Chapter 5 Recommendations

CHAPTER 5

RECOMMENDATION

5-1 Regional Characteristics

The project area was divided into two areas : Coastal area and Hinterland. Regional characteristics of these two areas are stated below.

5-1-1 Coastal area

Diarrhea and other diseases such as cholera have being studied in this area. The area is almost flat and covered with dry sandy soil and partly with silt or clay. In this area, small villages and labour camps are scattered throughout the area. Each village and camp consists of 30 to 50 houses.

The domestic water source for the people in this area depends mostly on shallow wells which are about 2.5 m in diameter and 5 to 10 m deep. The quality and capacity of the wells are satisfactory for domestic use.

The windmill with hand pump type is proposed as the water supply facilities and washing area and bathing sheds are planned as supply facilities and washing area and bathing sheds are planned as supplemental facilities.

5-1-2 Hinterland

Schistosomiasis has been studied in this area. The Hinterland is located in a hilly area with some rock outcrops. The elevation of this area is about 150 m above sea level. Although the Pemba River and its tributaries which run near the area are

a major source for domestic water, the river water is polluted by Schistosomiasis Haematobium.

The most effective countermeasure for this sistosomiasis pollution therefore, is to prevent people from having contact with the river water, not only for drinking but also for washing and bathing.

It is therefore proposed to obtain domestic water by withdrawal from the pipeline for Mombasa city which is considered to be the only available safe water source for this area.

5-2 Operation and Maintenance

5-2-1 Coastal area

As stated above, ample safe water can be obtained easily in this area in comparison with the Hinterland. Operation and maintenance of a safe water supply system, however, will be in an area where there are some problems to be resolved. As observed at some sites in the coastal areas, windmills and hand pumps have been abandoned either because of mechanical problems or a lack of spare parts. It is obvious that the payment for domestic water is not an easy matter for the people in the project area since they are a low income group. Without provision for proper operation and maintenance, however, it is almost impossible to have safe and clean domestic water.

For this purpose, operation and maintenance should be provided either by the sugar company or the people who benefit from the facilities on a self-reliance (self-help) basis. The items required to be provided for operation and maintenance of the safe water supply are as follows:

1. Social education
2. Periodic inspection of the water supply facilities
3. Technical knowledge and training with respect to simple mechanical repairs
4. Acquisition of the necessary spare parts and adequate funds for repairs

In order to provide these items, it is proposed that a kind of community organization be established by the beneficiaries, the sugar company and a local public institution.

5-2-2 Hinterland

At present, water is available for this area from the Mombasa pipeline. This water, however, is only available for a fixed water charge. This water charge has a definite economic impact on the low income people in the area.

It was agreed by MOWD in Mombasa to withdraw domestic water from the pipeline for the people living in the area. At a meeting with Prof. Muganbi in KMRI we were informed that the Government of Kenya will possibly assist in subsidizing the water charge payments. Based on this information, therefore, three intakes were proposed to be installed along the pipeline and suitable washing spaces and bathing sheds were planned as supplementary facilities. The use of the proposed facilities after completion will depend upon the people's participation in the expenses. Before the implementation of the plan in the area, therefore, it is necessary to establish an operation and maintenance organization and water usage control system, to confirm the people's share in the cost of water use and to educate the people in the area about the importance of safe water use for eradication of schistosomiasis.

5-3 Regional Environmental Arrangements

Although the objective of this survey was limited only to the planning of a safe water supply system, drastic countermeasures against communicable diseases such as regional environmental controls are necessary.

From the view point of wide and long-term planning, a river improvement plan and improvement and expansion of the drainage net work system etc. should be planned and phased into operation in order to avoid inundation of villages or camps.

In the area of the Hinterland, periodic cleaning and disinfection of the Pemba River and its tributaries are necessary for the eradication of schistosomiasis Haematobium. The construction of bridges over the river mentioned above is also one of the effective contermeasures for prevention of Schistosomiasis. Large capital investment and a long term schedule might be required in order to implement those countermeasures mentioned above. Environmental arrangements within areas such as establishment of dumping yards, improvement of the drainage system for sewage and latrines or toilets are economical ways and mandatory for the prevention of breeding of diseases insect carriers such as mosquitoes, flies, lice, ticks and so on.

5-4 Public Health Education

Provision of safe water for the people and suitable environmental controls in the project area are mandatory as countermeasures against communicable diseases.

Perpetual medical facilities, doctors, medicine and so on are necessary in the project area. Public health education and information stated below, however, should be disseminated and implemented for the people in the project area.

(1) Dissemination of basic knowledge about communicable diseases.

(2) Rigid enforcement of personal hygione i.e. cleaning their hands and feet, food, tableware and so on.

For the prevention of contagions diseases or those spread by mouth infection rigid enforcement of clean food and tableware, and maintenance personal hygions (clean hands and feet) are mandatory. In the Hinterland, urination in the river is strictly prohibited.

(3) Cleaning of water storage buckets

Domestic water will be stored in the buckets for each household after the proposed water supply plan is completed. It is mandatory that the water storage buckets or containers always be kept clean.

(4) Extermination of obnoxious insects

Disease carrier, insects such as mosquitoes, flies, lice, and etc. will breed in the dumping yards, toilets or latrines, and storm water puddles or ponds. Periodic disinfection of disease carrier insect breeding grounds is mandatory for prevention of contagion or infection with diseases.

In order to disseminate health education as stated above, a substantial school and health center are required.

5-5 Construction of Safe Water Facility

This construction will be carried out basically by local contractors. Considering the dry and sandy soil condition, construction should be done very carefully to avoid collapse of side wall (i.e. foundation work). Near the sea side, materials must be chosen that will be resistant to deterioration by salt air. If metals are used then painting must be done carefully to prevent corrosion.

In Hinterland, since domestic water will be withdraw from the Mombasa pipeline, construction of connections and supply meters should be carried out under the supervision of MOWD. Except for the aforementioned construction the remaining facilities will be constructed within the Project. Frequent communications between MOWD and the Project team are required in order to avoid inconsistencies in construction.

APPENDIX

APPENDIX

1 MEMBERS OF THE TEAM

2 ITINERARY OF THE TEAM

3 LIST OF OFFICIALS CONCERNED

4 LIST OF COLLECTED DATA

5 GEOELECTRIC RESISTIVITY SURVEY DATA

6 EXISTING WELL DATA (4 Camps)

7 EXISTING WELL DATA (Around Project area)

8 GEOLOGICAL MAP OF THE COASTAL AREA

9 CLIMATOLOGICAL DATA

10 POPULATION DATA

11 CONSTRUCTION COST DATA

12 STANDARD DESIGN OF WATER SUPPLY FACILITY

13 PHOTOGRAPHS

APPENDIX 1 MEMBERS OF THE TEAM

SAFE WATER SUPPLY DETAILED DESIGN SURVEY

UNDER

THE COMMUNICABLE DISEASES RESEARCH AND CONTROL PROJECT TEAM

Katsumoto AKAGI	Team Leader Sanitation Facilities Planner	Deputy Director Waste Management Division Ministry of Health & Welfare (Japanese Government)
Kazunobu ONOGAWA	Water Supply Planner	Deputy Director Water Supply Division Ministry of Health & Welfare (Japanese Government)
Yoshihisa KONDO	Project Coordinator	Japan International Cooperation Agency (J.I.C.A.)
Nagashige YOSHITAKE	Hydrogeologist & Water Source Planner	Technical Adviser Pacific Consultants Inter national (P.C.I.)
Gunjiro OZAWA	Facility Planner	(P.C.I.)
Masami KONDO	Water Supply Planner	(P.C.I.)

APPENDIX 2 ITINERARY

Date	Mr. K.Akagi Mr. K.Onogawa Mr. Y.Kondo	Mr. N.Yoshitake Mr. G.Ozawa	Mr. M.Kondo
Jan.17	Leave Narita 21:00 AF 273		
18	Arrive Paris 05:50		
19	Leave Paris 19:50 AF 467		
20	Arrive Nairobi 7:25 Courtesy call at Japanese Embassy. JICA Nairobi office. Meeting with Japanese experts. Courtesy call on Prof. Muganbi (KMRI Ministry of Reagion Department).		
21	Meeting with Japanese experts at Kenyata National Hospital. Courtesy call on Mr. K.S.A.Jeneby (Deputy Secretary of MOWD).		
22	Courtesy call on Dr. S.Kanani (Deputy Director of Medical Service, MOH). Courtesy call on Mr. M.G.Saini(Deputy Director of MOST). Internal meeting at JICA Nairobi office.		
23	Move to Mombasa.		
24	Courtesy call on Mr. I.C.O.Omeri (Provincial Public Health Office). Visit to Mombasa District Hospital. Observations at Msambweni water supply. Investigation of Fahamuni camp. Visit to Ramisi suger factory. Visit to Kinango Division.		
25	Visit to Ramisi suger factory. Investigation of Buibui camp and Mwachinga village. Internal meetingat the hotel.		
26	Observation of local contractor in Mombasa city. Courtesycall on Mr. Mwaura (Magurini Settlement Officer).		
27	Return to Nairobi.	Sampling water Field investi- gstion of the existing wells.	Return to Nairobi.
28	Meeting with Prof. Muganbi,Dr. Tairu Visit to Japanese Embassy and JICA.	Field investi- gation. Water quarity test.	Same as Mr. Akagi.

Date	Mr. K.Akagi Mr. K.Onogawa Mr. Y.Kondo	Mr. N.Yoshitake Mr. G.Ozawa	Mr. M.Kondo
Jan.29	Data arrangement.	Field investigation. Geoelectric resistivity survey. (Mwachinga Village)	Return to Diani. (Survey site)
30	Leave Nairobi.	Data arrangement.	
31		Geoelectic resistivity survey at Kanana & Kidimu camp.	Data collection at MOWD Mombasa. Procurement for yield test.
Feb. 1		Geoelectric resistivity survey at Fahamuni & Buibui camp. Topographic survey.	Data collection at MOWD Mombasa.
2		Geoelectic resistivity survey and Topographic survey at Buibi camp.	Survey at Ukunda area. Data arrangement.
3		Yield test at Kanana & Fahamuni camp Topographic survey at Fahamuni camp.	
4		Field investigation of the existing wells. Check of the yield amount at the Buibui spring.	
5		Data collection at Ramisi suger factory. Investigation at Kiwanbale camp and water supply facility of the factory.	Field investigation of Mwachinga Vil. with Mr. Shine. (Officer of MOWD, Kwale)
6		Data arrangement.	
7		Data collection at Msambweni District Hospital,MOWD Mombasa and local constructor.	

Date	Mr. K.Akagi Mr. K.Onogawa Mr. Y. Kondo	Mr. N.Yoshitake Mr. G.Ozawa	Mr. M.Kondo
Feb. 8		Meeting with Mr. Ali (MODD Nairobi) about the MOWD rural water supply project study area. Move to Tsavo from Mombasa.	
9		Move to Nairobi from Tsavo. Visit to JICA Nairobi office. Meeting with Japanese experts at Medial Research Center.	
10		Data collection at Mines and Geological Department. Meeting with Japanese experts. Courtesy call at Japanese Embassy and JICA	
13		Leave Nairobi 00:30 BA 054 Arrive London 06:05	
14		Leave London 12:10 BA 005	
15		Arrive Narita 15:30	

APPENDIX 3 LIST OF OFFICIAL CONCERNED

1. Ministry of Regional Development, Science, and Technology
    1) Mr. M. G. Saini, Deputy Minister
    2) Mr. Kiruja Rachiami, Under Secretary
    3) Mr. Mbatau Kaburu Wangai, Senior Asst. Secretary
    4) Prof. M. Muganbi, Acting Director, Kenya Medical Research Institute
    5) Mr. A. R. Gathogo, Administrative Officer, Kenya Medical Research Institute

2. Ministry of Health
    1) Dr. S. Kanani, Deputy Director, Medical Services

3. Ministry of Water Development
    1) Mr. K. S. A. Jeneby, Deputy Secretary
    2) Mr. Ali Sheikh

4. Ministry of Works and Housing
    1) Mr. Gideon Gitonga,

5. Ministry of Land & Settlement
    1) Mr. J. T. Mwaura, Settlement Manager, Provincial Settlement, & Controller, Dept. of Land Adjustment, Coast Provincial Headquarters
    2) Mr. Saini, Magarini Settlement Scheme
    3) Mr. Jujambili, Provincial Planning Officer, Coast Provincial Headquarters

6. University of Nairobi
    1) Dr. Kihuhibu Thairu, Chairman, KEMRI, & Head of Dept. of Micro Physiology
    2) Dr. Jean W. Inuugu, Dept. of Medical Physiology

7. Coast Provincial Headquarters

1) Dr. Kulumba Wamangala, Provincial Medical Officer, and Director General of Mombasa General Hospital
2) Dr. I. C. O. Oneri, Provincial Public Health Officer,
3) Mrs. Josphine Azsnga, Deputy Provincial Public Health Officer

8. Coastal Zone (Kidumu & Buibui) : Kwale District

1) Dr. Kure, Medical Officer of Health, Kwale District Headquarter, Kwale District Hospital
2) Mr. Evic J. Odongo, Public Health Officer, Musanbweni Hospital
3) Mr. Macharia, District Health Technician Officer, Musanbweni Hospital
4) Mr. Idi H. Boga, Public Health Technician, Mombasa Location
5) Mr. Jimon R. Machavia, District Health Education Officer
6) Mr. Peuben K. Kabil, District Officer, Southern Division
7) Mr. Bveno Bongo, Operator, Water Supply District Office
8) Mr. Muganga, Ministry of Water Development, Mombasa
9) Mr. Nuthanvi, -"- -"- , Mombasa
10) Mr. H.S.C. Fonseka, -"- -"- , Tiwi

Sugar Factory:

11) Mr. Ramanbhai M. Patel, General Manager
12) Mr. M. J. Desai, Asst. General Manager
13) Mr. John M. Mulli, Asst. Manager on Personnel Affairs
14) Mr. Ramsi, Asst. Manager
15) Mr. Maurice Barasa, Industiral Relations Officer

9. Hinterland Zone (Mwachinga) : Kwale District

1) Mr. G. W. Otieno, District Officer for Kinango Location, Kinango Division, Kwale District
2) Mr. Yusuf M. Nyawa, Location Chief, Kinango Location, Kinango Division
3) Mr. Sher Shign, Ministry of Water Development, Kwale

Main Laboratory, Kwale District, Mombasa:

4) Mr. David Moreo, Vector-borne Disease Division
5) Mr. Ramddan Musa, Lugogo, Vector-borne Division
6) Mr. George Bebora, Vector-borne Disease Division

Pwani Fabricators (Wind Mill)

7) Mr. Hashem Esmail Sodha, Executive Director,
8) Mr. Mussa Esmail, Executive Director,
Mowabundu Road, Industrial Area, Mombasa

10. Embassy of Japan

1) Mr. Takayaoshi Hagiwara, First Secretary
2) Mr. Masataka Hayama, First Secretary

11. J.I.C.A. Office

1) Mr. Susumu Yanai, Head Officer
2) Mr. Hayao Takenaka
3) Mr. Shunichi Nagashima
4) Mr. Iwasaki

12. Experts of THE COMMUNICABLE DISEASES RESEARCH AND CONTROL PROJECT

1) Dr. Tatsuro Naito
2) Dr. Yasuo Chiba
3) Dr. Masaaki Shimada
4) Dr. Toshiaki Hayashi
5) Dr. Masahiko Ehara
6) Dr. Katsuyuki Sato
7) Dr. Chiaki Miyazaki

APPENDIX 4 LIST OF COLLECTED DATA

1. REFERENCES

(1) STATISTICAL ABSTRACT 1979
Central Bureau of Statistics
Ministry of Economic Planning and Community Affairs

(2) Kenya Statistical Digest June 1981 Vol. XX - No.2
- ditto - Sept.1981 Vol. XX - No.3
- ditto - Dec. 1981 Vol. XX - No.4
- ditto - Mar. 1982 Vol.XXI - No.1

(3) Construction Cost Index Dec. 1975
Central bureau of statistics
Ministry of finance & planning Dec. 1975

(4) Consumer Price Indices Nairobi
- ditto - Mar. 1977

(5) 1982/1983 ESTIMATES OF REVENUE OF TH
OF THE GOVERNMENT OF KENYA 30th June, 1983

(6) KENYA: A Study in Physical and Human Geography

(7) Planning for Progress:
Our Fourth Development Plan
A Short Version of the Development Plan 1979 - 1983

(8) ECONOMICAL SURVEY, 1981
Central Bureau of Statistics Ministry
of Economic Planning and Development

(9) Report of the Civil Service Review
Comittee, 1979 - 1980

(10) The Electricity Industry in Kenya

(11) A GEOGRAPHY OF EAST AFRICA

(12) GEOLOGY OF SIMBA - KIBWEZI AREA
Ministry of Commerce and Industry
Geological Survey of Kenya

(13) GEOLOGY OF THE MOMBASA AND KWALE AREA
- ditto - (Copy)

(14) COMPLETION REPORT CHUINI WATER WELL
KWALE DISTRICT
Contract No. W.B.H./78-29 (Copy)

2. MAPS

(1)	MOMBASA	SB-37/3	Scale 1:250,000
(2)	MOMBASA	201/1	Scale 1: 50,000 (Copy)
(3)	GULANZE	200/1	- ditto -
(4)	KWALE	200/2	- ditto -
(5)	NDAVAYA	200/3	- ditto -
(6)	MSAMBWENI	200/4	- ditto -
(7)	UKUNDA	201/3	- ditto -
(8)	VANGA	202/1	- ditto -
(9)	SHIMONI	202/2	- ditto -
(10)	GEOROGY MAP OF THE NAIROBI		Scale 1:125,000

3. CONSTRUCTION COST DATA

(1) Cost for Connection with Main Pipe

(2) Price Schedule for Departmental Rigs to be Charge as from January, 1980 Onwords

(3) Quotation for Repairing and Plastering of Shallow Well

(4) Quotation for Digging Shallow Well

(5) Quotation for Windmill

(6) Quotation for the Repair of Windmill on Well

4. Existing Well Data

(1) Existing Well Data of Coast Area

APPENDIX 5 GEOELECTLIC RESISTIVITY SURVEY DATA

Table A-5-1 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 1 DATE: 29 / 1 / 1983 TIME: AM.10.30

PLACE: Mwachinga POINT: No.1

WEATHER: Fine TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	D_p = G — P_1 /P_2 (a/2)	D_c = G — C_1 /C_2 (3a/2)
1	1	6.28	15.8	99.2	0.5	1.5
2	2	12.6	5.0	63.2	1.0	3.0
3	3	18.8	2.0	39.1	1.5	4.5
4	4	25.1	1.1	27.5	2.0	6.0
5	5	31.4	0.65	20.3	2.5	7.5
6	6	37.7	0.5	18.9	3.0	9.0
7	8	50.2	0.38	19.0	4.0	12.0
8	10	62.8	0.3	18.9	5.0	15.0
9	12	75.4	0.25	18.8	6.0	18.0
10	14	87.9	0.34	30.3	7.0	21.0
11	16	100	0.24	24.0	8.0	24.0
12	20	126	0.16	21.0	10.0	30.0
13	25	157	0.17	28.1	12.5	37.5
14	30	188	0.21	39.5	15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A – 5-2 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 2 DATE: 29/ 1 /1983 TIME: AM. 11.00

