

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

**ETHIOPIA  
IRRIGATION DEVELOPMENT DEPARTMENT  
MINISTRY OF AGRICULTURE**

**BASIC DESIGN STUDY REPORT  
ON  
SMALL SCALE IRRIGATION DEVELOPMENT PROJECT  
IN  
ETHIOPIA**

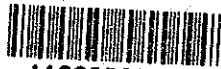
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## PREFACE

In response to a request from the Transitional Government of Ethiopia, the Government of Japan decided to conduct a Basic Design Study on the Small Scale Irrigation Development Project in Ethiopia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent a study team to Ethiopia headed by Mr. Yoshikatsu Nakamura, Director of First Basic Design Study Division, JICA and composed of members of Pacific Consultants International from September 19th to October 20th, 1992.

The team held a series of discussions with the officials concerned of the Transitional Government of Ethiopia and conducted a field survey in the study area. After the team returned back to Japan, further studies were made and this report was prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Transitional Government of Ethiopia for their close cooperation extended to the study team.

January, 1993



Kensuke Yanagiya

President

Japan International Cooperation Agency





January 14th, 1993

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

Letter of Transmittal

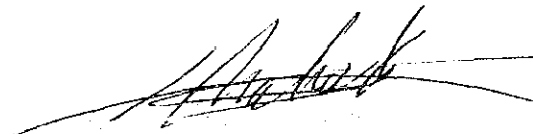
We are pleased to submit the Basic Design Study Report on Small Scale Irrigation Development Project in Ethiopia.

This study has been made by Pacific Consultants International based on a contract with JICA from September 15th, 1992 to January 14th, 1993. Throughout the study we have taken into full consideration the present situation in Ethiopia and have planned the most appropriate project in the scheme of Japan's grant aid.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fisheries. We also wish to express our deep gratitude to the officials concerned of the Ministry of Agriculture, Ministry for External Economic Cooperation, the Transitional Government of Ethiopia, JICA Ethiopia office and the Embassy of Japan in Ethiopia for their close cooperation and assistance during our study.

At last, we hope that this report will be effectively used for the promotion of the project.

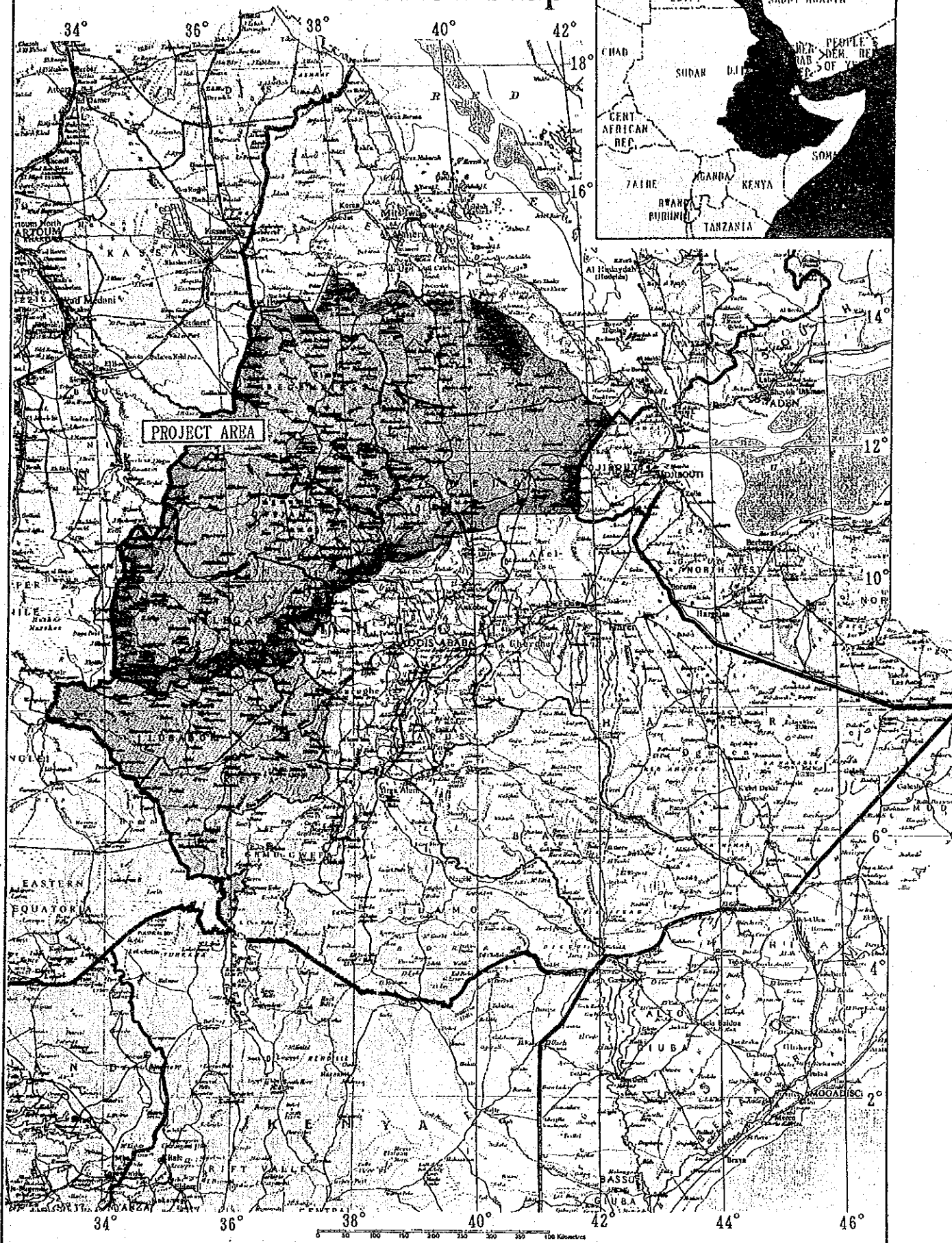
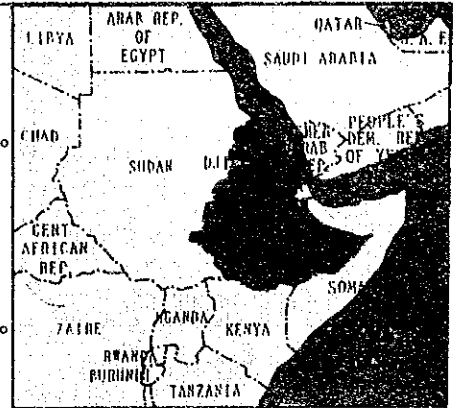
Very truly Yours,



Keiji Matsumoto, Team leader,  
Basic Design Study Team on  
Small Scale Irrigation Development Project  
in Ethiopia,  
Pacific Consultants International



# Location Map





## **Summary**



## SUMMARY

Ethiopia is situated in the North East Africa between latitudes 3° and 18° N and longitudes 33° to 48° E. It borders four African countries namely Sudan, Kenya, Somalia and Djibouti. The northern state Eritria has a 1,000 km coast line along the Red Sea. The country covers an area of 1,250,000 sq.km and has an estimated population of 49.5 million (1991). It has a rugged, mountainous topography and exhibits linguistic and cultural diversities with different ethnic groups.

The country has suffered serious droughts in 1974 and 1984. After the revolution in 1974, the continuous civil war and conflicts with the neighboring countries lead to the collapse of national economy. The Gross Domestic Product (GDP) in 1988 was estimated to be 10 billion Birr (U.S \$ 5 billion) and its Gross National Product (GNP) per capita was US\$ 120.

The agriculture sector occupies more than 40% of the GDP, about 90% of export and 75% of employment, therefore agriculture is considered as the base of the national economy. Development of agriculture is one of the most important national policies in the "Ten Years Perspective Plan" of the previous government in 1984 and the same policy is continued in the "Ethiopian Economic Policy during the Transitional Period" formed by the Transitional Government in 1991.

The government started the Small Scale Irrigation Development (SSID) project to stabilize the food supply and to improve the living standard of small scale farmers by installation of small scale irrigation systems. The project was started in 1984 through the Irrigation Development Department (IDD) of Ministry of Agriculture (MOA).

In SSID project, it is planned to develop an area of 180,000 ha by the small scale irrigation system. In this project 29 schemes of 2,600 ha area was completed already. The construction was started for 46 schemes of 9,600 ha area and the detailed design was completed for 33 schemes of 4,900 ha area. The government is planning to complete 72 schemes of 10,913 ha area at Northern, Northeastern, Northwestern, Western and Southwestern Zones within 5 years period between 1992 and 1997.

The equipment and machinery for the implementation of these programs was purchased through multilateral financial assistance including the grant aid support from the Government of Japan. However, there is lack of funds to purchase additional equipment and machinery for the project, and for this purpose, the Government of Ethiopia requested for the grant aid assistance from the Government of Japan.

In response to this request, the Government of Japan decided to conduct the Basic Design Study on the Small Scale Irrigation Development project. A study team held a series of discussions with the officials concerned of the Transitional Government of Ethiopia, and conducted a field survey in the study area.

The study team confirmed the rationality and necessity of the project and the transitional government of Ethiopia mutually understood the conditions of the Japanese grant aid system. The study team also confirmed on the site the contribution of the equipment and machinery to the SSID project purchased in 1984 and 1986 through the previous Japanese grant aid and other multilateral assistance. The study team found out the shortage of spare parts for the equipment and machinery purchased from Japan and they were kept in MOA's garages for repairs.

After the study team returned back to Japan, further studies were made on the requested Project based on the field survey and the basic design study report was prepared. The report confirms the Project liability and the selection of equipment and machinery for the Project.

The Project aims to purchase the additional construction equipment and machinery which will be necessary for the implementation of 49 schemes to develop 6,887 ha area in the Northern, Northeastern, Northwestern, Western and Southwestern Zones covering 7 provinces and 13 regions. As shown in Table S.1, a total of 95 units of 15 types of equipment and machinery and their spare parts will be additionally required for this Project.

The Project will be implemented by the Irrigation Development Department (IDD) under the Rural Infrastructure Development Main Department (RIDMD) of Ministry of Agriculture. The procurement shall be assisted by the Supply and Equipment and Service Department of RIDMD. IDD will be responsible for the recruitment of additional operation and maintenance staff for the equipment and machinery to be purchased under this Project. IDD is also responsible for providing the existing equipment and machinery and completing the construction of the Project. The Supply and Equipment Service Department will be responsible for the maintenance of existing equipment and machinery and the new equipment and machinery to be purchased under this Project.

The Ministry of Agriculture (MOA) will be responsible for preparing Exchange of Notes, banking arrangement, and obtaining import permits and custom clearance. It also needs to make arrangements for the Japanese engineers to enter Ethiopia. The administration procedure needed for the implementation of the project with the related governmental agencies should also be carried out by MOA.



The procurement will be divided into two stages; the first and the second stage will be implemented in the Japanese fiscal year 1993 and 1994 respectively. The implementation period for each stage including the detailed design and preparation of tender documents will be 9.5 months after signing the Exchange of Notes.

The implementation capacity of the SSID project will be expanded by the additional equipment and machinery to be purchased by the Project. The Project will contribute for stabilizing food production and improving the living standard of small scale farmers and for reconstruction of national economy. Therefore the Project is considered to be suitable for the Japanese grant aid program and is expected to be implemented as soon as possible, corresponding to the Ethiopian government program. There seems to be no obstacle on the Ethiopian government side for the implementation of the Project. Ethiopian government requests for the Japanese technical cooperation for the effective implementation of SSID project, using the equipment and machinery procured by the Project. Japanese technical cooperation is recommended to implement for planning, design and construction of irrigation system and for the operation and maintenance of the equipment and machinery. The following aspects need to be considered during the course of implementation of SSID project :

- For SSID planning

- (1) Under the limited financial conditions, the cost efficiency should be considered for deciding the priority of implementation.
- (2) An effective staff training program should be established to strengthen the SSID project throughout the planning, design and construction stages.
- (3) An effective management plan should be introduced and data base should be used during Project planning and design stages.
- (4) The SSID project should be implemented through small scale farmers organizations which will facilitate for more participation of the small scale farmers.
- (5) The agricultural extension services should be strengthened and institutional support should be provided for the small scale farmers organizations in the areas of the completed schemes.
- (6) Establishment of small scale farmers organizations should be promoted and an operation and maintenance manual should be prepared for the irrigation system.

