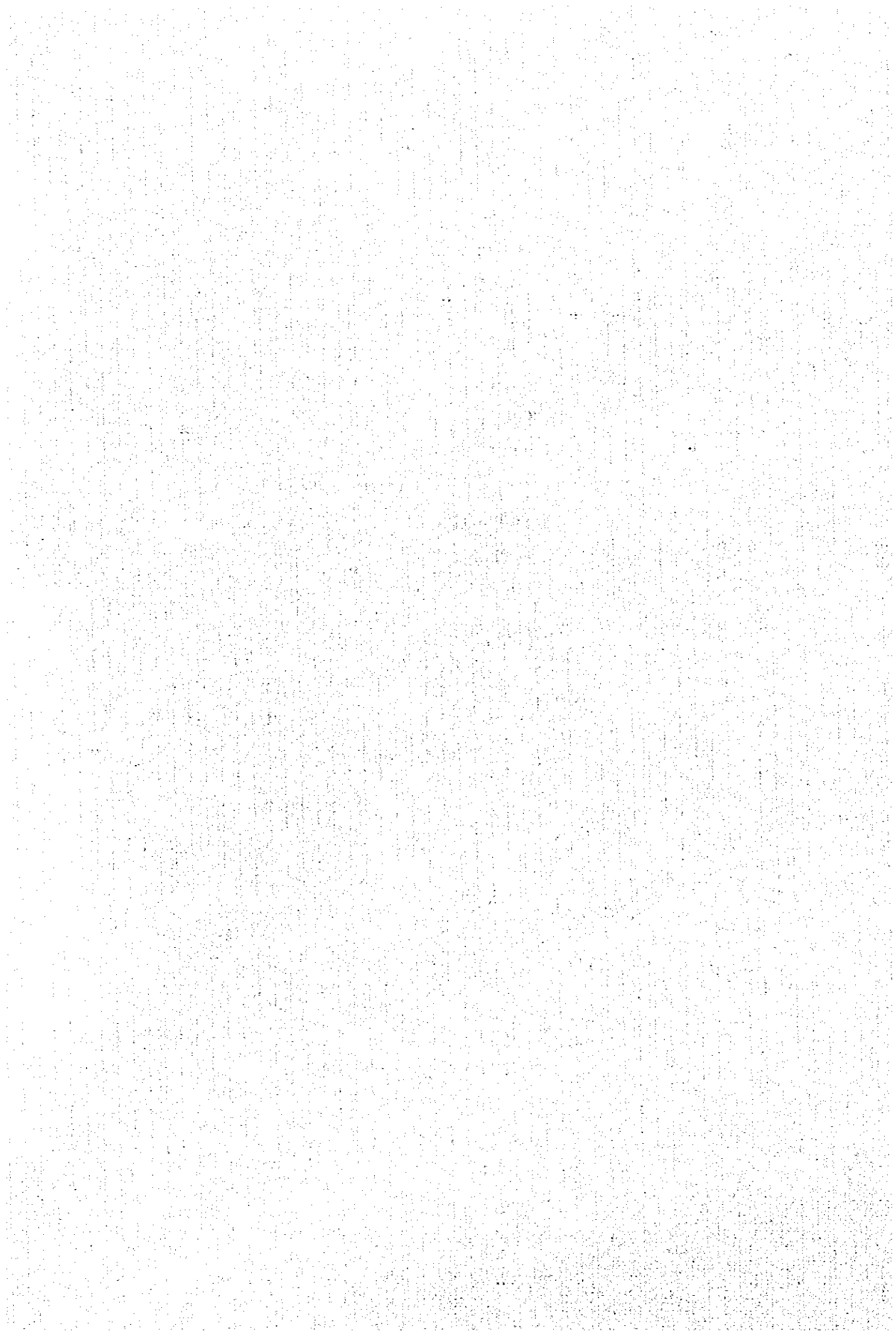


附 属 資 料

1. 要請書
2. Scope of Work (S/W)
3. Minutes of Meeting (M/M)
4. 調査用機材リスト
5. 面会者リスト
6. 水法
7. 質問票及び調査結果
8. 収集資料リスト
9. 価格調査票
10. ローカルコンサルタント等一覧

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附属資料1. 要 請 書

REPUBLIC OF KENYA

MINISTRY OF LAND RECLAMATION, REGIONAL
AND WATER DEVELOPMENT

TERMS OF REFERENCE FOR
FEASIBILITY STUDY ON MERU URBAN WATER
SUPPLY PROJECT AND
ENVIRONMENTAL IMPACT ASSESSMENT STUDY

MARCH 1994

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FEASIBILITY STUDY ON MERU URBAN WATER SUPPLY PROJECT
AND ENVIRONMENTAL IMPACT ASSESSMENT STUDY

1. INTRODUCTION

The Government of Kenya, in its national Master Plan has set up policy to supply potable treated water to all nationals by augmenting water supply projects throughout the country, with a priority order of i) ongoing projects, ii) tourism area, iii) district centres and iv) other urban centres. Tables 1 and 2 shows designated ten urban water supplies and their project status respectively.

Meru Municipality is an administrative centre of Meru District, standing on the eastern gentle slope of Mt Kenya. It has an estimated population of 78,000 with a high growth rate of more than 3.5% per annum.

Meru Water Supply System was designed and implemented in 1956. Since then Meru Town has expanded considerably. As such the existing water supply facilities are incapable to supplying adequate and fully treated water. In this regard, therefore, the facilities requires rehabilitation and expansion to meet the town's water demand.

To enable the realisation of this goal, it is necessary to carry out feasibility study and to identify possible effects of water consumption increase on the Kathita River and its protective measures. In this respect, the Government of Kenya is requesting the Government of Japan to extend technical assistance for a Development Study on MERU URBAN WATER SUPPLY PROJECT AND ENVIRONMENTAL IMPACT ASSESSMENT STUDY.

TABLE 1 DESIGNATED MAJOR WATER SUPPLIES IN KENYA

Urban name	Population (1000 nos)			Water Demand(1000m3/day)		
	1990	2000	2010	1990	2000	2010
Nairobi	1,413	2,261	3,456	333	553	802
Mombasa	480	673	904	100	152	203
Nakuru	172	470	870	35	87	152
Kisumu	176	376	579	26	55	89
Eldoret	113	273	487	20	48	84
Nyeri	97	219	371	16	35	60
Machakos	91	215	356	14	34	56
Meru	79	193	320	13	32	53
Kitale	56	142	249	9	23	41
Thika	59	136	218	11	25	39
Total	2,736	4,958	7,819	577	1,044	1,579
Proportion of National Total						
	12%	16%	19%	35%	38%	38%

Source: National Water Master Plan, 1992

TABLE 2 PROJECT STATUS OF TEN MAJOR WATER SUPPLIES

MUNICIPALITY	DONOR COUNTRY OR INTERNATIONAL AGENCY					REMARKS
	IBRD	GERMANY	JAPAN	EEC	AFBD	
Nairobi	Const		Const	Const	Const	3rd Phase ongoing (Co financing)
Mombasa	F/S	Const				Ongoing
Nakuru			X			Completed in 1992
Kisumu		X				Completed in 1988
Eldoret		Const				Ongoing
Nyeri					X	Completed in 1992
Machakos					X	Completed in 1991
Meru			O			Requesting to G.O.J
Kitale						Nothing going on
Thika					X	Completed in 1992

Source : Ministry of Land Reclamation, Regional and Water Development

2. OBJECTIVES OF THE STUDY

The objectives of the study will be to carry out the following:-

- a) To formulate rehabilitation and expansion plan for Meru Urban Water Supply Project up to a target year, 2010.
- b) To establish appropriate phased implementation programme of the proposed rehabilitation and expansion plan.
- c) To carry out technical and economical feasibility study on the first stage of the implementation programme.
- d) To carry out environmental impact assessment study due to an increase of water consumption.

3. STUDY AREA

The study covers all areas under jurisdiction of Meru Municipal Council, including current supply area of Meru Urban Water Supply.

4. SCOPE OF THE STUDY

4.1 Collection and review of previous studies and existing data:-

- i) Socio-economic conditions
 - a) General Socio-economy
 - b) Land use and urban development plan, (structure and physical)
- ii) Natural conditions
 - a) Meteorology
 - b) Climate
 - c) Topography
 - d) Hydro-geology
- iii) Sources of water, quantity and quality of water supplies.
- iv) Existing water supply facilities
 - a) Intake works
 - b) Raw water mains
 - c) Water treatment works
 - d) Reticulation works
- v) Quantity and quality of treated water at the treatment works and consumer points.

- vi) Environment and Ecology
 - a) Sources of water pollution, quality and quantity of pollutant and extent of pollution.
 - b) Water quality of ground water.
 - c) Water quality of surface water (Kathita river).
 - d) Laws/regulations/acts on environmental protection.
- vii) Construction and procurement costs
- viii) Laws and regulations related to water abstraction and use.

4.2 Field Investigations

- i) Field reconnaissances.
 - a) Existing water treatment plant.
 - b) Existing water distribution systems.
 - c) Pollutant sources.
- ii) Investigation on utilization of Kathita river.
- iii) Investigation on performance of existing water treatment plant.
- iv) Investigation on the quality and quantity of treated water at water treatment plant and quality at consumption points.
- v) Review of tariff structure and metering system.

4.3 Analysis of conditions of water.

- i) Comprehensive analysis of the present water treatment works
- ii) Distribution systems.

4.4 Water demand projection to the year 2010.

- i) Review of existing data.
- ii) Establish number and nature of the current water consumers.
- iii) Determine current water demand.
- iv) Determine future water demand to the years 2005 and 2010.

4.5 Formulation of Rehabilitation Plan

- i) Establish basic policy for rehabilitation
- ii) Identify scope of rehabilitation

4.6 Formulation of comprehensive expansion plan for the water supply.

- i) Establish basic policy for expansion.
- ii) Definition of supply area.
- iii) Determine population to be served.
- iv) Determine amount of water to be supplied.
- v) Selection of water source.
- vi) Treatment process assessment.
- vii) Preparation of alternative system for expansion.
- ix) Facility plan.
- x) Implementation program.

4.7 Identification of the project to be urgently implemented.

4.8 Feasibility study for identified water supply.

- i) Preliminary design
 - a) Design policy
 - b) Study and examination on design criteria.
 - c) Site and layout plan.
 - d) Facility plan.
 - e) Preliminary design drawings.
- ii) Construction plan.
- iii) Study on availability of work force, materials, etc.
- iv) Organisation, operation and maintenance plan.
- v) Cost estimation.
 - a) Construction and procurement costs.
 - b) Operation and maintenance costs.

vi) Implementation plan.

vii) Economic and financial analysis.

4.9 Comprehensive evaluation of the project.

4.10 Environmental impact assessment study

- i) Effects of increased water production and usage on living environment, human health and the Kathita River flow in terms of quantity and quality.
- ii) Evaluation of protective measures against possible river water contamination.
- iii) Effect of sludge from water treatment on Kathita River
- iv) Effect on flora and fauna at the project site as a result of water treatment plant construction.
- v) Assessment of improvement of water supply on the sewerage system

4.11 Recommendations

4.12 Transfer of knowledge.

Throughout the course of the study, knowledge will be transferred to the Kenya Government Personnel by the Foreign experts working on the project. This transfer of knowledge and training will be carried out in the field, the study office and in Japan.

For successful achievement of this programme, the study shall be carried out in close collaboration on day-to-day contact basis between the foreign study team and the Kenya Government counter parts.

MERU URBAN WATER SUPPLY PROJECT

HISTORICAL BACKGROUND

CONTENT

1. Introduction
2. Geography of the Project area
3. Sallient feature of Existing Water Supply Project
4. Problems encountered by Meru Water Supply
5. Study carried out for the Water Supply
6. Available information related to the
Water Supply
7. Comments

MERU URBAN WATER SUPPLY PROJECT

1. INTRODUCTION

Meru Municipal town is the District Headquarters of Meru District in Eastern Province of Kenya. The town is situated about 250km North-East of Nairobi. (See project location map). Meru Municipality covers an area of 62km² and lies between 37 44' longitudes and between 0 00" and 0 6" latitudes. It is one of the major urban centres in Kenya located within a high potential agricultural area.

The area is rich in water resources. Surface water is the most visible source of water supply for the town from springs and rivers originating from the slopes of Mt. Kenya as ground water is at low level as indicated in studies carried out in the district.

These studies are:-

- Meru district Water resources assessment study
- Meru District Water Development Study.
- Meru Water Supply Preliminary Design Report.

2. GEOGRAPHY OF PROJECT AREA

The project area is located approximately 95km North-West of Embu town, the provincial headquarters and about 250km North-East of Nairobi. The main centre, Meru Township, is classified as an urban centre and located at longitude 37 40'E and latitude 0 03' N.

The area is characterised by numerous deep and steep sided valleys and ridges on the Eastern Slopes of Mount Kenya, and has running streams in most of the valleys.