PLACE: Mwachinga POINT: No.2

WEATHER: Fine TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	$\rho = 2\pi a R$ (Ω - m)	$D_p = G - P_1 / P_2$ (a/2)	$D_c = G - C_1 / C_2$ (3a/2)
1	1	6.28	64	401.9	0.5	1.5
2	2	12.6	7.0	88.2	1.0	3.0
3	3	18.8	2.2	41.3	1.5	4.5
4	4	25.1	1.6	40.1	2.0	6.0
5	5	31.4	0.45	14.1	2.5	7.5
6	6	37.7	0.35	13.2	3.0	9.0
7	8	50.2	0.18	9.0	4.0	12.0
8	10	62.8	0.17	10.6	5.0	15.0
9	12	75.4	0.11	8.3	6.0	18.0
10	14	87.9	0.1	8.8	7.0	21.0
11	16	100	0.075	7.5	8.0	24.0
12	20	126			10.0	30.0
13	25	157			12.5	37.5
14	30	188			15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A- 5-3 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 3 DATE: 31 / 1 / 1983 TIME: 10.30

PLACE: Kanana POINT: No.1 near to well

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	$\rho = 2\pi a R$ (Ω - m)	$D_\rho = G - P_1 / P_2$ (a/2)	$D_c = G - C_1 / C_2$ (3a/2)
1	1	6.28	29.2	183.3	0.5	1.5
2	2	12.6	11.2	141.1	1.0	3.0
3	3	18.8	6.6	124.1	1.5	4.5
4	4	25.1	4.6	115.5	2.0	6.0
5	5	31.4	5.2	163.3	2.5	7.5
6	6	37.7	2.5	94.2	3.0	9.0
7	8	50.2	-	-	4.0	12.0
8	10	62.8	2.0	125.6	5.0	15.0
9	12	75.4	1.9	143.3	6.0	18.0
10	14	87.9	1.2	105.5	7.0	21.0
11	16	100	4.1	401.0	8.0	24.0
12	20	126	0.64	80.6	10.0	30.0
13	25	157			12.5	37.5
14	30	188			15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A– 5-4 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 4 DATE: 31 / 1 / 1983 TIME: 11.30

PLACE: Kanana POINT: No.2

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	D_p = G – P_1 /P_2 (a/2)	D_c = G – C_1 /C_2 (3a/2)
1	1	6.28	56	351.7	0.5	1.5
2	2	12.6	17.1	215.4	1.0	3.0
3	3	18.8	7.8	146.6	1.5	4.5
4	4	25.1	4.6	115.4	2.0	6.0
5	5	31.4	3.7	116.8	2.5	7.5
6	6	37.7	2.7	101.8	3.0	9.0
7	8	50.2	1.7	85.3	4.0	12.0
8	10	62.8	1.4	87.9	5.0	15.0
9	12	75.4	0.76	57.3	6.0	18.0
10	14	87.9	0.32	28.1	7.0	21.0
11	16	100	0.25	25.0	8.0	24.0
12	20	126	0.24	30.2	10.0	30.0
13	25	157	0.10	15.7	12.5	37.5
14	30	188			15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-5-5 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 5 DATE: 31 / 1 / 1983 TIME: _____

PLACE: Kanana POINT: No.3 near to stream

WEATHER: _____ TEMP.: _____

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	D_ρ = G — P_1 /P_2 (a/2)	D_c = G — C_1 /C_2 (3a/2)
1	1	6.28	155	973.4	0.5	1.5
2	2	12.6	68	856.8	1.0	3.0
3	3	18.8	35	658.0	1.5	4.5
4	4	25.1	20	502.0	2.0	6.0
5	5	31.4	9.5	298.0	2.5	7.5
6	6	37.7	4.9	170.0	3.0	9.0
7	8	50.2	1.4	70.2	4.0	12.0
8	10	62.8	0.25	15.7	5.0	15.0
9	12	75.4	-	-	6.0	18.0
10	14	87.9			7.0	21.0
11	16	100			8.0	24.0
12	20	126			10.0	30.0
13	25	157			12.5	37.5
14	30	188			15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-5-6 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 6 DATE: 31 / 1 / 1983 TIME:

PLACE: Kidimu POINT: No.1

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	D_p = G — P_1 /P_2 (a/2)	D_c = G — C_1 /C_2 (3a/2)
1	1	6.28	29	182.1	0.5	1.5
2	2	12.6	16.5	207.9	1.0	3.0
3	3	18.8	9.5	178.6	1.5	4.5
4	4	25.1	7.0	175.7	2.0	6.0
5	5	31.4	5.7	179.0	2.5	7.5
6	6	37.7	5.0	188.5	3.0	9.0
7	8	50.2	3.0	150.6	4.0	12.0
8	10	62.8	1.9	119.3	5.0	15.0
9	12	75.4	1.3	98.0	6.0	18.0
10	14	87.9	0.67	58.9	7.0	21.0
11	16	100	0.59	59.0	8.0	24.0
12	20	126	0.48	60.5	10.0	30.0
13	25	157	0.35	54.9	12.5	37.5
14	30	188	0.31	58.3	15.0	45.0
15	35	220	0.1	22.0	17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A - 5-7 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 7 DATE: 31 / 1 / 1983 TIME: 15.30

PLACE: Kidimu POINT: No.2

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	D_p = G — P_1 /P_2 (a/2)	D_c = G — C_1 /C_2 (3a/2)
1	1	6.28	-		0.5	1.5
2	2	12.6	205	2583	1.0	3.0
3	3	18.8	115	2162	1.5	4.5
4	4	25.1	59	1480.9	2.0	6.0
5	5	31.4	38	1193	2.5	7.5
6	6	37.7	19.5	735	3.0	9.0
7	8	50.2	7.2	361.4	4.0	12.0
8	10	62.8	3.2	201.0	5.0	15.0
9	12	75.4	-		6.0	18.0
10	14	87.9	1.9	167	7.0	21.0
11	16	100	5.3	503	8.0	24.0
12	20	126	17.7	2230	10.0	30.0
13	25	157	3.9	612	12.5	37.5
14	30	188	13.3	2500	15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A– 5-8 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 8 DATE: / / TIME: 16.10

PLACE: Kidimu POINT: No.3 near to well

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	D_p = G – P_1 /P_2 (a/2)	D_c = G – C_1 /C_2 (3a/2)
1	1	6.28	-		0.5	1.5
2	2	12.6	65	819	1.0	3.0
3	3	18.8	19	357.2	1.5	4.5
4	4	25.1	11.2	281.2	2.0	6.0
5	5	31.4	8.1	254.3	2.5	7.5
6	6	37.7	4.0	150.8	3.0	9.0
7	8	50.2	1.4	70.3	4.0	12.0
8	10	62.8	0.4	25.1	5.0	15.0
9	12	75.4	0.3	22.6	6.0	18.0
10	14	87.9	0.27	23.5	7.0	21.0
11	16	100			8.0	24.0
12	20	126			10.0	30.0
13	25	157			12.5	37.5
14	30	188			15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-5-9 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 9 DATE: 1 / 2 / 1983 TIME:

PLACE: Fahamuni POINT: No.1 near to well

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	D_p = G – P_1 /P_2 (a/2)	D_c = G – C_1 /C_2 (3a/2)
1	1	6.28	10.3	64.7	0.5	1.5
2	2	12.6	3.5	44.1	1.0	3.0
3	3	18.8	1.7	32.0	1.5	4.5
4	4	25.1	1.2	30.1	2.0	6.0
5	5	31.4	0.8	25.1	2.5	7.5
6	6	37.7	0.65	24.5	3.0	9.0
7	8	50.2	0.45	22.6	4.0	12.0
8	10	62.8	0.36	22.6	5.0	15.0
9	12	75.4	0.3	22.6	6.0	18.0
10	14	87.9	0.25	21.8	7.0	21.0
11	16	100	0.22	22.0	8.0	24.0
12	20	126	0.15	19.0	10.0	30.0
13	25	157	0.12	18.8	12.5	37.5
14	30	188	-	-	15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-5-10 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 10 DATE: 1 / 2 / 1983 TIME: 10.30

PLACE: Fahamuni POINT: No.2

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	$\rho = 2\pi a R$ (Ω - m)	$D_p = G - P_1 / P_2$ (a/2)	$D_c = G - C_1 / C_2$ (3a/2)
1	1	6.28	4.4.	27.6	0.5	1.5
2	2	12.6	1.7	21.4	1.0	3.0
3	3	18.8	1.1	20.7	1.5	4.5
4	4	25.1	0.84	21.0	2.0	6.0
5	5	31.4	0.73	22.9	2.5	7.5
6	6	37.7	0.60	22.6	3.0	9.0
7	8	50.2	0.50	25.0	4.0	12.0
8	10	62.8	0.36	22.6	5.0	15.0
9	12	75.4	0.34	25.5	6.0	18.0
10	14	87.9	0.30	26.4	7.0	21.0
11	16	100	0.25	25.0	8.0	24.0
12	20	126	0.18	22.7	10.0	30.0
13	25	157	0.15	23.5	12.5	37.5
14	30	188	0.11	20.7	15.0	45.0
15	35	220	0.11	24.2	17.5	52.5
16	40	251	0.09	22.6	20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-5-11 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 11 DATE: 1 / 2 / 1983 TIME:

PLACE: Fahamuni POINT: No.3

WEATHER: TEMP.: 33°

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	D_p = G − P_1 /P_2 (a/2)	D_c = G − C_1 /C_2 (3a/2)
1	1	6.28	11.5	72.2	0.5	1.5
2	2	12.6	3.9	49.1	1.0	3.0
3	3	18.8	2.1	39.5	1.5	4.5
4	4	25.1	1.7	42.7	2.0	6.0
5	5	31.4	0.85	26.7	2.5	7.5
6	6	37.7	0.77	29.0	3.0	9.0
7	8	50.2	0.52	26.1	4.0	12.0
8	10	62.8	0.49	30.7	5.0	15.0
9	12	75.4	0.5	37.7	6.0	18.0
10	14	87.9	0.37	32.5	7.0	21.0
11	16	100	0.32	32.0	8.0	24.0
12	20	126	0.15	18.9	10.0	30.0
13	25	157	0.12	18.8	12.5	37.5
14	30	188	0.11	20.7	15.0	45.0
15	35	220	-	-	17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-5-12 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 12 DATE: 1 / 2 / 1983 TIME: _____

PLACE: Buibui POINT: No.1 near to spring

WEATHER: _____ TEMP.: _____

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	$\rho = 2\pi a R$ (Ω - m)	$D_p = G - P_1 / P_2$ (a/2)	$D_c = G - C_1 / C_2$ (3a/2)
1	1	6.28	35	219.8	0.5	1.5
2	2	12.6	28	353	1.0	3.0
3	3	18.8	22	413	1.5	4.5
4	4	25.1	15	376	2.0	6.0
5	5	31.4	12	377	2.5	7.5
6	6	37.7	7.5	283	3.0	9.0
7	8	50.2	4.6	231	4.0	12.0
8	10	62.8	0.85	53.4	5.0	15.0
9	12	75.4	0.9	68.0	6.0	18.0
10	14	87.9	3.0	263	7.0	21.0
11	16	100	0.16	16	8.0	24.0
12	20	126	-	-	10.0	30.0
13	25	157			12.5	37.5
14	30	188			15.0	45.0
15	35	220			17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-5-13 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 13 DATE: 1 / 2 /1983 TIME: 15.30

PLACE: Buibui POINT: No.2

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	ρ = 2 π a R (Ω - m)	$D_p = G - P_1 / P_2$ (a/2)	$D_c = G - C_1 / C_2$ (3a/2)
1	1	6.28	40	251	0.5	1.5
2	2	12.6	23	290	1.0	3.0
3	3	18.8	13	244	1.5	4.5
4	4	25.1	8.4	211	2.0	6.0
5	5	31.4	6.4	201	2.5	7.5
6	6	37.7	5.0	188.5	3.0	9.0
7	8	50.2	3.2	160.6	4.0	12.0
8	10	62.8	2.5	157	5.0	15.0
9	12	75.4	1.9	143.2	6.0	18.0
10	14	87.9	1.8	158.2	7.0	21.0
11	16	100	0.32	32.0	8.0	24.0
12	20	126	0.57	71.8	10.0	30.0
13	25	157	0.53	83.2	12.5	37.5
14	30	188	0.29	54.5	15.0	45.0
15	35	220	0.22	48.4	17.5	52.5
16	40	251	0.39	97.9	20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-5-14 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 14 DATE: 1 / 2 /1983 TIME: 16.00

PLACE: Buibui POINT: No.3

WEATHER: TEMP.:

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	$\rho = 2\pi a R$ (Ω - m)	$D_p = G - P_1 / P_2$ (a/2)	$D_c = G - C_1 / C_2$ (3a/2)
1	1	6.28	50	314	0.5	1.5
2	2	12.6	25	315	1.0	3.0
3	3	18.8	14.8	274	1.5	4.5
4	4	25.1	9.8	246	2.0	6.0
5	5	31.4	6.4	201	2.5	7.5
6	6	37.7	4.6	173	3.0	9.0
7	8	50.2	2.6	130.5	4.0	12.0
8	10	62.8	1.7	106.7	5.0	15.0
9	12	75.4	1.1	82.9	6.0	18.0
10	14	87.9	0.71	62.4	7.0	21.0
11	16	100	0.47	47.0	8.0	24.0
12	20	126	-	-	10.0	30.0
13	25	157	0.07	11.0	12.5	37.5
14	30	188	0.3	56.4	15.0	45.0
15	35	220	0.08	17.6	17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

Table A-.5-15 DATA SHEET OF GEOELECTRIC RESISTIVITY SURVEY

SURVEY NO. 15 DATE: 2 / 2 / 1983 TIME: _____

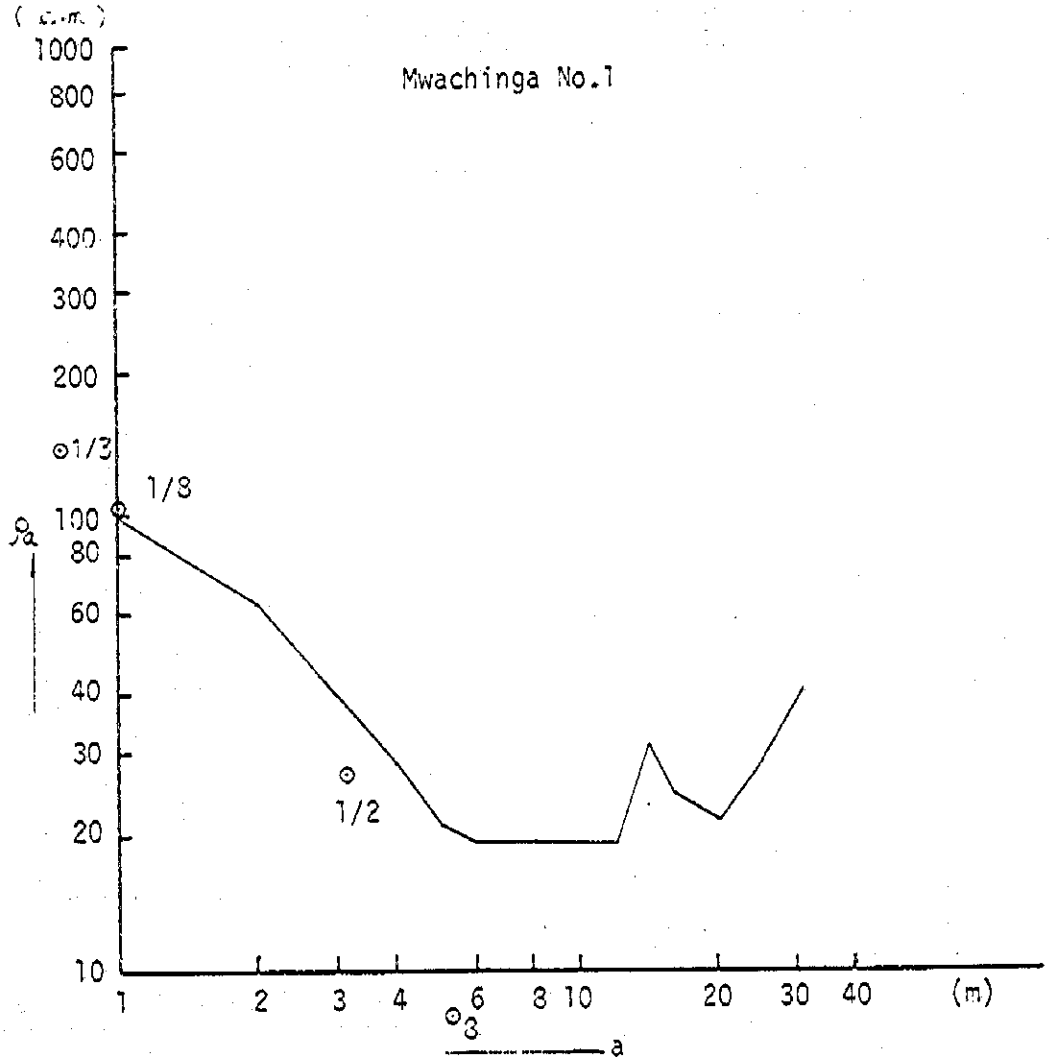
PLACE: UKUNDA POINT: No.1 near to Mr. Iddis house

WEATHER: _____ TEMP.: _____

REMARKS: Wenner's Method

NO.	a (m)	2 π a (m)	R (Ω)	$\rho = 2\pi a R$ (Ω - m)	$D_p = G - P_1 / P_2$ (a/2)	$D_c = G - C_1 / C_2$ (3a/2)
1	1	6.28	159	1000	0.5	1.5
2	2	12.6	63	794	1.0	3.0
3	3	18.8	40	752	1.5	4.5
4	4	25.1	26	652	2.0	6.0
5	5	31.4	17.1	537	2.5	7.5
6	6	37.7	14.1	531	3.0	9.0
7	8	50.2	8.0	401	4.0	12.0
8	10	62.8	6.5	408	5.0	15.0
9	12	75.4	4.6	347	6.0	18.0
10	14	87.9	5.2	457	7.0	21.0
11	16	100	3.0	300	8.0	24.0
12	20	126	7.5	945	10.0	30.0
13	25	157	-	-	12.5	37.5
14	30	188	1.2	225	15.0	45.0
15	35	220	2.2	484	17.5	52.5
16	40	251			20.0	60.0
17	50	314			25.0	75.0
18	60	377			30.0	90.0
19	70	440			35.0	105
20	80	502			40.0	120
21	100	628			50.0	150

