes and for livestock.

Code Number and Name of Ward	Name of District	Number of wells	Depth (m)	Discharge (cu.m/sec)	Purpose
No.11 Makore 1	Gokwe North	29	85 - 160	10 - 15	Domestic
No.12 Makore 2	-do-	31	35 - 160	12 - 15	Domestic
No.23 Chisina I	Gokwe South	38	33 - 69	N.A.	Domestic/
No.24 Chisina II	-do-	37	24 - 72	N.A.	Livestock
No.6 Mabura	Kwekwe	16	30 - 70	0.3 - 16	Domestic
No.7 Sidakeni	-do-	31	12 - 64	0.3 - 16	Domestic
No.20 - No.24 Sanyati Communal	Kadoma	156	60 - 90	0.1 - 4	Domestic/ Livestock
Total		338			

3.6 Present Agriculture

3.6.1 General Observations

Cropping activity in the area is largely dependent on agro-ecological conditions. About 84% of the area is classified as Natural Region III with Regions II and IV covering 0.3% and 15.7% respectively. Because of the low rainfall typical of Region III, this means that the Study Area does not receive adequate rainfall and is therefore not suitable for specialized cropping systems with cash crops such as tobacco, fruit and vegetables. Such cropping systems would only be possible with the development of extensive irrigation facilities.

In the area as a whole, the dominant crops are cotton and maize followed by sunflower and groundnuts. Minor crops include sorghum, finger millet and pearl millet. It is often stated that extensive livestock production should be an integral part of farming systems in Region III. Farms in the Study Area, however, especially in the small-scale commercial areas of Copper Queen and Chenjiri, are, on average, too small to allow economically viable extensive livestock systems to be practiced without some form of mixed cropping. While this is ecologically and environmentally undesirable, it is, for the most, part an economic necessity in areas of low and erratic rainfall and low soil fertility. A few farmers in the area practice specialized livestock systems such as broiler and egg production where a local market is available especially

around Gokwe and Sanyati Growth Points.

During the past decade, a number of pilot livestock projects have been developed in the communal, resettlement and small scale commercial areas particularly by the Agricultural and Rural Development Authority (ARDA) to introduce specialized dairy production in these three areas. In the Study Area efforts are being made to introduce dairying in Gokwe.

The goat population in the Study Area is quite large. Currently these animals are used to supplement family diets and for the generation of cash. Little has been done to assist farmers to improve the productivity of these animals. This and other points above will be discussed in more details later under the section on livestock production.

Almost all cultivation in the Study Area is done using draught animal power (DAP) because of the limited numbers of tractors available even among small scale commercial farmers. Some tractor contracting is practiced but the availability is not widespread, of which services are erratic and comparatively expensive. DDF rental services are not widely used either.

3.6.2 Cropping Pattern and Yields

The area planted to each of the four main crops, maize, cotton, sunflower and groundnuts, and their average yields between 1989/90 and 1993/94 are stated below:

Maize: The total area planted to maize dropped from 32,822 ha in 1990/91 to just over 25,000 ha during the great drought of 1991/92 but increased thereafter to reach 40,049 ha in 1993/94 . The largest decrease was in the Sanyati communal area. Maize yields are lower in the communal areas and highest in the large scale commercial area. The higher yields in the large scale commercial area may be due to the availability of supplementary irrigation facilities. Generally, communal area yields are lower because of:

- limited suitability of current maize technologies for Natural Region III and IV where the bulk of the crop is grown in the Study

Area; and

- lack of timely implementation of key husbandry practices such as planting and weed control. Lack of and/or poor access to animal/tractor power results in late land preparation and consequently delayed maize planting. In addition, labour bottlenecks during the cropping season generally lead to late first weeding of the crop.

