WATER SUPPLY SITUATION IN KASSALA PROVINCE AND WATER PROGRAMME PROPOSAL.

BY:
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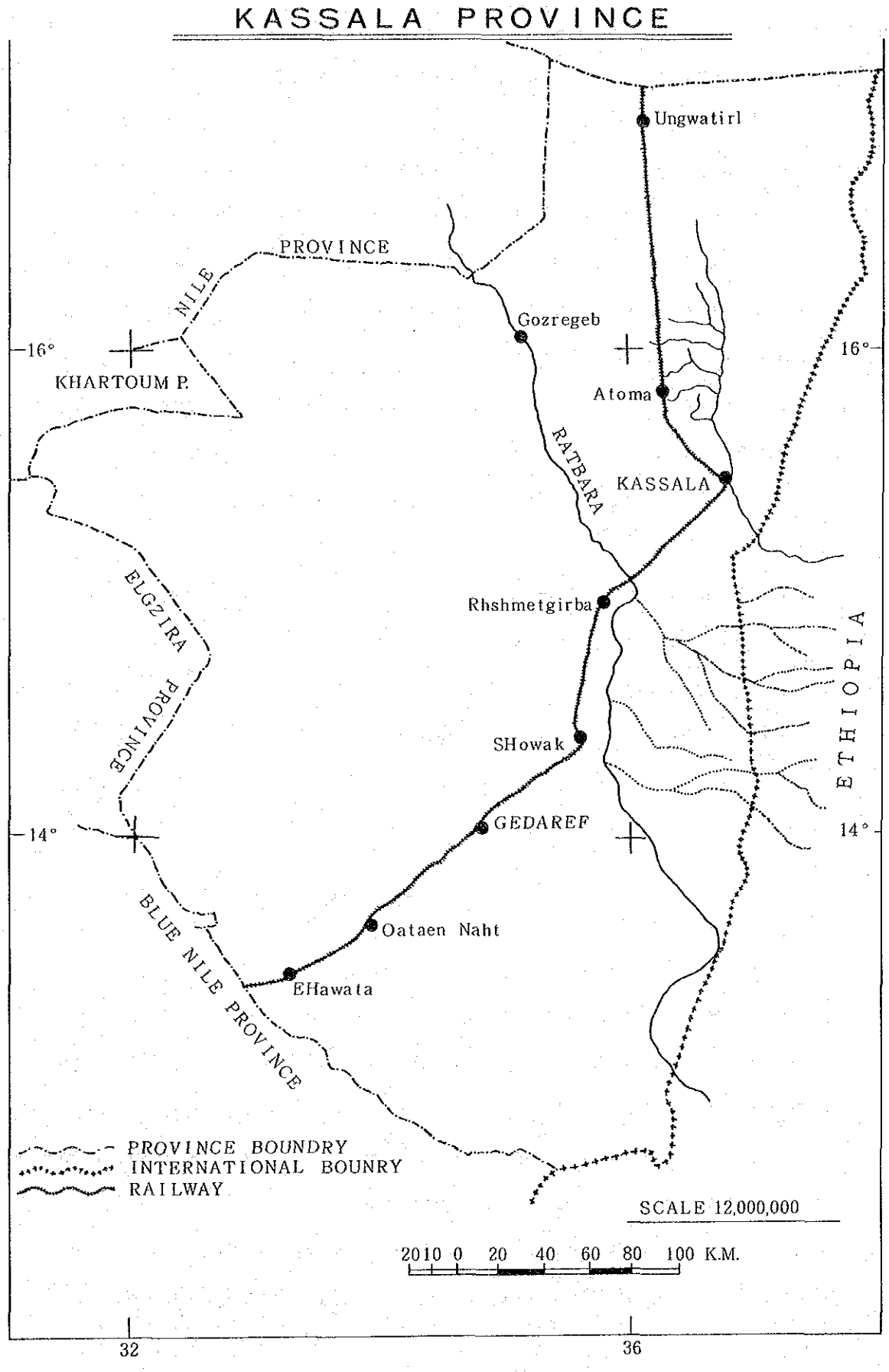
RURAL WATER ADMINISTRATION ----- KASSALA.

MAY, 1985.


KASSALA PROVINCE
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Introduction: -

The human population and livestock in Kassala Province suffers from shortage in water supply in the rural areas. Rural water administration is responsible for the operation and maintenance as well as the construction of new water supply sources in Kassala Province. Rural water administration can not increase the present quantities of water supply because of lack in Machineries and cash. Support of the rural water administration is required to be able to increase water quantities and relief the present critical situation.

Location: -

Kassala province lies east of Sudan approximatly between long. 37 - 30, 33 45' and lat. 13 15 N 18 15 N. It has borders with Ethiopia to the east Kassala province covers an area of 10,000 square Kilometers approximatly with a population of approximatly 1,512,325. Most of the population is rural 62.1% rural sedentary 11.8% nomads with 26.1% living in Towns.

Climate: -

The Climate of Kassala Province ranges from semidesert in the northern parts of the province to thick Savane in the southern parts annual rainfall ranges from 200mm in the north to 800mm in the south during the rain season (July--September). There are mainly two climatical seasons - a prolonged and hot summer (April--September) and a short cool dry winter (November--March). The summer are generally hot and dry but

fairly hot and humid during the rains (July--September) with maximium rainfall occuring in August. The temperatures ranges reaches as high as 45°C Summer (May) and 16°C in winter (January).

Geology and Hydrogeology: -

The geologic formations present in Kassala province are as follows: -

I. Basement Complex: -

Basement complex are the oldest rocks in the area (Pre-Comberian). It occupies the northern and western parts of Kassala province. The Basement complex consist of undifferentiated Basement complex, undifferentiated gneiss groups and undifferentiated schist groups. It is believed that the Basements complex was subjected to repeated deformations during the precomberian followed by intrusion of granites and quartz dykes in the comberion. The rocks are then subjected to erosian to form the depressions in which the Nubian sandstone was deposited later during the cretaceous. The Basement complex bears water in the upper weathered zone, fractures and joints. But it is considered as a poor aquifer and most of the boreholes drilled in the basement complex yield poor water both in quantity and quality.

II. Nubian Sandstones: -

They are present in the southern part of Kassala province. They consist of sandstones, Mudstones, conglomerates and intercalations of sandstones and Mudstones of variable

thickness. The Nubian sandstone is cretaceous in ege and is believed to be derived from the weathering products of the Basement complex. The Nubian sandstone is the best aquifer in Kassala province as far as water quality and quantity are concerned. Ground water occurs under confined and semiconfined condition and is present in the sandstones and conglomerates of the Nubian sandstone. The thickness of the Nubian sandstone ranges from 100 meters to more than 300 meters. The Nubian sandstone receives recharge either directly from the rainfall in outcrops areas or from the Volconic rocks where they overlies the Nubian formation. Well yield in the Nubian formation ranges from 7 M3/h to 36 M3/hr depending upon well depth and design specific capacity of Wells range from 0.3 M3/hr/m to 3.9 M3/hr/m.

The transmissivity of the Nubian formation depend on the number and thickness of sandstone lenses, grain size, degree of cementation, well depth, design and construction and development techniques. Trainsissivities of the Nubian sandstone formation ranges from 5 M2/day to 150 M2/day. Which are relatively law and reflect well construction techniques.

Volconic Rocks: -

Tertiary volconics occur in the southern parts of Kassala province in a north-south trending b d. They are composed of amygdoloidal olivine basalt which ranges in thickness up to several hundred feets. The Volconic outcrops

are weathered and exihibit deep fracture patterns which may extend several tens of meters below ground surface. The Volconic deposits were formed contemporaneaus with the Ethopian plateau Volconic series and were deposited as extensive lova and fissure flows overlying the Nubian sandstone ground water occurs under unconfined condition in the baselt. The occurence of ground water in this formation is controlled by fracture and joint patterns which are visible in surface exposing. It is believed that the degree of fracturing and thus the permeability of the Volconics decreases rapidly with depth. As a result of the limited storage capacity in the fractures and the seasonal nature of recharge, ground water levels in the basalts experience significant fluctnations between wet and dry seasons. Several Wells either, hand-dug or drilled were constructed in the basalt with yields generally less than 4.5 M3/hr and the water is generally poor in quality.

Alluvial Deposits: -

They occur along rivers, Khors, and Wadi areas. They are composed mainly of boulders, couples, gravels, sands, sandy clay and clays. They are believed to be quaternary in age, derived from the weathering products of the basement complex, the Nubian sandstone and the tertiary Volconics. The alluvial desposits are in some places (Gash and Atbara rivers) very good aquifers. They range in thickness from 30 meters to 50 meters. Transmissivities range from 457 M2/day to 2857 M2/day (Gash basin).