- (7) The dam/reservoir schemes should be reviewed and reconsidered in order to assess the water balance and economic efficiency of the irrigated area and the inundation area of the reservoir.
- (8) The cost for the implementation of the Project except for the equipment and machinery procurement cost should be arranged.

- For the implementation of the Project

- (1) Based on the construction schedule, a smooth distribution of the newly purchased equipment and machinery should be implemented and the present equipment and machinery should be rearranged.
- (2) A daily and periodical inspection manual for the construction equipment and machinery should be prepared as soon as possible.
- (3) A staff training program for the operation and maintenance of construction equipment and machinery should be established in collaboration with other similar governmental organizations such as the Ethiopian Road Construction Authority.
- (4) Financial arrangement should be made for the existing equipment and machinery and the additional equipment and machinery to be purchased by the Project.

The Project to procure the additional construction equipment and machinery will increase the implementation capacity of SSID project and it also can complete the 49 SSID schemes of 6,887 ha area in the Project area within the next 5 years.

The Project will benefit not only the SSID, but also helps to recover and reconstruct the Ethiopian national economy. Therefore this Project is the most favorable to be implemented under the Japanese grant aid. In addition to the Project, technical cooperation to dispatch Japanese experts and volunteers of irrigation planning, design and construction is recommended for the smooth and effective implementation of the Project.

Table S.1 Comparison of the Request and the Basic Design

	Original Request			Basic Design		
Project Area	1. Northwestern Zone (Gondar, Gojam) 2. Western Zone (Wollega, Ilubabor and Kofa)			1. Northern Zone (Tigray) * 2. Northeastern Zone (Wolo) * 3. Northwestern zone (Gondar, Gojam) 4. Western Zone (Wollega) 5. Southwestern Zone (Ilubabor, Kefa) *		
Number of Schemes and Area	Zone	Scheme	Area	Zone	Scheme	Area
	N-W	24	3,337 ha	N *	2	300 ha
	W	17	2,775 ha	N-E *	6	965 ha
				N-W	25	3,237 ha
				W	9	300 ha
				S *	7	1,200 ha
	Total	41	6,112 ha	Total	49	6,887 ha
Equipment and Machinery	Type		Quantity	Type		Quantity
	Bulldozer (200HP)		8	<u>First Stage</u>		
	Wheel Loader (150HP)		4	Bulldozer (200HP)		3
	Motor Grader (135HP, 3.5m)		3	Wheel Loader (150HP)		2
	Motor Scraper (16 m3)		2	Motor Grader (135HP, 3.5m)		1
	Dump Truck (13.5 ton)		20	Dump Truck (13.5 ton)		8
	Backhoe (115HP)		4	Vibration Roller (130HP)		3
	Vibration Roller (130HP)		3	Low-bed Semitrailor (40ton)		2
	Mobile Workshop		2	Water tanker		2
	Mobile Greasing Plant		2	Pick up		12
	Low-bed Semitrailor (40ton)		2	Station Wagon		4
	Stone Crusher (7ton/hr)		6	Drilling Machine (L=50m, Dia=65)		1
	Concrete Mixer (350litre)		12	Spare parts for existing equipment *		Lump sum
	Compactor (86kg)		6	Field Kits *		Lump sum
	Generator (25 KVA)		6	<u>Second Stage</u>		
	Water Tanker (275 HP)		6	Bulldozer		5
	Pickup		12	Wheel Loader		2
	Motor Cycle (100cc)		20	Motor Grader		2
	Drilling Machine (Truck Mounted)		1	Dump Truck		12
	Station Wagon (9 sheets)		4	Mobile Workshop		2
	Spare parts		Lump sum	Water Tanker		4
				Walk Type Roller (1ton) *		6
				Generator (25 KVA)		6
				Stone Crusher (7 m3/hr)		6
				Concrete Mixer (350litre)		12
				Spare parts		Lump sum
				Field Kits *		Lump sum

\* ; modified from the Original Request



**BASIC DESIGN STUDY REPORT  
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IN  
ETHIOPIA**

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## ABBREVIATIONS AND DEFINITIONS

### ABBREVIATIONS

2KR	: The Second Kennedy Round
4WD	: Four Wheel Drive
ADF	: African Development Fund
AMC	: Agricultural Marketing Corporation
CSA	: Central Statistic Authority
E/N	: Exchange of Notes
ERCA	: Ethiopian Road Construction Authority
EVDSA	: Ethiopian Valleys Development Study Authority
EWVCA	: Ethiopian Water Works Construction Authority
FAO	: United Nations Food and Agriculture Organization
GDP	: Gross Domestic Product
GNP	: Gross National Product
GVW	: Gross Vehicles Weight
IDD	: Irrigation Development Department
IFAD	: International Fund for Agriculture Development
JICA	: Japan International Cooperation Agency
MOA	: Ministry of Agriculture of Ethiopian Government
NMSA	: National Meteorological Service Agency
NWRC	: National Water Resources Committee
P/S	: Pre-feasibility Study
PA	: Peasant Association
PC	: Producers Cooperative
RIDMD	: Rural Infrastructure Development Main Department
SESD	: Supply and Equipment Service Department
SIDA	: Swedish International Development Agency
SSID	: Small Scale Irrigation Development
TG	: Transitional Government of Ethiopia
UNCDF	: United Nations Capital Development Fund
UNDP	: United Nations Development Program
WRDA	: Water Resources Development Authority
WSSA	: Water Supply and Sewage Authority

### DEFINITIONS

SSID project: Small Scale Irrigation Development project implemented by IDD of MOA

The Project : The Project of equipment procurement from the Government of Japan

Project Area: Area where the SSID schemes will be implemented by the equipment procured through the Project

Schemes : Individual irrigation project(s) under SSID project



## **Chapter 1 Introduction**



## CHAPTER 1 INTRODUCTION

### 1.1 Request of the Project

The Government of Ethiopia started the Small Scale Irrigation Development (SSID) project to stabilize the food production and to improve the living standard of small scale farmers by installing the small scale irrigation system. The SSID project was started in 1984 through the Irrigation Development Department (IDD) of Ministry of Agriculture. In SSID project, it is planned to develop an estimated area of 180,000 ha by the small scale irrigation system. In this project 29 schemes of 2,600 ha area was completed already. The construction was started for 46 schemes of 9,600 ha area and the detailed design was completed for 33 schemes of 4,900 ha area. The government is planning to complete 72 schemes of 10,913 ha area in Northern, Northeastern, Northwestern, Western and Southwestern Zones within 5 years period between 1992 to 1997.

The equipment and machinery for the implementation of these programs were purchased through multilateral financial assistance including the grant aid support from the Government of Japan. However there is lack of funds to purchase additional equipment and machinery for the project, and for this purpose, the Government of Ethiopia requested for the grant aid assistance from the Government of Japan.

### 1.2 Basic Design

In response to the request from the Transitional Government of Ethiopia, the Government of Japan decided to conduct a Basic Design on the SSID Project in Ethiopia and entrusted the study to the Japan International Cooperation (JICA). The JICA send a Basic Design Study Team (the Study Team) to Ethiopia headed by Mr. Yoshikatsu Nakamura, Director of First Basic Design Study Division, JICA, from September 21st to October 20th, 1992. The Study Team held a series of discussions with the officials concerned of Transitional Government of Ethiopia and conducted a field survey at the Project Area.

### 1.2.1 Purpose of the Basic Design Study

The objectives of the Basic Design Study are as follows :

- (a) To clarify the details of the Project requested by the Government of Ethiopia
- (b) To examine and assess the technical, institutional, and economic viability of the Project
- (c) To make a general layout and design
- (d) To estimate the cost of the Project and the schedule required for the implementing equipment and machinery procurement

### 1.2.2 Field Survey

In order to fulfil the above stated objectives, the Study Team conducted the field survey from September 21st to October 20th, 1992. The Study Team discussed and collected the information and data on the background of the Project, implementation organization, achievement and present situation of SSID by the Irrigation Development Department (IDD) under the Rural Infrastructure Development Main Department (RIDMD) of Ministry of Agriculture (MOA).

Based on the results of discussions and field survey, the Study Team and the Transitional Government of Ethiopia confirmed the main items of the Project and concluded the Minutes of Meetings signed among Mr. Nakamura, Leader of Basic Design Study Team, JICA, Ato Geremew Getahum, Head of Department of America and Asia, Ministry for External Economic Cooperation, and Ato Menker W/Kiros, Acting Head of Rural Infrastructure Development Main Department, Ministry of Agriculture on September 30th, 1992. (ref. Attachment IV)

### 1.2.3 Basic Design Report

Then, the Study Team conducted the further studies and analysis on the SSID Project in Japan. This Basic Design Report contains these study results confirming rationales of the SSID Project and design of equipment procurement together with implementation plan of the Project.



## **Chapter 2 Background of the Project**



## CHAPTER 2 BACKGROUND OF THE PROJECT

### 2.1 Background of the Project

#### 2.1.1 General

Ethiopia is situated in the North East Africa between latitudes 3° to 18° N and longitudes 33° to 48° E. It borders four African countries namely Sudan, Kenya, Somalia and Djibouti. The northern state Eritria has a 1000 km coast line along the Red Sea. The country covers an area of 1,250,000 sq.km which is about 3 times of the area of Japan. It has an estimated population of 49.5 million (1991) and its capital city is Addis Abeba.

The Great Rift Valley passes through the center of the country from north to south, and separates the undulated western highlands and the dried eastern lower plain lands. Compared to other African countries, Ethiopia has been independent for a long time and has a long historical background. It has a rugged and mountainous topography and exhibits linguistic and cultural diversities with different ethnic groups.

The country has suffered serious droughts in 1974 and 1984. In 1974 a military revolution was started to overthrow the emperor regime. After the revolution in 1974, the continuous civil war and conflicts with the neighboring countries lead to the collapse of national economy. After the end of civil war, a transitional government was formed in 1991 with an assurance to hand over the power to an elected government before 1994.

The government has started new programs for the recovery and reconstruction of national economy with bilateral and multilateral foreign assistance.

#### 2.1.2 Natural Resources

##### (1) Topography

The topography of Ethiopia is divided into three categories; Central Highland at the west to the center, Great Rift Valley at the center and the Lower plain land at the east. The Central Highland area is a deeply dissected table land

with elevations between 1,800 m to 3,000 m a.s.l. This area has a cool climate with a mean annual temperature of 10° C to 20° C and a mean annual rainfall of 1,000 mm. The soil condition in this area is fertile and suitable for agriculture.

The Great Rift Valley expands at the center of the country between Red Sea at the north and Lake Rudolf at the south. The mean annual rainfall of this area is less than 250 mm and therefore it is not suitable for agriculture without irrigation. The rolling topographic feature restricts the traffic condition of this area.

The Lowland area is covered with desert or savanna stretches along the border of Sudan on the western side and Somalia on the eastern side. The climate in this area is arid with a mean annual rainfall of less than 250 mm.

## (2) Geology

The basement upon which all younger formations were deposited is mainly metamorphic rocks of Precambrian period and forms shield-shaped configuration of the ground. Those metamorphic rocks consist of schist, granite, gneiss and become matrices of mineral deposit. Most of those exposed basement are found in Eritria in northern part, Wollega in south western part and Sidamo in southern part of the country. Thick younger formations deposited on the basement are sandstone and limestone, which were formed by transgression and regression in Mesozoic era, with ages of over 165 million years. Those Mesozoic rocks can be found at Ogaden in Harrar, some parts of Tigray and several valleys on dissected volcanic plateaus by Blue Nile River. Volcanic activities in the Oligocene of Tertiary period emitted huge amount of alkali basalt and molded volcanic plateaus with a thickness of 2,000 to 3,000 meters. Those basalt are called Trap Series and consist of alkali basalt, pyroclastic rocks, tuff, rhyolite formations. These series are classified into Ashangi formation and Magdala formation, depending on the time series of their emission. After those volcanic activities, tholeiite flowed out at the initial stage of the continental drift. This continental drift caused a series of volcanic activities and produced many volcanoes. The East African - Ethiopia Rift Valley was developed in the late Pliocene period. As mentioned previously, geological formations of Ethiopia contain from Precambrian rocks to unconsolidated formations of Quaternary period. And main configuration of

the country's topographical surface was formed by the volcanic rocks of Trap Series in Tertiary period as typical Ethiopian plateaus.