Cotton: The area planted to cotton also decreased drastically during the 1991/92 drought but increased again to pre-drought levels by 1993/94. The large cotton hectarage in each district confirms this crop's importance as a cash source under the semi-arid conditions of the Study Area. Yields were highest in the large scale commercial area and lowest in the Wards of Mabura and Sidakeni of Kwekwe District . The poorer yields in the communal areas are due to a number of reasons:

- communal and resettlement farmers generally apply low level of fertilizer to cotton; and

- there are problems of timely implementation of key cultural practices such as early planting as well as timely weeding, pest control and harvesting. Lack of adequate resources such as cash, and human, animal and/or mechanical power results in these practices being implemented late which invariably leads to considerable reductions in crop yields.

Sunflower: The biggest area planted to sunflower is in Chisina I and II communal areas in Gokwe South. The crop did not feature much in the Kadoma District during the drought of 1991/92 and is not grown in the Sachuru Resettlement area. Total hectarage in the Study Area in 1993/94 had risen to 7,552 ha more than half of which was in Chisina. Generally, sunflower are invariably considered as a crop of last resort and hence it is not planted to take advantage of favourable growing conditions. Average yields of this crop across the Study Area are similar between the different land holding systems although being quite low in the Kwekwe District. The general low yields and the sectoral differences are probably due to relatively low fertilizer use and the timing and level of

weed control.

Groundnuts: Drought conditions also affected planting of this crop in 1991/92. Little of the crop is grown in Kwekwe District and none in Sachuru Resettlement. The bigger hectarages are in the Sanyati and Chisina areas of Kadoma and Gokwe South Districts, respectively. Yields of groundnuts were higher in the large scale commercial area. Generally groundnuts production in the country as a whole is more successful in this sector.

3.6.3 Labour

According to the Farm Household Survey of the Study Area, most farmers in the Copper Queen and Chenjiri small scale commercial farms employ some permanent labour, the average being about two units per farm. Casual labour, especially for cotton picking, is employed by nearly all farms in these areas. In addition, about one-third of small scale commercial farmers employ some type of contractor during the year while a few are able to provide some type of contracting service to their neighbors. The most common contracting service reported was assistance with crop harvesting followed by transportation. Group activities among neighbors are important with the most common being ploughing, manure carting, weeding and harvesting.

In the communal and resettlement areas the majority of farmers do not employ permanent labour. Most farming tasks are performed by the farming family. Since most school-age children now attend school in these areas, these tasks are performed by the male head of household and by his wife or wives. Communal and resettlement farmers do, however, also employ casual labour on critical periods such as cotton harvesting. This is usually in the form of school children working for pocket money after school.

3.6.4 Livestock

The most important livestock species in the Study Area are cattle, goats and poultry (mainly chickens). Sheep are very few and rabbit production does not seem to be of interest to farmers. In this area,

Cattle are by far the most important because of the many roles they play in the farming systems of the area. Oxen and, sometimes, females, are used for draught power in land preparation and weeding. Cows provide milk to the household with any surplus being sold. This milk production is very seasonal. Cattle are also used for a number of traditional and customary rites such as bride wealth or lobola and when the family has a crisis such as payment of school fees, they may be sold for that purpose.

Goats, sheep and chickens are used as sources of meat and ready cash with chickens also providing eggs for the family from time to time.

It must be noted that as in other parts of the country relative numbers of cattle have been falling since 1991. This has been largely attributed to cattle deaths and unplanned disposal as a result of the 1991/92 drought. Cattle ownership in the communal areas is also highly skewed with up to 50 percent of households having no cattle in some areas. Non-cattle owning households generally achieve low crop yields.

Communal grazing (also referred to as common property management) in the communal and resettlement areas is an important feature of livestock production in these areas. Communal grazing has generally led to veld deterioration because of overstocking and lack of grassland improvement strategies.

Dairy production is non-existent in the Study Area because the area is generally considered unsuitable for this enterprise. Recently, however, the ARDA Dairy Development Programme has opened an office in Gokwe and are seeking to promote dairying among small farmers in both Gokwe North and Gokwe South. This will only succeed if ways are found to provide the milk animals with better quality feed than what exists at present.

