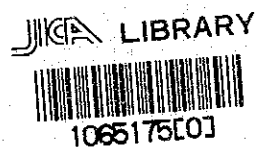


FINAL REPORT
FOR
THE FEASIBILITY STUDY ON MEDIUM SIZE DAMS
IN
MASVINGO PROVINCE IN THE REPUBLIC OF ZIMBABWE
FEASIBILITY REPORT

MARCH 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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MARCH 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団		
受入 月日	'88. 5. 6	534
登録 No.	17522	61.7 AFT

PREFACE

In response to the request of the Government of the Republic of Zimbabwe, the Japanese Government has decided to conduct a feasibility survey on the Medium Dams Project in Masvingo Province and entrusted the survey to the Japan International Cooperation Agency (JICA). The JICA sent to Zimbabwe a survey team headed by Mr. Kazunori Tamaki, Sanyu Consultants Inc., two times in 1986 and 1987.

The team exchanged views with the officials concerned of the Government of Zimbabwe and conducted a field survey in Masvingo Province. After the team returned to Japan, further studies were made and the present report has been prepared.

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

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

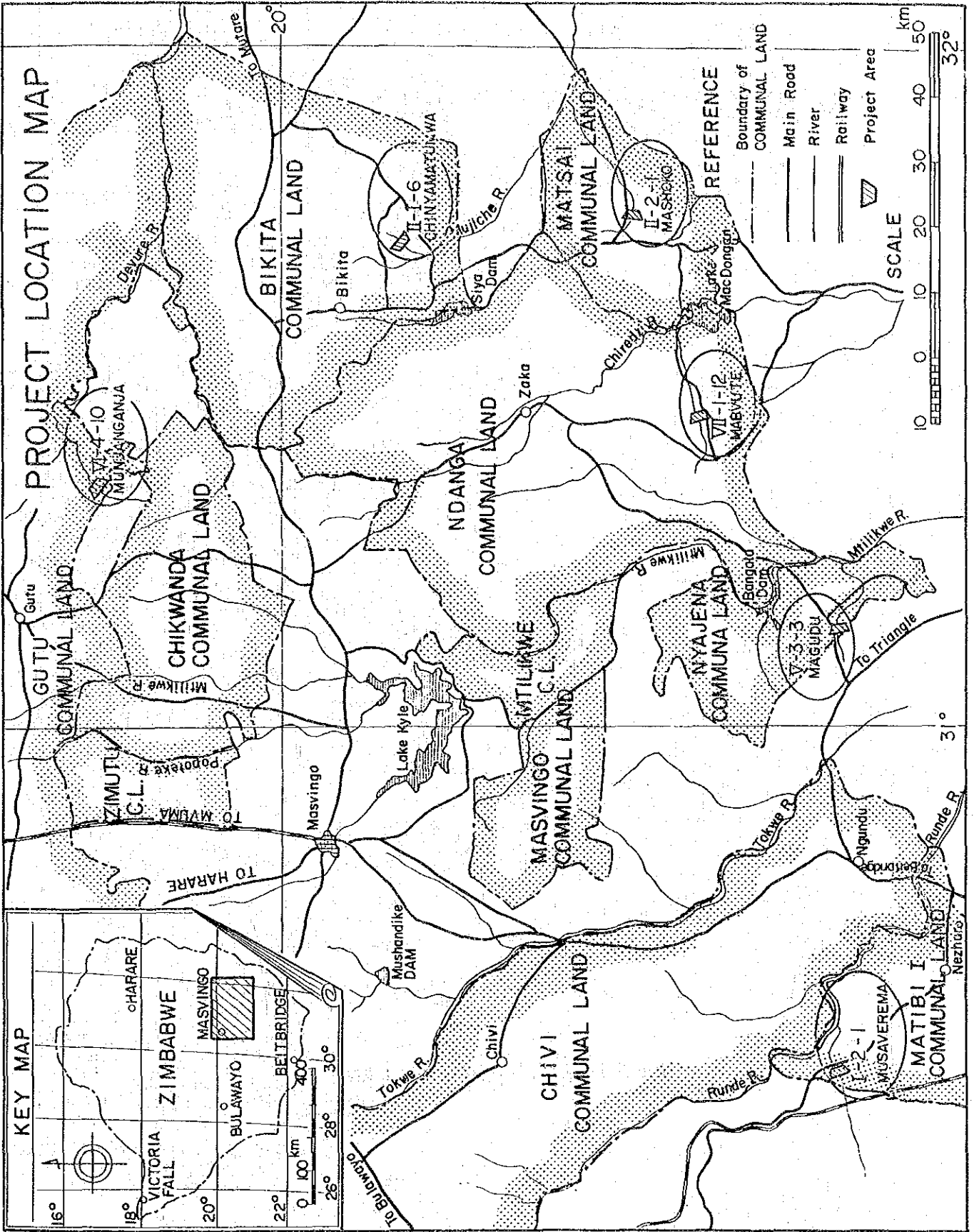
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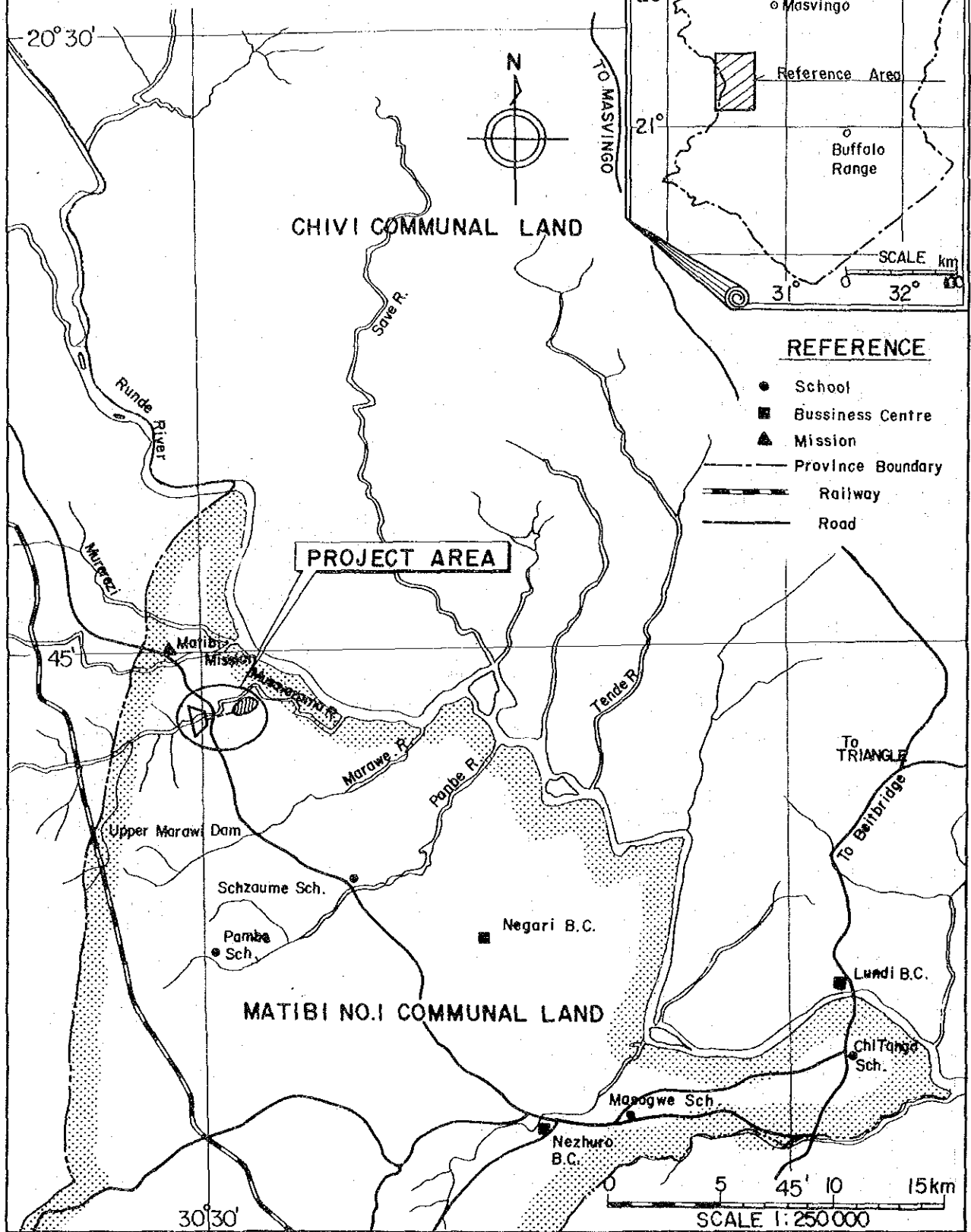
KENSUKE YANAGIYA

President

Japan International Cooperation Agency



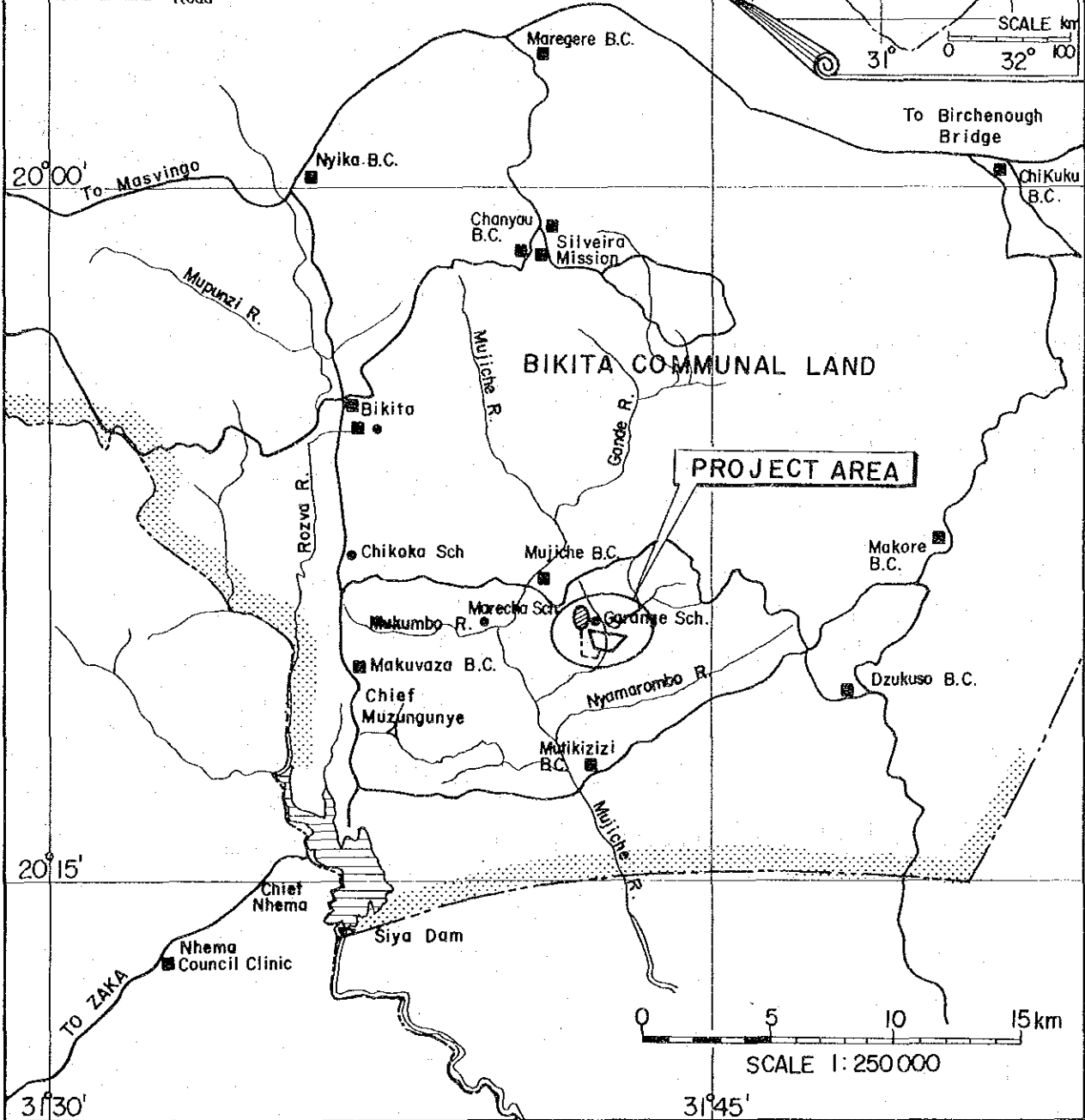
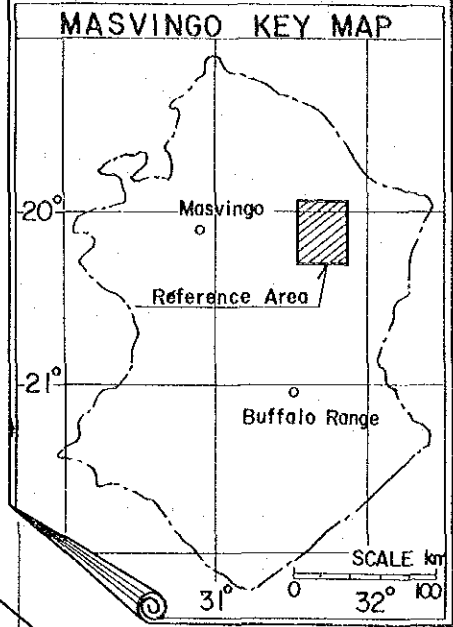
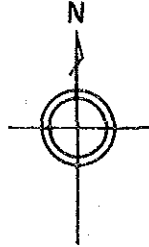
LOCATION MAP OF MUSAVEREMA(I-2-1) PROJECT

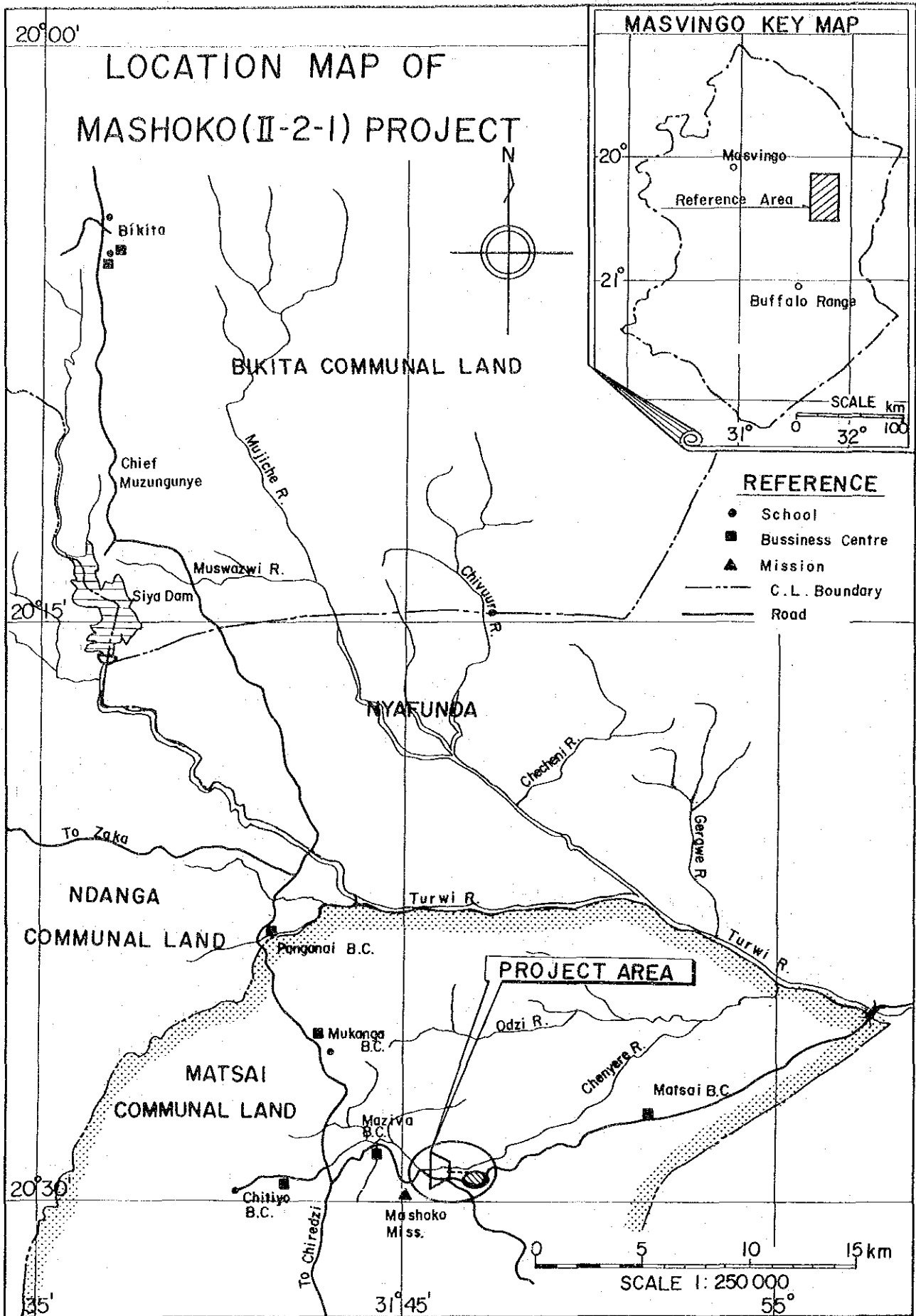


LOCATION MAP OF CHINYAMATUMWA PROJECT (II-1-6)

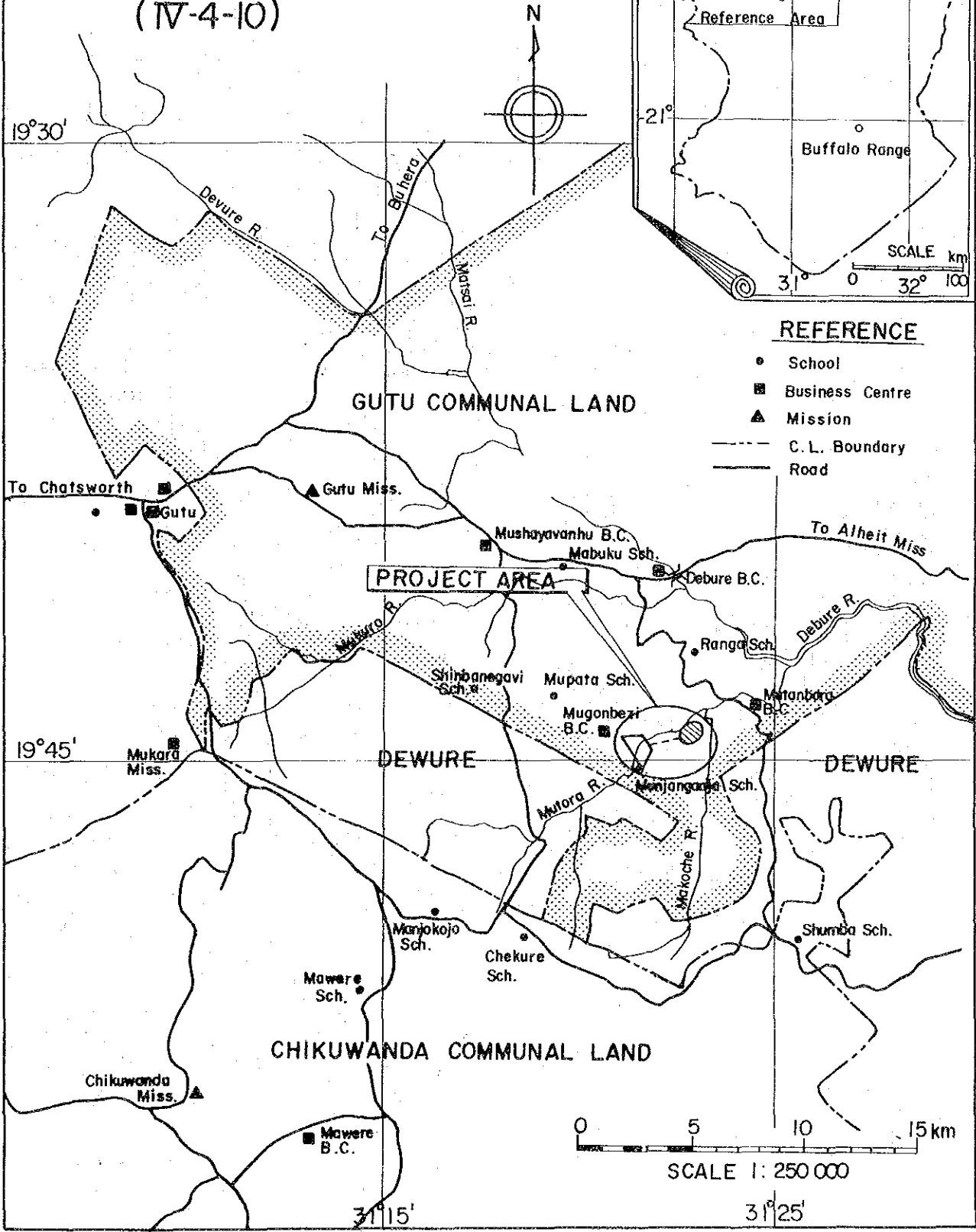
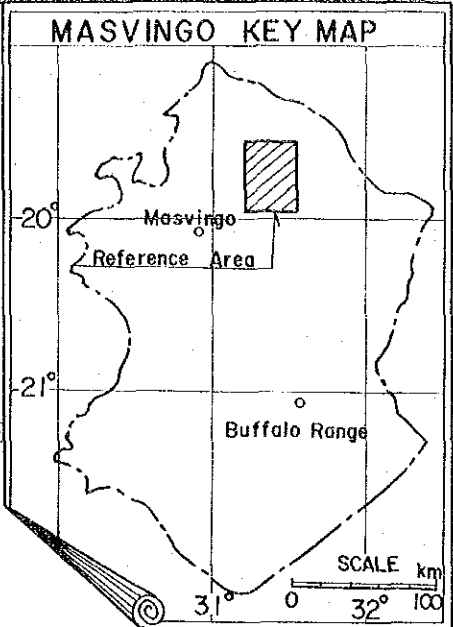
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- Business Center
- ▲ Mission
- - - C.L. Boundary
- Road





LOCATION MAP OF MUNJANGANJA PROJECT (IV-4-10)