The soils in the region are dark brown to dark reddish brown in colour and have a cloggy texture. They are deep and well drained. The top soils are underlain with volcanic rocks.

The mean rainfall is 128mm, and falls mainly in the months of March and May and October and December, giving two main rainy seasons. It can be described as highland equatorial. There are a number of rain guaging stations in the project area. The mean monthly rainfall, 1971 - 1980 is computed below :-

<u>Month</u>	<u>Rainfall</u>
January	58.9
February	49.7
March	101.0
April	290.1
May	143.5
June	8.2
July	10.0
August	7.1
September	23.8
October	159.3
November	310.5
December	212.9
	1284.0

The maximum temperature within the project area recorded is 30.2 C minimum 3 C. The annual evaporation varies from 1589mm to 1750mm.

3. SALIENT FEATURE OF EXISTING WATER SUPPLY SYSTEM

3.1 INTAKES

Meru Town is served by three intakes Old Gatambora, New Gatambora and Kathita intake.

- i) Old Gatambora - This intake was constructed in 1956 with a capacity of 70m³/d and obtains water from Gatambora Springs.

ii) New Gatambora - This intake was constructed in 1978 in Meru Forest edge and has a capacity of 2100m³/d. Water from this intake is treated and then distributed to consumers.

iii) Kathita Intake - The intake is on Kathita River 4km from the town and was constructed in 1987 with a design capacity of 10,280m³/d. Water from this intake is gravitated to the treatment plant, treated and then distributed to consumers.

3.2 TREATMENT PLANT

The existing treatment plant was constructed at three different stages:-

- i) The oldest unit was constructed in 1952 to treat water from Kathita River that used hydam which has since been abandoned at some unspecified time. It is a circular sedimentation tank with a capacity of about 437m³/d.
- ii) The second unit was constructed in 1956 to treat water from Old Gatambora. It is a circular combined settling and filtration unit with a capacity of about 260m³/d.
- iii) The third unit was constructed in 1980. The unit consists of clarifiers-cum-filters and has a capacity of about 3300m³/d.

3.3 DISTRIBUTION SYSTEM

The distribution system was first laid in 1956 and has since been extended with time to cover more areas.

Expansion of the distribution work was carried out in 1975 in which about 13km of distribution work was laid.

The pipes before 1975 were either asbestos-cement or galvanised steel and those laid there-after are UPVC. Some of the asbestos cement pipes have been replaced with UPVC pipes.

4. PROBLEMS ENCOUNTERED BY MERU WATER SUPPLY

4.1 INTAKES

- i) The Old Gatambora intake still supplies water to the town. However its contribution is insignificant as the water demand is comparably far much higher.
- ii) New Gatambora intake still supplies water to the town of about 2100m³/d which in most cases is only chlorinated before distribution to the consumers. However it occasionally experiences algal growth which affects its water quality.
- iii) Kathita intake experiences siltation problems resulting to less water entering the intake chamber and requires regular removal and clearing of sand. However it is still capable of supplying 10,280m³/d at present and a future capacity of 15,280m³/d with an addition of extra raw water main.

4.2 TREATMENT PLANT

The existing treatment plant is incapable of handling all the water from the three intakes.

Currently, the fine sand in the clarifiers-cum-filters has been removed in order to increase filtration rate. At the same time, the circular sedimentation tank has been converted to a composite filter. However, the maximum capacity of the treatment plant is still about 3900m³/d. This, therefore, implies that most of the time:-

- The towns' population is served partly with treated water.
- The Kalhita intake is usually throttled to reduce the amount of turbid water flowing to the treatment plant in order to improve the treatment of the water.
- The amount of water distributed is lower than that the intake can supply, due to the low capacity of the treatment plant.

4.3 DISTRIBUTION SYSTEM

The distribution system was lastly expanded in 1975. Some of the pipes laid before 1975 bursts often and the water mains are undersized to meet the towns growing needs. The distribution system requires major rehabilitation and expansion after complete analysis of the system.

5. STUDY CARRIED OUT FOR THE WATER SUPPLY

Two studies have been carried out separately in the project area.

- The National Water Master Plan carried out by JICA and completed in September 1992.
- Meru District Water Resources Assessment Study and Meru District Water Development Study carried out by WRAP and completed in June 1991.

5.1 National Water Master Plan

According to the National Water Master Plan the estimated population of Meru Municipality to the year 2010 will be:-

Year	1990	2000	2010
Population	78,900	192,900	319,900

The corresponding total water demand will be:-

Year	1990	2000	2010
Water demand (m ³ /d)	13,209	31,863	53,093

5.2 Meru District Development Study

The study gives a population estimate different from the National Water Master Plan.

Year	1993	2003	2013
Water demand (m ³ /d)	15,085	28,854	55,286

6. AVAILABLE INFORMATION RELATED TO THE WATER SUPPLY

The following information related to the water supply is available:-

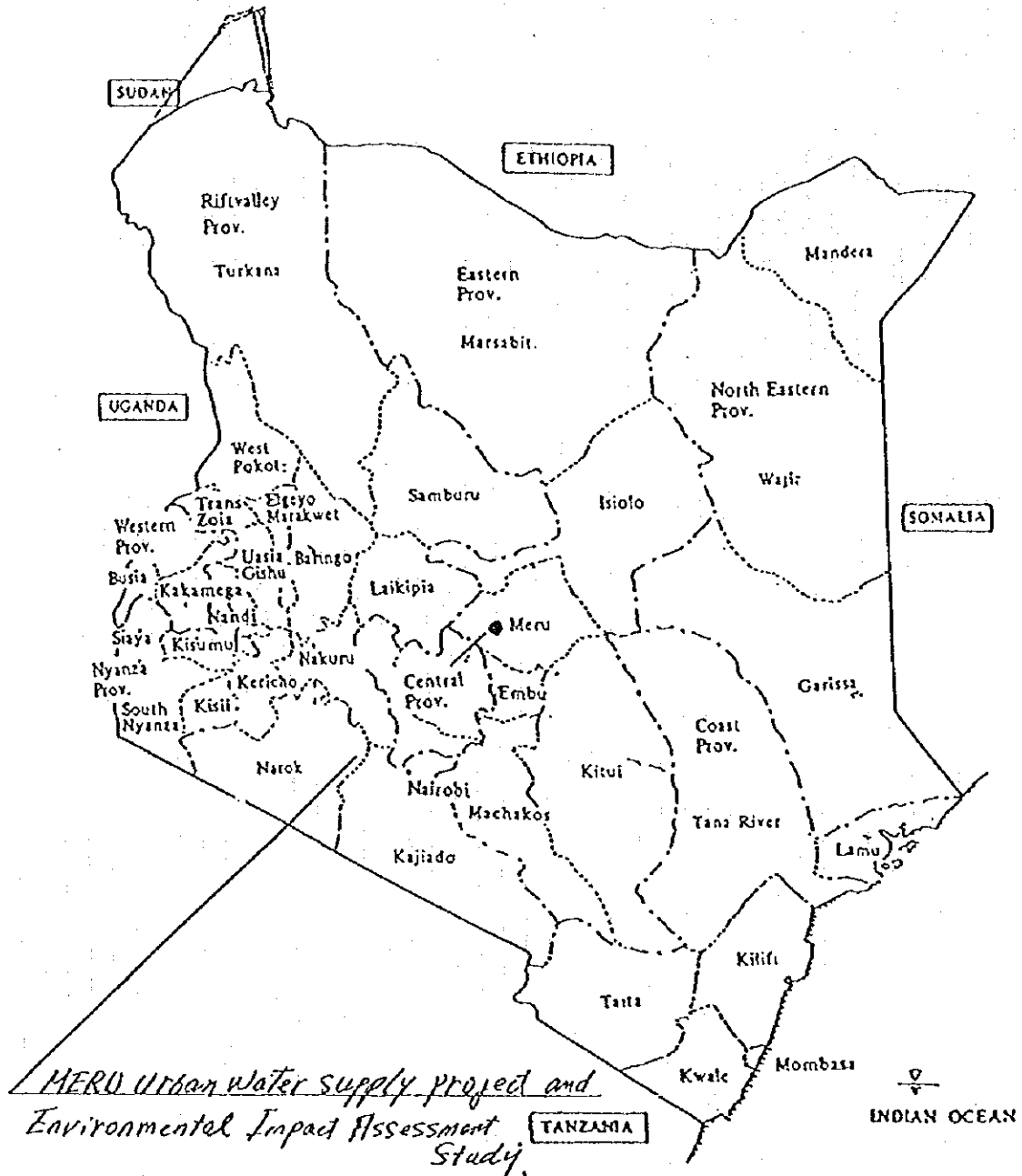
- i) River discharge data of river Kathita at gauging station 4F10 for the last 20 years.
- ii) Rainfall data at Meru Forest Station for the last 20 years.
- iii) Geology of Meru District.
- iv) River Kathita Water Chemical data from gauging stations 4F31, 4F10, 4F26, 4F29.
- v) Meru Municipality population census of 1989.
- vi) Meru Municipality Sewerage facilities layout plan, current status of the facilities capacity, amount of waste water generated and population connected to the sewer system:

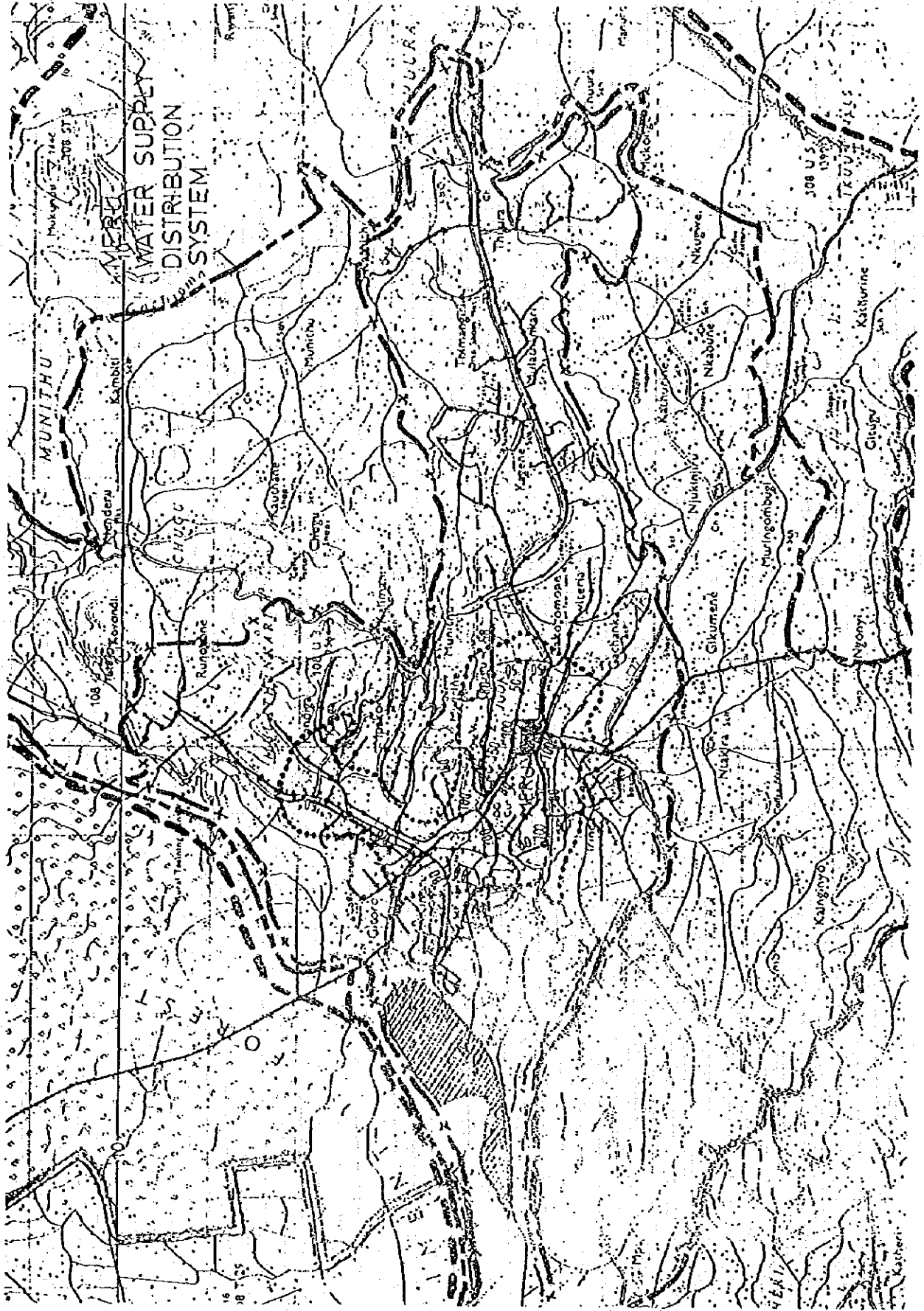
- vii) Water resources in Meru District.
- viii) Layout plan of existing Meru Municipality Water Supply system.
- ix) Preliminary study of Meru Municipality Sewerage system of 1983.

