No. 4

THE BASIC DESIGN STUDY REPORT
ON
THE GROUND WATER DEVELOPMENT PROJECT
IN LOWER SHABELLE RELATED TO ICARA-II
IN
SOMALI DEMOCRATIC REPUBLIC

OCTOBER, 1985

Japan International Cooperation Agency

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PREFACE

In response to the request of the Government of the Somali Democratic Republic, the Government of Japan decided to conduct a Basic Design Study on Ground Water Development in Lower Shabelle related to ICARA II and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Somalia a team headed by Mr. Seiyu Kamata, Head of Planning Section, Planning & Survey Division, Management Department, Waterworks Bureau, Yokosuka City, from May 31st to July 5th, 1985.

The team had discussions with the officials concerned of the Government of Somalia and conducted a field survey. After the team returned to Japan, further studies were made and the present Report has been prepared.

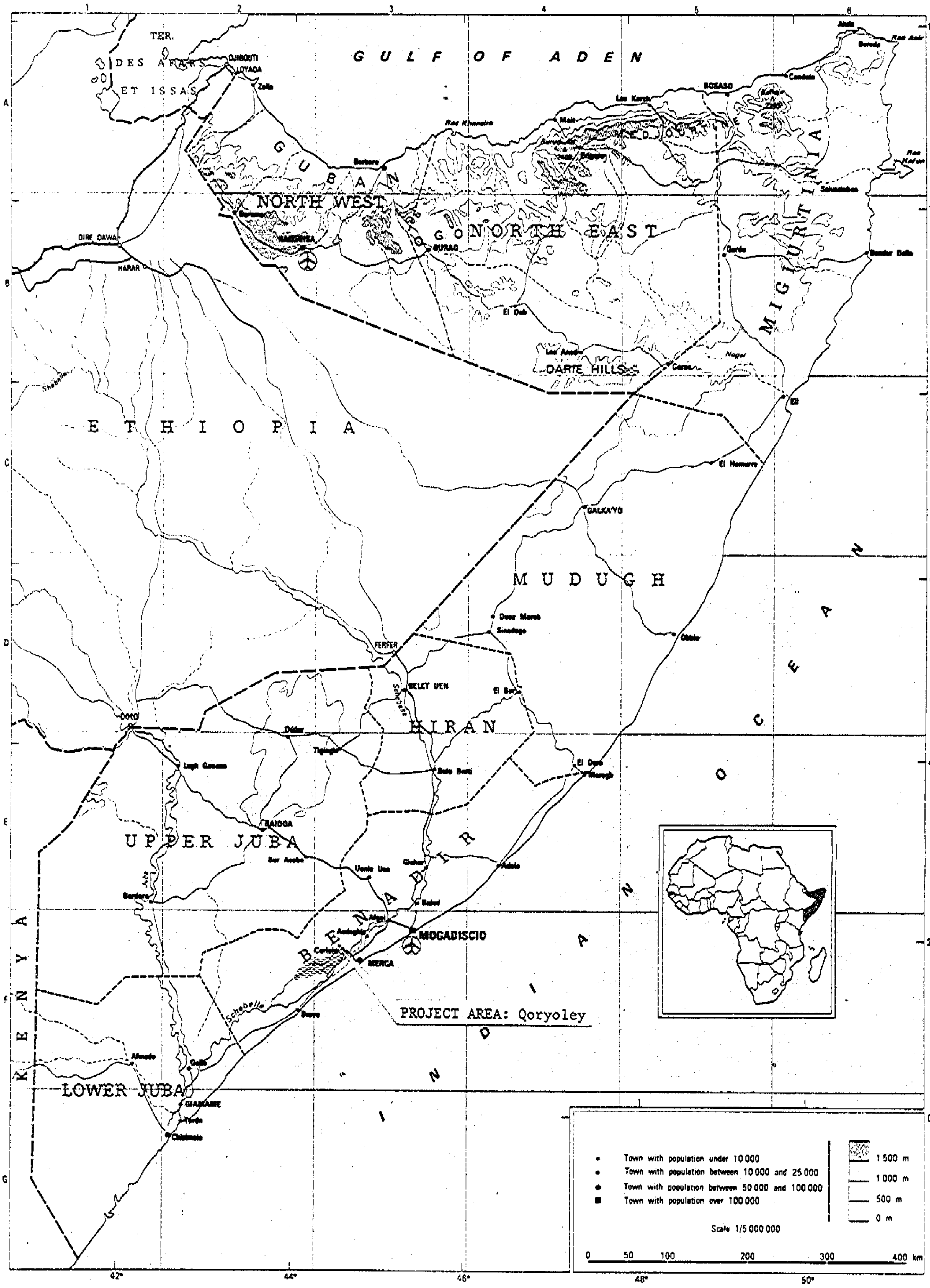
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

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

October, 1985

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency



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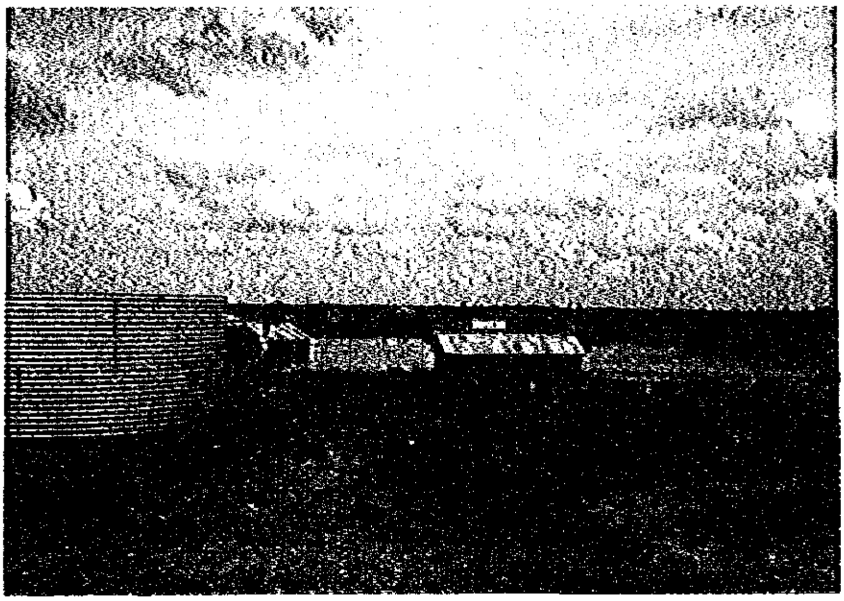
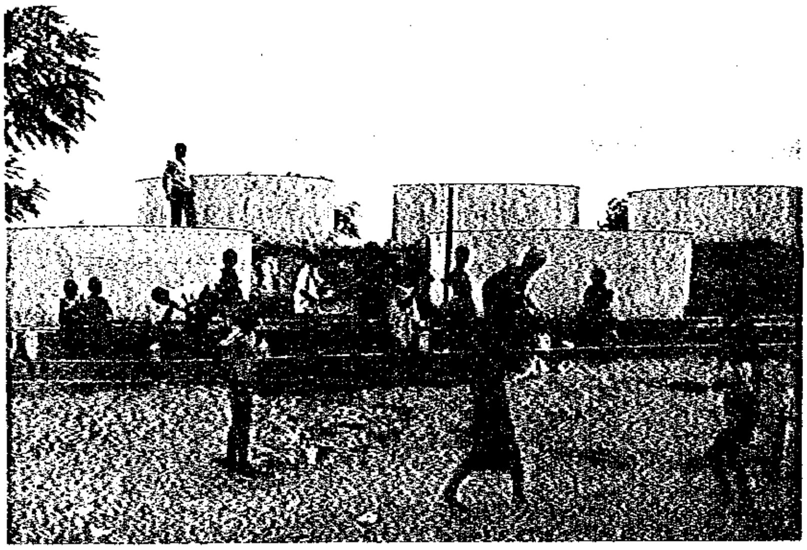
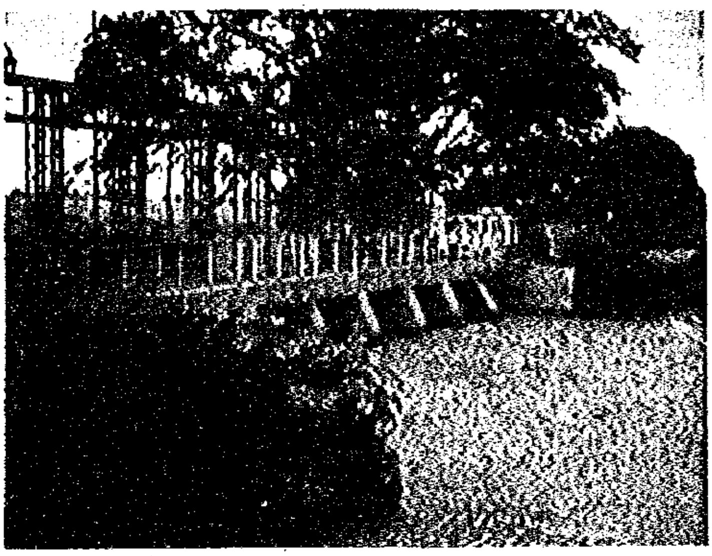
Refugee Camp scene





An Existing water supply facility in Camp 1.

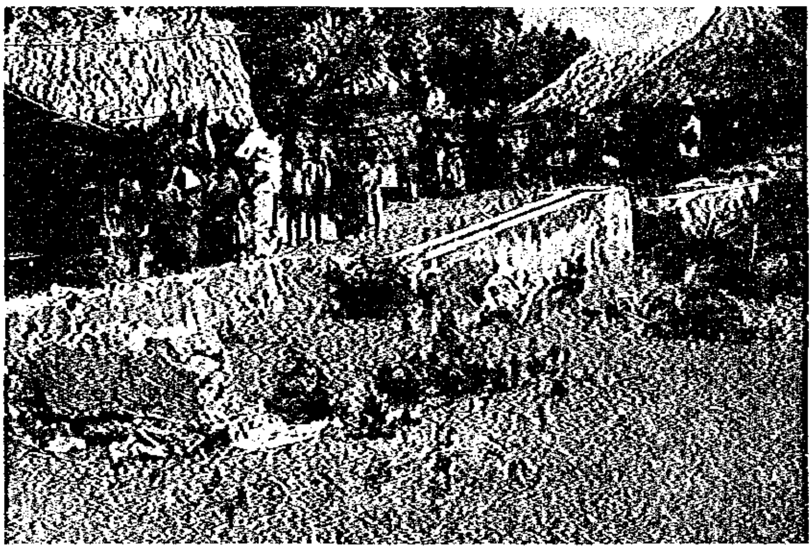
The Shabelle River



Public water filling station in Qoryooley Town

Donkey carts receiving water supply from donkey cart filling station

a village surrounding refugee camps.



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ABBREVIATIONS

CIDA	Canadian International Development Agency
ERDGS	Ecumenical Relief and Development Group for Somalia
FAO	Food and Agriculture Organization of the United Nations
FRG	Federal Republic of Germany
FYDP	Five Year Development Plan
GOS	Government of Somalia
GTZ	German Agency for Technical Cooperation
HWA	Hargeisa Water Agency
ICARA	The International Conference on Assistance to Refugees in Africa
IDA	International Development Association
IDWSSD	International Drinking Water Supply and Sanitation Decade
KfW	Kreditanstalt für Wiederaufbau
KWA	Kismayo Water Agency
lcd	litres per capita per day
MA	Ministry of Agriculture
MLG and RD	Ministry of Local Government and Rural Development
MMWR	Ministry of Mineral and Water Resources
MOH	Ministry of Health
MWA	Mogadishu Water Agency
NRC	National Refugee Committee
NTC	National Technical Committee
NWC	National Water Committee
OAU	Organization of African Unity
PF	Public Fountain
PHC	Primary Health Care
RWSD	Refugee Water Supply Division
So.Sh.	Somali Shillings
SRWU	Southern Refugee Water Unit
TYDP	Three Year Development Plan
UNDP	United Nations Development Programme
UNDTCD	United Nations Department of Technical Cooperation for Development

UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WDA	Water Development Agency

SUMMARY

CHAPTER 1

INTRODUCTION

SUMMARY

In the Somali Democratic Republic, there are over 700,000 refugees from the Ogaden area who lost their original homes because of continuous teritorial conflicts and droughts.

The Goverment of Somalia is initiating the 5-year Development Plan, which emphasizes the importance of agricultural improvement. However, most development funds for this plan depend on foreign aid. The progress is rather slow resulting in critical, daily suffering of the population.

Under such a condition, ICARA-II was held in 1984 in Switzerland following ICARA-1 which decided on immediate humanitarian assistance for refugees. At ICARA-II, not only assistance to refugees but also the necessity to provide an infrastructure to the refugee accepting countries, was discussed. The Government of Japan expressed its intentional position that they are ready to assist to provide aid to projects in the fields of water supply, sanitation and public health as well as food supply.

Among 35 refugee camps in Somalia, three camps in Lower Shabelle area have not been provided with a sufficient water supply system yet. The Government of Somalia submitted a request for Grant Aid to the Government of Japan, regarding the water supply provision for these three camps. This water supply will ensure a stable supply of clean and safe water to refugees in and around these camps, for supporting their daily activities.

In response to this request, the Government of Japan decided to carry out a preparatory study from February to March, 1985, through the Japan International Cooperation Agency (JICA).

From the result of the preparatory study, the Government of Japan confirmed the appropriateness of this project and recognized the necessity and appropirateness of the basic design study, and made a decision to carry out the study.

According to the decision, JICA sent a basic design study team to Somalia from May 31 to July 5, 1985. The study team discussed with the concerned authorities of the Government of Somalia, collected information on the water supply situation needed for optimum basic design water supply facilities and evaluated the refugees' conditions and groundwater conditions. The team also conducted various surveys; geographical surveying for water pipe-lines, potential capacity of existing wells, conditions of served areas, served population and construction materials and equipment. After the team returned to Japan, the team drew up the basic design plan based on the survey and study results.

The basic scheme for setting up the Project is as follows:

(1) Target year; 1990

(2) Water served area;
3 refugee camps in Lower Shabelle region, villages along the Shabelle River around the refugee camps and the villages along the water pipeline between the water resource and the camps.

(3) Served population;
Based on the standard population survey conducted in 1984, the estimated population growth is 300 people per year at refugee camps and a 3.4% natural population growth rate at Qoryooley Town and surrounding villages.
According to the above calculation, direct water served population will be 96,270 and indirect water served population will be 31,500.

(4) Water supply amount; 2,223 m^3/day
Daily maximum consumption per head; 15 lcd
Public use consumption; 5.5% of domestic use consumption
Estimated water leakage; 10% of daily maximum consumption

(5) Water resource;
Groundwater of Beled Amin
Three wells with 129 m^3/hour of pumping rate. However, one of the 3 wells is to serve as a backup.

(6) Groundwater transmission system

Groundwater is pumped by a well pump into an elevated tank. From there the water is transmitted by gravity to refugee camp 1 located at the terminal of the transmission pipeline. The terminal water pressure of the water transmission pipeline is designed with a view to future expansion of the presently indirect served area to the direct served area.

(7) Considering the salinity quality of the water resource, PVC pipes for water pipes below ϕ300mm and FRP pipes for water pipes above ϕ350mm are used.

The optimum diameter of the water transmission pipe was determined according to the peak-cut capacity of the elevated tank and public water filling station.

(8) The Elevated tank is to be made of reinforced concrete. By the optimum design method, the elevated tank's capacity is to be 6% of the maximum daily consumption, and the height of the elevated tank is to be GL +30.0m.

(9) At direct served areas, public water filling stations with a capacity of 6% of maximum daily consumption are to be built and donkey cart filling stations are to be set up for indirect served areas.

The details of the water supply facilities for the Project based upon the above decisions are as follows.

Water supply facilities

Area to be served	Direct water supply area --- 3 refugee Camps, Quryooley Town, and villages Indirect water supply area -- 9 villages
Population to be served	Direct water supply area -- 96,270 Indirect water supply area -- 31,500 127,720
Daily maximum water supply	Direct water supply area--- 1,683.1 m^3/day Indirect water supply area -- 540.5 m^3/day 2,223 m^3/day
Water source	Groundwater at Beled Amin
Production well	ø300 x ø250, Depth 90 m, Water intake rate 129 m^3/hour 3 wells (including a standby)
Well pump	ø 200 x 2.15 m^3/min. x 64.5 m x 70 ps x 3 units (including a standby unit)
Pump station	4.4 m x 10.0 m x 3 housings
Overhead Water supply tower	Effective capacity 160 m^3 (inner diameter 9.6 m x effective depth 3.5 m) Height HWL = GL + 33.5 m LWL = GL + 30.0 m A tower
Water intake pipe	ø200 x 1,400 m (Ductile cast iron pipe or PVC pipe)
Water supply pipe	FRP ø400 x 16,840 m (Paved road 13,840 m, unpaved road 3,000m) FRP ø350 x 1,500 m (Unpaved road) PVC ø300 x 4,850 m (Unpaved road) PVC ø250 x 3,650 m (Unpaved road)
Water distribution pipe	ø50 - ø150 PVC pipe 7,780 m
Large water supply station	3 stations
Public water supply station	2-hydrant, 7 stn. 5-hydrant, 1 stn. 7-hydrant, 2 stn. 10-hydrant, 16 stn.