### (3) Climate

Ethiopia has a diversified climate due to its topography and elevation as discussed above. Basically the climate can be divided into three categories; 1) dry climate, 2) tropical rainy climate and 3) temperate rainy climate. Their coverages are shown in APPENDIX VII.

#### i) Rainfall

The mean annual rainfall varies from less than 400 mm in the north and western area of the country to more than 2,400 mm in the Central Highland. It has dry and rainy seasons. Ethiopia can be divided into four rainfall patterns; i) rain in summer as in Gondar and Gojam provinces, ii) rain in summer and spring as in Tigray and Wolo provinces, iii) Rain during most of the year as in Wolega, Ilubar, and Kefa provinces and iv) rain in spring and fall as in southern provinces.

#### 2) Temperature

The average temperature ranges between 15° C to 20° C, and annual temperature deviation is within 5° C. The daily temperature deviation in the Central Highland is around 15° C.

#### 3) Humidity

Relative humidity ranges between 45% to 55% during the dry season and 70% to 80% during the rainy season.

#### 4) Hydrology

There are many rivers originated from Ethiopia and flows to neighboring countries such as the Abay River (Blue Nile). The total discharge of these rivers are estimated as 105.5 million m<sup>3</sup> per annum of which only 4% is utilized in Ethiopia.

Deforestation by reclamation and cutting of trees for fuel by the local people caused the destruction of the catchment areas. It resulted in the increase of peak discharge of floods and surface erosion of fertile top soil. Droughts in 1974 and 1984 were exaggerated by this deforestation.

Development of water resources is coordinated by the National Water Resources Committee (NWRC). Observation of river discharges is carried out by Ethiopian Meteorological Service under NWRC. Operation and management of the observation is very poor and only few data is available because of the shortage and deterioration of observation equipment and poor management system.

### 2.1.3 Socio-economical condition

#### (1) Population

Population of Ethiopia is the third largest in Africa after Nigeria and Egypt. According to the census carried out in 1984, the total population was estimated as 42 million and the annual population growth rate between 1985 and 1988 was 3.3%. The population density in 1988 was 39 per km<sup>2</sup> and 89% of the total population is distributed in the rural areas. The birth rate and infant mortality rate are 43.7/1000 and 154.3/1000 respectively. The life expectancy at birth is 39.5 years for male and 42.6 years for female.

The population of the labor force between age 15 to 65 is 44.7% of the total population, and more than 75% of this population is employed in the agriculture sector.

#### (2) National Economy

The total Gross National Product in 1987/88 is 10,108 million Ethiopian Birr and the GNP per capita was estimated as US\$ 120 in 1990. GDP in 1987/88 was estimated as 10,247 million Ethiopian Birr and the average increase rate of GDP between 1970 to 1989 is 2.5%. It was dropped to -7% caused by the drought in 1984/85. More than 40% of the GDP is occupied by the agriculture sector which is followed by other sectors.

On an average of 22% of the national GDP and 9% of the export and import

depends upon the international trade between 1984 to 1987. The import quantity exceeded 2 to 3 times of the export, which caused an imbalance of 10-15% against the GDP. The export amount of agriculture sector was estimated to be 90% of which 55 to 75% is occupied by coffee export.

During Derg era (1974-1991), 40% of the government budget was spent on national defence. The amount spent on the economic development, education and culture sectors is limited to 6.5 to 15% of the total budget.

Government controlled more than 50% of the consumer prices. Even though the annual increase of consumer price index was 4%, it mainly depends on agriculture production and it increased to 25% in 1986 and decreased to -14% caused by drought.

On October 1, 1992, the Transitional Government of Ethiopia announced the devaluation of Ethiopian Birr from E.B. 2.07 to E.B. 5.00 against 1 U.S \$, in order to adjust the exchange rate of the market and for the reconstruction of Ethiopian economy.

### (3) National Development Policy

Ten Years Perspective Plan was developed in 1984 by the previous government. But the development was interrupted by drought in 1984 and civil war. After regaining the normal situation 1991, the Transitional Government issued the "Ethiopian Economic Policy during the Transitional Period (EEPTP)" in November 1991 in order to recover and reconstruct the national economy. New national development policy and the sector plans for the new government which is expected to be formed in 1994 are under preparation by the concerned government agencies. Agriculture is the base of the national economy, and therefore agriculture development should be given importance in any national development policy. In EEPTP, the Transitional Government plans to implement the following :

- A social policy in compliance with the macro-economical policy (to be issued) will be restricted by the limited freedom of the Ethiopian government

- Higher degree of managerial autonomy will be given to public enterprises (with specific reference to state industries)
- Priority will be given for the conservation and development of natural resources (including water conservation)
- Priority will be given for the rehabilitation of most affected areas by war and drought
- Infrastructure destroyed due to lack of maintenance and upkeep should be restored
- Infrastructure of limited priority will be implemented, i.e. to assist private initiatives in productive activities
- Organizational structures and management systems for implementation of a new economic policy should be studied and initiated within the existing constraints

#### (4) Foreign Assistance

After the drought in 1984, emergency food aid assistance from U.S.A, EC, Canada and other international agencies was increased. Many bilateral and multilateral assistance is undergoing for the national development and most of which is grant aid assistance. The amount of foreign assistance was 14.9% of GNP and the amount per capita in 1990 was US\$ 17.6. Among the donor countries, the largest assistance is provided by Italy. Sweden is also contributing constantly to the agriculture and natural conservation sectors. Japanese assistance was concentrated on food aid, food production and technical training. Its total amount and the share is comparatively small. Japanese OECF loan is limited to Groundwater Development Project (2.1 billion yen in 1972) and construction of Addis Abeba Airport Extension Project (1.5 billion yen).



## 2.2 Agriculture

### 2.2.1 Agriculture in National Development Plan

Agriculture is the base of national economy covering more than 45% of GNP, 80% of labor force and more than 90% of the export value. Excepting northern and eastern areas, the Central Highlands has an annual rainfall of more than 1,000 mm and is covered by fertile soil, which are favorable for agriculture development. Only 11% of the total land area is estimated to be arable land and 2 to 3 million ha was defined as the potential area for irrigation development.

After the conclusion of civil war in 1991, the population is expected to be doubled in 2000 and the demand of calory consumption will also be increased. In order to overcome these demands, there is an urgent need to increase the productivity and production of food crops. Also the production of industrial crops such as cotton and maize needs to be increased in order to meet the agro-industrial development. Under these conditions, the agriculture sector shall contribute to the national development of the following items ;

- (1) Achievement of food supply and prepare food stock against future drought conditions
- (2) Increase the production capacity of industrial crops for domestic agro-industrial development
- (3) Increase the production of export commodities

The Transitional Government is preparing the new national development policies for the permanent Government in 1994 under the assistance of foreign countries and international agencies. Using foreign assistance, the development of medium and large scale irrigation development will be carried out for increasing the production of cash crops, and small scale irrigation development increase the production of food crops uplifting the living standard of the farming community.

### 2.2.2 Agricultural Development and Institutions

Drought in 1984 caused a serious food shortage and it was intensified by the civil war causing many deaths from hunger. After 1991, the Transitional

Government has started the reconstruction of national economy giving priority to the drought prone area. The agriculture development in these drought prone areas, Tigray and Wolo, is targeted towards the installation of irrigation system in order to maintain food production against droughts, along with the development of agro-industry. The agriculture development by the introduction of small scale irrigation system also will increase the productivity by increasing the inputs such as fertilizer.

## (2) Ministry of Agriculture

The agricultural development work is carried out by the Ministry of Agriculture (MOA) and the organization chart of MOA is shown in Table 2.1 and Fig.2.1. There are 11 departments directly connected to the Minister and 18 departments connected under the 3 main departments. In the local level there are 10 zonal offices except Eritria. Each zonal office has several regional offices and there are branch offices of central departments.

### 2.2.3

## Agriculture Production

### (1) Land Ownership and Holdings

Before 1974, most of the lands were owned by the Emperor, large land owners such as churches and the peasants cultivated the lended farms. In 1975, the Land Reform Decree declared that the land belongs to the country and the people can borrow the land from the Government. Each farm member of a farm family can cultivate 0.25 to 0.50 ha, which varies with development progress and land productivity of the regions. Therefore a farm family can cultivate 1.5 to 2.5 ha and its maximum is limited to 10 ha per farm family.

### (2) Cultivation Area and Production

Arable land is estimated to be 132,000 ha or 11% of the Ethiopia's total land area. In 1985, the cultivation area was estimated to be 40% of the total arable land. After 1975, this cultivation land is divided into state farms (5%) and private farms (95%).

## 1) Food Crops

The main food crops in Ethiopia are maize, teff, barley, wheat, sorghum, millet, oats and various variety of beans. Their cultivation area and yield varies with respect to year depending on the climatic conditions. The maximum food production recorded was 6.5 million ton in 1980, and during the drought in 1984, it was dropped to 5.7 million ton. The cultivation area was extended to 6.4 million ha in 1982, but it dropped to 5.7 million ha caused by the transmigration policy to migrate 30,000 farmers of the drought prone area to other regions. The unit yields of food crops is between 20 to 50% of the international standard.

## 2) Cash Crops

The cash crops in Ethiopia are composed of coffee, cotton and oil seeds. Coffee is harvested mainly on the southwestern Central Highlands. It is managed by small farmers in 40,000 to 45,000 ha area. Ethiopia is a member of International Coffee Organization and the value of coffee export shares more than 50% of the total export. Production of coffee peaked upto 240,000 ton but it went down upto 18,600 in 1985.

### 2.2.4

#### Agricultural Extension Services

Small scale individual farmers continue the traditional extensive cultivation method and system. Few simple irrigation systems are introduced. Their living standard is low, and mostly depends on the trading of agricultural products for other goods which are necessary for living. Also their educational background is poor. Therefore, the role of agricultural extension services becomes important for the successful introduction of irrigation system.

Ministry of Agriculture assigned agricultural extension workers under the zonal offices to each SSID scheme. Agricultural research institutes support the SSID project in conducting the research and demonstration of high yielding varieties and cultivation methods. Agricultural research centers train the farmers and provide the improved seeds to the farmers. Also the rural technology promotion centers are introducing and demonstrating the modernized agricultural production methods and promote the simple but improved cultivation techniques.

The extension services are provided through the farmers cooperatives and or through peasants associations. The producers cooperatives were organized by the previous Government consisting of several peasants associations. After 1991, the producers cooperatives didn't redefine its activities or functions and some troubles occurred in rural areas.

#### 2.2.5 Marketing System of Agricultural Products

Except for commercial or state farms, most of the agricultural products are consumed by the farmers themselves and only excess or commercial products come to the market. Mostly farmers bring the products to the local markets. After establishment of Agricultural Marketing Cooperation (AMC) in 1976, commercial marketing was started to main cities after collecting from individual farmers by peasants associations and service cooperatives.

#### 2.2.6 Agricultural Credit

There are non-institutional and private money lending agencies and public agricultural credit system available to the farmers for agricultural credit. Private money-lending has continued to flourish despite the high interest rate (60 to 200% per annum) charged and the wide spread banking facilities. The reasons for this trend includes easy access, informal procedures and speedy transactions. Most of the loans are used for agricultural production purposes. Agricultural and Industrial Development Bank (AIDB) is the public institution available for this purpose. The fund for the AIDB's credit for short-term or long-term loan to the producers cooperatives is obtained by borrowing from foreign institutions such as IFAD.

#### 2.2.7 Farm Budget

Each member of a farming family has land for cultivation ranging from 0.25 ha to 0.5 ha and a farming family owns a farm of about 2 ha area. Farm economy depends on the type of crops, cultivation period, method and yield of products and market prices etc. Average farm economy of a typical model farm can be estimated as shown in Table 2.2.

