3.3.4 Assessment of Background of the Request

(1) Necessity of SSID Project

The Central Highland is rather densely populated (some area shows the density of 240/km²) area in Ethiopia. The deforestation of the area is accelerated by the reclamation of cultivation area to cover the low productivity and cutting of trees for the fuel. This causes the big damage for the conservation of the river basin and increases the peak discharge of flood. Therefore it is necessary to provide the countermeasures for the land and basin conservation by increasing the productivity to have sustainable agricultural development, increase the farmers standard of living and providing the production forest for the fuel supply.

The existing simple and extensive irrigation system shall be improved on the following points;

- relief of the annual reconstruction of simple intakes
- improvement of operation and maintenance of irrigation canals
- installs the rational operation system for irrigation
- early completion by the utilization of construction equipment and machinery

On the other hand, installation of the reservoir helps to stabilize the irrigation and domestic water supply by the storage of unreliable rain in Tigray and Wolo Provinces.

The diversification of crops such as cash crops by the SSID Project contributes not only to assure the irrigation water for agricultural production but also helps for the sustainable development of regional economy.

(2) The Project Area

In the SSID Project, the development priority is given to the area with more than 400 mm of annual rainfall, which is mostly located in the central highland with the elevation of more than 1,480 m a.sl. These area can be developed by the small scale irrigation with surface water sources considering the typographical conditions.

The proposed 49 SSID schemes in the Project Area (5 zonal offices) have following regional characteristics and are expected to contribute for the future development of SSID project;

Northwestern, Western and Southwestern Zone

Considering the climatological and water resource conditions, these zones and the central zone have high potential for agriculture development and are considered as the food basket of Ethiopia. The annual rainfall in the area is more than 1,000 mm and most of the rivers are perennial rivers. Also there is rich groundwater potential and several springs can possibly be developed in the area. Therefore most schemes in the area are planned to intake water by the weir from the river originated by surface water and springs. Since traditional irrigation system also exists in the area, the SSID schemes in the area contributes for the rehabilitation or installation of permanent irrigation facilities. This means that the schemes in the area shows a high economic efficiency than the SSID schemes in the other areas.

Northern and Northeastern Zone

These zones together with Eritria were seriously damaged by droughts in 1974 and 1984, and during the civil war between 1974 and 1991. The TG gives high priority for reconstruction of development on these drought-prone and rejected zones.

Surface water sources in these zones, especially in the Northern zone, are unreliable because of their climatological and topographic conditions. Therefore surface water resources development for the irrigation in these zones has to rely on the diversion weir from few perennial rivers or on the reservoirs to store the scattered flow during the rainy season. Therefore the economic efficiency of the irrigation development in these zones becomes lower than other zones, because of its high construction costs. But from the regional economic view point, the impacts or the indirect benefits of the introduction of irrigation system can be expected as huge.
Previous foreign assistance for SSID Project concentrated in Shewa Province (The Central and South Central Zone), southern and southeastern zones. It is reasonable to involve these zones for the Project from the equity of the SSID assistance.

(3) SSID Schemes in the Project Area

SSID schemes to be implemented within the coming five years by the additionally procured equipment and machinery by the Project are categorized as follows;

1) SSID schemes which are waiting for the construction after the completion of detailed design
2) SSID schemes which were requested for the implementation by the formers and have been started their studies.

Some SSID schemes listed in the original request in 1988 have been completed their constructions or deleted or revised their scale of schemes because of the feasibility study results.

As stated in the Minutes of Discussions and the Technical Notes, there are many incomplete SSID schemes in the Project Area. These schemes were confirmed to be completed before the procurement of construction equipment and machinery for the Project by the IDD with maximum extend of existing capacities and they were excluded from the SSID scheme of Project.

Within 49 SSID schemes of the Project, 9 schemes have been completed their detailed design. According to their design, the types of intakes are 6 headworks and 3 earth dams. Other 40 SSID schemes are expected to be irrigated by the diversion weirs and pumps. The total area of 49 SSID schemes is estimated to be 6,877 ha, and the average irrigable area of a scheme is 140 ha. During the detailed design, there will be some changes of the irrigable area of the schemes which do not have the complete detailed designs.

(4) Design of SSID Project

Study and design of individual scheme is prepared by planning and Design Team of IDD after receiving the request of the farmers through the regional/zonal office of MOA. The technical staff of IDD is tabulated in Table 3.3. According to this table, the present technical staff is not sufficient for the further implementation of SSID project, especially the number of

experienced technical staff. To overcome the shortage of experienced technical staff, the IDD received the foreign technical assistance from IFAD, EEC, Italy, China, Cuba, South and North Korea. IFAD has been continued the technical assistance for SSID Project from 1985. Under the package of technical assistance, IFAD prepared the Planning and Design Manual for the SSID project. And the IDD prepares the planning, investigations and detailed design based on this Manual.

Investigations and designs prepared by the foreign consultants under the above technical assistance are good enough as well as economical justifications. But there are several problems in the existing studies or designs such as follows;

<Planning Stage>

- there is not enough attention on the water resources development planning within one river basin, usually, the new SSID schemes are planned to intake the whole amount water during the dry season

- there is no precise study on identification of cropping pattern and calendar on individual scheme planning

- there is no water balance study between inflow to reservoir and outflow for irrigation based on the climatological data and cropping calendar

- less attention is made for flood frequency analysis of irrigation facilities

- sedimentation in the reservoir and irrigation canal is not studied carefully

- not only the irrigation planning, but also the drainage needs to be studied more carefully.

<Design Stage>

- hydraulic study is carefully made but the structural stability including the durability of the irrigation facilities is sometimes necessary to line the irrigation canal slopes considering the O & M.

- less attention is paid for drainage alignment to prevent the sedimentation in irrigation canals.

<Construction Planning>

- coordination on the procurement of construction material and arrangement of construction equipment and machinery between the adjacent schemes shall be made in order to implement the construction effectively.

Considering these problems, the Japanese technical cooperation to send irrigation experts will be strongly required for improving the implementation capability of the IDD.

(5) Construction of SSID Schemes

The IDD prepares the detailed design and financial arrangement for the construction of SSID schemes. The construction of SSID schemes executed by the IDD directly with its owned equipment because of the following reasons;

1) Scale of SSID scheme is too small to invite the international contractors.
2) At present there is no general contractor in Ethiopia who own the construction equipment and machinery and the technical know-how.

Main systems of SSID schemes are constructed by the construction brigade of zonal office, IDD of MOA with its construction equipment and machinery, operator, supervisor and their expenses. The former provides the labor forces for the main system construction. On farm facilities are constructed by the farmers, under supervision of IDD technical staff. Land leveling of farm field is carried out by bulldozer or Motor grader of IDD.

The construction of SSID scheme is usually completed within one year as shown in Fig. 3.3. Their construction schedule is interrupted or suspended because of climatological conditions or financial shortage or difficulties of procurement of construction materials. In the Northern and Northeastern zone, there are also many SSID schemes suspended by the civil war.

(6) Construction Materials

1) Earth Materials

The embankment materials are usually obtained in the adjacent area or from the excavated materials for canals and irrigation facilities.

2) Cement

There are cement factories at Addis Ababa, Dire Dawa and Massawa in Ethiopia. The production capacity of Addis Ababa and Massawa is 70,000 ton a year, respectively. Dire Dawa has a productivity of 45,000 ton per year. The SSID project usually procures the bagged cement (50 kg/sack) from Addis Ababa Cement Factory. The IDD sends its vehicle to transport cement from the factory to the SSID scheme site. The low quality of cement at the production level along with low production volume and poor storage method on the site produces the low quality of concrete.

3) Aggregates

Most of the concrete aggregate (coarse and fine) is collected from the river bed adjacent to the site. The collected fine aggregates from the river usually contains much clayey material and it is used without washing for concrete. Coarse aggregates are also produced by the crushing the cobbles.

4) Steel and reinforcement bars

In Ethiopia, it is confirmed that the iron ore is in Tigray, Wollega and Kefa Province. A steel refinery factory produces the structural steel and reinforcement bars. But its production is insufficient for the construction demand and most of the steel and reinforcement bars are depending on the import.

(7) Construction Equipment and Machinery

A present, 365 units of construction equipment and machinery and supervisory vehicles are owned by the Rural Infrastructure Development Main Department including IDD and Supply and Procurement Service Department. They were procured under the financial assistance of UNDP/UNCDF, EEC, IFAD and Japan. Their regional distribution is summarized in Table 3.6. As shown in Table 3.6, 131 units of dump truck accounts for 36 % of all the equipment and machinery. The excavation machinery which includes bulldozer, motor scraper and backhoe (hydraulic excavator) is 35, 3 and 4 units, respectively. This means that the excavation works of SSID project is mainly carried out by the combination of bulldozer and dump truck, deferent from Japanese arrangement in which the backhoe excavation is considered as superior to the bulldozer. Also, because of the less volume of earthworks for SSID scheme, motor scraper is not needed and its excavation works are covered by bulldozer.

(8) Operation and Maintenance e of Construction Equipment and Machinery

Operation of construction equipment and machinery is done by the IDD's operators by the IDD's own costs. There is no training program for the operators, and the operator understands the operation technique only by On the Job Training. Repairs and maintenance of equipment and its periodical check and minor repairs are made by the mechanics of regional offices of IDD. Spare parts for the repairs are distributed from the central garage of RIDMD or purchased from the local dealer in Addis Ababa based on the zonal offices' requests. Medium to large scale repairs are usually done by the mechanics of central garage with mobile workshops on the site. Other serious damages are repaired by the local dealer of equipment and machinery in Addis Ababa with contract basis.

There are not enough facilities to repair the large scale repair in the garage of central and zonal offices at present. It is possible to say that the mobile workshop has the best facilities for repairs compare to other garages of IDD. Also there is no systematic training program for mechanics of the SSID project. Some of the mechanics have got the training in Japan through the JICA's technical cooperation program.

(9) Technical Cooperation

Considering the above mentioned conditions of SSID Project, the technical cooperation to strengthen the planning, design and construction management was strongly requested by the Government of Ethiopia to the Study Team during the field survey. It is recommended to start urgently the technical cooperation to send the Japanese experts and Japan Overseas Cooperation Volunteers (JOCV) on the irrigation engineering and construction machinery fields for the effective operation and implementation of SSID Project.

Fig. 3.3 Construction Schedule of Typical SSID Schemes (1/2)

Project : Abagenen. Region : North Gonder. Facility : Earth Dam

Description	1st Year			2nd Year												3rd Year	
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
1 Mobilization																	
2 Camp Construction																	
3 Access Road																	
4 Clear'g & Grubbing																	
5 Coffer dam																	
6 Foundation Construct'n																	
7 Dam Embank't Construct'n																	
8 Intake & Outlet																	
9 Spillway Work																	
10 Riprap'g & Sodd'g																	
11 Main canal exca. & fill																	
12 Main canal structure																	

Project : Muja. Region : Gojjam. Facility : Weir.

Description	1st Year			2nd Year												3rd Year	
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
1 Mobilization & Camp'g																	
2 Access Road Construction																	
3 U/S Coffer Dam																	
4 Foun'n/Exca. & Weir Const.																	
5 Divers'n channel const.																	
6 Inatke gate/scouring sluice construction																	
7 Canal Struct. Constructin																	
8 Canal Excavation & Fill																	
9 Drainage Structure Constr. & Drains Excavation																	
10 Farm Road Construction																	

Project : Jedeb. Region : Gojjam. Facility : Weir.

Description	1st Year			2nd Year												3rd Year	
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
1 Mobilization & Camp'g																	
2 Access Road Construction																	
3 U/S Coffer Dam																	
4 Foun'n/Exca. & Weir Const.																	
5 Divers'n channel const.																	
6 Inatke gate/scouring sluice construction																	
7 Canal Struct. Constructin																	
8 Canal Excavation & Fill																	
9 Drainage Structure Constr. & Drains Excavation																	
10 Farm Road Construction																	

Project : Gottu. Region : Welo. Facility : Weir.

Description	1st Year			2nd Year												3rd Year	
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
1 Mobilization & Camp'g																	
2 Access Road Construction																	
3 U/S Coffer Dam																	
4 Foun'n/Exca. & Weir Const.																	
5 Divers'n channel const.																	
6 Inatke gate/scouring sluice construction																	
7 Canal Struct. Constructin																	
8 Canal Excavation & Fill																	
9 Drainage Structure Constr. & Drains Excavation																	
10 Farm Road Construction																	

Fig. 3.3 Construction Schedule of Typical SSID Schemes (2/2)

Project : Tato Region : Wellega. Facility : Weir.

Description	1st Year			2nd Year												3rd Year	
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
1 Mobilization & Camp'g																	
2 Access Road Construction																	
3 U/S Coffer Dam																	
4 Foun'n/Exca. & Weir Const.																	
5 Divers'n channel const.																	
6 Inatke gate/scouring																	
sluice construction																	
7 Canal Struct. Constructin																	
8 Canal Excavation & Fill																	
9 Drainage Structure Constr.																	
& Drains Excavation																	
10 Farm Road Construction																	

Project : Gibe. Region : Wellega. Facility : Weir.

Description	1st Year			2nd Year												3rd Year	
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
1 Mobilization & Camp'g																	
2 Access Road Construction																	
3 U/S Coffer Dam																	
4 Foun'n/Exca. & Weir Const.																	
5 Divers'n channel const.																	
6 Inatke gate/scouring																	
sluice construction																	
7 Canal Struct. Constructin																	
8 Canal Excavation & Fill																	
9 Drainage Structure Constr.																	
& Drains Excavation																	
10 Farm Road Construction																	

Project : Ashago. Region : Tigay. Facility : Earth Dam

Description	1st Year			2nd Year												3rd Year	
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
1 Mobilization																	
2 Camp Construction																	
3 Access Road																	
4 Clear'g & Grubbing																	
5 Coffer dam																	
6 Foundation Construct'n																	
7 Dam Embank't Construct'n																	
8 Intake & Outlet																	
9 Spillway Work																	
10 Riprap'g & Sodd'g																	
11 Main canal exca. & fill																	
12 Main canal structure																	