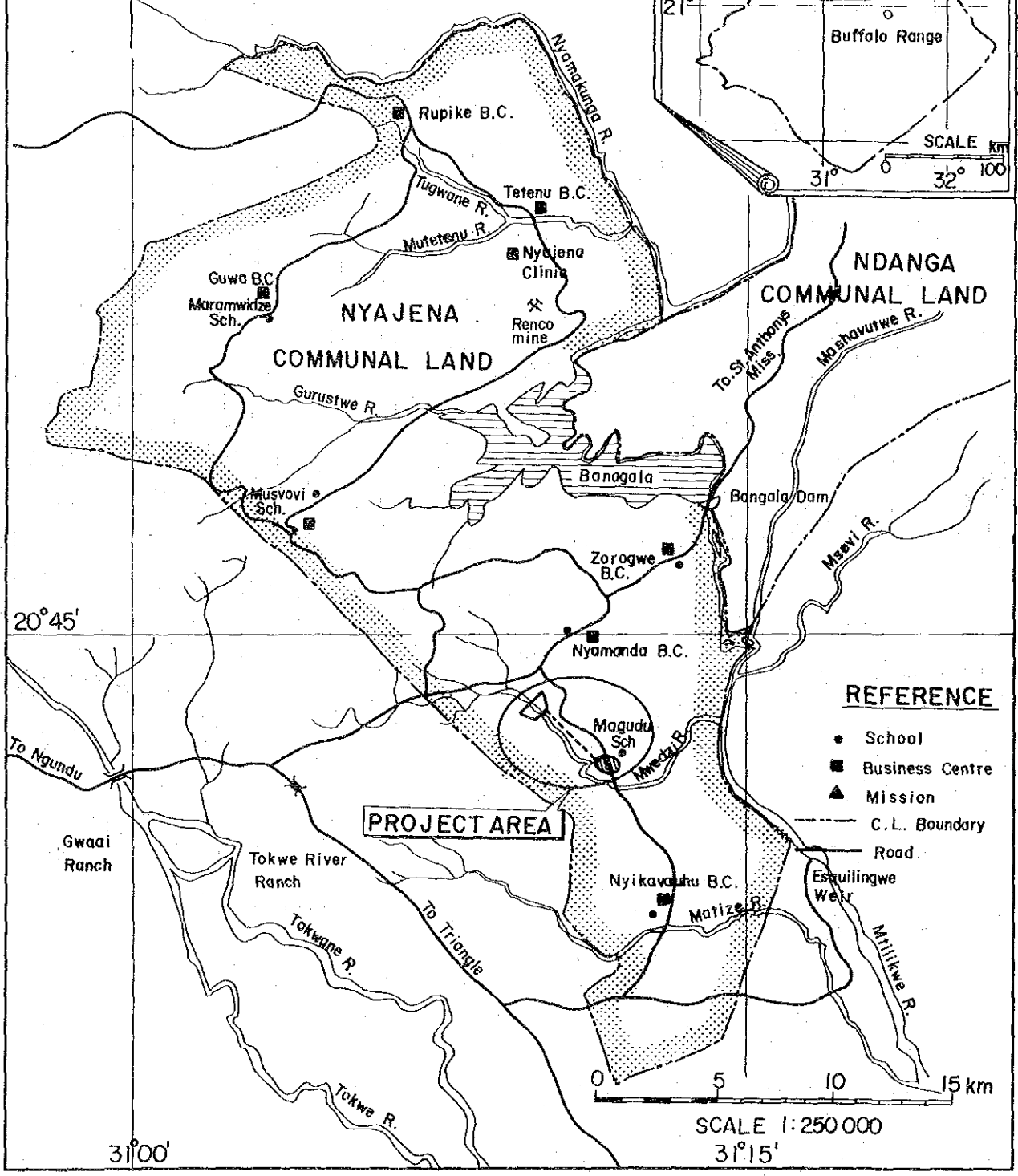
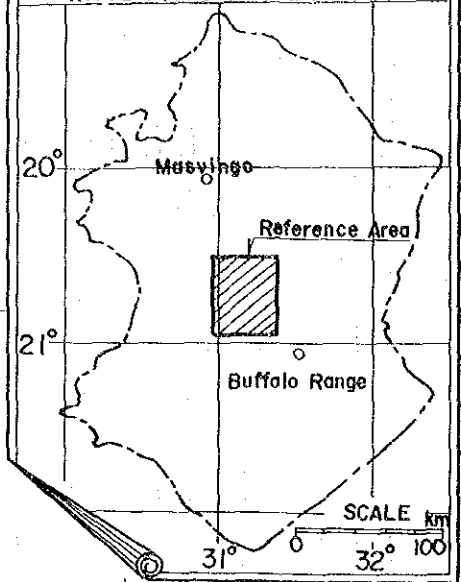
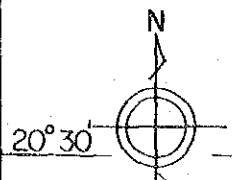


REFERENCE

- School
- Business Centre
- ▲ Mission
- - - C. L. Boundary
- Road

LOCATION MAP OF MAGUDU(∇-3-3) PROJECT

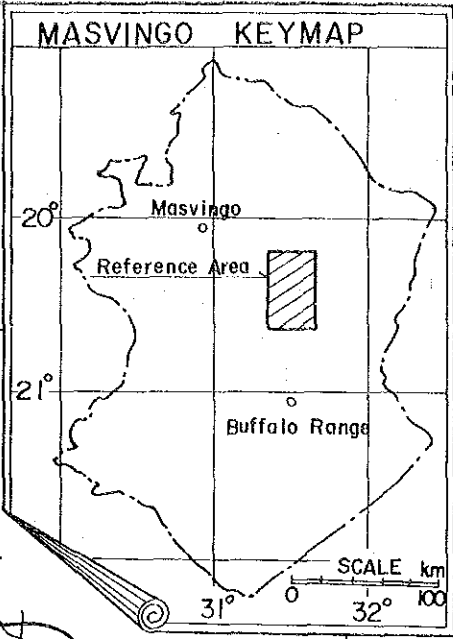
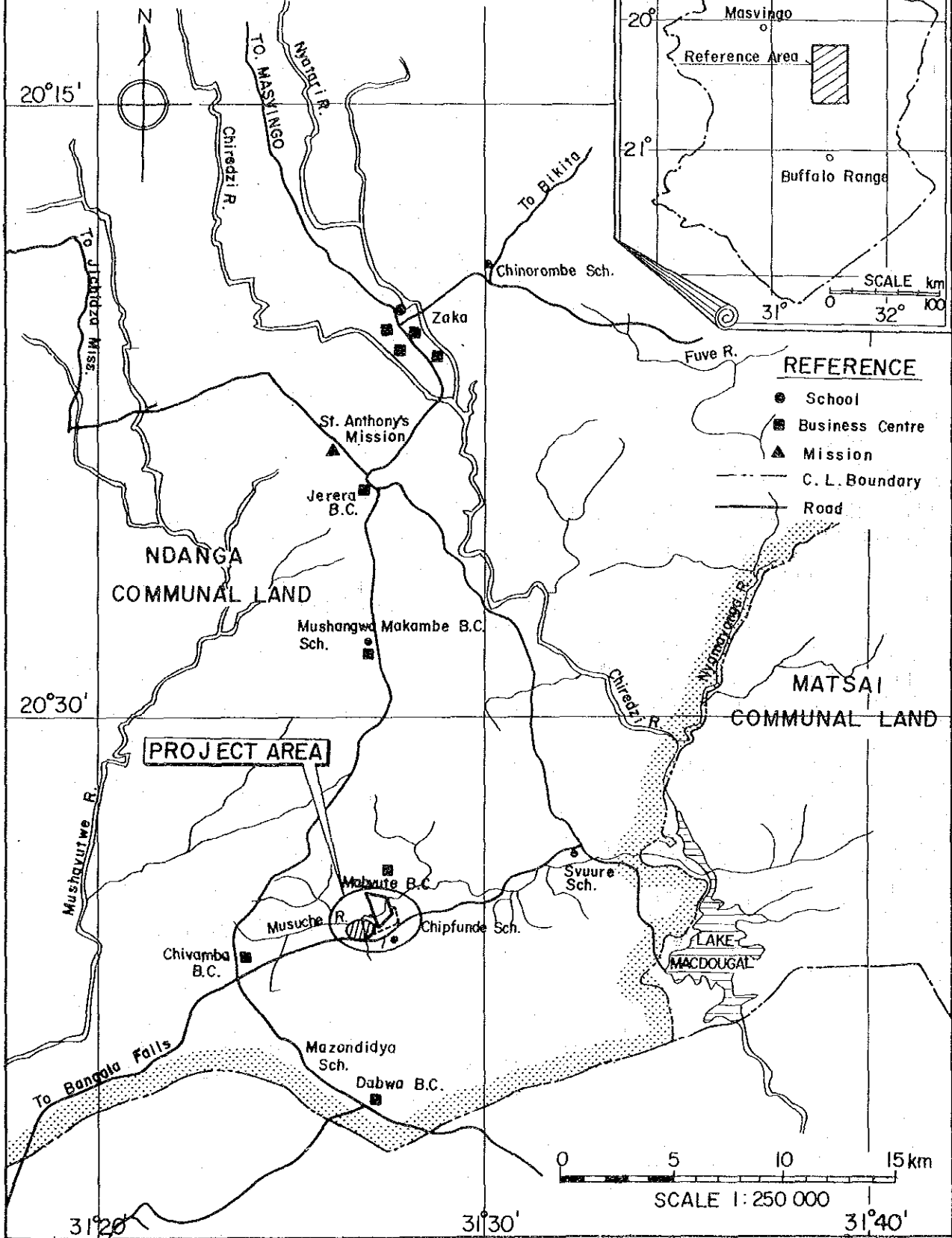
MASVINGO KEY MAP



REFERENCE

- School
- Business Centre
- ▲ Mission
- C.L. Boundary
- Road

LOCATION MAP OF MABVUTE (VII-1-12) PROJECT



REFERENCE

- School
- Business Centre
- ▲ Mission
- - - C. L. Boundary
- Road

CONTENTS

LETTER OF TRANSMITAL

PROJECT LOCATION MAP GENERAL	i
MUSAVEREMA (I-2-1)	ii
CHINYAMATUMWA (II-1-6)	iii
MASHOKO (II-2-1)	iv
MUNJANGANJA (IV-4-10)	v
MAGUDU (V-3-3)	vi
MABVUTE (VII-1-12)	vii
CONTENTS	viii
LIST OF ANNEXES	xi
LIST OF TABLES	xii
LIST OF FIGURES	xiv
GLOSSARY, ABBREVIATION AND MEASUREMENT	xv
OUTLINE OF THE PROJECT	xviii
CHAPTER 1. GENERAL	1-1
1.1. Backgrounds	1-1
1.2. Objectives of the Study	1-2
1.3. Background of the Study	1-3
CHAPTER 2. NATIONAL BACKGROUND	2-1
2.1. General Situation	2-1
2.2. National Economy	2-3
2.3. General Situation of Masvingo Province	2-7
2.4. Communal Land	2-12

CHAPTER 3. POTENTIAL DAM SITE AND PROJECT SELECTION	3-1
3.1. Identification of Potential Dam Sites	3-1
3.2. Preliminary Evaluation of the Projects	3-2
3.3. Project Selection for the Feasibility Study	3-3
CHAPTER 4. THE PROJECT AREA	4-1
4.1. Location and Topography	4-1
4.2. Meteorology and Hydrology	4-2
4.3. Dam Site and Geology	4-14
4.4. Soil Condition	4-18
4.5. Land Use and Cropping Pattern	4-23
4.6. Crop Production	4-29
4.7. Livestock Production	4-31
4.8. Marketing Structure and Gate Price	4-35
4.9. Farm Management and Latent Manpower	4-43
4.10. Farm Economy	4-51
4.11. Socio-Economy	4-54
CHAPTER 5. THE PROJECT PLAN	
5.1. Objectives and Components of the Project	5-1
5.2. Dam Site Hydrology	5-2
5.3. Reservoir Plan	5-5
5.4. Irrigation Plan	5-10
5.5. Proposed Land Use	5-14
5.6. Crop Production Plan	5-17
5.7. Stock Breeding Plan	5-25
5.8. Fish Farming Plan	5-26

5.9	Farm Management Plan	5-27
5.10.	Marketing Plan	5-30
5.11.	Farmer's Organization Plan	5-32
5.12.	Social Environment Improvement Plan	5-36
CHAPTER 6. PROPOSED PROJECT FACILITIES		
6.1.	Dam and Appurtenant Structures	6-1
6.2.	Conveyance Facilities	6-11
6.3.	On-Farm Facilities	6-16
6.4.	Construction Plan	6-20
6.5.	Cost Estimate	6-26
CHAPTER 7. PROJECT ORGANIZATION AND IMPLEMENTATION		
7.1.	Project Implementation Agencies	7-1
7.2.	Consulting Services	7-1
7.3.	Project Implementation Schedule	7-3
7.4.	Operation and Maintenance	7-5
CHAPTER 8. PROJECT EVALUATION		
8.1.	Project Justification	8-1
8.2.	Project Evaluation	8-3
REFERENCES		R-1

LIST OF ANNEXES

- A. Topography and Geology
- B. Meteorology and Hydrology
- C. Soil, Land Use and Agriculture
- D. Irrigation
- E. Dam and Reservoir
- F. Social Situation and Rural Water Supply
- G. Project Cost
- H. Project Benefit
- I. Structure Design

LIST OF TABLES

Table 2-1	Population Distribution among Administration Authorities
Table 2-2	Population and Number of Households of the Communal Land
Table 3-1	Summary of Priority Project
Table 4-1	Location Indices of Project Area
Table 4-2	Mean Annual Meteorology from 1976 to 1985
Table 4-3	Mean Monthly Rainfall
Table 4-4	Mean Annual Evaporation
Table 4-5	Sediment Volume in Reservoir
Table 4-6	Brief of Dam Site
Table 4-7	Land Use in Project Areas
Table 4-8	Yield per Hectare
Table 4-9	Input Supply per Hectare
Table 4-10	The Standard Input Supply per Hectare
Table 4-11	Summary of Livestock Situation
Table 4-12	Blended Prices of G.M.B. Masvingo
Table 4-13	Farmgate Price
Table 4-14	Indicators of Farm Management per Household
Table 4-15	Estimated Latent Manpower by Project Sites
Table 4-16	Social Aspects of Study Wards
Table 5-1	Design Flood Hydrograph
Table 5-2	Reservoir Yield at 10% and 20% Risk Level
Table 5-3	Net Irrigation Water Requirements Weighted for Acreage
Table 5-4	Design Discharge

Table 5-5	Estimated Crop Production in Each Project Area
Table 5-6	Facilities to be Improved
Table 6-1	Main Features of Water Conveyance Canal
Table 6-2	Main Features of Pumps and Pipeline
Table 6-3	Main Features of In-field Facilities
Table 6-4	Proposed Borrow Pits of Embankment Materials
Table 6-5	Project Cost
Table 8-1	EIRR of the Six Projects
Table 8-2	Expected Benefits and Costs on the Basis of Yield at Two Levels of Risk (20 instead of 10 per cent risk on reservoir yield)

LIST OF FIGURES

- Figure 3-1 Selection of Dam Site for Feasibility Study
- Figure 4-1 Mean Monthly Meteorology
- Figure 4-2 Location of Rainfall Station
- Figure 4-3 Mean Annual Evaporation
- Figure 4-4 Relation between Soil Erosion and Sediment Yield
- Figure 5-1 Proposed Cropping Pattern
- Figure 5-2 Proposed Organization Structure of Medium Size Dam Project
Promotion Committee
- Figure 6-1 Farmland Block Plan
- Figure 6-2 Project Cost Component
- Figure 7-1 Schedule of Consultant Service
- Figure 7-2 Project Implementation Schedule

GLOSSARY, ABBREVIATION AND MEASUREMENT

ABBREVIATION

WHO	World Health Organization
UNICEF	United Nations International Children's Emergency Fund
JICA	Japan International Cooperation Agency
MEWRD	Ministry of Energy, Water Resources and Development
MLG	Ministry of Local Government
MHA	Ministry of Home Affairs
GMB	Grain Marketing Board
ARDA	Agricultural Resettlement Development Association
D.D.P.	Department of Physical Planning, MLG
AGRITEX	Agricultural Technical Service, Ministry of Agriculture
P.W.E.	Provincial Water Engineer, MEWRD
WADCO	Ward Development Committee
VIDCO	Village Development Committee
I.M.C.	Irrigation Management Committee
L.G.P.O.	Local Government Promotion Officer
C.M.B.	Cotton Marketing Board
A.F.C.	Agricultural Finance Corporation
D.D.F.	District Development Fund
EIRR	Economic Internal Rate of Return
C.F.	Conversion Factor
S.C.F.	Standard Conversion Factor
LSU	Livestock Unit
O.M.	Operation and Maintenance
F.S.L.	Full Supply Level
D.W.L.	Dead Water Level
H.W.L.	High Water Level

SSEP	Siltation and Soil Erosion Research Project under National Master Plan for Rural Water Supply and Siltation
MAR	Mean Annual Runoff
CV	Coefficient of Variation
M.P.F.	Maximum Probable Flood

MEASUREMENT

Length

mm	millimeter
cm	centimeter
m	meter
km	kilometer

Area

sq.cm or cm ²	square centimeter
sq.m or m ²	square meter
sq.km or km ²	square kilometer
ha	hectare

Volume

l	liter
cu.m or m ³	cubic meter
MCM	million cubic meter

Weight

kg	kilogramme
t	metric tonne

Others

cu.m/sec	cubic meter per second
m ³ /sec	cubic meter per second
cm/sec	centimeter per second
t/sq.km	tonnes per square kilometer
t/ha	tonnes per hectare
kg/ha	kilogramme per hectare
kw	kilowatt
°C	degree centigrade
mg/l	milligramme per liter
%	per cent

CURRENCY EQUIVALENCY

Z\$	1.0 = US\$0.66
US\$	1.0 = 144 Yen
Z\$	1.0 = 95 Yen

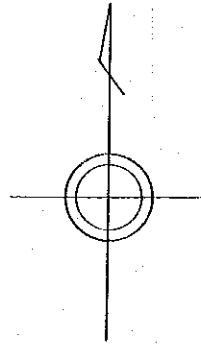
OUTLINE OF THE PROJECT

	Musaverema (I-2-1)	Chinyamatumwa (II-1-6)	Mashoko (II-2-1)	Munjanganja (IV-4-10)	Magudu (V-3-3)	Mabvute (VII-1-12)
1. Project Name						
2. Location						
District	Mwenezi	Bikita	Bikita	Gutu	Masvingo	Zaka
Communal Land	Matibi No.1	Bikita	Matsai	Gutu	Nyajena	Ndanga
3. Hydrology						
River Name	Musaverema	Chinyamatumwa	Chenyere	Mutora	Mmedzi	Musuche
Catchment Area (sq.km)	131.6	16.4	27.2	52.8	41.9	31.1
Annual Runoff (MCM)	4.454	1.689	1.306	4.171	2.891	3.349
4. Reservoir						
Full Supply Level (m)	680.0	751.0	664.0	1149.0	529.0	644.0
Dead Water Level (m)	675.0	741.0	655.5	1143.0	518.5	633.0
Reservoir Area (sq.km)	2.504	0.471	0.356	0.644	1.299	0.711
Reservoir Yield (MCM)	0.757	0.642	0.313	0.659	1.012	1.298
Full Supply Capacity (MCM)	6.653	2.255	1.453	1.831	5.672	3.132
Dead Water Capacity (MCM)	0.873	0.083	0.093	0.251	0.168	0.106
5. Dam						
Dam Type	Zone Type Fill Dam	Zone Type Fill Dam	Zone Type Fill Dam	Zone Type Fill Dam	Zone Type Fill Dam	Zone Type Fill Dam
Dam Height (m)	12.7	18.8	18.4	18.7	18.8	19.3
Dam Length (m)	1700.0	580.0	700.0	920.0	460.0	625.0
Embankment Volume (cu.m)	248 900	166 100	214 300	153 000	144 600	158 700
Intake Capacity (l/sec)	54	74	23	49	76	151
Spillway Design Flood (cu.m/sec)	835	163	228	349	415	343
6. Pump						
Type	-	Double Suction Volute	-	-	-	Double Suction Volute
Design Discharge (l/sec)	-	74	-	-	-	151
Actual Head (m)	-	28.5	-	-	-	43.0
7. Conveyance Facilities						
Method	Gravity	Pump	Gravity	Gravity	Gravity	Pump
Material	Concrete Flume	Steel Pipe	Concrete Flume	Concrete Flume	Concrete Flume	Steel Pipe
Design Discharge (l/sec)	54	74	23	49	76	151
Length (m)	5 600	870	800	4 720	7 940	860
Size (mm)		D=300				D=400
8. Night Storage Reservoir						
Design Capacity (cu.m)	4 600	4 300	1 400	4 300	6 500	8 700
Effective Depth	2.0	2.0	2.0	2.0	2.0	2.0
Size (m)	61x61	59x59	44x44	59x59	70x70	79x79
9. Irrigation Service Area						
Farm Area (ha)	44.0	50.0	21.0	51.0	70.0	100.0
Net Irrigation Area (ha)	36.2	34.7	15.2	33.3	51.1	70.5
10. Beneficiaries of Rural Water Supply						
Population (person)	2 590	1 610	570	1 710	2 800	3 930
Livestock (LSU)	1 800	2 000	790	1 500	2 430	3 000
11. Project Cost						
Foreign Currency Portion (Z\$1000)	2 265	2 647	1 647	1 962	2 137	3 593
Local Currency Portion (Z\$1000)	2 980	2 517	2 175	2 684	2 979	3 401
Total (Z\$1000)	5 245	5 164	3 822	4 646	5 116	6 994
12. Project Evaluation						
Economic Internal Rate of Return (per cent)	1.9	1.6	-	3.8	5.8	4.2

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GENERAL PLAN MUSAVEREMA PROJECT (I-2-1)