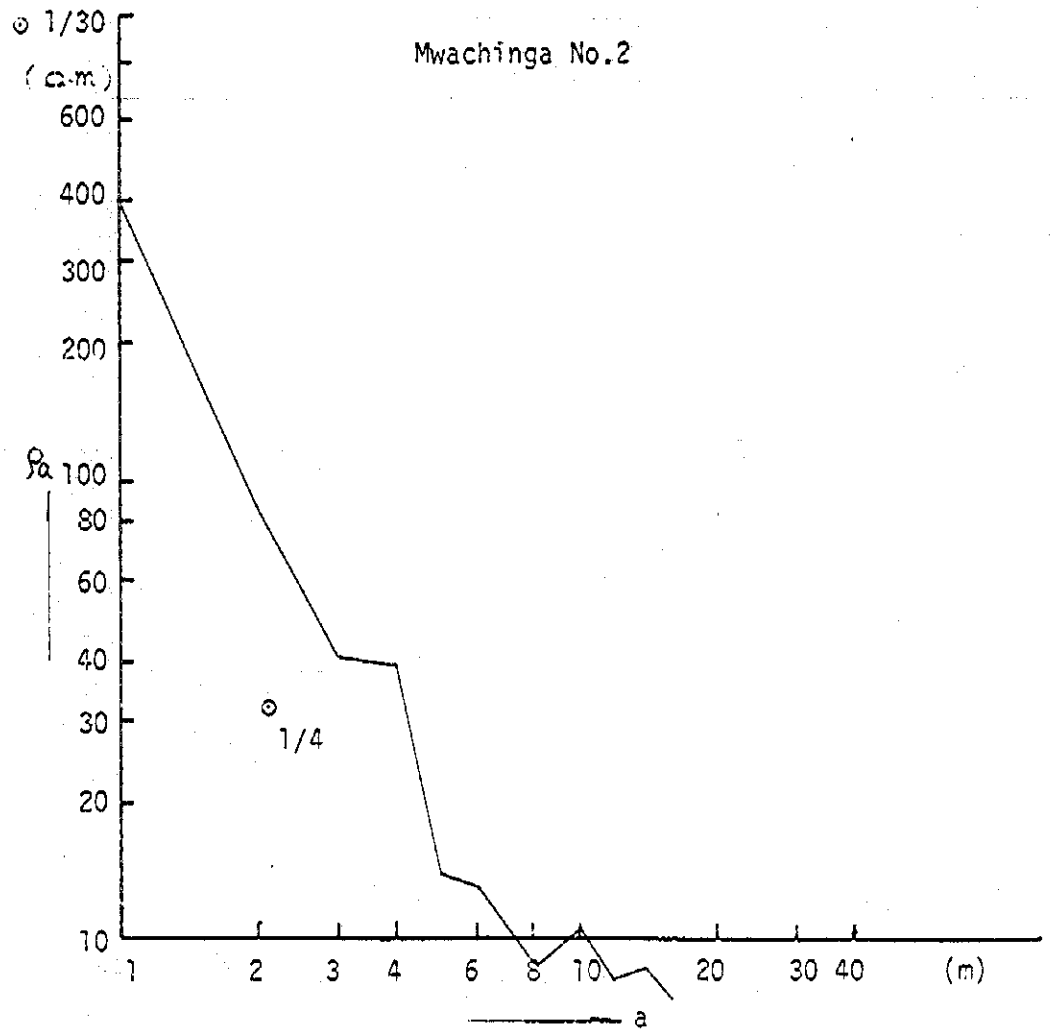
Fig. A-5-1 Geoelectric Resistivity Survey ρ-a Curve



Mwachinga No.1

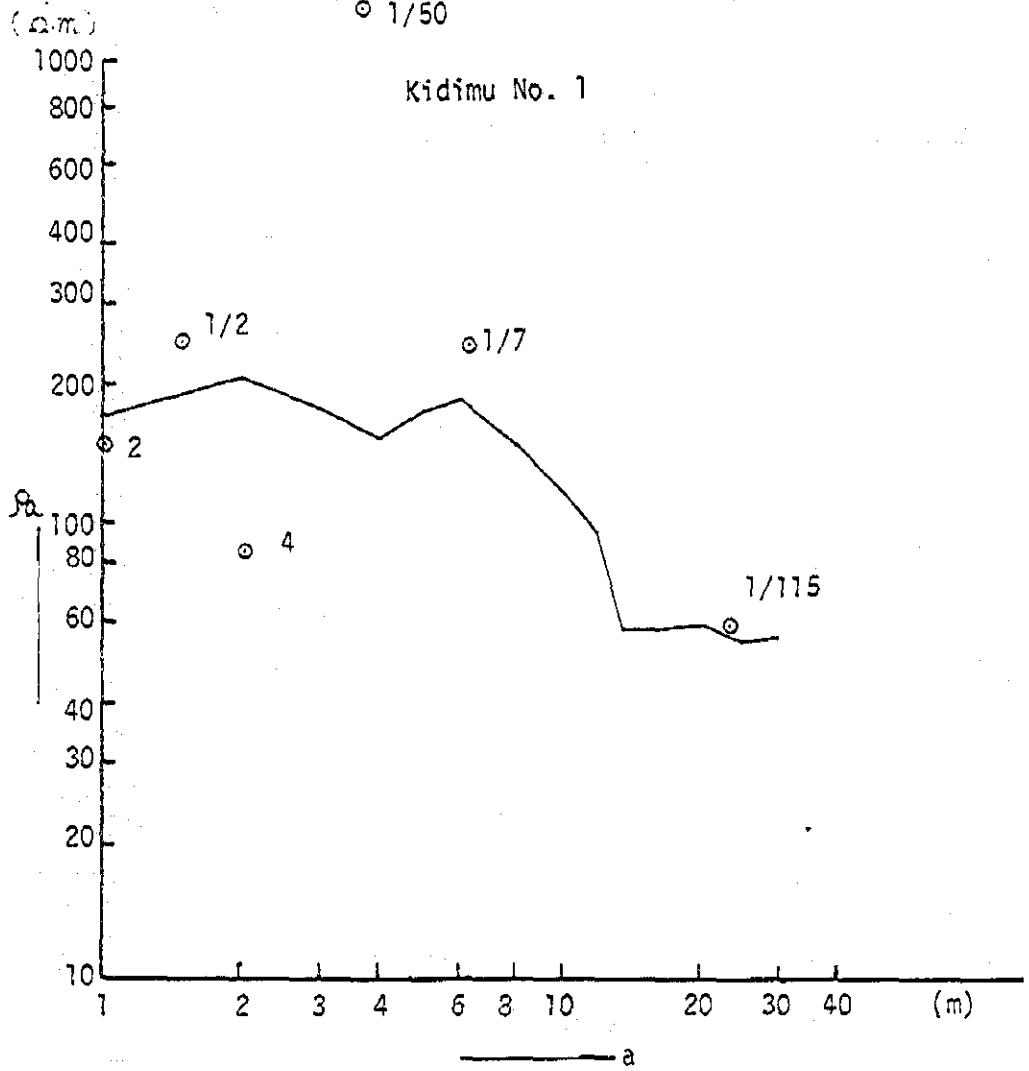
135	45	13	14	19	64 (Ω·m)

Fig. A-5-2 Geoelectric Resistivity Survey ρ-a Curve



990	33	8	(Ω-m)

Fig. A-5-3 Geoelectric Resistivity Survey ρ-a Curve



148	296	125	356	36	1	40	(Ω·m)

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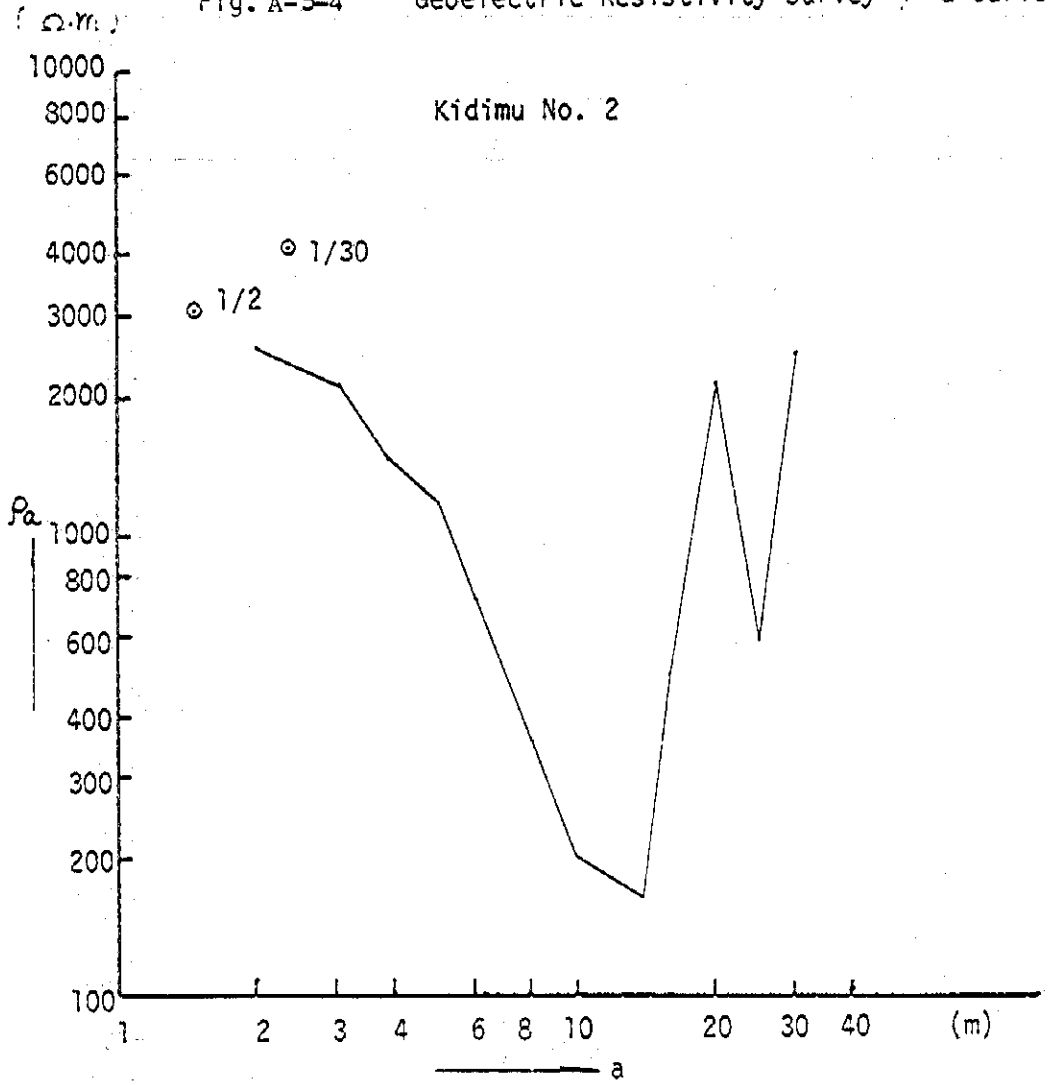
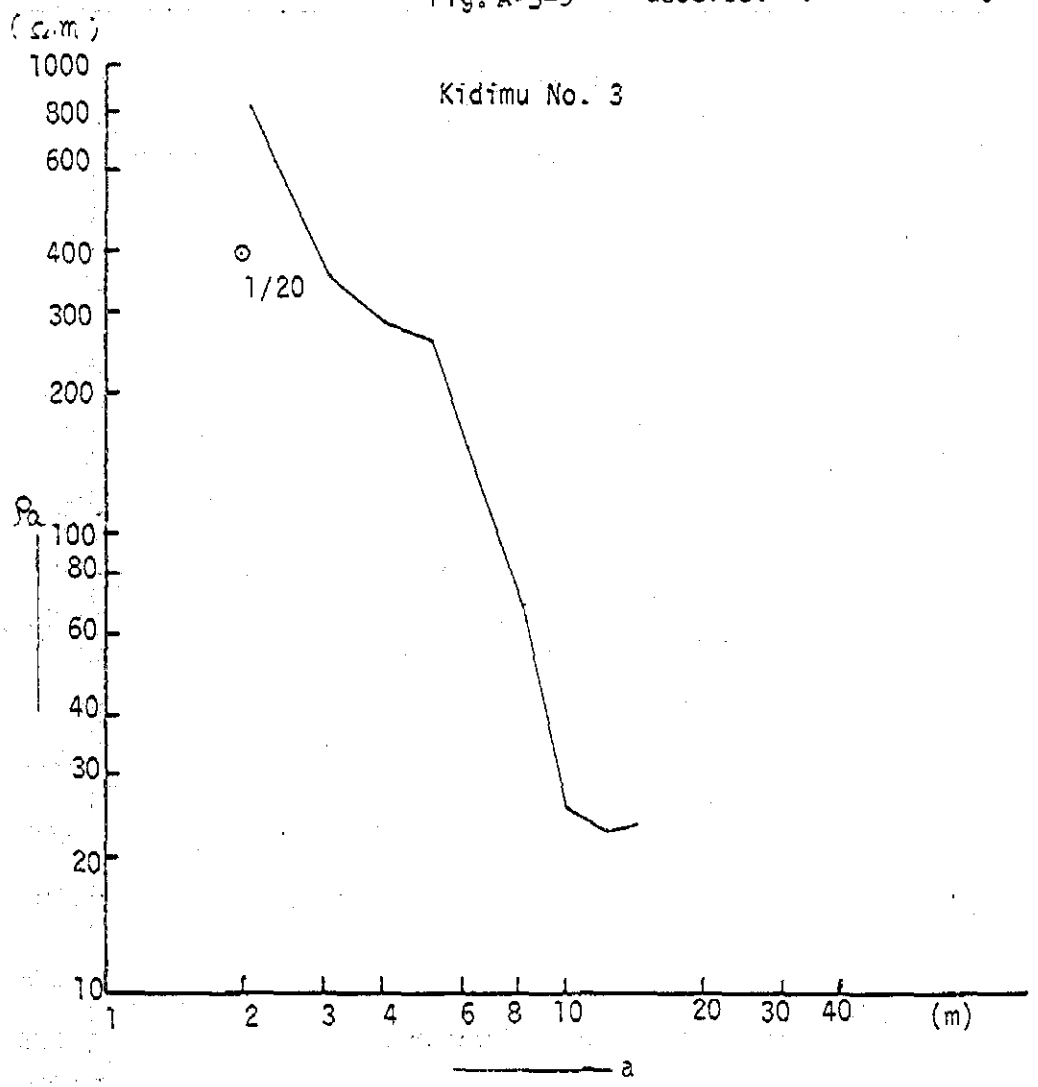
Fig. A-5-4 Geoelectric Resistivity Survey ρ-a Curve



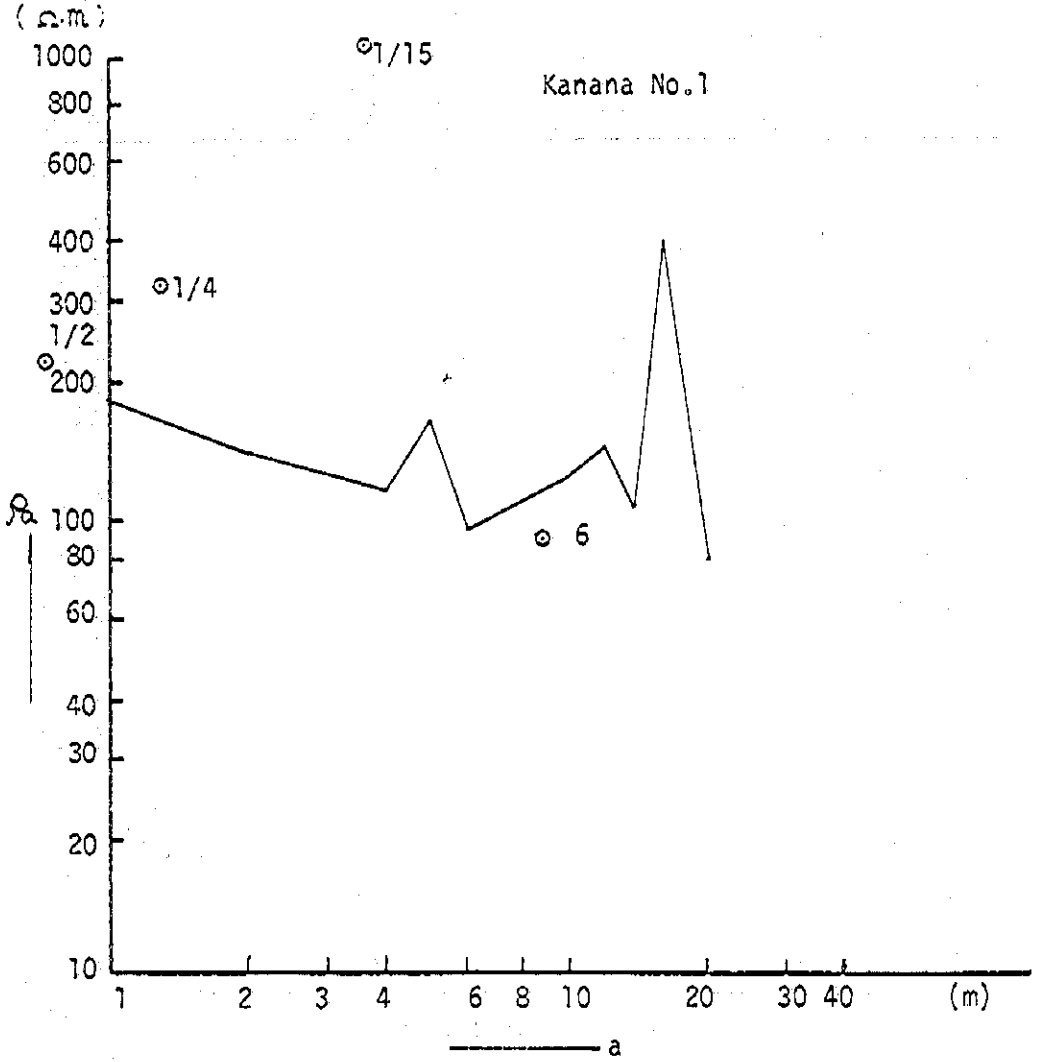
3100	1500	975	142	Unanalysable (Ω·m)

