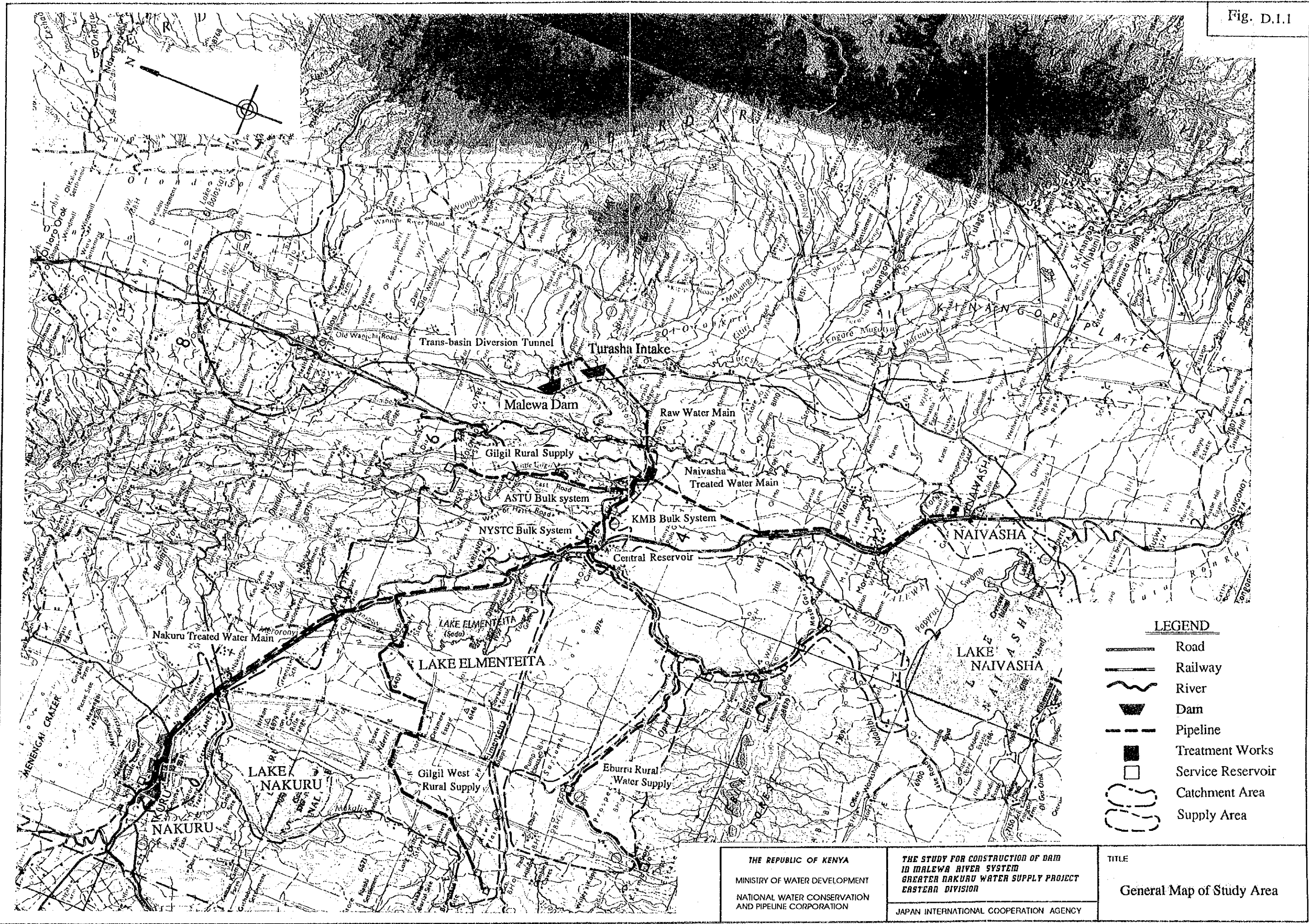


FIGURES

Fig. D.1.1

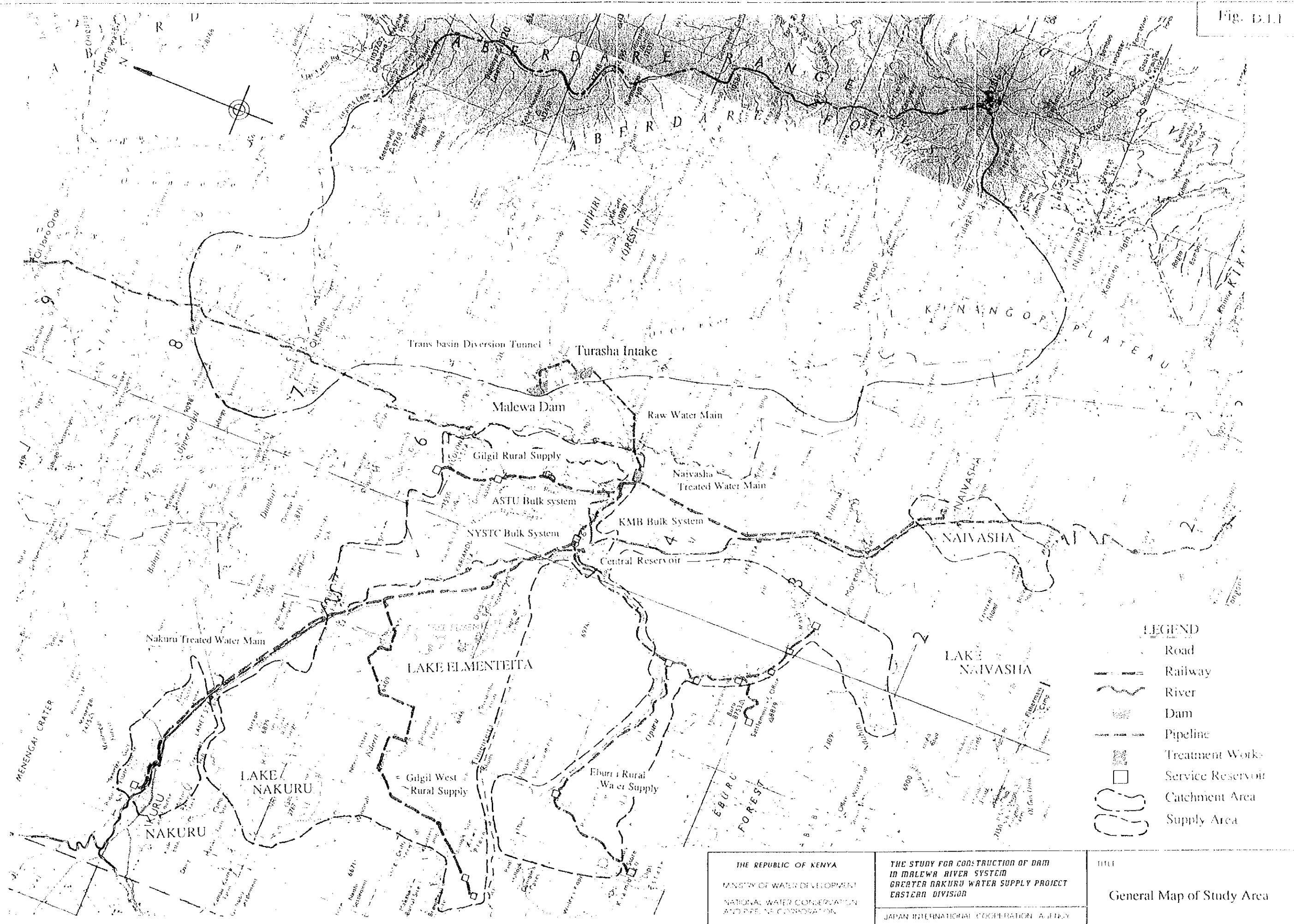


LEGEND

- Road
- Railway
- River
- Dam
- Pipeline
- Treatment Works
- Service Reservoir
- Catchment Area
- Supply Area

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<p>JAPAN INTERNATIONAL COOPERATION AGENCY</p>		

Fig. B.1.1



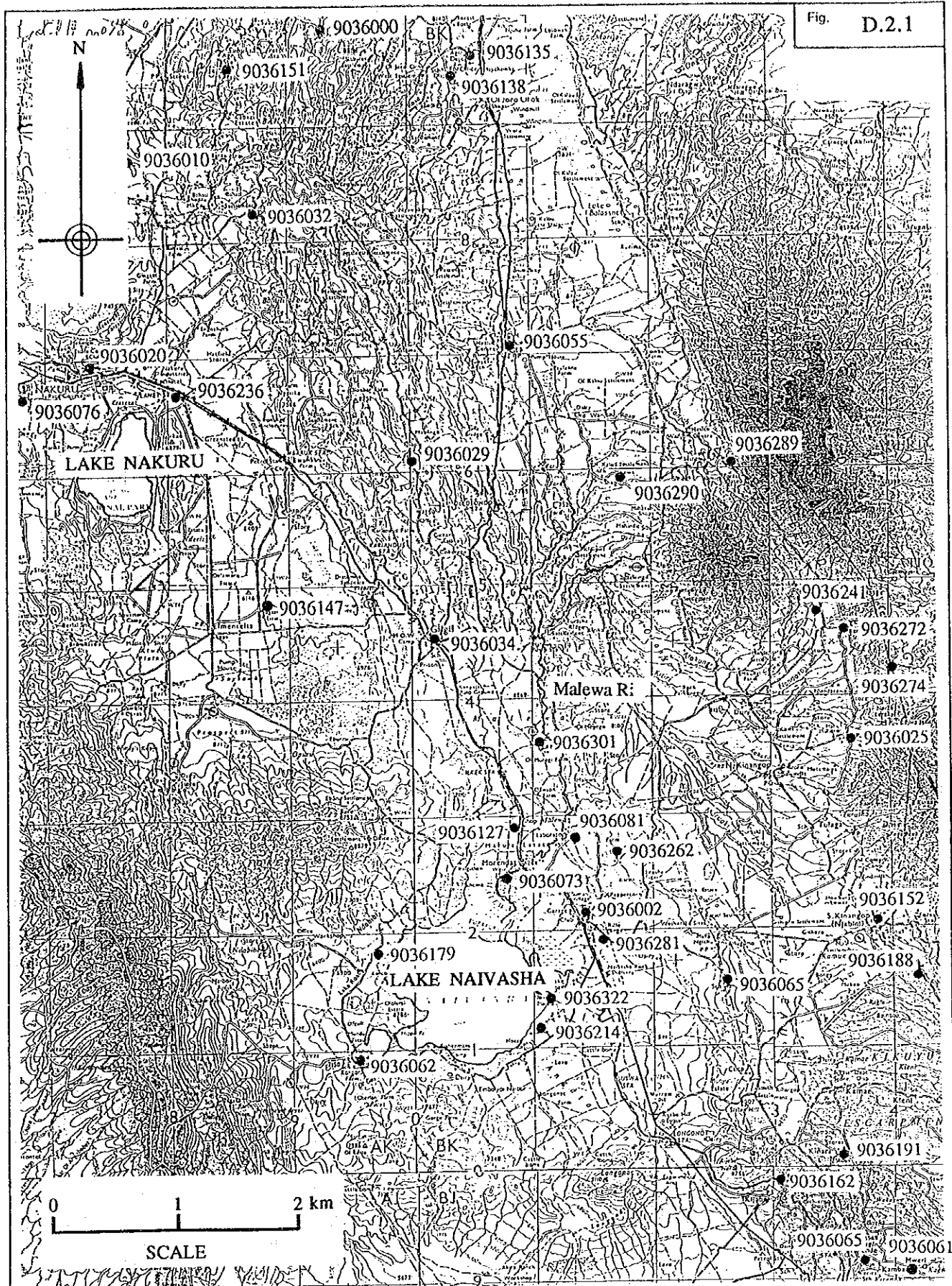
- LEGEND**
- Road
 - Railway
 - ~ River
 - ▬ Dam
 - Pipeline
 - ▣ Treatment Works
 - ▣ Service Reservoir
 - Catchment Area
 - Supply Area

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TITLE
 General Map of Study Area

Fig. D.2.1



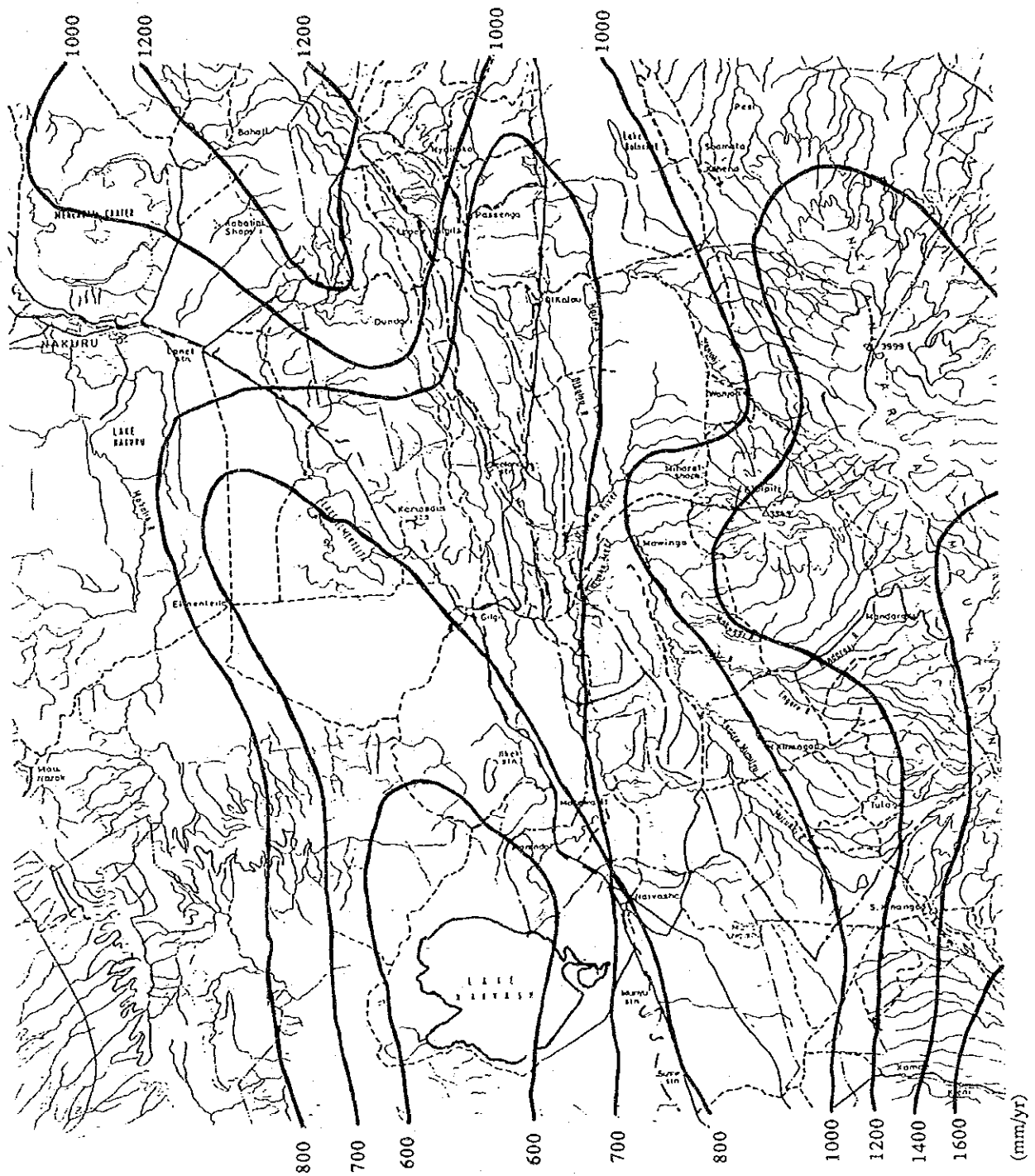
0 1 2 km
SCALE

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TITLE
Location Map of Rain Gauge Stations

Fig. D2.2

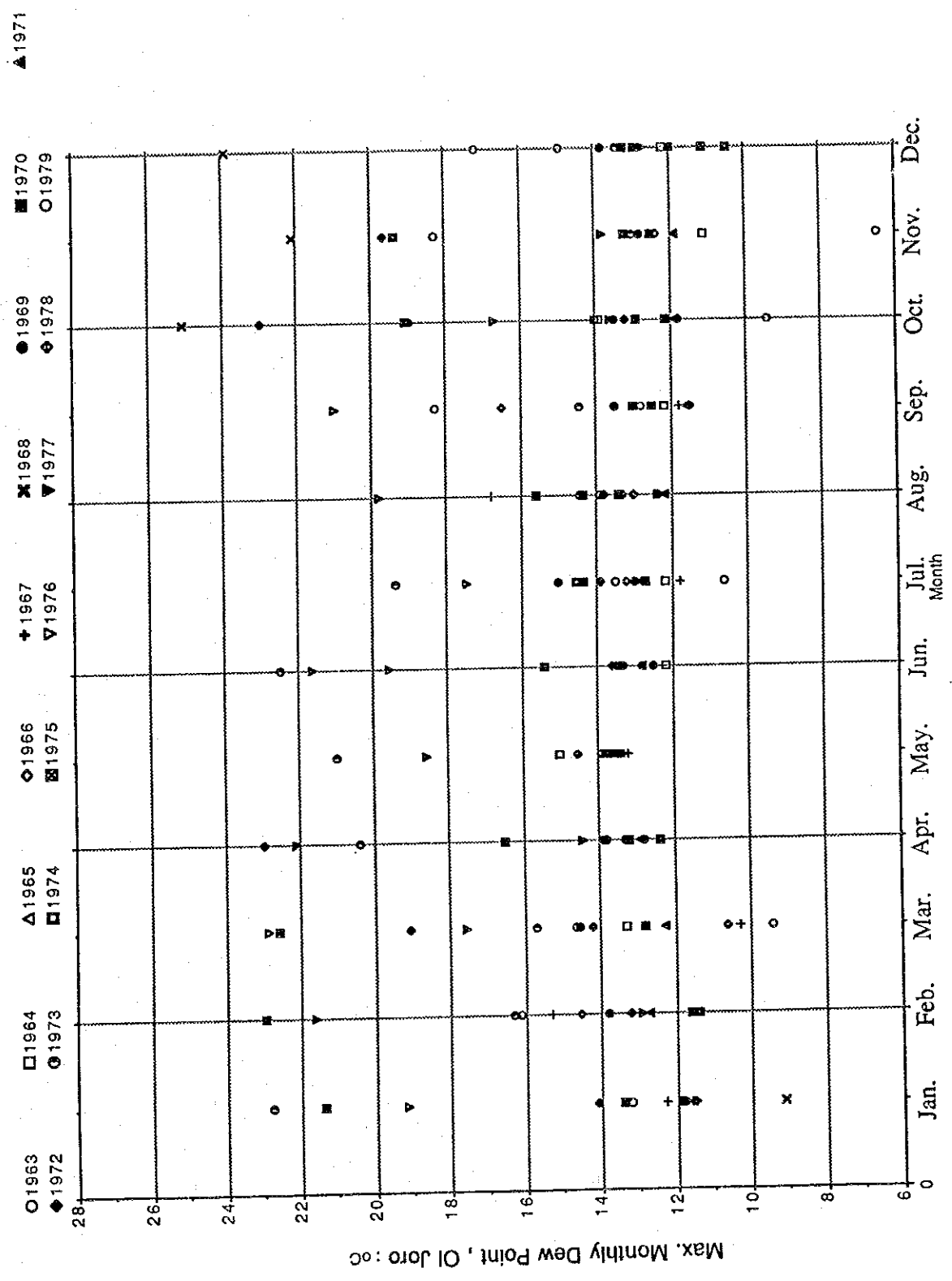


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TITLE
 Isohyetograph in Study Area

Fig. D.2.3

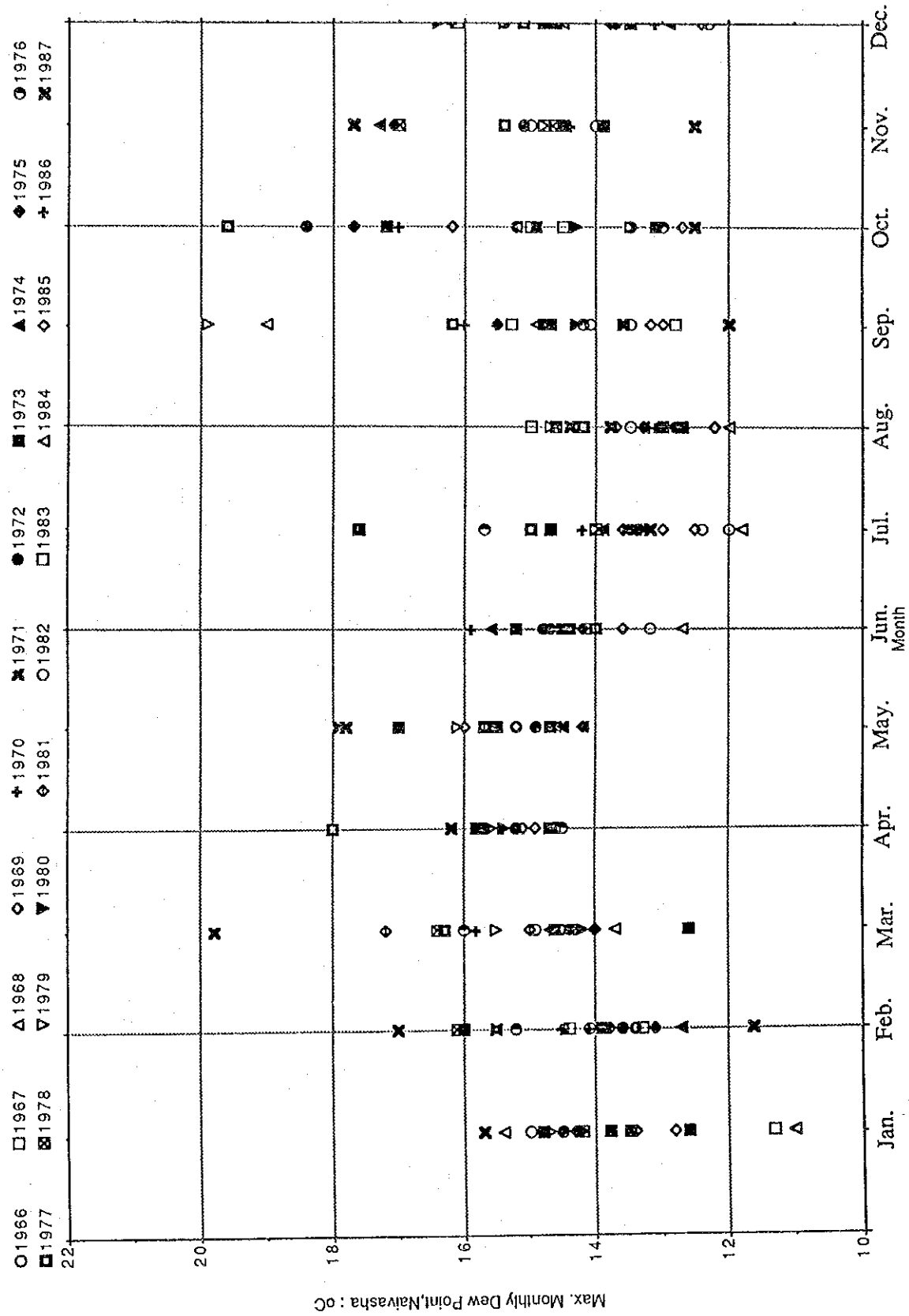


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TITLE
 Maximum Dew Point Temperature,
 Ol Joro Orok (1/2)

Fig. D.2.4

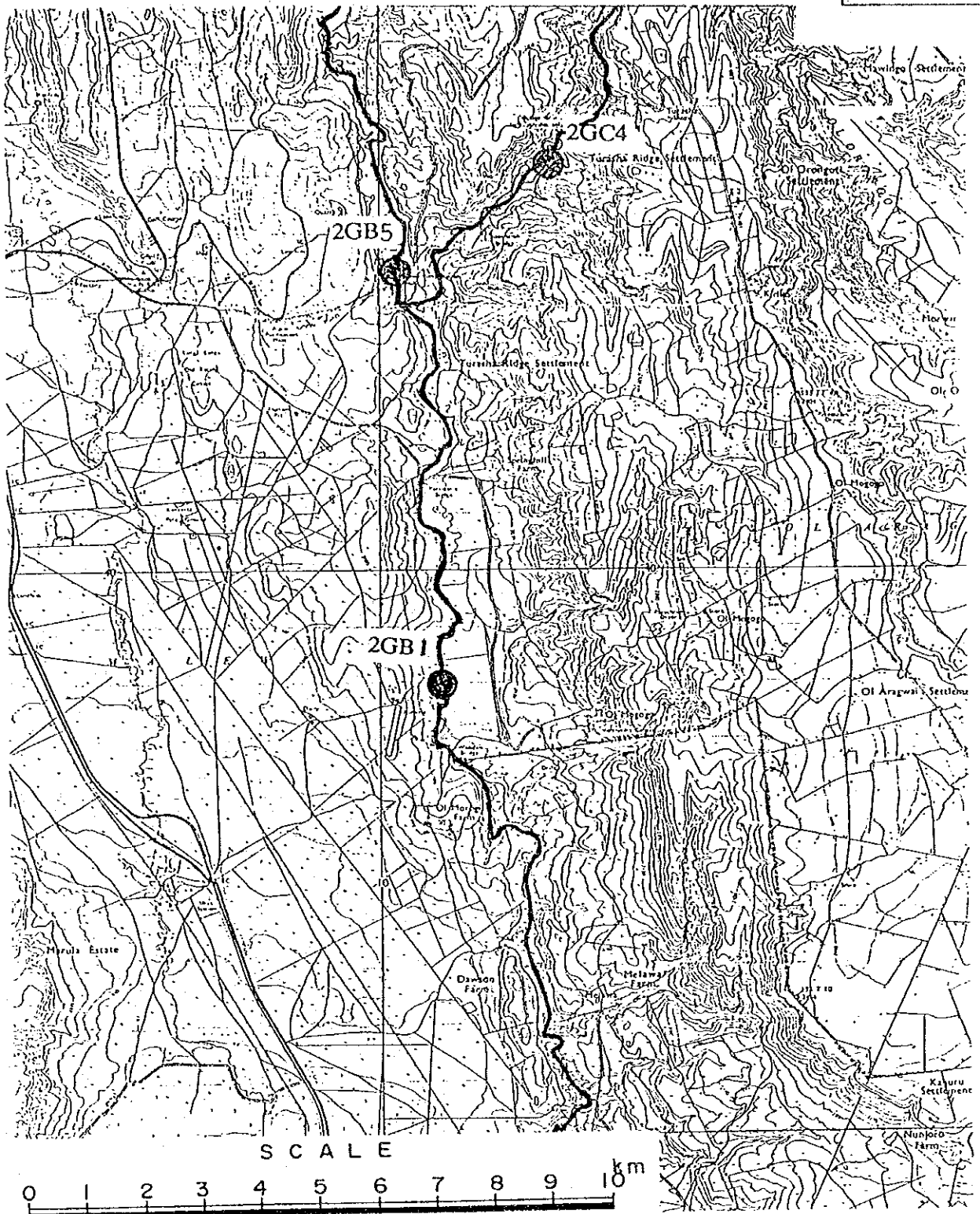


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 JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
 Maximum Dew Point Temperature,
 Naivasha (2/2)

Fig. D.3.1



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Fig. D.3.2

Hydrological Year	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1931	X	X	A	O	O	O	O	O	O	O	O	O
1932	X	X	X	X	X	X	X	X	X	X	X	X
1933	X	X	X	X	X	X	X	X	X	X	X	X
1934	X	X	X	X	X	X	X	X	X	X	X	X
1935	X	X	X	X	X	X	X	X	X	X	X	X
1936	X	X	X	X	X	X	X	X	X	X	X	X
1937	X	X	X	X	X	X	X	X	X	X	X	X
1938	X	X	X	X	X	X	X	X	X	X	X	X
1939	X	X	X	X	X	X	X	X	X	X	X	X
1940	X	X	X	X	X	X	X	X	X	X	X	X
1941	X	X	X	X	X	X	X	X	X	X	X	X
1942	X	X	X	X	X	X	X	X	X	X	X	X
1943	X	X	X	X	X	X	X	X	X	X	X	X
1944	X	X	X	X	X	X	X	X	X	X	X	X
1945	X	X	X	X	X	X	X	X	X	X	X	X
1946	X	X	X	X	X	X	X	X	X	X	X	X
1947	X	X	X	X	X	X	X	X	X	X	X	X
1948	X	X	X	X	X	X	X	X	X	X	X	X
1949	X	X	X	X	X	X	X	X	X	X	X	X
1950	X	X	X	X	X	X	X	X	X	X	X	X
1951	X	X	X	X	X	X	X	X	X	X	X	X
1952	X	X	X	X	X	X	X	X	X	X	X	X
1953	X	X	X	X	X	X	X	X	X	X	X	X
1954	X	X	X	X	X	X	X	X	X	X	X	X
1955	X	X	X	X	X	X	X	X	X	X	X	X
1956	X	X	X	X	X	X	X	X	X	X	X	X
1957	X	X	X	X	X	X	X	X	X	X	X	X
1958	X	X	X	X	X	X	X	X	X	X	X	X
1959	X	X	X	X	X	X	X	X	X	X	X	X
1960	X	X	X	X	X	X	X	X	X	X	X	X
1961	X	X	X	X	X	X	X	X	X	X	X	X

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TITLE
 Availability of
 Stream Gauging Records(1/2)

Hydrological Year	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan	Feb.	Mar.
1962	O	O	Δ	O	O	O	O	Δ	O	O	O	Δ
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	O	O	O	O	O	O	O	O	O	O	O	O
1963	Δ	X	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	O	O	O	O	O	O	O	O	O	O	O	O
1964	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	O	O	O	O	O	O	O	O	O	O	O	O
1965	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	O	O	O	O	O	O	O	O	O	O	O	O
1966	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1967	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1968	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1969	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1970	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1971	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1972	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1973	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1974	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1975	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1976	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	O	O	O	O	O	O	O	O	O	O	O	O
1977	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	O	O	O	O	O	O	O	O	O	O	O	O
1978	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1979	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1980	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	X	Δ	Δ	Δ	Δ	X	Δ	Δ	Δ	Δ
1981	Δ	X	X	X	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1982	O	Δ	Δ	Δ	Δ	X	X	Δ	Δ	X	Δ	X
	O	Δ	Δ	Δ	Δ	O	O	O	O	O	O	O
1983	X	X	Δ	O	O	Δ	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
1984	O	O	O	O	O	O	O	O	O	O	O	O
	Δ	Δ	Δ	Δ	Δ	X	X	X	X	X	X	X
1985	X	Δ	O	O	Δ	X	X	X	O	X	X	X
	Δ	Δ	Δ	Δ	Δ	X	X	X	X	X	X	X
1986	O	X	X	X	O	O	O	O	O	O	O	O
	X	X	X	X	X	X	X	X	X	X	X	X

Note :

(1) Upper, middle, and lower marks show availability of 2GB1,2GB5, and 2GC4 respectively.