Table 3.7 Existing Construction Equipment for SSID Project

as of Sep. 1992

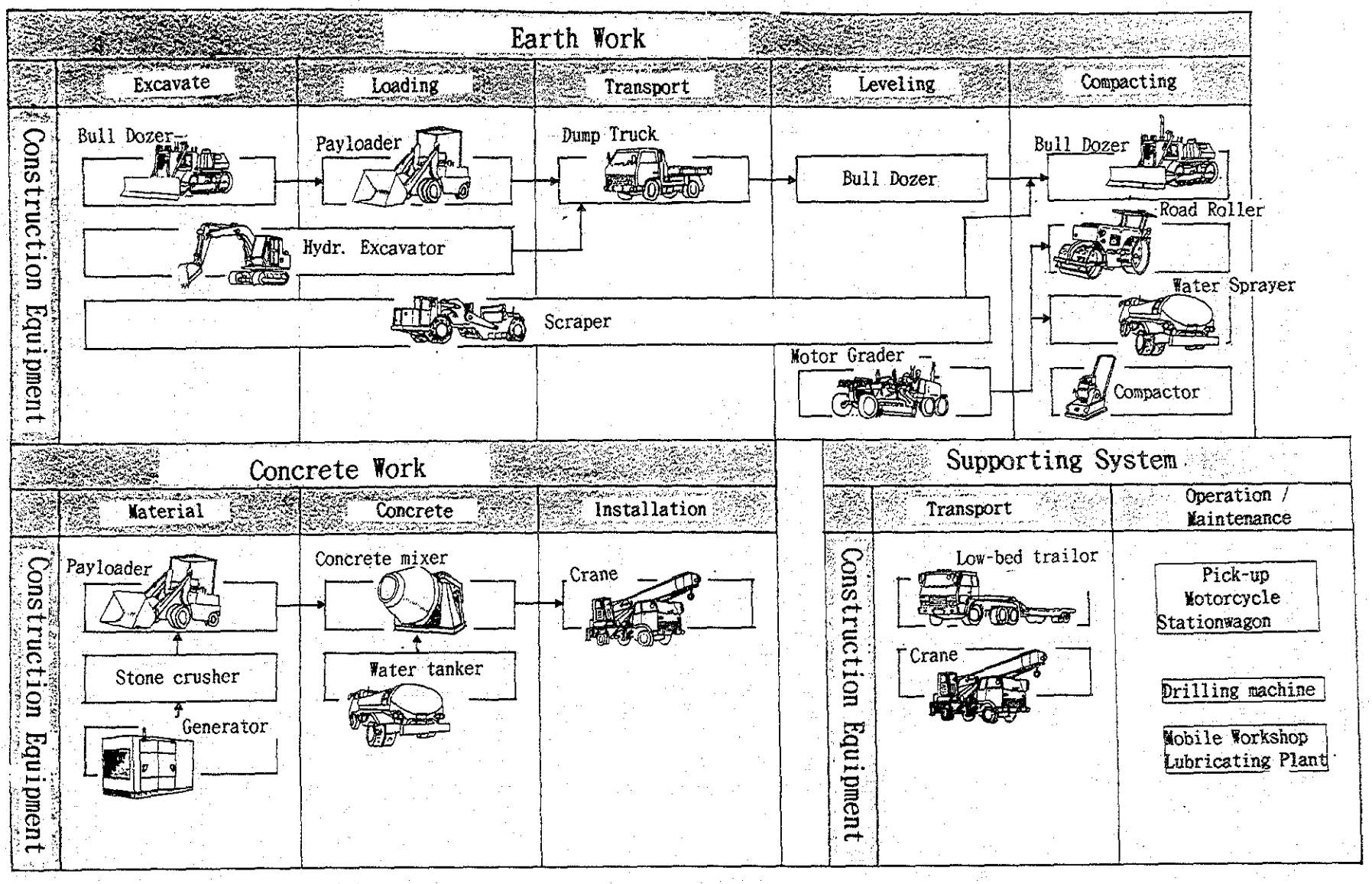
No.	Name of Equipment	Donor	Main Department	Northern Zone	N. Eastern Zone	N. Western Zone	Western Zone	S. Western Zone	Other Zone	Total	Remarks
1	Bulldozer	Japan	0	0	2	0	2	0	11	15	
		Others	0	2	2	3	0	0	13	20	
		Total	0	2	4	3	2	0	24	35	
2	Wheel Loader	Japan	1	0	0	1	1	0	2	5	
		Others	1	2	1	1	0	0	11	16	
		Total	2	2	1	2	1	0	13	21	
3	Backhoe Loader	Japan	0	0	0	0	0	0	0	0	
		Others	2	0	2	0	0	0	3	7	
		Total	2	0	2	0	0	0	3	7	
4	Excavator	Japan	1	0	0	0	0	0	3	4	
		Others	0	0	0	0	0	0	0	0	
		Total	1	0	0	0	0	0	3	4	
5	Vibro. Compactor	Japan	0	0	3	2	0	0	0	5	
		Others	0	0	0	0	0	0	0	0	
		Total	0	0	3	2	0	0	0	5	
6	Motor Grader	Japan	0	0	0	1	0	0	2	3	
		Others	9	0	0	0	0	0	6	15	
		Total	9	0	0	1	0	0	8	18	
7	Dump truck	Japan	4	0	8	0	2	0	31	45	incl. dumper & flat bed
		Others	14	0	12	7	2	12	40	87	
		Total	18	0	20	7	4	12	71	132	
8	M. Scraper	Japan	1	0	0	0	0	0	2	3	
		Others	0	0	0	0	0	0	0	0	
		Total	1	0	0	0	0	0	2	3	
9	Tractor	Japan	0	0	1	1	0	0	8	10	
		Others	0	3	3	0	0	0	15	21	
		Total	0	3	4	1	0	0	23	31	
10	Truck Semi-trailed	Japan	7	0	0	0	0	0	0	7	
		Others	0	0	0	0	0	0	0	0	
		Total	7	0	0	0	0	0	0	7	
11	Lowbed trailor	Japan	4	0	0	0	0	0	0	4	
		Others	1	0	0	0	0	0	0	1	
		Total	5	0	0	0	0	0	0	5	
12	Truck	Japan	0	0	0	0	0	0	0	0	
		Others	5	0	0	0	0	0	0	5	
		Total	5	0	0	0	0	0	0	5	
13	Mobile Workshop	Japan	3	0	0	0	0	0	0	3	
		Others	2	0	0	0	0	0	3	5	
		Total	5	0	0	0	0	0	3	8	
14	Mobile Greasing	Japan	0	0	0	0	0	0	3	3	
		Others	0	0	0	0	0	0	0	0	
		Total	0	0	0	0	0	0	3	3	
15	Water Brower	Japan	0	1	0	0	0	0	1	2	
		Others	1	0	0	1	0	0	5	7	
		Total	1	1	0	1	0	0	6	9	
16	Crane	Japan	3	0	0	0	0	0	0	3	
		Others	0	0	0	0	0	0	0	0	
		Total	3	0	0	0	0	0	0	3	
17	Station Wagon	Japan	2	1	1	2	1	1	5	13	
		Others	10	0	0	0	0	0	7	17	
		Total	12	1	1	2	1	1	12	30	
18	Pick-up	Japan	2	0	2	1	1	2	6	14	
		Others	3	0	0	3	2	0	8	16	
		Total	5	0	2	4	3	2	14	30	
	Total	Japan	28	2	17	8	7	3	74	139	
		Others	48	7	20	15	4	12	111	217	
		Total	76	9	37	23	11	15	185	356	

Note : number in Main Department includes number of equipment dismissed

Table 3.8 Requested Construction Equipment and Distribution Plan

No.	Equipment	Specification	Tigray	North Western Zone				Total	Western Zone			Total	N-E Zone	Main	Requested
			Tigray	Gondar	Gojam		Zonal		Wollega		Zonal		Wollo	Department	
			Ashago	Abagenen	Gedeb	Muga	Office		Gibe	Tato	Office		Gottu	A. Ababa	Total
1	Bulldozer	200 Hp	2	2	-	-	1	3	1	1		2	1	-	8
2	Wheel Loader	150 Hp, 2.5 m3	2	2	-	-	-	2	-	-	-	0	-	-	4
3	Motor Grader	135 Hp, B=3.5 m	1	2	-	-	-	2	-	-	-	0	-	-	3
4	Motor Scraper	16 m3	1	1	-	-	-	1	-	-	-	0	-	-	2
5	Dump Truck	13.5 m3	5	5	2	2	-	9	2	2	-	4	2	-	20
6	Hydro. Excavator	115 Hp, 0.7 m3	1	1	-	-	1	2	-	-	1	1	-	-	4
7	Vibration Roller	130 Hp	1	2	-	-	-	2	-	-	-	0	-	-	3
8	Mobile Workshop	150 Hp, tools	1	1	-	-	-	1	-	-	-	0	-	-	2
9	Mobile Greasing Plant	600 liter	1	1	-	-	-	1	-	-	-	0	-	-	2
10	Lowbed Truck & Tractor	40 ton load	-	-	-	-	-	0	-	-	-	0	-	2	2
11	Stone Crusher	7 m3/hr.	1	1	-	-	1	2	1	1	-	2	1	-	6
12	Concrete Mixer	350 liter	2	2	1	2	-	5	1	2	-	3	2	-	12
13	Plate Compactor	86 kg	1	1	-	-	1	2	1	1	-	2	1	-	6
14	Diesel Generator	15 KVA	1	1	1	1	-	3	1	1	-	2	-	-	6
15	Water Tanker	275 Hp, 16 ton	2	2	-	-	1	3	-	-	1	1	-	-	6
16	Pick-up	4WD, 9 sheets	2	2	1	1	-	4	2	2	1	5	1	-	12
17	Motor Cycle	100 cc	4	4	2	2	1	9	2	2	1	5	2	-	20
18	Drilling Machine	Truck-mount	-	-	-	-	-	0	-	-	-	0	-	1	1
19	Station Wagon	4WD	-	-	-	-	1	1	-	-	1	1	-	2	4
	Total		28	30	7	8	7	52	11	12	5	28	10	5	123

Fig. 3.4 Requested Construction Equipment and Its Usage



Chapter 4 Basic Design

CHAPTER 4 BASIC DESIGN

4.1 Design Criteria

The SSID project aims to develop small scale irrigation systems and thereby assures sustainable food production and increases the living standard of farmers. However, the development capability of the project is impeded by the shortage and deterioration of existing equipment and machinery. This Project is proposed in order to strengthen the construction capability by supplying the construction equipment and machinery needed for the SSID project. In this basic design, the quantity and quality of the appropriate construction equipment and machinery needed for the Project will be studied hereinafter.

The Project will be implemented under the Japanese Grant Aid System, and therefore the criteria of the grant aid system becomes one of the bases of the design. The criteria of the grant aid system, which are also described in the Minutes of Discussions signed by the Basic Design Study Team and the Transitional Government of Ethiopia, are as follows :

1) The equipment and machinery and machinery to be purchased under this Project shall be used only for the implementation of the Project.

2) Costs of the operation and management of the equipment and machinery shall be borne by the Ethiopian Government

3) Preparation of proper monitoring and evaluation systems for the purchased equipment and machinery should be made by the Ethiopian Government.

4) The following items should be carefully considered for the design of equipment and machinery procurement for the SSID project;

   i) Type and scale of the proposed SSID schemes
   ii) Geological and topographical conditions of the proposed SSID schemes
   iii) Operation and maintenance capability of existing construction equipment and machinery
   iv) Financial arrangement of Ethiopian Government for the implementation of the schemes

Considering the above mentioned conditions, the basic design for the equipment and machinery procurement shall be prepared based on the following criteria;

i) Adjust the basic design to the current national development policy and regulations in Ethiopia

ii) Select the equipment and machinery which suits the Ethiopian standard of construction equipment and machinery and economical efficiency

iii) Determine the specifications which meet the standard of the construction works and economical efficiency

iv) Determine the procurement plan based on the present situations and conditions of the executing agency, Ministry of Agriculture

v) Consider the adaptability and economical efficiency of the equipment and machinery and their operation and maintenance towards the variation of climatological and topographical conditions of the proposed SSID scheme sites

vi) Consider the present or future capability of technical staff and team of IDD for the operation and maintenance of equipment and machinery

vii) Standardize the equipment and machinery and select similar models /types to the existing equipment and machinery to facilitate easy operation and maintenance

viii) Abandon or show the alternatives of the requested equipment and machinery which would be less possible to be used in the proposed SSID schemes, or add the equipment and machinery which will be necessary for the construction and meet the requirements of the grant aid system

ix) Supply spare parts for the newly procured equipment and machinery within 15% of its purchase costs considering the difficulty of their purchase in Ethiopia and distribution of the work sites.

The SSID schemes to be constructed by the newly purchased equipment and machinery under the Project shall be limited by the following considerations;

i) The SSID schemes within the request which already started the construction of main system, shall be completed by the existing construction equipment and machinery in IDD

ii) The SSID schemes which are waiting for completion of on-farm irrigation system shall also be completed by the existing equipment and machinery in IDD

iii) The SSID schemes to be constructed by the newly procured equipment and machinery under the Project are limited to schemes for which the detailed design have been completed and are at a pre-feasibility or feasibility study stage.

The number of SSID schemes to be implemented by the assistance of the Project are 49 with an area of 6,887 ha out of the requested 72 schemes of 10,913 ha in the Project area in Northern, Northeastern, Northwestern, Western and Southwestern Zones. These SSID schemes consist of 3 small dams, 43 weir diversion works and 3 pumping intakes.

4.2 Irrigation Facilities to be Constructed by the Project

4.2.1 Work Volume

In the SSID project, the irrigation system from the intake facility to the quaternary irrigation system including related irrigation and drainage facilities is constructed. Work volume of the SSID schemes to be constructed under the Project is estimated for determining the required construction equipment and machinery. Seven schemes have been completed their detailed designs including quantity and cost of works, and the remaining 39 schemes have no data of their work volumes. Therefore the average work volume of weir intake schemes and small dam intake schemes were estimated based on the schemes which have calculated the quantities under SSID project (70 schemes of 12,000 ha for weirs and 10 schemes of 2,800 ha for dams). And the work volumes of the Project were estimated on the basis of zonal offices. The summary of work volume for the Project is shown in Table 4.1 and details of the estimation are tabulated and presented in Appendix VII.

4.2.2 Construction Planning

(1) Implementation Plan of the Project

The SSID schemes and the implementation plan within 5 years in the Project area are shown in Fig.3.2. It also includes 23 schemes to be constructed before the arrival of additional construction equipment and machinery of the Project.

(2) Implementation Plan in 1992/93

In 1992/93 seven schemes which already have their complete detailed design will be constructed. As shown in Table 3.3, all schemes were planned to be constructed within 13 to 14 months and construction of intakes, i.e, weir or earthfill dam will be completed within 3 to 4 months. According to the previous experiences of the SSID project and field inspection of the team, weirs of the SSID project were completed within 2.5 to 3 months. Therefore they can be completed in 3 to 4 months as shown in the plan. These schemes will be implemented by the existing construction equipment and machinery of IDD.

(3) Constraints of Construction Planning

The following points shall be carefully considered for the construction planning :

1) Limited Workable Period

As stated in the previous chapters, rainy days and rainfall patterns vary from location to location and the workable days for the construction of earthworks is limited to about 3 months of dry season. During the rainy season, the access roads to the schemes except the national highway is very difficult for the mobilization and demobilization of construction equipment and machinery. Therefore, careful consideration should be made with regard to the workable days.

2) Procurement of Construction Materials

The construction materials such as cement and reinforcement bars need to be transported from Addis Abeba or the local market to the work sites. The transportation from the market to the site shall be made during the limited dry season. Gravel and sand for the concrete works were collected from rivers or quarries adjacent to the schemes by man power provided by farmers and IDD shall pay for the procurement of these materials (60 Birr/4m^3 for sand and gravel). Pre-cast pipes for the related facilities are manufactured by SSID project at the site.

Table 4.1 Summary of Work Volume of the Project

Implementation Schedule (year)			93/94			94/95			95/96	96/97	TOTAL	REMARK
Intake Type			Weir	Dam	total	Weir	Dam	total	Weir	Weir		
Irrigation Area (ha)			1,270	150	1,420	2,275	200	2,475	1,660	1,332	6,887	
Construction Unit			9	2	11	16	1	17	10	11	49	
Item	Equipment	Unit										
Earth Works	Bulldozer	m3	1,152,040	255,064	1,407,104	2,063,693	340,085	2,403,778	1,505,816	1,208,281	6,524,979	
	Wheel Loader	m3	550,764	158,382	709,145	986,604	211,176	1,197,780	719,896	577,651	3,204,472	
	Backhoe Loader	m3	166,500	20,892	187,392	298,259	27,856	326,114	217,630	174,629	905,765	
	Vibro Compactor	Dam Works	0	2	2	0	1	1	0	0	3	
	Motor Grador	km	902,952	63,040	965,992	1,617,493	84,053	1,701,546	1,180,237	947,033	4,794,808	
	Dump Truck	m3	642,891	169,433	812,324	1,151,636	225,910	1,377,546	840,314	674,276	3,704,461	
	Motor Scraper	m3	0	83,098	83,098	0	110,797	110,797	0	0	193,895	
	Water Brower	Const. Works	-	-	-	-	-	-	-	-	-	
	Wark Roller	Const. Works	-	-	-	-	-	-	-	-	-	
On-farm	Tractor	ha	-	-	-	-	-	-	-	-	-	
Suport Works	Trailor	Machine	-	-	-	-	-	-	-	-	-	
	Truck	Const. Works	-	-	-	-	-	-	-	-	-	
	Mobil Workshop	Const. Works	-	-	-	-	-	-	-	-	-	
	Mobil Grasing	Const. Works	-	-	-	-	-	-	-	-	-	
	Motor Cycle	Const. Works	-	-	-	-	-	-	-	-	-	
	Crane	Machine	-	-	-	-	-	-	-	-	-	
	Station Wagon	Const. Works	-	-	-	-	-	-	-	-	-	
	Pick-up	Const. Works	-	-	-	-	-	-	-	-	-	
Inspection	Drilling Machine	Dam Works	-	-	-	-	-	-	-	-	-	
Temporary	Generator	Const. Works	-	-	-	-	-	-	-	-	-	
Concrete Works	Stone Crusher	m3	119,899	7,161	127,060	214,779	9,549	224,328	156,718	125,752	633,858	
	Concrete Mixer	m3	119,899	7,161	127,060	214,779	9,549	224,328	156,718	125,752	633,858	

4.3 Construction Equipment and Machinery for the SSID project

4.3.1 Requested Construction Equipment and Machinery

19 types of construction equipment and machinery requested and not requested and type of works to be done are tabulated in Table 4.2.

Works proposed for a mobile greasing plant can be done by using pick-ups with greasing machine which was requested separately.

The purpose of the requested motor cycles can be covered by using transportation vehicles such as dump trucks, pick-ups and station wagons proposed in the Project.

Motor scraper is used for excavation and short-range transportation of large scale earthworks such as construction of earth dams or ponds. Works of motor scraper can be replaced by the combination of bulldozers and dump trucks. IDD owns 3 units of motor scrapers but their operation hours are low, which means that there is less urgency and priority for motor scrapers.

Hydraulic excavator can be used for various purposes such as excavation, loading, shaping and finishing of slope and sometimes it also works as a crane. Especially, it is suitable for the canal construction works. IDD has only few excavators and are not widely used in the construction works. Even the canal construction in the SSID project is done by manual labor.

4.3.2 Construction Equipment and Machinery and Additional Requirement

Based on the estimated work volume to be done by the Project, the total requirement of equipment and machinery for each year was estimated on the zonal office basis. The summary of equipment and machinery requirement is summarized in Table 4.3 and the details are presented in Appendix VII. As shown in Table 4.3, the number of equipment and machinery required at the third year is estimated to be the maximum comparing with the other years.

The construction in 1992/93 will be executed by the existing equipment and machinery at IDD. The existing equipment and machinery will be depreciated within the next 5 years and the reduction of productivity of equipment and machinery was not considered in the estimation. Therefore, the replacement of existing equipment and machinery after their depreciation shall be done by the Ethiopian government using other sources of finances in order to maintain the construction capacity of the project.

The Project aims at procuring the additional equipment and machinery required for the construction of proposed SSID schemes from 1993/94. In order to complete the procurement to meet the maximum requirement in 1994/95 and increase the staffing arrangement for the O & M in IDD, the procurement shall be started in 1993/94 with two stages.

