

THE REPUBLIC OF SUDAN

BASIC DESIGN REPORT

ON

THE RURAL WATER SUPPLY PROJECT

RELATED TO ICARA-II

March, 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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P R E F A C E

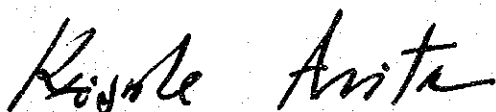
In response to the request of the Government of the Republic of Sudan the Government of Japan decided to conduct a basic design study on the Water Supply Project Related to ICARA-II and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the Sudan a study team headed by Mr. Shoji TAKAHASHI, Manager, Rokkosan Management Office, Water Supply Bureau, Kobe City Government, from November 25 to December 19, 1985.

The team had discussions on the Project with the officials concerned of the Government of the Republic of Sudan and conducted a field survey in East Sudan area. 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 Republic of Sudan for their close cooperation extended to the team.

March, 1986



Keisuke Arita
President

JAPAN INTERNATIONAL COOPERATION AGENCY

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ABBREVIATIONS

ICARA : International Conference on Assistance to
Refugees in Africa

UN : United Nation

OAU : Organization of African Unity

UNHCR : High Commissions for Refugees

COR : Office of the Commissioner for Refugees

UWA : Urban Water Administration

SUMMARY

S U M M A R Y

In recent years, many countries in the African continent have been facing to serious socio-economic problems due to consecutive draughts, tribal conflicts and world-wide economic recession. In many places, these problems resulted in outbreaks of refugees. The neighbouring countries which receive these refugees are in many cases under developing countries. Accordingly, these refugees cause much difficulties for the recipient countries of refugees.

For this reason it is internationally recognized that the assistance to these refugees requires international cooperation and the first International Conference on Assistance to Refugees in Africa (ICARA-I) was convened by the United Nation (UN) at Geneva in April 1981.

As numbers of refugees has been increasing it has become a heavy burden for these recipient countries to provide refugees and local people who have much influence by increasing numbers of refugees with social services such as water supply, school education and medical facilities.

In order to cope with the above matter, the ICARA-II was also convened by the UN in 1984 at Geneva. As a conclusion of the ICARA-II it was confirmed that it would be urgently required to provide refugees with social infrastructure for participation of refugees to productive activities in the recipient countries in stead of killing time with assistance provided.

The representative of the Government of Japan participated to the ICARA-II announced the intention of the Government of Japan to assist refugees in food supply, water supply and medical services.

In response to the intention of the Government of Japan, an request was made by the Government of the Republic of Sudan to assist in water supply schemes for refugees and local people who are influenced by refugees in the Eastern Region where an estimated population of refugees, 784,000 people, is received from Ethiopia.

For this purpose a preliminary survey team was despatched to Sudan in August, 1985 through the Japan International Cooperation Agency. Based on the conclusion of the preliminary survey team the basic design study team was despatched to Sudan from 25th Nov. to 19th Dec, 1985 through Japan International Cooperation Agency.

In the Eastern Region, the surface water is rarely obtainable due to the dry climate. Major sources of domestic water rely on the underground water and at present almost 1.1 million rural population obtains water from boreholes for domestic purposes. However many boreholes have been used for many years and are so deteriorated that their yields have been decreased. In addition, an increase in rural population caused by arrival of refugees worsened conditions of the shortage of domestic water in rural areas.

It is estimated that about 36% of rural population (about 400,000 people) including a large number of refugees are suffering from shortage of domestic water in the Eastern Region.

As for Kassala Town, almost 75% of the urban area is facing to water supply problems due to increase in water demand caused by arrival of refugees estimated to be 50,000 people corresponding to about 30% of total population of the Town.

In order to cope with the above problem the following schemes are proposed;

1. Village Water Supply in The Eastern Region

- 1) Construction of Village Water Supply Facilities : 34 places
- 2) Rehabilitation of Boreholes in Existing Village Water Supply Facilities : 73 places

2. Rehabilitation of Kassala Town Water Supply

Considering existing conditions of the water supply in Sudan, urgency and magnitude of the project, it is proposed for the project to provide following equipment, machinery and material including construction of some facilities;

Item	Content	Quantity
Equipment	1. Drilling Equipment, Rotary Type	3 sets
	2. Rehabilitation Service Machine	2 sets
Machinery & Material	1. Village Water Supply Facility	34 places
	1) Boreholes, 6 5/8 inches 180m	
	2) Tank, 50m ³ , 3m	
	3) Pump and Engine, 180 lit/min., 100m	
	2. Rehabilitation of Existing Boreholes	73 places
	1) Material	
	2) Pump and Engine, 180 lit/min., 100m	
	3. Rehabilitation of Kassala Town Water Supply	1 set
	1) Boreholes ø10 inches 50m, 10 boreholes	
	2) Pump and Motor 40m ³ /hr, 60 10 sets	
	3) Reservoir 2,000m ³ , 1,500m ³ one each	
	4) Booster Pump Station 350m ³ /h, 150m ³ /hr, one each	
	5) Pipes 27 km	

Construction of Kassala Town water supply facilities for rehabilitation is also to be made under the project by utilizing the above material, machinery and equipment.

During construction work for village water supply facilities, it is also proposed to complete the technology transfer to Sudanese counterparts on drilling and rehabilitation of boreholes, and construction of other village water supply facilities. For this purpose construction of village water supply facilities including ten boreholes will be made in addition to drilling of another 10 boreholes for Kassal Town water source and rehabilitation of existing boreholes in 36 places.

After completion of the technology transfer, the remaining work, construction of 26 new village water supply facilities and rehabilitation of 37 boreholes, will be made by Sudanese counterparts by themselves utilizing material, machinery and equipment to be provided by the project.

The responsible governmental institution of this project is the Office of Commissioner for Refugees, Ministry of Internal Affairs.

Construction period takes 22 months including the time required for procurement of material and equipment which corresponds to 26 months after the exchange of note including the time required for detail design and tendering.

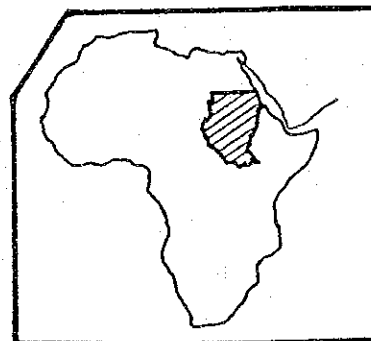
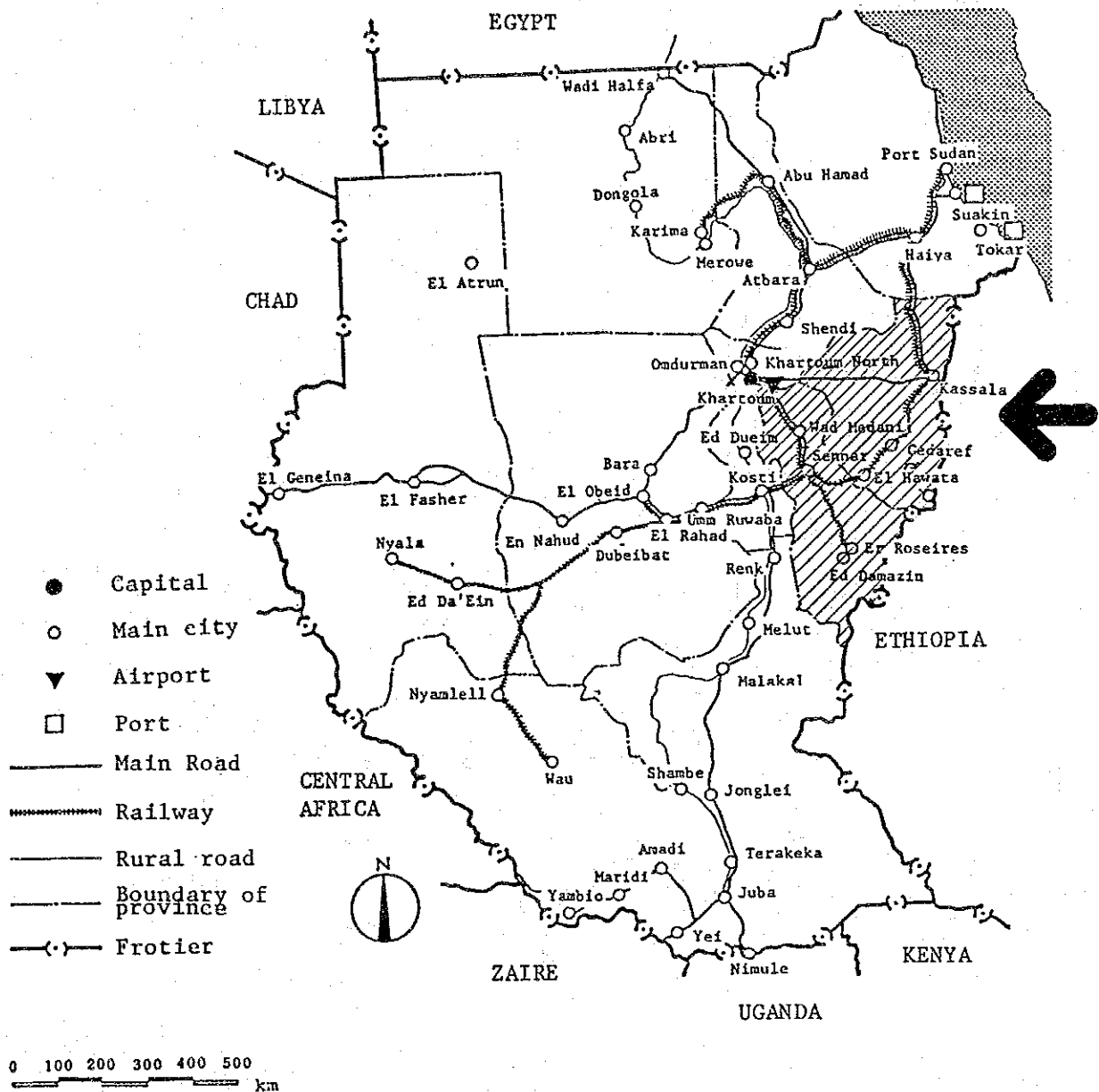
Operation and maintenance cost of the new village water supply facilities is estimated to be ¥37.6 million/year (S£ 494,600).

Number of population (about 400,000 people) suffering from shortage of domestic water in the Eastern Region will be decreased to 190,000 people after the completion of the project. In addition through this project the Sudanese authority will obtain necessary technology and equipment for underground water development.

In the Kassala Town water supply, the present problematic area corresponding to 75% of total urban areas will no more exist and further more the target volume of daily supply, 75 l/cap/day will be maintained by the project which will definitely be advantageous to improve financial aspects of the Urban Water Administration at Kassala since present revenue of water charge is only limited due to extended problematic area.

It is, therefore, concluded that this project is effective to solve water supply problem prevailing over the Eastern Region and suitable for the grant aid project of the Government of Japan.

Fig. 1 Location Map



CHAPTER 1 INTRODUCTION

CHAPTER 1

INTRODUCTION

In recent years many countries in the African continent are facing to social and economic problems due to consecutive droughts, tribal conflict and recession of international economy. Under the circumstance, many number of refugees have been moving from one place to the other. However, usually these neighbouring countries which receive the refugee are also under developing countries and to support these refugees has been a heavy burden to these recipient countries.

The Organization of African Unity (OAU) in cooperation with African nations has been making an effort to support refugees. At present, there are fourteen African countries which received these refugees and supporting them. Since number of refugees has been increasing so rapidly that to support these refugees is beyond capability of these recipient countries, it is recognized that international cooperation over the world is required for assistance of refugees. For this purpose, the first International Conference on Assistance to Refugee in Africa (ICARA-I) was held at Geneva in 1981. However, conditions of refugee problems have been continuously worsened in many countries in Africa. Consequently the General Assembly of the United Nation requested the Secretary-General to convene the Second International Conference on Assistance to Refugees in Africa at Geneva in 1984 (ICARA-II). The purpose of ICARA-II is not only to support refugees directly but also to provide for social infrastructure in order for these refugees and returnees to adopt their social lives in the settlements. It is also recognized to appropriate necessary budget for improvement of infrastructures on the refugee assistance funds.

The delegation of Japan led by the Principal Secretary of the Ministry of Foreign Affairs participated in ICARA-II and indicated the Japanese Government's intention to cooperate with ICARA-II in emergency foods supply, water supply and medical services. Consequently, a request was made by the Government of the Republic of Sudan (The Government) to the Japanese Government for cooperation of water supply schemes of refugees and Sudanese villagers who have a heavy influence by refugees in the Eastern Province of the Republic.