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CONVEYANCE CANAL

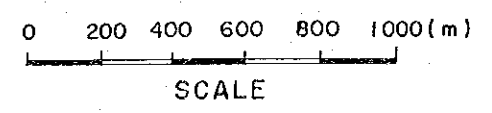
NIGHT STORGH

PROJECT SUMMARY

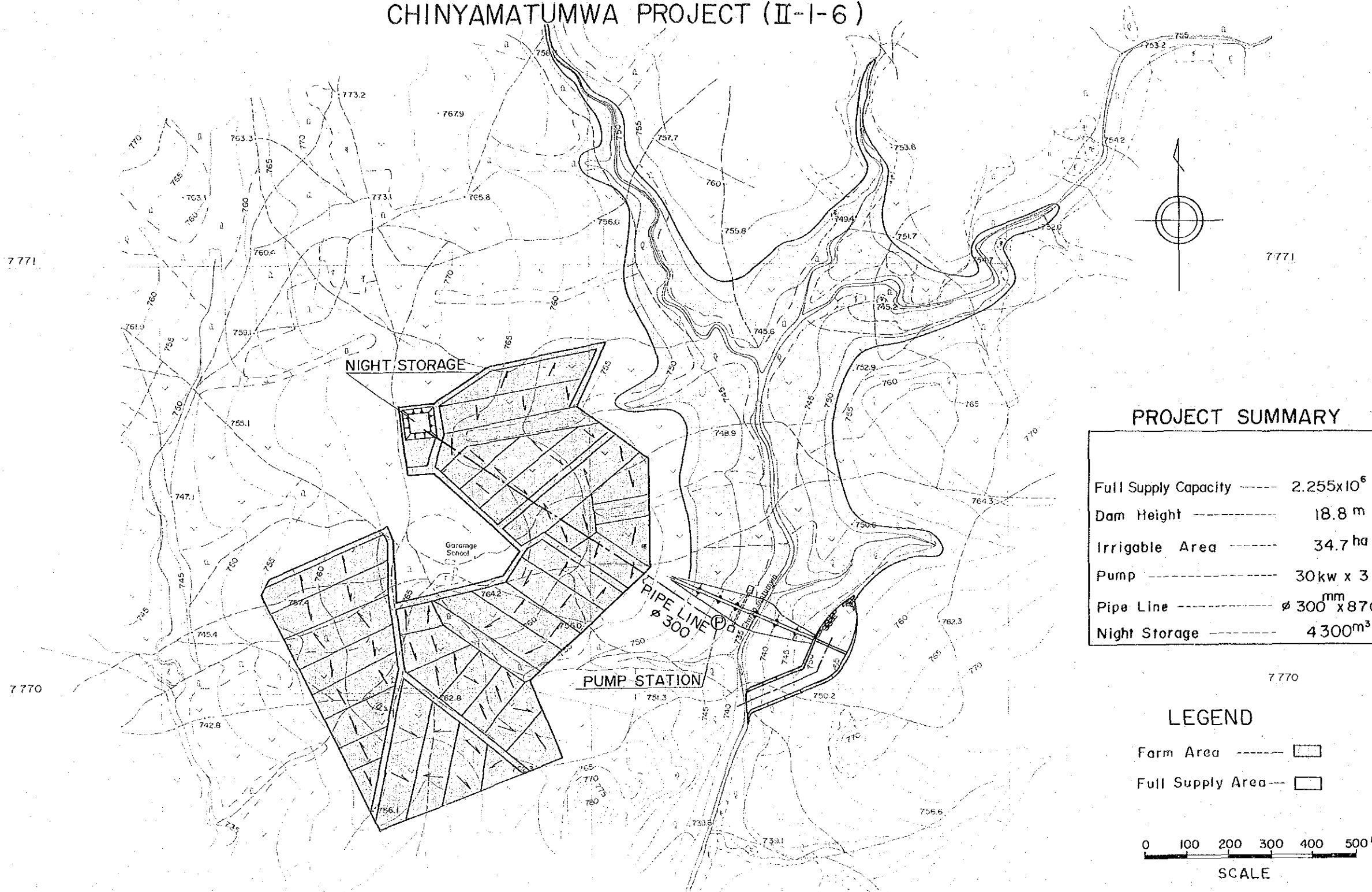
Full Supply Capacity	6.653x10 ⁶ m ³
Dam Height	12.7 m
Irrigable Area	36.2 ha
Conveyance Canal	5 630 m
Night Storage	4 600 m ³

LEGEND

- Farm Area
- Full Supply Area



GENERAL PLAN CHINYAMATUMWA PROJECT (II-1-6)

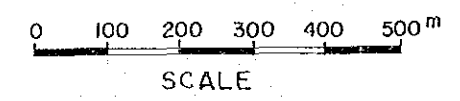


PROJECT SUMMARY

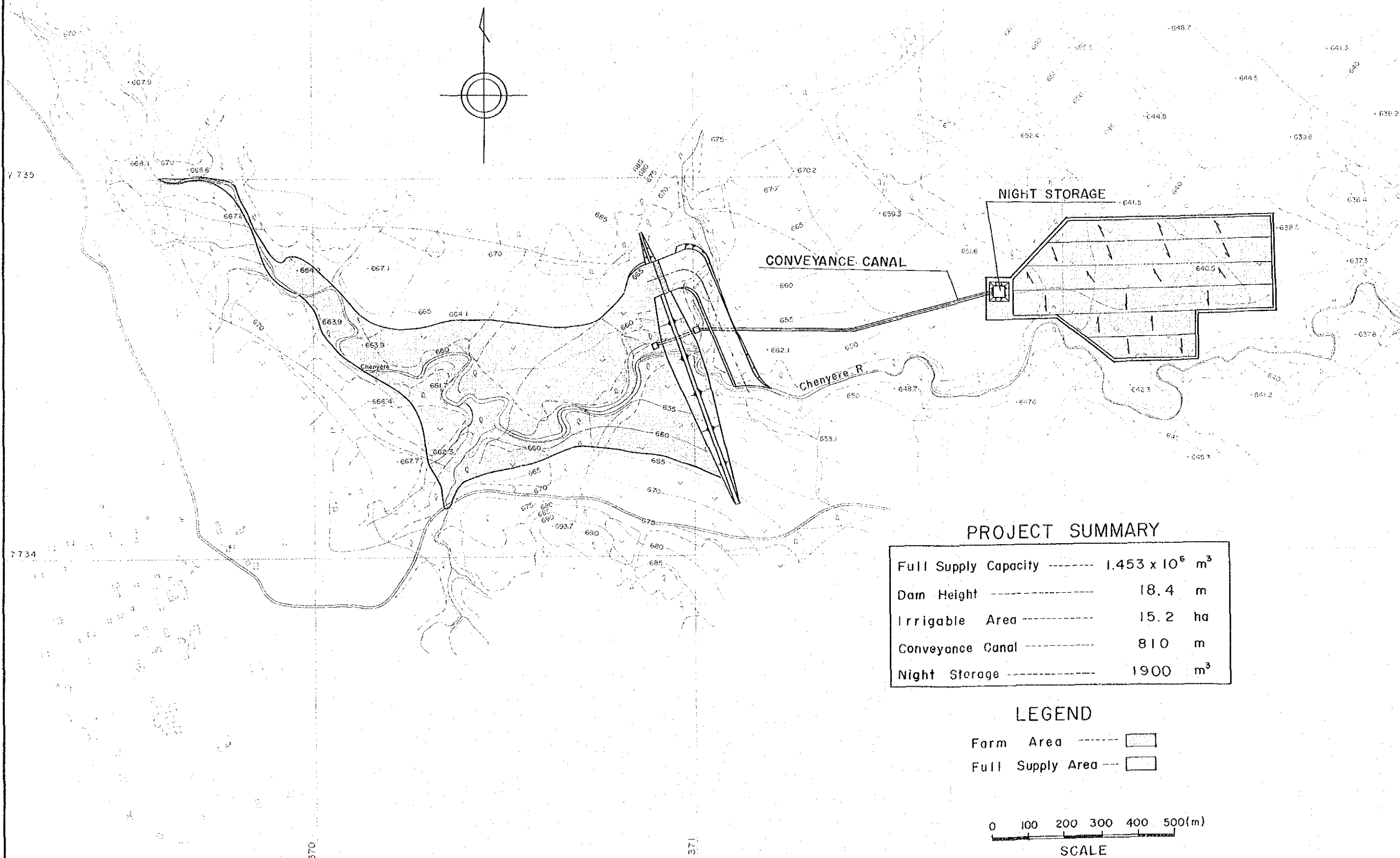
Full Supply Capacity	-----	2.255x10 ⁶ m ³
Dam Height	-----	18.8 m
Irrigable Area	-----	34.7 ha
Pump	-----	30kw x 3
Pipe Line	-----	∅ 300 ^{mm} x 870m
Night Storage	-----	4 300m ³

LEGEND

- Farm Area ----- □
- Full Supply Area --- □



GENERAL PLAN MASHOKO PROJECT (II-2-1)

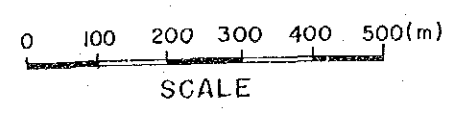


PROJECT SUMMARY

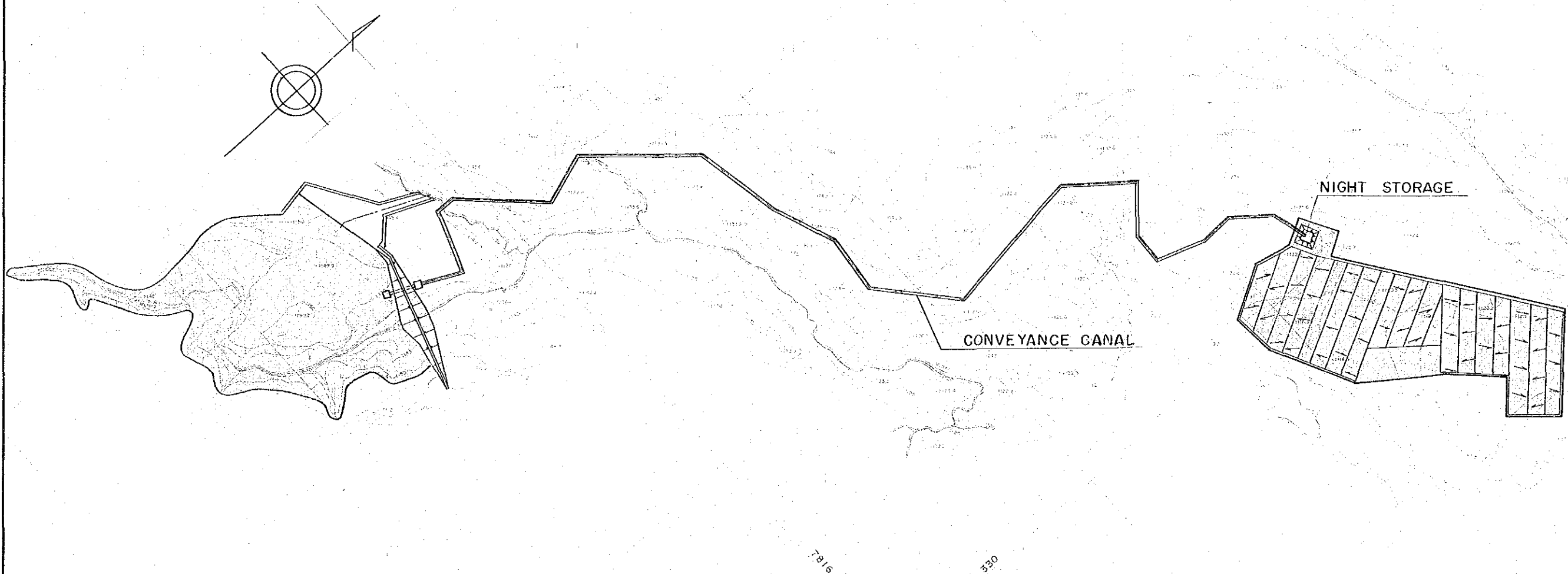
Full Supply Capacity	1.453 x 10 ⁶ m ³
Dam Height	18.4 m
Irrigable Area	15.2 ha
Conveyance Canal	810 m
Night Storage	1900 m ³

LEGEND

- Farm Area
- Full Supply Area



GENERAL PLAN MUNJANGANJA PROJECT (IV-4-10)

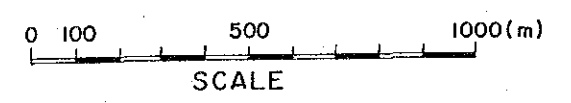


PROJECT SUMMARY

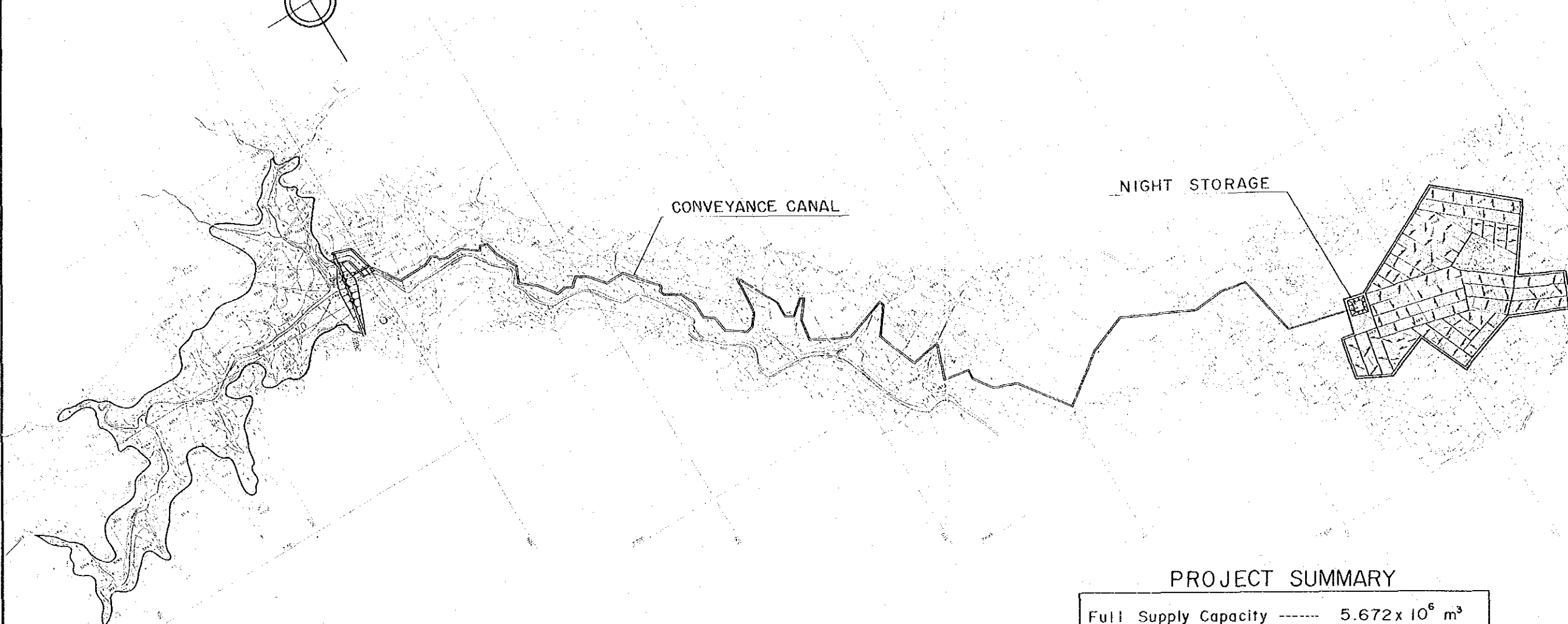
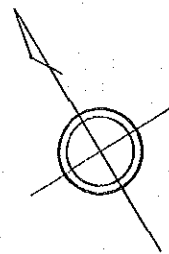
Full Supply Capacity	-----	1.831 x 10 ⁶ m ³
Dam Height	-----	18.7 m
Irrigable Area	-----	33.3 ha
Conveyance Canal	-----	4720 m
Night Storage	-----	4300 m ³

LEGEND

- Farm Area -----
- Full Supply Area -----





GENERAL PLAN
MAGUDU PROJECT (V-3-3)

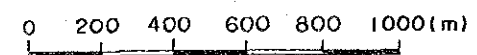


PROJECT SUMMARY

Full Supply Capacity	-----	5.672 x 10 ⁶ m ³
Dam Height	-----	18.8 m
Irrigable Area	-----	51.1 ha
Conveyance Canal	-----	7940 m
Night Storage	-----	6500 m ³

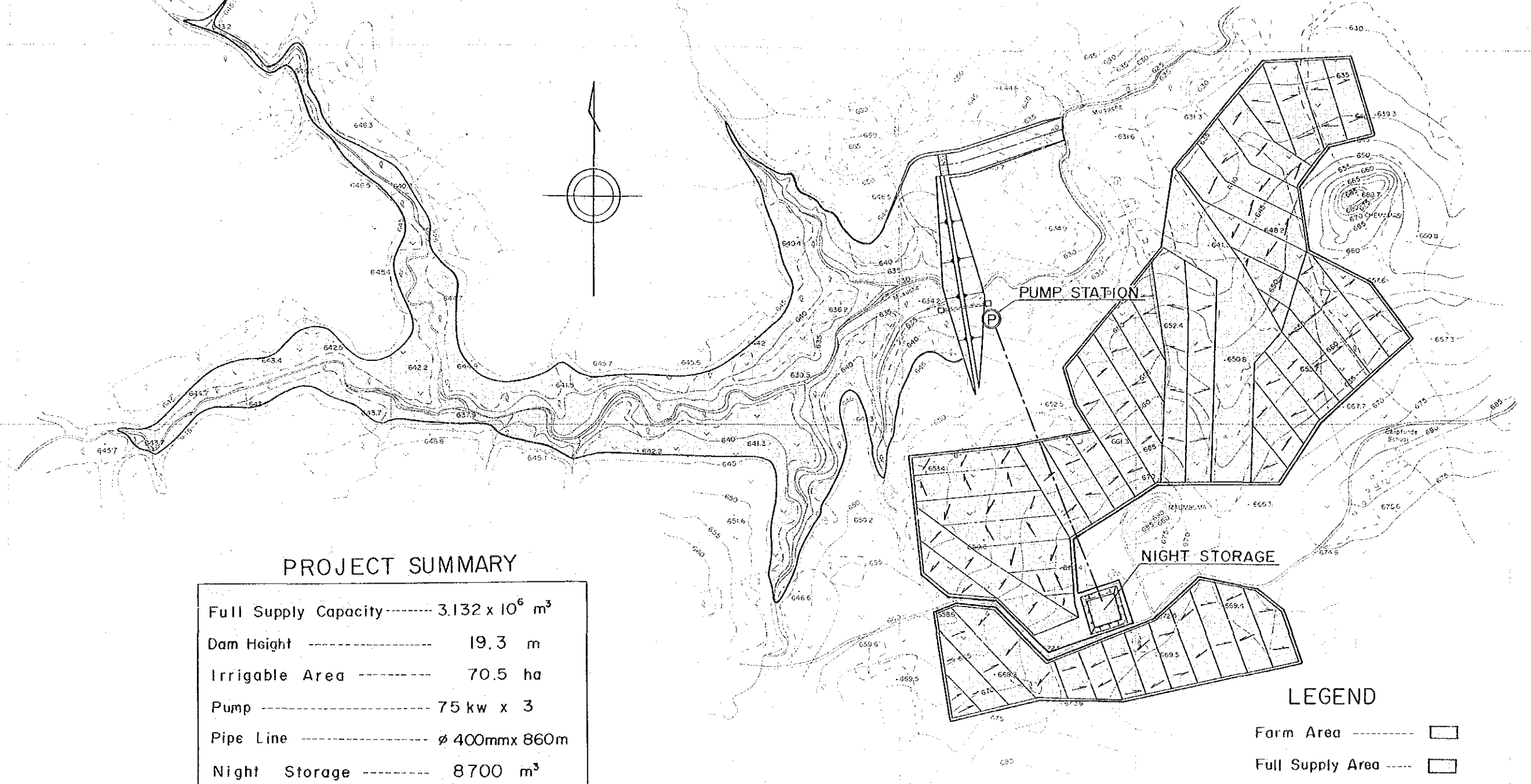
LEGEND

- Farm Area ----- 
- Full Supply Area ----- 



SCALE

GENERAL PLAN MABVUTE PROJECT (VII-1-12)

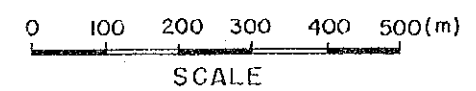


PROJECT SUMMARY

Full Supply Capacity	-----	3.132 x 10 ⁶ m ³
Dam Height	-----	19.3 m
Irrigable Area	-----	70.5 ha
Pump	-----	75 kw x 3
Pipe Line	-----	∅ 400mm x 860m
Night Storage	-----	8700 m ³

LEGEND

- Farm Area ----- □
- Full Supply Area ----- □



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CHAPTER 1 GENERAL

1.1. Background of the Project

The Study Area consists of eighteen communal lands in Masvingo Province which is located at the southeastern corner of Zimbabwe. The Study Area, as a whole, is subject to considerable fluctuation in agriculture products in rainy season due to insufficient and erratic rainfall. There is no opportunity to cultivate during the dry season without irrigation. Large areas remain without reliable water sources. In many remote areas, water sources are insufficient in meeting the minimum requirement of water supply for domestic use and animals.

The Zimbabwe Government concentrated great effort on water resources development in the Large Dams Scheme. The water developed by the Scheme has been mainly used for the irrigation purpose in commercial farms of large scale.

Under the circumstances, the Zimbabwe Government has placed emphasis on the development of the communal lands since the Independence. The scheme of the Medium Size Dams Project has been induced by the needs for water resources development in the communal land.

The government of Zimbabwe requested the government of Japan to extend technical cooperation for the formulation of the development plan of the Medium Size Dams Project in the communal lands in Masvingo Province.

In response to the request of the Government of the Republic of Zimbabwe, the Government of Japan dispatched the preliminary survey teams through JICA twice to the Republic of Zimbabwe; first in October 1985 for the preliminary discussion about the Study, and second in February 1986 for the arrangement of the Scope of Work. The Government of Japan decided to conduct the Feasibility Study on Medium Size Dams in Masvingo Province in accordance with the relevant laws and regulations in force in Japan.

1.2. Objectives of the Study

The objectives of the Study are to investigate the feasibility of implementing Medium Size Dams Projects in Masvingo Province in Zimbabwe and to formulate viable project plans for the purpose of supplying water for irrigation, domestic and livestock uses in communal lands of the Province.

The Study consists of the following two phases: the Inventory Study of Phase I and the Feasibility Study of Phase II.

The Phase I Study is mainly composed of the followings.

- 1) To collect and review all the available data and information required for the study.
- 2) To identify possible project sites and to conduct preliminary screening of the sites by use of available data and maps.
- 3) To carry out field survey for proposed project sites.
- 4) To conduct preliminary evaluation and to make an inventory of projects sites with priority.

In Phase II Study, the following works are to be carried out on the selected projects which are agreed between MEWRD and the Study Team based on the result of Phase I Study.

- 1) To carry out additional field survey necessary for the feasibility study.
- 2) To carry out the analysis on water resources, agriculture, irrigation, socio-economy, etc.
- 3) To make a development plan of each project based on the above analyses.
- 4) To make preliminary designs of dam and irrigation facilities.
- 5) To estimate cost and benefit of each project.
- 6) To conduct project evaluation.
- 7) To programme project implementation schedule.

1.3. Background of the Study

The Phase I Field Survey was conducted from September to December in 1986. The major works of the field survey were site investigation of the potential dam sites and collection of data and information, such as meteorology and hydrology, irrigation, agriculture and socio-economics from MEWRD, AGRITEX, local governments and other government organizations concerned.

Following the field survey, the home office work was conducted to finalize the Inventory Study. Preliminary analysis on water requirement, reservoir yield, reservoir capacity and dam dimensions were carried out for each potential dam site. Based on the project features, project cost and benefit was roughly estimated and a preliminary economic evaluation in terms of economic internal rate of return has been carried out.

Interim report on the Inventory Study was prepared and submitted to Zimbabwe Government in May 1987. The dam site inventory includes the following items.

- 1) SUMMARY OF PROJECT FEATURES
- 2) GENERAL PLAN (SCALE: 1/50 000)
- 3) PLAN OF DAM AND RESERVOIR (SCALE: 1/10 000)
- 4) DAM SITE GEOLOGY
- 5) STAGE CAPACITY CURVE

The Phase II Field Survey of the Feasibility Study was commenced in June 1978. Before the start of the field investigation, discussions were held with MEWRD and AGRITEX on the selection of the dam sites for the Phase II Feasibility Study and following six projects were selected.

<u>No.</u>	<u>Name</u>
(1) I-2-1	Musaverema
(2) II-1-6	Chinyamatumwt
(3) II-2-1	Mashoko
(4) IV-4-10	Munjanganja
(5) V-3-3	Magudu
(6) VII-1-12	Mabvute

The field work for the Phase II Feasibility Study of the above six projects was carried out from June to September in 1987.