Fig. A-5-5 Geoelectric Resistivity Survey ρ-a Curve



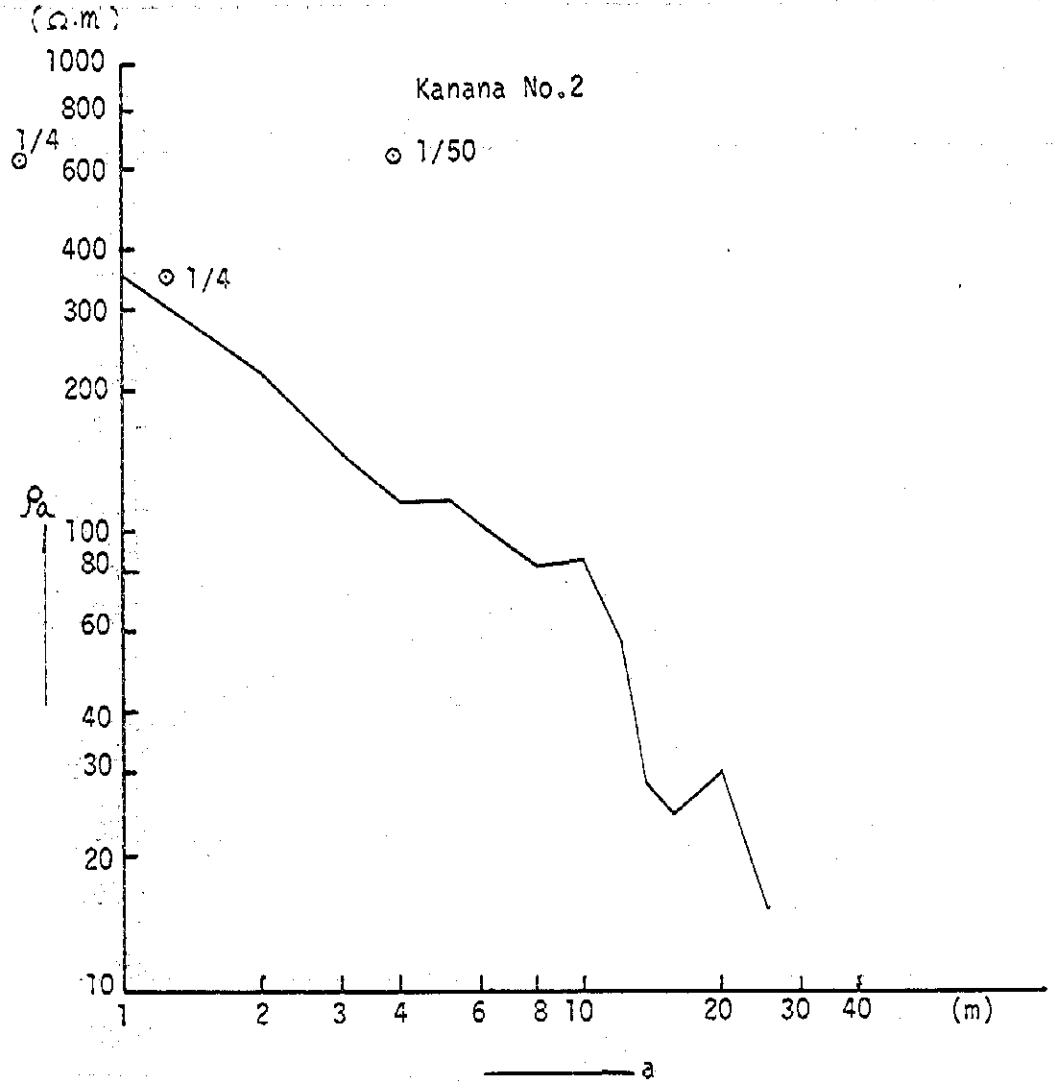
250	50	222	42	20	(Ω.m)

Fig. A-5-6 Geoelectric Resistivity Survey ρ-a Curve



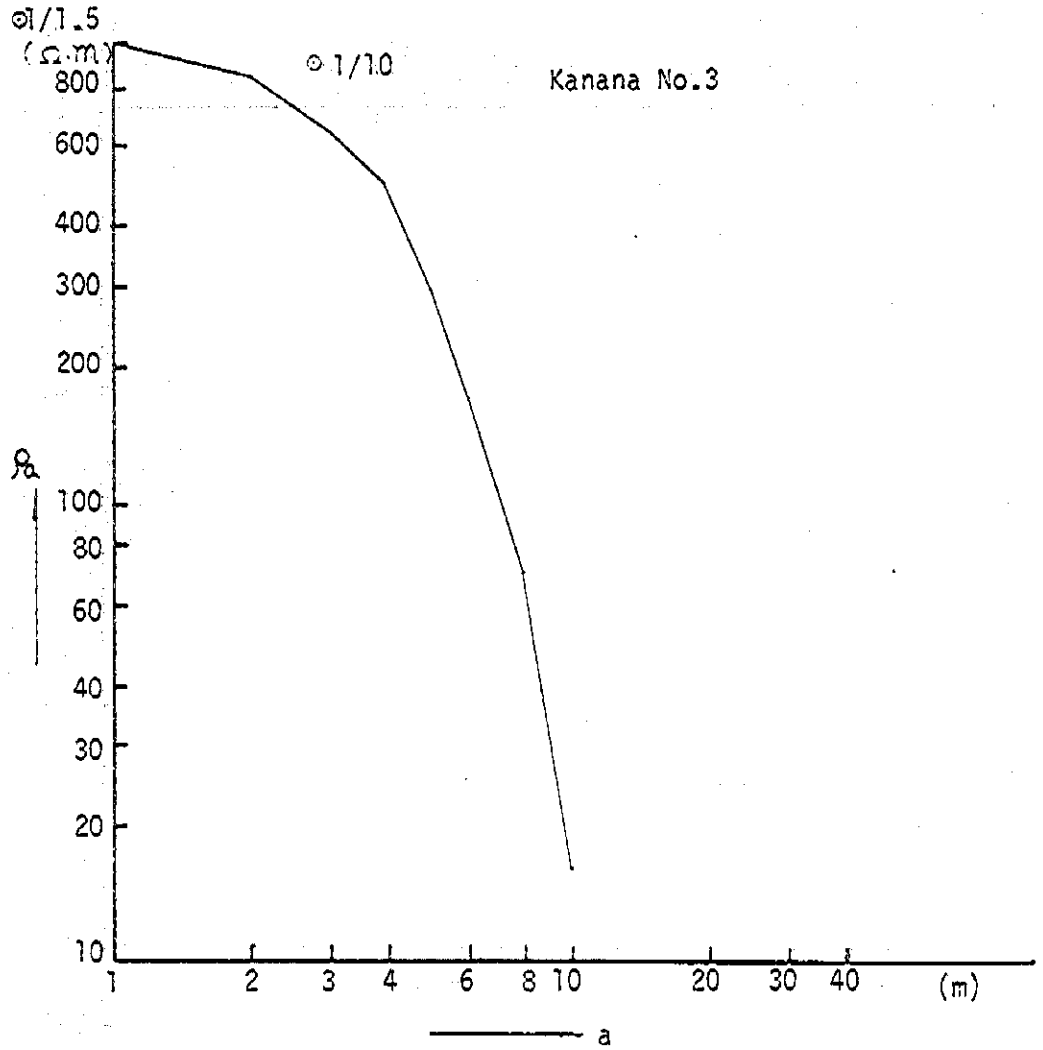
220	110	81	540	73	(Ω·m)

Fig. A-5-7 Geoelectric Resistivity Survey ρ-a Curve



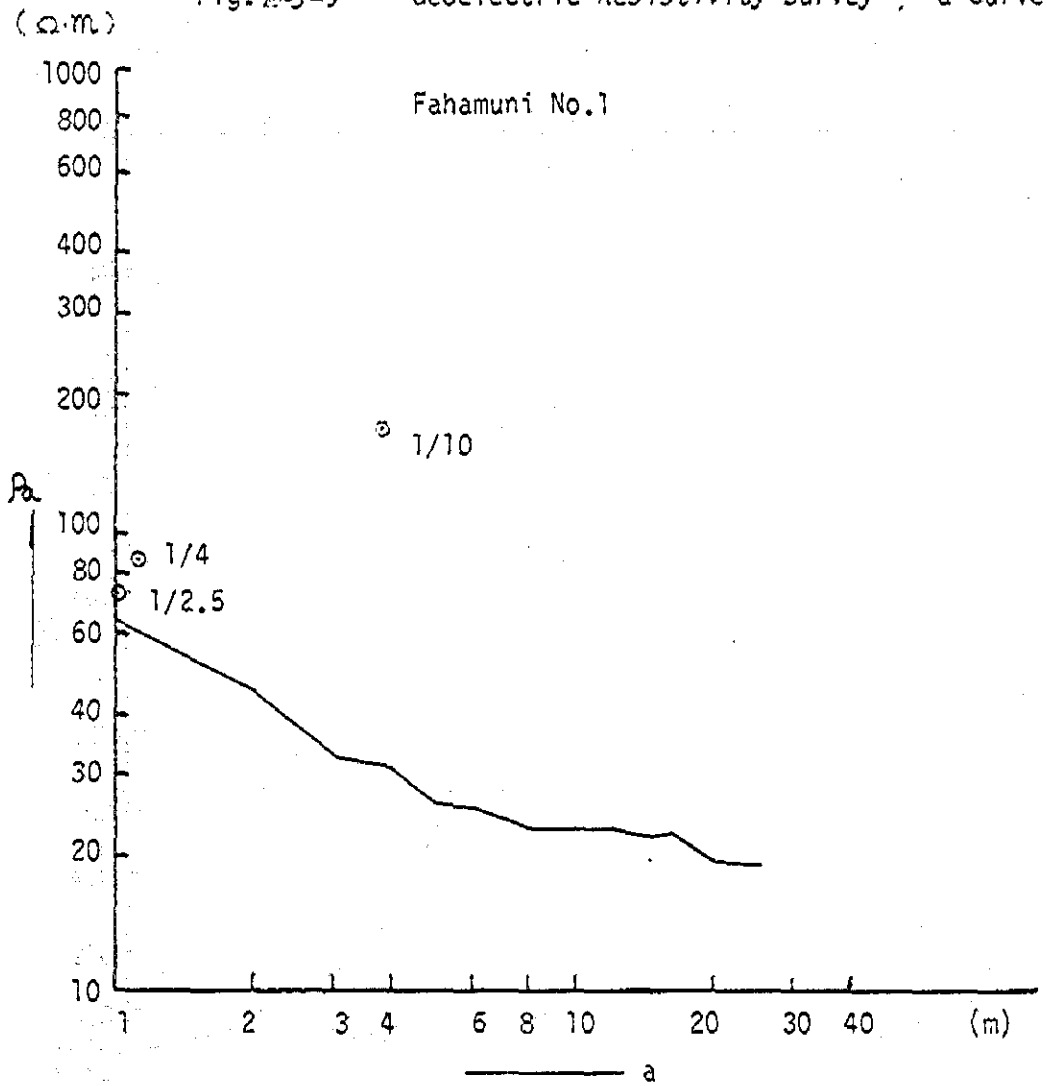
523	131	88	13	(Ω·m)

Fig. A-5-8 Geoelectric Resistivity Survey ρ-a Curve



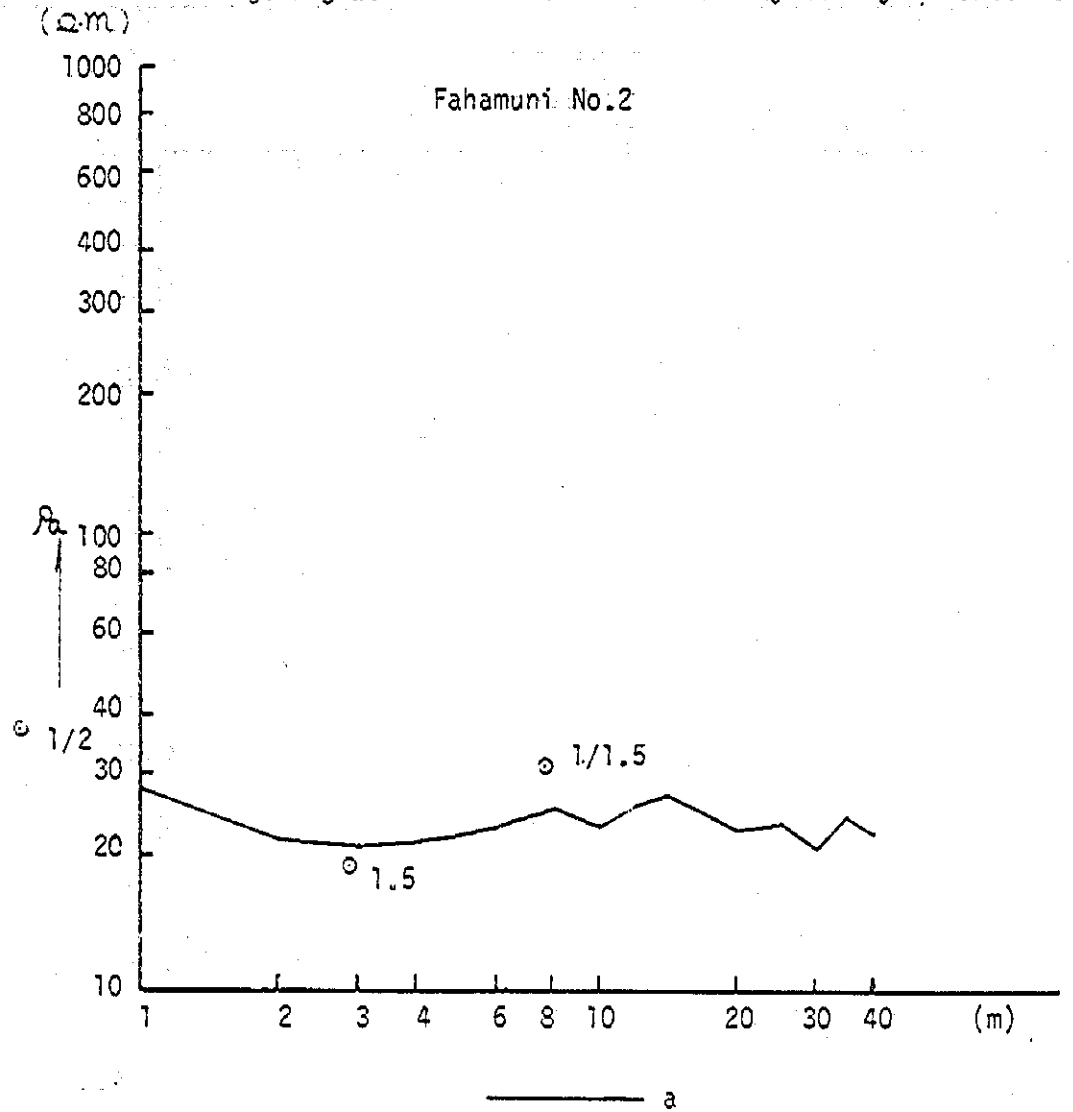
1150	767	91	45	(Ω·m)

Fig. A-5-9 Geoelectric Resistivity Survey ρ-a Curve



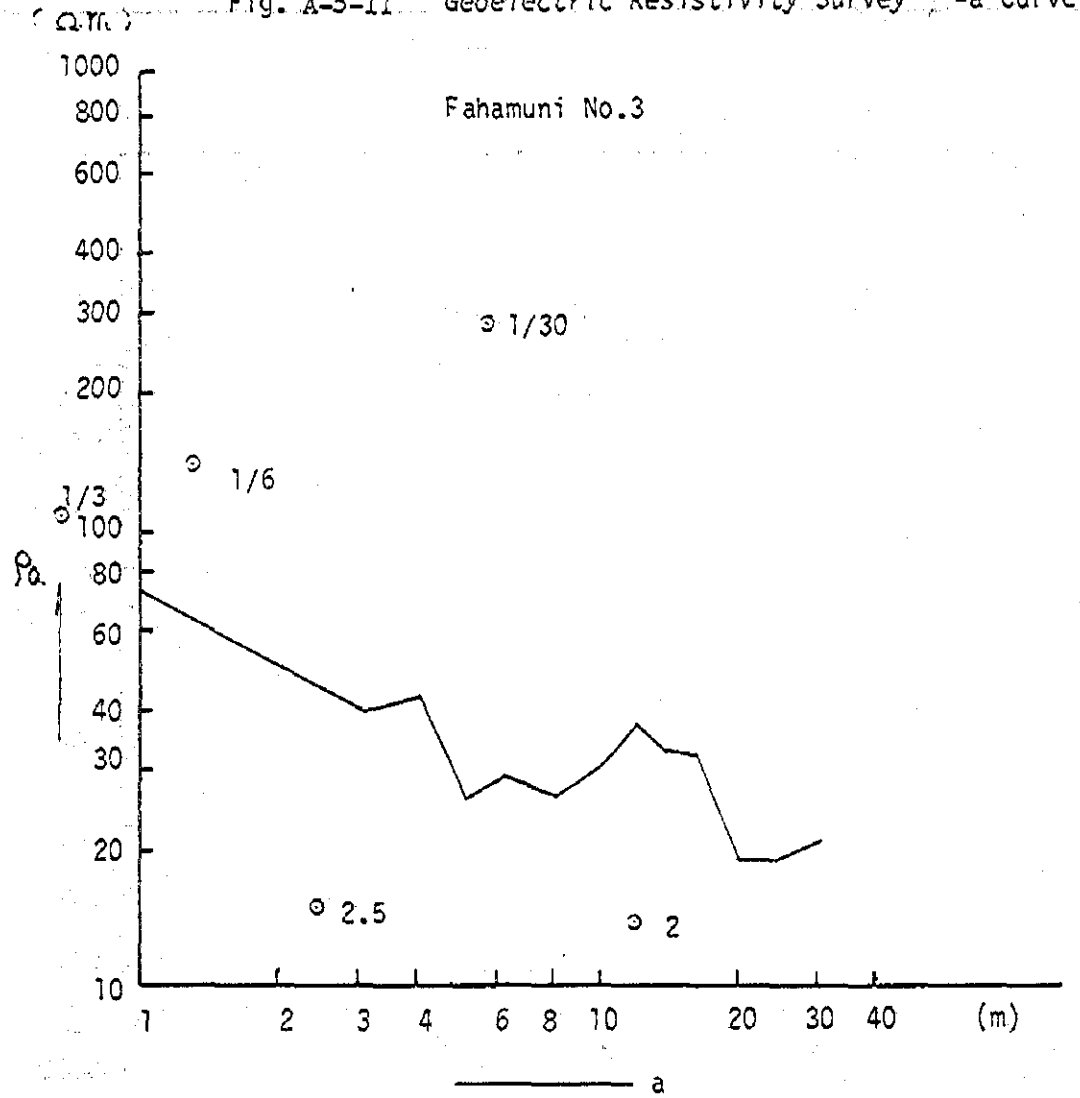
73	29	22	16	(Ω·m)