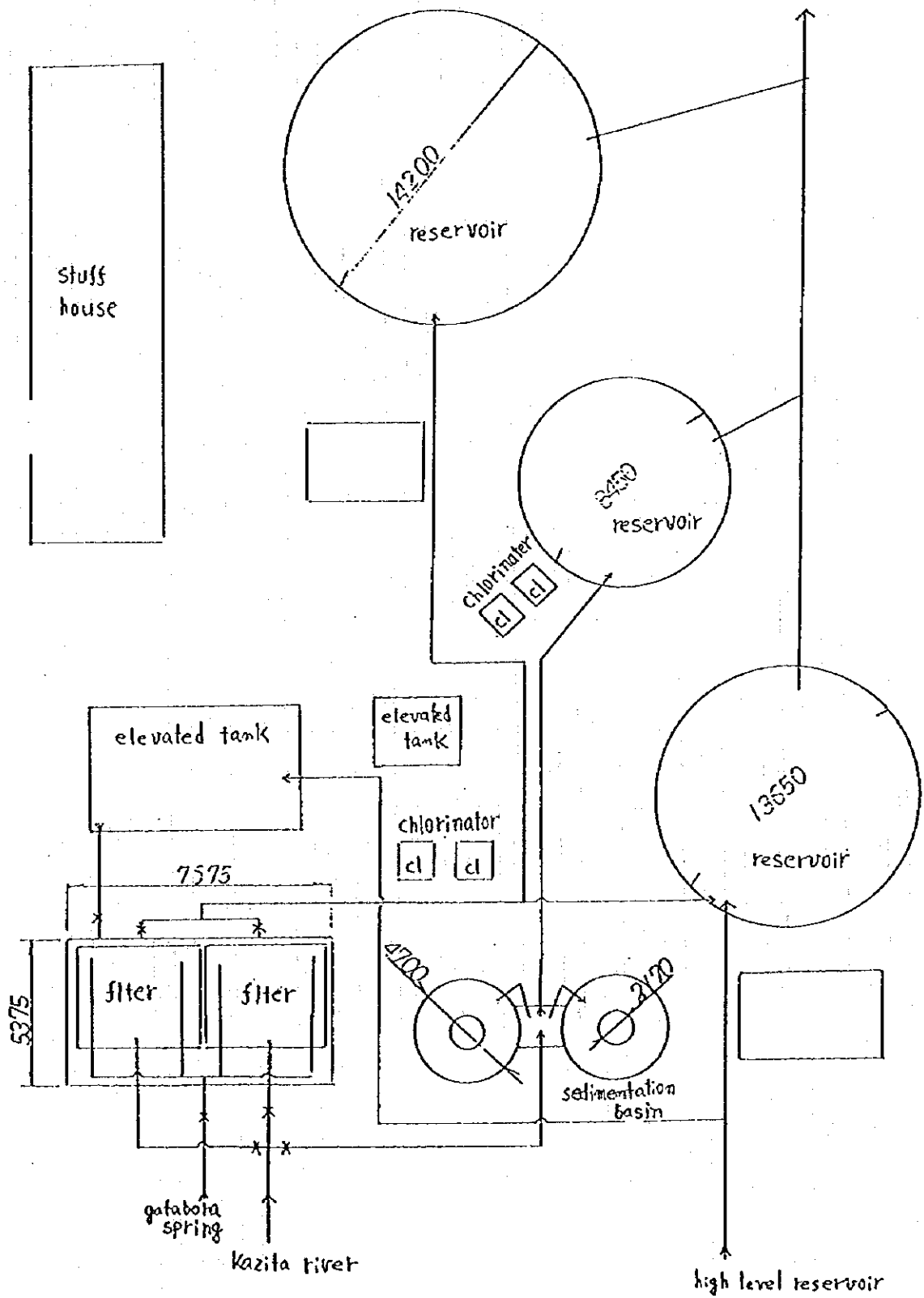
7. COMMENTS

Before detailed design can be embarked on the preliminary study Meru Municipality Water Supply requires to be revised and updated.

PROJECT LOCATION MAP







Meru water treatment plant

MINISTRY OF WATER DEVELOPMENT
Water Resources Assessment Project Documentation Section

River: KATHIA RIVER
R.G.St: 4F10
Area: 872 sq km

MONTHLY AND ANNUAL DISCHARGE DATA

The flows are in: CUMEC

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Daily		Days with readings
														max	min	
1959											12.45	12.16				385
1960	5.60	13.97	13.93	17.65	6.30	5.63	4.51	3.53	2.78	5.66	11.52	10.52	6.60	72.3	1.13	69
1961	5.23	3.95	3.29	18.13	14.11			4.34	3.29	91.66						55
1962			16.59	98.45	26.70	12.17	9.78	14.74	10.15	11.07	11.36	10.35				
1963	7.40	5.40	7.16	34.05		12.96	9.02		6.00	5.65	65.23	56.66				60
1964	36.40	19.20	15.48	49.91		18.58	12.99	10.39	8.17	8.29	21.21	30.94				99
1965	28.35	20.82	12.24	18.64	15.14	4.25	1.78	6.33	5.62	6.23	13.51	6.69	11.41	47.9	1.77	72
1966	6.03	4.93	6.56	43.81	18.54	9.16	6.78	5.50	4.47	11.73	38.55	10.68	13.83	470.6	3.71	70
1967	6.45	4.90	4.91	14.16	53.47	17.12	9.23	6.67	5.20	14.62	68.34	44.54	20.92	252.7	3.67	73
1968	17.42	15.72	29.92	53.07	46.66	29.43	13.57	9.95	7.17	12.82	54.39	49.43	29.96	222.1	5.76	64
1969	25.56	20.32	27.62	23.71	34.55	16.27	10.71	8.42	6.17	7.44	21.71	12.94	17.94	106.0	5.48	69
1970	8.57	6.63	9.01	24.44	10.52	7.53	5.75	4.97	4.04	4.27	8.62	5.47	8.30	154.4	3.51	67
1971			2.77	20.25	14.32	5.64	4.67	4.91	3.77	3.66	9.43	15.68				81
1972	4.11	4.07	2.99	2.73	6.69	3.73	2.94	3.47	2.45	8.45	47.57	17.10	8.25	187.0	2.05	82
1973	10.85	6.61	5.25	6.39	5.49	4.79	4.45	3.72	3.33	3.45	6.87	5.55	5.55	18.5	3.07	65
1974	3.31	3.11	4.37	23.40	12.48	6.51	5.27	4.01	3.30	3.37	12.45	7.15	7.39	82.8	2.45	66
1975	4.77	3.55	3.03	7.23	7.67	4.32	3.46	3.14	2.74	5.60	7.72	5.66	5.00	56.8	2.45	62
1976	3.97	3.64	2.94	6.31	4.53		3.20	2.63	2.24	2.64	2.79	9.97				78
1977	8.40	4.58	6.45	21.74	16.71	6.22	6.27	5.10	3.55	4.17	40.21	27.10	12.87	101.7	3.23	73
1978	15.35	9.65	25.87	71.56	37.64	18.04	12.24	8.06	6.55	16.15	18.55	27.32	22.28	158.1	4.24	74
1979	22.99	24.64	17.95	27.37	24.59	16.69	11.06	7.85	6.26	6.52	36.62	14.00	16.46	216.9	5.04	73
1980	8.91	6.65	5.58	8.10	9.59	6.32	5.01	4.67	4.00	4.99	229.22	10.56	25.61	8065.0	3.23	77
1981	8.22	5.06	12.22	24.19	31.61	14.22	8.70	6.23	4.97	6.24	14.75	9.73	12.21	92.9	4.46	74
1982	6.61	4.90	4.48	19.59	19.34	11.54	7.02	5.41	4.39			37.17				117
1983	15.77	10.19	6.80	12.64	12.48	7.46	5.56	4.90	4.27	4.23	8.21	10.90	8.83	70.8	3.56	
1984	7.75	4.70	4.11	5.23	3.75	2.71	2.29	2.18	2.04	23.73	32.73	16.04	6.95	200.5	1.60	17
1985	6.09	6.33	6.97	25.25	25.44	13.09	7.64	5.77	4.65	5.40	11.72					97
1986	4.47	4.40	16.05	18.19	6.64	6.15	4.48	4.48	3.87	3.94	15.76	26.76				75
1987	9.19	6.06	4.15	6.63	4.47	4.94	3.04	2.51	1.80	1.81	10.60	5.07	5.01	92.2	1.23	76
Max	36.4	26.6	29.9	96.5	53.5	29.4	13.6	14.7	10.2	91.7	229.2	69.4	30.0	8065.0	5.78	
Min	3.31	3.11	2.77	2.73	3.75	2.71	1.78	2.18	1.60	1.81	6.27	5.07	5.00	16.49	1.13	
Mean	11.18	8.72	9.61	24.99	15.83	10.41	6.81	5.70	4.56	10.52	31.04	16.83	13.22	456.63	3.28	
Runoff (mm)	34.1	25.6	29.3	76.2	57.5	31.8	20.8	17.4	13.9	32.1	94.7	57.4	40.3	1393.7	10.0	

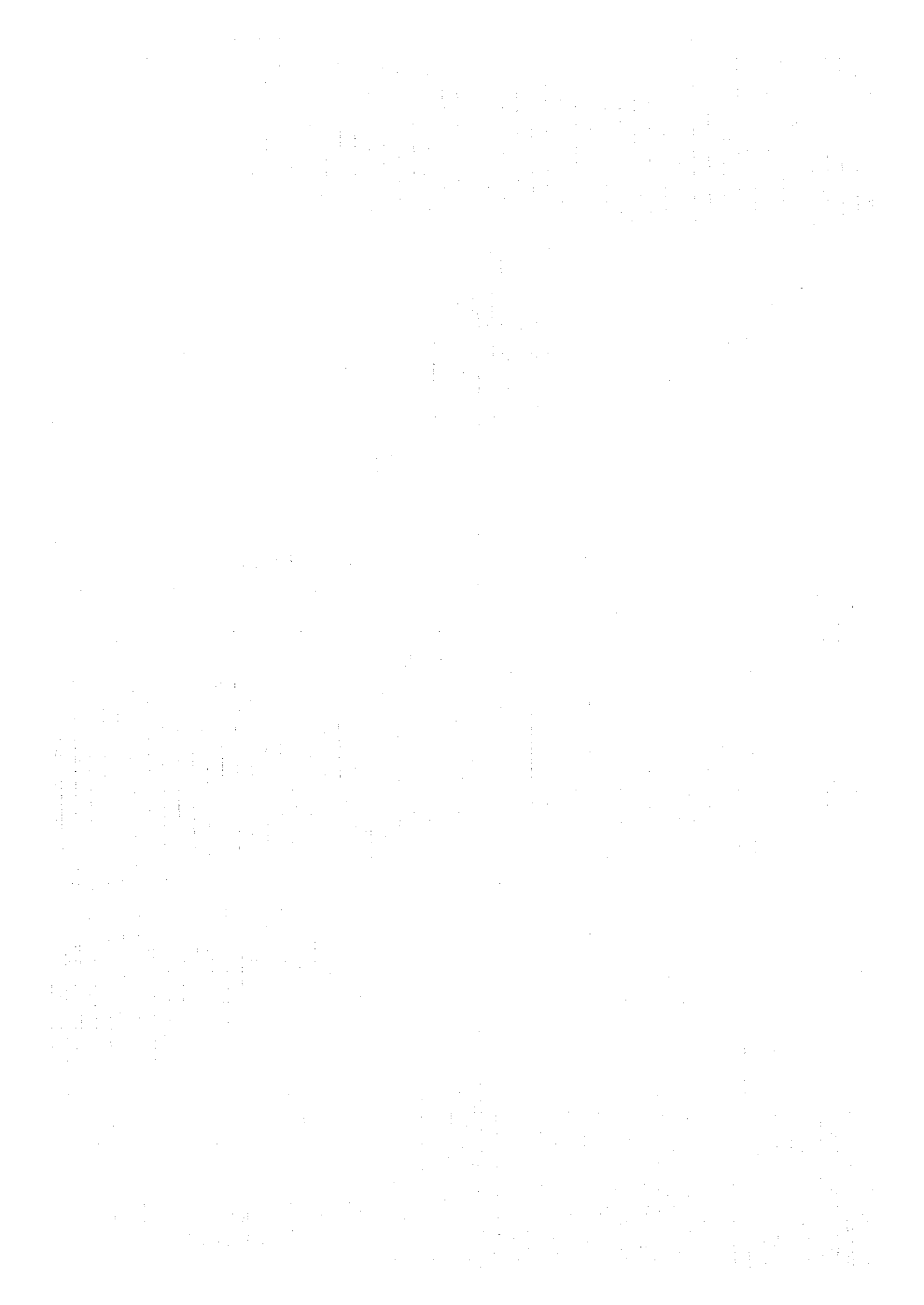
16-Jun-87

TABLE 2

METEOROLOGICAL DEPARTMENT
 MERRI FOREST STATION (8927088)