(2) Marks means the followings

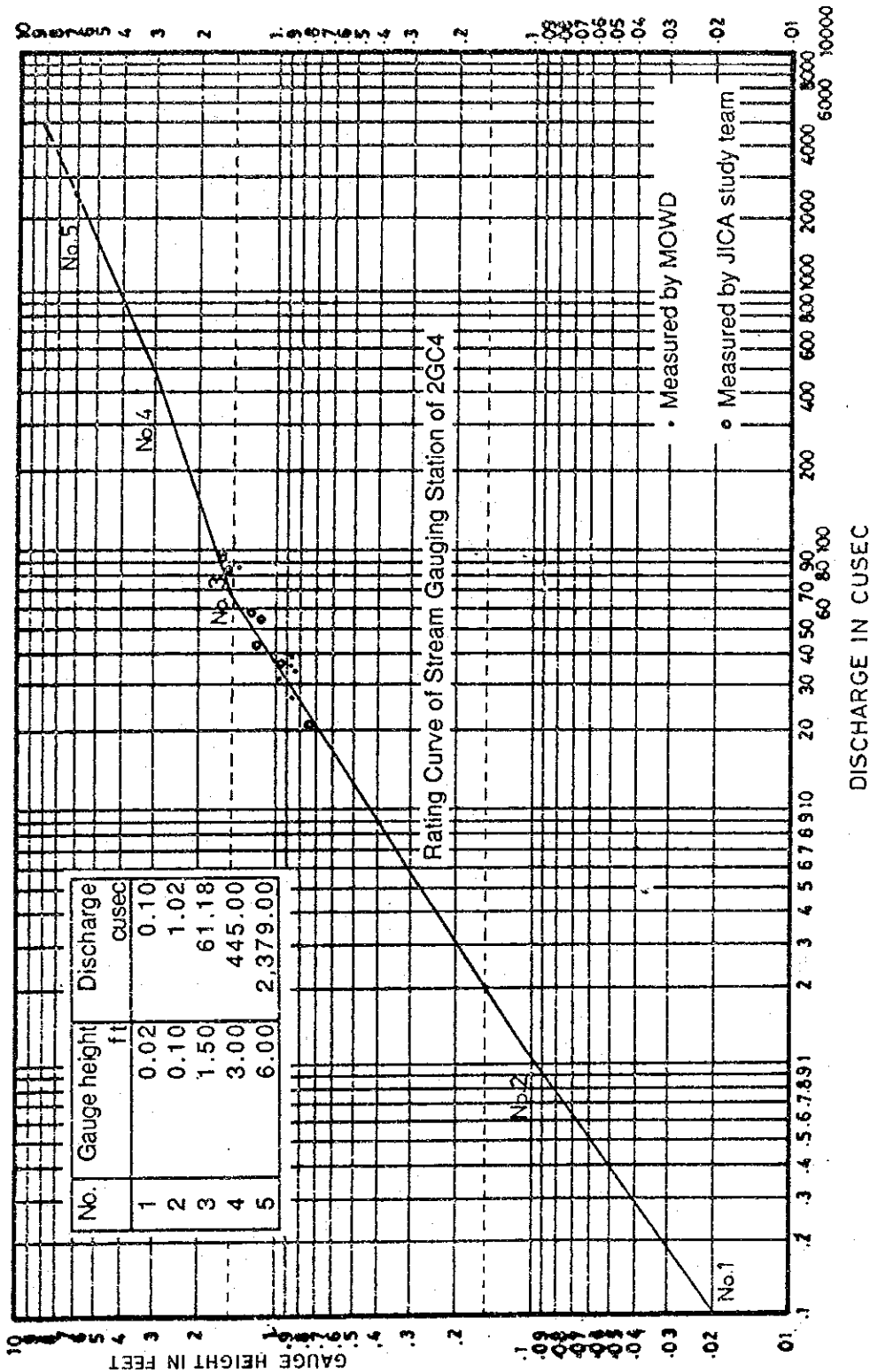
o : Complete data with interrupted period less than 7 days

Δ : Incomplete data with interrupted period more than 8 days

x : No data

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Fig. D.3.4

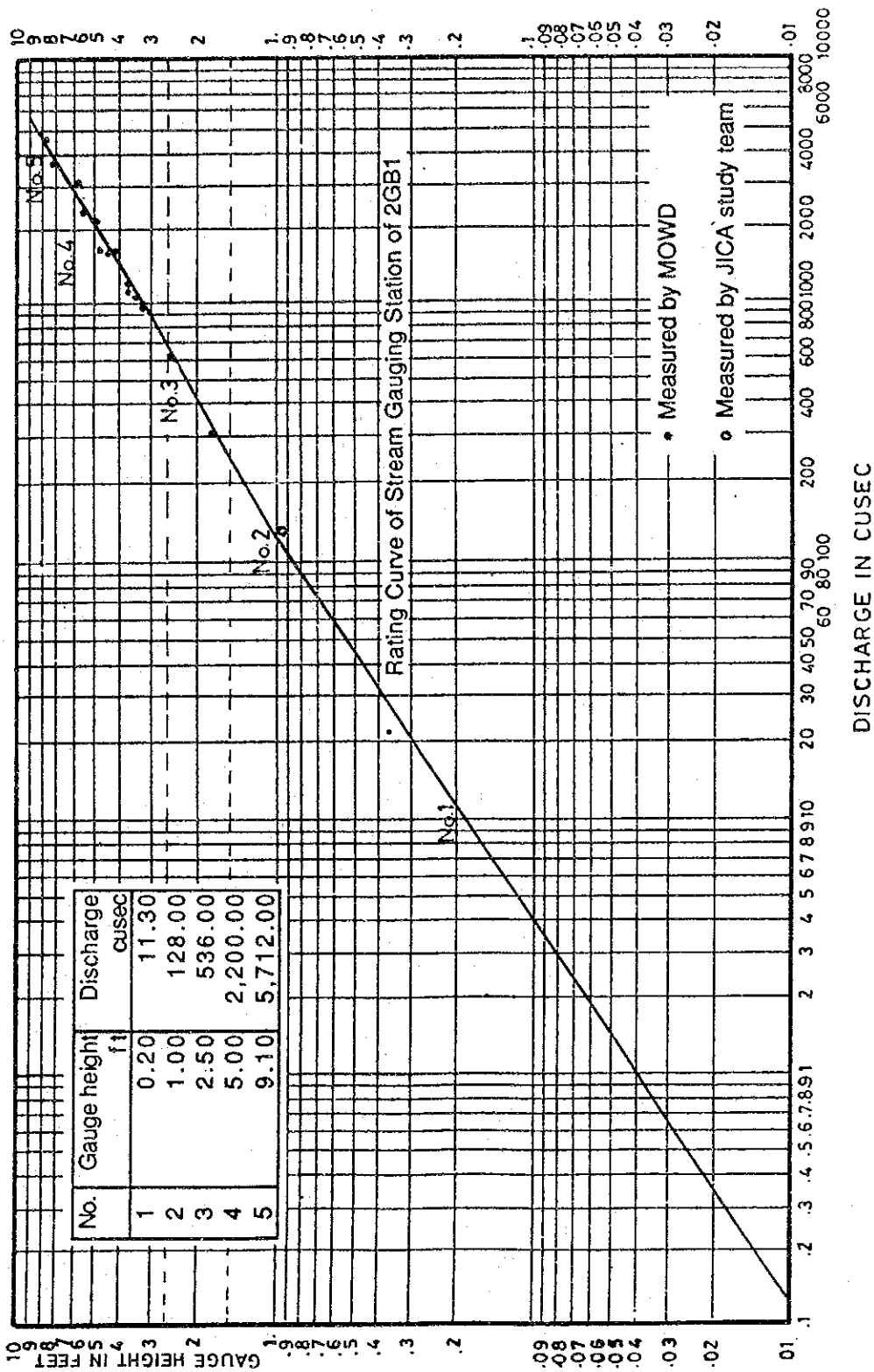


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TITLE
 Stage-discharge Relation at 2GC4

Fig. D.3.5

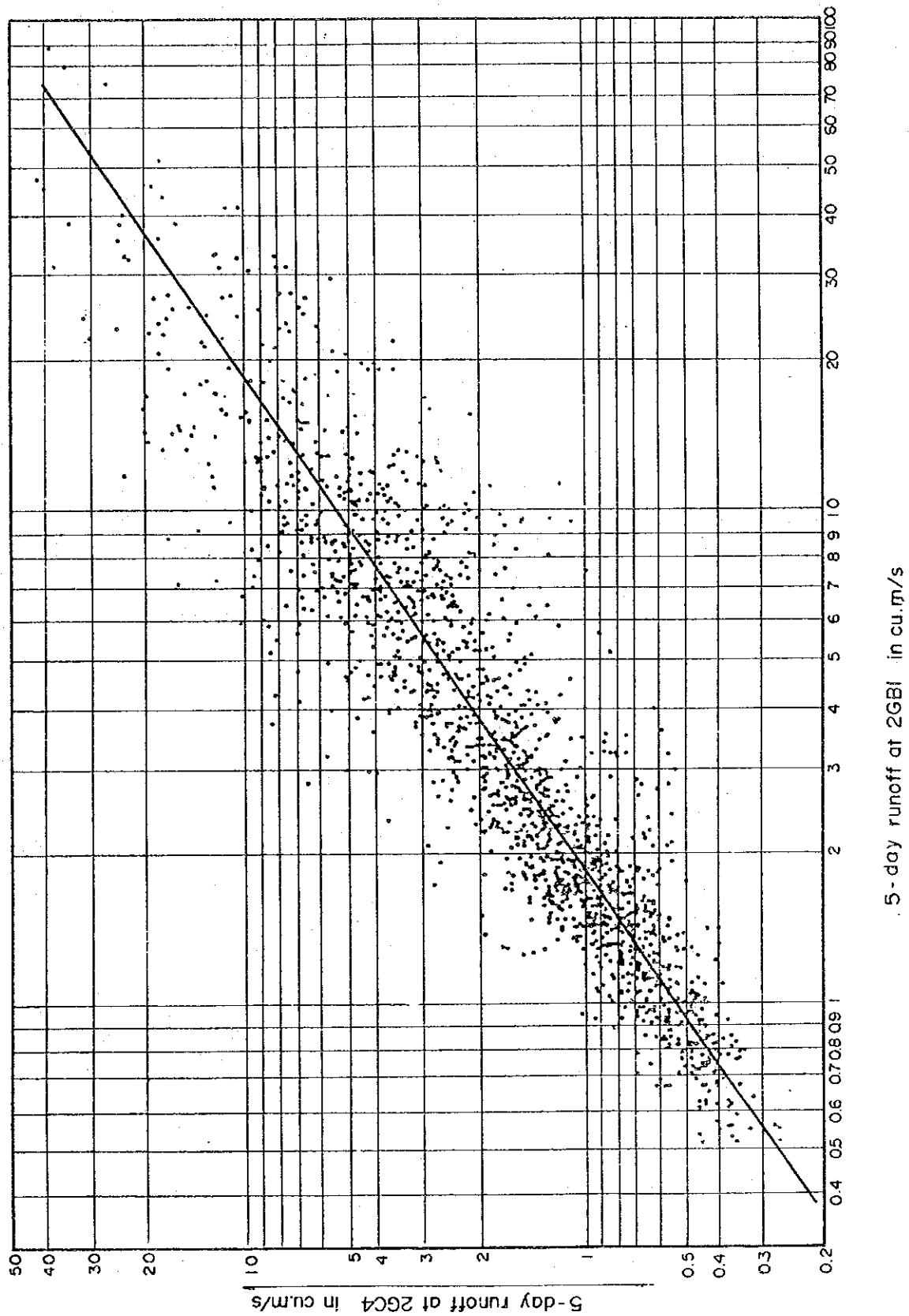


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TITLE
 Stage-discharge Relation at 2GB1

Fig. D.3.6



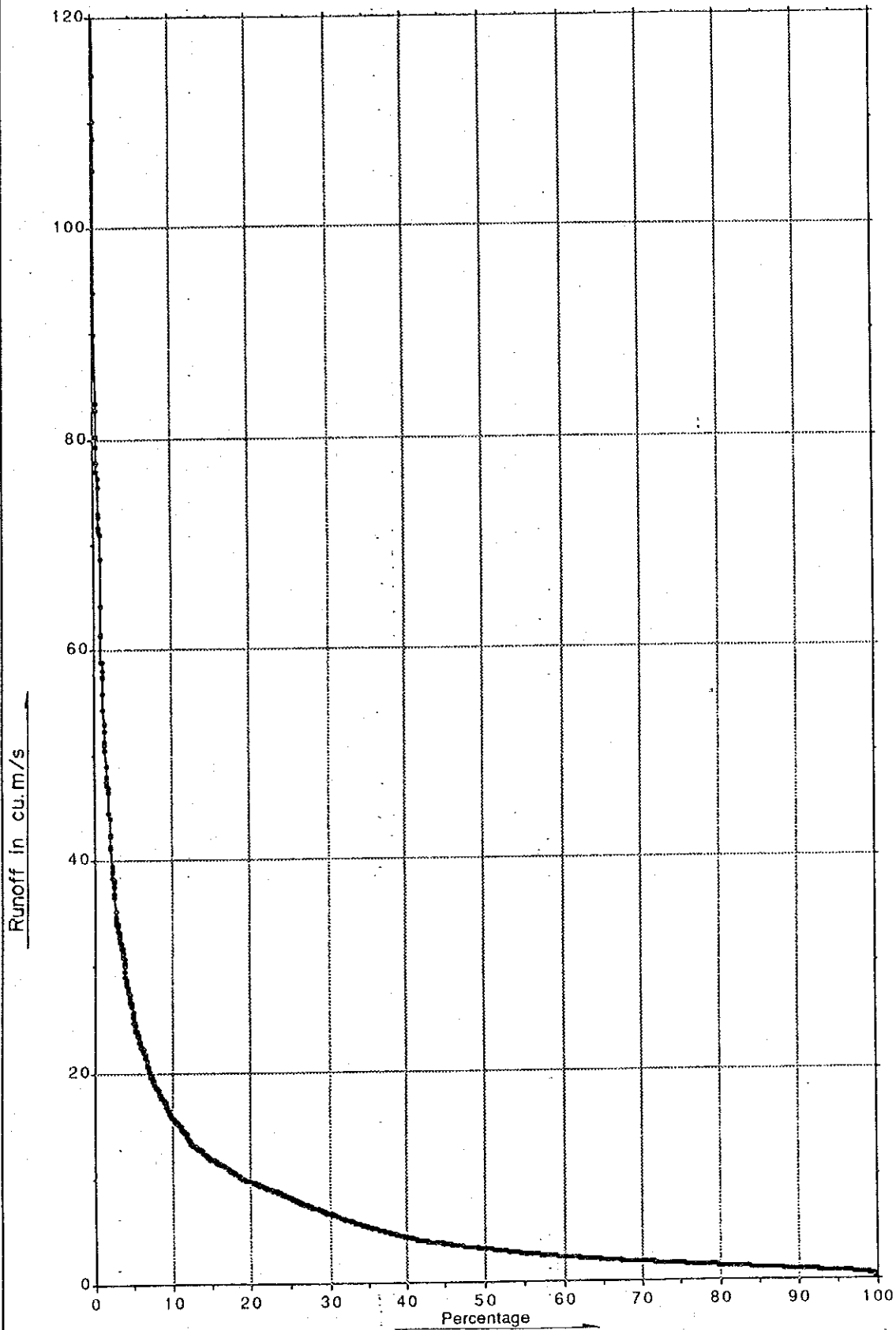
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TITLE
 Runoff Correlation
 between 2GB1 and 2GC4

Fig. D.3.7



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NATIONAL WATER CONSERVATION
AND PIPELINE CORPORATION

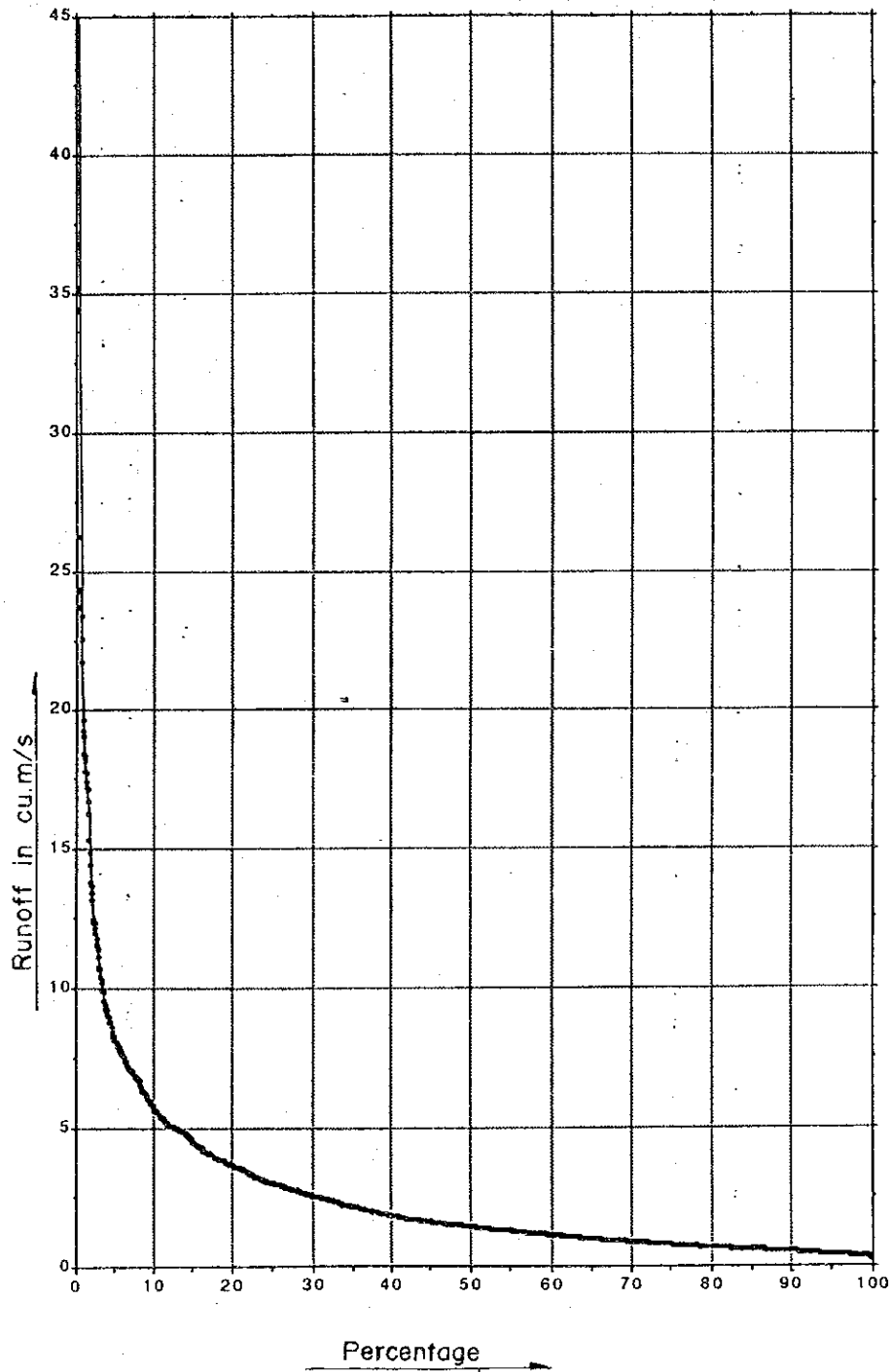
THE STUDY FOR CONSTRUCTION OF DAM
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TITLE

Flow Duration Curve at 2GB1

Fig. D.3.8



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 NATIONAL WATER CONSERVATION
 AND PIPELINE CORPORATION

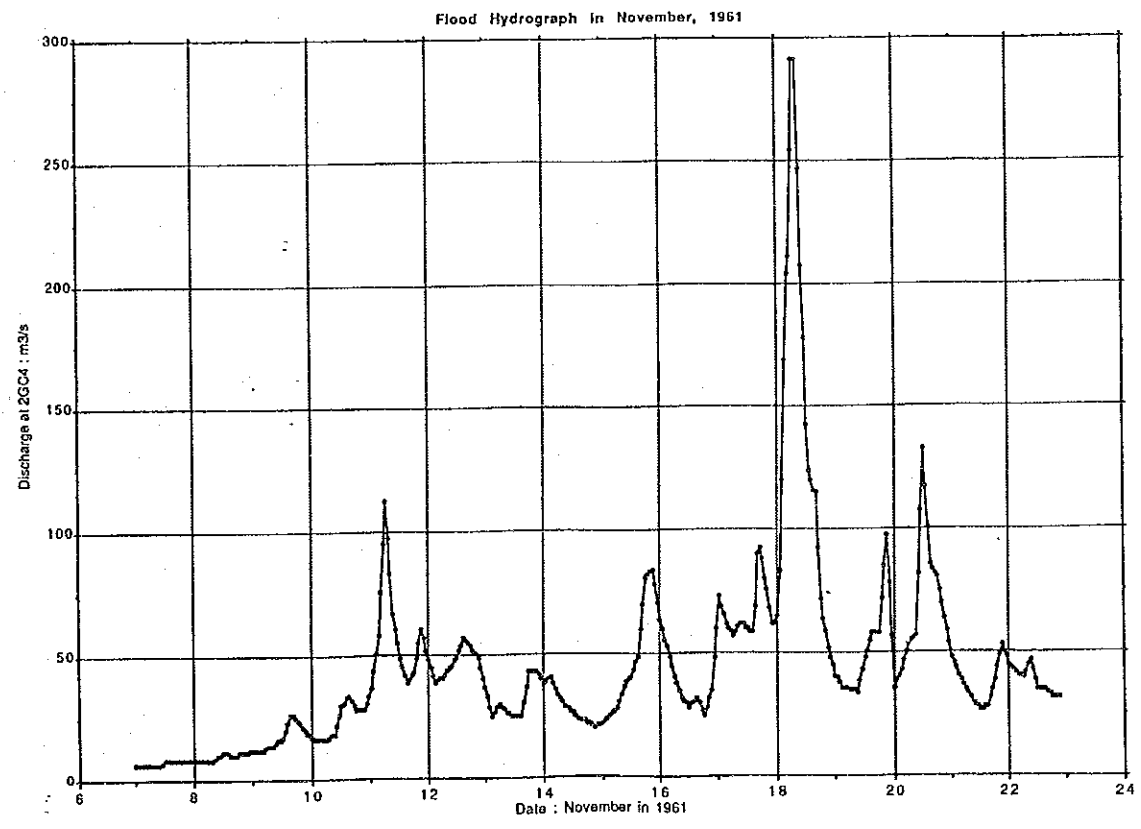
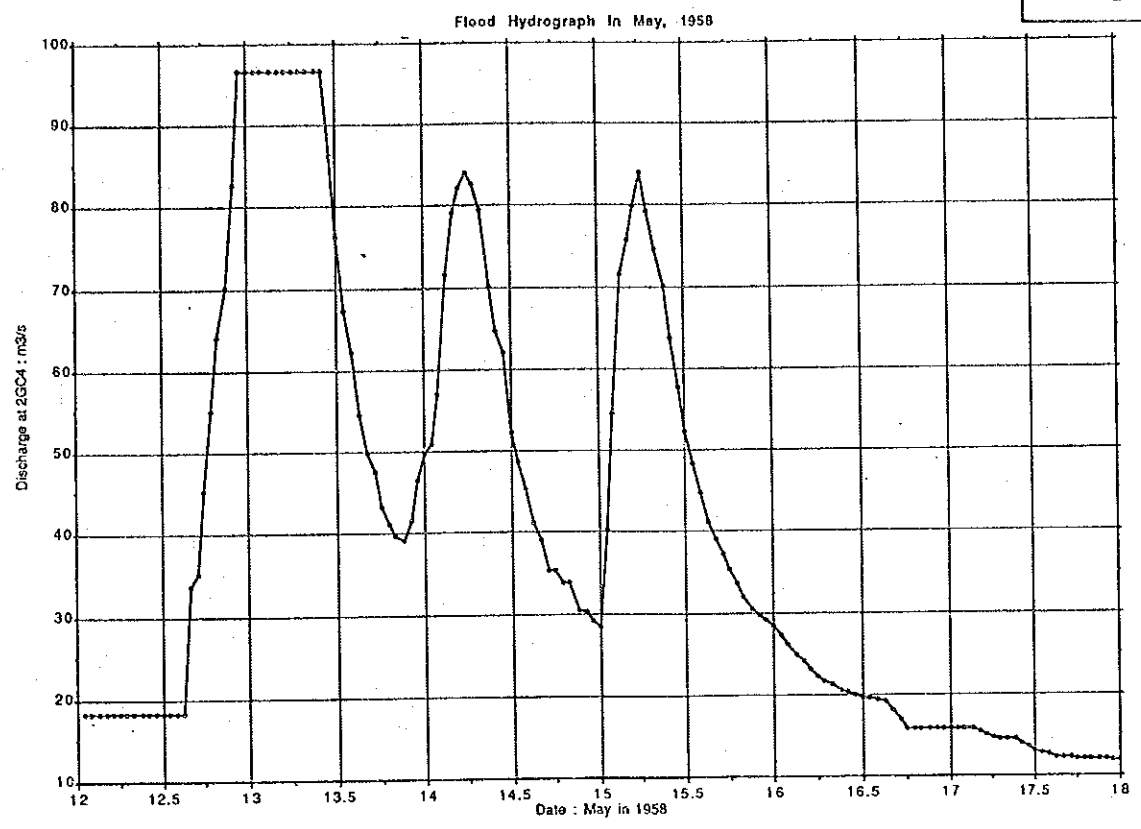
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JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