In response to the above request the Japanese Government dispatched a preliminary study team to the Republic through Japan International Cooperation Agency (JICA) in July, 1985.

Following to the preliminary study team the basic design study team was sent by JICA from 25 November to 19 December, 1985 to the Republic in order to identify contents and background of the request and to clarify the suitability and the extent of the project contribution under the grant aid cooperation of the Japanese Government.

Conclusion of discussions on the basic concept of the project made between the officials of the Republic concerned and the basic design study team is shown in Appendix 1.

This report is formulated to propose the Basic Design for the project based on the analysis of the project suitability and optimum size through site surveys and studies made at the home office to determine the extent of the Grant Aid Cooperation to the project.

CHAPTER 2 BACKGROUND OF THE PROJECT

CHAPTER 2

BACKGROUND OF THE PROJECT

2.1 General Description of the Republic of Sudan

The Republic of Sudan (The Republic) is the largest country in African continent occupying over 250 km². The total population is estimated to be 19.8 mill in 1984 and its average GNP is estimated at US\$400.

The density of population is extremely sparse and one third of the national area is covered by desert. The remaining two thirds of the land, however, is assumed to be arable lands for rain fed agriculture, irrigation and livestock. National economy heavily dependent on the agricultural sector especially cotton, sorghum, ground nuts and sesame. The manufacturing sector is relatively small and is limited to processing agricultural commodities such as cotton, oil seeds and sugar and to the production of consumer goods and building materials.

A development potential significance to Sudan's prospects is the discovery of oil reserves in the southwestern part of the country. An export pipeline carrying around 50,000 b/d is planned, however, construction has been interrupted by the unsettled security situation in the southern part of the country.

The public sector has long been important in the Sudanese economy. It embraces all modern irrigation facilities, the railways, virtually all power and water supplies, and a significant proportion of industry, commerce and finance. Although some industrial enterprises have been returned to the private sector in recent years, about half of the GDP is still generated within the public sector.

The Republic can not be an exception of other African countries, the deficit on current account of the balance of payment has been increased since the beginning of the 1970s. By end of 1981, external payment arrears had accumulated to above US\$2.2 billion.

An essential aspect of the Government's recovery program since 1979 was a concerted drive to increase foreign exchange earnings through increased exports. This was carried out under the Export Action Program (EAP), initiated in mid 1979. The EAP was designed to raise the volume of cotton exports at an average rate of 7 percent per annum during the period 1979-91.

Although cotton production decreased by 1981, a significant increase in cotton production (51%) was recorded in the season of 1981/82. Further increase in cotton production was attained in the following years; 23% in 1982/83, 10% in 1983/84 and 3% in 1984/85.

For this purpose, a large magnitude of capital was invested for rehabilitation of irrigation schemes; total capital investment by 1985 was US\$7.5 million. Further investment to rehabilitation of other irrigation schemes is under negotiation with the international financiers such as the World Bank.

In spite of these efforts made by the Government the projected target of the economic development is still beyond these recent attainment due to worldwide economic recession and consecutive droughts in recent years.

For this season, further policy measures were taken to prepare a comprehensive medium term recovery program, Prospect, Programs and Policies for Economic Development, 1982/83-1984/85 (PPPED) to scale down the existing economic development plan.

This document formed the basis for discussions at consultative group meeting in Paris in January, 1983 and concluded as PPPED-II (1983/84-1985/86) in October, 1983. The total budget consists of the following items;

Budget of PPPED-II (1983/84-1985/86)

	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	(S£ mil) (%)
Agriculture	274	483	757	31.8
Transport	188	250	438	18.4
Manufacturing	67	113	180	7.5
Energy and Mining	52	142	194	8.1
Water	52	62	14	4.8
Services	118	109	227	9.5
Regional Development	215	133	348	14.6
Contingency	126	-	126	5.3
Total	1092	1292	2384	100

Current price US\$1 = S£2.45

In 1983, three measures were enacted into law based on the Koran, called Sharia Laws which resulted in significant increase in commodity prices. Demonstrations and strikes in the public services began in response to the price increase. On 6th April, 1985, a group of senior military officers led by the Minister of Defence took over the Government. Decrees were issued calling for unification of the country, a guarantee of human rights and basic freedoms. A transitional Military Council was established to act as a legislative and policy making body for the country during the transition period until the civilian control will be established. Under the Transitional Military Council Sudan is relatively steady and calm.

In addition to the above socio-economic problems the Republic of Sudan has eight countries along the national border and inflow of a large number of refugees from these neighbouring countries causes serious impact in socio-economy of the Republic. These refugees started to arrive at the Republic since the 1960s and total number of refugees is estimated to be more than one million corresponding to 6% of the total national population of the Republic. These refugees are distributed in the Eastern and the Western and the Southern Regions in the Republic. Among socio-economic problems caused by these refugees, the shortage of domestic water has significant impacts to these refugees and local Sudanese villagers.

A summary of economic index of the Republic is shown in Appendix 5.

2.2 Refugees in the Republic of Sudan and Their Impacts

2.2.1 Present State of Refugees

There are eight countries along the national border of the Republic. Some of these neighbouring countries have been facing serious difficulties caused by consecutive droughts

and unsettled security problems which causes a large number of refugees arriving into the Republic. Refugees arrived at Sudan was receiving assistance from the High Commissioner for Refugees (UNHCR) through the office of the Commissioner for Refugees (COR) of the Ministry of Internal Affairs.

Since the 1960s by the end of November, 1985 a total of 642,000 refugees were registered by UNHCR in Sudan. Apart from these registered number of refugees there are other refugees who entered into Sudan and live in various parts in Sudan without registration at UNHCR.

Total number of these non-registered refugees is estimated to be more than 500,000 people. Refugees living in the Republic at present are summarized as below;

<u>Origin</u>	<u>Estimated Total Number of Refugees</u>	<u>Number of Refugees Registered by UNHCR</u>
Ethiopia	784,000	443,000
Chad	123,000	75,000
Uganda	250,000	124,000
Zaire	5,000	---
Total	1,162,000	642,000

(UNHCR December, 1985)

The project area of this basic design study is the Eastern Region where a large number of Ethiopian refugees are received.

2.2.2 Refugees from Ethiopia

1) By the End of 1983

By the end of 1983, it is estimated that about 500,000 refugees are received in Sudan. Of these refugees, 132,500 refugees were accommodated in the settlements in various places in the Eastern Region. The settlements were selected in places where refugees will be able to maintain self reliance on agriculture or employed labourer. By the end of 1983 season, agricultural production in these settlements were sufficient for self-support of refugees. However, a heavy drought hit the 1984 season which resulted in no harvest accordingly no employment in agricultural labourer. As a result all refugees required ration and many refugees started to move for food. However, a normal harvesting is expected in the season of 1984.

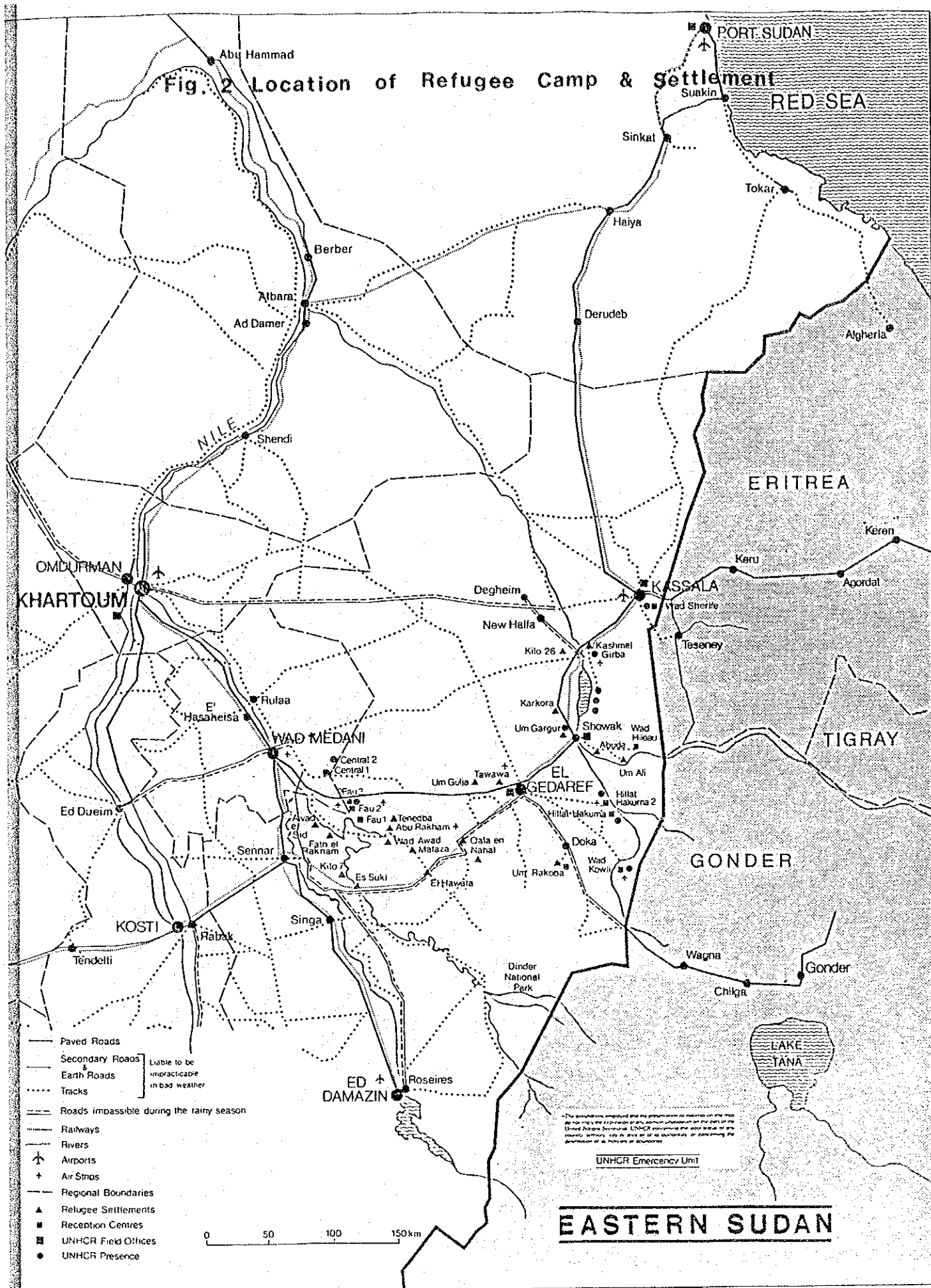
The settlements of refugees arrived by the end of 1983 are summarized as below.

Established Settlements for Ethiopian Refugees
in Eastern Sudan

<u>Settlements</u>	<u>Year established</u>	<u>Population</u>
Khashm-el-Girba	1979	6,200
Kilo 26	1979	3,100
Um Gargur	1972	5,000
Karkora	1978	3,000
Abuda	1981	5,200
Um Ali	1981	3,000
Um Rakoba	1976	7,900
Tawawa	1980	24,000
Um Gulja	1976	8,500
Hawata	1982	4,000
Mafaza	1983	4,100
Abu Rakham	1979	5,000
Wad Awad	1980	2,000
Tenedba	1981	5,000
Es Suki (3 settlements)	1979	6,500
Qala-el Nahal (6 settlements)	1969	40,000
Total assisted refugees in settlements		<u>132,500</u>

The location of refugee settlements is shown in Fig. 2.

These refugees arrived in Sudan without registration of UNHCR distribute various places in the Eastern Region receiving no public assistance. Numbers of these refugees are estimated to be 180,000 people in local urban areas and 200,000 people in rural areas. These non registered refugees are also suffering from the heavy drought in 1984 and some of them took refuge at refugee settlements. The origine of non registered refugees is mainly Eritrea and Tigray.



2) From 1984 to Present Time

Number of refugees arrived at Sudan during this period is estimated to be 300,000 people. Of these refugees, about 200,000 refugees were accommodated in new settlements at Wad el Hilewu and Um Rakoba to the east of Gedaref Town and existing settlements at Wad Sherife near Kassala Town at Towawa near Gedaref Town.