STATION: 1971 FOR 1980
 READING OF MONTHLY RAINFALL TOTAL IN mm

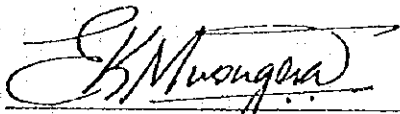
YEAR	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL TOTAL
1971	21.4	29.6	51.0	345.1	54.1	9.6	6.6	2.1	3.5	169.8	201.2	-	(1000)
1972	21.3	97.6	15.2	99.0	217.0	3.2	2.0	1.5	21.0	470.8	295.9	32.8	1407.3
1973	89.0	15.5	9.0	186.3	136.5	13.0	4.0	6.2	4.0	78.8	294.5	21.8	810.7
1974	3.5	27.6	146.9	354.9	24.2	10.1	20.5	17.5	5.0	103.8	409.0	65.5	1729.5
1975	45.4	23.1	29.1	256.3	151.1	17.9	19.0	6.0	27.4	272.9	165.3	86.0	1079
1976	5.2	76.4	26.2	283.1	50.7	0.0	16.0	0.0	25.2	103.2	198.8	237.2	1029.1
1977	23.9	34.0	91.0	378.0	158.8	0.0	15.5	4.5	24.0	159.6	561.6	160.3	1611.2
1978	45.5	85.8	472.7	492.7	18.7	0.0	16.2	8.0	21.2	239.3	282.9	162.0	1815
1979	253.8	21.3	109.2	253.4	129.4	14.0	0.0	0.0	0.0	119.0	376.5	133.6	1410.2
1980	74.0	-	38.9	138.6	159.5	0.0	0.0	0.0	16.0	74.0	388.5	-	889.5
MEAN	58.3	47.9	98.91	278.91	110.0	7.7	11.0	4.2	15.71	179.11	227.41	117.3	1310.4



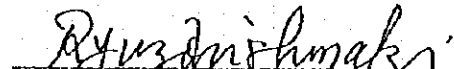
附属資料2. Scope of work (S/W)

SCOPE OF WORK
FOR
THE STUDY
ON
THE WATER SUPPLY FOR SEVENTOWNS IN EASTERN PROVINCE
IN
THE REPUBLIC OF KENYA
AGREED UPON BETWEEN
THE MINISTRY OF LAND RECLAMATION,
REGIONAL AND WATER DEVELOPMENT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

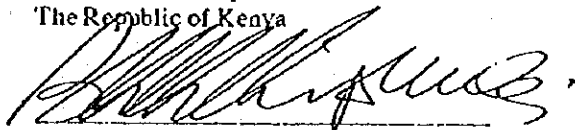
Nairobi, March 6, 1996



Mr. ERASTUS K. MWONGERA
Permanent Secretary,
Ministry of Land reclamation, Regional
and Water Development,
The Republic of Kenya



Mr. RYUZO NISHIMAKI
Leader, Preparatory Study Team,
Japan International Cooperation
Agency



Mr. B. K. KIPKULEI
Permanent Secretary,
Ministry of Finance,
The Republic of Kenya

I. INTRODUCTION

In response to the request of the Government of the Republic of Kenya (hereinafter referred to as "the Government of Kenya"), the Government of Japan decided to conduct the Study on the Water Supply for Seven Towns in Eastern Province in the Republic of Kenya (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of Kenya.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. to formulate a master plan for the water supply in study area up to the year 2010,
2. to conduct a feasibility study on priority project(s) to be selected from the master plan, and
3. to transfer technology on planning methods and skills to counterpart personnel in the course of the Study.

III. STUDY AREA

The Study will cover 6 towns and 1 rural area (Meru, Isiolo, Maua, Nkubu, Chogoria, Chuka and Tigania) in the Republic of Kenya which is shown in the Annex 1.

IV. SCOPE OF THE STUDY

In order to achieve the above mentioned objectives, the Study shall cover the following:

Phase I: Master Plan Study.

1. Collection and analysis of existing data and information on:
 - a. natural conditions including:
 - (a) geological and topographical conditions
 - (b) meteorological conditions
 - (c) hydrological and hydrogeological conditions
 - b. social and economic conditions
 - c. land use
 - d. infrastructure of urban area
 - e. environmental conditions
 - f. plans and policies on water resources development and water supply services
 - g. legal and institutional arrangements of water resources development and water supply

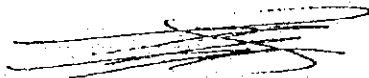
A
Ekm



services.

2. Review of on-going and planned projects relevant to the Study.
 - a. water use
 - b. organizations for operation and maintenance
 - c. institutional aspects of project implementation and monitoring
 - d. other related data and information
3. Survey on actual conditions of water resources through:
 - a. geological reconnaissance
 - b. hydrological investigation
 - c. hydrogeological observation
4. Survey on actual conditions of water supply services and related aspects such as:
 - a. existing water supply facilities with emphasis on capacity of water treatment, financial conditions and maintenance
 - b. water supply organizations with emphasis on operational performance
 - c. level of water use at household level
 - d. sanitary conditions such as toilets and other form of wastewater disposal
 - e. people's awareness on health and hygiene and their willingness to pay for better water supply services
 - f. education on health and hygiene at schools and public health centers
5. Water demand projection
6. Analysis and evaluation on water resources potential
7. Formulation of the Master Plan
 - a. formulation of basic policies and strategies of water supply services
 - (a) target area of water services
 - (b) target coverage rate in term of number of population served
 - (c) target level of services in terms of water quality, quantity and accessibility
 - (d) rehabilitation plan
 - (e) choice of technology
 - b. comparative study of technical alternatives for water supply plan
 - c. selection of the best alternative
 - d. schematic lay-out of facilities
 - e. operation and maintenance plan
 - f. institution and management plan
 - g. cost estimation and financial plan
 - h. implementation plan
 - i. evaluation of the Master Plan
8. Initial environment examination (IEE)
9. Identification of priority project(s)

Phase II: Feasibility Study for Priority Project(s)



1. Confirmation of planning framework
2. Additional survey and supplementary data collection
3. Preliminary design of facilities and equipment plan
4. Operation and maintenance plan
5. Institution and management plan
6. Rehabilitation plan
7. Cost estimation and financial plan
8. Environment impact assessment (EIA)
9. Project evaluation including:
 - a. technical evaluation
 - b. financial evaluation
 - c. economic evaluation
 - d. social evaluation
 - e. environmental evaluation
10. Formulation of Implementation program

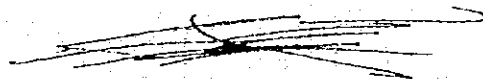
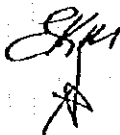
V. SCHEDULE OF THE STUDY

The Study will be carried out in accordance with the tentative schedule attached in the ANNEX 2.

VI. REPORTS

JICA will prepare and submit the following reports in English to the Government of Kenya.

1. Inception Report:
Twenty (20) copies at the beginning of the first field survey in the Republic of Kenya.
2. Progress Report (1)
Twenty (20) copies at the end of the first field survey.
3. Interim Report
Twenty (20) copies at the beginning of the second field survey.
4. Progress Report (2)
Twenty (20) copies at the end of the second field survey.
5. Draft Final Report:



Twenty (20) copies at the beginning of the third field survey.

The Government of Kenya shall present its comments to JICA within one (1) month after the receipt of the Draft Final Report.

6. Final Report:

Fifty (50) copies within two (2) months after the receipt of the comments on the Draft Final Report.

VII. UNDERTAKINGS OF THE GOVERNMENT OF THE REPUBLIC OF KENYA

1. To facilitate the smooth conduct of the Study, the Government of Kenya will take necessary measures:

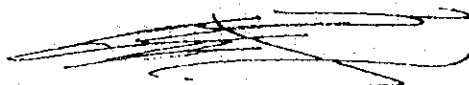
- a. to secure the safety of the JICA study team (hereinafter referred to as "the Team")
- b. to permit the members of the Team to enter, leave and sojourn in the Republic of Kenya for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees.
- c. to exempt the members of the Team from taxes, duties, fees and any other charges on equipments, vehicles, and other materials brought into and out of the Republic of Kenya for the conduct of the Study.
- d. to exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study.
- e. to provide necessary facilities to the Team for remittances as well as the utilization of the funds introduced into the Republic of Kenya from Japan in connection with the implementation of the Study.
- f. to secure permission for the Team to enter into private properties or restricted areas for the implementation of the Study.
- g. to secure permission for the Team to take all data and documents (including photographs and maps) related to the Study out of the Republic of Kenya to Japan, and
- h. to provide medical services as needed. Its expenses will be chargeable on members of the Team.

2. The Government of the Republic of Kenya shall bear claims, if any arises, against the members of the Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the member of the Team.

3. The Ministry of Land Reclamation, Regional and Water Development shall act as a counterpart agency to the Team and also as a coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. The Ministry of Land Reclamation, Regional and Water Development shall, at its own expense, provide the Team with the followings, in cooperation with other organizations concerned:

- a. available data and information related to the Study,
- b. counterpart personnel.



- c. suitable office space with necessary equipment in Nairobi and Meru,
- d. credentials or identification cards, and
- e. appropriate number of vehicles with drivers.

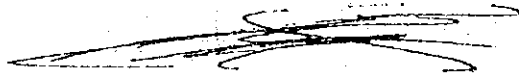
VIII. UNDERTAKINGS OF JICA

For the implementation of the Study, JICA shall take the following measures:

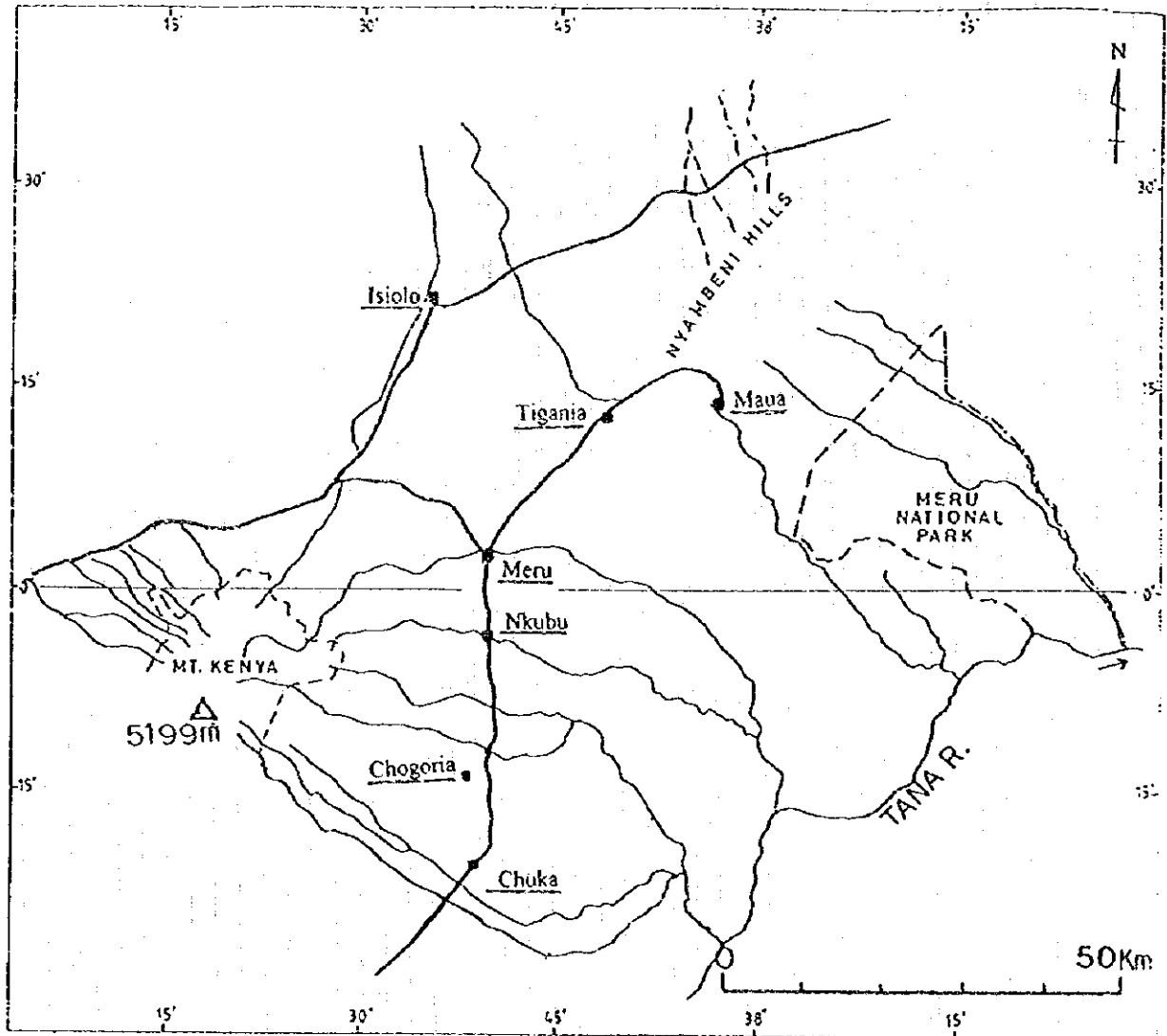
1. to dispatch, at its own expense, the Team to the Republic of Kenya, and
2. to pursue technology transfer to the counterpart personnel of the Republic of Kenya in the course of the Study.