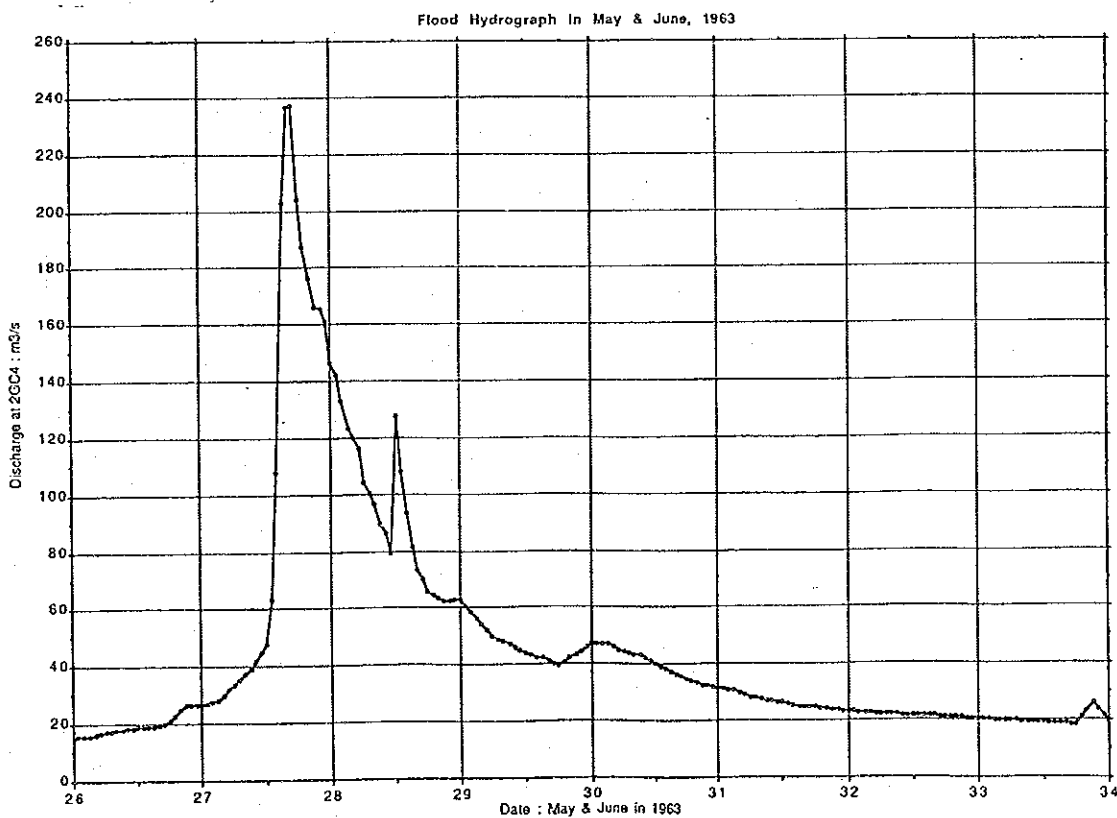
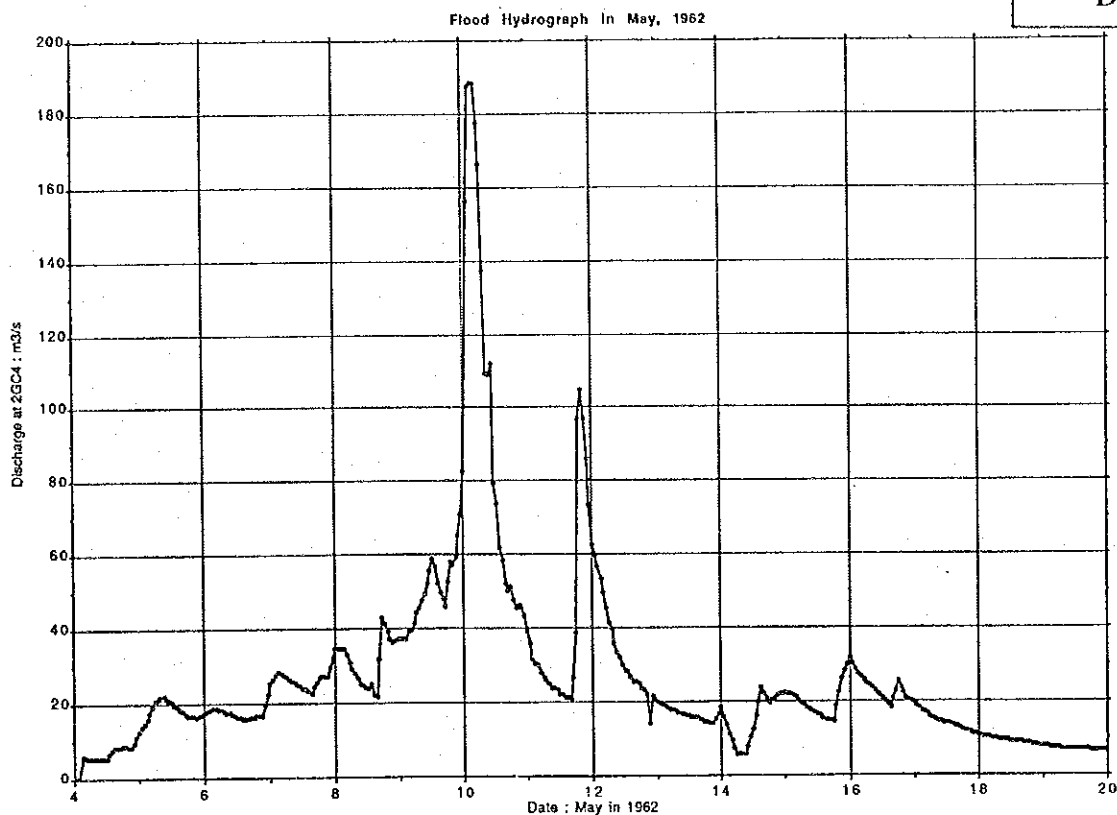
Flow Duration Curve at 2GC4

Fig. D.4.1



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Fig. D.4.2



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AND PIPELINE CORPORATION

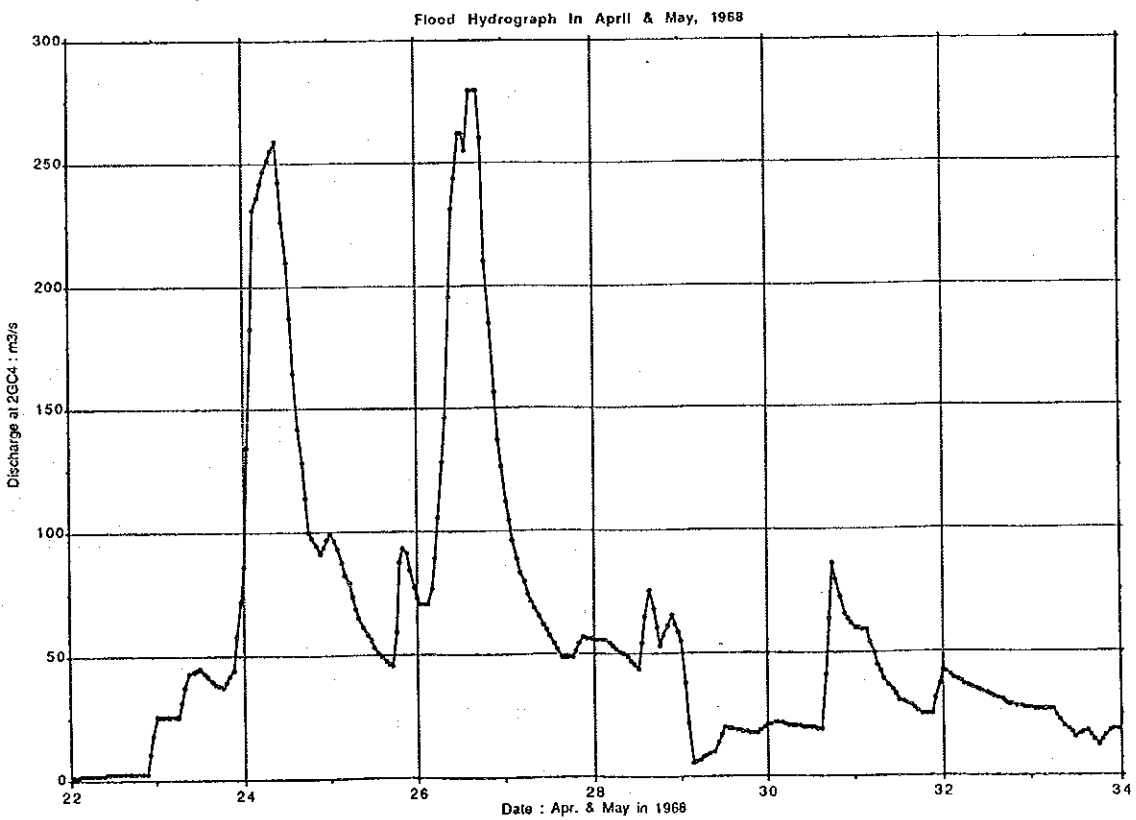
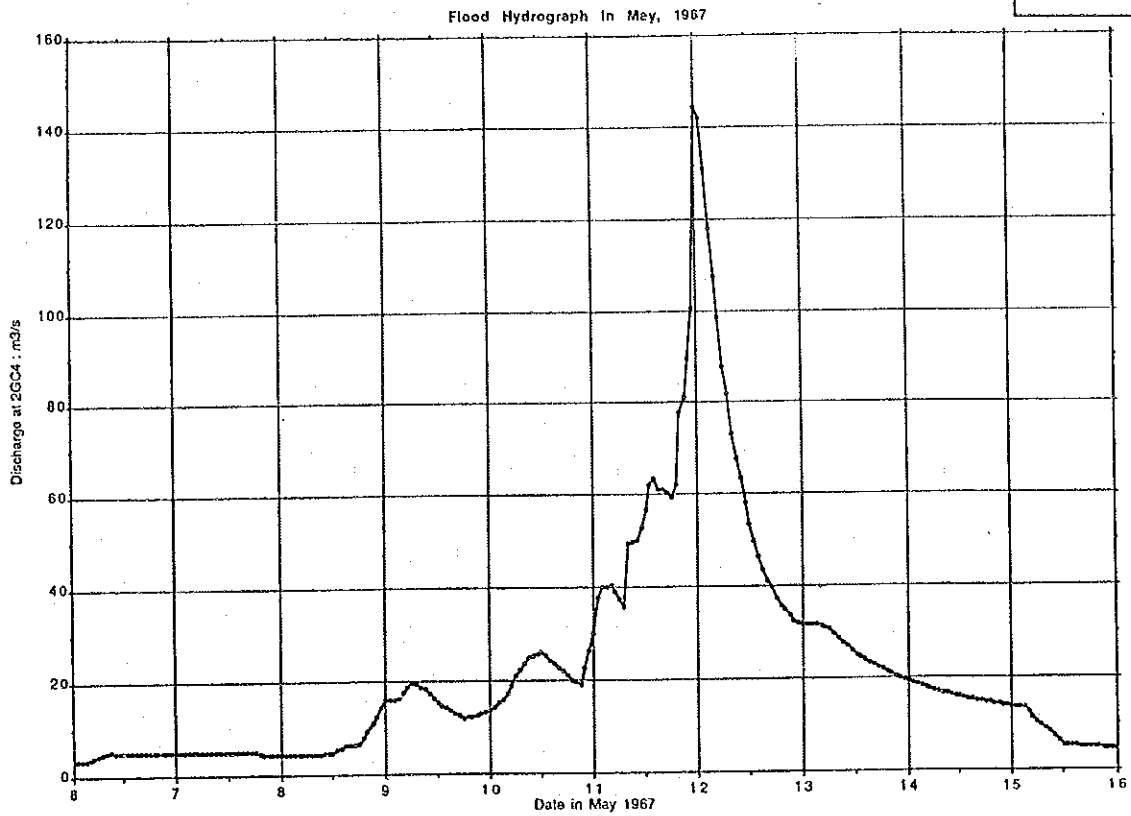
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TITLE

Flood Hydrograph (2/5)

Fig. D.4.3



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NATIONAL WATER CONSERVATION
AND PIPELINE CORPORATION

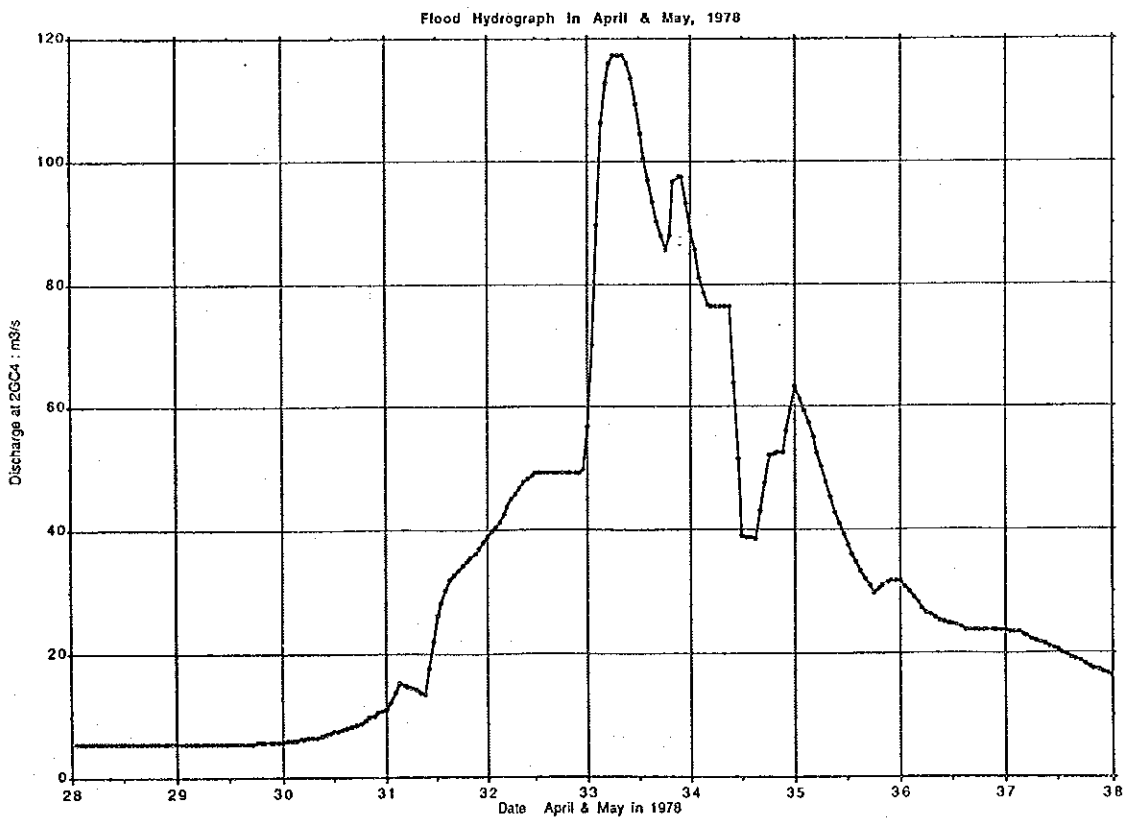
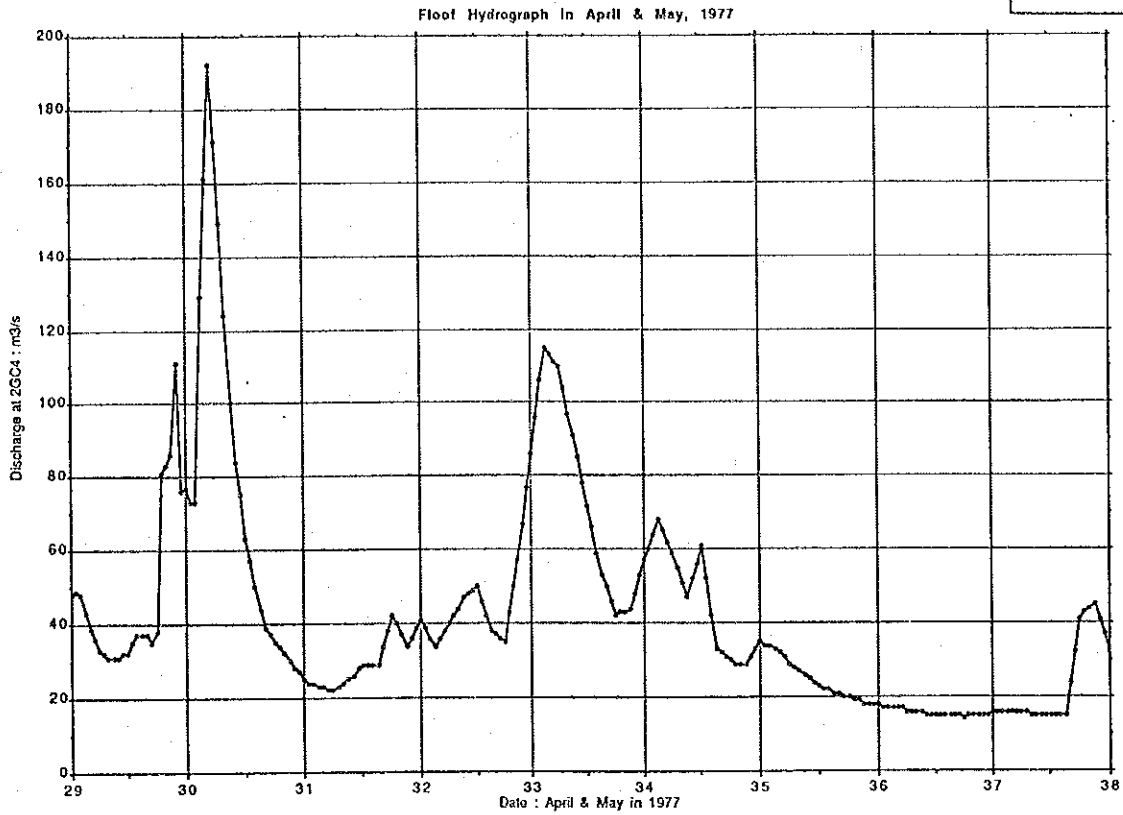
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TITLE

Flood Hydrograph (3/5)

Fig. D.4.4



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 AND PIPELINE CORPORATION

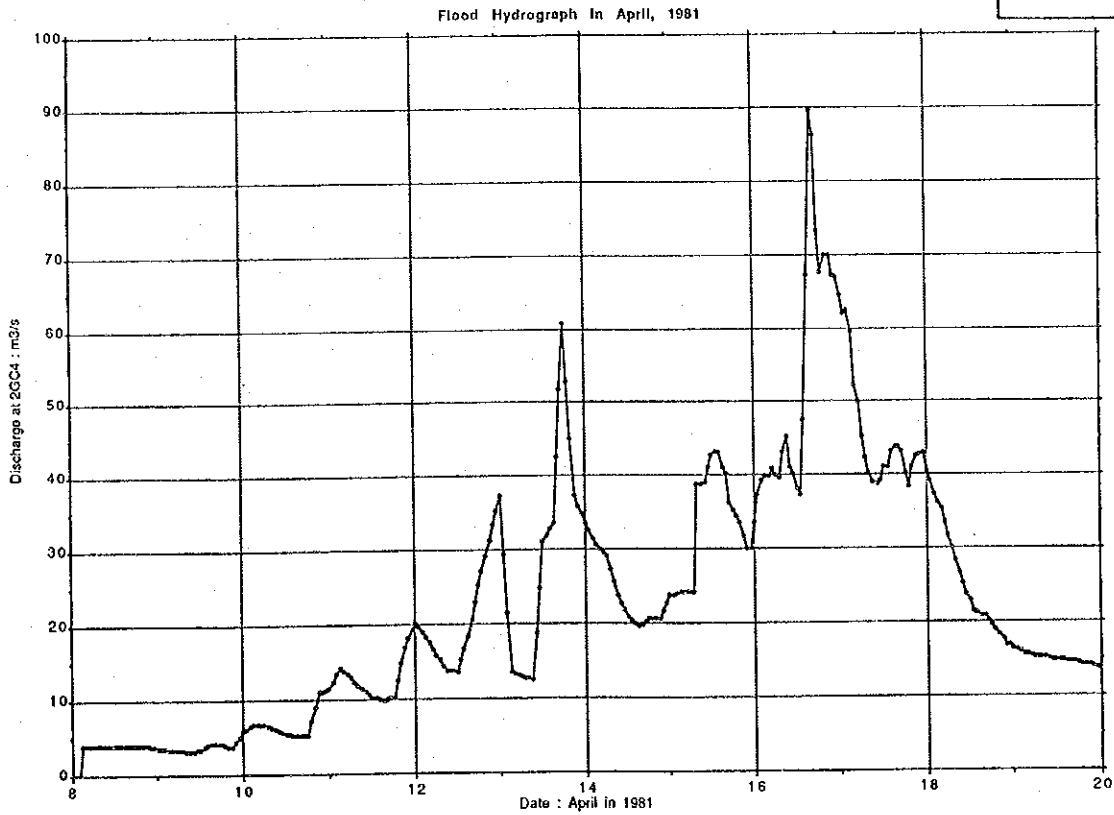
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JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

Flood Hydrograph (4/5)

Fig. D.4.5



THE REPUBLIC OF KENYA
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 AND PIPELINE CORPORATION

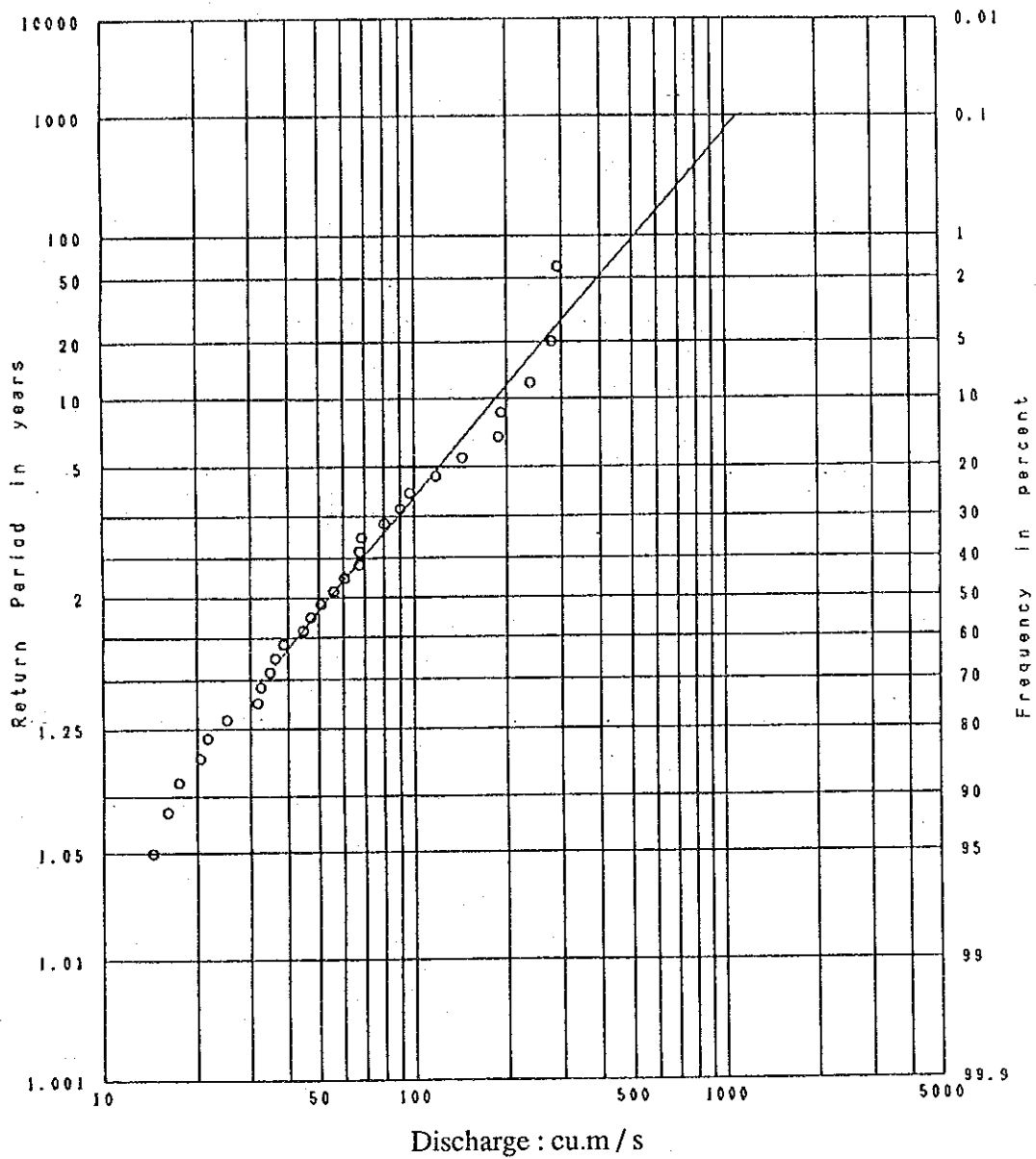
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 EASTERN DIVISION

JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

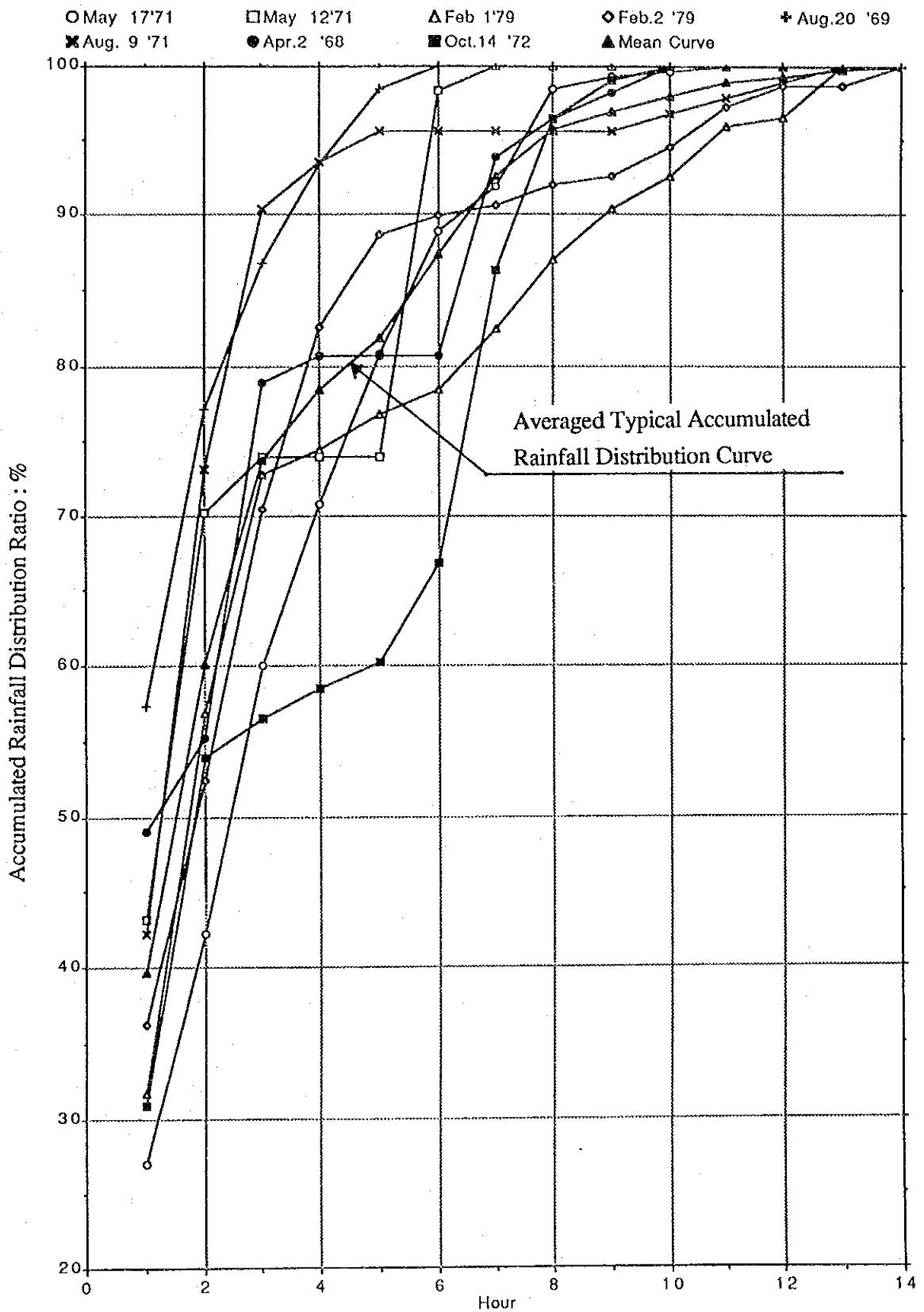
Flood Hydrograph (5/5)

Fig. D.4.6



<p>THE REPUBLIC OF KENYA MINISTRY OF WATER DEVELOPMENT NATIONAL WATER CONSERVATION AND PIPELINE CORPORATION</p>	<p>THE STUDY FOR CONSTRUCTION OF DAM IN MALEWA RIVER SYSTEM GREATER NAKURU WATER SUPPLY PROJECT EASTERN DIVISION</p> <hr/> <p>JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>TITLE Flood Frequency Analysis at 2GC4</p>
--	---	--

Fig. D4.7

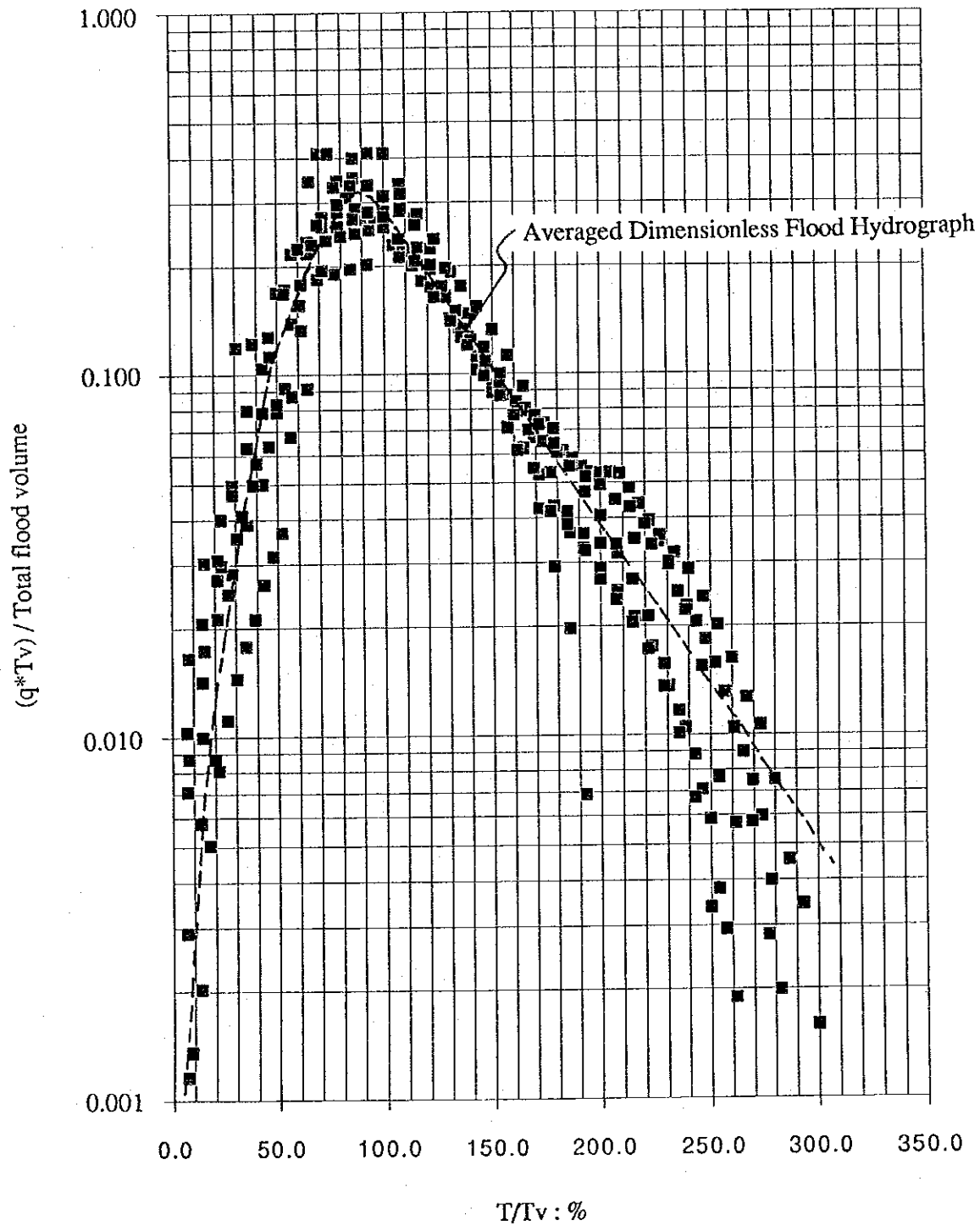


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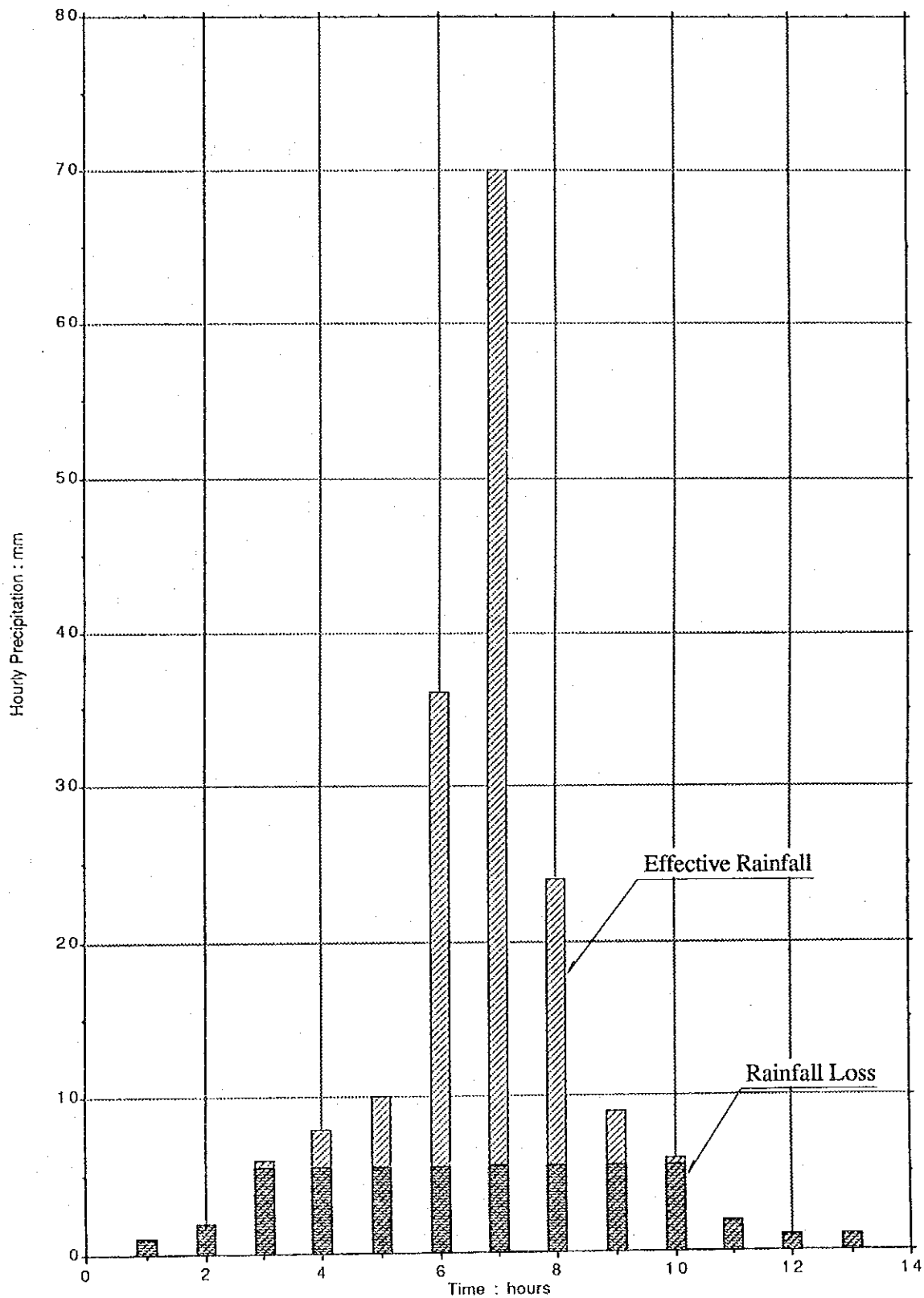
JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
 Accumulated Rainfall
 Distribution Ratio Curves



<p>THE REPUBLIC OF KENYA MINISTRY OF WATER DEVELOPMENT NATIONAL WATER CONSERVATION AND PIPELINE CORPORATION</p>	<p>THE STUDY FOR CONSTRUCTION OF DAM IN MALEWA RIVER SYSTEM GREATER NAKURU WATER SUPPLY PROJECT EASTERN DIVISION</p> <p>JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>TITLE</p> <p>Dimensionless Flood Hydrograph</p>
--	---	--

Fig. D4.9



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 NATIONAL WATER CONSERVATION
 AND PIPELINE CORPORATION

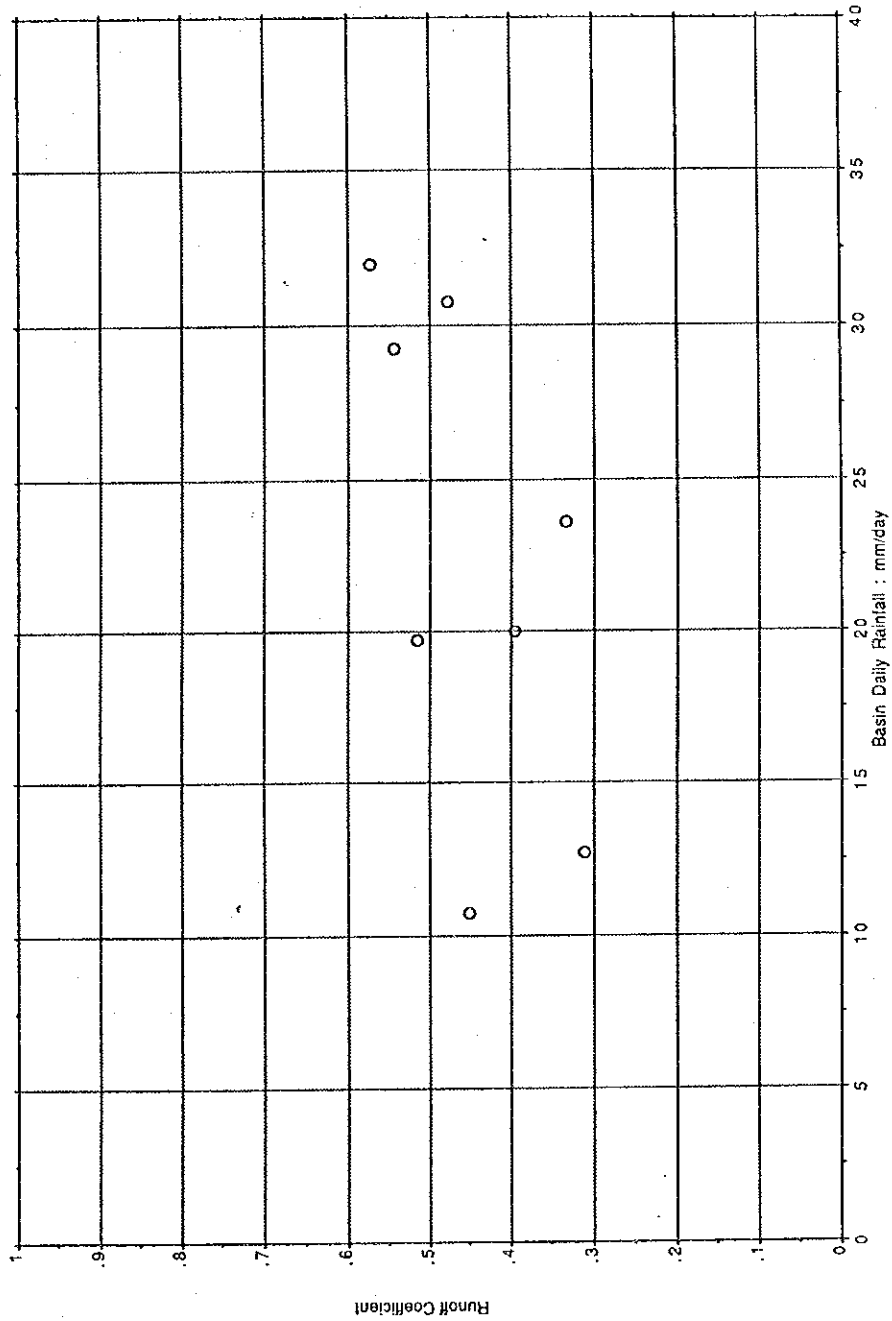
THE STUDY FOR CONSTRUCTION OF DAM
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 GREATER NAKURU WATER SUPPLY PROJECT
 EASTERN DIVISION

JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

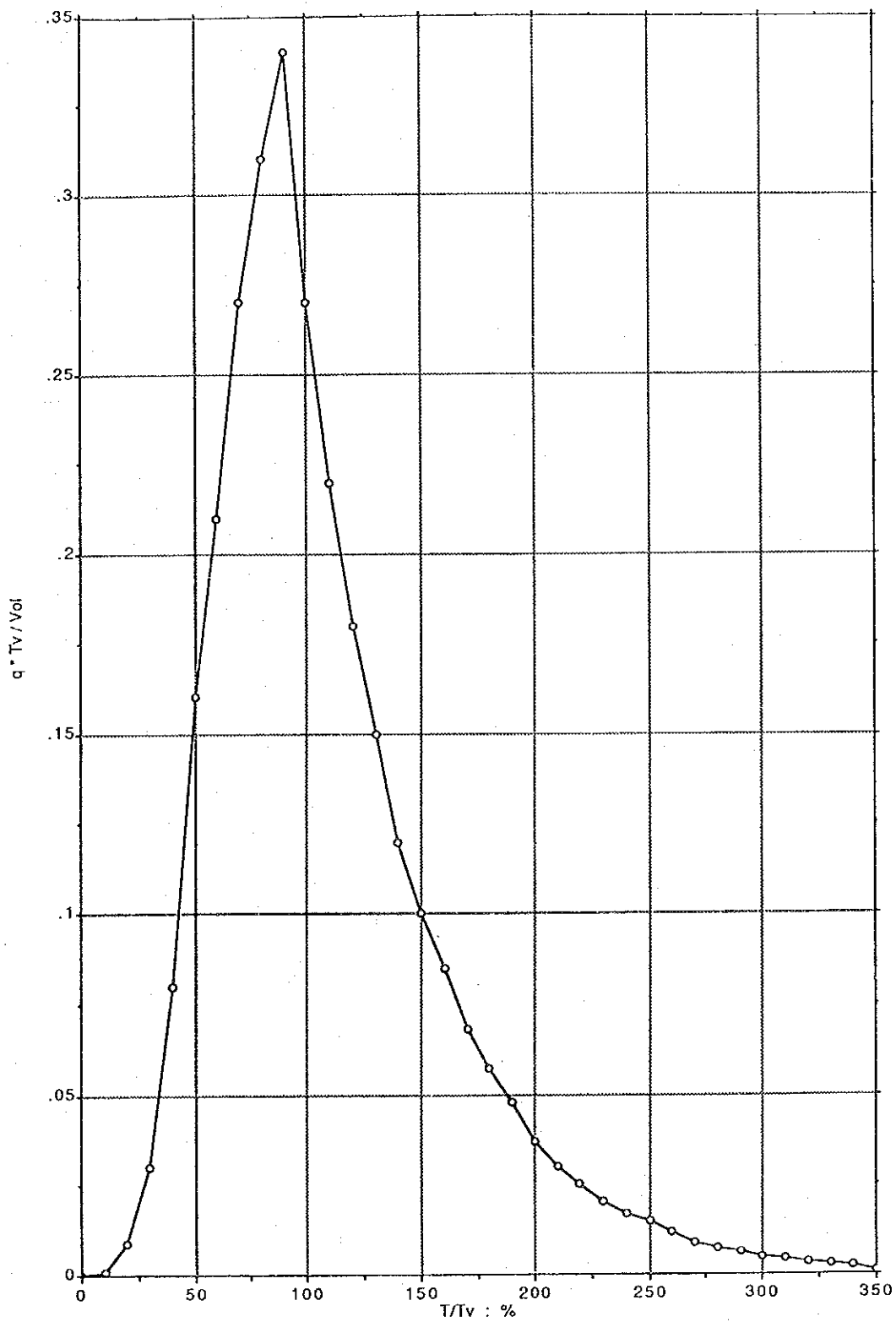
Probable Maximum
 Precipitation Pattern
 over Malewa Basin

Fig. D4.10



<p>THE REPUBLIC OF KENYA MINISTRY OF WATER DEVELOPMENT NATIONAL WATER CONSERVATION AND PIPELINE CORPORATION</p>	<p>THE STUDY FOR CONSTRUCTION OF DAM IN MALEWA RIVER SYSTEM GREATER NAKURU WATER SUPPLY PROJECT EASTERN DIVISION</p> <hr/> <p>JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>TITLE</p> <p>Runoff Coefficient</p>
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Fig. D4.11



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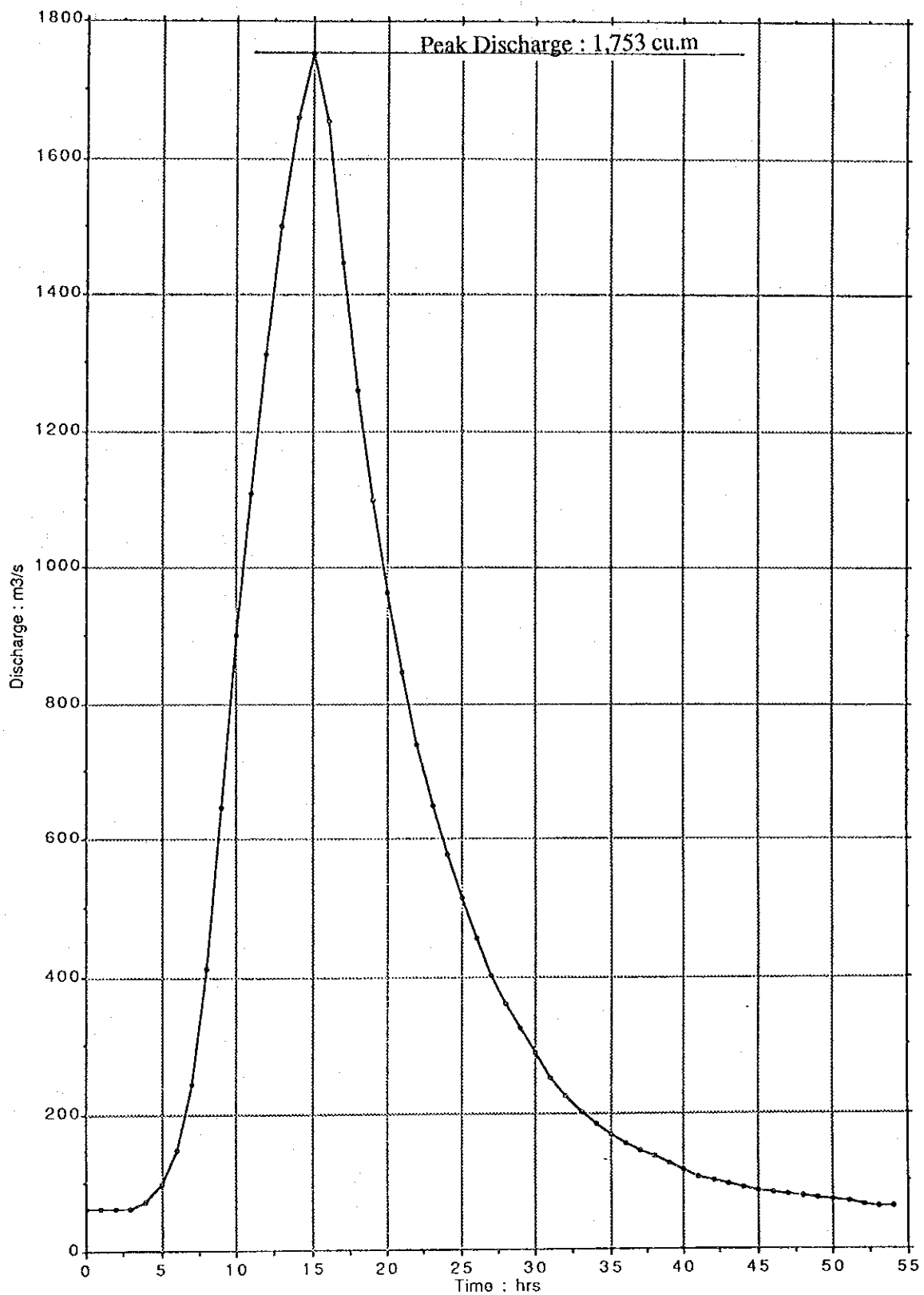
THE STUDY FOR CONSTRUCTION OF DAM
 IN MALEWA RIVER SYSTEM
 GREATER NAKURU WATER SUPPLY PROJECT
 EASTERN DIVISION

JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

Dimensionless Unit Hydrograph

Fig. D4.12

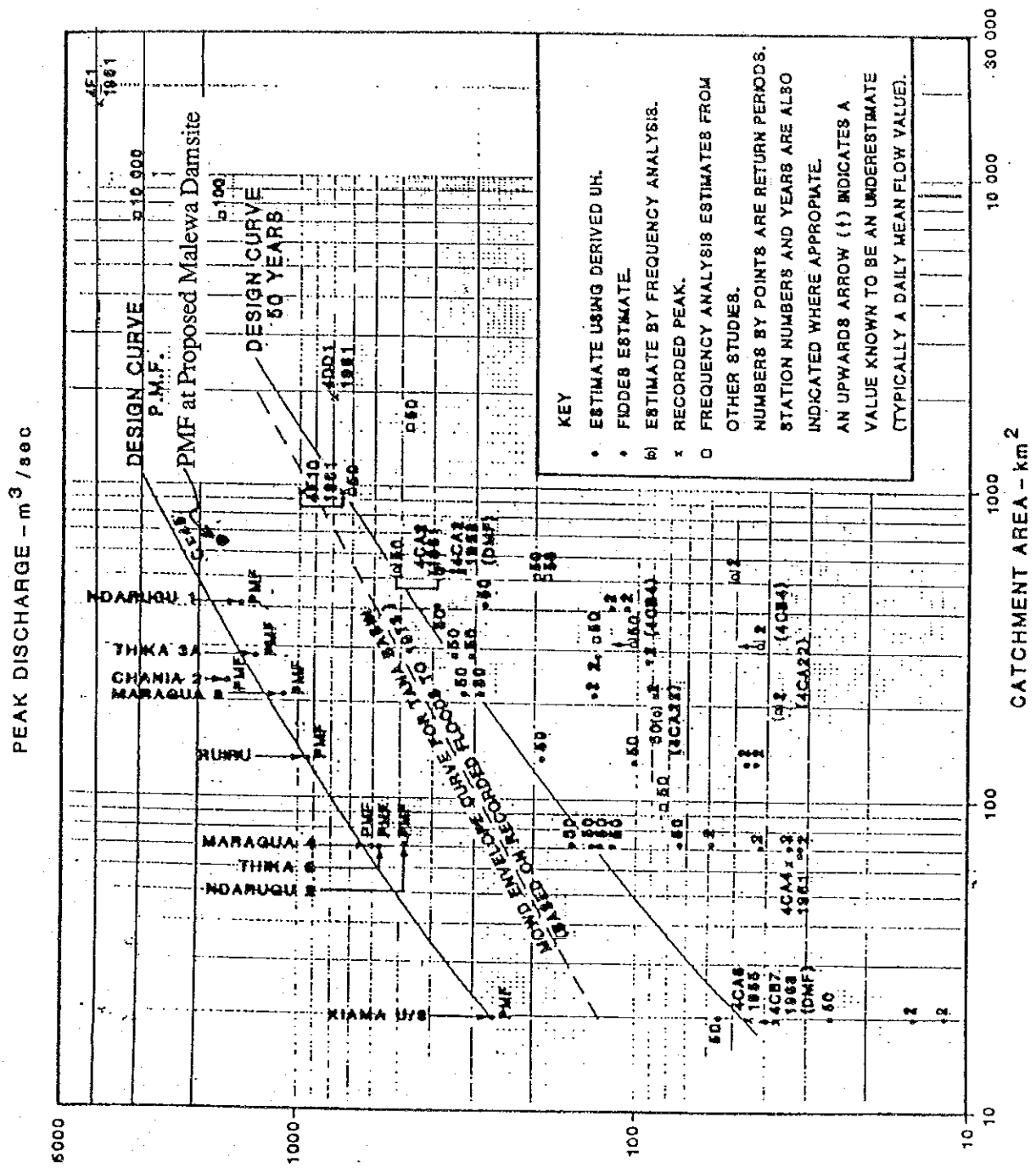


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THE STUDY FOR CONSTRUCTION OF DAM
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JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
Hydrograph of PMF at
Malewa Dam Site