Number of Ethiopian refugees from Tigray increased since October, 1984 and about 400,000 refugees were accommodated at Tuki Boab settlement to the North-east of Kassala Town. Settlements of these refugees arrived during this period is summarized as below;

Location of assisted new arrivals on 1 December, 1985

1. Eritreans

South Tokar district	23,000	
Wad Sherife*	128,000	
Kilo 26	9,400	
Karkora	7,400	
Kashm-el-Girba	3,900	
Shagrab 1 (Girba N)	<u>12,200</u>	
Sub-total		183,900

2. Tigrayans

Wad Kowli	32,200	
Hilat Hakuma 1 (Safawa)	12,700	
Hilat Hakuma 2 (Kona Zarbama)	15,300	
Shagarab 2 (Girba C)	18,600	
Shagarab 3 (Girba South)	800	
Fau 1	6,200	
Fau 2	8,100	
Fau 3	<u>6,100</u>	
Sub-total		110,000

3. <u>Mixed</u> (centres established early 1984)		
Um Rakoba	14,100	
Wad El Hilewu	<u>12,400</u>	
Sub-Total		26,500
Grand Total		<u>310,400</u>

*Number of refugees require for food supply.

2.2.3 Refugees from Chad

Arrival of refugees from Chad at Darfur Region in the western Sudan started since June, 1984. Total number of these refugees is estimated to be 120,000 people. Most of them were moving to the east or to the south together with local Sudanese suffering from a heavy drought, however these refugees were accommodated at settlements at Asernei and Angikoti. At these settlements, the Islamic African Relief Agency (IARA) is giving medical services in cooperation with German Emergency Doctor and OXFAM. At present, the most serious problem in this area is transporttion from Khartoum and Port Sudan.

2.2.4 Refugees from the South

Main origin of the refugees from the south to Sudan is Uganda. There are 47 refugee settlements in Equatoria Region. Total number of these refugees is estimated to be 124,000 people who are provided for cultivation lands forself-support.

Another 126,000 refugees are assumed to live in various parts in Equatoria Region without registration. Some of them (about 3,700 people) went home to Uganda in 1985.

2.3 Supporting System of Refugees

2.3.1 Introduction

Guided by the general principles enshrined in the UN and the OAU conventions relating to the status of refugees, to which the Government has accorded, in accepting refugees within its borders, the Sudan takes into account:

- (a) That the grant of asylum is a peaceful and humanitarian act,
- (b) That voluntary repatriation is the ideal solution to the problem of refugees, and
- (c) That in the absence of any foreseeable repatriation, refugees should be assisted to settle at a reasonable distance from the frontier of their respective countries of origin, with a view to enabling them to become self-sufficient.

For this purpose the Government established the COR to support refugees in cooperation with UNHCR. At present number of staff of the COR has increased to 1,500 people to assist refugees corresponding about 6% of the total national population.

By November, 1984, the financial source of the COR to assist refugees was provided through UNHCR. As number of refugees increases, the UNHCR requested for worldwide cooperation and in response to this request the total amount of cooperation for assistance to refugees provided by various countries and non government organizations reached at US\$76 million for the Eastern Region and at US\$8.6 million for the Western Region by the end of October, 1985.

2.3.2 Support for Refugees by the Sudanese Government

The basic concept to support refugees is to assist in self-support of refugees and cultivation and labour wage are the major means for self-support of refugees in Sudan. Accordingly it is an urgent task for the Government to provide the settlement in the area where refugees are able to maintain self-support and obtain necessary social services for this purpose.

A large number of refugees, however, brought a significant impact to the local community and it is a heavy burden for the Government to provide refugees and local Sudanese affected by refugees with medical services, domestic water and transportation especially in the Eastern and the Western Regions.

Refugees maintain their self-support by cultivation or labour wage and the Government provided settlements with 78,000 ha of agricultural lands which is equivalent to US\$3.7 million.

In this way, in addition to direct expenditure to assist refugees, a large amount of indirect expenditure is required for the Government: There are 10,000 school pupils in the Sudanese school who are not able to be accommodated in the twenty primary schools provided for refugees.

Among these heavy burden of the Government provision of domestic water is the most problematic: Available water source is only limited in the Eastern Region due to the dry climate. A large number of refugees living in local towns and villages caused significant increase in domestic water demand which is estimated to be 4.5 million cubic meters per year.

Fig. 3 Organization Chart of COR

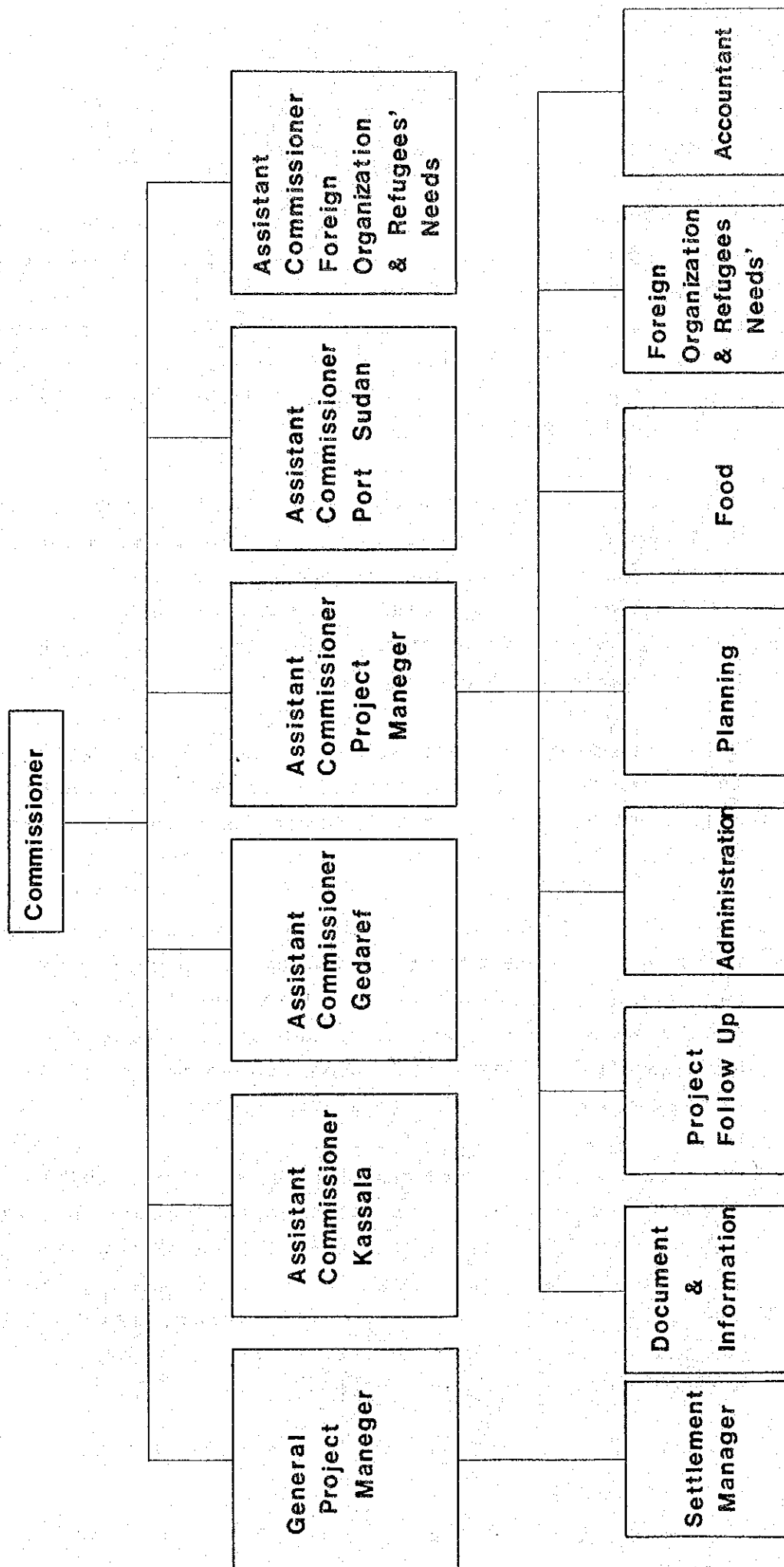


Table 1 COR BUDGET OF EASTERN SUDAN

(S£ 1,000)

Location	1983							1984		1985	
	Settlement	Water Supply	Health	Sanitation	Education	Agriculture	Selfkeep	Confingency	Total	Total	Total
Khasim El Gerba	35.1	20.9	10.1	18.1	86.1	8.2	6.0	13.0	197.5	—	460.5
Um Rakoba	38.2	125.4	5.0	24.6	61.6	13.5	47.0	71.0	386.4	142.4	287.7
Um Guija	63.4	72.6	8.7	23.2	44.9	23.9	17.0	13.1	266.8	404.5	—
Es Suki	71.4	27.6	32.6	38.3	133.6	33.6	60.0	—	399.0	447.5	695.8
Um Gargour	38.5	275.6	50.5	20.0	140.6	130.9	41.0	—	696.7	385.9	545.9
Qala El Mahal	71.4	23.0	23.0	18.4	60.7	—	—	1.2	197.6	387.1	517.0
Kilo 26	21.2	29.2	52.7	20.4	84.4	11.2	36.0	—	255.0	384.0	—
Abu Rkhum	85.9	58.3	43.4	58.4	237.9	57.7	47.0	18.4	586.8	—	—
El Havata	158.9	26.6	38.1	22.5	125.0	129.9	17.0	—	548.0	1,479.6	655.6
El Hafza	—	—	—	—	—	—	—	—	1,085.5	—	839.6
Noim Settlement	1,091.3	110.0	—	—	—	35.8	—	—	1,237.1	—	—
Wad Shariapi	27.8	6.6	—	—	—	—	—	—	52.0	387.4	915.0
Showak	—	—	—	10.5	—	—	—	—	370.5	—	—
Abuda	—	—	—	—	—	—	—	—	546.4	—	455.9
Um Ali	—	—	—	—	—	—	—	—	439.7	—	—
Tenidba	—	—	—	—	—	—	—	—	352.0	—	745.9
Tawawa	78.0	264.8	45.2	52.7	147,125	—	27.9	—	615.8	583.3	—
Total	—	—	—	—	—	—	—	—	8,232.8	4,610.7	6,129.9

※ Not Available

The COR is the Government Agency to handle these social services including domestic water supply, medical services and transportation in cooperation with the UNHCR. The organization chart of the COR is shown in Fig. 3. There is a local office of the COR at Showak and also there are branch offices at Kassala, Gedaref and Port Sudan. As the number of refugees increased, the number of the COR staff also increased to 1,500 at present.

The total expenditure of the COR spent during recent three years in cooperation with the UNHCR is about US\$2.6 million was shown in Table 1.

2.3.3 The United Nation High Commissioner for Refugees (UNHCR)

Activities of the UNHCR in Sudan is enormous compared with the offices of the UNHCR in other countries. There are eight local offices in addition to the head office at Khartoum. These offices are communicating by wireless network.

Total number of the senior staff in the UNHCR is 64 from 38 nations. (Appendix 6)

Since the 1960s by 17th October, 1985 a total of US\$85 million has been donated by 25 organizations in 21 nations. (Appendix 7)

For implementation of program of the UNHCR volunteer services are provided from more than 30 non governmental organization in various kinds of countries. (Appendix 8)

2.4 The Second International Conference on Assistance to Refugees in Africa (ICARA-II)

Objectives of the ICARA-II are summarized in the following three items;

- 1) To verify all the project implementation proposed in the ICARA-I in 1981,
- 2) To determine the necessity of additional assistance to refugees and returnee in Africa for settlement and commencement of new lives, and
- 3) To estimate the extent of influence to the national economy of the related African countries caused by refugees and to provide necessary assistance to these countries for provision of social infrastructures for refugees and returnees.

Most of refugees originated from rural areas. However, recently number of refugees from urban areas increased who tend to live also in urban areas of recipient countries. In general the African refugees consist of two major groups, one is women with children and the other is single males. The former group lives in rural areas and the latter live in urban areas.

In general, settlements are established in areas provided by the recipient country when the international assistance is provided for refugees. Through this kind of program basic human needs, living place, medical services and water supply are available for refugees. When refugees live in rural areas without registration of UNHCR no official assistance is available. Usually, the living standard of rural communities who receive these refugees is also in a very low level. Therefore these local communities also receive a significant impact by these new comers, the refugees, especially in domestic water supply.

In the past the recipient country used to provide basic human needs to refugees through international cooperation, however it is now recognized that this type of assistance fails to participate refugees to productive activities in the recipient country. For this reason, ICARA-II aims to provide assistance to refugee so as to make them participate to productive activities.

There were 14 African countries which intended to propose their needs to the ICARA-II. Survey teams consist of experts of the UN, the United Nation Development Program (UNDP), the UNHCR and the OAU visited these countries and exchanged opinions with the Government officials concerned. Major purpose of these tesms was to identify the requirement of these Governments for provision of necessary social infrastructure for refugees and returnees.

Based on the survey it is concluded that there are 128 projects for provision of the social infrastructure for refugees and local communities where receive their refugees.