Fig. A-5-10 Geoelectric Resistivity Survey ρ-a Curve



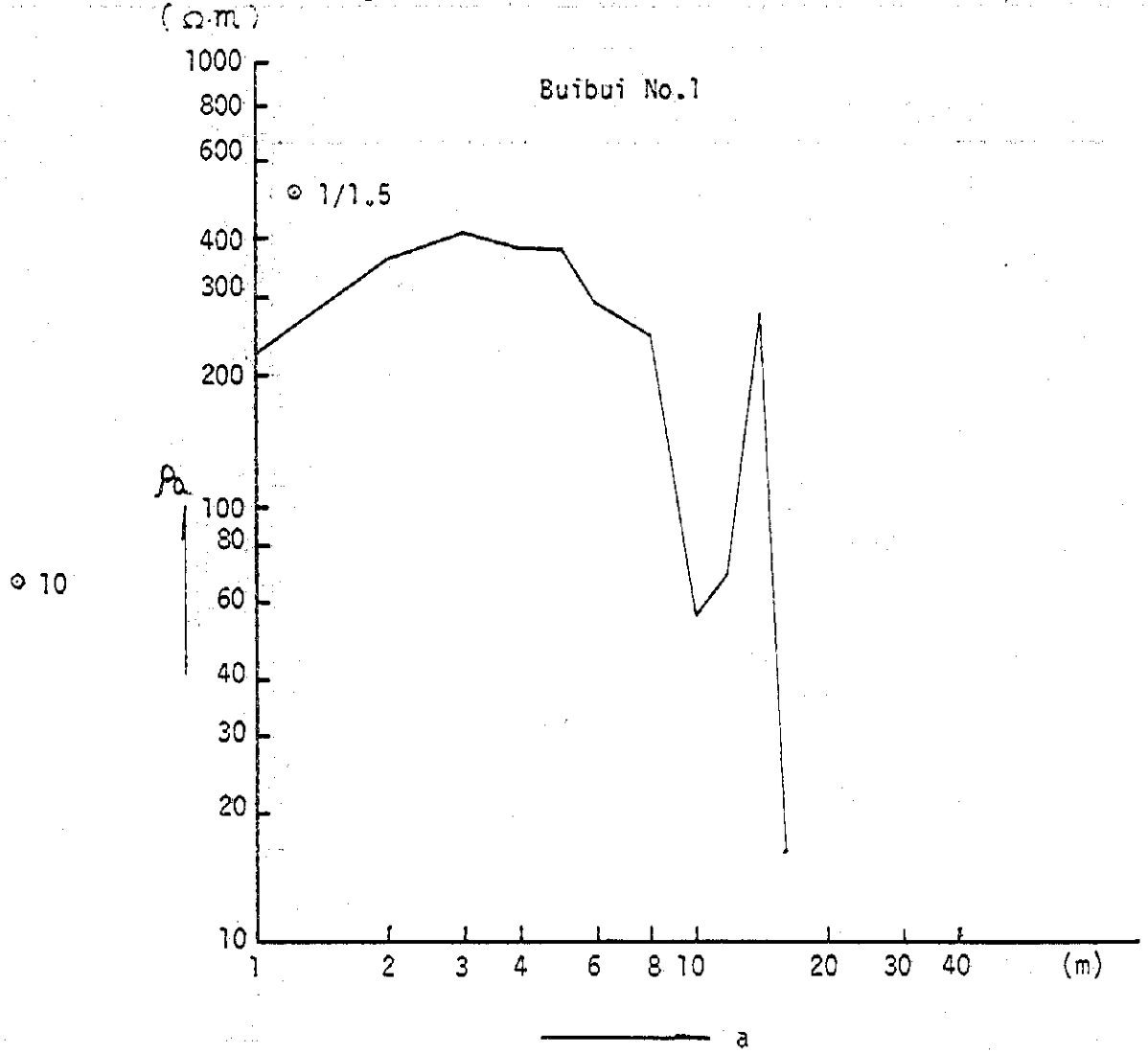
37	19	28	21	(Ω·m)

Fig. A-5-11 Geoelectric Resistivity Survey ρ-a Curve



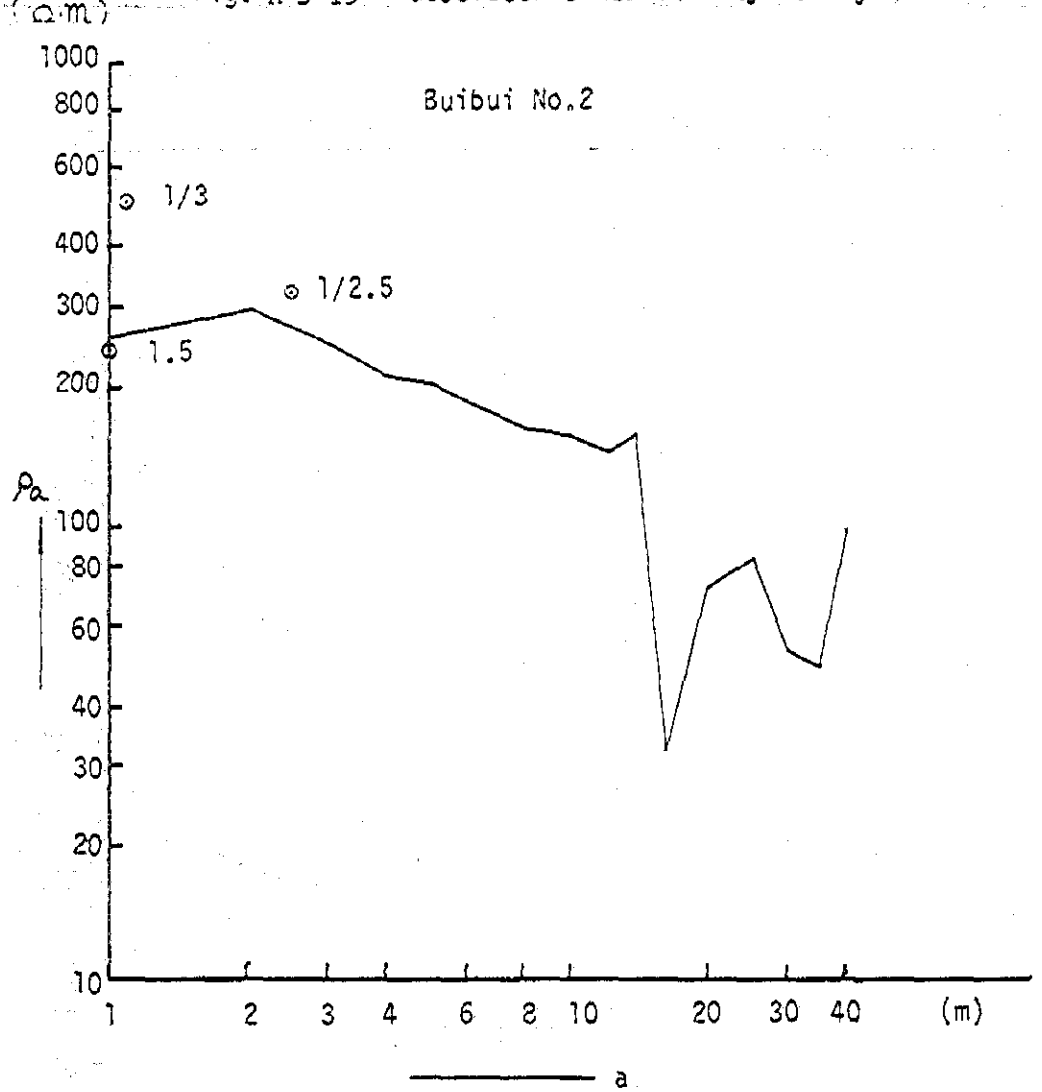
106	35	23	40	9	28	(Ω.m)

Fig. A-5-12 Geoelectric Resistivity Survey ρ-a Curve



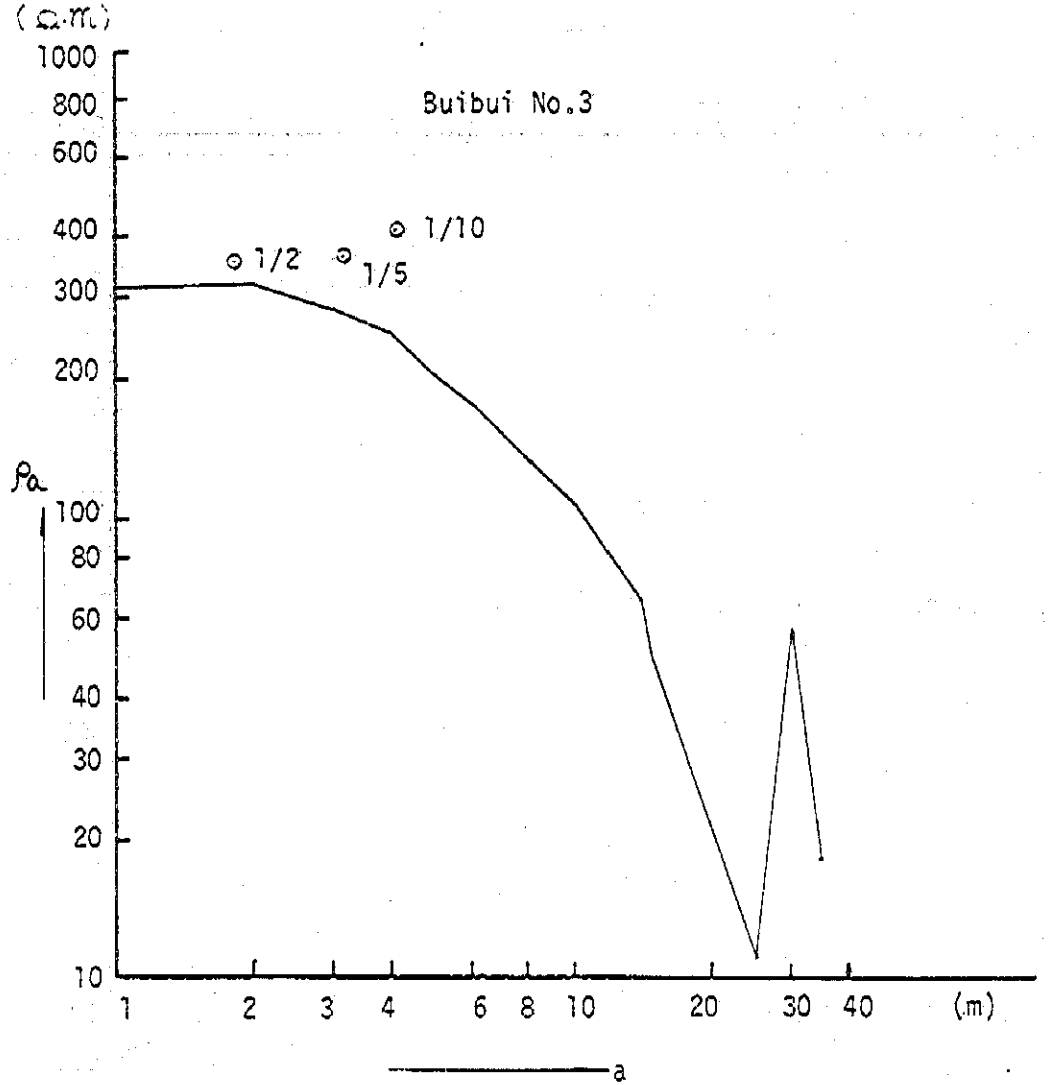
66	660	333	137	42	Unanalysable (Ω m)

Fig. A-5-13 Geoelectric Resistivity Survey ρ-a Curve



240	360	167	128	Unanalysable (Ω·m)

Fig. A-5-14 Geoelectric Resistivity Survey -a Curve



315	157	73	42	Unanalysable (Ω·m)

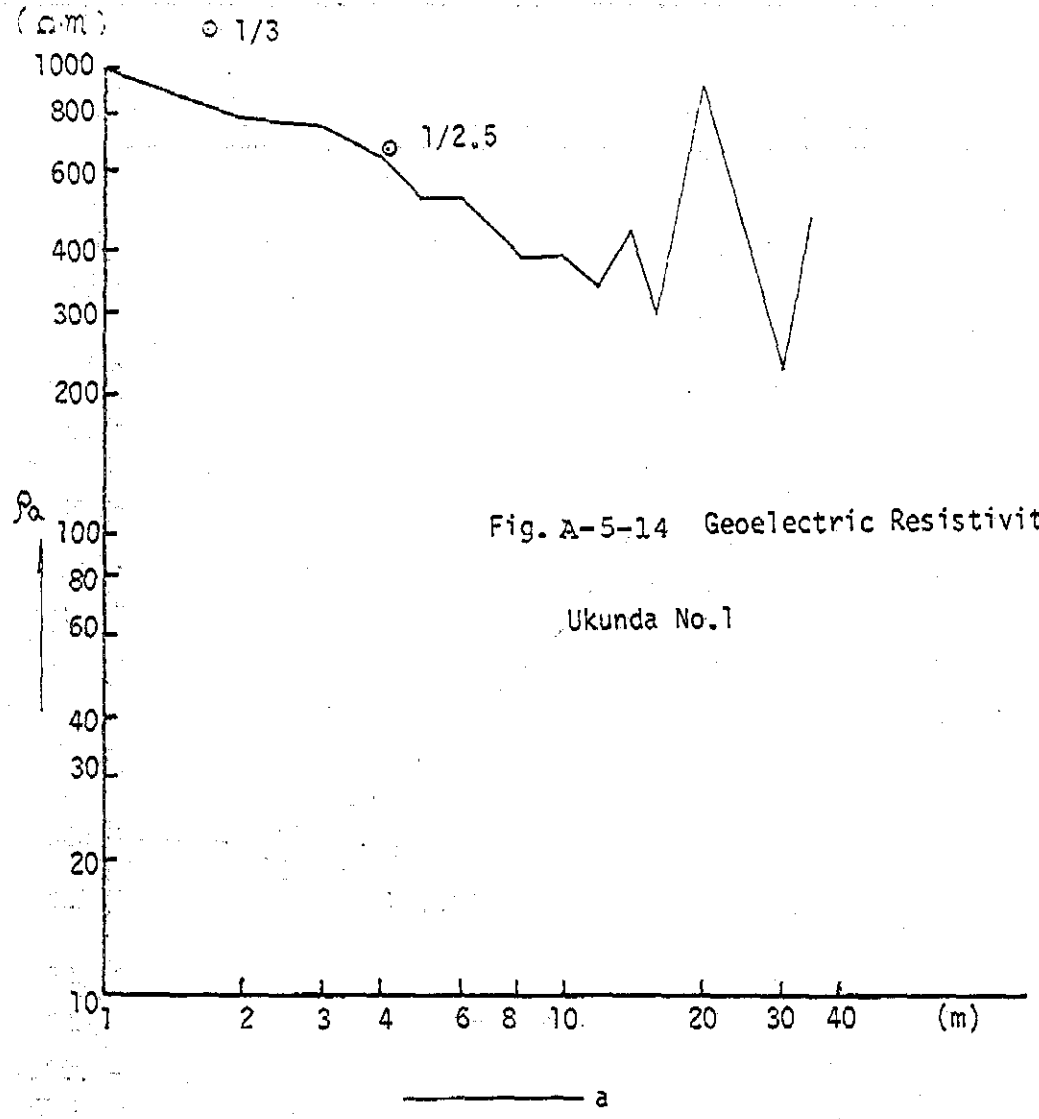


Fig. A-5-14 Geoelectric Resistivity Survey ρ-a Curve

Ukunda No.1

707	403	272	Unanalysable (Ω·m)

Fig. A-5-15 Presumed Columns of Geological Log Based on Geoelectrical Resistivity Method in Fahamuni Camp Area

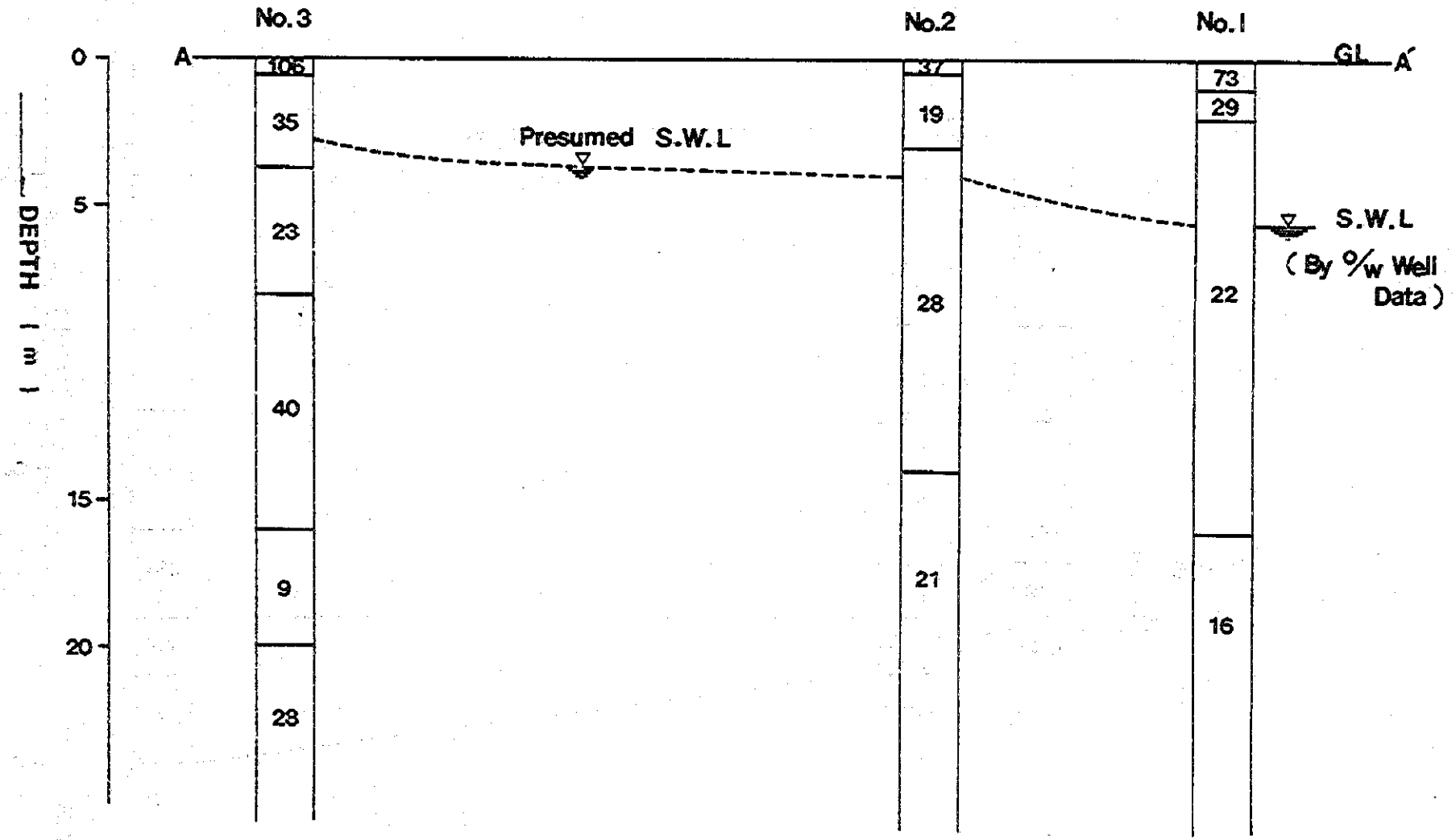


Fig. A－5-16 Presumed Columns of Geological Log Based on Geoelectrical Resistivity Method in Buibui Camp Area