Superficial Deposits: -

With the exception of the areas where there are outcrops of the Basement complex, the Nubian sandstones or the Volconic rocks much of the surface in Kassala Province is covered by grey and dark black soil which consist of silt and clay. This material is refered to as "Cotton Soil" or "Badoba" and are derived from the decomposition of the Volconic rocks in Kassala Province and the Ethiopian plateau. These soils range in thickness from 7 meters to 10 meters. The superficial deposits are believed to be pleistocene to recent in age.

Water resources: -

Three categories of water supply sources exist in the Rural areas of Kassala province.: -

1- Shallow ground water supply sources, i.e. shallow Wells along Khors and Wadis.
2- Deep ground water supply sources, i.e. boreholes.
3- Surface water sources, i.e. Hafirs and earth embankmant.

1- Shallow ground Water Supply sources: -

Hand dug Wells, are used to tap shallow ground water in the Basement complex and the Volconic rocks along Khors and Wadis. In some places they are only sources of domestic water sources. Shallow wells. Constructed by the Rural water administration in Kassala Province are usually lined with cement, rocks and bricks. They range in depth from 20 meters to 30 meters with a diameter of 1.5 meters. Shallow ground water supply

sources in the basement complex areas and the Volconic areas are inadequate both in quantity and quality and unreliable particularly during extended drought.

2- Deep Ground Water Supply Sources: -

Deep ground water is tapped by boreholes with engine pumps and water yards, were drilled in the Nubian sandstone, Volconic rocks and alluvial deposits. With exception of the Volconic areas boreholes in Kassala province usually produced fair to excellent ground water both in quantity and quality. In all boreholes steel casing (API) Steel slotted screens or baridge sollted screens or Johansons stainless steel screens in the diameters of 6-5/8 or 8-5/8 inches where installed.

3- Surface Water Sources: -

A- Earth dam embarkment: -

Earth dam embarkments were constructed accross Wadis and Khors to raise the level of water and divert it to fill hafirs in some places (Northern parts of Kassala Province). They are used to spread rain water drained by Khors and Wadis for Agricultural purposes.

B- Hafirs: -

Surface water supply sources (Khors and Wadis) are very important in areas where geologic formation an structure does not favour the prescence of ground water. A large number of hafairs (136) exist in the North-western and South-western parts of Kassala Province where soil and drainage favour their construction. They represent the only available water sources in Qali El

Nahol and northern Gedarief. The water holding capacities of those Hafairs range from 20,000m³ to 180,000m³. Climatic conditions, soil and drainage are critical factor in conservation of surface water by hafirs usually large hafirs (More than 20,000m³) keep rain water which last through out the dry season until the next rainy season.

Present Situation: -

Kassala Province suffers from shortage of water supply in rural areas. The large numbers of population and livestock depend on water supply from 136 hafirs & 185 boreholes and approximately 212 hand-dug shallow Wells. Surveys carried out by rural water Administration reached to the following findings: -

1- All the Hafirs and dams are silted in different degrees which reduced their water holding capcity and they need repair and removal of silt.

   i) Hafirs construction before 1957 are either completely silted or can now hold only 25% of their original water holding capacity.

   ii) Hafirs that were constructed between 1957 and 1966 can now hold 60% of their original water holding capacity.

   iii) Hafirs that were constructed after 1966 can now hold 75% of their original water holding capacity.

2- Boreholes, pumps, engines, water yards need rehabilitation by the provission of new pumps, engines, pipes,

valves and fittings.

3- Hand-dug shallow Wells are unreliable because most of them became completely dry during the dry season dut to the decline of the water level.

4- Total amount of water supply available now for boreholes and shallow Wells in approximately - 3,000,000m³ (three million cubic meters per year).

5- The human population needs alone is estimated as 8,057,844m³ (eight million fifty seven thousands & eight hundred fourty four cubic meters). Assuming consumption per person per day is 20 Liters.

6- The limited sources of funds and illness of most machineries and logistics of the rural water administration in Kassala province, due to lack of spare parts and supporting materials, greatly accelerate the deterioration of the existing water sources.

7- Boreholes represent the only reliable water supply sources, but the provision of water through construction of hafirs involve effective community participation but they would seluse less water permanely.

Rural Water Administration - Kassala Province - Organization: -

The rural water administration in Kassala Province was established to develop water supply sources in rural areas by: -

1- Drilling & Erection of boreholes.

2- Constructions of Hafirs & earth embankments

3- Digging shallow Wells.

4- Operation and maintenance of water supply sources.

The executive Manager stationed in Gedaref is directly under the director general of rural water administration in Kassala. There are maintenance sub-offices in Doka, New Halfa & Kassala. The general organization of Gedarif office is as follows: -

1- Ground Water Section: -

A geological section is headed by a senior geologist assisted by two geologist and one ground water Engineer assistant.

2- Drilling Section: -

Is headed by a chief drilling Engineer assisted by two drilling engineers and three drilling teams.

3- Surface Water Section: -

This section is responsible for making technical surveys, designs for all earth moving works, including hafirs, dams and earth embankment. This section is also responsible for the measurement of rainfall and discharge of Khors in elected Locations. It is headed by a Civil Engineer, Surveyors, Draftmen, Technical assis., and Skilled labours are also available.

4- Open Well Section: -

Is headed by an engineer stationed in Kassala with two teams. This section construct shallow hand-dug Wells along Khors and Wadis.

5- Instalation and Erection Section: -

Is headed by a chief engineer assisted by four assistant engineers and two teams. This section carries out

installation of pumps, erecting of water stand points, elevated tanks and pipe lines.

6- Mechanical Section: -

Is headed by a senior Mechanical engineer assisted by four Mechanical engineers, Technical assistants, Skilled Mechanics and Labourers. This section is responsible for maintaining Pumps, Engines, Vechicles, and heavy Machineries.

COST ESTIMATES: -

Cost estimate for drilling of one borehole 600 feet deep with final casing 6-5/8 diameter.

Casing Tube - 555 feet	LS	12,210
Filter-45 feet	LS	4,500
Bentonite	LS	4,500
Fuel and Lubricant	LS	10,800
Labour Expenses	LS	7,843
Development & Testing	LS	2,500
Over heads	LS	12,000
Contingences	LS	2,000
Total	LS	56,353

Cost estimates for construction of one open Well 50 feet deep.: -

Cement	LS	1,800
Building Material	LS	1,500
Fuel	LS	1,000
Explosives	LS	7,000
Labour	LS	3,000
Over heads	LS	2,400
Contingencies	LS	1,000
Total	LS	11,700

Cost of earth work for hafirs and dams can be considered as per cubic meter. For construction of hafirs 60,000m^3 the cost is LS 300,000.

INVENTRY OF EQUIPMENT & MACHINERIES RURAL WATER ADMINISTRATION. KASSALA PROVINCE.

	No.	Condition
Air hammer drilling rigs (Ingersol Rand T4)	1	idle-need drilling Tools & Spare Parts.
Mud rotary Drilling rigs (Conrad)	1	good.
Mud rotary Drilling rigs (Mehew 500)	1	idle-need mud pump.
Cable Tool drilling rigs....	1	idle-need spare parts.
Well Development Unit	1	good.
Buldozers	2	good.
Scrapers	3	one idle-need S.Parts.
Water Tankers	3	good.
Trucks	6	good.
Vehicles, Toyota, Landrover	4	good.
Water Engines & Pumps	185	need repairs & S. Parts.

添付資料－6

/REGIONAL ADMINISTRATION FOR/

ELECTRICITY & WATER

SUBJECT: KASSALA TOWN WATER SUPPLY

INTRODUCTION

** Kassala Town is wholy dependent on water extracted from boreholes for it's domestic water supply. The system has been established in 1949. Now there are ten wells sited to feed the main town, and five others for area west of Gash. The Demand for water, outstripped output of wells during the last five years. So we can now assume the town water supply as rather critical especially in dry season.

WATER SUPPLY

** Kassala town is naturally devided by the Gash River to two parts, east and west. The main town falls on the east side, whereas considerable residential areas are on the western side. Demography inhabitants 1985 gave: -

East bank	111,500
West bank	53,500
Total;	165,000

** The town tolerated the impact of refugees on her amenities especially drinking water. As thousands of refugees settled in the town while thousands others are bening watered from supply by tankers.

** The abstraction of Domestic water from groundwater is 3.9 million cubic meters per year this figure been derived from production capacity of wells, which is 587m^3/h at on average running hours of 21hr per day.