Table 2.1 Administrative Region and Zonal Office of MOA

No.	Administration Region 1986	Previous Region	Zone of MOA	MOA's Zonal Office	Area (km <sup>2</sup> )	Population in 1989	P. Dens. per km <sup>2</sup>	MOA Zonal Sum Area (km <sup>2</sup> )	MOA Zonal Sum Population	Remarks
1	Eritria AR.	Eritria	-	-	93,679	3,046,894	32.5	-	-	
2	Assab AR.	-	-	-	67,330	511,333	7.6	-	-	
3	Tigray AR.	Tigray	Northern	Mekele	53,498	2,677,962	50.1	53,498	2,677,962	Project Area
4	Dire Dawa AR.	-	-	-	29,245	461,342	15.8	-	-	
5	Osaden AR.	Harargha	Harargha	Harar	179,327	813,630	4.5	-	-	
6	Western Harargha	-	-	-	33,188	1,326,107	40.0	-	-	
7	Eastern Harargha	-	-	-	90,600	2,480,452	27.4	332,360	5,081,531	
8	Northern Wollo	Wollo	North-	Dese	30,835	1,449,673	47.0	-	-	
9	Southern Wollo	-	Eastern	-	20,702	2,392,404	115.6	51,537	3,842,077	Project Area
10	Northern Gondar	Gondar	-	-	62,020	1,819,520	29.3	-	-	
11	Southern Gondar	-	North-	-	17,079	1,671,893	97.9	-	-	
12	Eastern Gojjam	-	Western	Bahardar	13,936	1,519,100	109.0	-	-	
13	Western Gojjam	Gojjam	-	-	17,289	1,975,517	114.3	-	-	
14	Metekel	-	-	-	30,481	372,512	12.2	140,804	7,358,542	Project Area
15	Assossa	Wollega	Western	Mekemte	23,067	511,333	22.2	-	-	
16	Wollega	-	-	-	42,632	2,391,428	56.1	65,699	2,902,761	Project Area
17	Addis Abeba	-	-	-	5,188	2,291,137	441.7	-	-	
18	Northern Shewa	-	Central	Addis Abeba	27,030	2,298,111	85.0	-	-	
19	Western Shewa	Shewa	-	-	23,218	2,626,678	113.1	55,435	7,215,926	
20	Southern Shewa	-	Central	Nazaret	16,799	2,894,306	172.3	-	-	
21	Eastern Shewa	-	South	-	12,754	906,019	71.0	29,553	3,800,325	
22	Arssi	Arssi	South	Asela	23,710	1,928,226	81.3	-	-	
23	Bale	Bale	East	-	67,330	949,551	14.1	91,040	2,877,777	
24	Gambella	Illubabor	South-	-	26,065	174,395	6.7	-	-	
25	Illubabor	-	Western	Jimma	35,059	2,787,179	79.5	-	-	
26	Keffa	Keffa	-	-	40,083	1,028,625	25.7	101,207	3,990,199	Project Area
27	Northern Omo	Gamo	-	-	29,923	2,727,990	91.2	-	-	
28	Southern Omo	Goffa	Southern	Awasa	22,001	241,100	11.0	-	-	
29	Sidamo	Sidamo	-	-	20,742	2,664,247	128.4	-	-	
30	Borena	-	-	-	94,018	649,899	6.9	166,683	6,233,236	Project Area
	Total	14	10		1,248,825	49,588,563	39.7	478,222	23,084,578	Total
								38.29%	46.51%	

Notes : AR : Autonomous Region

Source : - Central Statistic Authority, Statistical Abstract 1988, population in 1989

- Irrigation Development Department of MOA

Table 2.2 Farm Economy of the Project Area

Items	Model I EL 2000-2200	Model II EL 1500-2000	Model III EL 1000-1500
Market price of products	432.26	457.44	437.10
Production Cost	30.30	46.64	9.82
Self Consumption	308.00	308.00	308.00
Production losses	43.20	45.70	43.71
Net Income	50.80	57.10	75.57

Source : FAO/AfDf, Small Scale Irrigation Project, Preparation Report, 1983.

Fig. 2.1 Organization of Ministry of Agriculture (1/2)

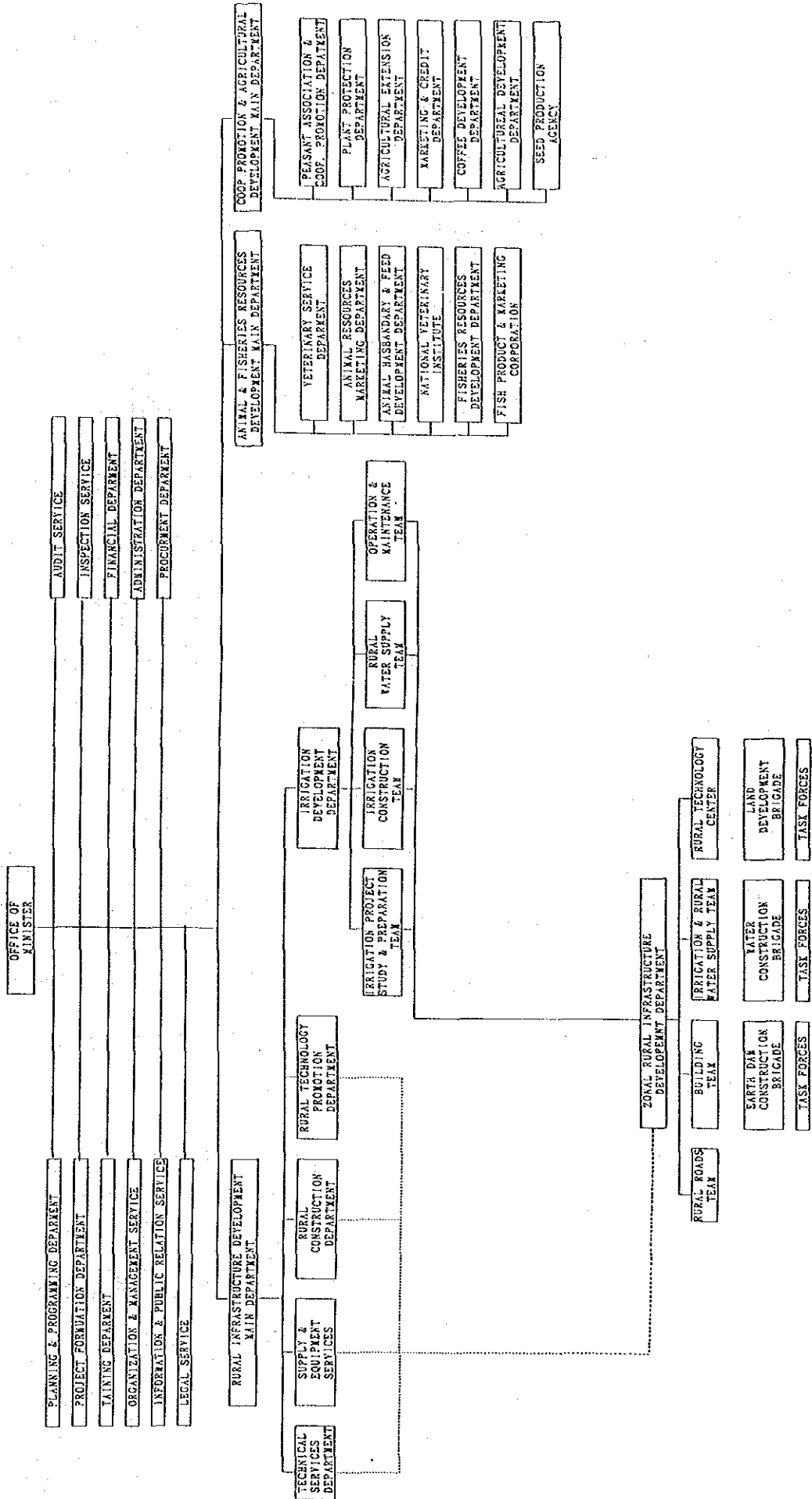


Fig. 2.1 Organization of Ministry of Agriculture (2/2)

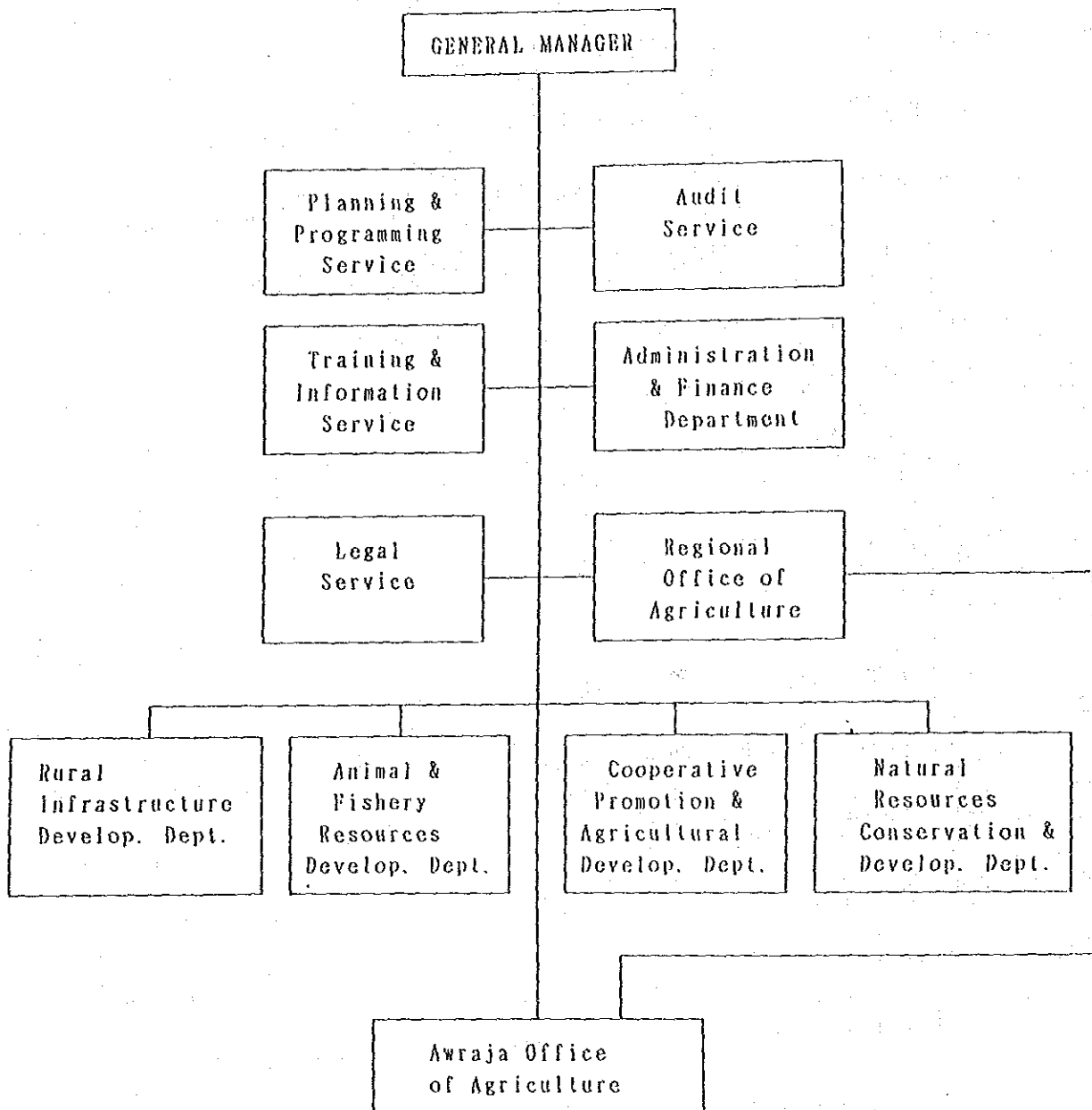
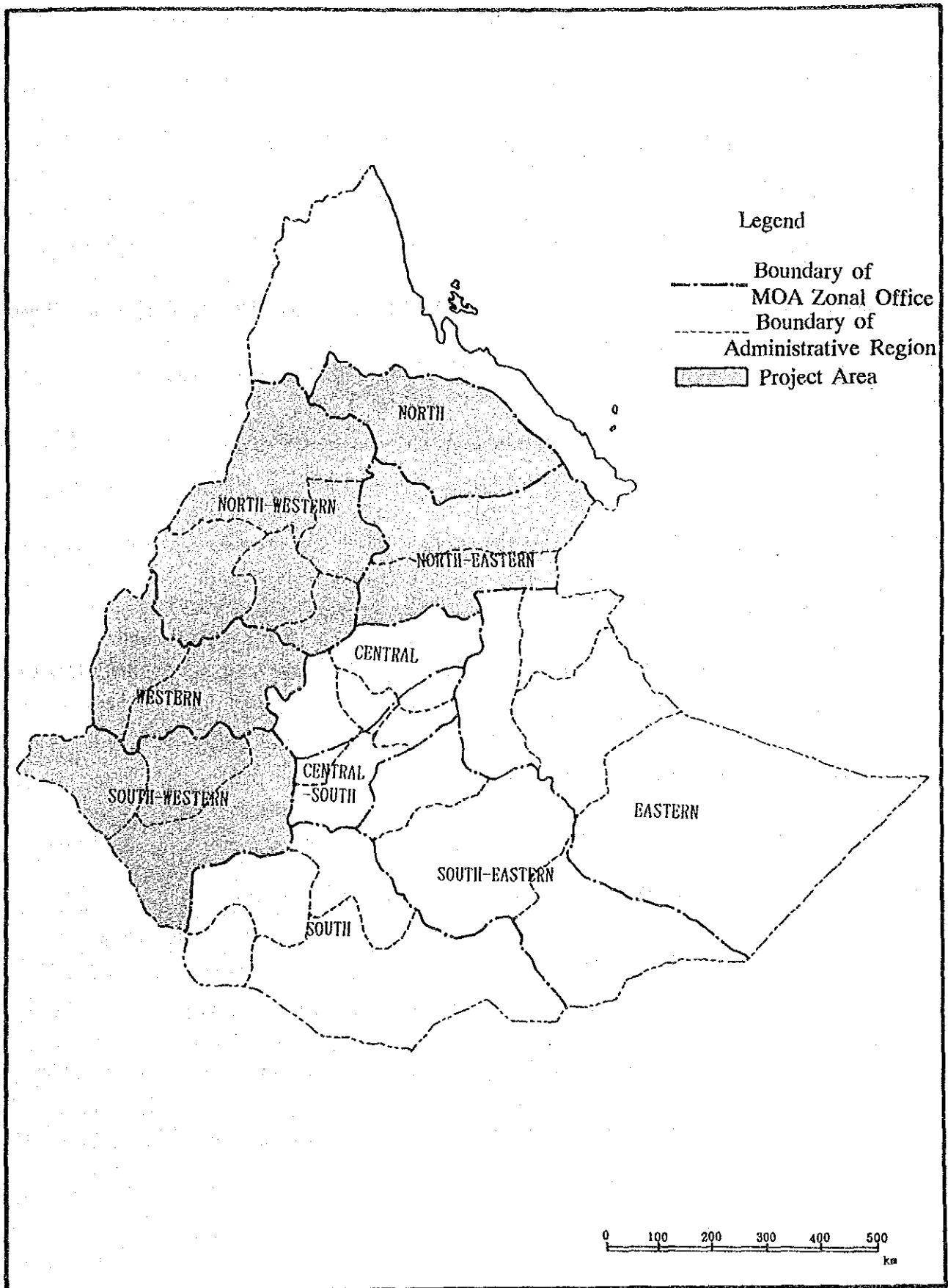