Total cost required for these project to be obtained from various types of the international cooperatio is estimated to be US\$362 million (Table 2). These proposed projects are classified into three categories;

1. Human resource development for primary education, technical training and medical services for refugees,
2. Improvement of infrastructure of agricultural and related sectors for increase in agricultural production, and
3. Improvement of transport infrastructure.

All the projects proposed aim at participation of refugees to productive activities within their community.

Table 2 PROJECT LIST OF ICARA-II

All sectors		Individual sectors b/						(US\$ 1,000)
Country	Number projects	Total amount of external financial assistance required	Roads, bridges, port facilities, energy	Agriculture, forestry, fisheries	Education training and	Health	Water supply	Social development, support systems
Angola	4	8 450	—	3 500	3 950	—	—	1 000
Botswana	5	4 140	—	630	—	110	—	3 400
Surundi	5	10 100	4 600	1 700	3 800	—	—	—
Ethiopia	14	40 050	12 420	19 400	210	4 960	3 100	—
Kenya	3	840	—	—	700	140	—	—
Lesotho	5	2 500	—	—	1 800	700	—	—
Rwanda	10	8 690	160	4 250	2 470	—	—	1 810
Somalia	14	79 900	23 350	16 550	9 000	14 900	15 100	1 000
Sudan	30	92 600	25 000	17 600	27 260	18 900	3 840	—
Swaziland	2	1 420	—	780	640	—	—	—
Uganda	12	35 850	11 000	7 150	5 800	5 200	6 700	—
United Republic of Tanzania	8	28 140	9 000	1 440	7 300	3 500	5 400	1 500
Zaire	11	38 800	11 000	12 700	6 000	5 850	3 250	—
Zambia	5	10 740	3 000	1 000	4 840	1 900	—	—
Total	128	362 260	99 530	86 700	73 770	56 160	37 390	8 710
Percentage breakdown	—	100	28	24	20	16	10	2

a/ Based on the individual country reports of the ICARA II technical team.

b/ Projects were determined on an individual basis. For the purpose of a summary presentation, they have been classified into the sectors shown in this table.

Total cost of the ICARA-II projects is estimated to be US\$362 million for 128 projects during coming three to five years, which corresponds to US\$0.8 million to US\$1 million per year. This amount is equivalent to about 3% of the official development aid (ODA) for these 14 African countries in 1982 which is deemed to be quite reasonable amount considering the benefits of the projects to refugees and even to local communities.

2.5 Background and Contents of the Requests for the Grant Aid Cooperation

The number of refugees arrived at the Eastern Region of Sudan from Ethiopia is estimated to be 786,000 people by the end of November, 1985. Only 440,000 refugees, however registered at UNHCR and the balance of 340,000 refugees distributed in different areas in the Eastern Region.

In Kassala Town, a rapid increase in urban population increased water demand which resulted in reduction of hydraulic pressure in the town water supply facility and problematic service areas were extended. The same impacts took place even in rural areas.

Objective of this request for Japanese Grant Aid Cooperation is to ease the shortage problem of domestic water supply in the Eastern Region. Contents of the request are summarized in five categories as shown below;

- | | |
|---|------------|
| 1. Construction of New Village Water Supply Facilities: | 41 places |
| 2. Rehabilitation of Boreholes in Existing Village Water Supply Facilities: | 165 places |
| 3. Provision of Construction Equipment for Hafir: | 1 set |

4. Improvement of Village Water Supply Facilities: 3 places
5. Rehabilitation of Town Water Supply Facility at Kassala and Khashim el Gerba: 2 places

Referring to the conclusion derived from the preliminary survey team dispatched in July, 1985, contents of the request were carefully analysed. Major concerns of the analysis were the background, technical aspects, necessity and urgency, required budget and time and benefit of each scheme. Suitability for the Grant Aid Cooperation is another importance. As the results it was found that the item 3 above might require a large amount of the local costs for the Government and details were not available for the item 4. Since the water supply facilities at Khashim el Gerba Town was constructed by the Chinese Cooperation, it appears to be not suitable for the Grant Aid Cooperation of Japanese Government. Accordingly following three items of the request are concluded to be suitable for the project:

1. Construction of New Village Water Supply Facilities
2. Rehabilitation of Boreholes in Existing Rural Water Supply Facilities, and
3. Rehabilitation of Kassala Town Water Supply.

CHAPTER 3 THE PROJECT AREA

CHAPTER 3

THE PROJECT AREA

3.1 General Description of the Project Area

3.1.1 Socio-economy

The project area is the East Region of Sudan which is a part of major agricultural zone in Sudan. Socio-economy in the areas is mainly dependent on agriculture including cattle keeping. Recent consecutive droughts brought serious impact to the regional socio-economy. In addition arrival of a large number of refugees from Ethiopia worsened the situation especially in shortage of domestic water supply in the Eastern Region.

Total Sudanese population of the Eastern Region is estimated to be 1,512,325 people in the census of 1983. Of this population 1,117,600 people distribute in rural areas and the balance, 394,725 people is urban dwellers in local towns. The growth rate of population in the region is estimated to be 5.8% during last 10 years which indicate a very steady growth rate.

Cattle keeping is one of major industries in the area and the number of cattle heads held in the region is significant;

<u>Type of Cattle</u>	<u>Number of heads</u>
Camel	628,000
Cow	768,000
Sheep	1,277,000
Goat	1,044,000

The Regional Capital, Kassala Town locates in the area near by the national border with Ethiopia holding total population of 165,000 people including about 50,000 people of Ethiopian refugees in 1983. Kassala locates on the middle way along the national highway from Port Sudan and Khartoum. Most of branch offices of the central Government also locate in Kassala Town. Due to these spatial conditions Kassala Town is playing an important role of socio-economic terminal.

The distance from Khartoum to Kassala is about 600km along the new national road which took over the role of railway which used to be the major transport mean. There is one airport at Kassala and domestic flight is available from Khartoum. However, no mean is available for communication with Khartoum except for wireless radios.

There are some other local towns in the Eastern Region along the national highway;

<u>Name</u>	<u>Population in 1983</u>
Gedaref	154,000
Showak	8,635
Khashim el Gerba	19,762

All of these local towns are also influenced by Ethiopian refugees and significant domestic water shortage is observed at Kassala and Gedaref.

3.1.2 Hydro-meteorology

The prevailing climate in the Eastern Region is the tropical continental type. Air temperature is relatively low ranging from 27°C to 30°C in the winter time from December to March. The lowest air temperature goes down to 16°C - 17°C. During the summer time air temperature sometimes exceeds 40°C and sand storms take place during April and May (Table 3).

Table 3 Meteorological Conditions at Gedaref

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Precipitation (mm)	0	0	1	4	27	86	154	188	92	24	3	0	579
Average mean temperature (°C)	26.0	27.1	30.0	31.8	32.2	30.0	27.1	26.0	27.1	29.0	29.0	26.6	28.5
Average max. temperature (°C)	34.8	36.0	38.6	40.1	40.0	37.0	32.7	31.0	33.0	36.5	36.8	35.0	36.0
Average min. temperature (°C)	17.2	18.1	21.1	23.5	24.5	23.0	21.5	20.8	21.1	21.6	21.0	18.1	21.0

In general rainfall amount in Sudan is very small and most of the area receives only 500mm/year. However, there are heavy rains in the Abyssinia Highlands in the adjacent area to the east of the Eastern Region. Annual rainfall at the Abyssinia Highlands exceeds 2,000 mm/year which decreases concentricly as distance increases from the Highlands. For this reason an annual rainfall in Gedaref is 600 mm/year and there is only 300 mm/year to 400 mm/year at Kassala further north of Gedaref (Fig. 4).

Rainfall concentrates during the months of June to September. The most wet month is July or August reaching the monthly rainfall to 100 mm/month - 200 mm/month. During the dry season from November to April there is no rainfall.

The headwaters of rivers in the Eastern Region come from the Abyssinia Highlands. There are five major rivers flowing toward the north-western direction; The Gash, The Atbara, The Rahad, The Diuder and The Blue Nile Rivers. Only the Atbara and the Blue Nile Rivers are perennial and the others are Wadis with only intermittent flows. The Sennar Dam at the Blue Nile and the Birba Dam at the Atbare River are effectively utilized multiporposely.