The part of the total cost of the Project to be borne by the Government of Somalia will be 173,000,000 So.Sh. (490,000,000 Yen). These water supply facilities will require and annual operation and maintenance cost of 9,180,000 So.Sh. (26,000,000 Yen).

The construction work will take approximately 13 months, including the period for transportation of construction materials and equipment. The Project will require a total implementation period of 18 months after the exchange of notes, including detailed design and tender procedures.

The implementation of the Project shall be undertaken by the Water Development Agency (WDA) under the Ministry of Mineral and Water Resources (MMWR) (the Refugee Water Supply Division (RWSD), which is a section of the WDA, shall directly take charge of the refugee camps). Therefore, the WDA must provide fulltime counterparts for the construction works as well as operation and maintenance personnel for the water supply facilities.

The execution of the Project based on the results of survey and study, will make it possible to realize a stable and year-round supply of safe and clean living water to the refugee camps in the Lower Shabelle region and to the population of the surrounding area by using groundwater for this purpose and thereby contribute greatly to the stabilization and upgrading of the living standards as well as improvement of the health and sanitary conditions of the refugees and people around the camps. As a consequence, it is expected to facilitate social development in the vicinity of the refugee camps, to promote the settlement of the refugees and also the wide-scale development of the Lower Shabelle area, which has a high agricultural potential. Thus, the implementation of the Project is recognized to yield sufficient results and therefore Japanese Grand Aid for the implementation of the Project is deemed quite worthwhile.

Chapter 1 INTRODUCTION

Recently, many African nations are facing critical social and economic problems due to a spell of droughts, agricultural policy failures, racial conflicts, border conflicts, fragile living infrastructure and an annually declining international economic environment.

Each nation is making efforts to overcome such critical situations as much as possible, while being forced to carry the burden of accepting refugees brought about by draughts, border conflicts and other problems. Refugees accepted by other nations are estimated to be in the region of 4 million. As those nations themselves are underdeveloped, refugees are causing an enormous burden to them. To solve the refugee problems, African nations themselves initiated by the OAU (Organization of African Unity), have been making efforts to accept refugees having respect for the "Non-Rufru Man Principle" (the principle of prohibition against forced repatriation) - the principle of international law. However, since it has become very difficult to find a solution among the African nations, international aid has become necessary. In view of this situation, in April, 1981, ICARA-I (The First International Conference on Assistance to Refugees in Africa) was held in Geneva, Switzerland with 85 nations participating, to discuss humanitarian aid, mainly immediate assistance to refugees. Following this conference, ICARA-II was held in Geneva in July, 1984. Together, the OAU and UNHCR (United Nations High Commissioner for Refugees), at ICARA-II presented a report on the necessity of providing an infrastructure in the refugee-receiving nations as well as refugee assistance.

The Government of Japan sent a delegation headed by Mr. I. Kitagawa, Parliamentry Vice Minister of Foreign Affairs, to express Japan's willingness to assist with projects in the fields of food, water supply, health and hygiene.

Following this conference, Mr. Shintaro Abe, Minister of Foreign Affairs, paid an official visits to African nations. It was under these circumstances, that the Government of Somalia requested Japanese Grant Aid regarding improvement of infrastructure, mainly water supply, in order to improve the living environment of refugees and people around the camps.

The concrete request from the Government of Somalia is to build water supply facilities in the Lower Shabelle area that will realize a stable supply of safe and clean water, from groundwater, to the refugee camps and surrounding villages so that the people's living may be stabilized, thereby making it possible for them to concentrate their efforts on the development of the area which has a high agricultural and stock farming potential.

The Government of Japan decided to examine the request from the Government of Somalia, and the Japan International Cooperation Agency (JICA) dispatched a preparatory study team headed by Mr. Yoshichika Ohta, an official of the Ministry of Foreign Affairs, to Somalia from February 14 to March 1, 1985. The team confirmed the appropriateness of implementation of the Project and determined the scope of the basic design study after studying and discussing the contents of the request and its background. JICA then dispatched a basic design study team headed by Mr. Kamata (Planning & Survey Div., Management Dept. Water Works Bureau, Yokosuka City) from May 31 to July 5, 1985.

The team discussed with the concerned authorities of the Government of Somalia about the details of the Project, collected information on the conditions of water supply, refugees, groundwater, serveyed geographic features for water pipe-lines, researched the existing wells, carried out pumping tests and evaluated served areas, served population and construction materials and equipment.

Basic agreements reached as a result of discussions with the Government of Somalia were drawn up in the form of minutes which were signed by the representatives of both Governments concerned.

The list of the study team members, the study schedule, the list of Somali staff concerned, discussion records, and the list of collected information are attached to the minutes as an annex.

After returning to Japan, the Team furthermore studied the results of site surveys and examined the effectiveness of the Project. This report summarizes the optimum proposals for implementing the Project according to the basic design of water supply facilities, the cost of the Project and the plan for operation & maintenance etc.

CHAPTER 2

BACKGROUND OF THE PROJECT AT THE NATIONAL LEVEL

CHAPTER 2 BACKGROUND OF THE PROJECT AT THE NATIONAL LEVEL

2-1 Outline of the National Development Plan

Somalia is one of the least developed countries whose GNP is U.S.$1,540 million and per capita GNP is U.S.$250 as of 1983. Its population is 5.1 million with approximately 700,000 refugees.

From 1982, the government launched its National Five Year Development Plan with a total budget of 16.3 billion Somali Shillings (264 billion yen at the currency exchange rate of 1982). The plan aims to increase agricultural and stock farming products which account for 95% of the nation's food supply and exports. Through this plan, the Government intends to raise the people's standard of living by raising the GNP some 4.8% annually.

The breakdown of the development budget is shown in Table 2-1.

Table 2-1 Capital Investment by the 5-year (1982-86) Development Plan

	Capital Investment (1 million shilling)	Ratio (%)
° Agriculture	7,663	47.0
° Mining and Manufacture	2,641	16.2
° Infrastructure	3,049	18.7
Energy and Power		(4.2)
Water Sources		(10.0)
Transportation and Communication		(4.5)
° Other Economic Affairs	717	4.4
° Social Affairs	1,516	9.3
Health Care		(2.1)
Others		(7.2)
° Local and Regional Development	717	4.4
Total	16,303	100

Note: 1 Somali shilling = 16.2 yen (1982)

In the FYDP Plan, 47% of the total budget is available for the agricultural and stock farming improvement program which mainly covers the programs for improving deserted farming fields or brackish irrigation water, as well as new agricultural development projects. 18.7% of the total budget is for infrastructure including 10% for water resource development.

The main theme of The FYDP is to improve people's environment including a stable water supply and the development of a water resource necessary for agricultural fields.
This means the construction of an environment that can permanently support farmers and nomads who occupy 78% of the total population as well as the 700,000 refugees. This target can never be achieved without firm development of water resources.

To achieve the target of ensuring a stable water supply for agriculture and stock farming and realizing the objectives of National Water Supply Decade, efforts must be made such as research and development of the entire country's groundwater supply, confirmation of potential water resources in each region, utilization of the Shabelle and Juba Rivers, construction of reservoirs utilizing rain water and surface water.

2-2 General Conditions of Refugees and Water Supply

2-2-1 Historical Background

In the 19th century, Somali was divided into 6 tribes each inhabiting present-day Somalia, Eastern Ethiopia and Northern Kenya, though they were not united in the form of a nation.

In 1885 Ethiopia invaded to occupy the Ogaden Region which had been ruled by Somali. In 1887, Britain made Northern Somalia their protectorate. In 1905 Italy directly ruled Southern Somalia. The land of Somalia was then divided into 3 different nations.

During World War II, most Somali land was under the temporary sovereignty of Britain, but, after the war, the land was divided into 3 parts again.
In 1960, both the British and Italian colonies became independent to jointly establish the Republic of Somalia. After the coup d'état in 1969, the country changed its name to the Somali Democratic Republic.

The refugee problem of Somalia originates from these past colonial influences. In 1950, before the country's independence, Ethiopia and Britain decided the border line between Somalia and Ethiopia to be a "Temporary Administrative Line". By this decision, the Ogaden region was put under the jurisdiction of Ethiopia. The inhabitants living there were forced to become Ethiopian though originally they were Somali. Since then, Somali in the Ogaden Region have been suffering from unfair treatment in one way or the other. Finally, in June 1977, the "Ogaden War" (conflict between Ethiopia and Somalia) took place over territorial possession rights. This incident caused many Somali to flood into Somalia as refugees from Ethiopia. During the first half of 1981, a combination of drought and flood caused the emergency situation known as "the world's biggest refugee problem." This emergency motivated and developed concentrated efforts of assistance by UNHCR, other nations' governments and civil organizations.

The number of refugees in Somalia, under institutional assistance, including and similar to UNHCR, is said to be 700,000. They are temporarily living in 35 refugee camps established in the Gedo, Hiran, Lower Shabelle and Northwest regions in Somalia. (Fig. 2-1, Table 2-2). The National Refugee Committee (NRC) is in charge of the refugee problem in Somalia.

2-2-2 Concept of the Refugee Settlement Program

In the beginning, the Government of Somalia considered the refugee problem to be of only a temporary nature and wanted to solve it in a short time.
However, the conflict still continues and it has became impossible to consider it merely as a temporary matter.

UNHCR is proposing the following 3 options for the permanent resolution of the refugee problems.

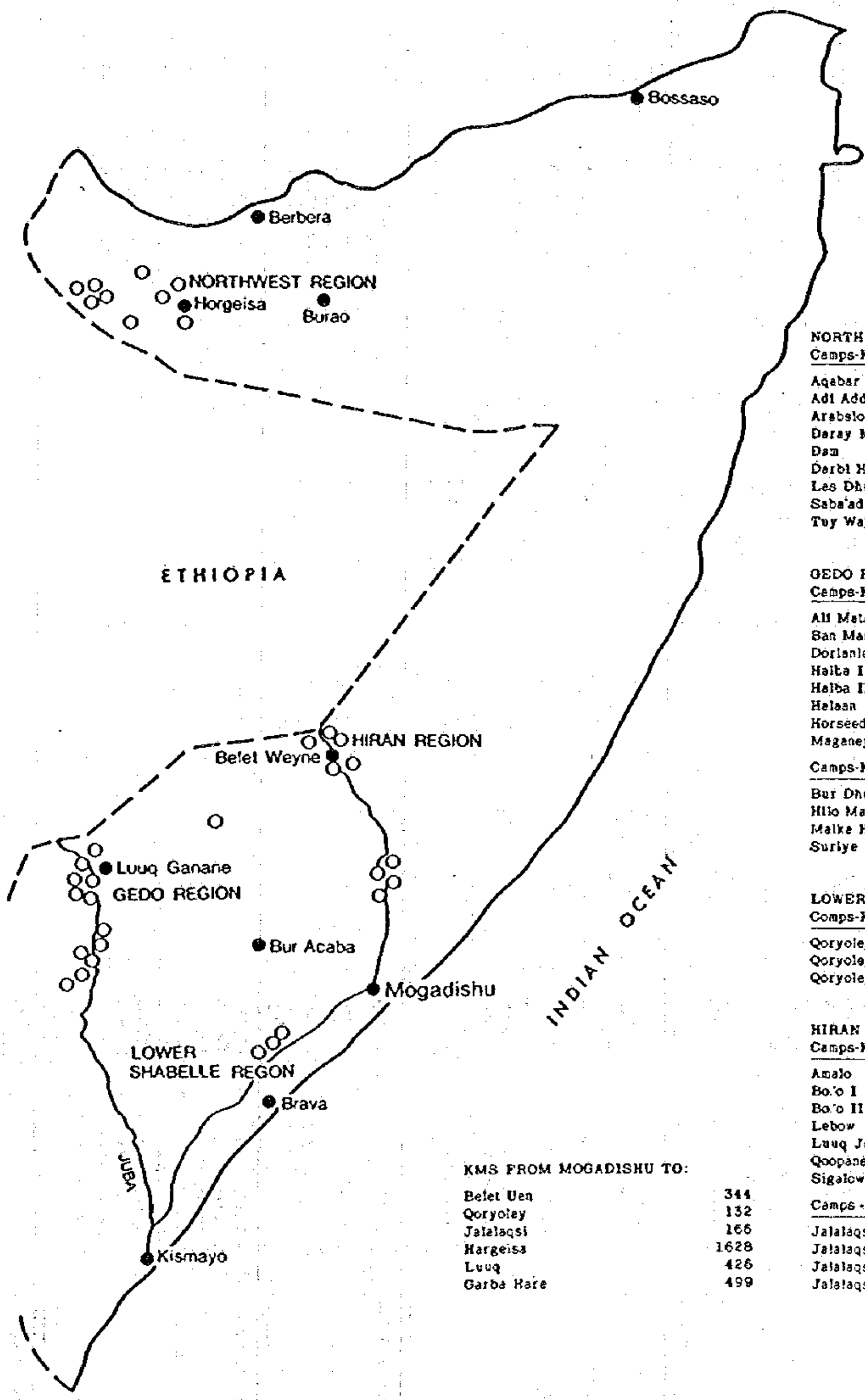
(1) Voluntary return to the original country
(2) To be settled in the country (Somalia) which they are temporarily in.
(3) To be settled in third countries.

In March, 1983, the Government of Somalia announced a new statement on the refugee issue in which the options decided by the government were the above (1) and (2).

The voluntary return to the original country means going back to Ethiopia. The settlement in the country (Somalia) which they are temporarily in means obtaining a permanent residence in Somalia and the provision of a passport.

According to the present situation, the Government of Somalia concluded that most of the refugees would prefer to settle in Somalia and therefore they worked out the refugee settlement program.