Following tests and surveys were executed for all the six projects.

- 1) Topographical survey on reservoir area, dam site and irrigable area.
- 2) Geological investigation by bore hole drilling with standard penetration test and permeability test.
- 3) Embankment material test.
- 4) Soil analysis for agriculture purposes.

This Final Report has been compiled according to the results of survey in the field and studies conducted in Japan, as well as on the basis of comments and discussion held between the Zimbabwe officials and the Study Team.

Government officials concerned are as follows:

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Mr. J.K. Mubako	District Administrator, Bikita
Mr. G.C. Maposa	District Administrator, Chiredzi
Mr. A.C. Chikurira	District Administrator, Gutu
Mr. A. Mpofo	District Administrator, Masvingo
Mr. G. Gumbo	District Administrator, Zaka
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The Team members are shown as follows:

<u>Expertise</u>	<u>Name</u>
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2. Deputy Team Leader/ Dam Engineer (I)	: Hironori TAKAHASHI
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7. Geologist	: Haruhiko NAKAMURA
8. Sociologist	: Atsushi CHITOSE
9. Agronomist	: Kunihiko OHNO
10. Agro-Economist	: Toshihide SHIBATA
11. Construction Planner	: Ken ISHIMARU
12. Surveyor	: Tsutomu KURIBAYASHI

CHAPTER 2 BACKGROUND

2.1. General

2.1.1. General Situation

The Republic of Zimbabwe achieved her Independence in 1980. Since the Independence Zimbabwe has steadily been stepping on the process of development of tribal societies. Such a remarkable stability would partly stem from perseverant maintenance of co-existence policy with expatriated white people, making full use of economic legacy created in the period of colonization. While following such co-existing policies, Zimbabwe became a member of SADCC (South Africa Development Coordination Conference) soon after the Independence, thus withstanding the racial discrimination in the Republic of South Africa, setting goals of socio-economic development in which native tribal people can take initiatives. As a prerequisite leverage to this goal, it is imperative to get rid of the current dual structure where there exists a great disparity between the subsistant economy in communal lands and commercial economy. And this is the reason why "growth with equity" was underlined in the Transitional National Development Plan which came into effect for three years after the Independence. The on-going "First Five Year National Development Plan (1986-1990)" has the following six major development objectives.

- 1) Transformation and control of economy as well as economic expansion,
- 2) Land reform and efficient utilization of land,
- 3) Raising the standards of living of the entire population, and, in particular, the peasant population,
- 4) Enlargement of employment opportunities and manpower development,
- 5) Development of science and technology, and
- 6) Maintenance of a correct balance between the environment and development.

These concepts aim to enhance the communal people's ability as high as that of European people, thereby accelerating economic independence in contrast with countries which experienced fails after having tried to pursue revolutionary development.

2.1.2. Current Achievement in Development

The current land use of the whole territory consists of 16.3 million ha of commercial farming areas, 16.6 million ha of communal lands, 0.2 million ha of urban areas and six million ha of land reserved for national parks, inland waters, etc. 56 per cent of the total population are the inhabitants in communal lands where the pace of development still remains in a low level. The agricultural production can hardly maintain 20 per cent of the national total. The Government formulated a budget plan in 1986/1987 fiscal year in which Z\$830 million standing at 20.6 per cent of the total national budget is to be invested to public development sector mainly in communal lands. This amount is equivalent to Z\$66 per capita inhabitant in communal lands, which would in turn amount to Z\$192 per capita if drought relief, medical care and education costs are included.

As a result of investing into the infrastructure development, many rural water supply facilities by boreholes are under construction, and consolidation of primary schools, clinics, rural development centres and road networks is under way. The finance for development becomes a burden on the national budget and 35 per cent of the national development expenses are relied upon external aid resources.

2.1.3. Development Strategies

Agriculture as a primary industry has a great income gap between its commercial sector and petty communal one. For a countermeasure to minimize such disparity, the Government has continued to subsidize on price control, agricultural credit, consolidation and maintenance of public facilities, etc. Direct objectives of these assistances include the support of subsistence of communal people by drought relief activities, but their ultimate goals should lie in the structural improvement by which communal

people can establish their independent economic base without governmental support.

Communal lands have very few employment opportunities at present due to low level of capital investment, leading to a flow of manpower towards urban areas. Even in urban areas labour opportunities are also limited, resulting in an enormous unemployment problem. Consolidation of irrigation facilities provides communal people with a larger labour absorbing capacity within agriculture, which in turn enables labour intensive agriculture. The Government is expecting irrigation schemes as one of the most useful public sectors to accelerate economic independence of communal lands.

2.2. National Economy

2.2.1. Economic Structure

Agriculture and manufacture are the major sectors in the country's economy. Gross Domestic Product is Z\$6 430 million, or Z\$786 per capita in 1985. G.D.P. derived from manufacture and that from agriculture represented 25 per cent and 14 per cent of the total G.D.P. in 1980, respectively, whereas their growth recorded during five years averaged only 1 per cent per annum for agriculture and 0.2 per cent per annum for manufacture. Although the Five Year Development Plan expects five per cent of growth per annum in agriculture and 6.5 per cent of it in manufacture, the latter figure is not likely to be realized because of the dependency on external trade.

Zimbabwe's trade is susceptible to the political situations prevailing among countries with transit ports. The land locked nature incurs an additional inland freight charges. Under the high rate of inflation over 20 per cent per annum, exchange rates changed from Z\$0.64/US\$1 in 1980 to Z\$1.67/US\$1 in 1986.

2.2.2. Structure of Agricultural Economy

Food self-sufficiency has globally been met in the country. As a whole, however, occasional deficiency arises in communal lands especially during continuous drought. Drought relief measures have been taken since

1982 by distributing free foods. Zimbabwe is one of the African countries to feed the nation without any external food aid. This is partly because the crop yield has fairly been stable under a considerable rate of irrigation coverage in commercial areas, and partly because the Government has taken due measures necessary for the food security. Consolidation of road networks and storage capacities of G.M.B. have been intensified since the Independence, thereby contributing much to this stabilization. Commercial lands with their advantages in agricultural production in various aspects like climate, land productivity or water supply have played a functional role in both food security and exports, thus contributing much to the State in terms of acquiring and saving foreign exchange.

On the other hand, communal lands have in many cases carried their population beyond their capacities on account of their original infertility of the land as well as poor resources, followed by an explosive recent population growth at the rate of over three per cent per annum. Under the conditions of chronic and critical hardship in sustaining daily life, local potential purchasing power has never been materialized and the radius of marketing sphere for local produce is seldom extended beyond their living circles. This is why communal people is often referred to as living on the border of monetary economy bloc. The arable land is estimated at 25 per cent of the communal lands in view of the natural region classification. Land degradation and erosion resulted from overgrazing are taking place, and the deterioration of land productivity is further accelerated by exploitable cultivation on unsuitable lands.

The government took the following measures to improve the above mentioned situations;

- 1) Provision of drought relief foods when need arises,
- 2) Extension of techniques through both AGRITEX and Veterinary services,
- 3) Strengthening of G.M.B. system and its efficient utilization,
- 4) Consolidation of cooperative systems and provision of resources for investment,
- 5) Prevention or alleviation of drought damage by securing irrigation source and domestic water,

- 6) Implementation of depopularizing measures in densely populated areas by promoting intensive and accelerated resettlement schemes.

Sales of communal farmers' surplus grains after replenishing their home granaries have increased through G.M.B. Monetary economy bloc is now expanding further to the remote areas in communal lands with infrastructure improvement and expansion of agricultural production.

2.2.3. Role of Agriculture in National Economy

In the commercial agricultural sector, inefficient or small scale farms have been screened out since the Independence, which led to a fast decreasing in the population ratio of white people. Labour absorbing capacity of commercial farms is actually decreasing with this process of screening. They, along with related sectors, still hold 270 thousand labourers, which stands at 25 per cent of the total employees in Zimbabwe. 700 to 1700 thousand ton of maize, 60 to 120 thousand ton of tobacco leaves, 100 to 150 thousand ton of raw cotton, 80 thousand ton of beef cattle, 100 to 190 thousand ton of crude sugar produced in these farms virtually support national export sector, having their share of 40 to 50 per cent in foreign exchange revenues.

On the contrary, communal lands are susceptible to drought damages. They have small investment in agricultural production and also production returns from investment are uncertain. The efforts made by the Government, raised the sales share of communal land products up to nearly 50 per cent by fortifying marketing structures including G.M.B., Cotton Marketing Board, Cold Storage Commission and Dairy Marketing Board. However, their share of sales, both in quantities and values, remains in 12 to 13 per cent of the national total or around Z\$30 per capita per annum. This level is quite low compared with that of the minimum wage, Z\$153 per month which has recently been applied to the payment for agricultural labourers.

The prospect of future agriculture was projected by the First Five Year National Development Plan, as standing on an important position to continue to play a nucleus role in national economy. Agriculture today

accommodates more than 70 per cent of local, economically active population, offers more than 25 per cent of the total labour opportunities, and holds more than 40 per cent in its share on commodity exports. Particularly, commercial farms received much higher and ample capital investment during two decades 1960s and 1970s, in which the rate of irrigable area coverage reached 16 per cent (in case of sown-area basis, it comes to 26 per cent). Most irrigated crops in commercial lands are for export or for major domestic market as industrial materials, while those in communal lands are mainly confined to local marketing.

2.2.4. Economy in Communal Land

Agriculture and pasturing are major economic activities in communal lands. Economic activities of 700 000 households in communal lands (average family members:6.3) shows that two of family members are engaged in agriculture. One to one and a half of them depend their livelihood on occasional employment or non-agricultural jobs. Farm income per capita per annum is estimated at Z\$60, hence a farm household receives only Z\$380 (even if home consumptive grains are converted into their value, Z\$570) per annum. The minimum wage for an agricultural labourer as decided by the Government is Z\$153 per month, then it follows that a common communal farm supports their family with income less than 30 per cent of the minimum wage level. This again implies that an average communal household still remains in the borderline of monetary economy. Their household budgets are supplemented with remittance from non-resident family members, public assistance, drought relief and other temporary jobs. The Government budget expenses to support communal people for medical, educational, social welfare, public services, etc. reached Z\$192 per capita per annum.

In the Five Year Plan, the Government puts importance on the agricultural development in communal lands, and intends to form and strengthen social capital in backward rural areas through investment to public infrastructure. Besides the promotion of the primary industry, the Government puts emphasis on agro-industries like marketing, processing and storage which will create employment opportunities. The Government also intends to mitigate expense presently required for price support on agricultural products and subsidies, which now is a burden on fiscal budgets.

2.3. General Situation of Masvingo Province

2.3.1. Population and Land Tenure

The Province consists of seven districts, namely, Mwenezi, Bikita, Chiredzi, Gutu, Masvingo, Chivi and Zaka.

From the view of administrative authorities, the Province is made up of seven district councils, four rural councils and one municipal council. According to the 1982 National Population Census, 18 communal lands, eight small scale commercial farming areas and one mine area fell under district councils in the Province. On the other hand, rural councils included six towns, large-scale commercial farming areas, two small-scale commercial farming areas and one resettlement area. Each district council is organized in each district but rural councils are responsible for commercial farming areas extending to several districts. One municipal council exists in Masvingo Municipalities, the headquarters of the Province. Apart from the areas under three kinds of councils, there is Gonarezhou National Park bordering on Mozambique on the south-west.

The population of the Province, according to the 1982 National Population Census, was 1 039 945 representing 13.7 per cent of that of the whole country and was estimated at 1 140 000 in 1985. The population distribution among administrative authorities is as follows;

Table 2-1 Population Distribution among Administrative Authorities

	1982	1985 (estimated)
District Councils	841 002 (80.9%)	923 187 (80.8%)
Rural Councils	167 522 (16.1%)	180 930 (15.8%)
Municipalities	30 642 (2.9%)	37 645 (3.3%)
Other area	779 (0.1%)	1 021 (0.1%)
Total	1 039 945 (100.0%)	1 142 783 (100.0%)

Source: The 1982 National Population Census, National Master Plan for Rural Water Supply & Sanitation by INTERCONSULT A/S.

The population density of the Province was 18.2 persons per sq.km in 1982 and was similar to the national average of 19.3. The communal lands in the northern part of the Province are densely populated, while the commercial farming areas and the communal lands located in the south of the Province are sparsely populated.

The population growth rate per annum in the Province was 3.05 per cent during 1969 - 82 (the inter-censal years). The growth rate of the entire communal lands was 2.6 per cent during the same period. As for the areas under rural councils, the growth rate was 2.9 per cent. There were about 209 000 households in the Province with the average household size of five. As a rule, the household sizes in the areas belonging to district councils are larger than those in the rural councils'.

The Province covers an area of about 57 000 sq.km accounting for 11.3 per cent of the whole country's. The land tenure of the Province is divided into communal lands, large scale commercial farming areas, small scale commercial farming areas, resettlement areas and national parks. The large scale farming areas comprise about 40 per cent of the total area of the Province, having only 5.7 per cent of the population, while the communal lands cover 37 per cent of the area with 77 per cent of the population.

2.3.2. Economic Activity

According to the 1982 National Population Census, 93.3 per cent of the total population of the Province live in rural areas and this figure is quite high, as compared with the national average of 74.3 per cent. This phenomenon shows that the main economic activities have been performed in the rural areas where a large number of dwellers are dependent on agriculture and the rural industries related to agricultural products.

Agriculture system in the Province can be largely classified into subsistence farming and commercial farming.

Subsistence farming has been performed by peasants in the communal lands with the average plotholding size of two to three ha, based on crop production supported by livestock. Main products accruing from this farming are the grain crops such as maize, rapoko and mhung for self-consumption by local farmers. A surplus from self-consumption has been purchased, mainly by G.M.B. But the purchased amounts fluctuate by year because the production is not stable due to rainfed agriculture. Several small scale irrigation schemes have been implemented in the communal lands throughout the Province for the purpose of the stable production, creation of employment and increase of cash income. The individual plot sizes range from 0.1 to 2.0 ha. A variety of crops are grown under the schemes. Main summer crops are maize, groundnuts and cotton, while sugar beans, tomatoes and wheat are produced in winter. Vegetables are grown throughout the year, but the products in some areas can not be purchased because the periods of their sales are synchronous with other producers. So far the system of production-marketing-sales in response to demand of consumers has not been improved.

Commercial farming in the Province is represented by sugar cane and wheat estates in Triangle and Hippo Valley, where large scale irrigation schemes bring water from Kyle, Bangala and Manjirenji dams, have been developed to a large extent in the lowveld. Especially, sugar is one of the main crops which can earn foreign exchange.

Following agriculture, the mining industry plays an important role in the Provincial economy, contributing to the provision of employment for more than 8 000. There are three large mines in the Province, namely Renco (gold), Bikita Minerals (lithium, cesium) and Mashava (asbestos), and are also several small scale mines throughout the Province.

There are a few production industries, which can offer some employment opportunities, in the Province. The most developed areas in this sector are Masvingo Town and the towns in the lowveld. Especially, the latter towns, such as Chiredzi and Triangle employ approximately 28 000 people in both agricultural and industrial sectors. Numerous persons tend to migrate to Chiredgi District from other districts, in order to get their jobs.

The 1982 National Census shows that Chiredzi District had a high intra-provincial net migration rate of 77.8 per cent. Apart from Chiredzi and Bikita (+14.1 per cent) Districts, the above rates of the remaining five districts were negative. In other words, it is anticipated that people in five districts are likely to emigrate to other districts like Chiredzi, seeking for employment. On the other hand, the inter-provincial migration rate of Masvingo Province was 12.1 per cent. 21 per cent of the population born in the Province have emigrated to other provinces, while immigration population in Masvingo accounted for only 10.6 per cent of the total population.

Masvingo town shares only one to three per cent in national outputs of industry sector and this figure is extremely low as compared with other headquarters of provinces such as Harare and Bulawayo. Such undeveloped industry sector of the Province causes the migration to other provinces.

Tourism sector is characterized as one of the most important sectors in the Province, having a high potential for growth. The Province is blessed with several internationally known tourist attractions, such as the Great Zimbabwe, the Lake Kyle and the Gonarezhou National Park.

2.3.3. Social Services

Main roads throughout the Province are constructed and maintained under two authorities. The Ministry of Transport is responsible for 2 300 km roads, of which the most important roads are Harare - Masvingo - Beit Bridge road (Route 304 - Route 504) through the north - south of the Province and the Birchenough Bridge - Masvingo - Bulawayo road (Route 409 - Route 509) linking the east - west in the Province. Several main roads linking between district centres and growth points, are now under construction by the Ministry. The District Development Fund (D.D.F.) is responsible for approximately 5 000 km of dirt or gravel roads. Several road linking service centres are also now under construction. Apart from the above authorities, Rural Councils have a responsibility for the maintenance of about 2 000 km of dirt and gravel roads in the commercial farming areas. In accordance with the expansion of resettlement areas, the

responsibility for the roads on the former commercial farming areas are transferred to Ministry of Lands, Agriculture, and Rural Resettlement.

There are six railway lines in the Province, mainly concentrating on the lowveld, most of which are operated for the transports of the agricultural products and inputs and the import commodities.

Water supply systems in the Province are largely divided into the urban areas and the densely populated rural areas. Piped water systems have already been installed in the urban areas such as Masvingo, Chiredzi and others. In line with the Government's rural development strategy, piped water systems have been promoted in important villages in communal lands, namely, growth points, district service centres and rural service centres. However, most inhabitants in communal lands are dependent on boreholes or insanitary water sources such as unprotected wells, rivers and streams.

Telephone exchanges exist in Bikita, Chatsworth, Chiredzi, Gutu, Mashava, Masvingo, Mwenezi, Triangle and Zaka. There are 14 full post offices in the Province, namely; Masvingo, Mangwandi, Chiredzi, Gutu, Triangle Zaka, Chikato, Bikita, Mwenezi, Mashava, Chivi, Mupandawana, Chatsworth and Renco Mine. Additionally 22 post agencies are provided.

Social services such as telecommunication, postal services and electricity services have been operated in only the areas with dense population.

As of 1985, there were 632 primary schools and 194 secondary schools with total enrolments of 331 892 and 83 881 respectively. A primary school teacher to pupil ratio is 1:45 in normal, against the recommended ratio of 1:40. A secondary school teacher to pupil ratio is 1:38 against recommended ratio of 1:30. Prior to the Independence, there were only 18 secondary schools in the Province but now the number reached 200. The education has been encouraged since the Independence, resulting in a significant progress.

There are 138 health facilities throughout the Province in 1985. Most of the health facilities were established in all district service centres, rural centres or business centres. At present, some of inhabitants in the communal lands have to walk more than 15 km to get health services. The construction of more clinics is needed as well as the enlargement of staffing at the existing clinics.

2.4. Communal Land

2.4.1. General

Masvingo Province is made up of seven districts. Each district has one district council and the 18 communal lands fall under the seven district councils. The 18 communal lands cover 21 263 sq. km in extent, accounting for about 37 per cent of the area of the Province. The 1982 National Population Census revealed that some 814 000 persons live in the entire communal lands in Masvingo, representing 78 per cent of the population of the Province.

The average population density is about 38 persons per sq. km which is 41 per cent higher than the national average of 27 persons per sq. km of the whole communal lands in the country. There were 150 403 households in all communal lands in the Province, implying the average household size of 5.4.

Table 2-2 shows the distribution of population, area, population density and household size by communal lands in the Province.

As for the age-sex distribution, two significant characteristics are seen, that is; 1) the age group below 15 years old occupies 54 per cent of the total population and 2) the proportion of males of the age between 20 and 40 years old is about a half of females. These facts, which can be seen in communal lands throughout the country, imply the high fertility rate and the migration of adult males to urban areas due to less employment opportunities in communal lands.

Table 2-2

Population and Number of Households of the Communal Lands

Communal Land	Population (1982)	No. of Households	Land Area (sq.km)	Population Density (persons per sq.km)	Household Size (persons)
I. BATANAI	73 327	13 912	2 063	35.5	5.3
1. Maranda	33 490	6 242	1 026	32.6	5.4
2. Matibi No.1	39 837	7 670	1 037	38.4	5.2
II. BIKITA	134 863	24 946	2 631	51.3	5.4
1. Bikita ^{*/}	100 374	18 958	1 931	52.0	5.3
2. Matsai	34 489	5 988	700	49.3	5.8
III. GAZA KOMANAI	62 660	11 880	5 286	11.9	5.3
1. Matibi No.2	31 012	5 521	2 206	14.1	5.6
2. Sangwe	17 400	3 615	635	27.4	4.8
3. Sengwe	14 248	2 744	2 445	5.8	5.2
IV. GUTU	164 701	31 472	3 621	45.5	5.2
1. Chikwanda	42 907	7 974	1 045	41.1	5.4
2. Denhere	3 818	738	75	50.9	5.2
3. Serima	9 019	1 738	200	45.1	5.2
4. Gutu	108 957	21 022	2 301	47.4	5.2
V. MASVINGO	103 343	18 295	1 716	60.2	5.6
1. Masvingo	34 892	6 283	505	69.1	5.6
2. Mtilikwe	16 094	2 941	299	53.8	5.5
3. Nyajena ^{**/}	40 165	6 799	622	64.6	5.9
4. Zimutu	12 192	2 272	290	42.0	5.4
VI. CHIVI	137 708	23 795	3 195	43.1	5.8
1. Chivi	103 656	18 072	2 517	41.2	5.7
2. Mashava	34 052	5 723	678	50.2	6.0
VII. ZAKA	137 891	26 103	2 751	50.1	5.3
1. Ndanga	137 891	26 103	2 751	50.1	5.3
Total	814 493	150 403	21 263	38.3	5.4

Note ^{*}/ Including Bikita Mine

^{**}/ Including Renco Mine

Source : The 1982 National Population Census by C.S.O.

2.4.2. Administrative Structure

The communal lands are administered by the district councils which form the basis of local governments. A local government consists of two bodies, namely a deliberative body composed of elected councillors and ex-officio traditional chiefs, and an administrative body headed by Chief Executive Officer who is at the same time, District Administrator (D.A.). D.As. are dispatched from the central government, Ministry of Local Government and Town Planning (M.L.G.T.P.).

A local government concerned with communal lands, is organized by four levels; village, ward, district and province. Masvingo Province has 1 186 villages. One village comprises about 100 families with about 1 000 persons, having a village development committee (VIDCO). The Province has 195 wards. One ward consists of five to six villages with a ward development committee (WADCO) and elected councillors.

The Provincial Authority is an autonomous legal body composed of the chairmen of all councils and selected chiefs in the Province. Administratively, the Authority falls under the M.L.G.T.P and the Provincial Administrator acts as a Chief Advisor. It is expected that the Provincial Council chaired by the nominated Governor, will represent all local authorities in the Province, not only in communal lands.

2.4.3. Historical Background

Traditionally, Mashona would perform sifting cultivation at subsistence level. At the end of the last century, "Native Reserves" to be occupied by only Africans under traditional tribal ways, were established.

Prior to the Independence, communal land was called "Tribal Trust Land" (T.T.L) and customary law remained to the interpretation of Kraal chiefs.

The division which had demarcated communal areas and other areas is of utmost importance because the division of lands, that is, commercial and communal areas, is still left.