** The only storage available is one overhead concrete tank with 50m³ capacity and 75 ft. high at the eastern side of Gash. While two overhead steel tanks, 100m^5 capacity, 14 hight at the western side of Gash.

** There is no ground storage at present. A Booster Station has been built in the water yard at Gash west area to maintain pressure throughout the distribution system, yet it is now fourmonths been shut down for lack of adequate water yield from the only two wells operating there.

** Four wells are bening cleaned and a fifth one will be constructed shortly.

** All these need Submersible pumps, rising pipes meters flow and pressure gauge and inter connection pipelines, to the existing system.

2/ Distribution

These existing transmission and distribution lines which form the network system are: -

10"	5,420 M.L.
8"	2,490 M.L.
6"	24,300 M.L.
4"	42,080 M.L.
2"	107,000 M.L.

** Except for the 2" lines of polythene tubing all other demensions are of A.C. pipes CLB. And C.L. detachable joints, C.I. Sluice plain ended values, C.L. Tees/bends crosses and Tapers are used as fillings throughout the system.

** The number of Consumers house connection is about 12,000.

** Also a Sector of the inhabitants rely on Public taps to obtain their needs for drinking water.

** These could reach 50% of the total inhabitants of the town.

** We quote hereunder the actual consumption from the feasibility study for Kassala water supply carried by HASKONING Royal Dutch consulting Engineers during last June.

House and yard connection	70 L/c/d.	57%
Via heighbours	20 L/c/d.	13%
Water Venders	20 L/c/d.	17%
Public taps	20 L/c/d.	10%
Private well	20 L/c/d.	3%
Average domestic demand	47.91/c/d	100%
Non domestic demand	12/c/d	
Lesses unaccounted for	15.1 L/c/d	
Total Average demand	75 L/c/d.	

VARIATION IN DEMAND

Peak hour - average hour:	1.5
Peak month - average month:	1.3

** Not exempting any connection all are metered, and the monthly consumption readings at consumers premises are bening collected regularly but, due to shortage to water meters spare parts almost 60% or more of the total installed water meters are not registering, and we deem very vital to urge provision of spare parts.

** There is also several shortage in tools and equipment of specialized nature, used in the distribution network. For instance, we need, A.C. pipes turning machines, Cutting machines, Wrenches and spanners, Flow and pressure recording

equipmemt, etc.

3/ PROBLEM AREAS IN DISTRIBUTION

Please refer to the attached plan for Kassala Area development Project, prepared by DHV consulting Engineers in August 1982 as part of their report on the water distribution system of Kassala Town.

Cost Estimate For Kassala and Khashm El Ginsba Towns Water Supply: -

1-	Submersible pumps (75m/m-100-150)Ø	
	- Max output: 40M³/H	
	- Head: 50M	
	- Number require from: 75Ø MM 10	
	100Ø MM 10	
	150Ø MM 10	
	TOTAL COST	300,000
2-	Detachable Joint - Valve and others	50,000
3-	P.V.C. Pipe or A.C. Pipe ..... (75m/m-100-150)Ø	400,000
4-	High pressure Filter plant out put 75M³/H (1)	500,000
5-	Concrete tank 500M³	250,000
6-	Steel Tank 200M³ in 15M Height	200,000
7-	Clorine pressuer plant (10)	50,000
8-	Generate sets 20-30KV (10)	200,000
9-	Rising main pipe heavy steel ..... (75m/m-100-150)Ø MM	300,000
		2,250,000 S. Pound.

添付資料－7

WATER PROGRAMME PROPOSAL

FOR KASSALA PROVINCE

Introduction: -

The number of population that live in Kassala Province is 1,512,325, 73.9% of whom are rural (62.1% rural sedentary and 11.8% nomadic). There exist also a very large number of livestock population (767,853 cows, 1,276,826 sheep, 1,043,514 goats and 627,873 camels).

The human population and the livestock population in Kassala province depend on the following types of water supply.: -

1- Surface water sources, i.e. hafirs, dams and earth embankment.

2- Shallow ground water sources, i.e. hand dug shallow Wells along Khors and Wadis.

3- Deep ground water sources, i.e. boreholes, the surface water sources and the shallow ground water sources are unreliable and depend on climatic conditions. They become totally inoperative during extended drought. During recent years drought struck most parts of Kassala Province especially the Northern parts of the province. This condition lead to the dislocation of most of the rural population, who are forced to immigrate with their livestock to the southern parts of the province, where there are reliable water sources (deep boreholes) and large grazing areas. A shortage number of refugee from Ethiopia and west Africa immigrated & settled in the southern parts of Kassala province. This condition placed a great strain on the provission of water supply and created aptrained relations between the resident rural sudanese

tribes in southern Gedarif and other rural tribes who have come from the northern parts of the province as well as between all sudanese tribes and the refugees. Under the situation described above it becomes inevitable that the existing water sources (boreholes, pumps, engines & water yards and hafirs) in Kassala province especially in southern parts of the province be rehabilitated and boreholes and hafirs be constructed. There is no accurate figures for the number of human population and animal population who immigrated from the Northern parts of Kassala province to the southern parts also there are no accurate figures for the number of refugees who settled there, but it is believed that it is significant.

Water Quantity: -

Water quantity in rural areas can be increased to meet the present water supply demand as the following: -

1- Hafirs & Dams

Were constructed by rural water administration in areas where the geology does not favour the drilling of boreholes and there are suitable soil and drainage conditions are attempts were made each year by the rural water administration to remove the silt accuanulations in Hafirs inorder to increase their water holding capacities. This technology of Hafirs & dam construction and silt removal needs to be strengthened through reinforcing the existing poor earth moving machineries and the law

cash involved of the rural water administration.

2- Boreholes Drilling: -

Boreholes drilled by the rural water administration in casing diameter of 65 & 8-5/8" are the only reliable water supply sources in Kassala province. Rural water administration can drill about 40 boreholes per year if the existing drilling rigs are repaired & materials, spare parts, logistics and cash are made available.

Open Well Construction: -

With the existing teams rural water administration can construct 10 open well each year. The number of open wells constructed can be increased if proper tools Vehicles and cash are made available.

Purpose and Objectives: -

The purpose of the programme is to increase water production and improve existing water sources to satisfy water demand.

The objectives of the programme include the following: -

1- Strengthening Rural water administration ensure efficient operation and maintenance of improved water sources.

2- Provide water production to meet the present demand of rural population and livestock.

Specific Objectives: -

1- To supply 185 new engines and pumps to replace the existing old engines and pumps.

2- To Drill 60 new boreholes and equip them with engines and pumps and water yards.

3- To construct 30 new hafirs with holding capacity of 60,000 cubic meters each and repair the other existing Hafirs in Kassala province.

4- To construct 50 new open wells.

(Programme for Kassala Province only us including post Sudan Province)

Supplies and Equipment required for KASSALA PROVINCE.

	Qty.		Approx. Value
Spare Parts for air hammer drilling rig ..... (Ingersol Rand)(Made in USA)	-	LS	500,000
Spare Parts for rotary drilling rig ..... (Made in USA)	-	LS	100,000
Spare Parts for Cable Tool drilling ..... rig (Made in Japan)	-	LS	60,000
Trucks (7 ton)	8	LS	480,000
Water Tanker (5,000 Gal.)	6	LS	600,000
Bucket Loader (With shavel 0.5 - 1.0m^3 ..... earth move)	2	LS	360,000
Buldozer (With spare parts)(45 ton)	4	LS	1,600,000
Scrapers (With spare parts)(7 m^3)	8	LS	3,200,000
Low level Trailer (65 ton carrier)	2	LS	1,200,000
Land Rover or Toyota pick up	8	LS	0320,000
Casing Tubes (6-5/8" - 8-5/8" API)	12,000m	LS	1,440,000
Screens (6-5/8" - 8-5/8" Jhonson)	900m	LS	0270,000
Galvanized pipes & fittings respectively ..... 3"-2"-1"	3,600m	LS	0360,000
Valves 3"-2"	750No	LS	22,000
Taps 1"	2,940No	LS	29,000
*1 Courrgated Zinc sheets, mild steel ..... Angles, barbed wire rolls	-	LS	1,440,000
*2 Elevated Tank with Tower	20	LS	1,000,000
*3 Survey Equipment	-	LS	50,000
*4 Camping Equipment	-	LS	100,000
SUB-TOTAL (A)	-	LS	13,131,000
Operation & construction expenses:	-		- 600,000
			12,531,000
Fuel and Lubricants	-	LS	1,950,000
Labour expenses & Incentives	-	LS	2,800,000
SUB-TOTAL (B)	-	LS	4,750,000
GRAND TOTAL	-	LS	17,881,000