Fig. 2-1 Location of Refugee Regions



KMS FROM MOGADISHU TO:

Belet Uen	344
Qoryoley	132
Jalalaqsi	166
Hargeisa	1628
Luuq	426
Garba Hare	499

NORTH WEST REGION

Camps-Kms to Hargelsa.		
Aqabar	53	N
Adi Addeys	82	N
Arabslo	35	W
Daray Ma' An	125	NW
Dam	9	E
Derbi Hore	217	NW
Les Dhure	42	N
Saba'ad	35	NE
Tuy Wajale	60	W

GEDO REGION

Camps-Kms to Luuq		
Ali Matan	9	S
San Mandule	5	S
Dorianley	10	S
Halba I	15	N
Halba II	15	N
Helaan g	8	SW
Horseed	2	W
Maganey	12	SW

Camps-Kms to Garba Hare		
Bur Dhubo	48	SE
Hilo Mareer	57	E
Malke Hidday	63	E
Suriye	60	E

LOWER SHABELLE REGION

Comps-Kms to Moqadishu		
Qoryoley I	139	SW
Qoryoley II	136	SW
Qoryoley III	136	SW

HIRAN REGION

Camps-Kms to Belet Ueh		
Amalo	20	S
Bo'o I	59	S
Bo'o II	57	S
Lebow	15	N
Luuq Jellow	25	S
Qoopane	18	N
Sigalow	2	N

Camps - kms to Mogodishu		
Jalalaqsi I	166	N
Jalalaqsi II	171	N
Jalalaqsi III	166	N
Jalalaqsi IV	166	N

Table 2-2 Present Situation of Refugee Camps

Region	Camp	Population	Established Year	Nationality	Cause of Refugee	Water Supply Ability	Electricity	Medical Facilities	Educational Organization	Others
GEDO	Halgan	18,000	1978	Ethiopia	Conflict	W4 62m^3/hr	N.A.	Clinic (2)	- Class	
	Horseed	15,000	1978	"	"	T T	"	" (2)	8	
	Ban Mandule	12,000	1978	"	"	T T	"	" (2)	10	
	Ali Matan	20,000	1979	"	"	T T	"	" (3)	8	
	Dorianley	17,000	1979	"	"	T T	"	" (2)	4	
	Maganey	11,000	1978	"	"	T T	"	" (2)	32	
	Halba I	20,000	1978	"	"	W1 5m^3/hr	"	" (3)	14	
	Halba II	19,000	1978	"	"	W2 105	"	" (2)	4	
	Bur Dhubo	20,000	1979	"	"	W2 T 33	"	" (3)	-	
	Hilo Mareer	12,000	1979	"	"	W3 T 58	"	" (2)	-	
	Suriye	16,000	1979	"	"	W2 25	"	" (2)	4	
	Malka Hidday	20,000	1979	"	"	T	"	" (3)		
Total:		200,000								
HIRAN	Qoogane	11,000	1978	"	"	T	"	" (1)	-	
	Lebow	6,000	1979	"	"	T	"	" (1)	-	
	Sigalow	16,000	1978	"	"	W3 T27.7m^3/hr	"	" (2)	15	
	Lugh Jellow	35,000	1978	"	"	W6 T79.2	"	" (4)	47	
	Amalow	17,000	1979	"	"	W3 43.9	"	" (2)	16	
	Bo I	28,000	1980	"	"	W3 47.8	"	" (3)	20	
	Bo II	11,000	1980	"	"	T	"	" (1)	4	
	Jalalaqsi I	21,000	1979	"	"	W2 78.5	"	" (1)	10	
	Jalalaqsi II	32,000	1979	"	"	W2 144.5	"	" (3)	8	
	Jalalaqsi III	14,000	1979	"	"	W3 111.9	"	" (2)	10	
	Jalalaqsi IV	18,000	1980	"	"	W3 67	"	" (2)	9	
Total:		209,000								
LOWER SHABELLI	Qoryoley I	8,000	1977	"	"	T 6 m^3/hr	"	Hospital (1), Clinic (4)	5	
	Qoryoley II	18,000	1977	"	"	T 9	"	Hospital (1), Clinic (8)	15	
	Qoryoley III	15,000	1978	"	"	T 8	"	Hospital (8), Clinic (6)	-	
Total:		41,000								
NORTH WEST	Dam	37,610	1978	"	"	N.A.	"	Clinic (6)		
	Sabaad	40,875	1979	"	"		"	" (6)	38	
	Arabsio	10,378	1980	"	"		"	" (2)	4	
	Agabar	32,504	1979	"	"		"	" (5)	20	
	Las Dhure	39,846	1979	"	"		"	" (6)	-	
	Dharbi Hore	15,000	1979	"	"		"	" (2)	-	
	Adi Addeys	26,987	1979	"	"		"	" (3)	20	
	Daray Ma'An	39,925	1979	"	"		"	" (6)	20	
	Tug Wajale	6,875	1979	"	"		"	" (1)	16	
Total:		250,000								
Grand Total:		700,000								

Note: W4 : Well 4

T : Purifying Facilities of Surface Water

This program's basic idea is to provide assistance to refugees till they are able to support themselves independently in the refugee camps or surrounding areas, while developing local societies where they are able to cooperate with local inhabitants for their social and economic daily activities.

The Implementation Program for Refugee Settlement, prepared by the Government of Somalia is as follows:

1) Preparation and provision of settlement areas for refugees willing to settle and instructions for refugees participating in the settlement program.

2) To offer every facility for settlement and immigration.

3) Continuous support till a refugee becomes completely independent.

4) In principle, when refugees become independent, the administration of the settled area should be transferred to the refugees.

The procedures for the implementation of these settlement programs are;

1) To establish a self-supporting system of food through agricultural development including stock raising by utilizing rain water and irrigation facilities (construction of facilities included).

2) Forwarding surplus agricultural produce to markets.

3) To activate commercial activities other than agricultural ones, including small-sized family industries.

4) To provide assistance to the social environmental services (medical, educational, etc.....) at the early stage of settlement.

5) To establish vocational training centers to facilitate getting jobs at the settled areas.

2-2-3 Situation of Refugee Camps

As mentioned before, the 700,000 refugees are living in 4 regions at 35 refugee camps, with assistance from the Government of Somalia, UNHCR and other assisting institutions.

This assistance is mainly concentrated on providing clothes, drinking water, food (edible oil, salt, canned meat, etc.) and medical assistance. For the time being assistance has reached a considerable level.

Most of the food support is still obtained from relief goods, though the "farms for refugees" program. Support by assisting organizations has been developed at some of the refugee camps. There, bananas, tomatoes, corn and onions are already being grown on rather small farms. About 3,000 ha of farm land had been developed by 1984. At the camp of Qoryooley, a factory was built with foreign assistance, in which women sew shirts using more than 100 sewing machines. The produced shirts are not only distributed among refugees but also sold outside the camp to gain economic support. This is a step toward self sufficiency and independence of refugees. 80% of refugees are women and children.

The result of a study on refugee camps is reported in Table 2-2. As shown in Table 2-2, most of the people temporarily living in refugee camps are Somali with Ethiopian nationality and came there because of border conflicts. However, it is reported that some refugees who came because of the drought are also in the camps. Though the cause of refugees mainly lies in border conflicts, the drought had also been a cause.

At present there is no camp supplied with electricity. The heating and lighting comes from slow oil lamps and fire wood, respectively. However, medical facilities are relatively well provided for. Every camp has at least one hospital or public health center. Though these facilities are nothing compared to modern hospitals, a minimum medical care is available in the camps.

It seems that a relatively small number of people are suffering from illness because of the assistance of these medical facilities and care.

Most of the houses in the camps are very simple ones made of frames consisting of tree trunks or branches with earthen walls. They can serve their function only temporarily.

2-2-4 Situation of the Water Supply at the Refugee Camps

The details and capacity of the water supply facilities of the 35 camps are summarized in Table 2-2.

Regarding the camps in the Northwest region, there is no detailed information, but the Northwest region is an arid area with no surface water, and depends fully on groundwater supply. At the moment, a service program to supply 10 lcd is being carried out with assistance from the People's Republic of China.

Regarding the 26 camps of the Southern region, Gedo, Hiran and Lower Shabelle, UNHCR and United Nations Children's Fund (UNICEF) developed water resources using groundwater and provided water supply facilities to 6 out of 12 camps in the Gedo area and 8 out of 11 camps in the Hiran area. These water supply facilities ensure over 15 lcd throughout the year.

At other camps in the Southern region, 5-7 lcd is supplied now. In the case of water supply, the surface water of the Shabelle River or the Juba Riber is treated by means of coagulo-sedimentation or slow sand filter. But during the dry season, these two rivers cannot provide adequate water supply so assistance is needed from the surrounding areas where well facilities are available.

Groundwater supply capacity at Gedo and Hiran regions has reached 15 lcd. However, in the Lower Shabelle region without any groundwater resource, a stable and year-round water supply is impossible.

In order to provide water supply facilities which ensure at least 15 lcd in the camps with no groundwater resource, studies and research are being carried out on expanding the capacity of raw water reservoirs and the combined treatment system of a natural settling basin with slow sand filters.

2-3 Current Status of Establishment Programmes for Water Supply Facilities

2-3-1 Current Status of Drinking Water Supply

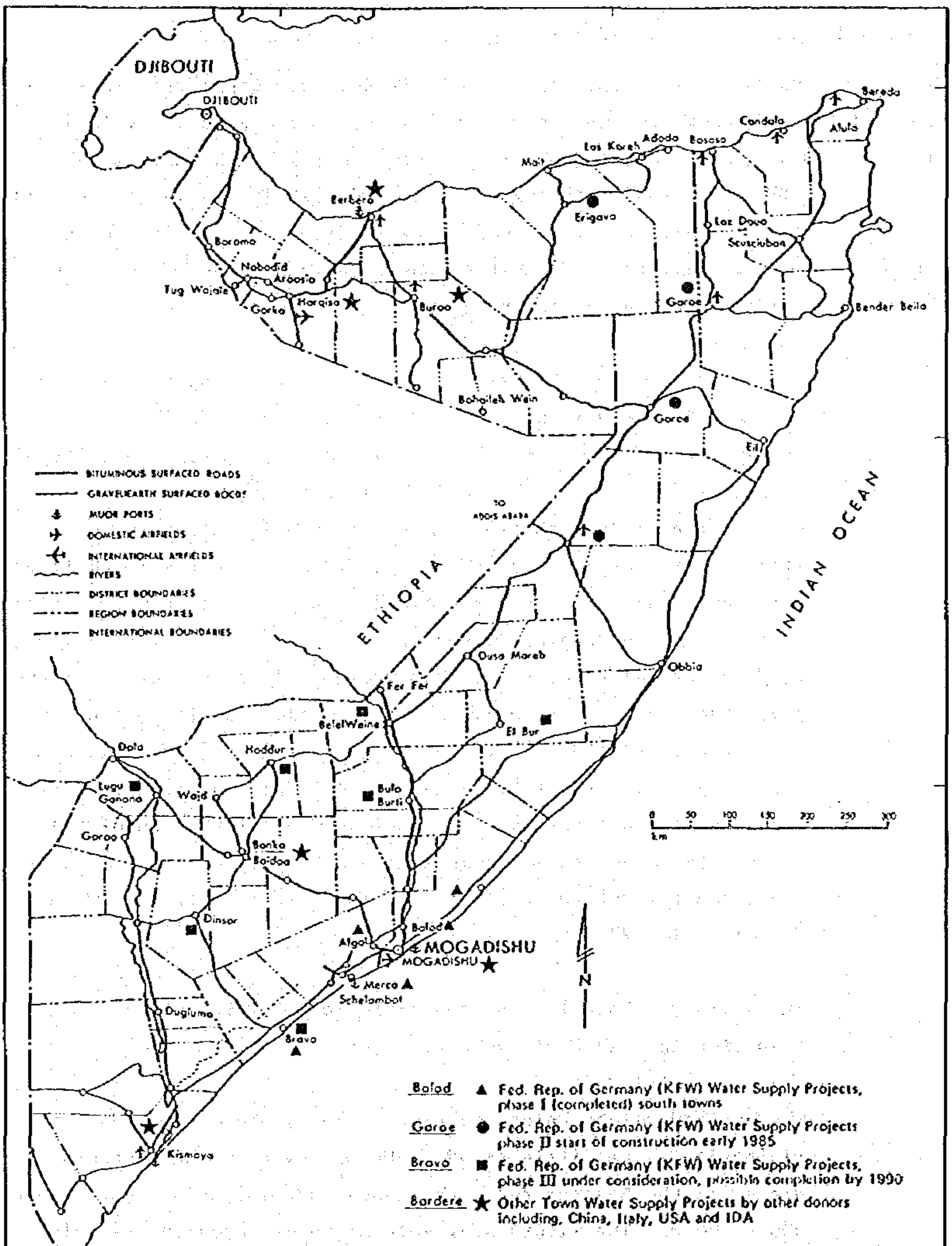
The life expectancy of a Somali is 40 years for rural areas and 43 years for urban areas. Such a short life expectancy is due to the high infantile mortality rate. That is, 170 infants out of 1000 die before reaching one-year old. It is considered that 80% of those died due to insufficient water supply conditions and poor sanitation. The most urgent need today, therefore, is to supply water and sanitary facilities.

As of 1984, out of a total of 71 areas, water supply facilities are provided in 3 main city areas (Mogadishu, Hargeisa and Kismayo) and 7 urban areas (Berbera, Baidoa, Burao, Merca, Afgoi, Balaad, and Jowhar). They were built with aid under bilateral treaty agreements with assistance from Kreditanstalt für Wiederautbar (KfW) of West Germany, U.S.A., People's Republic of China and Italy. Except in Kismayo, present water supply facilities all depend on groundwater from deep wells. In general, water is pumped to elevated tanks from where it is distributed through pipe lines by gravity to public water filling stations and house connection. Additionally, approximately 300 drilled wells and 2,000 dug wells are providing water to people in urban and rural areas and to some cattle. The estimated population receiving daily water accounts for approximately 60% of the total in urban areas and for 20% in rural areas. The diffusion of supply in Mogadishu is 87%.

The primary reason for the low diffusion of water supply facilities lies in a lack of water resources.

The northern areas belong to the Dry Zone, where the annual precipitation is as little as 50 - 300mm. Even in the southern areas, in the Savanna Zone, the annual precipitation just reaches 300 - 600mm. The rivers available as water resource are only two, Shabelle and Juba, which dry up during the dry season from

Fig. 2-2 Existing and Proposed Urban Water Supply System



December to March. Surface river water is relatively easy to develop as a water resource, but in Somalia its development as a daily water resource required throughout the year is deemed in appropriate, because the rives dry up during the dry season. Groundwater, another water resource, also has problems in Somalia. Recently, a growing number of old shallow wells have been abandoned due to increased salinity. Even among the newly drilled wells, there are many whose water is not suitable for drinking water because of high salinity and mineral content. Even in the case of deep wells, at certain places water has a high salinity and mineral content. Therefore, it cannot generally be said that deep wells as a whole are appropriate as a source of water supply.

Secondly, the refugee problem can be considered as a reason for the low diffusion of water supply services. Approximately 700,000 refugees have come into Somalia looking for water and fertile land and they have sheltered around cities and in the southern region along the Shabelle and Juba rivers with relatively rich water and land.

With UNHCR's assistance, water supply facilities are under preparation at 35 refugee camps. However, since capital assistance from UNHCR is to be used exclusively for refugee camps and not to be extended to the living environment services of the camps' surrounding areas for settling the refugees, for this the government of Somalia is responsible.

The third reason lies in the problem of water supply for the livestock of the rural and nomadic population that accounts for 80% of the nation's total population. Livestock is an indispensable source of food and also an important source of foreign currency earnings for the nation. For raising livestock, naturally, water is necessary throughout the year. When considering a water supply program for the dry season, water for livestock must be included, together with the daily water consumption of the people. Such being the case, since the scale must be expanded, the water supply program becomes even more difficult to implement.

2-3-2 Waterworks

(1) The waterworks administration is under the supervision and management of the MMWR. Under this Ministry, the WDA governs the nationwide development and construction of water supply facilities and their management. The administrative guidance and management is carried out by the National Technical Committee (NTC) supported by the National Water Committee (NWC).

In three cities, Mogadishu, Hargeisa and Kismayo, the self-supporting accounting system is adopted and administrative management and construction are undertaken by the Mogadishu Water Agency (MWA), Hargeisa Water Agency (HWA) and Kismayo Water Agency (KWA). These three agencies have the right of self-government.
The entire national organizational structure is shown in Fig. 2-3, and the organizational structure of WEA and its regional organizations are shown in Fig. 2-4 and 2-5.