Fig. D4.13



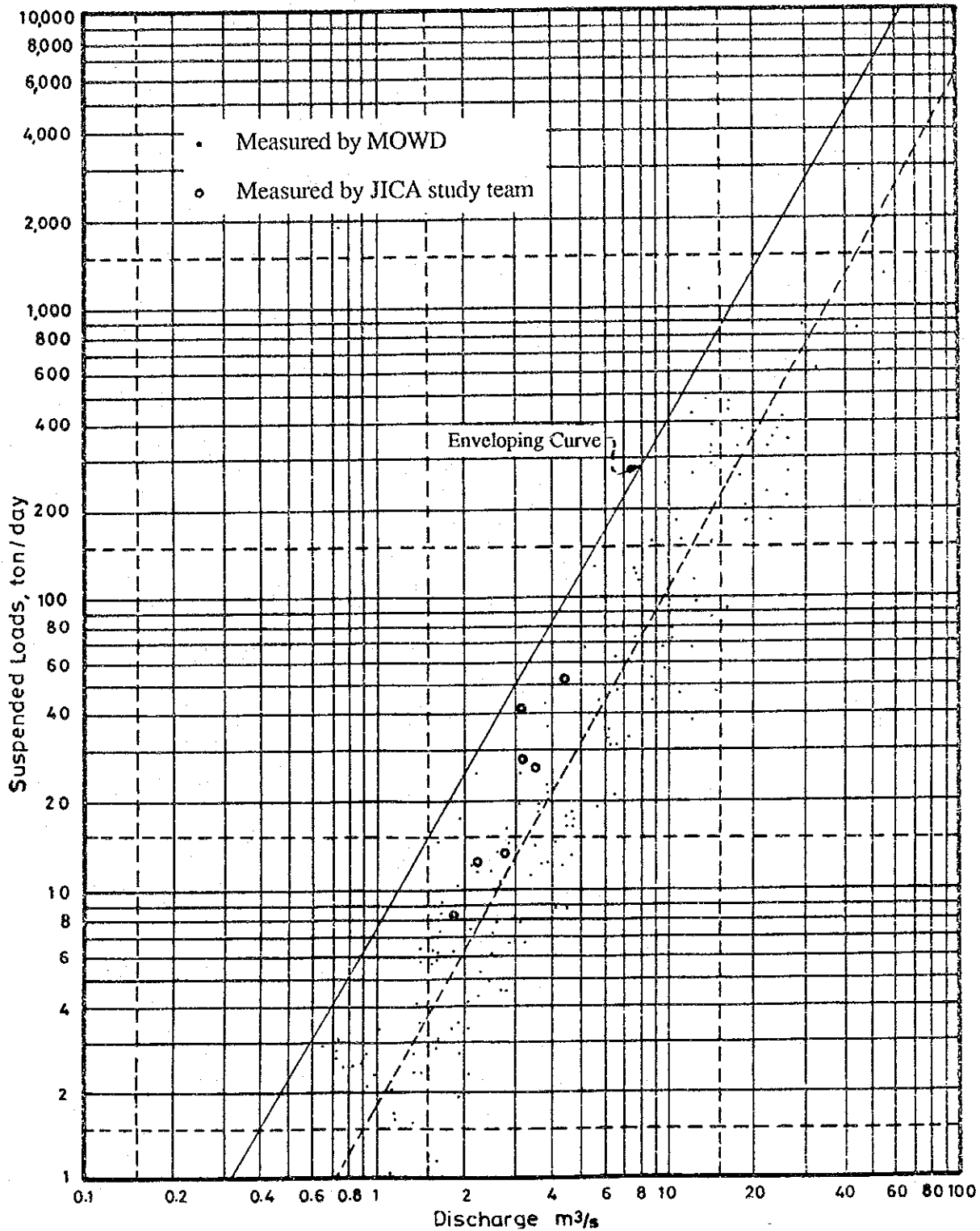
THE REPUBLIC OF KENYA
 MINISTRY OF WATER DEVELOPMENT
 NATIONAL WATER CONSERVATION
 AND PIPELINE CORPORATION

THE STUDY FOR CONSTRUCTION OF DAM
 IN MALEWA RIVER SYSTEM
 GREATER NAKURU WATER SUPPLY PROJECT
 EASTERN DIVISION

JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
 Flood Estimate in Thika River Basin

Fig. D.5.1

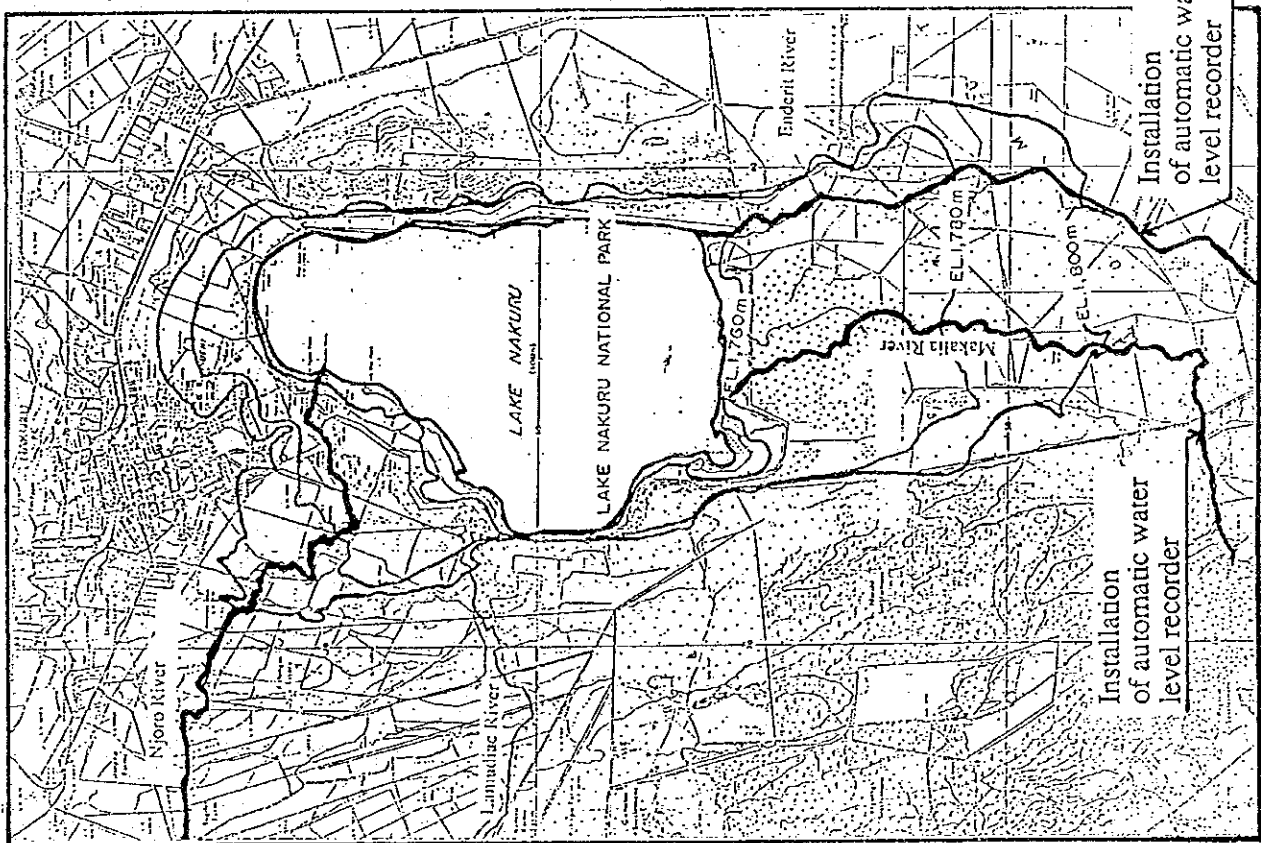
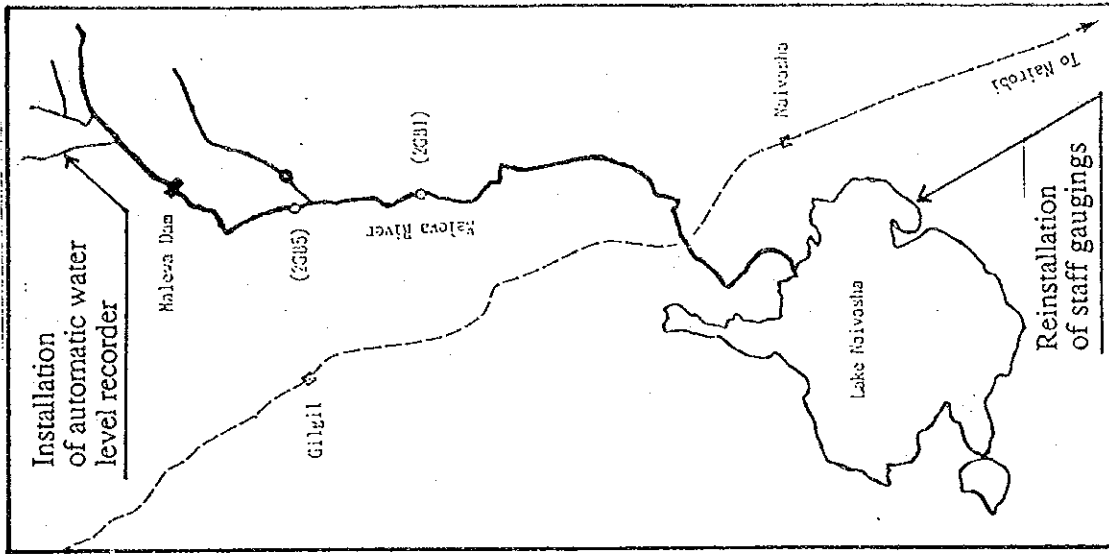


THE REPUBLIC OF KENYA
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THE STUDY FOR CONSTRUCTION OF DAM
 IN MALEWA RIVER SYSTEM
 GREATER NAKURU WATER SUPPLY PROJECT
 EASTERN DIVISION
 JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
 Suspended Load
 Measurement Record

Fig. D.6.1



THE REPUBLIC OF KENYA
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THE STUDY FOR CONSTRUCTION OF DAM
 IN MALEWA RIVER SYSTEM
 GREATER NAKURU WATER SUPPLY PROJECT
 EASTERN DIVISION
 JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
 Location Map of Installation of
 Automatic Water Level Recorders

ANNEX E

WATER DEMAND FORECAST & QUESTIONNAIRE SURVEY ON WILLINGNESS-TO-PAY

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Abbreviation and Local Terms

1. Abbreviation of Measures

1.1 Length

mm	=	millimeter
cm	=	centimeter
m	=	meter
km	=	kilometer

1.2 Area

m ² , sq.m	=	square meter
ha	=	hectare
km ² , sq.km	=	square kilometer

1.3 Volume

lit, l	=	liter
lcd	=	liter per capita per day
cu.m, m ³	=	cubic meter
cu.m/day, m ³ /day	=	cubic meter per day
MCM	=	million cubic meter

1.4 Weight

mg	=	milligram
mg/l	=	milligram per liter
g	=	gramme
kg	=	kilogram
t	=	ton

1.5 Time

s, sec	=	second
min	=	minute
h, hr	=	hour
d	=	day
yr	=	year

1.6 Money

Kshs.	=	Kenya Shilling(unit of Kenya currency, US\$1.00 = Ksh 23.0 = ¥ 150)
US\$, \$	=	US dollar
¥	=	Japanese Yen

1.7 Electric Measures

kV	=	kilovolt
kW	=	kilowatt
MW	=	megawatt
kWh	=	kilowatt hour
kVA	=	kilovolt ampere

1.8 Other Measures

mmho	=	micromho = conductance
ppm	=	parts per million
ppb	=	parts per billion
MPN	=	most probable number
‰	=	mill
%	=	per cent
PS	=	0.736 kW
°	=	degree
'	=	minute
"	=	second
°C	=	degree centigrade
n.a.	=	not available
COD	=	Chemical Oxygen Demand
T-N	=	Total Nitrogen
I -	=	Inorganic -
O -	=	Organic -
T-P	=	Total - Phosphorus
DO	=	Dissolved Oxygen
pH	=	Exponent of hydrogen ion concentration

1.9 Derived Measures Based on the Same Symbols

cu.m/sec, m ³ /s	=	cubic meter per second
cu.m/day, m ³ /day	=	cubic meter per day
t/ha	=	ton per hectare
lpcd	=	liter per capita per day

2. Other Abbreviations

BS	=	British Standards
JIS	=	Japanese Industrial Standards
ASTM	=	American Society for Testing and Material
GNP	=	gross national products

GDP	=	gross domestic product
GRDP	=	gross regional domestic product
El.	=	elevation
FWL	=	flood water level
FSL	=	full supply level
MSL	=	minimum supply level
HWL	=	normal operation level
LWL	=	minimum operation level
f.o.b	=	free on board
c.i.f.	=	cost, insurance and freight
ICB	=	international competitive bid
LCB	=	local competitive bid

3. Abbreviation of Organizations

MOA	=	Ministry of Agriculture
MENR	=	Ministry of Environment & Natural Resources
MOF	=	Ministry of Finance
MOLD	=	Ministry of Livestock Development
MOLG	=	Ministry of Local Government
MOTW	=	Ministry of Tourism & Wildlife
MOTC	=	Ministry of Transport & Communication
MORD	=	Ministry of Regional Development
MOWD	=	Ministry of Water Development
NES	=	National Environmental Secretariat
NWCPC	=	National Water Conservation & Pipeline Corporation
SOK	=	Survey of Kenya
KWS	=	Kenya Wildlife Service
NMC	=	Nakuru Municipal Council
NTC	=	Naivasha Town Council

ASTU	=	Anti-Stock Theft Unit
KYSTC	=	National Youth Service Training Center
GMB	=	Gilgil Military Barracks
KMB	=	Kenyatta Military Barracks
WWF	=	World Wide Fund for Nature
JICA	=	Japan International Cooperation Agency
OECD	=	Overseas Economic Cooperation Fund, Japan

I. INTRODUCTION

This annex presents the water demand forecast and the results of the questionnaire survey on a willingness-to-pay, both of which are the significant to the formulation and evaluation of the Project.

The purpose of the Project is to supply a safe and stable potable water to three urban areas and two rural areas in Eastern Division, Greater Nakuru Water Supply Project through the development and full treatment of the surface water available in the Malewa river basin. The urban areas include the Nakuru municipality and both the Gilgil and Naivasha towns, and the rural areas cover the Gilgil and Eburru rural areas.

With regard to the water supply plan over the Eastern Division, various efforts have so far been emphasized out by MOWD. Among them the under-listed documents comprehensively present the latest water supply plan, including the future water demand forecast.

- Greater Nakuru Water Supply Project, Preliminary Design Report, Sir Alexander Gibb and Partners (Africa), May 1985 (hereinafter referred to as the "1985 Preliminary Report")
- Greater Nakuru Water Supply Project, Supplementary Report to Preliminary Design Report, Sir Alexander Gibb and Partners (Africa), June 1982 (hereinafter referred to as the "Supplementary Report")
- Greater Nakuru Water Supply Project, Eastern Division, Stage 1, Preliminary Design Report, July 1988, Nippon Koei Co., Ltd. and Nihon Suido Consultants Co., Ltd. (hereinafter referred to as the "1988 Preliminary Report")
- Greater Nakuru Water Supply Project, Eastern Division, Stage 1, Final Design Report, July 1988, Nippon Koei Co., Ltd. and Nihon Suido Consultants Co., Ltd. (hereinafter referred to as the "Final Report")

It has been programmed that the Greater Nakuru Water Supply Project, Eastern Division will be realized in two stages. The Stage 1 Project is under implementation in accordance with the plan set forth by the Final Report and particularly envisages to serve both the Nakuru Municipality and Gilgil Town by using the unregulated runoff of the Turasha

river, the major tributary of the Malewa river. The Stage 2 Project (the Project) focuses to regulate the runoff of the Malewa river throughout the year by means of creating a reservoir to attain a long term water supply over the entire Eastern Division, excluding both the Subukia and Bahati rural areas.

The water demand forecast has been achieved under constant assistance and advice of the under-listed government personnel concerned.

- Mr. J.P.M.Thuku Head of Design Division, MOWD (retired in the course of the Study)
- Mr. Mina Head of Design Division, MOWD
- Mr. Muchori Rift Valley Provincial Water Office, MOWD
- Mr. Suti Nakuru District Water Office, MOWD

The questionnaire survey on willingness-to-pay owed much, especially to the following personnel, as well as ten interviewers:

- Mr. I. O. Oronje NWCP
- Mr. Muchori Rift Valley Provincial Water Office, MOWD

II. BASIC METHODOLOGY AND SOCIO-ECONOMIC PARAMETER FOR WATER DEMAND FORECAST

2.1 Proposed Water Supply Area

All the proposed service areas lie within the Rift Valley Province and their locations are as shown in Fig. E.2.1. The areal extent of the respective area is as summarized below.

Service Area	Area (km ²)
Urban Areas	
Nakuru municipality	91.7
Gilgil Town	3.9
Naivasha town	78.0
Rural areas	
Gilgil rural	550
Eburru	721
Total	1,644.6

The Nakuru municipality is the capital of the Rift Valley province and the fourth largest urban center within Kenya, following to Nairobi, Mombasa and Kisumu. It has been growing rapidly as the center of administration, commercial, transportation and industrial activities, education and culture, resulting in congesting population. Both the Gilgil and Naivasha towns play an important role in the public services such as education, health and government services and the rural trading activities within their region, while both the Gilgil and Eburru rural areas are prosperous in agriculture and livestock raising. The rapid population growth and economic activities have been causing a severe stress on the public potable water supply, and therefore the MOWD launched the Greater Nakuru Water Supply Project to realize a safe and steady water supply over a long period.

As far as the Naivasha town is concerned, its administrative area covers a vast area of approximately 940 km², including the area of the Lake Naivasha and is actually divided into 12 wards : Sokoni, Biashara, Milimani, Lake View, Karati, Olkaria, Malewa East and West, Naivasha East, Maraigushu, Mwachiringiri, and Hell's Gate. Of the entire wards, Sokoni,

Biashara, Milimani, Lake View and Karati wards are the most densely populated, concentrating about 30 % of the entire population while covering only 5 % of the whole town area, and most active in commerce, industry and others. Discussions were held among the MOWD officials, Town Clerk of NTC and the Study Team for demarcation of an urban center within the town administrative area. As the result, as shown in Fig. E.2.2 the whole of Baishara, Sokoni, Milimani, Lake view and Karari wards and portion of Hell's Gate have been designated as the urban area.

2.2 Basic Methodology for Water Demand Forecast

MOWD/NWCPC and the Study Team all concurred about the planning principles and water demand forecast as described below.

(1) Planning horizon

A planning horizon of the Project covers up to the year 2015.

(2) Water demand forecast, Nakuru Municipality and Gilgil Town

Although the water demand in the proposed water service area was initially forecasted by the 1985 Preliminary Report up to a year 2005, it has been updated by Final Design Report specifically for both the Nakuru municipality and Gilgil town. It is, therefore, determined to adopt the same figures to keep the consistency through all the stages of the entire project, but they must be extended to the target year 2015 with an appropriate method.

(3) Water demand forecast , Gilgil and Eburru rural areas

As for both the Gilgigl and Eburru rural areas, the water demand forecast should be quoted from the Supplementary Report. It must, however, be extended to the ultimate target year 2015 by means of extrapolation.

(4) Water demand forecast, Naivasha town

As far as the future water demand in Naivasha town is concerned, it is required to update the previous forecast in the light of the latest socio-economic situation, since the town has been subjected to the rapid population and economic growth in the recent years. The

demand forecast refers to "Design Manual for Water Supply in Kenya" (hereinafter referred to as the "Design Manual"), issued in August, 1986 by MOWD.

2.3 Benchmark Survey in Naivasha Town

A benchmark survey was conducted during the period from May 20 to June 15, 1989 to collect the latest socio-economic situation under the assistance of NTC. NTC has kindly organized a task force team to execute the survey. The team has consisted of six members as listed below.

- Mr. Al haji Jaafar T. Bidu : Town Clerk
- Mr. James K. Keriga : Building Superintendent
- Mr. Dishon K. Mboi : Social Service Officer
- Mr. Ileri Nyaga : Nursery Schools Supervisor
- Mr. Peter N. Kibaru : Public Health Technician
- Mr. Joseph K. Karanja : Assist. Education Officer

The survey items covered population, health facilities including a number of outpatient per day, education facilities including a number of enrollment, and commercial and industrial activities. The results of the benchmark survey are summarized in the succeeding section 2.4.

2.4 Socio - Economic Parameter

The basic socio-economic parameter adopted for the water demand forecast is summarized in this section. For both the Nakuru municipality and Gilgil town such have been based on the Final Design Report, while the same for both the Gilgil and Eburru rural areas has been quoted from the 1985 Preliminary Report. The socio-economic parameter of Naivasha town has referred to the results of the benchmark survey.

(1) Population

The future population and its growth rate in the respective service area have been forecasted at intervals of 5 years as summarized in Table E.2.1.

According to the benchmark survey the 1989 population in Naivasha town is as given below.

Ward	Population	Ward	Population
Sokoni	8,000	Biashara	20,000
Milimani	1,500	Lake View	3,000
Karati	4,000	Oi Karia	10,000
Malewa East	12,000	Malewa West	26,000
Naivsha East	8,000	Maraigushu	7,000
Mwichiringuri	4,000	Hell's Gate	23,000
		Total	126,500

The 1979 population in Naivasha town was 50,950 according to the 1979 census. The population growth is therefore as high as 10.6 per cent per annum. The population in the urban area is estimated at 37,500. The future population in Naivasha urban area has been forecasted based on the "Population Projections for Kenya 1980 - 2000, Central Bureau of Statistics".

The population in the proposed service area is estimated at approximately 406 thousand in 1990 and is forecasted to grow to 1,558 thousand in 2015, indicating the average population growth rate of 4.6 per cent per annum during the planning horizon. The most densely populated area is Nakuru municipality, sharing about 78 % of the whole population, and is followed by Naivasha town with a share of 9.4 %.

As stated in Section 3.1 of this report, water consumption for residential purposes varies largely with the income level of the households. Population distribution by the income level has also been estimated as given in Table E.2.2.

(2) Institutions

(2.1) Education facilities

The existing education facilities in the Nakuru municipality and both Gilgil and Eburu towns are obtained from the previous studies and the benchmark survey as summarized in Tables E.2.3 through E.2.5 respectively. NYSTC in Gilgil is counted as one of the

education facilities, although it is classified as a bulk water consumer in view of water supply.

(2.2) Health facilities

The existing health facilities have been surveyed as given also in Tables E.2.3 through E.2.5.

(2.3) Police and prison establishment

There are the police offices and prisons in both the Nakuru municipality and Naivasha town as listed up in Tables E.2.3 and E.2.5. The police establishment includes ASTU, one of the four bulk water consumers in Gilgil.

(2.4) Others

Two military establishments, KMB and GMB in Gilgil are classified into institutions and are also the bulk water consumers.

(3) Commercial centers

The commercial plot is 55 ha in Nakuru municipality, 1.5 ha in Gilgil town and 2.1 ha in Naivasha town. In addition in Naivasha town there is a resort hotel with 96 beds.

(4) Industries

The major industrial enterprises in Nakuru municipality and Naivasha town are given in Table E.2.6 together with water consumptions. There are only minor industries in Gilgil town such as KP&TC Pole Plant, Ngume Ltd., Keya Railways, Agip Depot, Nyanjepana Bakery, and Slaughter House.

(5) Livestock

According to the 1988 Preliminary Report, the number of livestock units was 10,000 in Nakuru municipality and 621 in Gilgil town in 1987, which derived from the Provincial Director of Livestock Production, MOLD in Nakuru. Further it has been predicted by the same authority the number of the livestock units in Nakuru municipality would decrease

in future due to urbanization, whereas it will grow in Gilgil town at the average annual rate of 5 % in the future.

The livestock is almost nil in Naivasha town. No data is unfortunately available for the two rural areas, although there anticipated existence of a large number of the livestock.

(6) Others

There are three military establishments in the proposed water service area : one is the Nakuru Military Barracks in Nakuru municipality and the others are the Kenyatta and Gilgil Military Barracks in Gilgil town.

III. WATER DEMAND FORECAST

3.1 Water Demand Category

According to the Design Manual, water demand is classified into 6 categories as described below.

- Residential : Consumption at residence supplied through individual connections and/or communal water points
- Institutional : Consumption in educational and health establishments, government offices and other public facilities
- Commercial : Consumption in hotels, trading centers, shops, etc.
- Industries : Consumption in manufacturing industries, agro-based industries, etc.
- Livestock : Supply for livestock
- Others : Military establishment in the current study

3.2 Unit Water Consumption

The unit water consumption by demand category has been set forth in the Design Manual as summarized in Table E.3.1. The unit water consumptions include the unaccounted for water amounting to 20 % of the net consumption.

The residential consumption has been divided into four consumption patterns, characterized by the income levels of the consumers. The commercial demand is based on the actual consumption rate in Nakuru municipality, i.e. 20 m³/ha/day.

3.3. Water Demand Forecast

The water demand in the proposed water service areas has been based on the unit water consumption and the corresponding socio-economic parameter and has been elaborated as described below.

(1) Residential demand

The water demand has been calculated based on the projected population and its category and the unit water consumption as given in Table E.3.2.

(2) Institutional demand

The water demands for the educational and health facilities and the police and prison have been based on the number of population served and the unit consumption rate. For the bulk water consumers such as ASTU and NYSTC their water demands have been given by the authorities concerned.

Initially the current water demand was calculated and the future demand was obtained by means of extrapolation of the current demand. In Nakuru municipality the future demand has been assumed to increase at the average annual growth rate of 5 % throughout the planning horizon, while those other areas have been presumed to grow with the same rate as the population. The forecasted demand is presented in Table E.3.2.

(3) Commercial demand

The current demand was initially calculated based on the extent of the existing commercial plot and the unit water consumption of 20 m³/ha/day. The future demand has been forecasted assuming that it will continuously grow at the annual rate of 5 % for the Nakuru and Gilgil Town and at the same rate as the population growth in Naivasha town. The forecasted population is given in Table E.3.2.

(4) Industrial demand

According to the 1988 Preliminary Report, the demand in Nakuru municipality has been assessed to be 7,910 m³/day in 1990, 8,000 m³/day in 1995 and thereafter to grow at the annual rate of 5 %, while the current demand of 120 m³/day in Gilgil town would increase at the average annual growth rate of 5 % during the planning horizon.

The present demand in Naivasha town is 100 m³/day. The future demand has been forecasted assuming that the present demand grows at the same rate as the population increase.

(5) Livestock

The demand has been based on the number of the livestock units and the unit water consumption as presented in Table E.3.2. For both the Eburru and Gilgil rural areas, the demand have been obtained simply from the previous studies and extended to the year 2015 by using the same growth rate during a 5-year period from 2000 to 2005.

(6) Others

This category particularly means the consumption in the military establishment in the current study. The water demand has been given by the authorities concerned for some definitive years and those of the intermediate years have been interpreted from these of the given years.