Fig. 2.2 Zonal Office of MOA and Project Area



## 2.3 Outline of the Project Area

### 2.3.1 Project Area

SSID Project is carried out in most of the areas in Ethiopia. The Project area is defined as the Zonal office areas which involve SSID schemes to be constructed by the existing and additionally purchased equipment under the Project. The Project area was confirmed between the Government of Ethiopia and the Basic Design Study Team during the field survey. The distribution of the Project area covering 5 zonal offices covering 7 provinces and 13 regions are shown in Table 2.3.

Table 2.3 Distribution of the Project Area

No.	Zonal Office	Province	Region
1.	Northern	Tigray	Tigray
2.	Northeastern	Wolo	Northern and Southern Wolo
3.	Northwestern	Gondar	Northern and Southern Gondar
		Gojam	Northern and Southern Gojam
4.	Western	Wolega	Asosa, Wolega
5.	Southwestern	Illubabor	Illubabor, Gambela
		Kefa	Kefa

The total acreage of the Project area is 478,222 km<sup>2</sup> which is 38% of Ethiopia's land area. The Project area is located in the Central Highland and extends from Tigray at north (14° 53'N), to Kefa at south (5° 15'N), and from Wolo at east (42° 24'E) to Illubabor at west (32° 56'E). The area extends over 1,060 km from the north to the south and 950 km from the east to the west. The Central Highland is a deeply dissected table land natural conditions such as climate, hydrology, soil and geology and socio-economical conditions such as ethnic group and language which varies from location to location.

## 2.3.2 Natural conditions in the Project Area

### (1) Topography

Great Rift Valley penetrates along the longitude of 40° E in Tigray and Wolo Provinces. The eastern part is a lower plain with an elevation of 500 m above the sea level up to Djibouti boundary. The northern edge falls to the Danakil Depression which has elevation of 100 m below the sea level at the border of Eritrian Province. The bottom edge of the Central Highland lies along the Great Rift Valley and the Central Highland rises upto 3,000 m height at the west. The steep slope at the eastern edge of the Highland acts as the natural wall which determines the climate at the eastern part. The Tekeze river runs along the border of Tigray and Wolo Provinces to Sudan forming round valley. Most of the towns and villages in the Province concentrated in the Central Highland of Tekeze basin.

The eastern part of the Gondar and Gojam Provinces is occupied by the Central Highland. The Provinces are bounded by the Tekeze river at the north of the Gondar Province and the Abay (Blue Nile) which includes Lake Tama and the largest river of Ethiopia, at the boundary of both Provinces and the east and south boundary of Gojam Province.

Mt.Ras Dejen (EL 4,450m), the highest mountain in Ethiopia, and Mt.Guna (EL 4,231m) in Gondar Province and Mt.Choke (EL 4,052m) in Gojam Province raises at the top of the Central Highland and lowers up to 500 m to 1000 m towards the west border with Sudan.

Mt.Tulu Welel (EL 3,200m) divides the Wellega Province to the eastern and western halves. The eastern half of the Province spreads on the left bank of the basin of the Abay which runs from the northern edge of the Province from east to west. Nekemete, the capital city of the Province is situated at the southern end of the basin and has a dense population with high economic activity in the Province. The western half forms the gentle high plateau to the west extending to Ilubabor and Kefa Provinces originated from Mt.Tulu Welel.

## (2) Soils

Tigray Province is located on the right bank of the Tekeze river and the soils were originated from limestone. The western part of the Province is covered mostly with Chromic, Eutric, and Calcic and Cambisols. These soils exist in the limestone area with rare rainfall and contaminated with gravel or rocks on the sloped area. Therefore this area is not suitable for agriculture. Vertic Cambisols and Vertic Unisols are spreaded near Mekele and the soil shows hard pan during the dry season and very sticky during the wet season. Therefore these soils can be cultivated only when the surface is wet and is not favorable for agriculture. The eastern low land of the Province is an arid zone mixed with Lithosols, Xerosols and Regosols. These soils extend over a small area and contains low organic matter and are not suitable for agriculture.

Wolo Province is located on the left bank of the Tekeze River and is formed on the volcanic basalts. Lithosols, Xerosols and Regosols are found along the national highway No.1. The western slope of the Central Highland is covered with Phaeozems containing many rock formations. Usually this soil appears on the steep slope with shallow depth and is not suitable for agriculture. However if the soil has enough depth, it can be used for agriculture. In the eastern part of the Province, the arid zone is extended from the eastern part of the Tigray Province and is not suitable for agriculture.

In the Gondar Province, Phaeozems with crushed rock extends from the Tana Lake upto Wolo Province. It continues to Luvisols to the west and the soil is fertile and shows high agricultural productivity.

Based on the soil groups, the Gojam Province can be divided into two areas; one is spreaded on the left bank of the Dinder River, the northern slope of Mt.Choke and the other is spreaded on the southern slope of Mt.Choke. The remaining area is covered with Vertisols of heavy clay and Nitrosols, which is suitable for cultivation. The latter is covered with Acrisols which contains many gravel, and Nitrosols which is favorable for agriculture. The physical and chemical properties of Nitrosols are suitable for agriculture and these soils extend to Wellega and Illubabor Provinces. These soils with high rainfall form the food basket of Ethiopia.

### (3) Water Resources

Annual rainfall in the Project area varies from 2000 mm in Kefa, Illubabor and Wollega Province to 500 mm in Tigray and Wolo Province. Seasonal distribution of rainfall also varies. In Tigray Province, 70 to 80% of the rainfall concentrates in July, August but Illubabor and Kefa Provinces get the rain through out the year. Other areas receive constantly from 200 to 250 mm/month from May to October. Most of the rivers in Tigray and a part of the Wolo Province becomes dry during the dry season. In the Abey river basin, many springs can provide constant water supply for agriculture and domestic use.

### (4) Land Use

Topographically, Tigray Province can be divided into two areas. The western half is located on the Central Highland and is covered with scattered cultivation land. Among these cultivation land, the natural forest area available is less and is replaced by bush land. Most of the eastern half is dry land covered with lower grass.

Wolo Province has land use similar to that of Tigray Province but the area of western dry part is larger than Tigray's dry area. Grass land and cultivated land occupies 30% of the total area.

Almost 50% of the Gojam Province is developed as cultivation land of which the perennial cultivation land is 60% and the remaining 40% is cultivated intermittently. Grass land covers 43% and the natural forest land covers only 2% of the area.

In Gondar Province, 65% of the land was developed as cultivation land, of which 60% is kept as fallow. Grass land and forest land covers 25% and 2% respectively.

Almost half of the Wollega Province is covered with grass land and cultivation land occupies 40% of the area. Because of the high annual rainfall, the forest area is larger than other Provinces.

Because of its highest annual rainfall in Ethiopia, Illubabor Province keeps the

natural forest area which covers more than 40% of the Province. Cultivation land with a high productivity is developed over 10% of the area. Grass land of 40% of the area extends to the Sudan border.

Kefa Province shows a similar type of land use as that of Illubabor Province. The land use of the Project area is summarized in Table 2.4.

Table 2.4 Land use of the Project Area Unit in %

Province	Cultivated	Grassland	Forest	Bush
Tigray	48	43	1	8
Wolo	27	70	1	2
Gojam	49	43	2	6
Gondar	64	25	2	9
Wollega	36	49	10	5
Illubabor	12	41	34	15
Kefa	12	46	39	3

Source : National Atlas of Ethiopia 1988

### 2.3.3

#### Socio-economic Conditions

##### (1) General

The Project area is one of the main centers of Ethiopian economic activities which occupy a large part of the agricultural production and population. After the revolution in 1974 and the civil war which lasted until 1991, 40% of the Government expenditure was allotted to the national defence and a small portion of expenditure was allotted for the economic development. Therefore the social infrastructure was collapsed and only very few rehabilitation works were carried out. The economic activities of the rural area were stagnated during the civil war.

In 1974 and 1984, severe droughts occurred in Ethiopia and many people were starved to death. Tigray Province which is also a part of the Project area, was damaged by the drought and the area had limited access during civil war along with Wolo Province. In these two areas, people living in remote areas still

depends on the food supply from foreign aid.

## (2) Access to the Project Area

### 1) Road Network

The transportation in the Project area depends mostly on the road net work. The national highway No.3 which runs through Gojam and Gondar Provinces and connects with Addis Abeba and Amsara has two lanes on each way and is partially covered with asphalt. National highway No.1 which connects Addis Abeba and Asmara and No.2 which connects Addis Abeba and Assab runs through the Tigray and Wolo Provinces at the center and the eastern side.

Wollega Province is connected with Addis Abeba by national highway No.5 upto Sudar border. And Illubabor Province is connected by branch road of No.39 and No.45 which diverts from No.5 and No.7. Kefa Province is connected with Addis Abeba by the national highway No.7.

### 2) Air Transportation

There is an international airport at Bahar Dar of Gojam Province and domestic airports at Mekele in Tigray Province, Dese (Comborcha) in Wolo Province, Gondar in Gondar Province and Jima in Kefa Province. Daily and weekly flight services are operated by the Ethiopian Airlines. There are also several airstrips in the Project area.





## **Chapter 3      Small Scale Irrigation Project**



## CHAPTER 3 SMALL SCALE IRRIGATION DEVELOPMENT PROJECT

### 3.1 Irrigation Development in Ethiopia

#### 3.1.1 Irrigation Development and Execution Agencies

The irrigable area in Ethiopia by medium to large scale irrigation system and small scale irrigation system are estimated as 3 million ha, and 0.1 million ha respectively. The above estimates vary slightly according to different agencies. UNDP/FAO, IFAD, WRDA and EUDSA estimated the irrigable area by medium to large scale irrigation system as 3 million ha, 2.8 million ha, 2.7 million ha and 3.5 million ha respectively. According to an FAO study report (1984), 27,000 ha of the irrigable area by small scale irrigation systems can be irrigated without reservoir and 85,000 ha needs reservoir for irrigation. Government institutions for irrigation development are shown in Table 3.1.