IX. CONSULTATION

JICA and The Ministry of Land Reclamation, Regional and Water Development will consult with each other in respect of any matter that may arise from or in connection with the Study.



Annex 1 LOCATION MAP OF THE STUDY AREA



The Study on the Water Supply For Seven Towns in the Eastern Province in the Republic of Kenya

The Study
on
The Water Supply
For
Seven Towns in Eastern Province
in
The Republic Of Kenya

TENTATIVE SCHEDULE

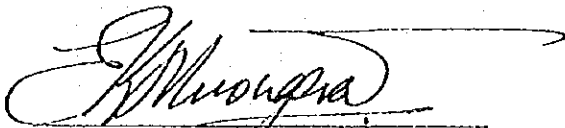
DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WORK IN KENYA	■	■	■	■	■			■	■			■						
WORK IN JAPAN	□				□	□	□				□	□		□				
REPORT PRESENTATION	▲				▲		▲	▲	▲	▲		▲				▲		
PHASE	PHASE I									PHASE II								
	ICR				P/R(1)		IT/R		P/R(2)		DF/R							F/R
	1st work in Kenya		2nd work in Kenya		1st work in Japan		2nd work in Japan		2nd work in Kenya		3rd work in Japan		3rd work in Kenya		3rd work in Japan			

NOTE ICR : Inception Report
P/R : Progress Report
IT/R : Interim Report
DF/R : Draft Final Report
F/R : Final Report

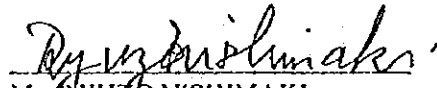
附属資料 3. Minutes of Meeting (M/M)

MINUTES OF MEETING
ON
SCOPE OF WORK
FOR
THE STUDY
ON
THE WATER SUPPLY FOR SEVEN TOWNS IN EASTERN PROVINCE
IN
THE REPUBLIC OF KENYA
AGREED UPON BETWEEN
THE MINISTRY OF LAND RECLAMATION,
REGIONAL AND WATER DEVELOPMENT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Nairobi, March 6, 1996



Mr. ERASTUS K. MWONGERA
Permanent Secretary,
Ministry of Land Reclamation, Regional
and Water Development,
The Republic of Kenya



Mr. RYUZO NISHIMAKI
Leader, Preparatory Study Team,
Japan International Cooperation
Agency

Based on the formal request of the Government of the Republic of Kenya, the Government of Japan, through the Japan International Cooperation Agency (JICA), has agreed to conduct a Study on the Water Supply for Seven Towns in Eastern Province in the Republic of Kenya (hereinafter referred to as "the Study").


The JICA Preparatory Study Team (hereinafter referred to as "the Team"), headed by Mr. RYUZO NISHIMAKI, visited Kenya from 27th February to 7th March, 1996, where they held a series of meetings with the Ministry of Finance (hereinafter referred to as "MOF"), Ministry of Land Reclamation, Regional and Water Development (hereinafter referred to as "MOLRRWD") and other authorities concerned of the Government of the Republic of Kenya. The list of participants is shown in the Appendix I.

During the visit, both sides agreed to the Scope of Work to be undertaken by the MOF, MOLRRWD and JICA for successful execution of the Study. In addition to the Scope of Work, the Team and the Kenyan representatives confirmed the following:

- 1) The title of the Study will be "The Study on the Water Supply for Seven Towns in Eastern Province in the Republic of Kenya".
- 2) The target year of the Master Plan Study will be 2010 and the target year of the Feasibility Study for implementation will be 2000.
- 3) The area of the Study will be six(6) towns and one(1) rural area (Meru, Isiolo, Maua, Nkubu, Chogoria, Chuka and Tigania) and its peri-urban areas. Peri-urban areas means expanding area of the towns.
- 4) The Study will cover the water supply system whose water sources are focused on surface water.
Concerning Isiolo town, groundwater will be an alternative of the surface water source.
- 5) Both sides agreed that the Study should cover the improvement of financial management including revenue collection system.
- 6) Both sides agreed that a pilot project would be implemented for the improvement of communal water points and the formulation of health and hygiene education scheme in the course of the Study.
- 7) Japanese side recognized that a pilot plant (additional lagoon system) for sewerage treatment is necessary to assess environmental impacts by water supply project for the Meru town.



- 8) The Kenyan side will organize a "Steering Committee" for the Study, comprising representatives from the MOF, MOLRRWD, Ministry of Local Government, Ministry of Health, Ministry of Environment and Natural Resources, Ministry of Land and Settlement and other relevant organizations.
- 9) MOLRRWD will organize a "Counterpart Team" which will cooperate with the team of the Study. The Counterpart Team will consist of the professional staff who are in charge of various aspects such as Water Supply Design and Planning, Operation and Maintenance, Surface Water Development, Groundwater Development, Socio-economy, Sanitation and Environment. Consequently, each member of the team of the Study will work together with a respective counterpart to transfer technologies from the Japanese side to the Kenyan side and achieve objectives of the Study effectively.
- 10) Kenyan side requested to transfer technology to the counterpart personnel by both through on-the-job training in the course of the Study and technical training in Japan related to the Study.
Japanese side agreed to convey the above request to JICA Headquarters in Tokyo.
- 11) Both sides agreed that Workshop(s) would be held after the submission of the Interim Report and Draft Final Report in order to present the report to organization concerned.
- 12) The Kenyan side will provide suitable office space in Nairobi and Meru with furniture, electricity, light and exclusive telephone line for the team of the Study. Telecommunication fees in the office, however, will be paid by the team of the Study. The Kenyan side requested that the team of the Study bring two photocopy machine, a facsimile machine, two Macintosh personal computers and three vehicles.
Japanese side agreed to convey the above request to JICA Headquarters in Tokyo.



LIST OF ATTENDANTS

KENYAN SIDE

1. MINISTRY OF LAND RECLAMATION, REGIONAL AND WATER DEVELOPMENT
(MOLRRWD)

- | | |
|----------------------------|--|
| a) Mr. Erastus K. Mwoigera | Permanent Secretary |
| b) Mr. P. N. Machiri | Director of Water Development |
| c) Mr. J. N. Maina | Deputy Director of Water Development |
| d) Mr. J. Z. Moguehe | Assistant Director of Water Development (Design) |
| e) Mr. S. C. M. Ochieng | Assistant Director of Water Development (Drilling) |
| f) Mr. Katsuyoshi Kitagawa | JICA Expert |

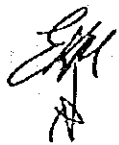
2. MINISTRY OF FINANCE (MOF)

- | | |
|-----------------------|---|
| a) Mr. B. K. Kipkulei | Permanent Secretary |
| b) Mr. D. R. Ongalo | Director of External Resources Department |
| c) J. M. Nyamumba | Assistant Desk Officer / Japanese Desk |

JAPANESE SIDE

1. JICA PREPARATORY STUDY TEAM

- | | |
|--------------------------|----------------------------------|
| a) Mr. Ryuzo Nishimaki | Team Leader |
| b) Mr. Satoshi Kimura | Study Planning |
| c) Mrs. Keiko Yamamoto | Water Supply Management Planning |
| d) Mr. Kenji Nakanosono | Water Supply Administration |
| e) Mr. Masatomo Watanabe | Water Resources Development |
| f) Mr. Yosuke Sasaki | Water Quality and Environment |



附属資料4. 調査用機材リスト

調査用機材リスト

種 別	名 称	仕 様	数 量	備 考
水 文 調 査	流速計	プロベラ式	2台	
地 下 水 調 査	水位計		2台	
測 量	光波速距儀	10秒読み 測距範囲：2km	1セット	
	オートレベル		1セット	
	スタッフ	5m×5段 アルミ製	2本	
	巻尺	50m (鋼製)	1本	
		50m (エスロン)	1本	
	G.P.S		1セット	
	高度計		1セット	
上 水 道	管路流量計		2セット	
環 境	簡易水質計		2セット	
共 通	車両	4WDワゴン車	3台	
	電話付きファックス		1台	
	コピー機		2台	
	パーソナルコンピューター	マッキントッシュ	2台	

附属資料5. 面会者リスト

面会者リスト

(1) 日本大使館

堀内伸介 大使
南部良一 専門官
木暮甲吉 二等書記官

(2) 土地開拓・地域・水開発省 (Ministry of Land Reclamation, Regional and Water Development)

Mr. Erastus K. Mwongera	Permanent Secretary
Mr. P. N. Machiri	Director of Water Development
Mr. J. N. Maina	Deputy Director of Water Development
Mr. J. Z. Moguche	Assistant Director of Water Development (Design)
Mr. S. C. M. Ochieng	Assistant Director of Water Development (Drilling)
Mr. S. Wanbua	Water Engineer of Eastern Province
Mr. R. N. Gakubia	Water Engineer of Meru District
Mr. Kyengo	Water Engineer of Isiolo District
Mr. S. Nderi	Water Engineer of Nyambene District
Mr. D. N. Nyaga	Water Engineer of Tharaka Nithi District
北川 勝義	国際協力事業団専門家

(3) 大蔵省 (Ministry of Finance)

Mr. B. K. Kipkulei	Permanent Secretary
Mr. D. R. Ongalo	Director of External Resources Department
Mr. J. M. Nyanumba	Assistant Desk Officer / Japanese Desk

(4) 環境・天然資源省 (Ministry of Environment and Natural Resources)

Prof. Kolch	Head of NEAP (National Environment Action Plan)
Mrs. V. Nyagah	Deputy Head of NEAP

(5) 国際協力事業団ケニア事務所

石田 幸男	事務所次長
山田 良春	事務所職員

(6) ジョモ・ケニヤッタ農工大学

田口 定則	チーム・リーダー
岩佐 順吉	アカデミック・アドバイザー
石見 芳夫	電子工学専門家
野坂 治朗	農業専門家
浅野 英一	土木工学専門家

(7) Education Center for Women in Democracy (NGO団体)

Mrs. V. Nowrojee	Representative
Mr. Patrick Onyango	Senior Program Officer

(8) Kalausi Consultant (社会調査、WID調査関連の民間コンサルタント)

Mr. J. A. Nyangaya	Project Manager
Mrs. P. Ngafia	Consultancy Staff
Mrs. D. Nyangaya	Consultancy Staff

附属資料6. 水 法

水法

第一章 総則

- 1 条 名称
- 2 条 用語の定義

第二章 水の所有権と管理

- 3 条 水の帰属
- 4 条 水管理
- 5~6条 水利権
- 7 条 大臣の責務

第三章 大臣の権限

- 8 条 用地取得
- 9 条 建設工事
- 10~12 条 受益者負担
- 13 条 排水事業
- 14 条 水源保全区域の設定
- 15 条 収用権
- 16 条 放置物の処置
- 17 条 非常事態の権限
- 18 条 財政上の権限

第四章 水資源評議会

- 19 条 水資源評議会
- 20~21 条 責務・権限

第五章 地方計画

- 22 条 流域分割
- 23 条 流域委員会
- 24 条 地方水委員会

第六章 機関

- 25~26 条 水配分委員会
- 27 条 地方水資源官
- 28~32 条 責務・権限

第七章 国の計画

- 33 条 国家計画
- 34 条 関連事業

第八章 水許可

- 35 条 許可取得の目的
- 36 条 許可申請
- 37 条 排水事業の許可
- 38 条 許可を要しない行為
- 39~44 条 事業の分類と定義
- 45 条 畑地灌漑許認可
- 46 条 許可の更新
- 47 条 許可の特例
- 48 条 土地や事業に付属した許可の継承
- 49 条 許可条件

第九章 地下水の採取と許可

- 50 条 許可の必要な井戸
- 51 条 井戸掘削の届出と記録の整備
- 52 条 記録の提出
- 53 条 近接井戸の試験
- 54 条 井戸掘削業者の義務
- 55 条 記録の機密保持
- 56 条 罰則
- 57 条 地下水浪費の禁止
- 58~65 条 不良井戸
- 66 条 給配水事業区域内の井戸規制
- 67 条 地下水採取の許可
- 68~69 条 地下水汚染の防止
- 70 条 自噴水掘削規制
- 71~72 条 井戸掘削業の許可
- 73 条 地下水採取の条件
- 74~76 条 水源保全地域
- 77 条 地下水利用の優先順位