Fig. 2-3 General Organization

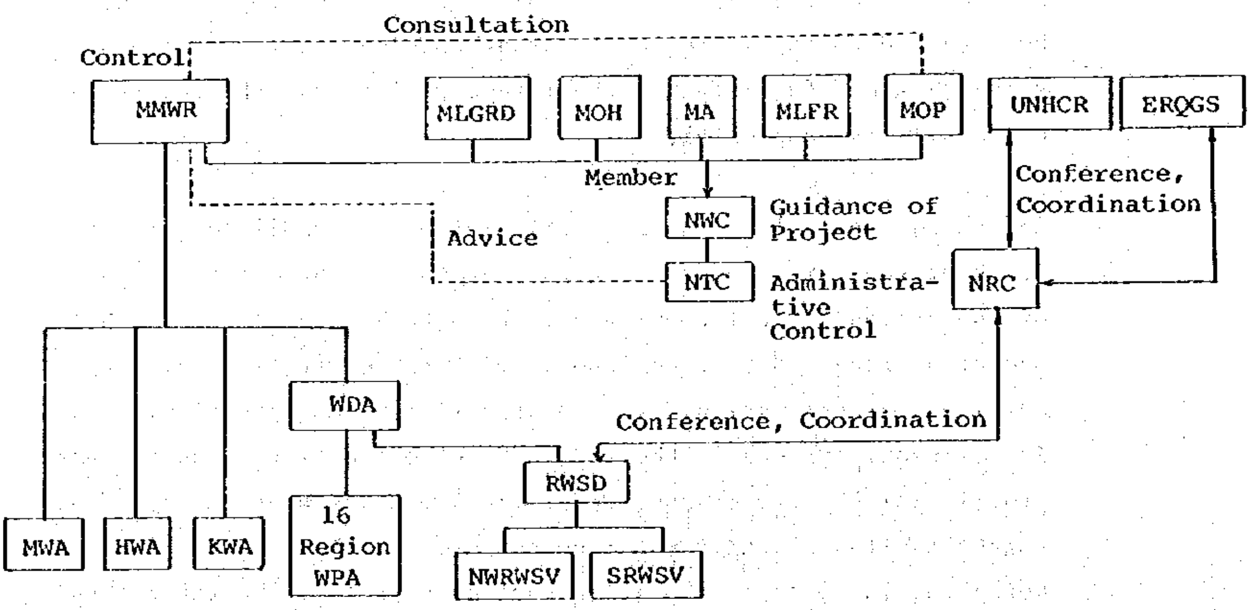


Fig. 2-4 Organizational Structure of WDA

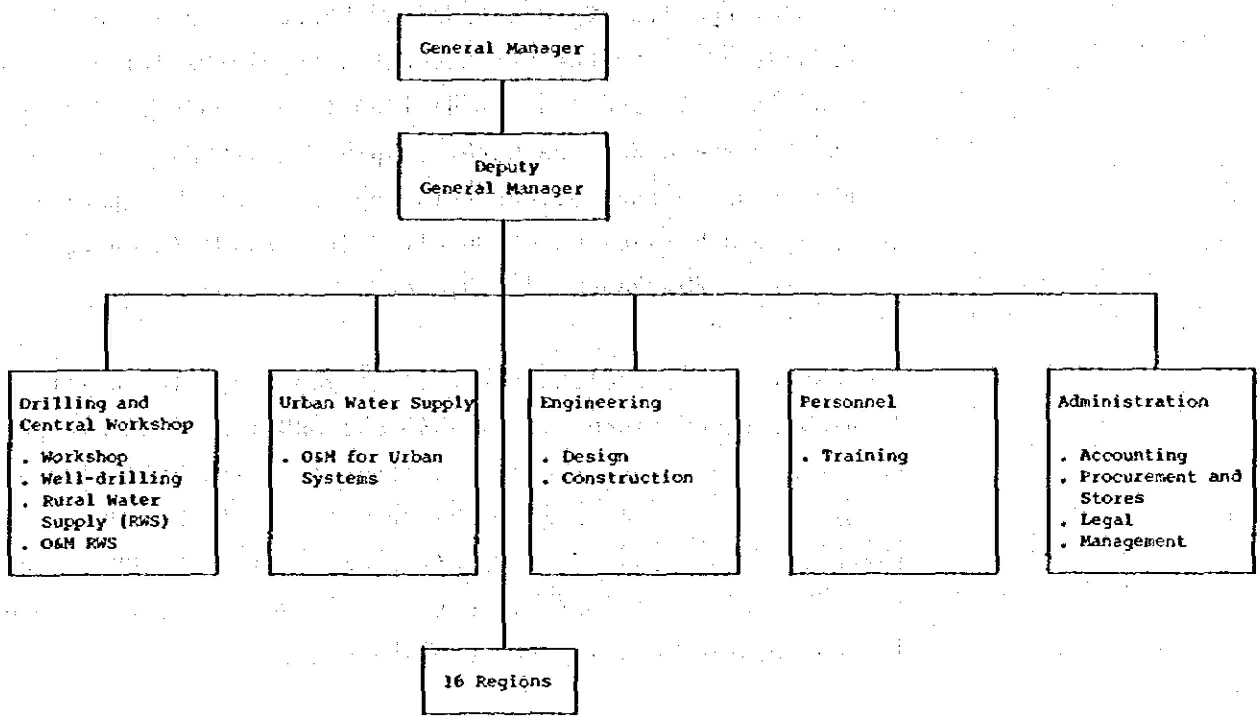
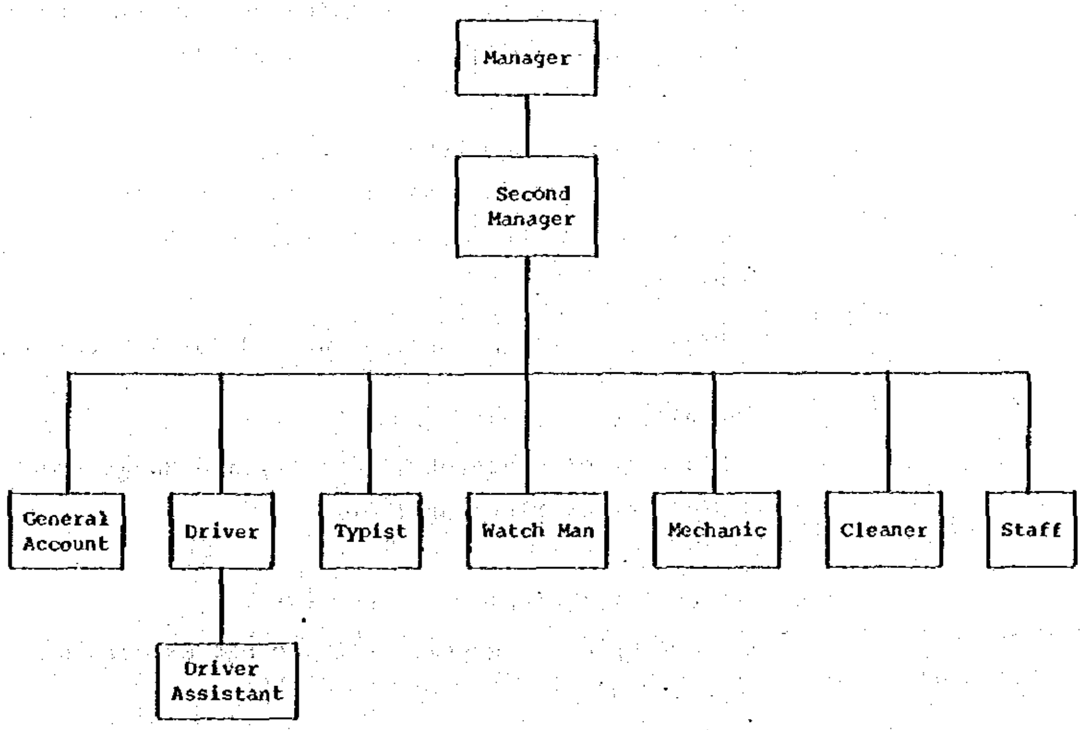


Fig. 2-5 Organizational Structure of WDA Regional Organization



The administrative organization in charge of water service in refugee camps is the Refugee Water Supply Division belonging to the WDA. The RWSD is divided into 2 units. One is the Northwestern Refugee Water Supply Unit (NWRWSU) in charge of the camps in the northwestern regions, and the other is the Southern Refugee Water Supply Unit (SRWSU) in charge of the camps in the southern regions.

The water supply project for the refugee camps in Somalia, is proposed and discussed by RWSD and NRC (National Refugee Committee) which are the institutions in charge of refugee camps under the WDA as an executive agency of the MMWR. Further discussions on the project are made by UNHCR for the final decision. According to the final decision, the project is implemented by using the UNHCR's fund.

For reference, the roles of the government ministries and agencies may be summarized as follows:

(a) Ministry of Mineral and Water Resources (MMWR)
provides instructions and guidance for the management of 4 agencies (WDA, MWA, HEA, and KWA).

(b) National Water Committee (N.W.C.)
decides on project plans for the 4 agencies. The members of the committee consists of the following ministers.

- ° Minister of local Government and Rural Development (MOLG+RD)
- ° Minister of Health (MOH)
- ° Minister of Livestock, Forestry and Range (MOLF+R)
- ° Minister of Planning (MOP)

(c) National Technical Committee (NTC)
is made up of 4 agencies and are the experts of MMWR to support NWC.

(d) Water Development Agency (WDA)
takes charge of construction and administrative management of water supply facilities and related services in the regions except in the 3 cities of Mogadishu, Hargeisa and Kismayo.

(e) Mogadishu Water Agency (MWA)
takes charge of construction and administrative management of water supply facilities and related services in Mogadishu.

(f) Hargeisa Water Agency (HWA)
takes charge of construction and administrative management of water supply facilities and related services in Hargeisa,

(g) Kismayo Water Agency (KWA)
takes charge of construction and administrative management of water supply facilities and related services in Kismayo.

(h) National Refugee Commission (NRC)
takes charge of countermeasures against refugees in Somalia.

(i) United Nations High Commissioner for Refugees (UNHCR)
was established in 1951 based on the decision made at the general meeting of the United Nations held in 1949. This organization is to give refugees international protection and to facilitate permanent settlement of the refugee problems.

(j) Economic Relief and Development Group for Somalia (ERDGS)
is a relief organization formed by European Protestants which also assists the agricultural program in Beled area.

(2) The present status of the nation's water administration.

In Somalia, a nationally unified rate is charged on drinking water, in August, 1983, the water rate was newly raised to 10 shillings/m^3 from the old 4.5 shillings/m^3. This charge was systematically decided according to the estimated water consumption irrespective of the actually consumed amount, and is levied on users in both urban and rural areas. But, in reality, the collection rate in rural areas is farely low. Table 2-3 shows the livestock water charge based on the new water charge started in August, 1983. As shown in the table, this charge is also determined by estimating water consumption per animal. However, it is quite doubtful whether this rate is applied and implemented equally in every district.

There are also shortages and malfunctions of water meters, and in many cases water leaks from water pipes and livestock pools. Countermesures against these problems are deemed necessary.

Table 2-3 Estimated Rate for Livestock Water

Variety of livestock	Estimated number of livestock in the region	Estimated water consumption	Charge per animal	So.Sh/m^3
Camels	5-5 mil. 2/	200 lit./day	0.70	3.5
Cattle	4-8 mil. 2/	60 lit./day	0.40	6.7
Goats Sheep	25 mil.	6 lit./day	0.10	16.7

The salaries for water rate collectors posted at the public water filling stations and other water supply stations in rural areas, are paid in principle by the government. However, the introduction of a commission payment system is being considered in order to collect more rates and achieve financial independence.

Presently, the current expenses for WDA are covered by the national budget. The current expenses for MWA, HWA and KWA, which employ the self-supporting accounting system, are also receiving deficit-covering supportive finance from the national budget.

2-3-3 Establishment Project for Water Supply Facilities

(1) The long-term targets

At present, the Government of Somalia is implementing the National Water Supply Decade. (Table 2-4) According to it, the water supply rate in cities, Mogadishu, Hargeisa and Kismayo, and 68 urban areas whose population ranges from 5,000 to 40,000, will be raised from the current 60% to 80%. The daily maximum water consumption per head will also be increased to 130 liters from the present 40 liters for house connections and to 30 liters from the present 15 liters for public function.

In 3,260 villages with less than 5,000 inhabitants, the Project aims to achieve a 50% diffusion of water supply from the present 20% and 25 lcd from the present 10 lcd.

For nomads who account for 50% of the nation's total population, similar objectives in rural villages are being provided.

According to the plan, percent of service coverage as a whole will be aimed at 57% by 1990, which means 3.88 million out of an estimated 6.8 million of total population in 1990.

The Government of Somalia estimates that US$350 million of the total budget is needed to achieve these targets of the Project. (See Annex-7) This calculation was based on the U.S. currency exchange rate of 1983. The official exchange rates for Somalian Shillings were US$1 = So.Sh. 15.05 in December, 1982, and US$1 = So.Sh. 40.0 in June 1985 while in general US$1 = So.Sh. 85.0. Since commodity prices are rapidly changing, the budget must be revised.

The present budget prepared is US$40 million. As it is difficult to increase the national funds as planned, implementation of the Project heavily depends on foreign assistance.

Up to now, the Project has been rearranged so many times that the degree of contents has somewhat been reduced.

At the moment, the investment budget for the 5-year plan from 1982 to 1986 is U.S.$150 million, and for the 3-year mid-term restoration project from 1984 to 1986 the budget is US$135 million.

Table 2-5 shows the water service level of the long-term Targets. Table 2-6 shows the water supply improvement Targets in rural area.

Table 2-4 Target of the Water Supply Plan

	Present Situation (1982)	Decade Target (1990)
Nationwide		
Population		6,800,000
Water Supply Coverage		57%
Urban Areas		
Water Supply Coverage	60%	80%
Daily Maximum Water Consumption per Head		
House Connection	40 lcd	140 lcd
Public Fountain	15 lcd	30 lcd
Rural Area		
Water Supply Coverage	20%	50%
Daily Consumption per Head	10 lcd	25 lcd

Table 2-5 Water Supply Level by 1990

	Presumed Basic Year 1982 Implementing Rate		Planned Year 1990 Implementing Rate	
Urban Water Supply	House connection	Public fountain	House connection by 130 lcd	Public fountain by 50 lcd
° Mogakishu	35%	65%	50%	50%
° Major towns	25%	75%	40%	60%
° Smaller towns	20%	80%	30%	70%
	(60%)		(80%)	
Rural Water Supply	Water filling stations	Public fountain	Water filling station by 20 lcd	Public fountain by 30 lcd
	75%	25%	40%	60%
	(20%)		(50%)	

Table 2-6 Water Supply Improvement Targets in Rural Area

Item	Unit of Quantity		Unit Cost So.Sh. (US$) Million		Total Cost So.Sh. (US$) Million	
Deep wells drilled	No.	50[1]	1.26	(0.084)	63.21	(4.20)
Deep well pumps	No.	90	0.15	(0.010)	13.55	(0.90)
Pump houses	No.	90	0.10	(0.007)	9.48	(0.63)
Houses for pump operat.	No.	90	0.30	(0.020)	27.10	(1.80)
Piping 2" diameter	No.	1600	0.26	(0.017)	409.36	(27.20)
Standposts	No.	550	0.12	(0.008)	66.22	(4.40)
Shallow wells dug	No.	2000	0.037	(0.0025)	75.25	(5.00)
Shallow wells rehabilitated	No.	1200	0.023	(0.0015)	27.09	(1.80)
Hand pumps	No.	8000	0.011	(0.00075)	90.30	(6.00)
Clear water storage in thousands m^3	No.	3600	0.226	(0.015)	812.70	(54.00)
Rain catchment area	Km^2	30	45.15	(3.00)	1354.50	(90.00)
Rainwater storage in thousand m^3		500	0.10	(0.007)	526.75	(35.00)
Slow sand filters		3	1.20	(0.080)	3.61	(0.24)
Infiltration galeries	Km	40	1.13	(0.075)	45.15	(3.00)
Fence	Km	750	0.075	(0.005)	56.44	(3.75)
			Total for Rural Water Supply: -			237.92
Individual latrines in thousand[2]		150	2.26	(0.15)	338.62	(22.50)
Total Rural Water Supply and Sanitation					3919.33	(260.42)

1) Forty wells already drilled have been excluded.
2) One latrine per household.

(2) Implementing the Water Supply Facilities Establishment Project

In order to realize the targets described above, numerous plans have been made in Somalia. However, in many cases, project implementation depends on the foreign aid conditions, because the fund raising for starting construction heavily depends on financial assistance from abroad. Even the four water supply projects (Table 2-8) preferentially planned by the government have not found any fund source (total budget US$42.6 million) Projects (Table 2-9) whose construction is planned to begin from this year, have no future possibility of financing (total budget US$12.24 million). Outlined below are the projects in 4 categories; (1) projects already completed (Table 2-7), (2) projects planned in the past but suspended because of financial difficulties (Table 2-8), (3) projects presently being planned with future financing prospects (Table 2-9), (4) projects being planned at present but no future prospects of fund raising (Table 2-10).

Table 2-7 Completed Projects

(1)

Project/Activity	Source of Assistance	Assistance Committed in US$		Duration of Total Project Begin-End Dates	Location and Nature of Assistance
			For Project Duration		
Comprehensive Groundwater	USAID		13,000,000	1979 - 1984	The groundwater development construction which required 140 borings in the Bay Region and Central Range Land Region. WDA is supervising this Project.
Rural Water Reservoirs	UNDP		199,000	1982 - 1983	The water supply system for Livestock during the dry season.
Intergrated Social Development, Water Supply, etc.	Italy Netherlands Norway Jayson (NGO) Switzerland UNICEF Canada FRG		4,200,000	1st term: 1982 - 1984 2nd term: 1984 - 1984	The provision of water supply and sanitary services to 3 villages in the Northwest Region. This project includes 60 hand drilled wells, 30 catchment basins, 4 deep-drilled wells, 20 relay pumps, 500 hand pumps, 30 water tank and 5 catchment dams.
Urban Water Supply System	China		Not identified.	Not identified.	The water supply facilities for Hargeisa and Baidera regions.
Urban Water Supply System	USAID		30-year repayment with low interest.	1969 -	The water supply facilities at Mogadishu and Kismayo.
Rural Groundwater	China		Not identified.	1982 -	24 Boring sites for agricultural water at Togdheer, Bari, Nugai and Sanaog regions.

(2)

Project/Activity	Source of Assistance	Assistance Committed in US$		Duration of Total Project Begin-End Dates	Location and Nature of Assistance
			For Project Duration		
Rural Water Supply and Sanitation	UNHCR		2,500,000	1982 - 1984	The relief assistance for 700,000 refugees at 36 refugee camps in 4 regions. Main objective of the water supply and Sanitary services is to realize 10-15 lcd water supply per refugee.
Rural Development	Belgian Survival Fund (BSF)		2,200,000	1983 - 1985	Water supply from the dug and drilled wells for 75,000 - 100,000 people living in the villages around Jowhar City. The administrative agency is WDA.
Rural Development	Saudi Government Aid		10,000,000	1983 -	The water supply facilities for approximately 40 villages in Mudog, Galgadud, Hiran, Bahool and Gedo regions. GTZ is the implementation organization.
Urban Water Supply	World Bank Islamic Development Bank Arab Fund		16,600,000	1984 - 1986	The 2nd stage construction at Mogadishu.
Urban Water Supply	W. Germany		26,400,000	1984 - 1986	Not identified.
Urban Water Supply	Italy		4,000,000	1984 - 1986	Not identified.
Urban Water Supply	China				At Hargeisa.
Comprehensive Groundwater Development	USAID		16,000,000	1984 - 1986	Not identified.