3.7 Irrigation and Drainage

3.7.1 Irrigation

(1) Communal and resettlement areas

In the communal areas, two schemes, namely, the Takavingwa (8 ha)

and Ngondoma (44 ha) are presently being operated. In these schemes, furrow irrigation is mainly adopted. After conveying water from a reservoir to a night storage facility, irrigation water is supplied to fields through open canals. And rotational irrigation is carried out regularly. On other hand, no irrigation scheme has been observed in the resettlement areas (Refer to Table 3-6 and Figure 3-7).

(2) Large and small scale commercial area

In the commercial farms, irrigation water is obtained mainly from boreholes, and the sprinkler irrigation method is adopted. After pumping up water from boreholes into a night storage facility, water is supplied to farms through a pipeline system. In this system, a booster pump is used to obtain the pressure necessary for sprinklers. In these areas, rotational irrigation is carried out strictly (Refer to Table 3-6 and Figure 3-7).

(3) Mtanke irrigation scheme

The Mtanke irrigation scheme is the only scheme proposed in the Study Area with completion of detailed design for the dam. This scheme will be situated 140 km north-west of Kwekwe and in the Gokwe South District. 105 ha are planned to be irrigated using the sprinkler irrigation system. The irrigation water will be supplied from Mtanke dam with a capacity of 4.8 MCM. Pre-feasibility study was carried out by AGRITEX in 1993.

3.7.2 Drainage

There is no particular drainage facility in the Study Area. Generally speaking, surface water flows down through lower parts of the field or small valleys into pools or rivers. Although most of the run-off water flowing downstream could be hardly utilized effectively, a certain amount of water which is utilized by livestock is stored in pools or reservoirs that are established in the rivers.

In addition, some gullies are observed in various places of the Study Area, therefore, drainage facilities should be designed from

viewpoints of not only on-farm drainage but also of soil conservation.

3.7.3 Operation and Maintenance

(1) Dam and main canal

A storage dam is under the control of the DWD. Practically, a Provincial Water Engineer is directly responsible for the operation of the dam. And generally, each dam has a designated post for a Water Bailiff and some subordinate staff who are employed by DWD, and in practice responsible for operation and maintenance of the dam and the main canal.

(2) Night storage and secondary canal, etc.

Irrigation systems on-farm level are operated and maintained by AGRITEX and the Irrigation Management Committee.

3.7.4 Legislation and Regulation

(1) Water act No.41 of 1976

The Water Act is a statutory instrument for supervision of development and utilization of water resources. In addition, prevention and control of water pollution and preservation of water resources are provided for in this Act.

MLWR is responsible for the administration of the Water Act.

Recently, it has been widely pointed out that this legislation needs periodical review in order to cope with changing needs by various interest groups.

(2) Irrigation management committee

Every irrigation scheme except one privately operated in the Study Area has organized an Irrigation Management Committee. This committee is composed of about 7 members (chairman, secretary, treasurer, etc.) who

are democratically elected by farmers. Its responsibilities are as follows:

- Operation of water distribution in the scheme;
- Maintenance of irrigation facilities;
- Collection of maintenance fees;
- Setting up of local rules and regulations; and
- Continuous training of irrigators

3.8 Socio-Economic Condition

3.8.1 Administrative Division

The Study Area consists of four districts belonging to Mashonaland West and Midland provinces, and include twenty wards. These twenty wards can be divided into communal area (eleven wards), resettlement area (three wards), small-scale commercial area (five wards), and large-scale commercial area (one ward). The number of these wards belonging to each district is as follows: ten wards in Kadoma District, two wards in Kwekwe District, two wards in Gokwe South District, and six wards in Gokwe North District.