(1) Implementation Schedule of SSID Schemes and Construction Equipment and Machinery

As shown in Table 3.2, the construction of the proposed SSID schemes will be implemented in the Project area. The equipment and machinery which will be procured in the Project will be used for the new schemes, and the schemes which already started their construction will be completed using the existing equipment and machinery at IDD. During the field survey, the priority of the requested equipment and machinery was discussed between the Government of Ethiopia and the Study Team based on the following criteria ;

First Priority :	Urgently required equipment and machinery to be used for the weir intake schemes but facing shortage
Second Priority :	Equipment and machinery to be used for the general construction work and high possibility of accelerating construction work
Third Priority :	Special equipment and machinery to be used for the earthfill dam construction and less possibility of usage at present

According to implementation schedule, equipment and machinery to be used for the construction of 9 weir intake schemes and 2 earthfill dam schemes shall be the first priority. The geo-technical investigation equipment and machinery, supervisory vehicle and spare parts for the existing equipment and machinery

shall also be included in the first priority group.

Equipment and machinery of the second priority shall be those which will not disturb the proposed construction implementation schedule even if its procurement is delayed by one year after the procurement of first priority equipment and machinery.

Equipment and machinery of the third priority included the special equipment and machinery for dam schemes.

As a result of the Study, the first priority consists of the following ;

i) earthwork equipment and machinery which include bulldozer, wheel loader, motor grader, vibration roller, dump truck and water tanker,
ii) maintenance service vehicle which include mobile workshop and low-bed semi-trailer, and
iii) investigation equipment and machinery and vehicles for supervision which include station wagon, pickups and drilling machine.

The spare parts for the existing equipment and machinery (hydraulic excavators and motor grader), which is very difficult to be purchased in Ethiopia is included in the first priority.

The second priority consists of equipment and machinery which will be used for wide range of common works but is less urgent for the construction. They are walk-type compactor, diesel generator, concrete mixer and stone crusher.

The third priority equipment and machinery consists of 1) motor scraper which is mainly used for large-scale earth moving works such as earthfill dams and reservoir/pond, 2) mobile greasing plant which is economically efficient for small scale earthworks 3) motor cycles for field inspection and 4) hydraulic excavator which is not common in Ethiopia.

(2) Determination of Equipment and Machinery to be Purchased

The equipment and machinery to be purchased by the Project is determined based on the construction equipment and machinery required for the implementation of SSID schemes.

1) Additionally Required Equipment and machinery for SSID Schemes in the Project

As shown in the last column of Table 4.3, the quantity of additionally required equipment and machinery is calculated by deducting the existing quantity from the total quantity,

2) Confirmation of Purpose and Familiarity

The selected equipment and machinery shall be confirmed based on their purpose of use and familiarity of Ethiopian operator.

3) Confirmation of the Present O & M Conditions of IDD

The selected equipment and machinery shall be confirmed about the possibility of their operation in sites and maintenance and repairs in the workshop along with the existing specification and model.

The equipment and machinery to be procured by the project can be divided into three categories and 15 types totaling 95 units as shown in Table 4.4. The Japanese government will bear the costs of the above procurement and the transportation cost upto the destination point in Ethiopia.

4.3.3 Specifications of Additional Required Equipment and Machinery

(1) Bulldozer (200 HP class)

The main properties considered for selecting Bulldozer (200HP class) include horse power of engine, air supercharger, torque converter, blade type, ripper, roll-over protective structures(ROPS) system, and numbers of units.

At first, the excavation works of river bed need be carried out roughly for the new construction or rehabilitation works of water intake facilities in the mountainous area of Ethiopia. Therefore, adequate horse power of engine with supercharger is required for the bulldozer. An oil hydraulic ripper is indispensable for excavation works at the rocky area. ROPS system is required for maintaining the safety of operator and the equipment body during the construction period.

The horse power of engine shows the nominal horse power of diesel engine of equipment. The bulldozer 200HP class with air supercharger is the appropriate equipment for construction works in the high mountainous area.

Torque converter is a device used to transmit the engine power to the driving gear by oil pressure. The equipment with torque converter is more effective for heavy construction works.

Blade is attached in front of the body and is operated by oil pressure. It is used for excavating and moving earthworks. The tilt type straight blade is required for this purpose.

Ripper which is mounted at the rear with 1 to 3 shanks is operated hydraulically and is used for crushing hard rock formations. By using ripper, the blade operation becomes more easy and the excavation work can be carried out effectively.

(2) Wheel Loader (150 HP class)

Wheel loader is used for loading loose soil and rock to dump truck and sometimes excavates soil by a bucket and transports it for a short distance of around 200 m. In general, the appropriate capacity of the bucket is one fourth to one fifth of vessel capacity of the dump truck. For example, 2 to 2.5 m^3 of bucket capacity is optimum for a dump truck of 8 m^3 vessel capacity. If the bucket capacity is too large or too small compared with the vessel capacity of dump truck, the capacity of the wheel loader may be considered as uneconomical.

In general, one wheel loader is considered as optimum against four or five dump trucks. However, it depends upon the transportation distance of soil. Based on the study of the specifications of dump truck which is discussed later, four (4) wheel loaders with 2 to 3 m^3 of bucket capacity is considered suitable for operation and maintenance of the Project.

Most of the wheel loaders have four wheel driving system and the driving force and capacity of excavation works have been increased by the development large sized tires with low contact pressure.

The advantages of wheel type comparing with the crawler type are as follows;

i) The mobility of wheel type is larger, and the wheel type can be driven on the pavement road without any special equipment,
ii) Wheel type is easier to move from site to site.

Since the soil loading work at the construction site is the main purpose of using wheel loader, a multi-purpose basket is required.

(3) Motor Grader (135 HP class)

The main points to be considered with regard to the specification of motor grader of 135 HP class are air supercharger, frame structure of body, length of blade, and scarifier.

Supercharger is one of the special devices used supplying air under high pressure to the cylinders of internal combustion engine. When the construction equipment is operated in high mountainous area under low air pressure condition, a supercharger is useful and sometimes indispensable for obtaining sufficient engine output for the equipment.

There are two types of frame structure which include rigid type and articulate type. The articulate type is more useful for the road with small radius at mountainous area.

The proper length of the blade depends upon the horse power of engine and a 3.7 m class of blade length is suitable for the motor grader 135 HP class, which is optimum for farm road works and temporary road works.

Scarifier is attached at the front of the blade and is operated by hydraulic power. It is used for crushing and digging up hard rock formations. By using a scarifier, the grading can be done effectively.

(4) Dump Truck (275 HP, 13.5 ton, 8 m^3 class)

Dump truck is used for transporting the tools required for the construction works and the materials such as the embankment soil of dam or sub-base of road, and surplus soil. Effective vessel capacity of the dump truck is related with the bucket capacity of wheel loader and a too large or a too small vessel capacity of dump truck comparing with bucket capacity of wheel loader is considered inadequate.

The main points to be considered with regard to the specification of dump truck are direction of loading, vessel capacity, freight tonnage, proper driving wheel system for undulating road and number of units required for one wheel loader.

The dump truck with rear dump system, 8 m^3 class of vessel capacity, 13.5 ton class of freight tonnage, 6x4 type of driving wheel system and air supercharger for high mountainous area is required for the construction of irrigation facilities of the Project. Except for special operation of round-transportation with long-distance, four (4) to five (5) units of dump truck against one (1) wheel loader is optimum for the normal transporting distance of 4 km. If more than five (5) dump trucks are used against one (1) wheel loader, the operating time of dump truck becomes lesser. On the contrary, if dump trucks of less than four (4) units are used against one (1) wheel loader, the operating time of wheel loader becomes shorter.

(5) Vibration Roller (130 HP class, front roller 9.5 ton class)

In the Project, vibration roller is used for compaction works of dam embankment and farm road. In general, a heavy vibration roller such as 9.5 t class is used for carrying out an enormous volume of earth work. A tamping roller is required for front roller. This type of vibration roller is also available for compaction of clayey soil and gravel.

There are three dam sites in the Project which require compaction works of 260,000 m^3, 160,000 m^3, and 200,000 m^3. Therefore, tamping roller is required for rapid compaction works of enormous embankment volume and high compaction efficiency by vibration.

(6) Mobil Workshop

Mobil workshop is a special truck with tools for repairing of construction equipment and machinery. This truck patrols the construction site regularly and inspects, services and repairs the construction equipment and machinery. The loading tools and spare parts for the equipment are standardized.

For mountainous area, 11 ton class of truck with diesel engine attached with air supercharger and four wheel driving system is required. The equipment and tools required for a mobile workshop are a hydraulic operated crane of 2 ton capacity, an engine generator, an air compressor, an oil hydraulic press, an

oxyacetylene welder set, an electric welder set, a mechanic tool set, a pneumatic tool set, a electric tool set, an oil hydraulic jack and other lifting device, cleaning equipment and tools, measuring instrument set, lubricating equipment and tools, machining tools, engine repair equipment and tools, electric testing instruments, Battery service equipment and tools, tire service equipment and tools, sheet metal equipment and tools etc.

(7) Low-bed Semi-trailer (40 ton class)

In general, trailer truck is a combination of traction truck and loading trailer and is used for transporting heavy equipment, machinery and goods. There are two trailer types ; semi-trailer type and full-trailer type. Low-bed semi-trailer type is required for carrying out heavy construction equipment and machinery such as crawler type bulldozer, vibration roller etc. A loading capacity of more than 34.6 ton is required for motor scraper which is the heaviest equipment and machinery already procured by the financial assistance of Japanese Government. Therefore, a low-bed semi-trailer with 40 ton loading capacity is required for the Project.

The main points considered in the specification of the low-bed semi-trailer are as follows ;

i) a diesel engine with air supercharger for safety driving with normal traction power in lowland areas of 500 m a.s.l. to high land areas of 3,000 m a.s.l. where the atmospheric pressure is low.
ii) a 6x4 wheel driving system for safety driving on undulating road, and
iii) an attachment type of rear ramp for rising up and lowering down on its own etc.

(8) Water Tanker (275 HP class, 13 m^3 class)

Water tanker is mainly used for supplying clean water for domestic use in the base camp of construction works, supplying cooling water for the engines of equipment and machinery at the site, sprinkling with water for road construction works and moisture control of embankment materials. Therefore, water tanker is indispensable for the construction works in remote areas.

The main points considered in the specification of the water tanker are as follows ;

i) a diesel engine with air supercharger for high mountainous area.
ii) a 6x4 wheel driving system for safety driving on undulating road, and
iii) 13 m^3 capacity water tank
iv) Suction, supply and sprinkling device with buffer function

The above mentioned description should be adaptable with the Ethiopian Standard.

(9) Pick-up

Pick-up truck is popular at construction site of many countries and is used for patrol, supervision, communication, field survey and transport of small tools and materials.

The main points to be considered in the specification of the pick-up are as follows ;

i) a diesel engine with air supercharger for high mountainous area,
ii) a 4x4 wheel driving system for safety driving on undulating road,
iii) 5 seats capacity, and
iv) steel type rear compartment of 1 ton loading capacity.

These descriptions should be adaptable with the Ethiopian Standard.

(10) Station Wagon (Wagon type, 4WD, to seat 9)

Station wagon is requested for supervising construction and communication between the Ministry of Agriculture and five zonal offices located in the Project area. The average distance from Addis Abeba to the Project site is 425 km (minimum 300 km to Nekemte, maximum 600 km to Mekele). This vehicle should be driven around high mountainous area with an altitude of approximately 2,000 m to 3,000 m a.s.l, and sometimes may be driven at areas of over 3,000 m a.s.l. Therefore, an engine with supercharger is required. Furthermore, 4x4 wheel driving system is required for safety driving on undulated road and an 80 HP engine power is required for transporting 9 persons to the construction site.

(11) Boring Machine

Existing plan and design have been carried out according to the Ethiopian Standard. But the soil mechanical data is not sufficient in many cases. Soil mechanical and geological survey are supposed to be carried out by geological engineer. However the lack of instrument for field survey hinders the field investigation.

Considering its transportation up to the site, a portable type of boring machine with a capacity of more than 50 m of drilling depth is required. Furthermore, field permeability testing and standard penetration testing apparatus, core sampling tools and pump and pipe set for drilling are also required.

(12) Walk Type Compactor (8.5 HP class, 1 ton)

In the Project, the embankment works are carried out not only for dams and farm roads but also for the maintenance roads (side road) of irrigation and drainage canals which have a total length of approximately 1,300 km. Although the total length of the compaction work is so long, the width and the compacting volume is relatively small, which is difficult to be compacted by heavy machine. A walk type compactor is used for this purpose. This equipment can also be used for the compaction works at the tail end or at the edge of the embankment of dams and farm roads.

The 8.5 HP class of walk type compactor is required and the horse power of the engine of this equipment should be sufficient enough so as to operate at high mountainous areas of altitude between 2,000 m to 3,000 m a.s.l.

(13) Diesel Generator (50 Hz, 25 KVA)

Diesel generator is used as an electric power source for wireless installation and lighting system in the base camp of construction works. The base camp is located at altitudes between 500 m to 3,000 m a.s.l. and the conditions of climate, air pressure, temperature, and the oxygen content of the air changes greatly depending upon the location of the site. Therefore, motor and generator should be able to generate a power of 25 KW at high mountainous area as well in low lands. For this reason, 4 cycle water cooled direct spray type diesel engine of more than 33 HP capacity with 1,500 rpm and 50 Hz frequency is required. The generator connected with the engine should have more than 25/30 KW power for 50/60 Hz frequency, 200/220 voltage and should be 3

phases of 4 line type.

The diesel engine with fuel tank, a generating device and an operation board should be installed on one steel platform. The diesel generator painted with steel anticorrosive material should be adaptable.

(14) Stone Crusher (Portable Joe Crusher type, 7 m^3/hr.)

Stone crusher is used for production of aggregate of maximum 25 mm in diameter for concrete and asphalt. There are a lot of concrete structures to be constructed such as spillway of dam, pumping station, intake gate, weir etc. For fine aggregate, the river sand can be used and for coarse aggregate, the crushed stone produced by stone crusher is used in many cases. The required volume of coarse aggregate for each Project site is 350 m^3 and the working period of stone crusher is half of a month. Therefore, 7 m^3/h of production capacity is required.

(15) Concrete Mixer (350 liter container with 2 cycle water cooled diesel engine)

At lowlands, more or less 11 KW, 15 HP of capacity is required for the attached diesel engine. It is necessary to have an equivalent capacity engine for the high mountainous area with an altitude of 2,000 m to 3,000 m a.s.l.

(16) Motor Scraper (400 HP class)

Motor scraper is a self-propelled excavation equipment used for excavating, loading and transporting soil. It consists of a scraper device with bowl and wheel tractor. This equipment can be operated economically at flat lands and can be used for transporting an enormous volume of earthwork for a distance of 500 m to 2,000 m. For this reason, motor scraper is used for the big construction works such as airport, sports ground, land reclamation for housing development and large highways. Since the push dozer with a high horse power is required for soil excavation and transportation, many motor scrapers together with a push dozer are used for construction.

A 400 HP class motor scraper is specified to have a soil volume of 16 m^3 of heaped capacity or 11 m^3 of struck capacity. As this equipment is not used widely, the quantity of production is very few in the world and the cost is very high.

Therefore, recently the equipment of comparatively low cost such as a 2 m^3 class of 4 wheel loader and a 8 m^3 class of dump truck are used together for middle scale earth works such as road construction works with 300 m to 5,000 m of transporting distance and the motor scraper has been used only in few cases.

In the request from the Ethiopian Government, two motor scraper are planned for two dam sites. However, the volume of earth works is not so large which is around 160,000 m^3 to 260,000 m^3. Considering the volume of these earth works, the 400 HP class of motor scraper is not appropriate for the Project from the technical and economical view points. Therefore, the motor scraper should be excluded from the equipment and machinery procured for the Project.

(17) Back Hoe

In Japan, back hoe (hydraulic excavator) is one of the main construction equipment and machinery and is used with dump truck for small scale earth works. This equipment is used for many purposes such as soil excavation, loading on dump truck, moderate rock excavation with the special attachment and so on. In agricultural infrastructure development projects of Japan, this equipment is used not only for normal use but also for other uses such as shaping slopes of irrigation and drainage canals, driving light sheet piles etc. In the Project, a large volume of excavation works is expected for main irrigation canal (181 km), secondary irrigation canal (255 km), tertiary irrigation canal (500 km) and drainage canal (314 km). It can be considered that the back hoe may be one of the necessary equipment and machinery for the Project. However, the construction condition of Ethiopia is quite different from that of Japan, and manual labor is mainly used for this kind of excavation works. Therefore, considering the employment opportunity of inhabitants in the Project area, back hoe should be excluded from the equipment and machinery to be procured by the Project.

(18) Greasing Plant

Greasing plant is a special type of vehicle used for patrolling sites, supplying grease and exchanging mobil oil of construction equipment and machinery where several construction sites are located far away from oil stations. This equipment is also used where many equipment and machinery are operated in one site. However, in the Project, even at dam construction sites where the most number of equipment and machinery are used, the proposed equipment and machinery for construction are 2 or 3 bulldozers, 1 or 2 vibration rollers, 1 or 2 wheel loaders and several dump trucks. Considering the maintenance of these equipment and machinery, it is not necessary to use any special vehicle and the pick-up should be enough for carrying the materials such as grease and mobil oil. Therefore, greasing plant should be excluded from the equipment and machinery procured for the Project.

(19) Motorcycle

Motorcycles with 150 cc engine were requested by Ethiopian Government. Motorcycle can be used for traveling to the construction sites for supervising, communication and maintenance. However, considering the priority of equipment and machinery procured and effective use of the limited budget, the motorcycle is excluded from the equipment and machinery procured for the Project.