Project/Activity	Source of Assistance	Assistance Committed in US$		Duration of Total Project Begin-End Dates	Location and Nature of Assistance
			For Project Duration		
Urban Water Supply	Somali Budget & Foreign Funding		Construction completed (as a part of the 3-year project)	1981 - 1982	The first stage construction of the Mogadishu water supply expansion project.
Urban Water Supply	Same as above.		Same as above.	1984 - 1984	Mogadishu second stage construction, Deep-drilling of 4 wells.
Urban Water Supply	Same as above.		Same as above.	1983 - 1984	Mogadishu second stage construction; 24 production wells, 65 km piping, 7 km sewer, 45 fountains, a power station and a reservoir with 24 pumps.
Urban Water Supply	Same as above.		Same as above.	- 1983	The first stage construction of water supply in Algoi, Balad, Jouhar, Meroa.
Rural Water Supply Deep Bore-Holes (Water Development Agency)	Same as above.		Same as above.	1973 - 1984	350 wells were drilled throughout the country.
Rural Water Supply Deep Bore-Holes (Water Development Agency)	Somali Budget		Same as above.	1983	10 deep-drilled wells were constructed.

Project/Activity	Source of Assistance	Assistance Committed in US$		Duration of Total Project Begin-End Dates	Location and Nature of Assistance
			For Project Duration		
Rural Water Supplies Deep Bore-Holes (Water Development Agency)	Same as above.		Construction completed (as a part of the 3-year project)	1984	4 deep-drilled wells were constructed.
Rural Water Supplies Deep Bore-Holes (Water Development Agency)	China		Same as above.	1983 - 1984	16 deep-drilled wells were constructed.
Rural Water Supplies Deep Bore-Holes (Water Development Agency)	Somali Budget		Same as above.	1983	3 irrigation ponds with the capacity of 20,000 - 30,000 m^3.
Rural Water Supplies Deep Bore-Holes (Water Development Agency)	Same as above.		Same as above.	1984	One irrigation pond with the capacity of 20,000 - 30,000 m^3.
Rural Investigation & Research	Somali Budget & Foreign Funding		Same as above.	1982 - 1984	Development of the preferential areas of Bay, Hiran, Galgadud, Mudugh regions, through the research of the Central Range Land Development Project and the Bay Region Agricultural Development Project. This project included 64 test drillings and recording, and 29 well-drillings.

Table 2-8 Project Planned in the Past

Project/Activity	Source of Assistance	Assistance Committed in US$		Duration of Total Project Begin-End Dates	Location and Nature of Assistance
			For Project Duration		
Rural Drinking Water (Priority Project)	——		3,100,000	2 - 3 years	Repair and improvement of shallow and deep-drilled wells being used in the Northwest Region.
Rural and Urban Water Supply (Priority Project)	——		15,100,000	3 years	The water supply plan for Sheikh, Odweyne, and Buhadle regions in the Northern Somalia. The shallow and deep-drilled wells are to be used and 150,000 people will be covered by this water supply project.
Underground Development (Priority Project)			200,000		The water supply construction using a natural fountain in the Bari region of the Northeast as water source.
Rural Development	——		24,200,000	over 5 years	The construction of water supply and Sanitary services in the lower and the Middle Shebelle regions. When the construction is completed, 240,000 people will benefit.

Table 2-9 The Presently Planned Projects with Future Prospective Financing

(1)

Project/Activity	Source of Assistance	Assistance Committed in US$		Duration of Total Project Begin-End Dates	Location and Nature of Assistance
			For Project Duration		
Urban Water Supply	Somali Budget & Foreign Funding		Planned	1985 - 1985	The 2nd stage of construction of Magadishu water supply expansion, 35 km of pipe line and power station.
Rural Water Supply Deep Bore-Holes (Water Development Agency)	Saudi Financing		Same as above.	1985	Not identified
Rural Water Supply Deep Bore-Holes (Water Development Agency)	Same as above.		Same as above.	1985	The Power Station for 53 pumps and existing wells.
Rural Water Supply Deep Bore-Holes (Water Development Agency)	Same as above.		Same as above.	1985	20 production wells.
Rural Water Supply Basin (Water Development Agency)	Somali Budget		Same as above.	1985	33 boring test and 21 pumps.
Rural Water Supply Basin (Water Development Agency)	Same as above.		Same as above.	1985	One irrigation pond with capacity of 20,000 - 30,000 m^3.

(2)

Project/Activity	Source of Assistance	Assistance Committed in US$		Duration of Total Project Begin-End Dates	Location and Nature of Assistance
			For Project Duration		
Rural Water Supply Shallow Wells and Traditional Method (Ministry of Home Affairs)	Somali Budget		Planned	1985	19 shallow wells and construction of 52 water catchment facilities by traditional method.
Rural Investigation and Research	Somali Budget & Foreign Funding		Same as above.	1985 - 1986	The second stage construction, following the 1st stage construction in the Bay region.
Urban Water Supply	Same as above.		Same as above.	1985 - 1987	Expansion of Hargeisa water supply facilities. 6 pumps, 3 reservoirs, 22.5 km trunk line, 10.4 km water pipe, a power station and a booster pump.
Urban Water Supply	Same as above.		Same as above.	1985 - 1987	The second stage construction of water supply in Erigavo, Qardo, Galkayo, Garowe and Dusamareb.
Urban Water Supply	Same as above.		Same as above.	1985	Expansion of Berbera water supply facilities, consisting of one reservoir, 1 water distribution facility and reconstruction of waterworks.
Urban Water Supply	Same as above.		Same as above.	1985	The Mogadishu second stage construction, 35 km piping and one power station.

Table 2-10 The Planned Projects without Any Prospects of Financing

Project/Activity	Source of Assistance	Assistance Committed in US$		Duration of Total Project Begin-End Dates	Location and Nature of Assistance
			For Project Duration		
Urban Wells	Undecided.		Planned budget 1,000,000	1985	Repair of Balad Road well water source area for Mogadishu water supply.
Urban Water Supply	Same as above.		Planned budget 10,250,000	1985 - 1987	The 2B stage construction of Mogadishu water supply expansion. To complete the present water-distribution facilities and development of Garas Bintow water source well area, including 23 production wells, pumps, a power station, near-by roads and piping for a reservoir.
Urban Water Supply	Same as above.		Planned budget 560,000	—	Repair of Kismayo water supply facilities, consisting of waterworks, water distribution facility and pumps.
Groundwater Investigation	Same as above.		Planned budget 430,000	1985	The test drillings and well drillings in the Shebelle and the Lower Shabelle regions.
ICARA - II Lower Shabelle Water Supply	Undecided. (Japan)		Undecided.	Undecided.	The test drilling and well drilling in the shebelle and the Lower Shabelle regions.

2-4 Present Status of Ground Water Utilization and Development Project

2-4-1 Present Status of Groundwater Utilization

Somalia consists of two climatic zones, the northern region of Somalia belongs to the Dry Zone and the yearly precipitaion is 50 ∿ 300mm. The southern region of Somalia belongs to the Savanna Zone and the yearly precipitation is 300 ∿ 600mm. The rainfall is limited to the period from April to June, and from October to November. Since a limited amount of rainfall can be expected only during these short periods, the Shabelle River and the Juba River are the only two reliable surface water resources. During the dry seasons, the level of river water drops considerably and sometimes dries up.

During the dry seasons and in the northern part, where no big rivers exist, water supply depends on groundwater resources. As shown in Table 2-11, there are also some regions depending on groundwater as a water resource during the dry seasons.

In particular, the water supply facilities in cities and villages (total water supply capacity 25,000 m^3/day) mostly depend on groundwater, except in Kismayo.

In the case of the refugee camps, as mentioned in 2-2-4 (Table 2-2), groundwater development projects were carried out in the north-western regions with support from the People's Republic of China, and in the Gedo and the Hiran regions with support from UNICEF. These water resources are used mainly for refugees' water for daily use and for agricultural development projects.

Table 2-11 Annual Water Requirements and Availability in Somalia 1980

Regions	Area (km^2)	Average Rainfall (mm)	Population (000)			Annual Water Requirement Million (m^3)			Average Annual Surface Water Resources million (m^3)	Total Annual Total Water Extraction Million (m^3)				Total Water Available Million (m^3)		% Ground Water Shortfall
			Human	Camels & Cattle	Sheep & Goats	Human	Livestock	Total		Drilled Wells No.	Drilled Wells Volume	Shallow Wells No.	Shallow Wells Volume	With Normal Rainfall	During Drought	During Drought
North West	86,000	300	690	1,115	7,130	2.55	7.83	10.38	-	59	3.22	21	0.66	129.00	4.38	58
North East	174,000	150	380	201	6,502	1.21	6.04	7.25	-	32	2.02	28	0.88	130.50	2.90	60
Central	113,000	150	391	1,204	6,202	1.32	7.81	9.13	-	165	10.41	22	0.67	84.75	11.10	-
Shabelle	82,000	350	1,233	1,968	2,806	8.04	9.05	17.09	2,090	134	8.45	52	1.64	143.50	10.09	41
Juba	116,000	350	641	2,645	1,483	2.14	15.30	17.44	6,066	153	9.65	37	1.67	203.00	11.32	35
Inter Riverine	66,000	400	403	909	600	1.99	5.25	7.24	-	107	6.76	32	1.01	127.00	7.76	-
Total	637,000	283	3,738	8,042	24,723	17.25	51.28	68.53	8,156	650	40.51	192	6.55	817.75	47.55	31

Source: From the UN Multi-Agency Drough Mission Report, October, 1980.

2-4-2 Projects Concerning Groundwater Research and Development

Despite the continuous research into groundwater resources and countless borings, there is only a limited amount of data available on groundwater locations, quality and quantity. This is because advanced measuring, recording and monitoring techniques are not available among the many contractors that conducted the well drillings. Thus the lack of research and information about water resource utilization continues even today.

The first groundwater borings were conducted by a United Nation's team in 1973. At that time, however, precise research and studies were not carried out. Though it is said that 60 ∿ 70 test drillings were conducted at that time, data on a considerable number of wells are missing due to the poor record keeping conditions.

Presently, the Government of Somalia is conducting a geological survey of water resources in order to systematize data analysis and collection. This survey is being carried out by the Geology Divisions of the MMWR and WDA reinforced by experts sent from West Germany, the United States Agency for International Development (USAID) and the food and agriculture organization of the United Nations (FAO).

Other ongoing projects are the foreign assisted groundwater development projects, by USAID, the Peoples Republic of China, and UNICEF (See Fig. 2-6 (1), 2-6 (2)). Since 1980, USAID has been conducting well drillings and a comprehensive survey of the groundwater in the Bay Region and the Central Range-Land Region has been carried out. Training programs for geologists, engineers and technicians, and data collection are also being carried out, while 74 borings for daily water use and 66 well drillings for livestock use are presently been conducted. These operations are to be continued till 1985 by USAID.

The People's Republic of China is conducting groundwater development (construction of 24 boreholes) at agricultural villages in Togdheer, Bari, Nugal and Sanaag districts.

UNICEF is actively involved in groundwater development as part of the integrated social development project for the areas surrounding the refugee camps. Groundwater development by foreign assistance is shown on Fig. 2-6 (2).

2-4-3 Possibility of Groundwater Development

Whenever droughts happened in the past, Somalia experienced water shortages due to shallow wells running dry or decreases in the well water. Though these shortages are not believed to indicate that the presently utilized groundwater volume exceeds the potential capacity of groundwater resources, there are several serious water quality problems in the shallow aquifers which is planned to be developed as a water source for drilled wells. The mineral contents of this stratum reportedly exceed 4,000 mg/lit. This figure remarkably exceeds 1,500 mg/lit., the maximum permissible limit of mineral contents stipulated in the 1971 International Standards for Drinking Water by the World Health Organization (WHO).

Actually, people living there are taking in at a least 3,000 mg/lit. of water.

The water quality of the Shabelle River and Juba River also fluctuates widely throughout the year. Comparing the two rivers, the water of the River Juba is generally of a higher quality than that of the Shabelle River.

Another problem pointed out is the danger of over-developing certain groundwater resources located in the Dry Zone and in the alluvium of the Shabelle River.

Fig. 2-6 (1) Areas of Major Ground Water Resources Studies and Well Drilling Projects

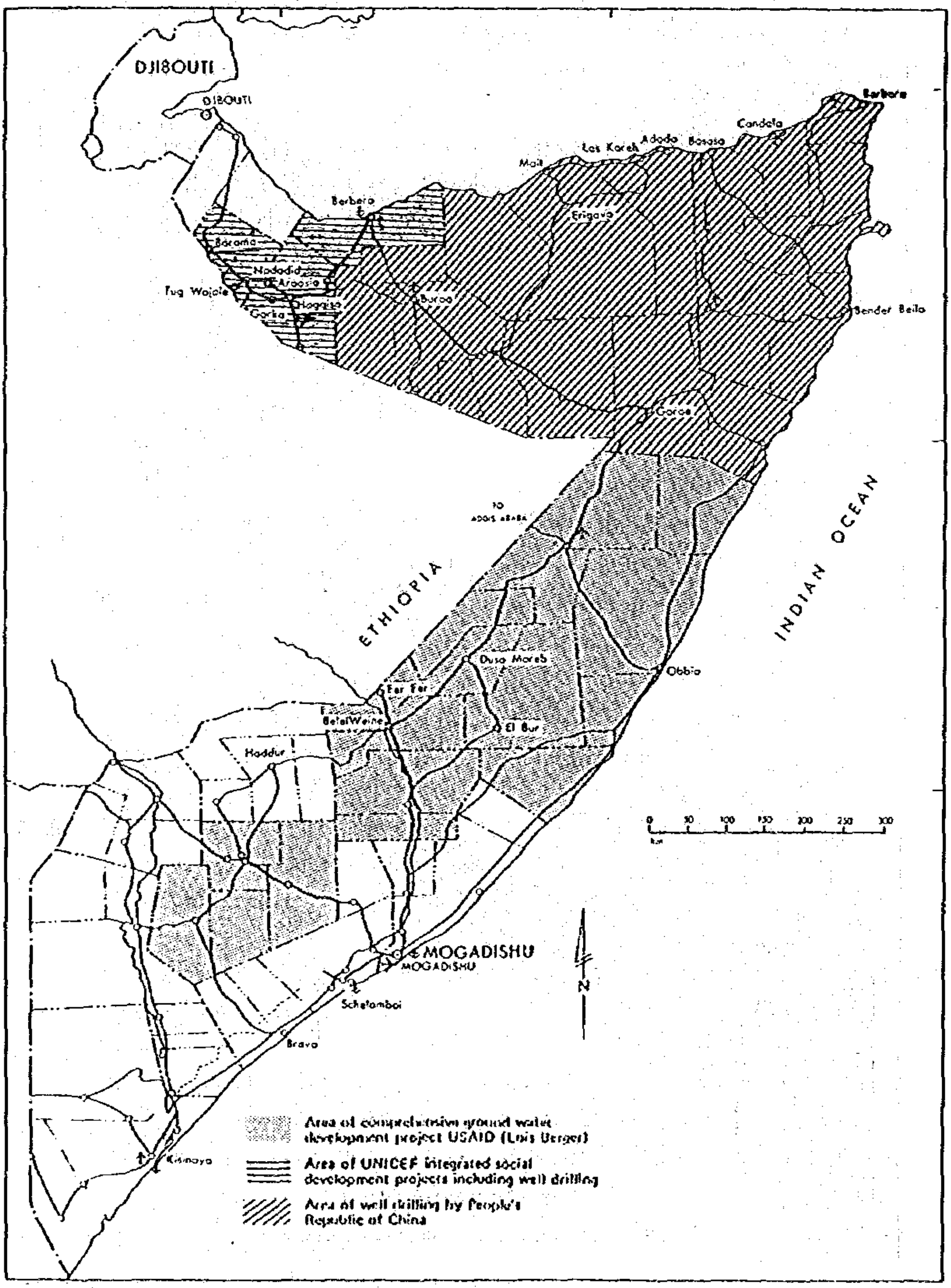
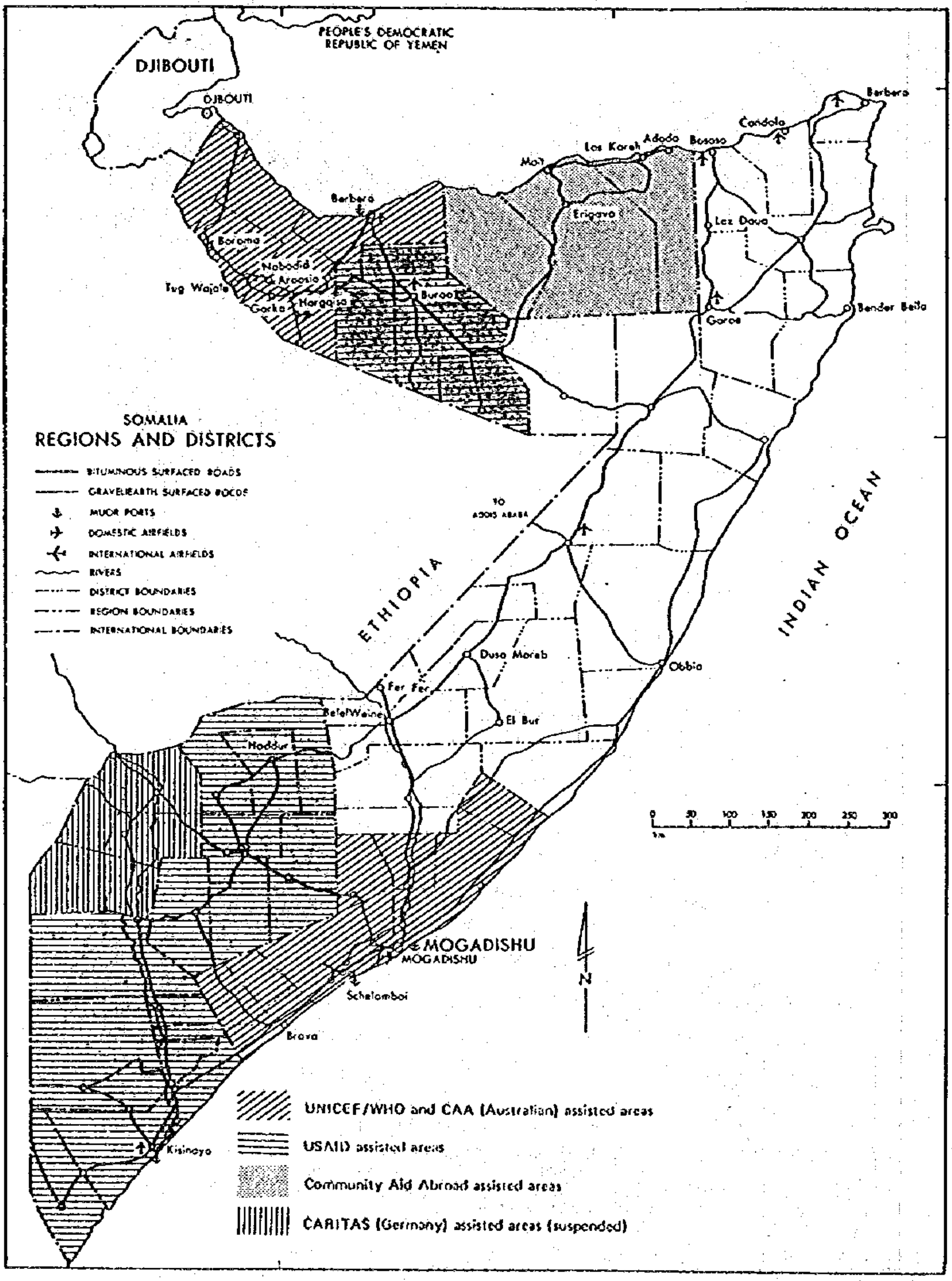