Each province has a provincial office of each department under the governor who is appointed by the government and conducts administration with a certain extent of autonomy. District-level administration is entrusted to District Administrator and the district office of each department. Up to this level, the mechanism and the organization are generally the ones that can be seen elsewhere. However, at the village level, the organization varies depending on the form of land holding system. First, there still remain a chief in the communal land, where one chief is stationed for one to three wards. The local chief has the rights to maintain public order, to arbitrate, and to judge. He also is a member of the local chief's council of national level. There are a number of villages under the ward. Several neighboring villages form a village development committee (VIDCO), which also is an autonomous organization and the terminal organization of local administration. There is no local chief system in the resettlement land, where the VIDCO is the only local administrative organization. The commercial land has a farm

owners' committee called the Intensive Conservation Area (ICA), where ICA is both the autonomous organization and the terminal organization of administration.

3.8.2 Distribution of Village

The distribution of villages in the Study Area is not clear. In other words, the existence of village itself is not regarded important. In the communal areas, many villages are divided according to the proper nouns they have. However in the resettlement areas, most of the villages are identified by the number. In the commercial land, there is no division of village. When thinking of these circumstances, a ward must be considered as the terminal unit of administration in the farming area. However in the communal land, because the existence of village is the basis of living for the residents, discussion must be made on the village.

According to the data supplied by Kadoma and Gokwe North offices of AGRITEX, the number of villages in one ward in these two districts are mostly seven to eight for the communal areas. As an exceptional case, there is a ward consisting of more than thirty villages. On the other hand, in the resettlement areas, the number of villages in one ward is twenty to thirty-three with an average of twenty-five.

The population of one village ranges from 98 to 450 households with an average of 244 for the communal areas. In the resettlement areas, small-size villages have a population of 20 to 33 scattered households.

The acreage of one village ranges 1,190 to 6,260 ha for the communal area, with the average of 2,863 ha. On the other hand, the area of one village ranges 565 to 4,949 ha with the average of 1,491 ha for the resettlement areas.

3.8.3 Village Formation

In general, villages are formed naturally by relatives or tribes, to which the groups later joined in many cases. However, in the Study Area, there is a trace that villages were formed politically by forcing the residents to migrate by the colonial government or relocating the excess

population in the communal area to the resettlement areas. Therefore the unity or mutual relationship among relatives is scarce. In the same way, festivals or customs as a rural community are rarely formed. As a result, the unity among residents is extremely weak.

With regard to the communal areas, residents immigrated to most villages in the 1940's or 1950's. Only in very few villages, residents were settled in the nineteenth century. Resettlement areas were formed at the end of 1970's to 1980's, and the number of resettlement areas is expected to increase with the movement of population.

In the case of small-scale commercial areas having no village, the lands purchased for the African colony were sold in lots by the colonial government from the end of 1950's to 1960's, where each farm has 300 to 625 ha of land. The proportion of arable area in the farm varies greatly ranging from 5 to 43%, which mainly depends on whether the farm is for raising stocks or for producing farm products. In many cases, there live two to three families of farm laborers in the farm in addition to the main family.

3.8.4 Distribution of Population and Family Structure

With respect to the distribution of population in the Study Area on the basis of the 1992 census, Mashonaland West province occupies 43.5% and three districts of Midland province stand 56.5%. According to the form of land holding, the population is distributed as follows: 70.9% of population are in communal area, 14.7% are in resettlement area, and 8.6% are in small-scale commercial farm area.

As to the family structure, Mashonaland West and Midland provinces have the family with large number of people of 5.8 people/household and 6.1 people/household, respectively. According to the form of land holding, the family structure can be indicated as follows: 6.0 people/household for the communal area, 6.4 people/household for resettlement area, and in small-scale commercial farm area the family member is slightly large with 7.3 people/household, and the large-scale commercial area has 4.0 people/household.

However, in reality, there still remains the large family system or polygamy, which is clearly shown from the results of interview to the farmers.

3.8.5 Birthrate

The birthrate of Kadoma District is 33.17/1,000 by the direct method and 43.13/1,000 by the indirect method. These rates are slightly lower than the average birthrate of Mashonaland West province. However, the number of births given by one female in her life is 6.36, which is higher than the average one of Mashonaland West province.