Since the Independence, there have been new Registrations which aim to allow all citizens to purchase lands and to transfer legal authority over land allocation from traditional leaders to district councils. At present traditional authorities co-exist with a local government for the purposes of social control other than land allocation. However, some traditional chiefs, kraalheads still have influence on land allocation because they were elected as the councillors of WADCOS.

2.4.4. Socio-cultural Characteristic

Rural homesteads in communal lands generally contain separate dwellings, outbuildings surrounded by courtyards. Traditional dwellings units are made of pole and dagga with thatched roof. It is likely, at present, that the dwellings made of modern materials such as brick and corrugated-iron roof, have been built. Mixed dwelling units composed of traditional and modern dwellings dominate in the rural areas, accounting for some 50 per cent of total households in the communal lands in the Province.

Social services such as health, education, electricity, telephone and others have been promoted in communal lands, especially in rural service centres and business centres, in line with the Government's rural development policy. However, such facilities have not been provided enough to meet human needs in the communal lands. Thus there is still a long distance toward fulfilling the satisfactory living standard in the communal lands.

To integrate communal lands into mainstream of socio-economic development of the country, growth points and service centres have been established. It is anticipated that those new settlements will form the nuclei of agro-industries in the communal lands and thereby create employment opportunities for rural people. As of 1985, there are two growth points, seven district centres, 64 rural service centres and a number of business centres throughout the Province.

2.4.5. Economic Activity

The majority of population in the communal lands are dependent on agriculture. About 90 per cent of all heads of the households are engaged in agriculture as the primary economic activity. There are a handful of school teachers and the employees involved in activities such as construction, trade and manufacturing.

Agriculture income depends on crop harvest and livestock sale. The average holding land size is about two ha. In the areas belonging to Natural Region V, most farmers tend to plant the drought resistant crops such as sorghum, mhunga and rapoko in place of maize. On the other hand, maize, which is a staple food stuff in Zimbabwe, is cultivated to a large extent in the Natural Region III areas. Nowadays cash crops, e.g. cotton, sunflower and tobacco are being introduced throughout the communal lands.

Cattle, called 'status symbol' play a vital role in traditional, economic and agricultural rural life. Cattle not only provide meat and milk but also plough the fields and carry crops from the fields. In addition, the manure of cattle is of great value as fertilizer for crop cultivation. Approximately 60 per cent of households in the communal lands in the Province keep cattle with average keeping heads per household of about five. From an economical point of view, cattle are more important in the lowveld than in the high and middle velds because crop production is not favourable in the lowveld due to scarce rainfall, so that cattle are expected to be the sole source of cash income for the communal farmers.

Remittances from those working outside communal areas are the characteristic of economic situation in communal lands. About 40 per cent of households in the communal lands in the Province receive remittances from outmigrants working in other sites.

2.4.6. Development Policy

The development strategy emphasizes communal lands in order to redress the inherited imbalance in socio-economic conditions between urban and rural areas in accordance with the Government's philosophy of "growth with equity".

The Five-Year Masvingo Provincial Development Plan is presented, in view of constraints and potentials in the Province. The Development Plan is formed, aiming to solve the problems in the Province, that is, over population, low agricultural production, lack of industrial development, lack of employment opportunities, poor transportation services and lack of social infrastructure, etc.

The development policy for the communal lands should put a special emphasis on the increase in agricultural productivity, the reinforcement of rural industries related to agricultural products for the purpose of the increase of income for communal farmers and the enlargement of employment opportunities, in parallel with the improvement of rural infrastructural services. The Medium Size Dam Project is identified under this policy.

Some irrigation schemes and other agricultural projects should be positively implemented in consideration of the features in the respective regions. The communal farmers in Chiredzi and Chivi Districts have still received food grains distributed from the Government as the drought relief service, despite of the comparatively good weather condition during the 1985-86 season. On the other hand, in the other districts such as Gutu and Masvingo, a surplus of maize occurred and as a result, AGRITEX recommended the introduction of other crops like oil seed crops even in the communal lands. Thus, agricultural situation is significantly distinct in each region, and so it is considered that agricultural systems suitable to the communal lands should be established, together with the improvement of marketing system and the promotion of agro-industries. The Provincial Development Plan (1985-90) proposes the following agricultural development plans;

- 1) the establishment of new irrigation schemes and expansion of existing ones.
- 2) growing of crops suitable to each agricultural region to increase yields of food and cash crops.
- 3) the promotion of improved cattle management technique aimed at increasing cattle sales
- 4) improving effectiveness of extension services
- 5) the encouragement of the formation of agricultural Co-operatives
- 6) improving knowledge and access to credit and marketing facilities.

CHAPTER 3. POTENTIAL DAM SITE AND PROJECT SELECTION

3.1 Identification of Potential Dam Sites

Before the visit to Zimbabwe a preparatory study on provisional list of potential dam sites has been performed in Japan. The list showed tentative dam sites for the discussion with the Government of Zimbabwe.

A procedure and condition for selection of potential dam sites based on available data are as follows:

1) Selection Study of Dam Sites on the Map of 1/50 000

The Study Team has obtained the latest 1:50 000 map that should be most accurate map for public use. The map involves not only land features and contours, but also water flow of creek, houses and huts, public institutions (business centre, school, clinic, airport etc.) and others which might be useful for the selection of potential dam sites.

2) Checking by Aerophotograph

An interval of contour line in 1/50 000 map is 20 meters and it is fairly rough for dam site identification. To confirm the proper location of dam sites, an observation of aerophotograph scaled 1/25 000 has been performed on each dam site. Some dam sites have been transferred to new sites.

3) Comparison with Existing Dam Scheme

On the scheme of medium size dams in Masvingo Province made by the Government of Zimbabwe, 15 projects were completed and three (3) projects are planned. After the comparison with existing or planned dam schemes, a few dam sites were eliminated to avoid the duplication. Finally 115 dams were selected as potential dam sites in the study in Japan.

4) Consultation with Zimbabwe Government

The list of dam sites made in Japan was mainly based on topographical condition through the 1:50 000 map. Social and agricultural aspects such as needs for water or agriculture development potentiality have not been taken into consideration on the selection of dam sites, because of lack of relevant data and information in Japan. In advance to the field investigation, meetings for the selection of dam sites were held among the Study Team, District Administrators, regional extension officers of AGRITEX and engineering officers of the District at each district administrator's office. Consequently 94 dam sites in the seven districts were selected as potential dam sites to be studied in the Phase I Study. It counts 75 dam sites from the dam list made in the study in Japan, and 19 dam sites newly proposed by the meeting.

3.2 Preliminary Evaluation of the Project

Priority ranking of the project implementation should be studied based on not only economic viability but also need and support from the inhabitants, governmental policy of area development, budget and implementation schedule. In the stage of inventory study, however, the priority ranking is evaluated according to the economic viability only. Based on the economic internal rate of return, the marks 'A', 'B' and 'C' have been given to each project. Each mark shows the following:

- A; Economic internal rate of return more than or equal to 5 per cent
- B; Economic internal rate of return more than zero per cent but less than 5 per cent
- C; Economic internal rate of return less than zero

The result of ranking by economic internal rate of return for 94 dam sites is summarized as follows:

<u>Rank</u>	<u>Economic Internal Rate of Return</u>	<u>Number of Sites</u>
A	more than 5 per cent	17
B	more than zero but less than 5 per cent	32
C	less than zero per cent	45

The major features of the 17, A'ranked priority projects are shown in Table 3-1. These 17 'A' ranked projects have relatively large irrigable areas ranging from 20 ha to 80 ha. As for water conveyance method, eight projects among 17 adopt gravity method and the other nine adopt pumping method.

3.3 Project Selection for the Feasibility Study

Based on the Dam Site Inventory in the Interim Report, meetings were held among the Study Team, MEWRD and AGRITEX, and the following priority projects were selected.

No.	Name	District	Communal Land	Irrigation Method	Ranking
(1) I-2-1	Musaverema	Mwenezi	Matibi I	Gravity	A
(2) II-1-6	Chinyamatsumwa	Bikita	Bikita	Pump	A
(3) II-2-1	Mashoko	Bikita	Matsai	Gravity	B
(4) IV-4-10	Munjanganja	Gutu	Gutu	Gravity	A
(5) V-3-3	Magudu	Masvingo	Nyajena	Gravity	A
(6) VII-1-12	Mabvute	Zaka	Zaka	Pump	A

The locations of the selected six projects are shown in Figure 3-1.

This selection was based on:-

- (i) The area irrigated.
- (ii) The ranking according to the EIRR.
- (iii) Preference for gravity fed schemes although MEWRD requested some pump schemes as a trial.
- (iv) The current projects being planned for implementation.
The reason for dropping the projects in Chivi and Chiredzi District was that Mbindangombe Project in Chivi and Chironga Project in Chiredzi are already being implemented there.

- (v) The areas that are most in need of irrigation.
Region IV Gutu and Region V Nyajena.

The reason for selecting Mashoko Project is as follows:

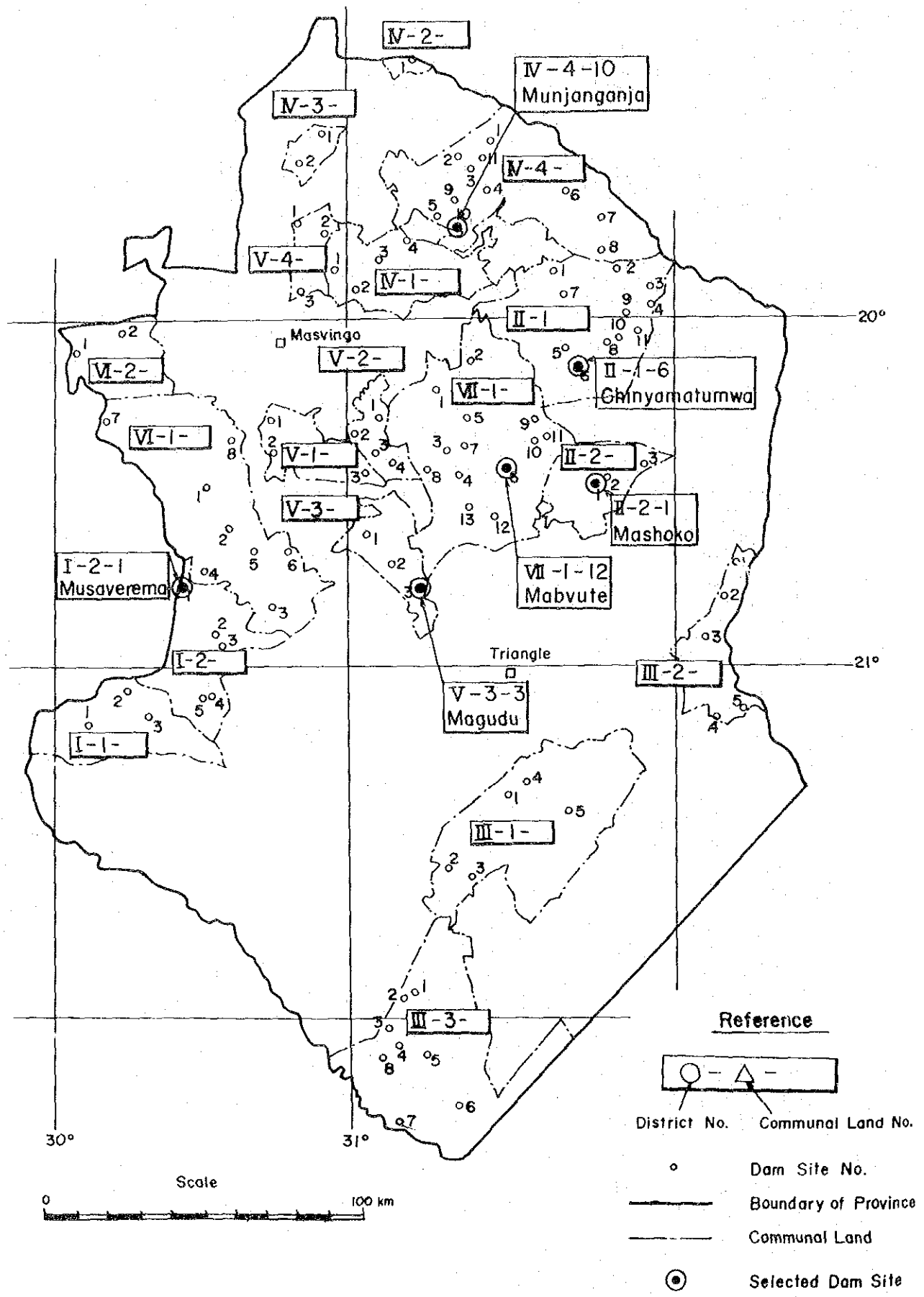
- There has been very little development in that area.
- There is ardent support from the people for the irrigation project.
- Economic viability of the project is fairly good.

Table 3-1 Summary of Priority Project

Location		Hydrology		Dam		Irrigation		Cost	Benefit	Evaluation	
District	No.	Catchment (km ²)	Capacity (10 ³ m ³)	Yield (10 ³ m ³)	Height (m)	Embankment (10 ³ m ³)	Area (ha)	Method	Total (10 ³ Z\$)	(10 ³ Z\$/yr.)	EIRR
Mwenezi	I-2-1	131.0	4 780	801	10	105	40.1	Gravity	1 488	155	8.9
Bikita	II-1-6	16.4	2 450	659	18	115	38.8	Pump	2 310	184	8.9
	II-1-10	16.3	1 500	319	15	81	18.8	Gravity	895	64	5.9
Chiredzi											
Gutu	IV-1-3	11.8	1 770	301	11	55	17.7	Gravity	697	82	9.9
	IV-4-2	17.5	1 390	350	13	82	20.6	Gravity	967	99	9.2
	IV-4-10	52.8	1 240	584	18	133	34.4	Gravity	1 472	164	9.5
Masvingo	V-1-3	48.7	4 270	1 313	18	147	77.2	Pump	3 221	248	8.8
	V-2-1	16.0	700	534	18	53	31.4	Pump	1 992	143	7.3
	V-2-4	20.5	1 750	732	18	90	43.1	Pump	2 371	135	5.7
	V-3-2	30.8	3 000	1 128	18	152	66.4	Pump	741	180	5.0
	V-3-3	41.9	5 780	954	17	129	56.1	Gravity	1 783	266	12.6
Chivi											
Zaka	VII-1-1	14.0	1 670	981	18	84	57.7	Pump	2 404	270	13.9
	VII-1-2	20.0	440	500	18	83	29.4	Pump	1 825	136	8.3
	VII-1-3	18.3	1 500	549	18	128	32.3	Gravity	1 139	155	11.6
	VII-1-8	25.1	4 500	1 443	18	220	84.9	Gravity	2 725	237	7.4
	VII-1-11	48.1	2 790	996	15	89	58.6	Pump	2 935	162	5.7
	VII-1-12	31.1	2 930	1 265	17	99	74.4	Pump	3 599	359	12.1

Note: These figures are based on the Inventory Study.

Figure 3-1
Selection of Dam Site for Feasibility Study



CHAPTER 4 THE PROJECT AREA

4.1. Location and Topography

4.1.1. Musaverema (I-2-1)

Project area is situated in the southeast of Matibi Mission, on the Musaverema river which meets the main stream of Runde river in its 6.0 km east. The driving trip from Masvingo to the area takes two hours, one hour on the Beitbridge main road crossing Runde river, and another one hour on the dirt road.

The dam site is located at 200 m upstream of the Musaverema river from the road bridge, which links the Matibi Mission with the Neshuro B.C. Between the bridge and dam site, existing weir of 20 m width and 2.0 m height, which is almost silted, is seen.

The geography in the catchment is characterized by the fairly plain area with an average of 1/20 slope along the Musaverema river. The boundary of the catchment is shared by a chain of granite hills with a height of 100 - 200 m.

4.1.2. Chinyamatumwa (II-1-6)

The project area is situated in the east of the Garange School, which is located 15 km southeast of Bikita District Office. The condition of the dirt road from Mutare main road to the project area through Bikita is fairly good. So, it makes possible a 30 minutes' driving access from Bikita to the area, and a total 2 hours trip from Masvingo.

The dam site is located on the Chinyamatumwa river. The catchment area of the dam is able to be seen in perspective from the access road on the ridge.

The geography of the project area is fairly plain. The bed slope of Chinyamatumwa river is 1/70 on an average. The eroded condition along tributaries of Chinyamatumwa river is not discernible, although a sheet runoff from the sandy soil, covering the entire area of catchment, forms a river bed sediment.

4.1.3. Mashoko (II-2-1)

The project area is situated closely 1.0 km northeast of the Mashoko Mission in the Matsai C.L. which is the most remote area from Masvingo town in the Province. The dam site is located on the Chenyere River, which meets Turgwi River of Sabi River basin, 4 km northeast. The trip from Zaka to the Project area takes one and a half hours driving on a dirt road. It enables access to the area from Masvingo within three hours.

The catchment is mantled with bushes and trees of 5.0 m height along the river, causing it to be impossible to have a wide overview of the entire area, unlike other areas.

The geography of the area consists of mild rolling hills along both the banks of Chenyere river, and its vicinity is configured by a chain of hills of 900 m altitude, running from northeast to southwest.

4.1.4. Munjanganja (IV-4-10)

The project area is situated 25 km southeast of Gutu District Office, and the dam site is located on the Mutore river between Munjanganja primary and secondary schools. The trip from Masvingo to the project area takes two and a half hours of travel through Gutu District Office, alternatively through Mutare main road and Manjokojo School, takes two hours, though the surface condition is worse to the project area.

The relatively plain catchment area of 52.8 sq.km, the altitude of which ranges from 1,130 m to 1,320 m, is bordered by the range of hills, with height of 100 m. The whole catchment area is open to view from the dam site.

The surface of relatively high area in the catchment is bare to the sandy soil, although the erosion is merely developed, even in the tributaries of the Mutore river. The vegetation of the area is predominant with the grass land in low bush, which is fitting for pasture. The geography of the downstream changes to become more mild than the upstream.

4.1.5. Magudu (V-3-3)

The project area is situated 13 km southwest of Bangala dam in the Nyajena C.L., and its dam site is located on the Mwedzi river. The irrigable area, neighbouring with the Magudu School, extends 5.0 km southeast of the dam site, including existing arable land.

The driving trip from Masvingo to the project area takes one and a half hours on the Triangle main road through Ngundu Halt and a further half hour on the access dirt road to Bangala dam.

The catchment of 41.9 sq.km varies its altitude from 510 to 600 m. The boundary of the catchment is delineated by two lines of hills running from east to southwest with a 5.0 km distance. The geography becomes steep at the foot of those hills, though a rather gentle geography on both banks of Mwedzi river is seen. The average bed slope of the river in the catchment is 1/130.

4.1.6. Mabvute (VII-1-12)

The project area is situated in the southern part of Ndanga C.L., which is 25 km south of Zaka District Office. The dam site is located just 0.5 km upstream from Mabvute B.C. along the Musuche river, which flows into Lake Macdaniel.

The trip to the project area takes one hour, driving from the Zaka District Office through St. Anthony's Mission and Chivamba B.C., which means two and a half hours driving distance from Masvingo.

The Musuche river course around the dam site has an average depth of five to seven meters, forming the deep section against the fairly gentle slope of surroundings. The catchment of 31.1 sq.km stretches over the altitude in the range from 630 m to 730 m. The northern ridge of the catchment is bordered with the road, from Rudhanda School to Chivamba School, which makes it possible to view the entire catchment.

Table 4-1 Location Indices of Project Area

Name of Dam (No. of Dam)	Musaverema (I-2-1)	Chinyamatumwa (II-1-6)	Mashoko (II-2-1)	Munjanganja (IV-4-10)	Magudu (V-3-3)	Mabyute (VI-1-12)
1. General						
District	Batanai	Bikita	Bikita	Gutu	Masvingo	Zaka
Communal Land	Matibi I	Bikita	Matsai	Gutu	Nyajena	Ndanga
Ward	No. 9	No. 6	No. 3	No. 26	Dowa 6	Dzoro North
Map Reference	2030D3	2031B1	2031B4	1931C4	2031C3	2031C2
2. Dam Site Location						
Coordinates	TN 397011	UN 654702	UN 709346	UP 278155	UN 143006	UN 388234
Latitude	20°46'00" - 20°46'26"	20°09'44" - 20°09'44"	20°29'10" - 20°29'10"	19°45'00" - 19°45'00"	20°46'28" - 20°46'28"	20°35'03" - 20°35'03"
Longitude	30°30'00" - 30°30'00"	31°42'40" - 31°42'40"	30°45'42" - 30°45'42"	31°21'00" - 31°21'00"	31°09'18" - 31°09'18"	31°27'07" - 31°27'07"
Altitude (m)	672	736	664	1134	514	630
3. Irrigable Area						
Coordinates	TN 4101, 4201	UN 6470, 6471	UN 7234	UP 3018	UN 1299, 1399	UN 3822, 3923
Latitude	20°46'00" - 20°46'00"	20°09'20" - 20°09'20"	20°29'00" - 20°29'00"	19°43'10" - 19°43'10"	20°48'00" - 20°48'00"	20°35'00" - 20°35'00"
Longitude	30°31'00" - 30°31'00"	31°42'20" - 30°42'20"	31°46'20" - 30°46'20"	31°22'40" - 23'20"	31°12'40" - 30°12'40"	31°27'00" - 30°27'00"
Altitude (m)	650-668	750-770	636-642	1130-1140	485-495	635-659
4. River at Dam Site						
Name of River	Musaverema	Chinyamatumwa	Chenyere	Mutore	Mwedzi	Mushuche
Name of Hydro.Zone	Lundi (EL2)	Turgwe (ES3)	Mkasini (ES1)	Devule (ES4)	Mid Umtilikwe (EUT2)	Upper Chiredzi (EC2)
Catchment Area (km2)	131.0	16.4	27.2	52.8	41.9	31.1
5. Common Utility						
Name of B.Centre (km)	Neshuro (26.)	Mujiche (4)	Magocha (3.)	Mutanbara (6.)	Nyamande (4)	Mabyute (0.5)
Name of School (km)	Shazhaume (10.)	Garange (1.)	Zindove (4,5)	Munjanganja (0.5)	Magudu (5)	Chipfunde (1.0)
Name of Mission	Matibi (3.)	—	Mashoko (2)	—	—	—

4.2. Meteorology and Hydrology

4.2.1. Meteorology

In order to work out the reservoir yield, the meteorological data up to 1986 is collected with the cooperation of both the Department of Meteorological Services and MEWRD in Harare.

Six project areas of the Feasibility Study are located in the northern part of the Province, stretching between Masvingo and Buffalo Range, from 20° to 21° in south latitude. In this zone, three meteorological stations are operated at Masvingo, Buffalo Range and Zaka observing rainfall, relative humidity, temperature, windspeed, sunshine hour and evaporation.

Mean annual records of 10 years from 1976 to 1985 are listed in Table 4-2 to compare the meteorological trend among those stations. Temperature and relative humidity show the proportional transition as the latitude varies from north to south.