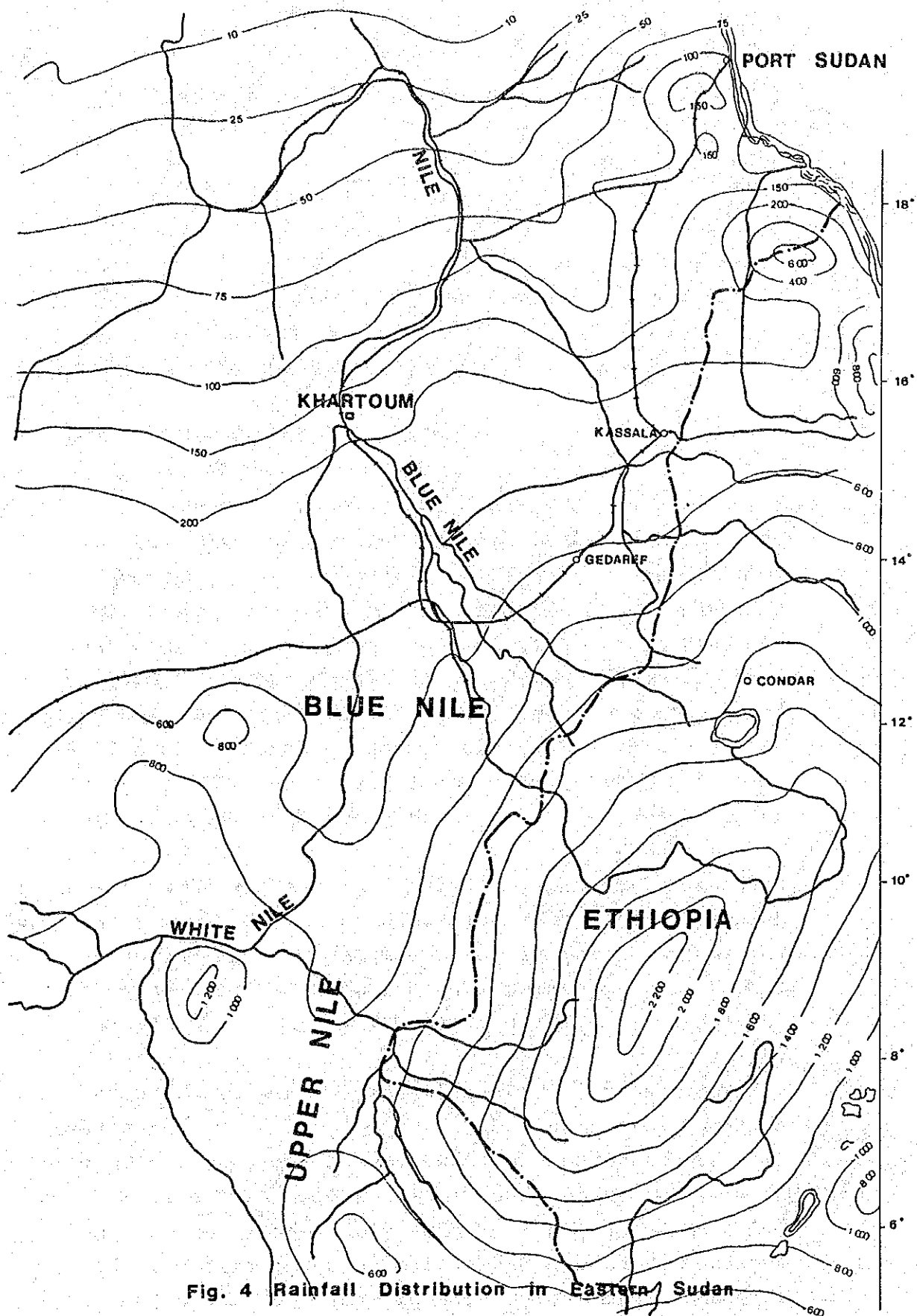


Fig. 4 Rainfall Distribution in Eastern Sudan

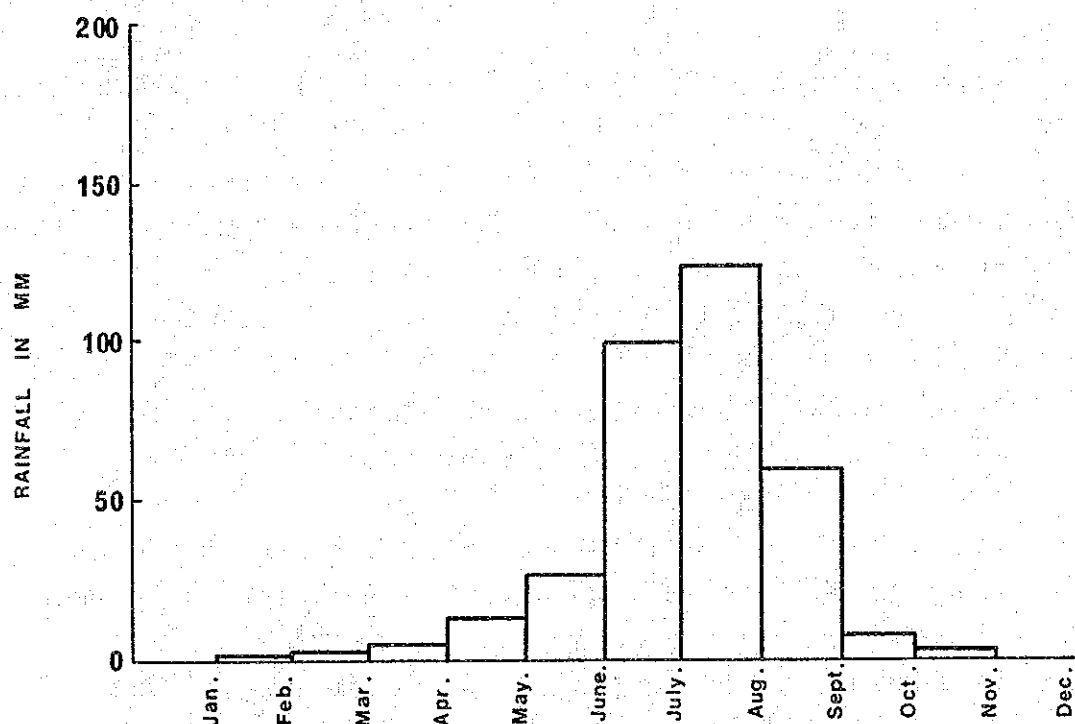


Figure. 5 Average Monthly Distribution of Rainfall in Kassala Town for the Period 1930-1960

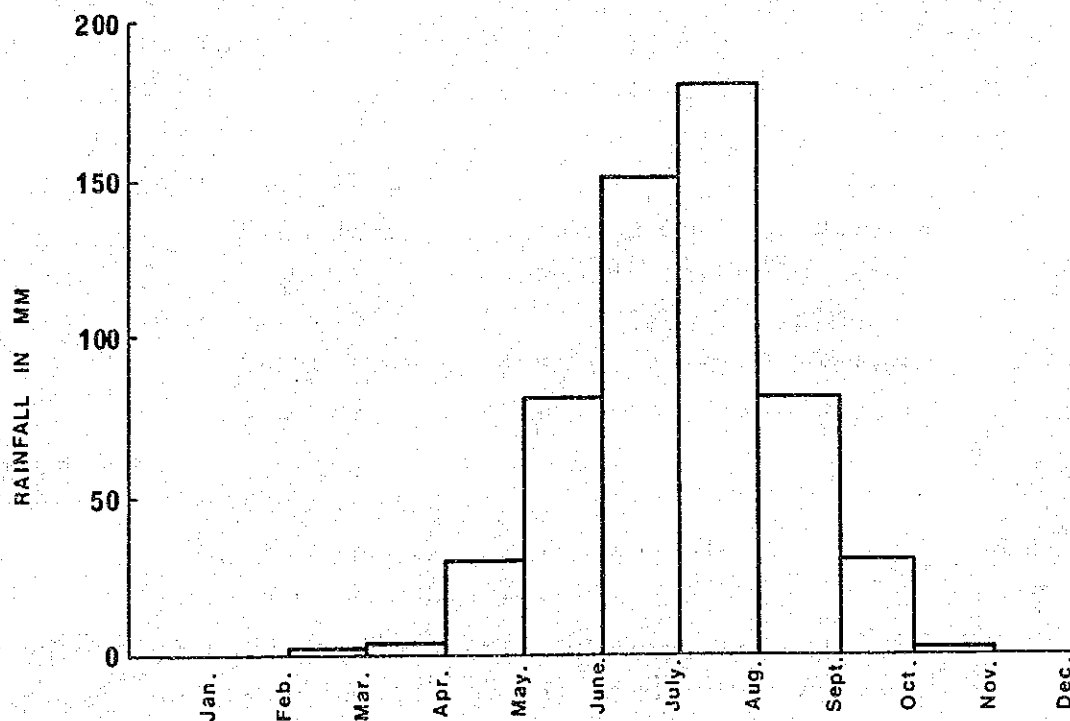


Figure. 6 Average Monthly Distribution of Rainfall in Gedaref Town for the Period 1984

3.1.3 Land Morphology

The project area extends over 10,000 km² and most part of the area is occupied by flat lands at altitude between 400m and 500m above sea level. Some small rocky pediments sparsely distributed over the area.

Around Gedaref Town there is a remnant of old hills consisting of the tertiary basalts.

The eastern end of the Eastern Region extends to the mountaneous land form towards the Abyssinia Highlands.

In general the project area is the wide flat land extending over the area between lower plain in the north-west and the lower slope of the Abyssinia Highlands in the south-east.

3.1.4 Geology

The surface geology in the Eastern Region is summarized as below (Fig. 7);

- Precambrian and Cambrian Basement Complex
- Cretaceous Nubian Sandstone Formation
- Ferrugineous Soil
- Tertiary Basalts
- The Quaternary Black Cotton Soil

1) The Precambrian-Cambrian Basement Complex

The term "Basement Cmplex" has been used by geologists in Sudan to include all metamorphic igneous complexes older than the Nubian Sandstone. The basement complex includes granitic gneisses, hornblendic gneisses,

calcsilicate, marble, pegmatites, quartz veins, basic and acidic dykes. Sparsely distributed rocky hills around Kassala Town are consisted of granitic gneisses.

Around Abouda near to Gedaref Town there is a heavily weathered granited extending over 6 km². This type of rocks distribute outside of the project area and the Basement Complex is rarely found in the area where these boreholds distribute around Gedaref.

2) The Nubian Sandstone Formation

This formation distributes over a wide area in the North Africa holding favourable underground aquifers. This sedimentary rocks lying unconformably on an originally uneven Basement surface as a result of faulting, minor warping and subsequent erosion. It is exhibited by an irregular outcrop pattern being dominated by multicoloured. The Nuaibn was dated by Omer (1978) as Cretaceous.

3) Ferrugineous Soils

These predominate in the vicinities of the Nubian outcrops especially the sandstones and is considered as paleosoil associated with the Nubian. This indicates a paleoclimate of the Sudanese type.

4) The Tertiary Basalts

There are volcanic basalts consist of the tertiary Basalts and Miocene dykes. Usually these rocks are covered by black cotton soils.

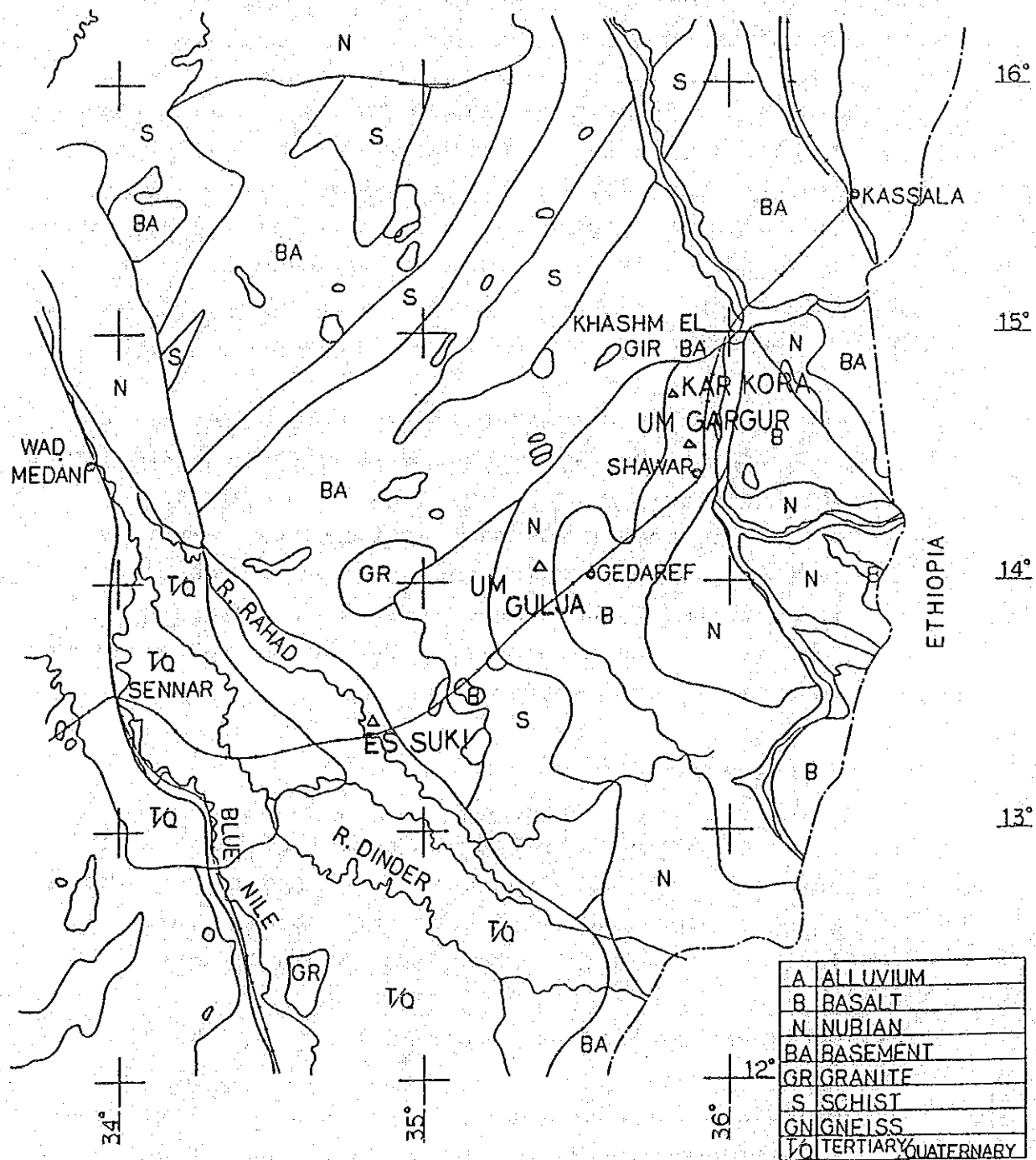


Fig. 7 Geological Map of Eastern Sudan

5) Black Cotton Soil

This is the similar type of soils so called black cotton soil in India. It is locally called as Badok which swells in the wet season and cracks during the dry season.

6) Recent Deposits

These deposits are found in alluvial areas along the Gash River near Kassala Town and along the Atbara River near Showak and Khashim el Gerba Towns. These deposits consist of gravels, sands and silts and the thickness of the deposit varies from place to place.

3.1.5 Hydrogeology

As shown in Fig. 7, major components of geology in the area are four groups;

1. Basement Complex consists of Metamorphic Rocks
2. Cretaceous nubian Sandstones
3. Tertiary Basalts
4. Alluvial Deposits

Basement complex occupies over a wide area in Sudan. In the Eastern Region, Basement Complex distributes around the area of Showak and Gedaref Towns forming a kind of basin structure. This type of complex is consisted of many kinds of metamorphic rocks with very low void ratio and impervious nature. Generally, it is very difficult to obtain underground water where this type of rock outcrops are observed on the ground surface.

Nubian Sandstones distribute in the depression of the basin structure of Basement Complex in the area around Gedaref Town. Weathered sandstones and gravel layers are favourable ground water aquifer in the area. The underground water in the Nubian Sandstone is usually artesian type. The thickness of aquifers varies from 100m to 300m. According to the records in the past a safe yield of these Nubian Sandstones is estimated to be between 170 m³/day and 850 m³/day and the specific yield ranges between 0.3 m²/hr and 4.0 m²/hr.

The tertiary volcanic rocks consist of basalt and volcanic clastic rocks which distribute on the older erosion surface of the Nubian Sandstone. Underground aquifers usually develop along the cracks and fractures in the Basalt rocks. In general water quality in this type of aquifer indicates higher salinity than that of the Nubian Sandstones in the area. An estimated safe yield of aquifer of this type is 110 m³/hr.

Colluvial and alluvial deposits distribute along the river courses in the area. Alluvial deposits along the Gash River near by Kassala Town extends over a wide area and the thickness of these deposits varies from 30 m to 70 m consisting of gravels and sands which yield potable underground water. The safe yield of this type of aquifer ranges from 500 m³/day to 1,000 m³/day.