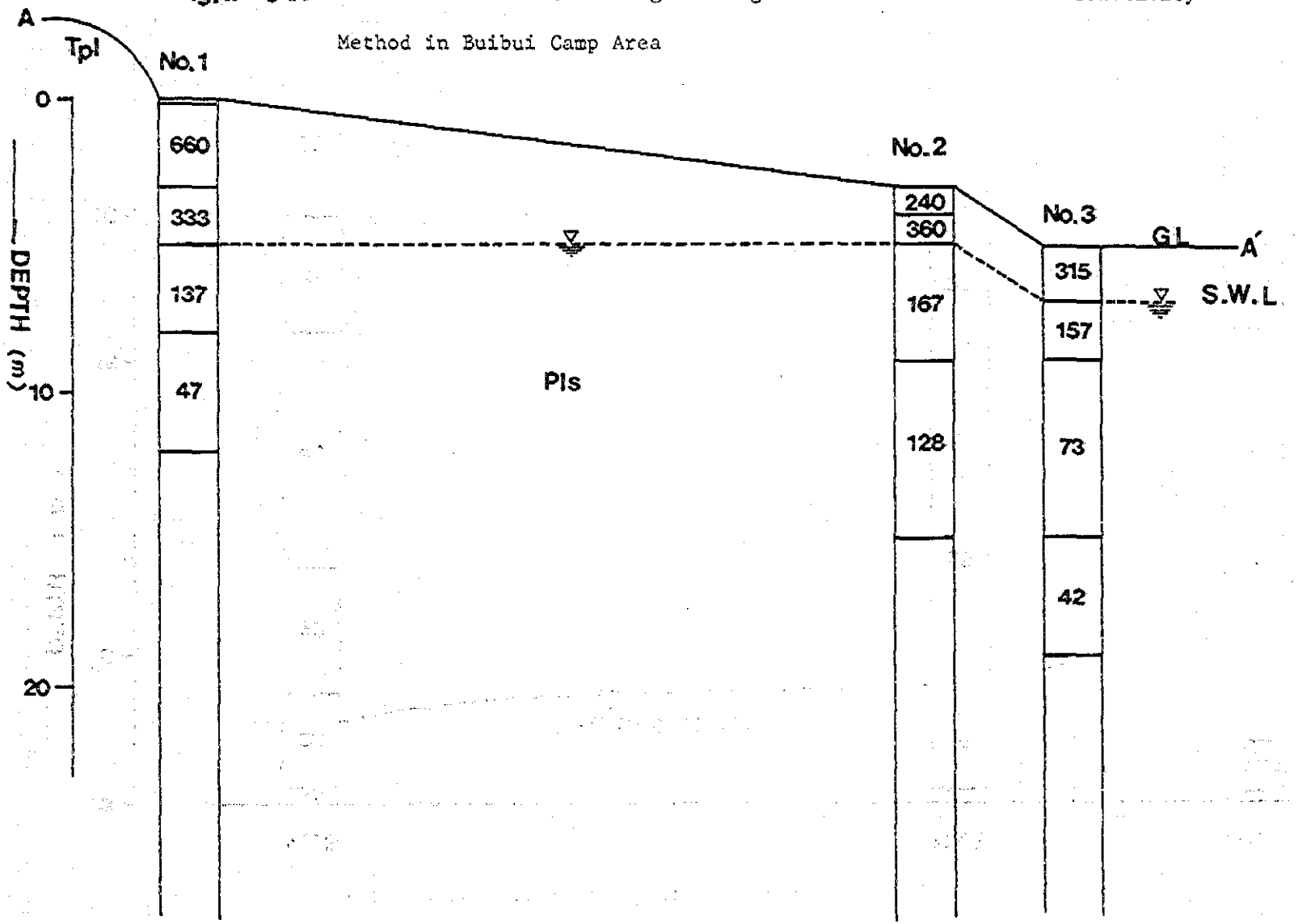


Fig. A-5-17 Presumed Columns of Geological Log Based on Geoelectrical Resistivity Method in Mwachings Area

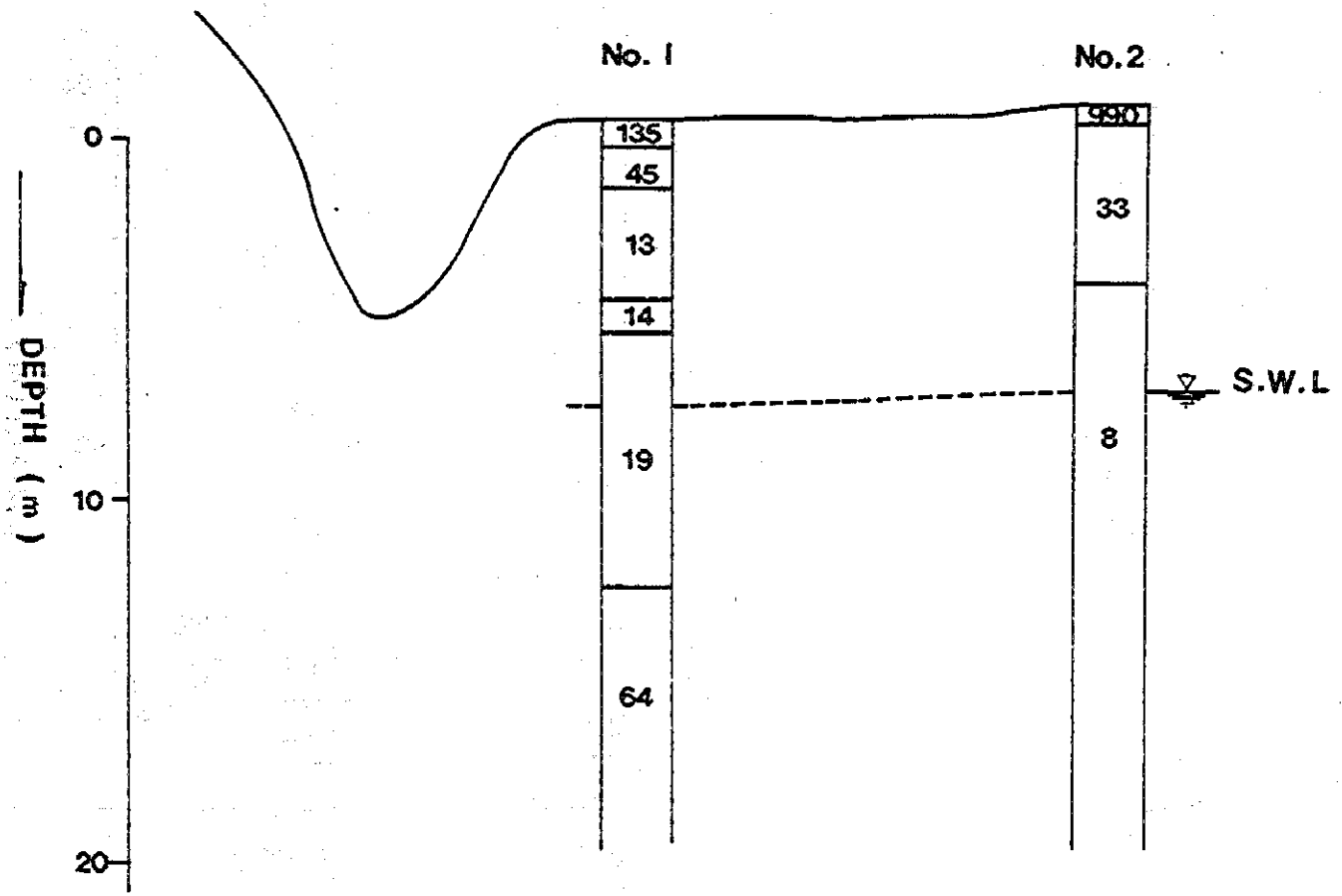


Fig. A-5-18 Presumed Columns of Geological Log Based on Geoelectrical Resistivity Method in Kidimu Camp Area

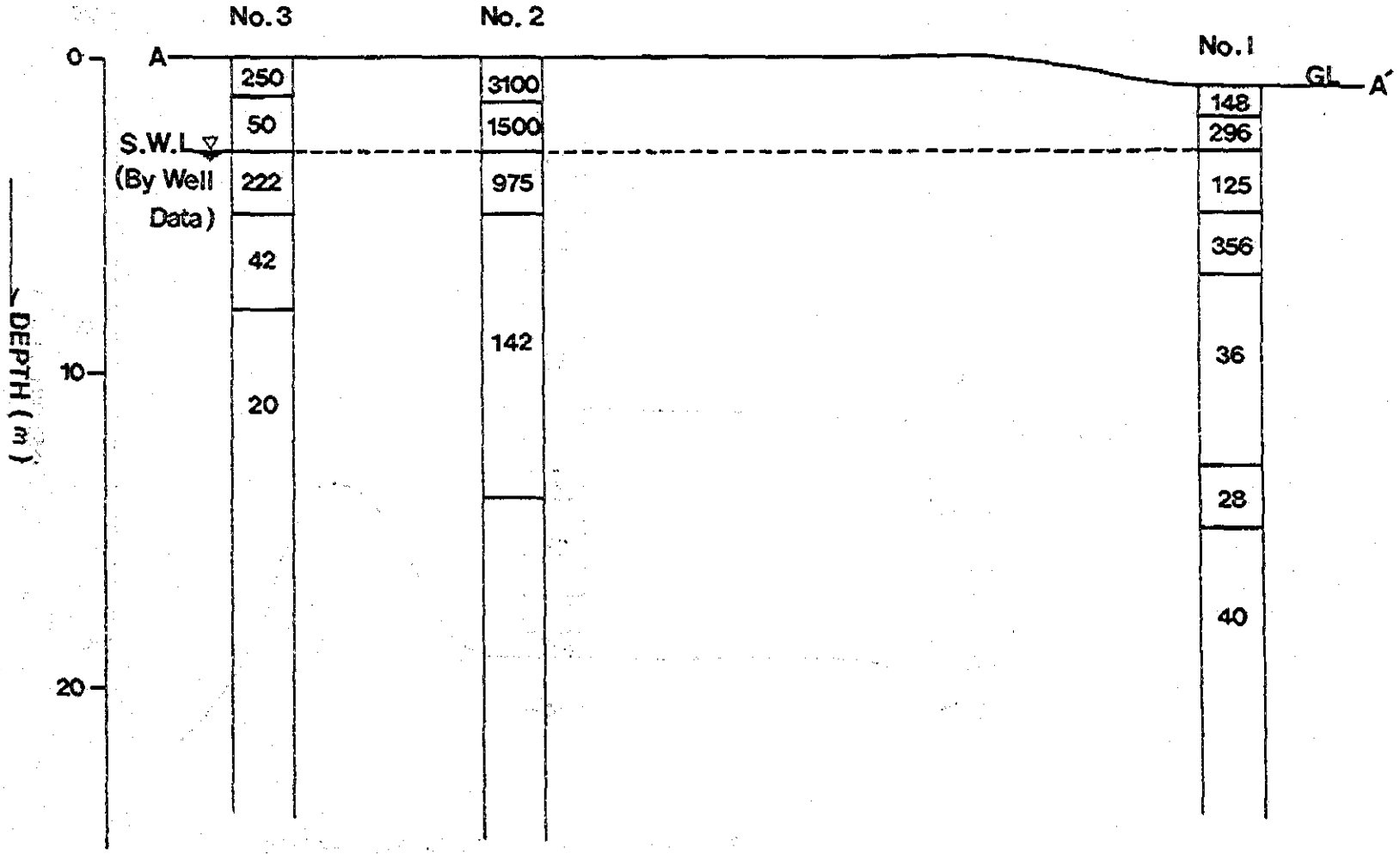
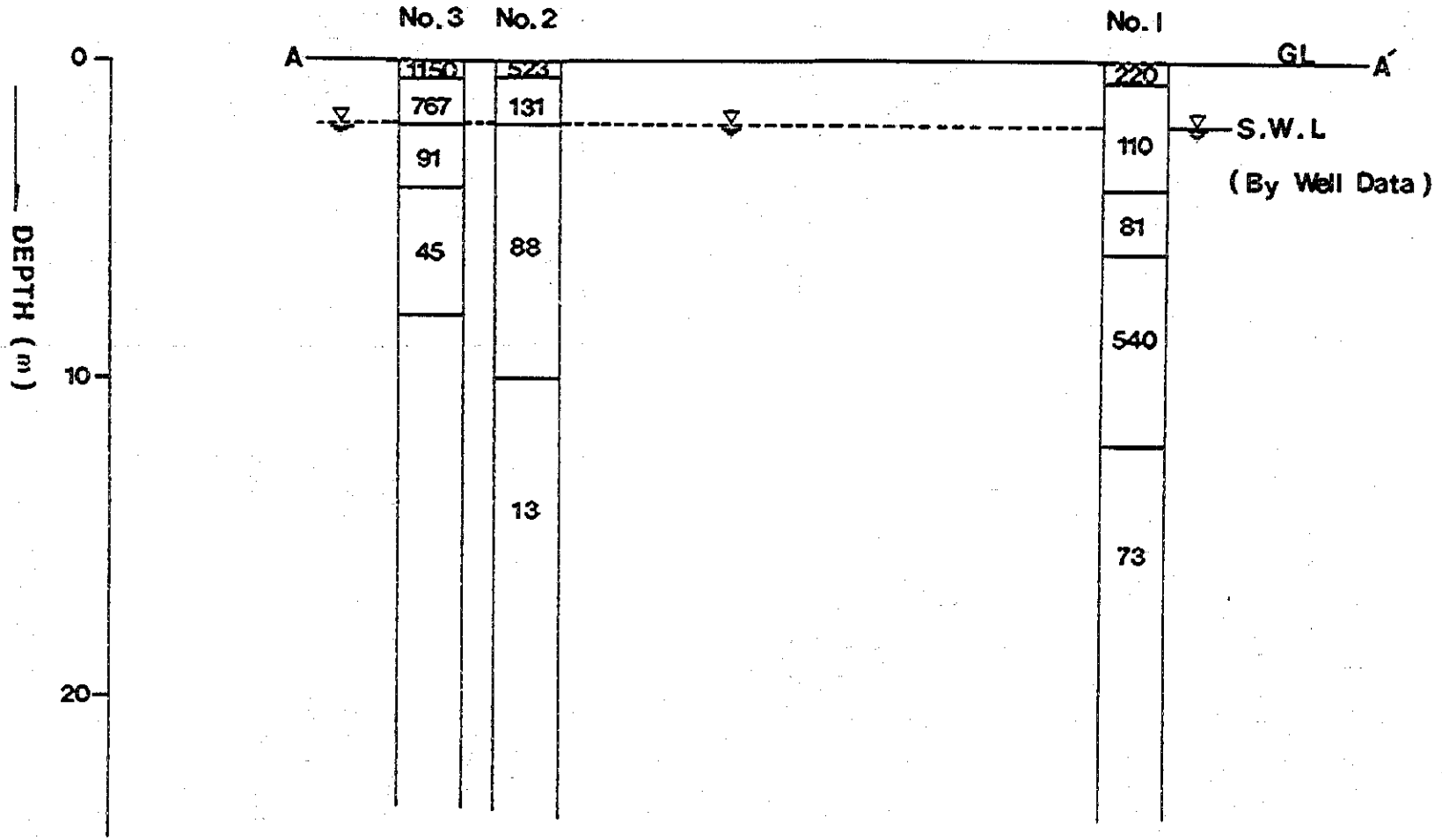


Fig. A-5-19 Presumed Columns Geological Log Based on Geoelectrical Resistivity Method in Kanana Camp Area



APPENDIX 6 EXISTING WELL DATA (4 Camps)

Table A-6-1 DATA SHEET OF EXISTING WELL/SPRING

Survey NO. B-1

Survey Condition

Date: 4th Feb. Time: 9:40 am Weather: Fine Temperature:31.5(° C)

Spring Location

BUIBUI Camp (About 200 m distant from Camp)

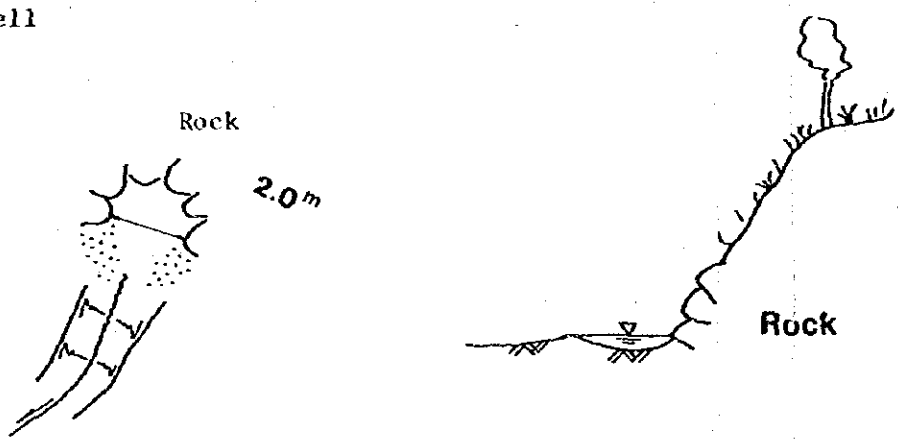
Detail of ~~Well~~/Spring

Depth of Well : -

Diameter : -

Water Level : G.L. - -

Sketch of Well



Water Qualitt

Water temp.	:	29.7 (°C)
Appearance	:	Clear
pH	:	5.4
Turbidity	:	7 (ppm)
Conductivity	:	1.5 (mʊ/cm)
Desolved Oxygen	:	5.6 (ppm)
Coliform Group	:	(/cc)

Remarks

Table **A-6-2** DATA SHEET OF EXISTING WELL/SPRING

Survey NO. F-1

Survey Condition

Date: 28th Jan. Time: 16:25 Weather: Fine Temperature:33.5(° C)

Well Location

FAHAMUNI Camp

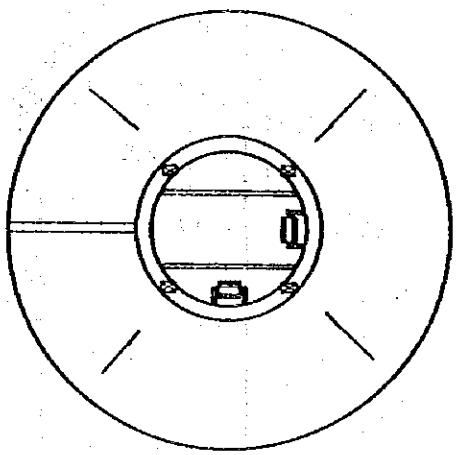
Detail of Well/~~Spring~~

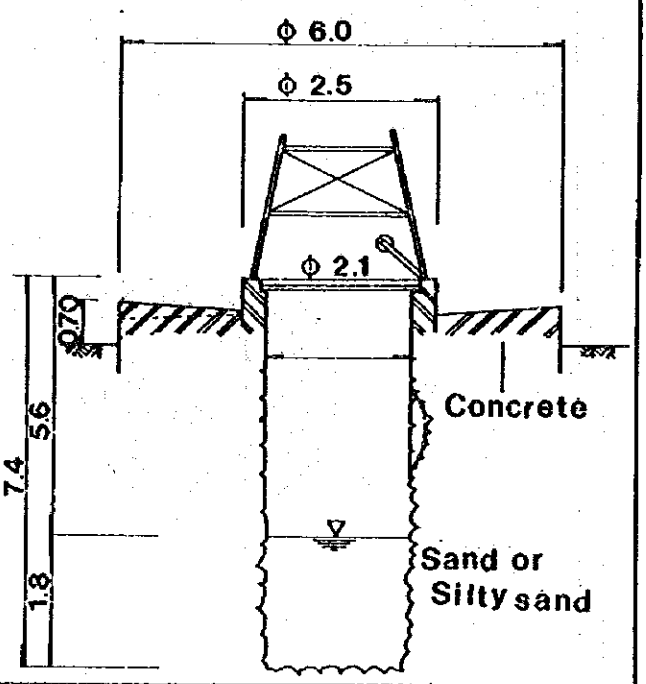
Depth of Well : 7.4 (m)

Diameter : 2.1 (m)

Water Level : G.L. - 4.70 (m)

Sketch of Well





Water Qualitt

Water temp.	:	28.9	(°C)
Appearance	:	Clear	
pH	:	7.0	
Turbidity	:	3	(ppm)
Conductivity	:	2.4	(mʊ/cm)
Desolved Oxygen	:	6.4	(ppm)
Coliform Group	:		(/cc)

Remarks

Table A-6-3 DATA SHEET OF EXISTING WELL/SPRING

Survey NO. K-1

Survey Condition

Date: 28th Jan. Time: 16:07 Weather: Fine Temperature: 34 (° C)