The average daily water demand of the proposed water service areas have been forecasted as described herein and as summarized in Table E.3.2.

IV. QUESTIONNAIRE SURVEY ON WILLINGNESS-TO-PAY

4.1 Objectives

Socio-economic aspects concerning water use can be clarified, to some extent, with a questionnaire survey on the beneficiaries. By the nature of the survey, its results may be subjective, but reflect the beneficiaries' behaviors and perceptions with regard to water supply, which are one of important components for the Study.

In the Study, a questionnaire survey was carried out for the following main objectives.

- (1) to assess the beneficiaries' willingness-to-pay for the improvement of water supply, a basis of benefit valuation of the Project, and
- (2) to identify the extent of water supply problems and needs for the Project.

4.2. Methods of the Survey

The questionnaire survey was conducted by ten interviewers for nine days in December, 1989. Samples were selected at random from the residents in Nakuru Municipality, taking into account time constraint and distribution zones.

The questionnaires were prepared by consumer's category: Residential including small industrial and commercial, Large industrial and commercial and Institutional consumers. The forms of questionnaires are shown in Tables E.4.1 through E.4.3

For the survey, zoning of water distribution was employed as sub-areas for the survey, totalling eight zones. Each zone was designated as shown in Fig. E.4.1

4.3. Analysis of Survey Results

The survey covered 1,225 households, 13 institutions, and 91 large industrial and commercial units. As the number of households are estimated at 40,000 sample households represents three per cent of all the households in the municipality. For other consumers categories, major units were covered.

4.3.1 Residential Category

Summary of results for residential category by sub-area is presented in Table E.4.4.

(1) Characteristics of sub-areas

Each sub-area based on the zoning for water distribution was designated with numbers from 1 through 8, beginning with the northeastern area down to the southwestern area.

Almost all the types of buildings of households interviewed were residential, accounting for 83% of total samples. However, the majority was commercial or industrial units in the Area 5, located at the center of the municipality. There were relatively substantial number of residential-cum-commercial industrial units in the Area 8 (refer to Q1 of Table E.4.4).

For the occupation of a main income earner, public sector wage labors ranked the first, 37% of total sample households, followed by business/commercial self-employed (25%) and private sector wage labors (24%). In the Area 5 and Area 8, the majority was business/commercial self-employed. However, it seems that those in the Area 5 are large and belong to the modern sector, while many in the Area 8 small and belong to the informal sector. The Area 7 is characterized by a substantial number of agricultural wage labors, 39% of sample households (refer to Q5).

The patterns of income distribution by sub-area indicate that higher income households live in the northern and hilly part (Areas 1 and 4), and central part (Area 5) in the municipality. On the other hand, lower-income households live in the southern and western parts, especially in Areas 3, 7 and 8 (refer to Q6).

(2) Water use

On the total households interviewed, 67% had individual connections for the municipal water supply system. Households in the northeastern and central parts were well equipped with the individual connections. However, in the south eastern (Areas 3, 6, 7 and 8), those who had individual connections were below the average above (refer to Q7), which is probably attributed to a larger share of lower income households in each area.

Those who were satisfied with the present situation for water supply account for only 30% of total sample households. A half of total households were not satisfied with the current water supply due to its low pressure, unstableness and insufficiency of quantity. It was observed that there were substantial differences in the extent of satisfaction to the water supply among sub-areas. In the Areas 1, 2 and 4, more than 50% of the households felt satisfactory with the present situation. In other areas, especially Areas 7, 3 and 8, however, there were few people who felt no problems on water supply (refer to Q9).

In Area 7, where only 6% enjoyed the current situation, almost all the households complained about insufficiency of quantity. In Area 8, 90% of the households were disappointed with the present situation due to a low pressure of water supply. Those in Area 3 found themselves unsatisfactory to the water supply, mainly because of its unstableness.

(3) Influences of water supply problems

More than a quarter of households in the municipality seemed conscious about influences of water supply problems on hygiene as well as on time-consuming. In Areas 1 and 2, many households recognized the negative influences of the problems on their health and hygiene. Few households in Area 4 thought that there were negative impacts owing to the problems on water supply (refer to Q10).

There was a tendency that people considered time-consuming a major negative influence of water supply problems as increase those who were not satisfied with the present situation. In Areas 3, 6 and 7, around 50% of the households thought that insufficient water supply forced them to take time to obtain required amount of water. Many of them also pointed out a negative influence on hygiene.

(4) Water consumption and willingness-to-pay (refer to Q8, 11 and 12)

Hearings on water consumption, cost for water and willingness-to-pay (WTP) may not clarify the exact situations quantitatively because it is difficult to think that all the interviewees could understand how much water they consumed, how much they paid for water: the answers might be rather subjective.

Nevertheless, they could provide some useful information on the relations between water consumption and cost/WTP for water.

Table E.4.5 presents a summary of results of an analysis on water consumption, average cost of water and willingness-to-pay in the municipality. A sample household was estimated to consume water about 30 m³ per month on average. However, 49 m³ of water would be required to satisfy it: 1.6 times of water as much as it consumed actually. It paid Kshs.115 for such volume of water per month.

If sufficient water was provided, the sample household would be ready for pay Kshs.97. This appears strange because it should pay more for more provision of water. This result may reflect a pattern of consumers' psychology that they would like to restrain their expenses as much as possible. But once the sample household understood that it costs much to improve water supply, it was willing to pay Kshs.123 per month for water: 1.07 times of actual amount of payment at present.

4.3.2 Institutional Capital Category

The number of samples for institutional category was 13, consisting 3 of schools, 3 of health facilities and 6 of official facilities. Although all the facilities were connected with the municipal water system, 39% obtained water through share connections (Table E.4.6).

Of total samples, 31% were satisfied with the existing situation of water supply while 54% complained about its unstableness. No samples recognized that there were negative influences of water supply problem.

A facility consumed 203 m³ per month, on the weighted average, but needed the volume of 303 m³ per month. If the water supply is improved, it would be willing to pay Kshs. 1,343/m³/month.

4.3.3 Commercial and Industrial Capital Categories

The survey covered 91 samples, of which 69 were commercial, including 45 of hotels, and the rest were industrial. Over 90% of samples were provided with water from the municipal water system (Table E.4.6). However, 7% drew water from underground.

A half of samples were satisfied with the current water supply, but a quarter suffered from its unstableness and insufficiency of quantity. Ten percent of total samples found their production of good negatively affected by the water supply problems.

On a weighted average, a unit consumed 100 m³ of water per month, but wanted more of 293 m³ per month. If water supply is improved, they would be ready for paying Kshs. 1,209 per month on average.

4.4. Estimate of Willingness-to-pay

(1) General setting

The benefits of increased consumption are measured in terms of willingness-to-pay. Fig. E.4.1 shows a conceptual model for the estimation of economic benefits. The definitions of parameters are as follows:

- Current water consumption (Q_0),
- Expenditure for the consumed water (P_0),
- Volume of water needed (Q_1),
- Willingness-to-pay per cubic meter at volume Q_0 (P_1) and
- Willingness-to-pay if per cubic meter at volume Q_1 (P_2).

The economic benefits are represented as an area Q_0BCQ_1 for an average consumer.

At present, Q_0 of water is consumed and P_0 of the financial average water rate is charged for the Q_0 . The point A determined by Q_0 and P_0 is not most likely to be on the demand curve since there exists some unsatisfied demand with the present capacity Q_0 . The implicit equilibrium price P_1 represents a willingness-to-pay for the amount Q_0 .

With the improvement and expansion of water supply, volume of supply would increase from Q_0 to Q_1 with the implicit equilibrium price P_2 gone down from P_1 . The economic benefits amount to the sum of producer's revenue shown as Q_0DCQ_1 and consumer's surplus as DBC . Although the assumed demand curve shifts, depending on increase in income etc., in a longer term, it is assumed the same as the current one for this evaluation.

(2) Estimation of economic benefits

Economic benefits of the Project is estimated, on the basis of results of the questionnaire survey for Nakuru municipality, in the aforementioned way. The data on the following by consumer category were derived from the survey:

Table E.4.7 presents the results of computation concerning the above items. A weighted average was calculated for each item. According to the results, the willingness-to-pay per unit at present with the volume of Q0 is lower than the average expenditure of water, which is contradictory with the theoretical model explained in the General Setting. This contradiction is probably attributed to the consumer's psychological defence against increase in water tariff. Therefore, consumer's capacity-to-pay is employed for the willingness-to-pay at Q0. The capacity-to-pay was derived from the data on average monthly income per main income earner, assuming it 3% of average household income, which is also assumed 1.2 times as much as the income of the main income earner. The unit economic benefit or economic value of water is obtained by consumer category with the following formula:

$$UB = \frac{1/2 * (P1 - P2) * (Q1 - Q0) + P2 * (Q1 - Q0)}{Q1 - Q0}$$

Based on the said table, unit economic benefit, or unit value of water at present on a weighted average, is calculated at Kshs.5.70/m³, which is lower than the the capacity-to-pay of Kshs.8.0/m³. In other words, an average household is ready to pay Kshs.5.70 for a cubic meter of water, when it satisfies with the quantity of water supplied. The obtained unit economic benefit is assumed to be also applied to residential categories in Naivasha town and Gilgil town.

However, it cannot be applied to those in rural areas because of the differences in household income. It is assumed that the patterns of water consumption and willingness-to-pay in rural areas be the same as those in Sub-area 7 of Nakuru municipality, where agricultural labours and self-employed households occupy 40% of total samples, with the lowest income. Unit economic benefit for residential beneficiaries in rural area is estimated at Kshs.4.55/m³, based on Table E.4.8.

For institutional and commercial-cum-industrial categories, the same method is applied to obtain unit economic benefit, with the assumption that it be valued the same among Nakuru municipality, Naivasha town and Gilgil town. Unit economic benefits are estimated at Kshs.6.91/m³ and Kshs.22.82/m³ for institutional and commercial-cum-industrial, respectively, based on Tables E.4.9 and E.4.10.

TABLES

Table E.2.1 Forecasted Population and Growth Rate

	Nakuru Municipal.	Gilgil Town	Naivasha Town	Gilgil Rural	Eburru Rural	Total
(1) Population growth rate (per cent per annum)						
1991 - 95	6.9	6.0	8.1	3.8	4.0	5.76
1996 - 00	6.9	5.0	5.3	2.9	3.5	4.72
2001 - 05	5.6	5.0	4.2	2.9	3.5	4.24
2006 - 10	5.0	5.0	4.2	2.9	3.5	4.12
2011 - 15	5.0	5.0	4.2	2.9	3.5	4.12
(2) Population (1,000)						
1990	295.6	18.0	41.2	20.5	30.9	406.2
1995	412.0	24.1	60.8	24.7	37.5	965.3
2000	574.0	30.7	78.7	28.5	45.7	757.6
2005	752.4	39.2	96.7	32.9	55.6	976.8
2010	960.3	50.0	118.7	38.0	66.0	1,233.0
2015	1,225.6	63.9	145.8	43.8	78.4	1,557.5

Data source :

- (1) Greater Nakuru Water Supply Project, Eastern Division, Stage 1, Preliminary Design Report, July 1988
- (2) Eburru Water Supply Project, Preliminary Design Report, 1982
- (3) Greater Nakuru Supply Project, Preliminary Design Report, May 1985

Table E.2.2 Distribution of Population Group in Urban Areas

Population Category	1990	1995	2000	2005	2010	2015
(1) Nakuru municipality						
High income	3.0	2.6	2.4	2.2	+n.a	+n.a
Medium income	12.6	12.5	12.0	12.6	+n.a	+n.a
Low income (1)	52.7	54.1	55.6	56.3	+n.a	+n.a
Low income (2)	31.7	30.8	30.0	28.9	+n.a	+n.a
(2) Gilgil town						
High income	1.5	3.0	5.0	6.5	+n.a	+n.a
Medium income	3.5	7.0	10.0	14.5	+n.a	+n.a
Low income (1)	55.0	60.0	57.0	51.0	+n.a	+n.a
Low income (2)	40.0	30.0	28.0	28.0	+n.a	+n.a
(3) Naivasha Town						
High income	0	0	0	0	0	0
Medium income	20.0	20.0	20.0	20.0	20.0	20.0
Low income (1)	80.0	80.0	80.0	80.0	80.0	80.0
Low income (2)	0	0	0	0	0	0

Data source : (1) Greater Nakuru water Supply Project, Eastern Division, Stage 1, Preliminary Design Report

Table E.2.3 Existing Institutions in Nakuru Municipality

(1)	Education Facilities	
(1.1)	Schools and Others	
	- Day schools	43,228 pupils and saffs
	- Boarding schools	2,220 pupils and staffs
	- Veterinary Laboratory	n.a
	- Soil Conservation Unit	n.a
	- Forest Training Center	n.a
	- Kenya Industrial Center	n.a
	- Medical Training Institute	n.a
	- Agriculture Society	n.a
(1.2)	Police and Prison	
	- Nakuru Prison	1,850 personss
	- Womens Probation Hostel	120 persons
	- Juvenile Remand Hostel	51 persons
	- Police Headquarters	223 persons
	- Police Station	97 persons
	- Police Training Center	74 persons
(2)	Health Establishment	
(2.1)	Health Center	
	- Langa Langa	200 outpatients
	- West Nakuru	150 outpatients
	- Lanet	100 outpatients
	- Bondeni	160 outpatients
	- Industrial area	110 outpatients
(2.2)	Dispensaries	
	- Forestry	20 outpatients
	- Union Carbide	20 outpatients
	- Unga	20 outpatients
	- Pyrethrum Board	20 outpatients
	- Post Office	20 outpatients
	- State House	20 outpatients
(2.3)	Hospital	
	- Provincial Hospital	850 beds, 1,500 outpatients
	- War Memorial	14 beds
	- Menengai	61 beds
	- Nursing Home	26 beds
	- Bondiani Maternity	100 beds

Data Source : The 1988 Preliminary Design Report

Table E.2.4 Existing Institutions in Gilgil Town

(1)	Education Facilities	
(1.1)	Schools and Others	
	- Day schools	1,996 pupils and saffs
	- Boarding schools	985 pupils and staffs
	- NYSTC	5,400 residents
	- Village Polytechnic	350 residents
	-	
(1.2)	Police	
	- ASTU	4,211 residents
	- Womens Probation Hostel	120 persons
(2)	Health Establishment	
	- Mathare Hospital	100 inpatients
(3)	Others	
	- Kenyatta Military Barracks	n.a
	- Gilgil Military Barracks	n.a

Data Source : The 1988 Preliminary Design Report

Table E.2.5 Existing Institutions in Naivasha Town

(1)	Education Facilities	
(1.1)	Schools and Others	
	- Day schools(29 schools)	23,000 enrollements
	- Boarding schools (1 school)	495 enrollements
	- Secondary schools (4 schools)	760 enrollments
	- WLFTI	760 attendants
	-	
(1.2)	Police	
	- Prison	1,000 person
(2)	Health Establishment	
	- District hospital	112 beds and 12,000 outpatients
	- Karati Health Center	n.a
	- Private clinic (12)	n.a

Table E.2.6 Present Industrial Water Consumption

(Unit : m³/day)

Enterprises	Current Consumption	Required Quantity	Future Requirement	Note
(1) Nakuru Municipality				
K.C.C	800	1,000	1,600	Future : 1990
Kenya Railway	908	1,333	n.a	
Eliano	35	400	420	Future : 1988
Spin Knit	80	200	418	Future : 1990
Eveready Batteries	100	150	200	Future : 1990-95
Pyrethum M. Board	n.a	n.a	n.a	
Nakuru Chrome Tanners	40	100	100	
Elliot's Bakeries	160	200	200	
Bedi Investment	100	100	200	Future : 1989
Gohil Soap Factory	68	91	114	Future : 1988
Flamingo Bottlers	400	600	1,200	Future : 1991
Londra	20	60	120	Future : 1990
Nakuru Oil Mills	800	1,600	1,600	
Unga Ltd.	n.a	n.a	n.a	
Miling Corporation	21	31	37	Future : 1989
Rift Valley Products	20	30	30	
K.P.L.	n.a	n.a	n.a	
Nakuru Flour Mills	22	23	27	Future : 1989
Coil Products	10	20	20	
Nakuru Fibers	15	20	40	Future : 1989
Nakuru Steam Laundry	5	14	60	
Kenya Milk Products	14	14	32	Future : 1989
KAPI Ltd.	n.a	n.a	n.a	
Samcon	7	9	11	Future : 1989
Valley Bakery	4	8	25	
Arar Timber Co.	n.a	n.a	n.a	
Mea Ltd	3.3	6.7	8	
Menengai Chipboard	6	6	6	
Kenya Oatmeal	5	100	100	
K.G.G.C.U	1.7	1.7	2	Future : 1989
Kenya Seed Ltd.	1.2	1.3	1.3	
Unga Feeds	1	1	1	
National Cereals	2.3	2.3	2.3	
Reliable Concrete	1	2	2	
Total	3,965.4	6,124	7,910	
(2) Naivasha Town				
Rumlika Wine	6.7	n.a	n.a	
Lake Chemist	2.0	n.a	n.a	
Pan Food Factory	16.7	n.a	n.a	
Consolidated Asphalt	2.5	n.a	n.a	
Sun	31.1	n.a	n.a	
National Cereal Board	2.5	n.a	n.a	
Sewer Treatment Works	26.7	n.a	n.a	
Naivasha Posho Mill	1.7	n.a	n.a	
Simbol Chemical	1.7	n.a	n.a	
Engineering Housing	5.2	n.a	n.a	
Total	96.8	-	-	

Table E.3.1 Unit Water Consumption

Demand Category	Unit Water Consumption
(1) Residential	
High income group	250 lpcd
Middle income group	150 lpcd
Low income group (1)	75 lpcd
Low income group (2)	20 lpcd
(2) Institutional	
Day school and technical institutes	25 lpcd
Boarding school	50 lpcd
Hospital, regional	400 l per bed/day
district	200 l per bed/day
outpatient	20 l lpcd
Police and prison	100 lpcd or as per demand
Local government offices	25 lpcd
Bulk water consumer	As per used or demand
(3) Commercial	20 m ³ /ha/day or as per used or demand
(4) Industrial	As per used or demand
(5) Livestock	50 l per livestock unit
(6) Military	As per demand

Data Source : (1) Design Manual for Water Supply in Kenya
(2) Greater Nakuru Water Supply Project, Eastern Division, Stage 1, Preliminary Design Report

Table E.3.2 Forecasted Average Daily Water Demand

Demand Categories	1990	1995	2000	2005	2010	2015
(1) Nakuru Municipality						
Residential	21,390	29,670	41,160	54,440	72,200	95,700
Institutional	3,210	4,100	5,230	6,680	8,530	10,900
Commercial	1,270	1,620	2,070	2,650	3,380	4,320
Industrial	8,000	8,000	10,210	13,030	16,600	21,200
Livestock	450	400	300	200	150	100
Military	1,200	1,400	1,720	2,200	2,810	3,580
Sub-total	35,520	45,190	60,690	79,200	103,670	135,800
(2) Gilgil Town						
Residential	1,050	1,650	2,320	3,200	4,400	6,060
Institutional, general public	180	250	320	400	510	650
NYSTC	1,310	1,760	2,240	2,860	3,650	4,660
ASTU	760	860	1,100	1,410	1,800	2,300
Commercial	30	40	60	70	80	90
Industrial	140	180	230	290	370	470
Livestock	30	40	60	70	80	90
Military, KMB	870	940	1,160	1,480	1,890	2,410
GMB	1,200	1,300	1,510	1,930	2,460	3,140
Sub-total	5,570	7,020	9,000	11,710	15,240	19,870
(3) Naivasha Town						
Residential	3,710	5,470	7,080	8,700	10,690	13,130
Institutional, general public	1,040	1,540	2,000	2,450	3,010	3,690
WLFTI	990	1,460	1,890	2,320	2,840	3,500
Prison	160	240	310	380	470	580
Commercial	110	160	210	260	320	390
Industrial	110	160	210	260	320	390
Sub-total	6,120	9,030	11,700	14,370	17,650	21,680
(4) Gilgil Rural						
Residential	650	870	1,070	1,290	1,550	1,870
Institutional	120	210	240	280	320	380
Commercial	10	10	10	10	10	10
Industrial	130	150	170	190	210	230
Livestock	280	320	360	390	420	460
Sub-total	1,190	1,560	1,850	2,160	2,510	2,950
(5) Eburru Rural	1,800	2,200	2,700	3,300	4,030	4,930
Total	50,200	65,000	85,940	110,740	143,100	185,230

Data source :

- (1) Greater Nakuru Water Supply Project, Eastern Division, Stage 1, Preliminary Design Report, July 1988
- (2) Greater Nakuru Supply Project, Supplementary Report to Preliminary Design Report, May 1985
- (3) Greater Nakuru Supply Project, Preliminary Design Report, May 1985

Table E.4.1 Form of Questionnaire for Residentials and Small Commercial/Industrial Consumers (1/2)

Form 1-Residential and Small Commercial/Industrial QUESTIONNAIRE for MALEWA DAM CONSTRUCTION STUDY
 Excuting agency: Japan International Cooperation Agency with cooperation of NWCPC and MOWD

INTERVIEWER: _____

DATE: Dec. '89

DIVISION : Nakuru Municipality, Gilgil, Naivasha, Eburru (Check appropriate one)

Reference No. of Samples Interviewed		1	2	3	4
Location:					
Sublocation:					
Name of the Street:					
Q1 Type of Building Surveyed (Check appropriate one)	Residential only				
	Residential & Commercial/Industrial				
	Commercial/Industrial only				
Q2 Status of Interviewee (Check appropriate one)	Householder (Male)				
	Householder (Female)				
	Householders' wife				
	Other member of Household				
	Owner				
	Person in charge of				
Q3 District where the interviewee was born (Fill the name of district)					
Q4 No. of persons per household No. of staff and employees per building (Fill the Nos. If including commercial/Industrial, fill the No. of staff & Employee.)					
Q5 Composition of Household (Check and fill the NUMBER if more than one)	Householder				
	Householder's Wife				
	Householder's children				
	Householder's or wife's parents				
	Kindred				
	Other				
Q6 Occupation of main income earner (Check appropriate one)	1: Public sector wage labour				
	2: Private sector wage labour				
	3: Agriculture wage labour				
	4: Business/commercial self-employed				
	5: Agriculture self-employed				
	6: Other				
Q7 His (Her) average income per month (Check appropriate one)	Less than Shs. 200				
	Shs. 200-500				
	Shs. 500-1000				
	Shs. 1000-2000				
	Shs. 2000-3000				
	Shs. 3000-5000				
	Shs. 5000-10000				
	Over Shs. 10000				
Q8 Type of Water Supply Source (Check appropriate one/ones. If other, fill the type of water supply source)	(Municipal system)				
	1: Individual House Connection				
	2: Share connections				
	3: Stand pipes				
	4: Supply from neighbours				
	5: Kiosk				
	6: Other				
	(Sources other than Municipal system)				
	6: Rain/River water				
	7: Pond/Reservoir water				
8: Ground water					
9: Other					
Q9 If using both the Municipal system & other sources, ratio of quantity of water used (Fill the percentage for each, totalling to 100%)	Municipal System (%)				
	Other sources(%)				
Q10 Average Monthly/Daily Water Consumption	Less than 10m ³ (10,000 lit.)				
	10 - 20 m ³				
Q10.1 For those who have meters (m ³ /MONTH) (Check appropriate one by P)	20 - 30 m ³				
	30 - 40 m ³				
	40 - 50 m ³				
	50 - 75 m ³				
Q10.2 Quantity of water NEEDED if sufficient water is available (Check appropriate one by N)	75 - 100 m ³				
	100 - 150 m ³				
	150 - 200 m ³				
	200 - 300 m ³				
	Over 300 m ³				

Table E.4.1 Form of Questionnaire for Residentials and Small Commercial/Industrial Consumers (2/2)

Q10.3 For those using containers for fetching water (Fill the capacity of each container used and its average times of use per DAY. Clarify them about all the containers)	Capacity (Lit.)				
	1				
	2				
	3				
	Average times of use per DAY				
	1				
	2				
Q11 Present status of Water Supply (Check appropriate one. If unsatisfactory, check the appropriate reasons.)	1: Satisfactory				
	2: Unsatisfactory				
	Poor quality				
	Low pressure				
	Unstable				
	Insufficiency of quantity				
Q12 Negative influence of water supply problem (Check appropriate ones. If other, fill the influence)	1: Health				
	2: Hygiene				
	3: Fire loss				
	4: Time-consuming				
	5: Other				
	Q13 Average cost of water per MONTH (Check appropriate one)	For free			
Less than Shs.15					
Shs. 15 - 20					
Shs. 20 - 25					
Shs. 25 - 30					
Shs. 30 - 35					
Shs. 35 - 40					
Shs. 40 - 50					
Shs. 50 - 75					
Shs. 75 - 100					
Shs. 100 - 125					
Shs. 125 - 150					
Shs. 150 - 200					
Shs. 200 - 250					
Shs. 250 - 300					
Over Shs. 300					
Q14 Willingness to be connected to Municipal system (applicable only to those NOT being supplied by Municipal system. If NO, check appropriate reason)	YES				
	NO				
	If NO, the REASON :				
	1: Expensive				
	2: Satisfied with present situation				
Q15 Willingness to pay for water per MONTH Q15.1 If the interviewee could get SUFFICIENT water at PRESENT (Check appropriate one by P) Q15.2 Willingness to pay when Water Supply is IMPROVED (Check appropriate one by I) (Before asking, explain to the interviewee that improving water supply costs a lot of money , part of which he (she) has to share)	3: Other				
	up to Shs. 15				
	up to Shs. 20				
	up to Shs. 25				
	up to Shs. 30				
	up to Shs. 35				
	up to Shs. 40				
	up to Shs. 45				
	up to Shs. 50				
	up to Shs. 75				
	up to Shs. 100				
	up to Shs. 125				
	up to Shs. 150				
	up to Shs. 200				
	up to Shs. 250				
	up to Shs. 300				
	up to Shs. 400				
Q16 Average monthly income per HOUSEHOLD (Check appropriate one)	Under Shs. 215				
	Shs. 215 - 399				
	Shs. 400 - 699				
	Shs. 700 - 999				
	Shs. 1000 - 1499				
	Shs. 1500 - 1999				
	Shs. 2000 - 2999				
Shs. 3000 - 5999					
Over Shs. 6000					

Table E.4.2 Form of Questionnaire for Institutional Consumers (1/2)

Form 2 - Institutional QUESTIONNAIRE for MALEWA DAM CONSTRUCTION STUDY
 Executing agency: Japan International Cooperation Agency with cooperation of NWPC and MOWD

INTERVIEWER: _____

DATE: Dec. '89

DIVISION : Nakru Municipality, Gilgil, Naivasha, Eburru (Check appropriate one)