*1: for pumps room roofing and fence

*2: 10,000 galon capacity (Fibre glass tanks. Brigiston) 36 feet hight

*3: Stuff, Leveling, tape, measurements, etc. *4: Mainly tent

Quantity	Discription	Unit Price	Total Price LS=
	To supply Spare Parts for Ingersol Rand Rig.		
30	: Drilling pipes 5½ x 25	6,348,400	190,452,000
1	: Sub 4FH Pin x 6-5/8 Api Rig Box ... with Flat & Float	6,766,450	6,766,450
1	: Sub 4FH Pin x 4½ Api Rig Box ..... with Flat & Flaot	4,656,600	4,656,600
1	: Sub 4FH Pin x 4 PH Box with ..... Flat & Float	4,006,600	4,006,600
1	: DHD 17 Total Spares Package	56,066,100	56,066,100
1	: DHD Down Hole Drill	58,369,600	58,369,600
2	: 8B8 Button Bit	17,327,600	34,655,200
50	: IHS Hammer Drill compound P/kg. ..	49,960	2,498,500
1 Set	: Down Hole Drill Hammer 16A	58,606,500	58,606,500
5 Sets	: Oil Seal Pt. No. 5062 1077 for ... Rotary Power Head TSW	217,750	1,088,750
5 Sets	: Pt. No. 5062099 for Rotary..... Power Head TSW	8,537,700	42,688,500
2	: HOSE Assembly Pt. No. 95424917 ... 1½ x 30	389,650	779,300
2	: " Pt. No. 95424925 ... 1½ x 26	355,300	710,600
2	: " Pt. No. 9542458 .... 1½ x 20	813,600	1,627,200
2	: " Pt. No. 95424941 ... 1½ x 45	573,000	1,146,000
	Total		*5 464,117,900

(Total Amount Four Houndred Sixty Four thousands and one hundred Seventeen Sudanese pounds and 90 PT.)

調査団注

*5: P－14の⊛500,000LSとの差は、当Specificationが4ケ月前に試算されたものであるため、その後の物価の値上りも考慮し、再評価したことによる。

REFERENCES:

- UNICEF, 15/1/1984 Water Supply Situation in the Red Sea Province and Water Programme Proposal.

- James M. Montgomery, July, 1983.

- Gedaref Water Supply and Obid Waste Disposal Feasibility Study Final Report.

- Abd El Moniem Mahd. Ahmed, July, 1982.

- Semi-Dtailed Soil Survey report of the Gash Kassala Area Report No. SSA/123 - Soil Survey.

- Administration - Wad Madani.

- TNO, 1982, Water Resources Assessment-Kassala-Gash Basin, Final Technical Report.

- Rural Water Administration, Files and Records.

- Regional, Ministry of Finance and Economy.

- Dec., 1984, The Gash Delta Water Supply Study.

- Regional, Ministry of Finance and Economy.

- Dec., 1984, Population Census in the Eastern Region.

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EXISTING WELLS IN KASSALA PROVINCE

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yield	Casing Diameter	Remarks
				ft		G/h		
1	5385	Umm El touor -B-	06/07/71	601	188	900	6-5/8	
2	2214	Ellukdi	19/03/68	1055	370	-	" "	
3	5413	Grerat	01/06/72	808	200	840	" "	
4	2287	Umm Brakiet -A-	67/68	535	375	900	" "	
5	5388	Umm Brakiet -B-	17/05/72	503	-	-	" "	
6	6707	Hashaba	74/75	696	105	2200	" "	
7	3184	Elgedema	67/68	873	157	1440	" "	
8	4248	Zehana	68/68	1114	173	720	" "	
9	6182	Elgera	70/71	637	105	1000	" "	
10	6181	Wad El helaw	73/74	588	144	1000	" "	
11	6708	Umm Wood	75/76	691	95	1800	" "	
12	3615	Gala Elnahel	57/58	425	148	-	" "	
13	3616	Gala Elnahel	57/58	425	100	-	" "	
14	1415	Gala Elnahel	68/69	136	062	420	" "	
15	2604	Gala Elnahel	62/63	388	190	900	" "	
16	3529	Gala Elnahel	62/63	300	090	4400	" "	
17	2774	Elamara	68/69	509	324	1007	- -	
18	2424	Elafa	70/71	140	-	-	- -	
19	2425	Tagoog	70/71	071	-	-	- -	

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yield	Casing Diameter	Remarks
20	3024	Wad Sharifie	70/71	121	020	-	- -	
21	3289	Wad El shagra	70/71	901	044	2604	" "	
22	5392	Umm Melaha	71/72	1218	222	660	" "	
23	2001	Tamargo	-	380	-	680	" "	
24	3294	Mahala	23/01/65	1254	091	1118	" "	
25	3296	Marud	09/02/70	1214	105	1308	" "	
26	0703	Elhari Elgadina	70/71	-	-	-	- -	
27	0222	Zerga	71/72	0315	075	1440	- -	
28	0173	Elkmadob	72/73	0180	159	1200	8-5/8	
29	0172	Domat	72/73	180	101	600	" "	
30	2412	Abo Asal	19/05/68	1020	520	560	6 "	
31	4272	Wad Kabrus	68/69	3036	204	829	" "	
32	3112	" "	68/69	0829	204	3036	" "	
33	3110	Wad Elhelengi	68/69	0783	174	3000	" "	
34	4268	" "	68/69	0871	164	2196	" "	
35	3111	El Sufara	69/70	0689	152	3210	" "	
36	4270	" "	69/70	0750	-	-	" "	
37	2276	El Huri Elgaded	67/68	0420	-	0800	" "	
38	2474	Wad Daeef	14/05/68	0347	060	1800	" "	

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yeild	Casing Diameter	Remarks
39	2475	Wad Daeef	17/05/68	0324	105	-	6-5/8	
40	2451	Abu Areif	68/68	0291	060	8000	" "	
41	4271	" "	67/68	0893	146	2778	" "	
42	3500	El Saraf	11/11/69	0942	230	-	" "	
43	4265	" "	68/69	0911	033	4000	" "	
44	3151	Ginan	69/70	1130	293	2370	" "	
45	5940	"	68/69	0645	112	-	" "	
46	3145	Tageli	68/69	0515	095	0840	" "	
47	-	Asar	70/71	-	-	-	- -	
48	3994	Sasaib	70/71	0884	116	3396	" "	
49	2500	Sasaib	05/06/68	0350	-	-	" "	
50	0173	El Toria Elgadida	71/72	0350	159	1200	" "	
51	3996	El Kmadieb "	71/72	0778	162	3140	" "	
52	0222	Ziragia El Gadida	71/72	0375	0075	1440	8 "	
53	-	Kanara	72/73	-	-	-	- -	
54	5409	Wad Widaida	72/73	0673	0250	1040	6 "	
55	4303	Sabonie	71/72	0612	0091	3243	" "	
56	2059	Tabark Alla	66/67	0695	0290	0960	" "	
57	2070	Tabark Alla	66/67	626-	0300	0960	" "	
58	2011	Kakoom	66/67	0868	0230	0700	" "	

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yield	Casing Diameter	Remarks
59	2034	Kakoom	66/67	0993	0340	0700	6-5/8	
60	2281	Abu Galoot	06/01/73	655	230	900	" "	
61	4301	Barper Wad fugara	72/73	806	150	1500	" "	
62	5389	" " "	24/04/72	834	125	1200	" "	
63	4254	Elgalla Salamet	14/04/71	586	285	2000	" "	
64	2490	Churieqana	30/05/68	606	195	1700	" "	
65	2489	Arida	02/12/68	450	230	1000	" "	
66	4310	Arida	67/68	-	-	-	- -	
67	1789	Shueib	64/65	555	335	1200	" "	
68	1828	"	64/65	520	-	-	" "	
69	4308	Umm Sawani	24/04/71	445	192	3000	" "	
70	4308	" "	13/12/68	380	130	2000	" "	
71	1924	Abu Elnaga	-	877	-	6000	" "	
72	3185	Umm El Tyour	04/06/69	580	235	0700	" "	
73	3302	Glabat	72/73	1022	249	0822	" "	
74	3301	Kinena	71/72	0986	074	0690	" "	
75	2903	Babakeri	71/72	0470	130	2000	" "	
76	5391	"	26/02/72	0691	290	0850	" "	
77	4255	Basonda	26/01/72	0717	150	-	" "	
78	4258	Basonda	06/03/71	0717	150	-	" "	