The prospecting underground water aquifers are found in the area of the Nubian Sandstone, Tertiary Basalts around Gedaref and Showak Towns and alluvial deposits of the Gash River around Kassala Town in the project area.

Fig. 8 indicates the hydrogeological profile of a borehole at Umm Gulja; the underground water is obtained from the Nubian Sandstone. The transmissibility of the aquifer is 60m²/day - 66m²/day. The permeability is estimated to be between 11.5×10^{-2} - 12.7×10^{-2} m/day.

Present yields varies between $324 \text{ m}^3/\text{day}$ and $369 \text{ m}^3/\text{day}$. However, since screens of this well is a slot type made on the site, more yield will be obtainable when suitable screens are used.

Fig. 9 and Fig. 10 indicate hydrogeological profiles of boreholes at Gargour and Karkora in the transition area between the Nubian Sandstones and the Tertiary basalts. The yielding aquifer is also the Nubian Sandstone. The transmissibility coefficient at Um Gargour is estimated to be $67 \text{ m}^2/\text{day}$ and the yield ranges between $5,000 \text{ m}^3/\text{day}$ and $6,000 \text{ m}^3/\text{day}$. These boreholes are also constructed with slot type screen and yield is only limited compared with the capacity of the aquifer.

Major aquifer of alluvial deposits is found at Gash River near Kassala Town. This deposits consist of gravels, sands and silts forming a prospective aquifer. The thickness of deposits varies between 27 m and 55 m at Kassala Town and at Gamman 10 km to the north from Kassala Town the thickness ranging from 17 m to 25 m, however at Arome further 10 km to the north it shows 75 m thick. The alluvial deposit of the Gash River extends to the north from Kassala Town in width of 15km.

Underground water in this aquifer is non-artesian. The transmissibility coefficient of this aquifer is estimated to be $1,350 \text{ m}^2/\text{day}$ and total volume of ground water storage is estimated at 600 million m^3 and it is also estimated that about 13% of the total storage volume will be extractable from aquifer which corresponds to 78 million m^3/year (Fig. 11).

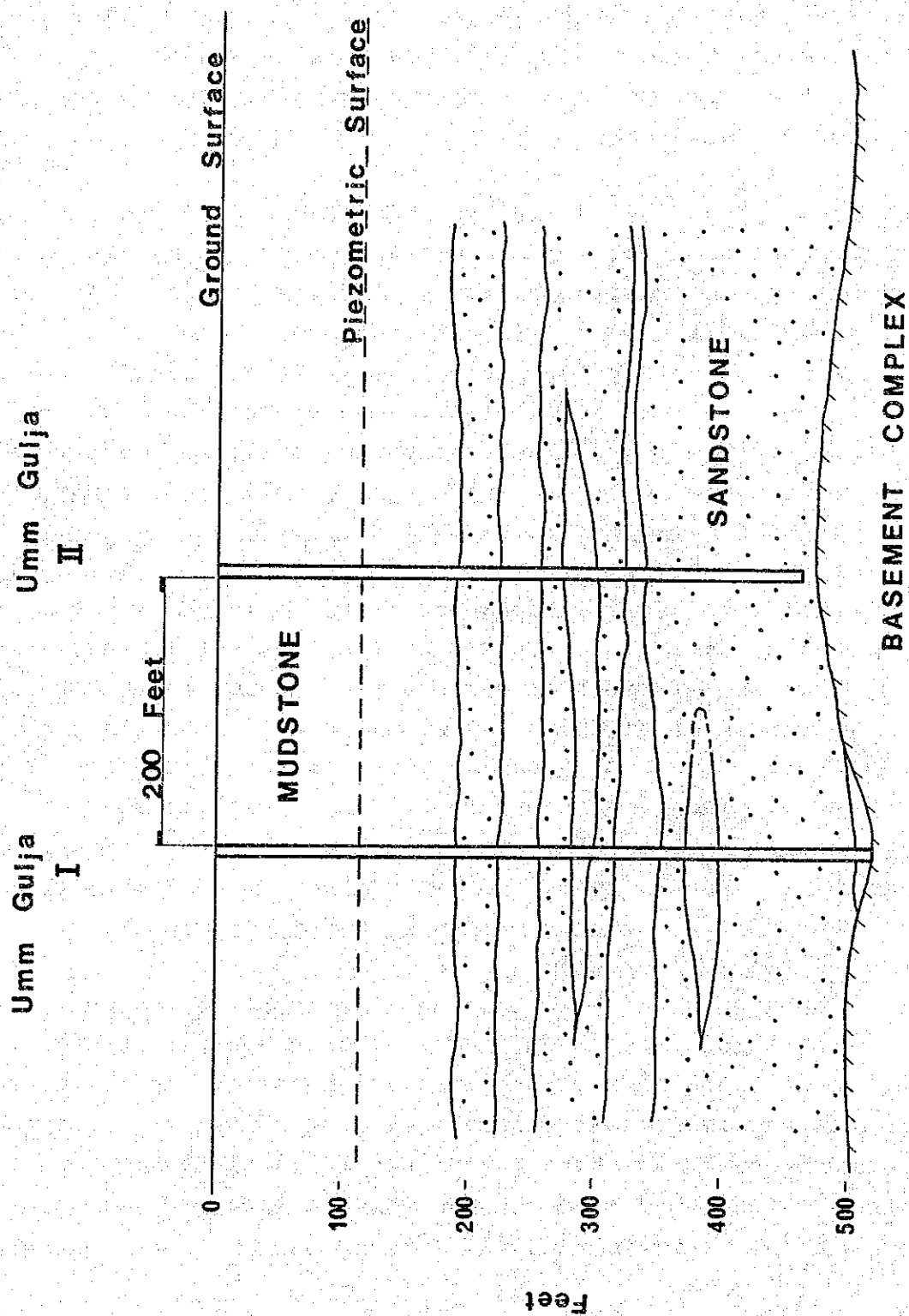


Fig. 8 Diagrammatic Representation - Umm Gulja

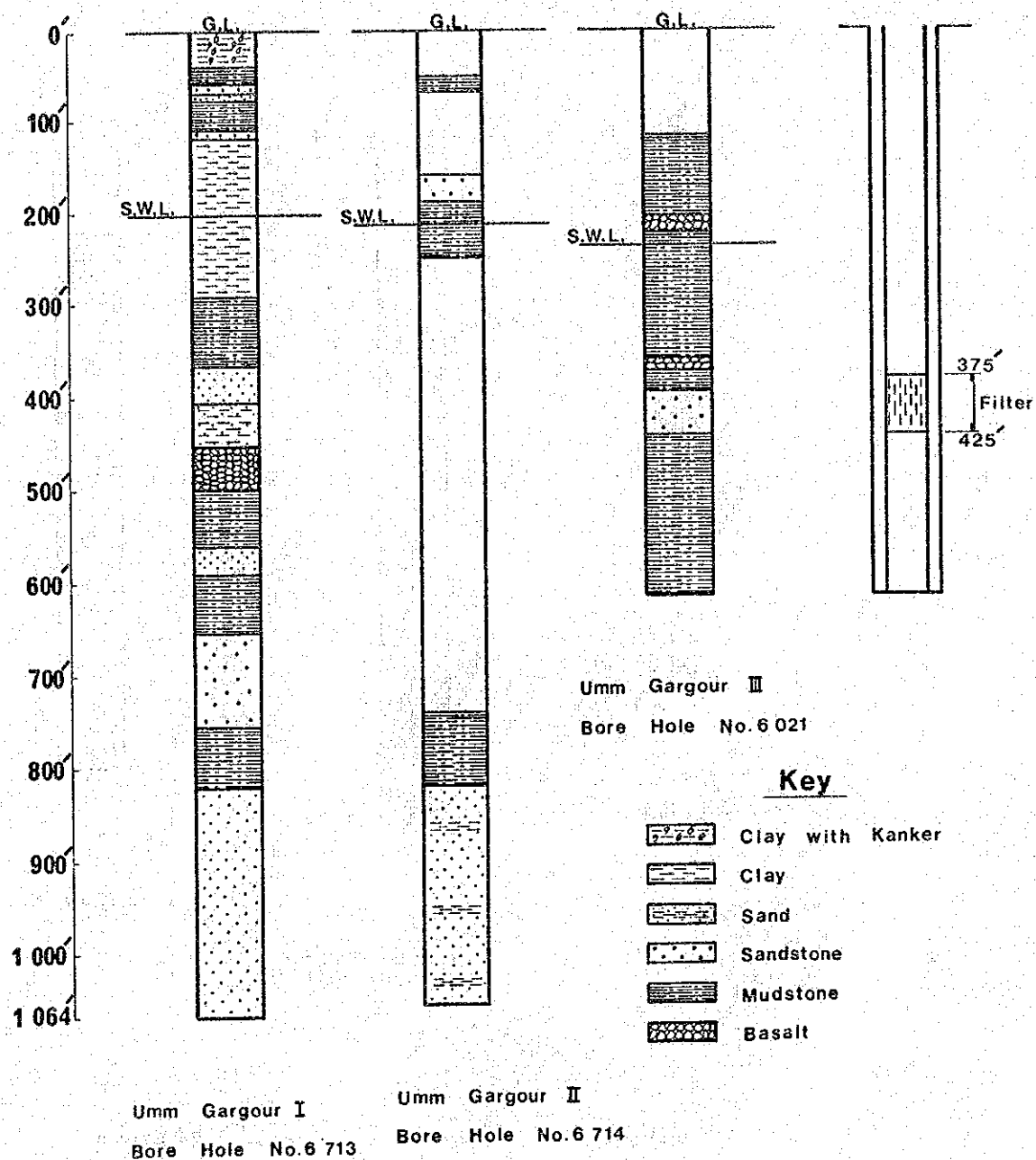
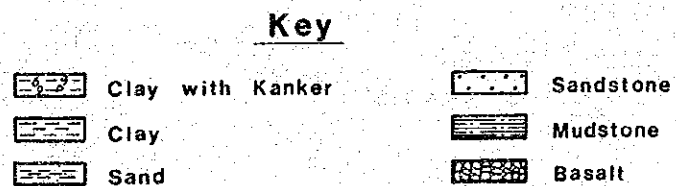
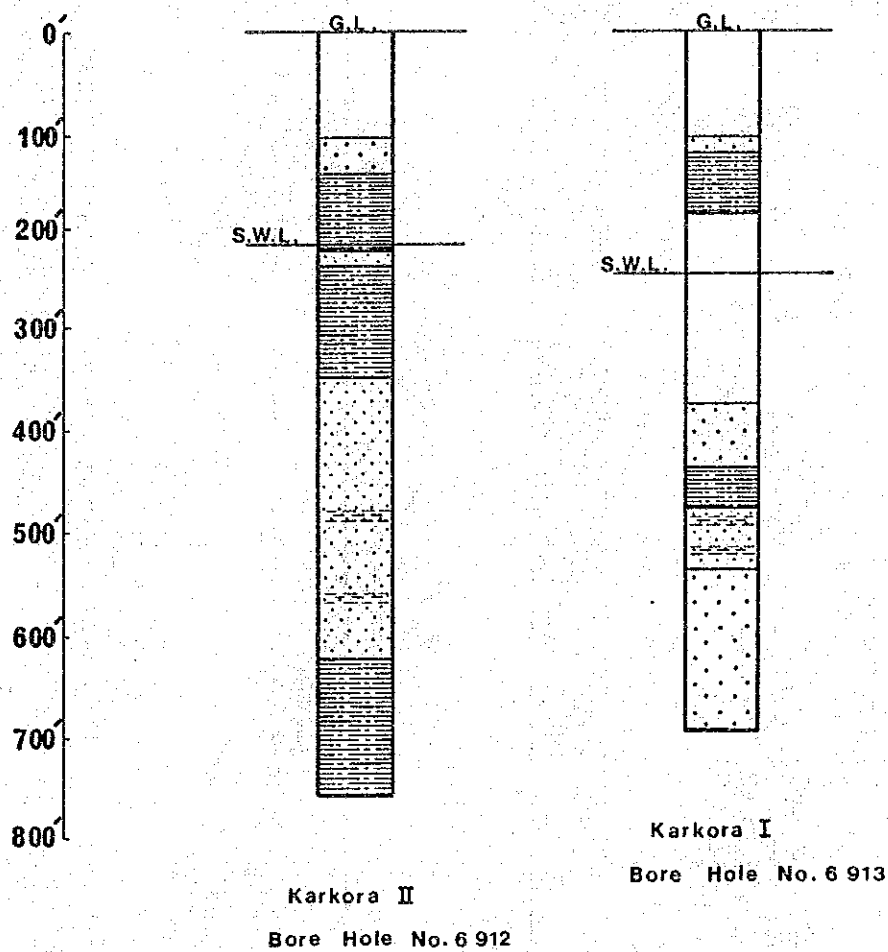