Fig. 2-6 (2) Regions Where Primary Health Care Programmes are Being Implemented



In view of these problems, it becomes necessary to find a solution to the problem of unequal water distribution from groundwater resources, and to conduct meaningful investigations for the utilization of the remaining groundwater.

It is most important to continue groundwater development while striving to solve these problems.

There is also the possibility of effectively utilizing the surface water that runs off during the rainy season by constructing effective reservoir facilities like underground reservoirs. Such attempts are already under way in certain limited areas. Further research and development in this field are expected to continue.

2-4-4 The Status of Groundwater Development in Refugee Camps

As a short-term water supply measure for the refugee camps, in the beginning of 1980, the international volunteer organizations and W.D.A. of the Government of Somalia constructed, in and around the camps, small surface water treatment devices (Coagulo-sedimentation treatment by PAC), dug wells and shallow wells. As a result, 5 ∿ 7 lcd of drinking water was made available. However, for water supply facilities whose water resources are the Shabelle River and the Juba River, no water supply is possible during the dry season, and during the rainy season, there is the problem of not being able to supply good quality water because of the high turbidity of the water. In addition the dug wells and shallow wells in and around the camps are not very sanitary and contain a very high salinity.

In order to stably supply safe water throughout the year, UNICEF and WDA financed by UNHCR, carried out groundwater development, i.e. constructed 47 production wells and conducted 179 test drillings at the refugee camps the Hiran, Gedo and Lower Shabelle regions.

As a result, one well was able to pump up 4.3 m^3/hr to 72 m^3/hr of groundwater, and the 15 lcd of water supply, based on a groundwater resource, was established in 6 out of 12 refugee camps in the Gedo region, and in 8 out of 11 refugee camps in the Hiran region. But the Lower Shabelle region was not able to adopt groundwater as a water resource due to the high salinity of the water.

For the water supply in the northwestern region where no surface water resource is available, the lesser target of 10 lcd is set for the present groundwater development with assistance from the People's Republic of China.

2-5 Contents of the Request

Projects for water supply facilities are taking place at 35 refugee camps. The objectives of these projects are to establish the infrastructure in the refugee camps and the surrounding areas and also to provide an environment for the refugees to settle in, while increasing the productivity of agriculture and livestock farming.

In the northwest region, the projects for water supply facilities are continuing with assistance from the People's Republic of China, and in the Hiran and Gedo regions of southern Somalia with assistance from UNICEF.
Regarding the projects in the 3 camps in the Lower-Shabelle region UNICEF made an attempt to develop a groundwater resource around the camps, in place of the conventional water purification method using surface water resource which is not available through the year. However, because the salinity of the groundwater around the camps was too high to be a water resource, the groundwater development project was Abandoned in the Lower Shabelle region. Later, Dr. Costantino Faillace, sent by the German Agency for Technical Cooperation (GTZ), of the Federal Republic of Germany to WDA as an adviser, had proposed to the Government of Somalia a plan seeking a water resource from the groundwater for the 3 camps in the Beled Amin area. According to the plan, the feasibility study was conducted with assistance from Italy, but the plan was suspended due to financial problems.

Under such circumstances, as a project related to ICARA-II, the Government of Somalia submitted a request for Grant Aid to the Government of Japan regarding the Project for water supply of 3 refugee camps and the surrounding areas in the Lower Shabelle region.

The outline of the request is to realize a stable, safe and year-round water suply to the 3 refugee camps and surrounding villages including Qoryooley Town, in order to improve the living environment, while developing the high potential agricultural and livestock farming in the Lower Shabelle area, in order to increase the living standards of the inhabitants.

The program is as follows:

1. Construction of the water supply facilities using the groundwater resource of the Beled Amin area to realize a stable water supply throughout the year.

2. Served Area
   Qoryooley Refugee Camp No. 1, 2 and 3
   Qoryooley Town and Villages surrounding the refugee camps.

CHAPTER 3

OUTLINE OF THE PROJECT AREA

CHAPTER 3 OUTLINE OF THE PROJECT AREA

3-1 General Situation

3-1-1 Location

The proposed area is located around the three refugee camps in the Qoryooley district of the Lower Shabelle region. This Region consists of Qoryooley Town, Qoryooley refugee camps, Beled Amin (which is the proposed water resource), and villages like Gaaywarrow which are scattered along the proposed pipeline (The planned water supplying area of the surrounding village was examined in 4-2, when considering the adequateness of the water resources and the water transmission pipeline.)

The Lower Shabelle region lies next to Mogadishu City's administration area and is part of the Southeast area. The Southeast area faces the Indian Ocean.

Shalambood City, the center of the Lower Shabelle region's administration, is located along the paved national road about 100 km southwest of Mogadishu City. 20 km to the west from Shalambood, is Qoryooley Town, the center of Qoryooley district.

The refugee camps 2 and 3 are about 4 km west from Qoryooley Town and Camp 1 is 4 km further west from camp 2 and 3. Qoryooley Town and the refugee camps are connected by an unpaved road.

Beled Amin area, the planned area for the water resource, is located between Shalambood City and Qoryooley Town.

3-1-2 Topography

The Lower Shabelle region is divided topography into two parts. Coastal dunes and inland plains.

The geological structure of the inland plains is flat and lacks variety and is located 60-70 m above sea level. In the middle of the plains the meandering Shabelle River flows Northeast to Southwest parallel with the coast line. The river is only 30-50 m wide, the hydraulic gradient is gentle, and the flow is slow. During the rainy season, the river easily overflows, causing flooding.

The inland plains have many flumes for irrigation using the water of the Shabelle River. In this area, irrigation is used for agricultural development and particularly in this area the main agricultural product is bananas.
The coastal sand dunes develop along the coast of the Indian Ocean and they are 120-150 m above sea level.

3-1-3 Geology

No outcrops of rocks can be seen on the surface of the Lower Shabelle area. The surface of this area is covered with alluvial deposit carried by rivers, sea and wind.

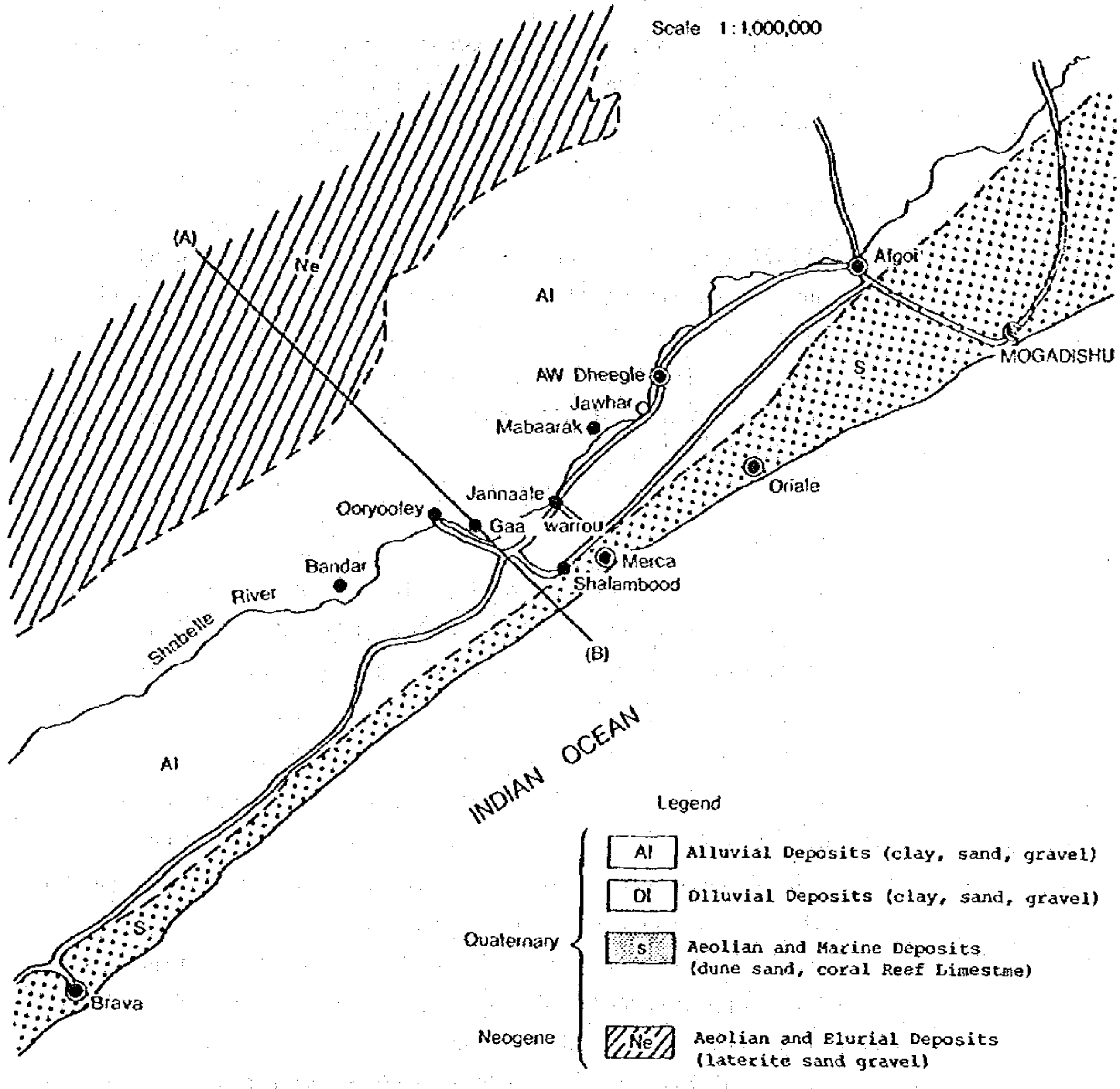
This area is divided geologically into three zones, as shown in Fig. 3-1, the alluvial deposit developed along the Shabelle River, the wind deposit and the residual deposit developed along the coast and the sand dunes formed by the deposits brought by the sea and wind.

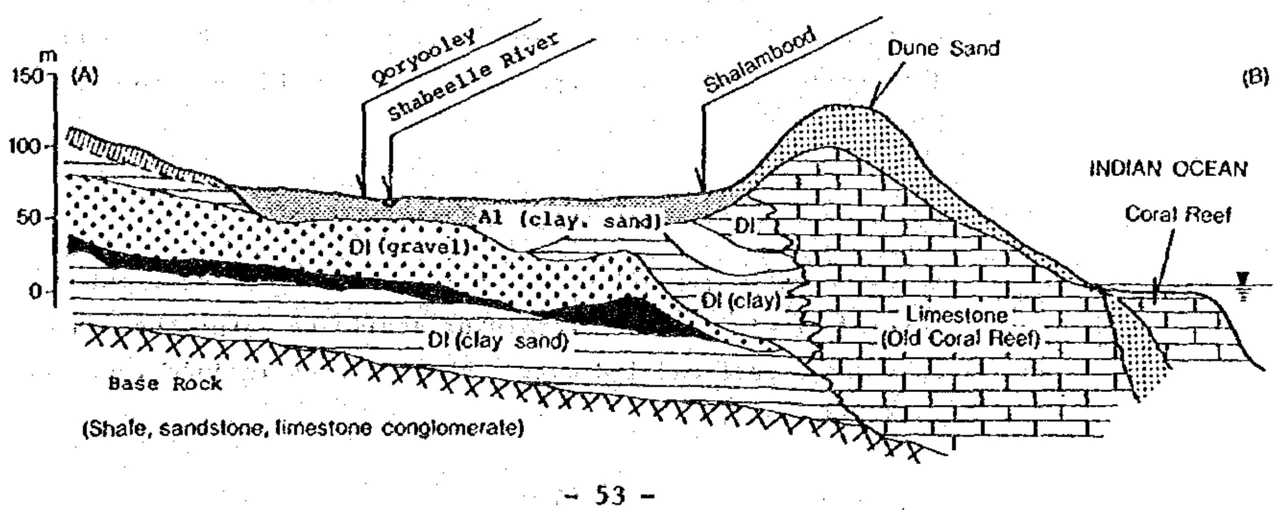
There is no information available about the situation of underground geological features and the geological structure around the planned area. Fig. 3-1 "the geological model section" was drawn up based on the geological data of wells and oil wells reported by Faillace (1964) and Agrotec (1978).

o Coral reef

Presently formed coral is seen in the shallow sea area.

Fig. 3-1 Geological Map





- Dune sand

  The sand dunes, along the coastal line, lying from northeast to southwest, are covering limestone which was the ancient coral reef formed during the pleistocene.

- Alluvial deposits

  Alluvial deposits consist of gray black colored clay, sand, and gravel, though the main composite is clay with a thin sand and gravel layer. This deposit is alluvium carried by the Shabelle River.
  Total thickness of Alluvial deposits is estimated to be from 10 m to 30 m thick.

- Limestone

  The porous limestone formed during the Pleistocene from the ancient coral reef is distributed under the sand dunes. This limestone is used for concrete aggregates and blocks.