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yield	Casing Diameter	Remarks
79	3297	Wad Kaseiba	71/72	1189	258	1920	6-5/8	
80	3288	El Hemra	68/69	0853	103	3120	" "	
81	1438	" "	68/69	0465	070	1100	" "	
82	2923	El Kafia	67/68	0494	054	1180	" "	
83	2176	El Samina	64/65	1100	-	1200	" "	
84	1788	Abu Arwa	68/69	0859	-	1000	" "	
85	1909	" "	68/69	0702	072	1600	" "	
86	2020	El Saraf Elahmer	21/03/69	0282	068	1200	" "	
87	3525	Saraf Saied	66/67	0500	045	1240	" "	
88	2920	" "	18/02/74	0530	227	1000	" "	
89	2742	Wad Genofa	68/69	0396	104	2500	" "	
90	5394	Allam	10/01/72	0735	190	0900	" "	
91	4300	Um Rakoba	71/72	1160	113	3000	" "	
92	4309	Gezoli	70/71	0889	287	2280	" "	
93	3992	Rashed	70/71	0609	047	2775	" "	
94	3991	Tawaret	72/73	0701	064	3360	" "	
95	3160	Greeb	19/04/69	0397	170	0600	" "	
96	2197	Greeb	18/03/68	0606	100	1200	" "	
97	3298	Girag El Sora	19/04/70	1099	-	-	- -	
98	5393	Umm Kharayiet	02/03/72	0847	065	1000	" "	

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yield	Casing Diameter	Remarks
99	1253	El Soubag East	60/61	0151	-	0900	6-5/8	
100	1414	El Soubag West	61/62	0248	247	0800	" "	
101	1641	El Karadas	62/63	0451	125	0700	" "	
102	1653	" "	27/12/73	0453	110	0700	" "	
103	6180	" "	27/12/73	0585	165	1000	" "	
104	1011	Kilo -6-	60/61	0600	220	0750	" "	
105	1503	" "	63/64	0305	200	0700	" "	
106	5411	" "	18/02/72	0513	157	0960	" "	
107	4312	Umm Khanger (Donkey)	02/11/70	0605	120	2000	" "	
108	3015	" "	09/03/69	0473	203	0600	" "	
109	0703	Umm Gulaga	57/58	0500	162	1300	" "	
110	0736	" "	13/05/82	0500	163	1200	" "	
111	9019	" "	-	0520	145	6000	" "	
112	9020	" "	21/05/82	0455	143.6	6000	" "	
113	0209	Umm Khanger School	70/71	0332	221	1440	" "	
114	1736	" " "	70/71	-	-	-	" "	
115	4316	El Azaza Elmtar	69/70	0736	-	1200	" "	
116	1693	Umm Shoraba	70/71	0215	203	0800	" "	
117	3436	El Azaza Elmtar	69/70	-	-	-	- -	
118	3532	Umm Seneibra	70/71	926½	330	4500	" "	

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yield	Casing Diameter	Remarks
119	4241	Umm Seneibra	70/71	937	150	1200	6-5/8	
120	1772	Wad Shaboot	64/65	511	120	1100	" "	
121	1779	" "	64/65	455	290	1050	" "	
122	0225	Wad Kabo	69/70	525	105	0720	8 "	
123	0325	" "	69/70	350	100	1220	" "	
124	0236	Elrwashda	69/70	1003	364	40	6 "	
125	4283	"	69/70	0620	-	-	- -	
126	3939	Dar Elzein	69/70	0706	126	Bailer	" "	
127	4283	" "	69/70	0960	340	1500	" "	
128	1845	Wad Bazel	64/65	0723	305	0620	" "	
129	1875	" "	64/65	0600	305	1050	" "	
130	3535	El Ugol	70/71	0625	-	Bailer	" "	
131	4282	" "	26/11/70	0605	-	1200	" "	
132	3534	El Sharafa	10/06/70	0965	320	Bailer	" "	
133	3528	Hilt Hassan	20/03/70	0645	148	1460	" "	
134	4314	Hilt Hassan	25/12/70	0695	171	2000	" "	
135	1623	Wad El Syed	63/64	0944	377	5600	" "	
136	1644	" " "	63/64	0940	310	0560	" "	
137	1777	Umm Sunta	63/64	0345	-	0900	" "	
138	3149	El Shimailab	69/70	1095	400	-	" "	

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yield	Casing Diameter	Remarks
139	5533	Tawawa	26/06/70	0710	126	Bailer	6-5/8	
140	4280	"	21/11/70	0780	-	2000	" "	
141	1918	Tubaktory	70/71	0300	-	3000	- -	
142	1846	Sheikhain	64/65	0460	170	1000	" "	
143	2856	"	64/65	-	-	-	- -	
144	5401	El Gammam	15/04/72	0429	190	0720	" "	
145	1692	Shasheina Wasat	65/66	1553	250	6000	" "	
146	2091	" El Sabtab	65/66	0750	250	800	" "	
147	6713	Umm Gargora	1975	1064	200	1300	" "	
148	6714	" "	-	-	-	-	- -	
149	9021	" "	1982	0607	225	3600	" "	
150	9022	Umm Gargora	1982	505	-	-	" "	
151	6912	Korkora	1974	760	220	1000	" "	
152	6913	"	1975	695	248	1000	" "	
153	9023	"	1982	505	217	-	" "	
154	9024	"	1983	480	217.5	-	" "	
155	4313	Wad Kabo North	1975	440	280	900	" "	
156	3146	Wad Kaba West	1975	470	340	-	" "	
157	2001	El Tamergo	1948	380	-	-	" "	
158	323	" "	1949	350	200	1440	" "	

Number	National Number	Location	Date of Drilling	Depth in ft.	Static water level in ft.	Yield	Casing Diameter	Remarks
159	4277	El Drabi	70/71	397	150	4800	6-5/8	
160	4304	Hilt Hakoma	69/70	740	135.10	4800	" "	
161	3290	Doka	67/68	756	-	-	" "	
162	3291	"	67/68	790	-	-	" "	
163	5012	"	67/68	597	-	-	" "	
164	2430	Golsa	70/71	40	-	-	" "	
165	2721	Deplawait	71/72	122	25	Bailer	" "	
166	8045	Mastoura	78/79	124	50	-	8 "	
167	-	El Ramla			929		6 "	
168	3295	Madagelseboot	70/71	1218	222	660	6 "	
169	-	Abouda	82/83	-	-	-	- -	
170	Kar-9015	Karakoon	81/82	79	30	2000	" "	

HAFIRS IN KASSALA PROVINCE

No.	Location	Long	Lat	Capacity M^3	Year of Construction	Remarks
1	Beia (1)	35 00	13 25	9243	49/50	Gala El nahal District
2	Beia (2)	35 00	13 25	9243	49/50	Gala El nahal District
3	Umm Beroush	34 58	13 17	7289	49/50	Gala El nahal District
4	Jabal Mrafa	34 50	13 19	6038	49/50	Gala El nahal District
5	Ban (1)	34 55	13 25	8989	49/50	Gala El nahal District
6	Ban (2)	34 55	13 25	9240	49/50	Gala El nahal District
7	Grain	34 48	13 32	11541	49/50	Gala El nahal District
8	Kartout	34 49	13 37	6152	49/50	Gala El nahal District
9	El Geer	35 04	13 40	1400	49/50	Gala El nahal District
10	Khor Kawisher	35 02	13 41	16324	49/50	Gala El nahal District
11	Jabal Beila	34 51	13 41	19569	54/55	Gala El nahal District
12	Galbi	34 44	13 37	29517	54/55	Gala El nahal District
13	Kartout	34 49	13 36	10781	54/55	Gala El nahal District
14	Umm Masan	34 43	13 29	10710	54/55	Gala El nahal District
15	El Areed	34 48	13 33	15000	55/57	Gala El nahal District
16	El Esma	34 52	16 40	10000	55/57	Gala El nahal District
17	Abu Hammiry	34 56	13 31	15000	57/58	Gala El nahal District
18	El ban Geded	34 48	13 30	15000	57/58	Gala El nahal District
19	El haliba	34 43	13 36	10000	59/60	Gala El nahal District