The temperature in two stations of Masvingo and Buffalo Range shows three to four degrees differences summarized as below:

	Annual Mean	
	<u>Daily Maximum</u>	<u>Daily Minimum</u>
Masvingo	26°	13°
Buffalo Range	30°	16°

On the other hand, the relative humidity of annual mean tends to diminish as increase of latitude, in particular Masvingo; 67 per cent, Buffalo Range; 63 per cent and Zaka; 64 per cent.

Mean monthly values of those annual mean are as listed in Figure 4-1.

4.2.2. Rainfall

To confirm the isohyet values of six project areas, the rainfall station located in the neighbourhood is selected for each project area. The station has been under operation for more than 30 years, and proved its reliability from comparison with the other nearby station in the common span of observation period.

For six project areas, the comparison of annual rainfall between isohyet and observed values at closed stations are listed in Table 4-3. It expresses only two per cents difference between two values in four project areas i.e, Musaverema (I-2-1), Mashoko (II-2-1), Munjanganja (IV-4-10), Mabvute (VII-1-12). According to this result, the interpolated values on the isohyet map are proved to be reliable.

In Chinyamatumwa (II-1-6) area, there is 270 mm difference of annual rainfall between two observing stations situated 10 km distance from dam site to each direction. The isohyet value of 800 mm, which is a mean of two observation values, shows 14 per cents difference, when compared to each observation value.

In Magudu (V-3-3) area, the observation value of 805 mm recorded 15 km far away from dam site is 13 per cents higher than the isohyet of 710 mm.

For those two stations, although there is a considerable difference between isohyet and observation values, the isohyet is also proved tolerable for practical use from these three reasons. Firstly, the difference is in the range of 13 and 14 per cents. Secondly, there is a rather distance between dam site and observing stations. Thirdly, isohyet shows conservative value in viewpoint of water resources of dam project.

4.2.3. Evaporation

The value interpolated on the map derived from the Climate Handbook of Zimbabwe is reviewed by the latest 10 to 20 years' record in three

stations, namely Makaholi, Manjirenji Dam, Bangala Dam and listed on Table 4-4.

From this table, the observed value of three stations reveals only two per cents difference with the interpolation on the map, so that the adoption of the map to estimate the evaporation at those stations are proved to be reliable.

In regard to the adoption of the map to estimate the annual evaporation in 6 project areas, it is also proved favorable from following two viewpoints. Firstly, the spatial variation in the northern part of the Province is little from 1 700 to 1 900 mm. Secondly, 6 project areas are closed to the three observing stations with evaporation values close to the map value.

Annual evaporation at six project areas is as listed in Table 4-4.

4.2.4. Siltation

The majority of small and medium size dams in middleveld of the Province are subject to the threats of high sediment yield which causes ill effect on the reservoirs of low storage ratio. Under these circumstances, a simple and reliable way of making quantitative estimates of areas affected by soil erosion is awaited.

In this regard, the siltation and soil erosion project (SSEP), which was essentially an integrated siltation and soil erosion research project, established the relationship between siltation and soil erosion and reported results in the title of "Soil and Water Conservation".

The report mentioned that the sediment yields in the middleveld are in the range of five times or more of those in the highveld, e.g. Manjirenji 319 tonnes/sq.km/annum, Siya 319 tonnes/sq.km/annum, Bangala 232 tonns/sq.km/annum, of which catchments are actually surveyed by the SSEP and situated closely to six dam sites of the Feasibility Study.

Table 4-2 Mean Annual Meteorology from 1976 to 1985

Station	Record Rainfall (mm.)	Temperature(°C) Max. Min.	Relative Humidity (%)	Wind Speed (knot)	Sunshine H. (hour)
Masvingo	630	26 13	67	6.1	8.1
Zaka	780	28 15	64	2.8	no data
Buffalo Range	180	30 16	63	3.3	8.8

Figure 4-1 Mean Monthly Meteorology

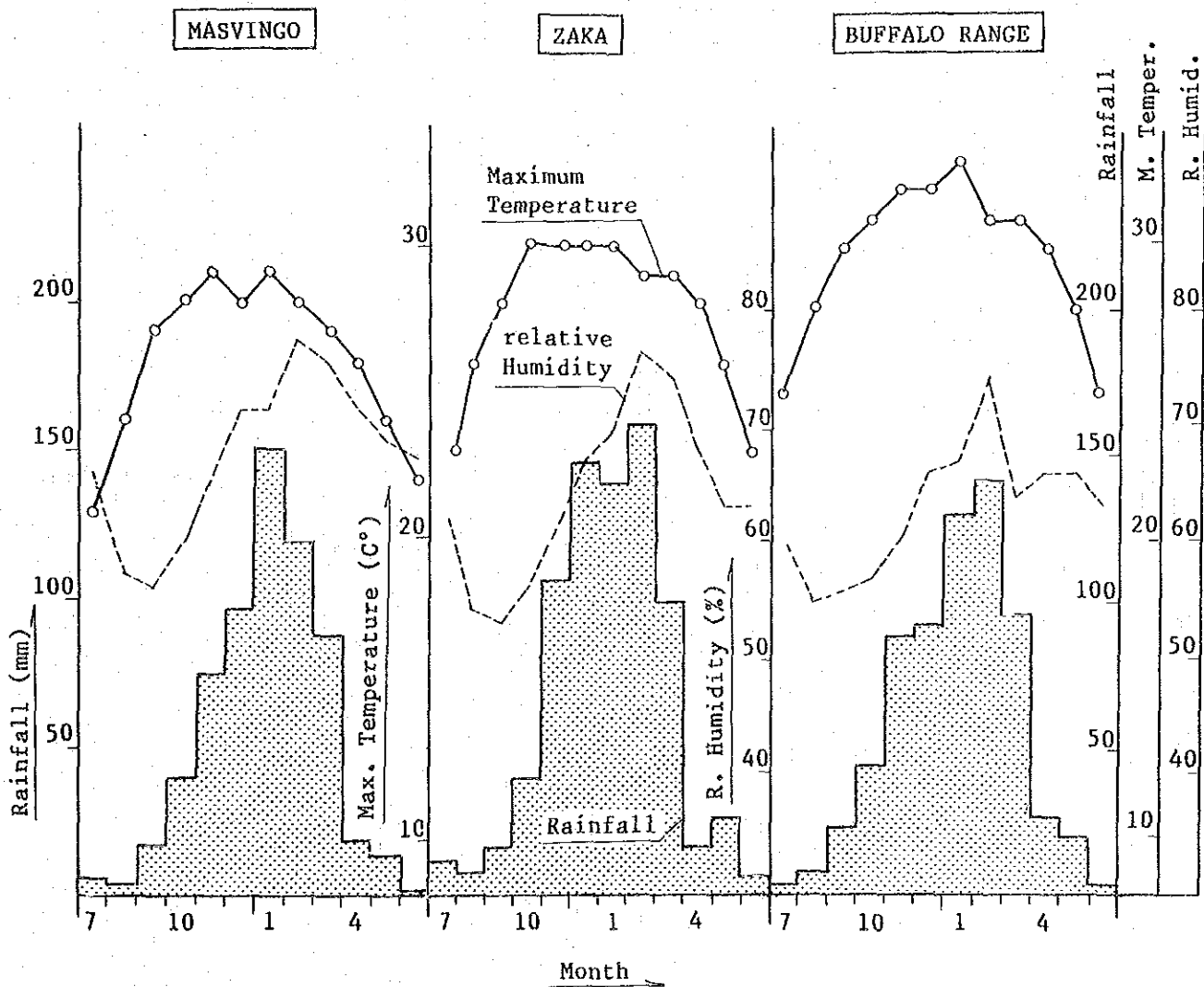
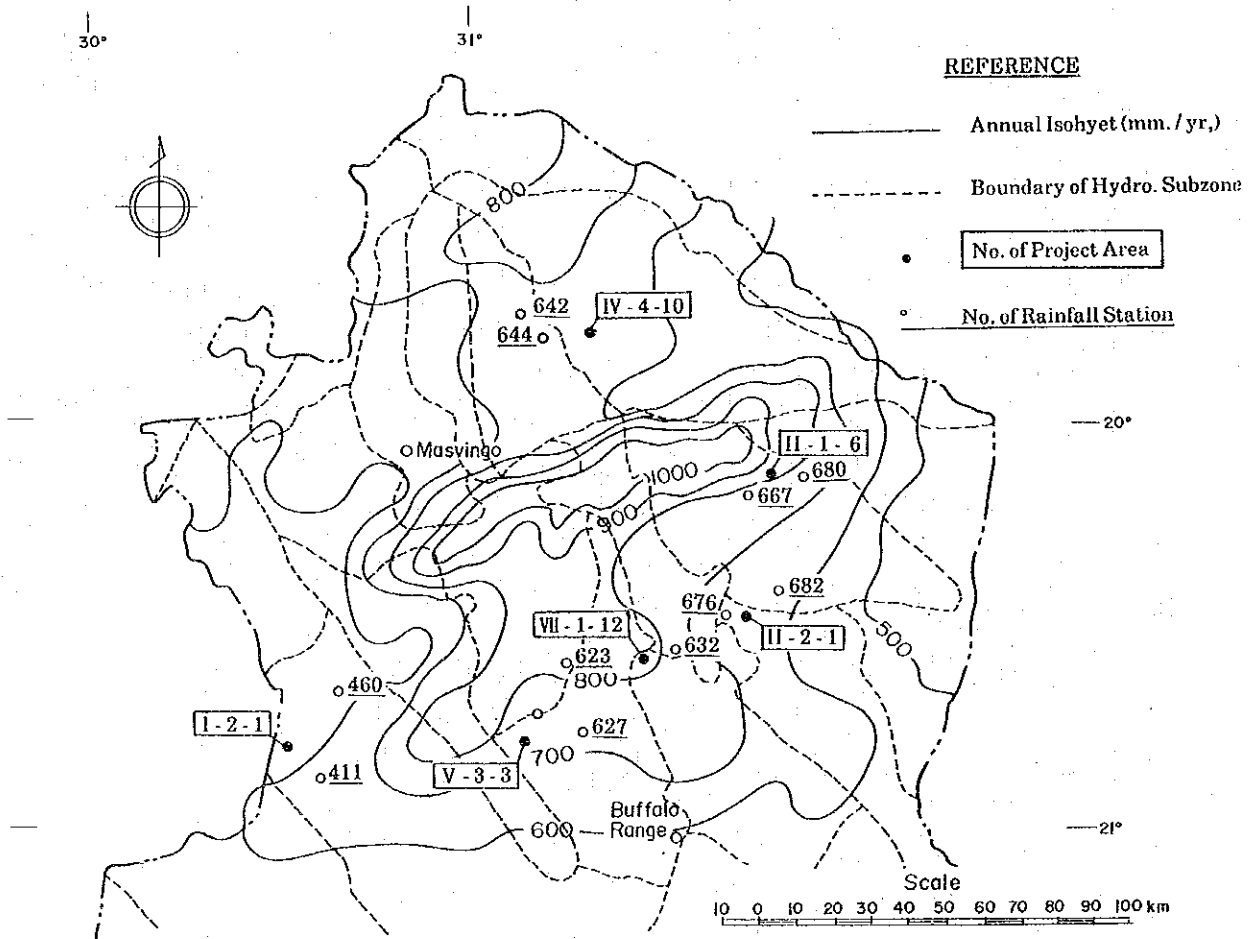


Table 4-3 Mean Monthly Rainfall

PROJECT AREA	Rainfall Station No.	Rainfall Station Name	Distance to Dam	First Record	Examined Data Period	Mean Annual Rainfall	Isohyet at Dam site
Musaverema (I-2-1)	460	Chendebvu Dam	22 ^{km}	1952	1961-85	592 ^{mm}	580 ^{mm}
	411	Stera	15	1961	- do -	611	
Chinyamatumwa (II-1-6)	667	Mushandure	10	1950	1951-85	968	800
	680	Makoro	12	1950	- do -	691	
Mashoko (II-2-1)	676	Mashoko	2	1950	1951-85	857	640
	682	Chiremwaremwa	10	1953	1953-85	631	
Munjanganja (IV-4-10)	644	Fungidza Hill	18	1947	1951-85	659	740
	642	Mukaro	22	1947	- do -	742	
Magudu (V-3-3)	627	Faversham	15	1952	1951-85	805	710
	615	Bangala	9	1961	1961-86	880	
Mabvute (VII-1-12)	623	Zingwena	5	1953	1956-85	739	810
	632	Svuure	7	1950	- do -	823	

Figure 4-2 Location of Rainfall Station



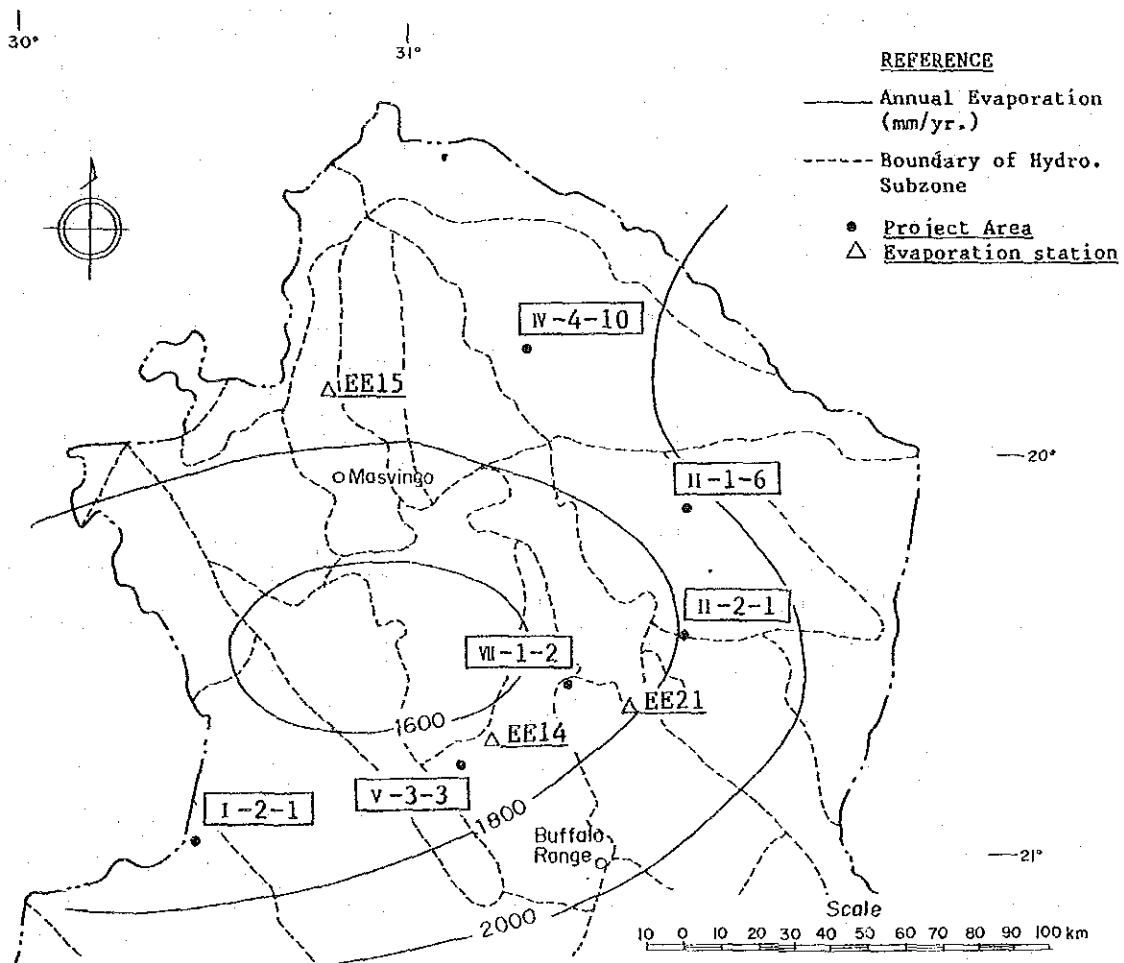
Note: Isohyet value..... derived from the map of Mean Annual Rainfall compiled by the Department of Meteorological Services

No. of Rainfall Station.... No. of Station Network listed by Meteorological Service

Table 4-4 Mean Annual Evaporation

Observing No.	Station Name	Examined Period	Data Mean	Map Value	Related Project	
EE15	Makoholi	1965-85	1880 mm	1900 mm	Chinyamatumwa Munjanganja	(II-1-6) (IV-4-10)
EE21	Manjirenji Dam	1975-85	1830	1800	Mashoko	(II-2-1)
EE14	Bangala Dam	1975-85	1660	1700	Mabvute Magudu Musaverema	(VII-1-12) (V-3-3) (I-2-1)

Figure 4-3 Mean Annual Evaporation



On this viewpoint, five dams among those six, which have relatively high storage ratio, between 0.8 and 2.0, are estimated to lose their volume in the range of 10 per cent of whole reservoir capacity within the dam life period of 20 years, which a moderate siltation value of the middlelevel is applied, around 300 tonnes/sq.km/annum.

On the other hand, Munjanganja dam (IV-4-10) in Gutu C.L. has a low storage ratio of 0.44 which causes 20 per cent dead volume of gross reservoir capacity if the sediment yield of 320 tonnes/sq.km/year of Manjirenji Catchment is applied. As a result, the estimated dead volume of Munjanganja becomes more significant than the other five areas.

The review of siltation on those six dams is based on the result of the SSEP, which enables the estimation of a sediment yield in a quantitative aspect by getting the strong correlation ($p = 0.71$) between the sediment yield from a catchment and a soil erosion index.

The method to estimate the state of active soil erosion is based on the stereoscopic interpretation of aerial photographs, as described in the mentioned report of SSEP. It is possible to identify footpaths, cattle tracks, broken contours, rill and gullies, and to extract information on which a map shows the state of erosion classification. The size of the catchments for five project areas, which are in the range from 30 to 50 sq.km, makes it possible to have a close investigation to confirm the actual state of erosion by the field trip.

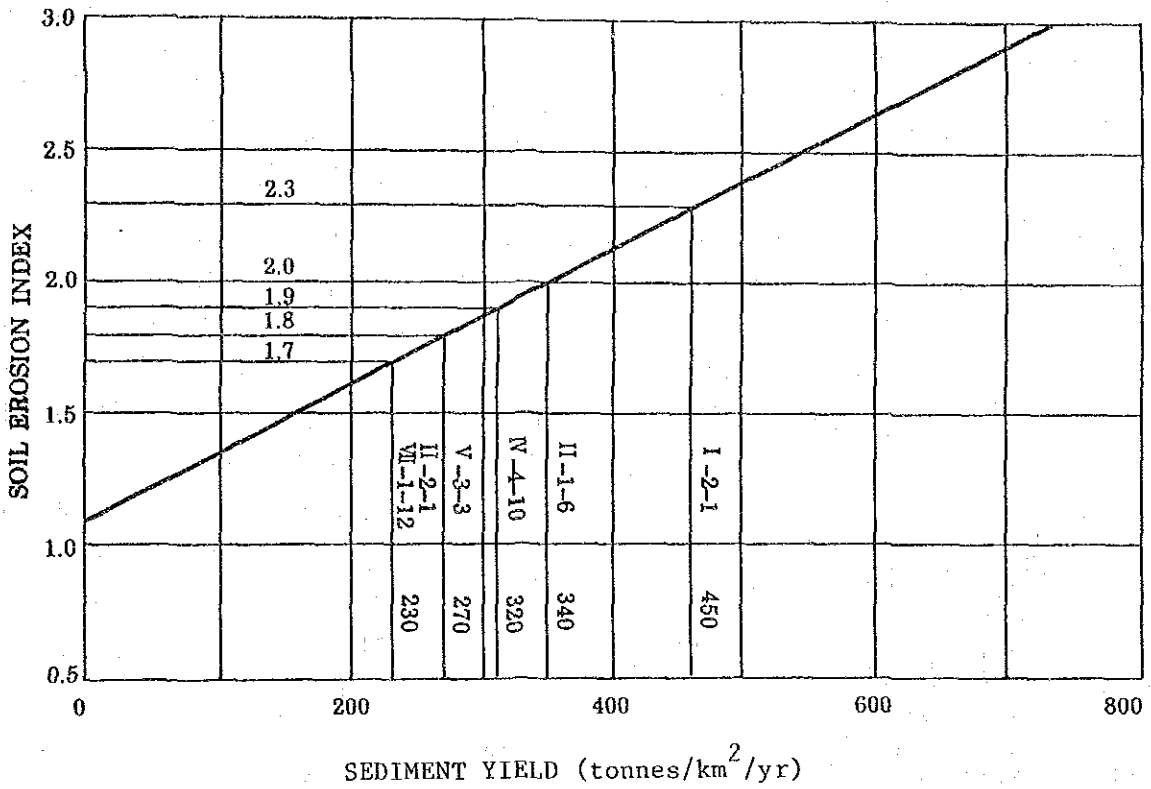
According to the principle of land state classification as mentioned in the report, the interpretation of aerial photographs is conducted from a scale of 1/25 000 with a stereoscope.

Based on the stereoscopic photo interpretation and field investigation, the soil sediment yield is decided by using the result of erosion index. The sediment volume to dam reservoir is interpolated from the Figure 4-4 which shows the relation between soil erosion index and sediment yield.

These results of six project areas are summarized in Table 4-5.

Comparing with the sediment volumes among six project areas, the minimum value is 230 tonnes/sq.km/yr. in Mashoko (II-2-1) and Mabvute (VII-1-12) areas, and maximum value is 450 tonnes/sq.km/annum in Musaverema (I-2-1) area.

Figure 4-4 Relation between Soil Erosion Index and Sediment Yield



(Copied from 'Soil and Water Conservation')

Table 4-5 Sediment Volume in Reseruoir

Project Area NO.	Name	Erosion Index	Sediment Yield (t./km ² /yr.)	Catchment Area (km ²)	Sediment Volume in 20yrs (×10 ³ m ³)
I-2-1	Musaverema	2.3	450	131.0	873
II-1-6	Chinyamatumwa	2.0	340	16.4	83
II-2-1	Mashoko	1.7	230	27.2	93
IV-4-10	Munjanganja	1.9	320	52.8	251
V-3-3	Magudu	1.8	270	41.9	168
<u>VII-1-12</u>	<u>Mabvute</u>	<u>1.7</u>	<u>230</u>	<u>31.1</u>	<u>106</u>

4.3. Dam Site and Geology

As to the selected six dam sites, location, geology, fill material condition, distance between dam and facilities involved, etc. are briefed in the following tables. In the table approximate hauling distance of embankment materials of prospected borrow area, or quarry site is shown in the parenthesis.