Well Location

KANANA Camp

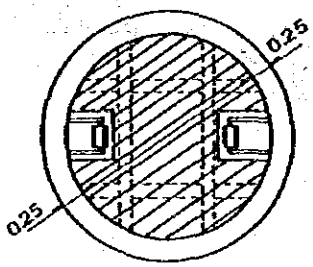
Detail of Well/Spring

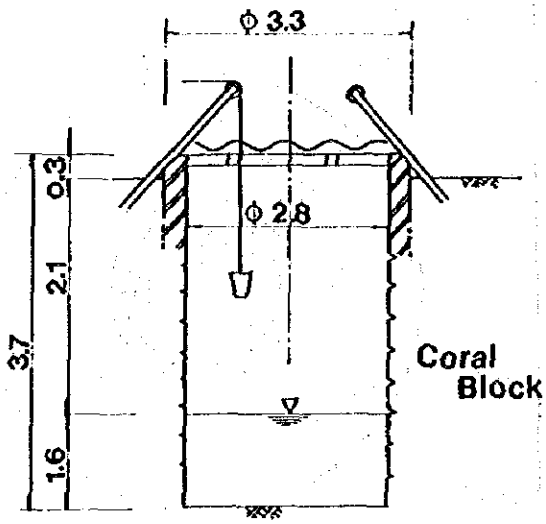
Depth of Well : 3.7 (m)

Diameter : 2.8 (m)

Water Level : G.L. - 1.8 (m)

Sketch of Well (m)





Water Qualitt

Water temp.	:	29.7	(°C)
Appearance	:	Clear	
pH	:	6.7	
Turbidity	:	3	(ppm)
Conductivity	:	2.3	(mʊ/cm)
Desolved Oxygen	:	5.0	(ppm)
Coliform Group	:		(/cc)

Remarks

Table A-6-4 DATA SHEET OF EXISTING WELL/SPRING

Survey NO. K-1

Survey Condition

Date: 27th Jan. Time: 12:00 Weather: Fine Temperature: 34 (° C)

Spring Location

KIDIMU Camp (About 250 m distance from Camp)

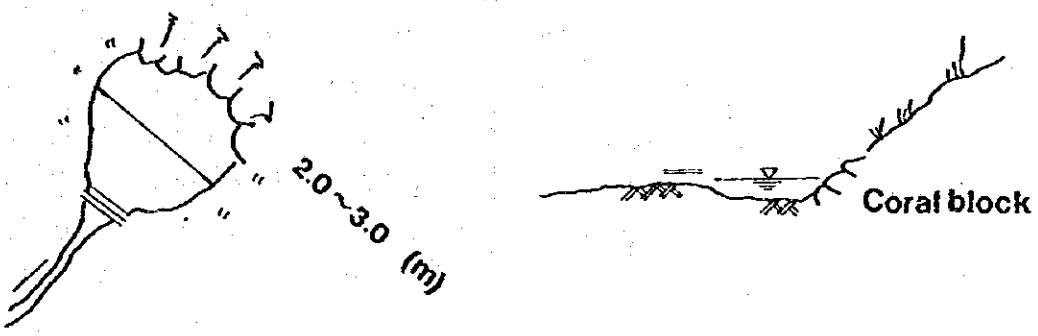
Detail of ~~Well~~/Spring

Depth of Well : -

Diameter : -

Water Level : G.L. -

Sketch of Well



Water Qualitt

Water temp.	:	30.6	(°C)
Appearance	:	Turbid with white & dark green	
pH	:	5.6	
Turbidity	:	16	(ppm)
Conductivity	:	0.8	(mʊ/cm)
Desolved Oxygen	:	5.7	(ppm)
Coliform Group	:		(/cc)

Remarks

Table **A-6-5** DATA SHEET OF EXISTING WELL/SPRING

Survey NO. K-2

Survey Condition

Date: 27th Jan. Time: 12:20 Weather: Fine Temperature: 34 (°C)

Well/~~Spring~~ Location

KIDIMU Camp

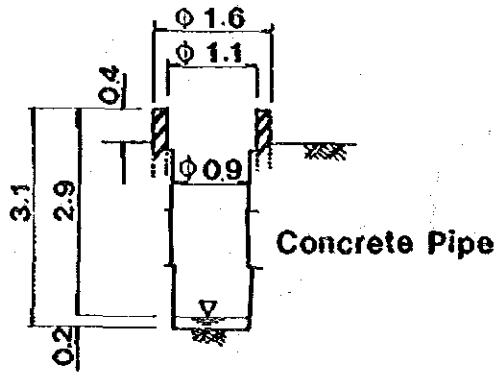
Detail of Well/~~Spring~~

Depth of Well : 3.1 (m)

Diameter : 0.9 (m)

Water Level : G.L. - 2.5 (m)

Sketch of Well



Water Qualitt

Water temp. : 30.0 (°C)

Appearance : Turbid with Brown

pH : 6.4

Turbidity : 12 (ppm)

Conductivity : 1.5 (mʊ/cm)

Desolved Oxygen : 5.5 (ppm)

Coliform Group : (/cc)

Remarks

APPENDIX 7 EXISTING WELL DATA (Around Project Area)

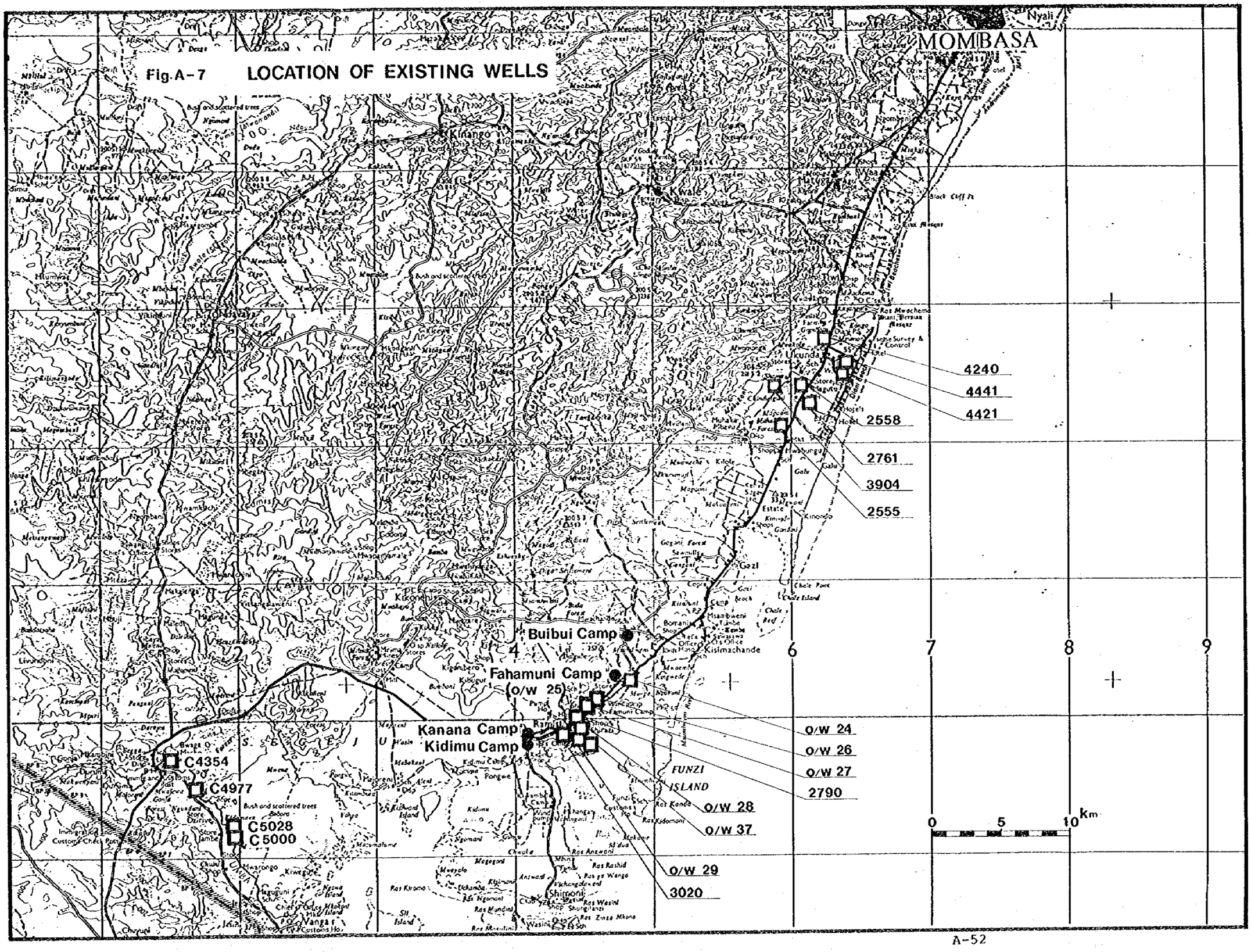
Table A- Data of Existing Well around the Project Area

Well No.	Year	Total Depth(m)	W.S.L. (m)	W.R.L. (m)	Yield (m^3/H)	Conduc-tivity	Diameter of Well(m)	Remarks
C2790	1958		170ft	30ft	2800GPH			
C3020			206-285ft		3000GPH			
C5028	1981	30	23-24	5.6	2.6			
C5000	1981	25	16	3.235	18			
C4166	1975	36	10	4.6	6			
C4354	1977	100	5-10	3.3	10.8			
C4977	1981	68	36	4.564	8			
C4240	1976	213.4	11	11.9	4.8			
C2558	1956	220ft	150ft	36-94ft	500GPH			
C2761	1958	98ft	86ft	86ft	720GPH			
C2555	1956	110ft	76ft	60ft	7000GPH			
C3011	1960	208ft	160-190ft	30ft	10000GPH			
C3906	1973	76.21	52.74	35.97	4.81			
C4421	1977	22	9.5	8.55	13.627			
C3904	1973	76.21	20.42	15.54	10.90			
C4536	1978	120	-	29	-			
C4142	1975	159	30-31	23.2	2.5			
C3905	1973	50.91	24.43	15.54	13.63			
C4195	1976	84	25.5	23.5	35.3			
o/w 24		9.10	4.10	-	-	550	2.14	Kiviogo
o/w 25		7.50	5.50	-	-	500	2.20	Fahamuni
o/w 26		8.50	3.20	-	-	630	2.00	Shivazi
o/w 27		3.92	1.62	-	-	410	1.32	Dalgube
o/w 28		2.60	1.30	-	-	420	1.70	Bodo

W.S.L. : Water Struck Level

W.R.L. : Water Rest Level

Fig.A-7 LOCATION OF EXISTING WELLS

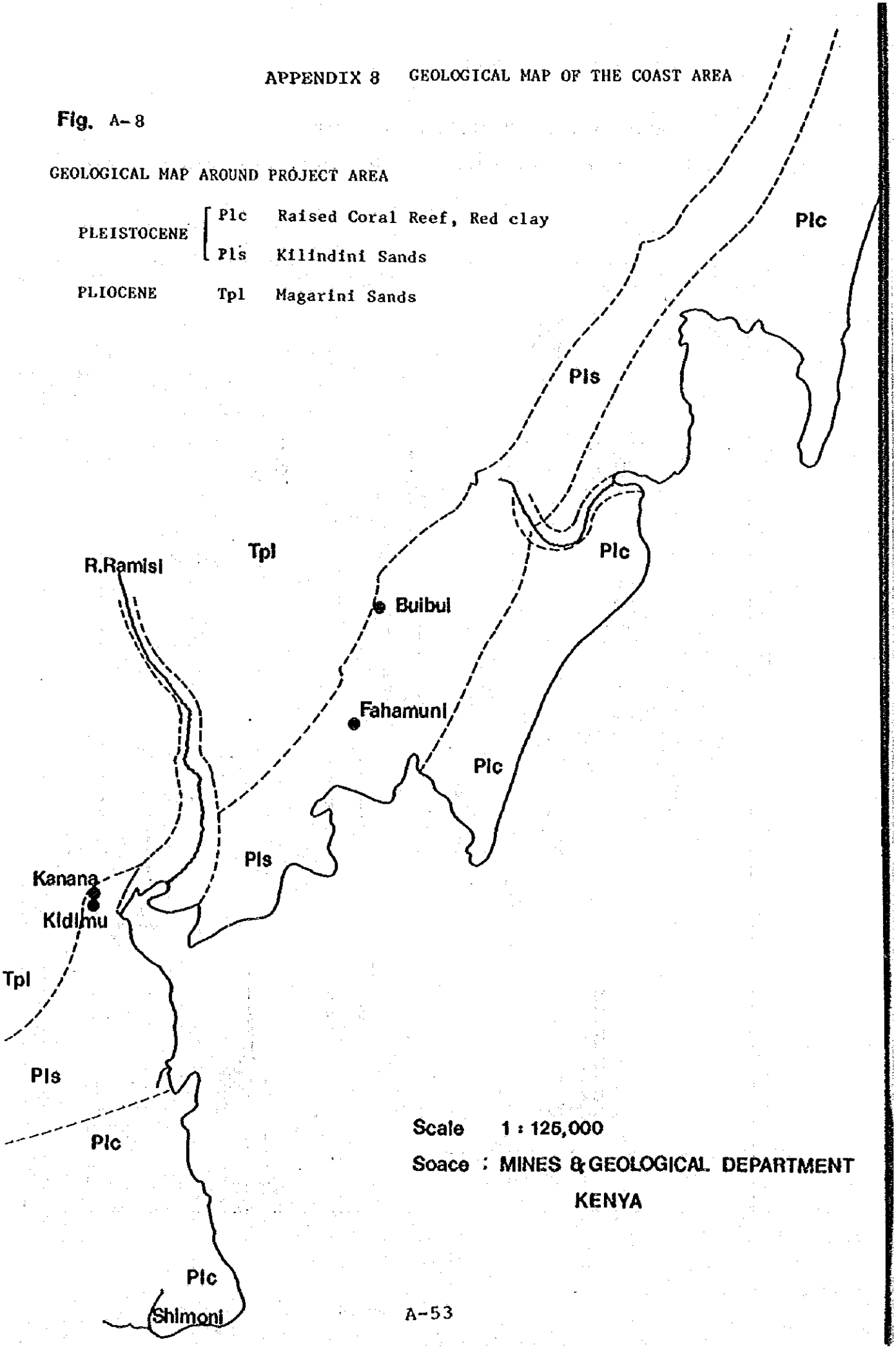


APPENDIX 8 GEOLOGICAL MAP OF THE COAST AREA

Fig. A-8

GEOLOGICAL MAP AROUND PROJECT AREA

PLEISTOCENE	Plc	Raised Coral Reef, Red clay
	Pls	Kilindini Sands
PLIOCENE	Tpl	Magarini Sands



Scale 1 : 125,000

Soace : MINES & GEOLOGICAL DEPARTMENT KENYA

APPENDIX 9 CLIMATOLOGICAL DATA

Fig. A-9 -1 Located columnal diagrams of rainfall

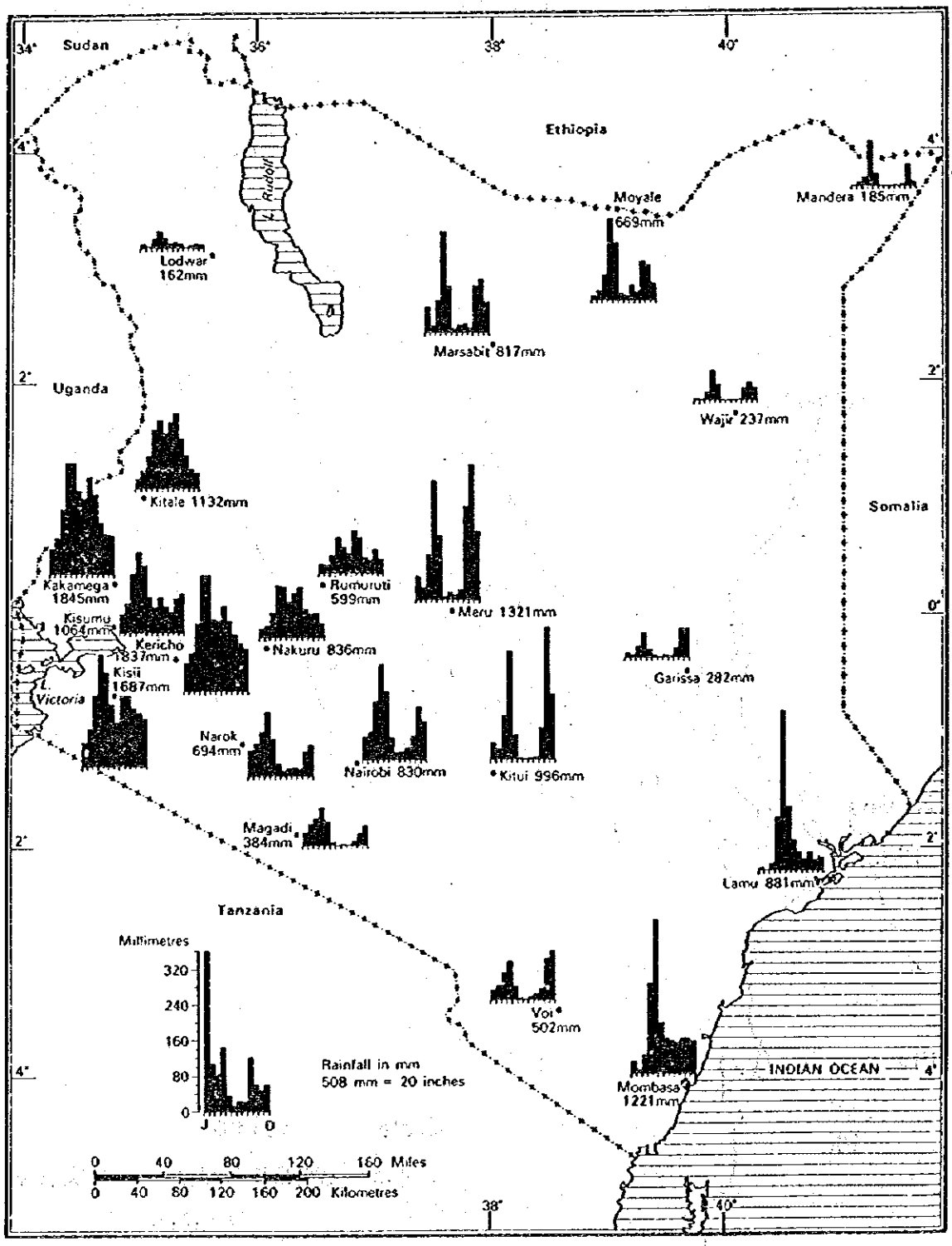


Fig. A-9-2 Annual potential evapolation from open water (Penmen Eo)