Table 4.2 Construction Equipment and its Usage

No.	Type of Equipment	Equipment Usuage
I Requested Equipment		
1	Bulldozer	Preparatory works, excavation, land leveling, excavation at the borrowed area
2	Wheel Loader	Excavation and loading of soils
3	Motor Grader	Land leveling and spreading embankment material at the site
4	Dump Truck	Transportation of soil and construction materials
5	Vibration Roller	Compaction of Embankment
6	Low-bed Semi-trailer	Transportation of heavy consruction equipment
7	Mobile Workshop	Maintenance and repair at the site
8	Water tanker	Water spreading for embankment and transportation of water
9	Pick-up	Transportation for supervisory staff, technician and small construction equipment and materials
10	Station Wagon	Transportation for supervisory staff, technician and small construction equipment and materials
11	Drilling Machine	Geo-technical investigation for dam and large scale structures
12	Walk type Compactor	Compaction of Small embankment
13	Diesel Generator	Electrical generation for small scale construction equipment
14	Stone Crusher	Manufacturing coarse aggregate for concrete
15	Concrete Mixer	Mixing of Concrete
16	Motor Scraper	Large scale and short hauling earth excavation and transportation
17	Hydraulic Excavator	Excavation of canal, shaping and surface compaction of slope
18	Mobile Greasing Plant	Greasing and oil changing for construction equipment at site
19	Motor Cycle	Transportation of supervisory staff to the site
II Equipment not Requested		
20	Tractor	Material transportation for on-farm works
21	Truck	Material transportation
22	Crane	Loading and unloading of construction materials

Table 4.3 Summary of Required Construction Equipment

Implementation Schedule (year)		93/94			94/95			95/96			96/97			Maximum Necessary and Additionally req. units		
Intake Type		Weir and Dam			Weir and Dam			Weir			Weir					
Irrigation Area (ha)		1,420			2,475			1,660			1,332			2,475		
Construction Unit		11			17			10			11			17		
Item	Equipment	Necess. Units	Present Units	Add. Req. Units	Necess. Units	Present Units	Add. Req. Units	Necess. Units	Present Units	Add. Req. Units	Necess. Units	Present Units	Add. Req. Units	Necess. Units	Present Units	Add. Req. Units
Earth Works	Bulldozer	11	11	0	19	11	8	12	11	1	10	11	-1	19	11	8
	Wheel Loader	7	8	-1	12	8	4	7	8	-1	6	8	-2	12	8	4
	Backhoe Loader	3	5	-2	6	5	1	4	5	-1	3	5	-2	6	5	1
	Vibro Compactor	8	5	3	4	5	-1	0	5	-5	0	5	-5	8	5	3
	Motor Grader	7	10	-3	13	10	3	9	10	-1	7	10	-3	13	10	3
	Dump Truck	48	61	-13	81	61	20	50	61	-11	40	61	-21	81	61	20
	Motor Scraper	1	1	-0	1	1	0	0	1	-1	0	1	-1	1	1	0
	Water Brewer	6	3	3	9	3	6	5	3	2	6	3	3	9	3	6
	Work Roller	11	11	0	17	11	6	10	11	-1	11	11	0	17	11	6
On-farm	Tractor	0	8	-8	0	8	-8	0	8	-8	0	8	-8	0	8	-8
Suport Works	Trailor	10	7	3	15	7	8	8	7	1	7	7	0	15	7	8
	Truck	3	5	-2	5	5	-0	3	5	-2	2	5	-3	5	5	0
	Mobil Workshop	5	5	0	7	5	2	4	5	-1	4	5	-1	7	5	2
	Mobil Greasing	1	0	1	2	0	2	1	0	1	1	0	1	2	0	2
	Motor Cycle	11	11	0	17	11	6	10	11	-1	11	11	0	17	11	6
	Crane	2	3	-1	3	3	-0	2	3	-1	1	3	-2	3	3	0
	Station Wagon	22	18	4	34	18	16	20	18	2	22	18	4	34	18	16
	Pick-up	11	16	-5	17	16	1	10	16	-6	11	16	-5	17	16	1
Inspection	Drilling Machine	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1
Temporary	Generator	11	11	0	17	11	6	10	11	-1	11	11	0	17	11	6
Concrete Works	Stone Crusher	11	11	0	19	11	8	14	11	3	11	11	0	19	11	8
	Concrete Mixer	11	11	0	19	11	8	14	11	3	11	11	0	19	11	8

Table 4.4 Equipment to be Procured by the Project

No.	Equipment	Specifications	No. of units
I Construction Equipment			
1	Bulldozer	200 HP, 18.5 t, 3 rippers	8
2	Wheel Loader	150 HP, 12.5 t, 2.5 m3 bucket	4
3	Motor Grader	135 HP, 11.4 t, 3.5 m blade	3
4	Vibration Roller	130 HP, 9.5 t, front steel roller	3
5	Dump Truck	275 HP, 13.5 t (8m3)	20
6	Water Tanker	275 HP, 13 m3 tank	6
7	Wlak-type Compactor	8.5 HP, 1 t	6
8	Diesel Generator	50 Hz, 25 KVA	6
9	Stone Crusher	Portable Joe crusher 7 m3/hr	6
10	Concrete Mixer	350 liter batch	12
11	Spare parts for exisiting equipment		1 set
II Maintenance Equipment			
1	Mobile Workshop	150 HP, 4WD, Repair tools and equipment	1
2	Low-bed Semi-trailer	275 HP, 40 t loading	2
III Investigation and Supervisory Vehicle			
1	Drilling machine	50m drilling, 65mm diameter	1
2	Pick-up	4 WD, 5 seats, 1 t loading	12
3	Station wagon	4 WD, 85 HP, 9 seats	4

Chapter 5 Project Implementation Plan

CHAPTER 5 PROJECT IMPLEMENTATION PLAN

5.1 Project Implementation

(1) Organization of Ethiopian Government

The Ministry of Agriculture will be given the entire responsibility for the Project implementation. The execution of the Project will be carried out by IDD under RIDMD. For the construction of the Small Scale Irrigation Development Project, IDD shall prepare, by their own expenses, the necessary staff, and additional necessary materials, equipment and machinery, which are not procured by Japanese Government, and will be carried out immediately after the conclusion of Exchange of Notes between the Government of Ethiopia and the Government of Japan. In cooperation with other governmental authorities concerned, the Ministry of Agriculture should be responsible for the smooth conclusion of Exchange of Notes, banking arrangement, and exemption from tax and duty not only for importing materials, equipment and machinery, but also for the Japanese engineers for the Project in Ethiopia.

(2) Consultant

Immediately after the conclusion of Exchange of Notes for the Project between the Government of Ethiopia and the Government of Japan, the consultant shall conclude the agreement for the various consulting services as stated below;

1) to prepare the detailed design and tender documents for the procurement of equipment and machinery

2) to execute tendering and its evaluation on behalf of Ethiopian Government

3) to advise and witness the contract between Ethiopian Government and a Contractor

4) to supervise the manufacturing of construction equipment, machinery and materials in Japan

5) other necessary services

(3) Contractor

The contractor shall procure and transport equipment, machinery and materials specified in the contract. Ethiopian branch office of the contractor has to provide technical advises for the equipment and machinery.

(4) Port of Delivery

The Study Team confirmed that the government of Ethiopia recommended Assab port which will be territory of Eritria after a national referendum in 1993, as one of expected delivery ports during the field survey period because of reasons stated below;

- In accordance with 1991 Charter, Ethiopian Government will be able to use Assab as a free port even after the independence of Eritria.

- There is no security problems between Assab port and Addis Ababa

However, Addis Ababa is decided to be the final delivery point of the Project in this study based on the principles of Japanese Grant Aid System.

(5) Tendering Packages

Materials, equipment and machinery to be procured in each fiscal year and tendering lots are determined considering following aspects;

- additional expenses for packing, transportation and administrative fee by increasing of tendering packages,

- additional expenses for tendering, supervision, inspection and administrative fee by increasing of tendering packages,

- practicability of one package tendering for spare parts procurement of existing equipment

- possibility of combined package tendering supplier and manufacturer (present status of affiliation of both supplier and manufacturer)

Based on the discussion on the priority of equipment and machinery between the Study Team and the government of Ethiopia, the proposed tendering package of each fiscal year is shown in Table 5.1.

Table 5.1 Proposed Tendering Packages

NO.	NAME	Priority	QT'Y	TOTAL QT'Y	REMARKS
PACKAGE 1 (SATGE 1)					
1	BULLDOZER (21 ton, 3 ripper)	1	4	8	divided into 2 phases
2	WHELL LOADER (2.5 m3)	1	2	6	divided into 2 phases
3	MOTOR GRADER (3.5m)	1	1	3	divided into 2 phases
7	VIBRO. ROLLER (9.5ton)	1	3		
18	DRILLING MACHINE (50m)	1	1		
	SPAREPARTS		L.S		incl.s/p for existings
	FIELD KITS		L.S		
	Total of Package 1		11		
PACKAGE 2 (STAGE 1)					
5	DUMP TRUCK (13.5ton)	1	10	20	divided into 2 phases
8	MOBILE WORKSHOP	1	2		
10	SEMITRAILER & LOWBED	1	2		
15	WATER TANKER (13,000 lit.)	1	2	6	divided into 2 phases
16	PICK UP (1 ton)	1	12		
19	STATION WAGON (4WD,9sheet)	1	4		
	SPAREPARTS		L.S.		
	FIELD KITS		L.S.		
	Total of Package 2		32		
FIRST STAGE TOTAL			43		
PACKAGE 3 (STAGE 2)					
1	BULLDOZER (21ton,3ripper)	1	4	8	divided into 2 phases
2	WHELL LOADER (2.5 m3)	1	4	6	divided into 2 phases
3	MOTOR GRADER (3.5m)	1	2	3	divided into 2 phases
13	WALK TYPE ROLLER (1ton)	2	6		
	SPAREPARTS		L.S.		
	FIELD KITS		L.S.		
	Total of Package 3		16		
PACKAGE 4 (STAGE 2)					
5	DUMP TRUCK (13.5ton)	1	10	20	divided into 2 phases
15	WATER TANKER (13,000 lit.)	2	4		
12	CONCRETE MIXER (350 lit.)	2	12		
14	DIESEL GENERATOR (50Hz,25KW)	2	6		
11	STONE CRUSHER (7ton/day)	2	6		
	SPAREPARTS		L.S.		
	FIELD KITS		L.S.		
	Total of Package 4		38		
STAGE 2 TOTAL			54		
GRAND TOTAL			97		

5.2 Scope of Work

The Project component is mainly the procurement of materials, equipment and machinery necessary for the construction of SSID project.

(1) Work to be undertaken by the Government of Japan

1) procurement of materials, equipment and machinery specified in section 4.3.3

2) procurement of consultants for the detailed design and supervision services for provision of the Project

(2) Work to be undertaken by the Government of Ethiopia

1) to complete SSID schemes in the Project

2) to ensure the necessary budget and personnel necessary for the completion of the Project

3) to bear all expenses for necessary materials, equipment and machinery aside from those to be borne by the Japanese Grant Aid for the completion of the Project

4) to ensure the site and right of access to the site

5) to exempt taxes and duty for materials, equipment and machinery upon arrival in Ethiopia

6) to exempt Japanese nationals concerned from customs duties, internal taxes and other fiscal levies which may be imposed in Ethiopia

7) to ensure the security of Japanese engineers to be dispatched to Ethiopia for the Project

8) to permit the members of the Japanese engineers to enter, leave and stay in Ethiopia

9) banking arrangement for the payment to the contractor and consultants under the Japanese grant aid

10) to maintain materials and equipment procured by the Project in good condition

11) to bear expenses for inland transportation from Addis Ababa to the SSID scheme sites

5.3 Implementation Program

The Project will start after the conclusion of Exchange of Notes (E/N) between the Government of Ethiopia and the Government of Japan. The MOA should have an agreement with a Japanese consultant on the design and supervision. After the conclusion of the agreement, the consultant should prepare detailed design and tender documents for the approval of both governments of Japan and Ethiopia. Only Japanese firms can offer the tendering of Procurement. The consultant should evaluate the offers after opening the tender and witness the contract between the Government of Ethiopia and the successful firm. It will take about four months to conclude the contract after the E/N.

The contractor should procure materials, equipment and machinery after the conclusion of contract. At least six months will be required to manufacture and procure equipment and machinery. It will take about two months for shipping and inland transportation respectively. 12 months will be required from the conclusion of E/N to the arrival of materials and equipment at final destination in each stage. Transfer of technology will need at least one month. Therefore, this Project will require a total period of about 10 months for each stage. In order to terminate the validity of E/N on March which is the end of Japanese fiscal year, staging of the Project was studied. Fig.5.1 shows the proposed schedule of the Project.

Fig. 5.1 Project Implementation Schedule

Item \ Year/Month	The 1st Year												the 2nd Year												The 3rd Year			Remarks
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
Conclusion of E/N						o-	-	-	-	-	-	-	-	-	-o			o=	=	=	=	=	=	=	=	=	=	o		
Procurement of Consultants							===												==									
Detailed Design							==-	--											=-	--								
Tender Preparation								----	-										=-	-								
Tender/Contract									o-	-o										o-	-o							
Shop Drawing/Manufacturing										o-	-	-	-	-	-	-	-	-	-	-	-	-	-	o				
Transportation													o=	=	=o									o=	=o			
Port/Custum clearance														===											===			
Inland transportation															=											=		
Final inspection/Handover															★											★		
CONSULTANTS ASSIGNMENT																												
Contracting							o-	-o	-	-	-	-	-	-	-o				o=	o-	-	-	-	-	-	-	-	o	
Detailed Design								==-	--										=-	--								
Tender document									----	-									=-	-								
Tendering/contracting support										o-	-o									o-	-o-							
Inspection / supervision											o-	-o	--	-o	=o						o-	-	-	-o	-o	=o			
Issuance of completion certificate															★											★		

Notes : ========== works in Ethiopia, ---------- works in Japan

5.4 Procurement Program

In accordance with the regulation of Japanese Grant Aid, the eligible countries for procurement of materials, equipment and machinery are principally limited to Japan and Ethiopia. Since there is no material, equipment and machinery which can be procured in Ethiopia, all material, equipment and machinery will be procured in Japan and exported to Ethiopia. Any material or equipment or machinery which is beyond the limitation of the Project or after invalidity of the E/N, should be purchased by the Government of Ethiopia.

5.5 Operation and Maintenance of Equipment and Machinery Procured

5.5.1 Operation and Maintenance of Existing Equipment and Machinery

The present conditions of construction equipment and machinery in the SSID project are comparatively good due to adequate technical ability and maintenance system. However, due to lack of spare parts, several equipment have been renovated and disposed. The parts of the disposed equipment and machinery have been utilized whenever necessary.

5.5 2 Operation and Maintenance Plan

IDD together with Supply and Equipment Service Department (SESD) in RIDMD of MOA is given the entire responsibility for operation and maintenance of equipment, machinery and spare parts for SSID project, which are procured by this Project and handed over to the Ethiopian Government. In this Project, spare parts for existing equipment and machinery are also procured and maintained by SESD. Spare parts to be supplied in this Project are limited only for the construction of irrigation facilities Therefore, spare parts necessary for the maintenance of other equipment and machinery after completion of the Project should be procured by MOA's own expenses. Procured equipment and machinery will be registered as MOA's property and maintained by SESD under RIDMD.

Maintenance and repair of the equipment and machinery of the Project will be carried out based on the following principles;

- Small scale repair works carried out by the mechanics of the site assigned by the zonal office of MOA on the site
- In case of the repair works beyond the capability of mechanics on the site, the Central Garage of RIDMD sends senior mechanics with mobile workshop to the site
- Zonal/regional office will assist their repair on the site
- Large scale damages of equipment and machinery are made in the Central Garage sending equipment from the site

5.5.3 Operation and Maintenance Expenses

(1) Basic consideration of O/M cost

Operation and maintenance expenses of equipment and machinery procured by the Project for 5 years until the Project termination in 1998 will be estimated. Scope of operation and maintenance of equipment is limited only during the construction of SSID Project and excludes after the termination of construction of Project and for the existing equipment and machinery. Also minor repair of equipment during the construction will be included in the construction cost.

1) Scope of work

Scope of the work for the estimation of operation and maintenance of the Project consists of the following items;

- Maintenance work and control of spare parts of the Project equipment and machinery in the Central Garage
- Repair works of the Project equipment and machinery in the Central Garage
- Repair works of the Project equipment and machinery on the site by sending the mechanics of the Central Garage of the mobile workshop

2) Staff

The required mechanical staff for the O & M of the Project is summarized in Table 5.2.