Reference No. of Samples Interviewed		1	2	3	4
Location:					
Sublocation:					
Name of the Street:					
Q1 Type of Building Surveyed (Check appropriate one)	Educational facilities (School etc.)				
	Health facilities (Hospital etc.)				
	Governmental or Official facilities				
	Military				
Q2 Position of Interviewee (Fill the name of position)					
Q3 Nature of facility (Check appropriate one)	Public				
	Private				
Q4 No. of Water Users per facility	Educational (staff&students)				
	Health(beds)				
	Health(Out patients per day)				
	Governmental/Official (Staff)				
	Military (Persons)				
Q5 Type of Water Supply Source (Check appropriate one/ones. If other, fill the type of water supply source)	(Municipal system)				
	1: Individual House Connection				
	2: Share connections				
	3: Other				
	(Sources other than Municipal system)				
	4: Rain/River water				
	5: Ground water				
6: Pond/Reservoir water					
7: Other					
Q6 If using both the Municipal system & other sources, ratio of quantity of water used (Fill the percentage for each, totalling to 100%)	Municipal System (%)				
	Other sources(%)				
Q7.1 Average Monthly Water Consumption (Check appropriate one by P)	(m3/MONTH)				
	Less than 20m3(20,000 lit.)				
	20 - 50 m3				
	50 - 75 m3				
	75 - 100 m3				
	100 - 150 m3				
	150 - 200 m3				
	200 - 300 m3				
	300 - 400 m3				
400 - 500 m3					
500 - 1000 m3					
Over 1000 m3					
Q8 Present status of Water Supply (Check appropriate one. If unsatisfactory, check the appropriate reasons.)	1: Satisfactory				
	2: Unsatisfactory				
	Poor quality				
	Low pressure				
	Unstable				
	Insufficiency of quantity				
Q9 Negative influence of water supply problem (Check appropriate ones. If other, fill the influence)	Expensive				
	1: Health				
	2: Hygiene				
	3: Fire loss				
	4: Service				
	5: Expansion of facility				
6: Other					

Table E.4.2 Form of Questionnaire for Institutional Consumers (2/2)

Q10 Average cost of water per MONTH (Check appropriate one)	For free				
	Less than Shs.50				
	Shs. 50 - 100				
	Shs. 100 - 200				
	Shs. 200 - 300				
	Shs. 300 - 500				
	Shs. 500 - 1000				
	Shs. 1000 - 2000				
	Shs.2000 - 3000				
Over Shs. 3000					
Q11 Willingness to pay for water per MONTH Q11.1 If the interviewee could get sufficient water at PRESENT (Check appropriate one by P) Q11.2 Willingness to pay when Water Supply is IMPROVED (Check appropriate one by I) (Before asking, explain to the interviewee that improving water supply costs a lot of money , part of which users have to share)	up to Shs. 50				
	up to Shs. 100				
	up to Shs. 200				
	up to Shs. 300				
	up to Shs. 500				
	up to Shs. 1000				
	up to Shs. 2000				
	up to Shs. 3000				
	up to Shs. 4000				
Q12.1 Average Monthly Revenue per FACILITY or OWNER (applicable only to PRIVATE facility)	Under Shs. 10000				
	Shs. 10000 - 25000				
	Shs. 25000 - 50000				
	Shs. 50000 - 100000				
	Shs. 100000 - 150000				
	Shs. 150000 - 300000				
	Shs. 300000 - 500000				
	Shs. 500000 - 1000000				
	Over Shs. 1000000				
Q12.2 Average YEARLY Revenue and/or Subsidy per FACILITY (applicable only to PUBLIC facility)	Under K£ 5000				
	K£ 5000 - 10000				
	K£ 10000 - 15000				
	K£ 15000 - 30000				
	K£ 30000 - 50000				
	K£ 50000 - 100000				
	Over K£ 100000				

Table E.4.3 Form of Questionnaire for Large Commercial/Industrial Consumers (1/2)

Form 3 - Large Commercial/Industrial QUESTIONNAIRE for MALEWA DAM CONSTRUCTION STUDY
 Excuting agency: Japan International Cooperation Agency with cooperation of NWCPC and MOWD

INTERVIEWER: _____

DATE: Dec. '89

DIVISION : Nakru Municipality, Gilgil, Naivasha, Eburru (Check appropriate one)

		1	2	3	4	
Reference No. of Samples Interviewed						
Location:						
Sublocation:						
Name of the Street:						
Q1 Type of Building Surveyed (Check appropriate one)	Hotel					
	Restaurant					
	Other Commercial					
	Industrial					
Q2 Status of Interviewee (Check appropriate one)	Owner					
	Manager					
	Person in charge of					
Q3 No. of staff and employees per building	(Fill the number)					
Q4 If Hotel, No. of bed	(Fill the number)					
Q5 If Industrial, Fill the following items:	Kind of Product					
	Yearly Production (Ton)					
	Area of building(m2)					
Q6 Type of Water Supply Source (Check appropriate one/ones. If other, fill the type of water supply source)	(Municipal system)					
	1: Individual House Connection					
	2: Share connection					
	3: Other					
	(Sources other than Municipal svstem)					
	4: Rain/River water					
	5: Pond/Reservoir water					
6: Ground water						
7: Other						
Q7 If using both the Municipal system & other sources, ratio of quantity of water used (Fill the percentage for each, totalling to 100%)	Municipal System (%)					
	Other sources(%)					
Q8.1 Average Monthly Water Consumption (Check appropriate one by P)	Less than 20m3(20,000 lit.)					
	20 - 50 m3					
	50 - 75 m3					
	75 - 100 m3					
	100 - 150 m3					
	150 - 200 m3					
	200 - 300 m3					
	300 - 400 m3					
	400 - 500 m3					
	500 - 1000 m3					
Q8.2 Quantity of water NEEDED if sufficient water is avairable (Check appropriate one by N)	1000 - 1500 m3					
	Over 1500 m3					
	1: Satisfactory					
	2: Unsatisfactory	Poor quality				
		Low pressure				
	Unstable					
	Insufficiency of quantity					
	Expensive					
	Q9 Present status of Water Supply (Check appropriate one. If unsatisfactory, check the appropriate reasons.)	1: Health				
		2: Hygiene	3: Fire loss			
4: Production						
5: Expansion of facility						
6: Other						

Table E.4.3 Form of Questionnaire for Large Commercial/Industrial Consumers (2/2)

Q11 Average cost of water per MONTH (Check appropriate one)	For free				
	Less than Shs.50				
	Shs. 50 - 100				
	Shs. 100 - 200				
	Shs. 200 - 300				
	Shs. 300 - 500				
	Shs. 500 - 1000				
	Shs. 1000 - 2000				
	Shs. 2000 - 3000				
	Shs. 3000 - 5000				
Q12 Willingness to pay for water per MONTH Q12.1 If the interviewee could get SUFFICIENT water at PRESENT (Check appropriate one by P) Q12.2 Willingness to pay when Water Supply is IMPROVED (Check appropriate one by I) (Before asking, explain to the interviewee that improving water supply costs a lot of money , part of which he (she) has to share)	Over Shs. 5000				
	up to Shs. 50				
	up to Shs. 100				
	up to Shs. 200				
	up to Shs. 300				
	up to Shs. 500				
	up to Shs. 1000				
	up to Shs. 2000				
	up to Shs. 3000				
	up to Shs. 4000				
Q13 Average Monthly Revenue per Building (Check appropriate one)	up to Shs. 5000				
	up to Shs. 6000				
	up to Shs. 7500				
	up to Shs. 10000				
	Under Shs. 5000				
	Shs. 5000 - 10000				
	Shs. 10000 - 15000				
	Shs. 15000 - 30000				
Shs. 30000 - 50000					
Shs. 50000 - 100000					
Shs. 100000 - 250000					
Shs. 250000 - 500000					
Over Shs. 500000					

Table E.4.4 Summary of Results of Questionnaire Survey (for Residential): 1/2

Question No.	Area 1		Area 2		Area 3		Area 4		Area 5		Area 6		Area 7		Area 8		Total										
	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%									
Number of Samples																			85	151	158	142	163	179	172	171	1225
1 Type of Building																											
1-1	Residential only	78	91.8	140	92.7	149	94.3	132	93.0	61	37.4	179	100.0	147	85.5	126	73.7	1014	82.8								
1-2	Residential & Commercial/Industrial	6	7.1	8	5.3	8	5.1	6	4.2	22	13.5	0	0.0	8	4.7	41	24.0	100	8.2								
1-3	Commercial/Industrial	1	1.2	3	2.0	1	0.6	4	2.8	80	49.1	0	0.0	17	9.9	4	2.3	111	9.1								
Sub-total		85	100.0	151	100.0	158	100.0	142	100.0	163	100.0	179	100.0	172	100.0	171	100.0	1225	100.0								
2 Status of Interviewee																											
2-1	Householder (Male)	32	37.6	61	40.4	72	46.5	21	14.583	13	8.0	41	22.9	77	43.5	49	29.5	366	29.9								
2-2	Householder (Female)	13	15.3	27	17.9	36	23.2	23	15.972	9	5.5	18	10.1	81	45.8	73	44.0	280	22.9								
2-3	Householder's wife	24	28.2	46	30.5	26	16.8	74	51.389	18	11.0	105	58.7	4	2.3	10	6.0	307	25.1								
2-4	Other member of Household	0	0.0	11	7.28	7	4.5	17	11.806	7	4.3	11	6.1	14	7.9	21	12.7	88	7.2								
2-5	Owner	0	0.0	0	0.0	0	0.0	4	2.7778	43	26.4	4	2.2	1	0.6	2	1.2	57	4.7								
2-6	Person in charge of	16	18.8	6	3.97	14	9.0	5	3.4722	73	44.8	0	0.0	0	0.0	11	6.6	127	10.4								
Sub-total		85	100.0	151	100.0	155	100.0	144	100.0	163	100.0	179	100.0	177	100.0	166	100.0	1225	100.0								
3 District where the interviewee was born																											
Householders who was born in Nakuru		13	28.9	19	21.6	37	34.3	4	9.1	3	13.6	11	18.6	26	16.5	19	15.6										
Others		32	71.1	69	78.4	71	65.7	40	90.9	19	86.4	48	81.4	132	83.5	103	84.4										
Sub-total		45	100.0	88	100.0	108	100.0	44	100.0	22	100.0	59	100.0	158	100.0	122	100.0										
4 No. of persons per household																											
Average (total)		9	6		5	6	10	6	5	23	9																
Average (residential only)		7	6		5	6	6	6	5	19	7																
5 Occupation of main income earner																											
5-1	Public sector wage labour	40	48.2	78	52.7	61	39.1	74	54.4	14	8.6	65	36.5	69	38.5	59	31.7	461	37.4								
5-2	Private sector wage labour	38	45.8	28	18.9	49	31.4	45	33.1	27	16.7	53	29.8	14	7.8	35	18.8	289	23.5								
5-3	Agriculture wage labour	1	1.2	0	0.0	5	3.2	1	0.7	0	0.0	0	0.0	70	39.1	0	0.0	77	6.3								
5-4	Business/commercial self-employed	4	4.8	36	24.3	40	25.6	15	11.0	77	47.5	36	20.2	19	10.6	81	43.5	311	25.2								
5-5	Agriculture self-employed	0	0.0	1	0.7	1	0.6	1	0.7	3	1.9	1	0.6	2	1.1	4	2.2	13	1.1								
5-6	Other	0	0.0	5	3.4	0	0.0	0	0.0	41	25.3	23	12.9	5	2.8	7	3.8	81	6.6								
Sub-total		83	100.0	148	100.0	156	100.0	136	100.0	162	100.0	178	100.0	179	100.0	186	100.0	1232	100.0								
6 His (Her) average income per month																											
6-1	Less than Shs. 200	0	0.0	5	3.4	1	0.7	0	0.0	0	0.0	0	0.0	2	1.1	1	0.6	9	0.8								
6-2	Shs. 200 - 500	0	0.0	6	4.1	10	6.5	0	0.0	0	0.0	0	0.0	9	5.1	7	4.0	32	2.7								
6-3	Shs. 500 - 1000	0	0.0	6	4.1	35	22.9	2	1.4	2	1.6	10	5.6	37	21.0	12	6.9	105	8.9								
6-4	Shs. 1000 - 2000	3	3.8	7	4.8	60	39.2	9	6.3	8	6.3	27	15.0	49	27.8	40	23.1	203	17.2								
6-5	Shs. 2000 - 3000	2	2.5	37	25.3	31	20.3	12	8.5	10	7.9	37	20.6	56	31.8	49	28.3	234	19.9								
6-6	Shs. 3000 - 5000	8	10.0	62	42.5	15	9.8	38	26.8	10	7.9	58	32.2	13	7.4	48	27.7	252	21.4								
6-7	Shs. 500 - 10000	38	47.5	17	11.6	1	0.7	65	45.8	20	15.9	37	20.6	10	5.7	14	8.1	203	17.2								
6-8	Over Shs. 10000	29	36.3	6	4.1	0	0.0	16	11.3	76	60.3	11	6.1	0	0.0	2	1.2	140	11.9								
Sub-total		80	100.0	146	100.0	153	100.0	142	100.0	126	100.0	180	100.0	176	100.0	173	100.0	1178	100.0								
7 Type of water supply source																											
7-1	Individual House Connection	84	95.5	124	86.1	67	42.1	123	86.6	123	77.4	92	53.5	115	65.0	82	46.3	814	66.6								
7-2	Share connection	4	4.5	10	6.9	9	5.7	7	4.9	29	18.2	19	11.0	54	30.5	90	50.8	222	18.2								
7-3	Stand pipes	0	0.0	7	4.9	83	52.2	12	8.5	4	2.5	61	35.5	3	1.7	5	2.8	175	14.3								
7-4	Supply from neighbours	0	0.0	2	1.4	0	0.0	0	0.0	1	0.6	0	0.0	3	1.7	0	0.0	6	0.5								
7-5	Kiosk	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	1	0.1								
7-6	Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0								
7-7	Rain/River water	0	0.0	1	0.7	0	0.0	0	0.0	2	1.3	0	0.0	1	0.6	0	0.0	4	0.3								
7-8	Pond/Reservoir water	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0								
7-9	Ground water	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0								
7-10	Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0								
Sub-total		88	100.0	144	100.0	159	100.0	142	100.0	159	100.0	172	100.0	177	100.0	177	100.0	1223	100.0								
8 Average monthly water consumption																											
8.1 Actual																											
8-1	Less than 10 m ³ (10,000 lit.)	1	1.2	4	3.3	35	32.4	27	19.0	16	10.7	116	64.4	88	67.2	28	16.0	315	28.7								
8-2	10 - 20 m ³	2	2.4	24	19.5	37	34.3	46	32.4	33	22.0	51	28.3	34	26.0	31	17.7	260	23.7								
8-3	20 - 30 m ³	9	10.6	47	38.2	29	26.9	58	40.8	31	20.7	7	3.9	6	4.6	29	16.6	218	19.8								
8-4	30 - 40 m ³	19	22.4	28	22.8	6	5.6	10	7.0	19	12.7	5	2.8	2	1.5	12	6.9	101	9.2								
8-5	40 - 50 m ³	54	63.5	10	8.1	0	0.0	0	0.0	22	14.7	1	0.6	1	0.8	6	3.4	95	8.6								
8-6	50 - 75 m ³	0	0.0	3	2.4	0	0.0	1	0.7	9	6.0	0	0.0	0	0.0	15	8.6	28	2.5								
8-7	75 - 100 m ³	0	0.0	2	1.6	0	0.0	0	0.0	6	4.0	0	0.0	0	0.0	12	6.9	20	1.8								
8-8	100 - 150 m ³	0	0.0	1	0.8	1	0.9	0	0.0	6	4.0	0	0.0	0	0.0	25	14.3	33	3.0								
8-9	150 - 200 m ³	0	0.0	1	0.8	0	0.0	0	0.0	6	4.0	0	0.0	0	0.0	6	3.4	13	1.2								
8-10	200 - 300 m ³	0	0.0	2	1.6	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	5	2.9	8	0.7								
8-11	Over 300 m ³	0	0.0	1	0.8	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	6	3.4	8	0.7								
Sub-total		85	100.0	123	100.0	108	100.0	142	100.0	150	100.0	180	100.0	131	100.0	175	100.0	1099	100.0								
8.2 Quantity of water needed																											
8-1	Less than 10 m ³ (10,000 lit.)	0	0.0	4	3.3	10	9.4	13	9.2	6	3.9	6	7.0	1	1.6	20	11.6	60	6.6								
8-2	10 - 20 m ³	0	0.0	9	7.4	18	17.0	30	21.1	17	11.0	50	58.1	22	34.9	20	11.6	167	18.2								
8-3	20 - 30 m ³	0	0.0	29	23.8	25	23.6	63	44.4	20	13.0	22	25.6	24	38.1	31	17.9	215	23.5								
8-4	30 - 40 m ³	0	0.0	36	29.5	31	29.2	30	21.1	29	18.8	3	3.5	3	4.8	20	11.6	152	16.6								
8-5	40 - 50 m ³	1	1.5	23	18.9	14	13.2	3	2.1	28	18.2	4	4.7	2	3.2	12	6.9	89	9.7								
8-6	50 - 75 m ³	15	23.1	11	9.0	5	4.7	2	1.4	22	14.3	1	1.2	5	7.9	8	4.6	69	7.5								
8-7	75 - 100 m ³	24	36.9	3	2.5	2	1.9	1	0.7	12	7.8	0	0.0	6	9.5	17	9.8	66	7.2								
8-8	100 - 150 m ³	18	27.7	3	2.5	0	0.0	0	0.0	6	3.9	0	0.0	0	0.0	21	12.1	48	5.2								
8-9	150 - 200 m ³	4	6.2	0	0.0	0	0.0	0	0.0	10	6.5	0	0.0	0	0.0	9	5.2	23	2.5								
8-10	200 - 300 m ³	0	0.0	1	0.8	1</																					

Table E. 4.4 Summary of Results of Questionnaire Survey (for Residential): 2/2

Question No.	Area 1		Area 2		Area 3		Area 4		Area 5		Area 6		Area 7		Area 8		Total	
	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
9 Present status of water supply																		
9-1 Satisfactory	54	63.5	78	51.7	23	14.6	81	57.0	51	31.3	36	20.1	11	6.4	27	15.8	361	29.5
9-2 Unsatisfactory																		
9-2 Poor quality	36	42.4	4	2.6	2	1.3	0	0.0	4	2.5	21	11.7	6	3.5	11	6.4	84	6.9
9-3 Low pressure	27	31.8	62	41.1	82	51.9	17	12.0	100	61.3	120	67.0	26	15.1	153	89.5	591	48.2
9-4 Unstable	6	7.1	75	49.7	121	76.6	13	9.2	54	33.1	118	65.9	116	67.4	28	16.4	534	43.6
9-5 Insufficiency of quantity	25	29.4	67	44.4	70	44.3	40	28.2	92	56.4	82	45.8	168	97.7	59	34.5	606	49.5
9-6 Expensive	0	0.0	47	31.1	11	7.0	0	0.0	22	13.5	21	11.7	2	1.2	0	0.0	104	8.5
10 Negative influence of water supply problem																		
10-1 Health	26	30.6	61	40.4	11	7.0	0	0.0	1	0.6	6	3.4	27	15.7	0	0.0	132	10.8
10-2 Hygiene	27	31.8	89	58.9	13	8.2	1	0.7	1	0.6	0	0.0	111	64.5	94	55.0	336	27.4
10-3 Fire loss	0	0.0	26	17.2	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	27	2.2
10-4 Time-consuming	17	20.0	20	13.2	65	41.1	2	1.4	22	13.5	87	48.6	96	55.8	39	22.8	348	28.4
10-5 Other	0	0.0	4	2.6	1	0.6	0	0.0	45	27.6	99	55.3	0	0.0	0	0.0	151	12.3
11 Average cost of water per month																		
11-1 For free	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	1	0.1
11-2 Less than Shs. 15	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	22	12.8	24	13.5	46	4.0
11-3 Shs. 15 - 20	0	0.0	1	0.7	14	8.7	2	1.4	1	0.6	1	0.9	23	13.4	3	1.7	46	4.0
11-4 Shs. 20 - 25	1	1.2	0	0.0	41	25.2	2	1.4	0	0.0	0	0.0	5	2.9	1	0.6	50	4.4
11-5 Shs. 25 - 30	4	4.7	5	3.5	10	6.2	4	2.9	0	0.0	1	0.9	37	21.5	0	0.0	61	5.3
11-6 Shs. 30 - 35	1	1.2	4	2.8	6	3.7	5	3.6	0	0.0	0	0.0	11	6.4	0	0.0	27	2.4
11-7 Shs. 35 - 40	2	2.4	2	1.4	9	5.6	4	2.9	0	0.0	1	0.9	11	6.4	1	0.6	30	2.6
11-8 Shs. 40 - 50	6	7.1	13	9.2	12	7.5	16	11.6	7	4.5	1	0.9	18	10.5	1	0.6	74	6.5
11-9 Shs. 50 - 75	6	7.1	27	19.1	36	22.4	44	31.9	12	7.8	40	37.4	10	5.8	5	2.8	180	15.8
11-10 Shs. 75 - 100	7	8.2	33	23.4	18	11.2	33	23.9	11	7.1	27	25.2	21	12.2	32	18.0	183	16.0
11-11 Shs. 100 - 125	4	4.7	21	14.9	7	4.3	23	16.7	5	3.2	11	10.3	4	2.3	22	12.4	97	8.5
11-12 Shs. 125 - 150	5	5.9	16	11.3	6	3.7	3	2.2	6	3.9	10	9.3	2	1.2	13	7.3	61	5.3
11-13 Shs. 150 - 200	8	9.4	11	7.8	1	0.6	2	1.4	15	9.7	10	9.3	3	1.7	19	10.7	69	6.0
11-14 Shs. 200 - 250	13	15.3	2	1.4	0	0.0	0	0.0	20	13.0	4	3.7	2	1.2	19	10.7	62	5.4
11-15 Shs. 250 - 300	10	11.8	4	2.8	0	0.0	0	0.0	26	16.9	1	0.9	0	0.0	19	10.7	60	5.3
11-16 Over Shs. 300	18	21.2	2	1.4	1	0.6	0	0.0	51	33.1	0	0.0	2	1.2	19	10.7	94	8.2
Sub-total	85	100.0	141	100.0	161	100.0	138	100.0	154	100.0	107	100.0	172	100.0	178	100.0	1141	100.0
12 Willingness to pay for water per month																		
12.1 If the interviewee could get sufficient water at present																		
12-1 Up to Shs. 15	4	8.7	3	2.1	6	3.9	0	0.0	0	0.0	1	1.3	27	18.6	25	14.5	66	6.4
12-2 Up to Shs. 20	0	0.0	5	3.4	3	1.9	1	0.7	1	0.7	0	0.0	16	11.0	2	1.2	29	2.8
12-3 Up to Shs. 25	1	2.2	6	4.1	38	24.7	2	1.4	0	0.0	0	0.0	4	2.8	0	0.0	51	5.0
12-4 Up to Shs. 30	36	78.3	12	8.3	4	2.6	6	4.3	0	0.0	0	0.0	34	23.4	0	0.0	92	9.0
12-5 Up to Shs. 35	5	10.9	3	2.1	2	1.3	4	2.9	0	0.0	0	0.0	15	10.3	0	0.0	29	2.8
12-6 Up to Shs. 40	0	0.0	8	5.5	10	6.5	2	1.4	0	0.0	2	2.6	18	12.4	2	1.2	42	4.1
12-7 Up to Shs. 45	0	0.0	0	0.0	4	2.6	5	3.6	1	0.7	1	1.3	12	8.3	0	0.0	23	2.2
12-8 Up to Shs. 50	0	0.0	10	6.9	14	9.1	19	13.8	7	5.0	31	40.8	7	4.8	2	1.2	65	6.3
12-9 Up to Shs. 75	0	0.0	28	19.3	43	27.9	46	33.3	14	10.1	20	26.3	4	2.8	13	7.5	180	17.5
12-10 Up to Shs. 100	0	0.0	28	19.3	16	10.4	42	30.4	12	8.6	9	11.8	2	1.4	21	12.1	141	13.7
12-11 Up to Shs. 125	0	0.0	20	13.8	6	3.9	10	7.2	5	3.6	5	6.6	3	2.1	21	12.1	74	7.2
12-12 Up to Shs. 150	0	0.0	17	11.7	7	4.5	1	0.7	5	3.6	5	6.6	1	0.7	13	7.5	49	4.8
12-13 Up to Shs. 200	0	0.0	4	2.8	0	0.0	0	0.0	9	6.5	2	2.6	0	0.0	25	14.5	43	4.2
12-14 Up to Shs. 250	0	0.0	0	0.0	0	0.0	0	0.0	21	15.1	0	0.0	0	0.0	12	6.9	37	3.6
12-15 Up to Shs. 300	0	0.0	0	0.0	1	0.6	0	0.0	23	16.5	0	0.0	0	0.0	18	10.4	42	4.1
12-16 Up to Shs. 400	0	0.0	1	0.7	0	0.0	0	0.0	41	29.5	0	0.0	2	1.4	19	11.0	64	6.2
Sub-total	46	100.0	145	100.0	154	100.0	138	100.0	139	100.0	76	100.0	145	100.0	173	100.0	1027	100.0
12.2 Willingness to pay when water supply is improved																		
12-1 Up to Shs. 15	0	0.0	1	0.7	1	0.6	0	0.0	0	0.0	0	0.0	17	10.4	19	11.9		
12-2 Up to Shs. 20	0	0.0	6	4.1	2	1.3	2	1.4	0	0.0	0	0.0	6	3.7	16	1.6		
12-3 Up to Shs. 25	0	0.0	4	2.7	3	1.9	0	0.0	1	0.7	1	1.3	1	0.6	1	0.6	12	1.2
12-4 Up to Shs. 30	0	0.0	8	5.5	9	5.8	2	1.4	0	0.0	0	0.0	15	9.5	0	0.0	34	3.3
12-5 Up to Shs. 35	0	0.0	4	2.7	20	12.9	2	1.4	0	0.0	1	1.3	8	5.1	0	0.0	35	3.4
12-6 Up to Shs. 40	5	16.1	8	5.5	10	6.5	6	4.3	0	0.0	1	1.3	26	16.5	1	0.6	57	5.6
12-7 Up to Shs. 45	7	22.6	2	1.4	10	6.5	7	5.0	0	0.0	1	1.3	18	11.4	0	0.0	45	4.4
12-8 Up to Shs. 50	7	22.6	9	6.2	11	7.1	18	12.8	2	1.4	1	1.3	27	17.1	1	0.6	76	7.5
12-9 Up to Shs. 75	6	19.4	14	9.6	13	8.4	18	12.8	4	2.9	10	12.5	17	10.8	5	3.1	87	8.6
12-10 Up to Shs. 100	4	12.9	27	18.5	35	22.6	39	27.7	10	7.2	22	27.5	14	8.9	13	8.0	165	16.2
12-11 Up to Shs. 125	0	0.0	20	13.7	23	14.8	31	22.0	8	5.8	12	15.0	9	5.7	22	13.5	125	12.3
12-12 Up to Shs. 150	0	0.0	17	11.6	11	7.1	9	6.4	9	6.5	19	23.8	10	6.3	16	9.8	91	8.9
12-13 Up to Shs. 200	0	0.0	20	13.7	5	3.2	6	4.3	6	4.3	8	10.0	8	5.1	22	13.5	75	7.4
12-14 Up to Shs. 250	0	0.0	4	2.7	1	0.6	0	0.0	10	7.2	2	2.5	0	0.0	17	10.4	34	3.3
12-15 Up to Shs. 300	1	3.2	1	0.7	0	0.0	1	0.7	14	10.1	2	2.5	3	1.9	23	14.1	45	4.4
12-16 Up to Shs. 400	1	3.2	1	0.7	1	0.6	0	0.0	74	53.6	0	0.0	2	1.3	19	11.7	101	9.9
Sub-total	31	100.0	146	100.0	155	100.0	141	100.0	138	100.0	80	100.0	158	100.0	163	100.0	1017	100.0
13 Average monthly income per household																		
13-1 Under Shs. 215	0	0.0	6	4.0	1	0.6	0	0.0	0	0.0	0	0.0	1	0.6	3	1.6	11	1.0
13-2 Shs. 215 - 399	0	0.0	3	2.0	3	1.9	0	0.0	1	2.8	0	0.0	0	0.0	1	0.5	8	0.7
13-3 Shs. 400 - 699	0	0.0	2	1.3	7	4.5	1	0.7	2	5.6	0	0.0	10	5.9	5	2.7	27	2.5
13-4 Shs. 700 - 999	0	0.0	3	2.0	2	1.3	6	4.3	2	5.6	5	2.8	28	16.6	13	7.1	59	5.4
13-5 Shs. 1000 - 1499	3	3.8	6															