- Diluvium deposits

  These deposits consist of clay, sand and gravel which is the sediment formed on the back of the ancient coral reef surface. According to the present well drilling documents, these deposits lie 10-30 m under the surface.
  In the strata between 10 m and 84 m under the surface, there is an approximately 30-meter deep aquifer made of sand and conglomerates holding good quality groundwater.
  The stratum of clay lies 60 m - 90 m under the surface. The depth of this stratum measures up to 30 m, but there is no information about any deeper strata below this stratum of clay.

- Aeolian and elurial deposits

  These deposits are efflorescent rock made up of sediment carried by wind and the remaining sediments after the aqueous substances were carried away. The deposits include laterite, sand and gravel.

o Base rocks

It is considered that base rocks are made up of Jurassic sandstone, Limestone, conglomerates and shale, or made up of Pre-Cambrian gneiss, migmatite and amphiblite.

3-1-4 Hydrology and Meteorology

(1) Hydrology

The river system of the Lower Shabelle region belongs to the Shabelle River water system that runs meandering from northeast to southwest through the center of the region.

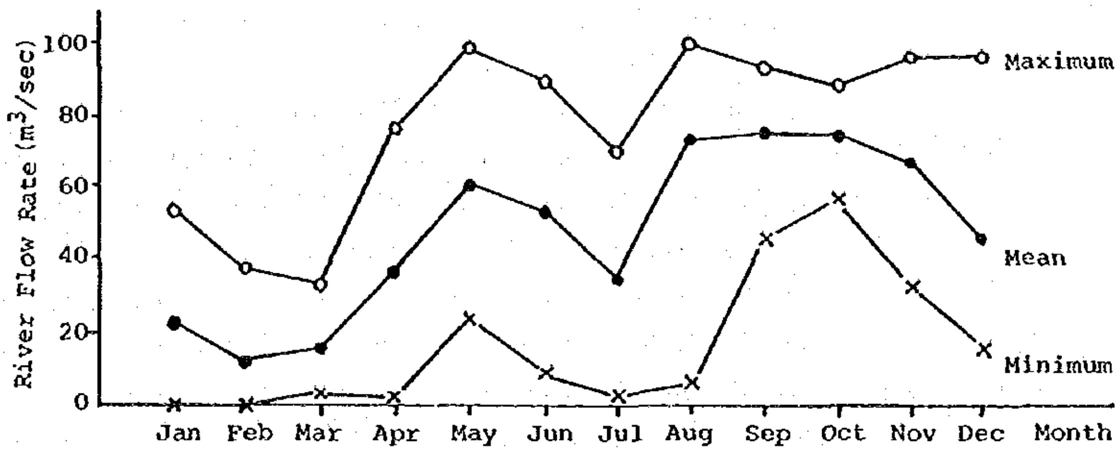
The Shabelle River is a long river originating in Ethiopia. The Shabelle River with its many tributaries flows toward the Lower Juba Region where it joins the Juba River and finally reaches the Indian Ocean.
At the Project area, the width of the river is approximately 30-50 m with a slow hydraulic gradient and flow rate. The discharge of River Shabelle according to the survey records for the past 12 years (station No.15: Awdheegle Observatory) is as follows. (Refer to the Annex -8 for details)

Average monthly flows .... 47.82 m^3/sec
Average maximum flows (August, 1977) .... 9,970 m^3/sec
Average minimum flows in February 1967,
and Jan.-Feb.1981 .... 0 m^3/sec

Fig. 3-2 has been made from the data of the observation records.
The discharge during three months from January to March is a very little, sometimes there is no discharge.
The catchment area of Awdheegle observatory is 280,000 km^2.

Around the Project area there are many channels for irrigation using the water of the Shabelle River. Of the discharge of main channels, measured in 1977, 277,000,000 m^3 water was used for agricultural purposes during the 5 months from August to December of that year. (Refer to Annex-8) This figure corresponds to approximately 31.5% of the average discharge of the Shabelle River between August and December. The irrigation area is 541.80 km^2.

Fig. 3-2 Monthly Shabelle River Flows



(2) Precipitation

The climate of the Lower Shabelle Region is divided into 3 seasons - the dry season from December to March, the rainy season from April to June and the middle season from July to November.

There is hardly any precipitation during the dry season from December to March. Particularly, from January to March, there is no rainfall.

The rainy season between April and June receives more than 50% of the yearly precipitation.

The yearly and monthly precipitation is shown in the Annex-8 and in Fig. 3-3. (See next page) These data were compiled from a 30-year record from 1929 to 1984 observed at Janaale Meteorological Observatory 10km north of Shalambood City.

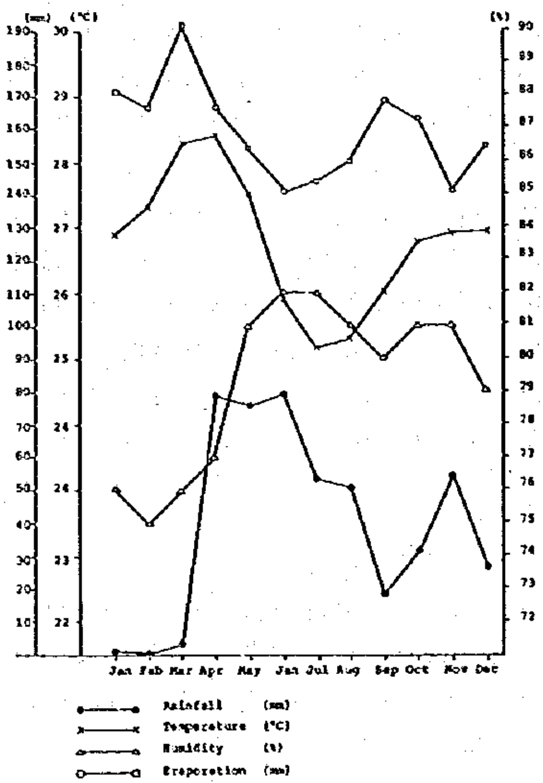
Average yearly precipitation (1929-1984)	465.0 mm/year
Maximum yearly precipitation (1951)	1,045.4 mm/year
Minimum yearly precipitation (1955)	148.9 mm/year
Maximum monthly precipitation (June,1951)	238.4 mm/month
Average maximum monthly precipitation (June)	80.4 mm/month
Average minimum monthly precipitation (Feb.)	0.1 mm/month

(3) Temperature

From March to April, the temperature rises, and begins to drop slowly from July to August when it shows the lowest. From August to October, the temperature rises again, from October to January, it becomes stable and after January it rises. According to Janaale Metrological Observatory, the yearly and monthly temperatures are shown in the Annex-8 and in Fig. 3-3. There are small differences between yearly and monthly temperatures.

Average yearly temperature	(1930-1984)	26.8 °C
Average monthly highest temperature	(Apr.)	28.4 °C
Average monthly lowest temperature	(June)	25.2 °C
Highest monthly temperature	(Aug. 1931)	30.9 °C
Lowest monthly temperature	(Aug. 1938)	23.5 °C
Highest daily temperature	(Mar.-May)	39.0 °C
Lowest daily temperature	(Jan.)	13.0 °C

Fig. 3-3 Meteorologic Data (Janaale)



(4) Evaporation Rate

The maximum evaporation (6.22 mm/d) occurs in March when the temperature is also high and the minimum evaporation (4.63 mm/d) occurs in July when the temperatures are low. The evaporation fluctuating pattern is almost the same as that of temperature. According to Jannale Metrological Observatory, yearly evaporation is as shown in the Annex-8 and in Fig. 3-3. The yearly evaporation is 1,914 mm. This evaporation is about 4 times as much as the yearly precipitation.

3-2 Hydrogeology

3-2-1 Mode of Occrurrence of Groundwater

The rocks of the Jurassic or the Precambrian constitute hydrogeologically a very hard impermeable rock bed. These rocks are being considered as the base rocks of the Project area.

The alluvial deposits and the diluvial deposit lying on the base rock make up an unsolidified stratum consisting of such sediments as clay, sand and gravel. It is a very appropriate stratum for holding groundwater. Particularly, the layers of sand and gravel satisfy the conditions for good aquifers. As for the water situation around the Project area, the plains in the district belonging to the Dry Steppe Zone have a very high evaporation rate corresponding to 4 times the volume of precipitation. This area has a long history of centralized agricultural development that provided many irrigation water channels, even used today, by utilizing the water of the Shabelle River. The area faces a lack of water during the dry season from December to March when there is hardly any flow of water in the Shabelle River. To overcome this water shortage, groundwater development (deep wells) is being carried out actively at Beled Amin and the area to the northeast through the southwest where agricultural development is taking place. Considering the groundwater recharging structure of the Project area, under such circumstances, recharging by rain fall on the plain cannot be expected.

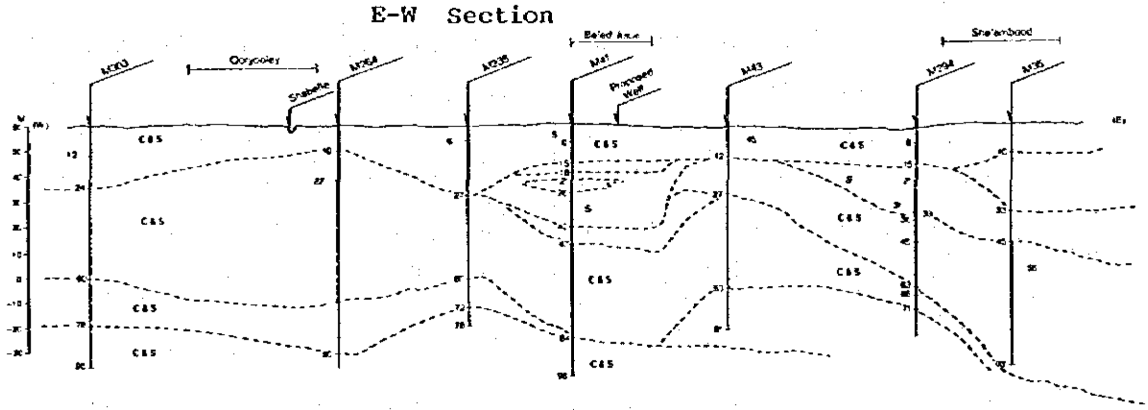
The groundwater recharging source is limited to the Shabelle River with its extensive basin, irrigation and irrigation channels.The main water source is the Shabelle River.

The upper stream of the Shabelle River is mountainous with a vast water catchment area consisting of rocks from the Jurassic to the Cretaceous. The area has a lot of rainfall, little evaporation and a lot of outflow due to the impermeable rock bed. The water flow reaches the plain containing sediments like sand and gravel, and penetrates into the ground with the help of the gentle hydraulic gradient. It is assumed that there must be a good groundwater supply under the plain.

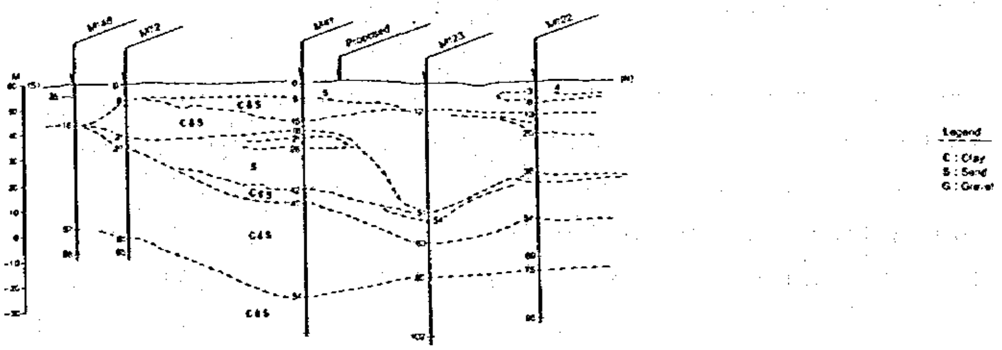
Fig. 3-4 is the presumed geological cross section of the Project area. This was drawn up based on the well data prepared and reported by Faillace in 1964. As shown, 10-80 m under the present surface, there is a deep continuous layer of gravel to form a desirable aquifer. The deep wells in the area where agricultural development is taking place, are being drilled toward this gravel layer. However, at the villages, the groundwater development concerning shallow wells is less than 10 meters deep. The target for these shallow wells is the alluvial sand layer that doesn't have good continuity like gravel. Also, the layer itself is not very deep, so it cannot be recognized as a good aquifer.

Fig. 3-4 Geological Cross Section

E-W Section



N-S Section



3-2-2 The Status of Existing Well Distribution

Because the Shabelle River dries up between December and March, the discharge is extraordinarily small. Because of such phenomena, Qoryooley and its surrounding areas face a critical shortage of water for daily and livestock use for 3-4 months every year. To overcome this water shortage, much efforts have been made to dig shallow and deep wells by manual or machinery excavation. Together with the refugee camps' establishment, deep well drilling for developing groundwater was carried out at 8 locations.

Despite such efforts, it was concluded as a result of investigation of groundwater around the Qoryooley area that the groundwater was not suitable for drinking water because of 3-10 g/ℓ of salinity.

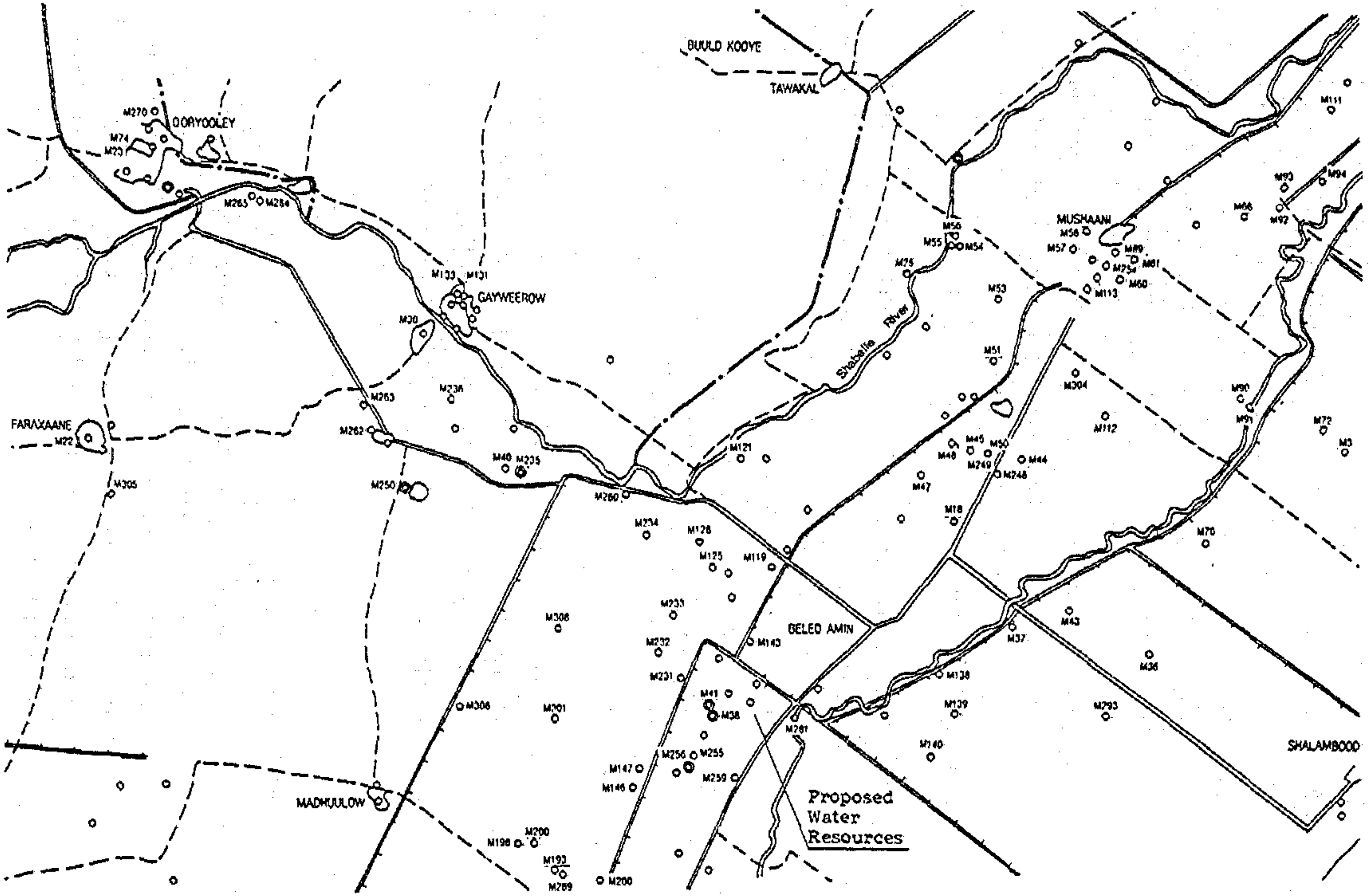
However, at the Beled Amin region located 11-12 km southeast from Qoryooley, many deep wells have been drilled and used for irrigation since the 1960s.