Fig. 9 Geological Logs and Distribution of Casing in Umm Gargour Bore Holes



G.L. = Ground Level
S.W.L. = Static Water Level

Fig. 10 Geological Logs and Distribution of Casing in Karkora Bore Holes

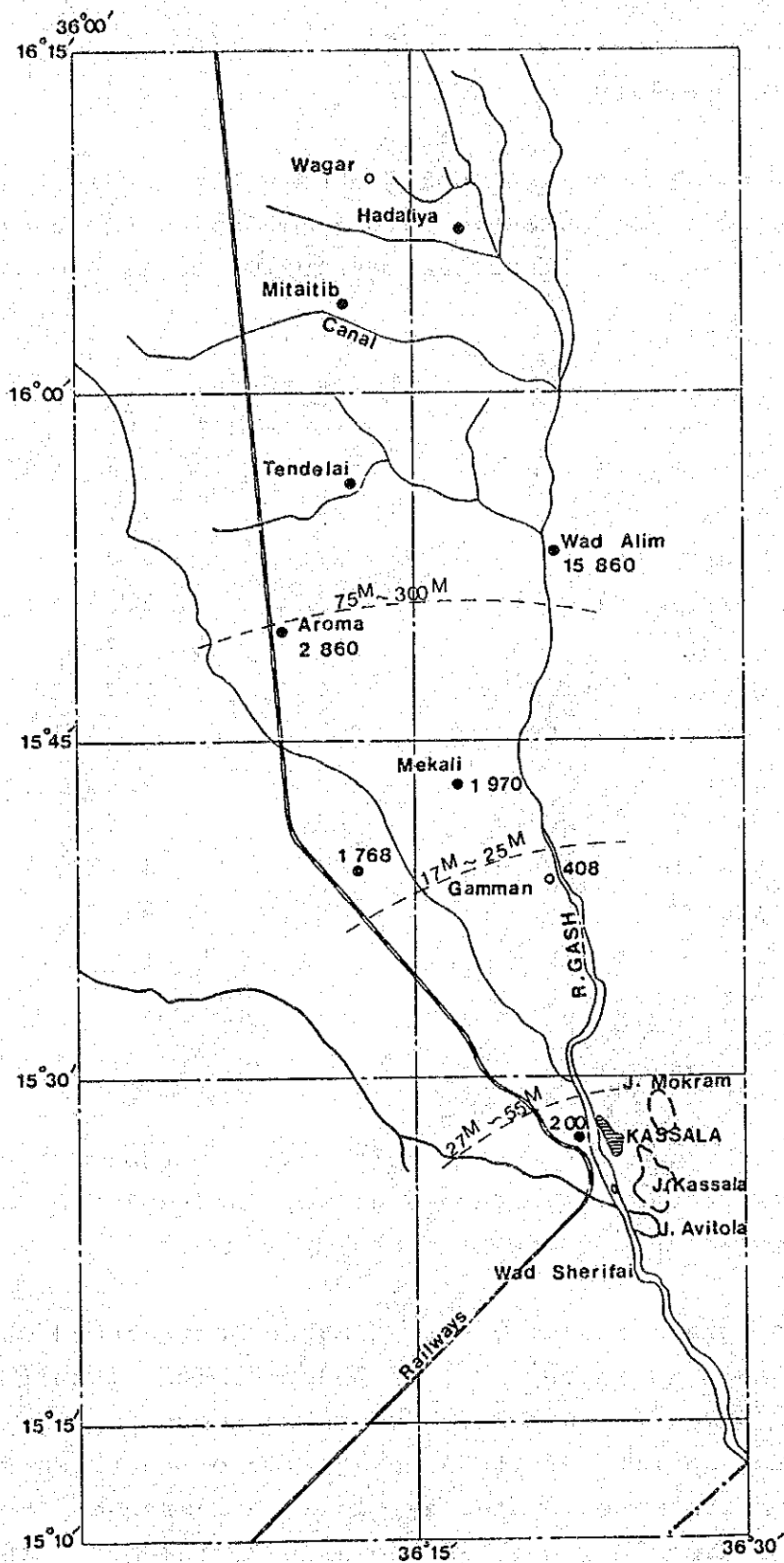


Figure. 11 Thickness of the Gash River Alluvial Deposit

3.1.6 Water Quality

The quality of the underground water in general is suitable for domestic purpose. During the Basic Design Study some water samples were examined as shown below;

	Temperature °C	pH	Electric Conductivity $\mu\text{v}/\text{cm}$
1. Wad Sherifay	34	7.4	998
2. Lafa	33	7.2	400
3. Wahlfa	38	8.2	380
4. Khashim El Gerba*	38	8.2	330
5. Showak	39	7.7	500
6. Gedaref COR Office	34	7.7	460
7. Gedaref NWC Office	29	7.7	420
8. Assar	29	6.8	1,400
9. Wad El Halangi	29	7.2	1,100
10. Kassab	29	7.1	1,300
11. Kgra**	29	8.2	700

* Surface water

** Shallow well

As shown in the above table, electric conductivity of the underground water ranges between 330-1,400 $\mu\text{v}/\text{cm}$ in the area around Gedaref and Showak Towns.

The total dissolved salts in the underground water at Kassala is in an order of 250ppm which is quite suitable for domestic purpose, however as shown in Fig. 12, the water quality of the same aquifer of the Gash River deposits deteriorates as distance increases from the area near Kassala Town. In the area to the north 30 km from Kassala Town the total dissolved salts in the underground water exceeds 16,000ppm.

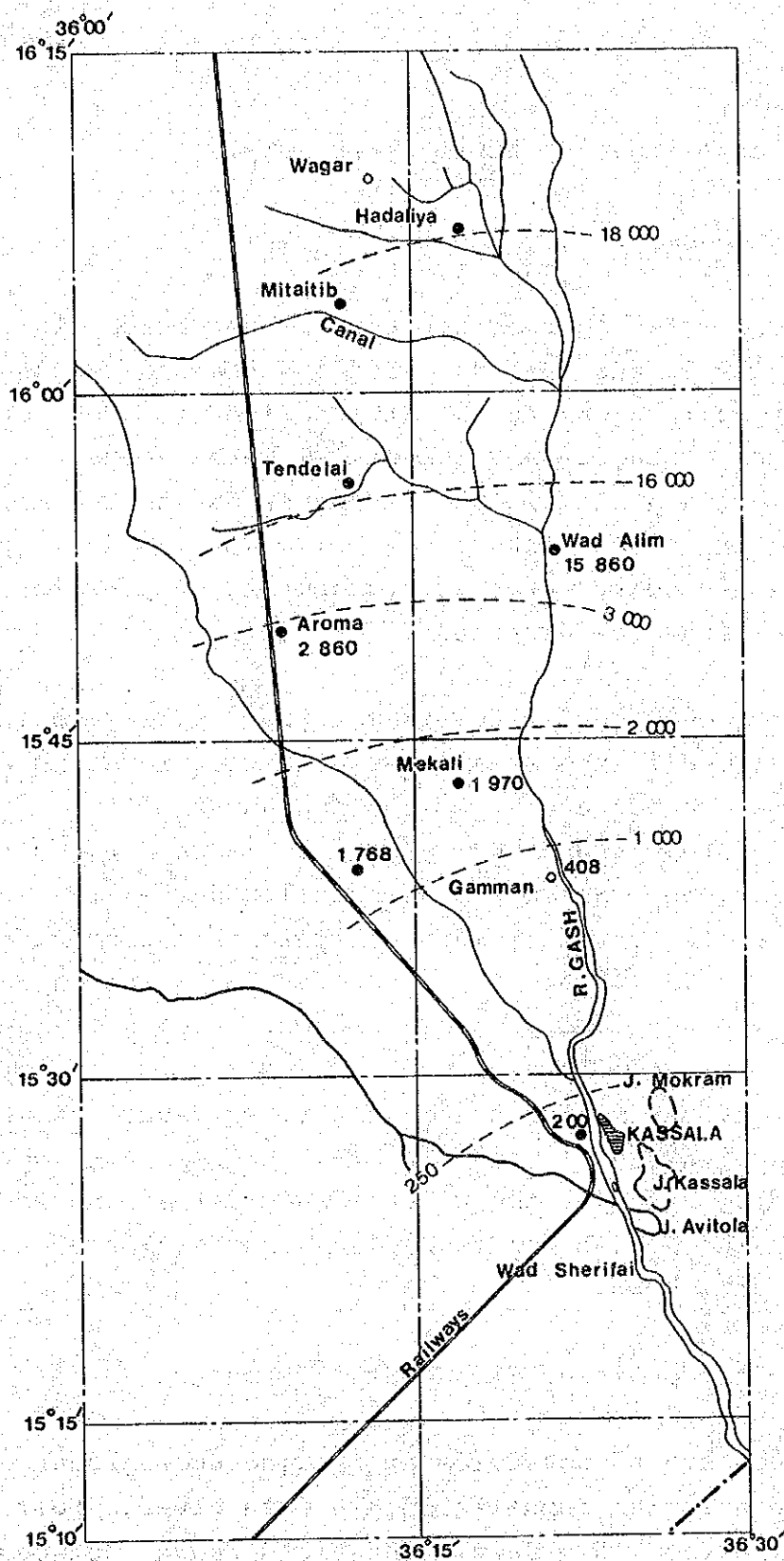


Figure. 12 Map Showing the Distribution of the Total Dissolved Solids in PPM. at Gash Delta

3.2 Present State of Rural Water Supply

3.2.1 Introduction

Major water sources for rural water supply in the Eastern Region is the surface water and the underground water. The surface water, the Atbara River is used for refugee camps at Showak and Khashim el Gerba where the underground water is not available. However during the months from January to April the river flow is considerably decreased. The necessary water is transported by tank lorries for 30km from the River to

The underground water from the alluvial deposits is utilized in the areas around Kassala Town and also the underground water from the Nubian Sandstones is used in a wide area around Gedaref Town. There are two types of wells, deep boreholes and shallow dug wells, however deep boreholes are much more reliable than seasonal shallow dry wells. There are about 500 boreholes in the Eastern Region and some of them were constructed in the 1940s.

Depths and yields are available for about 300 holes as shown in Fig. 13 and Fig. 14. All of these boreholes distribute over the alluvial deposit around Kassala Town and the Nubian Sandstones and the Tertiary Basalt around Gedaref Town.

3.2.2 Present State of Groundwater Usage

There are 65 boreholes extracting underground water from the alluvial deposits of the Gash River. Most of them do not exceed 100m deep. The yield ranges between $1 \text{ m}^3/\text{hr}$ and $45 \text{ m}^3/\text{hr}$. About 40% of borehole yields falls in the range between $2 \text{ m}^3/\text{hr}$ and $20 \text{ m}^3/\text{hr}$.