Table 5.2 Staff Required for O & M of the Project

Position	Present	Additional	Total
Storage keeper Work shop	10	0	10
Senior mechanics	10	3	13
Junior mechanics	10	3	13
Total	30	6	36

3) Additional annual operational expenses

The annual operational expenses which includes personnel expenses, trip allowance, fuel fee, and miscellaneous expenses for the equipment and machinery of Project as follows;

a) Personnel expenses
Senior mechanics 3 persons
Junior mechanics 3 persons

b) Trip allowance/year 6 months x 3 persons

c) Fuel fee 102,000 km
2 vehicles x 2 Round trips x 2 x 12 months = 48,000 km
3 vehicles x 50 km/day x 30 days x 12 months = 54,000 km

d) Miscellaneous expenses 10 % of a), b), and c)

(2) Operational Expenses

a) Personnel expenses

Senior technician E.B. 420/mon x 12 mon x 3 = E.B 15,120
Junior technician E.B. 347/mon x 12 mon x 3 = E.B 12,492

sub-total = E.B 27,612

b) Trip allowance E.B. 150/mon x 6 mon x 6 = E.B. 5,400

c) Fuel fee 102,000 km / 5(km/lit) x E.B 1.2/lit = E.B. 24,480

d) Miscellaneous expenses = E.B. 5,749

e) Total = E.B 63,241
(equivalent to US$ 30,552/year)

5.5.4 Issues and Improvement on Operation and Maintenance

Operation and maintenance of existing construction equipment and machinery of the SSID project is executed smoothly by IDD and SESD. By careful maintenance, some equipment is operated even after expiration of its useful life period. The equipment and machinery procured by the Project will be managed at the same level of the existing equipment and machinery. Further improvement in the management system is necessary for the following aspects;

(1) Increase the maintenance and repair capacity for the equipment made in Japan, which will increase the share in SSID project

(2) Introduce the rational equipment and machinery management system using data base on operation hour, items of repair, stock and procurement of spare parts in the Central Garage

(3) strengthen the maintenance and repair know-how for the newly introduced techniques such as electronic parts of the equipment or machinery.

Chapter 6 Project Evaluation and Conclusions

CHAPTER 6 PROJECT EVALUATION AND CONCLUSIONS

6.1 Evaluation of SSID project

The agricultural infrastructure and the national economy was seriously damaged by droughts in 1974 and 1984 and continuous civil war between 1974 and 1991. The Transitional Government has started its economic recovery and reconstruction plan for the new elected government which will be formed in 1994, by several foreign assistance.

In the agriculture based country of Ethiopia, the SSID project aims to strengthen the sustainable food products and increase the living standard of the farmers by installing the irrigation system and adapting diversified cropping system. Therefore, the SSID project will improve the national economy from a different approach of medium to large scale irrigation development which were targeted towards the increase in productivity of cash crops.

After establishment of SSID policy in 1984, IDD is introducing permanent irrigation systems by using technical and financial assistance from foreign countries and international agencies. Even during the difficult and social unrest period by civil war between 1974 and 1991, the IDD has completed 29 schemes of 2,600 ha and started the construction for 46 schemes of 9,600 ha. After conclusion of the civil war, the SSID project is strongly expected to contribute for the reconstruction and development of national economy.

6.2 Improvement of Construction Equipment and Machinery for the SSID project

6.2.1 The Project

Many efforts were made by IDD for extending the institutional and technical level of the IDD. The construction capacity of SSID can not meet the requirement because of the lack of construction equipment and machinery. It is facing the difficulty of implementing the plan for the next 5 years.

The Japanese Government contributed for the SSID project in 1984 and 2 KR programs from 1986. It was confirmed by the field survey that the equipment and machinery procured by the financial assistance of Japanese Government was used effectively for the implementation of SSID project together with the equipment and machinery provided by other foreign countries or agencies. It was also found out that some of the construction equipment and machinery kept in the central garage are waiting for the spare parts from Japan.

Under these conditions the government of Ethiopia requested the government of Japan for the additional construction equipment and machinery in order to implement the proposed SSID schemes within the next 5 years. Considering the previous assistance from Japan and the financial difficulties of the SSID project, the early implementation of the Project for procuring the additional construction equipment and machinery to SSID project is strongly requested.

6.2.2 Benefits of the Project

The Project will strengthen and increase the implementation capacity of the SSID project and the direct benefits of the SSID project on the sustainable food production and increasing the living standard of the farmers is summarized in Table 6.1.

Also, the indirect contribution of the Project is as follows :

- By the irrigation canals and facilities, the hard work of transporting drinking water from far away distances by women and children can be eliminated.

- The regional economic activities can be accelerated by increasing the peasants' living standard

- By the installation of permanent irrigation system the yield can be increased, the agricultural activities will be settled and the catchment area will be conserved

- The accumulation of the construction techniques will increase the opportunity for the private construction industry in Ethiopia

Table 6.1 Project Benefits

Item	Benefits	Scale of Benefits
1. Economic Benefits	1) To assure the stable cultivation in the wet season and to create the possibility of cropping in the dry season in the Northwestern, Western and Southwestern Zones	N-W Zone - 25 Schemes (3, 267 ha) Western Zone - 5 Schemes (1, 185 ha) S-W Zone - 7 Schemes (1, 200 ha)
	2) To assure the sustainable cultivation in the wet season and to extend the possibility of inland fishery by the irrigation reservoir in the Northern and Northeastern Zones	Northern Zone - 2 Schemes (300 ha) N-E Zone - 6 Schemes (965 ha)
2. Social Benefits		
1) Improvement of living standard	To improve the living standard of the farming community by the sustainable agriculture production	Beneficiaries of the Project is estimated as 3, 500 farm families families and 16, 000 people in the Project area
2) Natural Conservation	Less necessity for further destruction of catchement area by the settlement and increase the productivity of existing cultivation land	Conservation of forest resoruces decrease of flood damages and surface soil erosion

6.3 Conclusions

The Project is expected to increase the implementation capacity of SSID project by providing the construction equipment and machinery. This will result in the realization of sustainable food production and increase the living standard of the farmers, which will contribute for the reconstruction and development of Ethiopian national economy. Therefore the Project is highly favorable to implement under the Japanese Grant Aid and an early implementation of the Project is expected. The Ethiopian Government has enough capacity and is also anticipating for the construction equipment and machinery by the Project for implementing the SSID project smoothly and successfully.

In addition to the additional equipment and machinery to be procured by the Project, the Japanese technical cooperation is strongly expected on the irrigation and drainage planning, design and construction stages for the effective implementation of the Project.

6.4 Recommendations

Through the basic design study, the following points are recommended for the effective implementation of the SSID project in addition to the Japanese technical cooperation;

– 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' organization 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 organization 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 organization 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.

Appendix

APPENDIX

APPENDIX I
MEMBER LIST OF THE STUDY TEAM

Member List of the Study Team

Duty	Name	
Team Leader	Mr.Yoshikatsu NAKAMURA	Director, 1st Basic Design Study Div. Grant Aid Study & Design Dept. JICA
Agricultural Planning	Mr.Toru NISHIKAWA	Matsuto Agricultural Land Reclamation Office M.A.F.F
JICA Coordinater	Mr.Hisatoshi OKUBO	1st Basic Design Study Division. Grant Aid Study & Design Dept. JICA
Chief Engineer/ Agricultural Field Development	Mr.Keiji MATSUMOTO	Pacific Consultants International. (PCI)
Material & Equipment Planning	Mr.Yasuro HAGIHARA	ditto.
Irrigation Facility Planning	Mr.Seishiro SUZUKI	ditto.
Cost Estimate	Mr.Atsushi KISHI	ditto. (in home office work)

APPENDIX II
FIELD STUDY ACTIVITIES

FIELD STUDY ACTIVITIES

Date	Time	Activities	S.O.N.
9/21 (Mon)	14:00	Dep. Tokyo for Frankfurt LH 711	
9/22 (Tue)	19:55	Arr. Addis Ababa by LH-590	
		Guidance by Embassy/JICA at Ghion Hotel	Addis Ababa
9/23 (Wed)	8:30	Arrangement of rental cars (NTO)	
	9:30	Meeting at JICA Ethiopia Office	
	10:30	Courtesy call to Min. for External Economic Cooperation(Ato Geremew)	
	11:00	Courtesy call to Japanese Embassy	
	12:00	Lunchon with Embassy of Japan at SANGAM	
	15:00	Courtesy call to Min. of Agriculture Irrigation Development Dep. (Ato Takele Kassa) Vice Minister : Dr. Awetahgen Alemayhu	Addis Ababa
9/24 (Thu)	9:00	Central Statistical Office, Information & P&R Office (Ato Besrat Petros)	
	10:00	Mapping Authority	
	15:00	Dep. for Mekele by ET-200 (16:30-17:20) accompanied with Mr.Ota/Jin	
	18:00	Discussion with Zonal Office staff	Mekele
9/25 (Fri)	8:00	Field survey of Ashago earth dam site	
	10:00	Visit Garege of MOA Zonal Offce	
	11:00	Leave for Kobo	
	17:30	Arrive Kobo	Kobo
9/26 (Sat)	8:00	Visit Alewha weir site (Ethio-Italy Project)	
	9:00	Visit Golina weir site (Ethio-Italy Project)	
	10:30	Visit Negorin Irrigation Project(Completed)	
	11:30	Field Inspection of Gotu weir site	
	16:00	Arrival to Dese	
	17:00	Visit garage of MOA Zonal Office	
	18:30	Discussion with Zonal Officer	Dese
		(Team Leader arrived Addis Ababa by LH-590)	
9/27 (Sun)	6:30	Left for Comborcha	
	9:30	Left Comborcha for Addis Ababa by car	
	17:00	Arrival to Addis Ababa	
	20:30	Internal Meeting at Hotel Ghion	Addis Ababa
9/28 (Mon)	9:00	Courtesy call to MEEC with Minister	
	10:00	Discussion on SSID in MOA	
	14:00	Discussion on Planning of SSID in MOA	
	15:00	Visit Central mortor pool in Addis Ababa	Addis Ababa
9/29 (Tue)	9:00	Discussion on Minutes in MOA	
	18:30	Reception of MOA at Unity Hause	Addis Ababa

Date	Time	Activities	S.O.N.
9/30	9:00	Discussion on Planning of SSID in MOA	
(Wed)	11:30	Signing of Minutes at MEEC	
		Ato Geremew(MEEC), Ato Menker(MOA), Mr. Nakamura(JICA)	
	14:00	Discussion on Planning of SSID in MOA	Addis Ababa
10/ 1	6:30	Dep. for Ambo	
(Thu)		Visit Indris Irrigation Project	
	17:30	Arr. Adis Ababa	
	18:30	Internal Discussion at Unity Hause	Addis Ababa
		(Mr. Nakamura, Team Leader and Mr. Nishikawa left for Japan)	
10/ 2	8:00	Discussion on Planning of SSID in MOA	
(Fri)		Discussion on feild trip to N. Western Zone	
	14:00	Data collection Mapping Authority	Addis Ababa
10/ 3	8:00	Data collection(Central Statistical Authority)	
(Sat)			Addis Ababa
10/ 4	-	Data Processing and analysis	
(Sun)			Addis Ababa
10/ 5	8:00	Data collection(Mapping Authority)	
(Mon)	10:00	Discussion with Ato. Habutamu G, Head of IDD	
	14:30	Discussion on equipment spec. in MOA	Addis Ababa
10/ 6	8:00	Data collection	Addis Ababa
(Tue)	16:00	Discussion and data collection at UNDP	
		(Mr. Okubo left for Japan by LH-591, 22:40-11:45+3)	
10/ 7	8:00	Dep. for Bahar Dar (ET-530 10:00-10:30)	
(Wed)		with Ato Gebeyehu (Eng. geologist)	
	11:00	Discussion at N.W. Zonal Office of MOA	
	14:00	Visit Mendel and Tikurit Irrigation Projects	Bahar Dar
10/ 8	8:00	Visit Geray Irrigation Project	
(Thu)	14:30	Field Inspection of Zingini Weir Site	
	16:00	Visit Gilgel Abay Reserch Centre	Bahar Dar
10/ 9	6:00	Dep. for Gondar by car	
(Fri)	12:00	Field Inspection of Aba Genan Dam Site	
	15:00	Visit garage & Discussion on Current O/M	
		condition at MOA Gondar Office	Gondar
10/10	8:00	Visit Aba Zini Dam Project of WWCA	
(Sat)	10:00	Inspection of Current Spareparts Condition	
		at MOA Gondar Office	
	11:00	Dep. for Bahar Dar by car	
	15:00	Discussion at Rural Technology Promotion Office	Bahar Dar
		in Bahar Dar	

Date	Time	Activities	S.O.N.
10/11 (Sun)	8:00	Dep. Bahar Dar for A. Ababa (ET-575, 11:15-12:10) Arr. Addis Ababa	 Addis Ababa
10/12 (Mon)	8:00 13:30 15:00	Discussion and data collection at MOA Data collection at Road Construction Authority Reporting on Bahir Dar site inspections to JICA Ethiopia Office	 Addis Ababa
10/13 (Tue)	8:00 15:00 16:00	Discussion and data collection at MOA Discussion and data collection at SIDA Reporting on Bahir Dar site inspections to Embassy of Japan	 Addis Ababa
10/14 (Wed)	8:00	Discussion on Port of Entry at both of MOA and MEEC	Addis Ababa
10/15 (Thu)	8:00 10:00 14:00	Discussion on Equipment List on Priority Discussion and data collection at FAO Discussion on Technical Note at MOA	 Addis Ababa
10/16 (Fri)	8:00 14:00	Concluding Technical Notes with MOA Report to Embassy of Japan & JICA/Ethiopia	 Addis Ababa
10/17 (Sat)	8:00 22:40	Courtesy to MOA Dep. for Japan (LH-591, 22:40-11:45+3)	
10/20 (Tue)	12:15	Arrv. Narita by LH790	

APPENDIX III

List of Persons Contacted

APPENDIX III : List of Persons Contacted

MINISTRY FOR EXTERNAL ECONOMIC COOPORATION (MEEC)	
H.E.Dr. Abdulmojid Hussiem	Minister
Ato Israel K/Mariam	Vice Minister
Department of Americas and Asia	
Ato Geremew Getahun	Head of Department
Ato Yeshitila Amare	Senior Officer
W/tAbebawerk Abebe	Junior Officer
MINISTRY OF AGRICULTURE(MOA)	
Dr. Awetahgen ALemayhu	Vice Minister
Ato Takele Gebre	Head of Agricultural Extension Dep.
Ato Menker W/Kiros	Acting Head of Rural Infra. Main Department Head of Rural Technology Promotion Dep.
Irrigation Development Department(IDD)	
Ato Habtum Gesesse	Head of Department
Ato Takele Kassa	Acting Head
Ato Gebeyehu Bizuneh	Engineering Geologist
Ato Kibrom Rezene	Leader of Irrigation Construction Team
W/t Hiwot	Head of Equipment Services
Ato Menasseh Beyene	Expert of Equipment Service Team
Ato Tasew Gedlu	Expert of Equipment Service Team
W/t Messelu Feleke	Civil Engineer
Ato Doreje Taye	Civil Engineer
Ato Berhanu Negusse	Hydrologist
Tegray Zonal Office of MOA	
Ato Belay W Gerji	General Services Administration
Ato Afera Teklehaimanot	Head of Administration & Finance
Ato Kinife G/Aftse	Team Leader, Irrig'n & Rural Water Supply
Ato Sisay Teka	Agriculture Engineer
Ato Berhane Hailu	Head of Regional Office of MOA
North Eastern Zonal Office of MOA (Dessie)	
Ato Yesuf Abdella	Head of Rural Infra. Dev.
Ato Getnet Wagaye	Chief of IDD Team
Cetral Zonal Office (Addis Ababa)	
Ato Abu Tefera	Central Zone Irrigation Team Leader
Ato Bishaw Kebede	Agriculture Engineer
North Western Zonal Office of MOA	
Ato Kenfu Goshu	Head, North Western Zone Rural Infra.
Ato Teffera Demilew	IDD Team Leader
Ato Nega Zerefa	Head, Administration & Finance
Ato Jemal Kedir	Irrigation Engineer
Ato Tekele Giorgis Mamuye	Rural Technology Promotion Centre
Water Resources Development Authority	
Ato Kidane Asefa	Head, Water Utilization Division
F.A.O	
Dr.Ingo R. Loerbroks	FAO Representative in Ethiopia
SIDA	
Daag S. Skoog	Forestry Program Officer
UNDP	
Miss Claire Van Der Vaeren	Field Implementation Officer

CENTRAL STATICAL OFFICE

Ato Besrat Petros		Information and P&R

在ｴﾁｵﾋﾟｱ日本大使館 (Embassy of Japan)

今谷克広	Imaya Katsuhiro	参事官(Counsellor)
小林克己	Kobayashi Katsumi	二等書記官(Second Secretary)
太田富夫	Ota Tomio	二等書記官(Second Secretary)

JICAｴﾁｵﾋﾟｱ事務所(JICA Ethiopia Office)

坂田武穂	Sakata Takeho	所長(Resident Representative)
神　公明	Jin Kimiaki	所員(Assistant Resident Representat
久田信一郎	Hisada Shinichiro	調整員(JOCV Coordinator)

APPENDIX IV
MINUTES OF DISCUSSION

MINUTES OF DISCUSSIONS
ON THE BASIC DESIGN STUDY
ON SMALL SCALE IRRIGATION DEVELOPMENT PROJECT
IN ETHIOPIA

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

The JICA sent to Ethiopia a study team headed by Mr.Yoshikatsu Nakamura, Director, First Basic Design Study Division, Grant Aid Study and Design Department, JICA, from 22nd September to 17th October, 1992.

The Team held a series of discussions with the authorities concerned of the Transitinal Government of Ethiopia and conducted a field survey. In the course of discussions and the field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further work and prepare the Basic Design Study Report.

Addis Ababa 30th September, 1992

Mr. Yoshikatsu Nakamura
Leader
Basic Design Study Team, JICA

Ato Geremew Getahun
Head, Dept. of Americas and Asia
Min. for External Economic Cooperation
Transitional Government of Ethiopia

Ato Menker W/Kiros
Ag. Head, Rural Infrastructure Main Department
Min. of Agriculture
Transitional Government of Ethiopia

ATTACHMENT

1. Objective of the Project

The objective of the Project is to provide necessary construction machinery for small scale irrigation development schemes, thus contributing to the improvement of agricultural production and productivity in the farming communities.