As shown in Fig. 3-5, the distribution of deep wells is concentrated along the irrigated areas spreading from northeast to southwest with Beled Amin as the center. There are other wells scattered in different areas. But those deep wells are not used now.

3-2-3 Status of Groundwater Utilization

The water source of drinking and daily water supply for Qoryooley and surrounding villages is the Shabelle River, the groundwater is not used for drinking because of its high salinity. This area's groundwater, particularly that from the shallow wells, is mainly used for irrigation and other miscellaneous purposes.

Fig. 3-5 Existing Well Distribution



However, at the irrigated area around Beled Amin, the groundwater is pumped up from the deep wells to be used for irrigation, drinking and other daily needs. The groundwater intake at the project area in 1978 is as shown in Table 3-1.

Table 3-1 Average Annual Abstraction of Groundwater

Origin of water	Yield (ℓ/s)	Number of wells	Hours use per annum	Yield (Mm3)
Hand-dug wells	0.025	51	1,460	0.007
Banana packing stations	10.0	10	1,560	0.562
Other wells	10.0	10	730	0.263
Irrigation wells	35.0	132	1,008	16.760
TOTAL estimated average annual abstraction				17.592

According to the figures above, at least 30 deep wells for irrigation have been excavated since 1978. It is assumed that at least 21.4 million m^3/year of groundwater is consumed.

The number of daily pumping hours is 1,008 hr/120 days = 8.4 hr/day.

3-2-4 The Distribution of Groundwater

The groundwater level was studied and reported by Faillace (1964) and MacDonald (1978). According to their data, the groundwater level is high in the narrow area spreading from northeast to southwest from Beled Amin (irrigated area and old river line). The above can be seen in Fig. 3-6, 3-7 and 3-8, which also includes groundwater head and groundwater level distributions. Particularly, around Beled Amin, the groundwater is distributed at 1-2 m under the surface.

Fig. 3-6 Groundwater Piezometry

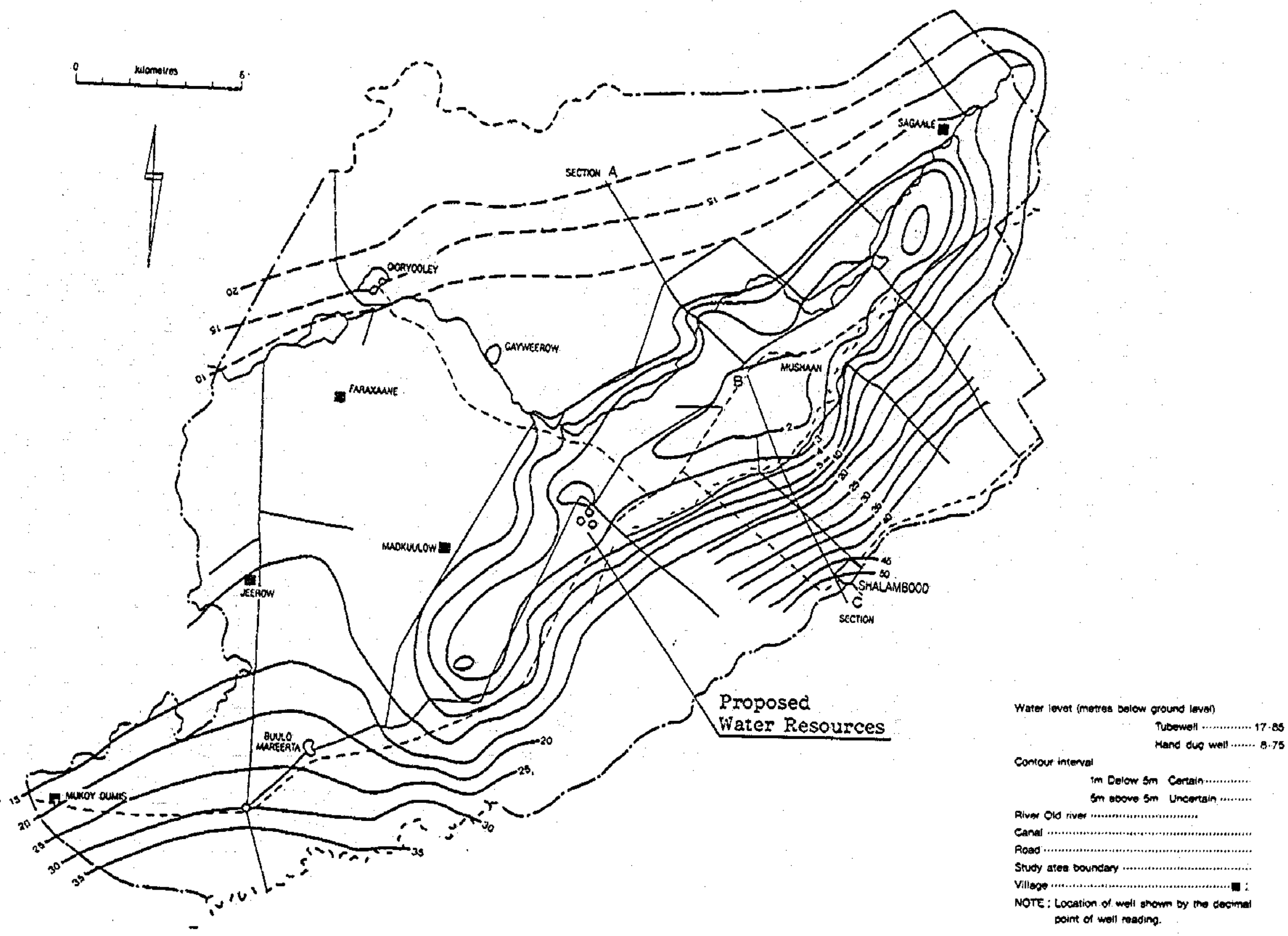


Fig. 3-7 Distribution Map of Groundwater Level

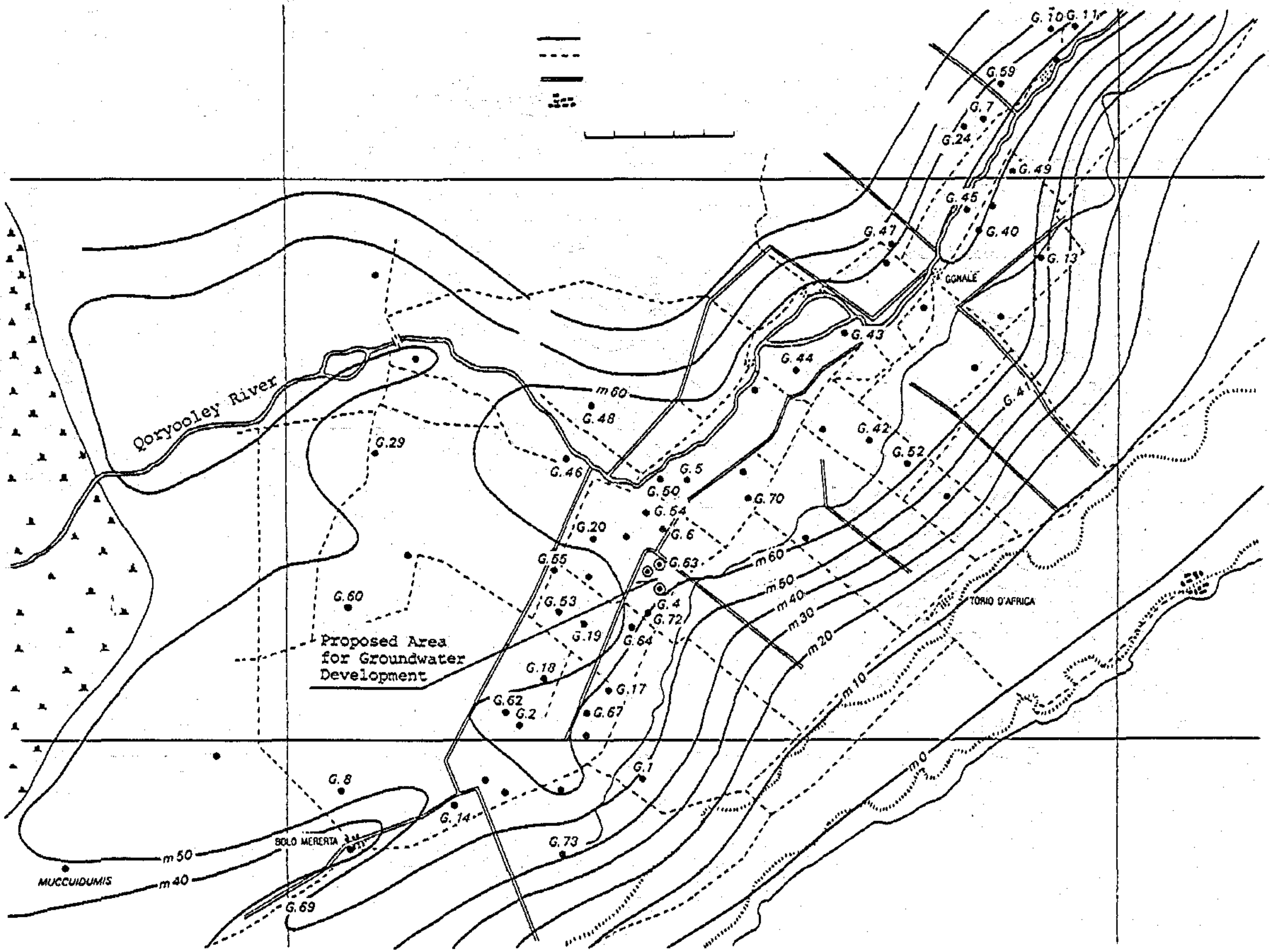
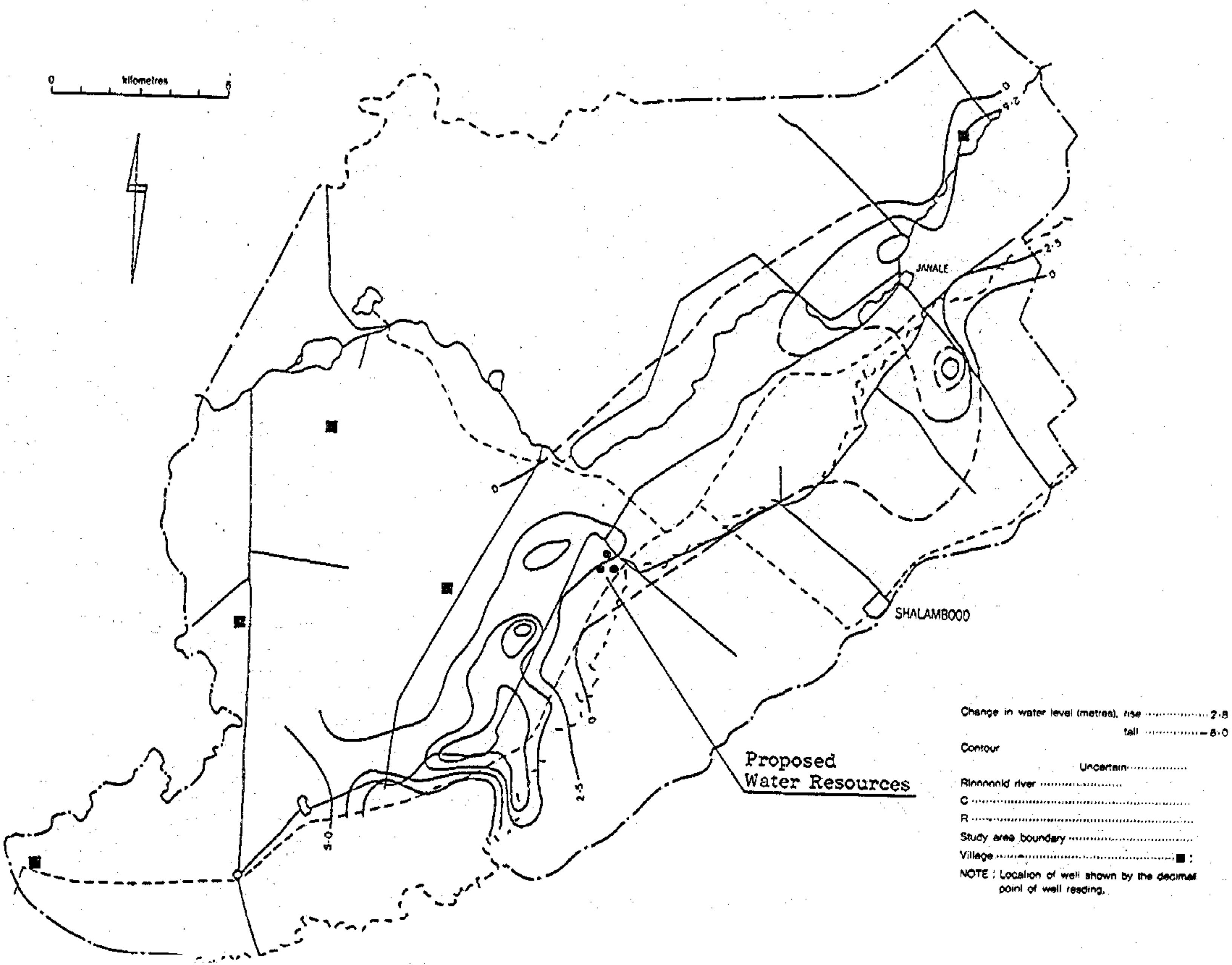


Fig. 3-8 Change in Water Level (1964 - 1978)

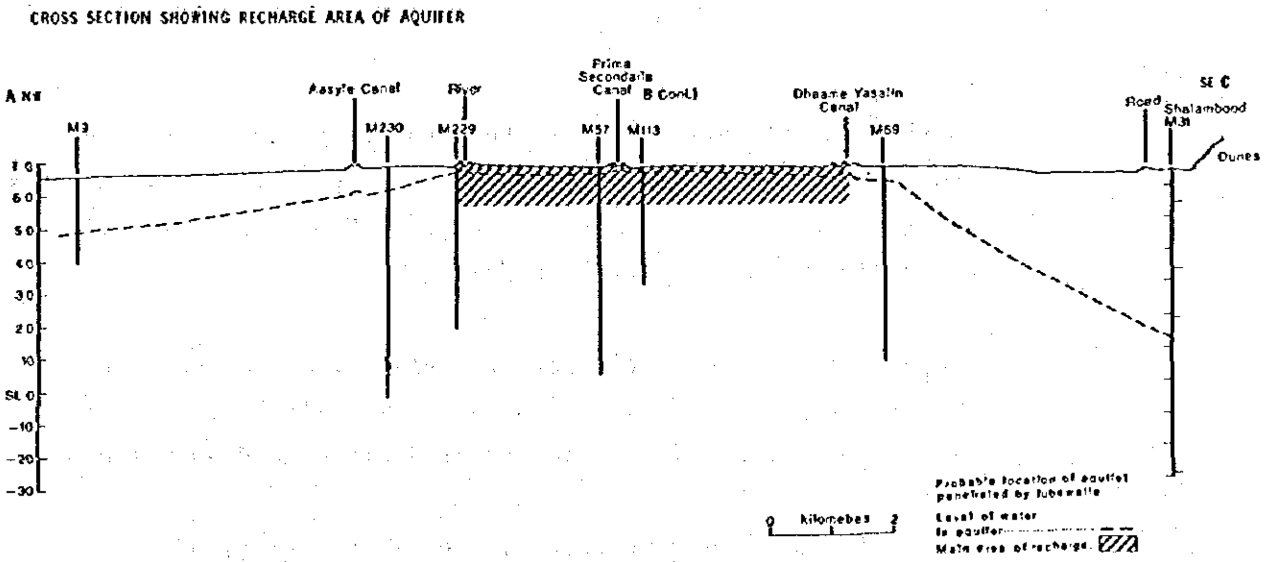


The groundwater generally flows from the high water level location in the northwest to the southwest and then to the southeast. But the main flow direction is supposed to be toward southeast (toward the Indian Ocean) where the hydraulic gradient is largest.

As, Fig. 3-8, the change in water level shows, it is reported that the groundwater level rose gradually but surely during the 14 years from 1964 to 1978 in the Beled Amin district, and the maximum rise was 11.7m at the southern Beled Amin.

This water level rise can be a result of farmland irrigation and flumes that increased the groundwater recharging capacity (refer to the Fig. 3-9).

Fig. 3-9 Cross Section Showing Recharge Area of Aquaifer



However, the groundwater level at the Qoryooley area is deeper than 10m below ground level. That is 8-9 m deeper than the Beled Amin's groundwater level.