Table 4-6 (1) Brief of Damsite

No.	I-2-1	Name	MUSAVEREMA
Location	District: Batanai	Communal Land: Matibi No.1	
	Map Ref.: 2030 D3	Coordinate: TN 397011	
Geology	The damsite consists of gneiss and flood plane deposits. Faults and folds are not recognized in the field.		
Slope of Abutment	Right: Very gentle (1:60)	Left: Gentle (1:45)	
Embankment Material	<p>Earth materials: Light reddish brown, silty sands or sandy silts on the right abutment (d=0.8km), and dark grey, less cohesive, silty or fine sands on the left abutment (d=0.8km).</p> <p>Rocks: Fully out-cropped, hilly, gneiss quarry on the upstream left abutment (d=0.9km).</p> <p>Sands: Deposits on the river-bed are abundant (d=0.2km).</p>		
Distance from Dam Centre	D.A. Office: 75 km	Main road: 0.5 km	
	Proposed Irri. Area: 6.0 km	School: 0.35 km (Primary School)	

No.	II-1-6	Name	CHINYAMATUMWA
Location	District: Bikita	Communal Land: Bikita	
	Map Ref.: 2031 B1	Coordinate: UN 654702	
Geology	The basement rocks around the damsite consist of pegmatite, dolerite and terrace deposit. The intrusion of dolerite dyke into pegmatite runs in parallel with the river stream.		
Slope of Abutment	Right: Moderate (1 : 10)	Left: Gentle (1 : 15)	
Embankment Material	<p>Earth materials: Dark reddish brown, cohesive, silty clay on the top of right abutment (d=0.5km), and light reddish brown or light grey, less cohesive, silty to gravelly sands on the both abutment (d=0.5km).</p> <p>Rocks: Very cracky granite quarry on the left abutment (d=0.2km).</p> <p>Sands: Deposit on the riverbed but less abundant (d=0.5km).</p>		
Distance from Dam Centre	D.A. Office: 22 km	Main road: 3.0 km	
	Proposed Irri. Area: 1.0 km	School: 0.5 km (Garange school)	

Table 4-6 (2) Brief of Damsite

No.	II-2-1	Name	MASHOKO
Location	District: Bikita	Communal Land: Matsai	
	Map Ref.: 2031 B4	Coordinate: UN 709346	
Geology	Gneiss, metabasite and terrace deposits are distributed around the damsite. The geology of damsite is complicated because of the intrusion of metabasite.		
Slope of Abutment	Right: Gentle (1:35)	Left: (1:13)	
Embankment Material	<p>Earth materials: Dark reddish brown, cohesive, silty clay but partly gravelly on the upstream right abutment (d=1.0km), and dark grey silty to clayey sands on both the lower abutments (d=0.5km).</p> <p>Rocks: Boulder-like, very cracky dolerite quarry on the upstream right abutment (d=0.7km).</p> <p>Sands: Deposit on the riverbed, but a little amount (d=0.5km).</p>		
Distance from Dam Centre	D.A. Office: 55 km	Main road: 0.5 km	
	Proposed Irri. Area: 1.0 km	School: 2.0 km (Mashoko Mission)	
No.	IV-4-10	Name	MUNJANGANJA
Location	District: Gutu	Communal Land: Gutu	
	Map Ref.: 1931 C4	Coordinate: UP 278155	
Geology	The rocks consist of massive granite, porphyritic granite and river deposits.		
Slope of Abutment	Right: Moderate (1 : 9)	Left: Gentle (1 : 17)	
Embankment Material	<p>Earth materials: Light reddish brown, silty sands or sandy silts on the upstream left abutment (d=0.5km), and dark reddish brown, cohesive, gravelly clay on the downstream left abutment (d=0.5km).</p> <p>Rocks: Massive granite quarry on the upstream right abutment (d=0.3km) and dolerite boulders on the left abutment (d=1.5km).</p> <p>Sands: Deposit on the riverbed of downstream tributary (d=0.5km).</p>		
Distance from Dam Centre	D.A. Office: 35 km	Main road: 2.0 km	
	Proposed Irri. Area: 6.5 km	School: 0.25 km (Munjanganja pri.)	

Table 4-6 (3) Brief of Damsite

No.	V-3-3		Name	MAGUDA
Location	District: Masvingo		Communal Land: Nyajena	
	Map Ref.: 2031 C3		Coordinate: UN 078021	
Geology	The damsite consists of gneiss, dolerite and talus deposits. Topographic relationship to the river system and outcrop of bolderlike dolerite indicates that dykes are present around the damsite.			
Slope of Abutment	Right: Gentle (1:12)		Left: Gentle (1:22)	
Embankment Material	Earth materials: Light reddish brown, sandy silts on the left abutment widely (d=0.5km), and grey spotted with brown, sandy silts on both sides of the lower abutment (d=0.2km). Rocks: Cracky, hilly, gneiss quarry on the upstream right abutment (d=0.8km). Sands: Deposit on the riverbed but not abundant (d=0.5km).			
Distance from Dam Centre	D.A. Office: 140 km (through Ngunda)		Main road: 0.6 km	
	Proposed Irri. Area: 8.6 km		School: 4.0 km (Nyamand Pri.) 7.0 km (Magudu Pri.)	
No.	VII-1-12		Name	MABVUTE
Location	District: Zaka		Communal Land: Ndanga	
	Map Ref.: 2031 C2		Coordinate: UN 388234	
Geology	The rocks around the damsite consist of gneiss, porphyritic granite, dolerite and river deposits. Both abutments have very deep soft weathered foundation.			
Slope of Abutment	Right: Moderate (1 : 10)		Left: Gentle (1 : 15)	
Embankment Material	Earth materials: Reddish brown, cohesive, partly less cohesive, sandy silts or silty sands on both abutments (d=0.5km). Rocks: Cracky hilly, gneiss quarry on the left abutment (d=1.0km). Sands: Deposit on the riverbed but less abundant (d=0.5km).			
Distance from Dam Centre	D.A. Office: 60 km		Main road: 80 km	
	Proposed Irri. Area: 1.3 km		School: 0.75 km (Chipfunde pri.)	

4.4. Soil Condition

4.4.1. General

On the Zimbabwean soil map with the scale of one to one million, all of 6 project areas are plotted in the zone of Fersiallitic group, which has the soil with appreciable reserves of weatherable minerals.

Generally, in Masvingo Province, most of the Fersiallitic group is coarse grained sandy soil. However, in detail the soil condition is not uniform but it varies considerably depending on topography, geology, rainfall, etc. from place to place. Fortunately each proposed project area has relatively clayey soils, and so they are suitable for application of irrigation.

But, each project area partly includes highly sandy zone or gravelly zone and soils in each area have comparatively high acidity in surface soils, low contents of exchangeable bases and low cation exchange capacities.

The contents of organic matter is less than one per cent in all of the areas.

4.4.2. Soil Condition in each Area

1) Musaverema (I-2-1)

Being surrounded by bend of lower stream in Musaverema river, there is a rather flat terrain, including the project area. Based on a geological map, the soils in the area appear to be derived from granulite gneiss. In the centre of the area, soil is moderately deep and relatively clayey. However, towards the outside, soil gradually becomes shallow and gravelly.

Soil Category

- 1 Moderately deep to moderately shallow, brown (7.5 YR ⁴/3) sandy clay loam over reddish brown (5 YR ⁴/6) sandy clay.

Test pit: 1 Sample (M-1-A, M-1-B, M-1-C)
(M-3-A)

- 2 Shallow, brown (7.5 YR ⁴/4) sandy loam over gravelly brown (7.5 YR ⁴/4) sandy loam.

Test pit: 1 Sample (M-2-A, M-2-B)

(A total of 9 auger borings were made.)

2) Chinyamatumwa (II-1-6)

According to the geological map, the whole area is almost covered with the soil derived from granite. Actually, northern areas stretching on the north of this project area consist of granitic coarse sandy soil, while in the east to south slopes of the project area, there is considerably reddish and clayey soil, probably affected from somewhat mafic rocks. Among both soils, intergrade soil lies down.

Soil Category

- 1 Moderately deep, reddish brown (5 YR ⁵/8) sandy clay loam over reddish (2.5 YR ⁴/8) sandy clay - clay.

Test pit: 1 Sample (B-1-A, B-1-B, B-1-C)

- 2 Moderately deep, brown (10 YR ⁷/3) sandy loam over reddish (7.5 YR ⁵/6) sandy clay.

Test pit: 2 Sample (B-2-A, B-2-B,
B-3-A, B-3-B, B-3-C)

- Moderately deep, dull brown (7.5 YR ⁶/3) loamy sand over dully yellow orange (5 YR ⁶/8) sandy loam.

Test pit: Sample (B-4-A)

(A total of 10 auger borings were made.)

3) Mashoko (II-2-1)

Along the north bank of the Chenyere river, there is fairly flat but relatively long and narrow area with the soil derived from gneiss, bordering on gentle slope with coarse sandy soils at the north. Project area is included in this, and the greater part of the area is composed of clayey soil with some parts which may be waterlogged occasionally in the rainy season. While, west and northeast parts of the area are moderately or highly sandy, due to the sands from northern bordering slopes.

Soil category

- Moderately deep, dull brown (7.5 YR ⁵/3) sandy loam over reddish brown (5 YR ⁵/6) sandy clay loam.

Test pit: 1 Sample (BM-1-A, BM-1-B, BM-1-C)

- Moderately deep, greyish yellow brown (10 YR ⁶/2) sandy loam over greyish yellow brown (10 YR ⁴/2) mottled sandy clay loam.

Test pit: 1 Sample (BM-2-A, BM-2-B, BM-2-C)

- Moderately shallow, greyish brown (10 YR ⁵/2) sandy loam over brown (7.5 YR ⁴/4) sandy clay loam.

- Moderately deep, greyish brown (10 YR ⁵/2) sandy loam over yellowish brown (10 YR ⁷/2) sandy loam.

(A total of 9 auger borings were made.)

4) Munjanganja (IV-4-10)

A soil survey of the proposed Ranga Irrigation Scheme which covers the Project area, had been carried out in 1985 by AGRITEX. According to this report, gneissic granite predominates in the north and south, with a dolerite dyke in the centre. The project area is located in the centre of the Ranga Scheme; it is reported that the soils of the area are affected by dolerite. But in the northern and southern range of the area there are shallow, coarse, sandy soils.

Soil category

- 1 Moderately deep, dull brown (7.5 YR ⁵/₄) sandy clay loam - clay over reddish brown (5 YR ⁴/₈) to dark reddish brown (5 YR ³/₆) sandy clay.

Test pit: 1 Sample (G-2-A, G-2-B, G-2-C)
(G-3-A)

- 2 Moderately deep, dark brown (10 YR ³/₄) sandy clay loam over dark brown (10 YR ³/₄) mottled clay.

Test pit: 1 Sample (G-1-A, G-1-B, G-1-C)

- 3 Shallow, bright reddish brown (5 YR ⁵/₆) loamy sand - Coarse sandy loam.

Sample (G-4-A)

(A total of 9 auger borings were made.)

5) Magudu (V-3-3)

Though the surrounding area is dissected, the project area is flat, and according to the report of a reconnaissance survey in Nyajena, the majority of the soils in the area have been derived from amphibolite rich

suites in the gneissic granite. Relatively clayey reddish type and yellowish type of the soils are predominant in this project area, but on the gentle slope of the northern part, very gravelly sandy soil occurs, and topsoils in the northeast part are sandy.

Soil category

- 1 Moderately deep, brown (7.5 YR ⁴/4) sandy clay loam over reddish brown (5 YR ⁴/6) clay.

Test pit: 1 Sample (N-1-A, N-1-B, N-1-C)

- 2 Moderately deep, dull yellow orange (10 YR ⁶/3) sandy clay loam over dull brown (7.5 YR ⁵/4), mottled sandy clay.

Test pit: 1 Sample (N-2-A, N-2-B, N-2-C)

- 3 Moderately deep, dull yellow orange (10 YR ⁶/4) sandy loam over brown (7.5 YR ⁵/6) sandy clay loam.
- 4 Moderately shallow, brown (7.5 YR ⁴/6) sandy loam over gravelly reddish brown (5 YR ⁴/6) sandy loam.

(A total of 14 auger borings were made.)

6) Mabvute (VIII-1-12)

The project area has relatively undulating and complicated topography and soils formed on granulite gneiss. As a whole, it is divided into three parts that are northwest, northeast and south. Northwest and northeast parts slope down towards the Musuche river, and both clayey and sandy soils are distributed on the slopes. Some small parts of the clayey soil zone give proof of waterlogging in the rainy season, while the south part of the area slopes down towards the depression of the Chinyika river, with relatively sandy soil.

Soil category

- 1 Moderately deep, orange (7.5 YR⁶/6) sandy loam - sandy clay over reddish brown (2.5 YR⁴/8) clay.

Test pit: 1 Sample (Z-1-A, Z-1-B, Z-1-C)

- 2 Moderately deep, reddish grey (2.5 YR⁶/1) sandy clay loam over brown (7.5 YR⁴/3) mottled sandy clay loam - sandy clay.

- 3 Moderately deep, brown (7.5 YR⁴/4) sandy loam over reddish brown (5 YR⁴/8) sandy clay loam - sandy clay.

Test pit: 1 Sample (Z-2-A, Z-2-B, Z-2-C)

- 4 Moderately shallow to moderately deep, dull brown (7.5 YR⁵/4) sandy loam over gravelly brown (7.5 YR⁴/6) sandy loam or orange to brown (7.5 YR⁴/4) sandy loam.

Test pit: 1 Sample (Z-3-A, Z-3-B, Z-3-C)

- 5 Moderately shallow brown (7.5 YR⁴/4) loamy sand over orange (7.5 YR⁶/6) sandy loam.

(A total of 14 auger borings were made.)

4.5. Land Use and Cropping Pattern

4.5.1. General

There is a small amount of reliable data on the present situations of land use and cropping pattern. Therefore, it was attempted to make use of such data in each "ward" concerned (in some cases, those of each "village concerned) to which some data are compiled to describe their current situations.

According to such data, the present land use in each ward or village concerned is shown in Table 4-7. Though the scale of area, or the ratio of the cropping area to the grazing area in each ward or village is different, as a whole the proportion of the cropping area to the grazing area is 33 to 67 per cent.

As to the scale of cropping area per household, there is not a noticeable difference among the wards, which is about 2 to 3 ha, 2.5 ha on an average. This average size is a little higher than that of Masvingo Province (2.1 hectares). As dry farming is undergone at present, the planting time of the main crops is September to November while the harvesting time is April to June. So the cropping per year is single, and the most important main crop is maize in all the areas concerned. Generally there are not distinct differences in cropping patterns among the project areas.

In due consideration of the information from extension worker in charge of each area, farm interview survey and field observation, the land use and cropping patterns in each project area are estimated.

Table 4-7 Land Use in Project Areas

Place	Total Area	Cropping Area	Grazing Area	House-Holds	Hectare per Households
	ha	ha	ha		ha
I-2-1					
W. 9	8,125	1,708	6,417	492	3.5
V. Chingore	1,178	310	868	103	3.0
II-1-6					
W. 6	8,550	3,300	5,250	700	4.7
V. Nyamhenge	890	347	543	120	2.9
II-2-1					
W. 2	18,680	3,200	15,480	1,800	1.8
V. Rusazu	2,360	850	1,510	356	2.4
IV-4-10					
W. 26	5,350	3,817	1,533	2,026	1.9
V. 5	625	525	100	250	2.1
V-3-3					
W. Dowa 6	?	?	?	497	?
V. Chikumba	340	300	40	144	2.1
VII-1-12					
W. Dzoro North	5,800	3,200	2,700	959	3.3
V. Mabute	?	?	?	103	?
Average	100%	33%	67%	-	2.5

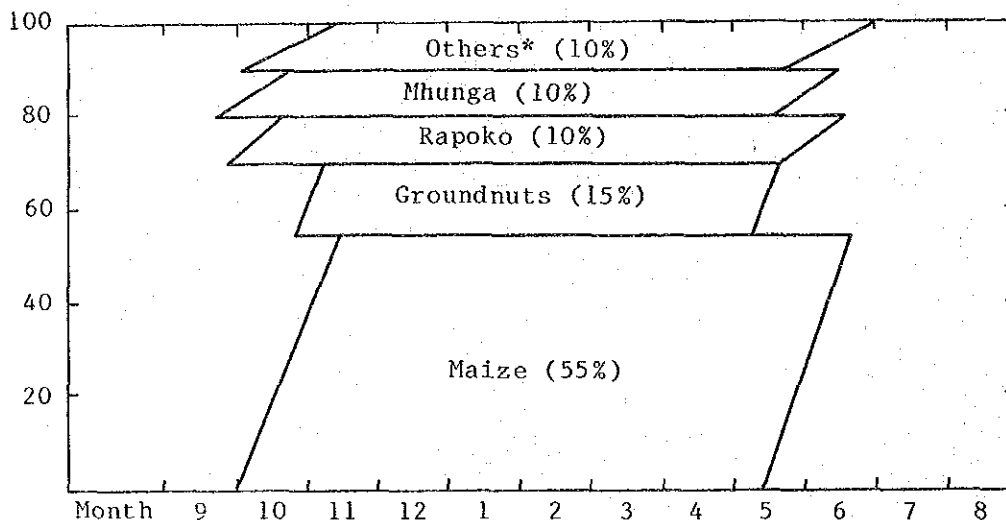
W.: Ward

V.: Village

4.5.2. Present Land Use and Cropping Pattern in the Project Areas

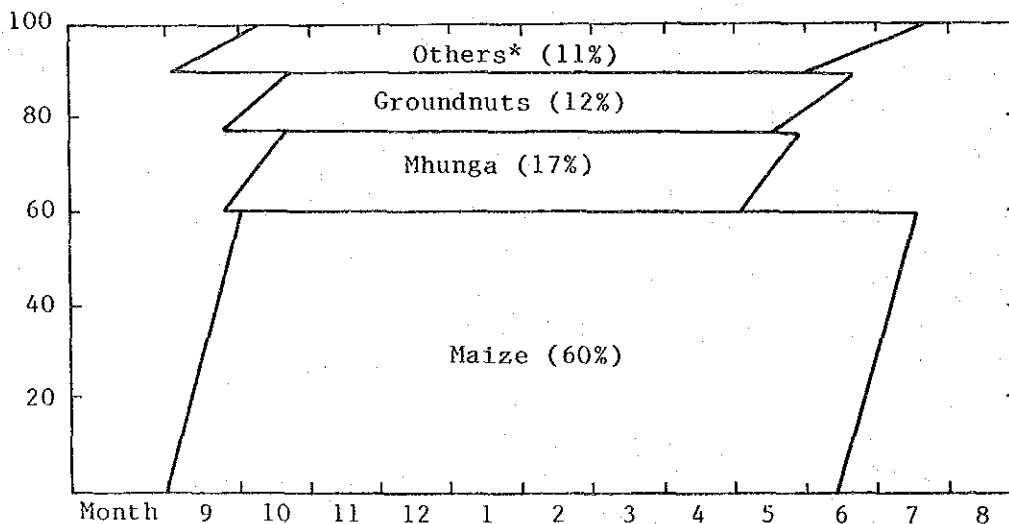
1) Musaverema (I-2-1)

Most of the area is generally flat farm land with a scattering of huts, surrounded by trees and shrubs along the banks of streams. There are some fallow lands to be seen conspicuously. Cropping pattern is as follows.



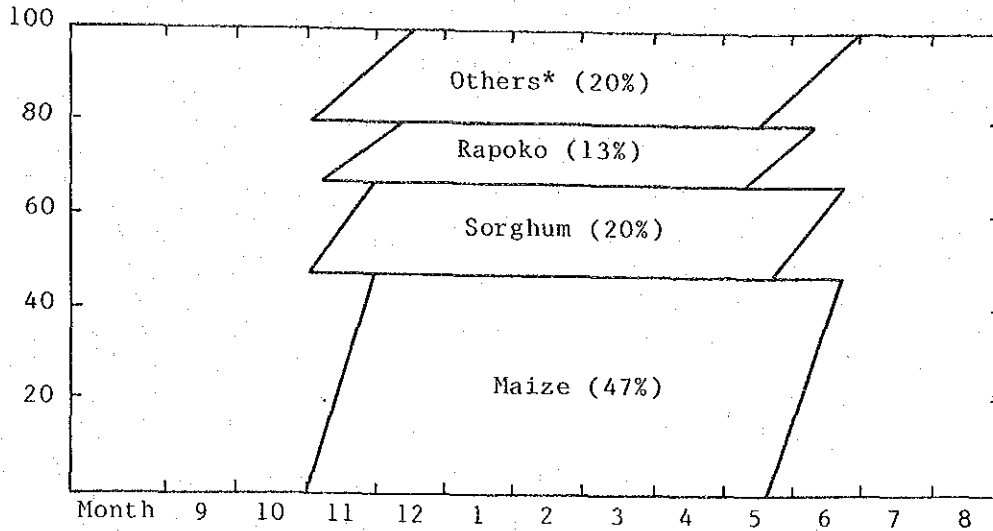
2) Chinyamatumwa (II-1-6)

Almost all of the area is undulated and sloped farm lands. There are some tall trees here and there. Some of the farm plots have some shrubs in themselves. Cropping pattern is as follows.



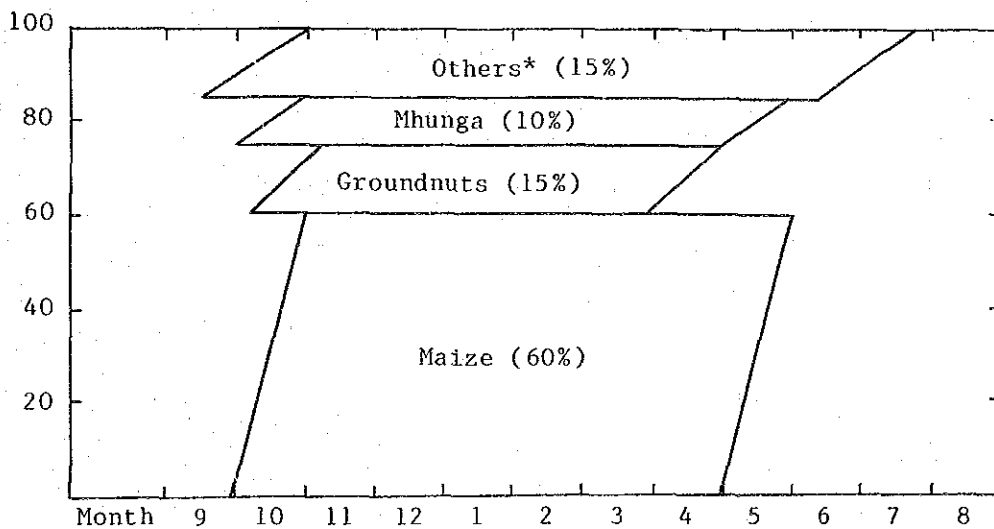
3) Mashoco (II-2-1)

Almost all the area is very flat farm lands and most of the plots are very large in size. There are some grazing lands in the eastern edge. Cropping pattern is as follows.