2. Project Areas

(1) The project areas in the Project proposal made by the Ethiopian side include 51 sites shown with a tentative time schedule in Annex I.

(2) Based upon the outcome of the field survey, the team has given its observations that some sites such as the following might be missed out of the above list:

- project sites partially completed

- sites where facilities have already been planned or designed

The team therefore has suggested to the Ethiopian side that these sites be included as the project areas and that some future sites where plans are yet to be done be excluded. The Ethiopian side has understood the above points and will prepare a new list of project sites by the 17th of October, 1992.

3. Responsible Agency and Executing Agency

(1) The Ministry for External Economic Cooperation (MEEC) shall serve as the focal point for faciltating the Project implementation, on condition that the Japan's Grant Aid is extended to the Project.

(2) The Ministry of Agriculture is responsible for procurement, utilization and maintenance of the equipment procured under the Grant.

4. Items requested by the Transitinal Government of Ethiopia

The Team has understood that the need for the items listed in Annex II requested by the Ethiopian side is basically genuine and urgent. However, the final component of the items, both types and quantity, will be decided after a further study in Japan, based upon in principle the criteria described in Annex III. The conditons on the use of the items are also listed in Annex III.

5. Japan's Grant Aid Programme System

(1) The Ethiopian side has understood Japan's Grant Aid system explained by the Team.

(2) The Ethiopian side will take necessary measures described in Annex IV for smooth implementation of the Project, on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

6. Technical Cooperation

The Ethiopian side has expressed the need for Japan's technical cooperation in connection with the Project; namely, dispatch of Japanese experts and Japan Overseas Cooperation Volunteers specializing in irrigation development and construction machinery, and technical training of counterpart personnel in Japan. The team has explained to the Ethiopian side that technical cooperation cannot be requested in the Grant Aid system and that separate official requests should be made through diplomatic channels.

7. Schedule of the Study

Based upon the Minutes of Discussions and technical examination of the study results, JICA will complete the final report and will send it to the Transional Government of Ethiopia by the end of February, 1993.

Annex I

Irrigation Projects to be Constructed from 1992/93-1996/97

Name of the project	Estimated Irrigable area by project (ha)				
	1992/93	1993/94	1994/95	1995/96	1996/97
A. N.Western Zone					
1. Debi	200				
2. Gabikura	200				
3. Gumero	160				
4. Laha	125				
5. Debehula	130				
6. Bocena		120			
7. Shenay		75			
8. Kolech		100			
9. Yechereka		190			
10. Timbil		200			
11. Tijan		180			
12. Wanka			85		
13. Yodan			180		
14. Tul			150		
15. Teme			200		
16. Sata			37		
17. Lomida			50		
18. Fute				200	
19. Ayine Kura				185	
20. Andasa				70	
21. Guanu				170	
22. Zufel				90	
23. Arno					20
24. Ardi					130
25. Dam (Abagenen)	50(1)				
26. Muga	200(1)				
27. Hlelitum					200
28. Jedeb	250(1)				
Sub-Total	1315	865	702	715	550

NOTE(1)- Those projects where the priority should be given for the given project years.

Name of the Project	Estimated Irrigable area by Project (ha)				
	1992/93	1993/94	1994/95	1995/96	1996/97
B. Tigray					
1. Senefti	100				
2. Mehoni	100				
3. Genfel	100				
4. Agula		200			
5. Ashago	100(1)				
Sub-Total	400	200			
C. N.Eastern Zone					
1. Temuga	100				
2. Legedeba	50				
3. Dirma	200				
4. Sirinka		130			
5. Dire		300			
6. Gottu	185(1)				
Sub-Total	535	430			
D. Western Zone					
1. Tato	50(1)				
2. Abebo	140				
3. Negesso		75			
4. Tinishu Yaha		125			
5. Gibe Nekemt	100(1)				
6. Tilku Yaya			185		
Sub-Total	290	200	185		
E. South West Zone					
1. Kolombo	195				
2. Gibelemu	175				
3. Gilgel Gibe		165			
4. Meki		190			
5. Anger			180		
6. Keto			180		
Sub-Total	370	355	360		
Total	2910	2050	1247	715	350

NOTE(1) - Those Projects where the priority should be given for the given project years.

Annex II Items requested by the Transitioanl Government of Ethiopia

1. Bulldozer (200HP)	8
2. Loader (150HP)	4
3. Motor Grader (135HP)	3
4. Motor Scraper (16 cub. m)	2
5. Dump Truck (13.5t)	20
6. Hydraulic Excavator (115HP)	4
7. Roller (130HP)	3
8. Mobile Workshop (150HP)	2
9. Mobile Greesing Plant (600L)	2
10. Lowbed (40ton) Truck & Tractor	2
11. Stone Crusher (7 ton)	6
12. Concrete Mixer (350L)	12
13. Compactor (86kg)	6
14. Generator (Diesel 25KVA)	6
15. Water Tanker (275 HP)	6
16. Pickup	12
17. Motor Cycle	20
18. Drilling Machine	1
19. Station Wagon	4
20. Spare Parts	15%
21. Field Kit for each item	

Annex III Criteria and conditions for provision of equipment

The following criteria will be used to decide the final componet of equipment:

1. Scale and type of irrigation facilities to be constructed

2. Geological and topographical conditions of proposed project sites

3. Technical and managerial capacity of the authorities responsible for equipment maintenace and operation

4. Financial viability of the construction schemes

The following conditions will be applied on the equipment procured under the Japan's Grant Aid:

1. The items to be procured by the Japan's Grant Aid are for exclusive use for the Project in the project areas.

2. The necessary budget for operation and maintenanc of the deployed equipment is to be borne promptly by the Ethiopian side.

3. An appropriate monitoring and evaluation system is to be established in order to avoid misuse of the equipment. Such systems may need to record items like operation hours, fuel consumption, maintenance record, etc.

Annex IV Necessary measures to be taken by the Transitional Government of Ethiopia

The Transitional Government of Ethiopia, where the laws and regulations permit, takes necessary measures as stipulated as follows, in case Japan's Grant Aid is extended to the Project.

1. To ensure prompt unloading and customs clearance at the Port of Asseb in Ethiopia and to bear the cost of internal transportation of the products under the Grant from the Port to the Project sites;

2. To exempt Japanese nationals from or bear the cost of customs duties, internal taxes and other fiscal levies which may be imposed in Ethiopia with respect to the supply of the products and sevices under the Verified Contracts financed by the Grant Aid;

3. To accord Japanese nationals whose services may be required in connection with the supply of the products and sevices under the Verified Contracts such facilities as may be necessary for their entry into Ethiopia and stay therein for the performance of their work;

4. To ensure that each equipment under the Grant be maintained and used properly and effectively: and

5. To bear all the expenses, other than those covered by the Grant, necessary for the Project.

APPENDIX V
TECHNICAL NOTES

TECHNICAL NOTES
ON
SMALL SCALE IRRIGATION DEVELOPMENT PROJECT

The Minutes of Discussions on the Basic Design Study on Small Scale Irrigation Development Project (hereinafter referred as " the Project") was concluded between the JICA Basic Design Study Team (hereinafter referred as "the JICA Team") and Ministry for External Economic Cooperation of Transitional Government of Ethiopia on September 30, 1992.

Following the conclusion of Minutes of Discussions of the Project, the JICA Technical Team continued technical discussions and field survey in Ethiopia up to October 17, 1992.

The JICA Technical Team and the Irrigation Development Department (hereinafter referred as "the IDD") of Ministry of Agriculture, the Transitional Government of Ethiopia made several discussions as described hereinafter.

These discussion results will be studied carefully by the JICA Team and concluded in the basic design report which will be delivered by the end of February 1993.

1. Project List to be constructed within 1992/93 - 1996/97

As stated in the Minutes of Discussions on this Project, item 2 of ATTACHMENT, the Project list to be constructed within 5 years is amended as shown in Table 1. Those projects are arranged based on the following considerations:

(1) Projects under construction of main system and on-farm will be completed within 1992/93 fiscal year by the best effort of IDD under maximum extend of existing construction equipment.

(2) Projects which are completed the design shall be started after receiving construction equipment from Japan, which is expected.

(3) Some projects under pre-feasibility study will have some modifications during the detailed design studies.

2. Construction Equipment List with Priority

The Construction equipment requested by IDD is as shown in Annex II of the Minutes of Discussions. Considering the possibility of staging of Grant Aid for the Project and discussion results between the JICA Team and IDD, the specifications for some equipment are amended by IDD with priority of each equipment. They are shown in Table 2.

3. Port of Entry for the Equipment

As stated in item 2 of Annex IV of Minutes of Discussions, the Transitional Government of Ethiopia ensured the prompt unloading and customs clearance at the Port of Asseb in Ethiopia and to bear the cost of internal transportation of the equipment from the Port to the Project sites by the responsibility of the Transitional Government of Ethiopia.

The JICA Team explained to IDD that Japanese Grant Aid shall cover all costs up to the entry to Ethiopia. And the JICA Team requested to IDD to reconfirm the port of entry with consciousness of future circumstance change.

This clause was confirmed by the Minister of Agriculture, Ato. Elias Negassa, to the JICA Team and IDD on October 14, 1992. Also this confirmation was reported to the Minister for External Economic Cooperation.

Addis Ababa, October 16, 1992

Mr. Keiji Matsumoto
Chief Engineer
Basic Design Study Team, JICA

Ato. Habtamu Gesesse
Head, Department of Irrigation Development
Ministry of Agriculture
Transitional Government of Ethiopia

TABLE 1 : PROJECTS TO BE CONSTRUCTED IN 1992/93 - 1996/97

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

[FILES : MAS-L2.WJ2]

(to continue)

(to be continued)

Ser. No.	Zone & No.	Location Province	Type	Present Status	Name	Irrig. Area	Implementation Schedule 92/93	93/94	94/95	95/96	96/97	On-Farm	Remarks
40	N/E - 1	N/Wollo	W	U/C	*Alewuha	360	360						ETIOITAL
41	N/E - 2	N/Wollo	W	U/C	*Gimbora	310	310						AFRICARE
42	N/E - 3	S/Wollo	W	D-C	*Dirma	200		200					
43	N/E - 4	N/Wollo	W	D-C	*Gotu	185		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			100				
52	N/E - 13	S/Wollo	-	PF/S	Legedeba	50			50				
53	N/E - 14	N/Wollo	-	PF/S	Sirinka	130			130				
54	N/E - 15	S/Wollo	-	PF/S	Dire	300				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	*Gibelium	50		50					
56	W - 2	Wollega	W	D-C	*Tato	60		60					
57	W - 3	Wollega	W	U/C	Gambela	80	80						
58	W - 4	Wollega	-	PF/S	Abeno	140			140				
59	W - 5	Wollega	-	PF/S	Negesso	75				75			
60	W - 6	Wollega	-	PF/S	Gibe Nekemt	100		100					
61	W - 7	Wollega	-	PF/S	Fute	200					200		
62	W - 8	Wollega	-	PF/S	Anger	180				180			
63	W - 9	Wollega	-	PF/S	Keto	180					180		
64	W - 10	Wollega	-	PF/S	Hlelitum	200					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	53						
66	S/W - 2	Kaffa	-	PF/S	Gibelemu	175		175					
67	S/W - 3	Kaffa	-	PF/S	Gilgel Gibe	165			165				
68	S/W - 4	Kaffa	-	PF/S	Meki	190			190				
69	S/W - 5	Kaffa	-	PF/S	Dedi	200			200				
70	S/W - 6	Illubabur	-	PF/S	Gumero	160			160				
71	S/W - 7	Illubabur	-	PF/S	Tilku Haya	185				185			
72	S/W - 8	Kaffa	-	PF/S	Tinishu Yaya	125				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 reamin : 12 projects, 2,098 ha
Projects design completed or under study : 49 projects, 6,887 ha

NOTES : * is top priority project for implementation
W ; weir, D : dam/resourvuire, P : pumping
U/C : under construction OF-C : on-farm construction
D-C : dsign 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 2 : LIST OF EQUIPMENT WITH PRIORITY

Sr. No.	No. in MINUTES	Name of Equipment	Specification	Q'ty
[PRIORITY 1]				
1	1	Bulldozer	200HP, o.w.18.5 ton, with triple shank	8
2	2	Wheel Loader	150 HP, o.w. 12.5 ton, 2.5 m3 bucket	4
3	3	Motor Grader	135 HP, o.w. 11.4 ton, 3.7m-blade	3
4	5	Dump Truck	275 HP, diesel, 13.5 ton	20
5	7	Vibro-Roller	130 HP, o.w. 9.5 ton, front steel roller	3
6	8	Mobile Workshop	4 WD, 150 HP, diesel truck with tools	2
7	10	Low-Bed Semi-Trailer	275 HP, Max.load 40 ton	2
8	15	Water Tanker	275 HP truck with 13 m3 tank	6
9	16	Pick-up	4 WD, 1ton playload	12
10	19	Station Wagon	4 WD, HP	4
11	18	Drilling Machine	Max. depth 50 m, with testing apparatus	1
12	20	Spare Parts		
13	21	Field Kits		
[PRIORITY 2]				
14	13	Walk-type Roller	1 ton	6
15	14	Diesel Generator	50 Hz. 25 KVA	6
16	11	Stone Crusher	7 m3/hr mobile type jaw crusher	6
17	12	Concrete Mixer	capacity 350 liter	12
[PRIORITY 3]				
18	4	Motor Scraper	400 HP, 16 m3,	2
19	6	Hydro. Excavator	115 HP, o.w. 18.6 ton, 0.7 m3-bucket	4
20	9	Mobil Greasing Plant	GVW 9.5ton, oil pump, 600 l water, etc.	2
21	17	Motor Cycle	150 cc, off-road type	20

APPENDIX VI
REFERENCES

REFERENCES

Ethiopian Mapping Authority, National Atlas of Ethiopia (1988)

Central Statistical Authority, Ethiopia Statistics Abstract 1988

Ethiopian Mapping Authority, Topographic Map at a scale of 1 to 250,000

Ethiopian Institute of Geological Surveys of Ministry of Mines and Energy, Hydrogeological Map of Ethiopia,1988

Ethiopian Institute of Geological Surveys of Ministry of Mines and Energy, Geological Map of Ethiopia, 1973

Ethiopian Mapping Authority, Map of Ethiopia at a scale of 1 to 2,000,000

Ethiopian Transport Construction Authority, Ethiopia Road Map

Ethiopian Mapping Authority, Map Catalogue 1990

Central Statistical Authority, Agricultural Sample Survey 1988/89(1981 E.C.), Results on area, production and yield of major crops by season. Sep. 1990

Central Statistical Authority, Rural Household Income, Consumption and Expenditure Survey May 1981–April 1982, Advance Report, 1988

Central Statistical Authority, Crop Production Forecast 1991/92(1984 E.C.), Results of area and production of major crops, May 1992

Central Statistical Authority, Average Producers' Prices of Agricultural Commodities in Rural Areas by Region September 1987–August 1988, January 1991

Office of the Population and Housing Census Commission, The 1984 Population and Housing Census of Ethiopia, Analytical Report at National Level, December 1991

Central Statistical Authority, Retail Prices of Goods and Services in Selected Urban Centers 1986 and 1987, September 1988

The Irrigation Development Department of Ministry of Agriculture, Irrigation Development Activities and Future Operations, June 1990

Office of the National Committee for Central Planning, National Irrigation Policy and Strategy Workshop, Discussion Papers, October 1990

APPENDIX VII : Back Data of the Project

A.	:	ADMINISTRATIVE REGION
B.	:	NATURAL CONDITION
C.	:	POPULATION
D.	:	SOCIO-ECONOMY
E.	:	AGRICULTURE
F.	:	SMALL SCALE IRRIGATION DEVELOPMENT PROJECT
G.	:	INVENTORY OF EQUIPMENTS
H.	:	CONSTRUCTION VOLUME AND COST
I.	:	CONSTRUCTION CAPABILITY OF MACHINERY
J.	:	REQUIRED EQUIPMENT