The birthrate and the number of births given by one female in her life for three districts of Midland province are shown below.

	Birthrate		
District	Direct method	Indirect method	No. of births given by one female in a life
North Gokwe	36.59/1,000	48.84/1,000	7.62
Kwekwe	35.74/1,000	43.08/1,000	6.60
Prov. average	35.12/1,000	44.49/1,000	6.27

3.8.6 Mortality and Infant Mortality

The mortality for each district of Study Area is shown in the Table below.

		Baby	Infant	Life Expectancy		
District	Mortality	mortality	mortality	Male	Female	Total
Kadoma	9.2/1,000	73/1,000	33/1,000	58	61	59
Masho. West Prov.	9.8/1,000	74/1,000	32/1,000	58	60	59
South/North Gokwe	10.3/1,000	84/1,000	38/1,000	56	59	57
Kwekwe	10.5/1,000	63/1,000	25/1,000	61	62	62
Midland Province	9.9/1,000	70/1,000	29/1,000	59	61	60

In the above Table, the infant mortality is extremely high, which is considered to be caused by the nutritious state and the hygienic situation of mother and child. In addition, malaria is considered one of the causes of death.

3.8.7 Increase Rate of Population

The natural increase rate of population based on the birthrate and the mortality shown above is as follows.

District/Province	Growth Rate (%/yr)
Kadoma	2.40
Mashonaland West	2.45
South and North Gokwe	2.83
Kwekwe	2.52
Midland	2.52

The increase of population in the Study Area is mainly based on the natural increase, where relatively high mortality is maintained against relatively high birthrate, leading to maintaining relatively low increase rate of population. Thus, these districts are considered to belong to the so called first transition period. If in the future, medical facilities are increased and living environment is improved, there will be a possibility that fairly high increase rate of population is recorded unless sufficient birth control measures are taken.

3.8.8 Social Infrastructure

The preparation state of social infrastructure in the Study Area is explained below.

(1) Domestic water

The domestic water in the Study Area depends mainly on deep wells. In the rainy season, surface water or shallow wells can supplement water supply. In many cases, deep wells are excavated by governmental agencies and, as a rule, the residents in the neighboring areas jointly use the well. Shallow wells are excavated by beneficiaries and, in many cases, only the families of beneficiaries use these wells. To use the surface water, an application must be submitted to Agritex. Then after confirming the portions borne by the residents either in the form of cash or labor supply, DDF, which is the sub-organization of MLGRUD, constructs the structure such as the small-scale dam or the weir.

As a whole, water is insufficient during the dry season, especially drinking water for animals. For these reasons, death of animals or drop of the amount of milk to suck occurs caused by epidemic diseases. In some districts, during the dry season, the deep wells which are generally used become impossible to use because of the draw-down of groundwater table, and sometimes people fetch water from deep wells located far from where they live.

(2) Road and traffic

Asphalt paved roads stretch by linking the central locations in the district, and many roads connecting business centres of villages are paved with gravel. However most of the roads connecting the villages are not paved, which cause traffic difficulty by becoming muddy after the rainfall.

In many cases, bus services are operated one or two times a day between business centres. The traffic measures between villages still depend on pick-up trucks, motorcycles, or oxcarts. Recently there have appeared a transportation business operated by some people who own pick-up trucks, but the number of people doing this kind of business is still small. Thus the transportation of cotton still causes headache to farmers.

The extension and the density of various roads within the Study Area are shown below.

	Simple asphalt pavement	Gravel pavement or unpaved roads	Small Trucks
Length	70 km	384 km	279 km
Density	0.8 m/person	4.3 m/person	3.1 m/person

(3) Educational facility

The current educational system consists of elementary school from first to seventh grade and secondary school from first to sixth grade. The high school education varies depending on the department and ranges from three to five years. There is no facility for higher education in the Study Area. In Kadoma and Gokwe North Districts, the following educational facilities for elementary and secondary education exist.