第十章 許可の手続き

- 78~79 条 許可申請
- 80 条 申請の訂正
- 81,88条 申請の許可, 不許可
- 82 条 申請目的の優先順位
- 83 条 申請の無効
- 84 条 申請の公告
- 85 条 異議申し立ての手続き

- 87 条 工事の認可
 - 88 条 不許可の場合の手続き
- 第十一章 ダム
- 89 条 ダム工事業者の免許
 - 90 条 管理上の事故・損害の報告

- 第十二章 施工・維持
- 91 条 施工途上での検査
 - 92 条 安全性の確保
 - 93 条 道路の横断
 - 94 条 竣工検査
 - 95 条 使用許可
 - 96 条 期限内未完成の場合の権利の剥奪
 - 97 条 維持

- 第十三章 許可の変更・取り消し
- 98 条 許可の変更
 - 99 条 許可の取り消し
 - 100 条 水文観測後の許可の変更
 - 101 条 取水地点の変更
 - 102 条 利用目的の変更
 - 103 条 誤許可の訂正
 - 104 条 水利権の分割
 - 105 条 共同事業
 - 106 条 許可の廃止
 - 107 条 施設能力により制限される許可

- 第十四章 地役権
- 108~109 条 施設管理者による地役権の取得
 - 110 条 隣地への接近権
 - 111 条 水路の管理
 - 112 条 工事による損失
 - 113~116, 120~121 条 土地所有者の権利
 - 117 条 地役権要求の却下・承諾
 - 118 条 地役権の失効
 - 119 条 維持
 - 122 条 地役権の登記
 - 123 条 地役権の決定

- 第十五章 給配水事業
- 124 条 給配水事業者の指定
 - 125 条 事業者間での共同事業
 - 126~127 条 給水制限の変更
 - 128, 131~132 条 給水区域外への給水
 - 129 条 事業者による供給能力の通知
 - 130 条 給配水事業権の譲渡
 - 133~134 条 大量な受給水契約
 - 135~141 条 事業者の怠慢に対する措置
 - 142 条 事業者による水利用の禁止制限
 - 143~147 条 事業者による利用規制
 - 148~149 条 事業者による土地の強制取得
 - 150 条 保全地域
 - 151 条 仲裁
 - 152 条 事業者に対する条項の適用免除

- 第十六章 雑則
- 153 条 公共施設に対する破損責任
 - 154 条 他の公共工事との調整
 - 155 条 鉱物調査に伴う報告
 - 156 条 放流時の警告
 - 157 条 水浪費の罰則
 - 158 条 水質汚染の罰則
 - 159 条 命令に従わない場合の罰則
 - 160 条 その他の罰則

- 第十七章 一般
- 161 条 信託地に対する法の適用
 - 163 条 水訴訟庁への提訴
 - 164~166 条 土地への立ち入り
 - 167~169 条 情報の提供
 - 170~173 条 命令・許可の証明
 - 174 条 エンジニアの資格
 - 175 条 仲裁による補償金の決定
 - 176 条 その他の組織
 - 177~180 条 罰則
 - 181 条 訴訟手続き
 - 182 条 規則
 - 183 条 経過措置

附属資料7. 質問票及び調査結果

質問票及び調査結果

質問表大項目	収集資料番号	備 考
1. 一般項目		
1.1 過去5年間統計資料	1,2,3,4,5	中央統計局にあり
1.2 人口密度	3,4,5,6,7	//
1.3 行政区分	6,7	//
1.4~1.5 国家開発計画	5	計画・国家開発省にあり
1.6 分野別開発計画	5	//
1.7 地方開発計画	6,7	地方政府(市役所等)にあり
2. 基本技術資料		
2.1 地形図、航空写真	19,20	1/50,000、1/250,000地形図調査対象地域を全てカバー、現在カウンターパートが本格調査のため新規に地形図を準備中、必要枚数：1/250,000-4枚 1/50,000-10枚 航空写真は1/30,000程度のものがあり土地・定住省のケニア測量局で購入可、手続きに約1ヶ月を要する。 必要枚数：約100枚程度
2.2 地形測量のためのデータ		ケニア測量局にあり
2.4 土地利用図	12,14	一部WRAP報告書にあり、詳細なものは市役所で入手可能
2.5 土壌図		農業省、土壌調査局にある
2.6 気象データ	13	WRAP報告書にまとめられている
2.7 降雨データ	13	同上
2.8 流出データ	13	同上
2.9 気象・水文のデータバンク	13	WRAPが行っている
3. 社会経済に関する基本資料		水資源省より回答あり、収集資料21
3.1 調査対象地域の開発計画	6,7,21	市役所及び計画・国家開発省にあり
3.2 各種予測	6,7,21	同上
3.3 都市部水需要	21	MLRR&WD1993にまとめられている
3.4 村落部水需要	6,7,21	郡及び計画・国家開発省にあり
4. 給水システム		
4.1 都市給水	12,14	MOLRRWDが管轄
4.2 村落給水	11,12,14	MOLRRWDが管轄
5. 地下水		
5.1 水文地質資料	12,13,14	MOLRRWDが管轄
5.2 井戸	12,13,14	MOLRRWDが管轄
5.3 水利権	9	MOLRRWDが管轄、井戸は全てMOLRRWDに登録義務あり
5.4 水質	12,13,14	MOLRRWDが管轄、全国の井戸で年4回分析を行っている
5.5 モニタリング		水質についてのみ(上記)
6. 表流水		
6.1 一般資料	12,13,14	流量観測は郡のMOLRRWD出先機関が行っている
6.2 河川構築物	12,14	MOLRRWD出先機関が管理
6.3 水利権	9	同上、一般に河川水の30%を下流に放流する義務があるとのこと
6.4 水質	12,14	MOLRRWDが管轄、全国の主要河川で年4回分析を行っている

7. 下水			
7.1 組織			各市役所が担当
7.2 下水道システム			各市役所が担当
7.3 下水処理場	15,16		各市役所が担当
7.4 トイレ等			各戸のトイレについては管理しているところが明確ではない
7.5 水質			市役所（メルー、イシオロ）で定期的に分析している
7.6 問題点			メルー市の処理場が完全な容量オーバー、その他は明らかになっていない
8. 環境			
8.1 組織			環境・天然資源省のNEAPが担当
8.2 法制度			環境アセスメント法案については素案を検討中
8.3 社会環境			NEAP及びNGOが資料を有す
8.4 自然環境			NEAPが資料を有す
8.5 類似プロジェクトの環境問題	24,25		ナクル湖の事例等
9. 単価	22		カウンターパートより回答あり

QUESTIONNAIRE
FOR
THE STUDY ON MERU DISTRICT WATER DEVELOPMENT
IN
KENYA

FEBRUARY, 1996

PREPARATORY STUDY TEAM
JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

CONTENTS

1. GENERAL MATTERS
2. BASIC TECHNICAL DATA FOR THE STUDY AREA
3. BASIC SOCIOECONOMIC DATA FOR THE STUDY AREA
4. DATA FOR WATER SUPPLY SYSTEM IN THE STUDY AREA
5. GROUNDWATER IN THE STUDY AREA
6. SURFACE WATER IN THE STUDY AREA
7. SEWAGE
8. ENVIRONMENT
9. UNIT COST
10. OTHERS

1. GENERAL MATTERS

1.1 Census and Statistical Data in the Past 5 Years

- (1) Population by province or district, age, sex, race, religion etc.
- (2) Occupational breakdown of population
- (3) Number of household
- (4) Production in agriculture, industry, mining, trade service etc. by province or district
- (5) Gross national product and national income per capita
- (6) Balance of international payment and national budget
- (7) Amount of import/export
- (8) Consumer price index and whole sale price index
- (9) Exchange Rate

1.2 Population Density Map

1.3 Administrative District Division Map

1.4 Current Long Term National Development Plan

1.5 Current Five Year National Development Plan

1.6 Current Five Year Sectoral Development Plan

- (1) Urban development
- (2) Agricultural development
- (3) Water resources development including surface water and groundwater

1.7 Current Regional Development Plan for the Study Area

1.8 Other Related Data and Information

2. BASIC TECHNICAL DATA FOR THE STUDY AREA

2.1 Topographical Maps and Photos Showing Scale, Covering Area and Date

- (1) Topographical maps
- (2) Aerial photos
- (3) Satellite imageries

2.2 Data for Topographical Survey

- (1) Control points
 - 1) Triangular net
 - 2) Description of point
 - 3) Data on coordinate and altitude
- (2) Bench marks
 - 1) Leveling survey net
 - 2) Description of B.M.
 - 3) Data on coordinate and altitude

2.3 Geological Data and Information

- (1) Geological maps showing scale and covering area
- (2) Geological study reports

2.4 Land Use Maps

- (1) Present situation maps
- (2) Future planning maps including descriptions of plan

2.5 Soil Classification Maps

2.6 Meteorological Data

- (1) Location maps of observation stations
- (2) List of stations including: location, name, observation items and period etc.
- (3) Observation data obtained at several typical stations regarding: temperature, relative humidity, evaporation, wind speed, sunshine hour etc.

2.7 Rainfall Data

- (1) Location map of observation stations
- (2) List of stations including: location, name, type of gauge and recorder, observation items and period etc.
- (3) Isohyetal map showing annual mean, seasonal mean, maximum year, minimum year
- (4) Monthly/daily data obtained at several typical stations
- (5) Rainfall intensity-duration curves of typical stations
- (6) Study reports on rainfall in the Study Area

2.8 Runoff Data

- (1) Location maps of observation stations
- (2) List of station including: location, name, type of gauge and recorder, observation items and period, availability of rating curves etc.
- (3) Runoff data obtained at several typical stations including: annual runoff volume, maximum/mean/minimum discharge and daily/monthly discharge

2.9 Availability of Data Bank System on Meteorological and Hydrological Data

2.10 Other Related Data and Information

3. BASIC SOCIOECONOMIC DATA FOR THE STUDY AREA

3.1 Current Regional Development Plan for the Study Area

- (1) Urban development plan
- (2) Rural development plan
- (3) Industrial, agricultural development plan
- (4) Other related plan

3.2 Forecast

- (1) Population
- (2) Income
- (3) Life style
- (4) Others

3.3 Urban Water Demand

- (1) Current and planned water served population
- (2) Current urban water consumption per capita and proposed water demand per capita in future
- (3) Water demand projection

3.4 Rural Water Demand

- (1) Distribution of villages in the study area
- (2) Description of villages (name, location, population, water resources and etc.)
- (3) Current and planned water served population
- (4) Current rural water consumption per capita and proposed demand per capita in future
- (5) Water demand projection

4. DATA FOR WATER SUPPLY SYSTEM IN THE STUDY AREA

4.1 Urban Water Supply

- (1) Organizations in charge of urban water supply and their budget
- (2) Type of current water resources, their locations, intake amount, water quality (see 5.2 and 6.3)
- (3) Water supply system such as conveyance main, pump station, pipe line net work
- (4) Served population ratio and type (house connection, public water taps, road tanker etc.)
- (5) Water treatment system and quality of raw water and treated water, water quality standard for domestic use
- (6) Water tariff system, finance and present condition of operation and maintenance
- (7) Discrepancy among water demand and supply
- (8) Water resources development plan or water supply system improvement plan meeting to the future water demand

4.2 Rural Water Supply

- (1) Organizations in charge of rural water supply and their budget
- (2) Type of current water resources, their locations, intake amount, water quality
- (3) Water conveyance and supply method to villages
- (4) Description of water resources (type, name, depth, diameter, pump, intake amount, owner, donor, completion year, distance to villages, water quality, etc., see 5.2 and 6.3)
- (5) Condition of operation and maintenance of water resources (community organization, fee collection, purchasing of spare parts, etc.)
- (6) Role of women and children in rural water supply, heavy labor for water transportation
- (7) Water born disease
- (8) Discrepancy among water demand and supply in the villages
- (9) Water resources development plan meeting to the future water demand

5. GROUNDWATER IN THE STUDY AREA

5.1 Hydrogeological Data

- (1) Hydrogeological maps and profiles
- (2) Geophysical survey results
- (3) Description of aquifers
- (4) Hydraulic parameters of aquifers (permeability, storage coefficient, etc.)
- (5) Water balance analysis results (recharge amount)
- (6) Groundwater potential of the study area
- (7) Previous study reports

5.2 Wells

- (1) Availability of data bank system on existing wells (well inventories)
- (2) Location map of existing wells
- (3) Well structure (depth, hole dia., casing installation, pump type, aquifer type, water depth, etc.)
- (4) Fluctuation of groundwater level
- (5) Discharge amount of wells
- (6) Draw-down of wells
- (7) Purpose of use
- (8) Owner, donor, completion year
- (9) Working hour
- (10) Well contractor and drilling procedure
- (11) Well logs
- (12) Accessibility to wells
- (13) Current problems on existing wells such as dried-up, breakdown of pump, water quality deterioration, superannuation, etc.