A. : ADMINISTRATIVE REGION

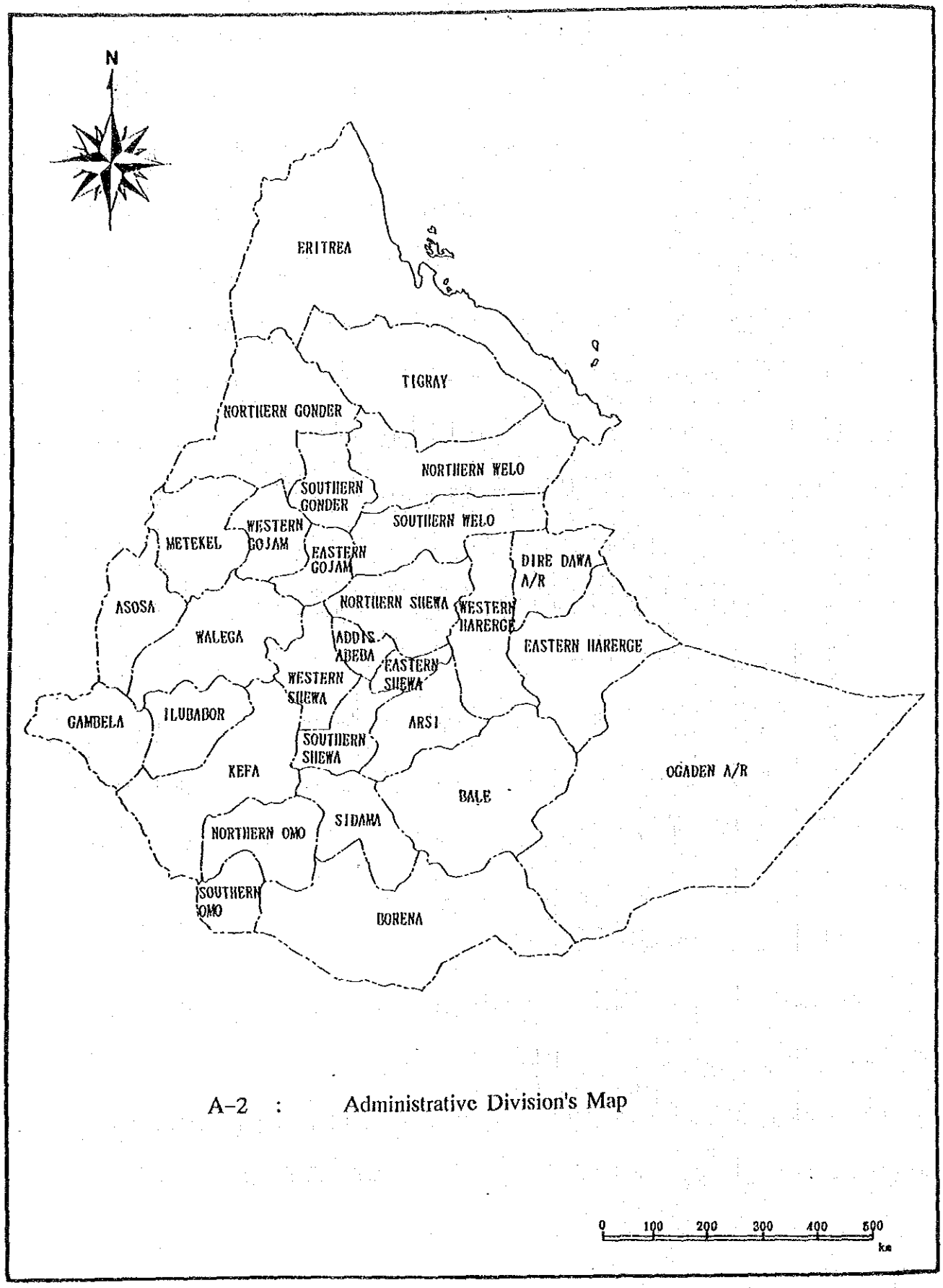
A-1 : Administrative region, Population and Zonal Office of MOA
A-2 : Administrative Division's Map

A-1 : Administrative region, Population and Zonal Office of MOA

No.	Administration Region 1986	Previous Region	Zone of MOA	MOA's Zonal Office	Area (km2)	Population in 1989	P.Dens. per km2	MOA Zonal Sum Area(km2)	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.	Harargha	Harargh	Harar	29,245	461,342	15.8			
5	Ogaden AR.				179,327	813,630	4.5			
6	Western Hararghe				33,188	1,326,107	40.0			
7	Eastern Hararghe				90,600	2,480,452	27.4	332,360	5,081,531	
8	Northern Wollo	Wollo	North-Eastern	Dese	30,835	1,449,673	47.0			
9	Southern Wollo				20,702	2,392,404	115.6	51,537	3,842,077	Project Area
10	Northern Gondar	Gondar	North-Western	Bahardar	82,020	1,819,520	29.3			
11	Southern Gondar				17,079	1,671,893	97.9			
12	Eastern Gojjam	Gojjam			13,936	1,519,100	109.0			
13	Western 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	Shewa	Central	Addis Abeba	5,188	2,291,137	441.7			
18	Northern Shewa				27,030	2,298,111	85.0			
19	Western Shewa				23,218	2,626,678	113.1	55,435	7,215,926	
20	Southern Shewa		Central South	Nazaret	16,799	2,894,306	172.3			
21	Eastern Shewa				12,754	906,019	71.0	29,553	3,800,325	
22	Arssi	Arssi	South East	Asela	23,710	1,928,226	81.3			
23	Bale	Bale			67,330	949,551	14.1	91,040	2,877,777	
24	Gambella	Illubabor	South-Western	Jimma	26,065	174,395	6.7			
25	Illubabor				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 Goffa	Souther	Awasa	29,923	2,727,990	91.2			
28	Southern Omo				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	6,283,236	Project Area
	Total	14	10		1,248,825	49,588,563	39.7	478,222	23,064,578	Total
								38.29%	46.51%	

Notes : AR. : Autonomous Region

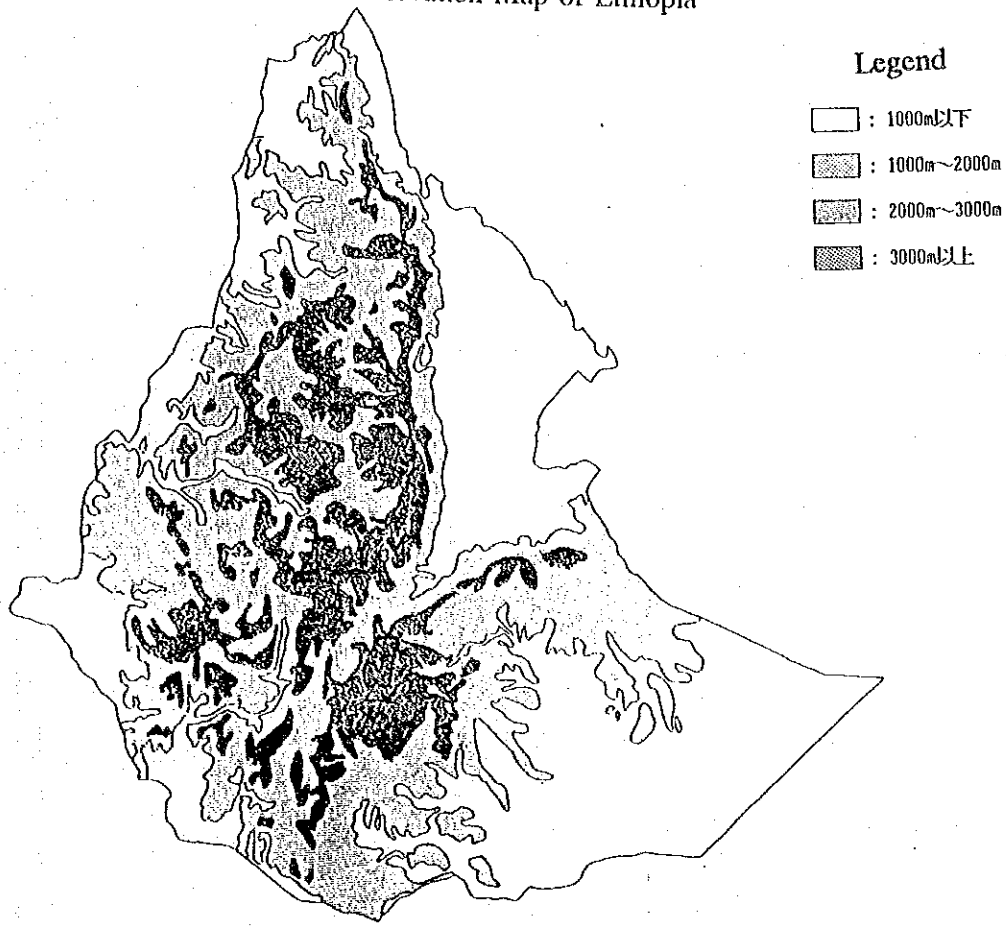
Source : - Central Statistic Authority, Statistical Abstract 1988, population in 1989
- Irrigation Development Department of MOA



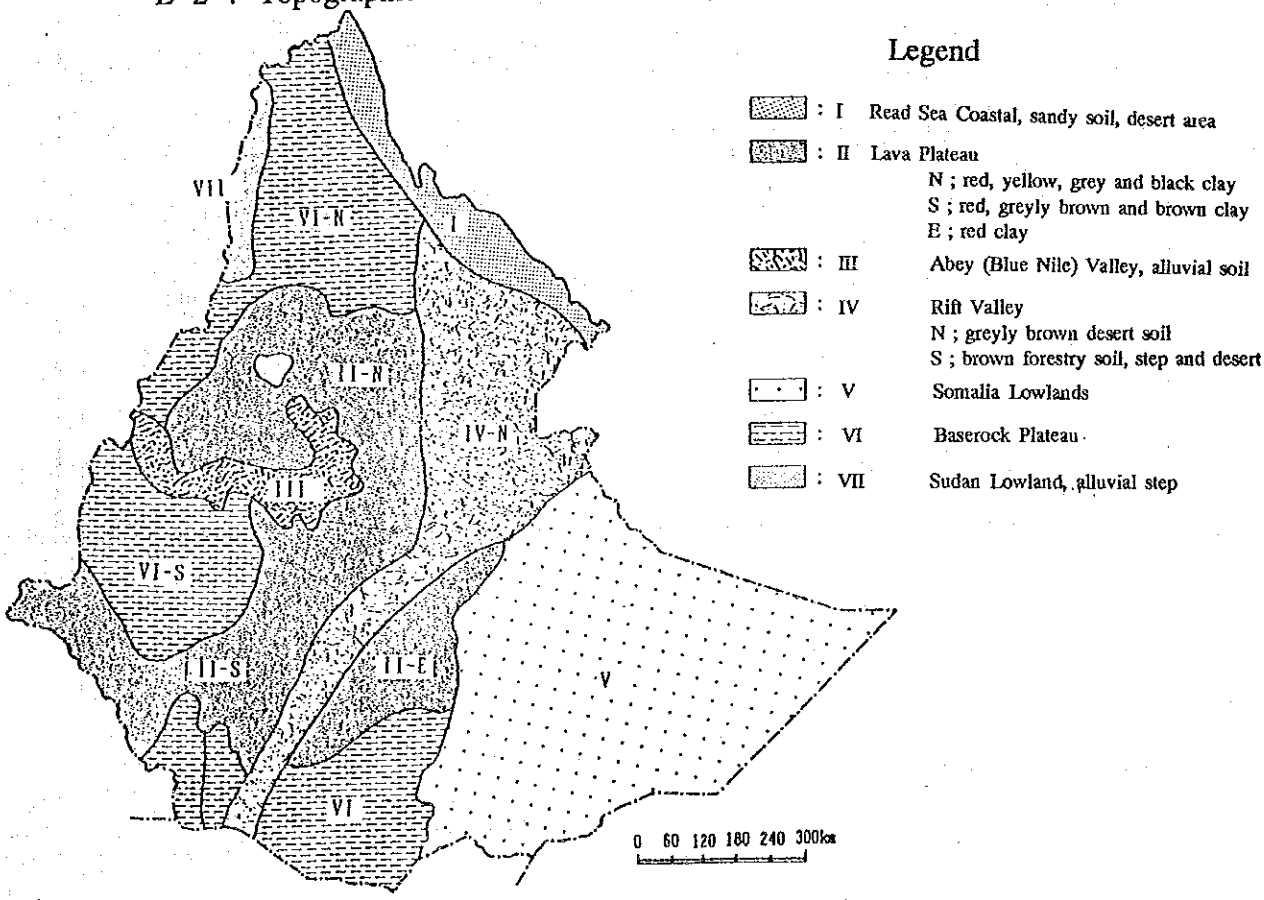
A-2 : Administrative Division's Map

B : Natural Condition

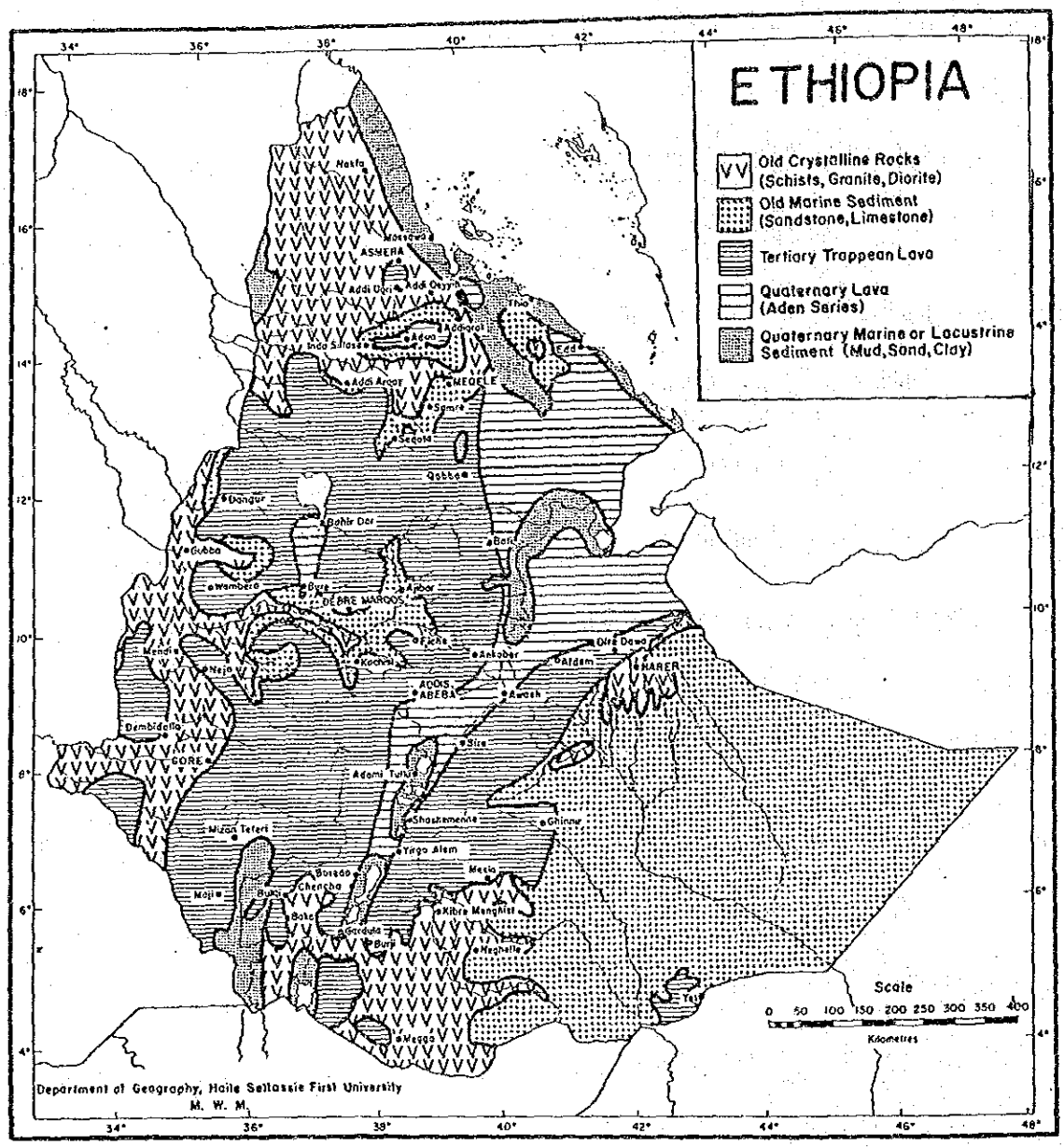
B-1 : Elevation Map of Ethiopia



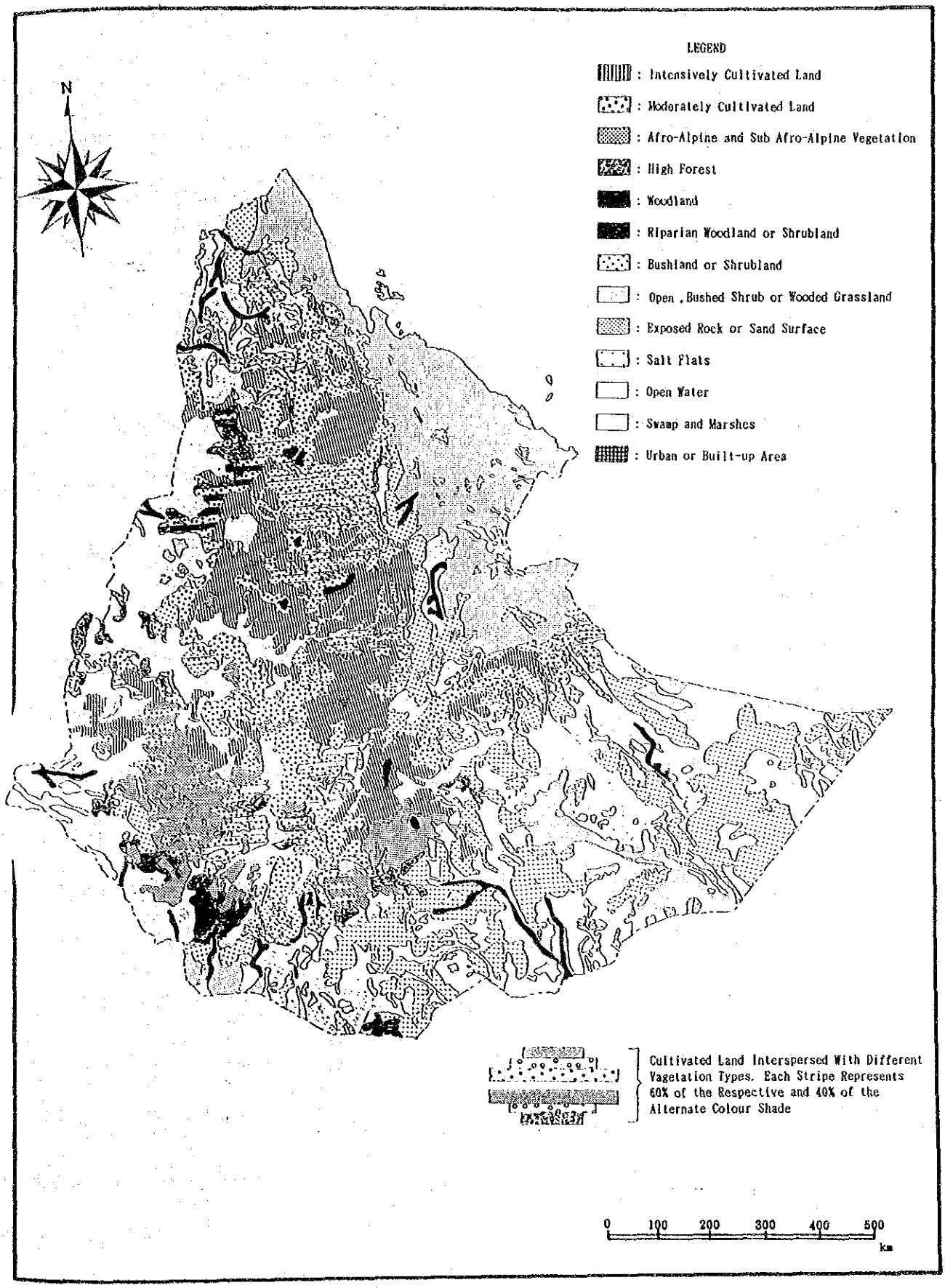
B-2 : Topographic Classification of Ethiopia