Table 3.1 Execution Agencies for Irrigation Development

	Scale	Function	Organization
1.	Medium to Large	Master plan study and feasibility study	Ethiopian Valleys Development Study Authority (EVDSA)
2.	Large	Detailed design and construction supervision	Water Resources Development Authority (WRDA)
3.	Large	Construction	Ethiopian Water Works Construction Authority (EWWCA)
4.	Small	Study Design and Construction	Irrigation Development Department (IDD) of MOA

The surface and groundwater development is coordinated by the National Water Resources Committee (NWRC). IDD sometimes worked for the medium

scale irrigation development, but IDD and WRDA made an agreement in 1986 that IDD works on the small scale irrigation development with an area of less than 200 ha. MOA provides agriculture and agricultural extension specialists to all the concerned agencies, for all scales and stages of irrigation development including the time after the construction. Basically the irrigation development in Ethiopia can be classified as shown in Table 3.2.

Table 3.2 Classification of Irrigation Project

Scale of Project	Irrigation Area (ha)	Purpose of Development	Executing Agencies	
			Main system	Onfarm
Large	More than 3,000ha	Commercial cropping by state or private farms	WRDA	IDD
Medium	200 - 3,000 ha	- ditto -	WRDA	IDD
Small	Less than 200 ha	Food cropping by farmers	IDD	IDD

The demarcation of small and medium scale development is made based on their background, easiness of construction of water intakes, etc. The medium to large scale irrigation development aims at producing the highly commercial crops by state or commercial farm management under the financial arrangement made by the international lending agencies.

### 3.1.2 Existing Irrigation Systems

Most of the existing farm lands are rain-fed cultivated and some areas where easy intakes are possible has simple irrigation system. Except for the Awash Valley Irrigation areas, it is limited by small scale irrigation systems.

After revolution in 1974, all of the land area belongs to the country and the farmers are released from tenant farming and they could cultivate in their own farms. Continuous extensive farming caused the low productivity and low

fertility of land. New reclamation was carried out up to the top of the mountain and the deforestation and destruction of basins resulted in the surface soil erosion. The soil and forest conservation is necessary for the national development not only to increase the crop productivity by installing irrigation system but also for the basin conservation of the country.

## 3.2 Small Scale Irrigation Development Project

### 3.2.1 Background of SSID project

#### (1) Background of SSID project

Economy of Ethiopia depends on its agriculture. There are many constraints of food supply. The living standard of the farming community remains low and sometimes it is rather difficult to feed themselves. After the land reform in March 1975, the farmers were released from tenant farming and their upgrading was one of the main policies in the Perceptive Ten Year Plan. But their farming standard still remains at low level depending on the natural climatic conditions and transitional cultivation method causing variation of cultivation areas and yields.

At present, only about 850,000 ha is developed by irrigation mainly in the Awash basin (650,000 ha) large scale irrigation projects. According to an FAO's study, the potential area for the SSID project was estimated as 165,000 ha to 187,000 ha which are concentrated on the Central Highland. The government's implementation plan to install the small scale irrigation system for the sustainable food production and supply and increase the living standards of the farmers in the favorable climatic conditions is delayed by the topographical and financial constraints. After the establishment of IDD under the Ministry of Agriculture for the SSID project, the implementation capacity of SSID project remains low at 2,000 ha in average per annum, even though the efforts are made at maximum extent within the limited conditions. After the revolution in 1974, and the issuance of land reform in 1975, the construction of SSID project was started by the Producers cooperatives. But its capacity was limited to introduce simple irrigation systems such as the gabion weir intakes, and they had the following difficulties :

- Destruction of installed simple weirs and irrigation facilities by the flood
- leakage of intake weirs and banks of irrigation canals,
- clogging of irrigation canals by the sediment caused by the lack of catch drains and drainage,

- destruction of irrigation canals and facilities by the absence of spillways
- erosion and decrease of flow capacities by the rapid flow in the irrigation canals
- shortage of diversions, cross drains and drops in the irrigation canals.
- destruction of irrigation canal level by the animals' canal crossing,
- field flooding and soil erosion caused by the poor operation of irrigation,
- poor operation and maintenance of irrigation system
- lack of construction equipment and machinery

## (2) Foreign Assistance for the SSID Project

Many foreign assistance was provided for the implementation of SSID project after the establishment of the IDD in 1984. At the early stage of SSID project, procurement of construction equipment and machinery under the financial assistance of ADF and UNDP/UNCDF contributed to the commencement of the project.

Beneficiaries of the previous foreign assistance was concentrated in the Central, Central south, Southeastern and Southwestern zones of MOA which have the annual rainfall exceeding 1,400 mm and is considered as the food basket area of Ethiopia. Especially the ADF and IFAD Projects which provided non-interest or low interest loan targeted at these zones considering the project efficiency.

Most foreign assistance for SSID project, including the Japanese assistance, was provided for the procurement of construction equipment and machinery. The IFAD has started its technical assistance since 1986. Technical assistance was also provided by EC, China and Korea. Total financial assistance including credits for peasants has been provided by ADF since 1986 and it is expected to be extended after the expiration of original agreement.

FAO's assistance is concentrated on the institutional and agricultural extension

services after their constructions, and UNDP's assistance is concentrated on the supply of fertilizer and improved seeds for the SSID project. SIDA continues the technical assistance for regional rural development such as Arsi Rural Development Project for natural conservation. The foreign assistance for the SSID project is summarized in Table 3.3.

### 3.2.2 Purposes of SSID Project

The SSID project aims at installing the small scale irrigation system for the following short-term and medium and long-term objectives;

Short term objectives ;

- to permit a second harvest during the dry season
- to obtain a single reliable harvest annually
- to improve the standard of living by expanded cultivation of cash crops.

Medium and long-term objectives;

- to accommodate more farmers in the adjacent low-lying irrigable areas
- to solve existing drinking water problems both for human and live stock
- to improve the standard of living of rural communities
- to promote the establishment of similar projects in other places where there is natural potential
- to improve the intake of protein required for the maintaining good health by introducing fish to the farmers.

### 3.2.3 Contents of SSID Project

#### (1) Executing Agencies

The SSID project was implemented by the IDD under the MOA from the planning of water resources development up to the installation of tertiary irrigation system. After the request of farmers organizations to the regional/zonal office of MOA, the control office of IDD identify the development potential and implement the SSID schemes contacting always with farmers organizations.



Farmers' income is still lower than Ethiopia's GNP per capita of US\$120. Therefore it is also possible to say that the SSID project is for the development of basic human needs. Considering investment efficiency of development, the medium to large-scale irrigation development is superior to SSID project for the development of the national economy. But beneficiaries of the SSID project reaches 70 % of population and there is no alternative except agricultural development in the regions. Therefore to solve the constrains of agricultural development including the marketing of agricultural products, the SSID project contributes for the development of national economy as a medium of development.

## (2) Irrigation Development Department (IDD)

Before the establishment of IDD, the Surface Water Department (SWD) of soil and Water Conservation Main Department worked on the construction of diversion weirs for irrigation in the central Highland and construction of reservoir for drinking water supply in the rural area. The IDD was developed from the SWD in 1984 under the Rural Infrastructure Development Main Department in the MOA. The organization chart of MOA and IDD is shown in Fig. 2.1, and the technical staff for the SSID project is shown in Table 3.4. Reorganization of government agencies are now going on, and therefore some rearrangement of MOA will be made soon under the TG of Ethiopia.

The MOA has eleven zonal offices and each department of MOA has a branch office in the zonal office. The decentralization of MOA is continuing and the zonal offices have get rights to decide by themselves for the implementation of regional agricultural development.

The central office of IDD limited its responsibility to identify, study and design the SSID schemes. The actual construction of SSID project is implemented under the management of zonal offices with the coordination of IDD for the construction equipment management and construction material arrangement. In Northeastern zonal office, the working group for planning and design of SSID project established close contacts of site conditions under the policy of decentralization in MOA. The central government to turn its weight for the policy making, approval of schemes and coordination and management of zonal offices.

According to the field inspection by the basic design study team, the IDP has

following problems;

- lack of experienced engineering staff for planning, design and constructional stages
- lack of construction equipment and machinery for implementation
- lack of finance to arrange of construction materials

### (3) Involvement of Farmers

SSID schemes start by the request of farmers organizations, water users associations and/or producers cooperatives to the zonal/regional offices to install permanent irrigation systems in their areas. The Central government implements the survey to confirm the potential of schemes. After that the central government prepares the design and arranges the government budget for the construction. The main irrigation systems are usually constructed by the Government finance with the contribution of labor forces by the farmers. The tertiary irrigation system will be basically constructed by the farmers themselves under the supervision of IDD. This system aims to involve the farmers, beneficiaries, for the construction and to recognize that the completed facilities and irrigation system belongs to both the government and the beneficiaries.

After the construction, the operation and maintenance of irrigation system is executed by the farmers organization (water users association) which requested the installation of the system. A Zonal office of the MOA sends agricultural extension workers to the completed schemes for the guidance and supervision of operation and maintenance of irrigation system.

### (4) Achievement of SSID Project

After establishment of the IDD in 1984, SSID project completed 29 schemes of 2,583 ha and they are operated and cultivation started by September 1992. Also 46 schemes of 9,571 ha have started the construction and 25 schemes of 5,677 ha have completed the construction of main system within 46 schemes. In addition to these achievement, 33 schemes of 4,907 ha completed their detailed designs and are waiting for the commencement of construction. Therefore, the SSID projects which include both completed and started ones were started for 108 schemes of 17,061 ha area.

#### (5) Implementation Schedule of SSID Schemes under the Project

SSID project extends its project area all over the nation covering 17,061 ha up to 1992. The MOA proposed the Project area, after considering the accessibility, emergency of reconstruction of drought prone area, covering 5 Zonal offices including 7 provinces as shown below;

Northern zone	:	Tigray Province
Northeastern zone	:	Walo Province
Northwestern zone	:	Gondar and Gojam Provinces
Western zone	:	Wollega Province
Southwestern zone	:	Illubabor and Kefa Provinces

There are 72 schemes in the Project area to be constructed within 5 years from 1992/93. Their name and implementation schedule with priority are shown in Fig.3.2.

#### (6) Selection of SSID Schemes

After receiving the farmers' requests to install the permanent irrigation system by the zonal office of the MOA, central office of the IDD makes the project identification to confirm the farmers' wills and to study the scale of schemes from the technical viewpoint. Then the IDD starts the preparation of budget for the detailed design and construction.

#### (7) Design Manual for SSID Project

The standardized manual for planning and design of SSID Project has not been prepared, and each SSID scheme is planned and designed on an adhoc basis. Mostly they are prepared under the technical agreement of North Korea and Cuba during the initial stage of the SSID Project.

In 1988, under the technical assistance of IFAD, the Manual for planning and design and standard design of irrigation facilities were prepared by the West German consultants after their studies on completed SSID project, and special conditions of SSID project. After the preparation of Planning Design Manual for SSID Project, all the planning and design of SSID schemes are prepared based on the Manual by the IDD.

### 3.2.4 Irrigation Planning of SSID Project

#### (1) Water Resources

The SSID Project adopts the following criteria for water resources development;

- Potential water source for development is defined by the estimated flood discharge of 5 year-probability
- Intake structures selected are mainly diversion weir or small earthfill dams based on the rainfall pattern, topographic and geological conditions
- Diversion weir is selected in the perennial river which has enough water to irrigate the scheme, and a small dam is constructed in rather arid and drought prone area where the river dries up during the wet season such as Tigray Province.

#### (2) Irrigation Method

SSID adopts the furrow irrigation method which was adopted for the traditional irrigation. The method was selected to achieve the target of the SSID project without rapid changes of irrigation and cultivation method and additional costs to introduce other method to the SSID Project. The irrigation water requirement of the SSID Project was also estimated by the furrow irrigation method.

#### (3) Crop water requirement

Crop water requirement of each SSID scheme is estimated by the modified Penman Method based on the analyzed climatological data of adjacent 130 stations. Based on the estimate of crop water requirement, the irrigation planning is made. These estimation are not yet confirmed in the field up to now, and it is expected that the estimation method will be modified based on the actual observed data in the several completed SSID scheme. Proposed cropping pattern models for the crop water requirements in several areas are shown in appendix VII.