5.3 Water Right

- (1) Existence of water right on groundwater
- (2) Registration procedure of groundwater right
- (3) List of registered groundwater right including : well name, owner, location, allowable discharge rate and amount, validity of right)

5.4 Groundwater Quality Measurement Data

5.5 Groundwater Monitoring System

- (1) Location of monitoring wells**
- (2) Monitoring items**
- (3) Monitoring period**
- (4) Monitoring results**
- (5) Proposed monitoring system in future**

6. SURFACE WATER IN THE STUDY AREA

6.1 General

- (1) Map of catchment area and channel system
- (2) Profile of main rivers and tributaries
- (3) Characteristics of rivers such as catchment area, length, width, river bed gradient, etc.
- (4) Erosion and sedimentation (watershed management)
- (5) Previous study reports
- (6) Surface water potential in the Study Area

6.2 River Structures such as Dam, Dike, Weir, Water Gate, Head Works, Diversion, Pumping Station, Intake, etc.

- (1) Location map
- (2) List of river structures including : location, name, type, main dimension, completion year, purpose of water use, construction cost, etc.
- (3) Amount of surface water resources developed by the river structures
- (4) Construction reports and drawings of river structures
- (5) Current problems on river structures such as siltation, superannuation, etc.
- (6) Future plan of river structures

6.3 Water Right

- (1) Location map of permitted water right
- (2) Registration procedure of surface water right
- (3) List of registered water right including owner, river, location, allowable intake rate, validity of right, etc.

6.4 Surface Water Quality Measurement Data

7. SEWAGE

7.1 Organization

- (1) Organizations in charge of sewage treatment and their budget

7.2 Sewerage System

- (1) Method of sewage treatment and discharge (cesspit, ceptic tank, house connection, etc.)
- (2) Existing sewerage system (pipeline system, pump station, treatment plant, discharging point, etc.)
- (3) Map of sewage pipeline system
- (4) Number of household connected to swage treatment plant through pipeline
- (5) Number of household equipped with individual treatment facility such as ceptic tank, cesspit, etc.
- (6) Number of household directly discharging sewage without treatment
- (7) Total volume of sewage effluent in the city
- (8) Total volume of treated sewage effluent in the city
- (9) Total volume of sewage effluent without treatment
- (10) Sewage tariff system and operation and management of sewerage system
- (11) Construction cost of sewerage system
- (12) Future project of sewerage system

7.3 Treatment Plant

- (1) Location of treatment plant
- (2) Treatment system
- (3) River discharged and points
- (4) Treatment capacity
- (5) Sewage quality and volume of influent and effluent
- (6) Main dimension of the treatment plant
- (7) Construction cost

7.4 Individual Treatment Facilities (cesspit, ceptic tank, etc.)

- (1) Type and its number of individual sewage treatment plant
- (2) Treatment capacity and efficiency of the individual treatment facilities

- (3) Effluent quality of the individual treatment facilities
- (4) Covering rate of the individual treatment facilities in the city
- (5) Construction and operation, maintenance cost of the individual treatment facilities
- (6) Discharging areas and points of effluent from individual treatment facilities

7.5 Water Quality

- (1) Quality of raw sewage
- (2) Water quality standard of effluent sewage (law and regulation)
- (3) Rivers being discharged with treated and untreated sewage
- (4) Discharging points
- (5) Water quality of discharged rivers

7.6 Current Problems Originated Sewage

- (1) Current problems originated from sewage such as nitrification, damage on fisheries, etc.
- (2) Groundwater contamination caused by sewage infiltration (especially Nitrate)

8. ENVIRONMENT

8.1 Organization

- (1) Organization or government agent responsible for environmental protection
- (2) Responsibility of the implementing agencies

8.2 Affiliation with Environmental Conventions including International and Bilateral

8.3 Legislation

- (1) Law or other regulation on environmental protection and environmental quality standard
- (2) Guideline on environmental protection
- (3) System of Initial Environmental Evaluation (IEE) and Environmental Impacts Assessment (EIA)

8.4 Socioeconomic Environment in the Study Area

- (1) Past problems such as dispute among villages, resettlement of Inhabitants, disintegration of community, etc. due to water resources development
- (2) Important and characteristic products of agriculture and industry in the Study Area
- (3) Important facilities such as road, railroad, station, hospital, church, school, public office, etc.
- (4) Existence of inhabitants who resist against the water resources development in their territory
- (5) Socioeconomic instability due to inflow of refugees
- (6) Important ruins and cultural assets
- (7) Traditional water right, fishing right etc. and these rightful claimant
- (8) Damage from disease and harmful Insects related with river, reservoir, pond, lake, marsh, sewage pond, etc.
- (9) Disease due to poor quality of surface water or groundwater
- (10) Domestic dispute relating with water allocation and water right
- (11) Heavy water conveyance work charged especially on women and children

8.5 Natural Environment in the Study Area

- (1) Present and expected environmental problems related with topography and geology

such as landslide, soil erosion, etc.

- (2) Present and expected environmental problems related with groundwater and surface water development such as land subsidence, decrease of river maintenance flow, water quality deterioration of river caused by increase of sewage, etc.
- (3) Present and expected environmental problems related with sediment transportation, river bed variation, river bank erosion, sedimentation in river bed, etc.
- (4) Conserved and important wild life, fish, insect, vegetation in the Study Area
- (5) Worthy and conservation landscape in the Study Area

8.6 Precedent Instance of Environmental Problems with Similar Projects

8.7 Other Related Data and Information

- (1) Location maps of national park and game reserve
- (2) National forestry plan
- (3) Previous study reports on environmental matters
- (4) Conservation plan on natural environment

9. UNIT COST

9.1 Unit Cost of Survey and Investigation

- (1) Topographic survey such as leveling and mapping
- (2) Test well drilling including installation of casing and screen
- (3) Geophysical exploration
- (4) Well logging
- (5) Pumping test
- (6) Boring for soil investigation
- (7) Standard penetration test
- (8) Soil test
- (9) Environmental survey for IEE and EIA including natural and socioeconomic environment
- (10) Well monitoring
- (11) River flow measurement
- (12) Water quality analysis

9.2 Unit Cost of Construction

- (1) Construction of water level recording station
- (2) Construction of rainfall recording station
- (3) Construction of water level gauge
- (4) Construction of groundwater level recorder
- (5) Construction of production well (mobilization, demobilization, drilling, well developing, etc.)
- (6) Installation of pump
- (7) Casing and screen
- (8) Submergible pump and hand pump
- (9) Excavation cost
- (10) Concrete
- (11) Others

9.3 Unit Cost of Man Power

- (1) Senior engineer
- (2) Junior engineer

- (3) Assistant engineer
- (4) Technician
- (5) Secretary
- (6) Typist
- (7) Driver
- (8) Labor and foreman
- (9) Drilling engineer
- (10) Translator and Interpreter (English-Domestic language)

9.4 Unit Cost of Miscellaneous Items

- (1) Rent a car, four-wheel drive type, sedan type
- (2) Gasoline, oil
- (3) Office rental
- (4) Taxi charge
- (5) Copy charge

附属資料 8. 収集資料リスト

資料リスト (収集資料)

平成8年3月22日作成

1/2

局長	副局長	課長	係長

地域	アフリカ	調査国又は母国名	ケニア	調査の題名又は調査項目	事前調査 (SW協議)	作成部署	
題名	ケニア	調査機関名		現地調査期間又は調査期間	8年2月25日~8年3月15日	担当者氏名	

番号	資料の名称	形態	版型	ページ数	オリジナルのコピー数	部	取得先名又は発行機関	寄附・購入(備考)の別	取付区分	利用表示	利用者所属氏名	納入日	納入機関
1	Economic Survey 1995	本	A4	190	オリジナル	/	General Bureau of Statistics	購入					
2	Statistical Abstract	本	A4	367	オリジナル	/	同上	購入					
3	Kenya Population Census, 1989, Vol I	本	A4	448	オリジナル	/	同上	購入					
4	Kenya Population Census, 1989, Vol II	本	A4	590	オリジナル	/	同上	購入					
5	Development Plan 1994-1996	本	A4	290	オリジナル	/	Ministry of Planning and National Development	購入					
6	Isiolo District Develop. Plan, 1994-1996	本	A4	141	コピー	/	同上	-					
7	Meru District Develop. Plan, 1994-1996	本	A4	144	コピー	/	同上	-					
8	Tambora District Develop. Plan, 1994-1996	本	A4	144	コピー	/	同上	-					
9	Water Act	複製	A4	64	コピー	/	Ministry of Water Development	-					
10	Design Manual for Water Supply in Kenya	本	A4	530	コピー	/	同上	-					
11	Tanniru Water Supply Scheme, Phase 2, D/S Main Report	本	A4	90	コピー	/	同上	-					
12	Meru Water Resources Assessment Study, Final Report, 1991	本	A4	78	コピー	/	WRAP	-					
13	Meru Waters Resources Assessment Study, Appendices, 1991	本	A4	229	コピー	/	WRAP	-					
14	Isiolo Water Resources Assessment Study, Final Report, 1991	本	A4	192	コピー	/	WRAP	-					
15	Meru Waters Resources Assessment Study, Technical Works - Risk Design, Report and Engineers Cost Estimate, 1992	本	A4	46	コピー	/	Ministry of Local Government	-					
16	同上資料設計図書類	図面	A0	6枚	系統	/	同上	-					
17	公営水栓図書類	図面	A0	9枚	コピー	/	Ministry of Land Reclamation, Reclamation and Water Development (MORREWD)	-					
18	Ministry of Water Dev. Organization Chart	図面	A1横置	1枚	コピー	/	同上	-					

国際協力基金団

国際協力基金団

国際協力基金団

資料リスト (収集資料)

平成 8 年 3 月 22 日作成

調査部長	
調査課長	
調査員	

調査部長	
調査課長	
調査員	

地域	アフリカ	調査の種別又は 採集年月	事前調査 (S/W協議)	作成部署
題名	ケニア国	調査題名又は 専門家氏名	ケニア国社会科学研究会	
		採集機関 又は採集期間	8年2月25日~8年3月15日	担当者氏名

番号	資料の名称	形態	版数	ページ数	オリジナル コピーの別	部数	収集年月又は 採集期間	著者・個人 (国籍)の別	取扱区分	利用表示	利用者所属氏名	献 本 数	附 属 数
19	1/250,000 地形図	図面	A0	4枚	コピー	1	Kinsey of Land and Settlement	-					
20	地形図 1:75,000	複製	A4	2枚	コピー	1	同上	-					
21	土地利用経済学と社会 Area Economic Data in the Study Area (ケニア国)	表	A4	18	オリジナル	1	MOLLERUD	-					
22	Unit (2枚) (貸借記録)	複製	A4	10	コピー	1	同上	-					
23	養畜次(養豚)と村証(同等)	複製	A4	9	コピー	1	同上	-					
24	養豚専門家 養豚記録簿(養豚専門家)	複製	A4	42	コピー	1	同上	-					
25	養豚専門家 養豚記録簿(養豚専門家)	複製	A4	125	コピー	1	同上	-					
26	ケニア国内農工大レポート	レポート	A4	16	オリジナル	1	ケニア農業	寄贈					
27	KALANSI CONSULTANTS 社内資料	レポート	A4	7	オリジナル	1	KALANSI CONSULTANTS	同上					
28	Howard Humphreys Ltd 社内資料	レポート	A4	20	コピー	1	JICA 1100事務所	-					
29	Carl Brokensha Ltd 社内資料	レポート	A4	3	コピー	1	同上	-					
30	Education Center for Women in Dombasi (ケニア国)のレポート	刊行物	A5	4	オリジナル	1	Education Center for Women in Dombasi	寄贈					

附属資料9. 価格調査票

価格調査票

Ksh1.0 = 〒1.91円 (1996年3月)