Urban Area	No. of schools	Total students	Total Teachers	Student per school	Student per teacher
Elementary school	15	12,288	357	819	34
Secondary school	6	4,911	183	982	27
High school	1	650	32	650	20

Communal Land	No. of schools	Total students	Total teachers	Student/ school	Student/ teacher	No. of wards
Elementary school	43	24,000	577	558	42	
Secondary school	19	7,161	296	377	24	
High school	1	634	28	634	23	15

Resettlement Land	No. of schools	Total students	Total teachers	Student/ school	Student/ teacher	No. of wards
Elementary school	40	16,310	341	383	45	
Secondary school	15	2,333	85	156	27	
High school	0	*	0	-	-	13

Small-scale commercial	No. of schools	Total students	Total teachers	Student/ school	Student/ teacher	No. of wards
Elementary school	8	2,135	52	267	41	
Secondary school	2	486	16	243	30	
High school	0	*	0	-	-	6

Large-scale commercial	No. of schools	Total students	Total teachers	Student/ school	Student/ teacher	No. of wards
Elementary school	16	8,245	183	515	45	
Secondary school	6	2,759	94	460	29	
High school	0	*	0	-	-	3

As shown in the above Tables, the number of students at one school ranges from 267 to 819 for elementary school, 243 to 982 for secondary school, and 643 to 650 for high school. The size of elementary and secondary school varies depending on the district. The number of students for one teacher ranges 34 to 45 for elementary school, 24 to 30 for secondary school, and 20 to 23 for high school. In the cases of secondary and high schools, the number of students for one teacher is generally considered appropriate. However, with regard to elementary schools except for those in city district, lack of teacher is significant.

(4) Medical and health facility

The Study Area was originally the habitat of tsetse flies. Therefore very few settlers have lived in this area. In 1940's, the government of that time exterminated the tsetse flies successfully and proceeded to immigrate the African people as the small-scale commercial farmers or communal farmers. Presently, the damage of tsetse flies is rarely seen. Instead, malaria is widespread. Based on the results of the study on villages, diarrhea and dysentery occur frequently following malaria as the diseases of area residents.

In order to cope with these diseases, the Ministry of Health has established one clinic in each ward. At the centre of the country, there exists a national hospital or the hospital operated by a religious group. The number of clinics and hospitals in Kadoma and Gokwe North is shown below.

	Urban	Communal Land	Resettl. Land	S.S.C.F.	L.S.C.F.	Total	Population/ Facil. & Staff
Clinics	3	9	12	3	1	28	8,484
Doctors	1	-	-	-	-	1	237,552
Nurses	14	31	25	8	4	82	2,897
Hospitals	1	3	-	-	-	4	59,388
Beds	200	230	-	-	-	430	522
Doctors	6	4	-	-	-	10	23,755
Nurses	133	104	-	-	-	237	1,002

(5) Electrification of farming villages

Supply of electricity to farming villages is almost none. Only some areas close to power lines can receive electricity. On the individual basis, there are some cases using solar energy as a power source of television. However no case is observed that jointly use the solar power electricity.

(6) Mail and communication facility

Each ward has one post office. Telephone service is not spread except for governmental agencies. Because, in addition to the remotely located villages, farm houses are scattered, communication problems exist

at various levels. Thus the preparation of communication facility is considered to be more urgently needed than electrification.

(7) Cargo collection and storage facility

In the Study Area, there are cargo collection and temporary storage facilities for cotton and maize, where the farmers bring and sell their products. However because the number of these facilities are few, and road network as well as condition are insufficient, farmers are obliged to use more labour and to bear more expenses.

(8) Business centre

Almost all the wards have several open spaces called business centres, where there are groceries, restaurants, bus terminal, or vegetable and fruit markets. In some cases, schools are build close to these locations. The reason for establishing the business centre is literally to establish the business centre for the scatteredly located farm houses. Therefore the business centres are constructed extremely artificially compared with the naturally formed cities or commercial districts. However, by establishing facilities and giving them some relationship with the daily living of residents, business centres can be developed to the central locations of farming villages.