### 3.2.5 Irrigation Facilities of SSID Project

#### (1) Intakes

##### 1) Diversion Weirs

Diversion weir is an intake structure which is commonly adopted in the SSID project. The design of weir is prepared based on the SSID Manual. The Design flood discharge is estimated for the flood of 50 year probability. The hydraulic and stability calculation of weir design in the SSID Manual is shown in Appendix VII. This method is reasonable for the design of small-scale weir.

##### 2) Small Dams

A small dam shorter than 15 m is selected as an intake structure to store the unreliable run-off in the drought prone area during the wet season. The dam is designed as an earthfill dam with homogenous core type based on the topographic and geological condition and also considering availability of embankment materials. Design flood discharge for these dams are considered for the flood of 100 year probability. Designs of dams waiting for the construction were prepared between 1984 and 1986 under the technical assistance of North Korea. However they are limited to the designs of embankments and apparent facilities and the water balance study report is not available for reservoir. In Dam project, the dam site is located in the rather gentle sloped hilly area, and a wide cultivation area is spreaded in the proposed reservoir area. Sometimes the inundation area seems to be bigger than the irrigable area. Also the unit cost per irrigable area is high. Therefore the existing dam planning in the Project area is recommended to be reviewed.

#### (2) Irrigation Facilities

Main irrigation canals are designed to be earth canals. Cross sectional and longitudinal profiles are designed considering the design discharge, stability of side slope, velocity for erosion of canal surface and possible sedimentation in the canal. Related irrigation facilities are drainage and

road crossing culverts, inverted syphons, drops, diversions, aqueducts, etc. They are standardized in the Manual.

### (3) On-farm Facilities

All irrigation canals up to the tertiary system are designed as earth canals. The typical alignment of tertiary system with facilities is shown in Appendix VII. These systems are prepared by the IDD, but their construction are executed by the farmers under the supervision of IDD.

## 3.2.6 Construction Costs of the Project

Within 5 years from 1992/93, 49 SSID schemes are planned to be constructed by the construction equipment and machinery to be procured by the Project. Other SSID schemes in the Project area will be constructed by the existing equipment and machinery of IDD with separate finance for the project. The construction cost of SSID schemes under the Project is estimated by the estimated quantity, stated in Chapter 4, and unit prices of IDD (ref. Appendix VII). The result is shown in Table 3.5, the total cost is estimated at 429 million Ethiopian Birr (US\$ 207 million) and it is expected to be more than 1,036 million Ethiopian Birr after devaluation in October 1992.

## 3.2.7 Construction Equipment and Machinery of SSID Project

### (1) Executing Agencies

Construction of SSID Project is executed by the IDD with mechanical support of Supply & Equipment Service Department (SESD). Both departments belong to the Rural Infrastructure Development Main Department (RIDMD) in the MOA. The IDD is a total managing organization for SSID Project through branch offices in the zonal offices. It is responsible for the services from identification of SSID schemes up to extension services after construction. The SESD has the responsibility of maintenance and arrangement of construction equipment and machinery and materials for the SSID Project.

The SESD has Central Store and Garage in Addis Ababa. 10 Chief or senior mechanics and 10 assistant mechanics are assigned in the garage to maintain the construction equipment and machinery for SSID Project. Therefore the additional construction equipment and machinery to be procured by the Project will be maintained or repaired by SESD after national property registration in Procurement and Property Administration Department of MOA.

The arrangement of construction equipment and machinery for construction of SSID schemes is made by the SESD under the construction plan of Irrigation Construction Division of IDD. At first, the required equipment and machinery should be arranged within the existing equipment and machinery in the Zonal office. If it is not sufficient, the SESD should arrange from the central garage or other Zonal offices. Therefore the collaboration works between the IDD and SESD is essential for the smooth construction of SSID Project.

Repair and maintenance of construction equipment and machinery for SSID Projects is implemented as follows;

- 1) minor repair work is done by mechanics at the base camp of SSID schemes under Zonal offices.
- 2) if mechanics in the field can not repair, the central garage sends a mobile workshop to the site with senior mechanics and to help them.
- 3) for serious or large scale repair which can not be done by 2), the broken equipment will be sent to the garage of local manufacturing agents in Addis Abeba.

Budget and actual expenditure for maintenance of construction equipment and machinery for the SESD are as follows;

Unit in Birr			
Fiscal Year	1990/91	1991/92	1992/93
Budget	1,448,300	1,448,300	1,326,500
Expenditure	605,853	42,879	-

Source :SESD Financial Report 1992

## (2) Construction

Construction of main irrigation system including intakes, irrigation canal and related facilities, are constructed by the IDD with its finance and construction equipment and machinery. There is no local general contractor available to implement it. Construction of on-farm system is executed by farmers themselves under the technical supervision and assistance of IDD.

## (3) Construction Equipment and machinery for SSID Project

The construction of SSID schemes are consisted of intakes (weir of small dam), irrigation canals and related structures. They are constructed by IDD's construction equipment and operated IDD's operator. Existing Construction equipment and machinery for SSID Project is summarized in Table 3.7. Most of them are operated at the construction sites and facing the shortage of quantity for the implementation of SSID Project.



Table 3.3 Foreign Assistance for SSID Project

International Agencies/Country	Name/Title of Project	Purpose	Province/Zone	Present Conditions	Implent. Period/Year	Grant/Loan Amount (in million)
UNDP/	ETH 82/C05	Equipment supply for AfDF project	Gojam, Shewa, Arsi, Gamu Goffa Prov. 30 sites	equipment under peration	1982	Grant US\$ 2.4 L/C US\$ 3.8
UNCDF	ETH 85/C02	Equipment supply for AfDF project	Gojam, Shewa, Arsi, Gamu Goffa Prov. 30 sites	equipment under peration	1985	Grant US\$ 4.6 L/C US\$ 2.5
IL0	Special Public Works Programme	Construction of dams, wells for drinking and irrigation	Low, plane & highland in Harerghe Prov.		2.5 year	Grant US\$ 2.2
IFAD	Special Country Program	SSID in the arid region	Arsi, Sidamo, Bale Harerghe Prov.	Technical assistance going on	1985-89 5 Years	Grant US\$ 20
176SET	Small Sacle Irrigation Development	(rainfall 400-800mm, 6500 ha)				
AfDB (ADF)	Small Scale Irrigation Project	Construction of SSID schemes totalling 3,800 ha	Gojam, Shewa, Arsi Gemu Gaffa Prov.	Agreement made with Soil & Water Conservation Department of MOA, Apr. 3, 790 ha(4,737 farmers	1985-90 5 Years	Loan US\$ 16.6 L/C US\$ 1.9
International Red Cross	Integrated Rural Development in Wollo region	SSID Project as a part of integrated rural development	Wolo Province	-		Grant US\$ 15.0 (Total)
Japan	Smallscale Irrigation Project	Equipment supply	Northern Shewa	equipment under peration	1984	Grant US\$ 1.6
Japan	2 K R	Equipment supply	Welo, Harerghe Prov.	equipment under peration	1986	Grant ¥ 550
EEC	EEC Programme-II	Financial & technical assistance	Eritrea, Tigray, Wolo	completed	1 year	Grant US\$ 6.0
EEC	EEC Programme-III	Financial & technical assistance	Shewa & Harerghe Pro. Northern & Southern Shewa Provinces	completed	3 years	Grant US\$ 5
Italia	Ethiopia-Italy Programme of Rehabilitation & Development	Water resources development and rehabilitation	Harerghe & Wolo Provinces 12 sites	Alowha weir and other constructions are suspended from the civil war	1985-88 4 years	Grant EB. 8.0
Sweden (SIDA)	Rural Development Project in Wolo Province	Implementation of SSID project and rural development	Wolo Province	Institutional strengthening in MOA Zonal Office SIDA preparing the reopening of assistance	3 years	Grant US\$ 1.5 (Total)
China	Hare River Irrigation Project (1,000 ha)	Technical assistance of SSID schemes 3,000 ha	Gemu Goffa Province 3 Cooperatives	Design completed, equipment ready by UNCDF finance for construction waiting from China	6 years - Mar. 1989	Loan US\$ 5.0
OXFAM		Financial assistance foe SSID schemes on the site (NGO)	Gamu Goffa & Shewa Provinces	-		Grant EB. 15.0

Table 3.4 Technical Staff of SSID Project

Function	IDD H/Q	Central		N		N-W		N-E		West		S-W		South		S-E		East		Total
		ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD	ZIDD		
1 Department Head	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
2 Team Leader	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	13
3 Irrig. & Drainage Expert	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
4 Irrigation Engineer	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
5 Civil Engineer	2	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	2	-	-	8
6 Hydrologist	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
7 Hydrology Technician	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
8 Agriculture Engineer	-	-	2	1	1	5	6	6	6	2	2	2	2	1	4	5	7	7	3	34
9 Construction Supervisor	-	-	1	-	-	-	1	3	3	-	-	-	-	-	-	3	3	3	3	8
10 Irrigation Technician	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
11 Asst. Civil Engineer	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
12 Asst. Cons. Supervisor	-	6	4	3	3	7	7	7	7	5	5	5	5	7	7	10	10	10	10	54
13 Irrigation Agronomist	3	1	1	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9
14 Soil Scientist	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
15 Economist	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
16 Sociologist	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
17 Geologist	3	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	8
18 O&M Specialist	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
19 Remote Sensing Expert	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
20 Draftsmen	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
21 Drivers	-	10	11	5	5	12	22	22	22	9	9	9	9	9	9	17	17	17	17	122
22 Operators	-	7	5	5	5	7	10	10	10	2	2	2	2	2	2	11	11	11	11	67
Total	35	29	27	15	15	36	54	54	54	4	4	4	4	4	30	52	52	52	52	375

Source : Irrigation Development Department, "Activities and future operations", June 1990

Note : ZIDD = Zonal Irrigation Development Division

Table 3.5 Achievement of SSID Project 1984-1992

as of September, 1992

Zonal Office	Completed		On-farm Development		Under Const. Canals		Design Completed		Total	
	No.	Area(ha)	No.	Area(ha)	No.	Area(ha)	No.	Area(ha)	No.	Area(ha)
North Western	3	167	5	1,563	4	825	4	550	16	3,105
Tigray	0	0	0	0	3	300	1	100	4	400
North Eastern	0	0	7	535	2	670	2	385	11	1,590
Western	1	50	0	0	1	80	2	110	4	240
South Western	3	335	1	53	0	0	0	0	4	388
Eastern	10	1,006	1	500	2	145	11	1,542	24	3,193
Southern	0	0	5	701	3	1,334	3	570	11	2,605
South Eastern	9	895	1	1,200	5	340	2	110	17	2,545
Central	0	0	4	585	1	200	4	1,030	9	1,815
Central South	3	130	1	540	0	0	4	510	8	1,180
Total	29	2,583	25	5,677	21	3,894	33	4,907	108	17,061