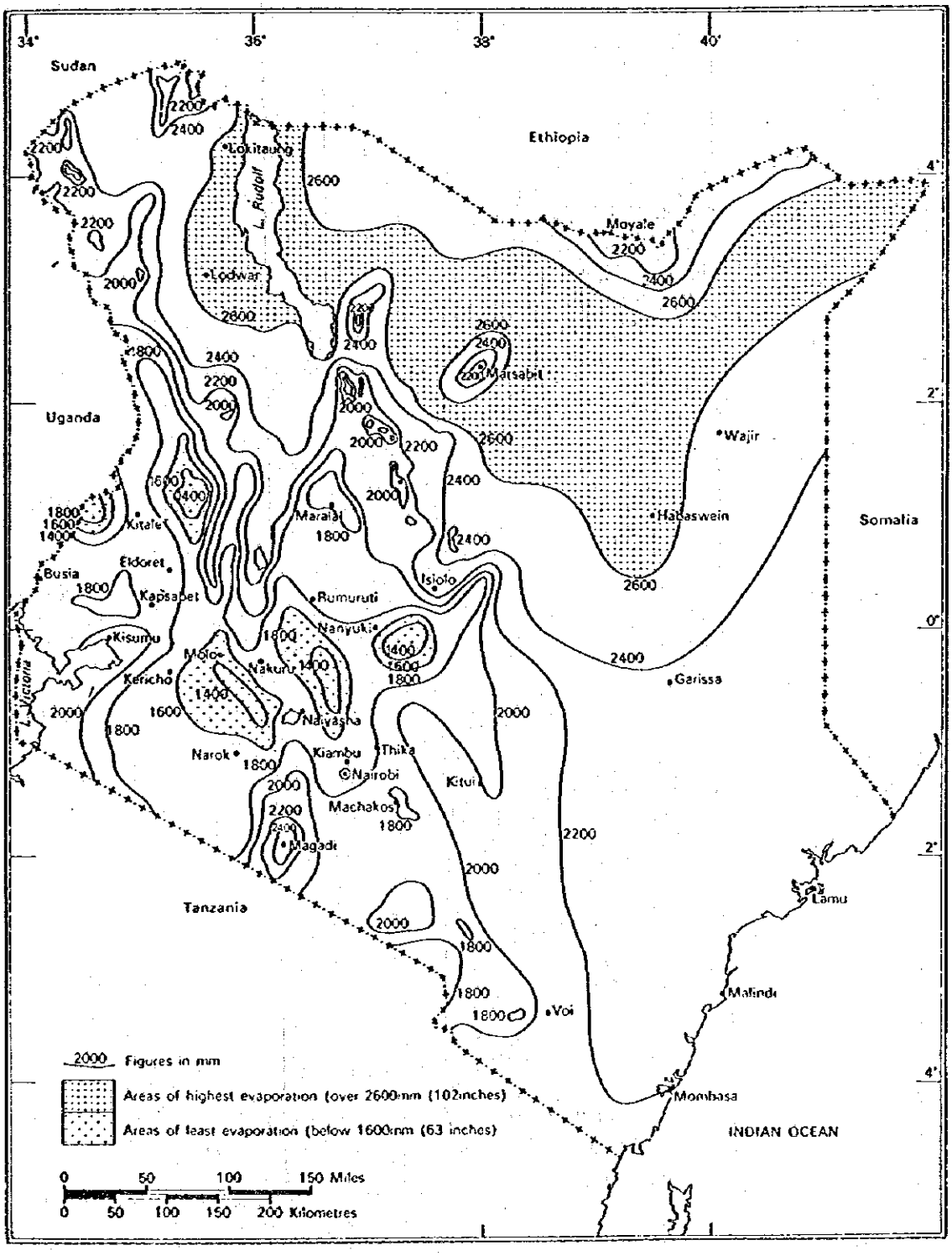


Fig. A-9-3 Temperature

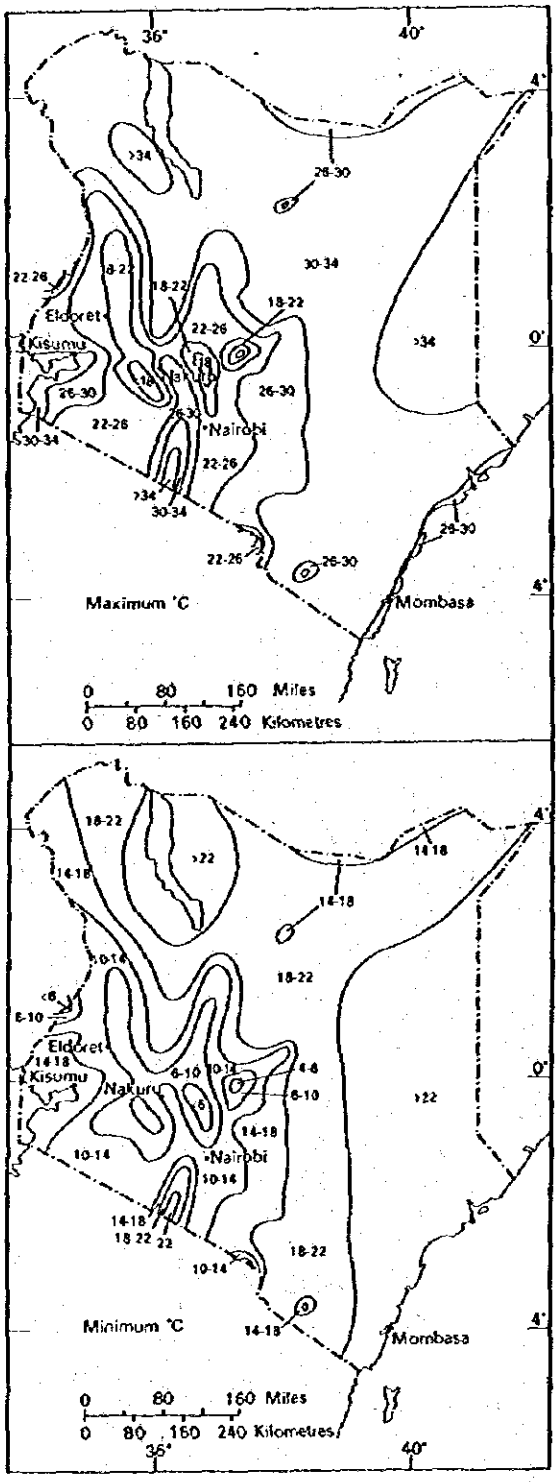


Fig. A-9-4 Relief

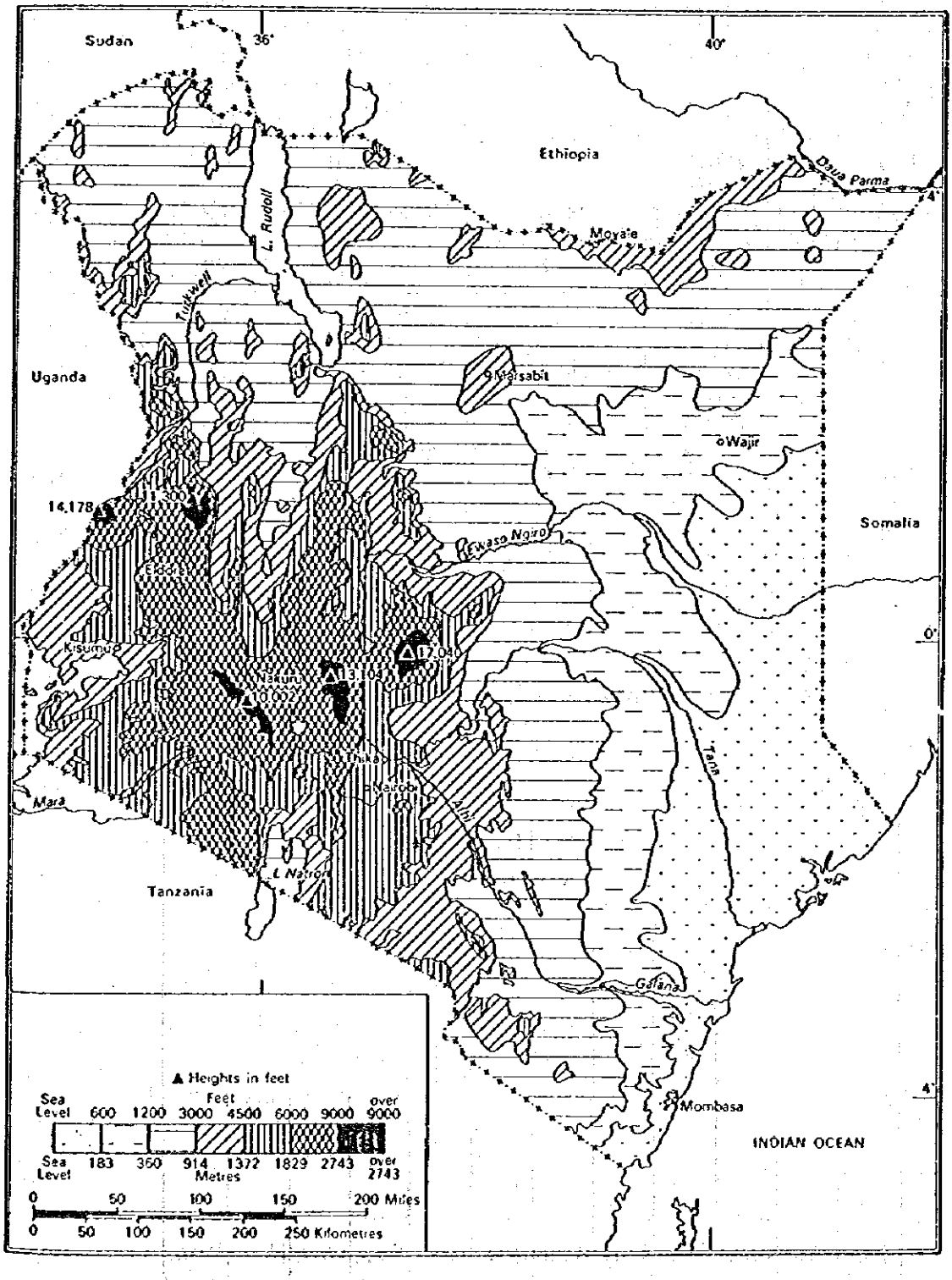
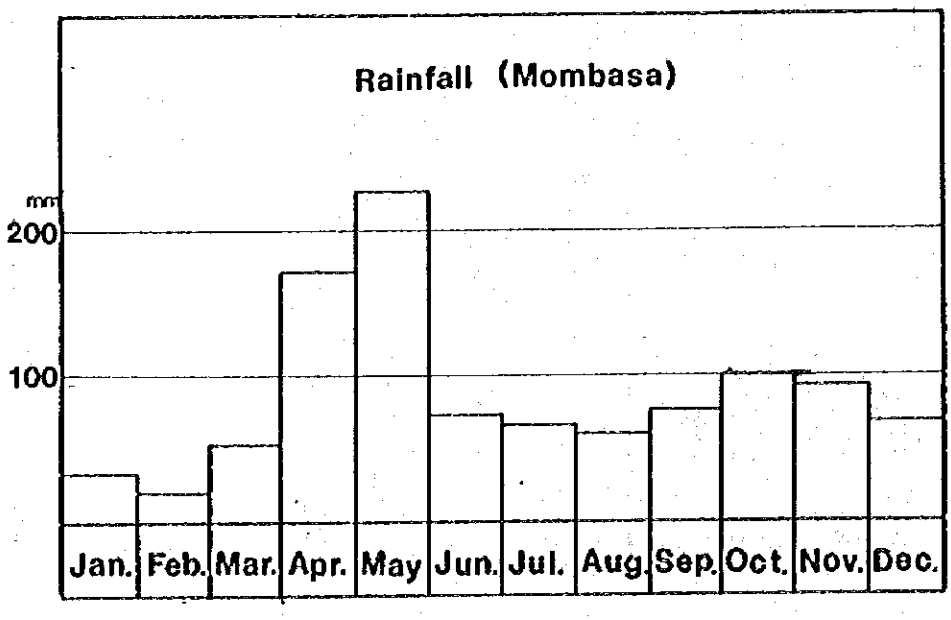


Table A-9-1 Climate of Mombasa

	Rainfall (mm)	Temperature		Related Humidity (at 1200 %)	Sunshine (hours/day)
		Mean Max(°C)	Mean Min(°C)		
Jan.	33.4	32.1	23.2	63	8.6
Feb.	20.1	32.4	23.6	61	9.1
March	54.4	32.7	24.2	63	9.0
April	173.9	31.2	23.8	68	7.5
May	228.2	29.2	22.6	72	6.5
June	75.1	28.5	21.2	68	7.5
July	68.2	27.7	20.3	68	7.0
Aug.	62.6	28.0	20.3	67	7.9
Sept.	77.9	28.9	20.8	65	8.5
Oct.	101.6	29.7	22.0	66	8.7
Nov.	92.8	30.6	23.0	68	9.0
Dec.	69.4	31.6	23.3	67	8.8
Total	1,057.6mm				
Remarks	(*)				

(*) Mean rainfall in 1971 to 1978



Source ; Meteorological Department

APPENDIX 10 POPULATION DATA

Table A-10-1 Population Changes by Province and District, 1969-79

Province & District	1969	1979	Increase (%)	Rate of Growth (%)
Nairobi	509,286	827,775	62.5	4.98
Central Pr.	1,675,647	2,345,833	40.0	3.42
Kiambu	475,576	686,290	44.3	3.74
Kirinyaga	216,988	291,431	34.3	2.99
Muranga	445,310	648,333	45.6	3.83
Nyandarua	176,928	233,302	31.9	2.80
Nyeri	360,845	486,477	34.8	3.03
Coast Pr.	944,082	1,342,794	42.2	3.59
Kilifi	307,568	430,986	40.1	3.43
Kwale	205,602	288,363	40.2	3.44
Lamu	22,401	42,299	88.8	6.56
Mombasa	247,073	341,148	38.1	3.28
Taita	110,742	147,597	33.3	2.91
Tana River	50,696	92,401	82.3	6.19
Eastern Pr.	1,907,301	3,719,851	42.6	3.61
Embu	178,912	263,173	47.1	3.93
Isiolo	30,135	43,478	44.3	3.73
Kitui	342,953	464,283	35.4	3.08
Machakos	707,214	1,022,522	44.6	3.76
Marsabit	51,581	96,216	86.5	6.43
Meru	596,506	830,179	39.2	3.36
North Eastern Pr.	245,757	373,787	52.1	4.28
Garissa	64,521	128,867	99.7	7.16
Mandera	95,006	105,609	11.1	1.06
Wajir	86,230	139,319	61.6	4.91
Nyanza Pr.	2,122,045	2,643,956	24.6	2.22
Kisii	675,041	869,512	28.8	2.56
Kisumu	400,643	482,327	20.4	1.87
Siaya	383,188	474,516	23.8	2.16
South Nyanza	663,173	817,601	23.3	2.12
Rift Valley Pr.	2,224,085	3,240,402	45.7	3.84
Kajiado	85,903	149,005	73.5	5.66
Kericho	479,135	633,348	32.2	2.83
Laikipia	66,506	134,524	102.3	7.30
Nakuru	290,853	522,709	79.7	6.04
Nandi	209,068	299,319	43.2	3.65
Narok	125,219	210,306	68.0	5.32
Samburu	69,519	76,908	10.6	1.02
Trans-Nzoia	124,361	259,503	108.7	7.63
Turkana	165,225	142,702	-13.6	-1.29
Uasin Gishu	191,036	300,766	57.4	4.64
West Pokot	96,254	158,652	64.7	5.11
Baringo	161,741	203,792	26.0	2.34
Elegeyo Marakwet	159,265	148,868	-6.5	-0.63
Western Pr.	1,328,298	1,832,663	38.0	3.27
Bungoma	345,226	503,935	46.0	3.85
Busia	200,486	297,841	48.6	4.04
Kakamega	782,586	1,030,887	31.7	2.79
Total Kenya	10,956,501	15,327,061	39.9	3.41

Source: Kenia Population Census, 1979

Table A-10-2 Population of Province and District

Province	District	Male	Female	Total	No.of households	Km^2	Density
Nairobi	-	479,448	348,327	827,775	200,447	684	1,210
Central	Kiambu	344,366	341,924	686,290	142,301	2,448	280
	Kirinyaga	142,986	148,445	291,431	53,729	1,437	202
	Muranga	310,632	337,701	648,333	129,238	2,476	261
	Nyandarua	114,856	118,446	233,302	43,197	3,528	66
	Nyeri	234,405	252,072	486,477	98,222	3,284	148
	Total	1,147,245	1,198,588	2,345,833	366,687	13,173	178
Coast	Kilifi	205,360	225,626	430,986	76,741	12,414	34
	Lamu	21,633	20,666	42,299	8,681	6,506	6
	Kwale	141,746	146,617	288,363	52,261	8,257	34
	Mombasa	189,942	151,206	341,148	82,571	210	1,622
	Taita/ Taveta	72,218	75,379	147,597	31,706	16,959	8
	Tana River	46,647	45,754	92,401	17,239	38,694	2
	Total	677,546	665,248	1,342,794	269,199	83,040	16
Eastern	Embu	127,867	135,306	263,173	50,241	2,714	96
	Isiolo	22,020	21,458	43,478	10,097	25,605	1
	Kitui	215,336	248,947	464,283	86,678	29,388	15
	Machakos	492,937	529,585	1,022,522	185,934	14,178	72
	Marsabit	48,860	47,356	96,216	21,005	73,952	1
	Meru	408,596	421,583	830,179	150,662	9,922	83
	Total	1,315,616	1,404,235	2,719,851	504,617	155,759	17
North-Eastern	Garissa	69,107	59,760	128,867	23,029	43,931	2
	Mandera	54,261	51,340	105,601	20,234	26,470	3
	Wajir	73,156	66,163	139,319	28,709	56,501	2
	Total	196,524	177,263	373,787	71,972	126,902	2
Nyanza	Kisii	423,450	446,062	869,512	141,607	2,196	395
	Kisumu	238,042	244,285	482,327	97,611	2,093	230
	Siaya	215,058	259,458	474,516	89,702	2,522	188
	South Nyanza	395,122	422,479	817,601	134,401	5,714	143
	Total	1,271,672	1,372,284	2,643,956	463,321	12,525	211

Table A-10-2 (Cont.)

Province	District	Male	Female	Total	No.of households	Km^2	Density
Rift Valley	Baringo	101,606	102,186	203,792	42,724	9,885	20
	Elgeyo Marakwet	73,737	75,131	148,868	33,657	2,279	65
	Kajiado	75,137	73,868	149,005	28,571	19,605	7
	Kericho	322,057	311,291	633,348	124,847	3,931	161
	Laikipia	69,548	64,976	134,524	30,281	9,718	13
	Nakuru	268,717	253,992	522,709	114,624	5,769	90
	Nandi	151,996	147,323	299,319	57,521	2,745	109
	Narok	104,727	105,579	210,306	37,747	16,115	13
	Samburu	36,992	39,916	76,908	16,714	17,521	4
	Trans-Nzoia	131,890	127,613	259,503	49,001	2,078	124
	Turkana	72,273	70,429	142,702	22,911	61,768	2
	Uasin Gisku	154,836	145,930	300,766	60,214	3,378	89
	West Pokot	78,625	80,027	158,652	29,141	9,090	17
	Total	1,642,141	1,598,261	3,240,402	647,953	163,883	19
Western	Bungoma	246,841	257,094	503,935	78,971	3,074	163
	Busia	140,142	157,699	297,841	55,105	1,626	183
	Kakamega	489,938	540,949	1,030,887	198,070	3,495	294
	Total	876,921	955,742	1,832,663	332,146	8,196	223
KENYA Total		7,607,113	7,719,948	15,327,061	2,956,369	564,162	27

Source: Kenya Population Census, 1979

Fig. A-4-1 Population distribution, 1962