(10) Industry

According to the report of the census conducted in 1992, the distribution of occupation in Mashonaland West and Midland provinces are as follows.

	Mashonaland West		Midland	
	Rural	Urban	Rural	Urban
Agriculture	68.12%	5.29%	75.24%	2.35%
Mining and construction	8.03%	16.81%	5.58%	13.97%
Heavy machine operator	2.88%	5.95%	0.93%	5.25%
Mechanic	1.18%	4.82%	0.59%	5.70%
Manufacturer	3.72%	14.45%	4.13%	11.65%
Service	6.44%	20.52%	6.17%	22.84%
Other	9.65%	32.18%	7.95%	38.24%

As is clearly shown in the above Table, the ratio of agricultural workers is still high being about 70% in the farming villages. Mining and construction workers, heavy machine operator, and mechanics in farming villages are mainly related to mining industry such as gold mining. In the cities, the construction industry has priority. Most of manufacturers produce agricultural products, and only some manufacturer are engaged in chemical industry. As for service industry, the ratio is more than 20% in city areas, but only 6% in farming villages. Strengthening the employment in service industry is considered necessary.

(11) Population according to the industry

The employment status for each industry is shown in the above section. The economically active population and non-active population of people of 15 years and older are shown in the Table below.

	Mashonaland West			Midland		
	Male	Female	Total	Male	Female	Total
Economically Active						
Wage earner	153,170	39,557	192,727	109,551	29,636	139,189
Employer	1,493	316	1,809	920	251	1,181
Self-employed	47,783	44,987	86,770	79,987	104,209	189,196
Non-paid family laborer	8,227	19,102	27,329	19,931	40,641	60,572
Unemployed	40,212	31,212	78,424	45,419	25,995	71,414
Total	251,885	135,174	387,059	254,808	200,744	455,552
Economically Non-active						
Students	44,281	28,276	70,810	54,742	37,569	92,311
Household worker	2,722	125,548	128,270	3,379	101,529	104,908
Retiree, sick people, elderly	10,227	14,850	25,077	10,885	18,212	29,098
Others	1,800	2,717	4,517	4,052	3,848	7,898
Total	59,281	169,393	228,674	73,059	161,158	234,215

From the above Table, it can be seen that the occupation that should be self-employed is maintained by wage earners, that is, agricultural laborers, and supported by female laborers also. Some of the male wage earners are considered to be laborers coming from other area to work, indicating that the desire to abandon farming has becoming stronger. The unemployment rate is extremely high, being 20.3% in Mashonaland West and 15.7% in Midlands.

(12) Social status of women

Women's advancement to society in the Study Area cannot necessarily be said active as seen from the Table indicating the economically active population, due to the reasons that the ratio of non-paid female laborers is more than twice than that of male or the ratio of students is higher for male being 61:39.

However, the existence of women is observed not only in securing the labor force but in various fields including the operation of stores in business centres or the improvement of living by joint cultivation of vegetables. Women's social status is expected to be improved gradually.

3.9 Local Administrative Organization and Services

Most of ministerial departments except the Ministry of Foreign Affairs have established branches or local offices in provinces and districts. Thus a vertically divided administrative organization which is directly linked to central departments has been established. However, the governor of a province has fairly strong authority and adjusts the relationship among the branch offices of central departments.

The services given by the administration to the residents extends to various fields including the construction of roads, supply of water source, expansion of medical and educational facilities, extension of communication functions, extension of agriculture and exterminating of harmful insects, and maintenance of public order. However due to the reasons such as the lack of budget, sufficient services are not necessarily provided.

3.10 Agricultural Production and Social Infrastructure

3.10.1 Infrastructure for Agricultural Production

Because most agricultural production depends on rain water, facilities related to irrigation are extremely limited. Because most of the access roads from farm to main road are mainly unpaved and easily become difficult to pass due to muddy after rain. As the agricultural