No.	Location	Long	Lat	Capacity M^3	Year of Const-ruction	Remarks
20	Gala El Bagar	34 59	13 10	18000	59/60	Gala El nahal District
21	Jabal Atash	35 09	13 18	16000	59/60	Gala El nahal District
22	Wad Wadeida	35 06	13 27	10000	59/60	Gala El nahal District
23	Um Baliel	35 20	13 26	15000	60/61	Gala El nahal District
24	Wad fortoug	35 17	13 25	16000	60/61	Gala El nahal District
25	Beila (2)	34 49	13 30	30000	66/67	Gala El nahal District
26	Galbi	34 49	13 37	25000	66/67	Gala El nahal District
27	Ban (3)	34 55	13 25	35000	67/68	Gala El nahal District
28	Balos	34 57	18 23	35000	67/68	Gala El nahal District
29	El Aaried	34 48	13 23	25000	67/68	Gala El nahal District
30	Som	35 22½	13 12	110000	67/68	Gala El nahal District
31	El Sunot	35 19	13 09	40000	67/68	Gala El nahal District
31	Wad Digna -A-	35 18	13 44	89333	49/50	Gala El nahal District
32	" " -B-	35 18	13 44	1163	49/50	Gala El nahal District
33	Bohirat El Hawata	34 38	13 35	125000	71/72	Gala El nahal District
34	El Mafaza	34 33	13 37	25000	72/73	Gala El nahal District
35	El Matama	35 05	13 38	25000	72/73	Gala El nahal District
36	Umm Sharaha	35 09	13 83	20000	69/69	Gala El nahal District
37	Salmeen	35 08	13 25	25000	68/69	Gala El nahal District
38	El Agar	34 59	14 50	3000	68/69	Gala El nahal District
39	Galat El Daroat	35 35	13 16	20000	68/69	Gala El nahal District

No.	Location	Long	Lat	Capacity M^3	Year of Const-ruction	Remarks
40	Hafir Abu Nahal -1-	34 56	13 08	185000	68/69	Gala El nahal District
41	El twam -2-	34 56	13 08	226000	68/69	Gala El nahal District
42	Abu nahal -3-	34 56	13 08	10000	68/69	Gala El nahal District
43	Abu nahal -2-	34 56	13 08	10000	68/69	Gala El nahal District
44	Abu nahal -5-	34 56	13 08	10000	68/69	Gala El nahal District
45	Abu nahal -6-	34 56	13 08	10000	68/69	Gala El nahal District
46	Gerain	33 45	13 37	25000	68/69	Gala El nahal District
47	El Gadmballia	35 02	14 02	160000	47/48	Northern-Gedarif
48	Tab El Mara	34 38	13 34	6725	47/48	Northern-Gedarif
49	Tab El Zaraf	34 27	13 33	7472	47/48	Northern-Gedarif
50	Waid Musran	35 19	15 15	16977	54/55	Northern-Gedarif
51	El Nawasil	35 28	14 54	11564	54/55	Northern-Gedarif
52	Kasmur	35 28	14 36	31150	54/55	Northern-Gedarif
53	El Migenins	35 13	14 34	5217	54/55	Northern-Gedarif
54	Siroog Muhmoud	34 58	14 51	22775	54/55	Northern-Gedarif
55	Abu Ganafid	34 36	14 51	22795	49/50	Northern-Gedarif
56	Abu Grade -2-	34 32	15 04	15191	54/55	Northern-Gedarif
57	El Mumdra	34 23	15 00	10733	54/55	Northern-Gedarif
58	El Agar	34 20	14 49	8190	54/55	Northern-Gedarif
59	Gorad	34 16	14 40	7694	54/55	Northern-Gedarif

No.	Location	Long	Lat	Capacity M^3	Year of Const-ruction	Remarks
60	Amat Romeia	34 41	14 10	10871	54/55	Northern-Gedarif
61	El Kradies	35 22	14 11	9070	54/55	Northern-Gedarif
62	El Twafa	35 04	14 11	20012	56/57	Northern-Gedarif
63	El Gadambaliya -2-	35 02	14 06	25000	58/59	Northern-Gedarif
64		35 03	14 06	20000	59/60	Northern-Gedarif
65	Wad Dioul	34 56	14 08	20000	59/60	Northern-Gedarif
66	Amat Rawabi	34 44	14 06	20000	59/60	Northern-Gedraif
67	El Faw	34 17	14 07	2000	59/60	Northern-Gedraif
68	Abu Rakhama	34 33	13 56	8000	59/60	Northern-Gedarif
69	Wad Rawyan	34 51	15 43	20000	59/60	Northern-Gedarif
70	Wad Rahad	34 30	15 34	20000	59/60	Northern-Gedarif
71	El Shageig	33 48	15 17	15000	59/60	Northern-Gedarif
72	El Hawa	34 00	15 43	30000	59/60	Northern-Gedarif
73	Salatna	34 30	13 25	35000	59/60	Northern-Gedarif
74	Miyas	34 35	13 47	15000	60/61	Northern-Gedarif
75	Camp (5)	34 48	13 55	15000	60/61	Northern-Gedarif
76	Abu Gnafid	34 40	14 50	12730	49/50	Northern-Gedarif
77	Abu Grad	34 40	13 03		49/50	Northern-Gedarif
78	El Giegi	35 07	15 25	25173	49/50	Northern-Gedarif
79	El Hoshieb	35 19	15 05	24333	49/50	Northern-Gedarif

No.	Location	Long	Lat	Capacity M^3	Year of Const-ruction	Remarks
80	El Rawashda	35 34	14 11	25000	60/61	Northern-Gedarif
81	Wad Yousif	35 16	13 45	2500	62/63	Northern-Gedarif
82	Khazan Dalasa	35 26	14 00	160000	63/64	Northern-Gedarif
83	El Souki	34 40	14 25	35000	66/67	Northern-Gedarif
84	Umm Kamda	34 34	13 20	30000	66/67	Northern-Gedarif
85	El Baniya	34 21	14 10	25000	67/68	Northern-Gedarif
86	Gabal Gaili	33 46	15 02	26000	68/69	Northern-Gedarif
87	El Gleita	34 25	15 45	15000	68/69	Northern-Gedarif
88	Umm Sarha	35 25	14 40	30000	71/72	Northern-Gedarif
89	El Bahogi	34 33	15 26	25000	70/71	Northern-Gedarif
90	Jabal Harba	34 38	14 01	25000	68/69	Northern-Gedarif
91	Grain -2-	33 45	13 23	25000	68/69	Northern-Gedarif
92	Kobri No. 1	35 03	14 03	7753	49/50	Northern-Gedarif
93	Kobri No. 2	35 05	14 03	7998	49/50	Northern-Gedarif
94	Al Lia	35 06	14 07	3131	49/50	Northern-Gedarif
95	Camp 4 (1)	24 52	13 59	13902	49/50	Northern-Gedarif
96	Camp 4 (2)	34 53	13 59	14374	49/50	Northern-Gedarif
97	Abu Siena	34 40	14 31	25888	49/50	Northern-Gedarif
98	Jabal El Atash	34 56	15 34	12600	51/52	Northern-Gedarif
99	El Atash	34 56	15 34	26619	54/55	Northern-Gedarif

No.	Location	Long	Lat	Capacity M^3	Year of Const-ruction	Remarks
100	El Gigi -2-	35 04	15 17	15688	54/55	Northern-Gedarif
101	El Mafaza	34 32	13 38	33000	72/73	Northern-Gedarif
102	Shag Elagar	34 33	14 50	30000	68/69	Northern-Gedarif
103	El Gargaf	36 11	14 47	60000	70/71	Northern-Gedarif
104	Jbal Haliba	34 43	13 36	10000	59/60	Northern-Gedarif
105	El Shabka	33 48	15 17	15000	59/60	Northern-Gedarif
106	El Kafai	35 49	13 22	14650	47/48	Southern-Gedarif
107	Kasab	35 26	13 51	5550	47/48	Southern-Gedarif
108	Shasheina	35 35	13 52	11340	49/50	Southern-Gedarif
109	El Syadein	35 21	13 33	81566	49/50	Southern-Gedarif
110	Sagea Songa	35 23	13 41	6113	49/50	Southern-Gedarif
111	Wad Digna -1-	35 18	13 44	11062	49/50	Southern-Gedarif
112	" " -2-	35 18	13 44	8933	49/50	Southern-Gedarif
113	Elmogran	35 01	13 49	20000	55/56	Southern-Gedarif
114	El Galba	34 59	13 55	15000	55/56	Southern-Gedarif
115	El Matana	35 05	13 46	20012	56/57	Southern-Gedarif
116	Abu Morwa	35 09	13 52	20012	56/57	Southern-Gedarif
117	El Gamhoria	35 05	13 51	50000	56/57	Southern-Gedarif
118	El Gorisha	35 56	12 30	15000	56/57	Southern-Gedarif
119	Khazan El Gorisha	35 56	12 30	23800	57/58	southern-Gedarif

No.	Location	Long	Lat	Capacity M^3	Year of Const-ruction	Remarks
120	Khazan Abu Galoat	33 30	13 40	102137	57/58	Southern-Gedarif
121	Camp -8-	35 05	13 58	20000	59/60	Southern-Gedarif
122	Elgongusa	35 08	13 38	10000	59/60	Southern-Gedarif
123	El Kafai	35 49	13 21	20000	59/60	Southern-Gedarif
124	El Kenyna -A-	35 50	13 18	20000	59/60	Southern-Gedarif
125	" " -B-	35 51	13 18	45000	59/60	Southern-Gedarif
126	Umm Tirimbi	34 45	13 50	15000	59/60	Southern-Gedarif
127	El Gelaa	34 55	13 52	12000	59/60	Southern-Gedarif
128	El Kiwashier	35 01	13 45	1000	60/61	Southern-Gedarif
129	Doka	35 45	13 30	40000	66/67	Southern-Gedarif
130	Khazan Rashid	35 59	13 30	120000	67/68	Southern-Gedarif
131	Jabal El Hmra	35 33	14 11	9745	54/55	Southern-Gedarif
132	El Mahak	35 20	13 34	28035	54/55	Southern-Gedarif

添付資料－8

WATER SUPPLY SITUATION IN KASSALA PROVINCE AND WATER PROGRAMME PROPOSAL

INTRODUCTION: -

Refugees in Kassala province: -

1- The association of Kassala province with the refugee problem from neighbouring Ethiopia goes back to 1967.