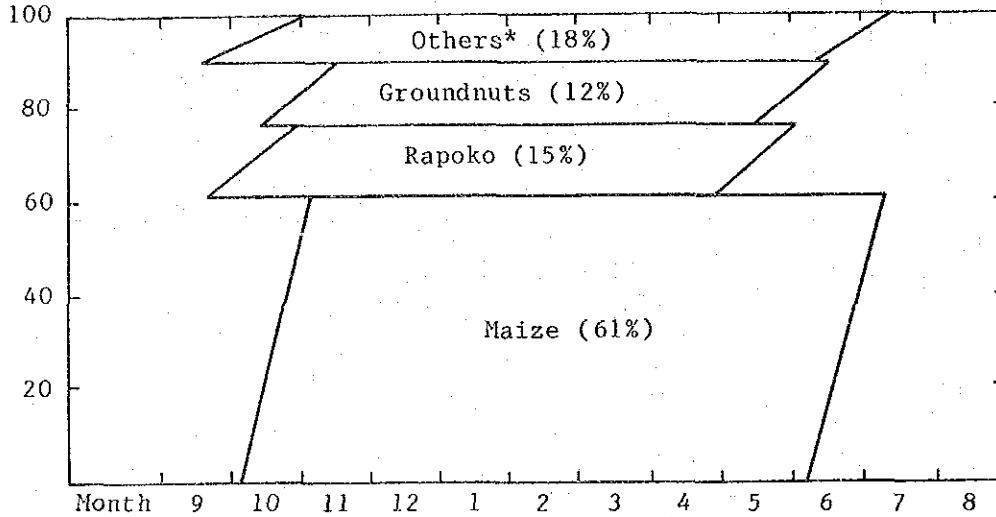
4) Munjanganja (IV-4-10)

Almost all of the area is farm lands slightly sloped down towards the river. Some huts and shrubs are scattered among them. There are some grazing lands in the northern range. Cropping pattern is as follows.



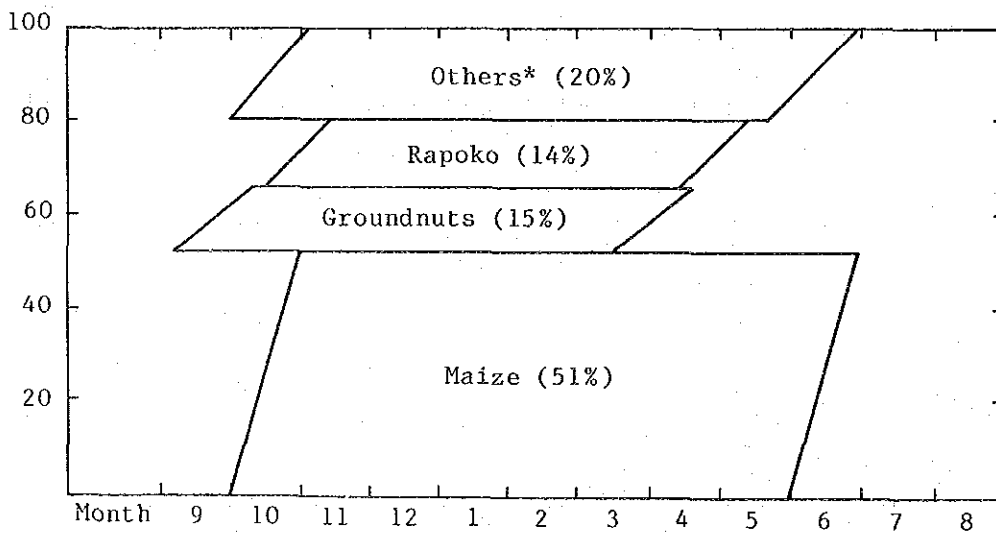
5) Magudu (V-3-3)

Almost all of the area consists of farm lands scattered about small rocky mounts, most of which have some huts put on. There are some trees around the mounts, and in some depressions. Cropping pattern is as follows.



6) Mabvute (VII-1-12)

Most of the area covered by farm lands, but two large rocky mounts occupy centre of the area, and there are two relatively wide waterways in the area. Some fallow lands are found around the Chipfunde school. Cropping pattern is as follows.



4.6. Crop Production

4.6.1. Crop Yields in Areas Concerned

General conditions of crop production in Masvingo Province are already mentioned in preceding chapter, and the yields per hectare of main crops in each District concerned are given in ANNEX. The present yields per hectare of most crops are extremely low and fluctuate year by year in each District, because of the lack of rain, less fertilizer or manure application, insufficient tillage etc. The yields of main crops in each project area are assumed by the data collected by AGRITEX.

4.6.2. Crop Production

The area of each ward concerned is so wide compared with the project area that the figures were modified to fit to each project area by the information from extension worker, the results of farmer's interview survey and so on. They were shown in Table 4-8.

While, as mentioned before there is considerable yearly fluctuation of crop yields in this region inspite of ordinary crop yield level on this Table. For example, the yield per hectare of maize in a bumper year comes up to 2.7 - 2.8 tonnes, while in a drought year it comes down to 0.1 - 0.5 tonnes, even to nothing in the worst case. If a farmer who has dry land of about 2.5 ha (average size) plants maize 60 per cent of his dry land and gets 1 tonne of yield per hectare, he will be able to feed his family somehow. In a bumper year he can get some surpluses and sales them to GMB, and while in a drought year he will be obliged to rely upon the drought relief.

4.6.3. Agricultural Inputs

The data on the amounts of seeds and fertilizer, which were collected by farmers interview, are given in Table 4-9. Compared with the standards shown in Table 4-10, seeds inputs of maize are very high and while those of groundnuts are very low. Probably it will be reflected that for maize

farmers make an effort to get yield as much as possible providing for drought, while for groundnuts it is not a crop as the staple foods, or sometimes it is planted as a catch crop or a mixed crop.

Table 4-8 Yield per Hectare

(Unit: tonne/ha)

Project Area	I-2-1	II-1-6	II-2-1	IV-4-10	V-3-3	VII-1-12
Maize	1.0	1.1	1.0	1.1	0.8	1.1
Goundnuts	0.3	0.3	0.2	0.6	0.2	0.5
Rapoko	0.4	0.9	0.3	0.6	0.3	0.8
Mhunga	0.4	0.7	0.5	0.8	0.3	0.7
Sorghum	0.4	0.8	0.6	0.5	0.7	0.6
B. Beans	0.2	0.3	0.1	0.2	-	0.1
Cotton	0.3	0.6	1.1	1.0	0.4	0.5
Sunflower	0.5	0.5	0.5	0.3	-	0.6

Table 4-9 Input Supply per Hectare

(Unit: kg/ha)

Project Area	I-2-1	II-1-6	II-2-1	IV-4-10	V-3-3	VII-1-12
Seed						
Maize	50	70	50	50	50	60
Goundnuts		20	20	50	12	
Cotton		10			10	10
Sunflower	4	4		10	12	
Fertilizer						
Maize	50 (Comp.D)	120 (A.N.)	50 (Comp.D)	100 (A.N.)		100 (A.N.)
Cotton		150 (Comp.L)			150 (Comp.L)	300 (Comp.L)

Note) Comp.: Compound, A.N.: Ammonium Nitrate

Table 4-10 The Standard Input Supply per Hectare
(Unit: kg/ha)

	Seeds	Fertilizer
Maize	25	Comp.D 200 + A.N. 100 or A.N. 100 + Manure 6,000 - 10,000
Groundnuts	100	Super P. 300 + Gypsum 100
Cotton	20	Comp.L 200 + A.N. 100
Sunflower	10	Comp.L 200 + A.N. 100 or A.N. 100 + Manure 8,000

Note) Comp.: Compound, P: Phosphate, A.N.: Ammonium Nitrate

4.7. Livestock production

The present livestock situations on the selected six sites are summarized in Table 4-11. The number of livestock was obtained from AGRITEX extension workers concerned. As to poultry and pigs, data were not available so that Table 4-11 shows the main four kinds of animals, namely cattle, donkeys, goats and sheep. As for LSU (Livestock Unit) shown in Table 4-11, the following conversion factors of livestock were employed in order to estimate the number of LSUs.

Cattle 0.65
Donkey 0.4
Goat and Sheep 0.1

The salient features of livestock situations on the six sites are as follows.

1) Musaverema (I-2-1)

The numbers of donkeys and goats/sheep are numerous compared with the number of cattle. Many donkeys are used to transport agricultural products or water in this area. The number of cattle per household is about three and the number of LSUs per sq.km is about 17. The grazing land against one LSU is estimated at 3 ha, judging from the current land use in this area.

2) Chinyamatumwa (II-1-6)

The number of heads per household regarding cattle and goats/sheep is four and three, respectively. This area is considered to be an advanced area for livestock production because the number of LSU per sq.km is very high and in addition, four dip tanks have been provided in the related two wards.

3) Mashoko (II-2-1)

Cattle are very important in farm economy in this area because crop production is not favourable due to scarce rainfall. At present, agricultural development in this area emphasizes increase of livestock production. The grazing land improvement project has been implemented in Tabatana VIDCO and the goat management programme is under way in Kuwirirana VIDCO.

4) Munjanganja (IV-4-10)

The number of cattle per household is three. The shortage of draught power often occurs during the land preparation seasons, resulting in delay in planting period of crops. This is because the number of cattle is not sufficient to meet farmers' requirements as draught power. The grazing land has been reduced by encroachment of cropped land resulting from the growth of population. Under the circumstances, the grazing land against one LSU is estimated at 1 to 2. For solution of such problems as overpopulation and deterioration of livestock grazing environment, the grazing land improvement project has been implemented in Mulwisi (VIDCO 4).

In addition, the small livestock introduction programme has been planned to an extent under co-operation of West Germany for the purpose of improvement of farmers' nutritional standards and increase of farm income as well.

5) Magudu (V-3-3)

This area belongs to Lowveld so that cattle play a vital role for farm economy. The high figure of the number of cattle per ha of seven explains this situation. Most of the farmers, however, do not own donkeys, goats and sheep.

6) Mabvute (VII-1-12)

Due to overpopulation in this area, mountains favorable for grazing land, have been exploited for cropped land to large extent. The grazing land against total area is below 50 percent and the grazing land against one LSU is estimated at 1 ha. The number of cattle per household is more than three, but the number of farmers who are keeping donkeys is few.

Table 4-11 Summary of Livestock Situation

Dam Name	C.L. (Ward)	Number				No. per household		No. per sq. km	
		Cattle	Donkeys	Goats & Sheep	LSU ^{*1}	Cattle	LSU	Cattle	LSU
Musaverema	Matibi No.1 (9)	1,400	349	3,376	1,387	2.9	2.9	16.9	16.8
Chinyamatumwa	Bikita (9)	5,600	N.A.	N.A.	N.A.	4.5	N.A.	76.7	N.A.
	- do - (14)	5,600	100	3,200	4,000	5.7	4.0	87.6	62.6
Mashoko	Matsai (2)	5,864	71	1,840	4,024	5.0	3.4	36.9	25.8
Munjanganja	Gutu (26) ^{*2}	2,869	282	3,332	2,327	3.0	2.4	30.9	25.0
Magudu	Nyajena (Dowa 6)	2,974	80	256	1,991	6.8	4.3	48.4	32.4
Mabvute	Ndanga (Dzofo North)	2,970	43	2,900	2,238	3.5	2.7	48.2	36.3

Notes) *1: Cattle = 0.65 LSU, Donkey = 0.4 LSU, Goat & Sheep = 0.1 LSU

*2: Excluding the figures of VIDCO 1 and VIDCO 6.

Data Source: Agritex, as of 1986

4.8. Marketing Structure and Local Market Price

4.8.1. General Situation

G.M.B. controls marketing of staple foodstuff and other food commodities. Local market prices of grains and oilcrops are therefore derived from G.M.B. producer prices. Since the size of farm yard sales is negligibly small, local market prices would be best defined as "prices actually received by farmers at the point of delivery of their produce at depots or major markets", and hence transportation component is subtracted from them.

Crop production in 1986/1987 suffered from heavy drought which affected quantities and quality of marketable produce, while a bumper crop was harvested in the previous crop year. Taking these into account, mean blended G.M.B. prices for these two crop years were adopted as the base of farmgate prices (but data for five years to arrange official estimates are not available).

Estimation of vegetable farmgate prices is based on prices at major markets or sales gardens located far from project sites. This is because vegetables are basically grown only for home consumption and hence markets are seldom found in the villages (and so farmgate prices are not obtainable).

Local market prices are listed in Table 4-12 by sites and by produce.

4.8.2. Marketing Situation in Each Project Area

1) Musaverema (I-2-1)

The proposed area is located within the economic sphere of Bumwa Mine, Belingwe District, where G.M.B. depot and co-operative stores are available. Farmers carry their produce to this mining township, Mataga, about 30 km far from Chingore Village, because no collection point is available at the adjacent business centres. Those who have cattle or donkeys use them to carry their grain bags, while farmers without cattle or with larger acreage, jointly hire lorries for transportation. Grains are

further marketed from the Depot in Mataga to Bulawayo, either by train or by lorries.

With regard to perishable produce, farmers can hardly meet their need of home consumption, and often purchase green vegetables at nearby upper-Marawi gardens, 6 km away from the area. Large scale vegetable markets are all located at distant places. Ngundu (70 km), Rutenga (85 km) and Zvishavane (85 km) are potential outlets among them. Cattle sales are often held at Neshuro pen, 30 km far from the area, and beef cattle are sent to Masvingo Cold Storage Commission.

2) Chinyamatumwa (II-1-6)

This area has comparatively convenient access to newly opened Nyika G.M.B. depot (34 km from the proposed area). Most of the farmers switched their deliveries from Jerera depot to the above-mentioned depot, since it started operation in September last year. A farmer's co-operative store is also available at Bikita township, only 22 km away from the proposed area. The store handles agricultural inputs such as seed, fertilizers and implements. This co-operative also offers electricity driven flour milling to farmers, as an approved agent of G.M.B. Until last summer Garange School (situated in the middle of the area) and Nagawanu School were temporarily used as collection points, but due to poor availability of transportation, they do not serve as intermediate points any more. Now farmers deliver their grain bags either by ox-carts or by contracted rollies to G.M.B. Nyika. About 30 per cent of their marketable produce seems to be collected through approved agents, or sold to local dealers who pay immediate cash to their customers without any quality check, though price levels offered by them are slightly lower than G.M.B. standard.

Users of A.F.C. loans have reached a high percentage in this area, and they have obligations to market their produce through G.M.B. for redemption. Inputs or co-operative goods provided by A.F.C. are delivered to farmers at Mutikizizi B.C., 6 km south of the proposed area. Makuva cattle pen (12 km from the proposal area) has been available for cattle sales. Vegetable prices can be estimated referring to the market prices in Bikita township.

3) Mashoko (II-2-1)

The area lies on the east edge of Mashoko township, focal point of economy in Matsai. This township is also a traffic centre, and a contact point between Nyika economic sphere and that of Chiredzi. The distance from here to G.M.B. depots in Chiredzi and to Nyika is more or less the same. Farmers in Matsai bring their cotton to Chiredzi G.M.B. depot (90 km in distance) their grain bags to Nandi G.M.B. depot (65 km in distance). They often use the big size lorries because road conditions along Chiredzi road are maintained better than Nyika road. The marketable grain quantities are quite limited here, owing mainly to frequent drought attacks. While farmers rely more on cattle sales, as compared with other areas. Place of cattle auction is available at Matsai B.C. cattle pen, 7 km east of the area. Because of the long distance to the crop market, farmers tend to sell their scanty produce locally, rather than carrying it to remote depots. Farmgate sales of small amount of grain are popular among villagers, and farmers sell their surplus as measured by tin or bucket, to others who earn cash from off-farm activities.

Vegetables and other relish for sadza are occasionally brought by vendors from Triangle and Chiredzi. Judging from their size of supply, small scale gardening in the proposed area would not have enough competitive position against sales-oriented commercial producers.

4) Munjanganja (IV-4-10)

Taking advantage of geographically favourable conditions, farmers around the proposed area can often avoid suffering severe damages from drought attack, and this makes their marketing activities more viable. The reliance on cash crops is placed heavier than southern part of the province. The distance from the area to Gutu G.M.B. depot is around 40 km and only 36 km to major vegetable market (Mupandawana). The agricultural products vary from grain on pulses to cotton, oriental tobacco and hand-irrigated vegetables, even in dry season from perennial streams. In Dewunde, 16 km from the proposed area, there is a temporary collection point for statutory items. Terminal co-operative stores for input supply are also available

at Tirizi, within the radius of only 5 km. More than 70 per cent of farmers who sell their produce utilize G.M.B. sales, while less than 30 per cent of them still rely on approved buyers, or sell locally. A cattle pen for cattle sales is available just outside of the village, near Ranga School though few villagers utilize it.

Local market prices of vegetables are estimated based on retail prices in Madondo Market, the biggest one in Gutu township. Cotton is delivered to Birchenough Bridge, 140 km from the area.

5) Magudu (V-3-3)

Although this area belongs to Masvingo District, the economy is more dependent on Chiredzi or Renco, rather than Provincial capital, Masvingo township. In spite of remoteness, no temporary collection point is available near the proposed area, mainly because of limited marketing quantities supplied from farms. The distance to Nandi Depot in Chiredzi is over 75 km, whereas that to Jerera Depot in Zaka is about 65 km. Recently G.M.B. has opened a temporary collection point at Musvovi (32 km from the area). Farmers prefer to dispose of their meagre produce locally, rather than to carry it to depot. Nevertheless, over 50 per cent of total farmers sell their grains through G.M.B., especially after a good harvest. However, whenever drought hits the area, share of G.M.B. delivery drops to almost nil, and farmers only locally sell scanty amount of grains, which remains in granary. The fact that transport charge amounts to 16.5 Z\$/ton or 2¢/km/bag, almost one tenth of grain price also discourages farmers to market their produce.

Vegetables are only sold at the roadside in Nyikavanhu, 5 km away from the proposed area. Hence, vegetable local market prices are estimated referring to the retail prices in Ngundu and Tokwe markets. With regard to cattle sales, there is a cattle pen at Nyikavanhu.

6) Mabvute (VII-1-12)

This area also falls in the economic sphere under the influence of Triangle and Chiredzi (55 to 70 km from Magudu School), but distance to Jerera depot in Zaka district is much shorter, and is only 36 km from the proposed area. A temporary collection point existed at Mushaya School, 20 km west of the area, but recently a new point was opened at Chivamba B.C. However, there seem to be many farmers who still carry their deliveries direct to Jerera. There are two G.M.B. approved buyers at Chivamba B.C., and one at Chipfunde School (owns a mill in Mavbute B.C.), but only 25 per cent of them sell through the routes other than G.M.B. Cotton planting has so far become popular among farmers in southern Zaka, or Bota, including this area. Cotton packs are all marketed to Chiredzi C.M.B. depot, where a ginnery is available. A co-operative store-godown is located at adjacent place to Jerera G.M.B. depot. Marketing of rapoko is quite limited. Most of the farmers raise it only for home consumption, for the purpose of brewing beer at home, or if any, it is only sold locally.

The estimation of vegetable prices has been made based on the retail prices in Jerera market. Cattle sales are held at Chivamba sales pen, 8 km west of the proposed area.

Table 4-12 Blended Prices of G.M.B. Masvingo

unit : Z \$ / ton,

Produce	1986/87 Blended Price	Estimated Delivery	1985/86 Blended Price	1985/86 Delivery	Mean Blended Price
White Maize	179.7	20,395	179.6	188,939	179.6
Ground Nuts Unshelled	496.7	5,446	457.3	6,443	477.0
Ground Nuts	860.5	308	--	--	860.5
Rapoko	275.0	85	286.5	4,500	280.8
Mhunga	230.0	297	241.2	2,000	235.6
Red Sorghum	100.00	253	100.0	1,000	100.0
White Sorghum	170.4	1,562	172.6	5,495	171.5
Sugar Bean	435.0	2	437.6	1,000	436.3
Sunflower	372.5	8,041	335.4	10,779	354.0
Wheat	329.2	91	327.0	222	328.1
Soyabean	384.4	1,561	322.4	500	353.4

Source : G. M. B. Depot, Masvingo

Table 4-13 Local Market Prices* (1)

Unit : Z\$/ton

Site	Commodity	Maize	G'nuts	Rapoko	Mhunga	Wheat	Sugar beans	White Sorghum	Sunflower	Cotton
(distance to the market)	Average Blended Price	179.6	477.0	280.8	235.6	328.1	436.3	171.5	354.0	725.0
	Less Sack Price	174.1	464.5	275.3	230.1	322.6	430.8	166.0	344.0	698.4
I-2-1 Musaverema (30km)	transport charge	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	-
	l.m.p.	167.5	457.9	268.7	223.5	316.0	424.2	159.4	337.4	-
II-1-6 Chinyamatumwa (34km)	transport charge	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	23.8
	l.m.p.	166.6	457.0	267.8	222.6	315.1	423.3	158.5	336.5	669.6
II-2-1 Mashoko (65km)	transport charge	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	25.2
	l.m.p.	159.8	450.2	261.0	215.8	308.8	416.4	151.6	329.7	668.2
IV-4-10 Munjanganja (40km)	transport charge	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	39.2
	l.m.p.	165.2	455.6	266.4	221.2	313.7	421.9	157.1	335.1	654.2
V-3-3 Magudu (75km)	transport charge	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.8
	l.m.p.	157.6	448.0	258.8	213.6	306.1	414.3	149.5	327.5	676.6
VI-1-12 Mabvute (36km)	transport charge	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	25.2
	l.m.p.	166.2	456.6	267.4	222.2	314.7	422.9	158.1	336.1	668.2

* Estimated as of Aug. 1987, Transportation (at the rate of 22¢/ton/km.) and sack cost are subtracted.

Abbreviated as l.m.p.

Table 4-13 Local Market Prices* (2)

unit = z\$/t

Site	Market (Distance from the site)	Character of Prices	Tomato	Cabbage (Head only)	Onion (Equivalent to mature bulbs)	Rape, L. (Leaf bundles)	Green Maize (per 4,000 cobs)	Potatoes (indicating) sweetpotato	Sugarcane (Raw stalks)
I-2-1 Musaverema	Ngundu (70km)	Estimated	300.0	480.0	300.0	420.0	400.0	-	-
		Transport	21.0	21.0	21.0	21.0	21.0	-	-
		l.m.p.	279.0	459.0	279.0	399.0	379.0	-	-
II-1-6 Chinyamatumba	Bikita (25km)	Estimated	300.0	520.0	300.0	420.0	400.0	300.0	480.0
		Transport	7.5	7.5	7.5	7.5	7.5	7.5	7.5
		l.m.p.	292.5	512.5	292.5	412.5	392.5	292.5	472.5
II-2-1 Mashoko	Chiredzi (65km)	Estimated	360.0	480.0	480.0	360.0	400.0	[300.0]	300.0
		Transport	19.5	19.5	19.5	19.5	19.5	19.5	19.5
		l.m.p.	340.5	460.5	460.5	340.5	380.5	[280.5]	280.5
IV-4-10 Munjanganja	Mupandawana (36km)	Estimated	300.0	500.0	520.0	340.0	400.0	340.0	-
		Transport	10.8	10.8	10.8	10.8	10.8	10.8	-
		l.m.p.	289.2	489.2	509.2	329.0	389.2	329.2	-
V-3-3 Magudu	Triangle (56km)	Estimated	360.0	480.0	480.0	360.0	400.0	[300.0]	300.0
		Transport	16.8	16.8	16.8	16.8	16.8	16.8	16.8
		l.m.p.	343.2	463.2	463.2	343.2	383.2	[283.2]	283.2
VII-1-12 Mabvute	Jerera (36km)	Estimated	300.0	500.0	360.0	510.0	400.0	350.0	500.0
		Transport	10.8	10.8	10.8	10.8	10.8	10.8	10.8
		l.m.p.	289.2	489.2	349.2	499.2	389.2	339.2	489.2

* Estimated as of Aug. 1967, Transportation in bulk (at the rate of 30¢/ton/km. by hired lorries.)