Table E.4.5 Water Consumption and Willingness-to-Pay in Nakuru Municipality
(For Residential)

1. Water Consumption per month								
	1)Average (m3/month)	2)Actual (Nos.)	3)Water needed (Nos.)	4) Percentage of 2)	5) Percentage of 3)	6) 1)/X4)	7) 1)/X5)	8) 7)/(6)
Less than 10m3	5	315	60	28.7	6.6	1.4	0.3	
10-20m3	15	260	167	23.7	18.2	3.5	2.7	
20-30m3	25	218	215	19.8	23.5	5.0	5.9	
30-40m3	35	101	152	9.2	16.6	3.2	5.8	
40-50m3	45	95	89	8.6	9.7	3.9	4.4	
50-75m3	62.5	28	69	2.5	7.5	1.6	4.7	
75-100m3	87.5	20	66	1.8	7.2	1.6	6.3	
100-150m3	125	33	48	3.0	5.2	3.8	6.6	
150-200m3	175	13	23	1.2	2.5	2.1	4.4	
200-300m3	250	8	12	0.7	1.3	1.8	3.3	
Over 300m3	300	8	15	0.7	1.6	2.2	4.9	
TOTAL		1099	916	100.0	100.0	30.1	49.3	1.64

2. Average cost of water per month				
	1)Average (Shs./month)	2) No. of household	3) Percentage	4) 1)x3)
Less than Shs.15	7.5	46	4.0	0.3
Shs.15 - 20	17.5	46	4.0	0.7
Shs.20 - 25	22.5	50	4.4	1.0
Shs.25 - 30	27.5	61	5.4	1.5
Shs.30 - 35	32.5	27	2.4	0.8
Shs.35 - 40	37.5	30	2.6	1.0
Shs.40 - 50	45	74	6.5	2.9
Shs.50 - 75	62.5	180	15.8	9.9
Shs.75 - 100	87.5	183	16.1	14.0
Shs.100 - 125	112.5	97	8.5	9.6
Shs.125 - 150	137.5	61	5.4	7.4
Shs.150 - 200	175	69	6.1	10.6
Shs.200 - 250	225	62	5.4	12.2
Shs.250 - 300	275	60	5.3	14.5
Over Shs.300	350	94	8.2	28.9
TOTAL		1140	100.0	115.2

3. Willingness-to-pay									
	1)Average (Shs./month)	2) At present (Nos.)	3)If water supply improved(Nos.)	4) Percentage of 2)	5) Percentage of 3)	6) 1)/X4)	7) 1)/X5)	8) 7)/(6)	9) 7)/ current cost
up to Shs.15	7.5	66	19	6.4	1.9	0.5	0.1		
up to Shs.20	17.5	29	16	2.8	1.6	0.5	0.3		
up to Shs.25	22.5	51	12	5.0	1.2	1.1	0.3		
up to Shs.30	27.5	92	34	9.0	3.3	2.5	0.9		
up to Shs.35	32.5	29	35	2.8	3.4	0.9	1.1		
up to Shs.40	37.5	42	57	4.1	5.6	1.5	2.1		
up to Shs.45	42.5	23	45	2.2	4.4	1.0	1.9		
up to Shs.50	47.5	65	76	6.3	7.5	3.0	3.5		
up to Shs.75	62.5	180	87	17.5	8.6	11.0	5.3		
up to Shs.100	87.5	141	165	13.7	16.2	12.0	14.2		
up to Shs.125	112.5	74	125	7.2	12.3	8.1	13.8		
up to Shs.150	137.5	49	91	4.8	8.9	6.6	12.3		
up to Shs.200	175	43	75	4.2	7.4	7.3	12.9		
up to Shs.250	225	37	34	3.6	3.3	8.1	7.5		
up to Shs.300	275	42	45	4.1	4.4	11.2	12.2		
up to Shs.400	350	64	101	6.2	9.9	21.8	34.8		
TOTAL		1027	1017	100.0	100.0	97.1	123.3	1.27	1.07

Table E.4.6 Summary of Results of Questionnaire Survey for Institutional and Large Commercial/Industrial Consumers (1/2)

A. Institutional			B. Large commercial/Industrial		
Question No.	(Nos.)	(%)	Question No.	(Nos.)	(%)
Number of Samples 13			Number of Samples 91		
1 Type of Building			1 Type of Building		
1-1	4	30.8	1-1	0	0.0
1-2	3	23.1	1-2	69	75.8
1-3	6	46.2	1-3	22	24.2
Sub-total	13	100.0	Sub-total	91	100.0
2 Nature of Facilities			2 Type of water supply source		
2-1	12	92.3	2-1	78	87.6
2-2	1	7.7	2-2	5	5.6
Sub-total	13	100.0	2-3	0	0.0
3 Type of water supply source			2-4	0	0.0
3-1	8	61.5	2-5	6	6.7
3-2	5	38.5	2-6	0	0.0
3-3	0	0.0	2-7	0	0.0
3-4	0	0.0	2-8	0	0.0
3-5	0	0.0	2-9	0	0.0
3-6	0	0.0	Sub-total	89	100.0
3-7	0	0.0	3 Average monthly water consumption		
3-8	0	0.0	3.1 Actual		
3-9	0	0.0	3-1	31	34.4
Sub-total	13	100.0	3-2	4	4.4
4 Average monthly water consumption			3-3	7	7.8
4.1 Actual			3-4	24	26.7
4-1	0	0.0	3-5	9	10.0
4-2	0	0.0	3-6	7	7.8
4-3	0	0.0	3-7	4	4.4
4-4	0	0.0	3-8	2	2.2
4-5	3	33.3	3-9	0	0.0
4-6	2	22.2	3-10	1	1.1
4-7	3	33.3	3-11	1	1.1
4-8	1	11.1	3-12	0	0.0
4-9	0	0.0	Sub-total	90	100.0
4-10	0	0.0	3.2 Quantity of water needed		
4-11	0	0.0	3-1	0	0.0
Sub-total	87	100.0	3-2	0	0.0
4.2 Quantity of water needed			3-3	0	0.0
4-1	0	0.0	3-4	7	14.0
4-2	0	0.0	3-5	19	38.0
4-3	0	0.0	3-6	11	22.0
4-4	0	0.0	3-7	1	2.0
4-5	2	22.2	3-8	4	8.0
4-6	1	11.1	3-9	3	6.0
4-7	2	22.2	3-10	2	4.0
4-8	3	33.3	3-11	0	0.0
4-9	0	0.0	3-12	3	6.0
4-10	1	11.1	Sub-total	50	100.0
4-11	0	0.0	4 Present status of water supply		
Sub-total	9	100.0	4-1	44	48.4
5 Present status of water supply			4-1 Satisfactory		
5-1	4	30.8	Unsatisfactory		
Unsatisfactory			4-2	4	4.4
5-2	0	0.0	Poor quality		
5-3	2	15.4	4-3	1	1.1
5-4	7	53.8	Low pressure		
5-5	0	0.0	4-4	23	25.3
5-6	0	0.0	Unstable		
Expensive			4-5	23	25.3
			Insufficiency of quantity		
			4-6	0	0.0
			Expensive		

Table E.4.6 Summary of Results of Questionnaire Survey for Institutional and Large Commercial/Industrial Consumers (2/2)

A. Institutional				B. Large commercial/Industrial			
Question No.		(Nos.)	(%)	Question No.		(Nos.)	(%)
6	Negative influence of water supply problem			5	Negative influence of water supply problem		
6-1	Health	0	0.0	5-1	Health	0	0.0
6-2	Hygiene	0	0.0	5-2	Hygiene	0	0.0
6-3	Fire loss	0	0.0	5-3	Fire loss	0	0.0
6-4	Service	0	0.0	5-4	Production	9	9.9
6-5	Expansion of facility	0	0.0	5-5	Expansion of facility	0	0.0
6-6	Other	0	0.0	5-6	Other	8	8.8
7	Average cost of water per month			6	Average cost of water per month		
7-1	For free	0	0.0	6-1	For free	0	0.0
7-2	Less than Shs. 50	0	0.0	6-2	Less than Shs. 50	0	0.0
7-3	Shs. 50 - 100	1	9.1	6-3	Shs. 50 - 100	8	8.8
7-4	Shs. 100 - 200	0	0.0	6-4	Shs. 100 - 200	38	41.8
7-5	Shs. 200 - 300	3	27.3	6-5	Shs. 200 - 300	13	14.3
7-6	Shs. 300 - 500	5	45.5	6-6	Shs. 300 - 500	10	11.0
7-7	Shs. 500 - 1000	1	9.1	6-7	Shs. 500 - 1000	7	7.7
7-8	Shs. 1000 - 2000	1	9.1	6-8	Shs. 1000 - 2000	4	4.4
7-9	Shs. 2000 - 3000	0	0.0	6-9	Shs. 2000 - 3000	4	4.4
7-10	Over Shs. 3000	1	9.1	6-10	Shs. 3000 - 5000	3	3.3
	Sub-total	11	100.0	6-11	Over Shs. 5000	4	4.4
					Sub-total	91	100.0
8	Willingness to pay for water per month			7	Willingness to pay for water per month		
8.1	If the interviewee could get sufficient water at present			7.1	If the interviewee could get sufficient water at present		
8-1	Up to Shs. 50	0	0.0	7-1	Up to Shs. 50	3	3.7
8-2	Up to Shs. 100	1	12.5	7-2	Up to Shs. 100	2	2.5
8-3	Up to Shs. 200	1	12.5	7-3	Up to Shs. 200	30	37.0
8-4	Up to Shs. 300	2	25.0	7-4	Up to Shs. 300	15	18.5
8-5	Up to Shs. 500	0	0.0	7-5	Up to Shs. 500	9	11.1
8-6	Up to Shs. 1000	1	12.5	7-6	Up to Shs. 1000	9	11.1
8-7	Up to Shs. 2000	0	0.0	7-7	Up to Shs. 2000	4	4.9
8-8	Up to Shs. 3000	1	12.5	7-8	Up to Shs. 3000	2	2.5
8-9	Up to Shs. 4000	2	25.0	7-9	Up to Shs. 4000	0	0.0
	Sub-total	8	100.0	7-10	Up to Shs. 5000	1	1.2
				7-11	Up to Shs. 6000	1	1.2
8.2	Willingness to pay when water supply is improved			7-12	Up to Shs. 7500	0	0.0
8-1	Up to Shs. 50	0	0.0	7-13	Up to Shs. 10000	5	6.2
8-2	Up to Shs. 100	0	0.0		Sub-total	81	100.0
8-3	Up to Shs. 200	1	14.3	7.2	Willingness to pay when water supply is improved		
8-4	Up to Shs. 300	3	42.9	7-1	Up to Shs. 50	0	0.0
8-5	Up to Shs. 500	0	0.0	7-2	Up to Shs. 100	0	0.0
8-6	Up to Shs. 1000	0	0.0	7-3	Up to Shs. 200	7	13.0
8-7	Up to Shs. 2000	1	14.3	7-4	Up to Shs. 300	19	35.2
8-8	Up to Shs. 3000	0	0.0	7-5	Up to Shs. 500	10	18.5
8-9	Up to Shs. 4000	2	28.6	7-6	Up to Shs. 1000	4	7.4
	Sub-total	7	100.0	7-7	Up to Shs. 2000	6	11.1
				7-8	Up to Shs. 3000	2	3.7
9.1	Average monthly revenue per facility or owner(Private)			7-9	Up to Shs. 4000	0	0.0
9-1	Under Shs. 10000	0	0.0	7-10	Up to Shs. 5000	1	1.9
9-2	Shs. 10000 - 25000	1	100.0	7-11	Up to Shs. 6000	3	5.6
9-3	Shs. 25000 - 50000	0	0.0	7-12	Up to Shs. 7500	0	0.0
9-4	Shs. 50000 - 100000	0	0.0	7-13	Up to Shs. 10000	2	3.7
9-5	Shs. 100000 - 150000	0	0.0		Sub-total	54	100.0
9-6	Shs. 150000 - 300000	0	0.0	8	Average Monthly Revenue per Building		
9-7	Shs. 300000 - 500000	0	0.0	8-1	Under Shs. 5000	2	3.0
9-8	Shs. 500000 - 1000000	0	0.0	8-2	Shs. 5000 - 10000	1	1.5
9-9	Over Shs. 1000000	0	0.0	8-3	Shs. 10000 - 150000	16	24.2
	Sub-total	1	100.0	8-4	Shs. 15000 - 30000	15	22.7
				8-5	Shs. 30000 - 50000	9	13.6
9.2	Average yearly revenue and/or subsidy per facility(Public)			8-6	Shs. 50000 - 100000	3	4.5
9-1	Under KL 500	1	11.1	8-7	Shs. 100000 - 250000	6	9.1
9-2	KL5000 - 10000	1	11.1	8-8	Shs. 250000 - 500000	6	9.1
9-3	KL10000 - 15000	0	0.0	8-9	Over Shs. 500000	8	12.1
9-4	KL15000 - 30000	1	11.1		Sub-total	66	100.0
9-5	KL30000 - 50000	4	44.4				
9-6	KL50000 - 100000	2	22.2				
9-7	Over KL 100000	0	0.0				
	Sub-total	9	100.0				

Table E.4.7 Economic Benefit Stream (up to Year 2015)*

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
I. Nakuru Municipality																			
1) Water Demand (1000m3/year)	15468	16408	17406	18460	19470	20535	21658	22843	24090	25422	26828	28312	29877	31533	33283	35130	37080	39138	41306
2) Total Sales Volume (1000m3/year)	15468	16408	17406	18460	19470	20535	21658	22843	24090	25422	26828	28312	29877	31533	33283	35130	37080	39138	41306
3) Sales Volume from Other Sources (1000m3/year)	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977	5977
4) Incremental Sales Volume (1000m3/year)	9491	10431	11429	12483	13493	14558	15681	16866	18113	19445	20851	22335	23900	25556	27306	29153	31103	33161	35329
5) Adjustment by Regulation** (1000m3/year)	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266	25266
6) Adjusted Incremental Volume (1000m3/year)	9491	10431	11429	12483	13493	14558	15681	16866	18113	19445	20851	22335	23900	25266	25266	25266	25266	25266	25266
Institutional	845	919	997	1076	1158	1244	1334	1429	1528	1632	1741	1856	1976	2079	2079	2079	2079	2079	2079
Commercial and Industrial	1981	2155	2337	2526	2721	2925	3140	3365	3586	3830	4086	4354	4636	4869	4869	4869	4869	4869	4869
Residential and Others	6665	7357	8095	8881	9614	10389	11207	12072	12999	13983	15024	16125	17288	18318	18318	18318	18318	18318	18318
2. Naivasha Town																			
1) Water Demand(1000m3/year)	3047	3209	3379	3559	3708	3864	4026	4195	4371	4554	4745	4944	5151	5366	5590	5825	6069	6323	6594
2) Total Sales Volume (1000m3/year)	3047	3209	3379	3559	3708	3864	4026	4195	4371	4554	4745	4944	5151	5366	5590	5825	6069	6323	6594
3) Sales Volume from Other Sources(1000m3/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4) Incremental Sales Volume (1000m3/year)	3047	3209	3379	3559	3708	3864	4026	4195	4371	4554	4745	4944	5151	5366	5590	5825	6069	6323	6594
5) Adjustment by Regulation** (1000m3/year)	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305	5305
6) Incremental Adjusted Volume (1000m3/year)	3047	3209	3379	3559	3708	3864	4026	4195	4371	4554	4745	4944	5151	5305	5305	5305	5305	5305	5305
Institutional	1093	1152	1213	1278	1331	1386	1444	1504	1566	1632	1700	1771	1845	1901	1901	1901	1901	1901	1901
Commercial and Industrial	109	115	121	128	133	139	145	151	157	164	170	178	185	191	191	191	191	191	191
Residential and Others	1844	1943	2045	2154	2244	2340	2438	2541	2647	2759	2875	2995	3121	3214	3214	3214	3214	3214	3214
3. Gilgil Town																			
1) Water Demand(1000m3/year)	2358	2478	2604	2738	2886	3042	3206	3380	3562	3754	3958	4172	4397	4636	4888	5155	5435	5732	6044
2) Total Sales Volume (1000m3/year)	2358	2478	2604	2738	2886	3042	3206	3380	3562	3754	3958	4172	4397	4636	4888	5155	5435	5732	6044
3) Sales Volume from Other Sources(1000m3/year)	1718	1733	1748	1764	1781	1799	1818	1838	1858	1874	1890	1906	1923	1941	1941	1941	1941	1941	1941
4) Incremental Sales Volume (1000m3/year)	640	745	856	973	1104	1243	1388	1542	1703	1881	2068	2266	2474	2695	2948	3214	3495	3791	4103
5) Adjustment by Regulation** (1000m3/year)	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664	2664
6) Incremental Adjusted Volume (1000m3/year)	640	745	856	973	1104	1243	1388	1542	1703	1881	2068	2266	2474	2664	2664	2664	2664	2664	2664
Institutional	261	304	349	396	447	501	558	617	679	747	818	893	972	1042	1042	1042	1042	1042	1042
Commercial and Industrial	20	24	27	31	35	39	43	48	52	57	63	68	74	79	79	79	79	79	79
Residential and Others	359	418	480	546	622	702	788	876	972	1076	1187	1305	1429	1544	1544	1544	1544	1544	1544
4. Gilgil Rural***																			
1) Water Demand(1000m3/year)	506	524	543	563	580	599	618	637	657	677	698	719	741	763	788	814	841	869	897
2) Total Sales Volume (1000m3/year)	506	524	543	563	580	599	618	637	657	677	698	719	741	763	788	814	841	869	897
3) Sales Volume from Other Sources(1000m3/year)	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289
4) Incremental Sales Volume (1000m3/year)	217	235	254	274	291	310	329	348	368	388	409	430	452	475	500	525	552	580	608
5) Adjustment by Regulation** (1000m3/year)	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469
6) Incremental Adjusted Volume (1000m3/year)	217	235	254	274	291	310	329	348	368	388	409	430	452	469	469	469	469	469	469
5. Eburru Rural****																			
1) Water Demand(1000m3/year)	726	757	788	821	855	890	926	964	1004	1045	1087	1132	1178	1226	1276	1329	1383	1440	1500
2) Total Sales Volume (1000m3/year)	726	757	788	821	855	890	926	964	1004	1045	1087	1132	1178	1226	1276	1329	1383	1440	1500
3) Sales Volume from Other Sources(1000m3/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4) Incremental Sales Volume (1000m3/year)	726	757	788	821	855	890	926	964	1004	1045	1087	1132	1178	1226	1276	1329	1383	1440	1500
5) Adjustment by Regulation** (1000m3/year)	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212
6) Incremental Adjusted Volume (1000m3/year)	726	757	788	821	855	890	926	964	1004	1045	1087	1132	1178	1212	1212	1212	1212	1212	1212
Total Incremental Volume (1000m3/year)	14121	15377	16707	18110	19452	20864	22351	23916	25559	27313	29160	31106	33155	35317	37620	40046	42602	45295	48134
Upper Limit of Supply(1000m3/year)	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916	34916
Total Incremental Adjusted Volume (1000m3/year)																			
Institutional	2199	2374	2559	2749	2936	3131	3336	3550	3773	4011	4260	4520	4793	5021	5021	5021	5021	5021	5021
Commercial and Industrial	2111	2294	2486	2685	2889	3103	3328	3563	3795	4051	4319	4600	4894	5139	5139	5139	5139	5139	5139
Residential and Others (1)****	8868	9717	10620	11581	12480	13430	14433	15489	16618	17817	19086	20424	21838	23075	23075	23075	23075	23075	23075
Residential and Others (2)*****	943	992	1042	1095	1146	1200	1255	1313	1372	1433	1496	1562	1630	1681	1681	1681	1681	1681	1681
Unit Economic Benefit (Kshs./m3)																			
Institutional	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91	6.91
Commercial and Industrial	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82	22.82
Residential and Others (1)****	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70
Residential and Others (2)*****	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55
Annual Benefits																			
Institutional	15195	16406	17682	18996	20286	21636	23049	24528	26075	27716	29435	31236	33121	34698	34698	34698	34698	34698	34698
Commercial and Industrial	48174	52357	56733	61270	65925	70810	75937	81317	86610	92443	98558	104968	111689	117267	117267	117267	117267	117267	117267
Residential and Others (1)****	50547	55389	60531	66012	71137	76553	82266	88287	94724	101559	108788	116416	124478	131528	131528	131528	131528	131528	131528
Residential and Others (2)*****	4292	4513	4743	4982	5216	5459	5711	5972	6242	6519	680								

Table E.4.8 Financial Benefit Stream

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	
(1000 Ksh)																																				
1. Nakuru Municipality																																				
1) Water Demand at Delivery Point (1000m ³ /year)	17677	18752	19892	21097	22251	23468	24732	26106	27531	29054	30661	32356	34145	36038	38038	40149	42377	44729	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	
2) Total Sales Volume (1000m ³ /year)	17677	18752	19892	21097	22251	23468	24732	26106	27531	29054	30661	32356	34145	36038	38038	40149	42377	44729	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	47207	
3) Sales Volume from Other Sources (1000m ³ /year)	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	6831	
4) Incremental Sales Volume (1000m ³ /year)	10846	11921	13061	14266	15420	16637	17921	19275	20701	22223	23830	25525	27315	29207	31207	33318	35546	37898	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	
5) Adjustment by Regulation** (1000m ³ /year)	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	29180	
6) Adjusted Incremental Volume (1000m ³ /year)	10846	11921	13061	14266	15420	16637	17921	19275	20701	22223	23830	25525	27315	29207	31207	33318	35546	37898	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	40376	
7) Unit Water Rate (Ksh./m ³)	2.64	2.85	3.08	3.32	3.59	3.88	4.19	4.52	4.89	5.28	5.70	6.15	6.65	7.18	7.75	8.37	9.04	9.77	10.55	11.39	12.30	13.29	14.35	15.50	16.74	18.08	19.52	21.08	22.77	24.59	26.56	28.68	30.98	33.46	36.13	
8) Annual Revenue (Ksh.1000)	28627	33981	40209	47432	55370	64520	75058	87186	101126	117249	135783	157080	181538	209452	242608	284305	336849	399757	475334	475334	475334	475334	475334	475334	475334	475334	475334	475334	475334	475334	475334	475334	475334	475334	475334	
2. Naivasha Town																																				
1) Water Demand at Delivery Point (1000m ³ /year)	3482	3667	3862	4067	4238	4416	4601	4795	4995	5205	5423	5650	5887	6132	6389	6657	6936	7226	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536
2) Total Sales Volume (1000m ³ /year)	3482	3667	3862	4067	4238	4416	4601	4795	4995	5205	5423	5650	5887	6132	6389	6657	6936	7226	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536
3) Sales Volume from Other Sources (1000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4) Incremental Sales Volume (1000m ³ /year)	3482	3667	3862	4067	4238	4416	4601	4795	4995	5205	5423	5650	5887	6132	6389	6657	6936	7226	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	7536	
5) Adjustment by Regulation** (1000m ³ /year)	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	
6) Incremental Adjusted Volume (1000m ³ /year)	3482	3667	3862	4067	4238	4416	4601	4795	4995	5205	5423	5650	5887	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	6126	
7) Unit Water Rate (Ksh./m ³)	2.64	2.85	3.08	3.32	3.59	3.88	4.19	4.52	4.89	5.28	5.70	6.15	6.65	7.18	7.75	8.37	9.04	9.77	10.55	11.39	12.30	13.29	14.35	15.50	16.74	18.08	19.52	21.08	22.77	24.59	26.56	28.68	30.98	33.46	36.13	
8) Annual Revenue (Ksh.1000)	9190	10453	11890	13522	15217	17125	19272	21688	24403	27459	30898	34769	39123	43975	47492	51292	55395	59827	64613	69782	75365	81394	87905	94938	102533	110735	119594	129162	139495	150654	162706	175723	189781	204963	221360	
3. Gilgil Town (Bulk Water Supply)																																				
1) Water Demand (1000m ³ /year)	1839	1919	2002	2089	2194	2305	2421	2542	2670	2803	2943	3091	3245	3407	3577	3756	3944	4141	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	
2) Total Sales Volume (1000m ³ /year)	1839	1919	2002	2089	2194	2305	2421	2542	2670	2803	2943	3091	3245	3407	3577	3756	3944	4141	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349	4349
3) Sales Volume from Other Sources (1000m ³ /year)	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503	1503
4) Incremental Sales Volume (1000m ³ /year)	336	416	499	535	619	709	803	903	1008	1123	1245	1373	1508	1650	1800	1958	2123	2293	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	
5) Adjustment by Regulation** (1000m ³ /year)	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	
6) Incremental Adjusted Volume (1000m ³ /year)	336	416	499	535	619	709	803	903	1008	1123	1245	1373	1508	1650	1800	1958	2123	2293	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	2468	
7) Unit Water Rate (Ksh./m ³)	2.64	2.85	3.08	3.32	3.59	3.88	4.19	4.52	4.89	5.28	5.70	6.15	6.65	7.18	7.75	8.37	9.04	9.77	10.55	11.39	12.30	13.29	14.35	15.50	16.74	18.08	19.52	21.08	22.77	24.59	26.56	28.68	30.98	33.46	36.13	
8) Annual Revenue (Ksh.1000)	887	1185	1536	1780	2224	2748	3363	4084	4925	5926	7092	8449	10025	11841	12789	13812	14917	16110	17399	18791	20294	21917	23671	25564	27609	29818	32204	34780	37562	40567	43813	47318	51103	55191	59607	
4. Gilgil Town (Other)																																				
1) Water Demand (1000m ³ /year)	748	799	852	909	965	1025	1088	1155	1226	1302	1382	1467	1558	1655	1758	1867	1984	2107	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	
2) Total Sales Volume (1000m ³ /year)	748	799	852	909	965	1025	1088	1155	1226	1302	1382	1467	1558	1655	1758	1867	1984	2107	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239	2239
3) Sales Volume from Other Sources (1000m ³ /year)	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405
4) Incremental Sales Volume (1000m ³ /year)	344	394	448	505	561	620	683	750	821	897	977	1063	1154	1250	1353	1463	1579	1703	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	
5) Adjustment by Regulation** (1000m ³ /year)	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249	1249
6) Incremental Adjusted Volume (1000m ³ /year)	344	394	448	505	561	620	683	750	821	897	977	1063	1154	1250	1353	1463	1579	1703	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	1834	
7) Unit Water Rate (Ksh./m ³)	3.30	3.78	4.08	4.40	4.76	5.14	5.55	5.99	6.47	6.99	7.55	8.15	8.80	9.51	10.27	11.09	11.98	12.94	13.97	15.09	16.30	17.60	19.01	20.53	22.17	23.94	25.86	27.93	30.16	32.58	35.18	38.00	41.04	44.32	47.86	
8) Annual Revenue (Ksh.1000)	1202	1488	1826	2224	2688	3186	3791	4495	5314	6269	7378	8664	10156	11876	12826	13852	14960	16157	17449	18845	20353															