2- The policy of the Government take place to relieve assistance, shelter, medical case and transfer away from sensitive border areas, all which required substantial public spending, the government has so far established many settlement in Kassala province, many of these settlement have become self supporting and social services, water supply and administration are given by the government, other rural settlements in Suki, Wad Awad, Abu Rakam, Umgargar, Karkora, Kilo 26, New Halfa have been established in order to reach self-sufficiency.

3- In the commining years the government hopes to accommodate some 1.3 million refugees in planned rural settlements in Kassala province with the help of the assistance.

The Technical team: -

The joint team of Japan and the technical committee made feasibility study of the planned rural settlements and sudanese villages towns, consisted of the following experts: -

1)	Eng. Karrar Mohamed Ahmed	FOR and team cordinator
2)	Eng. Siluman Osman	COR Rural Settlement
3)	Eng. Mohamed El Hussien	General Director NWC
4)	Eng. Mohamed Osman	General Director RA For Electricity of Water
5)	Four Eng's From Japan	Government Consultant

TEAMS OF REFERENCE OF THE MISSION: -

- Based on information maps provided by the government and on visit to proposed sites the team is undertake a technical approach of the proposed future and the existed water points for both Refugee and Sudanese settlements.
- Review the water resources and plan for domestic water supply systems (Bore-Holes) shallow wells, river pumps stations, pipe line, filteration and storage village distribution system) and derermine materials and

update costs for inclusions in the project proposals,

- Riview the locations and lay out of the villages and settlement.
- Province out line specification for all capital equipment indentified for immidiate purchases.

The Study: -

The joint team met for a series of meeting to discuss the work plan and review all available background information in Khartoum during the first days. It proceeded to Kassala province for a week Field visit to the area beginning in Showak (administrative Head-quarters of Refugee programme) to visit, Shagarab Abuda, East and West bank of El Gash River.

In addition the team was able to rely of considerable amount of back-ground materials related both Refugee and Sudanese water projects. With the assistance of government and Refugee administration in Kassala province.

Water Resources: -

Four system were constructed in Kassala province depend on the source of Water.

1- Deep Boreholes.
2- Shall Wells.
3- Under ground Earth Reservoir.
4- Over ground Earth reservoir.
5- Fiter plan from irrigation Cannal.
6- Distribution pipe line from nearest source.

The Proposal Requirement: -

1- Drilling new boreholes for both Sudanese and Refugees settlements.
2- Construction of new hafir and reservoirs.
3- Up grading the water system in towns wihch have from (40-70%) refugees populations and hence water has reached shortage and dangerous pro-portions.
4- Repair and maintain the existing water yards in Kassala province.
5- Up grading the water system for
   - Kassala Town
   - Kish El Girba
   - A Roma

Plan and Programme of Action: -

1- New bore Holes for Refugees.

a- Wad El Hileaw	No. 2	⎫	↑
b- Wad Sherife	2	⎭	

c- Hilat Hcoma (Hilat Hakuma)		1	8	
d- Wad Kole (Kowli)		2		
e- Umm Ali		1		
2- New Hafir for Refugees: (Capacity 40,000M³)				
1- Amm Sagata		No. 1	8	for Refugees.
2- Deheima	Hawata area	1		
3- Adinguar	(5,000 x6) refugees	1		
4- Umm barush	(3,000 x6) Sudanese Ave.	1		
5- Salin		1		
6- Pan, Balos, Bia		3		
3- Repair and Rehabiltate of Existing Wells for Refugees settlements: -				
1- Umm gargur		No. 2	15	
2- Karkora		2		
3- Wad El Helow (Hileaw)		3		
4- Wad Sherifiz		4		
5- El Suki		2		
6- Tawawa		2		
4- Upgrading of Existing Water Supply System for Refugees Settlement: -				
1- El Girba Water yards (Net Tank, Pump, Filter Plant)				
2- Abu Nabl areas, near Hawata area (Treatment Plant, Pumps, Filter Plant)				

Drilling of new bore-holes for Sudanese Village: -

1- Umm El Tour	60- Abu Gallot
10- Wad El Helow	72- Umm El Tyour
16- Gala El Nahl	74- Glabat
	77- Kinena
22- Umm Melaha	82- Basonda
27- Zerga	83- Wad Kesila
29- Domat	86- El Kafia
37- El Huri El Gaded	89- El Samina
46- Tagli	90- El Sarig El Ahmer
54- Widaida	97- Wad Genofa
94- Wad Widaida	115- Allam
56- Tabarkalla	132- El Azaz El Matar
116- Girgor El Sora	142- El Sharafa
138- Umm Sharaba	150- Sheikhain
144- El Shimailab	167- Umm Gargora
161- El Gamam	

168- Hilt Hakoma 169- Doka

170- El Ramla 171- Madagelseboot

Mainttenance and Rehabilitation of Existing Boreholes and the System of Water Supply: -

These water yards constructed and errected Ten years ago, some of them are out of order and other need major maintenance.

1- The Total number about 150 water yards as follow: -

2- Rehabilitation and rectification of existing hafirs: -

- North Gadarief	No. 8	17	for Sudanese
- South Gadarif	4		
- Galal Nahl	2		
- Kassala Area	1		
- El Shoak Area	2		

3- Construction of new hafir for Sudanese village: -

- Gash Delta	No.10	Capacity	40,000M^3	30
- South Gadarief Council	11	"	"	
- Qala El Nahl	2	"	"	
- North Gadarief	7	"	"	

SPECIFICATION OF MACHINERY AND EQUIPMENT: -

1- Earth moving machine: -

a- Scrapers and spare parts (12-16m^3) capacity	3	Units
b- Buldozer (D8)	1	"
c- Low level trailer (65 (65 ton carrier)	1	"
d- Water Tanker 5000 Gall.	1	"
e- Fuel Tanker 5000 gall.	1	"

2- Pumps: -

a- Turbine pump and diesel engine for wells.

- Average head 80 M
- Out put 10 M^3/H

b- Submersable pump (electrical pump)

- Size (50-17-100mm dia.)
- Average head 200M
- Out put 25M^3/H

c- Generater Sets (20-25KV)

3- Casing Pipe: -
   - Size (6-5/8 - 8 dia. ∅)
   - Steel Pipe 3 to 6m length

} 600 ft. av.

4- Screen: -
   - Size (6-5/8" - 8" dia. ∅)

5- Rising Main Pipe: -
   - Galvanized iron steel, 3M length
   - Szie (50 - 75 - 100 mm dia. ∅)

6- Distribution Pipe: -
   - P.V.C. Pipe
   - Galvanized Pipe
   - Size (75 - 100 - 150 mm dia. ∅)
   - Bent -valve-Tee (75 - 100 - 150 mm ∅)

7- Storage Tank: -

a- Fiber Glass Tank (25 - 50 M^3) Complete

b- Steel Stamtion Tower >m Height

c- Sheet Metal Steel Tank (25 - 50 M^2) complete

8- Mobile Work Shop: -

Truck 10 Tons payload as work shop suitable for maintanance and irrication of water yards with Try Pod or drag.

Caot Estimater: -

1- Cost estimate for drilling of one bore hole 600 feet deap with final casing 6-5/8" diameter: 180M.