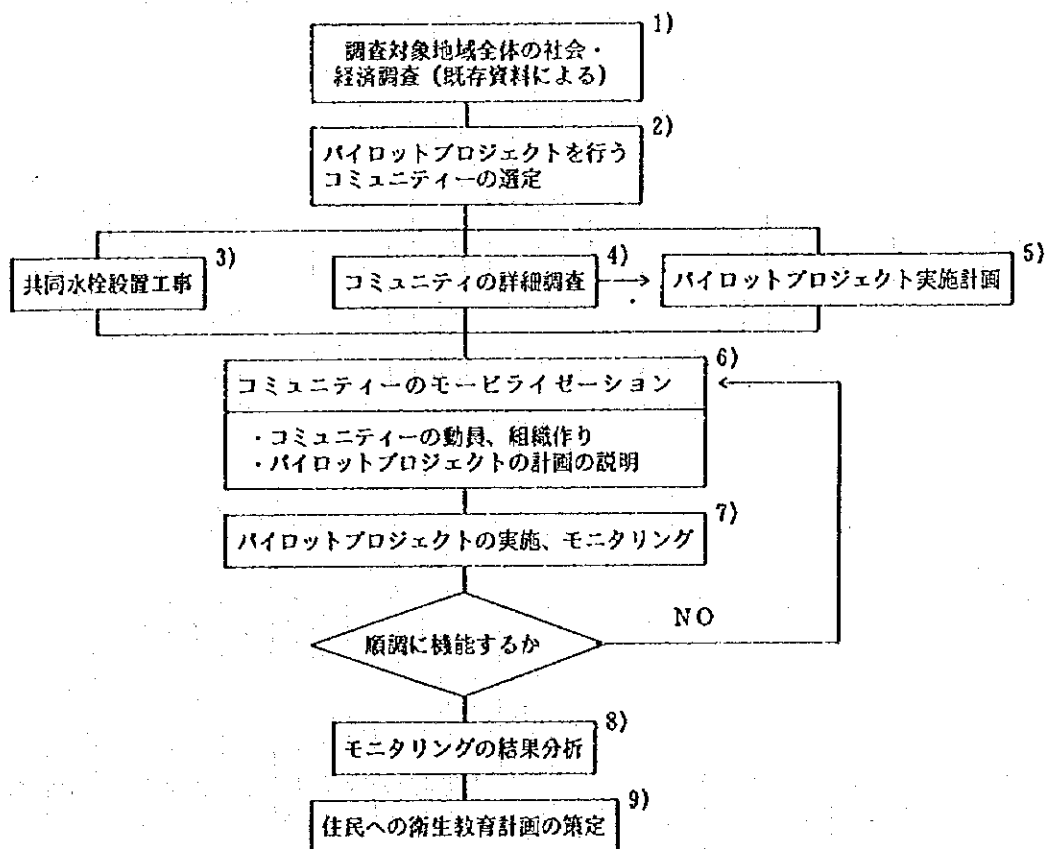
項目	単位	単価 (Ksh)	仕様・その他
1. 調査、分析費			
(1) 測量			
a. 平面測量	/ha	60,000	1/500、急峻地、1mコンター、4日/ha
b. 縦断測量	/km	23,000	縦1/500、横1/1,000、急峻地、25m間隔、1日/km
c. ベンチマーク調査	1箇所	250	
(2) 井戸掘削	/m	18,000	径10"、ケーシング、スクリーン込み
(3) 電気探査	/地点	41,000	探査深度300m
(4) 井戸検層	/本	20,000	比抵抗その他3項目
(5) 揚水試験	/試験	60,000	段階、連続、回復
(6) 土質ボーリング	/m	5,000	径3"
(7) 貫入試験	/回	3,000	
(8) 土質試験	/試験	5,000	物理試験1式
(9) 流量観測	/本・回	30,000	移動費等込み
(10) 水質分析			
a. 土水分析	/試料	15,000	温度等26項目の他に大腸菌、サンプリング含まず
b. 下水分析	/試料	32,000	BOD 5、HCN、S、オイル・グリース、フェノール、 有害金属類、pH、温度、大腸菌、サンプリング含まず
c. サンプリング	/試料	25,000	車両費、ドライバー、技官2名、前日宿泊
(11) 地形図	1枚	200	ケニア測量局
(12) 空中写真	1枚	200	ケニア測量局
2. 建設費			
(1) 水位観測所設置工事	1箇所	390,000	フロート、自記式
(2) 雨量計設置工事	1箇所	140,000	
(3) 水位レベルゲージ 設置工事	1箇所	35,000	測水標
(4) 地下水位観測所設置工事	1本	10,000	フロート自記式
(5) 井戸ハンドポンプ設置費	1本	80,000	
(6) ケーシング、スクリーン	1m	3,000	径10"
(7) 井戸水中ポンプ	1台	300,000	揚程30m
(8) 井戸ハンドポンプ	1台	100,000	インディアン・マークⅡ
(9) コンクリート	/m ²	10,000	グレード25
(10) 共同水栓設置工事	1箇所	50,000	収集資料17の図面参照、工事期間は約3週間
(11) 家畜水飲み場設置工事	1箇所	50,000	収集資料17の図面参照、工事期間は約3週間
(12) 送水用PVCパイプ	/m	500	径2"、クラスC (共同水栓送水用)
(13) 送水管敷設費	/m	500	掘削、埋設
3. 人件費			
(1) 上級技師	/人・月	15,000	
(2) 中級技師	/人・月	12,000	
(3) 初級技師	/人・月	10,000	
(4) 技術員	/人・月	8,000	
(5) 秘書	/人・月	5,000	
(6) タイピスト	/人・月	4,000	
(7) ドライバー	/人・月	5,000	
(8) 人夫	/人・日	150	
(9) ボーリング技師	/人・月	13,000	
(10) 通訳	/人・月	5,000	英語⇄現地語
(11) 欧米系コンサルタント 会社中級技師	/人・月	350,000	中級技師、\$250/人・日、Kalausi Consulatatntの単価
4. その他			
(1) レンタカー	/台・日	11,000	4WD車、1日100kmまでの料金
(2) ガソリン	/ℓ	35	
(3) タクシー代	/km	30	
(4) コピー代	/枚	4	A4サイズ
(5) 事務所	/m ² ・月	900	1平方メートル当たりの単価、ナイロビ市
(6) コピーマシン	1台	349,000	ゼロックス5328卓上型
(7) 電話付きファックス	1台	36,000	サンヨー-SFX-33
(8) パソコン	1台	143,000	ペンティアム75MHzマルチメディア卓上型
(9) プリンター	1台	50,000	上記パソコンに接続可能なレーザープリンター
(10) 4WD車	1台	2,950,100	三菱パジェロ、ガソリン車、エアコン付き

下水処理施設 パイロットプラント建設費用

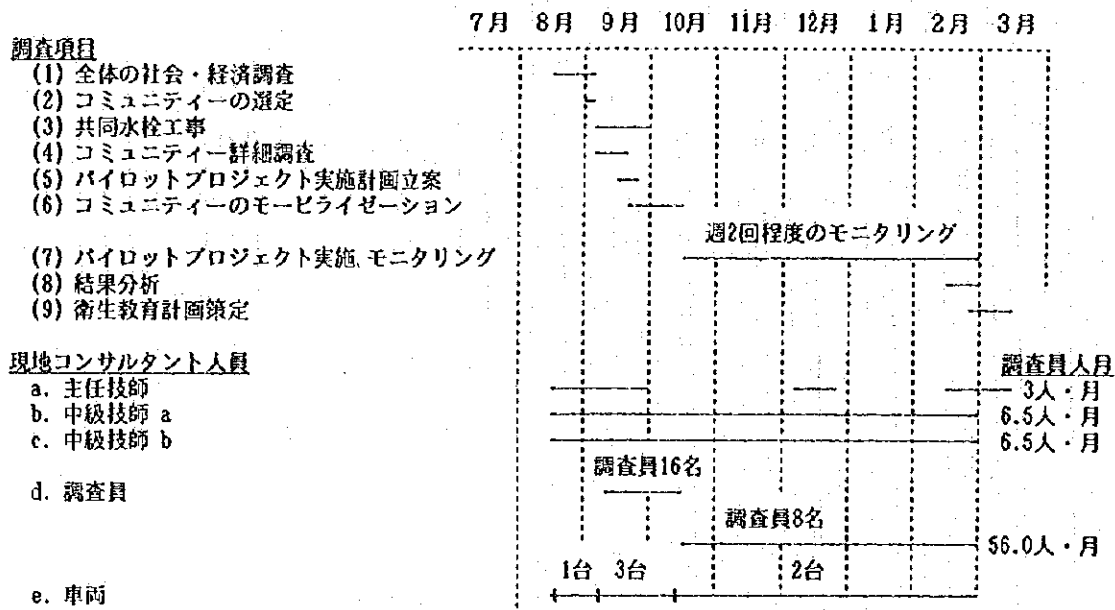
メルー市の下水処理施設改善、拡張工事については、1992年に地元コンサルタントのWanjohi Consulting Engineers により詳細設計、積算及び入札図面作成が行われており、工事の発注準備は完全に終わっている（収集資料15、16参照）。この当時の積算金額は約Ksh 3,000,000であり、1992年から1996年の間の物価上昇は約2倍となっていることから、現在での工事費はKsh 6,000,000程度と想定される。これにContingenyとして25%の上載せをすると、約Ksh 7,500,000となり、日本円に換算すると（Ksh1.0=¥1.91円、1996年3月中旬）、¥14,325,000円となる。従って、メルー市における下水処理施設パイロットプラントの建設費用としては、約1,500万円程度が見込まれる。なお、MORLLWDの土木工事技術者によると、ケニアにおいてはこの程度の工事に通常6ヶ月程度かかるとのことである。

共同水栓改善、住民衛生教育 パイロットプロジェクト費用

題記のパイロットプロジェクトは、次のフローからなると考える。



以上のフローは、次の工程と人員計画に従って行われるものと想定する。またパイロットプロジェクトは4つのコミュニティーを対象として行うことを想定する。



従って、金額は次の様に見積もられる。ただし、これには共同水栓の工事費は含まれない。

項目	単位	数量	単価 (Ksh)	金額 (Ksh)	備考
1. 人件費					
(1) 主任技師	人・月	3.0	35,000	1,050,000	
(2) 中級技師	人・月	13.0	15,000	195,000	
(3) 調査員	人・月	56.0	10,000	560,000	
2. 車両費※					
	台・月	15.0	200,000	3,000,000	レンタカー、ピックアップ
3. ドライバー					
	人・月	15.0	5,000	75,000	現地雇用
4. 宿泊・日当					
(1) 主任技師	人・泊	50.0	2,500	125,000	ホテル
(2) 中級技師	人・泊	240.0	250	60,000	民家借上げ
(3) 調査員	人・泊	1,700.0	250	425,000	民家借上げ
5. 材料費					
	式	1.0	250	400,000	住民教育用資材、共同水栓修理用機材等

合計 5,890,000 @1.91円

↓
¥ 11,249,900

※) 車両費が全体の半分以上を占める。このためレンタカー会社からの借上げではなく、別の機関、例えば地元農民等からの借上げを考慮すべきであろう。

附属資料10. ローカルコンサルタント等一覧

ローカルコンサルタント等一覧

社名	住所	電話、FAX	備考
1. コンサルタント			
Kalaus Consultants	P.O.Box 41983, Nairobi, KENYA	Tel 562304 Fax 561316	NGOとの関連の強いコンサルタント、特に女性問題、エイズ等
Carl Bro Kenya Ltd	P.O.Box 50572, Nairobi, KENYA	Tel 228191 Fax 333886	地元の大手西欧系コンサルタント
Howard Humphreys Ltd	P.O.Box 16028, Kampala, UGANDA	Tel 243254 Fax 243250	東アフリカ地域をカバーする大手西欧系コンサルタント、事務所はケニアにはなくウガンダにある
Oda Management Service	P.O.Box 74113, Nairobi, KENYA	Tel 217584 Fax 331757	村落形態調査等を得意とする地元コンサルタント
GS Consult Ltd	P.O.Box 72387, Nairobi, KENYA	Tel 560332 Fax 560438	住民教育、衛生教育等を得意とする地元コンサルタント
Development Solution for Africa Ltd	P.O.Box 19911, Nairobi, KENYA	Tel 564612 Fax 567514	同上
Pillar Management Service	P.O.Box 55216, Nairobi, KENYA	Tel 220441 Fax 210754	同上
Community Management and Training Services	P.O.Box 292, Nairobi, KENYA	Tel 891360	同上
2. 測量会社			
Geomaps	P.O.Box 61071, Nairobi, KENYA	Tel 337167 Fax 210624	政府登録業者
Geo-Top Surveys	P.O.Box 34763, Nairobi, KENYA	Tel 222620 Fax 242979	同上
Mapsurveys Ltd	P.O.Box 44902, Nairobi, KENYA	Tel 224480 Fax 218461	同上
Survey and Land Services	P.O.Box 75195, Nairobi, KENYA	Tel 228792	同上
Urban-Rural Surveying	P.O.Box 62692, Nairobi, KENYA	Tel 336072	同上
3. 井戸さく井業者			収集資料23参照、ケニアには政府登録の井戸さく井業者が25社ある
4. 建設業者			
Abbas Construction Co.	P.O.Box 59348, Nairobi, KENYA	Tel 762304	
Bhogal Construction	Lunga Lunga Rd, Ind Area Nairobi, KENYA	Tel 555596 Fax 540474	
Capital Construction Co Ltd	P.O.Box 30604, Nairobi, KENYA	Tel 547433 Fax 554221	
Deek's Contractors Ltd	P.O.Box 49032, Nairobi, KENYA	Tel 742790	
Epc Builders Ltd	P.O.Box 55628, Nairobi, KENYA	Tel 505576	
5. 水質分析機関			
Jomo Kenyatta University of Agriculture and Technology	P.O.Box 50572, Nairobi, KENYA	Tel 724121	日本人専門家が指導しており、信頼性が高い
University of Nairobi	ATN: Dr. ASANO	Fax 724878	
Government Chemist Laboratory Kenya Bureau of Standard			

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