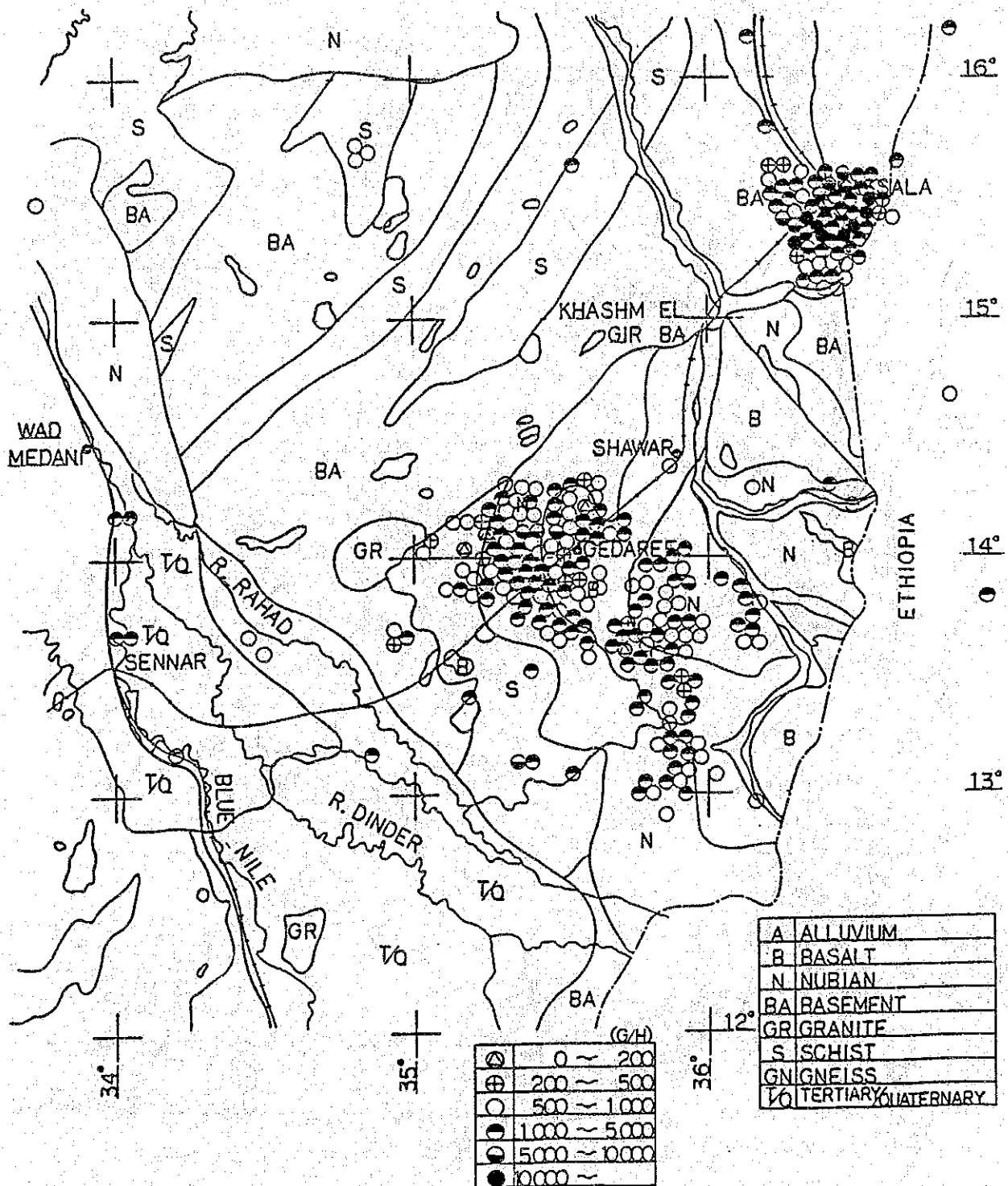


Fig. 13 Distribution of Well Yield

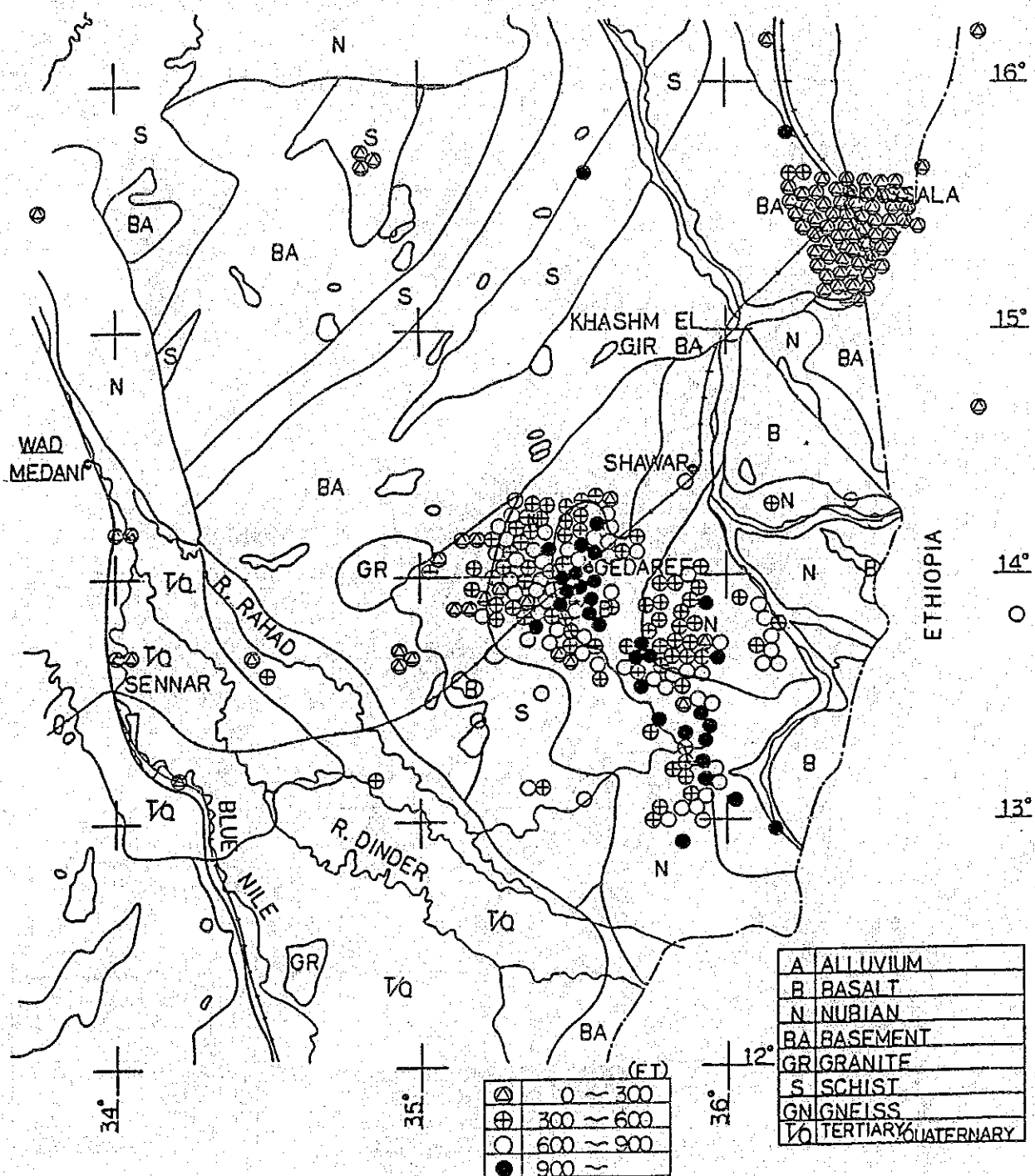


Fig. 14 Distribution of Well Depth

There are about 150 boreholes in the area of the Nubian Sandstones and the Tertiary Basalt. The depth of boreholes in the sandstones varies between 100 m and 300 m. However, boreholes in the Tertiary Basalt tends to be deeper than the depth of borehole in the sandstones since the water holding aquifer, the sandstones, lies beneath the Tertiary Basalt. Almost of 45% of 56 boreholes in the Tertiary Basalts is deeper than 300 m.

A large yield is obtained from the alluvial deposits. There are 15 boreholes yielding more than $45 \text{ m}^3/\text{hr}$. Most of the yield from single hole falls in the range between $2 \text{ m}^3/\text{hr}$ and $20 \text{ m}^3/\text{hr}$ in the Nubian Sandstones and the Tertiary Basalts. Although no borehole yields a large volume in these type of rocks most of boreholes give reliable yield.

There are some boreholes in the area of the Basement Complex where aquifer develops at fractures or weathered zone at intrusion. However, this type of aquifer develops only in a limited extent. There are 22 boreholes in the Basement Complex. All these holes are shallower than 300 m and 10 holes are less than 100 m deep. These boreholes are yielding quite satisfactorily ($2 \text{ m}^3/\text{hr}$ - $20 \text{ m}^3/\text{hr}$).

3.2.3 Rural Water Supply at Sudanese Villages

Rural population in the Eastern Region is about 1.1 million out of 1.5 million of the regional total population. Although the surface water is utilized for domestic purpose along the river courses only to a limited extent, major water source for rural population is the underground water.

There are about 500 boreholes in the area which are the main sources for rural water supply. Usually one water yard is located in each village in rural areas. There are one borehole and one storage tank connected to public taps and cattle trough in the water yard. Operation and maintenance is undertaken by three villagers appointed by the Rural Water Administration Office. Most of pumps and engines are very old and deteriorated.

An average daily consumption of water is usually determined by size of population and availability of water source. A favourable conditions allow villagers to consume 30-40 l/day/cap, however only 2-3 l/day/cap is available in many places due to deterioration of facilities or increase in population caused by arrival of refugees.

Under the circumstance, there are 159 places which urgently require rehabilitation of boreholes and another 35 places where supply capacity is insufficient for the present population. The size of population suffering from water shortage is estimated to be 400,000 people corresponding to 36% of total rural population.

3.2.4 Water Supply at Refugee Camps

At present most of refugee camps and settlements are suffering from shortage of domestic water. Only 15 l/day/cap - 5 l/day/cap of water is available. This is attributed to the fact that selection of the sites for refugee settlement is made based on various kinds of considerations and availability of water is not the only one factor, in addition continuously increasing number of refugees worsen the water supply conditions.

At present there are 27 boreholes as the sources of domestic water supply. However it is urgently required to construct 6 new water supply facilities and to rehabilitate 15 boreholes in existing water supply facilities at refugee camps.

Present conditions of these refugee settlements and camps are summarized in Table 4.

3.3 Present State of Water Supply at Local Towns

3.3.1 Introduction

There are four major local towns in the area;

<u>Name</u>	<u>Population</u>
Kassala Town	165,000
Gedaref	154,000
Khashim et Gerba	19,800
Showak	8,600

The source of urban water supply is the underground water in Kassala and the rest of the towns utilize the surface water. Where the surface water is used for water supply, water treatment plants are used. Major components of the urban water supply facilities are water source, elevated tank and distribution pipes. The private connection of water supply is only limited and many public taps are distributed over the urban area. The daily consumption of water varies over a wide range between 10 l/day/cap and 60 l/day/cap.

Table 4 LIST OF REFUGEE CAMP

Set up year	WAD SHEREF	Wad El Hellow	Helat Hcoma	Wad Role	Umm Ali	Umm Gargor	Karkorer	El Sauki	Tawawa
Set up Year	1982	1984	1984	1984	1981	1978	1980	1978	1979
Area (Km ²)	2.5 × 3.5	3.0 × 1.5	1.5 × 2.0	3.0 × 1.0	3.0 × 2.0	3.0 × 2.0	3.0 × 2.0		3.0 × 2.0
Population	172,000	14,000	A 12,500 B 15,500	31,900	3,000	5,000	3,000	6,500	24,000
Clinic	2	1		2	—	2	3	4	—
Hospital	1	1	1	2	—	—	—	—	—
School	4	—	—	—	—	2	3	4	—
Feeding Center	6	—	—	—	—	—	—	—	—
Distribution Center	6	—	—	—	—	—	—	—	—
Water Source	30	2	9	16	—	2	3		—
Deep Well	4	4	Atbara River		4	4	4	3	4
Hand Pump	6	—	—	—	—	—	—	—	—
Police Office	1	1	1	—	—	—	—	1	—
Water Supply(L/day)		5	15	12	10	10	10	10	10

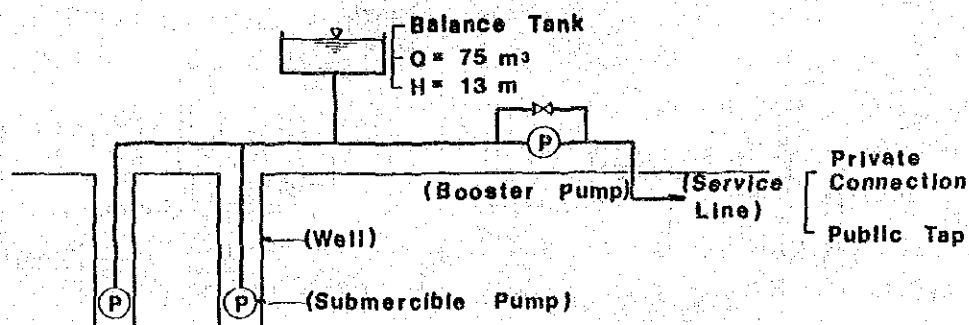
(—) Details are not available.

3.3.2 Water Supply with Groundwater Source

The water supply facility at the West Kassala Town serves all the urban area in the western part of the town. An average consumption is estimated to be about 40 l/day/cap. Existing facilities were rehabilitated under the cooperation of Dutch Government in 1983.

The water source is boreholes ($H = 50$ m, $\phi = 250$ mm). The underground water level is GL-15 m to -20 m and the unit yield is $45 \text{ m}^3/\text{hr}$ pumped by submercible motor pump. The energy source of pumps are public supply of electricity with emergency generator sets. Schematic diagram of this water supply facility is illustrated as Fig. 15.

Fig. 15 Flow System of Kassala Town Water Supply



The capacity of the water source is so small that the existing booster pumps are not used at present.

The water supply system in East Kassala Town is also similar type of the above illustration.