- Casing Tube 600 ft.	14,000
- Filter 60 ft.	6,000
- Bentonite	4,500
- Fuel	10,000
- Development & Testing	3,000
- Contingenees	4,000
- Over Heads	6,000
- Labour Expenses	8,000
Total	55,500 Pounds

2- Cost estimate for Construction hafir (40,000M^3 Cap) Cost per M^3 Including: -

- Inlet - Out Let Pipe
- Fencing
- Coment & Concrete Material

- Juel - (abrroalim-Spare Parts)
- Wages and Other Expenses

Total Cost = 40,000 x 6 = 240,000 Pounds

3- Cost Estimate for Erection of Water: - 180M

- Diesel Engin with Pump Complete with rising main	15,000
- Steel Pump House	8,000
- Elevated Tank complete with Tawer ($50M^3$-$8M^3$)	40,000
- Water Points at Water Yard	2,000
- Fuel	2,000
Total	67,000

4- Estimate Cost for Maintenance and Rehabilitation of Existing Boreholes: -

- Replacement of Engine & Pumps	15,000
- Improvement of Water Yards	10,000
- Development Test	3,000
Total	28,000

5- Estimate Cost for Rectification of Hafir: -

Cost including-earth moving-fud- material-labour-fencing-construction of wires: - 20,000 Pounds

20,000 Pounds per Hafir 20m000 Pounds

6- Estimate Cost for Filtration Plant: - $25M^3/H$

- Pumps (2)	20,000
- Steel Tank	40,000
- Drain Pipes Values & Distribution System	15,000
- Construction Material	20,000
- Labour	20,000
Total	115,000 Pounds

7- Estimate Cost for Earth Moving Machine:

- Screpars with Spare Parts (3)	1,200,000
- Buldozer (1)	400,000
- Water Tank (5,000 Gall.)	60,000
- Fud Tanker (10,000 Gall.)	80,000
- Low level Jrader	200,000
Total	1,940,000 Pounds

TOTAL COST ESTIMATE DUE TO THE REQUIREMENT FOR REFUGEES

SPECIFICATION	NEW BOREHOLES FOR REFUGEES	NEW HAFIR REF.	REPAIR EXIT HAF. -REF.	REP OF EXIST WELL REF.	UP GRADING OF EXISTING WATER SUPPLY	ERECTION OF NEW WELL	TOTAL SUD. POUNDS	
QUANTITI	8 No.	8 No.	8 No.	15 No.	3 No.	8		
Cost (LS)	444,000	1,920,000	160,000	420,000	150,000	536,000	3,630,000	
Unit Cost (LS)	@55,000	@240,000	@20,000	@28,000	@50,000	@67,000		

TOTAL COST ESTIMATE DUE TO THE REQUIREMENT FOR SUDANES VILLAGE

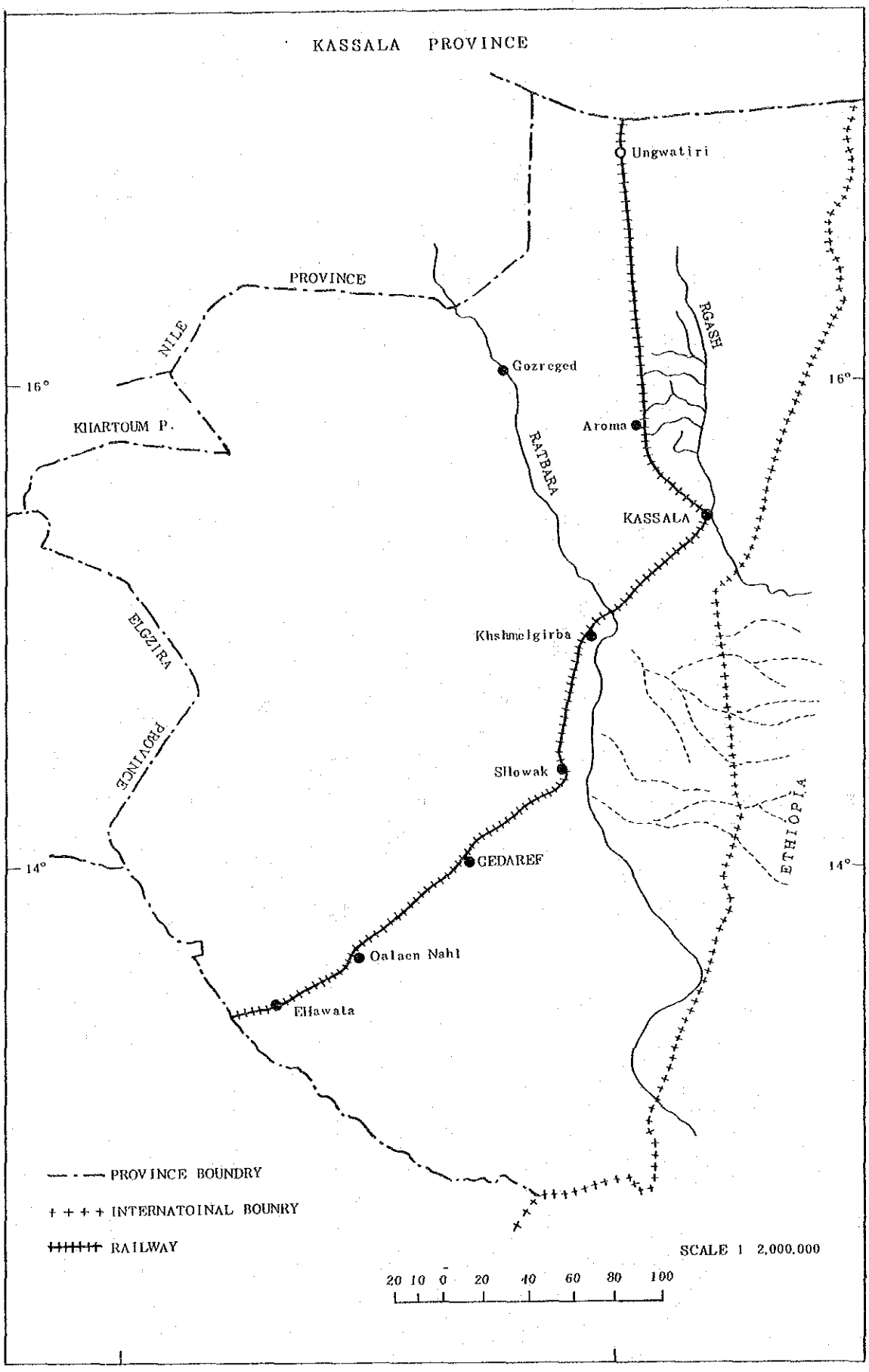
SPECIFICATION	NEW BOREHOLES FOR REFUGEES	NEW HAFIR 40,000M^3	REPAIR EXIT HAF. -REF.	REP OF EXIST WELL REF.	UP GRADING OF EXISTING WATER SUPPLY	ERECTION OF NEW WELL	TOTAL SUD. POUNDS	
QUANTITY	33	30	17	150	3	33		
Cost (LS)	1,831,500	7,200,000	340,000	4,200,000	600,000	2,221,100	16,382,500	
Unit Cost (LS)	@55,500	@240,000	@20,000	@28,000	@200,000	@67,000		

SUMMARY OF COST

COST ESTIMATE OF SUD. VILLAGE	COST ESTIMATE OF REF. SETT.	EARTH MOVING MACHINERY	TOTAL	REMARK
16,382,500	3,630,000	1,940,000	21,952,500	The Cost due to Local price included taxes and other dubes. Where government project from duties about 30% Reduction.

添付資料－９＜資料入手リスト＞

1）地形図	
①　S＝1／200万（スーダン東部域）	1
②　S＝1／100万（ハルツーム）	1
③　S＝1／25万（カサラ）	1
2）地質図その他	
①　スーダン全域地質図（S＝1／200万）	1
②　タメ池分布図	1
③　新設井戸分布図（ボーリング深井戸）	1
3）地質説明書（ゲダレフ地域）	1
4）降雨資料	1
5）UNHCR　Brifing Note	1
6）COR難民センサス	1
7）カサラ地域の給水の現状と水計画に関するプロジェクト	1
8）カサラ町及びカシム・エル・ゲルバ町の給水の現状とプロポーザル	1
9）カサラ地域の現状と水計画に関するプロポーザル（COR）	1
10）カサラ町及びカシム・エル・ゲルバ町の給水の現状とプロポーザル（COR）	1
11）スーダンの一般諸事情に関する資料その他	1式


KASSALA PROVINCE
Ungwatiri
PROVINCE
NILE
RGASH
Gozreged
16°
KHARTOUM P.
Aroma
RATBARA
KASSALA
Khshmelgirba
ELGZIRA
PROVINCE
Sllowak
ETHIOPIA
14°
GEDAREF
Oalaen Nahl
Ellawata
PROVINCE BOUNDRY
INTERNATOINAL BOUNRY
RAILWAY
SCALE 1 2,000,000
20 10 0 20 40 60 80 100