B-3 : Geological Map of Ethiopia



B-4 : Land Use and Land Cover Map of Ethiopia



B-5 : List of Meteorological Stations in Ethiopia (1/3)

No.	Name of Place	Lati.	Long.	Alti. (m)	Zone	Region
1	Abiy Adi	13.32	39.01	1870	Tigrey	Temben
2	Abobo	7.48	34.24	530	Ilubabor	Gambela
3	Adaba	7.01	39.24	2485	Bale	Genale
4	Addis Ababa	9.02	38.45	2408	Shewa	Menagesha
5	Addis Zemen	12.07	37.52	2020	Gondar	Libo
6	Adigrat	14.16	39.27	2457	Tigrey	Agame
7	Adikeyih	14.50	39.20	2490	Eritrea	Akele Guzay
8	Adi Ugri	14.53	38.49	2022	Eritrea	
9	Adola	5.55	39.05	2170	Sidamo	
10	Adwa	14.10	38.54	1980	Tigrey	Adwa
11	Agaro	7.51	36.38	1560	Kefa	Lumi
12	Akaki	8.52	38.47	2100	Shewa	Menagesha
13	Akordat	15.33	37.53	626	Eritrea	Akordat
14	Alaba Kolito	7.22	38.06	1850	Shewa	Haykoch
15	Alamata	12.31	39.41	2200	Welo	Raya&Kobo
16	Alemaya	9.26	42.03	2125	Harerge	Harer
122	Aleta Wendo	6.35	38.25	1860	Sidamo	Sidama
17	Ambo	8.58	37.52	2080	Shewa	Jibat Mecha
18	Arba Minch	6.05	37.38	1290	Gomo Gofa	Gamo
19	Arjo	8.45	36.30	2565	Wolega	Arjo
20	Asela	7.52	39.08	2450	Arsi	Chilalo
21	Asendabo	7.44	37.14	1870	Kefa	Jima
22	Asmara	15.17	38.55	2325	Eritrea	Hamasen
23	Asosa	10.04	34.31	1750	Wolega	Asosa
24	Atnago	8.29	36.57	916	Kefa	Lumi
25	Awasa	7.04	38.30	1890	Sidamo	Sidama
26	Awash	8.59	40.09	1430	Shewa	Yerer Kereyu
27	Bahirdar	11.36	37.24	1590	Gojam	Bahirdar
28	Bako Jinka	5.50	36.38	1450	Gamo Gofa	Gamo
29	Bako Shewa	9.07	37.05	980	Wolega	Nekemte
30	Bambesi	9.45	34.44	1660	Wolega	Asosa
31	Barentu	15.10	37.36	2090	Eritrea	Gash Setit
32	Bati	11.13	40.03	1722	Welo	Ambasel
33	Bedele	8.27	36.23	1200	Ilubabor	Buno Bedele
34	Begi	9.21	34.32	2850	Wolega	Asosa
35	Bilate	6.39	37.58	1725	Sidamo	Welayta
36	Bokoji	7.32	39.15	2600	Arsi	Chilaro
37	Bonga	7.13	36.17	1960	Kefa	Kefa
38	Bulki	6.11	36.32	2100	Gamo Gofa	Gofa
39	Burji	5.24	37.56	1720	Sidamo	Arero
40	Butajira	8.07	38.27	1600	Shewa	Yerer Kereyu
41	Chagni	10.55	36.26	2580	Gojam	Metekel
42	Chefa	10.54	39.50	2180	Welo	Kalu
43	Chencha	6.15	37.37		Gamo Gofa	Gamo
44	Dabat	13.00	37.46		Gondar	Wegera
45	Dangira	11.17	36.55		Gojam	Midir

(Cont.)

B-5 : List of Meteorological Stations in Ethiopia (2/3)

No.	Name of Place	Lati.	Long.	Alti. (m)	Zone	Region
46	Debre Birhan	9.38	39.30		Shewa	Teglet Bulga
47	Debre Markos	10.21	37.43		Gojam	Debre Markos
48	Debre Tabor	11.53	38.02		Gondar	Debre Tabor
49	Debre Zeit	8.44	39.02		Shewa	Yerer Kereyu
50	Degeh Bur	8.09	43.33		Harerge	Degeh Bur
51	Dembi Dolo	8.30	34.46		Welega	Kelem
52	Dese	11.10	39.40		Welo	Dese Zuriya
53	Didesa	9.00	36.06		Welega	Gimbi
54	Diksis	8.08	39.35		Arsi	Arba Gugu
55	Dila	6.25	38.18		Sidamo	Gedeo
56	Dire Dewa	9.36	41.52		Harerge	Dire Dewa
57	Dodola	6.58	39.11		Sidamo	Genale
58	Faghena	15.33	38.54		Eritrea	Hamasena
59	Felege Neway	6.18	36.52		Gamo Gofa	Gofa
60	Fiche	9.48	38.45		Shewa	Selale
61	Filiklik	10.03	38.13		Gojam	
62	Fincha	9.32	37.23		Welega	Horo Gudru
63	Gambela	8.15	34.35		Ilubabor	Gambela
64	Gewani	10.05	40.38		Shewa	Timuga
65	Gidami	8.58	34.35		Welega	Kelem
66	Gidole	5.37	37.29		Gamo Gofa	Gardula
67	Gimbi	9.05	35.47		Welega	Gimbi
69	Goba	7.01	40.00		Bale	Mendoyu
70	Gode	6.06	43.35		Harerge	Gode
71	Goha Tsion	10.02	38.14		Shewa	Selale
72	Gonder	12.32	37.26		Gonder	Gonder
73	Gore	8.10	35.33		Ilubabor	Gore
74	Gorgora	12.15	37.18		Gonder	Gonder
68	Grawa	9.08	41.50		Harerge	Gara Muleta
75	Guder	8.57	37.47		Shewa	Jibat Mecha
76	Hagere Mariam	5.38	38.15		Sidamo	Arero
77	Hagere Selam	6.28	38.31		Sidamo	Sidamo
78	Hamaro	7.22	42.13		Harerge	Gursum
79	Harer	9.12	42.07		Harerge	Harer Zuriya
80	Hosaina	7.35	37.50		Shewa	Hadiya
81	Humera	14.10	36.35		Gonder	Wegera
82	Indaselasie	14.06	38.16		Tigray	Shire
83	Itang	8.10	34.15		Ilubabor	Gambela
84	Jijiga	9.20	42.43		Harerge	Jijiga
85	Jima	7.40	36.50		Kefa	Jima
86	Kebri Dehar	6.40	44.18		Harerge	Kebri Dehar
87	Keren	15.45	38.26		Eritrea	Keren
88	Kofcle	7.04	38.47		Arsi	Chilalo
89	Koka Dam	8.25	39.10		Shewa	Yerer Kereyu
90	Kombolcha	11.05	39.45		Welo	Dese
91	Konso	5.15	37.35		Gomo Gofa	Gardula
92	Kulumsa	8.08	39.08		Arsi	Chiralo
93	Kuyera	7.15	38.40		Arsi	Chiralo
94	Langano	7.35	38.40		Shewa	Haykoch Butajira
95	Maichew	12.46	39.32		Tigay	Raya Azebo
96	Mega	4.05	38.20		Sidamo	Arero
97	Mekele	13.30	39.29		Tigray	Iderta
98	Melka Werer	9.28	40.23		Harerge	Chercher
99	Mendi	9.47	35.05		Welega	Gimbi

(Cont.)

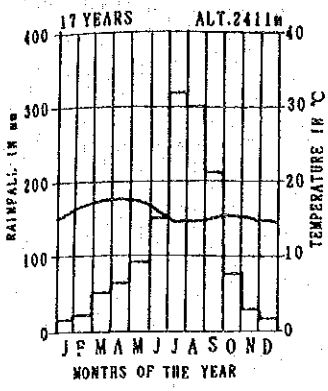
B-5 : List of Meteorological Stations in Ethiopia (3/3)

No.	Name of Place	Lati.	Long.	Alti. (m)	Zone	Region
100	Metehbila	8.52	39.59		Shewa	Yere Kereyu
101	Metema	12.57	36.04		Gondar	Chilga
102	Metu	8.19	35.35		Ilubabor	Gore
103	Midagaloloa	8.47	42.07		Harerge	Gara muleta
104	Mierab Abaya	6.20	37.50		Gamo gofa	Gamo
105	Mitsiwa	15.37	39.27		Eritrea	Mitsiwa
106	Mojo	8.37	39.09		Shewa	Yerer Kereyu
107	Munesa	7.35	38.54		Arsi	Chilalo
108	Nakfa	16.40	38.20		Eritrea	Sahil
109	Nazareth	8.33	39.17		Shewa	Yerer Kereyu
110	Negele	5.17	39.45		Sidamo	Borena
111	Nejo	9.30	35.29		Welega	Gimbi
112	Nekemte	9.03	36.36		Welega	Nekemte
113	Ogolcho	8.04	39.02		Arsi	Chilalo
114	Poko	8.15	34.25		Ilubabor	Gmbela
115	Robit	10.01	39.59		Shewa	Yifat Timuga
116	Sodo	6.50	37.43		Sidamo	Welayita
117	Tepi	7.05	35.15		Ilubabor	Mocha
118	Teseney	15.07	36.40		Eritrea	Gasha Setit
119	Ticho	7.49	39.32		Arsi	Ticho
120	Waldia	11.49	39.36		Welo	Yeju
121	Welsio	8.33	37.59		Shewa	Chebo Gurage
123	Wendo Genet	7.10	38.35		Shidamo	Sidama
124	Wenji	8.25	39.15		Shewa	Yerer Kereyu
125	Wush Wush	7.16	36.11		Kefa	Kefa
126	Yabelo	4.53	38.06		Sidamo	Arero
127	Yirga Chefe	6.14	38.15		Sidamo	Gedeo
128	Yirgalem	6.45	38.23		Shidamo	Sidama
129	Yubdo	8.57	35.27		Welega	Gimbi
130	Ziway	8.00	38.45		Shewa	Yerer Kereyu

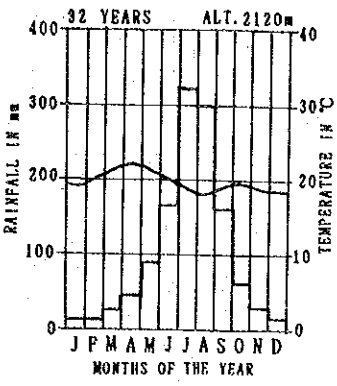
B-6 : Climatological Characters of Main Stations (1/2)

SUMMER RAIN

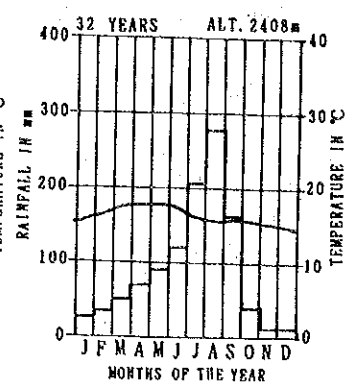
① DEBRE MARKOS



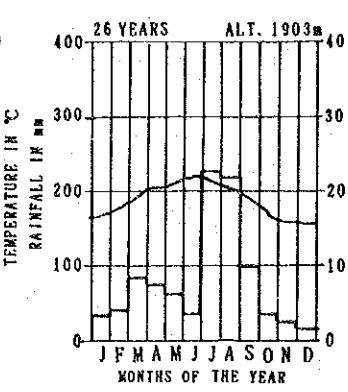
② GONDER



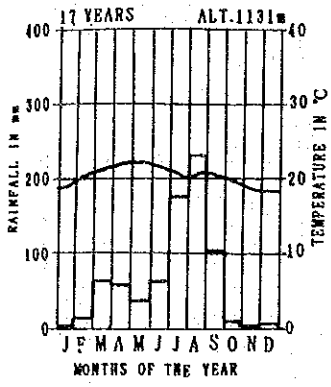
③ ADDIS ABEBA



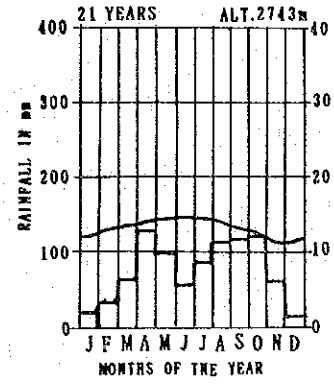
④ KOMBOLCHA



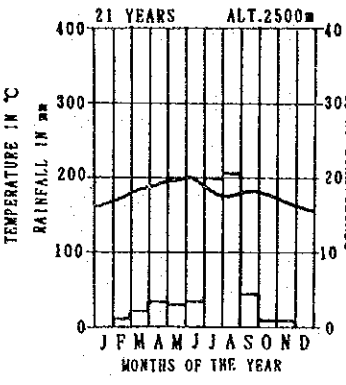
⑤ NAZRET



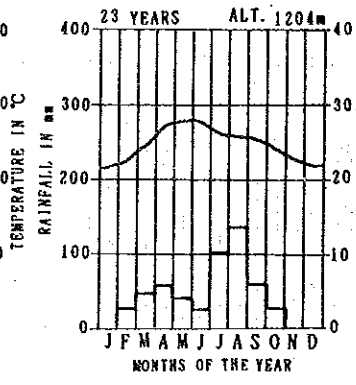
⑥ GOBA



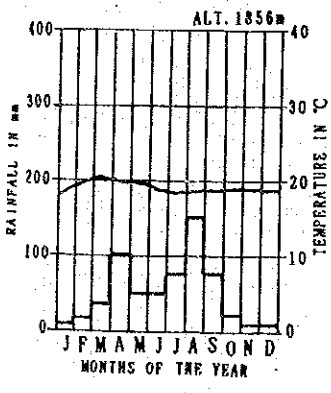
⑦ MEKELE



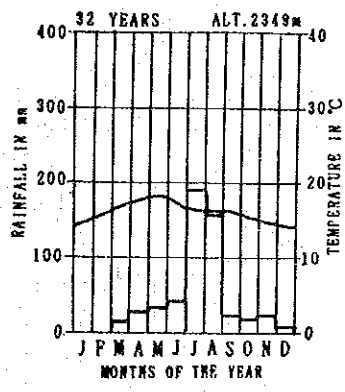
⑧ DIRE DAWA



⑨ HARER

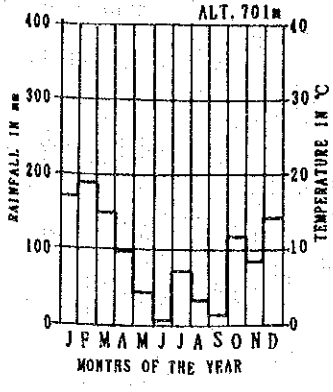


⑩ ASMERA

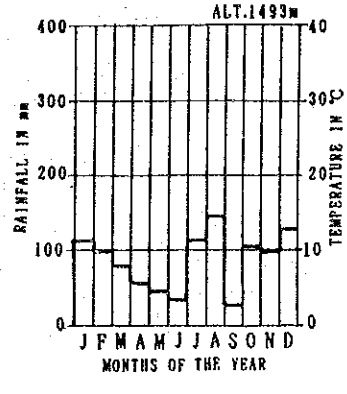


WINTER RAIN

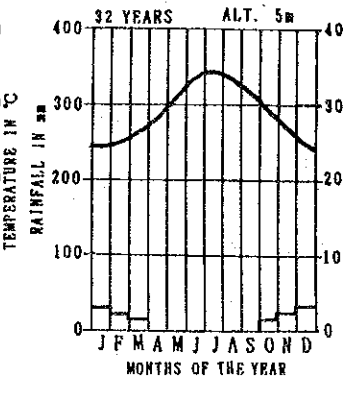
⑪ FILFIL



⑫ MERARA



⑬ MITSIWA



⑭ ASEB