Fig. 3.1 Achievement of SSID Project 1984-1992

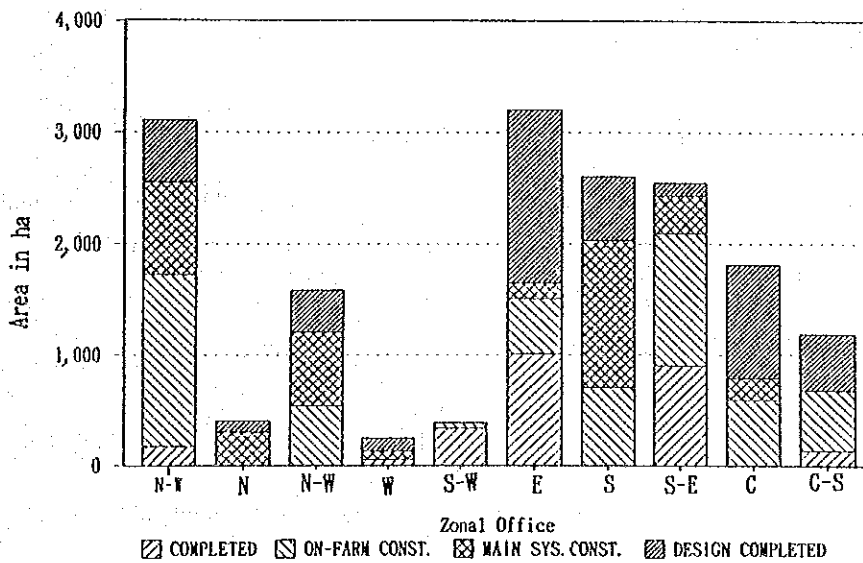


Fig. 3.2 Implementation Schedule of SSID Schemes of the Project Area

Ser. No.	Zone & No.	Location Province	Type	Present Status	Name	Area (ha)	Implementation Schedule (ha)					On-Farm	Remarks
							92/93	93/94	94/95	95/96	96/97		
1	N/W - 1	W-Gojam	W	U/C	*Mendel	100	=====						
2	N/W - 2	E-Gojam	W	U/C	*Azuari	75	=====						
3	N/W - 3	E-Gojam	W	D-C	*Jedeb	250		#####					
4	N/W - 4	E-Gojam	W	D-C	*Muga	200		#####					
5	N/W - 5	N-Gondar	D	D-C	*Abagenen	50		#####					
6	N/W - 6	W-Gojam	W	D-C	*Yesir	50		#####					
7	N/W - 7	W-Gojam	W	OF-C	Geraye	770						770	ADF/EEC
8	N/W - 8	W-Gojam	W	OF-C	Tkurewuha	162						162	ADF/EEC
9	N/W - 9	W-Gojam	W	OF-C	Kilti	131						131	ADF/EEC
10	N/W - 10	W-Gojam	W	OF-C	Petam	400						400	ADF/EEC
11	N/W - 11	W-Gojam	W	U/C	Zengni	250	=====						
12	N/W - 12	W-Gojam	W	U/C	Bucheksi	400	=====						
13	N/W - 13	W-Gojam	W	OF-C	Tekurit	100						100	
14	N/W - 14	W-Gondar	-	PF/S	Gabikura	200			#####				
15	N/W - 15	W-Gojam	-	PF/S	Laha	125			#####				
16	N/W - 16	W-Gojam	-	PF/S	Debehula	130			#####				
17	N/W - 17	E-Gojam	-	PF/S	Bogena	120			#####				
18	N/W - 18	S-Gondar	-	PF/S	Shenay	75			#####				
19	N/W - 19	E-Gojam	-	PF/S	Kolech	100			#####				
20	N/W - 20	W-Gojam	-	PF/S	Yechereka	190			#####				
21	N/W - 21	Metekel	-	PF/S	Timbil	200			#####				
22	N/W - 22	E-Gojam	-	PF/S	Tijan	180			#####				
23	N/W - 23	S-Gondar	-	PF/S	Wanka	85			#####				
24	N/W - 24	E-Gojam	-	PF/S	Yodan	180			#####				
25	N/W - 25	W-Gojam	-	PF/S	Tule	150			#####				
26	N/W - 26	E-Gojam	-	PF/S	Teme	200			#####				
27	N/W - 27	E-Gojam	-	PF/S	Sata	37				#####			
28	N/W - 28	S-Gondar	-	PF/S	Lomida	50				#####			
29	N/W - 29	N-Gondar	-	PF/S	Ayine Kura	185				#####			
30	N/W - 30	W-Gojam	-	PF/S	Andasa	70				#####			
31	N/W - 31	N-Gondar	-	PF/S	Guanu	170				#####			
32	N/W - 32	N-Gondar	-	PF/S	Zufel	90				#####			
33	N/W - 33	N-Gondar	-	PF/S	Arno	20				#####			
34	N/W - 34	Metekel	-	PF/S	Ardi	130				#####			
***** SUB-TOTAL						5,625	825	550	1,140	795	752	1,563	
						34	4	4	8	5	8	5	
35	Tigray-1	Tigray	W	U/C	*Genfel	100	=====						
36	Tigray-2	Tigray	W	U/C	*Seneafti	100	=====						
37	Tigray-3	Tigray	W	U/C	*Mehoni	100	=====						
38	Tigray-4	Tigray	D	D-C	*Ashago	100		#####					
39	Tigray-5	Tigray	D	PF/S	Agula	200		#####					
***** SUB-TOTAL						600	300	100	200	0	0	0	
						5	3	1	1	0	0	0	

(to be continued)

Ser. No.	Zone & No.	Location Province	Type	Present Status	Name	Irrig. Area	Implementation Schedule					On-Farm	Remarks	
							92/93	93/94	94/95	95/96	96/97			
40	N/E - 1	N/Wollo	W	U/C	*Alcuha	360	-----							
41	N/E - 2	N/Wollo	W	U/C	*Gimbora	310	-----							ETIOITAL AFRICARE
42	N/E - 3	S/Wollo	W	D-C	*Dirma	200		#####						
43	N/E - 4	N/Wollo	W	D-C	*Gotu	185		#####						
44	N/E - 5	S/Wollo	W	OF-C	Hardibo	150						150	R/CROSS	
45	N/E - 6	S/Wollo	D	OF-C	Borkena	150						150	O/F only	
46	N/E - 7	N/Wollo	W	OF-C	Mersa	40						40		
47	N/E - 8	S/Wollo	D	OF-C	Bati	100						100	R/CROSS	
48	N/E - 9	S/Wollo	P	OF-C	Bulbulo	20						20	SIDA	
49	N/E - 10	S/Wollo	P	OF-C	Kekewa	72						72	R/CROSS	
50	N/E - 11	S/Wollo	P	OF-C	Komboalcha	3						3	SIDA	
51	N/E - 12	N/Wollo	-	PF/S	Temuga	100			#####					
52	N/E - 13	S/Wollo	-	PF/S	Legedeba	50			#####					
53	N/E - 14	N/Wollo	-	PF/S	Sirinka	130			#####					
54	N/E - 15	S/Wollo	-	PF/S	Dire	300			#####					
***** SUB-TOTAL						2,170	670	385	280	300	0	535		
						15	2	2	3	1	0	7		
55	W - 1	Wollega	W	D-C	*Gibelim	50		#####						
56	W - 2	Wollega	W	D-C	*Tato	60		#####						
57	W - 3	Wollega	W	U/C	Gambela	80	-----							
58	W - 4	Wollega	-	PF/S	Abeno	140			#####					
59	W - 5	Wollega	-	PF/S	Negesso	75			#####					
60	W - 6	Wollega	-	PF/S	Gibe Nekent	100		#####						
61	W - 7	Wollega	-	PF/S	Fute	200				#####				
62	W - 8	Wollega	-	PF/S	Anger	180			#####					
63	W - 9	Wollega	-	PF/S	Keto	180				#####				
64	W - 10	Wollega	-	PF/S	Illelitum	200				#####				
***** SUB-TOTAL						1,265	80	210	140	255	580	0		
						10	1	3	1	2	3	0		
65	S/W - 1	Illubabur	W	U/C	*Kolombo	53	-----							
66	S/W - 2	Kaffa	-	PF/S	Gibelemu	175		#####						
67	S/W - 3	Kaffa	-	PF/S	Gilgel Gibe	165			#####					
68	S/W - 4	Kaffa	-	PF/S	Weki	190			#####					
69	S/W - 5	Kaffa	-	PF/S	Dedi	200			#####					
70	S/W - 6	Illubabur	-	PF/S	Gumero	160			#####					
71	S/W - 7	Illubabur	-	PF/S	Tilku Haya	185			#####					
72	S/W - 8	Kaffa	-	PF/S	Tinishu Yaya	125			#####					
***** SUB-TOTAL						1,253	53	175	715	310	0	0		
						8	1	1	4	2	0	0		
TOTAL						10,913	1,928	1,420	2,475	1,660	1,332	2,098		
						72	11	11	17	10	11	12		

Projects under construction of main system : 11 projects, 1,928 ha  
 Projects on-farm development remain : 12 projects, 2,098 ha  
 Projects design completed or under study : 49 projects, 6,887 ha

NOTES : ##### Schemes to be constructed by the Project  
 ===== Schemes to be constructed by existing construction equipment  
 \* is top priority project for implementation  
 W : weir, D : dam/reservoir, P : pumping  
 U/C : under construction OF-C : on-farm construction  
 D-C : design completed, PF/S : pre-feasibility or investigation  
 ADF/EEC : loan by African Development Fund and grants by EEC or UNCDF  
 ETIOITAL : Ethio-Italy Project  
 R/CROSS : grant by Red Cross  
 SIDA : grant by Swedish International Development Agency  
 AFRICARE : grant by AFRICARE

Table 3.6 Summary of Project Cost

No.	Type of Work	Total Quantity		Unit Cost	Total Costs
		Unit	Amount	Birr	Birr
1	Excavation	m <sup>3</sup>	3,262,489	5.0	16,312,447
2	Earthworks by labor	m <sup>3</sup>	2,275,000	4.0	9,100,000
3	Backfill and Embankment	m <sup>3</sup>	1,631,245	5.0	8,156,223
4	Compaction	m <sup>3</sup>	2,446,867	10.0	24,468,670
5	Loading and Conveying	m <sup>3</sup>	2,055,113	6.0	12,330,676
6	Grading	m	4,794,789	0.5	2,397,395
7	Concrete Works	m <sup>3</sup>	633,858	316.0	200,299,027
8	Concrete Reinforcement	kg	31,692,884	1.7	53,877,903
9	Sub Total (1-8)	Birr			326,942,341
10	Miscellaneous (5%)	Birr			16,347,117
11	Subtotal (9-10)				343,289,458
12	Indirect Cost (25%)				85,822,365
Total Project Cost		Birr			429,111,823
In U.S Dollars		US \$			207,300,397

### 3.3 Request of Additional Construction Equipment and Machinery

#### 3.3.1 Background of the Request

The Government of Ethiopia is implementing the SSID Project since 1984. Its efforts can not meet the expansion of the SSID project because of the limited number of equipment, and the lack of spare parts for the procured equipment. Considering the shortage of finance for the procurement of additional construction equipment and machinery for the future development plan of SSID Project, the Government of Ethiopia requested for the financial assistance to the Government of Japan in 1988.

#### 3.3.2 Previous Japanese Assistance for SSID Project

The Government of Japan assisted in the procurement of construction equipment and machinery through "Small Scale Irrigation Development Project" in 1984 (amounting 400 million yen) and 2KR started from 1986 (650 million yen) under the Japan's Grant Aid System. Through the previous Japanese assistance, a total of 125 units of 21 types were procured.

#### 3.3.3 Contents of the Request

The Request made to the Japanese Government by the Ethiopian Government is to procure the additional construction equipment and machinery for the construction of 49 SSID schemes within the coming 5 years in the Project Area. The Request was made for 123 units of 19 types of construction equipment and machinery as shown in Table 3.8.

##### (1) Project Area and Schemes

The original Request was made by the previous government before the establishment of the present transitional Government of Ethiopia (TG). Therefore there are some changes in the Project Area and the schemes to be completed by the Project, even though there is no change in the basic policy of the SSID Project. The TG gave the high priority for reconstruction and development of the area which were affected seriously by the civil war and droughts in 1974 and 1984, such as Tigray and walo provinces. Therefore the Project Area was modified through the confirmation of the field survey

between the study team of JICA and the Government of Ethiopia as shown below;

Stages	Project Area	SSID Schemes	Total Area
Original Request	2 zonal offices	45 schemes	6,122 ha
Modified Request	5 zonal offices	51 schemes	7,272 ha
Confirmed Request	5 zonal offices	49 schemes	6,887 ha

(2) Requested Equipment and machinery and their Distribution

After establishment of the IDD for the SSID Project in 1984, the construction equipment and machinery was procured under the financial assistance of UNCDF, EEC, the Government of Japan and Italy. They are distributed to the Regional offices for the construction of each scheme as shown in Table 3.7. Additional Equipment and machinery to be procured under the Project is summarized based on the type and purpose as shown below;



Type of Equipment and machinery	Purposes
Bulldozer	preparatory works, excavation, backfilling and spreading the embankment material
Wheel Loader	loading the excavated embankment material at the brow area
Motor Grader	spreading embankment materials and land leveling
Dump Truck	transportation of excavated soil and embankment materials
Back hoe	excavation of canals and general works
Vibration Roller	compression of embankment
Water Tanker	water transportation and spreading for embankment compaction
Mobile Workshop/Mobile greasing plant	maintenance and repair of construction equipment and machinery at the site
Low bed semi-trailer	transportation of construction equipment and machinery
Stone crusher	production of concrete aggregate
Concrete mixer	mixing concrete
Tamper/Ramer	compassion of small scale embankment
Diesel Generator	electric generating at the site
Pick-up/Station wagon/Motor cycle personal	transportation of supervisory

The proposal of equipment and machinery to zonal offices of the Request are shown in Table 3.8.